GPU Solutions for PSCAD: IT17112

Reporting Period	June 25, 2020 - July 2, 2020
Activities	• Examined the effects of scaling the size of the system on per-time step solving time and matrix factoring time on Quadro RTX 3000, Tesla P100, and V100 PCIe GPUs. See figure 1 for details • Produced example data sets of double ($n = 2$) and quadruple ($n = 4$) the original size of the *Province* data set for testing • Collected per-time step solving times over all time steps as well as matrix factoring times over all three GPUs • Compared to the baseline timings, doubling the size of the system to 14,724 x 14,724 resulted in slightly less than a doubling of the average per-time step solving time across all GPUs. Interestingly, the factoring times scaled differently for each GPU, with the Quadro RTX 3000 factoring time increasing by ~ 1.54x, the Tesla P100 factoring time increasing by ~ 1.81x, and the V100 factoring time increasing by ~ 2.11x • Similarily, the result of scaling the system by $n = 4$ produced less than a factor of two increase in the per-time step solving times for each GPU compared to the $n = 2$ results, but matrix factoring time varied according to which card was used. Further research into the hardware and logic differences between the types and generations of GPUs studied will be needed to fully explain this behaviour • The average time solving time per time step $\bar{t}_{step}$ and the matrix factoring time were plotted against the system size factor n. In terms of per-time step solving speed, all GPUs were within the linear scaling regime, while the matrix factoring steps showed early signs of deviating from linear scaling. As observed above, the degree of deviation from linearity depended on the hardware used
Issues	• None
Milestones Accomplished	• Examined effects of scaling the problem size over three choices of hardware
Milestones Not Accomplished	• None
Next Week's Milestones	• End of IU meeting, discussion of next directions in project
Forwarded Issues	• None

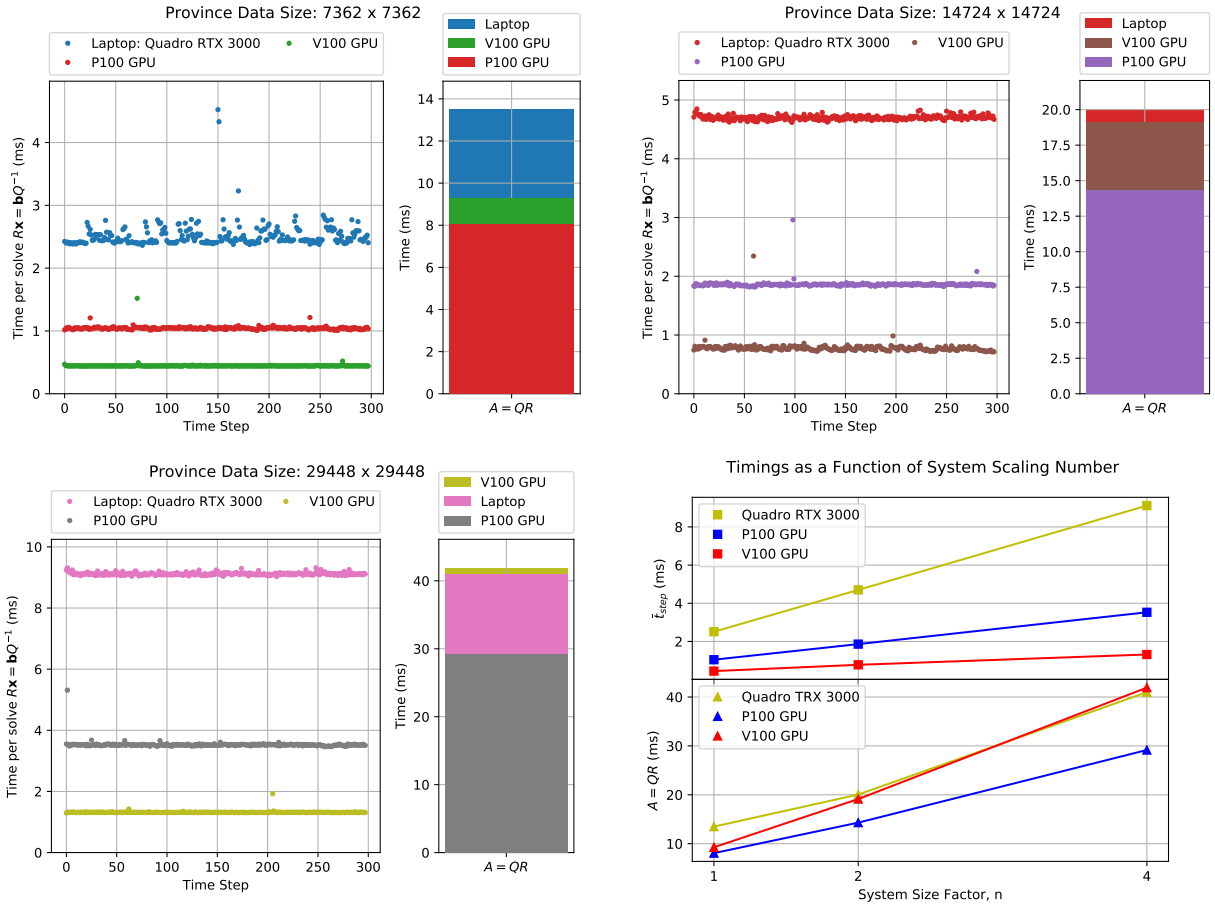

Figure 1: *Top and bottom left*: per-time step solving time and matrix factoring time for each of the three GPUs tested. The system size is given at the top of each plot. The original size of the *Province* data set is 7362 x 7362, and subsequent systems are either twice or quadruple this size. *Bottom right*: the average per-time step solving time and matrix factoring time for each of the GPUs tested as a function of system size facor. A value of $n = 1$ corresponds to the original *Province* system size.