

Experimental Assessment of the Optimized Perfect Club Benchmarks on a Cray Y-MP

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Abstract

This study provides an experimental assessment of the dynamic behavior of the optimized Perfect Club Benchmarks for the memory behavior as run on a Cray Y-MP. The goal of this study is to provide a basis for the generation of realistic synthetic memory workloads and port utilization estimates for shared memory machines. An analysis of the optimized data will appear in a future edition of this technical report.

Key words: benchmarks, Perfect Club, Cray Y-MP, memory utilization, shared memory.

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1 Introduction

This technical report describes the memory access behavior of the optimized Perfect Club Benchmarks [2] on a Cray Y-MP. These programs, which have been drawn from scientific and engineering applications, have been developed in a cooperative effort by several universities, research centers, and industry. This report is a companion to an earlier work [7] which studied the behavior of the unoptimized version of these programs.

2 Methodology

Two studies of the Perfect Club Benchmarks on Cray systems have recently appeared. Malony, Larson, and Reed [4] have developed a tracing facility for the Cray X-MP and Cray 2 in which they use Cray compiler support for automatic instrumentation to dump and analyze hardware performance monitor (`hpm`) data on exit and entry to subroutines. This is a general, relatively low-cost technique for obtaining dynamic information about program behavior. It uses the real time clock for timing and is therefore susceptible to errors due to multiprogramming. The technique also introduces some overhead, which in some cases can be analyzed and removed.

Vajapeyam, Sohi, and Hsu [8] decomposed programs into basic blocks and used the Cray tool `jumptrace` to obtain execution frequencies of the basic blocks. They also obtained hardware performance monitor data for the entire programs. This technique is also a relatively fast, low overhead method of obtaining information about program execution. Their technique does not provide dynamic information about program execution. In addition, they did not profile library routines in the basic blocks, and since the vector length was not available, they used average vector lengths to estimate utilization.

Neither of the above studies was designed to provide information about the utilization of the individual ports and therefore could not be used to provide accurate synthetic workload models. Also, they did not look at the effect of optimization on their results.

This study uses a memory reference tracing facility in `sim` which became available

with release 6.0 of the UNICOS operating system. `sim` is a Cray Y-MP simulator which provides exact, instruction level timing of programs run on a single Cray Y-MP processor ignoring memory conflicts. `sim` takes a fully-linked object module as input and traces execution of the program. The memory tracing facility generates a file which has an entry containing the opcode, the time of issue, the starting address, the stride, and the vector length for each memory reference. For scalar operations the vector lengths and strides are 1. This file was then used as input to a program which profiled port utilization.

This approach has two advantages: it is nonintrusive and it allows the study of memory reference patterns with arbitrarily fine granularity. Unfortunately a program run under `sim` on a Cray Y-MP executes more than 1000 times slower than it would normally take. The memory reference trace files generated by `sim` are also very large. The shorter traces were 200 to 500 megabytes in compressed format. The larger benchmarks had to be checkpointed and run in pieces to produce files that could fit on a single disk. As mentioned above, `sim` assumes that there are no memory conflicts, so it gives slightly different timing values than provided directly by `hpm`.

The programs were run under version 6.14 of UNICOS on a Cray Y-MP8/864. The Perfect Club Benchmark Suite 1 was used for the baseline runs. Minor modifications had to be made to the source in order to allow compilation under version 4.0.4.4 of the Cray Fortran compiler.

The port utilization program processed the trace information produced by `sim` and kept track of the number of cycles in a given time partition (10,000 cycles for this paper) during which each port was busy. It also kept a record of the distribution of strides and vector lengths for each of the programs. It used the Cray Y-MP port assignment strategy as now described. All writes (scalar, block, and vector) are performed on port C. Vector and block reads are performed on ports A and B. The default port for such reads is port B. Scalar and vector operations are not allowed to proceed simultaneously. An estimate was kept of the number of possible cycles in which a vector reference was delayed because a scalar operation was in progress and vice versa. (This upper bound was calculated by counting the number of times that a vector reference was initiated on the cycle after a scalar reference completed.) The

sum of the setup and shutdown times for vector reads is 5 cycles and for vector writes is 6 cycles, and this time was counted in the port utilization. Scalar write operations use port C for 5 cycles, but consecutive scalar operations can be done on consecutive cycles. Similarly, scalar read operations use port A for 5 cycles, but consecutive scalar reads can be done on consecutive cycles.

3 Results of the measurements

A summary of the hardware performance monitor measurements for the optimized and unoptimized Perfect Club Benchmarks is given in Table 1. The complete hardware performance monitor data is given in Appendix A.

The speedup columns gives the ratio of unoptimized to optimized values for three of the quantities in the table. The time entry refers to the total execution time. The ARC2D values in the table may be anomalous as the optimized and unoptimized code was run with different versions of the Fortran compiler. The values shown in the table for the unoptimized ARC2D are taken from the previous technical report [7]. When ARC2D is run with the later version of the compiler used for the optimized ARC2D, the timing is almost exactly the same as in the optimized case.

The SPEC77 benchmark is the only other one for which the optimized and unoptimized values are shown for different versions of the compiler. The newer compiler accounts for a speedup of 1.10 out of the total 3.07 shown in the table. That is, if the unoptimized SPEC77 is compiled with the newer compiler, its speedup is 1.10 relative to the old compiler.

The mem speedup entry gives the ratio of unoptimized to optimized memory references. Except in the case of DYFESM, this number is fairly close to 1. More importantly, the meminst speedup gives the ratio of unoptimized to optimized memory instructions. This value varies widely. Large values of this show that a major part of the optimization came from vectorization. For example, as shown by the hardware performance monitor data, in MG3D, the average vector length for floating point operations increased from 23.00 to 61.73 with optimization.

It is interesting to note that memory conflicts often increased (both in number and percentage) with optimization.

The percentage of reads for the entire Perfect Club suite varied from 58% to 71% which is consistent with the commonly assumed 2/3 fraction of reads, showing little change from the unoptimized case.

Program	Cycles	Instructions		Memory		% Memory		% Vect	speedup		
		total	mem	refs	confs	confs	reads	refs	mem	meminst	time
ADM	3916	1415	164	693	223	32.09	60.67	84.33	1.46	3.22	2.93
ADM opt	1335	434	51	476	105	21.95	62.62	94.43			
ARC2D	2212	400	40	1937	106	5.47	70.82	99.88	0.85	0.95	1.08
ARC2D opt	2043	331	42	2292	165	7.20	71.38	99.97			
BDNA	1534	301	34	669	42	6.35	58.63	96.89	1.00	1.26	1.02
BDNA opt	1509	289	27	669	29	4.40	58.63	98.02			
DYFESM	2029	580	50	833	49	5.91	57.69	97.71	3.10	1.56	3.09
DYFESM opt	656	249	32	269	55	20.60	77.30	93.77			
FLO52	902	239	23	717	38	5.29	71.47	99.21	1.01	1.00	1.01
FLO52 opt	893	233	23	711	45	6.37	72.22	99.19			
MDG	28824	8521	259	2842	186	6.55	61.59	62.04	0.80	2.67	4.68
MDG opt	6158	873	97	3561	283	7.96	58.98	99.34			
MG3D	20843	6057	749	10370	1601	15.44	58.22	96.17	1.23	5.03	2.36
MG3D opt	8850	944	149	8443	901	10.67	56.46	99.84			
OCEAN	3482	960	216	2344	223	9.53	51.39	92.68	1.01	4.08	1.38
OCEAN opt	2516	465	53	2331	259	11.13	52.51	99.67			
QCD	3295	1234	137	323	18	5.42	58.04	58.89	0.78	4.89	3.30
QCD opt	998	217	28	414	122	29.54	71.62	97.41			
SPICE	1363	327	88	101	11	11.35	71.02	15.40	0.72	3.83	3.10
SPICE opt	440	84	23	141	37	26.36	64.15	85.93			
SPEC77	9010	2898	240	1689	2045	121.10	70.01	93.99	0.83	2.89	3.07
SPEC77 opt	2932	549	83	2041	1480	72.49	68.40	99.10			
TRACK	1696	497	70	124	6	4.70	65.66	45.35	1.57	3.04	2.49
TRACK opt	680	229	23	79	6	8.02	70.40	75.58			
TRFD	1321	525	42	670	248	37.07	66.03	98.13	1.00	1.14	1.24
TRFD opt	1064	455	37	668	154	22.99	66.17	98.90			

Table 1: Hardware performance monitor data for the Perfect Club benchmarks. All counts are in millions.

Following [8] TRACK, SPICE, and QCD are classified as scalar code, while BDNA, MG3D, FLO52, ARC2D, SPEC77, and MDG are classified as vector code. The remaining benchmarks are assumed to be mixtures by Vajapeyam et al, but are almost completely vectorized as far as memory references are concerned. The three scalar programs became significantly more vectorized with optimization.

The results of dynamic memory behavior as obtained from `sim` are discussed in the remainder of this report. A summary of statistics generated for the `sim` runs is given in Appendix B. Figures 1 through 39 show the memory behavior for the 13 Perfect Club Benchmarks. There are four noteworthy aspects to the memory references patterns

which are presented in the following subsections: phases, granularity, asymmetry in port utilization, and scalar clustering.

3.1 Program phases

As in the case of the unoptimized programs, they all had start-up phases which were relatively short compared to the overall program duration. Many of the programs evolved through the same distinct phases with unique patterns of memory activity as did the unoptimized programs.

Scalar code tends to show substantially less phase behavior. Port utilization for the scalar program SPICE is shown in Figure 31. There is significantly more activity on port B for the optimized SPICE whereas the unoptimized program had port B virtually quiet. This is another illustration of the vectorization introduced by the optimization. The overall memory utilization is quite low and fairly uniform over the duration of the program.

3.2 Granularity

Each program has a characteristic granularity and different aspects of utilization substructure appear when averages over shorter windows are taken. Figure 37 shows the port utilization for the benchmark TRFD when activity is averaged over 1,000,000 cycles. This is similar to the unoptimized case, but the spikes in the utilization of port A are considerably smaller, while the average utilization is somewhat larger.

3.3 Asymmetry in port utilization

Port utilization is less asymmetric for the optimized programs because of the vectorization introduced. As in the unoptimized case, the fraction of reads can be predicted from the port utilizations. If A , B , and C represent the utilizations (fractions of cycles that the port is busy) of their respective ports and x is the fraction of reads, then the following relationship should hold:

$$x = \frac{A + B}{A + B + C}$$

Table 2 gives the predicted and computed x for the benchmarks.

Benchmark	A	B	C	x	x pred	% vector
ADM	0.130	0.094	0.146	0.607	0.605	84.33
ADM opt	0.156	0.173	0.207	0.626	0.614	94.43
ARC2D	0.269	0.437	0.296	0.708	0.705	99.88
ARC2D opt	0.390	0.527	0.371	0.712	0.714	99.97
BDNA	0.140	0.185	0.226	0.586	0.590	96.89
BDNA opt	0.128	0.189	0.221	0.586	0.589	98.02
DYFESM	0.157	0.176	0.222	0.577	0.600	97.71
DYFESM opt	0.260	0.219	0.158	0.773	0.752	93.77
FLO52	0.296	0.391	0.268	0.725	0.720	99.21
FLO52 opt	0.297	0.385	0.271	0.722	0.716	99.19
MDG	0.104	0.048	0.098	0.616	0.608	62.04
MDG opt	0.100	0.308	0.287	0.590	0.587	99.34
MG3D	0.172	0.221	0.291	0.582	0.575	96.17
MG3D opt	0.237	0.367	0.473	0.565	0.561	99.84
OCEAN	0.229	0.205	0.453	0.514	0.489	92.68
OCEAN opt	0.258	0.312	0.524	0.525	0.521	99.67
QCD	0.136	0.026	0.092	0.580	0.637	58.89
QCD opt	0.172	0.266	0.173	0.716	0.717	97.41
SPEC77	0.112	0.138	0.117	0.700	0.681	93.99
SPEC77 opt	0.336	0.423	0.359	0.684	0.679	99.10
SPICE	0.194	0.011	0.082	0.710	0.714	15.40
SPICE opt	0.164	0.175	0.188	0.642	0.643	85.93
TRACK	0.138	0.022	0.074	0.657	0.684	45.35
TRACK opt	0.067	0.081	0.069	0.704	0.682	75.58
TRFD	0.192	0.304	0.266	0.660	0.651	98.13
TRFD opt	0.224	0.369	0.313	0.662	0.655	98.90

Table 2: Port utilization and fraction of reads for vectorized code.

3.4 Scalar clustering

The optimized benchmarks which still have a significant amount of scalar activity still retain the scalar clustering properties of their unoptimized counterparts. The probability distributions for the fraction of cycles busy were computed by calculating the histogram of the fraction of cycles busy in each 10,000 cycle partition. A resolution of 100 bins (0.01) was used for the histograms. These distributions have a markedly different form for vector and scalar code. Scalar code is typified by the behavior of SPICE as shown in Figure 32. Port B has a roughly exponential distribution which decays rapidly while ports A and C have distributions which are peaked around their mean. There is somewhat more spreading than in the unoptimized case, and there is a definite tail for the port B distribution.

Acknowledgments:

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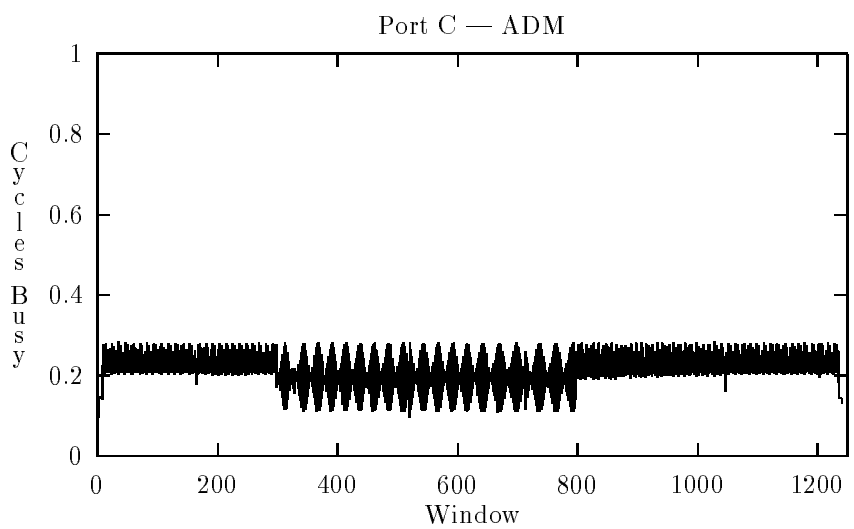
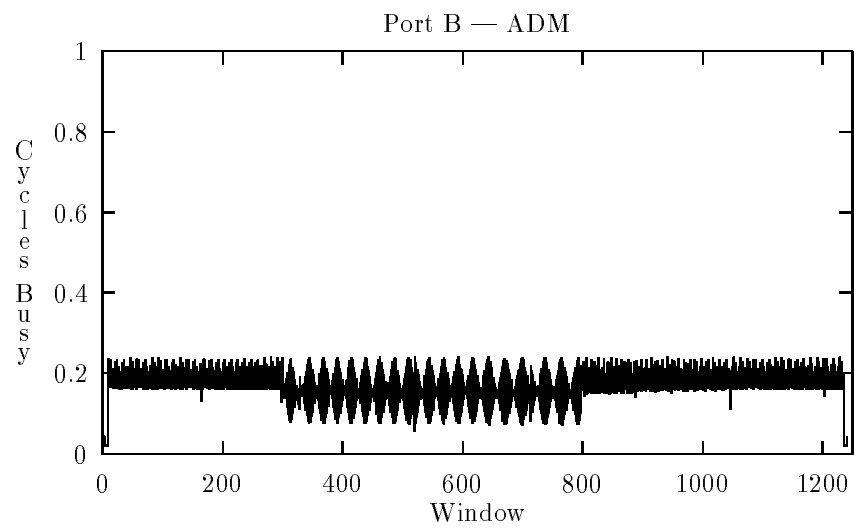
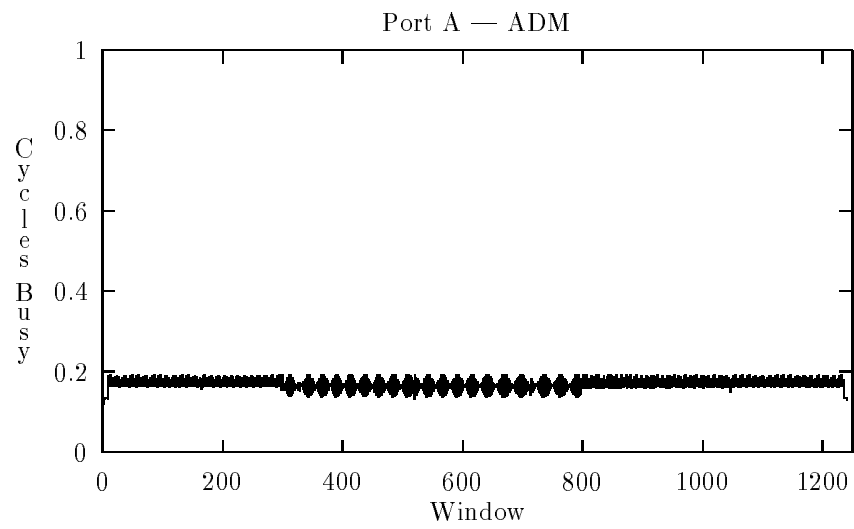


Figure 1: Port utilization for the optimized ADM.

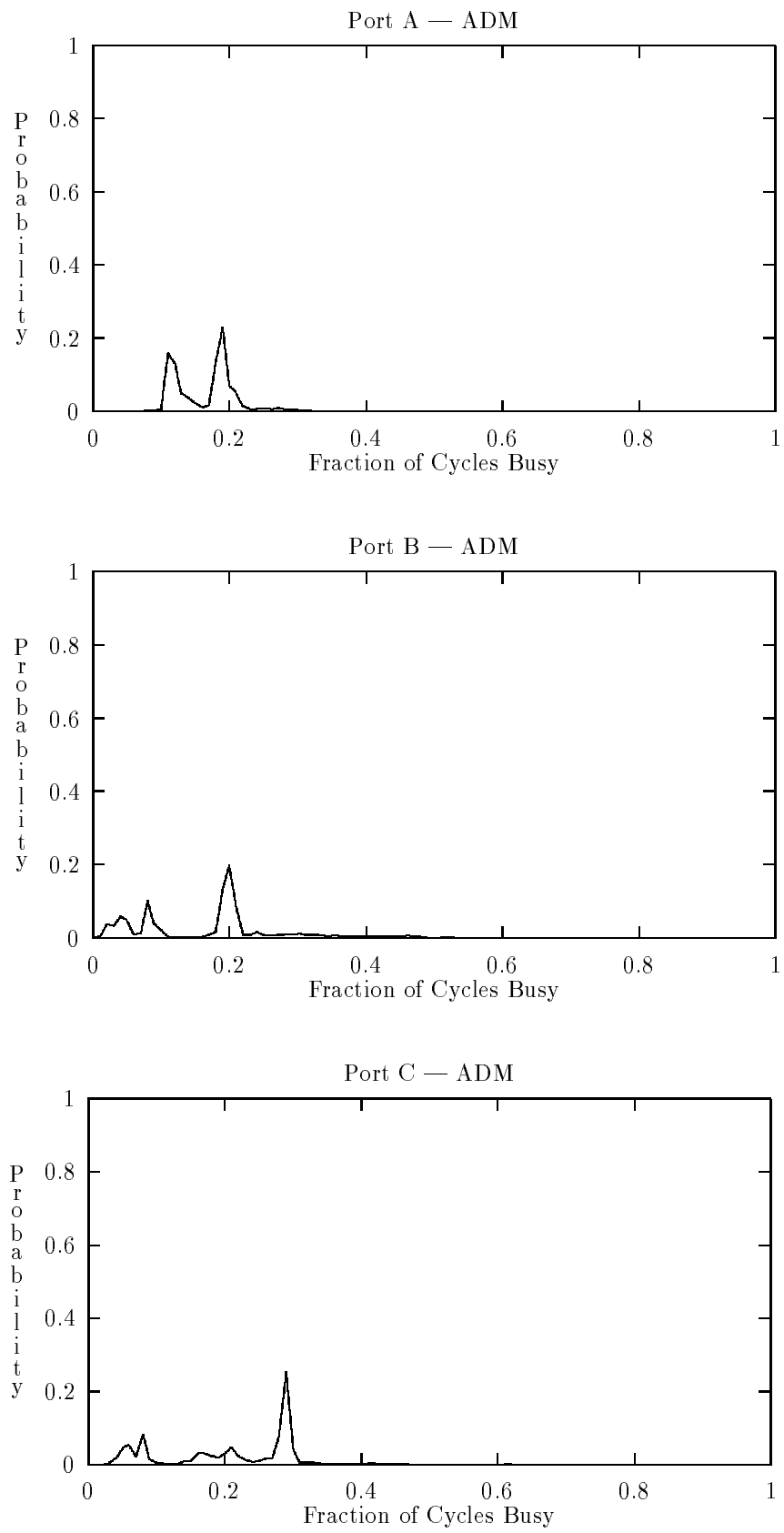


Figure 2: Port utilization histogram for the optimized ADM.

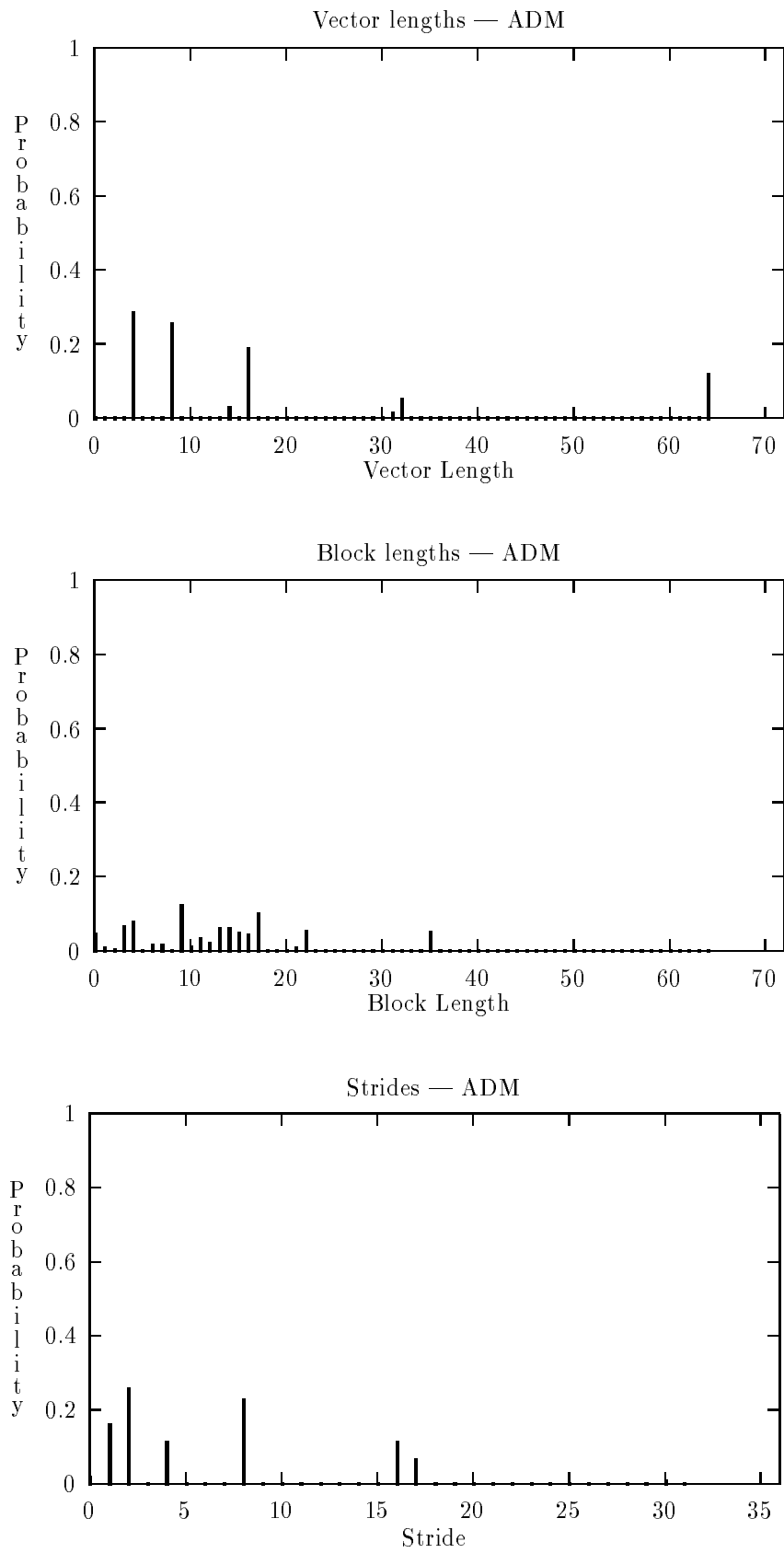
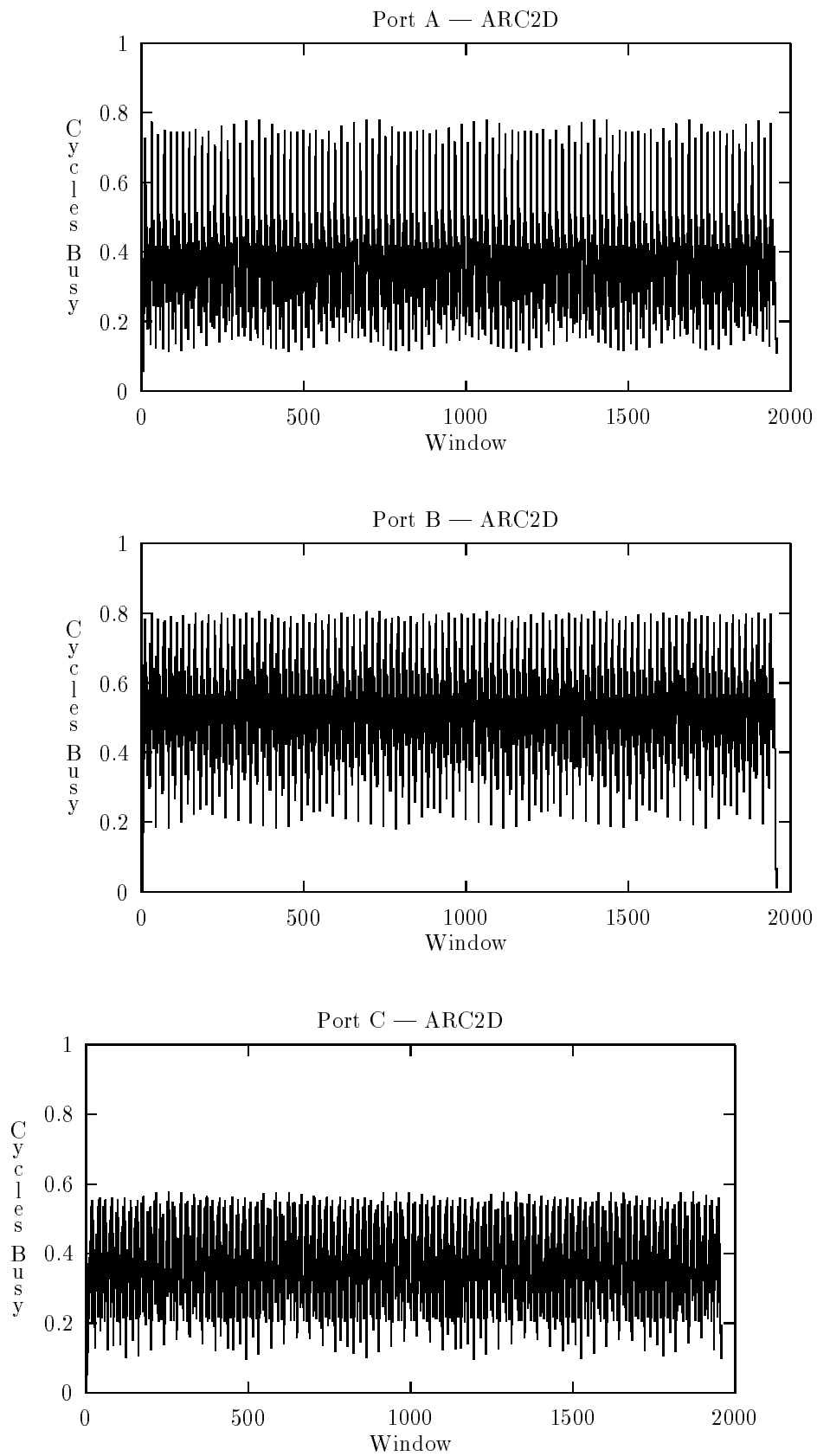


Figure 3: Distributions of lengths and strides for the optimized ADM.



ARC2D

could not be optimized.

Figure 4: Port utilization for the optimized ARC2D.

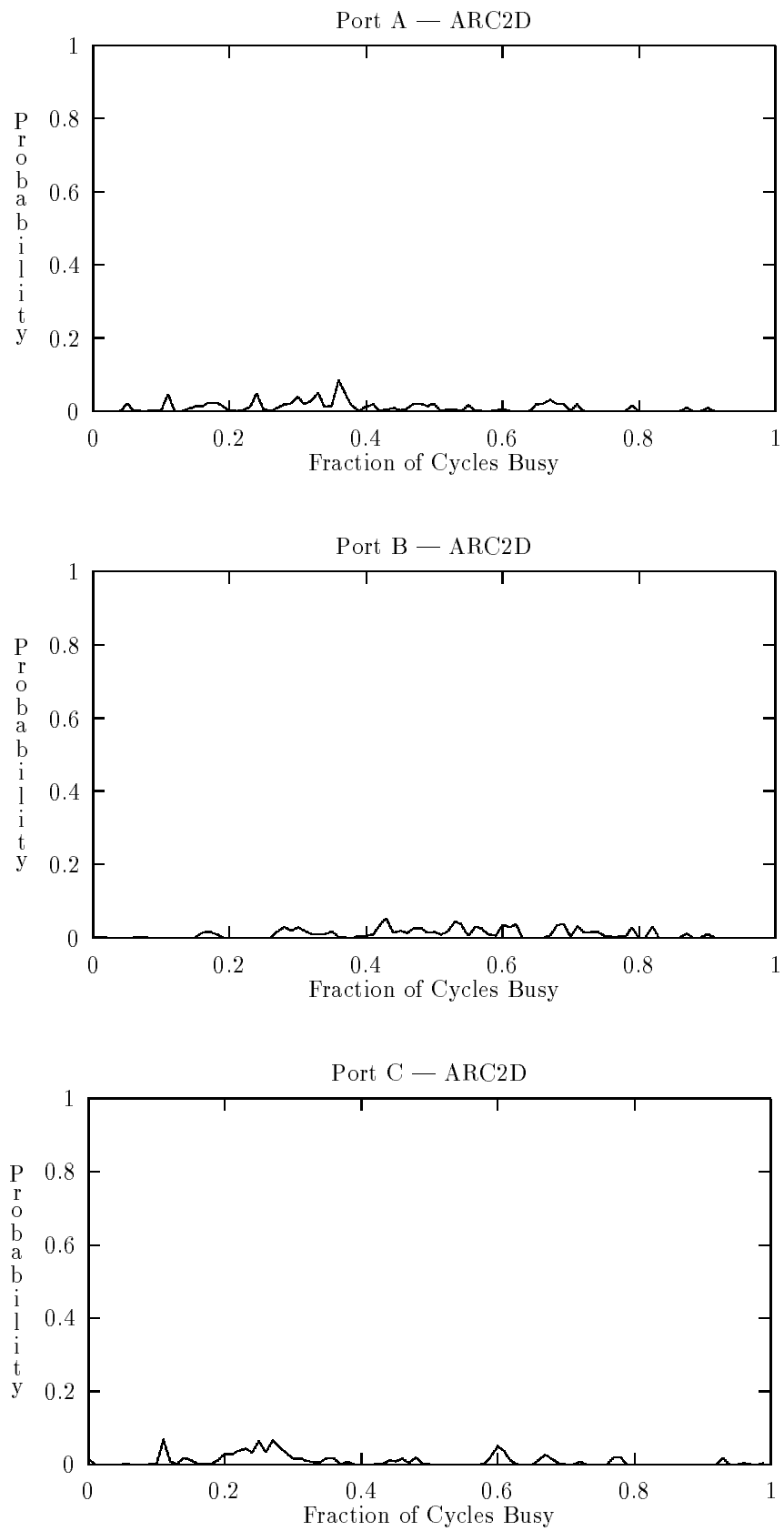


Figure 5: Port utilization histogram for the optimized ARC2D.

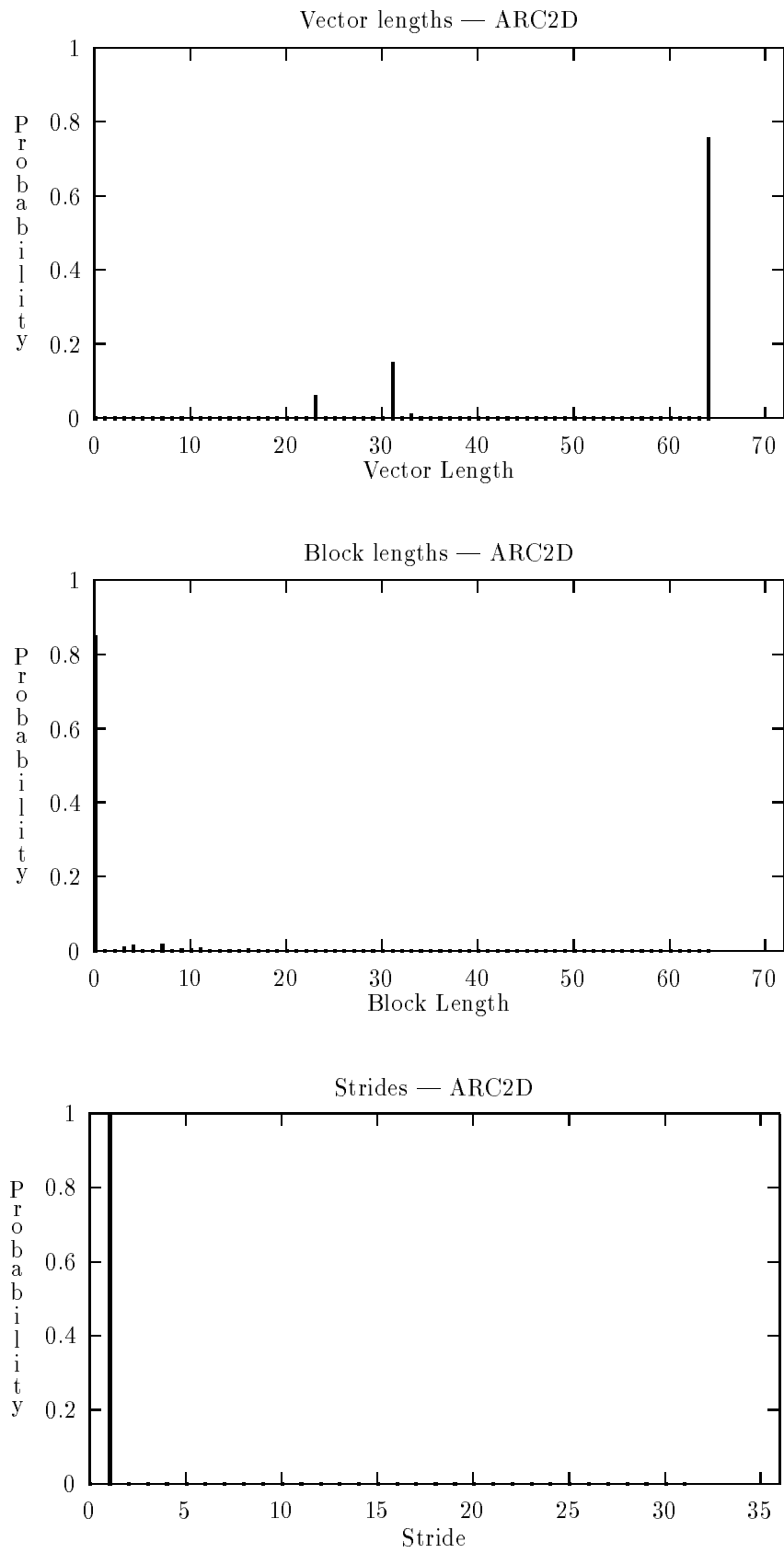


Figure 6: Distribution of lengths and strides for the optimized ARC2D.

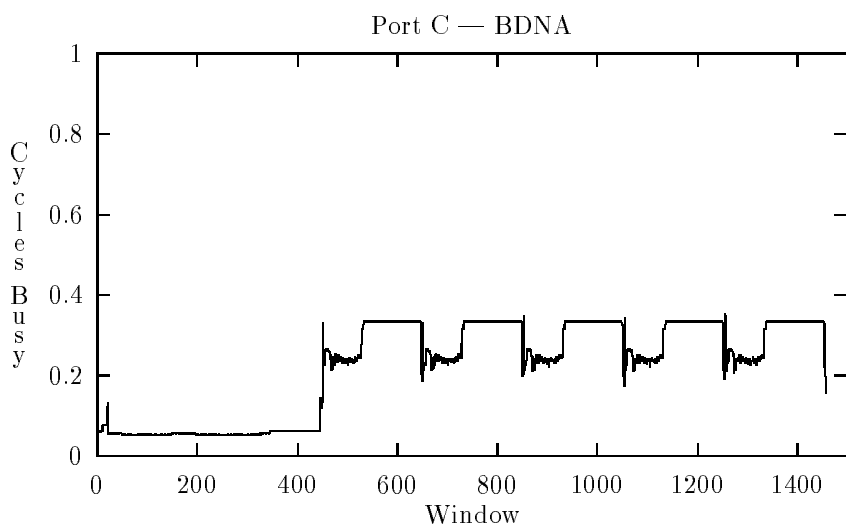
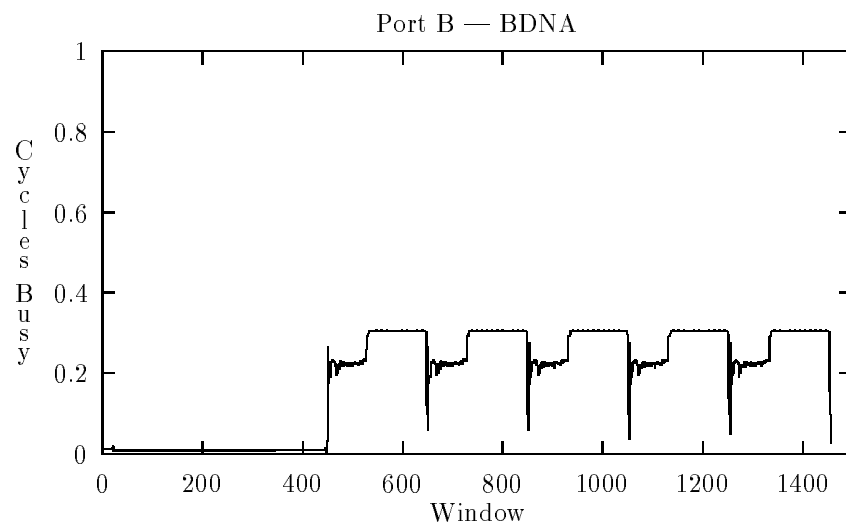
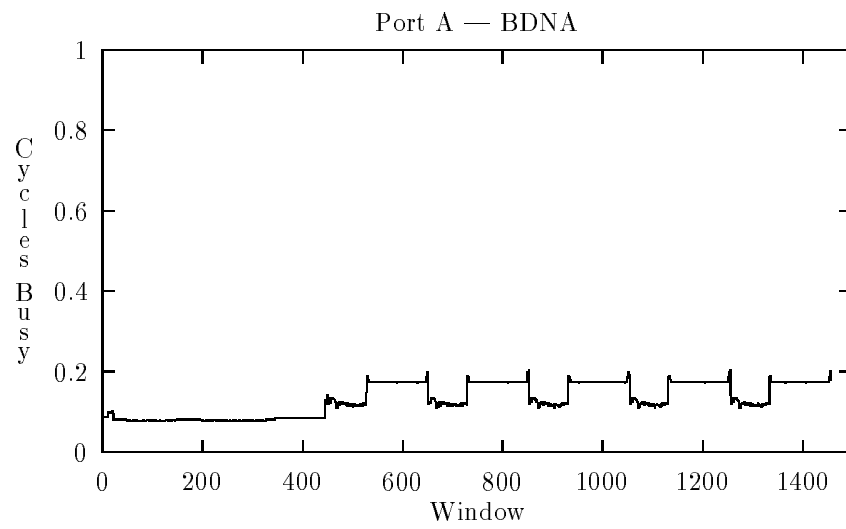


Figure 7: Port utilization for the optimized BDNA.

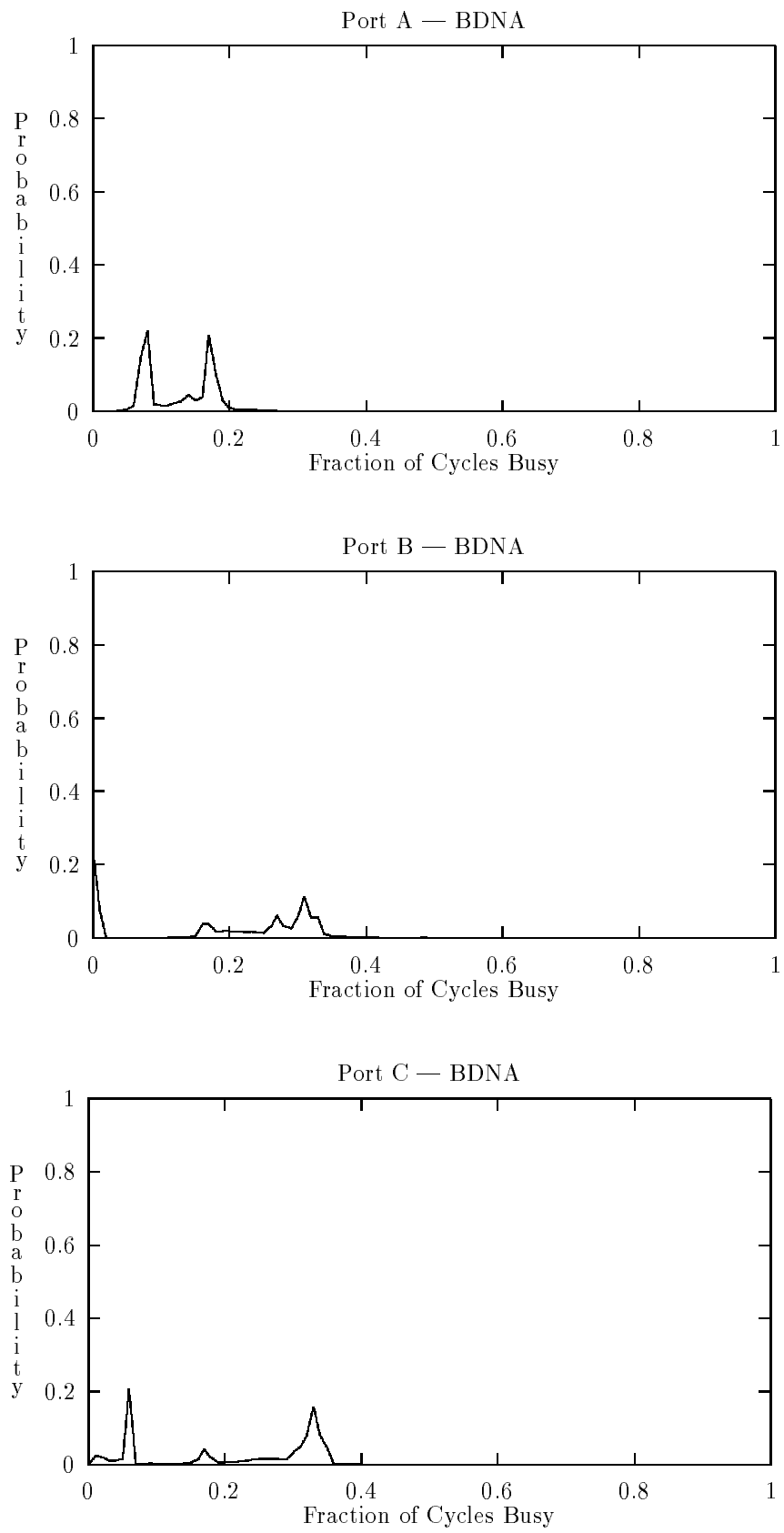


Figure 8: Port utilization histogram for the optimized BDNA.

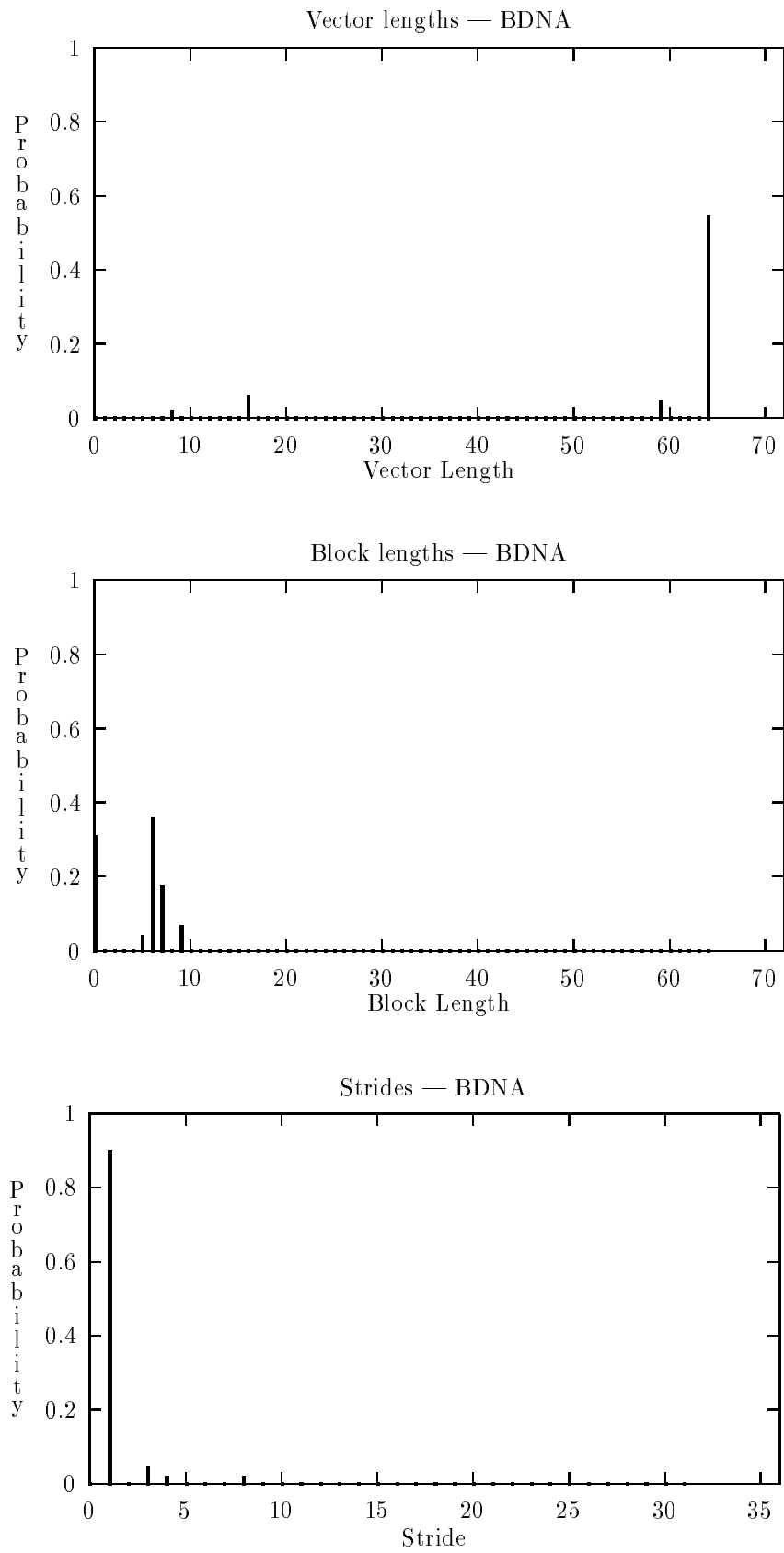


Figure 9: Distribution of lengths and strides for the optimized BDNA

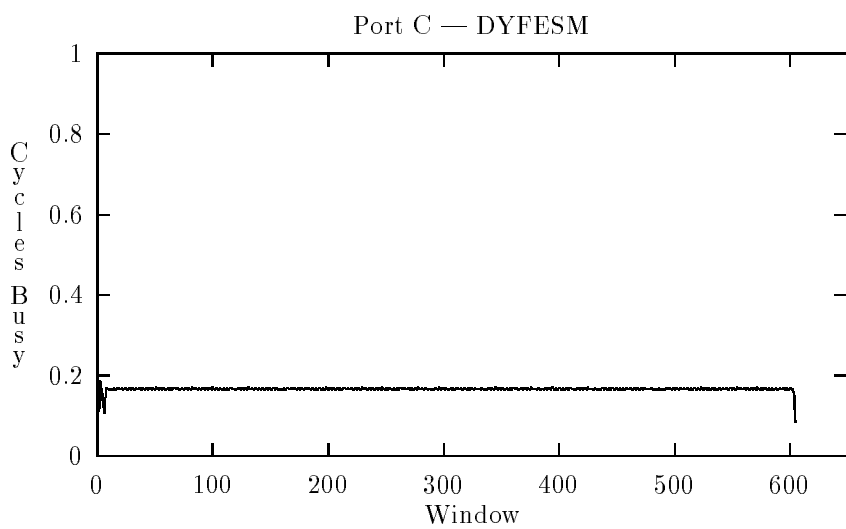
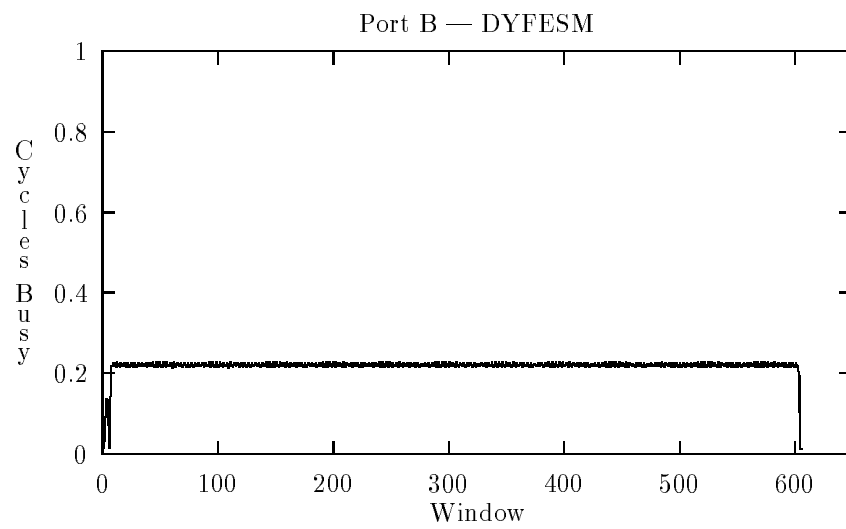
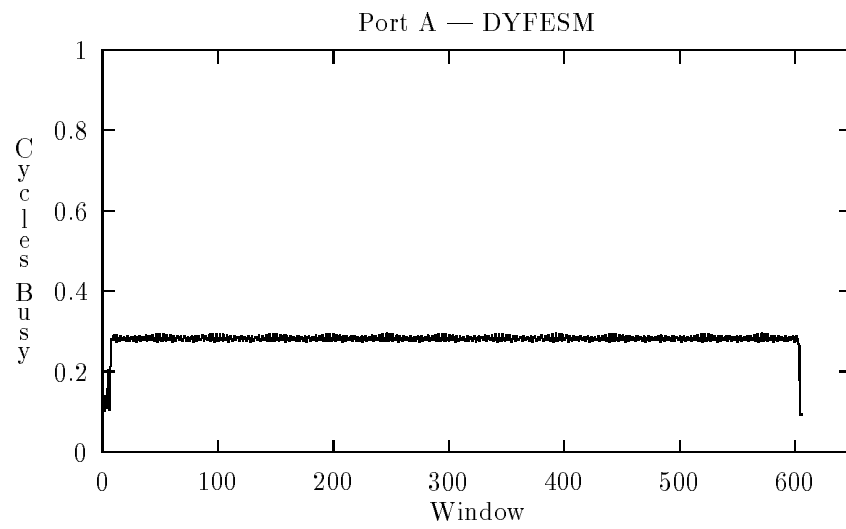


Figure 10: Port utilization for the optimized DYFESM

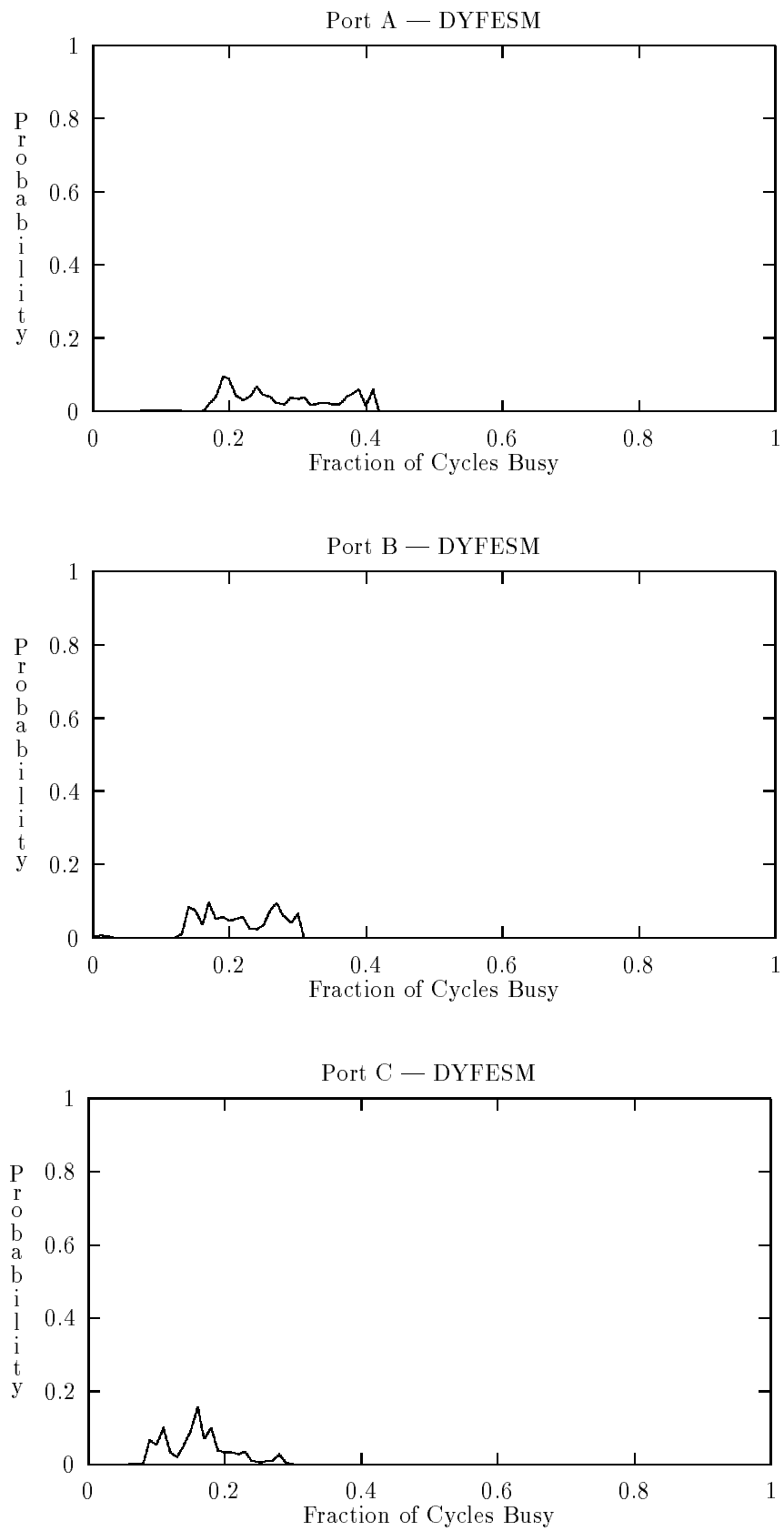


Figure 11: Port utilization histogram for the optimized DYFESM

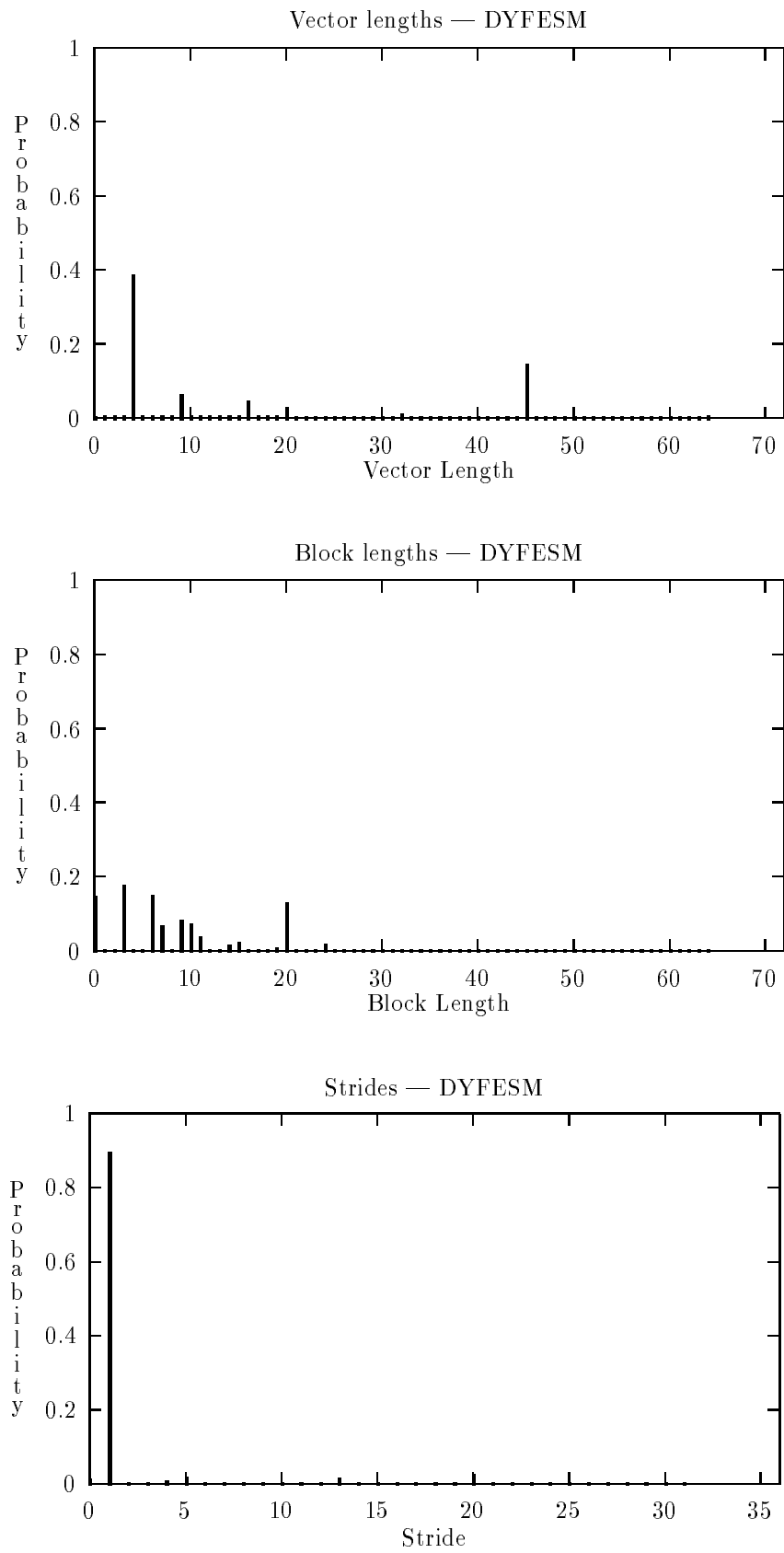


Figure 12: Distribution of lengths and strides for the optimized DYFESM.

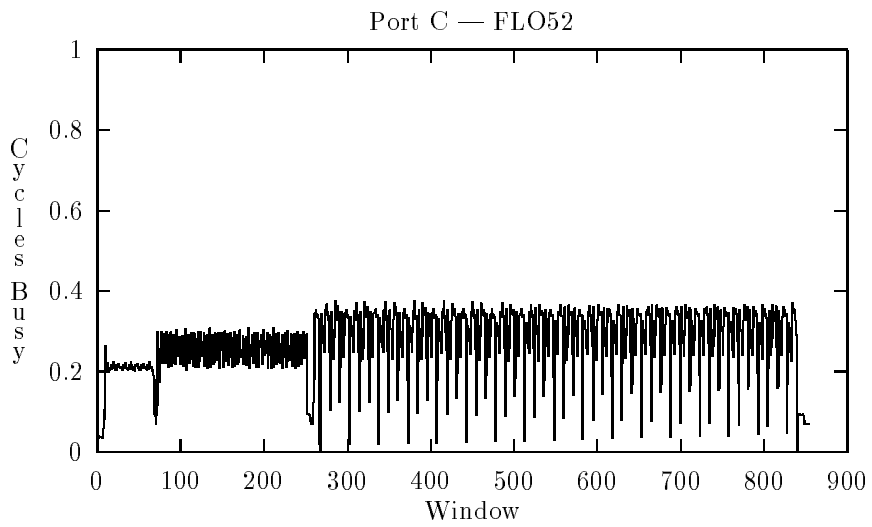
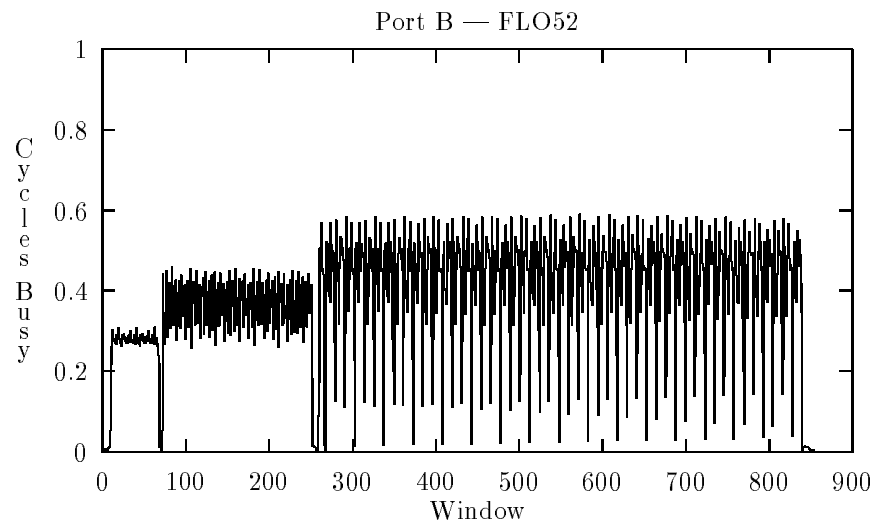
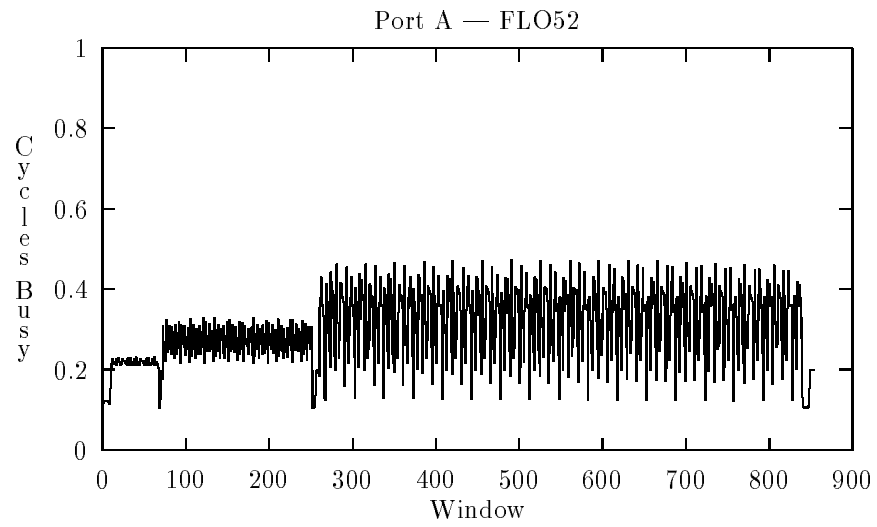


Figure 13: Port utilization for the optimized FLO52.

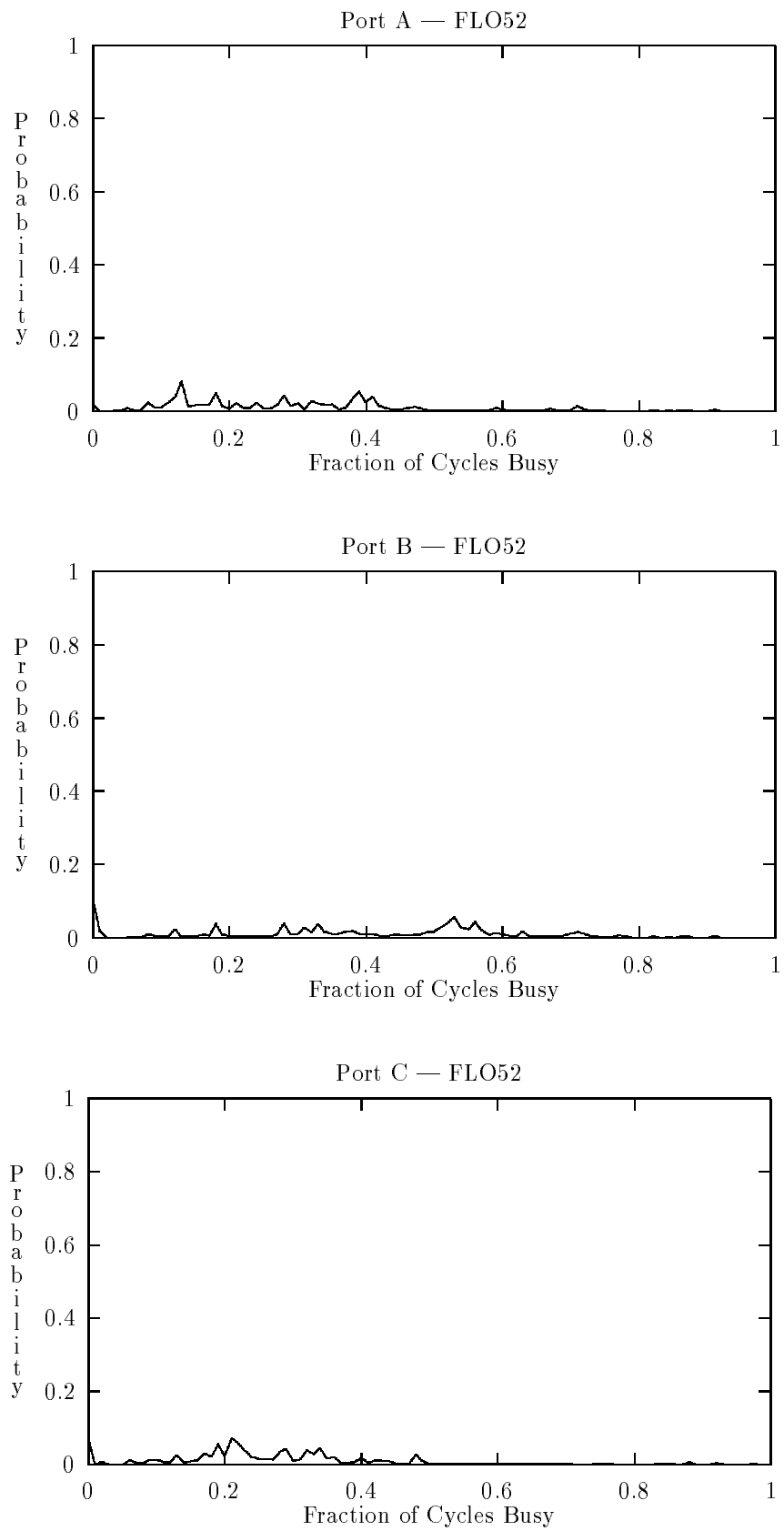


Figure 14: Port utilization histogram for the optimized FLO52.

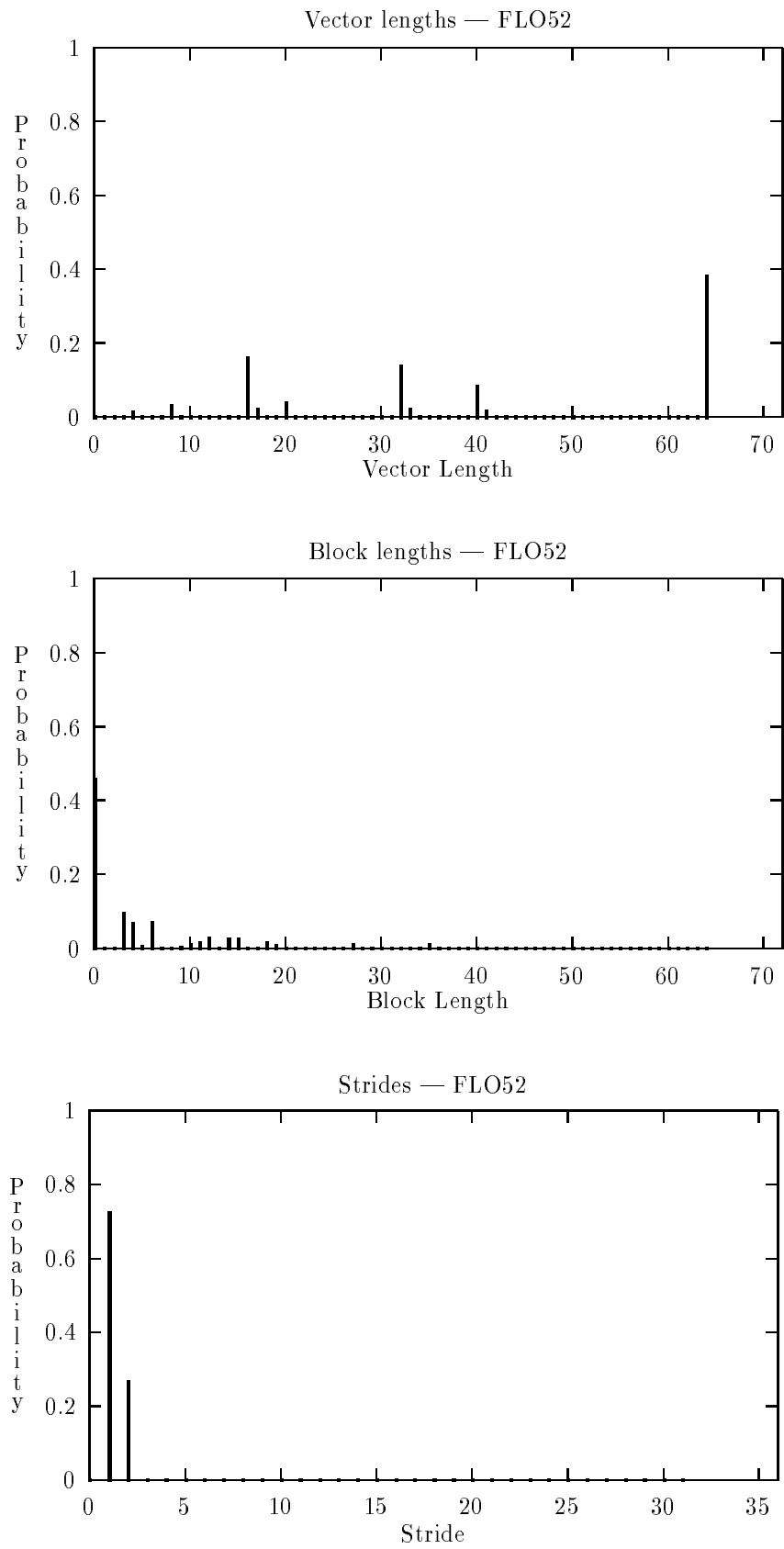


Figure 15: Distribution of lengths and strides for the optimized FLO52.

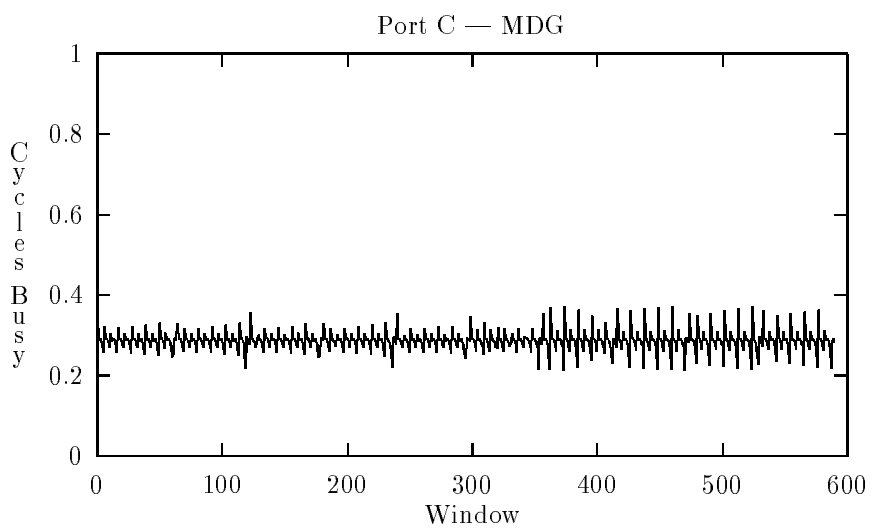
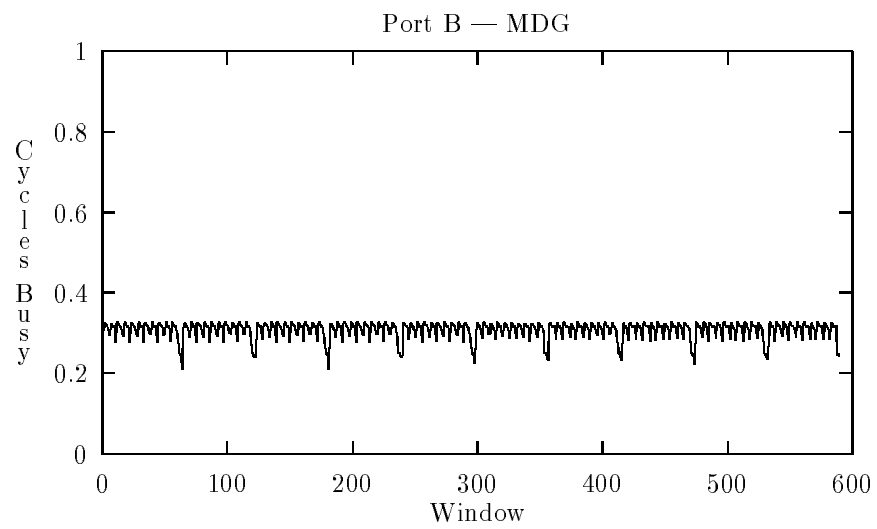
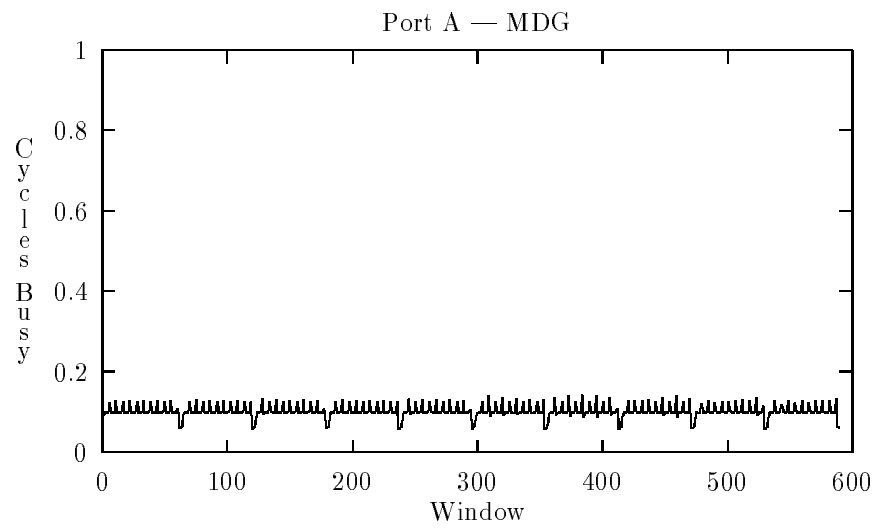


Figure 16: Port utilization for the optimized MDG.

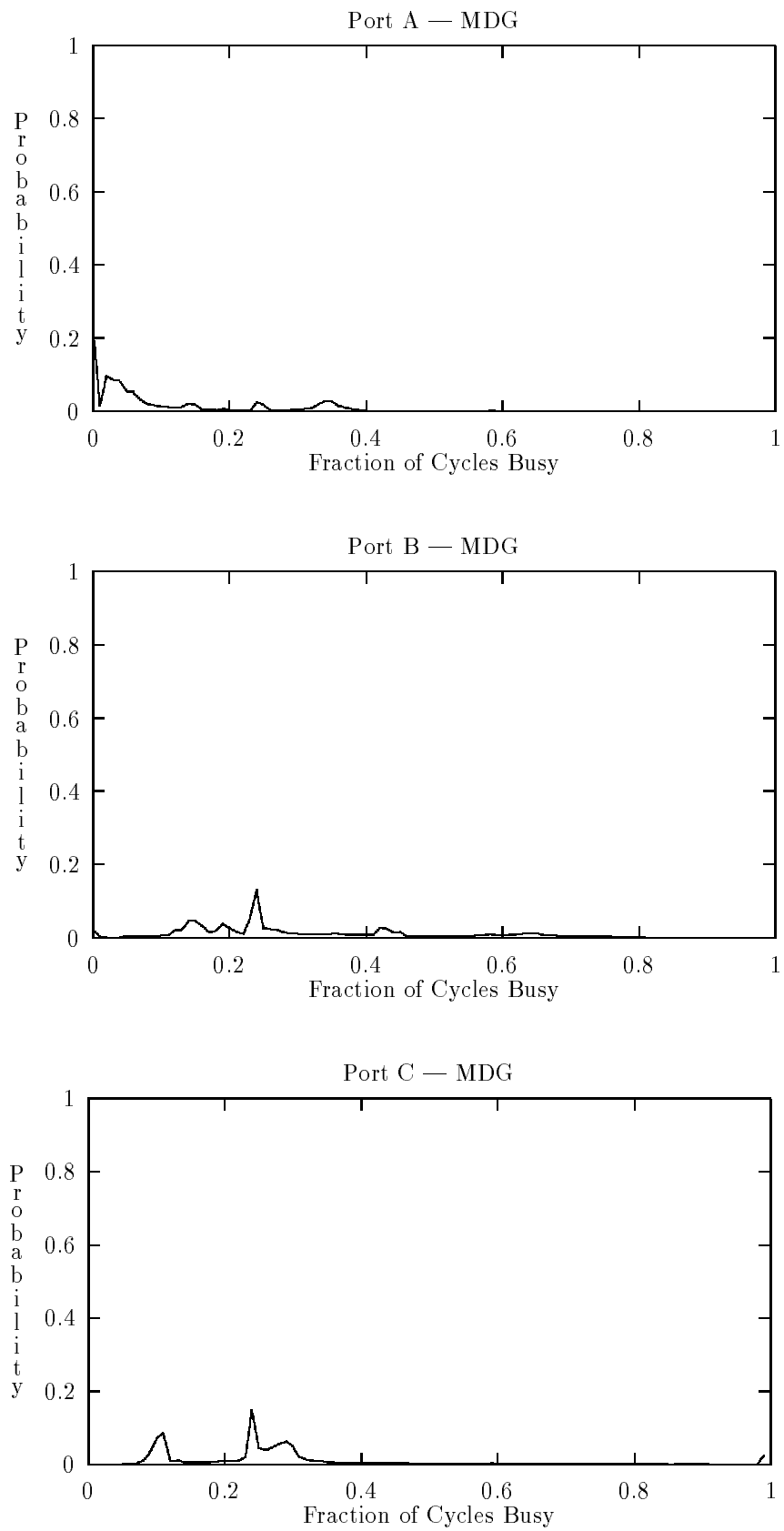


Figure 17: Port utilization histogram for the optimized MDG.

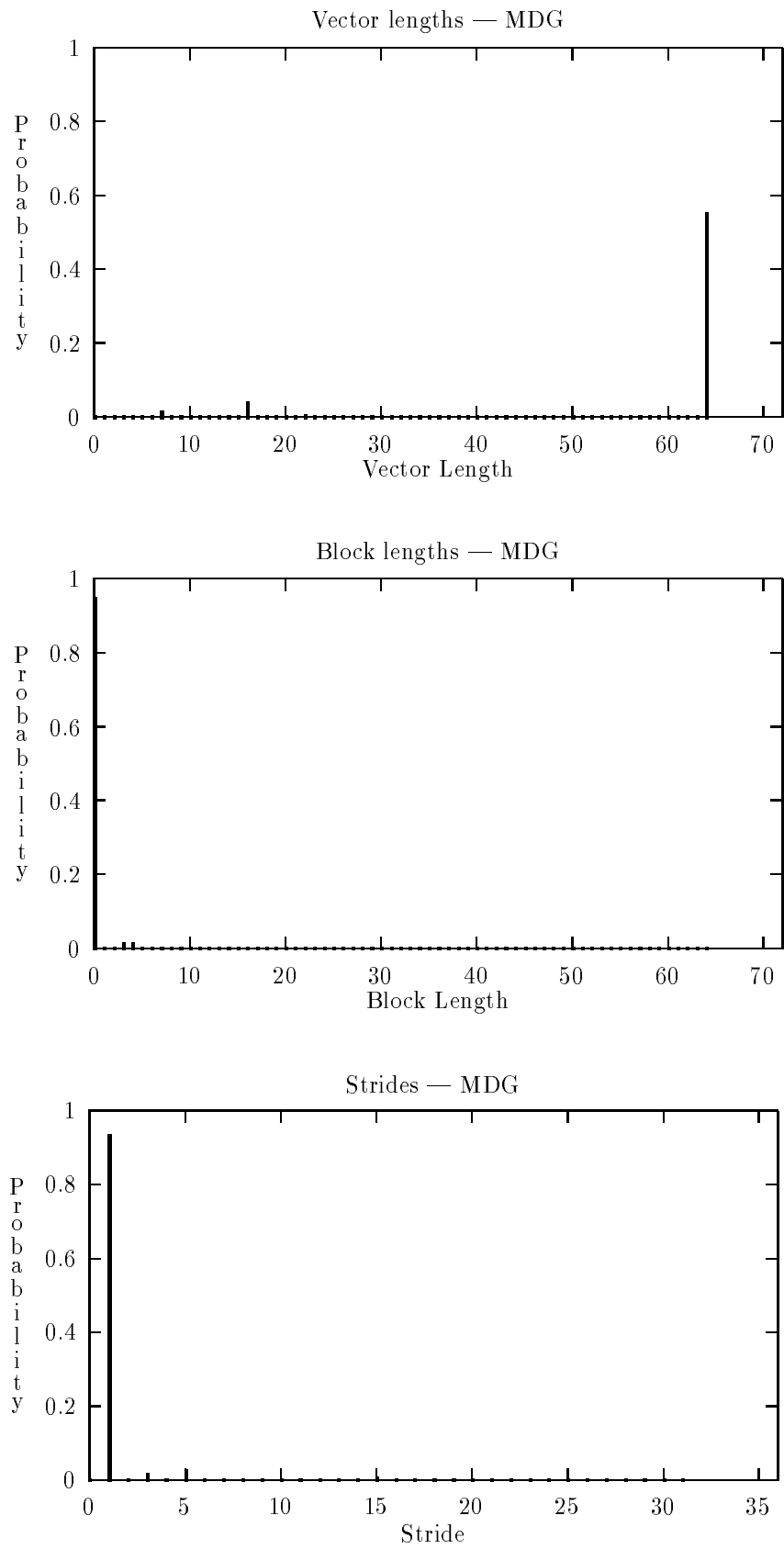


Figure 18: Distribution of lengths and strides for the optimized MDG.

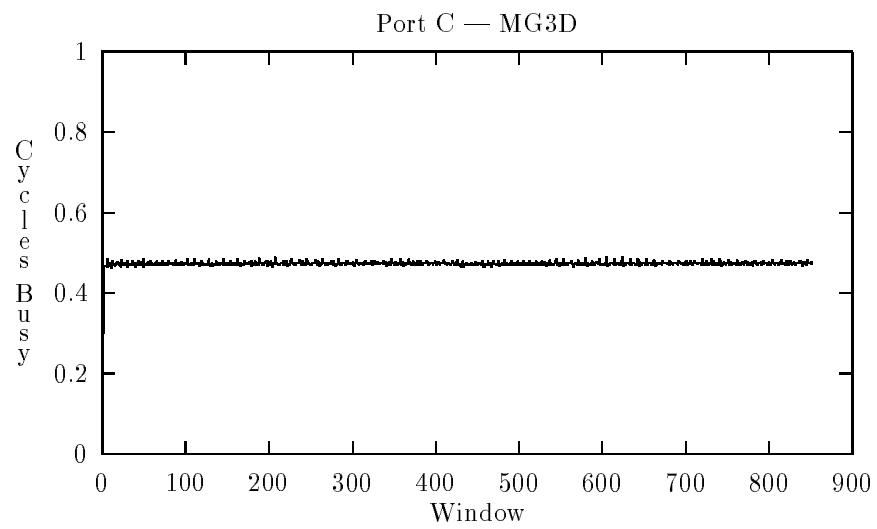
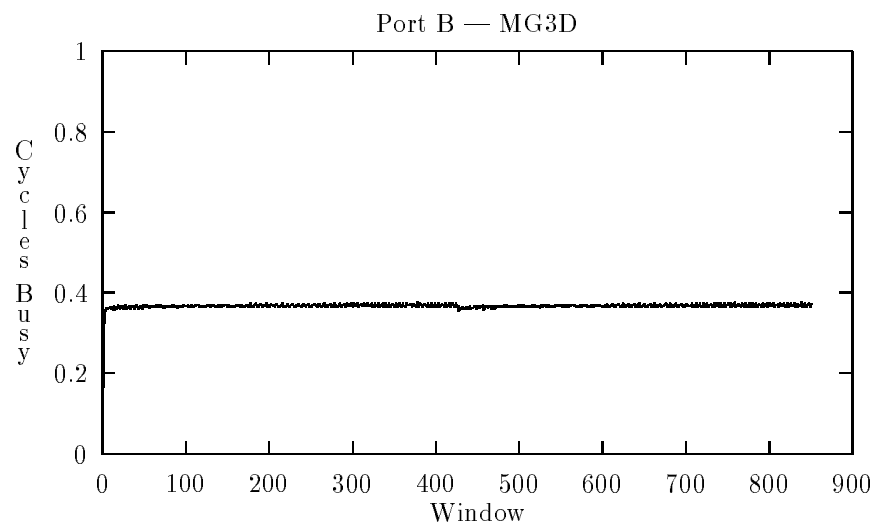
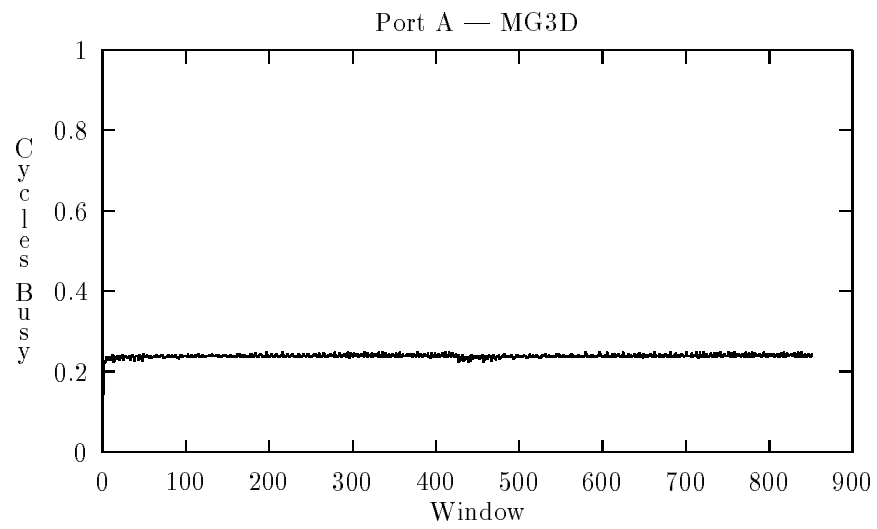


Figure 19: Port utilization for optimized MG3D.

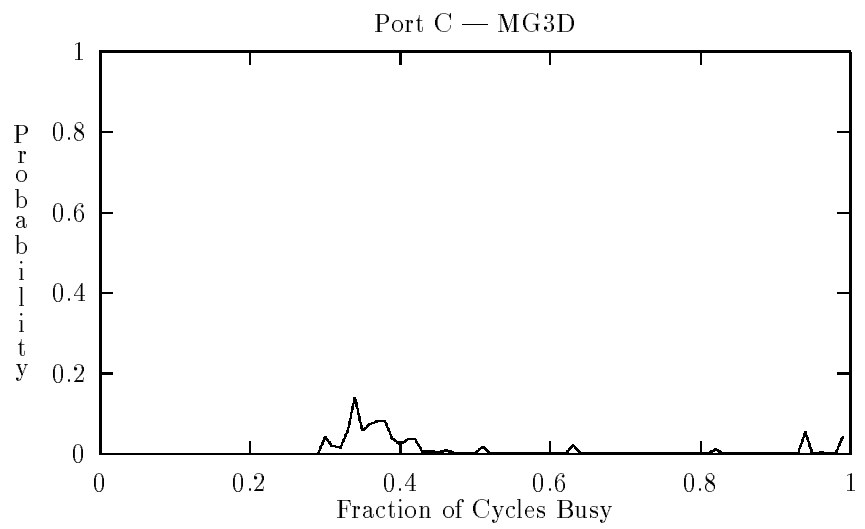
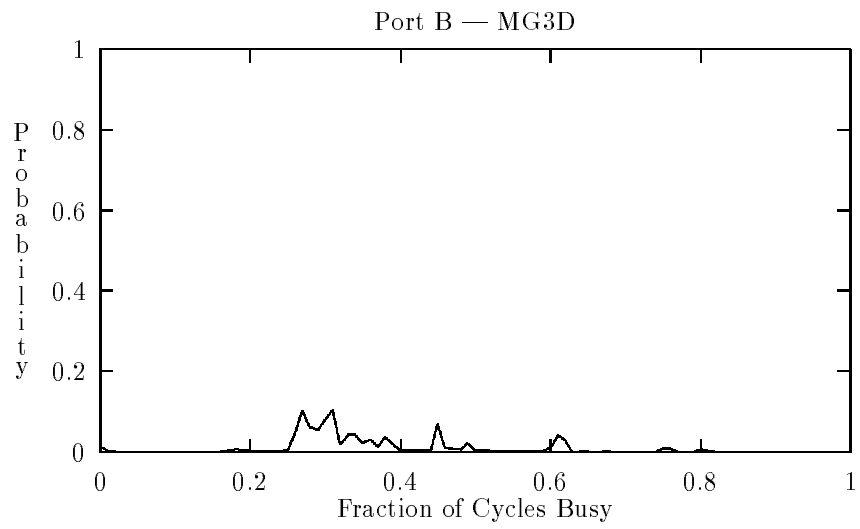
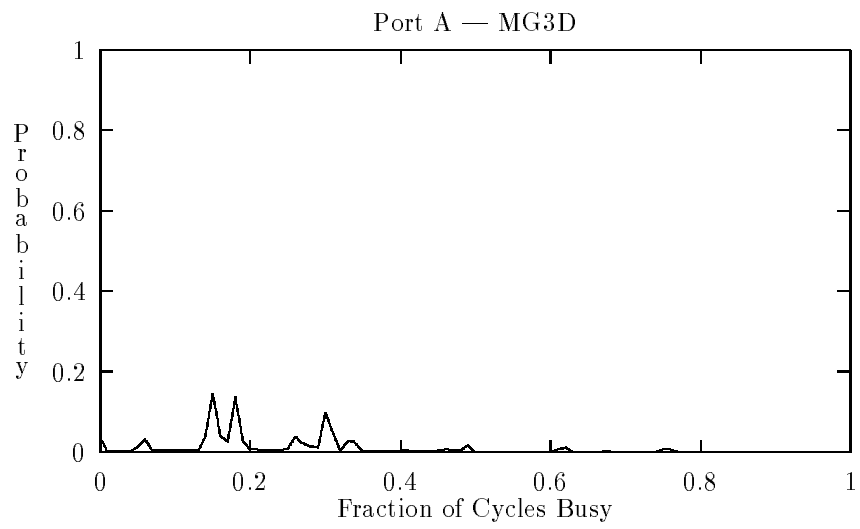


Figure 20: Port utilization histogram for optimized MG3D.

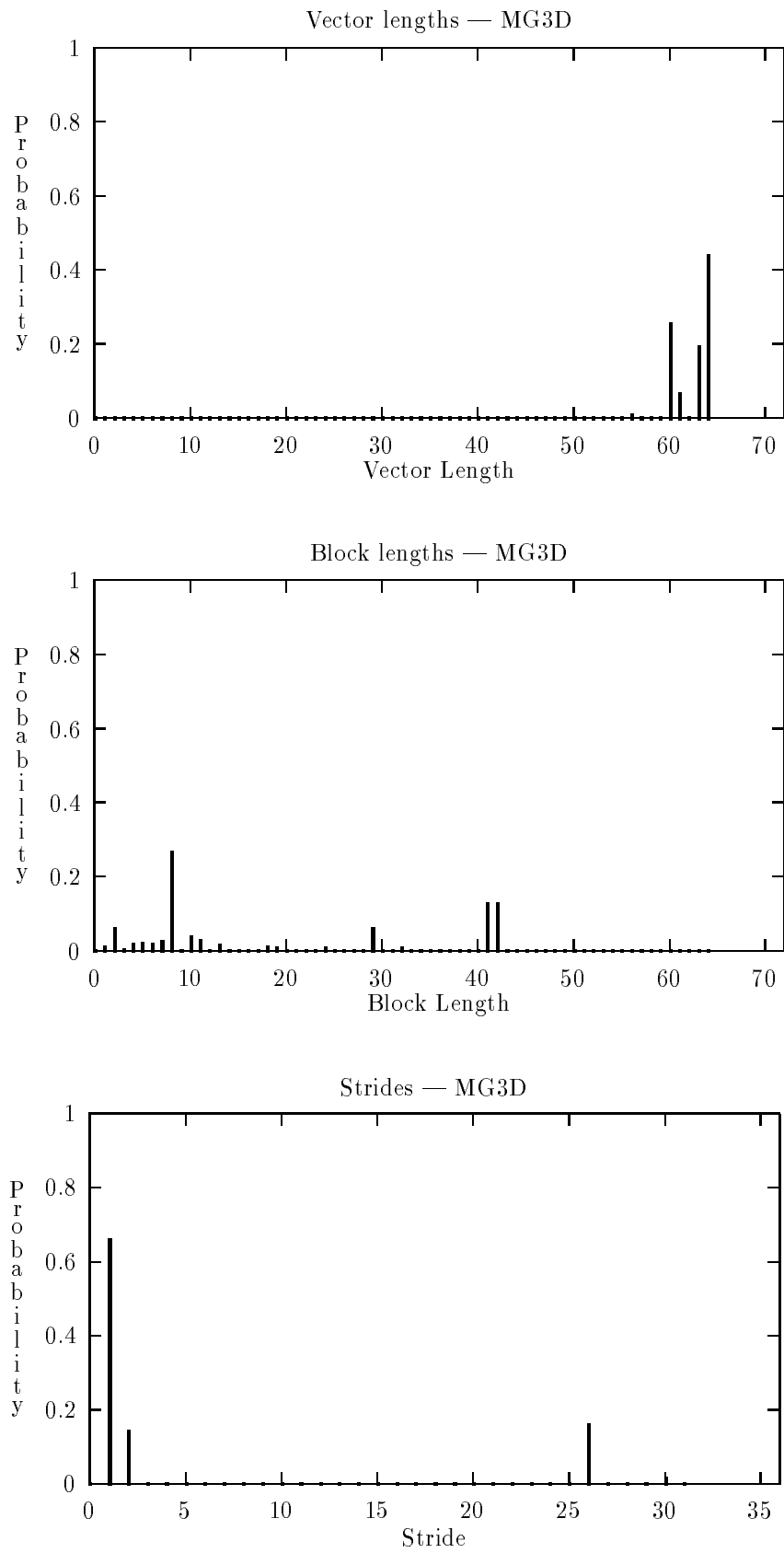


Figure 21: Distribution of lengths and strides for the optimized MG3D.

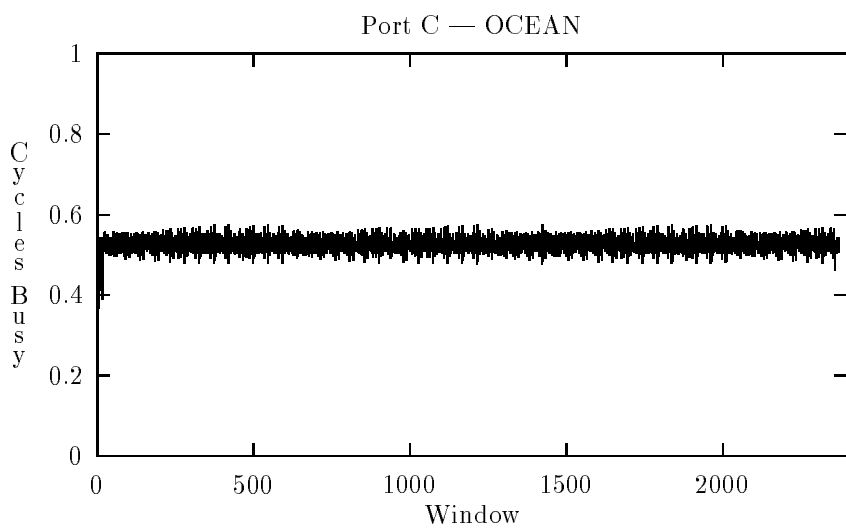
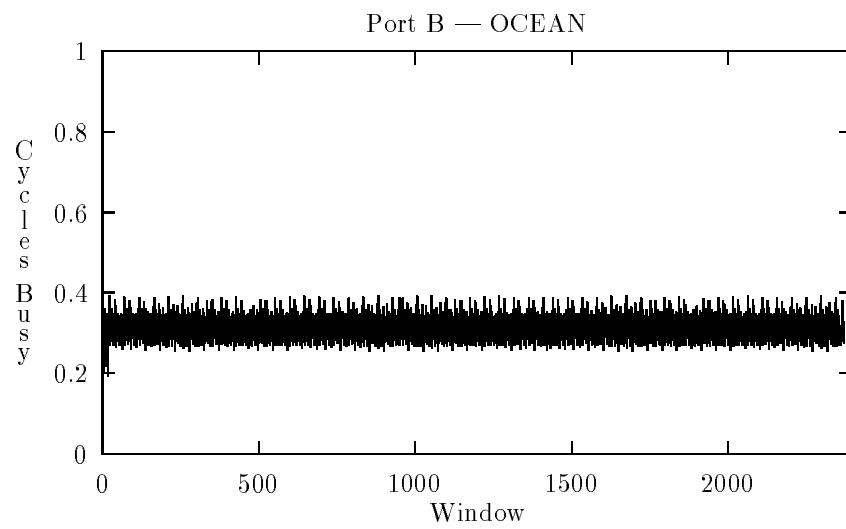
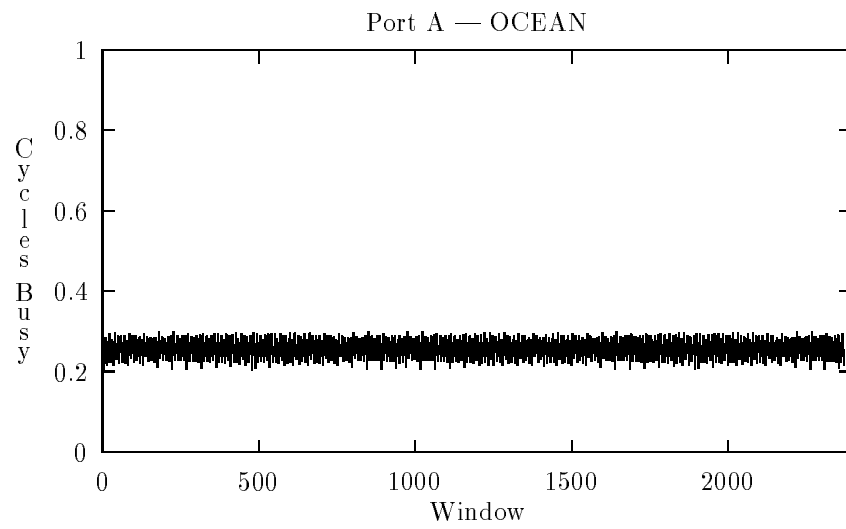


Figure 22: Port utilization for the optimized OCEAN.

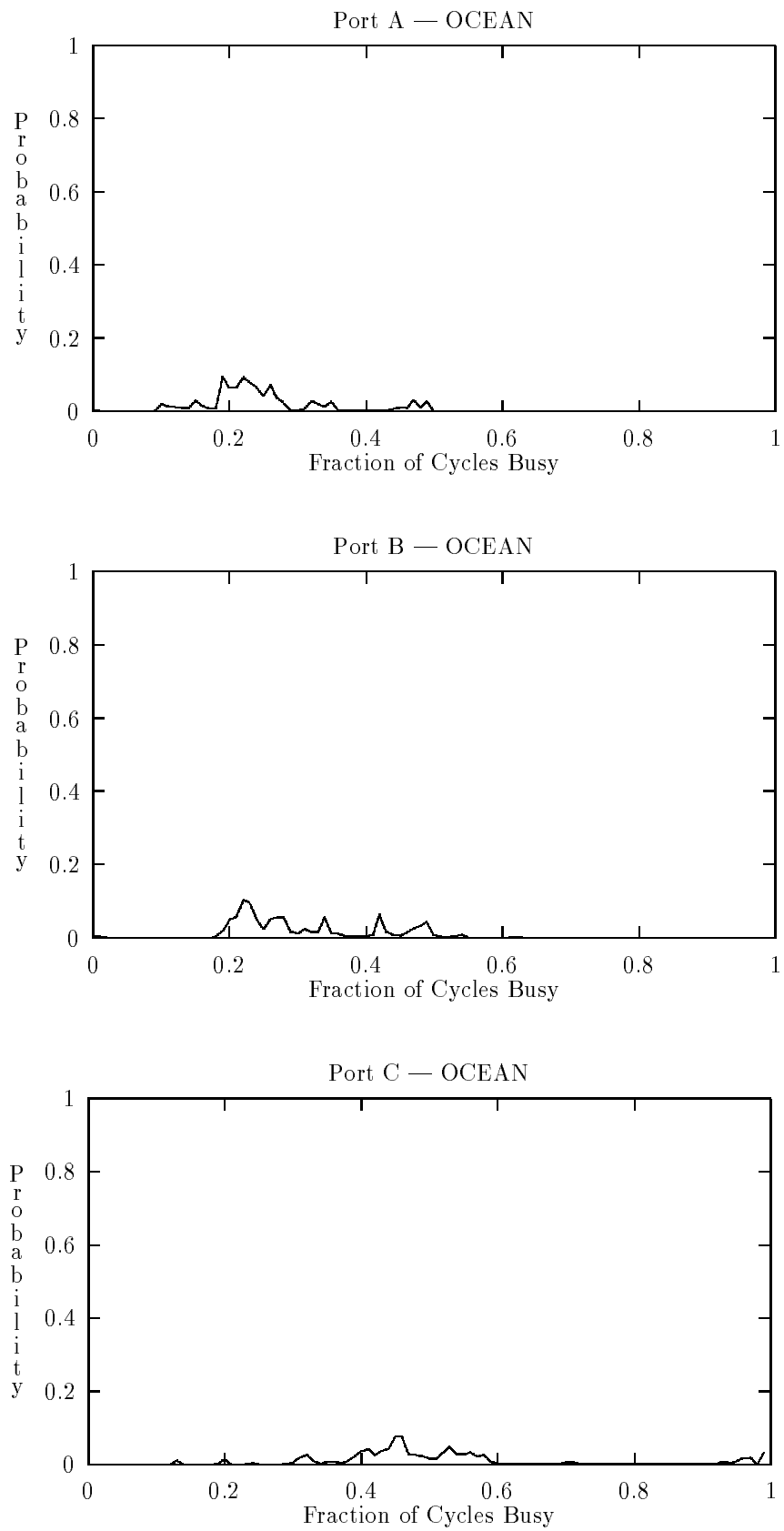


Figure 23: Port utilization histogram for the optimized OCEAN.

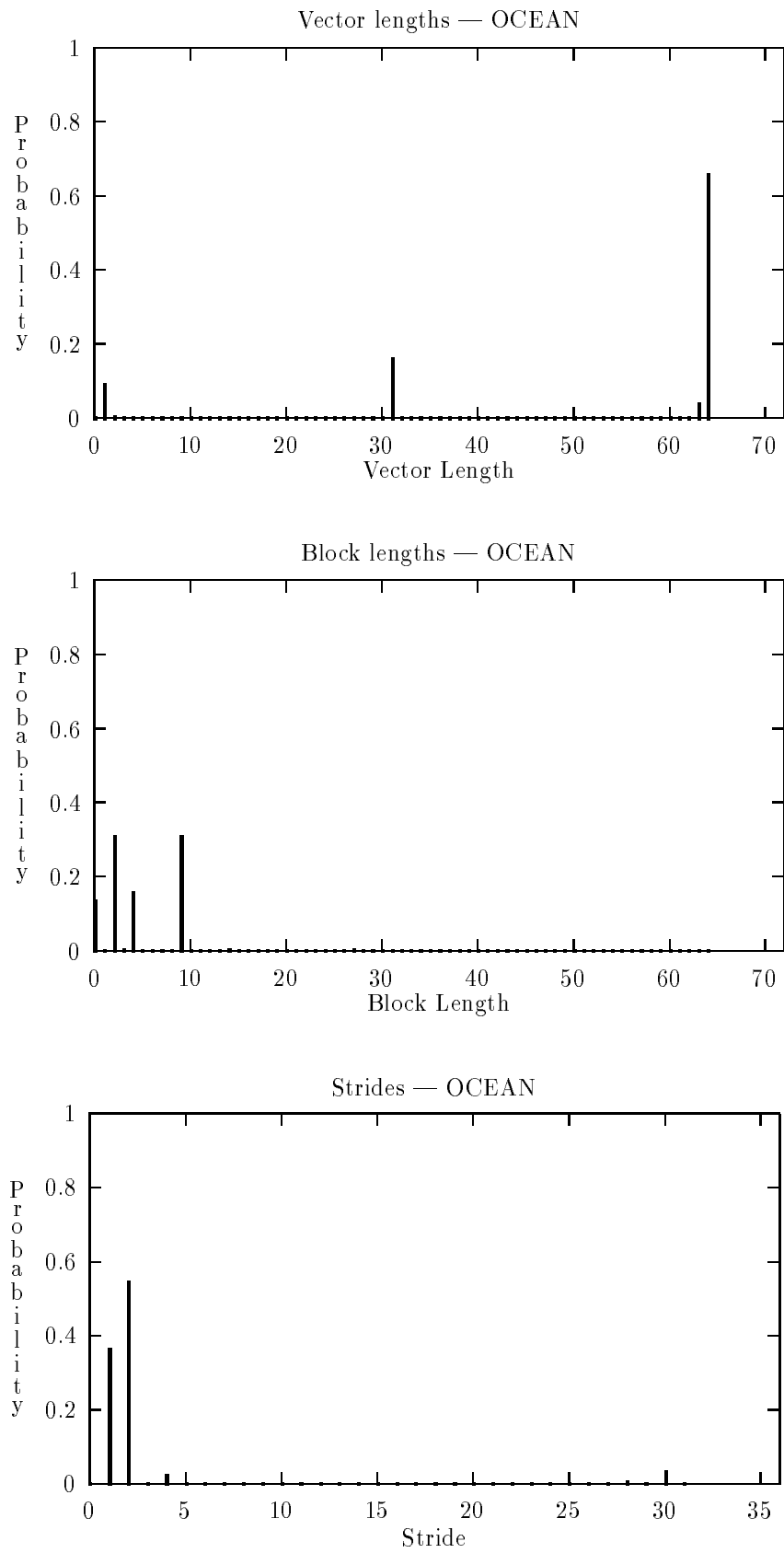


Figure 24: Distribution of lengths and strides for the optimized OCEAN.

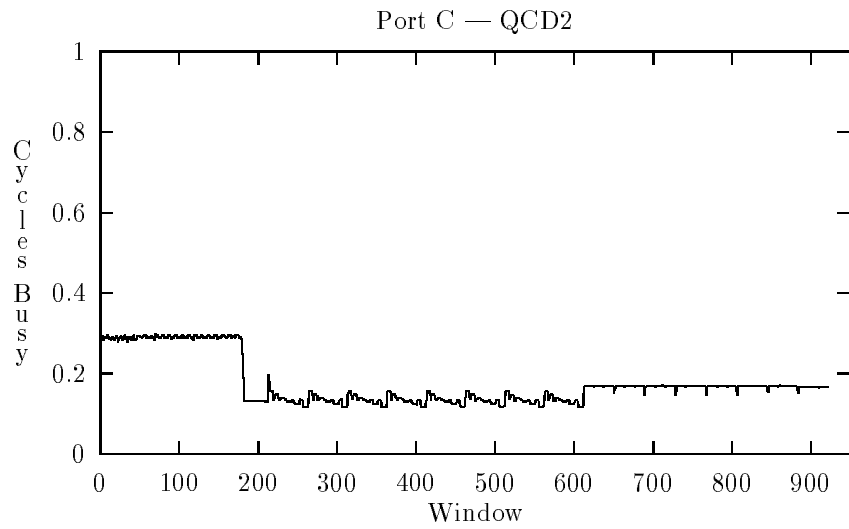
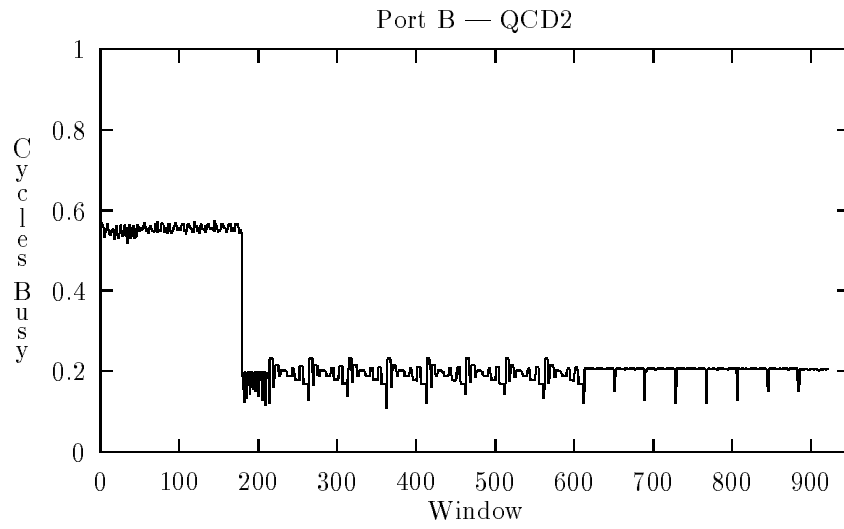
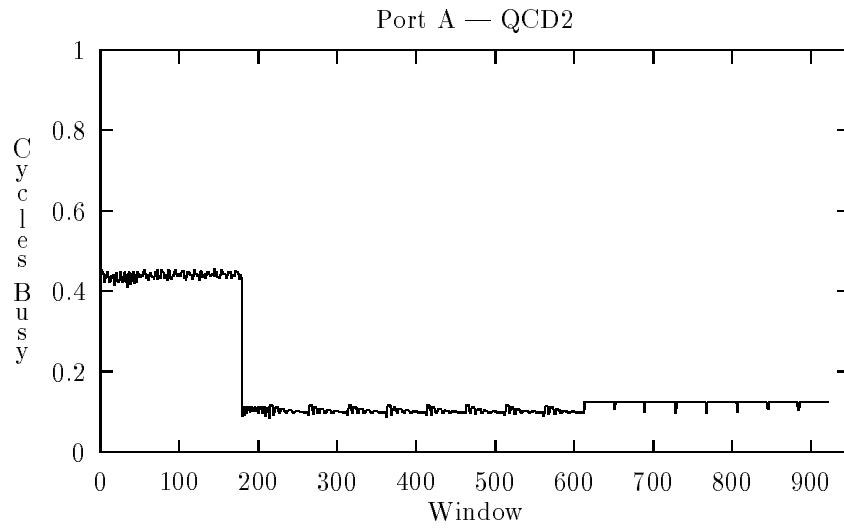


Figure 25: Port utilization for the optimized QCD.

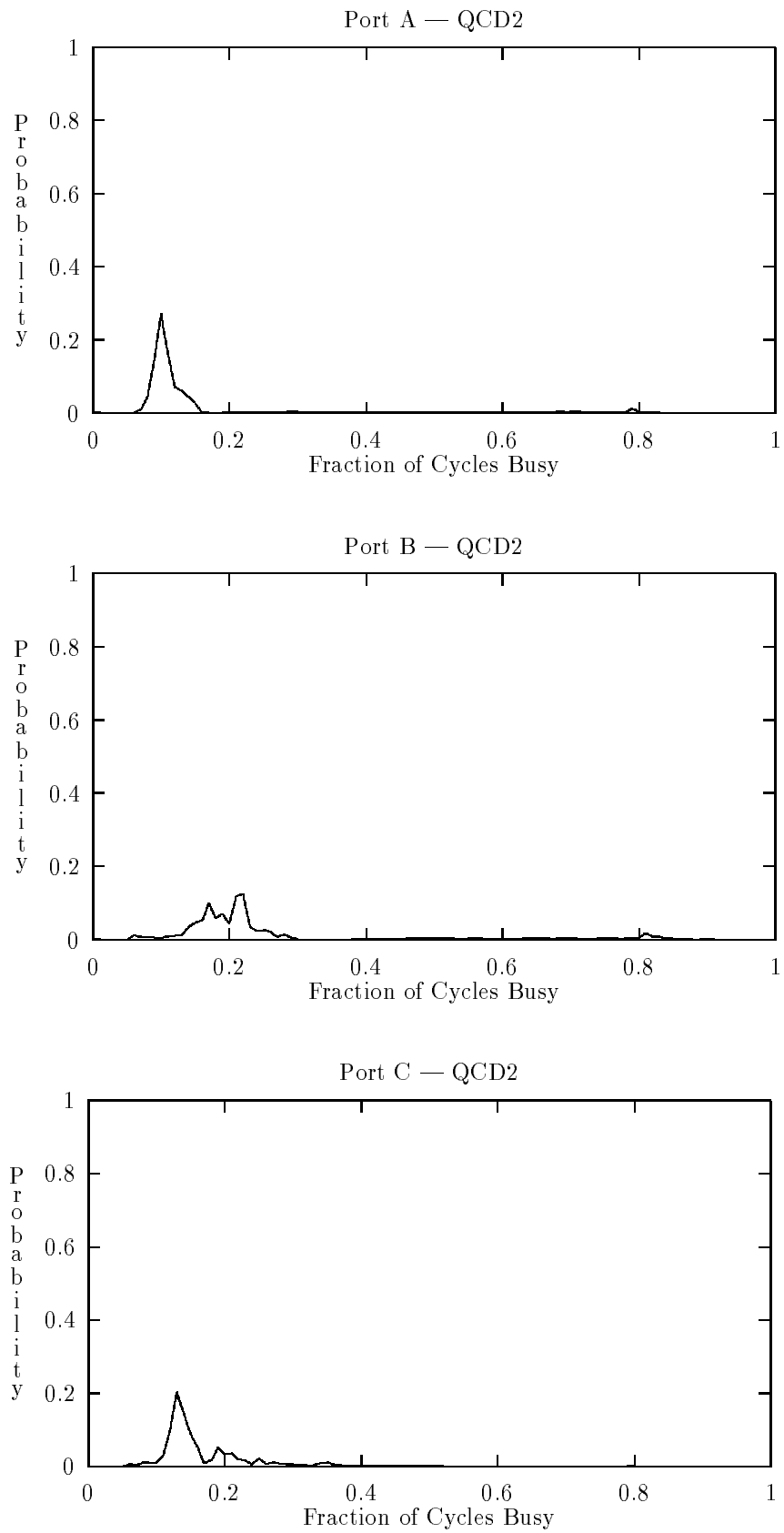


Figure 26: Port utilization histogram for the optimized QCD.

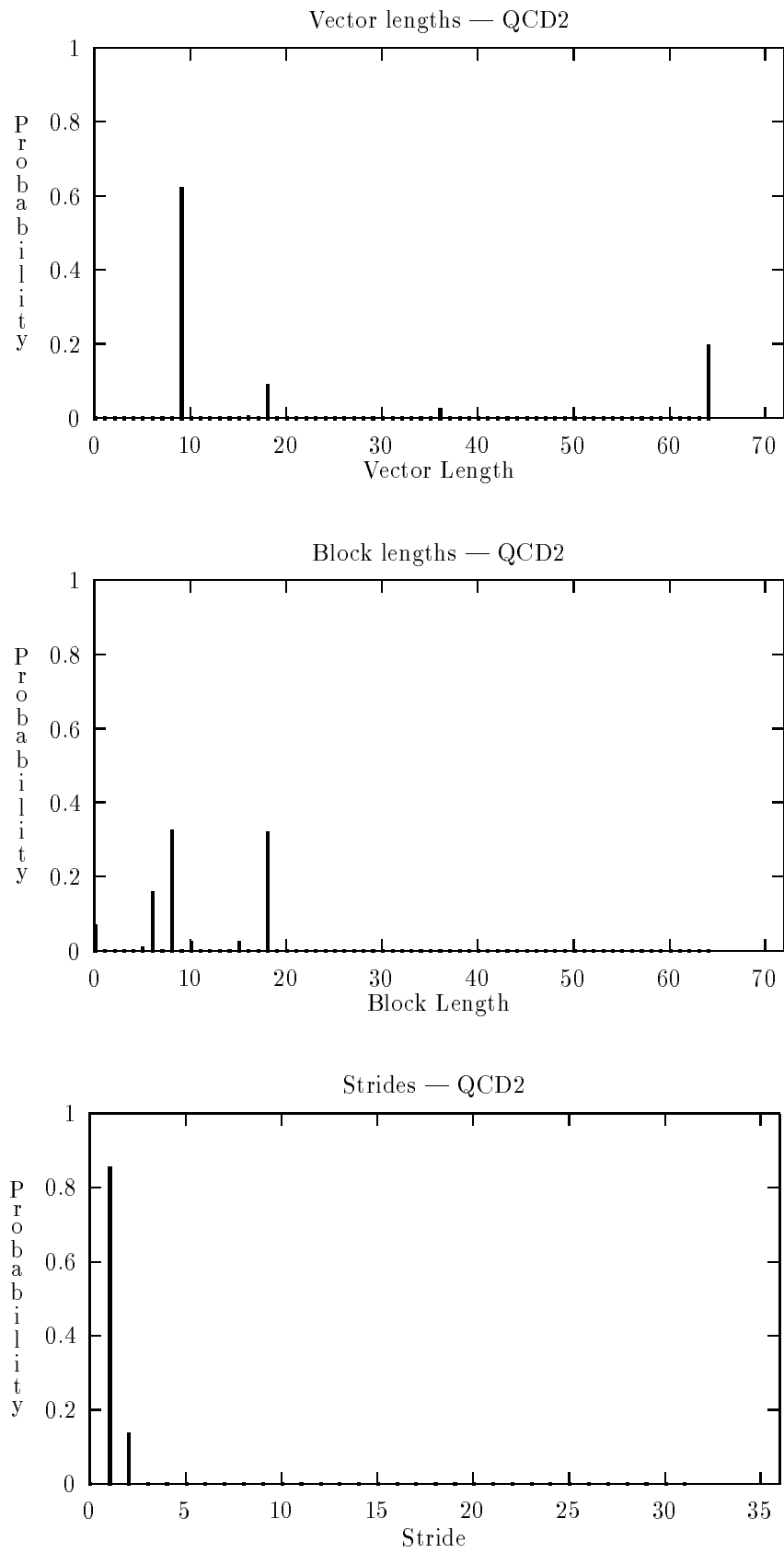


Figure 27: Distribution of lengths and strides for the optimized QCD.

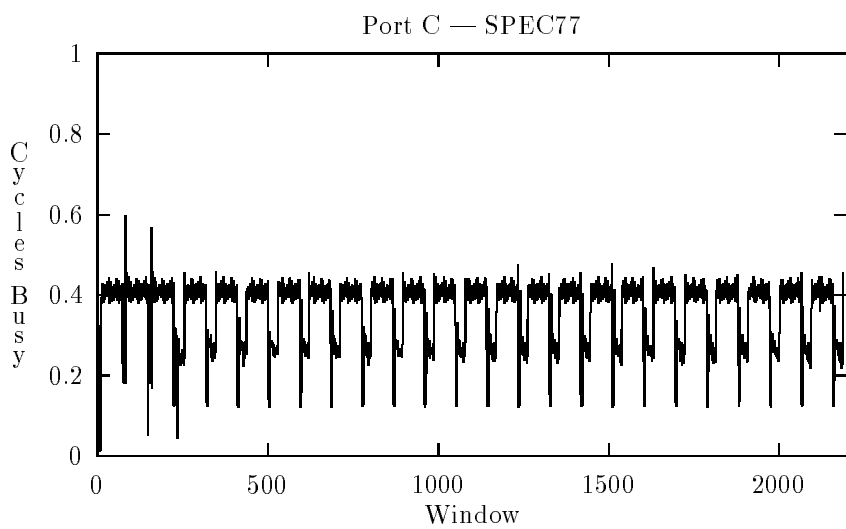
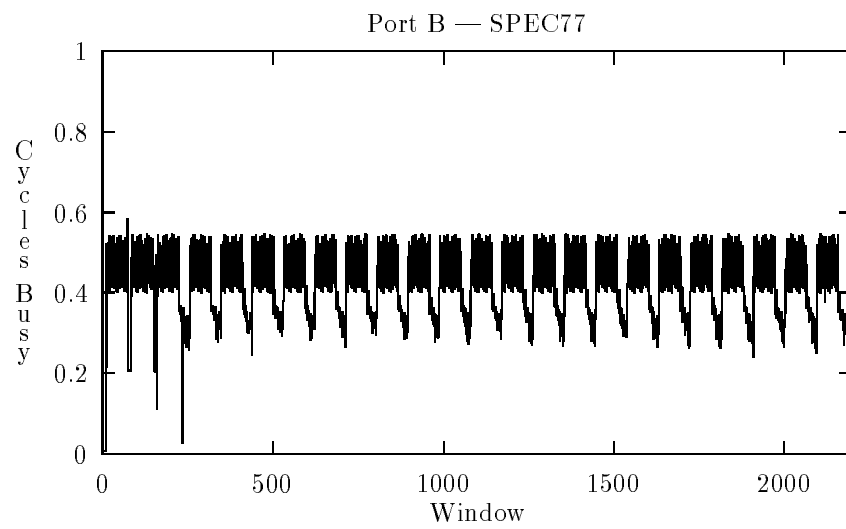
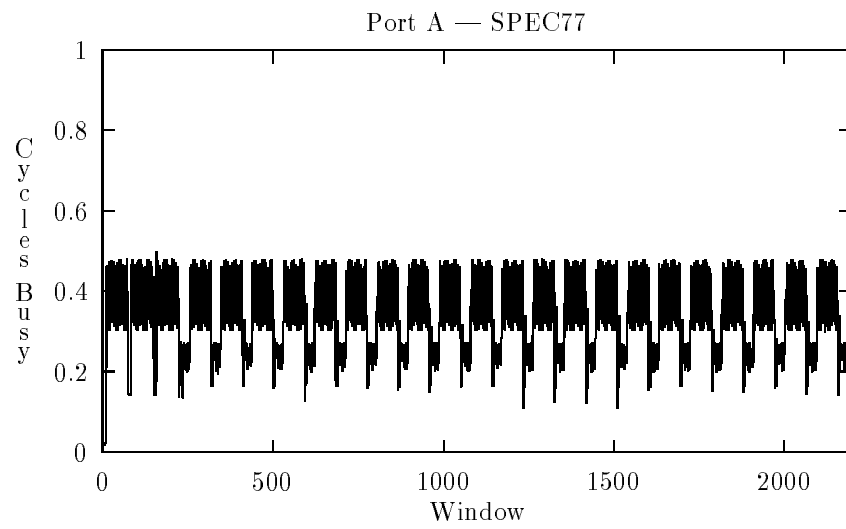


Figure 28: Port utilization for the optimized SPEC77.

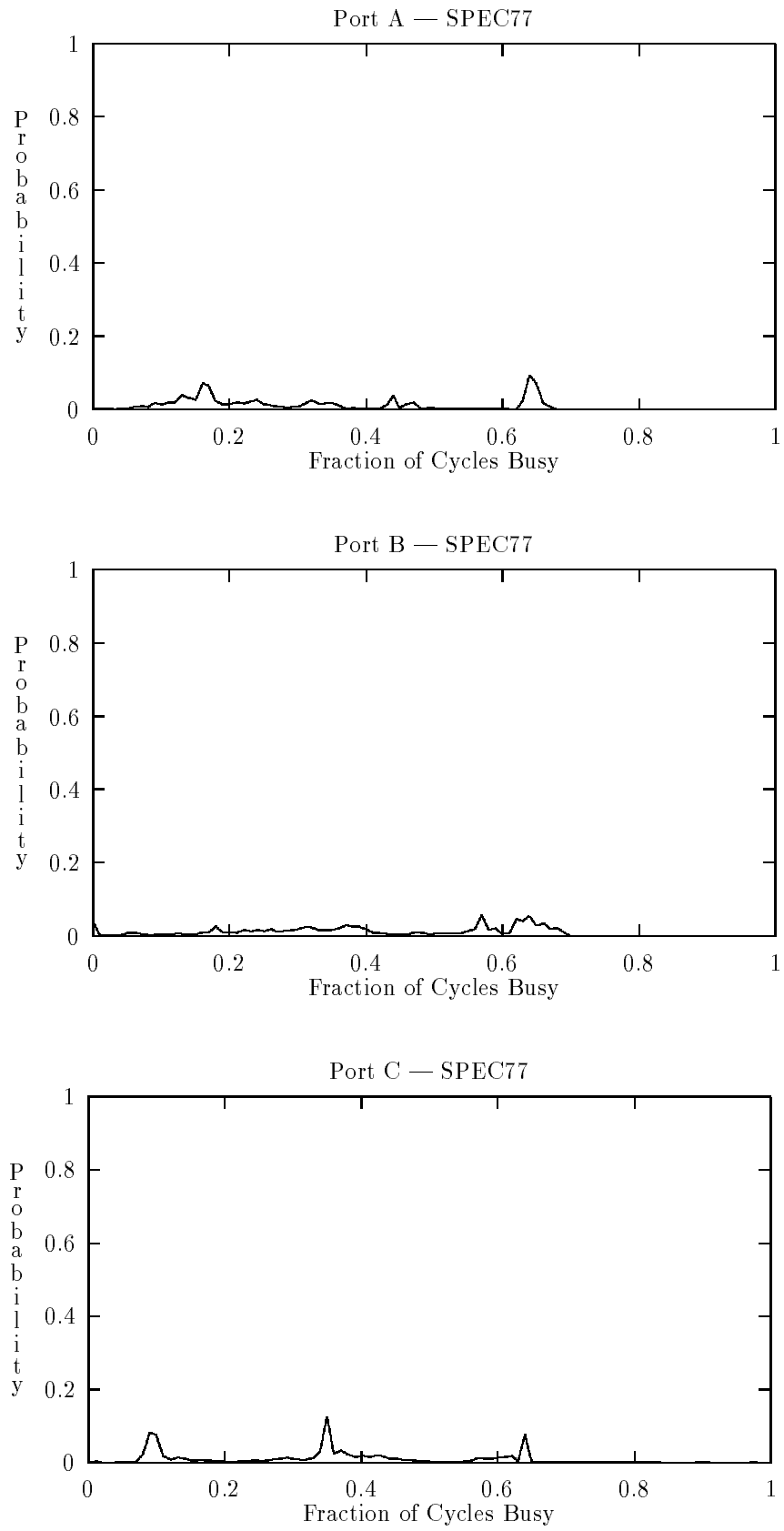


Figure 29: Port utilization histogram for the optimized SPEC77.

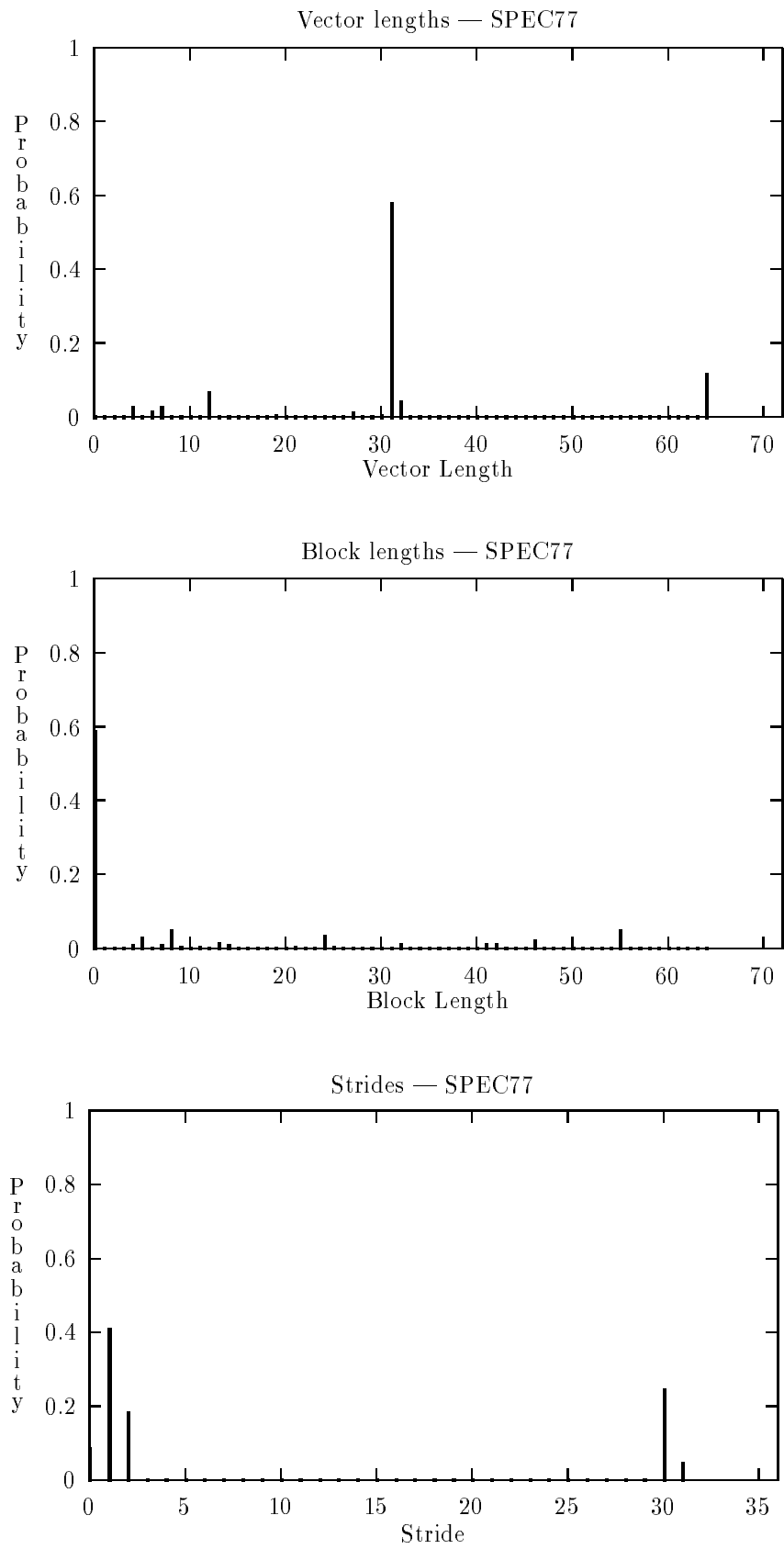


Figure 30: Distribution of lengths and strides for the optimized SPEC77.

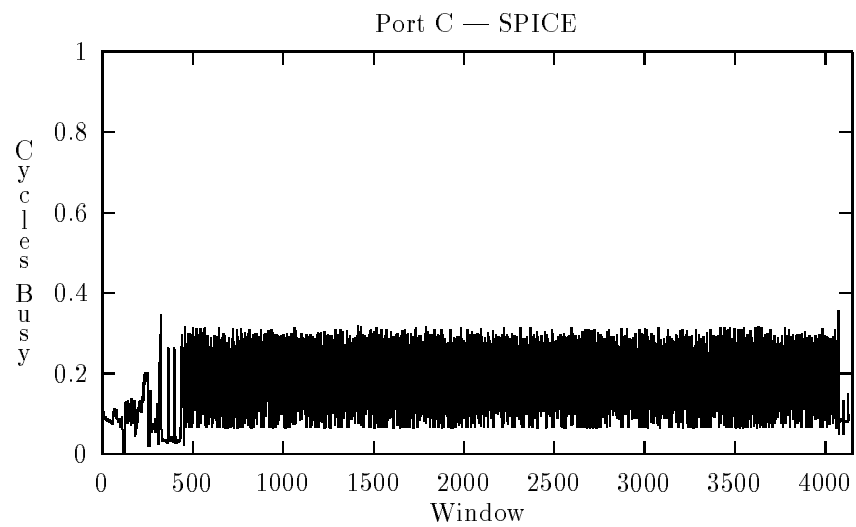
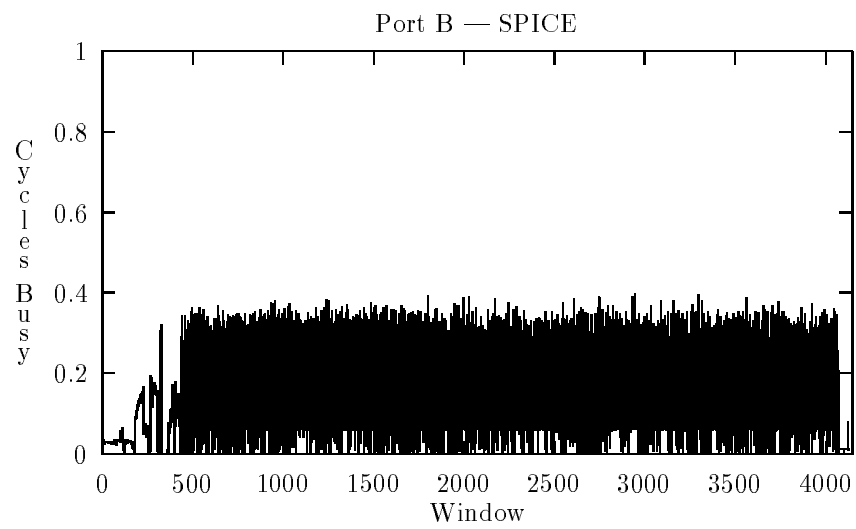
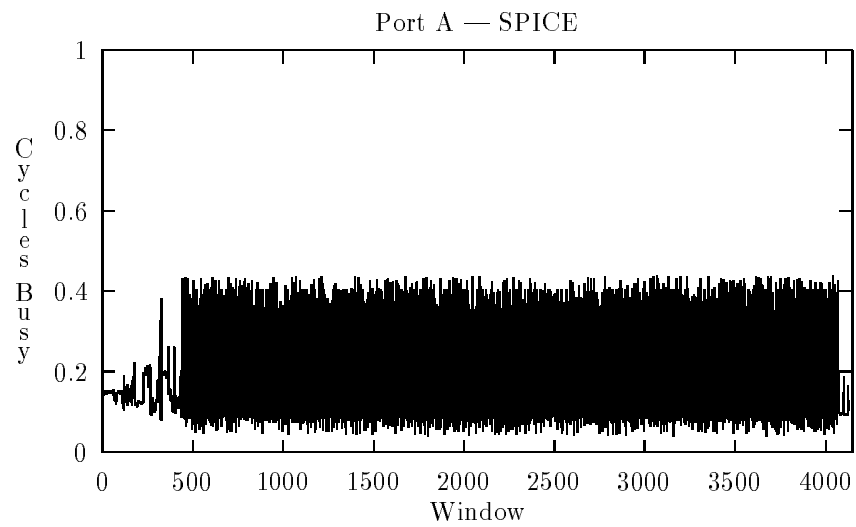


Figure 31: Port utilization for the optimized SPICE.

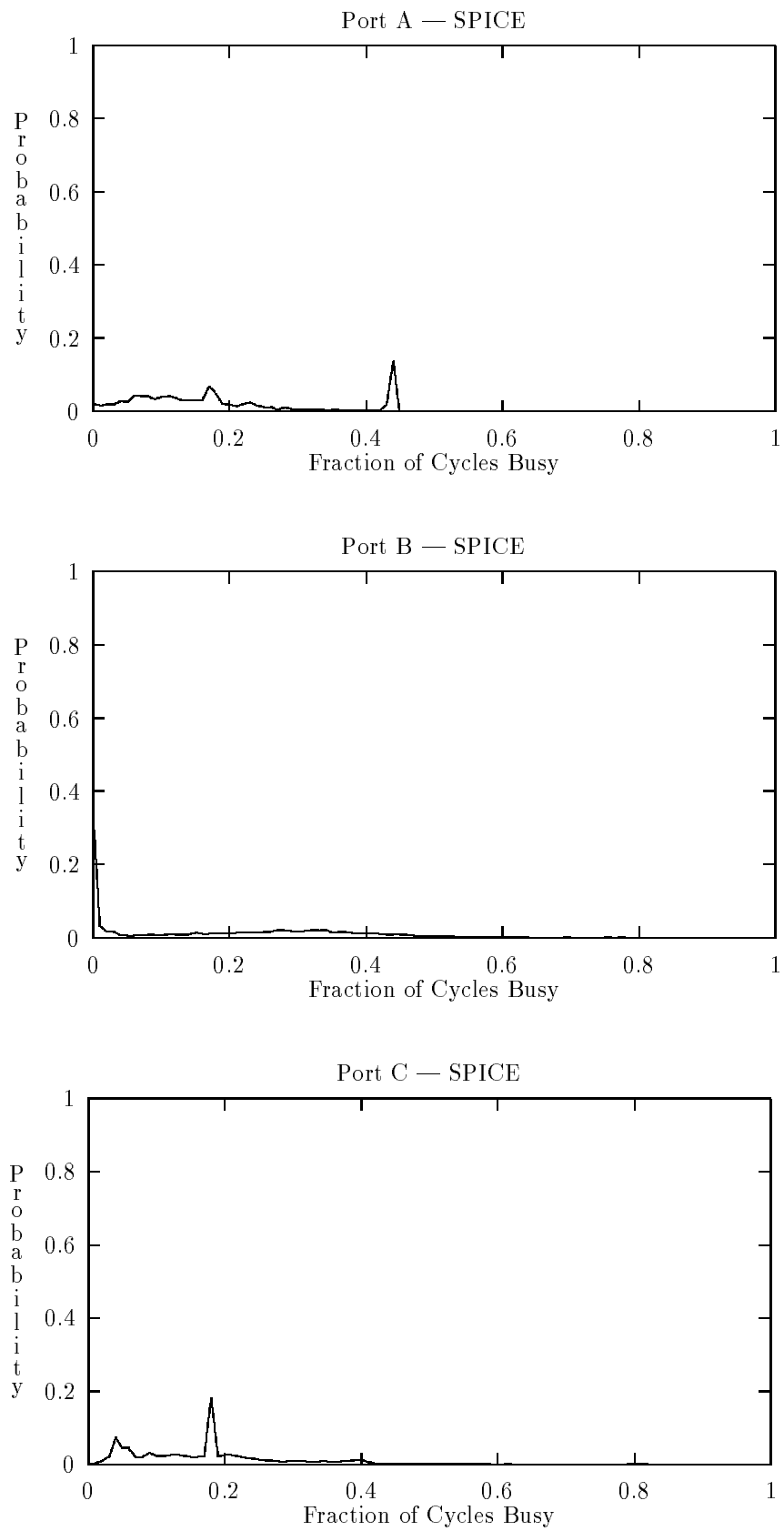


Figure 32: Port utilization histogram for the optimized SPICE.

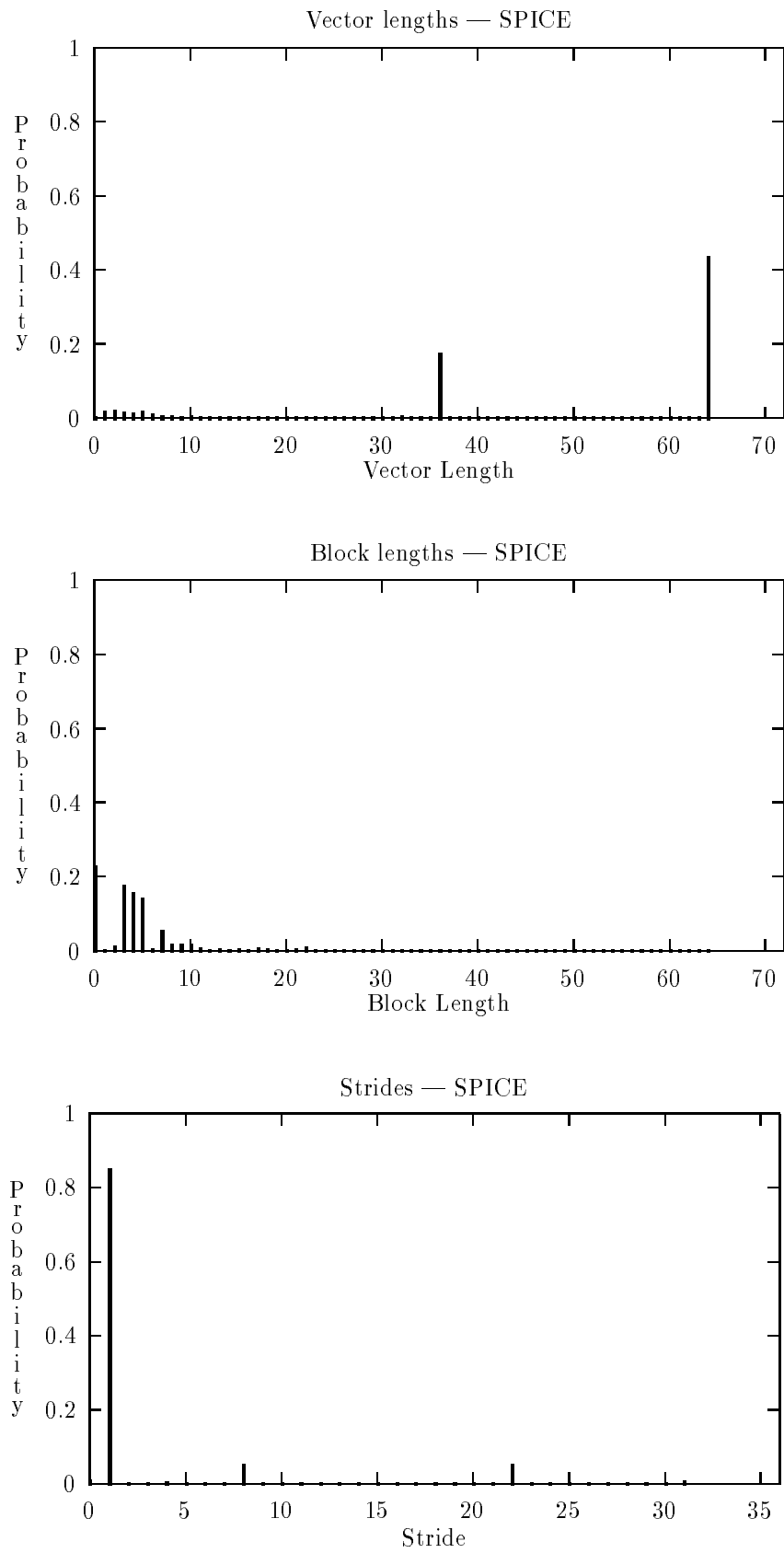


Figure 33: Distribution of lengths and strides for the optimized SPICE.

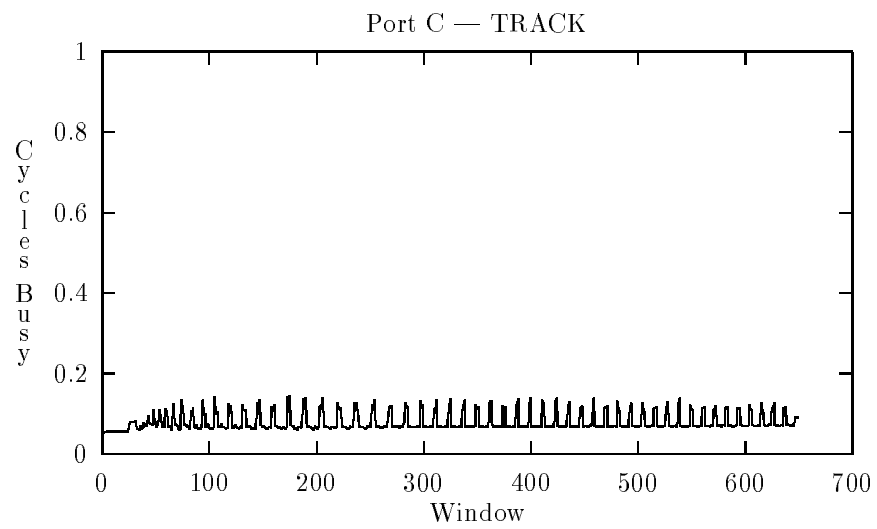
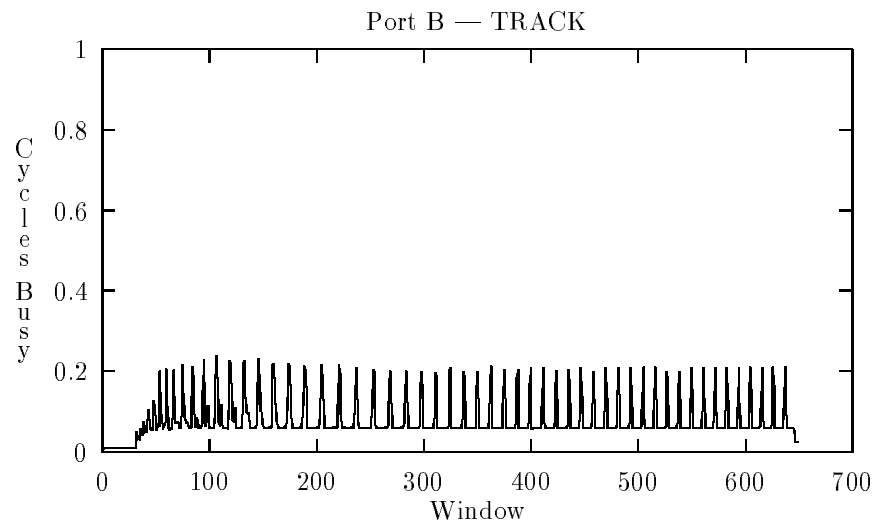
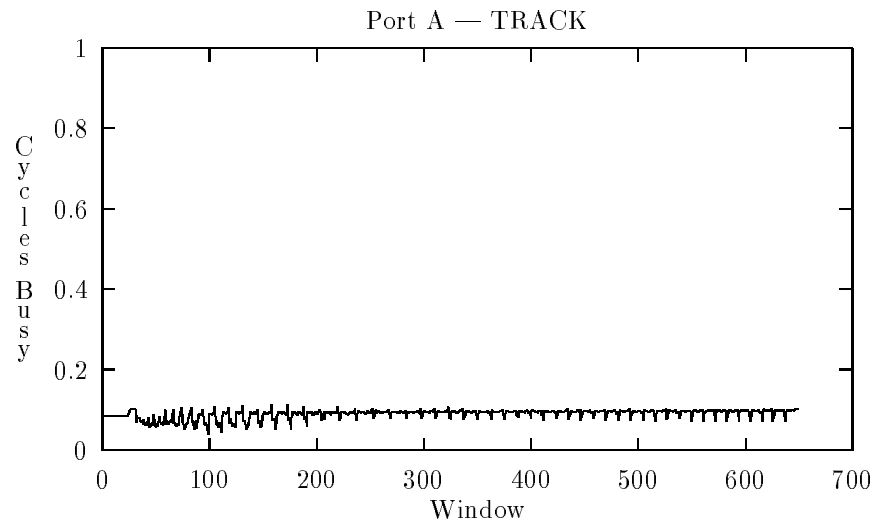


Figure 34: Port utilization for the optimized TRACK.

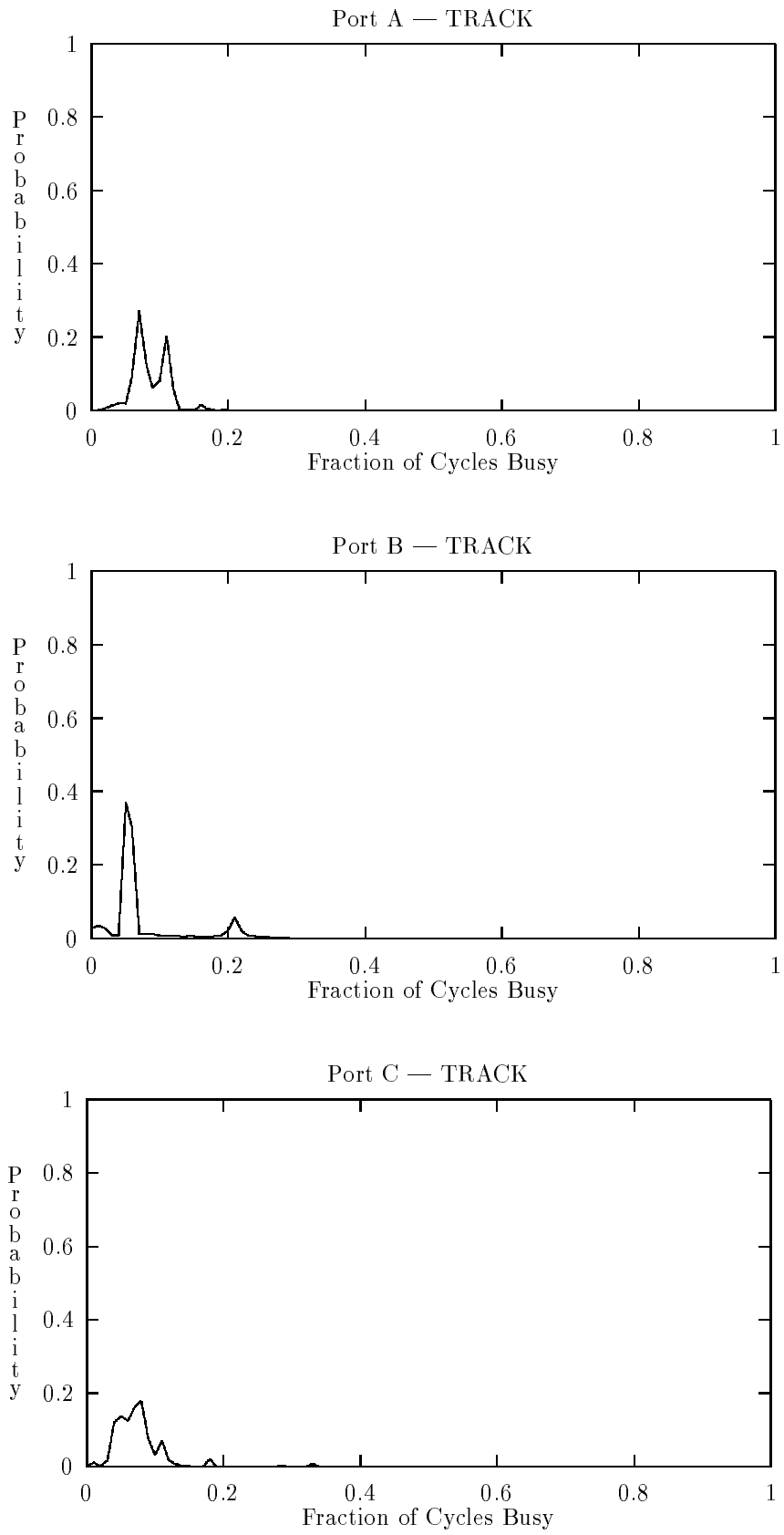


Figure 35: Port utilization histogram for the optimized TRACK.

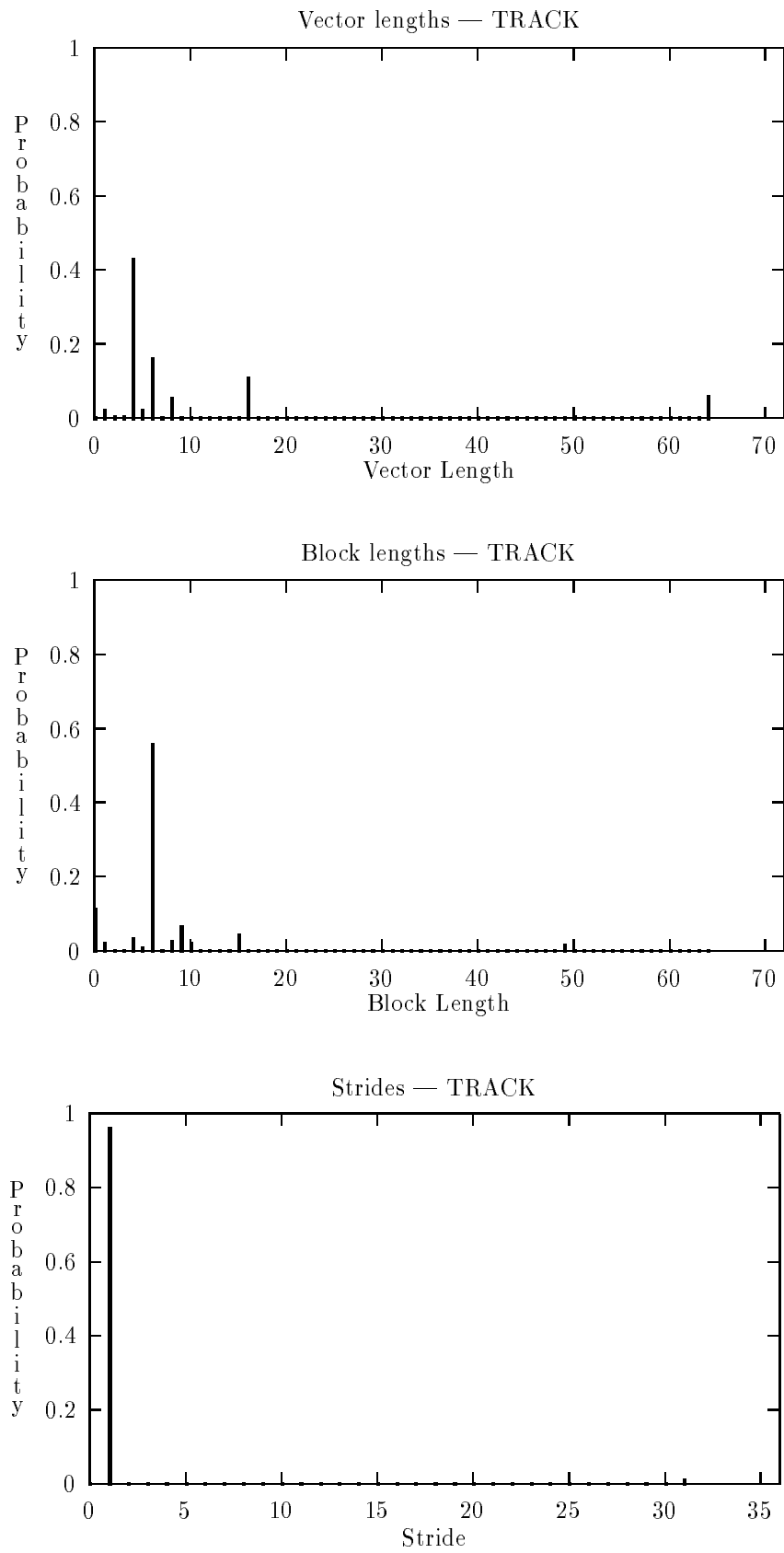


Figure 36: Distribution of lengths and strides for the optimized TRACK.

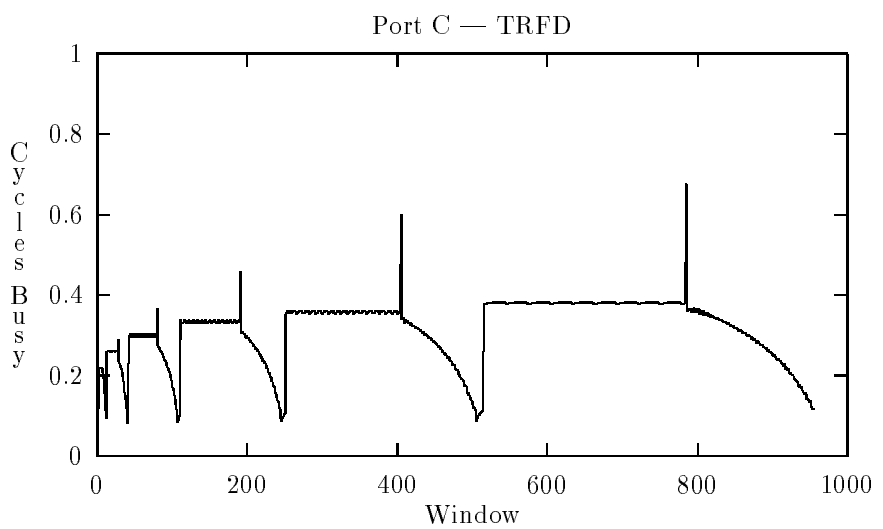
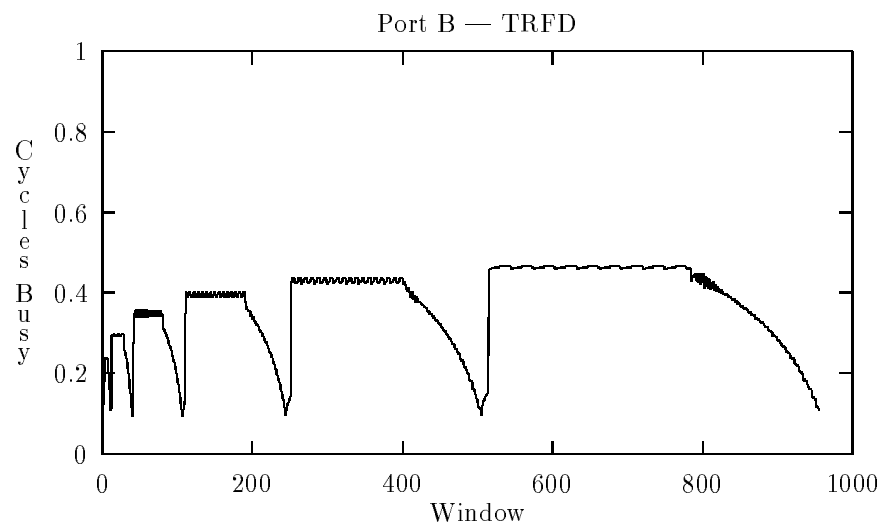
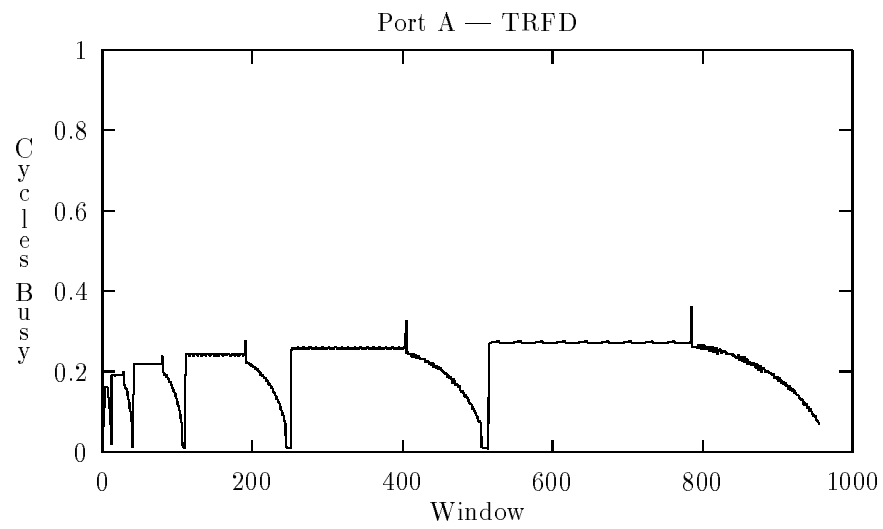


Figure 37: Port utilization for the optimized TRFD.

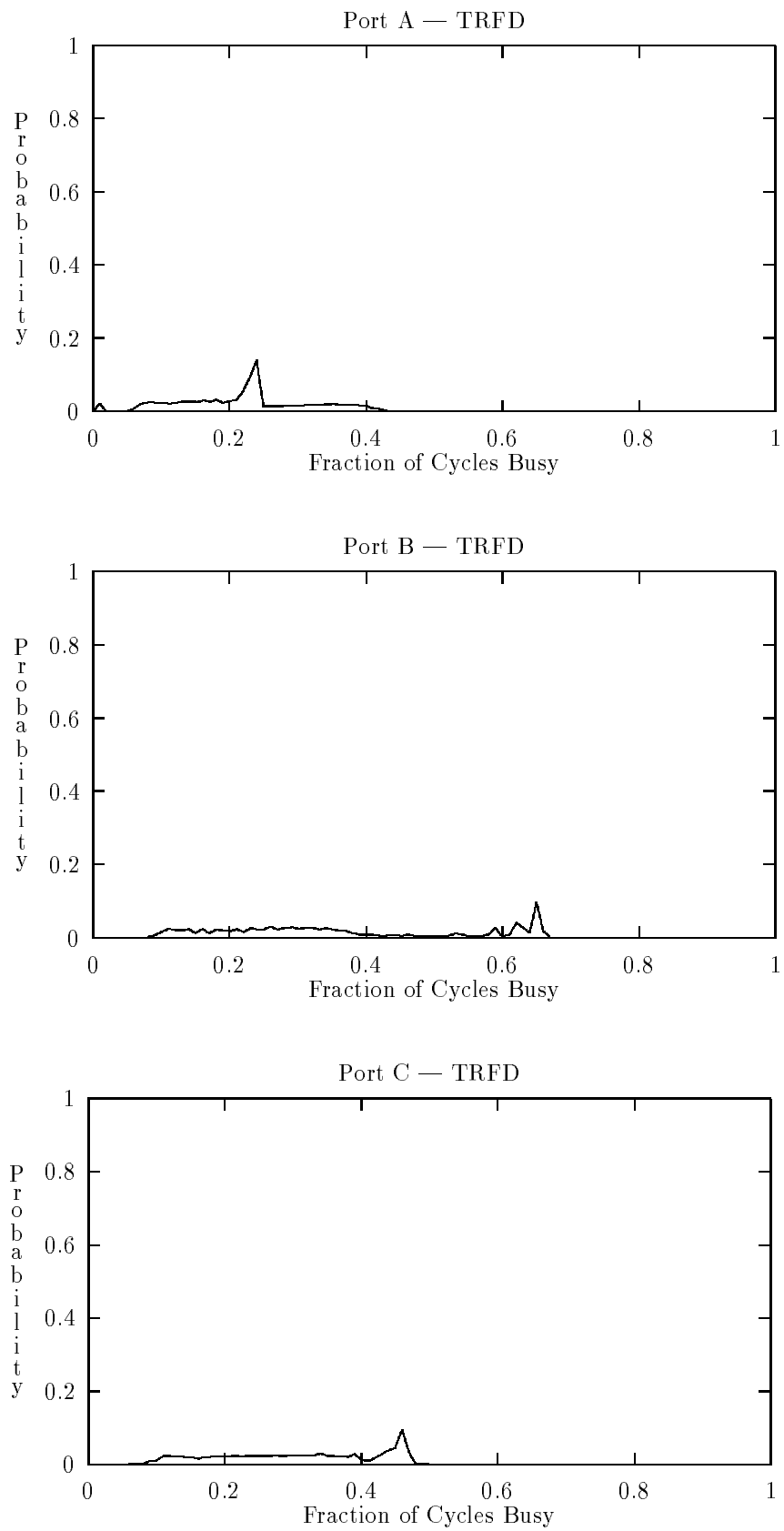


Figure 38: Port utilization histogram for the optimized TRFD.

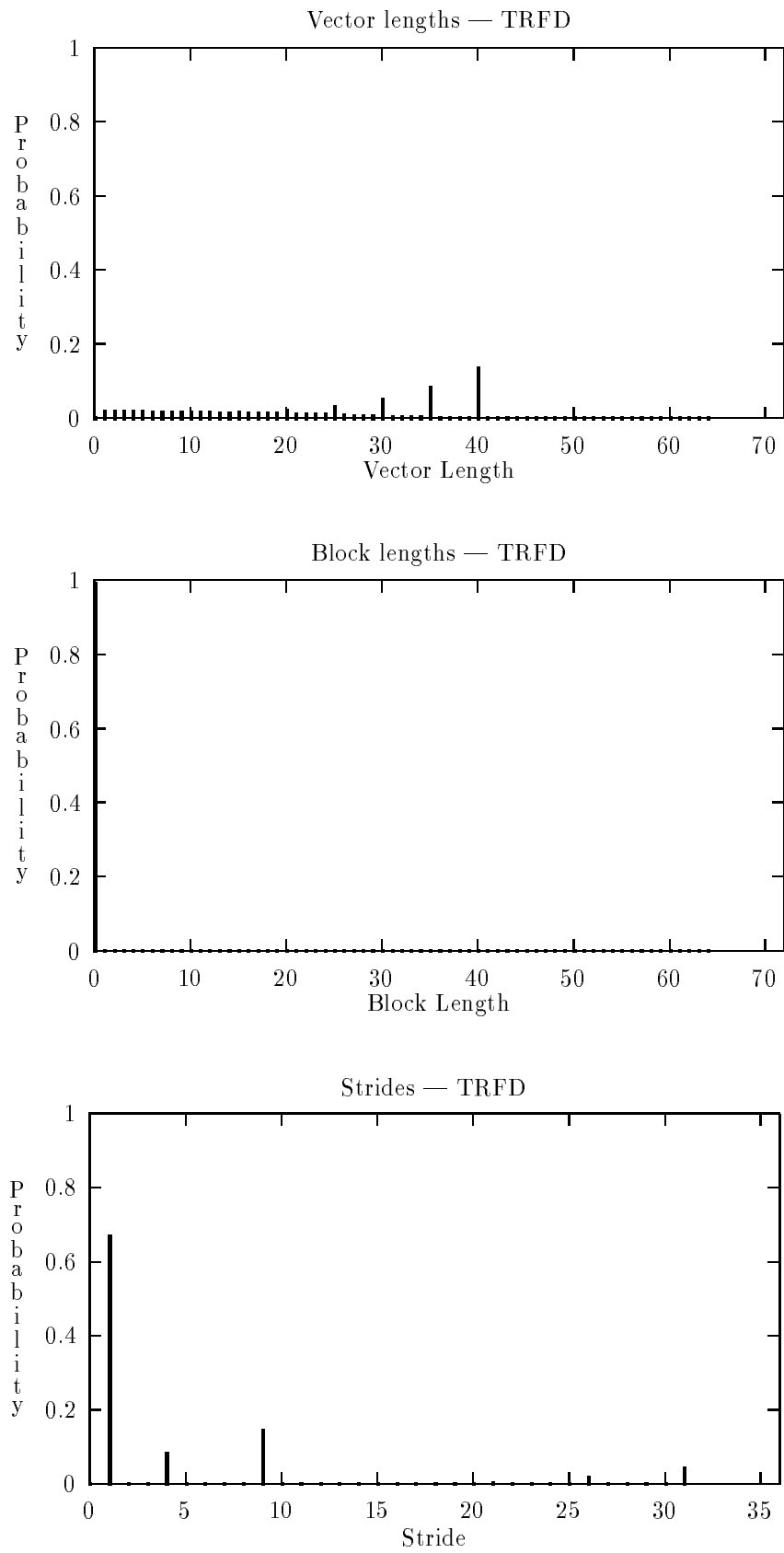


Figure 39: Distributions of lengths and strides for the optimized TRFD.

A Hardware Performance Monitor Data

A.1 Statistics for optimized ADM run on hpm

CP: 8.023s, Wallclock: 13.434s, 7.5% of 8-CPU Machine
 HWM mem: 373941, HWM stack: 14311, Stack extensions: 0
 Group 0: CPU seconds : 8.02 CP executing : 1337336855

```
-----
Million inst/sec (MIPS) : 54.13      Instructions : 434310851
Avg. clock periods/inst : 3.08
% CP holding issue : 53.46      CP holding issue : 714920851
Inst.buffer fetches/sec : 0.62M    Inst.buf. fetches: 4999973
Floating adds/sec : 30.74M      F.P. adds : 246620840
Floating multiplies/sec : 28.06M   F.P. multiplies : 225135415
Floating reciprocal/sec : 1.64M    F.P. reciprocals : 13140251
I/O mem. references/sec : 0.12M    I/O references : 961079
CPU mem. references/sec : 59.38M   CPU references : 476437382
```

Floating ops/CPU second : 60.43M
 CP: 8.019s, Wallclock: 14.043s, 7.1% of 8-CPU Machine
 HWM mem: 373941, HWM stack: 14311, Stack extensions: 0

Group 1: CPU seconds : 8.01981 CP executing: 1336634670

```
-----
Hold issue condition      % of all CPs      actual # of CPs
Waiting on semaphores : 0.00      2211
Waiting on shared registers : 0.00      1
Waiting on A-registers/funct. units: 6.56      87688820
Waiting on S-registers/funct. units: 13.92     186052768
Waiting on V-registers : 13.83     184840054
Waiting on vector functional units : 19.76     264130349
Waiting on scalar memory references: 0.66      8879965
Waiting on block memory references : 5.65      75507655
```

CP: 8.010s, Wallclock: 12.209s, 8.2% of 8-CPU Machine
 HWM mem: 373941, HWM stack: 14311, Stack extensions: 0

Group 2: CPU seconds : 8.01087 CP executing : 1335145546

```
-----
Inst. buffer fetches/sec : 0.62M total fetches : 5000218
                                fetch conflicts : 6596256
I/O memory refs/sec : 0.14M actual refs : 1154259
  avg conflict/ref 0.41: actual conflicts : 473912
Scalar memory refs/sec : 3.32M actual refs : 26560600
Block memory refs/sec : 56.16M actual refs : 449876781
CPU memory refs/sec : 59.47M actual refs : 476437381
  avg conflict/ref 0.22: actual conflicts : 104554753
CPU memory writes/sec : 22.23M actual refs : 178097555
CPU memory reads/sec : 37.24M actual refs : 298339826
```

CP: 8.009s, Wallclock: 12.979s, 7.7% of 8-CPU Machine
 HWM mem: 373941, HWM stack: 14311, Stack extensions: 0

Group 3: CPU seconds : 8.01030 CP executing: 1335050177

```
-----
(octal) type of instruction  inst./CPUsec      actual inst.  % of all inst.
(000-017)jump/special : 3.04M      24390763     5.62
(020-077)scalar functional unit : 41.59M    333128405    76.70
(100-137)scalar memory : 3.32M      26560600     6.12
(140-157,175)vector integer/log.: 0.17M      1365127      0.31
(160-174)vector floating point : 3.09M      24742073     5.70
(176-177)vector load and store : 3.01M      24123863     5.55
```

```
-----
type of operation          ops/CPUsec      actual ops  avg. VL
Vector integer&logical : 3.41M      27346176    20.03
Vector floating point : 57.49M     460541116   18.61
Scalar functional unit : 41.59M     333128405
```

A.2 Statistics for optimized ARC2D run on hpm

```

STOP (called by ARC2D )
CP: 12.248s, Wallclock: 12.687s, 12.1% of 8-CPU Machine
HWM mem: 1298918, HWM stack: 831213, Stack extensions: 0
Group 0: CPU seconds : 12.25 CP executing : 2041544218

Million inst/sec (MIPS) : 26.99 Instructions : 330645038
Avg. clock periods/inst : 6.17
% CP holding issue : 81.14 CP holding issue : 1656477946
Inst.buffer fetches/sec : 0.03M Inst.buf. fetches: 404988
Floating adds/sec : 65.91M F.P. adds : 807294424
Floating multiplies/sec : 105.64M F.P. multiplies : 1294069182
Floating reciprocal/sec : 10.83M F.P. reciprocals : 132672490
I/O mem. references/sec : 0.24M I/O references : 2967775
CPU mem. references/sec : 187.12M CPU references : 2292102035

Floating ops/CPU second : 182.38M
STOP (called by ARC2D )
CP: 12.244s, Wallclock: 12.588s, 12.2% of 8-CPU Machine
HWM mem: 1298918, HWM stack: 831213, Stack extensions: 0
Group 1: CPU seconds : 12.24523 CP executing: 2040870882

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 1102
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 4.07 83002226
Waiting on S-registers/funct. units: 0.70 14249193
Waiting on V-registers : 28.45 580592539
Waiting on vector functional units : 38.90 793856781
Waiting on scalar memory references: 0.04 858619
Waiting on block memory references : 20.56 419558627
STOP (called by ARC2D )
CP: 12.256s, Wallclock: 12.780s, 12.0% of 8-CPU Machine
HWM mem: 1298918, HWM stack: 831213, Stack extensions: 0
Group 2: CPU seconds : 12.25643 CP executing : 2042737546

Inst. buffer fetches/sec : 0.03M total fetches : 406180
fetch conflicts : 1031272
I/O memory refs/sec : 0.19M actual refs : 2292661
avg conflict/ref 0.81: actual conflicts : 1862095
Scalar memory refs/sec : 0.06M actual refs : 770576
Block memory refs/sec : 186.95M actual refs : 2291331500
CPU memory refs/sec : 187.01M actual refs : 2292102076
avg conflict/ref 0.07: actual conflicts : 165064074
CPU memory writes/sec : 53.51M actual refs : 655896956
CPU memory reads/sec : 133.50M actual refs : 1636205120
STOP (called by ARC2D )
CP: 12.266s, Wallclock: 12.599s, 12.2% of 8-CPU Machine
HWM mem: 1298918, HWM stack: 831213, Stack extensions: 0
Group 3: CPU seconds : 12.26689 CP executing: 2044481915

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 1.30M 15942465 4.82
(020-077)scalar functional unit : 18.57M 227821038 68.90
(100-137)scalar memory : 0.06M 770576 0.23
(140-157,175)vector integer/log.: 0.39M 4780507 1.45
(160-174)vector floating point : 3.27M 40142846 12.14
(176-177)vector load and store : 3.36M 41187524 12.46

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 22.03M 270290613 56.54
Vector floating point : 182.33M 2236612681 55.72
Scalar functional unit : 18.57M 227821038

```

A.3 Statistics for optimized BDNA run on hpm

```

STOP (called by BDNA )
CP: 9.056s, Wallclock: 12.429s, 9.1% of 8-CPU Machine
HWM mem: 485824, HWM stack: 260227, Stack extensions: 0
Group 0: CPU seconds : 9.06 CP executing : 1509440765

Million inst/sec (MIPS) : 31.89 Instructions : 288858669
Avg. clock periods/inst : 5.23
% CP holding issue : 69.38 CP holding issue : 1047262048
Inst.buffer fetches/sec : 0.44M Inst.buf. fetches: 4010772
Floating adds/sec : 62.64M F.P. adds : 567299194
Floating multiplies/sec : 57.62M F.P. multiplies : 521844022
Floating reciprocal/sec : 10.18M F.P. reciprocals : 92161734
I/O mem. references/sec : 0.12M I/O references : 1126435
CPU mem. references/sec : 73.85M CPU references : 668820247

Floating ops/CPU second : 130.44M
STOP (called by BDNA )
CP: 9.057s, Wallclock: 9.644s, 11.7% of 8-CPU Machine
HWM mem: 485824, HWM stack: 260227, Stack extensions: 0
Group 1: CPU seconds : 9.05758 CP executing: 1509595973

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 2262
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 4.48 67701307
Waiting on S-registers/funct. units: 8.57 129419118
Waiting on V-registers : 19.64 296468735
Waiting on vector functional units : 37.60 567664033
Waiting on scalar memory references: 0.13 1997460
Waiting on block memory references : 4.31 65100408
STOP (called by BDNA )
CP: 9.055s, Wallclock: 9.747s, 11.6% of 8-CPU Machine
HWM mem: 485824, HWM stack: 260227, Stack extensions: 0
Group 2: CPU seconds : 9.05645 CP executing : 1509409000

Inst. buffer fetches/sec : 0.44M total fetches : 4010667
fetch conflicts : 3310454
I/O memory refs/sec : 0.05M actual refs : 436992
avg conflict/ref 0.54: actual conflicts : 236757
Scalar memory refs/sec : 1.46M actual refs : 13245400
Block memory refs/sec : 72.39M actual refs : 655574989
CPU memory refs/sec : 73.85M actual refs : 668820389
avg conflict/ref 0.04: actual conflicts : 29446550
CPU memory writes/sec : 30.55M actual refs : 276714693
CPU memory reads/sec : 43.30M actual refs : 392105696
STOP (called by BDNA )
CP: 9.058s, Wallclock: 9.929s, 11.4% of 8-CPU Machine
HWM mem: 485824, HWM stack: 260227, Stack extensions: 0
Group 3: CPU seconds : 9.05919 CP executing: 1509864755

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 3.19M 28886110 10.00
(020-077)scalar functional unit : 22.27M 201734059 69.84
(100-137)scalar memory : 1.46M 13245398 4.59
(140-157,175)vector integer/log.: 0.88M 7989265 2.77
(160-174)vector floating point : 2.57M 23300392 8.07
(176-177)vector load and store : 1.51M 13704341 4.74

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 37.77M 342203226 42.83
Vector floating point : 130.61M 1183240968 50.78
Scalar functional unit : 22.27M 201734059

```

A.4 Statistics for optimized DYFESM run on hpm

```

STOP (called by DYFESM )
CP: 3.936s, Wallclock: 10.031s, 4.9% of 8-CPU Machine
HWM mem: 176730, HWM stack: 7279, Stack extensions: 0
Group 0: CPU seconds      :      3.94      CP executing      :      656169799

Million inst/sec (MIPS) :      63.12      Instructions      :      248509593
Avg. clock periods/inst :       2.64
% CP holding issue      :      50.75      CP holding issue  :      332976600
Inst.buffer fetches/sec :      0.24M      Inst.buf. fetches:      961256
Floating adds/sec       :      39.46M      F.P. adds        :      155361447
Floating multiplies/sec :      36.89M      F.P. multiplies  :      145229060
Floating reciprocal/sec :       0.01M      F.P. reciprocals :       42530
I/O mem. references/sec :      0.04M      I/O references   :      163105
CPU mem. references/sec :      68.34M      CPU references   :      269061918

Floating ops/CPU second :      76.36M
STOP (called by DYFESM )
CP: 3.937s, Wallclock: 10.538s, 4.7% of 8-CPU Machine
HWM mem: 176730, HWM stack: 7279, Stack extensions: 0
Group 1: CPU seconds      :      3.93806  CP executing      :      656343835

  Hold issue condition          % of all CPs      actual # of CPs
  Waiting on semaphores         :      0.00          1035
  Waiting on shared registers    :      0.00           1
  Waiting on A-registers/funct. units: 9.81          64402179
  Waiting on S-registers/funct. units: 11.39         74730715
  Waiting on V-registers        :      6.09          40002108
  Waiting on vector functional units : 15.11         99176999
  Waiting on scalar memory references: 6.13           40211943
  Waiting on block memory references: 3.54           23233401
STOP (called by DYFESM )
CP: 3.937s, Wallclock: 9.343s, 5.3% of 8-CPU Machine
HWM mem: 176730, HWM stack: 7279, Stack extensions: 0
Group 2: CPU seconds      :      3.93791  CP executing      :      656319058

Inst. buffer fetches/sec      :      0.24M      total fetches      :      961179
                                :              fetch conflicts :      1301863
I/O memory refs/sec          :      0.06M      actual refs        :      232967
  avg conflict/ref 0.37:      :              actual conflicts :      86900
Scalar memory refs/sec       :      4.26M      actual refs        :      16759055
Block memory refs/sec        :      64.07M      actual refs        :      252302857
CPU memory refs/sec          :      68.33M      actual refs        :      269061912
  avg conflict/ref 0.21:      :              actual conflicts :      55425627
CPU memory writes/sec        :      15.51M      actual refs        :      61067801
CPU memory reads/sec         :      52.82M      actual refs        :      207994111
STOP (called by DYFESM )
CP: 3.938s, Wallclock: 9.543s, 5.2% of 8-CPU Machine
HWM mem: 176730, HWM stack: 7279, Stack extensions: 0
Group 3: CPU seconds      :      3.93835  CP executing      :      656391598

  (octal) type of instruction  inst./CPUsec      actual inst.      % of all inst.
(000-017)jump/special        :      4.20M      16529482          6.65
(020-077)scalar functional unit : 47.18M      185803229         74.77
(100-137)scalar memory        :      4.26M      16759050          6.74
(140-157,175)vector integer/log.: 0.15M       582145            0.23
(160-174)vector floating point : 3.38M      13302393          5.35
(176-177)vector load and store : 3.94M      15533124          6.25

  type of operation            ops/CPUsec        actual ops      avg. VL
Vector integer&logical         :      4.46M      17584617         30.21
Vector floating point          :      76.61M     301715643        22.68
Scalar functional unit         :      47.18M     185803229

```


A.5 Statistics for optimized FLO52 run on hpm

STOP (called by FL052Q)
 CP: 5.352s, Wallclock: 16.992s, 3.9% of 8-CPU Machine
 HWM mem: 611714, HWM stack: 158925, Stack extensions: 0
 Group 0: CPU seconds : 5.35 CP executing : 892150853

Million inst/sec (MIPS) :	43.57	Instructions :	233234315
Avg. clock periods/inst :	3.83		
% CP holding issue :	66.99	CP holding issue :	597609711
Inst.buffer fetches/sec :	0.09M	Inst.buf. fetches:	506184
Floating adds/sec :	59.44M	F.P. adds :	318176161
Floating multiplies/sec :	54.51M	F.P. multiplies :	291778851
Floating reciprocal/sec :	5.85M	F.P. reciprocals :	31327705
I/O mem. references/sec :	0.72M	I/O references :	3873972
CPU mem. references/sec :	132.76M	CPU references :	710638545

Floating ops/CPU second : 119.80M
 STOP (called by FL052Q)
 CP: 5.348s, Wallclock: 16.783s, 4.0% of 8-CPU Machine
 HWM mem: 611714, HWM stack: 158925, Stack extensions: 0
 Group 1: CPU seconds : 5.34873 CP executing: 891454603

Hold issue condition	% of all CPs	actual # of CPs
Waiting on semaphores :	0.00	782
Waiting on shared registers :	0.00	2
Waiting on A-registers/funct. units:	6.37	56824765
Waiting on S-registers/funct. units:	7.19	64094767
Waiting on V-registers :	24.09	214738594
Waiting on vector functional units :	35.66	317867218
Waiting on scalar memory references:	0.54	4801800
Waiting on block memory references :	8.45	75285992

STOP (called by FL052Q)
 CP: 5.354s, Wallclock: 13.383s, 5.0% of 8-CPU Machine
 HWM mem: 611714, HWM stack: 158925, Stack extensions: 0
 Group 2: CPU seconds : 5.35513 CP executing : 892521552

Inst. buffer fetches/sec :	0.09M	total fetches :	506319
		fetch conflicts :	619044
I/O memory refs/sec :	0.71M	actual refs :	3810445
avg conflict/ref 0.47:		actual conflicts :	1798235
Scalar memory refs/sec :	1.07M	actual refs :	5728752
Block memory refs/sec :	131.63M	actual refs :	704909764
CPU memory refs/sec :	132.70M	actual refs :	710638516
avg conflict/ref 0.06:		actual conflicts :	45300062
CPU memory writes/sec :	36.86M	actual refs :	197390722
CPU memory reads/sec :	95.84M	actual refs :	513247794

STOP (called by FL052Q)
 CP: 5.353s, Wallclock: 13.747s, 4.9% of 8-CPU Machine
 HWM mem: 611714, HWM stack: 158925, Stack extensions: 0
 Group 3: CPU seconds : 5.35351 CP executing: 892252270

(octal) type of instruction	inst./CPUsec	actual inst.	% of all inst.
(000-017)jump/special :	2.89M	15470443	6.63
(020-077)scalar functional unit :	33.18M	177621154	76.16
(100-137)scalar memory :	1.07M	5728741	2.46
(140-157,175)vector integer/log.:	0.15M	806857	0.35
(160-174)vector floating point :	2.99M	15990134	6.86
(176-177)vector load and store :	3.29M	17617005	7.55

type of operation	ops/CPUsec	actual ops	avg. VL
Vector integer&logical :	6.80M	36399373	45.11
Vector floating point :	117.96M	631476261	39.49
Scalar functional unit :	33.18M	177621154	

A.6 Statistics for optimized MDG run on hpm

```

STOP (called by MDG )
CP: 36.963s, Wallclock: 68.152s, 6.8% of 8-CPU Machine
HWM mem: 1291321, HWM stack: 9584, Stack extensions: 0
Group 0: CPU seconds : 36.96 CP executing : 6160669289

Million inst/sec (MIPS) : 23.62 Instructions : 873122668
Avg. clock periods/inst : 7.06
% CP holding issue : 81.40 CP holding issue : 5014869568
Inst.buffer fetches/sec : 0.09M Inst.buf. fetches: 3277503
Floating adds/sec : 70.57M F.P. adds : 2608412877
Floating multiplies/sec : 42.04M F.P. multiplies : 1554064946
Floating reciprocal/sec : 7.23M F.P. reciprocals : 267144129
I/O mem. references/sec : 0.12M I/O references : 4390078
CPU mem. references/sec : 96.34M CPU references : 3561122844

Floating ops/CPU second : 119.84M
STOP (called by MDG )
CP: 36.933s, Wallclock: 68.416s, 6.7% of 8-CPU Machine
HWM mem: 1291321, HWM stack: 9584, Stack extensions: 0
Group 1: CPU seconds : 36.93416 CP executing: 6155693475

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 781
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 2.72 167286670
Waiting on S-registers/funct. units: 2.04 125807271
Waiting on V-registers : 38.53 2371764679
Waiting on vector functional units : 35.01 2155273317
Waiting on scalar memory references: 0.49 29923428
Waiting on block memory references : 13.28 817234749
STOP (called by MDG )
CP: 36.947s, Wallclock: 59.310s, 7.8% of 8-CPU Machine
HWM mem: 1291321, HWM stack: 9584, Stack extensions: 0
Group 2: CPU seconds : 36.94732 CP executing : 6157886977

Inst. buffer fetches/sec : 0.09M total fetches : 3275919
fetch conflicts : 4397606
I/O memory refs/sec : 0.11M actual refs : 4136096
avg conflict/ref 0.44: actual conflicts : 1811922
Scalar memory refs/sec : 0.64M actual refs : 23612248
Block memory refs/sec : 95.74M actual refs : 3537511108
CPU memory refs/sec : 96.38M actual refs : 3561123356
avg conflict/ref 0.08: actual conflicts : 283454422
CPU memory writes/sec : 39.54M actual refs : 1460860553
CPU memory reads/sec : 56.84M actual refs : 2100262803
STOP (called by MDG )
CP: 36.993s, Wallclock: 47.820s, 9.7% of 8-CPU Machine
HWM mem: 1291321, HWM stack: 9584, Stack extensions: 0
Group 3: CPU seconds : 36.99353 CP executing: 6165588596

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 1.95M 72220887 8.27
(020-077)scalar functional unit : 14.46M 534980742 61.27
(100-137)scalar memory : 0.64M 23612248 2.70
(140-157,175)vector integer/log.: 1.79M 66097845 7.57
(160-174)vector floating point : 2.77M 102523706 11.74
(176-177)vector load and store : 1.99M 73687254 8.44

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 73.96M 2735958146 41.39
Vector floating point : 127.64M 4721752378 46.06
Scalar functional unit : 14.46M 534980742

```

A.7 Statistics for optimized MG3D run on hpm

```

STOP (called by MAIN )
CP: 53.108s, Wallclock: 283.743s, 2.3% of 8-CPU Machine
HWM mem: 0, HWM stack: 50000, Stack extensions: 0
Group 0: CPU seconds : 53.11 CP executing : 8851530801

Million inst/sec (MIPS) : 17.77 Instructions : 943774148
Avg. clock periods/inst : 9.38
% CP holding issue : 87.02 CP holding issue : 7702676639
Inst.buffer fetches/sec : 0.03M Inst.buf. fetches: 1405346
Floating adds/sec : 99.28M F.P. adds : 5272530247
Floating multiplies/sec : 81.51M F.P. multiplies : 4328692130
Floating reciprocal/sec : 1.59M F.P. reciprocals : 84587012
I/O mem. references/sec : 0.58M I/O references : 30740423
CPU mem. references/sec : 158.98M CPU references : 8443213709

Floating ops/CPU second : 182.38M
STOP (called by MAIN )
CP: 53.129s, Wallclock: 285.741s, 2.3% of 8-CPU Machine
HWM mem: 0, HWM stack: 50000, Stack extensions: 0
Group 1: CPU seconds : 53.12934 CP executing: 8854889244

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 29286
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 2.89 256038177
Waiting on S-registers/funct. units: 0.83 73531155
Waiting on V-registers : 47.69 4222850674
Waiting on vector functional units : 52.84 4678722607
Waiting on scalar memory references: 0.05 4491961
Waiting on block memory references : 19.32 1710714571
STOP (called by MAIN )
CP: 53.101s, Wallclock: 286.121s, 2.3% of 8-CPU Machine
HWM mem: 0, HWM stack: 50000, Stack extensions: 0
Group 2: CPU seconds : 53.10194 CP executing : 8850322766

Inst. buffer fetches/sec : 0.03M total fetches : 1405268
fetch conflicts : 2307969
I/O memory refs/sec : 0.69M actual refs : 36403554
avg conflict/ref 0.65: actual conflicts : 23599816
Scalar memory refs/sec : 0.26M actual refs : 13917746
Block memory refs/sec : 158.74M actual refs : 8429296219
CPU memory refs/sec : 159.00M actual refs : 8443213965
avg conflict/ref 0.11: actual conflicts : 900555896
CPU memory writes/sec : 69.23M actual refs : 3676084112
CPU memory reads/sec : 89.77M actual refs : 4767129853
STOP (called by MAIN )
CP: 53.108s, Wallclock: 287.077s, 2.3% of 8-CPU Machine
HWM mem: 0, HWM stack: 50000, Stack extensions: 0
Group 3: CPU seconds : 53.10908 CP executing: 8851512809

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 1.05M 55873875 5.92
(020-077)scalar functional unit : 10.94M 581246609 61.59
(100-137)scalar memory : 0.26M 13917745 1.47
(140-157,175)vector integer/log.: 0.01M 710076 0.08
(160-174)vector floating point : 2.96M 156967318 16.63
(176-177)vector load and store : 2.54M 135058501 14.31

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 0.69M 36910412 51.98
Vector floating point : 182.44M 9689180543 61.73
Scalar functional unit : 10.94M 581246609

```

A.8 Statistics for optimized OCEAN run on hpm

```

STOP (called by OCEAN )
CP: 15.124s, Wallclock: 15.772s, 12.0% of 8-CPU Machine
HWM mem: 355827, HWM stack: 38539, Stack extensions: 0
Group 0: CPU seconds : 15.12 CP executing : 2520756354

Million inst/sec (MIPS) : 30.72 Instructions : 464582062
Avg. clock periods/inst : 5.43
% CP holding issue : 77.62 CP holding issue : 1956632305
Inst.buffer fetches/sec : 0.05M Inst.buf. fetches: 768910
Floating adds/sec : 61.94M F.P. adds : 936828653
Floating multiplies/sec : 36.63M F.P. multiplies : 554043483
Floating reciprocal/sec : 1.25M F.P. reciprocals : 18922813
I/O mem. references/sec : 0.59M I/O references : 8985511
CPU mem. references/sec : 154.09M CPU references : 2330555484

```

```

Floating ops/CPU second : 99.82M
STOP (called by OCEAN )
CP: 15.121s, Wallclock: 15.168s, 12.5% of 8-CPU Machine
HWM mem: 355827, HWM stack: 38539, Stack extensions: 0
Group 1: CPU seconds : 15.12214 CP executing: 2520357089

```

Hold issue condition	% of all CPs	actual # of CPs
Waiting on semaphores	: 0.00	504
Waiting on shared registers	: 0.00	1
Waiting on A-registers/funct. units:	3.49	88077200
Waiting on S-registers/funct. units:	4.86	122542468
Waiting on V-registers	: 15.15	381791474
Waiting on vector functional units	: 27.42	691123356
Waiting on scalar memory references:	0.74	18735930
Waiting on block memory references	: 27.90	703249058

```

STOP (called by OCEAN )
CP: 15.096s, Wallclock: 15.389s, 12.3% of 8-CPU Machine
HWM mem: 355827, HWM stack: 38539, Stack extensions: 0
Group 2: CPU seconds : 15.09682 CP executing : 2516135911

```

Inst. buffer fetches/sec	: 0.05M	total fetches	: 769380
		fetch conflicts	: 1023933
I/O memory refs/sec	: 0.56M	actual refs	: 8437392
avg conflict/ref	0.43:	actual conflicts	: 3657415
Scalar memory refs/sec	: 0.51M	actual refs	: 7684726
Block memory refs/sec	: 153.86M	actual refs	: 2322870515
CPU memory refs/sec	: 154.37M	actual refs	: 2330555241
avg conflict/ref	0.11:	actual conflicts	: 259423322
CPU memory writes/sec	: 73.32M	actual refs	: 1106848529
CPU memory reads/sec	: 81.06M	actual refs	: 1223706712

```

STOP (called by OCEAN )
CP: 15.153s, Wallclock: 23.630s, 8.0% of 8-CPU Machine
HWM mem: 355827, HWM stack: 38539, Stack extensions: 0
Group 3: CPU seconds : 15.15335 CP executing: 2525557582

```

(octal) type of instruction	inst./CPUsec	actual inst.	% of all inst.
(000-017)jump/special	: 1.80M	27299896	5.88
(020-077)scalar functional unit	: 23.18M	351302420	75.62
(100-137)scalar memory	: 0.51M	7684605	1.65
(140-157,175)vector integer/log.	: 0.09M	1379004	0.30
(160-174)vector floating point	: 2.08M	31548988	6.79
(176-177)vector load and store	: 2.99M	45366265	9.76

type of operation	ops/CPUsec	actual ops	avg. VL
Vector integer&logical	: 4.57M	69222541	50.20
Vector floating point	: 98.47M	1492129660	47.30
Scalar functional unit	: 23.18M	351302420	

A.9 Statistics for optimized QCD run on hpm

```

STOP (called by QCD2 )
CP: 6.008s, Wallclock: 12.084s, 6.2% of 8-CPU Machine
HWM mem: 2436711, HWM stack: 19945, Stack extensions: 0
Group 0: CPU seconds : 6.01 CP executing : 1001422566

Million inst/sec (MIPS) : 36.17 Instructions : 217308270
Avg. clock periods/inst : 4.61
% CP holding issue : 56.68 CP holding issue : 567575537
Inst.buffer fetches/sec : 1.20M Inst.buf. fetches: 7201784
Floating adds/sec : 17.94M F.P. adds : 107804375
Floating multiplies/sec : 22.35M F.P. multiplies : 134312834
Floating reciprocal/sec : 0.47M F.P. reciprocals : 2824693
I/O mem. references/sec : 0.26M I/O references : 1575252
CPU mem. references/sec : 68.86M CPU references : 413723161

Floating ops/CPU second : 40.77M
STOP (called by QCD2 )
CP: 5.989s, Wallclock: 12.778s, 5.9% of 8-CPU Machine
HWM mem: 2436711, HWM stack: 19945, Stack extensions: 0
Group 1: CPU seconds : 5.98933 CP executing: 998221905

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 622
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 5.28 52723257
Waiting on S-registers/funct. units: 18.06 180248594
Waiting on V-registers : 12.19 121656249
Waiting on vector functional units : 7.55 75399944
Waiting on scalar memory references: 1.49 14827450
Waiting on block memory references : 11.87 118456542
STOP (called by QCD2 )
CP: 5.987s, Wallclock: 12.944s, 5.8% of 8-CPU Machine
HWM mem: 2436711, HWM stack: 19945, Stack extensions: 0
Group 2: CPU seconds : 5.98808 CP executing : 998012591

Inst. buffer fetches/sec : 1.20M total fetches : 7201693
fetch conflicts : 7981090
I/O memory refs/sec : 0.23M actual refs : 1386334
avg conflict/ref 0.52: actual conflicts : 727188
Scalar memory refs/sec : 1.79M actual refs : 10733891
Block memory refs/sec : 67.30M actual refs : 402989270
CPU memory refs/sec : 69.09M actual refs : 413723161
avg conflict/ref 0.30: actual conflicts : 122205918
CPU memory writes/sec : 19.61M actual refs : 117409057
CPU memory reads/sec : 49.48M actual refs : 296314104
STOP (called by QCD2 )
CP: 5.990s, Wallclock: 9.794s, 7.6% of 8-CPU Machine
HWM mem: 2436711, HWM stack: 19945, Stack extensions: 0
Group 3: CPU seconds : 5.99030 CP executing: 998383449

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 2.97M 17779123 8.18
(020-077)scalar functional unit : 26.68M 159845761 73.56
(100-137)scalar memory : 1.79M 10733884 4.94
(140-157,175)vector integer/log.: 0.17M 1004202 0.46
(160-174)vector floating point : 1.75M 10463034 4.81
(176-177)vector load and store : 2.92M 17482095 8.04

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 5.67M 33992893 33.85
Vector floating point : 39.92M 239153418 22.86
Scalar functional unit : 26.68M 159845761

```

A.10 Statistics for optimized SPEC77 run on hpm

```

STOP (called by SPEC77 )
CP: 17.503s, Wallclock: 22.576s, 9.7% of 8-CPU Machine
HWM mem: 1535561, HWM stack: 64039, Stack extensions: 0
Group 0: CPU seconds : 17.50 CP executing : 2917309722

Million inst/sec (MIPS) : 31.36 Instructions : 549003518
Avg. clock periods/inst : 5.31
% CP holding issue : 76.26 CP holding issue : 2224684291
Inst.buffer fetches/sec : 0.15M Inst.buf. fetches: 2632500
Floating adds/sec : 55.80M F.P. adds : 976759057
Floating multiplies/sec : 48.14M F.P. multiplies : 842571874
Floating reciprocal/sec : 0.84M F.P. reciprocals : 14720348
I/O mem. references/sec : 1.98M I/O references : 34692311
CPU mem. references/sec : 116.63M CPU references : 2041448709

```

```

Floating ops/CPU second : 104.78M
STOP (called by SPEC77 )
CP: 17.509s, Wallclock: 27.102s, 8.1% of 8-CPU Machine
HWM mem: 1535561, HWM stack: 64039, Stack extensions: 0
Group 1: CPU seconds : 17.51009 CP executing: 2918348601

```

Hold issue condition	% of all CPs	actual # of CPs
Waiting on semaphores	: 0.00	9868
Waiting on shared registers	: 0.00	1827
Waiting on A-registers/funct. units:	5.55	162035250
Waiting on S-registers/funct. units:	3.11	90678069
Waiting on V-registers	: 25.60	747237838
Waiting on vector functional units	: 29.35	856467930
Waiting on scalar memory references:	4.17	121786021
Waiting on block memory references	: 24.57	717074159

```

STOP (called by SPEC77 )
CP: 17.589s, Wallclock: 23.203s, 9.5% of 8-CPU Machine
HWM mem: 1535561, HWM stack: 64039, Stack extensions: 0
Group 2: CPU seconds : 17.59025 CP executing : 2931708308

```

Inst. buffer fetches/sec	: 0.15M	total fetches	: 2633943
		fetch conflicts	: 10165677
I/O memory refs/sec	: 2.97M	actual refs	: 52253361
avg conflict/ref	0.76:	actual conflicts	: 39590158
Scalar memory refs/sec	: 1.04M	actual refs	: 18379301
Block memory refs/sec	: 115.01M	actual refs	: 2023069408
CPU memory refs/sec	: 116.06M	actual refs	: 2041448709
avg conflict/ref	0.72:	actual conflicts	: 1479849223
CPU memory writes/sec	: 36.68M	actual refs	: 645152919
CPU memory reads/sec	: 79.38M	actual refs	: 1396295790

```

STOP (called by SPEC77 )
CP: 17.583s, Wallclock: 22.470s, 9.8% of 8-CPU Machine
HWM mem: 1535561, HWM stack: 64039, Stack extensions: 0
Group 3: CPU seconds : 17.58327 CP executing: 2930545142

```

(octal) type of instruction	inst./CPUsec	actual inst.	% of all inst.
(000-017)jump/special	: 1.25M	21977440	4.00
(020-077)scalar functional unit	: 21.64M	380441421	69.30
(100-137)scalar memory	: 1.05M	18379301	3.35
(140-157,175)vector integer/log.:	0.14M	2454734	0.45
(160-174)vector floating point	: 3.50M	61492692	11.20
(176-177)vector load and store	: 3.65M	64257950	11.70

type of operation	ops/CPUsec	actual ops	avg. VL
Vector integer&logical	: 4.25M	74660213	30.41
Vector floating point	: 103.21M	1814808449	29.51
Scalar functional unit	: 21.64M	380441421	

A.11 Statistics for optimized SPICE run on hpm

```

STOP (called by SPICE )
CP: 2.641s, Wallclock: 4.029s, 8.2% of 8-CPU Machine
HWM mem: 0, HWM stack: 25000, Stack extensions: 0
Group 0: CPU seconds : 2.64 CP executing : 440322684

Million inst/sec (MIPS) : 31.90 Instructions : 84276920
Avg. clock periods/inst : 5.22
% CP holding issue : 67.59 CP holding issue : 297633302
Inst.buffer fetches/sec : 0.36M Inst.buf. fetches: 961861
Floating adds/sec : 13.03M F.P. adds : 34413023
Floating multiplies/sec : 8.29M F.P. multiplies : 21905295
Floating reciprocal/sec : 0.66M F.P. reciprocals : 1756564
I/O mem. references/sec : 0.10M I/O references : 258357
CPU mem. references/sec : 53.43M CPU references : 141168862

Floating ops/CPU second : 21.98M
STOP (called by SPICE )
CP: 2.641s, Wallclock: 3.686s, 9.0% of 8-CPU Machine
HWM mem: 0, HWM stack: 25000, Stack extensions: 0
Group 1: CPU seconds : 2.64149 CP executing: 440247689

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.06 248631
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 4.85 21369804
Waiting on S-registers/funct. units: 26.66 117390761
Waiting on V-registers : 13.94 61351325
Waiting on vector functional units : 7.12 31349338
Waiting on scalar memory references: 0.84 3683192
Waiting on block memory references : 13.15 57873792
STOP (called by SPICE )
CP: 2.640s, Wallclock: 3.826s, 8.6% of 8-CPU Machine
HWM mem: 0, HWM stack: 25000, Stack extensions: 0
Group 2: CPU seconds : 2.64076 CP executing : 440126119

Inst. buffer fetches/sec : 0.36M total fetches : 961956
fetch conflicts : 1289019
I/O memory refs/sec : 0.17M actual refs : 454903
avg conflict/ref 0.41: actual conflicts : 186063
Scalar memory refs/sec : 7.52M actual refs : 19860423
Block memory refs/sec : 45.94M actual refs : 121308439
CPU memory refs/sec : 53.46M actual refs : 141168862
avg conflict/ref 0.26: actual conflicts : 37218235
CPU memory writes/sec : 19.16M actual refs : 50607123
CPU memory reads/sec : 34.29M actual refs : 90561739
STOP (called by SPICE )
CP: 2.642s, Wallclock: 4.432s, 7.5% of 8-CPU Machine
HWM mem: 0, HWM stack: 25000, Stack extensions: 0
Group 3: CPU seconds : 2.64270 CP executing: 440450387

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 2.57M 6797512 8.07
(020-077)scalar functional unit : 19.50M 51526446 61.14
(100-137)scalar memory : 7.52M 19860425 23.57
(140-157,175)vector integer/log.: 0.70M 1857421 2.20
(160-174)vector floating point : 0.55M 1450617 1.72
(176-177)vector load and store : 1.05M 2784441 3.30

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 30.06M 79434510 42.77
Vector floating point : 23.11M 61066486 42.10
Scalar functional unit : 19.50M 51526446

```

A.12 Statistics for optimized TRACK run on hpm

```

STOP (called by TRACK )
CP: 4.079s, Wallclock: 4.418s, 11.5% of 8-CPU Machine
HWM mem: 231791, HWM stack: 2816, Stack extensions: 25
Group 0: CPU seconds      :      4.08      CP executing      :      679967240

Million inst/sec (MIPS) :      56.20      Instructions      :      229280724
Avg. clock periods/inst :       2.97
% CP holding issue      :      51.42      CP holding issue  :      349644336
Inst.buffer fetches/sec :      0.65M      Inst.buf. fetches:      2668158
Floating adds/sec       :      11.00M      F.P. adds         :      44881063
Floating multiplies/sec :      11.45M      F.P. multiplies   :      46730222
Floating reciprocal/sec :       0.16M      F.P. reciprocals  :      632642
I/O mem. references/sec :       0.01M      I/O references    :      46517
CPU mem. references/sec :      19.27M      CPU references    :      78624623

Floating ops/CPU second :      22.61M
STOP (called by TRACK )
CP: 4.080s, Wallclock: 4.105s, 12.4% of 8-CPU Machine
HWM mem: 231791, HWM stack: 2816, Stack extensions: 25
Group 1: CPU seconds      :      4.08031  CP executing      :      680052436

Hold issue condition      % of all CPs      actual # of CPs
Waiting on semaphores      :      0.00              2062
Waiting on shared registers :      0.00              1
Waiting on A-registers/funct. units:  3.73             25368488
Waiting on S-registers/funct. units: 31.20            212188045
Waiting on V-registers      :      1.67             11390494
Waiting on vector functional units :  7.07            48103421
Waiting on scalar memory references:  1.67            11388374
Waiting on block memory references:  1.12             7601460
STOP (called by TRACK )
CP: 4.079s, Wallclock: 4.115s, 12.4% of 8-CPU Machine
HWM mem: 231791, HWM stack: 2816, Stack extensions: 25
Group 2: CPU seconds      :      4.07994  CP executing      :      679989245

Inst. buffer fetches/sec :      0.65M      total fetches      :      2667903
                                fetch conflicts :      3479051
I/O memory refs/sec       :      0.01M      actual refs         :      35456
  avg conflict/ref  2.98:      actual conflicts :      105805
Scalar memory refs/sec    :      4.71M      actual refs         :      19198989
Block memory refs/sec     :      14.57M      actual refs         :      59425614
CPU memory refs/sec       :      19.27M      actual refs         :      78624603
  avg conflict/ref  0.08:      actual conflicts :      6305944
CPU memory writes/sec     :      5.70M      actual refs         :      23269134
CPU memory reads/sec      :      13.57M      actual refs         :      55355469
STOP (called by TRACK )
CP: 4.079s, Wallclock: 4.103s, 12.4% of 8-CPU Machine
HWM mem: 231791, HWM stack: 2816, Stack extensions: 25
Group 3: CPU seconds      :      4.07936  CP executing      :      679893839

(octal) type of instruction  inst./CPUsec      actual inst.      % of all inst.
(000-017)jump/special       :      2.90M          11822700          5.16
(020-077)scalar functional unit :  46.28M          188789881         82.34
(100-137)scalar memory      :      4.71M          19198986          8.37
(140-157,175)vector integer/log.:  0.42M           1705671           0.74
(160-174)vector floating point :  0.96M           3919614           1.71
(176-177)vector load and store :  0.94M           3844045           1.68

type of operation           ops/CPUsec        actual ops        avg. VL
Vector integer&logical      :      15.32M         62508750         36.65
Vector floating point       :      11.27M         45984251         11.73
Scalar functional unit      :      46.28M         188789881

```


A.13 Statistics for optimized TRFD run on hpm

```

STOP (called by TRFD )
CP: 6.389s, Wallclock: 20.766s, 3.8% of 8-CPU Machine
HWM mem: 1151738, HWM stack: 2304, Stack extensions: 1
Group 0: CPU seconds : 6.39 CP executing : 1065000330

Million inst/sec (MIPS) : 71.22 Instructions : 455105229
Avg. clock periods/inst : 2.34
% CP holding issue : 49.26 CP holding issue : 524590421
Inst.buffer fetches/sec : 0.09M Inst.buf. fetches: 580474
Floating adds/sec : 34.11M F.P. adds : 217987502
Floating multiplies/sec : 34.07M F.P. multiplies : 217702411
Floating reciprocal/sec : 0.12M F.P. reciprocals : 735432
I/O mem. references/sec : 0.72M I/O references : 4621660
CPU mem. references/sec : 104.58M CPU references : 668283650

Floating ops/CPU second : 68.30M
STOP (called by TRFD )
CP: 6.367s, Wallclock: 18.102s, 4.4% of 8-CPU Machine
HWM mem: 1151738, HWM stack: 2304, Stack extensions: 1
Group 1: CPU seconds : 6.36815 CP executing: 1061357915

Hold issue condition % of all CPs actual # of CPs
Waiting on semaphores : 0.00 562
Waiting on shared registers : 0.00 1
Waiting on A-registers/funct. units: 9.88 104842061
Waiting on S-registers/funct. units: 4.27 45327302
Waiting on V-registers : 1.33 14150612
Waiting on vector functional units : 1.24 13191794
Waiting on scalar memory references: 11.58 122906924
Waiting on block memory references : 19.38 205715996
STOP (called by TRFD )
CP: 6.386s, Wallclock: 20.523s, 3.9% of 8-CPU Machine
HWM mem: 1151738, HWM stack: 2304, Stack extensions: 1
Group 2: CPU seconds : 6.38651 CP executing : 1064418675

Inst. buffer fetches/sec : 0.09M total fetches : 580483
fetch conflicts : 805370
I/O memory refs/sec : 0.64M actual refs : 4099438
avg conflict/ref 0.60: actual conflicts : 2439391
Scalar memory refs/sec : 1.15M actual refs : 7368623
Block memory refs/sec : 103.49M actual refs : 660915026
CPU memory refs/sec : 104.64M actual refs : 668283649
avg conflict/ref 0.23: actual conflicts : 153616927
CPU memory writes/sec : 35.40M actual refs : 226061010
CPU memory reads/sec : 69.24M actual refs : 442222639
STOP (called by TRFD )
CP: 6.380s, Wallclock: 21.400s, 3.7% of 8-CPU Machine
HWM mem: 1151738, HWM stack: 2304, Stack extensions: 1
Group 3: CPU seconds : 6.38108 CP executing: 1063513118

(octal) type of instruction inst./CPUsec actual inst. % of all inst.
(000-017)jump/special : 4.82M 30784081 6.76
(020-077)scalar functional unit : 57.46M 366673503 80.57
(100-137)scalar memory : 1.15M 7368625 1.62
(140-157,175)vector integer/log.: 0.12M 784454 0.17
(160-174)vector floating point : 3.10M 19767712 4.34
(176-177)vector load and store : 4.66M 29726839 6.53

type of operation ops/CPUsec actual ops avg. VL
Vector integer&logical : 1.96M 12503904 15.94
Vector floating point : 68.31M 435901813 22.05
Scalar functional unit : 57.46M 366673503

```

B Data from sim

B.1 Statistics for ADM run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 4998975
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 114881510

Buffer Address
0 0171440

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -433987912

? Total instructions executed = 434287912

Individual instruction counts:

000= 0 032= 4184593 064= 6238742 116= 437643 150= 49149
001= 0 033= 0 065= 0 117= 273340 151= 144381
002= 4019043 034= 655782 066= 5187332 120= 3596541 152= 93878
003= 107453 035= 520107 067= 2222593 121= 551436 153= 0
004= 232 036= 208660 070= 2580601 122= 2652877 154= 447191
005= 1052431 037= 294608 071= 9358115 123= 928930 155= 2841
006= 1506893 040= 5355664 072= 23062 124= 619506 156= 223
007= 1034434 041= 38677 073= 290251 125= 961284 157= 125
010= 1154858 042= 3406309 074=23489587 126= 951993 160= 46179
011= 2211508 043= 1470258 075=17468586 127= 1854030 161= 387200
012= 1758421 044= 1489159 076= 1015504 130= 37800 162= 0
013= 3440268 045= 522473 077= 155246 131= 2220253 163= 0
014= 1092989 046= 216896 100= 79072 132= 151164 164= 2603675
015= 1520836 047= 1227810 101= 290448 133= 442953 165= 6769805
016= 1502140 050= 937816 102= 231102 134= 525662 166= 0
017= 3945584 051= 7871225 103= 242329 135= 964939 167= 237223
020= 6430609 052= 1190157 104= 205034 136= 797876 170= 249014
021= 46284 053= 3460 105= 452182 137= 1773018 171= 7322612
022= 8066705 054= 3696860 106= 1232895 140= 4646 172= 275407
023=12396983 055= 4321108 107= 1978726 141= 146 173= 6475303
024=49007705 056= 1871507 110= 21706 142= 99005 174= 375655
025=31741254 057= 1121976 111= 32515 143= 35 175= 336499
026= 329430 060= 8906649 112= 97130 144= 241 176=14735101
027= 716300 061= 6128104 113= 257948 145= 11708 177= 9388773
030=79089185 062= 6087005 114= 560525 146= 174229
031=11262570 063= 4302028 115= 1141369 147= 817

Average instruction length = 1.22 parcels

? Information on conditional jumps

Awaiting operand = 31893462 7.3%
Out of buffer = 1423992 0.3%
Forward = 3439867 0.8%
Backward = 3027420 0.7%
Not taken = 10159317 2.3%
Total = 16626604 3.8%

Information on unconditional jumps

Out of buffer = 300200 0.1%
Forward = 1260490 0.3%
Backward = 246403 0.1%
Total = 1506893 0.3%

Information on return jumps

Out of buffer = 956584 0.2%
Total = 1034434 0.2%

Information on B register jumps

Out of buffer = 516413 0.1%
Total = 1052431 0.2%

? Information on various operations

Clock periods account for = 25869148

Scalar floating operations = 26618301
Vector floating operations = 458278373
Vector floating instructions = 24742073
Vector floating average VL = 18
Total floating operations = 484896674
Megaflops = 3124

Scalar loads = 16828385
Vector loads = 270323779
Vector load instructions = 14735101
Vector load average VL = 18
Total words loaded = 287152164

Scalar stores = 9735841
Vector stores = 158164953
Vector store instructions = 9388773
Vector store average VL = 16
Total words stored = 167900794

? Virtual memory page status:

Page hits = 346158895; Page loads = 454

page	modified	used	address	page	modified	used	address
0	no	239	1245000	16	no	512	1222000
1	yes	19	1032000	17	no	512	1223000
2	yes	20	1033000	18	no	237	1224000
3	yes	20	1034000	19	yes	4056	1126000
4	yes	19	1035000	20	yes	388	1047000
5	yes	71	1036000	21	yes	31	1162000
6	no	512	1210000	22	yes	285	1242000
7	no	512	1211000	23	yes	25	1104000
8	no	512	1212000	24	yes	81	1031000
9	no	512	1213000	25	yes	25	1037000
10	no	512	1214000	26	yes	8	1057000
11	no	512	1215000	27	yes	16	1067000
12	no	512	1216000	28	yes	7	1077000
13	no	512	1217000	29	yes	9	1322000
14	no	512	1220000	30	yes	530	1244000
15	no	512	1221000	31	no	512	1243000

? Simulator time used = 8258.34 seconds

? Vector stride distribution

Stride	Words moved
1	245214078
2	106086438
4	27994400
8	28003760
16	11197760
32	0
64	8698144
128	0
256	0

B.2 Statistics for optimized ARC2D run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 111903
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 2841513

Buffer Address
0 0145240

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -399722669

? Total instructions executed = 400022669

Individual instruction counts:

000=	0	032=	9966956	064=	97867	116=	2032	150=	9366
001=	0	033=	0	065=	0	117=	25794	151=	428062
002=	6828711	034=	18948	066=	61496	120=	82317	152=	9164
003=	12388	035=	17233	067=	28122	121=	21984	153=	0
004=	123	036=	12715	070=	29022	122=	11283	154=	1882542
005=	348718	037=	204962	071=	8656153	123=	943	155=	2590
006=	44622	040=	717834	072=	210	124=	31497	156=	2866
007=	337934	041=	4031	073=	999626	125=	125571	157=	2142
010=	344994	042=	2047205	074=	21342005	126=	182379	160=	327133
011=	6231678	043=	664831	075=	11487542	127=	1331978	161=	2375679
012=	23232	044=	1646450	076=	480656	130=	25886	162=	0
013=	36969	045=	7293	077=	107312	131=	7744	163=	0
014=	102557	046=	41956	100=	28605	132=	10957	164=	5597103
015=	378914	047=	1610942	101=	3984	133=	34202	165=	14765850
016=	38665	050=	11881	102=	11630	134=	14013	166=	0
017=	1609235	051=	2444971	103=	9910	135=	5560	167=	1431962
020=	9311200	052=	19349	104=	11900	136=	23891	170=	372138
021=	1203	053=	4731	105=	8570	137=	107059	171=	8465436
022=	1232761	054=	1025246	106=	34584	140=	194099	172=	653332
023=	19614159	055=	1308279	107=	83609	141=	16	173=	6141356
024=	58682786	056=	33678	110=	15635	142=	359221	174=	2363477
025=	49435041	057=	53617	111=	2834	143=	1520	175=	1359860
026=	1581	060=	11660969	112=	5986	144=	17	176=	26585404
027=	9677	061=	571352	113=	9568	145=	140	177=	10921143
030=	80061675	062=	78144	114=	5809	146=	325133		
031=	439817	063=	197461	115=	11882	147=	366637		

Average instruction length = 1.08 parcels

? Information on conditional jumps

Awaiting operand = 1346478 0.3%
Out of buffer = 30982 0.0%
Forward = 109585 0.0%
Backward = 568074 0.1%
Not taken = 521160 0.1%
Total = 1198819 0.3%

Information on unconditional jumps

Out of buffer = 7880 0.0%
Forward = 25983 0.0%
Backward = 4282 0.0%
Total = 30265 0.0%

Information on return jumps

Out of buffer = 20480 0.0%
Total = 52945 0.0%

Information on B register jumps

Out of buffer = 13807 0.0%
Total = 62373 0.0%

? Information on various operations

Clock periods account for = 2710636

Scalar floating operations = 71306
Vector floating operations = 270337421
Vector floating instructions = 5137981
Vector floating average VL = 52
Total floating operations = 270408727
Megaflops = 16626

Scalar loads = 384690
Vector loads = 166086687
Vector load instructions = 3220912
Vector load average VL = 51
Total words loaded = 166471377

Scalar stores = 168637
Vector stores = 68471670
Vector store instructions = 1323213
Vector store average VL = 51
Total words stored = 68640307

? Virtual memory page status:

Page hits = 192355688; Page loads = 43175358

page	modified	used	address	page	modified	used	address
0	yes	94	4574000	16	yes	40	1410000
1	yes	187	6074000	17	yes	34	1411000
2	yes	1365	1416000	18	yes	7101	7063000
3	yes	94	4575000	19	yes	1	7101000
4	yes	126	1417000	20	yes	20	4242000
5	yes	79	1432000	21	yes	301	1522000
6	yes	21	1422000	22	yes	44	1602000
7	yes	492	1412000	23	no	512	1523000
8	no	512	1413000	24	no	512	1524000
9	no	512	1414000	25	no	512	1525000
10	yes	484	7065000	26	no	512	1526000
11	yes	12	7064000	27	no	439	1527000
12	yes	88	1405000	28	yes	1	7062000
13	yes	141	1442000	29	yes	3	1404000
14	yes	38	1406000	30	yes	4	331000
15	yes	40	1407000	31	yes	188	5563000

? Simulator time used = 2163.66 seconds

? Vector stride distribution

Stride	Words moved
1	234541613
2	16744
4	0
8	0
16	0
32	0
64	0
128	0
256	0

B.3 Statistics for optimized BDNA run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 4010294
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 98384594

Buffer Address
0 0146740

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -288143727

? Total instructions executed = 288443727

Individual instruction counts:

000=	0	032=	175919	064=	2348880	116=	639	150=	296739
001=	0	033=	0	065=	0	117=	225596	151=	897407
002=	2951353	034=	193900	066=	413847	120=	2042739	152=	217492
003=	349686	035=	193775	067=	352	121=	2872550	153=	0
004=	288	036=	155872	070=	373	122=	494445	154=	2831392
005=	1875047	037=	478405	071=	2966842	123=	83724	155=	97287
006=	1381559	040=	7905339	072=	8	124=	165690	156=	111892
007=	1265746	041=	642	073=	1619783	125=	301385	157=	35854
010=	1340130	042=	4405309	074=	8217347	126=	755361	160=	829416
011=	1365150	043=	4657425	075=	8585240	127=	372225	161=	2046182
012=	1679759	044=	7890105	076=	1573663	130=	325216	162=	0
013=	3882042	045=	2925134	077=	209730	131=	235796	163=	0
014=	2295806	046=	1514744	100=	1707771	132=	267754	164=	1712925
015=	3837450	047=	258183	101=	1530	133=	82651	165=	4794912
016=	4245142	050=	171890	102=	606411	134=	140141	166=	0
017=	1984459	051=	12118906	103=	54600	135=	177859	167=	839331
020=	14506941	052=	1725046	104=	253979	136=	109704	170=	1718946
021=	111	053=	89449	105=	15575	137=	637902	171=	6473894
022=	6026202	054=	11302800	106=	123268	140=	295274	172=	1541562
023=	8232971	055=	5543563	107=	279791	141=	35876	173=	1490745
024=	13711610	056=	5422352	110=	822954	142=	555848	174=	1852479
025=	8577347	057=	459916	111=	91	143=	24	175=	1722329
026=	240745	060=	14010394	112=	1468	144=	71555	176=	7992794
027=	585175	061=	4054701	113=	1475	145=	35848	177=	5711555
030=	27783360	062=	1444120	114=	80822	146=	784315		
031=	8578802	063=	470507	115=	7280	147=	120		

Average instruction length = 1.33 parcels

? Information on conditional jumps

Awaiting operand = 58398951 20.2%
Out of buffer = 587733 0.2%
Forward = 4226473 1.5%
Backward = 3056286 1.1%
Not taken = 13347179 4.6%
Total = 20629938 7.2%

Information on unconditional jumps

Out of buffer = 465231 0.2%
Forward = 345603 0.1%
Backward = 1035956 0.4%
Total = 1381559 0.5%

Information on return jumps

Out of buffer = 834438 0.3%
Total = 1265746 0.4%

Information on B register jumps

Out of buffer = 545522 0.2%
Total = 1875047 0.7%

? Information on various operations

Clock periods account for = 29131036

Scalar floating operations = 4678079
Vector floating operations = 1176626911
Vector floating instructions = 23300392
Vector floating average VL = 50
Total floating operations = 1181304990
Megaflops = 6758

Scalar loads = 10131044
Vector loads = 379733172
Vector load instructions = 7992794
Vector load average VL = 47
Total words loaded = 389864216

Scalar stores = 3117348
Vector stores = 271199698
Vector store instructions = 5711555
Vector store average VL = 47
Total words stored = 274317046

? Virtual memory page status:

Page hits = 646382692; Page loads = 1477892

page	modified	used	address	page	modified	used	address
0	yes	443	1470000	16	yes	40	403000
1	yes	513	1467000	17	yes	50	1554000
2	no	512	1465000	18	no	512	1555000
3	no	512	1466000	19	no	512	1556000
4	yes	94	764000	20	yes	32	405000
5	yes	266	404000	21	yes	230	1404000
6	yes	577	1557000	22	yes	134	406000
7	yes	3493	1135000	23	yes	6072	1134000
8	yes	268	400000	24	yes	72	1564000
9	yes	141	1544000	25	yes	12	1604000
10	yes	113	407000	26	yes	403	1464000
11	yes	4	1545000	27	yes	24	1654000
12	yes	31	1574000	28	yes	16	1644000
13	no	18	1575000	29	yes	17	1614000
14	yes	176	401000	30	yes	19	1624000
15	yes	38	402000	31	yes	15	1634000

? Simulator time used = 6735.83 seconds

? Vector stride distribution

Stride	Words moved
1	621934262
2	19138
4	18812256
8	2285816
16	0
32	0
64	0
128	0
256	0

B.4 Statistics for optimized DYFESM run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 960201
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 21728465

Buffer Address
0 0132040

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -248219618

? Total instructions executed = 248519618

Individual instruction counts:

000=	0	032=	3179613	064=	93228	116=	72	150=	53927
001=	0	033=	0	065=	0	117=	8196	151=	203870
002=	3713719	034=	199250	066=	56085	120=	451992	152=	156739
003=	610	035=	131180	067=	27366	121=	303664	153=	0
004=	143	036=	117721	070=	42378	122=	504983	154=	16524
005=	155396	037=	216943	071=	6482195	123=	148630	155=	53920
006=	929199	040=	329302	072=	8	124=	1125963	156=	129
007=	148228	041=	59	073=	208	125=	904520	157=	92
010=	1438703	042=	9089052	074=	10383214	126=	2894343	160=	16
011=	5752242	043=	251833	075=	6185796	127=	5671320	161=	9
012=	25500	044=	2877665	076=	1253243	130=	31552	162=	0
013=	179050	045=	18854	077=	203251	131=	12206	163=	0
014=	193098	046=	499811	100=	54396	132=	10012	164=	6189771
015=	718642	047=	771419	101=	53445	133=	7712	165=	193852
016=	2492070	050=	456583	102=	109803	134=	45211	166=	0
017=	784164	051=	1693679	103=	53045	135=	159260	167=	6
020=	7423593	052=	212991	104=	54118	136=	6070	170=	3
021=	245186	053=	2311	105=	165	137=	2381373	171=	5196154
022=	4041205	054=	233571	106=	632969	140=	2645	172=	4036
023=	19186855	055=	650110	107=	194719	141=	104	173=	1718540
024=	14803904	056=	36189	110=	17324	142=	41594	174=	6
025=	11593379	057=	14764	111=	51	143=	12	175=	175
026=	6360	060=	12642487	112=	25868	144=	187	176=	11055939
027=	5622	061=	6802820	113=	36655	145=	52168	177=	4477199
030=	53702996	062=	3552758	114=	484798	146=	46		
031=	5965058	063=	128299	115=	376362	147=	0		

Average instruction length = 1.25 parcels

? Information on conditional jumps

Awaiting operand = 22701448 9.1%
Out of buffer = 142733 0.1%
Forward = 651230 0.3%
Backward = 2817242 1.1%
Not taken = 8114997 3.3%
Total = 11583469 4.7%

Information on unconditional jumps

Out of buffer = 57005 0.0%
Forward = 410173 0.2%
Backward = 519026 0.2%
Total = 929199 0.4%

Information on return jumps

Out of buffer = 143295 0.1%
Total = 148228 0.1%

Information on B register jumps

Out of buffer = 81849 0.0%
Total = 155396 0.1%

? Information on various operations

Clock periods account for = 13873888

Scalar floating operations = 3900114
Vector floating operations = 296733091
Vector floating instructions = 13302393
Vector floating average VL = 22
Total floating operations = 300633205
Megaflops = 3611

Scalar loads = 13158075
Vector loads = 191909734
Vector load instructions = 11055939
Vector load average VL = 17
Total words loaded = 205067809

Scalar stores = 3602722
Vector stores = 54893524
Vector store instructions = 4477199
Vector store average VL = 12

Total words stored = 58496246

? Virtual memory page status:

Page hits = 268537849; Page loads = 185

page	modified	used	address	page	modified	used	address
0	yes	731	475000	16	yes	5343	455000
1	yes	270	323000	17	yes	38	375000
2	yes	1143	476000	18	yes	40	376000
3	yes	621	477000	19	yes	40	377000
4	yes	495	401000	20	yes	26	400000
5	yes	2	307000	21	yes	2356	456000
6	yes	134	374000	22	yes	21	431000
7	yes	70	501000	23	yes	9	421000
8	yes	1262	511000	24	yes	25	411000
9	yes	1498	512000	25	yes	2799604	310000
10	yes	144	521000	26	yes	22523904	316000
11	yes	109	452000	27	yes	22523904	317000
12	yes	397	471000	28	yes	22523904	320000
13	no	512	472000	29	yes	6023520	321000
14	no	512	473000	30	yes	13347151	322000
15	no	512	474000	31	yes	1023	373000

? Simulator time used = 4938.38 seconds

? Vector stride distribution

Stride	Words moved
1	229956960
2	356935
4	6293872
8	101080
16	0
32	7752190
64	0
128	0
256	0

B.5 Statistics for optimized FLO52 run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 503350
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 12075670

Buffer Address
0 0131600

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -232912054

? Total instructions executed = 233212054

Individual instruction counts:

000=	0	032=	1134456	064=	1373675	116=	5836	150=	9552
001=	0	033=	0	065=	0	117=	30486	151=	74991
002=	5663399	034=	56568	066=	3926597	120=	480346	152=	528
003=	5986	035=	47951	067=	1104185	121=	428308	153=	0
004=	104	036=	32122	070=	1152290	122=	417642	154=	154438
005=	211824	037=	175296	071=	6191467	123=	400196	155=	8901
006=	75834	040=	1324158	072=	20	124=	443518	156=	700
007=	152986	041=	653	073=	85401	125=	1308269	157=	1082
010=	428942	042=	2610938	074=	14341814	126=	186100	160=	32613
011=	5215990	043=	361654	075=	8226243	127=	169705	161=	667989
012=	164407	044=	2472607	076=	11476	130=	119596	162=	0
013=	188427	045=	219114	077=	43917	131=	34311	163=	0
014=	227999	046=	55391	100=	529631	132=	45320	164=	2406454
015=	428860	047=	2200139	101=	4374	133=	71371	165=	3292138
016=	222704	050=	487722	102=	19359	134=	129837	166=	0
017=	2456905	051=	2230883	103=	3857	135=	131108	167=	586325
020=	15318615	052=	306150	104=	4929	136=	135797	170=	72118
021=	282663	053=	1945	105=	588	137=	344199	171=	2724622
022=	1828428	054=	505387	106=	29939	140=	66932	172=	6070
023=	12776445	055=	1103098	107=	36836	141=	64	173=	5540921
024=	19767955	056=	174504	110=	139373	142=	36874	174=	660884
025=	18249142	057=	46954	111=	5971	143=	1034	175=	250626
026=	21945	060=	5106276	112=	4215	144=	114	176=	12590362
027=	21175	061=	2075294	113=	4685	145=	1192	177=	5026644
030=	44610356	062=	2333956	114=	20988	146=	75776		
031=	1663723	063=	1563164	115=	43101	147=	124040		

Average instruction length = 1.24 parcels

? Information on conditional jumps

Awaiting operand = 17694178 7.6%
Out of buffer = 85276 0.0%
Forward = 578233 0.2%
Backward = 3097824 1.3%
Not taken = 5658177 2.4%
Total = 9334234 4.0%

Information on unconditional jumps

Out of buffer = 24108 0.0%
Forward = 50890 0.0%
Backward = 24944 0.0%
Total = 75834 0.0%

Information on return jumps

Out of buffer = 106893 0.0%
Total = 152986 0.1%

Information on B register jumps

Out of buffer = 48844 0.0%
Total = 211824 0.1%

? Information on various operations

Clock periods account for = 14704228

Scalar floating operations = 11453867
Vector floating operations = 629829200
Vector floating instructions = 15990134
Vector floating average VL = 39
Total floating operations = 641283067
Megaflops = 7268

Scalar loads = 4463597
Vector loads = 507841160
Vector load instructions = 12590362
Vector load average VL = 40
Total words loaded = 512304757

Scalar stores = 1266194
Vector stores = 195218797
Vector store instructions = 5026644
Vector store average VL = 38
Total words stored = 196484991

? Virtual memory page status:

Page hits = 707934125; Page loads = 1084917

page	modified	used	address	page	modified	used	address
0	yes	21	1542000	16	no	414	1047000
1	yes	53902	2157000	17	yes	40	1036000
2	yes	82061	2160000	18	yes	38	1037000
3	yes	329	1565000	19	yes	40	1040000
4	yes	168	1041000	20	yes	1	2252000
5	yes	339	1062000	21	yes	83	656000
6	yes	5	2002000	22	yes	674	1052000
7	yes	161	1577000	23	yes	23	715000
8	yes	203	312000	24	yes	1001	1042000
9	yes	113	311000	25	yes	1656	1043000
10	yes	203	313000	26	yes	1652	1044000
11	yes	1	1630000	27	yes	1019	1564000
12	yes	120	1035000	28	yes	14	306000
13	yes	159	1034000	29	yes	740	310000
14	no	512	1045000	30	yes	160	1072000
15	no	512	1046000	31	yes	24	1102000

? Simulator time used = 5878.40 seconds

? Vector stride distribution

Stride	Words moved
1	589507387
2	113485910
4	0
8	1632
16	0
32	0
64	0
128	0
256	0

B.6 Statistics for optimized MDG run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 740438
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 19464882

Buffer Address
0 0121040

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -870641198

? Total instructions executed = 870941198

Individual instruction counts:

000= 0 032= 1403499 064= 131018 116= 47 150= 2617756
001= 0 033= 0 065= 0 117= 4717 151= 3850628
002=25160302 034= 89212 066= 319356 120=10830803 152= 700384
003= 8799884 035= 85511 067= 591 121= 281412 153= 0
004= 104 036= 7953 070= 603 122= 291037 154=15162248
005= 2285730 037= 3920269 071=15711014 123= 665232 155= 1903523
006= 337123 040= 3843576 072= 8 124= 321518 156= 1389986
007= 2280477 041= 29 073=13702307 125= 518436 157= 621
010= 8490391 042=10707787 074=20325027 126= 122153 160= 5665101
011=14029000 043= 5715461 075= 6369610 127= 447078 161= 9512614
012= 420901 044= 5455245 076= 7483742 130= 13760 162= 0
013= 155424 045= 5228209 077= 1832858 131= 104384 163= 0
014= 1038593 046= 39765 100= 134747 132= 176398 164= 4432817
015= 3017556 047= 9957284 101= 152236 133= 247499 165=15012543
016= 473609 050= 6565 102= 78698 134= 392736 166= 0
017= 3545344 051=18101974 103= 152519 135= 320963 167= 3761973
020=81211948 052= 799623 104= 77233 136= 1143 170=11518890
021= 252276 053= 3363 105= 76044 137= 537397 171=20183744
022=11831061 054= 6030065 106= 147787 140=10192524 172=13569106
023=26459868 055= 6409634 107= 177331 141= 629 173=10980665
024=45334274 056= 6870277 110= 12384 142= 2141987 174= 7886253
025=33269192 057= 1001460 111= 75954 143= 8 175=15921240
026= 1238367 060= 1018745 112= 155 144= 1237 176=44696793
027= 7044595 061= 1307031 113= 228882 145= 1969 177=28990466
030=156707698 062= 5599969 114= 229781 146=12213029
031=10278587 063= 1878073 115= 6792920 147= 63

Average instruction length = 1.29 parcels

? Information on conditional jumps

Awaiting operand = 9231849 1.1%
Out of buffer = 56573 0.0%
Forward = 724870 0.1%
Backward = 2409463 0.3%
Not taken = 3998029 0.5%
Total = 7132362 0.8%

Information on unconditional jumps

Out of buffer = 14750 0.0%
Forward = 75265 0.0%
Backward = 313 0.0%
Total = 75578 0.0%

Information on return jumps

Out of buffer = 141377 0.0%
Total = 528117 0.1%

Information on B register jumps

Out of buffer = 10934 0.0%
Total = 528223 0.1%

? Information on various operations

Clock periods account for = 12537332

Scalar floating operations = 1794452
Vector floating operations = 1028537394
Vector floating instructions = 23798719
Vector floating average VL = 43
Total floating operations = 1030331846
Megaflops = 13696

Scalar loads = 3335504
Vector loads = 481679259
Vector load instructions = 10323865
Vector load average VL = 46
Total words loaded = 485014763

Scalar stores = 2119023
Vector stores = 335588263
Vector store instructions = 6704547
Vector store average VL = 50
Total words stored = 337707286

? Virtual memory page status:

Page hits = 793800268; Page loads = 26745237

page	modified	used	address	page	modified	used	address
0	yes	1	4601000	16	yes	24	4620000
1	yes	16	4707000	17	yes	12	4722000
2	yes	398	4530000	18	yes	15	4655000
3	yes	123	4526000	19	yes	9	4631000
4	yes	512	4527000	20	yes	9	4651000
5	yes	2548	4700000	21	yes	1	4542000
6	yes	6	373000	22	yes	2	4554000
7	yes	1	302000	23	yes	29	4706000
8	yes	8174	4677000	24	yes	1	4543000
9	yes	289	4613000	25	yes	1	4577000
10	yes	286	4641000	26	yes	1	4555000
11	yes	326	4621000	27	yes	1	4566000
12	yes	56	4614000	28	yes	2	4600000
13	yes	38	4615000	29	yes	1	4567000
14	yes	40	4616000	30	yes	1	4545000
15	yes	40	4617000	31	yes	1	4570000

? Simulator time used = 7367.44 seconds

? Vector stride distribution

Stride	Words moved
1	656909335
2	980
4	0
8	0
16	0
32	0
64	0
128	0
256	0

B.7 Statistics for optimized MG3D run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 204167
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 4608995

Buffer Address
0 0112700

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -943482032

? Total instructions executed = 943782032

Individual instruction counts:

000=	0	032=10765648	064=	248258	116=	302268	150=	135	
001=	0	033=	0	065=	106828	117=	602116	151=	301957
002=20275227	034=	245507	066=	18274	120=	339891	152=	1131	
003= 214918	035=	191597	067=	30189	121=	520183	153=	0	
004= 6385	036=	174982	070=	137017	122=	35629	154=	1133	
005= 249672	037=	174971	071=16374531	123=	43837	155=	123		
006= 1302500	040=	732245	072=	8	124=	54928	156=	534	
007= 221749	041=	17727	073=	101900	125=	6409016	157=	1114	
010= 2612022	042=	3059581	074=17288160	126=	199883	160=	16		
011=18155012	043=	207429	075=11078706	127=	327567	161=	1323053		
012= 6338664	044=	2859506	076=	1224	130=	13943	162=	0	
013= 1857749	045=	73966	077=	294182	131=	27960	163=	0	
014= 254832	046=	112878	100=	77288	132=	134615	164=56153966		
015= 1547896	047=	2589487	101=	762393	133=	62303	165=11239990		
016= 321328	050=	177584	102=	575370	134=	61386	166=	0	
017= 2517054	051=	2393115	103=	549118	135=	56538	167=	1323050	
020=22208873	052=	1435109	104=	553451	136=	99139	170=	95469	
021= 14376	053=	1623	105=	175672	137=	520192	171=45631134		
022=10492000	054=	468858	106=	91120	140=	9071	172=	95398	
023=25102823	055=	553453	107=	98953	141=	1124	173=39782192		
024=132746547	056=	255516	110=	38394	142=	97202	174=	1323050	
025=41364979	057=	134487	111=	4317	143=	10	175=	97028	
026= 1547	060=	6512083	112=	115020	144=	3338	176=76253803		
027= 3701531	061=	1480514	113=	489020	145=	5364	177=58804706		
030=248345839	062=	352402	114=	493430	146=	94919			
031=14486060	063=	2137859	115=	84215	147=	95880			

Average instruction length = 1.12 parcels

? Information on conditional jumps

Awaiting operand = 8944061 0.9%
Out of buffer = 27370 0.0%
Forward = 531654 0.1%
Backward = 2743161 0.3%
Not taken = 2089744 0.2%
Total = 5364559 0.6%

Information on unconditional jumps

Out of buffer = 24512 0.0%
Forward = 172714 0.0%
Backward = 25926 0.0%
Total = 198640 0.0%

Information on return jumps

Out of buffer = 27158 0.0%
 Total = 30768 0.0%

Information on B register jumps

Out of buffer = 29191 0.0%
 Total = 31233 0.0%

? Information on various operations
 Clock periods account for = 13099260

Scalar floating operations = 485393
 Vector floating operations = 1591940390
 Vector floating instructions = 25800494
 Vector floating average VL = 61
 Total floating operations = 1592425783
 Megaflops = 20261

Scalar loads = 1695532
 Vector loads = 784172128
 Vector load instructions = 12589113
 Vector load average VL = 62
 Total words loaded = 785867660

Scalar stores = 435268
 Vector stores = 602809609
 Vector store instructions = 9666866
 Vector store average VL = 62
 Total words stored = 603244877

? Virtual memory page status:
 Page hits = 1357778444; Page loads = 40104018

page	modified	used	address	page	modified	used	address
0	yes	2221	2457000	16	yes	165	2627000
1	yes	3	274000	17	yes	53	2707000
2	yes	6444	2456000	18	no	512	2146000
3	yes	208	2446000	19	no	512	2147000
4	yes	160	2717000	20	no	512	2150000
5	yes	624	2727000	21	no	512	2151000
6	yes	4	305000	22	no	512	2152000
7	yes	131	2421000	23	no	512	2153000
8	yes	18	2737000	24	no	512	2154000
9	yes	90	2455000	25	no	512	2155000
10	yes	50	2447000	26	no	512	2156000
11	yes	56	2450000	27	no	445	2157000
12	yes	40	2451000	28	yes	18	2557000
13	yes	40	2452000	29	yes	740	2556000
14	yes	139	2445000	30	yes	164	2453000
15	yes	69	2617000	31	yes	10208	2555000

? Simulator time used = 7459.76 seconds

? Vector stride distribution

Stride	Words moved
1	925559872
2	461421865
4	0
8	0
16	0
32	0
64	0
128	0
256	0

B.8 Statistics for optimized OCEAN run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 189305
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 4987490

Buffer Address
0 0124200

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -464282513

? Total instructions executed = 464582513

Individual instruction counts:

000=	0	032=	4160825	064=	2914971	116=	32	150=	2373
001=	0	033=	0	065=	0	117=	69866	151=	368432
002=	11604618	034=	308412	066=	3054864	120=	714880	152=	96016
003=	49835	035=	155473	067=	448040	121=	4040	153=	0
004=	77	036=	155592	070=	448061	122=	3032	154=	208901
005=	165152	037=	282707	071=	11908087	123=	96138	155=	1972
006=	351865	040=	533709	072=	78	124=	97048	156=	320803
007=	160344	041=	23	073=	901	125=	1829233	157=	4
010=	150708	042=	4712191	074=	35546688	126=	108344	160=	788
011=	9188982	043=	428036	075=	19575189	127=	802354	161=	321714
012=	12766	044=	2711622	076=	3792023	130=	194602	162=	0
013=	169347	045=	5485	077=	48071	131=	925	163=	0
014=	399357	046=	412891	100=	57077	132=	1322	164=	6879813
015=	200132	047=	2817788	101=	753	133=	70544	165=	3767324
016=	1499760	050=	860593	102=	4036	134=	38166	166=	0
017=	3346989	051=	2631589	103=	532	135=	1355635	167=	321668
020=	20762568	052=	156892	104=	910	136=	618337	170=	165626
021=	3138334	053=	480	105=	106	137=	1216202	171=	10216422
022=	6464685	054=	465259	106=	1744	140=	4152	172=	1780934
023=	22916981	055=	1331279	107=	3038	141=	7	173=	7773031
024=	31987713	056=	23074	110=	9068	142=	1451	174=	321668
025=	26713949	057=	4048	111=	23	143=	10	175=	162294
026=	1294	060=	20759908	112=	641	144=	389	176=	24216432
027=	526	061=	12920395	113=	1774	145=	822	177=	21149832
030=	90090842	062=	2069343	114=	14102	146=	49529		
031=	4708232	063=	8873437	115=	370686	147=	161836		

Average instruction length = 1.17 parcels

? Information on conditional jumps

Awaiting operand = 4996539 1.1%
Out of buffer = 61009 0.0%
Forward = 136250 0.0%
Backward = 1562837 0.3%
Not taken = 1996160 0.4%
Total = 3695247 0.8%

Information on unconditional jumps

Out of buffer = 5055 0.0%
Forward = 85358 0.0%
Backward = 1158 0.0%
Total = 86516 0.0%

Information on return jumps

Out of buffer = 32805 0.0%
Total = 39562 0.0%

Information on B register jumps

Out of buffer = 12425 0.0%
Total = 40465 0.0%

? Information on various operations

Clock periods account for = 6796348

Scalar floating operations = 4391322
Vector floating operations = 367454933
Vector floating instructions = 7771129
Vector floating average VL = 47
Total floating operations = 371846255
Megaflops = 9118

Scalar loads = 916415
Vector loads = 300074450
Vector load instructions = 5969546
Vector load average VL = 50
Total words loaded = 300990865

Scalar stores = 976764
Vector stores = 271384204
Vector store instructions = 5215224
Vector store average VL = 52
Total words stored = 272360968

? Virtual memory page status:

Page hits = 528914286; Page loads = 43378731

page	modified	used	address	page	modified	used	address
0	yes	32	1133000	16	yes	512	1211000
1	yes	511	1015000	17	yes	512	371000
2	no	512	1016000	18	yes	512	1212000
3	yes	38	1000000	19	yes	512	372000
4	yes	40	1001000	20	yes	512	1213000
5	yes	40	1002000	21	yes	512	373000
6	yes	38	1003000	22	yes	496	1214000
7	yes	145	1004000	23	yes	401	374000
8	yes	1998	1256000	24	yes	14405	1255000
9	yes	14	1132000	25	yes	8	274000
10	yes	9	1025000	26	yes	229	1153000
11	yes	512	366000	27	yes	374	777000
12	yes	512	1207000	28	yes	58	1154000
13	yes	512	367000	29	yes	840	1017000
14	yes	512	1210000	30	yes	217	1005000
15	yes	512	370000	31	yes	3	1267000

? Simulator time used = 4302.23 seconds

? Vector stride distribution

Stride	Words moved
1	211805045
2	336625573
4	19989828
8	0
16	0
32	0
64	0
128	0
256	0

B.9 Statistics for optimized QCD run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 7201009
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 169457527

Buffer Address
0 0131600

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -216986096

? Total instructions executed = 217286096

Individual instruction counts:

000=	0	032=	517356	064=	2074845	116=	98364	150=	112143
001=	0	033=	0	065=	0	117=	148931	151=	92121
002=	3597122	034=	603617	066=	31769	120=	622341	152=	49160
003=	70999	035=	302434	067=	549978	121=	1337510	153=	0
004=	92	036=	302121	070=	549978	122=	1407	154=	216128
005=	401093	037=	423008	071=	4087959	123=	29897	155=	116541
006=	1512239	040=	10376050	072=	28	124=	2532689	156=	14964
007=	400874	041=	19891	073=	120426	125=	98103	157=	23482
010=	433336	042=	4064044	074=	7899200	126=	1283677	160=	200120
011=	827608	043=	714683	075=	7219407	127=	771225	161=	186453
012=	1140	044=	497355	076=	417501	130=	2518	162=	0
013=	377476	045=	72145	077=	113374	131=	295738	163=	0
014=	1493083	046=	2508343	100=	75011	132=	6736	164=	160298
015=	2937027	047=	420835	101=	485	133=	40416	165=	5079837
016=	115173	050=	713627	102=	354	134=	627339	166=	0
017=	5586528	051=	1546757	103=	212	135=	111991	167=	50450
020=	12834189	052=	423818	104=	113014	136=	766948	170=	256212
021=	627358	053=	1266	105=	3184	137=	525653	171=	3135066
022=	7301263	054=	1749881	106=	13483	140=	83107	172=	54146
023=	8182939	055=	46532	107=	41857	141=	7	173=	1276178
024=	15276703	056=	4243	110=	21557	142=	28235	174=	64274
025=	8451607	057=	68845	111=	24	143=	19855	175=	130324
026=	29868	060=	6879053	112=	16935	144=	34717	176=	12469761
027=	86758	061=	12188405	113=	30781	145=	45	177=	5012339
030=	32095003	062=	1243534	114=	297074	146=	60768		
031=	1758746	063=	4451462	115=	819325	147=	22592		

Average instruction length = 1.38 parcels

? Information on conditional jumps

Awaiting operand = 61833760 28.5%
Out of buffer = 3802211 1.7%
Forward = 6729782 3.1%
Backward = 637726 0.3%
Not taken = 4403863 2.0%
Total = 11771371 5.4%

Information on unconditional jumps

Out of buffer = 1052924 0.5%
Forward = 337447 0.2%
Backward = 1174792 0.5%
Total = 1512239 0.7%

Information on return jumps

Out of buffer = 158784 0.1%
Total = 400874 0.2%

Information on B register jumps

Out of buffer = 326130 0.2%
Total = 401093 0.2%

? Information on various operations

Clock periods account for = 29470032

Scalar floating operations = 8901566
Vector floating operations = 236040568
Vector floating instructions = 10463034
Vector floating average VL = 22
Total floating operations = 244942134
Megaflops = 1385

Scalar loads = 6924449
Vector loads = 279781717
Vector load instructions = 12469761
Vector load average VL = 22
Total words loaded = 286706166

Scalar stores = 3810330
Vector stores = 105761588
Vector store instructions = 5012339
Vector store average VL = 21
Total words stored = 109571918

? Virtual memory page status:

Page hits = 390522842; Page loads = 257446

page	modified	used	address	page	modified	used	address
0	yes	40	11217000	16	yes	2592	11132000
1	yes	40	11122000	17	yes	380	344000
2	yes	40	11123000	18	yes	134	1560000
3	yes	38	11124000	19	yes	134	570000
4	yes	37	11125000	20	yes	386	1571000
5	yes	135	11126000	21	yes	386	601000
6	yes	1224	314000	22	yes	43	1561000
7	yes	1224	316000	23	yes	43	571000
8	yes	44482	11137000	24	yes	115	1572000
9	yes	1224	317000	25	yes	54	326000
10	yes	17337	11130000	26	yes	115	602000
11	yes	7873	11136000	27	yes	54	346000
12	yes	1387	421000	28	yes	155	11120000
13	yes	7020	11144000	29	yes	160	11121000
14	yes	8033	11131000	30	yes	216	11207000
15	yes	52	343000	31	yes	176	11177000

? Simulator time used = 5107.90 seconds

? Vector stride distribution

Stride	Words moved
1	314983244
2	16923474
4	0
8	8
16	0
32	0
64	0
128	0
256	0

B.10 Statistics for optimized SPEC77 run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 2614166
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 70437494

Buffer Address
0 0137440

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -548695682

? Total instructions executed = 548995682

Individual instruction counts:

000= 0 032= 2658109 064= 2710610 116= 592613 150= 158342
001= 0 033= 0 065= 43062 117= 489632 151= 314166
002= 7014920 034= 456579 066= 7565791 120= 737440 152= 109430
003= 321770 035= 334085 067= 2187657 121= 2417197 153= 0
004= 205 036= 111706 070= 2569023 122= 1846118 154= 347545
005= 449970 037= 1577661 071= 3075076 123= 133276 155= 89420
006= 815537 040= 1236022 072= 1686 124= 669936 156= 353153
007= 439698 041= 6680 073= 539993 125= 2064063 157= 36966
010= 2456571 042= 1643530 074=11252856 126= 1693967 160= 186195
011= 5009306 043= 982753 075= 9193195 127= 1099602 161= 445447
012= 1301151 044= 428763 076= 1336068 130= 42592 162= 0
013= 1496318 045= 50709 077= 373432 131= 54571 163= 0
014= 771936 046= 198264 100= 22762 132= 133160 164=10366895
015= 1019318 047= 374252 101= 334215 133= 1796157 165=16521598
016= 213384 050= 208124 102= 253377 134= 159305 166= 0
017= 631536 051= 2573854 103= 247041 135= 329460 167= 292070
020=15079285 052= 903894 104= 233366 136= 409446 170= 340850
021=13332912 053= 1182 105= 1101836 137= 389974 171=22018369
022=20441312 054= 937789 106= 219446 140= 8589 172= 415746
023= 4075885 055= 814425 107= 176650 141= 19 173=10601671
024=83063264 056= 24988 110= 8627 142= 35677 174= 303851
025=47450847 057= 626024 111= 139219 143= 3383 175= 578684
026= 39181 060= 1455314 112= 76974 144= 5 176=44687171
027= 1666352 061= 2251151 113= 133635 145= 14177 177=19570780
030=122318536 062= 2554599 114= 48101 146= 346578
031= 6218495 063= 3520149 115= 329815 147= 58588

Average instruction length = 1.20 parcels

? Information on conditional jumps

Awaiting operand = 24083250 4.4%
Out of buffer = 363916 0.1%
Forward = 1868067 0.3%
Backward = 4913269 0.9%
Not taken = 6118184 1.1%
Total = 12899520 2.3%

Information on unconditional jumps

Out of buffer = 151372 0.0%
Forward = 479100 0.1%
Backward = 336437 0.1%
Total = 815537 0.1%

Information on return jumps

Out of buffer = 278732 0.1%
Total = 439698 0.1%

Information on B register jumps

Out of buffer = 225119 0.0%
Total = 449970 0.1%

? Information on various operations

Clock periods account for = 27125344

Scalar floating operations = 21150891
Vector floating operations = 1812900968
Vector floating instructions = 61492692
Vector floating average VL = 29
Total floating operations = 1834051859
Megaflops = 11268

Scalar loads = 13250292
Vector loads = 1372091084
Vector load instructions = 44687171
Vector load average VL = 30
Total words loaded = 1385341376

Scalar stores = 5133281
Vector stores = 627257690
Vector store instructions = 19570780
Vector store average VL = 32
Total words stored = 632390971

? Virtual memory page status:

Page hits = 2025142363; Page loads = 3352023

page	modified	used	address	page	modified	used	address
0	yes	159	5276000	16	yes	113	5516000
1	yes	276	4751000	17	yes	17	5576000
2	yes	2585	5001000	18	yes	60	4753000
3	yes	105	5200000	19	yes	57	4754000
4	yes	142	5657000	20	yes	60	4755000
5	yes	2402	5002000	21	yes	130	4756000
6	yes	48	5205000	22	yes	15	4760000
7	yes	50	5206000	23	no	512	5247000
8	yes	98	5577000	24	no	512	5250000
9	yes	87	5175000	25	no	512	5251000
10	yes	65	5003000	26	no	512	5252000
11	no	512	5176000	27	no	512	5253000
12	no	512	5177000	28	no	68	5254000
13	yes	49	4757000	29	yes	8407	5000000
14	yes	167	5356000	30	yes	152	4752000
15	yes	161	5436000	31	yes	167	5216000

? Simulator time used = 15977.66 seconds

? Vector stride distribution

Stride	Words moved
1	992043555
2	823823882
4	4894980
8	56
16	0
32	173698025
64	1809408
128	0
256	0

? Checkpoint complete

?

seconds	clocks
elapsed 63261.37463	10543562459076

B.11 Statistics for optimized SPICE run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 961066
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 22463358

Buffer Address
0 0225200

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -83970162

? Total instructions executed = 84270162

Individual instruction counts:

000=	0	032=	136383	064=	117229	116=	2563	150=	122269
001=	0	033=	0	065=	0	117=	30478	151=	81030
002=	993947	034=	173376	066=	469767	120=	1007357	152=	208
003=	572575	035=	130407	067=	73820	121=	3139377	153=	0
004=	103	036=	76836	070=	76406	122=	282025	154=	181699
005=	184698	037=	217696	071=	1403927	123=	693681	155=	34932
006=	345675	040=	663646	072=	8864	124=	356917	156=	170413
007=	159083	041=	57028	073=	349224	125=	1251390	157=	17300
010=	97770	042=	1833522	074=	2227159	126=	1343150	160=	78931
011=	1489052	043=	342512	075=	2015797	127=	3165071	161=	112277
012=	60156	044=	716515	076=	483905	130=	198289	162=	0
013=	138283	045=	58503	077=	187264	131=	204234	163=	0
014=	1250228	046=	1029661	100=	436176	132=	176661	164=	134916
015=	655219	047=	772836	101=	2799655	133=	526837	165=	242343
016=	456807	050=	364504	102=	308725	134=	127701	166=	0
017=	380785	051=	1952951	103=	156435	135=	917918	167=	56121
020=	2987603	052=	37404	104=	4382	136=	927800	170=	126584
021=	821	053=	11202	105=	144353	137=	1532073	171=	173760
022=	1537870	054=	572174	106=	27052	140=	56899	172=	145344
023=	4023890	055=	548198	107=	47822	141=	194	173=	319117
024=	3864759	056=	128946	110=	49801	142=	47593	174=	61224
025=	2775209	057=	431537	111=	24	143=	5551	175=	480384
026=	153075	060=	1041089	112=	1227	144=	68778	176=	1746041
027=	193685	061=	1751123	113=	1762	145=	4933	177=	1038437
030=	10955396	062=	3014975	114=	739	146=	453005		
031=	922311	063=	640429	115=	169	147=	132220		

Average instruction length = 1.62 parcels

? Information on conditional jumps

Awaiting operand = 14642552 17.4%
Out of buffer = 252131 0.3%
Forward = 1067036 1.3%
Backward = 1410918 1.7%
Not taken = 2050346 2.4%
Total = 4528300 5.4%

Information on unconditional jumps

Out of buffer = 131655 0.2%
Forward = 123824 0.1%
Backward = 221851 0.3%
Total = 345675 0.4%

Information on return jumps

Out of buffer = 124610 0.1%
 Total = 159083 0.2%

Information on B register jumps

Out of buffer = 98265 0.1%
 Total = 184698 0.2%

? Information on various operations

Clock periods account for = 9911816

Scalar floating operations = 4392626
 Vector floating operations = 53682389
 Vector floating instructions = 1450617
 Vector floating average VL = 37
 Total floating operations = 58075015
 Megaflops = 976

Scalar loads = 15163568
 Vector loads = 73737421
 Vector load instructions = 1746041
 Vector load average VL = 42
 Total words loaded = 88900989

Scalar stores = 4698276
 Vector stores = 44396164
 Vector store instructions = 1038437
 Vector store average VL = 42

Total words stored = 49094440

? Virtual memory page status:

Page hits = 110538430; Page loads = 434101

page	modified	used	address	page	modified	used	address
0	yes	1	640000	16	yes	40	2046000
1	yes	4	540000	17	yes	146	2047000
2	yes	8	542000	18	yes	2211	2072000
3	yes	6	616000	19	yes	138	2041000
4	yes	241	2172000	20	yes	28	2162000
5	no	512	2173000	21	yes	511	667000
6	no	512	2174000	22	yes	509	670000
7	no	512	2175000	23	yes	258	671000
8	no	512	2176000	24	yes	139	612000
9	no	512	2177000	25	yes	492	674000
10	no	512	2200000	26	yes	15141	2071000
11	no	512	2201000	27	yes	3	541000
12	yes	274	2202000	28	yes	158	611000
13	yes	40	2043000	29	yes	298	2042000
14	yes	40	2044000	30	yes	161	2152000
15	yes	38	2045000	31	yes	73	535000

? Simulator time used = 2190.20 seconds

? Vector stride distribution

Stride	Words moved
1	64197151
2	4790242
4	860672
8	4655694
16	0
32	116112
64	0
128	0
256	0

B.12 Statistics for optimized TRACK run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 2667173
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 59859346

Buffer Address
0 0120600

? Device interrupt status

Next: Dev = 0; PH = 0, Time = 9223372036854775807

Dev PH Time
0 0 -228984613

? Total instructions executed = 229284613

Individual instruction counts:

000=	0	032=	674090	064=	2171723	116=	69	150=	169134
001=	0	033=	0	065=	10	117=	25649	151=	106162
002=	2159564	034=	242141	066=	25188755	120=	3513849	152=	3512
003=	168488	035=	147682	067=	438238	121=	348609	153=	0
004=	113	036=	1036954	070=	632642	122=	71210	154=	81811
005=	748542	037=	344279	071=	5270286	123=	300908	155=	8167
006=	275851	040=	1905236	072=	932	124=	78669	156=	269613
007=	731332	041=	26	073=	431436	125=	833092	157=	12912
010=	166135	042=	2618638	074=	41115423	126=	472129	160=	0
011=	1003950	043=	803438	075=	22051484	127=	6357829	161=	465
012=	76782	044=	1129805	076=	536362	130=	430831	162=	0
013=	343068	045=	659649	077=	180653	131=	135519	163=	0
014=	1116479	046=	1551942	100=	345299	132=	8782	164=	1713431
015=	201902	047=	1131540	101=	5062	133=	214558	165=	326317
016=	1843662	050=	928507	102=	45766	134=	226996	166=	0
017=	2985804	051=	4392483	103=	6810	135=	754875	167=	0
020=	6190436	052=	143238	104=	9955	136=	331750	170=	113566
021=	64630	053=	11725	105=	124	137=	3887005	171=	968522
022=	5207302	054=	3316735	106=	297471	140=	51206	172=	226191
023=	3656600	055=	960552	107=	107033	141=	100619	173=	571122
024=	7339278	056=	334544	110=	59565	142=	2515	174=	0
025=	5148544	057=	510219	111=	32	143=	1870	175=	535396
026=	144677	060=	2700593	112=	7201	144=	187002	176=	2480002
027=	111034	061=	2040500	113=	870	145=	6202	177=	1364042
030=	11425433	062=	14841116	114=	104099	146=	163897		
031=	1552371	063=	7509578	115=	218550	147=	5640		

Average instruction length = 1.28 parcels

? Information on conditional jumps

Awaiting operand = 27984268 12.2%
Out of buffer = 481985 0.2%
Forward = 3116228 1.4%
Backward = 717754 0.3%
Not taken = 3903800 1.7%
Total = 7737782 3.4%

Information on unconditional jumps

Out of buffer = 73408 0.0%
Forward = 92754 0.0%
Backward = 183097 0.1%
Total = 275851 0.1%

Information on return jumps

Out of buffer = 358624 0.2%
Total = 731332 0.3%

Information on B register jumps

Out of buffer = 162599 0.1%
Total = 748542 0.3%

? Information on various operations

Clock periods account for = 15335928

Scalar floating operations = 50782062
Vector floating operations = 41461843
Vector floating instructions = 3919614
Vector floating average VL = 10
Total floating operations = 92243905
Megaflops = 1002

Scalar loads = 12793815
Vector loads = 33389081
Vector load instructions = 2480002
Vector load average VL = 13
Total words loaded = 46182896

Scalar stores = 6406351
Vector stores = 13465552
Vector store instructions = 1364042
Vector store average VL = 9

Total words stored = 19871903

? Virtual memory page status:

Page hits = 68550639; Page loads = 111046

page	modified	used	address	page	modified	used	address
0	yes	256	601000	16	yes	512	460000
1	yes	12	642000	17	yes	37	537000
2	yes	6222	641000	18	yes	221	461000
3	yes	16	664000	19	yes	164	674000
4	yes	9	611000	20	yes	90	640000
5	yes	9	654000	21	yes	118	644000
6	yes	512	453000	22	no	512	645000
7	yes	512	454000	23	no	512	646000
8	yes	512	455000	24	no	512	647000
9	yes	589	573000	25	no	512	650000
10	yes	103	536000	26	yes	70	574000
11	yes	444	325000	27	yes	40	575000
12	yes	512	456000	28	yes	40	576000
13	yes	349	431000	29	yes	38	577000
14	yes	512	457000	30	yes	26	600000
15	yes	449	652000	31	yes	18	617000

? Simulator time used = 4016.97 seconds

? Vector stride distribution

Stride	Words moved
1	44700176
2	138348
4	127456
8	131304
16	0
32	0
64	0
128	0
256	0

B.13 Statistics for optimized TRFD run under sim

? Information on instruction buffers

Buffer count = 4
Buffer size = 32 words
No bypass on boundary out fetches
Coincidence check cost = 0 CP
Total buffer loads = 579178
Boundary buffer loads = 0
Wasted buffer loads = 0
CP waiting for loads = 12864183

Buffer Address
0 0107100

? Device interrupt status

Next: Dev = 0; PN = 0, Time = 9223372036854775807

Dev PN Time
0 0 -454807332

? Total instructions executed = 455107332

Individual instruction counts:

000=	0	032=	9301051	064=	117622	116=	33	150=	72
001=	0	033=	0	065=	1	117=	770	151=	14
002=	10261339	034=	705	066=	111	120=	869	152=	4
003=	388463	035=	686	067=	2711	121=	2103	153=	0
004=	80	036=	503	070=	2712	122=	249	154=	113061
005=	1238	037=	2905856	071=	20284447	123=	124	155=	72
006=	1756	040=	230130	072=	36	124=	135	156=	226342
007=	1067	041=	20	073=	56601	125=	2905957	157=	0
010=	393679	042=	7895323	074=	42551078	126=	84672	160=	56525
011=	11571427	043=	2559	075=	20848601	127=	3906706	161=	56724
012=	1220	044=	7178398	076=	110795	130=	730	162=	0
013=	1990	045=	350	077=	29	131=	299	163=	0
014=	60412	046=	115394	100=	1212	132=	222	164=	9685550
015=	452178	047=	7496873	101=	348	133=	619	165=	0
016=	569801	050=	114698	102=	164	134=	182	166=	0
017=	7079917	051=	2214747	103=	46	135=	455	167=	56700
020=	14534534	052=	393538	104=	64	136=	169818	170=	56717
021=	1	053=	355	105=	132	137=	123904	171=	9628850
022=	6985556	054=	234247	106=	167284	140=	80	172=	169946
023=	49472325	055=	8200	107=	1075	141=	4	173=	0
024=	29139833	056=	6326	110=	747	142=	39	174=	56700
025=	21848399	057=	57784	111=	20	143=	4	175=	56567
026=	95	060=	15144224	112=	15	144=	0	176=	19566184
027=	56869	061=	1873688	113=	50	145=	25	177=	10160660
030=	101020390	062=	113343	114=	126	146=	334075		
031=	4063232	063=	289526	115=	136	147=	54082		

Average instruction length = 1.14 parcels

? Information on conditional jumps

Awaiting operand = 26978898 5.9%
Out of buffer = 229411 0.1%
Forward = 533200 0.1%
Backward = 4398965 1.0%
Not taken = 15198459 3.3%
Total = 20130624 4.4%

Information on unconditional jumps

Out of buffer = 277 0.0%
Forward = 905 0.0%
Backward = 851 0.0%
Total = 1756 0.0%

Information on return jumps

Out of buffer = 801 0.0%
Total = 1067 0.0%

Information on B register jumps

Out of buffer = 558 0.0%
Total = 1238 0.0%

? Information on various operations

Clock periods account for = 19728660

Scalar floating operations = 526026
Vector floating operations = 435899615
Vector floating instructions = 19767712
Vector floating average VL = 22
Total floating operations = 436425641
Megaflops = 3686

Scalar loads = 7071140
Vector loads = 435145533
Vector load instructions = 19566184
Vector load average VL = 22
Total words loaded = 442216673

Scalar stores = 298126
Vector stores = 225756270
Vector store instructions = 10160660
Vector store average VL = 22
Total words stored = 226054396

? Virtual memory page status:

Page hits = 664031988; Page loads = 2052230

page	modified	used	address	page	modified	used	address
0	yes	38	4256000	16	yes	4104	2430000
1	yes	40	4257000	17	yes	3743	2501000
2	yes	40	4260000	18	yes	10608	2523000
3	yes	38	4261000	19	yes	19968	2524000
4	yes	28	4262000	20	yes	1404	2525000
5	yes	134	4263000	21	yes	2340	2576000
6	yes	254820	254000	22	yes	1440	2621000
7	yes	137211	252000	23	yes	20480	2622000
8	yes	1080	2313000	24	yes	10880	2623000
9	yes	5130	2314000	25	yes	820	2675000
10	yes	12284	2333000	26	yes	9	251000
11	yes	18056	2334000	27	yes	279	4255000
12	yes	518	2405000	28	yes	3403	4265000
13	yes	4514	2406000	29	yes	6720	4264000
14	yes	7600	2426000	30	yes	159	4301000
15	yes	19456	2427000	31	yes	149	4271000

? Simulator time used = 9133.48 seconds

? Vector stride distribution

Stride	Words moved
1	588553524
2	11591314
4	59094695
8	14520
16	920100
32	0
64	0
128	0
256	0

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