How is the error computed:

Relative residual:

$$RR = \frac{\|b - Ax\|}{\|b\|}$$

Name	av. RR	Failure rate
TAMU 500		
CPU/GPU	$1.52 \cdot 10^{-7}$	0 %
Case 118		
CPU/GPU	$4.40 \cdot 10^{-6}$	0 %
RTS - 1 TP		
CPU/GPU	$2.21 \cdot 10^{-7}$	0%
RTS - 2 TP		
CPU/GPU	$3.74 \cdot 10^{-7}$	0%
ACTIVSg200		
CPU/GPU	$3.02 \cdot 10^{-7}$	0%
ACTIVSg2000)	
CPU/GPU	$7.31 \cdot 10^{-7}$	0%
ACTIVSg10k		'
CPU/GPU	$1.16 \cdot 10^{-6}$	0%
ACTIVSg70k		•
CPU/GPU	$4.93 \cdot 10^{-7}$	0%

Table 1: The error levels achieved in PaStiX. Failure rate is 0% for all the test cases.

All results presented in this document have been computed on one node of the PNNL marianas supercomputer. PaStiX computations can be split into nine basic phases:

- 1. Internal csc
- 2. Coeftab
- 3. Ordering
- 4. Symbolic factorization
- 5. Reordering
- 6. Mapping and scheduling
- 7. Factorization
- 8. Solve
- 9. Iterative refinement

Method Internal csc	TAMU 500												
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total	Method	Internal csc	Coeftab	Order	Symbol	Reorder	Map	Factor	Solve	Refine	Total		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total	CPU	0.0197	0.0092	0.4024	0.0041	0.0248	0.0051	0.0882	0.0085	0.0119	0.5739		
Method	GPU	0.0198	0.0093	0.4049	0.0041	0.0248	0.0052	0.0885	0.0085	0.012	0.5771		
Method		'											
CPU GPU 0.142 0.0489 0.0489 3.042 0.0286 0.0306 0.0305 0.3887 0.0355 0.3887 0.0554 1.5238 0.3491 5.3491 0.0465 GPU 0.1481 0.0465 3.1728 0.0307 0.1082 0.0308 0.3969 0.0573 1.5777 5.5689 Method Internal csc Coeftab Order Symbol Reorder DPU 0.0005 0.0002 0.0002 0.0005 0.0002 0.0002 0.0003 0.0008 0.0002 0.0035 0.0004 0.0001 0.0157 Map Factor Solve Refine DPU 0.0005 0.0002 0.0002 0.0003 0.0002 0.0003 0.0004 0.0001 0.0158 Method Internal csc Coeftab Order Symbol DPU 0.001 0.0004 0.02479 0.0004 0.0014 0.0005 0.0076 0.0008 0.0006 0.0379 Map Factor Solve Refine DPU 0.001 0.0006 0.0253 0.0004 0.0014 0.0005 0.0076 0.0008 0.0006 0.0382 Method Internal csc Coeftab Order Symbol Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine DPU 0.001 0.0004 0.0263 0.0003 0.0013 0.0004 0.0073 0.0007 0.0001 0.0377 Map Factor Solve Refine DPU 0.001 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 Total DPU 0.001 0.0004 0.0263 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine DPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 Notal DPU 0.0016 0.0079 0.0016 0.0016 0.0005 0.5142 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine DPU 0.0160 0.0079 0.038 1.6269 0.0025 0.006 0.0345 0.0345 0.0329 0.0481 0.7391 0.29897													
CPU					•		_						
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total													
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total	GPU	0.1481	0.0465	3.1728	0.0307	0.1082	0.0308	0.3969	0.0573	1.5777	5.5689		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total	·												
CPU GPU 0.0005 0.0002 0.0099 0.0003 0.0008 0.0002 0.0035 0.0004 0.0001 0.0157 GPU 0.0005 0.0002 0.01032 0.0002 0.0006 0.0002 0.0033 0.0004 0.0001 0.0158 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine One Note Note Note Note Note Note Note Not													
CPU 0.0005 0.0002 0.01032 0.0002 0.0006 0.0002 0.0033 0.0004 0.0001 0.0158							•						
Nethod Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total													
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0004 0.02479 0.0004 0.0017 0.0005 0.0076 0.0008 0.0006 .0379 GPU 0.001 0.0006 0.0253 0.0004 0.0014 0.0005 0.0076 0.0008 0.0006 .0382 ACTIVSg200 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0	GPU	0.0005	0.0002	0.01032	0.0002	0.0006	0.0002	0.0033	0.0004	0.0001	0.0158		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0004 0.02479 0.0004 0.0017 0.0005 0.0076 0.0008 0.0006 .0379 GPU 0.001 0.0006 0.0253 0.0004 0.0014 0.0005 0.0076 0.0008 0.0006 .0382 ACTIVSg200 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0004 0.0263 0.0003 0.0015 0.0004 0.0066 0.0007 0.0001 0.0377 GPU 0.010 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve	In ant to the annual of												
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GPU 0.001 0.0006 0.0253 0.0004 0.0014 0.0005 0.0076 0.0008 0.0006 .0382 ACTIVSg200 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0004 0.0263 0.0003 0.0013 0.0004 0.0073 0.0007 0.0001 0.0377 GPU 0.001 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td>							_						
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Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.001 0.0004 0.0263 0.0003 0.0013 0.0004 0.0073 0.0007 0.0001 0.0377 GPU 0.001 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve R					ACTI	VSg200							
GPU 0.001 0.0003 0.0213 0.0003 0.0015 0.0004 0.0066 0.0006 0.0001 0.0321 ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897	Method	Internal csc	Coeftab	Order	Symbol	Reorder	Map	Factor	Solve	Refine	Total		
ACTIVSg2000 Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142	CPU	0.001	0.0004	0.0263	0.0003	0.0013	0.0004	0.0073	0.0007	0.0001	0.0377		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897	GPU	0.001	0.0003	0.0213	0.0003	0.0015	0.0004	0.0066	0.0006	0.0001	0.0321		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897													
CPU 0.0153 0.0085 0.3556 0.0048 0.0174 0.0073 0.0848 0.009 0.0048 0.5076 GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897						-							
GPU 0.0146 0.0079 0.361 0.0046 0.0202 0.006 0.0856 0.0092 0.005 0.5142 ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897					•		•						
ACTIVSg10k Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897													
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897	GPU	0.0146	0.0079	0.361	0.0046	0.0202	0.006	0.0856	0.0092	0.005	0.5142		
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897		A CITINA COLOR											
CPU 0.0907 0.0338 1.6269 0.0225 0.0703 0.0345 0.3239 0.0481 0.7391 2.9897	Method	Internal can	Coaftab	Order			Man	Factor	Solve	Pefine	Total		
					•		-						
0.0700 0.0303 1.0772 0.0224 0.0043 0.0344 0.3302 0.0407 0.737 3.0073													
	OI U	0.0700	0.0505	1.0//2	0.0227	0.0073	0.0377	0.5502	0.0707	0.137	5.0075		
ACTIVSg70k													
Method Internal csc Coeftab Order Symbol Reorder Map Factor Solve Refine Total	Method	Internal csc	Coeftab	Order		•	Map	Factor	Solve	Refine	Total		
CPU 0.8378 0.2742 13.4336 0.1793 0.5734 0.3912 2.366 0.4065 0.2232 18.6851					-		_						
GPU 0.8222 0.268 13.4487 0.1771 0.6525 0.38 2.371 0.3989 0.2205 18.7389													

Table 2: PaStiX performance on the CPU and on the GPU.

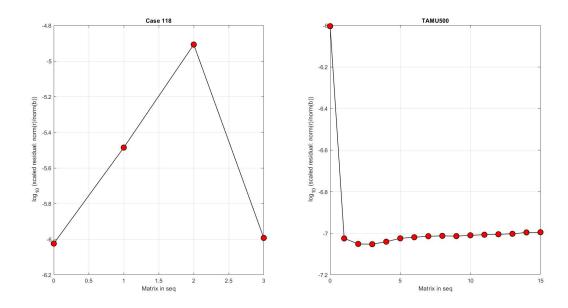


Figure 1: RR for Case 118 (left) and TAMU500 (right)

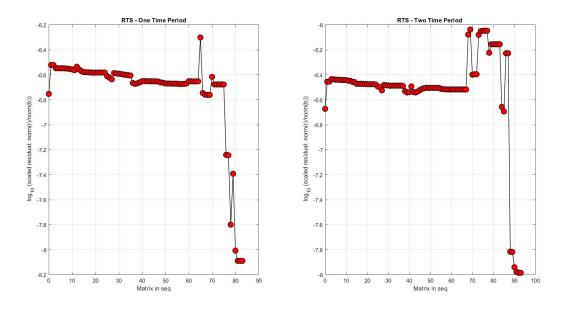


Figure 2: RR for RTS One (left) and Two (right) Time Period

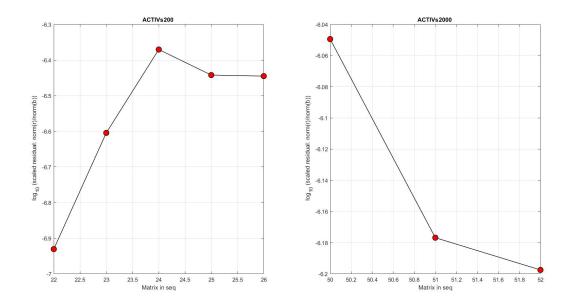


Figure 3: RR for ACTIVs200 (left) and ACTIVs2000 (right)

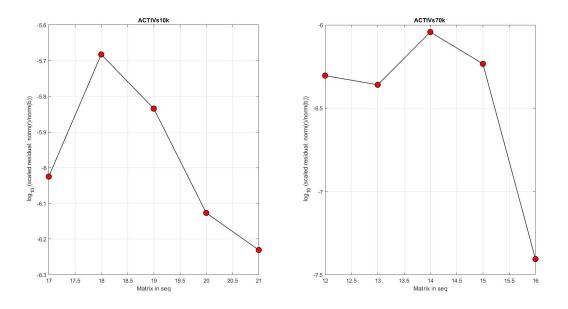


Figure 4: RR for ACTIVs10k (left) and ACTIVs70k (right)