

Impacts and Actions Resulting from the August 14, 2003 Blackout

Cornell University

David W. Hilt

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Summary of August 14 Blackout

- **Impacts**

- Over 50 million people
- 60-65,000 MW
- 30 hours to restore
- Manufacturing disrupted
- 400+ Generators tripped

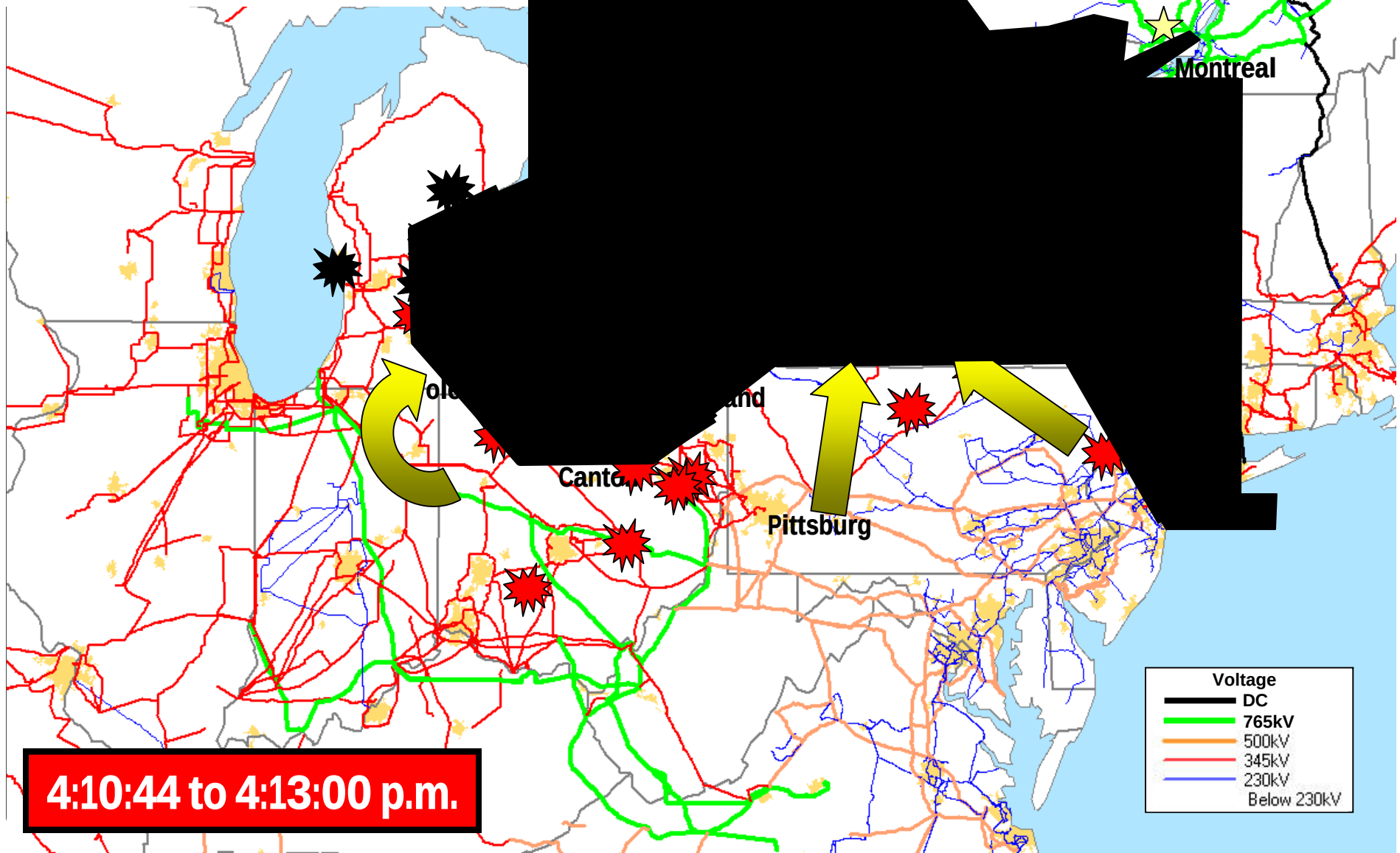


- **Statistics**

- Line trips began at 3:05 PM
- Cascading began at 4:06 PM
 - Lasted approximately 12 seconds
- Thousands of discrete events



August 14, 2003 What Happened?



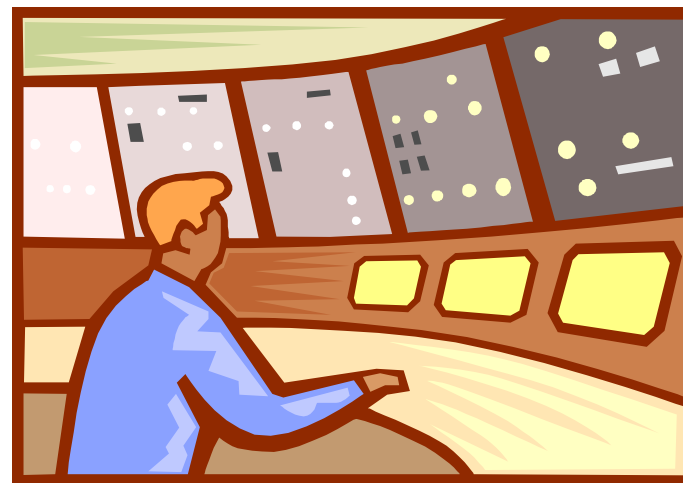
Every Blackout has Impacts

- **November 9, 1965 – NY Blackout**
 - 30,000,000 people and over 20,000 MW of demand – up to 13 hours
- **July 13, 1977 - New York City**
 - 9,000,000 people and 6,000 MW of demand – up to 26 hours
- **July 2, 1996 – Western US**
 - 2,000,000 customers (10 % of the Western Interconnection) and 11,850 MW of demand for up to several hours
- **August 10, 1996 – Western US**
 - 7,500,000 customers; 28,000 MW of demand for up to 9 hours

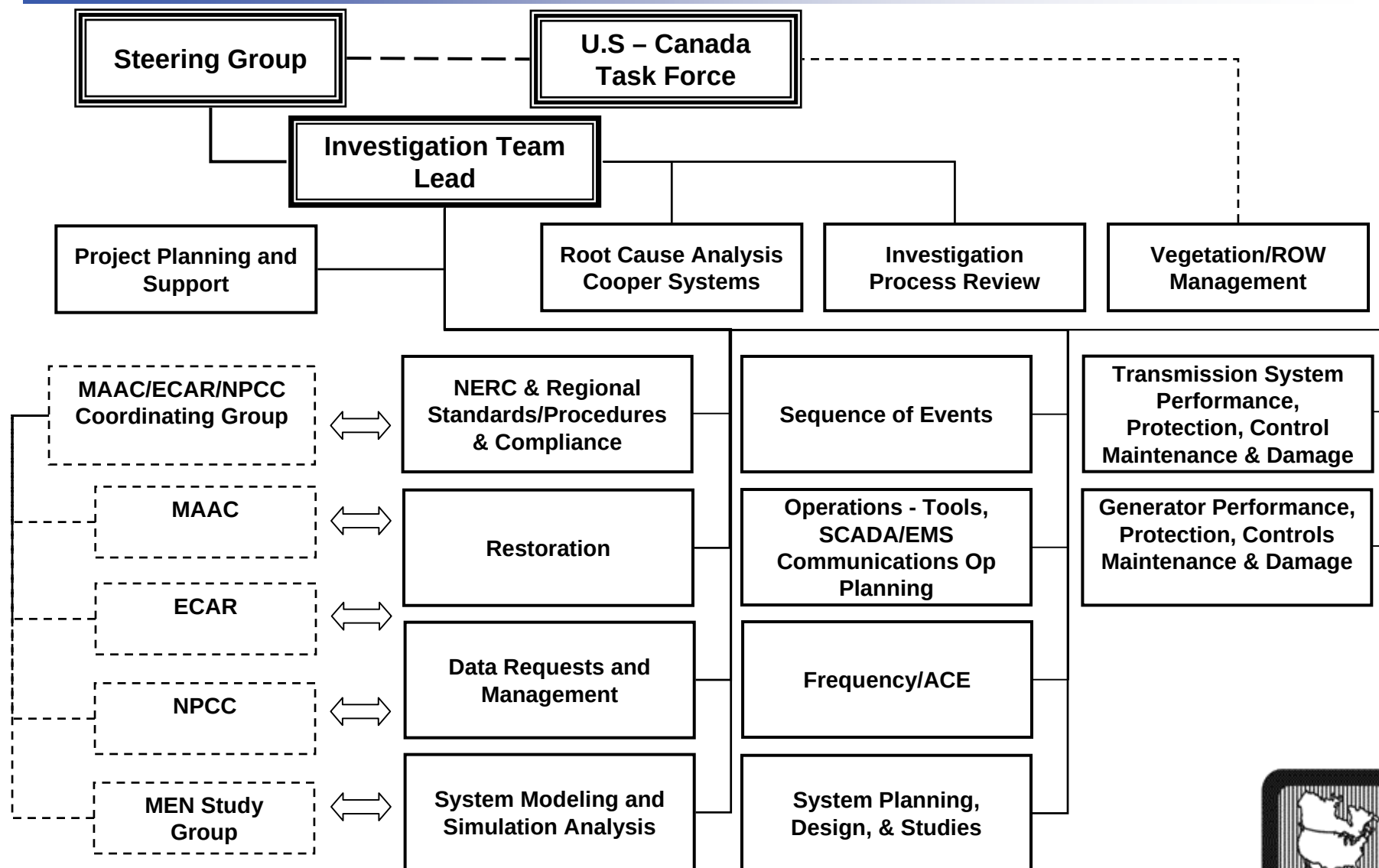


Recommendations

- The three Ts
 - Tools
 - Trees
 - Training
- Need to implement throughout the industry



Investigation Organization Overview



Causes of the August 14 Blackout

- Inadequate situational awareness
- Ineffective vegetation management
- Inadequate diagnostic support
- Failure to follow NERC Operating Policies and Planning Standards



Near-Term Actions

- **Voltage and Reactive Management**
 - Ensure sufficient voltage support for reliable operations
- **Reliability Communications**
 - Strengthen and implement communication protocols between Control Area Operators, Reliability Coordinators, and ISOs
- **Failures of System Monitoring and Control Functions**
 - Review, update, and train on plans for loss of monitoring and control systems

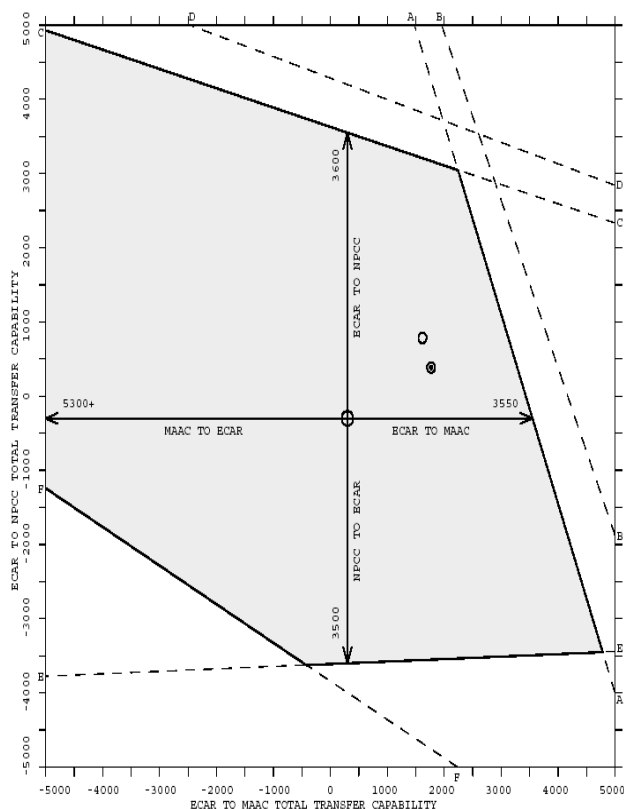


Near-Term Actions

- **Emergency Action Plans**
 - Review, update, and train on emergency plans and actions
- **Train for Emergencies**
 - Conduct emergency training drills
- **Vegetation Management**
 - Confirm that ROWs are clear of obstructions



Key Findings



- Inadequate system planning and design studies, operations planning, facilities ratings, and modeling data accuracy
- Operating with insufficient reactive margins
- More effective system protection and controls could slow or minimize spread of cascading outage



Key Findings

- Compliance requires objective measurements and concrete actions to resolve violations
- Problems from prior blackouts were repeated



NERC Blackout Recommendations

- Corrective Actions
- Strategic Initiatives
- Technical Initiatives

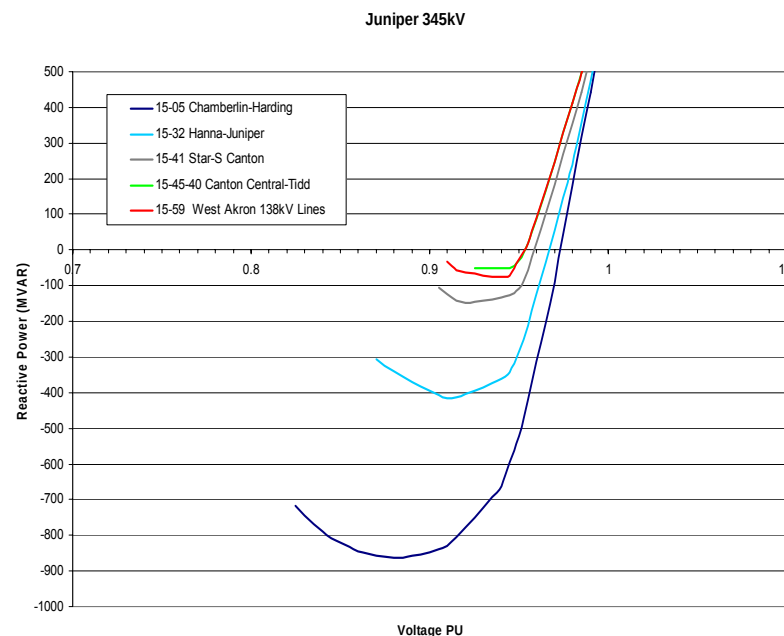
Goals:

1. Correct root cause deficiencies
2. Address contributing factors
3. Identify objective and measurable actions



Corrective Actions: FE

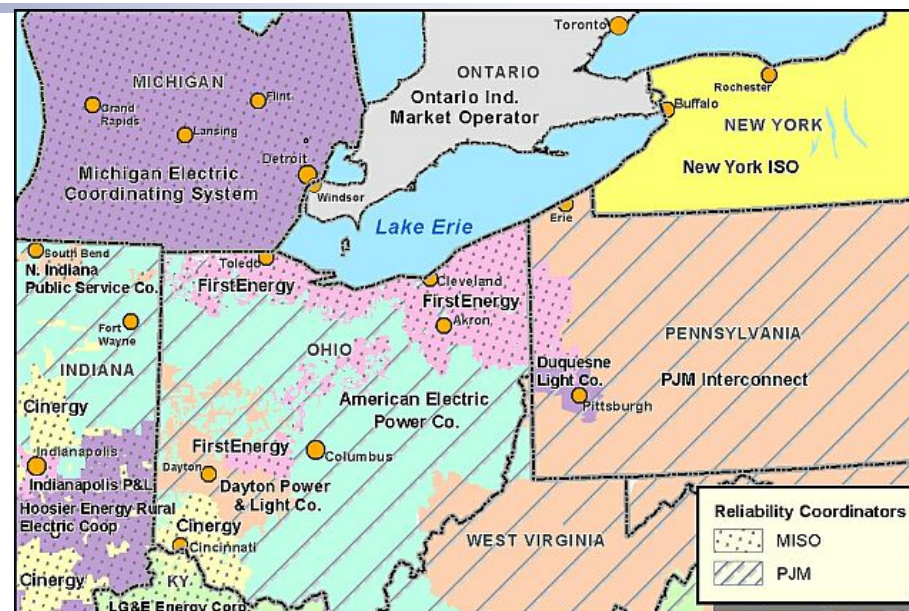
- Voltage criteria and reactive resources
- Operational preparedness and action plan
- Emergency response capabilities and preparedness
- Control center and operator training



Corrective Actions: Reliability Coordinators

- MISO

- Reliability tools
- Visualization tools
- Operator training
- Communications
- Operating agreements



- PJM

- Communications protocols and procedures



NERC Strategic Initiatives



- Strengthen compliance
- Readiness audits
- Vegetation-related outage reporting
- Track implementation of recommendations



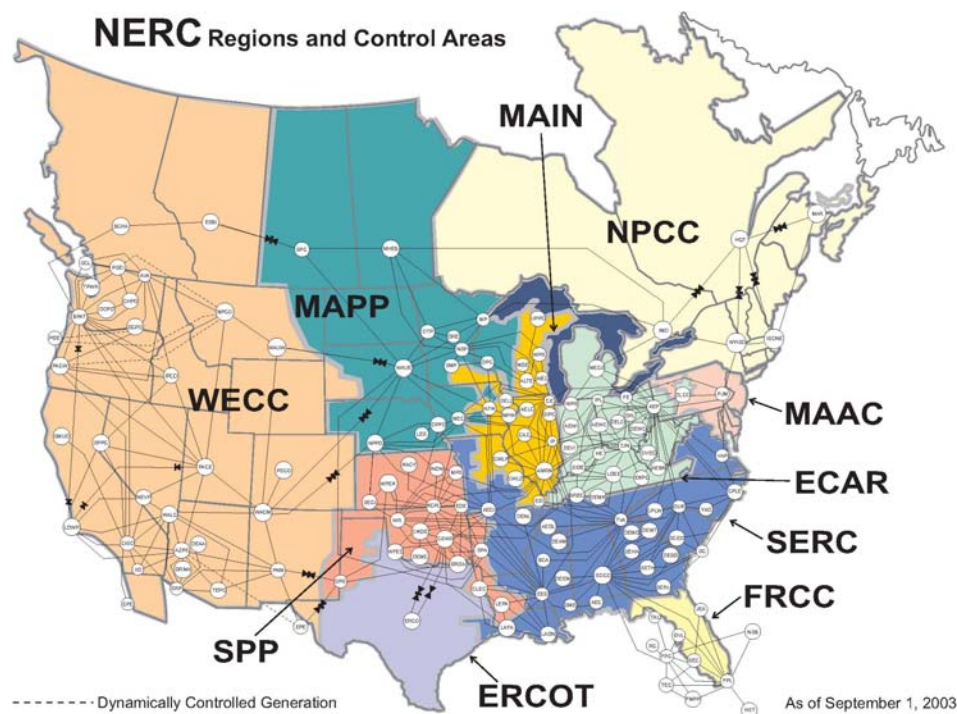
Performance Reviews

- Strengthen NERC Compliance Enforcement Program
 - Regions to submit results to NERC
 - Provide list of non-compliant entities
- *Confidential* reports to the NERC Board
 - Specific violations
 - Results of audits
- Release of confirmed violations
 - Identification of violators



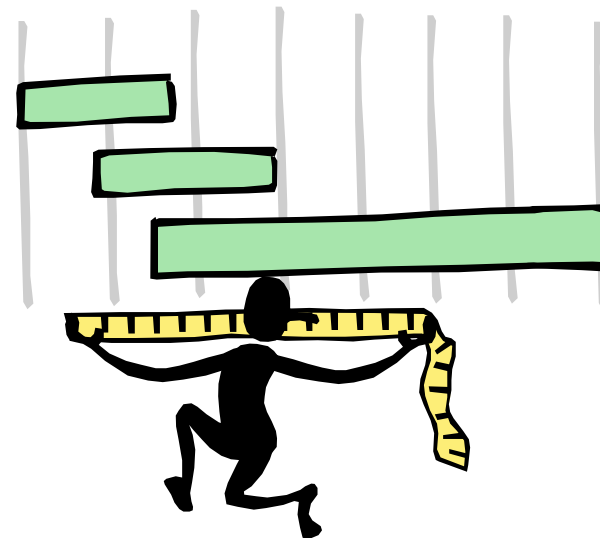
Readiness Audits

- Audit control areas and reliability coordinators
- Conduct on a 3-year cycle
- Report to the Board



Readiness Audit Program Status

- On target to audit one-third of control areas and reliability coordinators in 2004
- Audits Completed as of October 14, 2004
 - 57 Control Areas
 - 6 Reliability Coordinators
 - 1 Transmission Operator



Vegetation-Related Outage Reports

- Report tree contacts to the Regions (230+ kV)
- Regions report to NERC
- Regions to conduct and report on annual vegetation management surveys



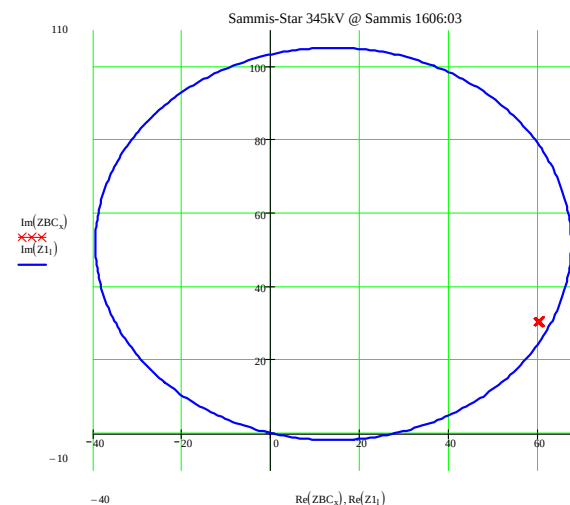
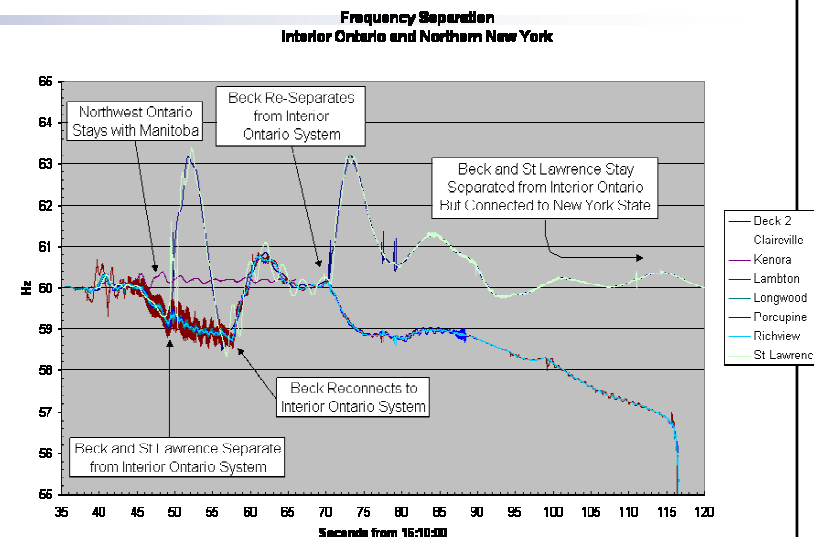
Recommendations Tracking

- NERC and Regions will track:
 - Implementation of recommendations
 - Compliance audits
 - Readiness audit recommendations
 - Lessons learned from system disturbances
 - Use regional processes as model



Technical Initiatives

- Forward looking to prevent future blackouts
 - New standards, procedures, protocols
 - Existing technologies to be considered
 - New technologies
 - Changes in system planning, design, and assessment
 - Changes to operator training programs



The Gory Details

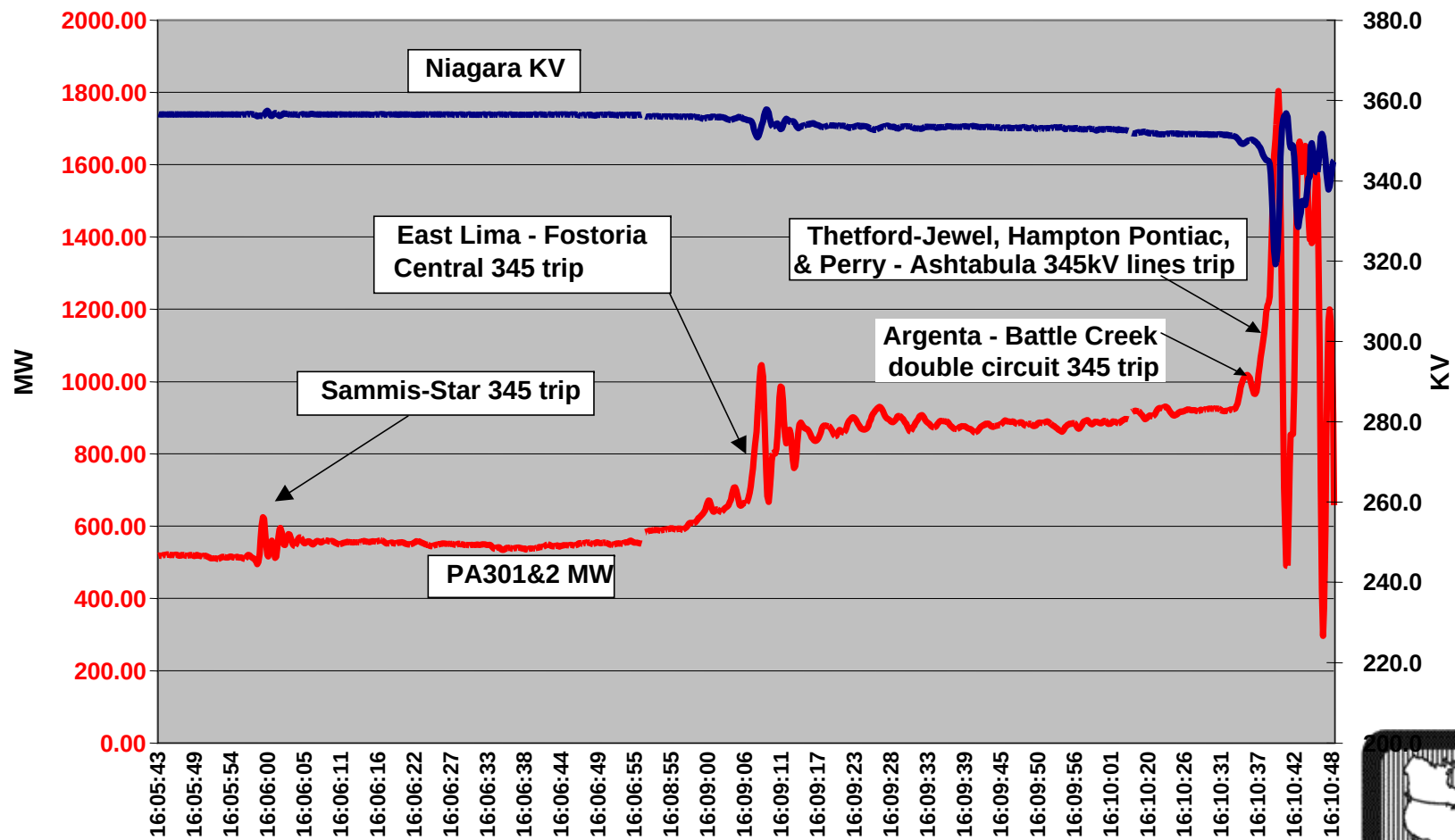
Really Interesting Plots for
Engineers



NY to Ontario 345kV Line Flows at Niagara

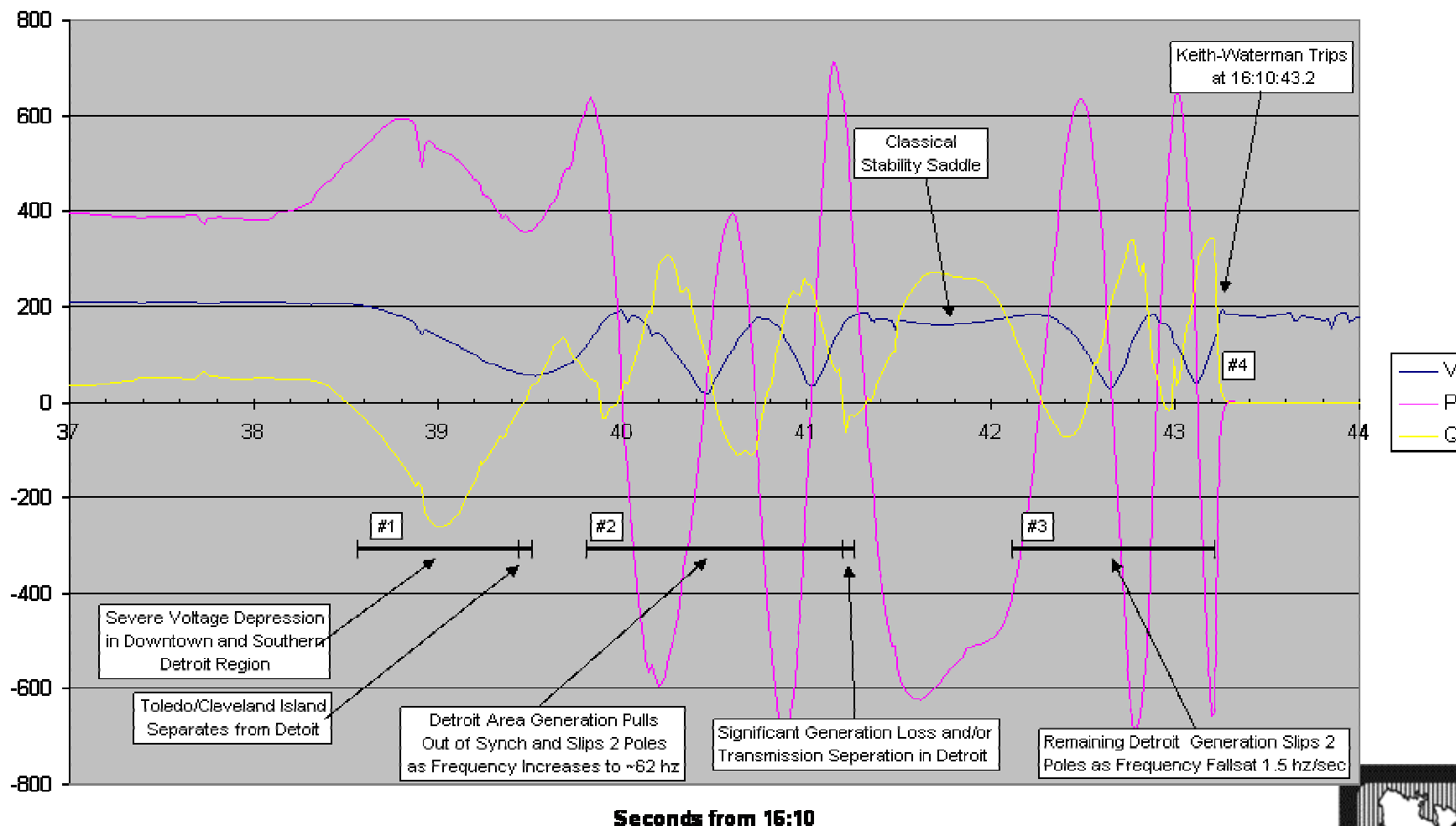
Progressively Worsening Stability Conditions

New York to Ontario 345 kV Line Flow at Niagara
(does not include 230 kV line flow)



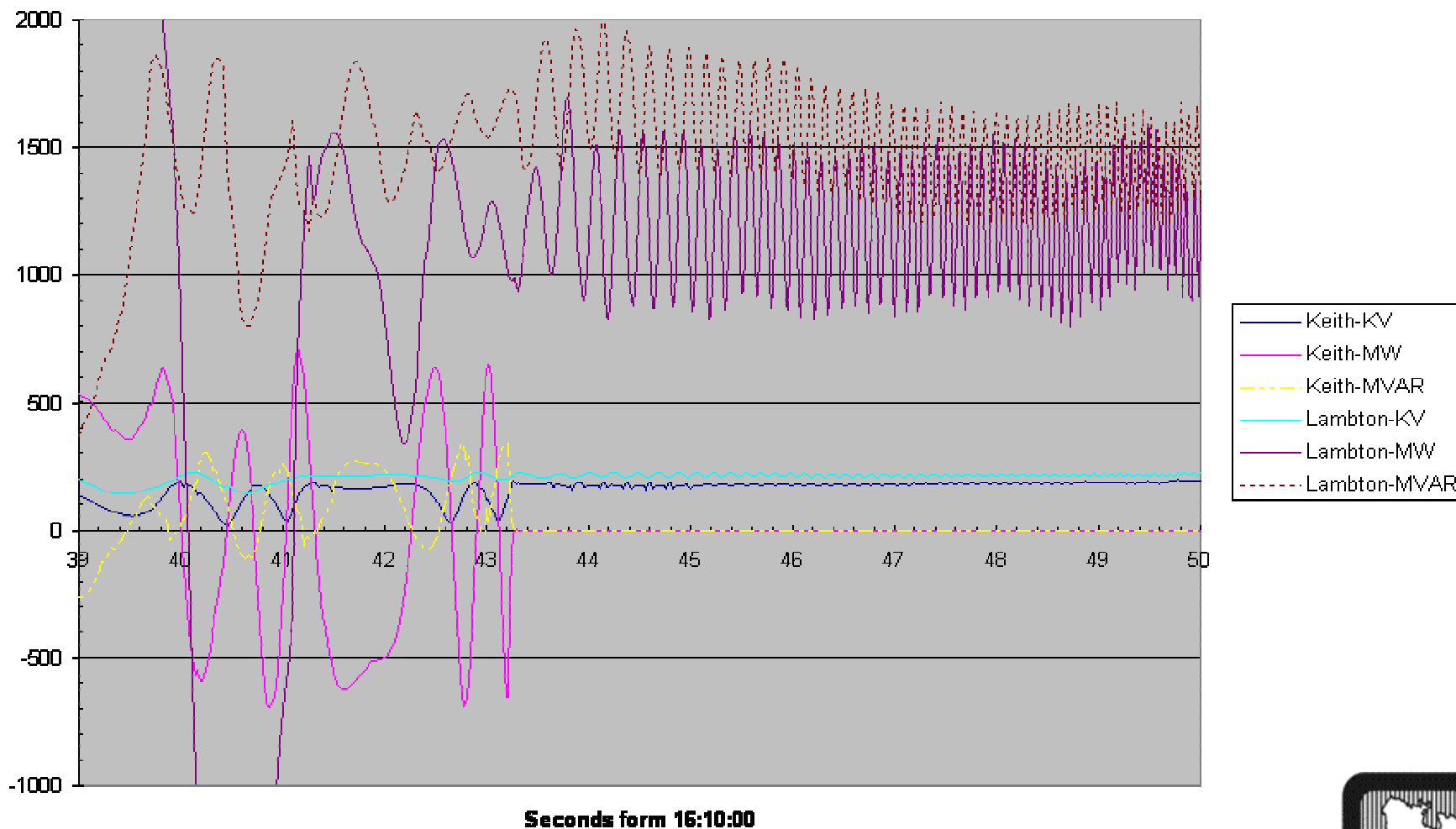
Detroit Units Slip Poles

Keith-Waterman (J5D) 230 kV - Tie Line



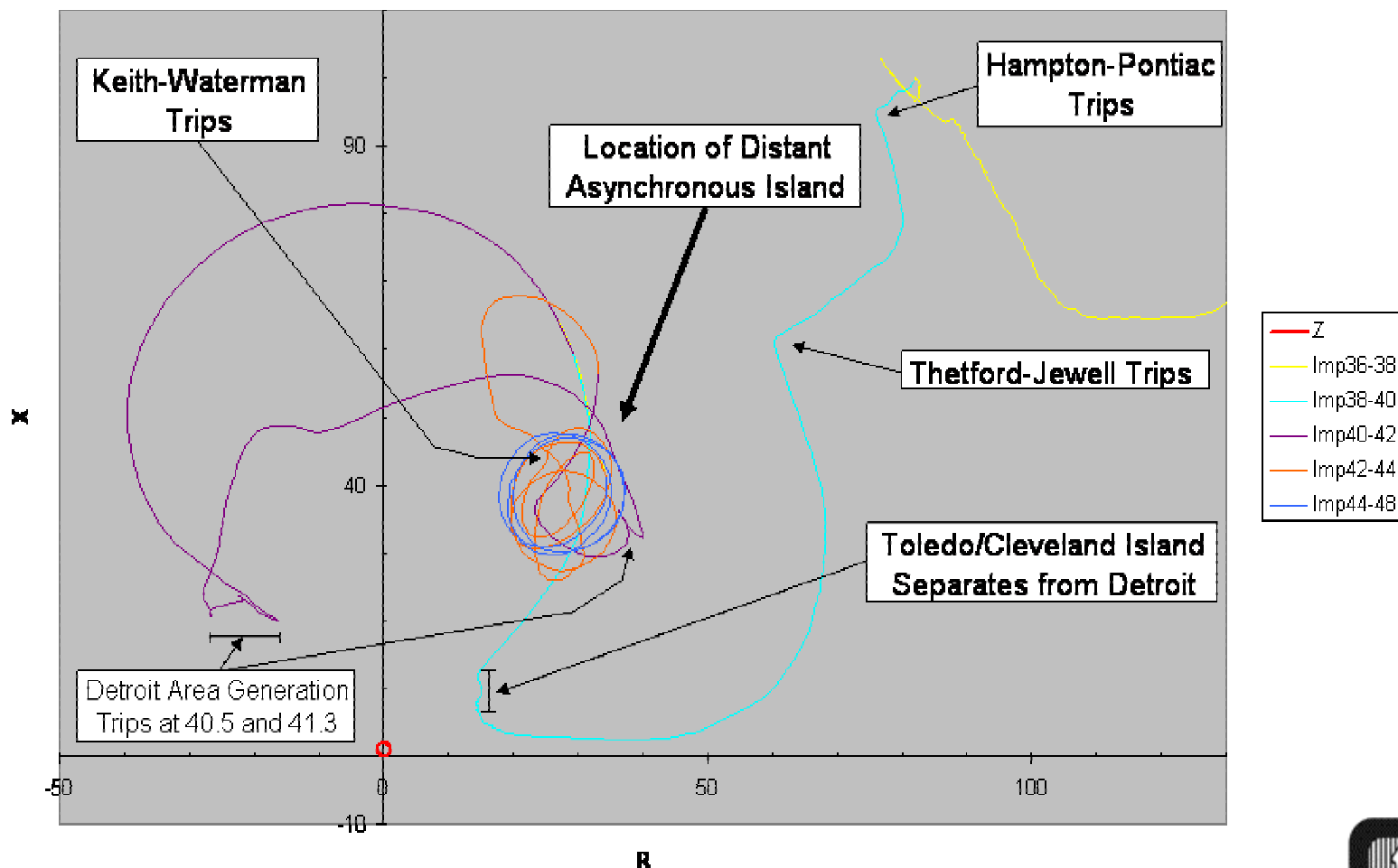
Severe Under Frequency Condition

Ontario - Michigan Net Tie Line Flow



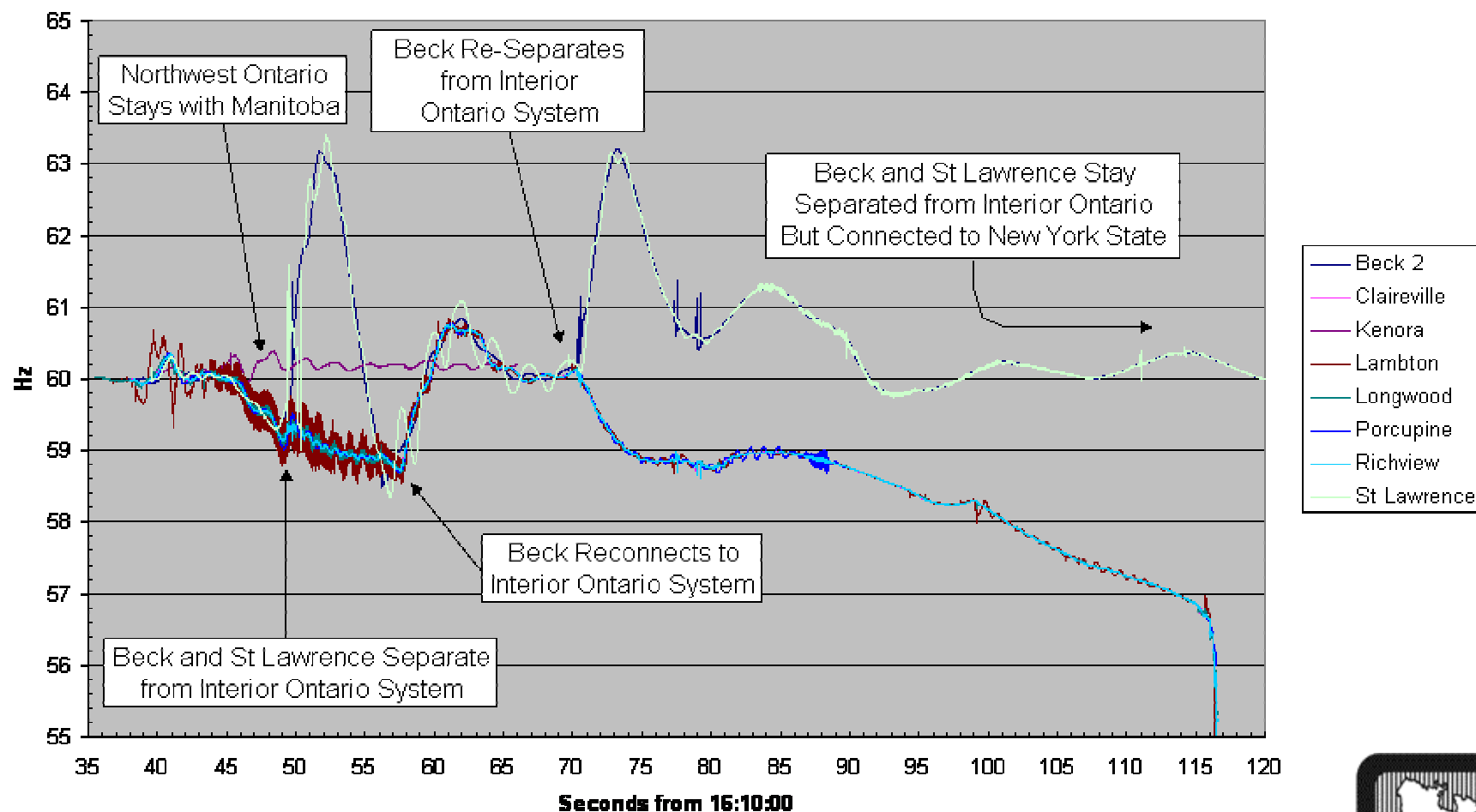
View Into Detroit from Lambton

Lambton-St Clair Tie Lines



Frequency in Ontario and New York

Frequency Separation Interior Ontario and Northern New York



Next Steps

- Implement strategic initiatives and recommendations
- Readiness audits
- Enact reliability legislation – mandatory standards and compliance enforcement

