

# PMU Application Requirements Task Force: Update on Data Quality Attributes Document and Methodology for Examining Data Quality Impacts

Pacific Northwest National Laboratory and  
National Institute of Standards and Technology  
Team

March 22, 2017



# Overview

- Phasor Applications Requirements Task Force (PARTF)  
Background and Expert Team Effort
- Finalized version posted
- NIST Application Testing

# The PARTF Vision

- The synchrophasor community begins using **consistent terms** and definitions for data issues, quality, and availability.
- We use a developed **methodology** to understand how different stages of the data process path (measurement, filters, communications) affect each application and algorithm – and determine the priorities for improving PMUs, data networks, and applications.
- This approach can give grid operators and application users **confidence about the quality and trustworthiness** of the guidance coming out of synchrophasor applications.
- These methodologies get **built into applications** (data quality metric in dashboard), improving application performance, transparency, and acceptance.

# The PARTF Expert Effort

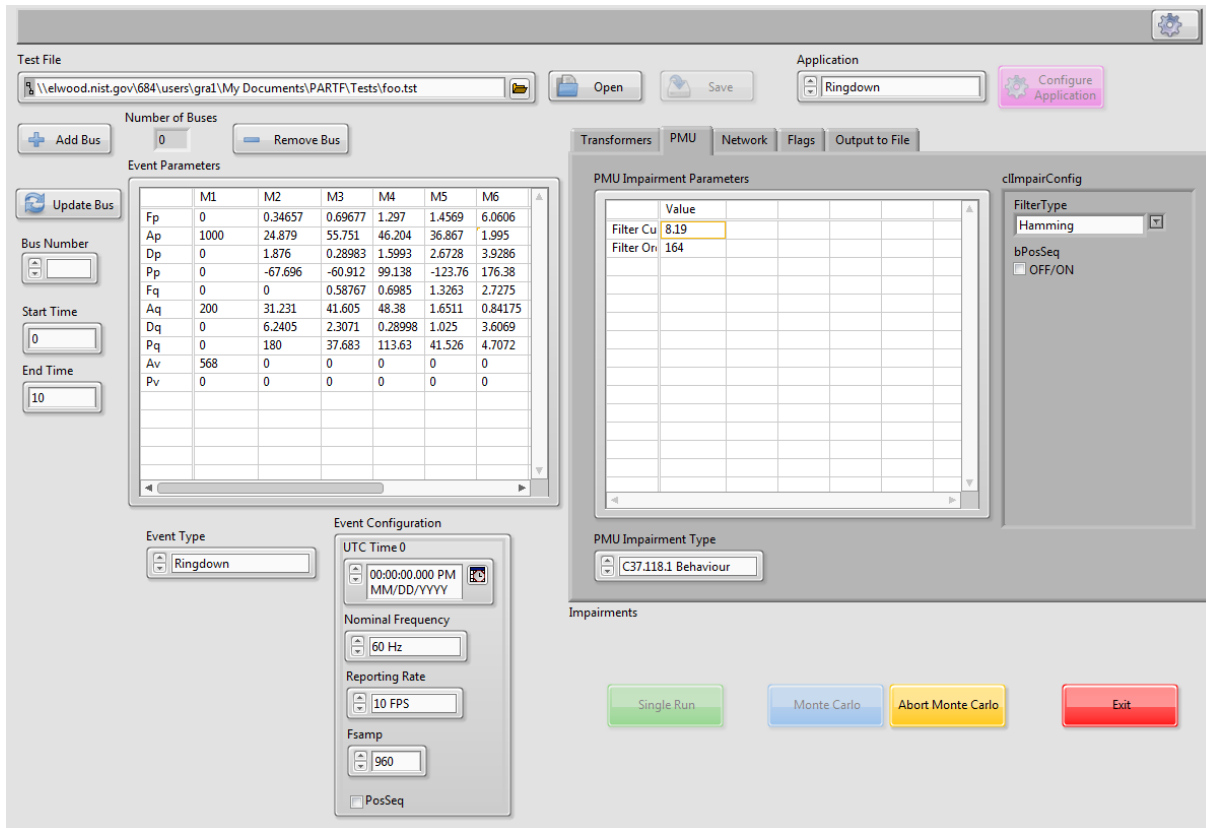
The complex PARTF scope requires a rigorous methodology and consistent approach to be useful. We can help the synchrophasor community and PARTF volunteers by developing a proposal for review, feedback, and improvement.

- PNNL and NIST have contributed expert resources and funds to develop a proposed methodology and definitions framework
  - Alison Silverstein (NASPI) – framework & readability
  - Laurie Miller (PNNL) – power systems & advanced mathematics
  - Dhananjay Anand (NIST) – applied mathematics & control theory
  - Allen Goldstein (NIST) – electrical engineer & digital signal processing
  - Yuri Makarov (PNNL) – power engineering & advanced mathematics
  - Frank Tuffner (PNNL) – power engineering & PMU applications
  - Kevin Jones (Virginia Power) – power engineering & PMU applications
- We still seek your feedback on these recommendations

# PARTF Definitions and Methodology Paper

- Updated release is available on the NASPI website at:  
<https://www.naspi.org/File.aspx?fileID=1689>
- Feedback from the last round of emails, revisions, and webinar have been incorporated
- Further updates are expected as more people view the document and the NIST Application Framework begins being utilized

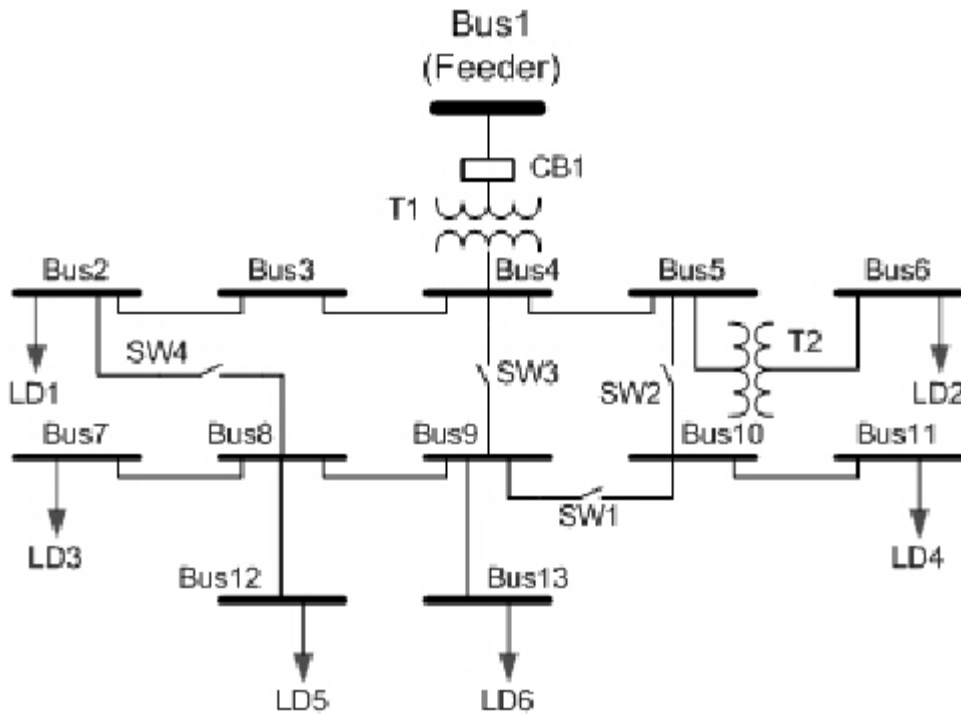
# PARTF Application Requirements Framework



Front Panel

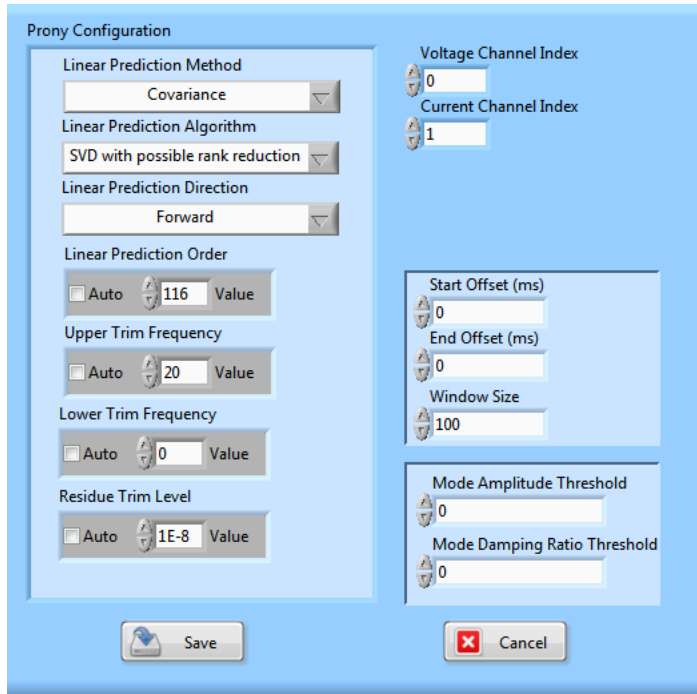
- The framework is a highly composable architecture:
  - Composable: consists of recombinant components that can be selected and assembled in various combinations.
  - 1 or more “buses” represent very small to large systems feeding into a single application.

# PARTF Framework Buses



The framework can be made to simulate a modified IEEE 13 bus model or many other configurations from single bus to as many as the computer memory and CPU will support. Historical data can also be used.

- Each Bus consists of the following components:
  - Event Module
  - Transformer Impairment Module
  - PMU Impairment Module
  - Network Impairment Module
  - Flag Impairment Module
- All modules use “plug-ins” so that users may develop their own behavior or choose from a list of existing behaviors.



Example Configuration panel for the Prony Analysis application

## The Application module

- PMU data from all buses is aggregated for input to a single application.
- Also uses plug-ins so that all applications share a common Application Programming Interface.
- Each application will have it's own configuration panel.



# Monte-Carlo Style Analysis

- Monte-Carlo style analysis allows for automatic recursion with varying impairment parameters to subject the application to the range of data quality from ideal to highly impaired.
- The Monte Carlo Engine is a scriptable engine using the Python programming language. A simplified Python API is provided so even non-Python programmers can easily write compiled Monte-Carlo analysis scripts - or *Pythonista's* can get all *Pythonic* on it!

# Next Steps

- Continue work in progress on the Framework
  - Development and Alpha in progress (PNNL's Ringdown tool from the DSI Toolbox)
  - Beta will follow (beginning to evaluate several candidate apps)
  - Talking to some professors about unfunded guest researcher opportunities to get involved with the beta program.
- PARTF data quality white paper is expected to be a living document/effort
  - Suggestions and changes are welcomed from the community
  - Next update/release will be dependent on significance of the changes

# Questions?

Document available on the NASPI website at:

<https://www.naspi.org/File.aspx?fileID=1689>