

RAW DATA FROM PERFORMANCE EXPERIMENTS COMPARING BLOCK MATRIX-VECTOR PRODUCTS WITH SINGLE MATVECS*

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1. Machine and experiment information. This document contains table of raw performance data created during the investigations described in the paper [4]. As described in this paper, we ran a variety of performance tests on matrices of various sparsity patterns and levels coming both from real applications [3] and from test sets we artificially constructed. The tests were performed on a shared memory machine with 8 Intel Xeon E7-4870 2.4Ghz processors, each with 10 cores (i.e., a total of 80 CPU cores) and a total of 1 terabyte main memory. Each processor has 30 megabytes of L3 cache (3 megabytes per core). Experiments were run in serial. Using compiled Trilinos codes [2], we compare performance of large sparse operators being applied to blocks of vectors of varying block sizes. For each matrix \mathbf{A} , we compare multiplying the matrix times the entire block versus multiplying the matrix times each vector individually. For each matrix, the experiment is repeated for the projected operator $(\mathbf{I} - \mathbf{CC}^*)\mathbf{A}$ for subspaces \mathcal{U} of different dimensions.

Performance is measured in multiple ways. First, each experiment is performed 100 times and the average time in seconds for those experiments is taken. Second, we compiled the Intel Performance Counter Monitor (PCM) libraries [1], and these were used to take measurements directly from the processor for each experiment. Namely, the PCM allows one to measure bytes read by the processor, the percentage of cache hits and the number of cache misses occurring during the experiment. A *cache hit* refers to the instance that a wanted piece of data is already stored in cache on the processor, increasing the speed of access. A *cache miss* is when a wanted piece of data is not on the cache and thus must be accessed from main memory, causing a delay due to data movement needs. For further information about these experiments and their interpretation, see [4].

TABLE 2.1
Bytes read onto the processor for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescal1	8.0675e+10	1.1853e+11	1.5871e+11	2.0135e+11	2.4113e+11	2.7977e+11	3.2087e+11	3.6265e+11	4.0321e+11	4.433e+11	4.8071e+11	5.1967e+11	5.6337e+11	6.0198e+11	6.4268e+11	6.8075e+11	7.1867e+11	7.6502e+11	8.0435e+11
CoupCons3D	6.3573e+10	9.4147e+10	1.2685e+11	1.5876e+11	1.8961e+11	2.2086e+11	2.5608e+11	2.8276e+11	3.1693e+11	3.482e+11	3.7968e+11	4.0996e+11	4.4239e+11	4.7724e+11	5.0314e+11	5.3868e+11	5.6996e+11	6.0199e+11	6.3478e+11
rajat31	7.5695e+10	1.1009e+11	1.5199e+11	1.8876e+11	2.2579e+11	2.6475e+11	3.0383e+11	3.4124e+11	3.7833e+11	4.1463e+11	4.511e+11	4.8644e+11	5.2949e+11	5.6647e+11	6.0677e+11	6.4243e+11	6.8043e+11	7.178e+11	7.5495e+11
FullChip	1.0396e+11	1.5284e+11	2.0723e+11	2.5678e+11	3.0925e+11	3.7806e+11	5.0841e+11	4.7048e+11	5.189e+11	5.6912e+11	6.1769e+11	6.6893e+11	7.2056e+11	7.696e+11	8.2341e+11	8.8669e+11	9.2833e+11	9.7875e+11	1.0309e+12
cage14	8.2339e+10	1.26e+11	1.6643e+11	2.0748e+11	2.4652e+11	2.8794e+11	3.2944e+11	3.7047e+11	4.1347e+11	4.5355e+11	4.9825e+11	5.37e+11	5.7711e+11	6.207e+11	6.5914e+11	7.0172e+11	7.4477e+11	7.8536e+11	8.26e+11
RM07R	1.0543e+11	1.5719e+11	2.0854e+11	2.5801e+11	3.0987e+11	3.5744e+11	4.1723e+11	4.6791e+11	5.1767e+11	5.7253e+11	6.2506e+11	6.7469e+11	7.2903e+11	7.79e+11	8.3247e+11	8.8274e+11	9.375e+11	9.9232e+11	1.0451e+12
epb3	7.622e+07	8.9784e+07	1.3476e+08	1.7824e+08	2.0415e+08	2.4248e+08	2.5581e+08	3.0742e+08	3.3874e+08	3.3849e+08	3.8671e+08	4.4361e+08	1.3365e+09	1.3235e+09	4.2142e+08	4.5542e+08	2.4057e+09	6.3998e+08	5.5366e+08
qcdRealPart	1.16e+09	1.5151e+09	2.5712e+09	3.3184e+09	3.6077e+09	5.4336e+09	3.1002e+09	6.7952e+09	5.8362e+09	4.9533e+09	5.6375e+09	7.85e+09	7.4405e+09	6.2058e+09	7.0258e+09	7.5009e+09	9.4579e+09	7.0704e+09	7.8937e+09
crashbasis	7.9944e+08	1.3006e+09	2.8053e+09	2.2409e+09	5.2113e+09	4.0814e+09	3.7834e+09	4.2858e+09	5.8607e+09	8.5e+09	8.6883e+09	7.7815e+09	8.8408e+09	7.3107e+09	1.0237e+10	1.0502e+10	1.2924e+10	1.1097e+10	1.4496e+10
Hamrle3	2.5016e+10	3.4609e+10	4.6721e+10	5.7783e+10	7.3011e+10	8.2699e+10	9.3992e+10	1.1596e+11	1.1925e+11	1.428e+11	1.4192e+11	1.6654e+11	1.6507e+11	1.7557e+11	1.8804e+11	1.9816e+11	2.125e+11	2.2337e+11	2.3479e+11
HV15R	7.7625e+11	1.1703e+12	1.5595e+12	1.9454e+12	2.3444e+12	2.737e+12	3.1455e+12	3.5616e+12	3.8135e+12	4.1982e+12	4.5818e+12	5.0357e+12	5.3558e+12	5.7463e+12	6.133e+12	6.5232e+12	6.8899e+12	7.3189e+12	7.7468e+12
lung2	1.7585e+08	3.6408e+08	4.4769e+08	4.2902e+08	1.8592e+08	2.1894e+08	2.6369e+08	2.9283e+08	1.7661e+09	5.3155e+08	6.0093e+08	7.0181e+08	7.5739e+08	8.2453e+08	8.4573e+08	9.7611e+08	1.0249e+09	1.1617e+09	1.2903e+09
ML_Geer	3.0577e+11	4.5779e+11	6.0768e+11	7.6244e+11	9.1379e+11	1.0746e+12	1.2202e+12	1.3724e+12	1.5255e+12	1.6843e+12	1.8445e+12	1.9954e+12	2.1502e+12	2.3032e+12	2.4558e+12	2.6112e+12	2.7628e+12	2.9194e+12	3.0698e+12
pre2	1.9064e+10	2.7348e+10	4.0208e+10	4.8038e+10	5.8583e+10	7.9607e+10	7.9818e+10	8.4985e+10	9.648e+10	1.0403e+11	1.1464e+11	1.2312e+11	1.3264e+11	1.4219e+11	1.5359e+11	1.6063e+11	1.7317e+11	1.8241e+11	1.8985e+11
twotone	4.25e+08	4.6754e+08	5.9093e+08	1.6024e+09	1.4206e+09	1.3652e+09	1.2449e+09	1.9578e+09	2.7223e+09	3.1595e+09	1.9534e+09	2.3696e+09	2.6835e+09	2.9964e+09	2.9645e+09	3.9528e+09	3.4386e+09	3.9245e+09	3.749e+09

TABLE 2.2
Bytes read onto the processor for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescal1	5.6682e+10	7.2434e+10	8.7459e+10	1.0381e+11	1.4553e+11	1.6181e+11	1.7772e+11	1.9044e+11	2.1133e+11	2.4744e+11	2.6559e+11	2.8201e+11	2.968e+11	3.1608e+11	3.5836e+11	3.7047e+11	3.8567e+11	4.022e+11	4.2347e+11
CoupCons3D	3.5343e+10	3.7164e+10	3.7672e+10	3.7651e+10	7.0341e+10	7.2095e+10	7.1714e+10	7.8609e+10	7.5653e+10	1.0768e+11	1.1102e+11	1.1375e+11	1.1609e+11	1.1514e+11	1.5048e+11	1.5025e+11	1.5297e+11	1.5364e+11	1.5525e+11
rajat31	4.8167e+10	5.5428e+10	6.2251e+10	7.367e+10	1.1041e+11	1.2032e+11	1.2934e+11	1.3804e+11	1.4599e+11	1.8451e+11	1.9306e+11	2.0164e+11	2.0984e+11	2.206e+11	2.5954e+11	2.6892e+11	2.7848e+11	2.8602e+11	2.956e+11
FullChip	6.8672e+10	8.7274e+10	1.046e+11	1.2543e+11	1.7578e+11	1.9282e+11	2.6842e+11	3.4905e+11	2.4604e+11	2.9819e+11	3.1892e+11	3.3349e+11	3.5341e+11	3.7067e+11	4.2671e+11	6.7294e+11	4.573e+11	4.7861e+11	4.9604e+11
cage14	4.586e+10	5.2647e+10	6.4214e+10	7.1726e+10	1.1143e+11	1.176e+11	1.2422e+11	1.3227e+11	1.3843e+11	1.7773e+11	1.858e+11	1.9235e+11	2.0204e+11	2.0952e+11	2.5049e+11	2.5773e+11	2.6083e+11	2.7082e+11	2.7951e+11
RM07R	5.3289e+10	5.5757e+10	5.9283e+10	6.0381e+10	1.1435e+11	1.1572e+11	1.1861e+11	1.1726e+11	1.2216e+11	1.7198e+11	1.7456e+11	1.7919e+11	1.776e+11	1.8195e+11	2.3388e+11	2.3558e+11	2.3373e+11	2.4167e+11	2.4367e+11
epb3	5.65e+07	7.7558e+07	1.0394e+08	1.122e+08	1.4102e+08	1.7641e+08	1.7232e+08	2.4289e+08	2.6535e+08	3.1419e+08	3.9066e+08	4.5677e+08	9.8586e+08	1.4609e+09	9.5094e+08	1.0188e+09	1.5694e+09	1.594e+09	1.8367e+09
qcdRealPart	7.1277e+08	7.6646e+08	1.0335e+09	1.2802e+09	1.8369e+09	2.1477e+09	2.2777e+09	2.1795e+09	2.6206e+09	2.8324e+09	3.1061e+09	3.5177e+09	3.5156e+09	3.7384e+09	4.3008e+09	4.4538e+09	5.4673e+09	4.67e+09	5.1779e+09
crashbasis	6.5622e+08	1.0281e+09	1.9557e+09	2.2013e+09	3.2607e+09	4.0807e+09	4.7704e+09	5.8058e+09	6.5234e+09	8.6188e+09	8.0955e+09	8.7644e+09	1.0856e+10	1.1949e+10	1.1206e+10	1.1796e+10	1.2505e+10	1.4947e+10	1.3816e+10
Hamrle3	1.6955e+10	2.5005e+10	2.838e+10	3.5328e+10	4.5236e+10	5.058e+10	5.9231e+10	6.4659e+10	6.6807e+10	8.3293e+10	8.5358e+10	9.6244e+10	9.6769e+10	1.0322e+11	1.14e+11	1.2151e+11	1.1964e+11	1.3166e+11	1.378e+11
HV15R	4.0058e+11	4.1117e+11	4.2675e+11	4.4173e+11	8.3974e+11	8.4611e+11	8.6552e+11	8.8273e+11	9.0624e+11	1.2358e+12	1.2532e+12	1.2845e+12	1.2785e+12	1.3024e+12	1.6744e+12	1.693e+12	1.6957e+12	1.7169e+12	1.7513e+12
lung2	1.0238e+08	2.8281e+08	2.9991e+08	3.5426e+08	1.205e+08	1.453e+08	1.9493e+08	2.5854e+08	1.2041e+09	5.5445e+08	9.6405e+08	1.0501e+09	1.4707e+09	1.7711e+09	2.1968e+09	2.4077e+09	2.8354e+09	3.2336e+09	3.3842e+09
ML_Geer	1.5923e+11	1.6217e+11	1.691e+11	1.7115e+11	3.2723e+11	3.3011e+11	3.3355e+11	3.3978e+11	3.4398e+11	4.9852e+11	4.9966e+11	5.1112e+11	5.1562e+11	5.2393e+11	6.7499e+11	6.8044e+11	6.8317e+11	6.9304e+11	6.9774e+11
pre2	1.0926e+10	1.4083e+10	1.3931e+10	1.552e+10	2.5396e+10	3.3868e+10	3.0557e+10	2.9212e+10	3.1925e+10	4.0336e+10	4.1843e+10	4.295e+10	4.4426e+10	4.5882e+10	5.5267e+10	5.6828e+10	5.8355e+10	5.9749e+10	6.1349e+10
twotone	2.1045e+08	2.8746e+08	5.6325e+08	9.7684e+08	1.4667e+09	1.5776e+09	1.4547e+09	2.4265e+09	3.4745e+09	5.7747e+09	3.3063e+09	3.6469e+09	4.0625e+09	4.5052e+09	4.6718e+09	5.5444e+09	5.3795e+09	6.1088e+09	7.954e+09

2. Unprojected application of matrices from the Sparse Matrix Library.

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TABLE 2.3
Average time taken for each matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescale1	0.16195	0.24352	0.32572	0.40639	0.48811	0.56899	0.64599	0.73059	0.80859	0.89247	0.9764	1.0563	1.1326	1.2229	1.2944	1.3839	1.4603	1.548	1.6382
CoupCons3D	0.14656	0.22052	0.29352	0.3688	0.44235	0.51428	0.59014	0.66072	0.73903	0.81194	0.88212	0.96089	1.0323	1.1016	1.1803	1.2509	1.3296	1.4045	1.4646
rajat31	0.16659	0.25137	0.33422	0.41995	0.50179	0.58208	0.66852	0.75476	0.83586	0.92289	1.0038	1.081	1.1719	1.2546	1.3267	1.412	1.4924	1.5934	1.6724
FullChip	0.22812	0.34358	0.45662	0.57297	0.68471	0.79598	0.91304	1.0175	1.1445	1.2516	1.3573	1.4773	1.5979	1.7076	1.8095	1.967	2.0392	2.1616	2.2816
cage14	0.19322	0.29023	0.38677	0.48079	0.58056	0.67369	0.77492	0.86891	0.96791	1.0638	1.1559	1.255	1.3479	1.439	1.546	1.6378	1.7424	1.8404	1.9316
RM07R	0.24902	0.37249	0.49241	0.62072	0.74117	0.86325	0.98803	1.1152	1.2366	1.3649	1.4844	1.6171	1.7365	1.8658	1.9836	2.1153	2.234	2.3626	2.4657
epb3	0.0017878	0.0026972	0.00357	0.0044969	0.0053661	0.0063011	0.0071348	0.0080904	0.008988	0.0098089	0.010765	0.011588	0.012517	0.013413	0.014478	0.015364	0.016118	0.017101	0.017864
qcdRealPart	0.0067096	0.0097403	0.013513	0.017066	0.020162	0.023179	0.025524	0.029362	0.033471	0.035156	0.038655	0.041492	0.043596	0.04685	0.050558	0.051947	0.055342	0.056578	0.059075
crashbasis	0.0063802	0.0096594	0.012771	0.016246	0.019597	0.023182	0.025567	0.028965	0.03287	0.037807	0.039513	0.043233	0.075014	0.047158	0.054188	0.053691	0.056477	0.059203	0.065625
Hamrle3	0.044554	0.066676	0.088918	0.11093	0.13411	0.15606	0.1786	0.38778	0.22123	0.5322	0.26639	0.62994	0.30878	0.33343	0.35503	0.37751	0.40423	0.42594	0.44847
HV15R	1.8627	2.7819	3.7325	4.6445	5.5417	6.4951	7.4041	8.3676	9.2514	10.227	11.081	11.983	13.024	13.871	14.883	15.71	16.731	17.687	18.568
lung2	0.0024257	0.0036319	0.0048416	0.0060494	0.0073144	0.008519	0.0097378	0.010925	0.012127	0.013373	0.014615	0.015812	0.017039	0.018265	0.019301	0.020732	0.022068	0.023023	0.024538
ML_Geer	0.72959	1.0941	1.4609	1.8244	2.1907	2.5362	2.916	3.2642	3.6443	3.9926	4.4903	4.7188	5.1027	5.4447	5.8313	6.1741	6.5595	6.9007	7.2924
pre2	0.043903	0.066355	0.12226	0.1083	0.13018	0.20956	0.17395	0.19471	0.21682	0.23768	0.26126	0.28233	0.30273	0.32528	0.34596	0.36867	0.39091	0.4118	0.43252
twotone	0.0053207	0.0079432	0.010618	0.013264	0.015942	0.018874	0.021453	0.024512	0.027275	0.030456	0.03276	0.035805	0.038925	0.041834	0.044792	0.048293	0.050079	0.052572	0.055216

TABLE 2.4
Average time taken for each matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescale1	0.12507	0.18741	0.27193	0.37693	0.45699	0.50293	0.55657	0.64951	0.74525	0.82769	0.87528	0.93689	1.0179	1.1289	1.2043	1.2438	1.3118	1.4004	1.5073
CoupCons3D	0.079656	0.10086	0.11793	0.13225	0.20454	0.21192	0.23355	0.24954	0.26498	0.33737	0.34332	0.3669	0.38123	0.39582	0.46871	0.47591	0.49787	0.51506	0.52723
rajat31	0.10745	0.1298	0.16289	0.22006	0.29839	0.32229	0.34443	0.3778	0.42659	0.51355	0.53696	0.55404	0.59059	0.64048	0.72788	0.74849	0.7718	0.80519	0.85329
FullChip	0.15417	0.20045	0.26172	0.33753	0.44976	0.48713	0.54035	0.59161	0.66743	0.77816	0.82197	0.87212	0.93459	1.0036	1.1108	1.1584	1.1962	1.2665	1.3406
cage14	0.1478	0.21125	0.27385	0.3271	0.4244	0.47353	0.54162	0.60175	0.66408	0.75888	0.8081	0.87321	0.94497	0.98515	1.0842	1.1325	1.1979	1.2665	1.3264
RM07R	0.14052	0.16567	0.19647	0.2243	0.34625	0.369	0.39292	0.42519	0.45469	0.57567	0.59361	0.6209	0.65397	0.67951	0.80209	0.81897	0.84214	0.87566	0.8954
epb3	0.0014521	0.0017896	0.0022653	0.0027224	0.0037134	0.004323	0.0046208	0.0051522	0.005576	0.0066331	0.0071627	0.0075605	0.0079263	0.0085359	0.0096322	0.010097	0.010511	0.011178	0.011842
qcdRealPart	0.0048116	0.0064272	0.0084071	0.010887	0.014403	0.015645	0.017139	0.019546	0.022219	0.025044	0.026906	0.028277	0.030024	0.033096	0.035894	0.03786	0.0389	0.0411	0.043722
crashbasis	0.0049796	0.006506	0.0094521	0.012682	0.017546	0.019594	0.021164	0.026692	0.030581	0.033313	0.035523	0.037512	0.079759	0.046131	0.049649	0.051262	0.053589	0.058617	0.062772
Hamrle3	0.031808	0.056354	0.075446	0.087472	0.11167	0.11833	0.14132	0.19289	0.17542	0.26481	0.20381	0.29273	0.24927	0.26214	0.28514	0.2912	0.31299	0.33567	0.34905
HV15R	1.0297	1.1898	1.4116	1.6176	2.5233	2.6431	2.8128	3.0314	3.2544	4.1708	4.2753	4.4175	4.6745	4.8623	5.7989	5.8932	6.1145	6.2758	6.4646
lung2	0.0018324	0.0022106	0.0028058	0.0031797	0.004484	0.005032	0.0054289	0.0060343	0.006357	0.0077517	0.0084178	0.0088158	0.0095125	0.009972	0.011387	0.011972	0.012479	0.013257	0.01366
ML_Geer	0.40401	0.46385	0.52122	0.59976	0.96002	1.0001	1.0648	1.117	1.2011	1.5595	1.6064	1.6613	1.7236	1.7985	2.1595	2.2018	2.266	2.3192	2.399
pre2	0.029001	0.036197	0.046872	0.058165	0.078702	0.1051	0.092053	0.10279	0.11392	0.13534	0.13908	0.14611	0.15826	0.16553	0.19	0.1967	0.19994	0.21073	0.22094
twotone	0.0040532	0.0050939	0.0067718	0.0082089	0.011267	0.013138	0.014554	0.016598	0.018673	0.021834	0.022788	0.024703	0.026535	0.028591	0.031556	0.033974	0.034837	0.036865	0.0382

3. Projected application of matrices from the Sparse Matrix Library.

TABLE 2.5
Cache hit ratio for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescale1	0.25101	0.29161	0.27384	0.26455	0.26937	0.27113	0.2777	0.25775	0.25693	0.25901	0.26526	0.26787	0.25668	0.26668	0.25972	0.26463	0.2619	0.25955	0.26386
CoupCons3D	0.18281	0.19676	0.19793	0.18308	0.19048	0.19431	0.17263	0.19984	0.18619	0.18794	0.18537	0.19525	0.18888	0.18187	0.1926	0.18845	0.18588	0.18596	0.18125
rajat31	0.25708	0.29257	0.23911	0.2531	0.26037	0.24803	0.24068	0.24752	0.25006	0.25711	0.25763	0.25198	0.25035	0.25369	0.2436	0.25524	0.25259	0.25186	0.25323
FullChip	0.2493	0.26065	0.24619	0.25531	0.25341	0.33282	0.60616	0.31482	0.24086	0.24399	0.24702	0.24926	0.2495	0.2459	0.25182	0.30555	0.25333	0.26164	0.25572
cage14	0.2749	0.23845	0.25603	0.25939	0.26797	0.27007	0.26735	0.26963	0.26208	0.26528	0.25448	0.29307	0.26766	0.2629	0.26919	0.26727	0.2621	0.26417	0.26617
RM07R	0.18677	0.19806	0.20682	0.21699	0.21868	0.22008	0.20946	0.21132	0.21696	0.20901	0.20912	0.21012	0.20723	0.21164	0.21091	0.21074	0.2105	0.20899	0.20424
epb3	0.69367	0.74572	0.70883	0.70836	0.71377	0.71633	0.71819	0.71786	0.71727	0.729	0.71915	0.68835	0.35069	0.40266	0.68157	0.6718	0.2791	0.72355	0.77574
qcdRealPart	0.55107	0.58033	0.53593	0.52067	0.55274	0.26933	0.5058	0.31702	0.54977	0.59499	0.59013	0.33986	0.34323	0.60007	0.59177	0.52656	0.35303	0.60815	0.60172
crashbasis	0.65236	0.64359	0.3116	0.50794	0.22688	0.56561	0.60745	0.60849	0.57357	0.33417	0.4102	0.56582	0.53795	0.49946	0.55278	0.54498	0.31433	0.54203	0.49887
Hamrle3	0.13081	0.25757	0.24554	0.25739	0.14971	0.22819	0.25512	0.28434	0.18872	0.31946	0.21728	0.34043	0.20899	0.24019	0.21847	0.22864	0.22736	0.23121	0.23139
HV15R	0.21693	0.2106	0.21707	0.21738	0.21518	0.21928	0.2212	0.22665	0.16504	0.16169	0.15954	0.15208	0.15934	0.15758	0.15604	0.15421	0.15933	0.15551	0.1491
lung2	0.37113	0.3337	0.37886	0.4385	0.68549	0.68279	0.67929	0.67549	0.22724	0.60315	0.5951	0.60118	0.59271	0.59153	0.59511	0.5895	0.60242	0.59576	0.59849
ML_Geer	0.1488	0.14575	0.14467	0.16574	0.1431	0.13701	0.14314	0.14026	0.14489	0.14262	0.14392	0.15176	0.15688	0.13428	0.13055	0.12978	0.13559	0.12915	0.12972
pre2	0.15448	0.15862	0.16249	0.21359	0.21254	0.13562	0.14387	0.15015	0.13558	0.15087	0.14175	0.15305	0.1449	0.14922	0.14251	0.15089	0.14713	0.14638	0.18119
twotone	0.74435	0.76832	0.795	0.508	0.58523	0.67006	0.64296	0.57979	0.60999	0.54678	0.61828	0.59813	0.59518	0.59225	0.59785	0.57405	0.59176	0.57773	0.6303

TABLE 2.6
Cache hit ratio for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescale1	0.29993	0.29063	0.31369	0.29251	0.2816	0.29165	0.30309	0.30391	0.27921	0.28745	0.2897	0.29035	0.29016	0.28023	0.27747	0.28573	0.2884	0.28935	0.27873
CoupCons3D	0.1378	0.17382	0.25285	0.37314	0.27025	0.28734	0.32872	0.26232	0.36399	0.29516	0.29849	0.28312	0.31073	0.3277	0.27453	0.29656	0.29569	0.31879	0.3278
rajat31	0.23851	0.31298	0.47334	0.38644	0.36211	0.39426	0.39412	0.41599	0.42747	0.39173	0.41186	0.41273	0.43975	0.41968	0.40119	0.3985	0.40396	0.42106	0.41887
FullChip	0.29214	0.27914	0.30009	0.25922	0.26361	0.26973	0.56969	0.65228	0.2898	0.27927	0.27878	0.29042	0.28165	0.28282	0.26759	0.64371	0.29738	0.35191	0.28804
cage14	0.50428	0.57591	0.54515	0.55724	0.49984	0.5408	0.56046	0.56666	0.58011	0.54271	0.56181	0.567	0.57313	0.57346	0.54544	0.55961	0.57489	0.57252	0.57385
RM07R	0.26337	0.31827	0.32605	0.41088	0.27925	0.31446	0.33377	0.40276	0.39732	0.34496	0.36276	0.36462	0.41027	0.40923	0.34879	0.37442	0.39326	0.39265	0.39992
epb3	0.71289	0.68032	0.6931	0.70462	0.72061	0.70366	0.71701	0.70218	0.69508	0.69787	0.7059	0.72854	0.34387	0.27637	0.60605	0.6046	0.41018	0.67688	0.67642
qcdRealPart	0.62966	0.66412	0.64209	0.65503	0.6104	0.57009	0.43672	0.51952	0.61894	0.62343	0.62338	0.61713	0.51609	0.61346	0.62163	0.61821	0.42159	0.6206	0.62235
crashbasis	0.65381	0.71125	0.50501	0.57691	0.4708	0.51442	0.50425	0.47044	0.45048	0.36544	0.36887	0.43963	0.49187	0.31732	0.41859	0.43366	0.4335	0.32629	0.42461
Hamrle3	0.35284	0.27924	0.3607	0.30616	0.35234	0.36345	0.32837	0.31955	0.37389	0.3421	0.35436	0.32662	0.34207	0.34224	0.34115	0.32692	0.38017	0.34294	0.34151
HV15R	0.23988	0.29397	0.38248	0.41568	0.29624	0.33476	0.35532	0.40821	0.35203	0.28306	0.29227	0.29718	0.33948	0.33588	0.29109	0.30436	0.32784	0.33847	0.3331
lung2	0.40978	0.30528	0.3049	0.35552	0.67129	0.67273	0.66196	0.65156	0.21296	0.56182	0.55811	0.55441	0.57523	0.55363	0.5353	0.50969	0.50881	0.47149	0.48574
ML_Geer	0.15881	0.20228	0.26193	0.31576	0.21017	0.22432	0.24976	0.2818	0.31633	0.23631	0.26843	0.27217	0.29542	0.30449	0.23485	0.24526	0.25825	0.27316	0.2844
pre2	0.22325	0.22522	0.31569	0.35991	0.44112	0.26299	0.30319	0.34236	0.32992	0.31282	0.31537	0.33135	0.34557	0.34662	0.3231	0.33141	0.32838	0.34349	0.35186
twotone	0.82189	0.841	0.79661	0.5845	0.57107	0.69784	0.65733	0.55827	0.5638	0.40899	0.5327	0.53086	0.52255	0.50695	0.51504	0.49742	0.50753	0.49647	0.40974

TABLE 2.7
Cache misses for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescale1	5.423e+08	7.7809e+08	1.0488e+09	1.3346e+09	1.6037e+09	1.8501e+09	2.1268e+09	2.4069e+09	2.68e+09	2.9457e+09	3.1825e+09	3.4337e+09	3.7349e+09	3.9947e+09	4.2629e+09	4.5064e+09	4.7377e+09	5.0839e+09	5.3178e+09
CoupCons3D	5.5867e+08	8.2158e+08	1.099e+09	1.3874e+09	1.6494e+09	1.9192e+09	2.2356e+09	2.4521e+09	2.7678e+09	3.0272e+09	3.2965e+09	3.5746e+09	3.8561e+09	4.1525e+09	4.3732e+09	4.6799e+09	4.9556e+09	5.2496e+09	5.5986e+09
rajat31	5.0592e+08	7.1033e+08	1.0086e+09	1.2446e+09	1.4847e+09	1.7535e+09	2.0084e+09	2.2565e+09	2.4971e+09	2.7311e+09	2.9634e+09	3.1782e+09	3.5001e+09	3.7329e+09	4.0182e+09	4.2459e+09	4.5038e+09	4.7386e+09	4.9833e+09
FullChip	8.1541e+08	1.2103e+09	1.6336e+09	2.0293e+09	2.439e+09	3.1225e+09	4.8375e+09	3.78e+09	4.0843e+09	4.4927e+09	4.8955e+09	5.2899e+09	5.7104e+09	6.056e+09	6.5307e+09	7.1162e+09	7.3643e+09	7.7697e+09	8.2017e+09
cage14	6.7747e+08	1.0466e+09	1.3755e+09	1.7131e+09	2.0262e+09	2.3729e+09	2.7283e+09	3.0463e+09	3.4184e+09	3.7375e+09	4.1058e+09	4.4525e+09	4.7599e+09	5.1565e+09	5.437e+09	5.7873e+09	6.15e+09	6.505e+09	6.8215e+09
RM07R	9.3407e+08	1.3874e+09	1.8396e+09	2.2701e+09	2.7246e+09	3.1237e+09	3.6789e+09	4.1355e+09	4.5532e+09	5.0503e+09	5.5082e+09	5.9669e+09	6.4371e+09	6.892e+09	7.3619e+09	7.8149e+09	8.2955e+09	8.7959e+09	9.3679e+09
epb3	1.1204e+06	1.2231e+06	1.9245e+06	2.5616e+06	2.8864e+06	3.4774e+06	3.6485e+06	4.3431e+06	4.7658e+06	4.7508e+06	5.455e+06	6.3105e+06	1.4226e+07	1.3974e+07	4.952e+06	5.5012e+06	3.4078e+07	8.5188e+06	6.3585e+06
qcdRealPart	7.1197e+06	9.4082e+06	1.5616e+07	2.0229e+07	2.1719e+07	3.7964e+07	1.7621e+07	5.8244e+07	3.5355e+07	3.2266e+07	3.5893e+07	6.0894e+07	6.1459e+07	4.1702e+07	4.7296e+07	5.5028e+07	7.2834e+07	4.9232e+07	5.27e+07
crashbasis	4.6621e+06	6.7538e+06	1.9539e+07	1.1541e+07	4.6567e+07	2.2543e+07	2.2022e+07	2.4907e+07	3.1573e+07	4.8305e+07	6.2837e+07	4.371e+07	8.0364e+07	3.5756e+07	5.6166e+07	6.0339e+07	8.6133e+07	6.3676e+07	8.5971e+07
Hamrle3	1.7338e+08	2.2779e+08	3.0562e+08	3.79e+08	4.92e+08	5.4918e+08	6.1647e+08	8.7685e+08	7.9145e+08	1.1091e+09	9.2815e+08	1.282e+09	1.0943e+09	1.1598e+09	1.2424e+09	1.3e+09	1.4082e+09	1.4789e+09	1.5438e+09
HV15R	6.9439e+09	1.0406e+10	1.4006e+10	1.7426e+10	2.1125e+10	2.4758e+10	2.8324e+10	3.2386e+10	3.2927e+10	3.6565e+10	4.0165e+10	4.4104e+10	4.6925e+10	5.0294e+10	5.3875e+10	5.7496e+10	6.071e+10	6.4773e+10	6.8663e+10
lung2	2.7542e+06	4.418e+06	5.2277e+06	4.5729e+06	2.4063e+06	2.8186e+06	3.3959e+06	3.799e+06	2.4059e+07	7.0049e+06	7.3727e+06	8.752e+06	9.6539e+06	1.0281e+07	1.0323e+07	1.1592e+07	1.1628e+07	1.3036e+07	1.3699e+07
ML_Geer	2.7165e+09	4.0431e+09	5.3751e+09	6.7535e+09	8.0913e+09	9.5161e+09	1.0793e+10	1.2123e+10	1.3501e+10	1.4892e+10	1.6662e+10	1.7697e+10	1.9115e+10	2.0404e+10	2.1791e+10	2.3128e+10	2.4537e+10	2.5867e+10	2.7284e+10
pre2	1.5241e+08	2.0658e+08	3.571e+08	3.9138e+08	4.902e+08	7.1621e+08	6.5026e+08	6.8062e+08	7.7815e+08	8.3343e+08	9.2144e+08	9.9237e+08	1.0616e+09	1.1453e+09	1.2389e+09	1.2927e+09	1.4062		

TABLE 2.8
Cache misses for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescal1	3.582e+08	5.8544e+08	8.7334e+08	1.2396e+09	1.5318e+09	1.6286e+09	1.8507e+09	2.1135e+09	2.534e+09	2.7619e+09	2.8719e+09	3.1047e+09	3.3882e+09	3.7811e+09	4.0818e+09	4.125e+09	4.3411e+09	4.6569e+09	5.0744e+09
CoupCons3D	2.7719e+08	3.0637e+08	2.8396e+08	2.5988e+08	5.6663e+08	5.4493e+08	5.354e+08	5.7447e+08	5.2291e+08	8.2178e+08	8.055e+08	8.4331e+08	8.3225e+08	8.0391e+08	1.1276e+09	1.0887e+09	1.118e+09	1.0936e+09	1.0873e+09
rajat31	2.5984e+08	2.5932e+08	2.3665e+08	3.7327e+08	5.7238e+08	5.7494e+08	5.9187e+08	5.8398e+08	6.5769e+08	9.0956e+08	9.0117e+08	9.1456e+08	9.0159e+08	1.0081e+09	1.2654e+09	1.257e+09	1.2771e+09	1.2632e+09	1.3583e+09
FullChip	5.1488e+08	6.545e+08	8.6019e+08	1.193e+09	1.5909e+09	1.6807e+09	2.8823e+09	4.0327e+09	2.2053e+09	2.6292e+09	2.7611e+09	2.8353e+09	3.0856e+09	3.3231e+09	3.7898e+09	7.9626e+09	3.9925e+09	4.2386e+09	4.4817e+09
cake14	3.349e+08	4.2341e+08	5.813e+08	7.1025e+08	1.0404e+09	1.0516e+09	1.1345e+09	1.262e+09	1.3722e+09	1.6977e+09	1.7217e+09	1.7893e+09	1.9434e+09	2.0811e+09	2.4329e+09	2.4484e+09	2.4904e+09	2.6313e+09	2.7713e+09
RM07R	4.29e+08	4.2189e+08	3.7227e+08	3.7696e+08	8.7929e+08	8.1799e+08	8.121e+08	7.0675e+08	7.5538e+08	1.2217e+09	1.1742e+09	1.1779e+09	1.0833e+09	1.1294e+09	1.5994e+09	1.5491e+09	1.4633e+09	1.5011e+09	1.5073e+09
epb3	7.9685e+05	1.1535e+06	1.4974e+06	1.6115e+06	1.9997e+06	2.5072e+06	2.2065e+06	2.8277e+06	3.2946e+06	3.5614e+06	3.8422e+06	3.2487e+06	8.402e+06	1.0965e+07	4.2795e+06	4.0951e+06	8.1089e+06	6.1911e+06	6.3817e+06
qcdRealPart	3.8209e+06	4.2767e+06	5.7916e+06	7.5458e+06	1.1705e+07	1.2626e+07	1.3173e+07	1.1496e+07	1.6624e+07	1.9416e+07	2.0879e+07	2.2027e+07	1.8102e+07	2.5666e+07	2.7669e+07	3.0035e+07	3.2761e+07	3.0059e+07	3.389e+07
crashbasis	3.4822e+06	3.2893e+06	1.6634e+07	1.9904e+07	3.3058e+07	3.7793e+07	4.1428e+07	6.534e+07	8.2953e+07	9.5134e+07	8.5567e+07	9.1407e+07	1.3959e+08	1.4547e+08	1.36e+08	1.3601e+08	1.3806e+08	1.7992e+08	1.7504e+08
Hamrle3	6.9866e+07	1.8467e+08	2.6701e+08	3.4394e+08	3.9774e+08	3.9688e+08	5.0151e+08	6.658e+08	6.4246e+08	8.3196e+08	7.4138e+08	9.4083e+08	9.2934e+08	1.003e+09	1.0663e+09	1.0867e+09	1.0588e+09	1.2686e+09	1.3436e+09
HV15R	3.2596e+09	3.0789e+09	2.4504e+09	2.5e+09	6.3733e+09	5.8908e+09	5.8085e+09	5.2476e+09	4.3762e+09	7.9988e+09	7.6486e+09	7.6958e+09	6.8609e+09	6.9956e+09	1.0429e+10	1.0061e+10	9.6531e+09	9.3185e+09	9.4366e+09
lung2	1.8639e+06	3.095e+06	3.5162e+06	3.0432e+06	1.5169e+06	1.6817e+06	1.9435e+06	2.1544e+06	1.3252e+06	4.4032e+06	5.1665e+06	5.2756e+06	6.48e+06	7.2376e+06	8.2132e+06	7.6432e+06	9.1413e+06	9.4847e+06	9.3357e+06
ML_Geer	1.2905e+09	1.1801e+09	9.2063e+08	8.0757e+08	2.295e+09	2.1135e+09	1.9964e+09	1.7308e+09	1.646e+09	3.1197e+09	2.911e+09	2.9176e+09	2.604e+09	2.5858e+09	3.9884e+09	3.8453e+09	3.7375e+09	3.5049e+09	3.4338e+09
pre2	7.1182e+07	9.2757e+07	9.1818e+07	1.1479e+08	1.9756e+08	2.5842e+08	2.0708e+08	2.0598e+08	2.4398e+08	3.0078e+08	3.0372e+08	3.0774e+08	3.1415e+08	3.3637e+08	4.0932e+08	4.1157e+08	4.1614e+08	4.2979e+08	4.4969e+08
twotone	2.2484e+06	2.8678e+06	5.5672e+06	1.1499e+07	1.6531e+07	1.03e+07	1.1867e+07	1.9799e+07	2.2676e+07	4.6507e+07	2.8726e+07	3.0029e+07	3.3619e+07	3.7521e+07	3.9281e+07	4.5496e+07	4.5345e+07	4.8772e+07	7.08e+07

TABLE 2.9
Ratio of average time required for each matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8	Block 9	Block 10	Block 11	Block 12	Block 13	Block 14	Block 15	Block 16	Block 17	Block 18	Block 19	Block 20
Freescal1	1.5445	2.3087	3.3393	4.6375	5.6175	6.1873	6.8927	8.0012	9.2166	10.202	10.757	11.531	12.582	13.848	14.887	15.279	16.169	17.189	18.402
CoupCons3D	1.087	1.3721	1.6072	1.793	2.7744	2.8844	3.166	3.3991	3.5855	4.5705	4.6704	4.9638	5.1701	5.3895	6.3539	6.4675	6.7401	6.9676	7.1997
rajat31	1.29	1.5491	1.9495	2.62	3.5679	3.8759	4.1216	4.505	5.1036	6.1211	6.4194	6.6631	7.0555	7.6574	8.7784	9.0118	9.3089	9.6013	10.204
FullChip	1.3516	1.7502	2.2927	2.9455	3.9412	4.284	4.7345	5.2326	5.8318	6.8389	7.267	7.6745	8.1884	8.8158	9.8225	10.012	10.559	11.132	11.751
cake14	1.5299	2.1836	2.8322	3.4017	4.3861	4.9202	5.5915	6.2328	6.861	7.8469	8.3895	9.0452	9.8149	10.269	11.221	11.755	12.375	13.075	13.734
RM07R	1.1286	1.3343	1.596	1.8068	2.803	2.9921	3.1815	3.4313	3.6771	4.6394	4.7987	4.9914	5.2725	5.4629	6.4696	6.5817	6.7853	7.0421	7.263
epb3	1.6245	1.9905	2.5381	3.027	4.152	4.8025	5.1811	5.7315	6.2038	7.4386	7.9847	8.4822	8.8656	9.5457	10.645	11.172	11.738	12.419	13.258
qcdRealPart	1.4342	1.9796	2.4885	3.1895	4.2862	4.7247	5.3718	5.9912	6.6382	7.8362	8.3525	8.8594	9.6417	10.596	11.359	12.39	12.652	13.802	14.802
crashbasis	1.5609	2.0206	2.9604	3.9033	5.3719	5.9166	6.6222	8.2937	9.3035	9.6924	10.788	11.28	14.886	14.673	14.66	16.231	17.08	18.812	19.131
Hamrle3	1.4278	2.5356	3.394	3.9427	4.9961	5.3077	6.3301	4.4768	7.9293	5.4734	9.1813	6.0411	11.302	11.793	12.851	13.113	13.937	14.974	15.566
HV15R	1.1056	1.283	1.5127	1.7414	2.732	2.8485	3.0392	3.2605	3.5178	4.4858	4.6298	4.7924	5.0246	5.258	6.2341	6.3772	6.5781	6.7416	6.9631
lung2	1.5109	1.826	2.3181	2.6281	3.6782	4.1348	4.46	4.9713	5.2423	6.3764	6.9116	7.2481	7.8159	8.1896	9.4396	9.8169	10.178	10.94	11.134
ML_Geer	1.1075	1.2718	1.4271	1.6437	2.6293	2.7602	2.9213	3.0799	3.296	4.2966	4.293	4.5767	4.729	4.9549	5.9252	6.0624	6.2181	6.3855	6.5795
pre2	1.3211	1.6365	1.5335	2.6852	3.6272	3.5108	4.2335	4.7512	5.254	6.2635	6.3882	6.7275	7.3188	7.6333	8.7871	9.0705	9.2064	9.7228	10.216
twotone	1.5235	1.9239	2.551	3.0944	4.2405	4.8725	5.4272	6.0941	6.8464	7.8857	8.3472	8.969	9.5437	10.252	11.272	11.96	12.522	13.323	13.836

TABLE 3.1
For recycled subspace dimension 10, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	4.8166e+09	9.3277e+09	1.1084e+10	1.4296e+10	1.7607e+10	2.0615e+10	2.3884e+10	2.8236e+10	3.0261e+10	3.3737e+10
CoupCons3D	1.0696e+09	1.7635e+09	2.4847e+09	3.1844e+09	3.7603e+09	5.1911e+09	5.3231e+09	5.9705e+09	6.6928e+09	7.3967e+09
rajat31	6.2393e+09	1.0415e+10	1.4568e+10	1.8666e+10	2.292e+10	2.6983e+10	3.424e+10	3.5565e+10	3.9164e+10	4.3844e+10
FullChip	4.5848e+09	9.8843e+09	1.0707e+10	1.3911e+10	1.7004e+10	2.0061e+10	2.2958e+10	2.6114e+10	2.9203e+10	3.3876e+10
cake14	1.8886e+09	3.0449e+09	4.507e+09	5.6851e+09	7.0199e+09	1.0558e+10	9.684e+09	1.0536e+10	1.2069e+10	1.324e+10
RM07R	1.5918e+09	2.6595e+09	3.856e+09	4.9841e+09	6.0768e+09	7.188e+09	8.2567e+09	9.0134e+09	1.0552e+10	1.1548e+10
epb3	1.3718e+07	1.5447e+07	1.4922e+07	1.4676e+07	2.2788e+07	9.778e+07	2.9277e+07	3.1172e+07	4.133e+07	6.9315e+07
qcdRealPart	4.825e+07	6.2639e+07	8.0614e+07	1.3145e+08	1.9169e+08	1.2771e+08	1.625e+08	1.8231e+08	2.0559e+08	2.7648e+08
crashbasis	9.664e+07	2.3184e+08	3.2799e+08	3.2089e+08	3.6349e+08	4.4872e+08	5.0056e+08	5.7362e+08	6.2245e+08	7.0404e+08
Hamrle3	8.7621e+08	1.6055e+09	2.2321e+09	2.8393e+09	4.4119e+09	4.1503e+09	4.7123e+09	5.4015e+09	6.8185e+09	6.7162e+09
HV15R	1.2931e+10	2.2391e+10	3.0259e+10	3.8848e+10	4.9013e+10	5.7079e+10	6.6387e+10	7.6397e+10	8.3251e+10	9.4543e+10
lung2	2.8035e+07	1.2147e+07	1.8222e+07	5.1748e+07	3.347e+07	4.6155e+07	5.972e+07	7.0522e+07	5.418e+07	2.1602e+08
ML_Geer	5.6769e+09	8.7618e+09	1.1714e+10	1.5724e+10	1.9209e+10	2.2829e+10	2.7676e+10	2.8766e+10	3.9429e+10	4.0429e+10
pre2	5.097e+08	8.4315e+08	1.1423e+09	2.827e+09	1.8119e+09	2.1357e+09	2.391e+09	2.8155e+09	2.9769e+09	3.5194e+09
twotone	3.7648e+07	6.0118e+07	1.1878e+08	1.0179e+08	1.6313e+08	2.8939e+08	1.582e+08	2.2154e+08	2.375e+08	2.6878e+08

TABLE 3.2

For recycled subspace dimension 10, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	3.0118e+09	7.0461e+09	8.7684e+09	1.1529e+10	1.4423e+10	1.7144e+10	2.0108e+10	2.6755e+10	2.5957e+10	2.8794e+10
CoupCons3D	3.8536e+08	4.5867e+08	8.6373e+08	1.104e+09	1.3839e+09	2.0159e+09	2.2663e+09	2.774e+09	2.9771e+09	3.2325e+09
rajat31	3.8756e+09	7.4907e+09	1.1394e+10	1.4926e+10	1.8601e+10	2.249e+10	2.5388e+10	2.9958e+10	3.342e+10	3.7372e+10
FullChip	2.8242e+09	5.1898e+09	8.1682e+09	1.0721e+10	1.3087e+10	1.5951e+10	1.837e+10	2.1226e+10	2.3663e+10	2.6756e+10
age14	1.1775e+09	2.0451e+09	3.376e+09	4.1124e+09	4.9054e+09	6.0463e+09	7.0066e+09	8.0361e+09	8.8771e+09	9.5154e+09
RM07R	5.5416e+08	6.0379e+08	1.1999e+09	1.3874e+09	1.717e+09	2.5553e+09	2.7934e+09	3.5537e+09	3.7114e+09	3.9226e+09
epb3	8.7357e+06	9.8771e+06	2.8769e+07	1.4903e+07	3.9395e+07	8.5457e+07	2.7843e+07	3.5548e+07	4.7112e+07	5.4523e+07
qcdRealPart	1.7165e+07	3.8767e+07	5.253e+07	4.0633e+07	9.0843e+07	5.2883e+07	8.8435e+07	7.4687e+07	8.4621e+07	9.191e+07
crashbasis	3.8494e+07	1.0306e+08	7.2704e+07	1.0455e+08	1.3107e+08	1.4963e+08	3.0645e+08	2.2915e+08	3.0369e+08	3.8756e+08
Hamrle3	7.548e+08	1.7275e+09	2.567e+09	3.3297e+09	4.816e+09	4.9583e+09	5.6535e+09	6.4667e+09	7.2148e+09	7.9465e+09
HV15R	5.2096e+09	6.6749e+09	1.1773e+10	1.3122e+10	1.5825e+10	1.9658e+10	2.4204e+10	2.6143e+10	3.1583e+10	2.9127e+10
lung2	2.2344e+07	9.8989e+06	1.5708e+07	2.4632e+07	3.2545e+07	5.2903e+07	5.0957e+07	6.395e+07	7.4119e+07	1.9516e+08
ML_Geer	2.2689e+09	3.1864e+09	5.2218e+09	6.2925e+09	7.0815e+09	9.3922e+09	9.5457e+09	1.5664e+10	1.6994e+10	1.395e+10
pre2	2.1977e+08	3.5409e+08	9.5249e+08	1.5485e+09	1.6914e+09	2.1195e+09	2.3771e+09	2.815e+09	2.933e+09	3.4132e+09
twotone	1.9793e+07	3.168e+07	4.0227e+07	5.6027e+07	6.2353e+07	1.5201e+08	8.724e+07	1.0752e+08	1.3248e+08	1.7429e+08

TABLE 3.3

For recycled subspace dimension 10, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.68638	1.3641	2.054	2.7365	3.4446	4.0966	4.8047	5.4758	6.1496	6.9186
CoupCons3D	0.1829	0.36772	0.54511	0.75996	0.9148	1.0927	1.2833	1.4531	1.6346	1.8321
rajat31	0.89506	1.802	2.6796	3.5803	4.5024	5.3682	6.3015	7.2532	8.0925	9.039
FullChip	0.67575	1.3532	2.0206	2.7203	3.6865	4.4323	5.0711	5.8094	6.5092	7.1157
age14	0.3589	0.71581	1.1065	1.4576	1.8345	5.4319	2.5653	2.8777	3.2403	3.5868
RM07R	0.28368	0.56256	0.84503	1.1228	1.4021	1.6707	1.9454	2.25	2.517	2.7857
epb3	0.0070167	0.013921	0.020984	0.027961	0.035944	0.041667	0.050396	0.056607	0.063756	0.071564
qcdRealPart	0.01113	0.022492	0.03368	0.045547	0.055583	0.064345	0.075589	0.084713	0.097695	0.11337
crashbasis	0.024351	0.048692	0.074747	0.10113	0.12368	0.14642	0.16403	0.19318	0.21511	0.24191
Hamrle3	0.18973	0.3975	0.58735	0.79939	0.98305	1.1962	1.3338	1.5182	1.7139	2.377
HV15R	2.1156	4.24	6.3456	8.4937	10.401	12.775	14.808	16.899	19.133	21.071
lung2	0.0090351	0.018433	0.027519	0.036812	0.046738	0.055901	0.066543	0.074158	0.083044	0.09335
ML_Geer	0.89545	1.7834	2.7029	3.5697	4.4781	5.3644	6.292	7.2683	19.76	8.9007
pre2	0.10619	0.2095	0.31937	0.4254	0.52401	0.64392	0.7429	0.85567	0.94865	1.0661
twotone	0.014946	0.029321	0.045057	0.060292	0.075702	0.13343	0.10478	0.11955	0.13471	0.15007

TABLE 3.4

For recycled subspace dimension 10, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.65714	1.3324	2.0549	2.6791	3.4489	4.0432	4.7294	5.401	6.0666	6.8585
CoupCons3D	0.10886	0.17562	0.29357	0.41426	0.50229	0.65217	0.74937	0.88146	0.97113	1.0643
rajat31	0.83209	1.6174	2.481	3.2408	4.0728	4.8947	5.6622	6.6482	7.293	8.2244
FullChip	0.60908	1.2712	1.9863	2.6178	3.2204	3.8795	4.4205	5.0905	5.6675	6.1512
age14	0.35389	0.7088	1.0932	1.4025	1.7356	2.0939	2.4346	2.7529	3.0699	3.3803
RM07R	0.16746	0.2467	0.42304	0.51359	0.65151	0.86996	0.98497	1.1906	1.2812	1.3956
epb3	0.0066919	0.012329	0.018749	0.02471	0.030873	0.037044	0.04362	0.050661	0.057193	0.063151
qcdRealPart	0.0083995	0.016462	0.024813	0.030838	0.038604	0.046945	0.05341	0.064265	0.069182	0.078103
crashbasis	0.017499	0.032754	0.052591	0.065956	0.084889	0.10076	0.11969	0.14389	0.15796	0.19694
Hamrle3	0.2109	0.48124	0.71336	0.95215	1.1767	1.4217	1.6347	1.8323	2.0458	2.3504
HV15R	1.3272	1.9967	3.4094	3.9875	4.6671	6.0485	6.6814	8.0936	8.6563	9.3457
lung2	0.0083318	0.01614	0.024678	0.032959	0.040057	0.048581	0.056613	0.06649	0.075738	0.084925
ML_Geer	0.61044	0.94682	1.6083	1.9192	2.2841	2.8737	3.2098	4.1418	9.7736	4.4896
pre2	0.081695	0.16022	0.31794	0.43853	0.55728	0.67241	0.77238	0.90872	0.99753	1.1099
twotone	0.012826	0.02289	0.036048	0.046124	0.057075	0.080577	0.080391	0.093703	0.10741	0.11859

TABLE 3.5
For recycled subspace dimension 10, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	0.17326	0.089047	0.16544	0.16539	0.16798	0.16185	0.16069	0.10686	0.16793	0.16136
CoupCons3D	0.17872	0.20269	0.23045	0.22574	0.15712	0.1356	0.21374	0.2142	0.20515	0.21299
rajat31	0.1616	0.16118	0.15334	0.15624	0.15963	0.15453	0.10645	0.16384	0.15459	0.15979
FullChip	0.1842	0.086675	0.18312	0.18015	0.18498	0.18828	0.18067	0.18806	0.18667	0.12488
cage14	0.26703	0.20574	0.25915	0.25021	0.26202	0.32725	0.26285	0.19685	0.26499	0.25507
RM07R	0.16655	0.16766	0.22552	0.22577	0.22634	0.2237	0.22397	0.16331	0.22738	0.22308
epb3	0.59068	0.53004	0.73069	0.65771	0.8278	0.42265	0.68809	0.70754	0.55343	0.63026
qcdRealPart	0.43142	0.55847	0.67837	0.377	0.28071	0.45837	0.56837	0.46943	0.44225	0.39876
crashbasis	0.29723	0.20588	0.1455	0.33559	0.25252	0.3584	0.23308	0.31739	0.32746	0.27543
Hamrle3	0.19214	0.26128	0.2557	0.24834	0.1527	0.25532	0.23947	0.24265	0.17079	0.26721
HV15R	0.21295	0.18793	0.21588	0.21932	0.13102	0.20733	0.15032	0.18991	0.17313	0.18636
lung2	0.35141	0.65508	0.65242	0.45139	0.70466	0.73183	0.65675	0.67997	0.64896	0.51712
ML_Geer	0.15448	0.21907	0.15358	0.21468	0.21839	0.22363	0.15344	0.15049	0.31815	0.12519
pre2	0.22662	0.29259	0.26366	0.080637	0.2548	0.28268	0.28704	0.27696	0.20371	0.2863
twotone	0.51731	0.43549	0.43724	0.47626	0.52867	0.28143	0.55301	0.53509	0.55762	0.53165

TABLE 3.6
For recycled subspace dimension 10, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	0.17644	0.090062	0.15845	0.16397	0.16801	0.15544	0.16498	0.10405	0.16855	0.16228
CoupCons3D	0.35236	0.38398	0.30955	0.29844	0.21641	0.22978	0.25203	0.23753	0.23971	0.25371
rajat31	0.15909	0.15044	0.15602	0.15338	0.15429	0.15656	0.11156	0.15351	0.15512	0.15997
FullChip	0.17784	0.1217	0.17867	0.1774	0.1713	0.17992	0.17434	0.17858	0.17949	0.11446
cage14	0.30984	0.2831	0.31232	0.32828	0.33902	0.3319	0.33925	0.27791	0.34329	0.3359
RM07R	0.21042	0.33496	0.33128	0.38655	0.36274	0.32077	0.32041	0.21312	0.30504	0.30969
epb3	0.51764	0.49442	0.49382	0.79863	0.51328	0.31182	0.68726	0.67323	0.73553	0.64904
qcdRealPart	0.79591	0.52785	0.50313	0.63552	0.3831	0.53811	0.43659	0.48442	0.64994	0.51535
crashbasis	0.75813	0.37702	0.37225	0.3592	0.5599	0.3977	0.27952	0.411	0.4117	0.44099
Hamrle3	0.1787	0.21104	0.2136	0.21048	0.15331	0.23834	0.22209	0.22133	0.22554	0.22323
HV15R	0.23093	0.28881	0.26732	0.28668	0.2413	0.29042	0.21728	0.29425	0.1873	0.30621
lung2	0.31936	0.65471	0.6274	0.71901	0.56343	0.66791	0.5478	0.61214	0.53719	0.52375
ML_Geer	0.24144	0.26967	0.17117	0.25748	0.25909	0.27276	0.2027	0.14582	0.22617	0.27858
pre2	0.44881	0.39397	0.27714	0.14227	0.25131	0.25731	0.25882	0.26439	0.18638	0.25863
twotone	0.57316	0.72524	0.60353	0.65947	0.63019	0.37325	0.52691	0.53323	0.624	0.53151

TABLE 3.7
For recycled subspace dimension 10, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	5.1892e+07	9.5281e+07	1.1842e+08	1.5286e+08	1.8914e+08	2.2055e+08	2.5585e+08	2.9197e+08	3.2447e+08	3.6142e+08
CoupCons3D	9.93e+06	1.6387e+07	2.3321e+07	2.8351e+07	3.437e+07	4.6734e+07	4.9535e+07	5.5706e+07	6.2724e+07	6.8768e+07
rajat31	6.8632e+07	1.1551e+08	1.6167e+08	2.0747e+08	2.5449e+08	3.0088e+08	3.8424e+08	3.9443e+08	4.322e+08	4.8692e+08
FullChip	4.8256e+07	1.0669e+08	1.1236e+08	1.4611e+08	1.9213e+08	2.2625e+08	2.5682e+08	2.9101e+08	3.2492e+08	3.731e+08
cage14	1.8737e+07	2.9519e+07	4.5044e+07	5.6656e+07	6.972e+07	1.2036e+08	9.6581e+07	1.0202e+08	1.1931e+08	1.3065e+08
RM07R	1.4095e+07	2.3981e+07	3.5327e+07	4.5603e+07	5.6377e+07	6.5976e+07	7.5941e+07	7.9805e+07	9.8021e+07	1.0535e+08
epb3	1.5392e+05	1.77e+05	2.2066e+05	1.8592e+05	2.753e+05	7.6764e+05	2.6010e+05	2.7486e+05	4.1986e+05	7.8758e+05
qcdRealPart	4.6461e+05	5.2146e+05	6.0888e+05	1.1547e+06	1.2898e+06	8.4048e+05	1.1481e+06	1.2974e+06	1.3833e+06	2.0612e+06
crashbasis	9.2379e+05	2.0546e+06	3.5329e+06	3.1479e+06	3.4013e+06	4.2382e+06	4.6008e+06	5.3107e+06	5.5071e+06	6.5258e+06
Hamrle3	8.2357e+06	1.6368e+07	2.2525e+07	2.8711e+07	4.1778e+07	4.216e+07	4.8926e+07	5.604e+07	6.8244e+07	6.9819e+07
HV15R	1.2113e+08	2.0568e+08	2.8199e+08	3.5863e+08	4.4308e+08	5.2487e+08	6.1332e+08	7.0318e+08	7.688e+08	8.7076e+08
lung2	2.8526e+05	1.4125e+05	1.8512e+05	6.3162e+05	2.9307e+05	4.8909e+05	4.6397e+05	7.2289e+05	4.4498e+05	6.5284e+05
ML_Geer	5.2366e+07	8.2972e+07	1.0728e+08	1.4887e+08	1.798e+08	2.1648e+08	2.6181e+08	2.5685e+08	4.439e+08	3.6337e+08
pre2	4.9273e+06	8.1491e+06	1.1035e+07	3.5188e+07	1.7204e+07	2.0738e+07	2.3004e+07	2.7164e+07	2.8249e+07	3.4162e+07
twotone	2.638e+05	4.4832e+05	9.9740e+05	7.5851e+05	1.3501e+06	2.6217e+06	1.0633e+06	1.7706e+06	1.8284e+06	1.9304e+06

TABLE 3.8

For recycled subspace dimension 10, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	3.3271e+07	7.6937e+07	1.0373e+08	1.3574e+08	1.7415e+08	2.0361e+08	2.4061e+08	3.0127e+08	3.1067e+08	3.4629e+08
CoupCons3D	3.4906e+06	4.0023e+06	7.6926e+06	9.5945e+06	1.303e+07	1.9634e+07	2.2411e+07	2.7742e+07	2.9644e+07	3.2704e+07
rajat31	4.286e+07	8.5062e+07	1.297e+08	1.6969e+08	2.1321e+08	2.5797e+08	2.8762e+08	3.4232e+08	3.8043e+08	4.2898e+08
FullChip	3.0255e+07	6.113e+07	9.8748e+07	1.2935e+08	1.5877e+08	1.9193e+08	2.2059e+08	2.5268e+08	2.8088e+08	3.0682e+08
cage14	1.2478e+07	2.3509e+07	3.9437e+07	4.8408e+07	5.9053e+07	7.097e+07	8.2955e+07	9.2083e+07	1.0432e+08	1.1323e+08
RM07R	4.5839e+06	3.816e+06	9.5176e+06	1.0462e+07	1.3617e+07	2.1878e+07	2.3386e+07	3.0066e+07	3.2262e+07	3.3846e+07
epb3	1.3033e+05	1.4154e+05	4.2336e+05	2.1169e+05	5.5179e+05	7.6676e+05	2.4343e+05	2.9652e+05	4.0337e+05	4.2334e+05
qcdRealPart	85004	4.0126e+05	6.1071e+05	2.7568e+05	6.1047e+05	4.2892e+05	8.8337e+05	7.3844e+05	6.4269e+05	8.0825e+05
crashbasis	3.5126e+05	8.4549e+05	8.2362e+05	1.0699e+06	1.7456e+06	1.6608e+06	2.9052e+06	2.5435e+06	3.2446e+06	4.4261e+06
Hamrle3	7.2912e+06	2.0331e+07	2.9516e+07	3.8335e+07	5.2716e+07	5.6977e+07	6.6848e+07	7.6265e+07	8.5424e+07	9.4296e+07
HV15R	4.6951e+07	5.3032e+07	1.0366e+08	1.1023e+08	1.2559e+08	1.6394e+08	1.8965e+08	2.1955e+08	2.4895e+08	2.3388e+08
lung2	2.5119e+05	1.1959e+05	1.6795e+05	2.0734e+05	3.2707e+05	4.8883e+05	4.3578e+05	4.9806e+05	5.6642e+05	7.6986e+05
ML_Geer	2.1331e+07	2.7826e+07	4.7566e+07	5.7032e+07	6.2468e+07	8.4833e+07	8.0722e+07	1.306e+08	1.9807e+08	1.2236e+08
pre2	2.0902e+06	3.2389e+06	1.0262e+07	1.7603e+07	1.8897e+07	2.358e+07	2.6751e+07	3.1662e+07	3.2738e+07	3.8753e+07
twotone	1.7498e+05	3.2708e+05	4.0568e+05	6.2663e+05	5.499e+05	1.3641e+06	7.4036e+05	9.8319e+05	1.2125e+06	1.6397e+06

TABLE 3.9

For recycled subspace dimension 10, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	1.9345	3.9549	5.9653	7.8242	10.012	11.877	13.829	15.98	17.845	20.029
CoupCons3D	1.1874	1.9318	3.2363	4.3229	5.4721	7.1627	8.1837	9.7405	10.559	11.56
rajat31	1.8535	3.5993	5.5527	7.2652	9.0633	10.989	12.546	14.891	16.282	18.239
FullChip	1.8071	3.71	5.8744	7.6312	8.8469	10.62	12.283	13.787	15.472	16.943
cage14	1.9574	3.9401	5.8101	7.6592	9.5287	4.635	13.251	15.038	17.016	18.364
RM07R	1.1826	1.7639	2.9887	3.6307	4.6805	6.1897	7.141	8.4849	9.2416	10.036
epb3	1.8782	3.5275	5.2585	7.0591	8.813	10.813	12.174	14.494	16.429	17.87
qcdRealPart	1.5807	2.9888	4.6154	5.4502	7.2169	8.881	10.29	11.193	13.255	14.188
crashbasis	1.5058	2.7758	4.1896	5.2577	6.9214	8.5609	10.382	12.054	13.454	15.558
Hamrle3	2.2081	4.6848	6.9189	9.3352	11.936	14.059	17.336	19.286	20.726	19.695
HV15R	1.2586	1.8876	3.2277	3.7226	4.4966	5.6908	6.311	7.5936	8.152	8.8597
lung2	1.8663	3.5232	5.3755	7.3799	8.7228	10.408	12.107	14.948	14.834	18.871
ML_Geer	1.3683	2.1057	3.5557	4.2986	5.0968	6.4317	7.1788	9.3676	8.9159	10.028
pre2	1.5556	3.0179	6.0045	8.2586	10.723	12.664	14.52	17.099	18.366	20.827
twotone	1.7523	3.2544	4.9347	6.2874	7.4345	7.7709	11.135	12.567	14.556	15.774

TABLE 3.10

For recycled subspace dimension 10, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	8.4254e+09	1.4048e+10	1.9727e+10	2.6193e+10	3.1069e+10	3.6503e+10	4.3684e+10	4.8923e+10	5.3794e+10	5.8874e+10
CoupCons3D	1.3463e+09	2.2606e+09	3.1302e+09	4.0465e+09	5.6824e+09	5.8129e+09	7.8601e+09	7.6587e+09	8.4925e+09	9.3477e+09
rajat31	1.1498e+10	1.9019e+10	2.9878e+10	3.6761e+10	4.1938e+10	5.3025e+10	5.7725e+10	6.5386e+10	7.794e+10	8.4381e+10
FullChip	7.5868e+09	1.263e+10	1.7682e+10	2.2604e+10	3.729e+10	3.5095e+10	3.7806e+10	4.2666e+10	4.6959e+10	5.1467e+10
cage14	3.7529e+09	4.9548e+09	6.9991e+09	8.9458e+09	1.3905e+10	1.3077e+10	1.6595e+10	2.1307e+10	1.8877e+10	2.0916e+10
RM07R	1.7814e+09	2.9938e+09	4.4913e+09	5.4069e+09	6.4996e+09	7.7363e+09	8.9148e+09	1.0154e+10	1.1232e+10	1.3278e+10
epb3	8.059e+06	1.0923e+07	1.3499e+07	1.6989e+07	1.0896e+08	2.6932e+07	3.1102e+07	4.107e+07	3.8208e+07	6.2559e+07
qcdRealPart	3.6459e+07	6.1769e+07	7.245e+07	1.1562e+08	1.7146e+08	1.4818e+08	2.0442e+08	1.784e+08	2.1395e+08	1.9549e+08
crashbasis	9.0962e+07	1.5899e+08	2.1308e+08	4.4876e+08	3.3301e+08	3.8633e+08	4.4759e+08	5.0144e+08	5.4943e+08	8.8754e+08
Hamrle3	2.0028e+09	3.4287e+09	4.8403e+09	7.9391e+09	7.5539e+09	8.8034e+09	1.3257e+10	1.4847e+10	1.322e+10	1.4276e+10
HV15R	1.6747e+10	2.3354e+10	3.3067e+10	4.4444e+10	5.5009e+10	6.2601e+10	7.4572e+10	8.5761e+10	9.196e+10	1.0172e+11
lung2	1.9931e+07	2.1417e+07	2.7169e+07	3.5985e+07	4.4979e+07	1.9306e+08	5.7832e+07	7.7981e+07	7.9952e+07	8.8444e+07
ML_Geer	1.9931e+07	2.1417e+07	2.7169e+07	3.5985e+07	4.4979e+07	1.9306e+08	5.7832e+07	7.7981e+07	7.9952e+07	8.8444e+07
pre2	9.6761e+08	1.6873e+09	2.3284e+09	3.0523e+09	3.7051e+09	4.4139e+09	5.0584e+09	7.3172e+09	6.4076e+09	9.6126e+09
twotone	2.7085e+07	6.3694e+07	8.5527e+07	1.0361e+08	1.3482e+08	1.4956e+08	1.9159e+08	1.9702e+08	4.0584e+08	2.3839e+08

TABLE 3.11

For recycled subspace dimension 10, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	5.4193e+09	1.2361e+10	1.6006e+10	2.418e+10	2.6593e+10	3.3414e+10	3.6127e+10	4.2917e+10	4.9312e+10	5.3869e+10
CoupCons3D	6.2457e+08	9.5688e+08	1.5753e+09	1.9333e+09	2.5777e+09	2.9034e+09	3.7198e+09	3.9044e+09	4.1278e+09	4.4435e+09
rajat31	7.2184e+09	1.4357e+10	2.17e+10	2.8877e+10	3.5846e+10	4.3377e+10	5.11e+10	5.7252e+10	8.0367e+10	7.2141e+10
FullChip	4.7793e+09	9.3285e+09	1.416e+10	1.8563e+10	2.2971e+10	2.7606e+10	3.2154e+10	3.6771e+10	4.0248e+10	4.7295e+10
cage14	1.9182e+09	3.3124e+09	5.2065e+09	6.6546e+09	8.1826e+09	9.9767e+09	1.4942e+10	1.344e+10	1.7684e+10	2.1165e+10
RM07R	7.2822e+08	9.9711e+08	2.3339e+09	2.0118e+09	2.2114e+09	2.9794e+09	3.2238e+09	4.0022e+09	4.1931e+09	4.4626e+09
epb3	7.3798e+06	9.2534e+06	1.4766e+07	1.4814e+07	9.9553e+07	3.1346e+07	3.3971e+07	5.1495e+07	5.1609e+07	7.676e+07
qcdRealPart	1.8342e+07	2.2285e+07	3.0331e+07	4.1744e+07	8.2673e+07	6.1626e+07	8.3594e+07	7.341e+07	8.5201e+07	8.5375e+07
crashbasis	6.125e+07	5.6162e+07	8.781e+07	2.1502e+08	1.3867e+08	1.7662e+08	2.2284e+08	2.544e+08	2.9649e+08	6.4405e+08
Hamrle3	1.452e+09	2.8952e+09	4.4533e+09	6.798e+09	7.3282e+09	8.7573e+09	1.1655e+10	1.3318e+10	1.5788e+10	1.4561e+10
HV15R	7.5653e+09	8.328e+09	1.4565e+10	1.7092e+10	2.3148e+10	2.5907e+10	2.9767e+10	3.4571e+10	3.7247e+10	4.2218e+10
lung2	9.1475e+06	1.3099e+07	2.4095e+07	3.7252e+07	5.2448e+07	1.8035e+08	6.1806e+07	9.6942e+07	1.0285e+08	1.3468e+08
ML_Geer	9.1475e+06	1.3099e+07	2.4095e+07	3.7252e+07	5.2448e+07	1.8035e+08	6.1806e+07	9.6942e+07	1.0285e+08	1.3468e+08
pre2	6.1848e+08	1.2252e+09	1.8769e+09	2.5002e+09	3.0674e+09	3.7542e+09	4.3147e+09	5.877e+09	5.5813e+09	6.5994e+09
twotone	2.177e+07	3.0841e+07	4.2884e+07	6.2161e+07	6.7828e+07	1.053e+08	1.2363e+08	1.4023e+08	3.8311e+08	1.9159e+08

TABLE 3.12

For recycled subspace dimension 10, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	1.169	2.3386	3.517	4.6616	5.9047	7.0175	8.1875	9.4437	10.654	11.867
CoupCons3D	0.23891	0.47118	0.71026	0.94671	1.1894	1.4162	1.6514	1.8991	2.1356	2.411
rajat31	1.5743	3.1712	4.6762	6.3722	7.8358	9.5155	11.108	12.635	19.365	15.817
FullChip	1.094	2.2003	3.319	4.3377	15.516	7.253	8.5216	9.5988	10.759	11.679
cage14	0.58794	1.2004	1.8323	2.4667	3.0755	3.6073	4.238	4.7676	5.2702	6.087
RM07R	0.32982	0.64563	0.97656	1.2828	1.6207	1.936	2.275	2.58	2.976	3.1977
epb3	0.010712	0.022386	0.03193	0.044756	0.053147	0.06808	0.074233	0.090715	0.09002	0.11309
qcdRealPart	0.014002	0.025721	0.039565	0.054074	0.066901	0.075165	0.090224	0.10517	0.1128	0.12849
crashbasis	0.031917	0.061519	0.10119	0.12419	0.16437	0.17674	0.21765	0.22843	0.27491	0.2865
Hamrle3	0.38965	0.83022	1.188	1.5957	1.9724	2.3824	2.7714	3.1746	3.5599	3.979
HV15R	2.3748	4.7778	7.1212	9.7314	11.99	14.286	16.701	19.094	21.392	23.76
lung2	0.014715	0.029203	0.044253	0.060471	0.074246	0.088834	0.10505	0.119	0.13502	0.14808
ML_Geer	1.1244	2.246	3.495	4.4793	5.6254	6.7424	7.906	9.1891	10.117	11.24
pre2	0.2039	0.40565	0.60363	0.81676	1.0194	1.2483	1.4409	1.663	1.8071	2.925
twotone	0.020247	0.040759	0.062369	0.082562	0.10611	0.12461	0.14644	0.16737	0.18762	0.20902

TABLE 3.13

For recycled subspace dimension 10, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	1.135	2.2854	3.5347	4.6203	5.9397	6.9697	8.0652	9.6073	10.607	11.81
CoupCons3D	0.17661	0.30606	0.48165	0.60755	0.73254	0.90123	1.0305	1.2221	1.3282	1.4591
rajat31	1.506	2.9923	4.5025	5.9889	7.408	9.0176	10.473	12.072	17.27	14.967
FullChip	1.026	2.2496	3.5075	4.5732	5.6134	6.6518	7.8024	8.8397	9.8566	10.735
cage14	0.56504	1.13	1.7421	2.31	2.8189	3.3825	3.9272	4.4371	4.9141	5.4059
RM07R	0.22535	0.35327	0.58259	0.70443	0.84323	1.0596	1.2184	1.4352	1.5718	1.6916
epb3	0.01046	0.020993	0.030341	0.041929	0.048208	0.063861	0.066447	0.08754	0.085663	0.10962
qcdRealPart	0.010736	0.019453	0.03176	0.036761	0.050533	0.056607	0.062271	0.081578	0.079052	0.1011
crashbasis	0.025797	0.045567	0.082001	0.09752	0.13318	0.14097	0.1824	0.19359	0.23901	0.24637
Hamrle3	0.39437	0.84169	1.2308	1.6723	2.0409	2.4739	2.8448	3.2537	3.6769	4.0849
HV15R	1.5714	2.517	4.1908	5.0251	6.0642	7.64	8.5277	10.236	11.016	12.06
lung2	0.014101	0.027499	0.042202	0.054655	0.06944	0.084501	0.098237	0.1137	0.12703	0.14204
ML_Geer	0.81097	1.3524	2.2171	2.7395	3.2918	4.12	4.655	5.5264	6.0228	6.5525
pre2	0.19289	0.37384	0.58761	0.78228	0.97401	1.1813	1.3599	1.5622	1.747	2.0629
twotone	0.019659	0.035778	0.053948	0.072212	0.089286	0.10911	0.12853	0.14664	0.16915	0.18564

TABLE 3.14

For recycled subspace dimension 10, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	0.17135	0.10124	0.17379	0.099004	0.17591	0.17185	0.13697	0.16131	0.17808	0.18124
CoupCons3D	0.23411	0.23479	0.23506	0.24394	0.12909	0.22368	0.12776	0.23627	0.23315	0.24082
rajat31	0.17452	0.17295	0.085412	0.13054	0.17316	0.11934	0.18179	0.18198	0.14489	0.12314
FullChip	0.14806	0.14634	0.14916	0.1469	0.19014	0.12873	0.15931	0.16562	0.13614	0.14715
cage14	0.10714	0.2046	0.21902	0.21568	0.11672	0.2249	0.104	0.088708	0.22425	0.12832
RM07R	0.30784	0.5178	0.41728	0.49556	0.43615	0.49152	0.50751	0.48584	0.51814	0.47063
epb3	0.91003	0.93231	0.92853	0.90702	0.7012	0.90193	0.91991	0.91398	0.91838	0.85581
qcdRealPart	0.7489	0.75185	0.83985	0.72539	0.64341	0.69833	0.6383	0.78093	0.75183	0.81497
crashbasis	0.67015	0.69279	0.71636	0.52211	0.69634	0.67896	0.71555	0.67064	0.7182	0.52259
Hamrle3	0.47578	0.49302	0.46881	0.36478	0.41795	0.48622	0.35726	0.36408	0.47957	0.42693
HV15R	0.37742	0.50348	0.49201	0.45156	0.43293	0.4551	0.47016	0.46798	0.48702	0.49113
lung2	0.89642	0.86734	0.89933	0.92556	0.90927	0.70785	0.89254	0.90824	0.89362	0.8873
ML_Geer	0.4853	0.4787	0.49585	0.46292	0.47733	0.47523	0.47608	0.48814	0.44664	0.46439
pre2	0.51754	0.53307	0.52297	0.51879	0.52215	0.52831	0.52787	0.46234	0.51459	0.51251
twotone	0.91524	0.82506	0.82848	0.87106	0.84293	0.87357	0.82686	0.86545	0.73469	0.85198

TABLE 3.15

For recycled subspace dimension 10, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	0.1778	0.090108	0.16752	0.10361	0.17738	0.14844	0.11036	0.18472	0.15497	0.1352
CoupCons3D	0.23969	0.26388	0.2558	0.27375	0.14834	0.25699	0.14686	0.26397	0.26105	0.26567
rajat31	0.17575	0.17194	0.16638	0.17597	0.17092	0.17564	0.15035	0.11746	0.46985	0.10539
FullChip	0.14437	0.14564	0.14573	0.14529	0.14491	0.14591	0.15634	0.17088	0.12687	0.094201
cage14	0.19171	0.26072	0.26428	0.26742	0.1934	0.2508	0.1479	0.26629	0.17331	0.1509
RM07R	0.35513	0.61506	0.44711	0.58254	0.54964	0.58623	0.60345	0.57991	0.59839	0.60463
epb3	0.86488	0.9222	0.88165	0.93347	0.67494	0.89008	0.91226	0.89589	0.89682	0.83579
qcdRealPart	0.8917	0.8932	0.83205	0.87696	0.7239	0.82196	0.76741	0.86263	0.85171	0.88173
crashbasis	0.74779	0.83038	0.77619	0.63182	0.77448	0.76461	0.74714	0.73096	0.74598	0.5439
Hamrle3	0.46019	0.47193	0.45659	0.36972	0.40054	0.4731	0.39325	0.39322	0.38301	0.41127
HV15R	0.37326	0.56857	0.5409	0.47554	0.50072	0.5145	0.52582	0.51861	0.55104	0.52258
lung2	0.88372	0.92628	0.85448	0.88641	0.83624	0.70919	0.88139	0.81998	0.86116	0.83536
ML_Geer	0.48474	0.50774	0.50243	0.47075	0.51808	0.5087	0.51092	0.45214	0.4879	0.51552
pre2	0.52258	0.51781	0.52356	0.51791	0.52557	0.51835	0.52673	0.46991	0.52534	0.51232
twotone	0.90187	0.89831	0.89297	0.86846	0.86133	0.81968	0.85332	0.84187	0.69952	0.82676

TABLE 3.16

For recycled subspace dimension 10, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescal1	9.5097e+07	1.5422e+08	2.2125e+08	2.8479e+08	3.4835e+08	4.1048e+08	4.9303e+08	5.4609e+08	6.0473e+08	6.6123e+08
CoupCons3D	1.351e+07	2.2783e+07	3.158e+07	4.0887e+07	5.402e+07	5.8667e+07	7.5093e+07	7.7049e+07	8.4496e+07	9.0354e+07
rajat31	1.298e+08	2.1747e+08	3.2553e+08	4.1015e+08	4.833e+08	5.8591e+08	6.6742e+08	7.5243e+08	9.7998e+08	9.513e+08
FullChip	8.1353e+07	1.3501e+08	1.8931e+08	2.4254e+08	4.6113e+08	4.0307e+08	4.404e+08	4.9458e+08	5.4112e+08	5.9206e+08
cage14	3.7866e+07	5.3908e+07	7.5894e+07	9.7648e+07	1.6181e+08	1.4218e+08	1.7634e+08	2.189e+08	2.0398e+08	2.2111e+08
RM07R	1.565e+07	2.7701e+07	4.1058e+07	4.9746e+07	5.9934e+07	7.1539e+07	8.2382e+07	9.3939e+07	9.8061e+07	1.2158e+08
epb3	91747	1.1139e+05	1.4019e+05	1.9981e+05	8.2678e+05	2.6808e+05	2.8738e+05	3.699e+05	3.1988e+05	5.7592e+05
qcdRealPart	2.8508e+05	4.8071e+05	4.6813e+05	9.0114e+05	1.2733e+06	1.1397e+06	1.6786e+06	1.1654e+06	1.5951e+06	1.2137e+06
crashbasis	8.0303e+05	1.4570e+06	1.8841e+06	3.7219e+06	2.881e+06	3.3696e+06	3.7031e+06	4.3108e+06	4.4561e+06	7.6855e+06
Hamrle3	2.2352e+07	3.7877e+07	5.5141e+07	9.7692e+07	8.7056e+07	1.0084e+08	1.4198e+08	1.5944e+08	1.5087e+08	1.648e+08
HV15R	1.5339e+08	2.1435e+08	3.1086e+08	4.1152e+08	5.1265e+08	5.8138e+08	6.987e+08	8.0369e+08	8.5379e+08	9.455e+08
lung2	1.6294e+05	2.3826e+05	2.3667e+05	2.8462e+05	3.2543e+05	1.4528e+06	4.9348e+05	5.7691e+05	6.6097e+05	7.9713e+05
ML_Geer	6.2427e+07	1.0438e+08	1.4246e+08	1.8085e+08	2.2881e+08	2.7215e+08	3.1575e+08	3.4962e+08	4.1482e+08	4.6559e+08
pre2	1.0427e+07	1.7777e+07	2.4649e+07	3.2528e+07	3.9316e+07	4.7756e+07	5.5187e+07	7.3488e+07	7.1139e+07	1.043e+08
twotone	1.9251e+05	4.8352e+05	6.5413e+05	7.0511e+05	8.8825e+05	9.642e+05	1.3325e+06	1.284e+06	2.8554e+06	1.6717e+06

TABLE 3.17
For recycled subspace dimension 10, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	6.1903e+07	1.3665e+08	1.9064e+08	2.725e+08	3.1819e+08	4.0302e+08	4.2558e+08	5.0614e+08	5.929e+08	6.4702e+08
CoupCons3D	6.4755e+06	1.0125e+07	1.6817e+07	2.0884e+07	2.5888e+07	3.0971e+07	3.7048e+07	4.1733e+07	4.4242e+07	4.7755e+07
rajat31	8.3117e+07	1.6659e+08	2.5318e+08	3.3828e+08	4.1904e+08	5.0861e+08	5.9961e+08	6.7141e+08	1.0449e+09	8.3356e+08
FullChip	5.1767e+07	1.1227e+08	1.7357e+08	2.2904e+08	2.8109e+08	3.3532e+08	3.9011e+08	4.4307e+08	4.8395e+08	5.7632e+08
cage14	2.2038e+07	3.9746e+07	6.1878e+07	8.0175e+07	1.0092e+08	1.1963e+08	1.6718e+08	1.6036e+08	2.1785e+08	2.3433e+08
RM07R	6.2839e+06	8.3449e+06	1.9457e+07	1.7442e+07	1.9083e+07	2.5857e+07	2.774e+07	3.5438e+07	3.6949e+07	3.8779e+07
epb3	98771	94481	1.7516e+05	1.5345e+05	8.0636e+05	3.0408e+05	2.7905e+05	4.491e+05	3.9226e+05	6.9368e+05
qcdRealPart	1.3607e+05	1.5156e+05	2.5112e+05	2.2788e+05	6.5382e+05	4.7518e+05	6.4207e+05	5.3529e+05	5.8467e+05	5.8727e+05
crashbasis	3.7458e+05	5.4892e+05	9.4203e+05	1.8741e+06	1.6258e+06	1.9349e+06	2.4549e+06	2.9259e+06	3.2842e+06	6.5087e+06
Hamrle3	1.6122e+07	3.3822e+07	5.3489e+07	7.878e+07	8.9216e+07	1.0436e+08	1.3462e+08	1.5298e+08	1.9516e+08	1.7673e+08
HV15R	6.8575e+07	7.0531e+07	1.3429e+08	1.5486e+08	2.0007e+08	2.3171e+08	2.5767e+08	3.0831e+08	3.2917e+08	3.8596e+08
lung2	1.2266e+05	1.3279e+05	2.9029e+05	2.8987e+05	5.2195e+05	1.3727e+06	5.1318e+05	8.8673e+05	8.0576e+05	1.0129e+06
ML_Geer	2.9467e+07	4.4251e+07	7.5593e+07	9.4661e+07	1.0481e+08	1.3501e+08	1.4984e+08	2.1443e+08	2.0943e+08	2.0246e+08
pre2	6.5902e+06	1.37e+07	2.0981e+07	2.8042e+07	3.4796e+07	4.2538e+07	4.8681e+07	6.3605e+07	6.3164e+07	7.4816e+07
twotone	1.4422e+05	2.5848e+05	4.0407e+05	5.025e+05	6.0709e+05	9.8959e+05	1.1101e+06	1.305e+06	2.9193e+06	1.7498e+06

TABLE 3.18
For recycled subspace dimension 10, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.9668	3.9212	6.0501	7.8734	10.052	11.995	13.823	16.06	17.99	19.835
CoupCons3D	1.4306	2.5968	3.9886	5.1004	6.1309	7.5915	8.468	10.22	11.262	11.679
rajat31	1.8954	3.7645	5.7457	7.5751	9.5226	11.357	13.198	15.23	16.015	18.917
FullChip	1.8913	4.127	6.3341	8.4225	3.7801	11.079	12.835	14.559	16.119	17.787
cage14	1.9292	3.7812	5.741	7.6154	9.2686	11.089	13.085	14.487	16.429	17.388
RM07R	1.3597	2.163	3.5716	4.2931	5.1751	6.6024	7.4579	9.0401	9.6299	10.581
epb3	1.9903	3.7599	5.696	7.4493	9.5206	11.151	13.241	15.777	17.136	19.745
qcdRealPart	1.5955	3.262	4.9202	5.6789	7.8518	9.2735	10.337	12.59	13.184	16.162
crashbasis	1.7166	3.0186	5.256	6.8295	8.5877	10.134	12.163	13.886	15.925	17.671
Hamrle3	2.0437	4.0564	6.0924	8.3458	10.104	12.589	14.134	16.383	18.428	20.397
HV15R	1.3237	2.1087	3.5427	4.2429	5.0476	6.4369	7.1059	8.5969	9.2684	10.107
lung2	1.8158	3.7863	5.8246	7.4893	8.6677	11.589	13.226	15.767	17.22	19.356
ML_Geer	1.4418	2.4156	3.8036	4.9119	5.8479	7.304	8.2276	9.5739	10.67	11.637
pre2	1.9096	3.6901	5.732	7.7147	9.6098	11.205	13.388	14.807	17.085	14.627
twotone	2.0063	3.6276	5.2567	6.7041	8.793	10.6	12.776	13.417	15.891	18.285

TABLE 3.19

For recycled subspace dimension 50, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.845e+10	3.1104e+10	4.3736e+10	5.5673e+10	7.1699e+10	8.0651e+10	9.6916e+10	1.1404e+11	1.256e+11	1.3699e+11
CoupCons3D	1.488e+09	2.5531e+09	3.5947e+09	4.6116e+09	5.6667e+09	6.6626e+09	7.634e+09	8.4108e+09	9.3489e+09	1.3915e+10
rajat31	2.5808e+10	4.3129e+10	6.0224e+10	8.1883e+10	9.3969e+10	1.1702e+11	1.284e+11	1.5112e+11	1.6974e+11	1.8616e+11
FullChip	1.8788e+10	2.7377e+10	3.7156e+10	5.1541e+10	6.5768e+10	7.31e+10	8.2365e+10	9.2972e+10	1.0401e+11	1.1859e+11
cage14	4.6529e+09	7.3143e+09	1.0503e+10	1.7106e+10	1.8652e+10	1.9391e+10	2.3814e+10	2.6756e+10	2.8137e+10	3.191e+10
RM07R	2.1015e+09	3.4819e+09	5.1096e+09	6.0105e+09	9.6375e+09	9.0774e+09	1.0444e+10	1.1861e+10	1.7048e+10	1.4583e+10
epb3	1.4224e+08	2.0767e+08	3.1908e+08	3.8633e+08	4.401e+08	7.4491e+08	5.8911e+08	8.3216e+08	7.7936e+08	8.9447e+08
qcdRealPart	1.3924e+08	2.4016e+08	3.33e+08	4.1326e+08	4.6326e+08	5.455e+08	6.9462e+08	7.5837e+08	8.6886e+08	9.6492e+08
crashbasis	3.2939e+08	4.9375e+08	7.2568e+08	9.4143e+08	1.1471e+09	1.3711e+09	1.4925e+09	1.7795e+09	2.0037e+09	2.2077e+09
Hamrle3	3.1908e+09	5.4294e+09	7.224e+09	9.7357e+09	1.1959e+10	1.4899e+10	1.8538e+10	1.8439e+10	2.0788e+10	2.7057e+10
HV15R	1.8504e+10	3.2652e+10	4.4238e+10	5.5549e+10	7.1113e+10	8.3408e+10	9.3982e+10	1.0816e+11	1.2233e+11	1.3415e+11
lung2	2.5708e+08	2.8023e+08	5.5205e+08	5.4998e+08	6.6431e+08	7.9758e+08	9.2528e+08	1.2716e+09	1.0497e+09	1.251e+09
ML_Geer	7.5277e+09	1.2449e+10	1.855e+10	2.4413e+10	3.2604e+10	3.571e+10	4.2759e+10	4.8071e+10	4.9767e+10	5.7921e+10
pre2	1.2668e+09	2.1182e+09	2.8895e+09	3.838e+09	4.6672e+09	5.3945e+09	7.9367e+09	6.7617e+09	8.1643e+09	8.312e+09
twotone	2.2151e+08	4.0532e+08	5.5621e+08	7.0215e+08	8.8157e+08	9.458e+08	1.1868e+09	1.3411e+09	1.5023e+09	2.027e+09

TABLE 3.20

For recycled subspace dimension 50, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.4657e+10	2.4576e+10	3.7106e+10	4.8882e+10	6.5505e+10	7.3418e+10	8.5653e+10	1.0444e+11	1.1022e+11	1.2317e+11
CoupCons3D	5.3212e+08	6.3492e+08	1.3776e+09	2.4814e+09	3.8514e+09	5.3413e+09	6.2097e+09	7.4306e+09	8.1886e+09	9.1708e+09
rajat31	1.6909e+10	3.3595e+10	5.06e+10	6.6984e+10	8.3661e+10	1.0018e+11	1.1733e+11	1.3633e+11	1.54e+11	1.7398e+11
FullChip	1.1001e+10	2.1372e+10	3.7243e+10	4.1921e+10	6.0763e+10	6.9946e+10	7.6812e+10	9.1008e+10	9.72e+10	1.0779e+11
cage14	3.7495e+09	7.7716e+09	1.1526e+10	1.5372e+10	1.7578e+10	2.3741e+10	2.6365e+10	3.0809e+10	3.2019e+10	3.6583e+10
RM07R	7.5075e+08	8.4861e+08	2.1248e+09	2.0494e+09	3.8873e+09	5.4823e+09	6.6009e+09	8.0391e+09	9.4544e+09	9.5933e+09
epb3	5.1826e+07	8.1866e+07	7.0983e+07	8.1587e+07	1.1866e+08	2.3606e+08	1.0477e+08	1.0982e+09	1.4228e+08	1.7642e+08
qcdRealPart	5.3728e+07	5.9885e+07	7.2537e+07	8.3024e+07	8.2124e+07	9.8427e+07	1.4076e+08	1.3093e+08	1.6202e+08	1.5905e+08
crashbasis	1.1555e+08	1.2628e+08	1.9372e+08	2.227e+08	2.6013e+08	3.2933e+08	3.0028e+08	6.3779e+08	8.9681e+08	1.125e+09
Hamrle3	3.1144e+09	7.0788e+09	9.8959e+09	1.3502e+10	1.6638e+10	2.0466e+10	2.1874e+10	2.8084e+10	2.9103e+10	3.2227e+10
HV15R	9.9962e+09	1.517e+10	2.7122e+10	3.0687e+10	3.6374e+10	4.575e+10	5.4773e+10	6.1271e+10	6.6881e+10	7.6047e+10
lung2	1.2078e+08	7.3805e+07	2.502e+08	1.2489e+08	1.4378e+08	1.5132e+08	1.8326e+08	4.0028e+08	1.7345e+08	3.2223e+08
ML_Geer	4.5994e+09	8.7325e+09	1.3931e+10	1.7161e+10	2.0522e+10	2.422e+10	2.8588e+10	3.35e+10	3.7673e+10	4.0237e+10
pre2	4.8902e+08	1.1633e+09	3.4811e+09	5.2056e+09	6.8332e+09	8.1998e+09	9.1973e+09	1.1633e+10	1.2374e+10	1.4512e+10
twotone	8.2426e+07	1.3193e+08	1.4657e+08	1.6261e+08	1.7665e+08	1.5768e+08	2.6951e+08	2.9574e+08	3.4366e+08	6.9537e+08

TABLE 3.21
For recycled subspace dimension 50, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freyscale1	2.6574	5.5329	7.9717	10.589	13.245	16.064	18.775	28.282	24.134	26.863
CoupCons3D	0.30937	0.62358	0.94484	1.2397	1.5661	1.8692	2.1974	2.492	2.8225	3.1163
rajat31	3.649	7.2346	10.772	14.579	17.937	21.557	25.135	29.153	32.777	36.368
FullChip	2.3717	4.7178	7.1312	9.538	16.598	14.547	17.163	19.612	22.079	24.21
cage14	0.95935	1.9098	2.8702	5.255	4.7678	5.7445	6.7289	7.6426	8.5555	9.5288
RM07R	0.40217	0.80714	1.2075	1.5984	2.0161	2.4085	2.8187	3.1911	7.386	3.9998
epb3	0.037707	0.077898	0.11315	0.15201	0.19067	0.22632	0.26504	0.30477	0.33917	0.38365
qcdRealPart	0.033153	0.06549	0.098232	0.13036	0.16473	0.19324	0.23353	0.26026	0.29658	0.33286
crashbasis	0.081126	0.1593	0.24321	0.31981	0.40475	0.50063	0.59351	0.66551	0.75266	0.83127
Hamrle3	0.72642	1.4587	2.2102	2.9132	3.7381	4.4469	5.1274	5.9638	6.6829	7.3792
HV15R	3.1303	6.2078	9.393	12.417	15.684	18.625	21.814	25.103	27.983	31.247
lung2	0.049575	0.10087	0.15215	0.20184	0.25232	0.30136	0.35618	0.39984	0.45611	0.49597
ML_Geer	1.4956	2.9923	4.4525	5.9921	7.4292	8.8858	10.373	11.964	13.522	14.9
pre2	0.30943	0.61572	0.92712	1.2384	1.5514	1.8673	2.1925	2.5601	2.7973	3.0992
twotone	0.061469	0.12217	0.18698	0.24295	0.31255	0.37244	0.42467	0.49342	0.5504	0.60458

TABLE 3.22
For recycled subspace dimension 50, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freyscale1	2.6414	5.3231	7.9543	10.543	13.184	15.977	18.614	21.764	24.055	26.705
CoupCons3D	0.212	0.35194	0.62448	0.95138	1.34	1.7223	2.065	2.4054	2.6854	2.9581
rajat31	3.5756	7.0098	10.541	14.209	17.468	21.051	24.46	28.393	31.901	35.372
FullChip	2.3249	4.643	7.0956	9.4048	16.042	14.017	16.495	18.88	21.237	23.23
cage14	1.06	2.2256	3.3102	6.0324	5.3913	6.5239	7.5328	8.6633	9.6966	10.683
RM07R	0.26067	0.41684	0.67676	0.9504	1.3786	1.9101	2.2195	2.5635	5.911	3.1726
epb3	0.030513	0.055008	0.079843	0.1022	0.12793	0.15093	0.17829	0.20084	0.22595	0.25388
qcdRealPart	0.024139	0.042431	0.062392	0.076616	0.098997	0.11494	0.13837	0.15535	0.16883	0.19438
crashbasis	0.06439	0.11267	0.16587	0.2119	0.27313	0.32939	0.38328	0.49711	0.59569	0.693
Hamrle3	0.88073	1.8776	2.7942	3.669	4.6546	5.5583	6.3693	7.4201	8.2335	9.1134
HV15R	2.4424	4.1619	6.699	8.2864	10.12	12.45	14.179	16.75	18.298	20.133
lung2	0.039943	0.071438	0.10361	0.13402	0.16336	0.19797	0.23084	0.26331	0.29707	0.33194
ML_Geer	1.3225	2.4587	3.8239	4.9079	5.9756	7.2788	8.3639	9.7968	10.855	11.865
pre2	0.24061	0.53298	1.1391	1.6122	2.0677	2.4839	2.9054	3.3441	3.76	4.1065
twotone	0.048379	0.083865	0.12288	0.15842	0.19518	0.23359	0.27053	0.30718	0.35583	0.40398

TABLE 3.23
For recycled subspace dimension 50, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freyscale1	0.098186	0.15174	0.13903	0.14543	0.11912	0.14124	0.12612	0.15286	0.10234	0.11325
CoupCons3D	0.17369	0.23329	0.23286	0.23075	0.23038	0.22903	0.1799	0.1694	0.17354	0.12605
rajat31	0.14604	0.14665	0.14277	0.10283	0.13938	0.099436	0.14048	0.12409	0.11393	0.13476
FullChip	0.083162	0.15448	0.1101	0.13831	0.12803	0.1223	0.16453	0.15942	0.16048	0.11984
cage14	0.24597	0.23176	0.24314	0.16648	0.17204	0.2401	0.22584	0.16552	0.24138	0.21168
RM07R	0.23636	0.23859	0.15858	0.17564	0.13224	0.24135	0.23867	0.23535	0.22262	0.23463
epb3	0.36276	0.40897	0.30457	0.35187	0.36845	0.19893	0.27359	0.17681	0.32407	0.35284
qcdRealPart	0.2768	0.40335	0.37327	0.3602	0.22979	0.22354	0.2432	0.31077	0.29718	0.29338
crashbasis	0.31766	0.2171	0.29473	0.32102	0.29976	0.28932	0.22098	0.27063	0.28004	0.27753
Hamrle3	0.25581	0.23035	0.17581	0.23452	0.23968	0.20501	0.17505	0.23532	0.24068	0.16514
HV15R	0.20932	0.15771	0.13283	0.21243	0.15067	0.15947	0.18946	0.16264	0.15788	0.19282
lung2	0.16896	0.2715	0.17883	0.32423	0.30171	0.33348	0.32207	0.20363	0.23586	0.29912
ML_Geer	0.15833	0.16093	0.22392	0.20537	0.15603	0.18446	0.15993	0.17727	0.23185	0.16959
pre2	0.27492	0.27175	0.28333	0.27707	0.28235	0.27556	0.16409	0.20462	0.26957	0.19887
twotone	0.22789	0.24285	0.29672	0.28848	0.3342	0.24207	0.23543	0.31689	0.31175	0.2086

TABLE 3.24

For recycled subspace dimension 50, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.072114	0.14591	0.13773	0.14369	0.085936	0.14272	0.14279	0.10481	0.14529	0.13824
CoupCons3D	0.23367	0.41012	0.33576	0.28105	0.24405	0.21762	0.16777	0.15072	0.15521	0.15168
rajat31	0.14385	0.14517	0.14436	0.14003	0.13947	0.13881	0.14258	0.13292	0.13588	0.11448
FullChip	0.15263	0.14492	0.079354	0.10475	0.13447	0.10103	0.14032	0.098699	0.12843	0.14528
cage14	0.23126	0.22835	0.2232	0.18427	0.18587	0.19756	0.22521	0.20487	0.23702	0.16755
RM07R	0.30091	0.43419	0.2264	0.30485	0.22033	0.26885	0.25337	0.24078	0.23246	0.24709
epb3	0.52175	0.46888	0.433	0.53254	0.52336	0.35443	0.58377	0.096141	0.59988	0.63629
qcdRealPart	0.29914	0.52861	0.4759	0.53459	0.60142	0.51699	0.62482	0.60216	0.62753	0.61948
crashbasis	0.25886	0.47144	0.44483	0.46004	0.53931	0.52566	0.50853	0.48626	0.43809	0.38658
Hamrle3	0.20131	0.18649	0.13194	0.19288	0.19292	0.12959	0.13894	0.16306	0.20371	0.19641
HV15R	0.1943	0.15162	0.1719	0.21303	0.22544	0.2227	0.15535	0.2117	0.21787	0.15778
lung2	0.24052	0.45975	0.36785	0.55317	0.59094	0.6183	0.59856	0.4012	0.60907	0.47081
ML_Geer	0.14382	0.13534	0.19911	0.21828	0.22158	0.14501	0.2241	0.22366	0.16585	0.22646
pre2	0.37749	0.34281	0.24599	0.23101	0.2238	0.22055	0.21891	0.13637	0.22771	0.13457
twotone	0.34534	0.49283	0.57834	0.58718	0.57545	0.59014	0.49622	0.56877	0.58327	0.36863

TABLE 3.25

For recycled subspace dimension 50, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	2.1372e+08	3.5988e+08	5.1313e+08	6.5359e+08	8.439e+08	9.4526e+08	1.1178e+09	1.4807e+09	1.4437e+09	1.5871e+09
CoupCons3D	1.5289e+07	2.6986e+07	3.7948e+07	4.9059e+07	5.995e+07	7.087e+07	7.6972e+07	8.7528e+07	9.6384e+07	1.5239e+08
rajat31	3.0223e+08	5.0729e+08	7.1151e+08	9.3752e+08	1.1122e+09	1.3482e+09	1.5165e+09	1.7534e+09	1.9718e+09	2.1705e+09
FullChip	2.037e+08	3.1457e+08	4.2074e+08	5.9327e+08	8.5717e+08	8.5879e+08	9.7395e+08	1.0968e+09	1.2299e+09	1.3784e+09
cage14	5.2583e+07	8.2039e+07	1.1868e+08	2.0825e+08	2.1089e+08	2.1944e+08	2.6963e+08	2.8895e+08	3.1863e+08	3.6081e+08
RM07R	2.0685e+07	3.4514e+07	4.8727e+07	5.8462e+07	1.0458e+08	9.0973e+07	1.037e+08	1.1704e+08	1.9729e+08	1.458e+08
epb3	1.796e+06	2.3955e+06	3.7155e+06	4.5148e+06	4.9459e+06	7.5864e+06	6.5778e+06	1.0241e+07	8.9406e+06	1.0312e+07
qcdRealPart	1.4216e+06	2.57e+06	3.5111e+06	4.2702e+06	4.591e+06	5.4675e+06	7.1723e+06	7.7885e+06	8.9504e+06	9.8153e+06
crashbasis	3.6761e+06	5.2653e+06	7.886e+06	1.045e+07	1.2656e+07	1.6137e+07	1.7354e+07	2.0872e+07	2.3748e+07	2.5959e+07
Hamrle3	3.75e+07	6.5828e+07	8.5949e+07	1.1714e+08	1.4465e+08	1.8255e+08	2.2244e+08	2.2273e+08	2.5002e+08	3.0147e+08
HV15R	1.8621e+08	3.3328e+08	4.2961e+08	5.6275e+08	6.9313e+08	8.2243e+08	9.5055e+08	1.0632e+09	1.2139e+09	1.3207e+09
lung2	2.6994e+06	3.2338e+06	4.7125e+06	6.366e+06	7.831e+06	9.2869e+06	1.0711e+07	1.3536e+07	1.2134e+07	1.4631e+07
ML_Geer	7.731e+07	1.2673e+08	1.9252e+08	2.5006e+08	3.2608e+08	3.7228e+08	4.2674e+08	4.8259e+08	5.1872e+08	5.8483e+08
pre2	1.4795e+07	2.4955e+07	3.3585e+07	4.4785e+07	5.4618e+07	6.3252e+07	8.5383e+07	7.8282e+07	9.6058e+07	9.6649e+07
twotone	2.4574e+06	4.6225e+06	6.2921e+06	8.0682e+06	9.9493e+06	1.0429e+07	1.3411e+07	1.5416e+07	1.7092e+07	2.1005e+07

TABLE 3.26

For recycled subspace dimension 50, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.6155e+08	2.952e+08	4.4507e+08	5.8623e+08	7.5743e+08	8.8266e+08	1.0318e+09	1.2016e+09	1.3273e+09	1.4801e+09
CoupCons3D	5.247e+06	6.1858e+06	1.3757e+07	2.7097e+07	4.4231e+07	6.1719e+07	7.1837e+07	8.5857e+07	9.4907e+07	1.0726e+08
rajat31	1.9906e+08	3.9963e+08	6.0278e+08	7.9721e+08	9.979e+08	1.1911e+09	1.3999e+09	1.6167e+09	1.828e+09	2.0361e+09
FullChip	1.2669e+08	2.5519e+08	4.1747e+08	4.9746e+08	7.8825e+08	8.0686e+08	9.2202e+08	1.0631e+09	1.1675e+09	1.2854e+09
cage14	4.314e+07	9.3735e+07	1.3968e+08	2.0137e+08	2.1272e+08	2.934e+08	3.2069e+08	3.6554e+08	3.9244e+08	4.4093e+08
RM07R	7.1573e+06	7.1378e+06	1.6699e+07	1.7794e+07	3.4484e+07	5.7037e+07	7.1153e+07	8.7777e+07	1.1868e+08	1.0514e+08
epb3	5.4563e+05	9.7261e+05	8.4118e+05	9.1448e+05	1.3738e+06	2.2148e+06	1.1214e+06	1.6004e+07	1.59e+06	1.9298e+06
qcdRealPart	5.5082e+05	5.4429e+05	7.8619e+05	7.9322e+05	7.8205e+05	9.6267e+05	1.5407e+06	1.4258e+06	1.6323e+06	1.6776e+06
crashbasis	1.3118e+06	1.4423e+06	2.3486e+06	2.6394e+06	3.2365e+06	3.98e+06	3.5097e+06	7.4907e+06	1.0266e+07	1.2845e+07
Hamrle3	3.6163e+07	8.7434e+07	1.2096e+08	1.666e+08	2.0629e+08	2.4848e+08	2.6818e+08	3.5204e+08	3.6121e+08	4.0043e+08
HV15R	1.0476e+08	1.5243e+08	2.7646e+08	3.2022e+08	3.798e+08	4.7728e+08	5.4577e+08	6.339e+08	6.9181e+08	7.7586e+08
lung2	1.1803e+06	7.9906e+05	1.1647e+06	1.5501e+06	1.637e+06	1.7679e+06	2.0685e+06	3.3741e+06	1.7525e+06	3.2656e+06
ML_Geer	4.8826e+07	9.4529e+07	1.5499e+08	1.9166e+08	2.2863e+08	2.6604e+08	3.1791e+08	3.7469e+08	4.205e+08	4.4947e+08
pre2	5.7251e+06	1.3116e+07	4.1593e+07	6.3437e+07	8.4298e+07	1.0102e+08	1.1328e+08	1.3579e+08	1.5343e+08	1.693e+08
twotone	8.8728e+05	1.4839e+06	1.7345e+06	1.8633e+06	2.0072e+06	1.6872e+06	2.6961e+06	3.2772e+06	3.7952e+06	5.9267e+06

TABLE 3.27

For recycled subspace dimension 50, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	1.9876	3.8487	5.958	7.9359	9.9411	11.911	13.885	11.968	17.941	19.867
CoupCons3D	1.3719	2.2488	3.9446	6.0397	8.6156	11.077	13.225	15.54	17.127	19.206
rajat31	1.9622	3.8587	5.8741	7.7953	9.703	11.706	13.597	15.584	17.554	19.473
FullChip	1.9592	3.9354	5.9797	7.876	9.7969	11.718	13.607	15.577	17.509	19.372
cage14	2.1688	4.6177	7.0986	9.0439	11.33	13.527	15.944	18.156	20.262	22.294
RM07R	1.2969	2.0647	3.3928	4.6856	6.7715	9.6136	10.947	12.841	14.506	16.087
epb3	1.65	2.8929	4.2245	5.3876	6.7823	8.1386	9.5221	10.761	11.472	13.347
qcdRealPart	1.4506	2.6013	3.619	4.7313	6.0404	7.129	8.4815	9.6391	10.184	11.311
crashbasis	1.5858	2.8244	4.1046	5.3208	6.6912	7.8921	8.974	11.942	13.861	16.51
Hamrle3	2.429	5.1723	7.56	10.236	12.726	15.201	17.052	19.92	22.694	24.842
HV15R	1.5536	2.6795	4.2886	5.3292	6.4742	7.9959	9.1021	10.654	11.729	13.041
lung2	1.6135	2.8942	4.104	5.2416	6.539	7.8373	9.0242	10.291	11.767	13.476
ML_Geer	1.7683	3.2611	5.1827	6.5281	8.0507	9.9541	11.167	12.958	14.56	16.047
pre2	1.568	3.4801	7.3869	10.294	13.504	15.882	18.75	20.576	24.263	26.596
twotone	1.604	2.7386	3.9833	5.1867	6.269	7.6663	9.0502	10.009	11.539	13.358

TABLE 3.28

For recycled subspace dimension 50, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	3.8667e+10	6.5584e+10	8.6219e+10	1.1029e+11	1.3704e+11	1.6137e+11	1.8779e+11	2.1372e+11	2.3974e+11	2.6538e+11
CoupCons3D	3.8271e+09	6.5567e+09	7.6624e+09	1.1512e+10	1.2093e+10	1.3468e+10	1.6546e+10	1.8839e+10	2.1777e+10	2.3426e+10
rajat31	5.5088e+10	8.7052e+10	1.2329e+11	1.5735e+11	1.9201e+11	2.2491e+11	2.6376e+11	2.978e+11	3.3371e+11	3.9455e+11
FullChip	3.1498e+10	5.6811e+10	7.3288e+10	9.4316e+10	1.1834e+11	1.3977e+11	1.6361e+11	1.847e+11	2.0087e+11	2.2225e+11
cage14	1.0339e+10	1.6591e+10	2.3304e+10	3.0211e+10	3.6565e+10	4.4123e+10	5.073e+10	5.7028e+10	7.0722e+10	7.1887e+10
RM07R	3.496e+09	5.8567e+09	8.171e+09	1.054e+10	1.6215e+10	1.5079e+10	1.7454e+10	1.9739e+10	2.2111e+10	2.8414e+10
epb3	3.3062e+08	5.5211e+08	7.4812e+08	9.8797e+08	1.4491e+09	1.4306e+09	1.6395e+09	1.8902e+09	2.074e+09	2.356e+09
qcdRealPart	1.3399e+08	1.9562e+08	2.8461e+08	3.7503e+08	6.9127e+08	5.2478e+08	6.2531e+08	7.1302e+08	7.3866e+08	1.3729e+09
crashbasis	9.1348e+08	1.5159e+09	2.1109e+09	2.7317e+09	3.342e+09	5.3347e+09	4.6053e+09	7.0914e+09	5.7931e+09	6.4295e+09
Hamrle3	8.5063e+09	1.507e+10	2.0258e+10	3.2759e+10	3.8556e+10	4.1004e+10	5.0274e+10	5.5483e+10	5.4775e+10	6.268e+10
HV15R	2.9422e+10	4.6241e+10	6.0462e+10	8.5996e+10	9.814e+10	1.2385e+11	1.4099e+11	1.6197e+11	1.7652e+11	1.916e+11
lung2	5.6153e+08	9.2343e+08	1.2979e+09	1.731e+09	2.0296e+09	2.4027e+09	2.9045e+09	3.1764e+09	3.6289e+09	3.9312e+09
ML_Geer	5.6153e+08	9.2343e+08	1.2979e+09	1.731e+09	2.0296e+09	2.4027e+09	2.9045e+09	3.1764e+09	3.6289e+09	3.9312e+09
pre2	3.8428e+09	8.0592e+09	9.119e+09	1.1726e+10	1.4339e+10	1.6915e+10	2.2495e+10	2.2377e+10	2.4721e+10	2.7553e+10
twotone	6.9634e+08	1.1588e+09	1.6024e+09	2.0604e+09	2.4241e+09	3.0054e+09	3.4089e+09	3.8297e+09	4.1758e+09	4.786e+09

TABLE 3.29

For recycled subspace dimension 50, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	2.3478e+10	4.8709e+10	7.3424e+10	1.0141e+11	1.242e+11	1.4895e+11	1.7482e+11	1.9947e+11	2.2264e+11	2.433e+11
CoupCons3D	2.5291e+09	4.2364e+09	6.8256e+09	6.7467e+09	8.7735e+09	1.0965e+10	1.2507e+10	1.4359e+10	1.5901e+10	1.8405e+10
rajat31	3.4064e+10	6.9165e+10	1.0295e+11	1.3819e+11	1.7313e+11	2.0789e+11	2.4211e+11	2.8113e+11	3.1224e+11	3.6889e+11
FullChip	2.0746e+10	4.1059e+10	6.1794e+10	8.8941e+10	1.0264e+11	1.2247e+11	1.4315e+11	1.6257e+11	1.8172e+11	2.0557e+11
cage14	6.5075e+09	1.2798e+10	1.9201e+10	2.822e+10	3.4977e+10	3.8632e+10	4.944e+10	5.7438e+10	5.7644e+10	6.7015e+10
RM07R	1.8864e+09	3.301e+09	5.1815e+09	6.6544e+09	8.9953e+09	9.8597e+09	1.132e+10	1.3188e+10	1.451e+10	1.6003e+10
epb3	2.144e+08	4.2393e+08	6.4603e+08	8.3236e+08	1.5068e+09	1.2565e+09	1.4613e+09	1.6605e+09	1.8405e+09	2.1171e+09
qcdRealPart	6.0522e+07	6.8109e+07	9.8917e+07	1.2187e+08	3.959e+08	1.5767e+08	2.036e+08	2.2508e+08	2.0579e+08	6.0596e+08
crashbasis	5.9771e+08	1.1747e+09	1.749e+09	2.3402e+09	2.9224e+09	4.515e+09	4.1338e+09	6.1139e+09	5.3085e+09	5.8997e+09
Hamrle3	5.8767e+09	1.5656e+10	2.0721e+10	2.3983e+10	2.9549e+10	3.8845e+10	4.1051e+10	5.0031e+10	5.5926e+10	6.7534e+10
HV15R	1.4981e+10	2.541e+10	4.0943e+10	5.4593e+10	6.3956e+10	8.3567e+10	8.9397e+10	1.0329e+11	1.1739e+11	1.2877e+11
lung2	3.7503e+08	7.2768e+08	1.1071e+09	1.5072e+09	1.7928e+09	2.716e+09	2.6602e+09	2.9217e+09	3.3683e+09	3.6642e+09
ML_Geer	3.7503e+08	7.2768e+08	1.1071e+09	1.5072e+09	1.7928e+09	2.716e+09	2.6602e+09	2.9217e+09	3.3683e+09	3.6642e+09
pre2	2.5592e+09	5.677e+09	7.77e+09	1.0292e+10	1.2866e+10	1.54e+10	1.9895e+10	2.0487e+10	2.3112e+10	2.5608e+10
twotone	4.4942e+08	8.8895e+08	1.2972e+09	1.7444e+09	2.0833e+09	2.6522e+09	3.0129e+09	3.4125e+09	4.6245e+09	4.2607e+09

TABLE 3.30

For recycled subspace dimension 50, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescale1	5.3044	10.304	15.507	20.66	25.774	30.727	36.148	41.271	46.27	51.559
CoupCons3D	0.63031	1.2557	1.9472	2.5457	3.1563	3.8208	4.3856	5.258	5.6711	6.3065
rajat31	6.9893	14.145	21.109	28.094	34.828	41.779	48.791	56.129	63.282	94.086
FullChip	4.4802	9.0198	13.47	18.045	23.246	27.833	32.566	45.392	41.681	46.657
cage14	2.0643	4.0575	6.1605	8.0195	10.145	12.102	14.487	16.383	18.511	20.671
RM07R	0.70189	1.395	2.0569	2.8097	3.4202	4.1762	4.7663	5.5254	6.1172	6.9027
epb3	0.088415	0.16822	0.25932	0.34948	0.43462	0.51274	0.62352	0.6835	0.79577	0.8595
qcdRealPart	0.044256	0.086436	0.12491	0.17752	0.21864	0.26012	0.30775	0.34375	0.38704	0.42823
crashbasis	0.19217	0.39571	0.58183	0.79637	0.96452	1.3473	1.5392	1.7872	1.935	2.2578
Hamrle3	1.7859	3.5383	5.4444	7.0495	8.8692	10.577	12.423	14.099	15.922	17.634
HV15R	4.5111	8.9187	13.402	18.028	22.374	27.277	31.766	36.634	40.365	44.721
lung2	0.12601	0.25031	0.38108	0.52365	0.64905	0.786	1.2159	1.0408	1.1631	1.303
ML_Geer	2.5594	5.1371	7.694	10.318	12.982	15.45	18.102	20.728	23.264	25.988
pre2	0.79411	1.6025	2.3982	3.298	4.0072	4.9662	5.7994	6.7486	7.4228	8.2783
twotone	0.1508	0.29956	0.45433	0.59997	0.74892	0.90382	1.0572	1.202	1.3596	1.51

TABLE 3.31

For recycled subspace dimension 50, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescale1	5.1367	10.27	15.475	20.61	25.798	30.77	36.059	41.278	46.333	51.572
CoupCons3D	0.57151	1.0874	1.7165	2.2067	2.6917	3.3138	3.7451	4.3926	4.8636	5.4064
rajat31	6.9468	13.89	20.953	27.786	34.38	41.331	48.218	55.486	62.59	93.665
FullChip	4.4054	9.0649	13.639	18.213	22.698	27.162	31.883	38.889	40.721	45.518
cage14	2.0092	4.0067	6.045	7.8949	10.075	12.165	14.222	16.019	18.115	20.274
RM07R	0.5926	1.0847	1.656	2.2698	2.634	3.2764	3.7043	4.3277	4.7683	5.339
epb3	0.084723	0.16556	0.26326	0.32843	0.426	0.49883	0.59824	0.65689	0.77963	0.83673
qcdRealPart	0.036018	0.071506	0.097589	0.14058	0.17122	0.20411	0.25137	0.26631	0.3132	0.32482
crashbasis	0.19582	0.40652	0.57091	0.78951	0.96896	1.3127	1.4847	1.7601	1.901	2.1942
Hamrle3	1.7595	3.5897	5.3684	7.0794	8.911	10.6	12.475	14.234	16.044	17.815
HV15R	3.7028	6.6928	10.518	13.59	16.583	20.567	23.319	27.201	30.013	32.972
lung2	0.12625	0.24887	0.38115	0.51575	0.63522	0.77673	1.1916	1.0066	1.1568	1.2668
ML_Geer	2.263	4.2459	6.5588	8.5768	10.642	12.854	14.892	17.301	19.225	21.394
pre2	0.78533	1.5846	2.4409	3.2498	4.0596	4.8391	5.6629	6.4636	7.2806	8.0912
twotone	0.15043	0.29334	0.43611	0.58403	0.72009	0.88566	1.0265	1.1524	1.3129	1.4513

TABLE 3.32

For recycled subspace dimension 50, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescale1	0.1296	0.12615	0.16244	0.15868	0.1499	0.15055	0.13754	0.13904	0.13526	0.13736
CoupCons3D	0.1183	0.12937	0.14199	0.12285	0.22626	0.14979	0.2238	0.23321	0.19434	0.20554
rajat31	0.11852	0.15407	0.11161	0.14762	0.13304	0.12636	0.14291	0.17069	0.12653	0.11116
FullChip	0.13858	0.095209	0.13405	0.13405	0.14911	0.11499	0.11654	0.10671	0.094866	0.11226
cage14	0.18668	0.18077	0.20129	0.18586	0.18827	0.19822	0.19931	0.20071	0.14809	0.20395
RM07R	0.20072	0.47184	0.48208	0.48827	0.37813	0.48703	0.47703	0.47659	0.46793	0.41447
epb3	0.57988	0.52923	0.54856	0.54007	0.45029	0.47943	0.54951	0.53992	0.55854	0.473
qcdRealPart	0.6754	0.70073	0.68323	0.6784	0.51201	0.63434	0.69375	0.64185	0.6975	0.50371
crashbasis	0.435	0.5076	0.48167	0.45097	0.48364	0.39656	0.49693	0.39166	0.48891	0.43995
Hamrle3	0.41302	0.38911	0.48345	0.36607	0.38213	0.42343	0.3889	0.38522	0.47985	0.47025
HV15R	0.42147	0.4427	0.48528	0.40197	0.41451	0.42815	0.44316	0.43984	0.45129	0.45462
lung2	0.50554	0.51771	0.51096	0.51502	0.51242	0.49332	0.55221	0.51861	0.50915	0.51248
ML_Geer	0.44376	0.41216	0.46258	0.46818	0.46239	0.46438	0.46244	0.46893	0.44968	0.48633
pre2	0.49702	0.43683	0.49049	0.51266	0.49638	0.5044	0.45782	0.50938	0.50241	0.50575
twotone	0.51013	0.5306	0.53475	0.52823	0.51402	0.52658	0.52496	0.52868	0.50635	0.53054

TABLE 3.33

For recycled subspace dimension 50, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.10303	0.16501	0.12448	0.10661	0.12784	0.13383	0.12924	0.13831	0.13343	0.14579
CoupCons3D	0.11926	0.13475	0.1201	0.15691	0.23669	0.13512	0.22783	0.22039	0.13693	0.13113
rajat31	0.16669	0.087674	0.15555	0.13574	0.12606	0.12814	0.13256	0.14305	0.12096	0.11481
FullChip	0.13674	0.13068	0.13214	0.091109	0.14952	0.13893	0.14186	0.11941	0.11138	0.10305
cage14	0.20726	0.19281	0.21002	0.16009	0.10801	0.21541	0.10755	0.10146	0.22175	0.1849
RM07R	0.19833	0.49549	0.49212	0.51846	0.44244	0.50246	0.49509	0.49635	0.49067	0.50257
epb3	0.57201	0.5678	0.569	0.53824	0.43475	0.48171	0.55919	0.53421	0.55696	0.47777
qcdRealPart	0.74022	0.81692	0.79088	0.82774	0.56906	0.79671	0.82133	0.80382	0.85147	0.65237
crashbasis	0.42671	0.51266	0.485	0.45014	0.49304	0.39922	0.49798	0.40385	0.49156	0.43724
Hamrle3	0.40645	0.34335	0.38023	0.45625	0.46792	0.39003	0.46595	0.44465	0.42369	0.38464
HV15R	0.38447	0.39926	0.39084	0.44856	0.41724	0.41886	0.46339	0.46678	0.443	0.4636
lung2	0.50929	0.53255	0.51191	0.51244	0.52404	0.45512	0.54826	0.51261	0.50909	0.50559
ML_Geer	0.4487	0.45893	0.45798	0.47268	0.4703	0.46927	0.46815	0.43196	0.45931	0.45126
pre2	0.49071	0.45707	0.49226	0.49667	0.50011	0.50042	0.47183	0.50044	0.50067	0.50141
twotone	0.56329	0.5298	0.53576	0.52689	0.51249	0.52873	0.5358	0.53292	0.47332	0.53128

TABLE 3.34

For recycled subspace dimension 50, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	4.5436e+08	7.5377e+08	1.0238e+09	1.3057e+09	1.6246e+09	1.91e+09	2.2013e+09	2.5118e+09	2.815e+09	3.1335e+09
CoupCons3D	4.2164e+07	7.1397e+07	8.4706e+07	1.3809e+08	1.4253e+08	1.5689e+08	1.9561e+08	2.1416e+08	2.6093e+08	2.7578e+08
rajat31	6.248e+08	1.0318e+09	1.4415e+09	1.8565e+09	2.2508e+09	2.6337e+09	3.1067e+09	3.5182e+09	3.9252e+09	5.1479e+09
FullChip	3.5681e+08	6.3322e+08	8.3176e+08	1.0715e+09	1.3767e+09	1.6302e+09	1.92e+09	2.2767e+09	2.3636e+09	2.6129e+09
cage14	1.2063e+08	1.9533e+08	2.7475e+08	3.5613e+08	4.3093e+08	5.2101e+08	5.9787e+08	6.7557e+08	8.0917e+08	8.442e+08
RM07R	3.8308e+07	6.3593e+07	8.8629e+07	1.1149e+08	1.6602e+08	1.6395e+08	1.8997e+08	2.1509e+08	2.408e+08	2.9905e+08
epb3	3.764e+06	6.5715e+06	8.4021e+06	1.1965e+07	1.5906e+07	1.7216e+07	1.8751e+07	2.2788e+07	2.3799e+07	2.843e+07
qcdRealPart	1.3761e+06	1.7636e+06	2.7817e+06	3.4555e+06	6.8594e+06	4.8878e+06	5.7547e+06	7.1421e+06	6.7103e+06	1.2629e+07
crashbasis	1.0978e+07	1.7099e+07	2.5461e+07	3.1206e+07	4.0262e+07	5.9998e+07	5.9224e+07	7.9971e+07	7.4308e+07	8.1042e+07
Hamrle3	1.0272e+08	1.8472e+08	2.4055e+08	3.7535e+08	4.4727e+08	5.0778e+08	5.9216e+08	6.632e+08	6.7481e+08	7.684e+08
HV15R	3.1801e+08	4.9728e+08	6.3247e+08	9.0809e+08	1.0272e+09	1.2793e+09	1.4461e+09	1.6568e+09	1.8292e+09	1.9976e+09
lung2	6.4577e+06	1.0819e+07	1.5356e+07	2.0167e+07	2.3982e+07	2.8916e+07	3.7624e+07	3.7315e+07	4.2556e+07	4.6309e+07
ML_Geer	1.5083e+08	2.8499e+08	3.5478e+08	4.5398e+08	5.644e+08	6.6498e+08	7.673e+08	8.772e+08	9.9678e+08	1.0785e+09
pre2	4.6574e+07	9.0241e+07	1.1038e+08	1.357e+08	1.7329e+08	2.0686e+08	2.6107e+08	2.7141e+08	3.0337e+08	3.3609e+08
twotone	8.1269e+06	1.3266e+07	1.8516e+07	2.4002e+07	2.8309e+07	3.5229e+07	3.9885e+07	4.4859e+07	4.9932e+07	5.5802e+07

TABLE 3.35

For recycled subspace dimension 50, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	2.7857e+08	5.8438e+08	8.8173e+08	1.1914e+09	1.4683e+09	1.7624e+09	2.0736e+09	2.3744e+09	2.6497e+09	2.8954e+09
CoupCons3D	2.6938e+07	4.7869e+07	7.3439e+07	8.2621e+07	1.0883e+08	1.2925e+08	1.5588e+08	1.774e+08	1.9518e+08	2.278e+08
rajat31	4.0264e+08	8.0098e+08	1.2324e+09	1.6254e+09	2.0421e+09	2.4371e+09	2.8556e+09	3.3142e+09	3.6776e+09	4.8285e+09
FullChip	2.3665e+08	4.8199e+08	7.2854e+08	1.0498e+09	1.2182e+09	1.4529e+09	1.7005e+09	1.9503e+09	2.1511e+09	2.4347e+09
cage14	7.7297e+07	1.5502e+08	2.3253e+08	3.4911e+08	4.339e+08	4.5674e+08	6.0287e+08	6.9354e+08	6.9847e+08	8.2194e+08
RM07R	2.1358e+07	3.7446e+07	5.8845e+07	7.248e+07	9.9596e+07	1.1223e+08	1.298e+08	1.5137e+08	1.6629e+08	1.8486e+08
epb3	2.4404e+06	5.0221e+06	7.5188e+06	1.0097e+07	1.5277e+07	1.5343e+07	1.6923e+07	2.0205e+07	2.1443e+07	2.5833e+07
qcdRealPart	6.0223e+05	6.3693e+05	1.0298e+06	1.1657e+06	3.8149e+06	1.6217e+06	2.0782e+06	2.4023e+06	2.0491e+06	5.1764e+06
crashbasis	7.4226e+06	1.4325e+07	2.173e+07	2.7787e+07	3.6272e+07	5.3367e+07	5.4232e+07	7.1634e+07	7.0158e+07	7.6331e+07
Hamrle3	7.08e+07	1.7823e+08	2.6112e+08	2.9677e+08	3.6792e+08	4.6826e+08	5.1079e+08	6.1232e+08	6.9966e+08	8.2739e+08
HV15R	1.6085e+08	2.7376e+08	4.5343e+08	5.8494e+08	6.9562e+08	8.7485e+08	9.535e+08	1.1035e+09	1.2613e+09	1.3691e+09
lung2	4.4081e+06	8.3605e+06	1.3003e+07	1.7991e+07	2.1286e+07	3.045e+07	3.4744e+07	3.4835e+07	4.0018e+07	4.3532e+07
ML_Geer	8.7805e+07	1.6952e+08	2.5497e+08	3.3281e+08	4.1044e+08	4.9865e+08	5.7717e+08	7.1721e+08	7.6691e+08	8.8433e+08
pre2	3.0956e+07	6.6706e+07	9.6113e+07	1.265e+08	1.5887e+08	1.8947e+08	2.3669e+08	2.5285e+08	2.8637e+08	3.1531e+08
twotone	5.267e+06	1.0451e+07	1.5394e+07	2.0827e+07	2.5077e+07	3.1591e+07	3.571e+07	4.0538e+07	5.1813e+07	5.092e+07

TABLE 3.36

For recycled subspace dimension 50, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.9432	3.9955	5.9901	7.9642	10.001	11.962	13.955	16.022	17.988	20.05
CoupCons3D	1.7954	3.439	5.2375	6.8472	8.4504	10.426	11.986	13.355	15.412	16.944
rajat31	1.9874	3.9241	5.9578	7.8834	9.8536	11.858	13.805	15.78	17.82	19.847
FullChip	1.9694	4.0344	6.0888	8.0899	9.9537	11.884	13.872	12.266	17.809	19.71
cake14	1.95	3.9764	5.9578	7.9584	10.05	12.026	13.831	15.641	17.445	19.943
RM07R	1.7056	3.1324	4.8815	6.5677	7.6199	9.434	10.98	12.461	14.05	15.541
epb3	1.9467	3.7859	6.2863	7.5118	9.5278	11.634	14.119	15.725	18.496	19.334
qcdRealPart	1.555	3.4087	4.8612	6.1349	7.7534	9.2551	11.755	12.208	14.949	14.823
crashbasis	2.0221	4.1369	5.8679	7.9638	9.9902	11.552	14.121	15.373	17.608	19.989
Hamrle3	1.978	4.0008	5.8809	8.1434	9.9628	12.046	14.021	16.117	17.823	20.226
HV15R	1.6463	3.0013	4.6964	6.0571	7.4035	9.0521	10.423	12.111	13.076	14.723
lung2	1.9935	4.1024	6.0493	7.7863	9.4043	11.755	13.672	15.799	17.862	19.913
ML_Geer	1.7597	3.2965	5.1094	6.6623	8.2359	10.044	11.669	13.497	15.036	16.484
pre2	1.9827	3.9368	6.0271	7.8966	10.184	11.639	13.702	15.307	17.534	19.481
twotone	2.0511	4.0119	5.9515	7.6137	9.7993	11.871	13.901	15.092	16.832	19.758

TABLE 3.37

For recycled subspace dimension 100, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	3.61e+10	6.0459e+10	8.3705e+10	1.0852e+11	1.3261e+11	1.5915e+11	1.7992e+11	2.1207e+11	2.3596e+11	2.5511e+11
CoupCons3D	2.1496e+09	3.5502e+09	6.512e+09	6.3527e+09	7.7781e+09	9.2367e+09	1.0741e+10	1.2107e+10	1.355e+10	1.4778e+10
rajat31	5.2875e+10	8.8003e+10	1.1723e+11	1.5758e+11	1.9094e+11	2.1755e+11	2.5783e+11	2.9139e+11	3.2599e+11	3.6312e+11
FullChip	3.1389e+10	5.3068e+10	7.4337e+10	9.3882e+10	1.1452e+11	1.3861e+11	1.584e+11	1.7648e+11	2.0288e+11	2.2402e+11
cage14	7.5754e+09	1.2229e+10	1.8248e+10	2.3097e+10	2.796e+10	3.6378e+10	3.8597e+10	4.6764e+10	4.8368e+10	5.6323e+10
RM07R	2.6612e+09	4.4172e+09	6.0787e+09	8.3786e+09	1.0768e+10	1.1751e+10	1.3247e+10	1.501e+10	1.872e+10	1.8696e+10
epb3	2.6475e+08	4.6798e+08	6.7307e+08	8.0972e+08	1.332e+09	1.0945e+09	1.2707e+09	1.5261e+09	1.7144e+09	1.9045e+09
qcdRealPart	2.3686e+08	3.8529e+08	5.2832e+08	9.2159e+08	7.6881e+08	9.617e+08	1.0926e+09	1.2695e+09	1.4177e+09	1.5507e+09
crashbasis	7.5802e+08	8.6281e+08	1.2532e+09	1.6473e+09	1.9842e+09	3.2649e+09	2.7494e+09	3.1164e+09	3.4969e+09	4.8363e+09
Hamrle3	5.798e+09	1.0387e+10	1.3555e+10	1.858e+10	2.2797e+10	2.688e+10	3.1352e+10	3.5017e+10	4.3679e+10	4.2815e+10
HV15R	2.4516e+10	4.2409e+10	5.9239e+10	7.6017e+10	9.4108e+10	1.1213e+11	1.3231e+11	1.5003e+11	1.6491e+11	1.8199e+11
lung2	3.2591e+08	5.4752e+08	8.1424e+08	1.0536e+09	1.3127e+09	1.516e+09	1.7578e+09	2.6261e+09	2.0653e+09	2.4814e+09
ML_Geer	1.2076e+10	1.8673e+10	2.7577e+10	3.2494e+10	4.0153e+10	5.1637e+10	5.5216e+10	6.4854e+10	6.9366e+10	8.1566e+10
pre2	3.3843e+09	3.479e+09	4.8789e+09	6.2562e+09	8.2066e+09	9.7832e+09	1.0806e+10	1.4864e+10	1.4198e+10	1.8288e+10
twotone	9.7735e+08	7.1709e+08	9.9904e+08	1.2443e+09	2.0506e+09	1.7102e+09	2.0601e+09	2.404e+09	2.6423e+09	2.6915e+09

TABLE 3.38

For recycled subspace dimension 100, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	2.4252e+10	4.8364e+10	7.2126e+10	9.6014e+10	1.2719e+11	1.4899e+11	1.7461e+11	1.9154e+11	2.1575e+11	2.4443e+11
CoupCons3D	7.7205e+08	9.4826e+08	2.4007e+09	4.0999e+09	6.9395e+09	9.6101e+09	1.1819e+10	1.3808e+10	1.5699e+10	1.7194e+10
rajat31	3.3091e+10	6.9049e+10	1.0181e+11	1.3228e+11	1.6501e+11	2.0508e+11	2.336e+11	2.7123e+11	3.0821e+11	3.3853e+11
FullChip	2.1311e+10	4.651e+10	6.7031e+10	8.4542e+10	1.0491e+11	1.2689e+11	1.4891e+11	1.7126e+11	1.9135e+11	2.1213e+11
cage14	6.9983e+09	1.6246e+10	2.1911e+10	2.8395e+10	3.477e+10	4.1407e+10	4.91e+10	5.4678e+10	6.1279e+10	6.7499e+10
RM07R	9.4268e+08	1.081e+09	1.9151e+09	3.2107e+09	7.8699e+09	1.0979e+10	1.1329e+10	1.3625e+10	1.4561e+10	1.6887e+10
epb3	1.219e+08	1.1351e+08	1.4928e+08	1.6878e+08	3.5236e+08	1.6055e+08	1.7689e+08	2.5416e+08	3.1215e+08	2.9391e+08
qcdRealPart	8.1672e+07	9.8e+07	1.0857e+08	2.8377e+08	1.2516e+08	1.7021e+08	1.782e+08	1.9832e+08	2.2659e+08	2.4112e+08
crashbasis	3.6959e+08	2.1646e+08	3.0406e+08	3.5799e+08	4.2185e+08	1.0918e+09	1.3566e+09	9.9049e+08	1.6871e+09	3.7114e+09
Hamrle3	7.8141e+09	1.3841e+10	2.3228e+10	2.6186e+10	3.2622e+10	4.0628e+10	4.44e+10	5.0075e+10	5.6756e+10	6.3214e+10
HV15R	1.8963e+10	2.7287e+10	4.3468e+10	5.4577e+10	6.7867e+10	8.1291e+10	9.1186e+10	1.0889e+11	1.2188e+11	1.3103e+11
lung2	1.2013e+08	1.387e+08	1.7991e+08	2.1573e+08	2.3742e+08	2.7573e+08	2.9e+08	7.2751e+08	2.8934e+08	5.2492e+08
ML_Geer	8.1396e+09	1.8876e+10	2.2952e+10	3.4441e+10	3.7643e+10	4.5766e+10	5.3019e+10	6.1198e+10	7.0301e+10	7.2708e+10
pre2	1.171e+09	2.1034e+09	7.5145e+09	9.7277e+09	1.4683e+10	1.6027e+10	1.7948e+10	2.1157e+10	2.5453e+10	2.7423e+10
twotone	1.4942e+08	1.7873e+08	2.6141e+08	2.5183e+08	5.4583e+08	2.7269e+08	3.2936e+08	5.1048e+08	6.3575e+08	7.6594e+08

TABLE 3.39

For recycled subspace dimension 100, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	5.2941	10.258	15.368	20.647	25.596	31.068	35.835	41.484	45.992	51.644
CoupCons3D	0.4789	0.95141	1.4234	1.9176	2.3741	2.8744	3.3053	3.8192	4.2677	4.782
rajat31	7.0948	14.157	21.217	28.281	35.464	42.305	49.6	56.584	63.855	70.516
FullChip	4.5113	8.8818	13.544	17.965	22.8	27.38	31.637	36.527	41.057	45.722
cage14	1.6985	3.3908	5.1585	6.8399	8.3496	10.085	12.018	13.524	15.369	17.051
RM07R	0.55223	1.1003	1.6475	2.2084	2.7313	3.3153	3.8565	4.4191	4.9361	5.8355
epb3	0.077442	0.1529	0.23262	0.30655	0.37947	0.46256	0.5399	0.61933	0.69715	0.76797
qcdRealPart	0.055225	0.11256	0.16657	0.22287	0.27881	0.33631	0.3818	0.45059	0.50619	0.557
crashbasis	0.14583	0.29757	0.44065	0.59357	0.73397	0.90461	1.0727	1.2339	1.3849	1.4849
Hamrle3	1.373	2.8545	4.2904	5.7737	7.1547	8.5855	10.034	11.332	12.868	14.079
HV15R	4.3603	8.7757	13.034	17.528	21.723	26.36	30.76	34.892	39.59	43.608
lung2	0.098134	0.19761	0.29213	0.39939	0.48878	0.59868	0.68763	0.78126	0.89469	0.98721
ML_Geer	2.204	4.3703	6.6832	8.8892	11.072	13.213	15.586	17.699	19.786	22.279
pre2	0.57356	1.1297	1.6936	2.276	2.8267	3.4479	3.9934	4.5781	5.1304	5.7386
twotone	0.11391	0.22861	0.33632	0.45982	0.55585	0.68064	0.7907	0.91072	1.03	1.1305

TABLE 3.40

For recycled subspace dimension 100, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	5.1649	10.22	15.332	20.528	25.515	30.924	35.628	41.305	45.755	51.475
CoupCons3D	0.34224	0.58535	0.96608	1.6645	2.3921	3.1328	3.6931	4.3265	4.8383	5.3866
rajat31	7.0097	13.942	20.983	27.863	34.921	41.841	48.785	55.712	62.767	69.428
FullChip	4.4752	8.7895	13.45	17.859	22.353	26.869	30.945	35.849	40.182	44.753
cage14	1.9975	4.124	6.1597	8.1376	9.9412	11.893	14.092	16.012	18.074	20.018
RM07R	0.38127	0.62044	0.99982	1.5007	2.2286	3.1484	3.7455	4.3888	4.8497	5.4456
epb3	0.061338	0.10836	0.15553	0.20036	0.24386	0.29627	0.34013	0.39345	0.44441	0.48679
qcdRealPart	0.042538	0.074262	0.10659	0.13679	0.16949	0.20337	0.23082	0.27197	0.29812	0.33071
crashbasis	0.11676	0.21398	0.3053	0.39959	0.49572	0.60343	0.73728	0.8881	1.1057	1.4363
Hamrle3	1.6966	3.6631	5.4631	7.2693	8.9906	10.783	12.437	14.098	16.024	17.565
HV15R	3.8008	6.9349	10.709	13.727	16.776	20.628	23.768	27.55	30.692	33.566
lung2	0.079238	0.13981	0.19801	0.26005	0.31899	0.38492	0.44146	0.50198	0.56884	0.6592
ML_Geer	2.226	4.325	6.638	8.5747	10.602	12.757	14.755	16.953	18.911	21.038
pre2	0.44776	1.0426	2.1867	3.176	3.9891	4.864	5.6214	6.4009	7.2226	8.0252
twotone	0.090437	0.15963	0.23023	0.29851	0.36132	0.4366	0.5048	0.59286	0.67986	0.76942

TABLE 3.41

For recycled subspace dimension 100, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	0.14195	0.14089	0.13783	0.13598	0.14352	0.12796	0.1401	0.1215	0.12237	0.13385
CoupCons3D	0.25572	0.22969	0.12885	0.22992	0.23245	0.23447	0.2357	0.23937	0.23683	0.23221
rajat31	0.12638	0.096204	0.13961	0.10653	0.11129	0.14216	0.12216	0.12464	0.12359	0.11795
FullChip	0.15646	0.10028	0.11986	0.15605	0.15465	0.12302	0.14649	0.15273	0.12923	0.13344
cage14	0.24394	0.18286	0.2367	0.23885	0.23663	0.1626	0.23683	0.18817	0.23728	0.1768
RM07R	0.2509	0.25229	0.23612	0.2046	0.15516	0.21848	0.24951	0.25076	0.14753	0.26421
epb3	0.30743	0.34769	0.33638	0.31078	0.18581	0.23822	0.23716	0.29865	0.3161	0.30839
qcdRealPart	0.3913	0.36328	0.26075	0.16244	0.24276	0.29547	0.30488	0.29516	0.29456	0.28854
crashbasis	0.18442	0.23311	0.26915	0.3044	0.28401	0.16772	0.27129	0.27529	0.28187	0.16752
Hamrle3	0.23702	0.2382	0.17417	0.23371	0.22904	0.23695	0.23388	0.23912	0.16903	0.23639
HV15R	0.13686	0.2079	0.20467	0.20567	0.17685	0.19797	0.15975	0.16068	0.18356	0.1783
lung2	0.2528	0.24124	0.31369	0.2924	0.2951	0.3044	0.29913	0.16302	0.23312	0.29739
ML_Geer	0.17284	0.15343	0.18305	0.16262	0.23084	0.17208	0.23929	0.21473	0.2329	0.16851
pre2	0.11147	0.2037	0.197	0.20655	0.26221	0.28213	0.29106	0.19461	0.27055	0.16917
twotone	0.088553	0.31844	0.30213	0.29788	0.18117	0.23246	0.29806	0.30942	0.30831	0.23699

TABLE 3.42
For recycled subspace dimension 100, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.13979	0.14115	0.14098	0.13821	0.10042	0.12495	0.11138	0.14336	0.14303	0.1326
CoupCons3D	0.29231	0.40854	0.21862	0.27392	0.22415	0.21145	0.20672	0.20688	0.20233	0.20027
rajat31	0.096294	0.11814	0.10828	0.14157	0.14001	0.11507	0.13546	0.12289	0.12034	0.12725
FullChip	0.1576	0.087216	0.1018	0.12567	0.12933	0.14243	0.1193	0.12028	0.1247	0.1267
cage14	0.21672	0.13501	0.20594	0.21333	0.21361	0.21133	0.16668	0.21533	0.20976	0.21949
RM07R	0.31001	0.43236	0.39622	0.35683	0.17011	0.14062	0.23529	0.23546	0.16099	0.23286
epb3	0.38391	0.52724	0.5746	0.52501	0.35889	0.57861	0.61176	0.63692	0.59505	0.63931
qcdRealPart	0.4259	0.39263	0.58958	0.31993	0.53321	0.53432	0.63103	0.58806	0.60734	0.62027
crashbasis	0.20633	0.45456	0.48924	0.523	0.5356	0.31811	0.23167	0.4944	0.42069	0.23195
Hamrle3	0.10431	0.18781	0.11311	0.19155	0.18777	0.16541	0.18294	0.19155	0.18851	0.15257
HV15R	0.098127	0.19891	0.15013	0.16569	0.16402	0.15035	0.19873	0.18285	0.17008	0.18929
lung2	0.33361	0.43331	0.54692	0.5699	0.58	0.58725	0.63401	0.4007	0.61074	0.59078
ML_Geer	0.20895	0.11502	0.14109	0.15257	0.13398	0.20683	0.19001	0.19137	0.13565	0.21776
pre2	0.1986	0.24869	0.13625	0.15118	0.11907	0.21611	0.22972	0.21641	0.16883	0.19309
twotone	0.28709	0.5094	0.52092	0.60035	0.40104	0.56732	0.65872	0.58749	0.57135	0.45433

TABLE 3.43
For recycled subspace dimension 100, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	4.2316e+08	7.189e+08	9.9705e+08	1.289e+09	1.5823e+09	1.8956e+09	2.1441e+09	2.4999e+09	2.7791e+09	3.0368e+09
CoupCons3D	2.4318e+07	4.0241e+07	6.6667e+07	7.1707e+07	8.829e+07	1.0431e+08	1.2095e+08	1.3692e+08	1.5384e+08	1.6615e+08
rajat31	6.3191e+08	1.0277e+09	1.4007e+09	1.8528e+09	2.2539e+09	2.5994e+09	3.0473e+09	3.4471e+09	3.8464e+09	4.2738e+09
FullChip	3.6655e+08	6.118e+08	8.6432e+08	1.0936e+09	1.3601e+09	1.6173e+09	1.8768e+09	2.0981e+09	2.3778e+09	2.6324e+09
cage14	8.9381e+07	1.4214e+08	2.1529e+08	2.7285e+08	3.2979e+08	4.0463e+08	4.566e+08	5.2718e+08	5.7205e+08	6.3856e+08
RM07R	2.8009e+07	4.7008e+07	6.3113e+07	8.6819e+07	1.0708e+08	1.2468e+08	1.4064e+08	1.5851e+08	1.9813e+08	1.9046e+08
epb3	3.1801e+06	5.6095e+06	8.2577e+06	9.9064e+06	1.4459e+07	1.2936e+07	1.4974e+07	1.8412e+07	2.0602e+07	2.3254e+07
qcdRealPart	2.7705e+06	4.2841e+06	5.898e+06	9.1989e+06	8.3005e+06	1.0493e+07	1.2113e+07	1.3996e+07	1.5469e+07	1.7236e+07
crashbasis	7.7088e+06	9.676e+06	1.4454e+07	1.8876e+07	2.2783e+07	3.5241e+07	3.4211e+07	3.8824e+07	4.3445e+07	5.2622e+07
Hamrle3	6.9458e+07	1.2864e+08	1.6546e+08	2.3031e+08	2.8054e+08	3.3192e+08	3.8818e+08	4.3275e+08	5.1067e+08	5.2966e+08
HV15R	2.5465e+08	4.5049e+08	6.3078e+08	8.0657e+08	9.9979e+08	1.1904e+09	1.393e+09	1.5754e+09	1.7448e+09	1.9266e+09
lung2	3.8235e+06	6.6465e+06	9.9008e+06	1.291e+07	1.6144e+07	1.8225e+07	2.1145e+07	2.7237e+07	2.4451e+07	2.9983e+07
ML_Geer	1.2671e+08	1.9568e+08	3.0321e+08	3.4457e+08	4.4011e+08	5.4435e+08	6.0519e+08	7.015e+08	7.6122e+08	8.7408e+08
pre2	4.3983e+07	4.2273e+07	5.8818e+07	7.5394e+07	1.0009e+08	1.1985e+08	1.32e+08	1.6998e+08	1.7385e+08	2.0571e+08
twotone	1.3013e+07	8.4933e+06	1.1811e+07	1.458e+07	2.1631e+07	2.0073e+07	2.4372e+07	2.8475e+07	3.1263e+07	3.1266e+07

TABLE 3.44
For recycled subspace dimension 100, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	2.9007e+08	5.8241e+08	8.7006e+08	1.1577e+09	1.5041e+09	1.7689e+09	2.0759e+09	2.3128e+09	2.6018e+09	2.9195e+09
CoupCons3D	8.4351e+06	1.0353e+07	2.292e+07	4.7182e+07	8.2696e+07	1.1587e+08	1.4381e+08	1.6836e+08	1.9183e+08	2.107e+08
rajat31	3.8384e+08	8.1028e+08	1.2166e+09	1.588e+09	1.9804e+09	2.427e+09	2.7944e+09	3.2114e+09	3.6401e+09	4.0084e+09
FullChip	2.4953e+08	5.2781e+08	7.7372e+08	1.0093e+09	1.2546e+09	1.5195e+09	1.7478e+09	2.022e+09	2.2654e+09	2.5141e+09
cage14	8.3164e+07	1.8707e+08	2.6888e+08	3.4939e+08	4.2901e+08	5.1002e+08	6.0126e+08	6.7354e+08	7.5763e+08	8.3599e+08
RM07R	9.6391e+06	1.0144e+07	1.8306e+07	3.2538e+07	7.8549e+07	1.2459e+08	1.3047e+08	1.5819e+08	1.6729e+08	1.9782e+08
epb3	1.5829e+06	1.3301e+06	1.9206e+06	2.052e+06	3.3205e+06	1.8596e+06	2.0221e+06	3.1928e+06	3.8089e+06	3.6211e+06
qcdRealPart	8.8842e+05	1.067e+06	1.2615e+06	2.6355e+06	1.3197e+06	1.9386e+06	1.9204e+06	2.3009e+06	2.6235e+06	2.7445e+06
crashbasis	3.4581e+06	2.5972e+06	3.7716e+06	4.3263e+06	5.3894e+06	1.0648e+07	1.7769e+07	1.1692e+07	1.8943e+07	3.7686e+07
Hamrle3	9.6902e+07	1.717e+08	2.6608e+08	3.2586e+08	4.0584e+08	5.0344e+08	5.5459e+08	6.2386e+08	7.0587e+08	7.8287e+08
HV15R	1.9382e+08	3.0008e+08	4.8184e+08	6.0702e+08	7.3221e+08	8.7397e+08	1.0187e+09	1.2135e+09	1.3329e+09	1.4474e+09
lung2	1.4046e+06	1.6206e+06	2.1453e+06	2.6344e+06	2.8591e+06	3.2743e+06	3.4504e+06	6.2683e+06	3.2182e+06	5.9511e+06
ML_Geer	9.1628e+07	2.036e+08	2.6399e+08	3.8169e+08	4.3567e+08	5.327e+08	6.176e+08	7.1264e+08	7.9602e+08	8.5026e+08
pre2	1.2393e+07	2.4015e+07	8.48e+07	1.197e+08	1.8407e+08	2.0008e+08	2.2266e+08	2.6488e+08	3.1921e+08	3.3595e+08
twotone	1.7691e+06	2.1599e+06	3.227e+06	2.9715e+06	5.2818e+06	3.1135e+06	3.7063e+06	5.9878e+06	7.1469e+06	7.728e+06

TABLE 3.45

For recycled subspace dimension 100, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	1.9435	3.9797	5.9695	7.96	9.9457	11.945	13.91	15.892	17.902	19.955
CoupCons3D	1.4117	2.4663	4.0668	6.896	10.15	13.114	15.507	18.021	20.522	22.31
rajat31	1.9764	3.9452	5.9329	7.883	9.8699	11.899	13.774	15.797	17.674	19.655
FullChip	1.9841	3.954	5.9514	7.9583	9.8416	11.888	13.775	15.835	17.694	19.719
cage14	2.3827	4.8478	6.9547	9.3668	11.739	14.281	16.87	19.148	21.26	23.37
RM07R	1.3702	2.2753	3.6566	5.456	8.0509	11.374	13.641	16.036	17.805	18.695
epb3	1.5898	2.8403	4.0752	5.2749	6.3951	7.8329	8.8798	10.353	11.372	12.714
qcdRealPart	1.5426	2.6485	3.8627	4.9464	5.9782	7.3	8.4002	9.712	10.456	11.639
crashbasis	1.6059	2.8814	4.1949	5.3719	6.7249	7.8293	9.5052	11.375	14.432	20.249
Hamrle3	2.4817	5.1122	7.7936	10.187	12.809	15.212	17.773	20.663	21.849	25.045
HV15R	1.7464	3.16	4.9414	6.2441	7.7213	9.4134	10.812	12.623	13.942	15.427
lung2	1.6167	2.8646	4.0238	5.1903	6.4887	7.7055	8.804	10.308	11.315	13.41
ML_Geer	2.0389	4.0072	6.0074	7.7142	9.533	11.82	12.942	15.588	17.211	18.755
pre2	1.5719	3.6436	7.8	11.043	14.185	16.96	19.805	22.497	25.62	27.961
twotone	1.6108	2.7984	4.1086	5.3066	6.5033	7.7798	8.9624	10.534	11.582	13.608

TABLE 3.46

For recycled subspace dimension 100, bytes read onto the processor for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	7.4134e+10	1.2238e+11	1.7356e+11	2.224e+11	2.7107e+11	3.2308e+11	3.6805e+11	4.1944e+11	4.699e+11	5.1875e+11
CoupCons3D	5.6633e+09	9.4929e+09	1.4395e+10	1.7939e+10	2.0811e+10	2.5933e+10	3.1247e+10	3.2068e+10	3.5889e+10	4.2675e+10
rajat31	1.0499e+11	1.7386e+11	2.4058e+11	3.0944e+11	3.7894e+11	4.6779e+11	5.2932e+11	5.9431e+11	6.6209e+11	7.0687e+11
FullChip	6.429e+10	1.0214e+11	1.499e+11	1.9012e+11	2.3065e+11	2.6964e+11	3.1017e+11	3.4673e+11	3.9336e+11	4.3373e+11
cage14	2.1599e+10	3.4052e+10	4.4396e+10	5.6211e+10	6.9284e+10	8.7484e+10	1.0239e+11	1.0991e+11	1.2812e+11	1.4211e+11
RM07R	7.1896e+09	9.1949e+09	1.2754e+10	1.6607e+10	2.0049e+10	2.8609e+10	2.9495e+10	3.7055e+10	3.9226e+10	4.1269e+10
epb3	9.0384e+08	1.521e+09	2.1024e+09	3.6793e+09	3.3152e+09	3.9587e+09	4.5295e+09	5.1601e+09	7.8651e+09	9.1708e+09
qcdRealPart	5.3559e+08	8.8628e+08	1.2242e+09	1.5791e+09	1.9264e+09	2.4697e+09	2.6256e+09	2.999e+09	3.2766e+09	3.6828e+09
crashbasis	1.7661e+09	2.9206e+09	5.428e+09	5.2904e+09	6.388e+09	7.7854e+09	8.7999e+09	1.2697e+10	1.2084e+10	1.2412e+10
Hamrle3	1.6878e+10	2.8098e+10	4.6815e+10	5.2692e+10	6.8805e+10	7.5886e+10	9.136e+10	1.0206e+11	1.1352e+11	1.2482e+11
HV15R	4.3907e+10	7.5378e+10	9.9918e+10	1.3178e+11	1.5807e+11	1.9494e+11	2.2179e+11	2.52e+11	2.8059e+11	3.0944e+11
lung2	1.2393e+09	2.0505e+09	2.8675e+09	3.649e+09	5.9088e+09	5.0817e+09	6.148e+09	7.0005e+09	7.7079e+09	1.1226e+10
ML_Geer	1.2393e+09	2.0505e+09	2.8675e+09	3.649e+09	5.9088e+09	5.0817e+09	6.148e+09	7.0005e+09	7.7079e+09	1.1226e+10
pre2	7.5291e+09	1.2544e+10	1.7522e+10	2.2489e+10	2.7474e+10	3.2785e+10	3.7534e+10	4.6552e+10	4.7703e+10	5.219e+10
twotone	1.3966e+09	2.3025e+09	3.2122e+09	4.4892e+09	5.2802e+09	5.9857e+09	6.9172e+09	8.2434e+09	1.0388e+10	9.6688e+09

TABLE 3.47

For recycled subspace dimension 100, bytes read onto the processor for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	5.2054e+10	9.8689e+10	1.484e+11	1.9356e+11	2.4523e+11	2.9084e+11	3.4412e+11	3.9364e+11	4.4311e+11	4.9204e+11
CoupCons3D	3.5297e+09	6.7307e+09	1.2547e+10	1.3563e+10	1.6766e+10	1.8871e+10	2.3645e+10	2.7018e+10	2.981e+10	3.3663e+10
rajat31	6.8174e+10	1.367e+11	2.0458e+11	2.7429e+11	3.4265e+11	4.3123e+11	7.8157e+11	5.5207e+11	6.5292e+11	6.6871e+11
FullChip	4.0101e+10	8.09e+10	1.2152e+11	1.6417e+11	2.0772e+11	2.4552e+11	2.8685e+11	3.2699e+11	3.6169e+11	4.0383e+11
cage14	1.2579e+10	2.5448e+10	3.7412e+10	5.1337e+10	6.389e+10	7.686e+10	8.5556e+10	1.0387e+11	1.135e+11	1.292e+11
RM07R	4.2406e+09	6.003e+09	9.1676e+09	1.2025e+10	1.808e+10	1.7801e+10	2.0564e+10	2.3782e+10	2.8046e+10	2.9243e+10
epb3	6.0491e+08	1.2043e+09	1.7827e+09	3.104e+09	2.9851e+09	3.6027e+09	4.1798e+09	4.8178e+09	7.0176e+09	6.0127e+09
qcdRealPart	3.2434e+08	6.2223e+08	8.999e+08	1.1841e+09	1.4774e+09	1.7381e+09	2.0424e+09	2.3964e+09	2.5814e+09	2.961e+09
crashbasis	1.1674e+09	2.307e+09	4.6314e+09	4.6041e+09	5.7002e+09	6.9804e+09	8.0704e+09	9.3373e+09	1.0345e+10	1.1617e+10
Hamrle3	1.4339e+10	2.3908e+10	3.4738e+10	4.5694e+10	5.7853e+10	7.543e+10	8.8705e+10	1.0062e+11	1.1319e+11	1.2303e+11
HV15R	2.5647e+10	4.4198e+10	7.6426e+10	9.1229e+10	1.2191e+11	1.4217e+11	1.6164e+11	1.9023e+11	2.1511e+11	2.373e+11
lung2	8.2941e+08	1.6366e+09	2.4596e+09	3.2283e+09	4.9285e+09	4.6593e+09	5.7002e+09	6.5741e+09	7.3078e+09	9.7072e+09
ML_Geer	8.2941e+08	1.6366e+09	2.4596e+09	3.2283e+09	4.9285e+09	4.6593e+09	5.7002e+09	6.5741e+09	7.3078e+09	9.7072e+09
pre2	5.01e+09	9.9907e+09	1.4903e+10	2.2213e+10	2.7332e+10	3.0085e+10	3.4797e+10	4.5547e+10	4.4895e+10	5.1924e+10
twotone	9.1512e+08	1.804e+09	2.6978e+09	5.0447e+09	4.6929e+09	5.4079e+09	6.3174e+09	7.1689e+09	8.7586e+09	9.0498e+09

TABLE 3.48

For recycled subspace dimension 100, average time taken for each projected matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	10.063	20.321	30.326	40.476	50.484	60.9	71.081	81	90.383	101.46
CoupCons3D	1.1322	2.2204	3.3847	4.453	5.7635	6.6952	7.895	8.9042	10.107	11.237
rajat31	13.87	27.557	41.46	55.664	69.524	113.27	95.839	110.79	124.71	138.74
FullChip	8.7504	17.462	26.28	34.862	44.208	53.303	61.971	71.122	80.044	88.729
cage14	3.8473	7.762	11.645	15.62	19.401	23.452	26.879	31.419	35.305	38.784
RM07R	1.1295	2.2193	3.4015	4.4578	5.652	6.6722	7.9185	8.9058	10.161	11.169
epb3	0.19403	0.40749	0.59242	0.84791	0.99834	1.2482	1.4011	1.6704	1.7828	2.0852
qcdRealPart	0.12441	0.24988	0.37466	0.4962	0.61064	0.73073	0.84342	0.9765	1.0934	1.2299
crashbasis	0.38283	0.7535	1.1319	1.5149	1.8966	2.5405	3.0345	3.372	3.95	4.2408
Hamrle3	3.4106	6.9592	10.46	13.909	17.268	20.89	24.391	27.887	31.314	34.794
HV15R	7.0975	14.187	21.324	28.407	35.798	42.812	49.849	63.666	64.01	71.1
lung2	0.26663	0.53729	0.79413	1.0744	1.4504	1.6192	1.8917	2.1366	2.3595	2.6983
ML_Geer	4.3388	8.6946	13.027	17.476	21.822	26.105	30.599	34.795	39.426	43.607
pre2	1.56	3.1027	4.7873	6.2294	7.7252	9.6414	11.168	17.55	14.391	15.972
twotone	0.29726	0.59885	0.89417	1.6179	2.0253	1.7926	2.0499	2.3157	2.631	2.9054

TABLE 3.49

For recycled subspace dimension 100, average time taken for each projected matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	9.9916	20.272	30.365	40.429	50.22	60.965	70.903	80.901	90.228	101.42
CoupCons3D	1.0652	2.0434	3.1364	4.0975	5.1688	6.1456	7.2473	8.2136	9.2936	10.314
rajat31	13.788	27.565	41.421	55.301	69.138	113.14	124.79	110.09	123.63	137.84
FullChip	8.6618	17.464	26.357	34.984	43.652	52.681	61.137	70.35	79.005	87.666
cage14	3.8543	7.6993	11.563	15.457	19.192	23.388	26.444	31.003	34.959	38.48
RM07R	1.02	1.9391	3.0026	3.8744	4.8723	5.8058	6.8541	7.7818	8.7869	9.5824
epb3	0.19417	0.40877	0.5896	0.82805	0.98739	1.2212	1.3903	1.6559	1.7767	2.0789
qcdRealPart	0.11896	0.23593	0.37008	0.45111	0.65014	0.71892	0.802	1.059	1.0345	1.255
crashbasis	0.39547	0.79068	1.1491	1.4962	1.9011	2.5466	2.9604	3.3295	3.8272	4.1522
Hamrle3	3.4496	7.0584	10.433	13.99	17.346	20.963	24.363	28.002	31.454	34.999
HV15R	6.2803	11.968	18.436	24.047	29.884	36.218	41.727	47.983	53.442	59.255
lung2	0.26952	0.53108	0.80517	1.0593	1.4233	1.602	1.8533	2.1515	2.4086	2.7666
ML_Geer	4.0292	7.82	11.837	16.065	19.37	23.724	27.325	31.798	35.32	39.324
pre2	1.5558	3.0908	4.7169	6.3391	7.9592	9.5314	10.99	16.272	14.192	15.738
twotone	0.29616	0.58389	0.88255	1.6364	2.0037	1.7668	2.0825	2.38	2.6523	2.9219

TABLE 3.50

For recycled subspace dimension 100, cache hit ratio for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	0.11553	0.15394	0.12574	0.13361	0.13589	0.12399	0.13484	0.13408	0.12993	0.13847
CoupCons3D	0.22654	0.20121	0.1277	0.18755	0.23194	0.1712	0.13041	0.21384	0.22468	0.1861
rajat31	0.14011	0.1388	0.13633	0.12859	0.1349	0.1498	0.15748	0.13809	0.12222	0.11145
FullChip	0.11057	0.13071	0.10561	0.11179	0.11735	0.12961	0.12852	0.097542	0.094816	0.098799
cage14	0.084304	0.11981	0.1932	0.1997	0.19677	0.12089	0.11722	0.16409	0.14147	0.18969
RM07R	0.3541	0.46867	0.50323	0.46896	0.41807	0.39492	0.43848	0.39161	0.39426	0.44165
epb3	0.48851	0.49661	0.47909	0.37798	0.42158	0.49849	0.4822	0.49429	0.36255	0.34211
qcdRealPart	0.54079	0.51797	0.52633	0.51567	0.46454	0.43889	0.51512	0.5295	0.50914	0.46714
crashbasis	0.50953	0.4837	0.37308	0.48931	0.48369	0.43111	0.49555	0.39819	0.4563	0.48272
Hamrle3	0.46191	0.46276	0.39447	0.45886	0.41127	0.45773	0.4326	0.44841	0.45229	0.45701
HV15R	0.38908	0.3788	0.44336	0.42561	0.40847	0.42023	0.425	0.46086	0.43907	0.43257
lung2	0.49138	0.5067	0.499	0.49825	0.4497	0.48607	0.49829	0.4824	0.4805	0.42478
ML_Geer	0.44617	0.43256	0.45213	0.43734	0.42302	0.44483	0.45579	0.45497	0.45581	0.47805
pre2	0.49138	0.49461	0.50648	0.4956	0.49443	0.49766	0.50372	0.52587	0.50105	0.50535
twotone	0.51274	0.51658	0.52337	0.52402	0.55083	0.5154	0.50535	0.48021	0.44455	0.50263

TABLE 3.51

For recycled subspace dimension 100, cache hit ratio for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	0.082935	0.10755	0.11757	0.13857	0.13298	0.14484	0.13893	0.13317	0.1299	0.13159
CoupCons3D	0.22553	0.2224	0.12273	0.12955	0.22804	0.1476	0.21784	0.22696	0.23241	0.22885
rajat31	0.13339	0.13087	0.13465	0.13891	0.12972	0.15596	0.53325	0.13091	0.19599	0.10757
FullChip	0.098549	0.13035	0.1329	0.12334	0.11298	0.12939	0.12605	0.093236	0.10242	0.10602
cage14	0.10399	0.10075	0.20001	0.138	0.15133	0.19176	0.19772	0.17677	0.17683	0.18811
RM07R	0.36714	0.48062	0.48369	0.47337	0.38612	0.48563	0.48647	0.48146	0.46334	0.42666
epb3	0.49761	0.50155	0.4664	0.38612	0.42096	0.49252	0.47212	0.49569	0.36649	0.43652
qcdRealPart	0.52662	0.52433	0.54185	0.52189	0.49224	0.47842	0.53071	0.55464	0.52235	0.48237
crashbasis	0.50519	0.49372	0.38449	0.48307	0.49164	0.43767	0.49475	0.42495	0.49045	0.48401
Hamrle3	0.35202	0.45073	0.46186	0.47197	0.46903	0.39781	0.41309	0.41403	0.4349	0.4332
HV15R	0.37268	0.47641	0.40078	0.44977	0.39006	0.44179	0.44579	0.44405	0.44212	0.43541
lung2	0.50689	0.49637	0.49264	0.49051	0.46439	0.48379	0.49233	0.48904	0.49061	0.45716
ML_Geer	0.40901	0.42732	0.4563	0.42791	0.4585	0.44471	0.44515	0.4495	0.44522	0.46807
pre2	0.49245	0.49606	0.49312	0.45186	0.47118	0.50076	0.50213	0.51108	0.50077	0.47096
twotone	0.52419	0.52302	0.51872	0.49401	0.55452	0.51955	0.52064	0.52133	0.48424	0.51355

TABLE 3.52

For recycled subspace dimension 100, cache misses for each projected matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	8.857e+08	1.4691e+09	2.0488e+09	2.631e+09	3.1921e+09	3.8154e+09	4.3653e+09	4.9686e+09	5.5465e+09	6.1593e+09
CoupCons3D	6.9635e+07	1.1666e+08	1.6635e+08	2.2247e+08	2.4728e+08	3.2126e+08	3.6094e+08	3.9186e+08	4.4115e+08	5.0768e+08
rajat31	1.221e+09	2.0335e+09	2.8418e+09	3.6701e+09	4.489e+09	6.179e+09	6.2752e+09	7.0179e+09	7.8274e+09	8.2732e+09
FullChip	7.4531e+08	1.1699e+09	1.7171e+09	2.177e+09	2.6961e+09	3.1667e+09	3.6351e+09	4.0732e+09	4.6249e+09	5.0928e+09
cage14	2.6823e+08	4.1764e+08	5.3394e+08	6.779e+08	8.3838e+08	1.0501e+09	1.2253e+09	1.3329e+09	1.5314e+09	1.7026e+09
RM07R	7.6442e+07	1.0596e+08	1.4713e+08	1.9062e+08	2.3263e+08	3.148e+08	3.3274e+08	4.0576e+08	4.3742e+08	4.8199e+08
epb3	1.1169e+07	1.8297e+07	2.6357e+07	4.1038e+07	4.1792e+07	4.7747e+07	5.7085e+07	6.2357e+07	8.835e+07	1.1534e+08
qcdRealPart	6.0889e+06	1.0728e+07	1.3795e+07	1.8963e+07	2.1614e+07	2.8743e+07	3.1043e+07	3.3631e+07	3.8855e+07	4.1529e+07
crashbasis	2.0294e+07	3.6167e+07	6.1024e+07	6.4836e+07	7.8229e+07	1.0199e+08	1.1586e+08	1.68e+08	1.5431e+08	1.6265e+08
Hamrle3	2.0265e+08	3.4878e+08	5.5259e+08	6.4793e+08	8.2674e+08	9.4864e+08	1.1337e+09	1.244e+09	1.4102e+09	1.5272e+09
HV15R	4.8842e+08	8.0962e+08	1.1063e+09	1.434e+09	1.7003e+09	2.1189e+09	2.4061e+09	2.8315e+09	3.0526e+09	3.3628e+09
lung2	1.4744e+07	2.4149e+07	3.3846e+07	4.3581e+07	6.3441e+07	6.1824e+07	7.3692e+07	8.4723e+07	9.4749e+07	1.2291e+08
ML_Geer	2.5649e+08	4.6459e+08	6.1605e+08	8.3115e+08	1.0313e+09	1.1794e+09	1.329e+09	1.5251e+09	1.7197e+09	1.8708e+09
pre2	9.2143e+07	1.5337e+08	2.0541e+08	2.7565e+08	3.3582e+08	4.076e+08	4.6279e+08	6.3232e+08	5.9052e+08	6.4881e+08
twotone	1.6543e+07	2.7071e+07	3.7822e+07	5.8417e+07	7.0158e+07	7.227e+07	8.4595e+07	1.0043e+08	1.3233e+08	1.2028e+08

TABLE 3.53

For recycled subspace dimension 100, cache misses for each projected matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescape1	5.9777e+08	1.1558e+09	1.757e+09	2.3172e+09	2.9187e+09	3.4706e+09	4.0963e+09	4.6913e+09	5.2557e+09	5.8518e+09
CoupCons3D	4.4141e+07	8.534e+07	1.4391e+08	1.6919e+08	2.1272e+08	2.3747e+08	2.9636e+08	3.4272e+08	3.7729e+08	4.2734e+08
rajat31	8.1086e+08	1.6132e+09	2.4275e+09	3.2528e+09	4.0611e+09	5.7166e+09	1.0711e+10	6.55e+09	7.8802e+09	7.8388e+09
FullChip	4.6709e+08	9.4445e+08	1.4247e+09	1.9384e+09	2.4405e+09	2.8819e+09	3.3789e+09	3.8671e+09	4.2682e+09	4.7853e+09
cage14	1.539e+08	3.0828e+08	4.5689e+08	6.3667e+08	7.9301e+08	9.2862e+08	1.0507e+09	1.2477e+09	1.397e+09	1.5936e+09
RM07R	4.6475e+07	7.1324e+07	1.0955e+08	1.4333e+08	2.0388e+08	2.1344e+08	2.4634e+08	2.8415e+08	3.3087e+08	3.5214e+08
epb3	7.6044e+06	1.4646e+07	2.2649e+07	3.5284e+07	3.7976e+07	4.3921e+07	5.3171e+07	5.8622e+07	8.1884e+07	7.401e+07
qcdRealPart	3.873e+06	7.7998e+06	1.1447e+07	1.5105e+07	1.8913e+07	2.2478e+07	2.5793e+07	3.0763e+07	3.2681e+07	3.7346e+07
crashbasis	1.411e+07	2.9548e+07	5.0234e+07	5.7981e+07	7.0537e+07	9.3213e+07	1.0738e+08	1.2399e+08	1.3757e+08	1.5388e+08
Hamrle3	1.7764e+08	2.9862e+08	4.3127e+08	5.7076e+08	7.2275e+08	9.1504e+08	1.0789e+09	1.2329e+09	1.3806e+09	1.5151e+09
HV15R	2.8223e+08	4.9701e+08	8.4232e+08	1.0417e+09	1.3418e+09	1.5857e+09	1.7928e+09	2.1189e+09	2.4114e+09	2.6475e+09
lung2	9.801e+06	1.9576e+07	2.9406e+07	3.8791e+07	5.4147e+07	5.6808e+07	6.8817e+07	7.8564e+07	8.8049e+07	1.0786e+08
ML_Geer	1.7952e+08	3.2635e+08	4.7283e+08	6.6187e+08	7.7108e+08	9.7554e+08	1.1237e+09	1.2929e+09	1.4464e+09	1.6229e+09
pre2	6.1515e+07	1.2286e+08	1.8413e+08	2.7724e+08	3.3473e+08	3.7509e+08	4.3099e+08	5.67e+08	5.5813e+08	6.4532e+08
twotone	1.079e+07	2.1478e+07	3.2358e+07	5.8889e+07	6.2702e+07	6.4917e+07	7.6005e+07	8.6168e+07	1.0313e+08	1.1098e+08

TABLE 3.54
 For recycled subspace dimension 100, ratio of average time required for each projected matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
Freescall1	1.9835	3.996	6.0059	7.993	9.9606	11.994	13.952	15.984	17.974	20.001
CoupCons3D	1.8833	3.6836	5.5424	7.303	8.9025	10.923	12.738	14.753	16.47	18.146
rajat31	1.9813	4	5.9871	7.944	9.9485	11.983	18.272	15.906	17.821	19.872
FullChip	1.9779	4.0128	6.0006	8.0299	9.9087	11.901	13.918	15.89	17.908	19.933
cage14	1.9984	4.0192	5.9407	8.0052	9.9921	12.083	14.092	15.979	17.729	19.978
RM07R	1.8196	3.4739	5.2992	6.9127	8.6491	10.501	12.251	13.931	15.454	17.107
epb3	1.9428	3.9324	5.946	8.0161	9.8523	11.516	14.411	15.346	17.797	20.191
qcdRealPart	1.9552	3.7891	6.0797	7.3988	11.045	11.532	13.225	17.341	16.738	20.282
crashbasis	2.0477	4.21	5.9851	7.8979	10.047	11.998	13.509	16.25	18.109	19.724
Hamrle3	2.0293	4.0375	6.0567	7.9373	10.156	11.91	13.836	16.083	18.168	20.078
HV15R	1.7717	3.3765	5.2018	6.7988	8.3315	10.206	11.8	9.782	15.091	16.736
lung2	2.0424	4.0116	6.1653	8.1061	10.426	12.04	14.375	16.641	18.715	21.42
ML_Geer	1.8475	3.6205	5.4322	7.3006	8.9642	10.872	12.534	14.53	16.357	17.35
pre2	2.0061	3.9423	5.8802	8.1997	10.292	11.758	13.894	14.958	17.859	19.659
twotone	1.9964	3.9367	6.0128	8.2442	9.7382	11.694	14.426	16.498	18.024	19.856

TABLE 4.1
Bytes read onto the processor for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	1.899e+06	2.9697e+06	3.6922e+06	4.6346e+06	5.5629e+06	6.2236e+06	7.6516e+06	7.6595e+06	8.1007e+06	9.5337e+06
dim = 100000, band = 4	2.8571e+06	1.7381e+07	2.4717e+07	3.2291e+07	5.7243e+07	5.4811e+07	7.9777e+07	1.3459e+08	1.6352e+08	2.8693e+08
dim = 1000000, band = 4	1.6306e+10	3.225e+10	1.093e+11	1.5017e+11	1.0782e+11	1.5323e+11	2.1572e+11	3.3595e+11	2.6148e+11	1.6377e+11
dim = 10000000, band = 4	1.6171e+11	3.2342e+11	4.8488e+11	6.4674e+11	8.082e+11	9.6985e+11	1.1318e+12	1.2931e+12	1.4556e+12	1.617e+12
dim = 10000, band = 10	2.6586e+06	1.3464e+06	4.5852e+06	6.9465e+06	8.3824e+06	5.4116e+06	1.0817e+07	1.2134e+07	1.392e+07	1.4567e+07
dim = 100000, band = 10	3.9471e+07	5.7164e+07	9.5244e+07	1.5896e+08	1.7525e+08	3.1112e+08	3.8475e+08	7.2567e+08	8.5826e+08	8.9365e+08
dim = 1000000, band = 10	3.0807e+10	6.1571e+10	9.2362e+10	1.2318e+11	1.54e+11	1.847e+11	2.1551e+11	2.4633e+11	2.7721e+11	3.0804e+11
dim = 10000000, band = 10	3.0836e+11	6.1638e+11	9.2492e+11	1.2323e+12	1.5399e+12	1.8458e+12	2.1541e+12	2.4616e+12	2.7708e+12	3.0752e+12
dim = 10000, band = 20	3.9251e+06	6.6076e+06	9.2437e+06	1.1105e+07	1.3446e+07	8.8455e+06	1.5355e+07	1.3937e+07	2.4761e+07	2.081e+07
dim = 100000, band = 20	1.3099e+09	2.9272e+09	3.8065e+09	5.2744e+09	8.3073e+09	1.1407e+10	1.2201e+10	9.3689e+09	1.33e+10	1.8253e+10
dim = 1000000, band = 20	5.5134e+10	1.102e+11	1.6548e+11	2.2053e+11	2.7562e+11	3.3069e+11	3.8598e+11	4.4109e+11	4.9587e+11	5.5116e+11
dim = 10000000, band = 20	5.5038e+11	1.102e+12	1.6524e+12	2.2031e+12	2.7534e+12	3.362e+12	3.8563e+12	4.4057e+12	5.9414e+12	5.5669e+12
dim = 10000, band = 30	5.105e+06	8.7386e+06	1.2297e+07	1.7126e+07	2.9979e+07	2.5327e+07	2.7638e+07	3.1708e+07	3.1635e+07	3.9474e+07
dim = 100000, band = 30	5.9047e+09	1.194e+10	1.7902e+10	2.419e+10	3.0291e+10	3.6259e+10	4.2939e+10	4.7216e+10	5.3787e+10	5.9373e+10
dim = 1000000, band = 30	7.9423e+10	1.5895e+11	2.3826e+11	3.1756e+11	3.971e+11	4.7647e+11	5.5577e+11	6.3534e+11	7.1486e+11	7.9424e+11
dim = 10000000, band = 30	7.9339e+11	1.5876e+12	2.3818e+12	3.1758e+12	3.9677e+12	4.7593e+12	5.5503e+12	7.1603e+12	7.2704e+12	7.9227e+12
dim = 10000, band = 40	7.0652e+06	1.1246e+07	1.6692e+07	2.0521e+07	2.5648e+07	2.1484e+07	4.0229e+07	4.1439e+07	4.7679e+07	4.5592e+07
dim = 100000, band = 40	9.5477e+09	1.92e+10	2.9354e+10	3.8509e+10	4.7434e+10	5.6506e+10	6.74e+10	7.5976e+10	8.6751e+10	9.7488e+10
dim = 1000000, band = 40	1.0368e+11	2.0746e+11	3.1121e+11	4.1505e+11	5.1865e+11	6.2254e+11	7.2611e+11	8.2991e+11	9.3389e+11	1.0372e+12
dim = 10000000, band = 40	1.0354e+12	2.0732e+12	3.1056e+12	4.1425e+12	5.1798e+12	6.2212e+12	7.2504e+12	8.2876e+12	9.3215e+12	1.036e+13
dim = 10000, band = 50	2.6081e+06	1.4222e+07	3.733e+07	1.53e+07	2.6953e+07	3.9508e+07	2.3644e+07	5.0094e+07	5.5744e+07	4.3662e+07
dim = 100000, band = 50	1.2533e+10	2.5123e+10	3.7683e+10	4.975e+10	6.2837e+10	7.4986e+10	8.7893e+10	1.0032e+11	1.1307e+11	1.2454e+11
dim = 1000000, band = 50	1.2797e+11	2.5613e+11	4.5544e+11	5.2778e+11	6.4009e+11	7.6841e+11	8.9867e+11	1.0263e+12	1.1507e+12	1.2794e+12
dim = 10000000, band = 50	1.2802e+12	2.5587e+12	3.8369e+12	5.1172e+12	6.4223e+12	7.6753e+12	8.9767e+12	1.0249e+13	1.1523e+13	1.2803e+13

4. Unprojected application of artificially constructed banded matrices.

TABLE 4.2
Bytes read onto the processor for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	1.0237e+06	2.5338e+06	3.3713e+06	3.5169e+06	3.6854e+06	4.391e+06	4.8808e+06	5.5245e+06	6.4042e+06	6.0141e+06
dim = 100000, band = 4	7.4959e+06	1.1319e+07	1.8661e+07	5.4121e+07	1.6545e+08	3.9095e+08	7.9733e+08	1.2949e+09	1.8873e+09	2.3807e+09
dim = 1000000, band = 4	9.7159e+09	1.2961e+10	2.2953e+10	6.3828e+10	4.7656e+10	4.3303e+10	5.2515e+10	1.3549e+11	1.4581e+11	6.2372e+10
dim = 10000000, band = 4	9.7035e+10	1.2928e+11	2.2621e+11	2.5862e+11	2.9071e+11	3.8763e+11	4.2019e+11	5.172e+11	5.4948e+11	5.8161e+11
dim = 10000, band = 10	2.6954e+06	1.316e+06	1.7725e+06	5.4134e+06	5.9696e+06	2.3699e+06	8.0724e+06	8.6821e+06	9.6935e+06	1.0552e+07
dim = 100000, band = 10	3.5316e+07	7.154e+07	1.4815e+08	3.385e+08	6.5155e+08	1.1828e+09	1.6887e+09	2.3178e+09	2.7427e+09	3.2836e+09
dim = 1000000, band = 10	1.703e+10	2.028e+10	3.731e+10	4.0547e+10	4.3761e+10	6.08e+10	6.4049e+10	8.1016e+10	8.436e+10	8.7578e+10
dim = 10000000, band = 10	1.7055e+11	2.0318e+11	3.7341e+11	4.0602e+11	4.3812e+11	6.0815e+11	6.3994e+11	8.1068e+11	8.4296e+11	8.7504e+11
dim = 10000, band = 20	3.2854e+06	5.0545e+06	6.777e+06	8.0964e+06	9.9034e+06	1.1895e+07	1.324e+07	1.6845e+07	1.698e+07	1.8118e+07
dim = 100000, band = 20	9.4912e+08	1.5499e+09	2.4403e+09	3.3481e+09	4.272e+09	5.6938e+09	6.3355e+09	6.8506e+09	8.1251e+09	9.0794e+09
dim = 1000000, band = 20	2.9224e+10	3.2488e+10	6.1764e+10	6.5042e+10	6.8288e+10	9.754e+10	1.0073e+11	1.2998e+11	1.3316e+11	1.3651e+11
dim = 10000000, band = 20	2.9151e+11	3.2486e+11	6.1629e+11	6.4962e+11	6.8212e+11	9.9016e+11	1.0075e+12	1.2982e+12	1.3319e+12	1.6436e+12
dim = 10000, band = 30	4.6457e+06	6.6127e+06	9.617e+06	4.1627e+06	1.4118e+07	1.5253e+07	1.9033e+07	9.6074e+06	2.309e+07	2.6551e+07
dim = 100000, band = 30	3.2344e+09	3.7641e+09	7.1603e+09	7.7984e+09	8.3646e+09	1.1777e+10	1.2547e+10	1.5508e+10	1.6211e+10	1.6766e+10
dim = 1000000, band = 30	4.1381e+10	4.4611e+10	8.6064e+10	8.9302e+10	9.2587e+10	1.3396e+11	1.3725e+11	1.7859e+11	1.8191e+11	1.852e+11
dim = 10000000, band = 30	4.1312e+11	4.4626e+11	8.5977e+11	8.9313e+11	9.2571e+11	1.338e+12	1.3722e+12	2.203e+12	1.8586e+12	1.8476e+12
dim = 10000, band = 40	5.3274e+06	8.5489e+06	1.2385e+07	1.4518e+07	1.7868e+07	1.9097e+07	2.4559e+07	2.838e+07	3.0174e+07	3.2553e+07
dim = 100000, band = 40	4.9936e+09	5.4153e+09	1.0643e+10	1.09e+10	1.1242e+10	1.6246e+10	1.6892e+10	2.1709e+10	2.2242e+10	2.277e+10
dim = 1000000, band = 40	5.3469e+10	5.6857e+10	1.1034e+11	1.1373e+11	1.1708e+11	1.7067e+11	1.7391e+11	2.2764e+11	2.3062e+11	2.3406e+11
dim = 10000000, band = 40	5.34e+11	5.6793e+11	1.1007e+12	1.1358e+12	1.1673e+12	1.7038e+12	1.7366e+12	2.2725e+12	2.3016e+12	2.3387e+12
dim = 10000, band = 50	5.3105e+06	1.0399e+07	1.4021e+07	1.79e+07	2.2606e+07	1.9854e+07	3.1389e+07	3.603e+07	2.009e+07	4.4133e+07
dim = 100000, band = 50	6.461e+09	6.8224e+09	1.3324e+10	1.3617e+10	1.4053e+10	2.0442e+10	2.0887e+10	2.7337e+10	2.7736e+10	2.7992e+10
dim = 1000000, band = 50	6.565e+10	6.8989e+10	1.3495e+11	2.0599e+11	1.4159e+11	2.0714e+11	2.1062e+11	2.7728e+11	2.7892e+11	2.8261e+11
dim = 10000000, band = 50	6.5668e+11	6.8938e+11	1.3467e+12	1.3798e+12	1.4132e+12	2.0674e+12	2.1039e+12	2.7953e+12	2.7964e+12	2.829e+12

TABLE 4.3
Average time taken for each matrix to act on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	0.00020209	0.00040809	0.00060853	0.00081293	0.001011	0.0012181	0.0014174	0.0016135	0.001818	0.002026
dim = 100000, band = 4	0.0019935	0.0040359	0.0060534	0.0080696	0.010107	0.012058	0.014132	0.016231	0.018205	0.020273
dim = 1000000, band = 4	0.037523	0.073697	0.11717	0.14899	0.18034	0.21848	0.25868	0.29336	0.32566	0.36541
dim = 10000000, band = 4	0.36929	0.73346	1.1016	1.4632	1.8261	2.1979	2.5576	2.9321	3.291	3.6629
dim = 10000, band = 10	0.00036497	0.00071618	0.0010869	0.0014568	0.0018237	0.002162	0.0025498	0.0029188	0.0032883	0.0036293
dim = 100000, band = 10	0.0036535	0.0072905	0.010873	0.014568	0.018162	0.021863	0.025457	0.02934	0.032903	0.03649
dim = 1000000, band = 10	0.076137	0.15199	0.22822	0.3039	0.37991	0.4556	0.53224	0.60685	0.68353	0.75862
dim = 10000000, band = 10	0.75791	1.5207	2.2818	3.0435	3.7924	4.5557	5.3066	6.0703	6.836	7.5866
dim = 10000, band = 20	0.00064934	0.001305	0.0019841	0.0026236	0.0033086	0.0039027	0.0045739	0.0052235	0.0058956	0.0066719
dim = 100000, band = 20	0.0079715	0.015946	0.023222	0.030828	0.040577	0.051145	0.10611	0.058623	0.068314	0.081467
dim = 1000000, band = 20	0.14057	0.27995	0.42333	0.56343	0.70398	0.84606	0.98783	1.1281	1.2691	1.4101
dim = 10000000, band = 20	1.4089	2.8172	4.231	5.6339	7.0512	8.4654	9.8465	11.277	12.886	19.638
dim = 10000, band = 30	0.00094247	0.001879	0.0028638	0.0038054	0.0047435	0.0057858	0.0067274	0.007613	0.0085719	0.0096977
dim = 100000, band = 30	0.01786	0.035618	0.053434	0.071762	0.088964	0.10574	0.12455	0.13917	0.15779	0.1739
dim = 1000000, band = 30	0.20569	0.41451	0.6202	0.82695	1.0337	1.2423	1.4474	1.654	1.8601	2.0689
dim = 10000000, band = 30	2.0533	4.1143	6.179	8.2125	10.282	12.318	14.401	16.423	44.79	20.558
dim = 10000, band = 40	0.0012261	0.0024682	0.0037595	0.0049384	0.0062755	0.0074914	0.0085703	0.0098616	0.011271	0.012244
dim = 100000, band = 40	0.026241	0.052494	0.078433	0.10431	0.1279	0.1522	0.18019	0.20397	0.23163	0.25923
dim = 1000000, band = 40	0.27076	0.54297	0.81216	1.0826	1.3539	1.6274	1.8978	2.1659	2.4461	2.7095
dim = 10000000, band = 40	2.7136	5.4327	8.1019	10.815	13.513	16.183	19.046	21.639	24.4	27.142
dim = 10000, band = 50	0.0014974	0.0030352	0.0045591	0.0061513	0.0076672	0.0091622	0.010527	0.012224	0.013795	0.015161
dim = 100000, band = 50	0.034044	0.066678	0.099077	0.13141	0.16537	0.19766	0.22967	0.26445	0.29769	0.32836
dim = 1000000, band = 50	0.33547	0.66743	1.011	1.3424	1.6793	2.007	2.3532	2.6754	3.0203	3.3354
dim = 10000000, band = 50	3.345	6.6903	10.033	13.411	23.134	20.064	23.392	26.742	30.096	33.43

TABLE 4.4
Average time taken for each matrix to act on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	0.000157	0.00024574	0.000412	0.00049242	0.0005928	0.00075331	0.00084051	0.0010177	0.001096	0.0011939
dim = 100000, band = 4	0.0016213	0.0024814	0.004136	0.0049588	0.0060037	0.0077167	0.0086717	0.010406	0.011348	0.012368
dim = 1000000, band = 4	0.022663	0.029799	0.053337	0.05581	0.061633	0.088475	0.093348	0.11278	0.1183	0.12758
dim = 10000000, band = 4	0.21818	0.27583	0.49521	0.55228	0.62076	0.84138	0.8991	1.1203	1.1748	1.2446
dim = 10000, band = 10	0.00029357	0.00047522	0.0007713	0.00096445	0.0011707	0.0014418	0.0016531	0.0019443	0.002135	0.0023413
dim = 100000, band = 10	0.0029619	0.0048392	0.0077348	0.0096174	0.0111794	0.014831	0.016833	0.019925	0.021858	0.023917
dim = 1000000, band = 10	0.04226	0.052357	0.096721	0.10583	0.11739	0.15995	0.16893	0.2128	0.22409	0.23305
dim = 10000000, band = 10	0.42174	0.52244	0.96094	1.0607	1.1648	1.5872	1.6772	2.1229	2.2149	2.319
dim = 10000, band = 20	0.00051492	0.00087753	0.0014083	0.0017625	0.0021364	0.0026552	0.0030114	0.0035462	0.0039031	0.004282
dim = 100000, band = 20	0.0056068	0.0092716	0.015617	0.018712	0.022897	0.02892	0.032053	0.038632	0.041948	0.046143
dim = 1000000, band = 20	0.077112	0.093453	0.17494	0.19064	0.20889	0.2857	0.30184	0.38401	0.39773	0.41797
dim = 10000000, band = 20	0.77247	0.93666	1.7465	1.891	2.083	4.7254	3.0377	3.8279	3.9666	4.2454
dim = 10000, band = 30	0.00073733	0.0012555	0.0020261	0.0025044	0.0030987	0.0038244	0.0043882	0.0050649	0.0056444	0.0061938
dim = 100000, band = 30	0.01014	0.013969	0.025981	0.028449	0.033359	0.044109	0.047562	0.059463	0.062063	0.066825
dim = 1000000, band = 30	0.1118	0.13367	0.25152	0.27083	0.29969	0.41034	0.43474	0.55068	0.57023	0.59713
dim = 10000000, band = 30	1.1146	1.3344	2.5141	2.6941	2.9842	4.0929	4.3154	5.5494	11.603	5.9821
dim = 10000, band = 40	0.00095545	0.0016573	0.002656	0.003326	0.0040472	0.0050041	0.0056955	0.0066914	0.007367	0.0080802
dim = 100000, band = 40	0.014434	0.018297	0.035517	0.038269	0.043784	0.058263	0.061844	0.077682	0.079149	0.08411
dim = 1000000, band = 40	0.1461	0.17315	0.32671	0.35063	0.38512	0.5333	0.55718	0.71205	0.73462	0.77068
dim = 10000000, band = 40	1.4616	1.7258	3.2599	3.4884	3.8516	5.2906	5.5805	7.0957	7.3413	7.6749
dim = 10000, band = 50	0.0011695	0.002041	0.003262	0.0041116	0.0050065	0.0061351	0.0070479	0.008274	0.0090184	0.010014
dim = 100000, band = 50	0.018506	0.022777	0.043779	0.047362	0.05378	0.070333	0.073937	0.093027	0.095876	0.10103
dim = 1000000, band = 50	0.18185	0.21194	0.40262	0.43097	0.47508	0.65376	0.68923	0.87648	0.9072	0.95192
dim = 10000000, band = 50	1.8101	2.1292	4.032	4.3029	4.756	6.5597	6.8592	8.7582	9.0398	9.4913

TABLE 4.5
Cache hit ratio for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	0.85612	0.87821	0.88862	0.89707	0.89884	0.89415	0.90634	0.90958	0.90329	0.9033
dim = 100000, band = 4	0.95286	0.90794	0.91288	0.91111	0.90837	0.92329	0.91403	0.90292	0.90384	0.89361
dim = 1000000, band = 4	0.11715	0.11176	0.62409	0.65699	0.56386	0.58935	0.57988	0.63523	0.61044	0.13026
dim = 10000000, band = 4	0.11148	0.11384	0.1103	0.11057	0.11113	0.11231	0.11054	0.11277	0.11112	0.11195
dim = 10000, band = 10	0.8738	0.93858	0.90986	0.90497	0.90613	0.93913	0.90997	0.91627	0.91692	0.91759
dim = 100000, band = 10	0.87025	0.89001	0.90378	0.88835	0.89894	0.88912	0.90375	0.85271	0.87079	0.87998
dim = 1000000, band = 10	0.10814	0.10749	0.10745	0.10975	0.11127	0.10939	0.10959	0.10864	0.11152	0.10785
dim = 10000000, band = 10	0.10688	0.10526	0.10662	0.10822	0.10875	0.10955	0.10808	0.10916	0.10903	0.11007
dim = 10000, band = 20	0.8901	0.89839	0.91099	0.91755	0.91607	0.9468	0.92778	0.93918	0.91462	0.93576
dim = 100000, band = 20	0.39348	0.38287	0.41794	0.42191	0.35357	0.28591	0.32644	0.43039	0.34836	0.27157
dim = 1000000, band = 20	0.10884	0.10464	0.10698	0.10639	0.10599	0.10723	0.10681	0.10852	0.10701	0.10784
dim = 10000000, band = 20	0.10668	0.10641	0.10827	0.10662	0.10899	0.16631	0.10516	0.10836	0.42351	0.1469
dim = 10000, band = 30	0.89833	0.90658	0.91456	0.91304	0.91162	0.91737	0.91738	0.91764	0.92475	0.92166
dim = 100000, band = 30	0.13888	0.13682	0.13563	0.13434	0.12917	0.12785	0.12366	0.12858	0.12605	0.12798
dim = 1000000, band = 30	0.10589	0.10938	0.10612	0.10554	0.10778	0.10731	0.10654	0.10664	0.10744	0.10637
dim = 10000000, band = 30	0.10513	0.10589	0.10579	0.10407	0.10663	0.10578	0.10701	0.34645	0.18219	0.10675
dim = 10000, band = 40	0.89872	0.90983	0.91228	0.91548	0.91921	0.93748	0.90881	0.91525	0.91589	0.92078
dim = 100000, band = 40	0.11943	0.11867	0.11041	0.13116	0.11273	0.11239	0.10975	0.11165	0.11014	0.10973
dim = 1000000, band = 40	0.10774	0.10794	0.10615	0.10756	0.10555	0.1051	0.10589	0.10548	0.10558	0.10709
dim = 10000000, band = 40	0.1052	0.10507	0.10634	0.10415	0.10531	0.1038	0.1052	0.10505	0.10589	0.10627
dim = 10000, band = 50	0.94722	0.90731	0.90663	0.9448	0.92502	0.91385	0.946	0.91738	0.91713	0.9349
dim = 100000, band = 50	0.11078	0.10945	0.10428	0.10584	0.10466	0.10772	0.10401	0.10636	0.10735	0.10645
dim = 1000000, band = 50	0.10636	0.10534	0.45	0.20769	0.10611	0.10291	0.12306	0.10349	0.10702	0.10319
dim = 10000000, band = 50	0.10517	0.10643	0.10632	0.1065	0.12168	0.10629	0.11569	0.10627	0.10556	0.10565

TABLE 4.6
Cache hit ratio for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	0.86948	0.8323	0.84382	0.8437	0.85921	0.86444	0.86706	0.86378	0.87962	0.8798
dim = 100000, band = 4	0.89325	0.89174	0.89785	0.88794	0.85526	0.8491	0.80189	0.76693	0.73507	0.70796
dim = 1000000, band = 4	0.14973	0.26168	0.35499	0.66349	0.76603	0.46921	0.66958	0.69534	0.64203	0.71445
dim = 10000000, band = 4	0.13925	0.21803	0.17288	0.2116	0.26831	0.21589	0.2577	0.21932	0.23867	0.27003
dim = 10000, band = 10	0.85641	0.90751	0.92194	0.86891	0.88588	0.9417	0.88942	0.88988	0.88058	0.89155
dim = 100000, band = 10	0.87859	0.87403	0.89272	0.87214	0.83457	0.80456	0.78416	0.75995	0.75577	0.74777
dim = 1000000, band = 10	0.12697	0.18698	0.18283	0.21833	0.34764	0.24217	0.27047	0.24559	0.27856	0.34124
dim = 10000000, band = 10	0.12898	0.17603	0.17779	0.21389	0.33521	0.23111	0.26674	0.24318	0.267	0.33982
dim = 10000, band = 20	0.85156	0.87165	0.88498	0.87997	0.8863	0.87964	0.88351	0.88176	0.88486	0.88725
dim = 100000, band = 20	0.57417	0.69034	0.48248	0.65419	0.67102	0.57063	0.66139	0.56284	0.64624	0.65994
dim = 1000000, band = 20	0.12889	0.22967	0.20134	0.2372	0.44663	0.27206	0.33374	0.27695	0.3139	0.45193
dim = 10000000, band = 20	0.12721	0.2095	0.1912	0.23386	0.45058	0.2187	0.3376	0.28017	0.31293	0.65926
dim = 10000, band = 30	0.86402	0.87687	0.8839	0.94283	0.88545	0.8912	0.8857	0.93678	0.8885	0.88678
dim = 100000, band = 30	0.18636	0.54141	0.25031	0.39285	0.59959	0.36659	0.56647	0.36343	0.47933	0.60081
dim = 1000000, band = 30	0.12404	0.2304	0.18763	0.2391	0.47326	0.26679	0.35564	0.28348	0.32041	0.46808
dim = 10000000, band = 30	0.12322	0.23094	0.19045	0.23492	0.47294	0.2666	0.35694	0.60731	0.23627	0.47977
dim = 10000, band = 40	0.87248	0.87755	0.88914	0.88384	0.88054	0.89656	0.88797	0.8894	0.8913	0.89179
dim = 100000, band = 40	0.145	0.4605	0.21771	0.32422	0.60596	0.32959	0.54522	0.32562	0.41023	0.58309
dim = 1000000, band = 40	0.12494	0.25203	0.18981	0.24418	0.52021	0.27662	0.39715	0.29435	0.33909	0.52231
dim = 10000000, band = 40	0.12408	0.24894	0.18988	0.23983	0.5267	0.27235	0.38973	0.28645	0.33764	0.51965
dim = 10000, band = 50	0.88351	0.88267	0.88969	0.88488	0.88082	0.90534	0.88644	0.88732	0.92528	0.88446
dim = 100000, band = 50	0.13655	0.4197	0.21232	0.30952	0.59789	0.32988	0.49355	0.31274	0.37311	0.56782
dim = 1000000, band = 50	0.12593	0.25357	0.18945	0.27355	0.52597	0.27611	0.3956	0.2822	0.34844	0.53155
dim = 10000000, band = 50	0.12202	0.24896	0.19122	0.24509	0.53345	0.28034	0.39213	0.33326	0.33861	0.52871

TABLE 4.7
Cache misses for each matrix when acting on the block of vectors one-at-a-time.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	28463	45047	52787	65993	79039	87813	1.0048e+05	1.0755e+05	1.118e+05	1.3324e+05
dim = 100000, band = 4	49956	2.388e+05	3.3551e+05	4.3519e+05	5.8043e+05	5.4081e+05	7.4767e+05	9.9184e+05	1.0785e+06	1.3483e+06
dim = 1000000, band = 4	1.0927e+08	2.1844e+08	1.3442e+09	1.7266e+09	8.9257e+08	1.5472e+09	2.3913e+09	3.9664e+09	2.6166e+09	1.127e+09
dim = 10000000, band = 4	1.1073e+09	2.2035e+09	3.3545e+09	4.4251e+09	5.5172e+09	6.627e+09	7.7252e+09	8.8378e+09	9.9093e+09	1.1061e+10
dim = 10000, band = 10	39828	25965	64271	97331	1.1881e+05	79744	1.496e+05	1.6699e+05	1.8966e+05	2.0024e+05
dim = 100000, band = 10	3.3709e+05	5.2462e+05	6.2540e+05	1.0508e+06	1.1728e+06	1.5456e+06	1.5639e+06	2.8917e+06	2.8034e+06	2.8469e+06
dim = 1000000, band = 10	2.3753e+08	4.7261e+08	7.1096e+08	9.3166e+08	1.1705e+09	1.3904e+09	1.6331e+09	1.865e+09	2.1087e+09	2.3321e+09
dim = 10000000, band = 10	2.3716e+09	4.7497e+09	7.0858e+09	9.3714e+09	1.167e+10	1.4019e+10	1.6326e+10	1.8715e+10	2.0935e+10	2.3383e+10
dim = 10000, band = 20	55877	91702	1.2918e+05	1.51e+05	1.8642e+05	1.3241e+05	2.1703e+05	1.9922e+05	3.3794e+05	2.8372e+05
dim = 100000, band = 20	6.0209e+06	1.3078e+07	1.6085e+07	2.1579e+07	3.6788e+07	5.9423e+07	9.4971e+07	3.9718e+07	6.3433e+07	1.0467e+08
dim = 1000000, band = 20	4.4259e+08	8.9346e+08	1.3189e+09	1.7668e+09	2.2081e+09	2.6512e+09	3.0778e+09	3.5303e+09	3.9569e+09	4.417e+09
dim = 10000000, band = 20	4.421e+09	8.7889e+09	1.3247e+10	1.7571e+10	2.2067e+10	2.9917e+10	3.1021e+10	3.5256e+10	5.4623e+10	5.3591e+10
dim = 10000, band = 30	74773	1.1935e+05	1.7033e+05	2.3489e+05	2.798e+05	3.4492e+05	3.7613e+05	4.2993e+05	4.3370e+05	5.278e+05
dim = 100000, band = 30	4.5183e+07	8.9581e+07	1.3753e+08	1.8128e+08	2.3893e+08	2.8515e+08	3.402e+08	3.7705e+08	4.3517e+08	4.712e+08
dim = 1000000, band = 30	6.515e+08	1.3098e+09	1.9673e+09	2.6061e+09	3.2606e+09	3.9114e+09	4.5749e+09	5.2035e+09	5.8833e+09	6.5293e+09
dim = 10000000, band = 30	6.5252e+09	1.295e+10	1.955e+10	2.6052e+10	3.2473e+10	3.9175e+10	4.5243e+10	6.3975e+10	7.3009e+10	6.4782e+10
dim = 10000, band = 40	98197	1.5504e+05	2.2354e+05	2.8038e+05	3.5076e+05	3.0328e+05	5.341e+05	5.637e+05	6.4714e+05	6.2336e+05
dim = 100000, band = 40	7.3417e+07	1.4957e+08	2.3551e+08	3.1334e+08	3.8513e+08	4.6114e+08	5.4673e+08	6.2528e+08	7.0485e+08	7.9692e+08
dim = 1000000, band = 40	8.4651e+08	1.7234e+09	2.5674e+09	3.4256e+09	4.2707e+09	5.1556e+09	5.9841e+09	6.8642e+09	7.7319e+09	8.5664e+09
dim = 10000000, band = 40	8.6653e+09	1.7171e+10	2.561e+10	3.4407e+10	4.307e+10	5.1487e+10	6.0824e+10	6.8785e+10	7.7891e+10	8.5557e+10
dim = 10000, band = 50	46342	1.9037e+05	2.8954e+05	2.1785e+05	3.7177e+05	5.2869e+05	3.375e+05	6.7598e+05	7.5505e+05	6.1125e+05
dim = 100000, band = 50	9.95e+07	2.023e+08	3.0809e+08	4.0932e+08	5.1554e+08	6.1947e+08	7.3757e+08	8.2346e+08	9.316e+08	1.0231e+09
dim = 1000000, band = 50	1.0616e+09	2.1674e+09	4.3407e+09	4.4723e+09	5.325e+09	6.5222e+09	7.4571e+09	8.4853e+09	9.5499e+09	1.0813e+10
dim = 10000000, band = 50	1.0638e+10	2.1303e+10	3.194e+10	4.2219e+10	6.3177e+10	6.3899e+10	7.4737e+10	8.5413e+10	9.5797e+10	1.0669e+11

TABLE 4.8
Cache misses for each matrix when acting on the block of vectors all at once.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	20866	37358	48657	50784	53220	62946	69119	77244	88539	84720
dim = 100000, band = 4	1.0526e+05	1.5461e+05	2.4146e+05	3.0075e+05	4.6878e+05	6.361e+05	9.5793e+05	1.3718e+06	1.8374e+06	2.0664e+06
dim = 1000000, band = 4	4.9397e+07	3.1765e+07	8.316e+07	6.4914e+08	2.9822e+08	1.6259e+08	2.0827e+08	1.3385e+09	1.4834e+09	1.5933e+08
dim = 10000000, band = 4	5.0713e+08	3.7463e+08	8.9026e+08	8.0359e+08	6.3768e+08	1.1515e+09	9.9247e+08	1.5268e+09	1.4367e+09	1.2843e+09
dim = 10000, band = 10	42159	25555	32114	75113	84653	42586	1.1064e+05	1.2108e+05	1.3532e+05	1.4597e+05
dim = 100000, band = 10	2.2308e+05	3.3546e+05	3.9497e+05	5.8909e+05	1.0343e+06	1.6258e+06	2.0701e+06	2.7874e+06	3.0933e+06	3.4206e+06
dim = 1000000, band = 10	1.0977e+08	8.6654e+07	1.6253e+08	1.4325e+08	8.0055e+07	1.8882e+08	1.7144e+08	2.431e+08	2.2071e+08	1.6741e+08
dim = 10000000, band = 10	1.0896e+09	8.9209e+08	1.6342e+09	1.4514e+09	8.469e+08	1.9649e+09	1.717e+09	2.4939e+09	2.2783e+09	1.7216e+09
dim = 10000, band = 20	48189	72849	95026	1.1349e+05	1.3775e+05	1.6548e+05	1.8191e+05	2.2276e+05	2.326e+05	2.49e+05
dim = 100000, band = 20	2.0309e+06	1.7865e+06	7.2361e+06	4.1679e+06	4.4771e+06	8.9598e+06	6.674e+06	1.2575e+07	9.2914e+06	9.5468e+06
dim = 1000000, band = 20	2.0466e+08	1.2669e+08	2.7729e+08	2.3054e+08	9.6825e+07	2.9907e+08	2.2494e+08	3.7316e+08	3.2437e+08	1.9086e+08
dim = 10000000, band = 20	2.0351e+09	1.3218e+09	2.7846e+09	2.3114e+09	9.7509e+08	6.1818e+09	2.1992e+09	3.7426e+09	3.2723e+09	6.5328e+09
dim = 10000, band = 30	66242	92818	1.3281e+05	65767	1.9429e+05	2.1017e+05	2.5843e+05	1.3709e+05	3.1371e+05	3.5993e+05
dim = 100000, band = 30	1.7934e+07	4.6078e+06	3.063e+07	1.6742e+07	8.2011e+06	2.9704e+07	1.3937e+07	3.9155e+07	2.5809e+07	1.6628e+07
dim = 1000000, band = 30	2.9845e+08	1.6261e+08	4.0823e+08	3.2242e+08	1.2549e+08	4.2286e+08	2.9597e+08	5.3264e+08	4.5333e+08	2.5365e+08
dim = 10000000, band = 30	2.993e+09	1.6536e+09	4.0613e+09	3.2508e+09	1.2514e+09	4.2333e+09	2.8955e+09	1.1807e+10	1.3498e+10	2.4352e+09
dim = 10000, band = 40	74270	1.1849e+05	1.7208e+05	1.9963e+05	2.445e+05	2.6217e+05	3.333e+05	3.8641e+05	4.0404e+05	4.3392e+05
dim = 100000, band = 40	3.2798e+07	7.6504e+06	4.771e+07	2.9677e+07	1.0707e+07	4.3872e+07	1.9079e+07	6.0851e+07	4.2742e+07	2.2798e+07
dim = 1000000, band = 40	3.8413e+08	1.9515e+08	5.1904e+08	4.0753e+08	1.3358e+08	5.1751e+08	3.203e+08	6.5718e+08	5.3516e+08	2.6431e+08
dim = 10000000, band = 40	3.883e+09	1.9185e+09	5.193e+09	4.0664e+09	1.2836e+09	5.1999e+09	3.2749e+09	6.554e+09	5.4019e+09	2.6371e+09
dim = 10000, band = 50	76000	1.4281e+05	1.9178e+05	2.4626e+05	3.0591e+05	2.7612e+05	4.2269e+05	4.8768e+05	2.9528e+05	5.9111e+05
dim = 100000, band = 50	4.4229e+07	1.1345e+07	5.9794e+07	3.9991e+07	1.3403e+07	5.9286e+07	2.7852e+07	7.586e+07	5.9611e+07	2.9081e+07
dim = 1000000, band = 50	4.7999e+08	2.3365e+08	6.4165e+08	1.5701e+09	1.6075e+08	6.3718e+08	3.9316e+08	8.1204e+08	6.487e+08	3.1158e+08
dim = 10000000, band = 50	4.828e+09	2.4105e+09	6.4335e+09	4.938e+09	1.5758e+09	6.3565e+09	3.9495e+09	8.4799e+09	6.5948e+09	3.1826e+09

TABLE 4.9
Ratio of average time required for each matrix to act on a block of vectors versus a single vector.

Matrix	Block 2	Block 4	Block 6	Block 8	Block 10	Block 12	Block 14	Block 16	Block 18	Block 20
dim = 10000, band = 4	1.5538	2.4087	4.0622	4.8459	5.8635	7.4213	8.3022	10.092	10.851	11.786
dim = 100000, band = 4	1.6266	2.4593	4.0995	4.9161	5.9404	7.6793	8.5909	10.258	11.22	12.201
dim = 1000000, band = 4	1.2079	1.6174	2.7312	2.9966	3.4176	4.8595	5.052	6.1509	6.5388	6.983
dim = 10000000, band = 4	1.1816	1.5043	2.6972	3.0196	3.3993	4.5938	4.9216	6.1134	6.4256	6.7955
dim = 10000, band = 10	1.6088	2.6542	4.2576	5.2961	6.4195	8.0027	9.0764	10.658	11.687	12.902
dim = 100000, band = 10	1.6214	2.6551	4.2682	5.2815	6.4941	8.1401	9.2572	10.866	11.958	13.109
dim = 1000000, band = 10	1.1101	1.3779	2.5428	2.7859	3.0898	4.2129	4.4435	5.6105	5.9012	6.1439
dim = 10000000, band = 10	1.1129	1.3742	2.5268	2.7881	3.0713	4.1809	4.4249	5.5955	5.8321	6.1136
dim = 10000, band = 20	1.586	2.6897	4.2587	5.3745	6.457	8.164	9.2172	10.862	11.917	12.836
dim = 100000, band = 20	1.4067	2.3257	4.0352	4.8557	5.6427	6.7853	4.2293	10.544	11.053	11.328
dim = 1000000, band = 20	1.0971	1.3353	2.4795	2.7069	2.9673	4.0522	4.2778	5.4463	5.641	5.9281
dim = 10000000, band = 20	1.0966	1.3299	2.4767	2.6851	2.954	3.4464	4.3191	5.4312	5.5409	4.3237
dim = 10000, band = 30	1.5647	2.6728	4.2448	5.265	6.5326	7.932	9.132	10.645	11.853	12.774
dim = 100000, band = 30	1.1355	1.5688	2.9174	3.1714	3.7497	5.0058	5.3462	6.8362	7.0796	7.6855
dim = 1000000, band = 30	1.0871	1.2899	2.4332	2.6201	2.899	3.9637	4.205	5.3271	5.5181	5.7723
dim = 10000000, band = 30	1.0857	1.2973	2.4413	2.6244	2.9022	3.9872	4.1952	5.4064	4.6629	5.8198
dim = 10000, band = 40	1.5585	2.6859	4.2387	5.3879	6.4493	8.0157	9.304	10.856	11.765	13.199
dim = 100000, band = 40	1.1001	1.3942	2.717	2.9351	3.4233	4.5936	4.8051	6.0935	6.1507	6.4893
dim = 1000000, band = 40	1.0792	1.2756	2.4136	2.5911	2.8445	3.9324	4.1103	5.2601	5.4058	5.6888
dim = 10000000, band = 40	1.0772	1.2707	2.4142	2.5804	2.8503	3.9231	4.102	5.2467	5.4157	5.6553
dim = 10000, band = 50	1.562	2.6897	4.2929	5.3473	6.5298	8.0353	9.373	10.83	11.768	13.211
dim = 100000, band = 50	1.0872	1.3664	2.6512	2.8834	3.252	4.27	4.507	5.6284	5.7973	6.1535
dim = 1000000, band = 50	1.0841	1.2702	2.3894	2.5684	2.8291	3.9089	4.1004	5.2416	5.4067	5.708
dim = 10000000, band = 50	1.0823	1.273	2.4114	2.5667	2.0559	3.9233	4.1052	5.24	5.4067	5.6783

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