

# Real-Time Generator Parameter Validation

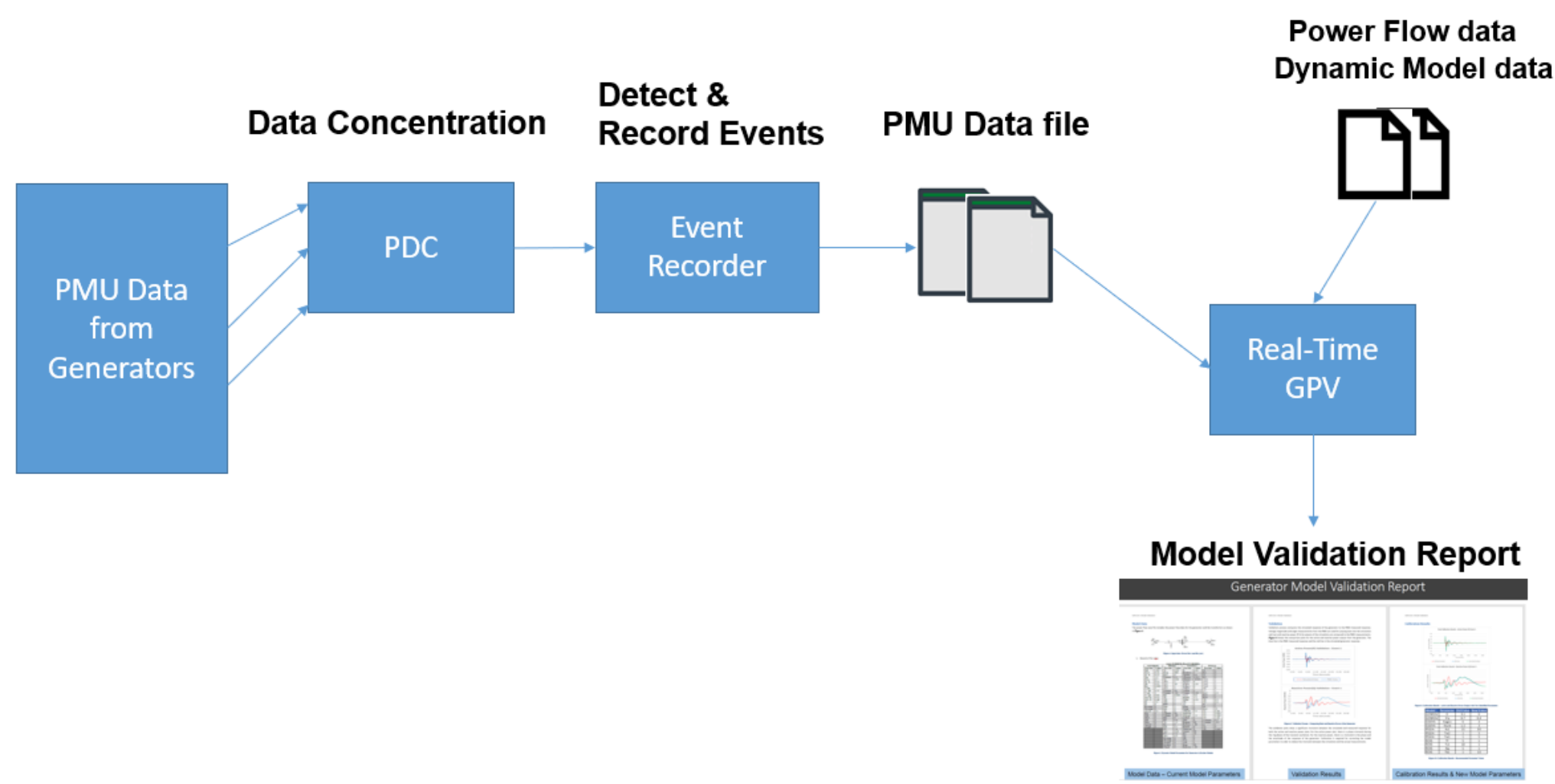
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## Introduction

Models are extensively used for planning and performing system studies. PMU data can be effectively used to validate generator models without taking units offline. NERC reliability standards MOD-26 and MOD-27 require periodic validation of generators, governor and excitation system models. Electric Power Group (EPG) has developed Real-Time Generator Parameter Validation (RT-GPV) application to perform generator model validation using Synchrophasor Data in real-time.

## Overview

RT-GPV is a fully automated application that generates a detailed report with results from validating multiple generators whenever a significant event is detected. Results include identification of good and questionable models as well as comparison plots of PMU data and simulated data. Report also provides recommendations for key parameters to be considered for tuning and calibration.



## Benefits

- **Synchrophasor Based Application for Real-Time Generator Model Validation**
  - Can be Installed in Substation or in Control Centers
- **Validate Models without taking units offline**
- **Automatically Identify Good vs Questionable Models without visual inspection**
  - 4 Criteria used for Quantifying Mismatch
- **Efficient Process for Periodically Validate Models**
  - Perform validation for each significant event
- **Automated Process – Save Time, Cost & Effort**
- **Validate Multiple Units Simultaneously for multiple events**
  - Verify Model Accuracy for different event conditions
- **Recommendation of Key Parameters based on Sensitivity Analysis**
  - Narrow down from several parameters to few key parameters for calibration
- **Meet NERC MOD-26 and MOD-27 Reliability Standards**
  - Automated report generated for each significant event
  - Summary Report over long term performance of generator models
  - Emailing Capability for Notification for severe mismatches

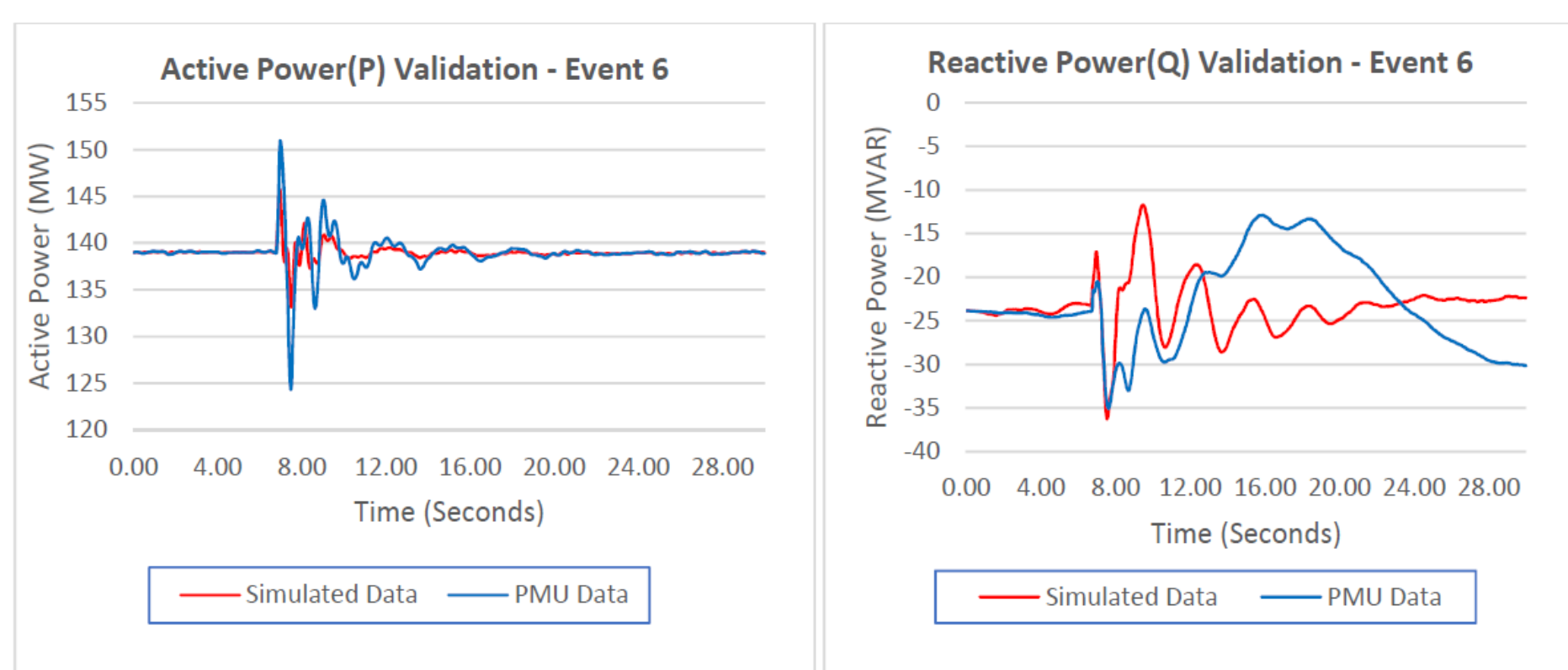
## Key Steps

### Input Data & Initialization (2 - 6)

- Get Input PMU Data
- Perform System Reduction
- Match Generator Initial Conditions in Simulation and PMU data

### Validation Process (7 – 11)

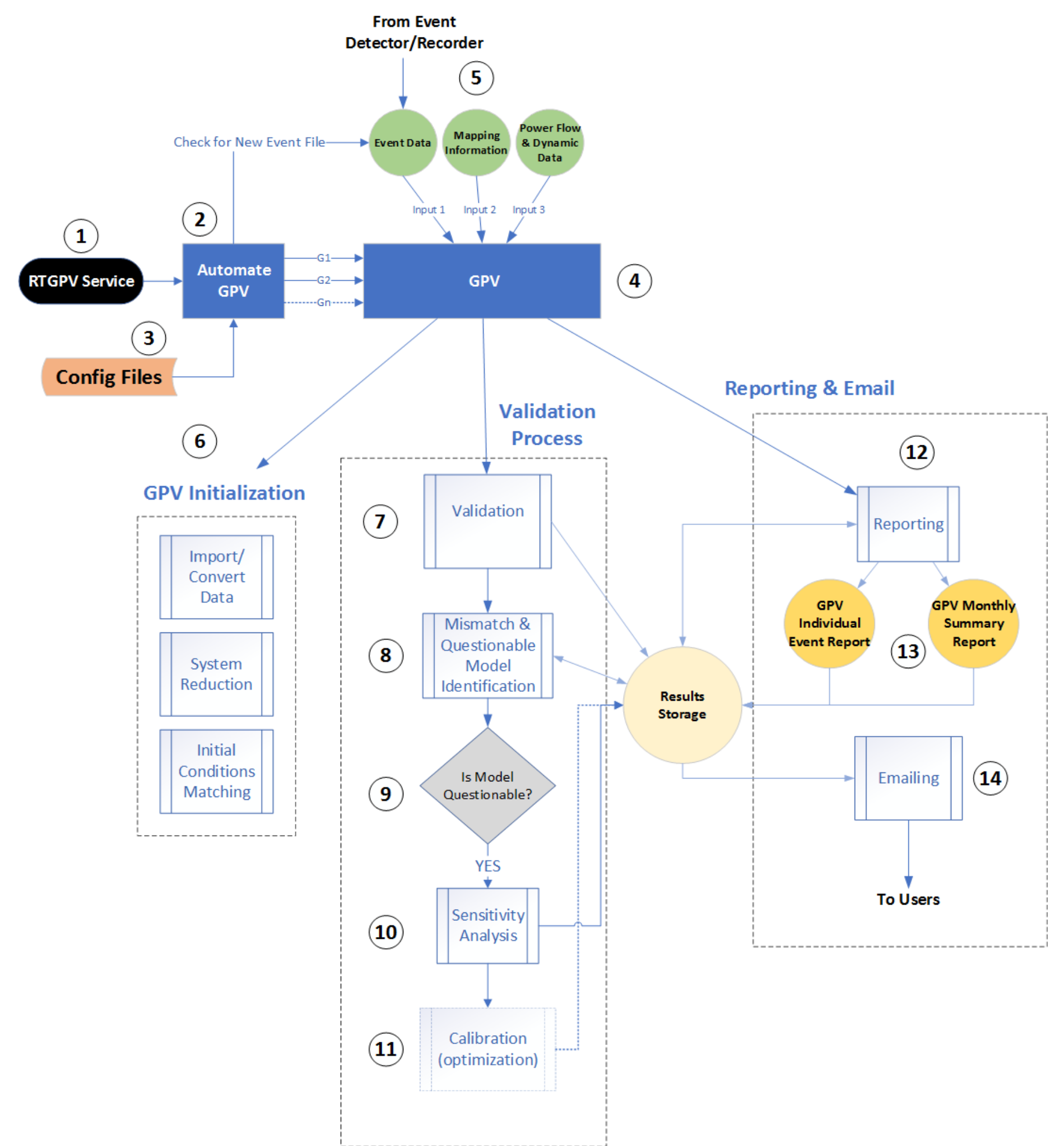
- Run Hybrid Dynamic Simulation Using PMU measurements at Generator
- Use Voltage and Angle as Input, Compare P & Q response
- Quantify mismatch in PMU and Simulated data using various criteria – accumulated error, first swing peak value and time, settling time etc.
- Automatically Identify Good vs Questionable Models
- Run Sensitivity Analysis and recommend key parameters for Questionable Models



### Reporting & Email (12 - 14)

- Generate Automated Report – Individual and Summary Report
- Individual Event Report
  - Summary – No. of Generators, List of Good & Questionable
  - Validation Results – Comparison Plots for Simulated vs PMU
  - Sensitivity Results & Recommendation of Key Parameters
- Summary Report
  - Performance of Generator Models for events over several days, weeks, months
  - Identify Models requiring investigation and tuning
  - Identify events where Simulation did not match reality
- Word and PDF Format, Email

## Methodology



## Automated Reports

