

Data Validation & Conditioning Applications

DOE/WECC Projects

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Presentation

- Two Projects Underway
- Modeless Data Validation - DOE Project
 - Phasor Data Validation and Conditioning (PDVC)
 - 6 Modules for Data Validation
 - Prototype Completed and Demonstrated
 - Error Simulation Utility Utilized for Validation
 - Project Nearing Completion
- Modeless and LSE Data Validation - WECC Project
 - Synchrophasor Data Validation and Conditioning Application (SDVCA)
 - Project started in April 2014
 - Leverages LSE work done at Dominion and EPG Modeless Data Validation
 - User Selection of Validated Data Stream

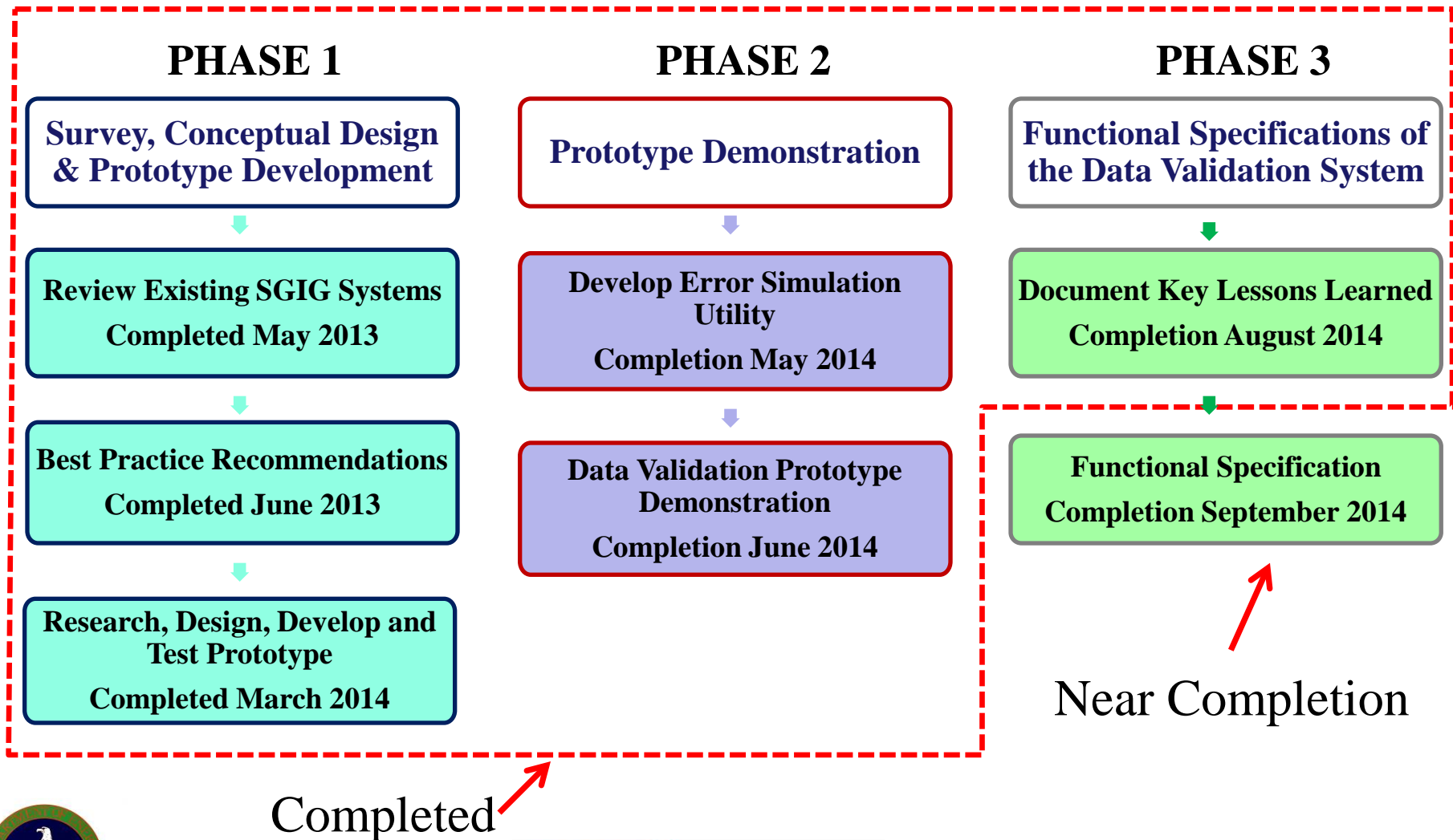


DoE Project Introduction

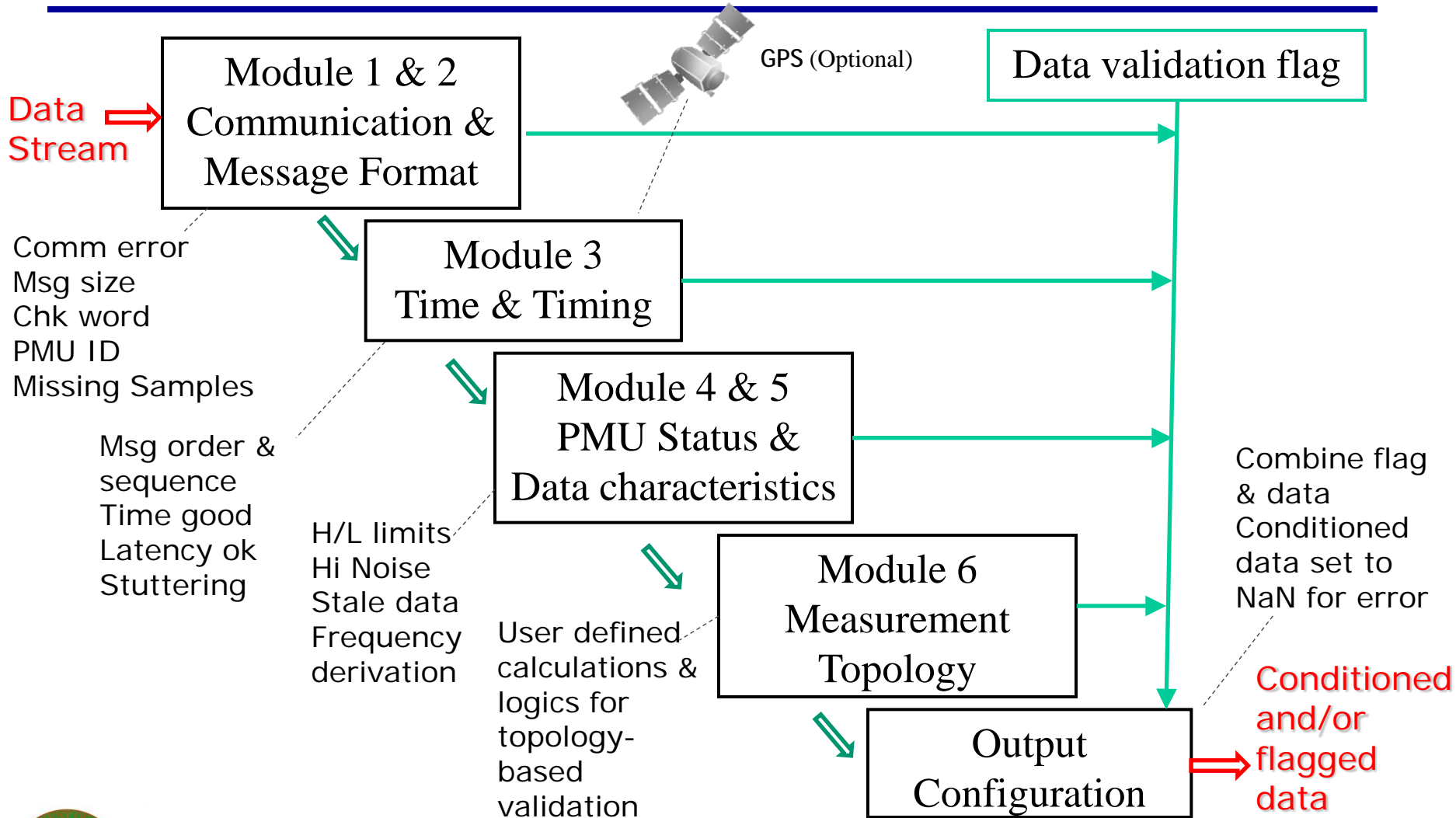
- Synchrophasor Data Quality is the Top 10 Issues identified by NASPI
 - Timing source, algorithms, hardware
 - Latency, dropouts, bandwidth, errors
- Need
 - Detect and fix data problems
- DOE Modeless Data Validation and Conditioning Project
 - RFP issued in June 2012 - Awarded to EPG in December 2012
 - Completion by December 2014



Project Plan & Status



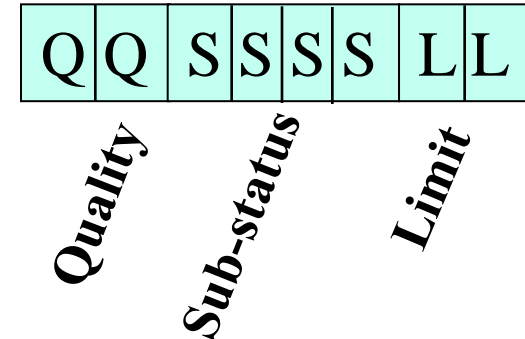
Algorithms Process & Stages – 6 Modules



Data Quality Flag & Output

- Standard-based Data Quality Flag

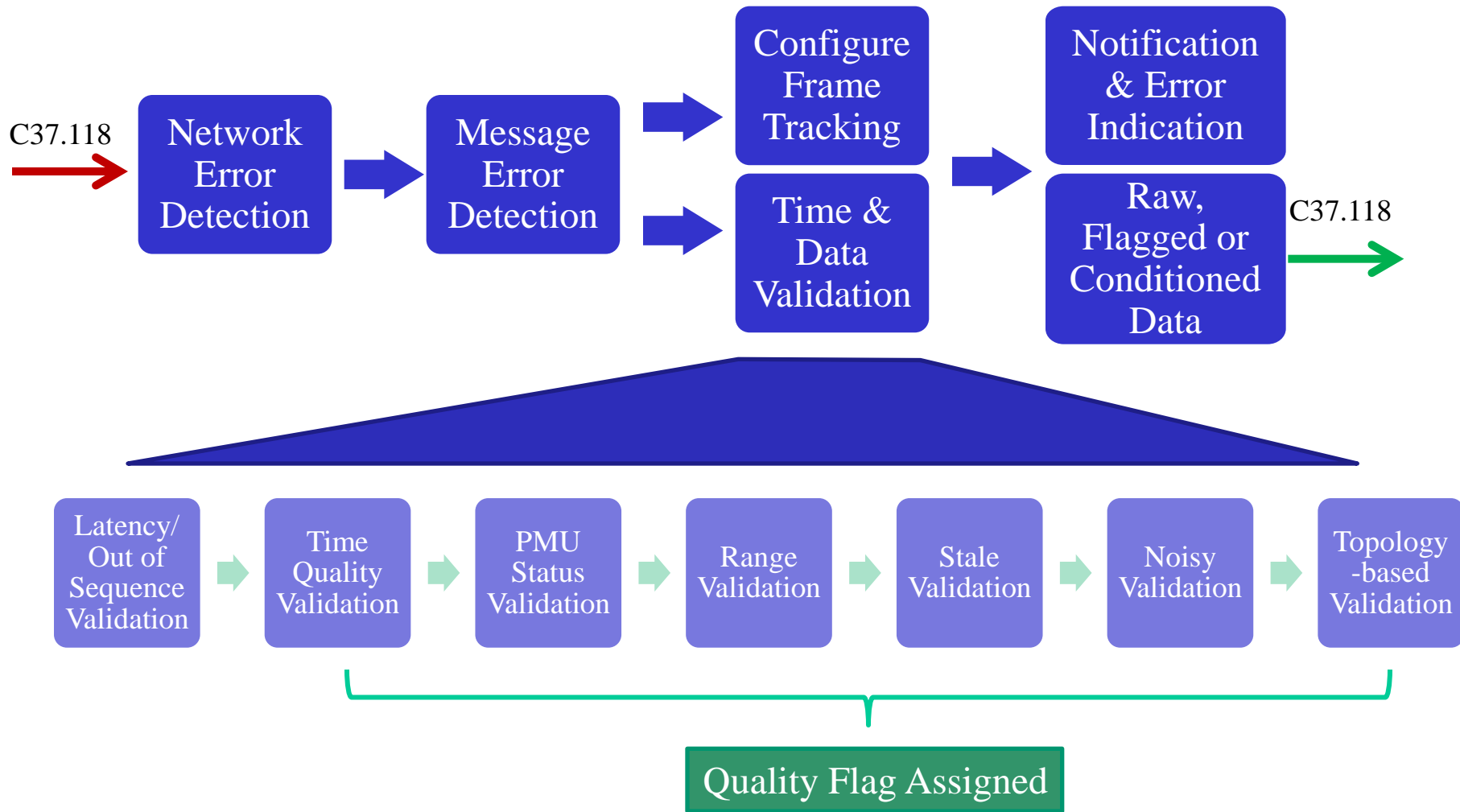
- Flag for each value
 - Phasor magnitude & angle
 - Frequency & ROCOF
- Can be sent in IEEE 118 stream



- Quality – Good, Bad, Uncertain, Reserved (for future use)
- Sub-status – reason for the quality indication
- Limit – value at H/L limit, cannot move, or ok
- Outputs
 - Raw value
 - Raw value with flag
 - Conditioned with flags (bad and/or uncertain values cleaned)



PDVC Prototype Workflow



PDVC – Sample Result

File Configuration Monitoring Account Help

Input Monitoring

- Input System
 - TEST
 - TEST.PMU1
 - Status
 - V21
 - V22
 - C21
 - Frequency
 - Latency
 - TEST.PMU2

PMU Values PMU Plot

Input PMU Characteristics

ID Code: 9999
 Station Name: PMU1
 Host Machine Date/Time: 02-27-2014 09:42:24.182
 PMU Data Time: 02-27-2014 09:42:24.166

Inal	Signal Name	Signal Type	Value	Quality C	Data Quality
1 0	Status	Status	0x00C0 (Good Data)	0xC0	Good
2 1	V21	Voltage	51.9615 kV / 57.295...	0x64 0x64	Uncertain, Topology Validation Failure/Uncertain...
3 2	V22	Voltage	536.936 kV / -57.295...	0x56 0xC0	Uncertain, Engineering Unit Exceeded High Limit/...
4 3	C21	Current	500 A / -42.9718 De...	0x64 0x64	Uncertain, Topology Validation Failure/Uncertain...
5 4	Frequency	Frequency	59 Hz / 0 Hz/s	0xC0 0x...	Good/Good
6 5	To.A.Latency	Analog	0.000963004 Seconds	0xC0	Good

Refresh

Auto Refresh

Refresh Interval 1 Seconds

Sort Signal lists by: ALL Signals Voltage Magnitude: Convert to L-L kV

Measurement Values

Measurement Quality:

Uncertain: Topology Validation Failure

Uncertain: Engineering Unit Exceeded High Limit



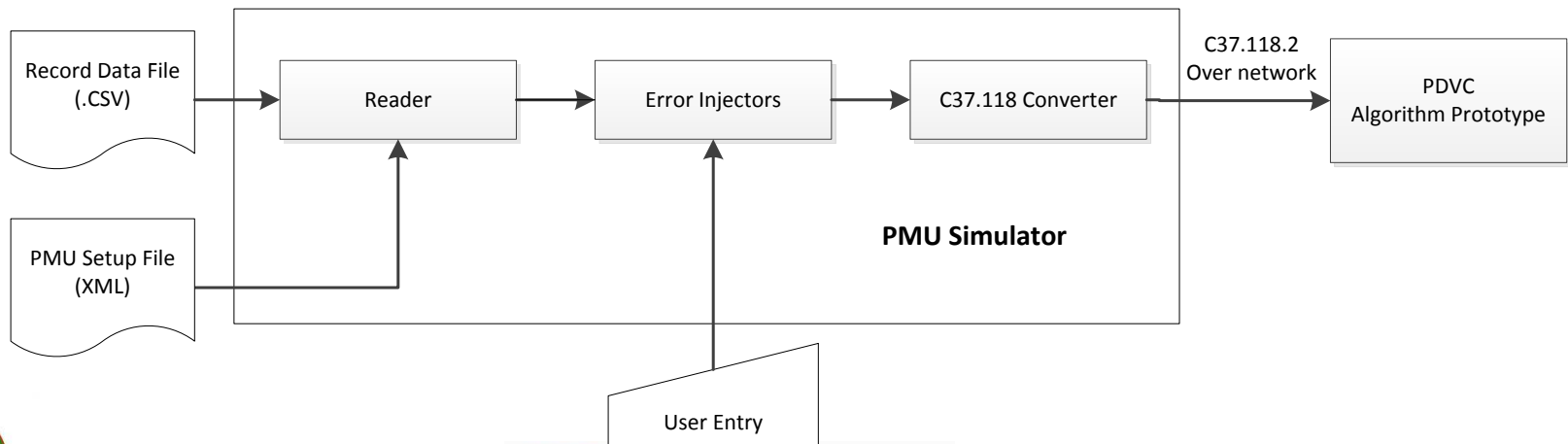
Error Simulation Utility

■ Data Source

- Recorded real data in CSV file format
- Real-time simulation

■ Functionality

- Replay or Simulate real-time C37.118 stream
- Inject errors at protocol level, PMU level, and measurement level
- Manage PMU/Signal and communication options

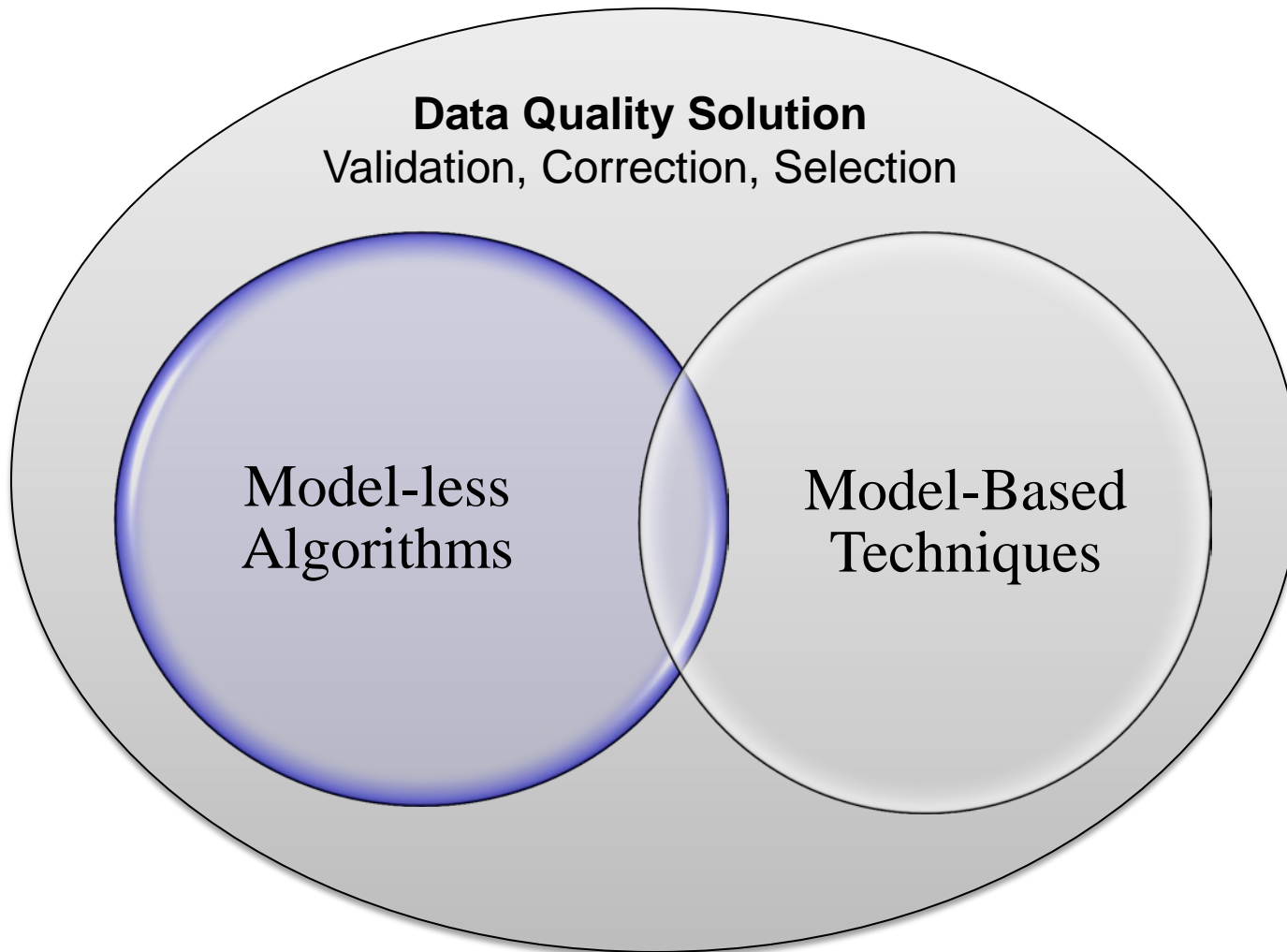


DOE Project Current Status

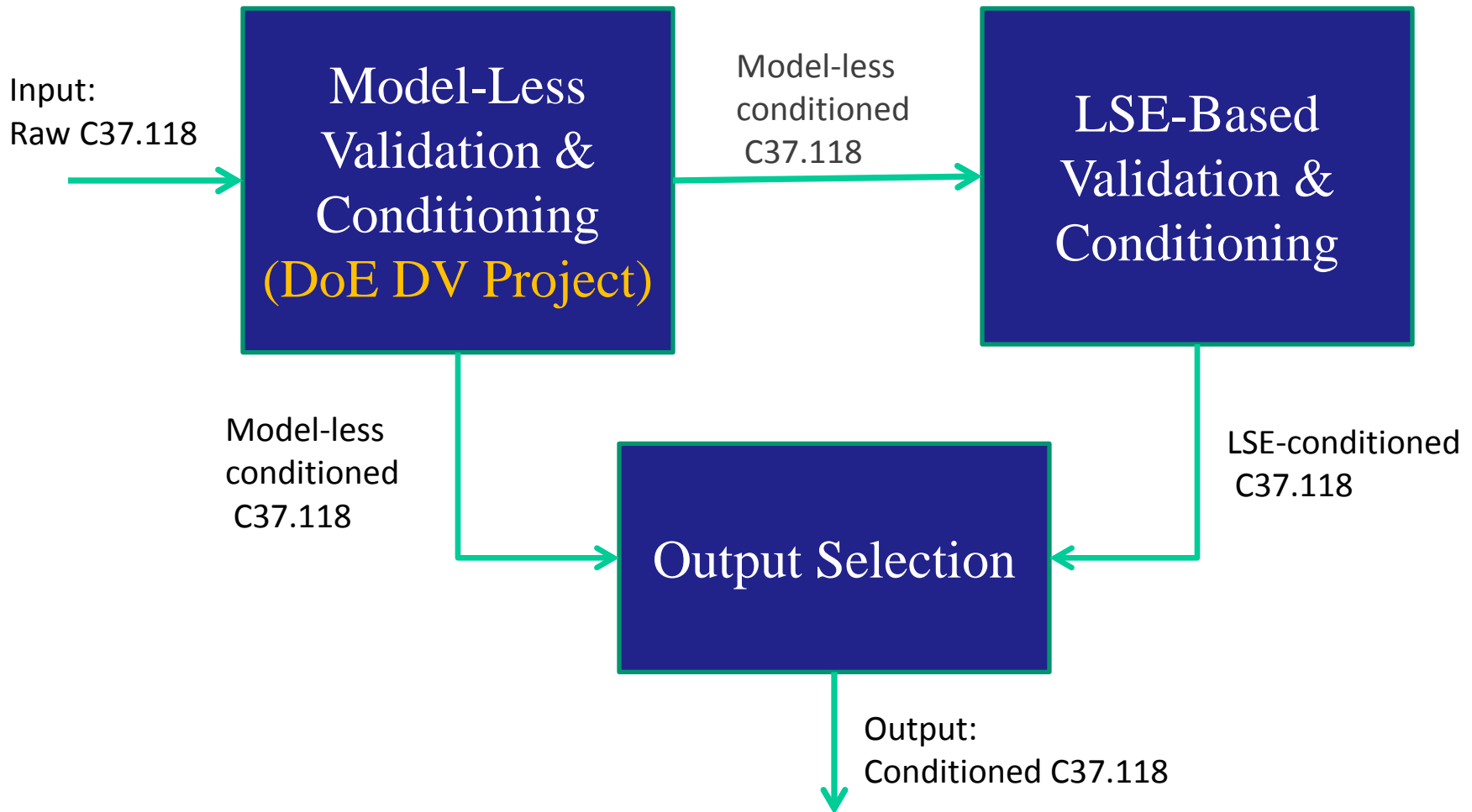
- PDVC and Error Simulation Utility prototype available for download
<https://www.electricpowergroup.net/researchapps/>
- Functional Specifications being finalized for delivery to DOE
- EPG planning to release a commercial product that incorporates modeless data validation and additional functionality by 4Q2014



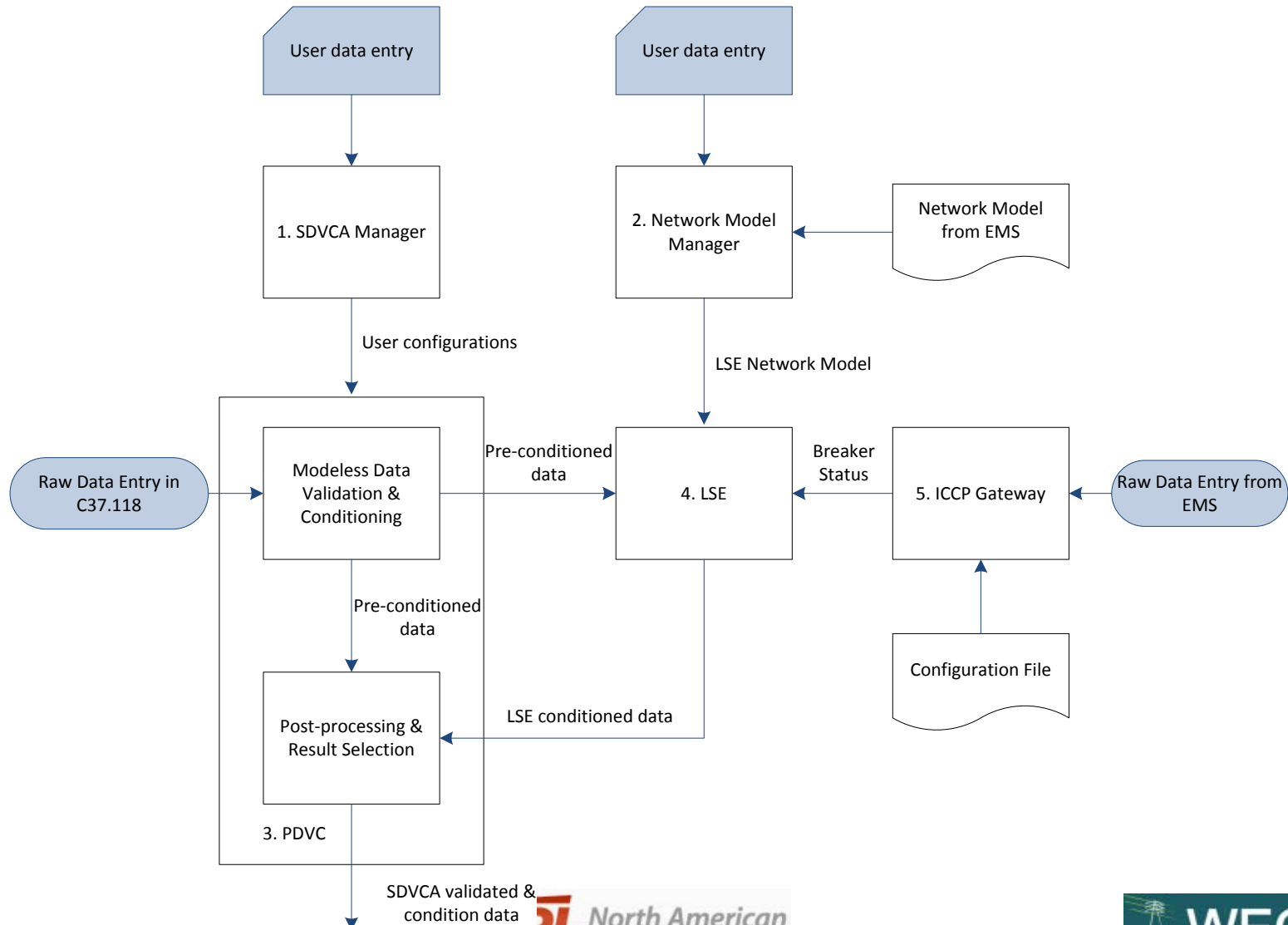
WECC Synchrophasor Data Validation and Conditioning Application (SDVCA)



WECC Data Validation & Conditioning Project



SDVCA Data Flow



WECC Project Status

- Model-less Algorithm Implementation - **Completed**
- Building upon LSE work at Dominion*. LSE Evaluation and Design - **Completed**
 - Algorithm Design
 - System Design
 - Detailed Report
- WECC Approved System Design – **Completed**
 - LSE Network Model Editor
 - LSE Service
 - LSE Integration with Model-less Algorithm
 - LSE Integration with ICCP Gateway for Breaker Status
- Implementation – Ongoing (Targeting Feb. 2015)
- Testing & Installation – Planned (Targeting March/April 2015)



*LSE code developed by Kevin Jones, Dominion: providing consulting support to EPG

Thank You

Any Questions?

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Electric Power Group



NASPI North American
SynchroPhasor Initiative

