



Rensselaer

**CERTS Project
Voltage Stability Applications using Synchrophasor Data**

**Report 9
Compiled Application and Source Code**

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Introduction

This is a report for Task 9. A compiled report for Tasks 6, 7, and 8 on using the computer code was completed at a previous date.

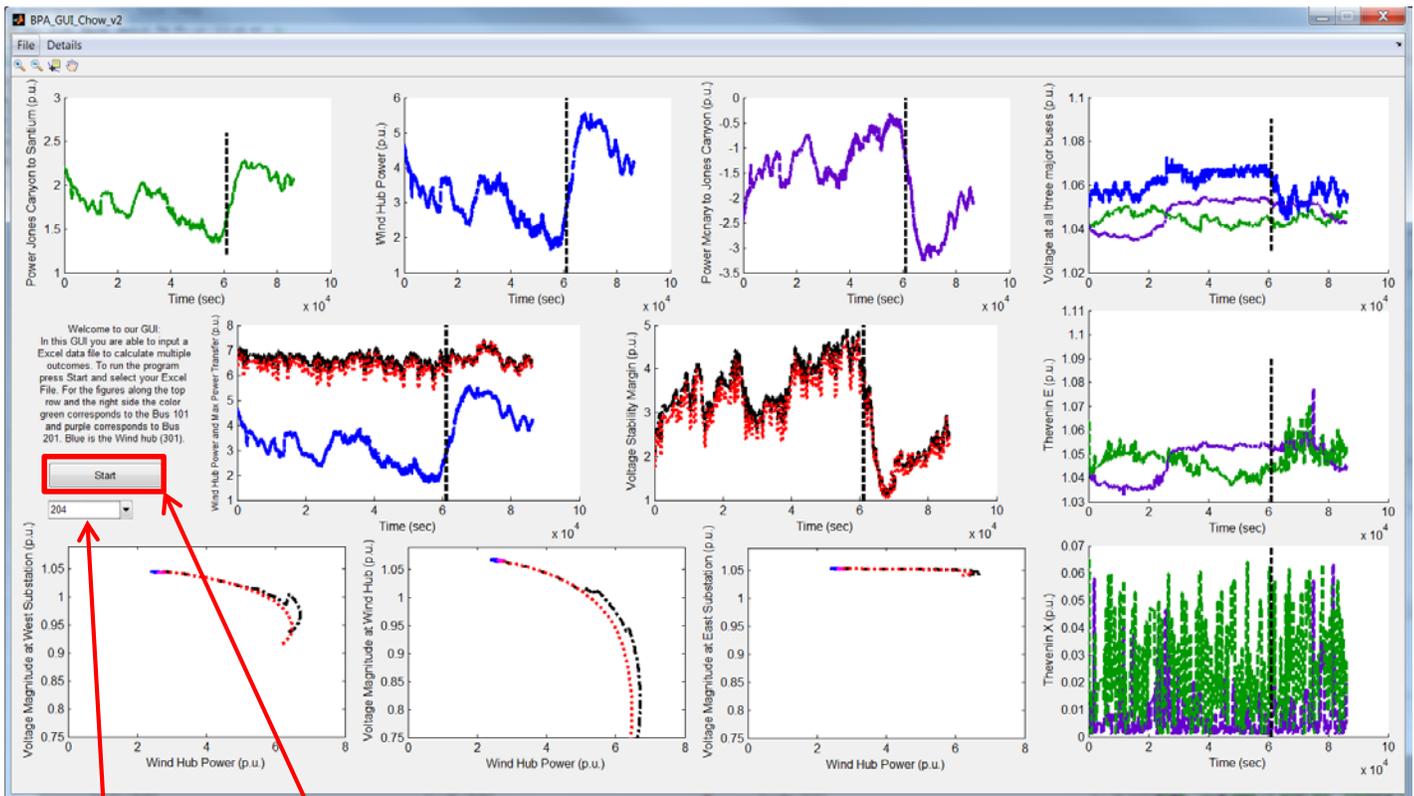
Task 9: Compiled Application and Source Code

During the JSIS meeting from 03/03/15 to 03/05/15 in Salt Lake City the current BPA General User Interface (GUI) was delivered to Anthony Faris.

The GUI takes data from the Jones Canyon region and runs five minute data windows to compute voltage stability margin. The size of data window can be adjusted by a user. The computer code The GUI generates a number of plots; the PV curves at each bus, the power transfer from the wind turbines, the power flowing between wind hub and the east bus (Santium) and the west bus (McNary), the voltages at each bus, the Thevenin equivalent values at Santium and McNary, the maximum power transfer at the wind hub, and the stability margin of the system.

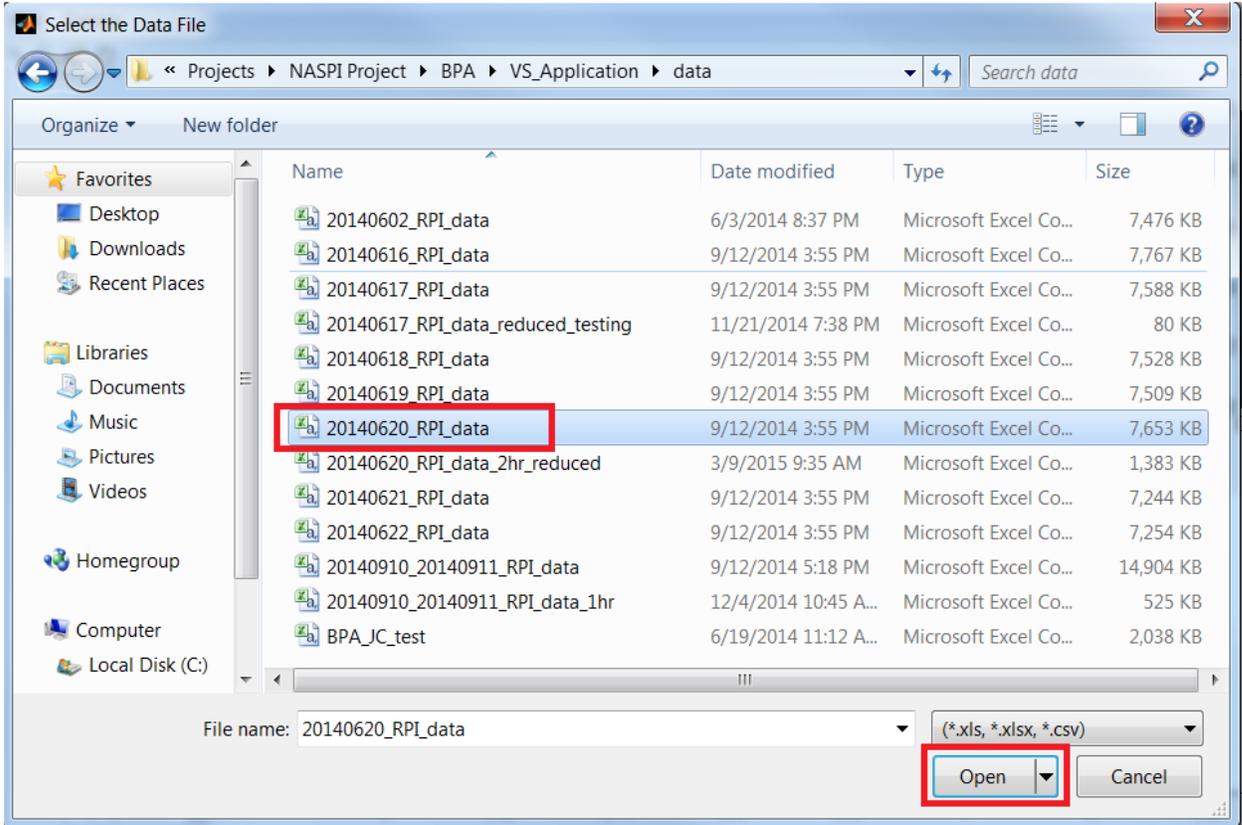
Operation of GUI

To run the GUI, the start button is pressed to open and load a data set. This can be seen below:

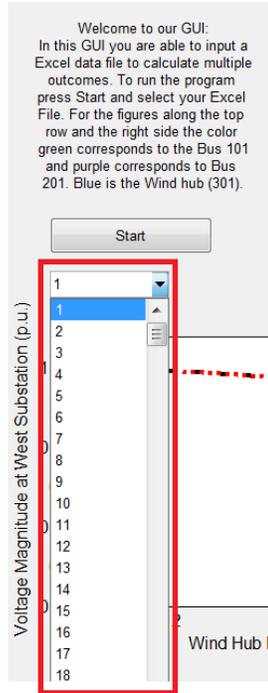


Adjusting PV time period
(5 min chunks)

Start Button



Once the data file is selected, the program will run the desired window length (done in the base BPA_GUI_Chow_v2 code). This process will take around 15 minutes (on a 2-year old laptop) to run a 24 hour segment. Once the process is completed an investigator can go back and look at any PV curve during any time period by using the pull down menu. This will allow an investigator to look back at any points of concern, particularly the times when the voltage stability margin is low, as seen below:



Results from GUI

The plots from the previously submitted Reports 6, 7, and 8 showed the results from the GUI being run on seven separate days. The program showed the PV curves consistently solving to and even going beyond the point of voltage collapse, resulting in an accurate representation of the voltage stability margin. The PV curves show both the short-term (no capacitor bank switching) and the long-term (capacitor bank switching allowed) effects of using the reactive power support present near the wind turbines.

Continued work

Calculating the Thevenin values seems to be of some concern and is currently being worked on. On one hand, the variation of the Thevenin voltage and reactance may be quite large from one 5-minute period to the next 5-minute period. On the other hand, the voltage stability margin seems to be quite consistent despite of this variation. As researchers, we need to continue the investigation to develop better methods of computing the Thevenin equivalent parameters.

We will also keep in contact with Tony Faris and others at BPA if they have any questions or concerns with the GUI.

Conclusions

In this report, we have stated that the software has been delivered to BPA for evaluation on an off-line basis. For the remaining part of the project, we have begun investigating a wind hub in the Southern California Edison service area. ERCOT also has shown an interest to work with us on voltage stability analysis.

