How is the error computed:

Relative residual:

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

Normwise Backward Residual Error (NBRE v2)

$$\text{NBRE} = \frac{\|b - Ax\|_\infty}{\||b| + |A||x|\|_\infty}$$

Name	av. RR	av. NRBE	Failure rate
TAMU 500			
LU	$1.83 \cdot 10^{-9}$	$1.52 \cdot 10^{-23}$	0 %
QR	$1.77 \cdot 10^{-9}$	$1.49 \cdot 10^{-23}$	0 %
RTS – 1 TP			
LU	$1.22 \cdot 10^{-4}$	$9.93 \cdot 10^{-13}$	5%
QR	$1.22 \cdot 10^{-4}$	$9.94 \cdot 10^{-13}$	5%
RTS – 2 TP			
LU	$1.59 \cdot 10^{-4}$	$2.68 \cdot 10^{-12}$	4%
QR	$1.59 \cdot 10^{-4}$	$2.68 \cdot 10^{-12}$	4%
ACTIVSg200			
LU	$1.68 \cdot 10^{-9}$	$1.99 \cdot 10^{-16}$	0%
QR	$1.68 \cdot 10^{-9}$	$2.99 \cdot 10^{-16}$	0%
ACTIVSg2000			
LU	$1.62 \cdot 10^{-10}$	$5.06 \cdot 10^{-17}$	0%
QR	$1.62 \cdot 10^{-10}$	$5.06 \cdot 10^{-17}$	0%
ACTIVSg10k			
LU	$6.09 \cdot 10^{-7}$	$1.79 \cdot 10^{-17}$	0%
QR	$5.42 \cdot 10^{-7}$	$1.48 \cdot 10^{-17}$	0%

Table 1: The error levels achieved in cuSolver. Metis reordering was used for all the test cases.

All results presented in this document have been computed on one node of Oak Ridge OLCF summit supercomputer. Note: at a first glance, it seems that the error levels are the same for QR and LU on the figures, however, subtle small differences exist. The data have been thoroughly checked to ensure we are not using duplicates.

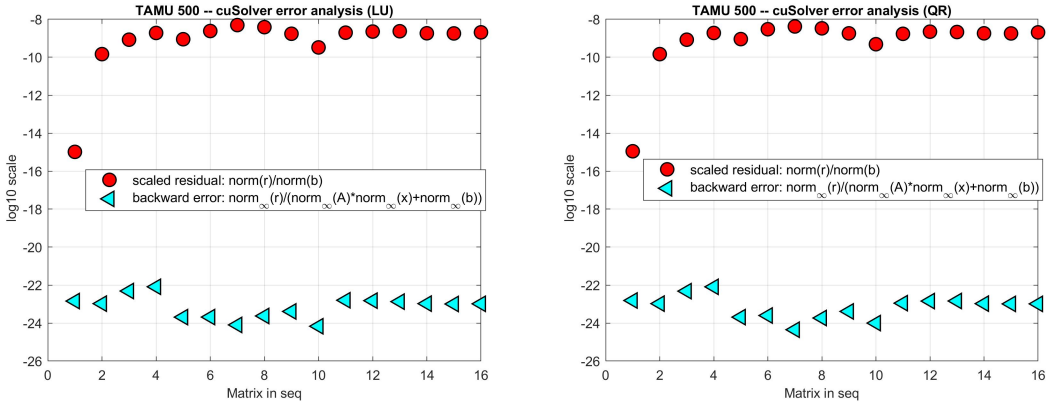

Figure 1: Error levers for TAMU 500

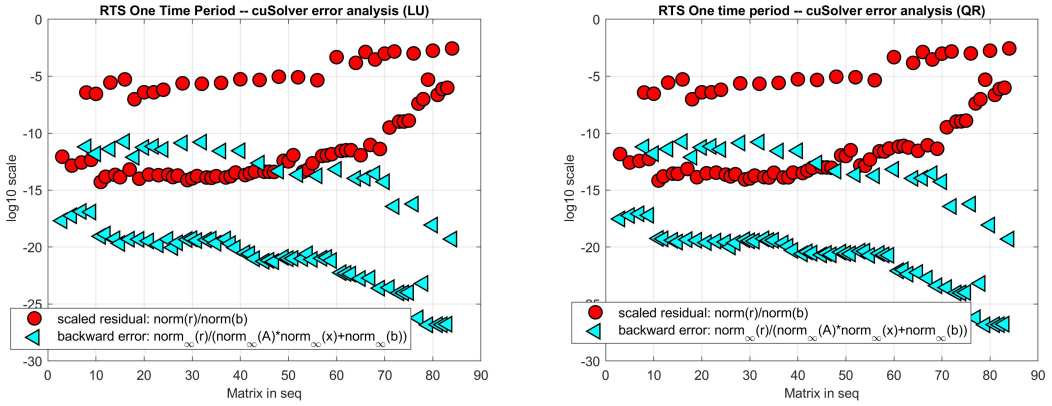

Figure 2: Error levers for RTS One Time Period

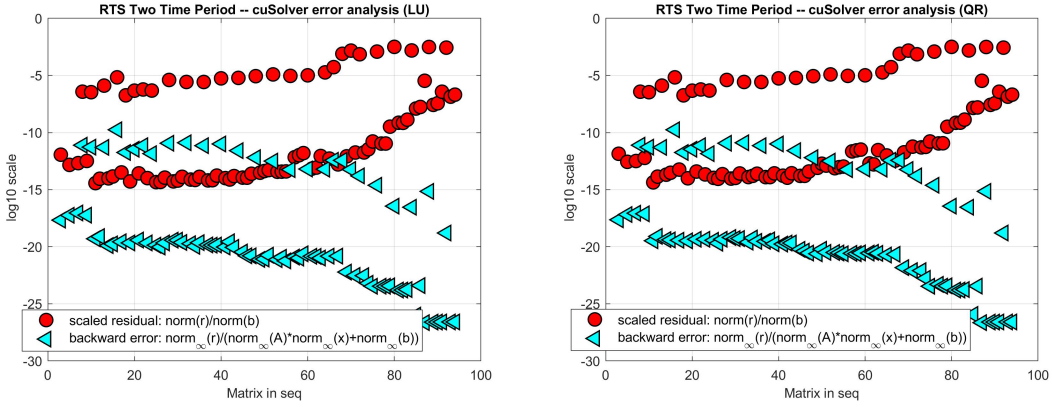

Figure 3: Error levers for RTS Two Time Period

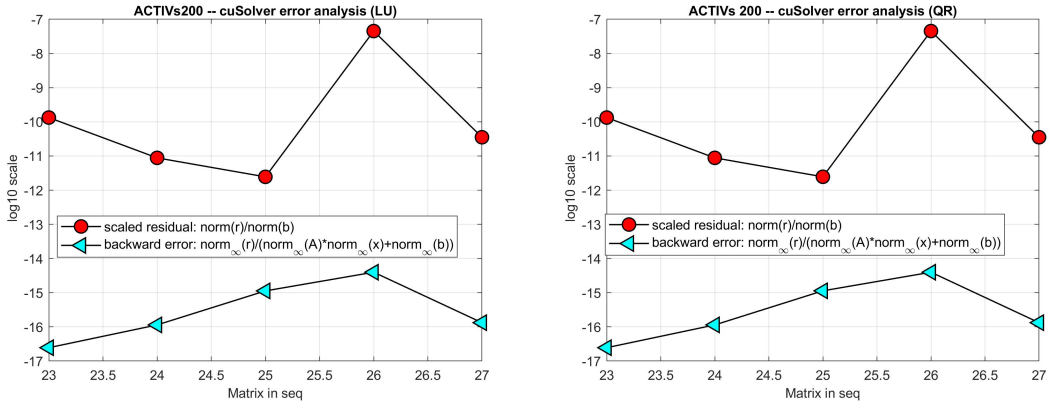

Figure 4: Error levers for ACTIVSg200

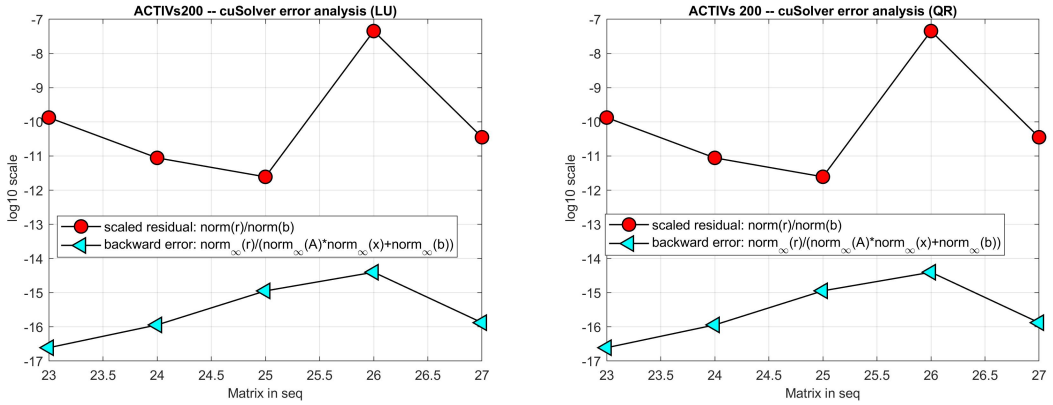

Figure 5: Error levers for ACTIVSg2000

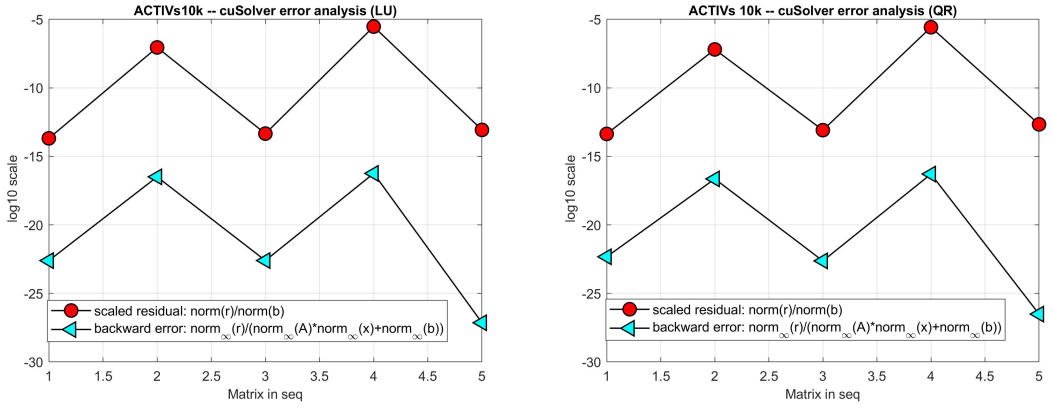

Figure 6: Error levers for ACTIVSg10k

	RTS - 1 TP		RTS - 2 TP	
Reordering	Average time LU	Average time QR	Average time LU	Average time QR
none	740.82 ms	203.03 ms	7150.24 ms	1309.61 ms
1	6.52 ms	16.18 ms	43.18 ms	86.45 ms
2	16.26 ms	37.45 ms	91.12 ms	133.31 ms
3	19.55 ms	43.88 ms	65.00 ms	131.76 ms

	TAMU 500	
Reordering	Average time LU	Average time QR
none	$\approx$ 1762715.23 ms	$\approx$ 7088.85 ms
1	18369.79 ms	4233.98 ms
2	4678.50 ms	7308.98 ms
3	1695.81 ms	4265.44 ms

	ACTIVSg200		ACTIVSg2000		ACTIVSg10k	
Reordering	Av. time LU	Av. time QR	Average time LU	Av. time QR	Av. time LU	Av. time QR
none	3066.97 ms	1289.74 ms	–	83919.5 ms	–	–
1	17.17 ms	36.75 ms	8826.67 ms	1792.54 ms	31898.50 ms	5726.92 ms
2	44.58 ms	92.95 ms	8802.65 ms	6451.32 ms	100377.00 ms	73907.70 ms
3	44.01 ms	108.62 ms	2641.67 ms	4300.18 ms	18191.00 ms	17335.20 ms

Table 2: Performance results for cuSolver with different re-ordering options. Note that the ratio between the timings resulting from best and worst reordering in some cases is larger than a 1000.