

Voltage Collapse Simulation (Eastern Interconnection Scenario)

**Simulation Prepared by Dennis J. Ray
Executive Director
Power Systems Engineering Research Center**

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Introduction to the Simulation

These slides illustrate a voltage collapse scenario for the Eastern Interconnection based on a series of generator and line outages. An actual voltage collapse may not occur due to operator and protection system responses. This simulation does not model those responses. Neither does the simulation model dynamics associated with frequency and real power.

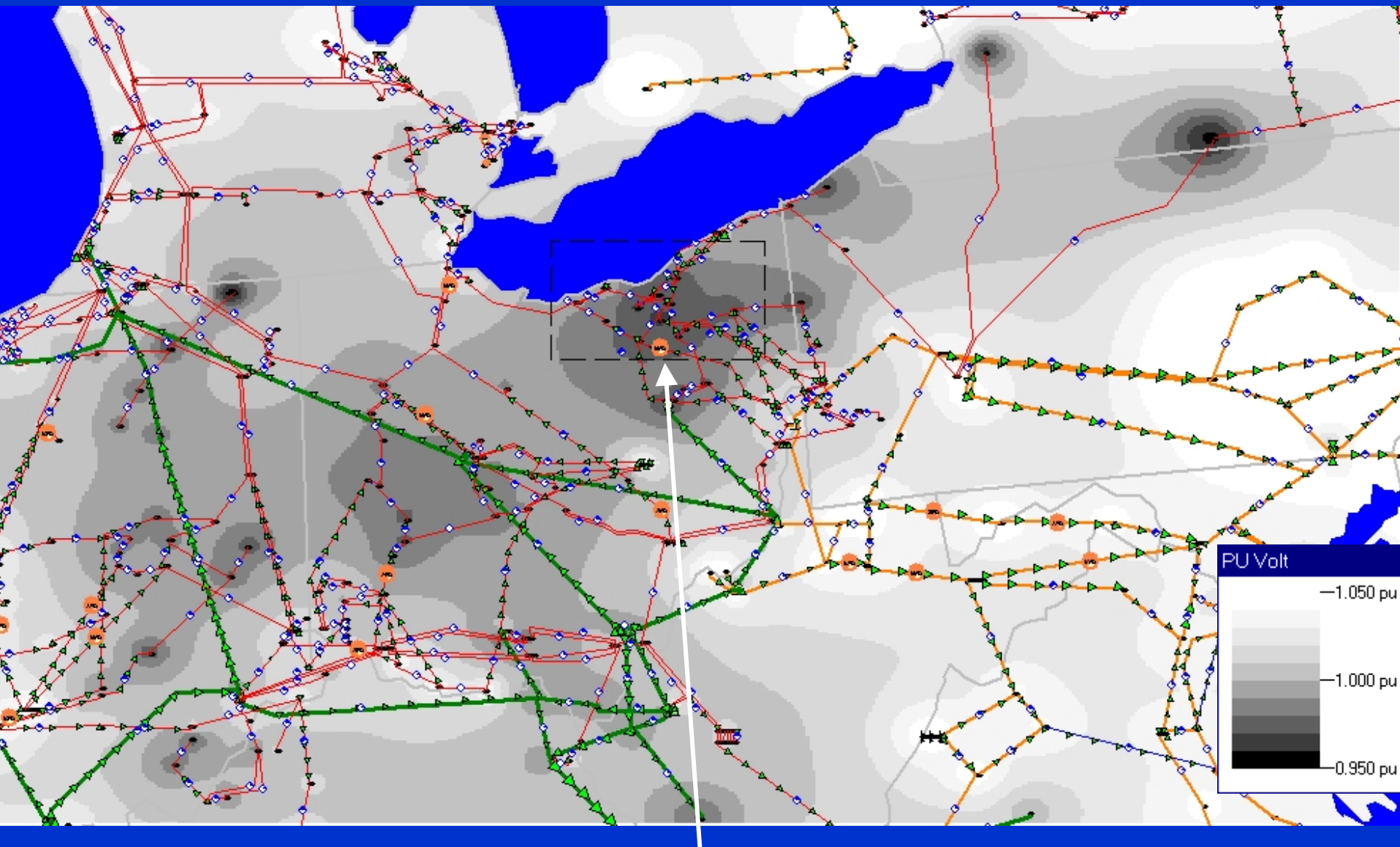
The simulation model uses 1998 FERC Form 715 data for the Eastern Interconnection. The data were adjusted for expected conditions at the time of system peak in the summer of 1998. The underlying planning model was prepared by the North American Electric Reliability Council's Multi-Regional Modeling Working Group. The model includes about 17,800 buses, 4,600 generating units, and 30,000 lines and transformers. Transmission voltages range from the sub-transmission level up to 765,000 volts (or 765 kV). The diagrams here only show lines at and above the 345 kV level.

Selected generation and line events are used to illustrate the general consequences of such events in the U.S.-Canadian Outage Task Force timeline. This simulation was developed with a [presentation](http://pserc.org) describing the Blackout of 2003 that is available on the PSERC web site, <http://pserc.org>.

Symbols in the Simulation Window

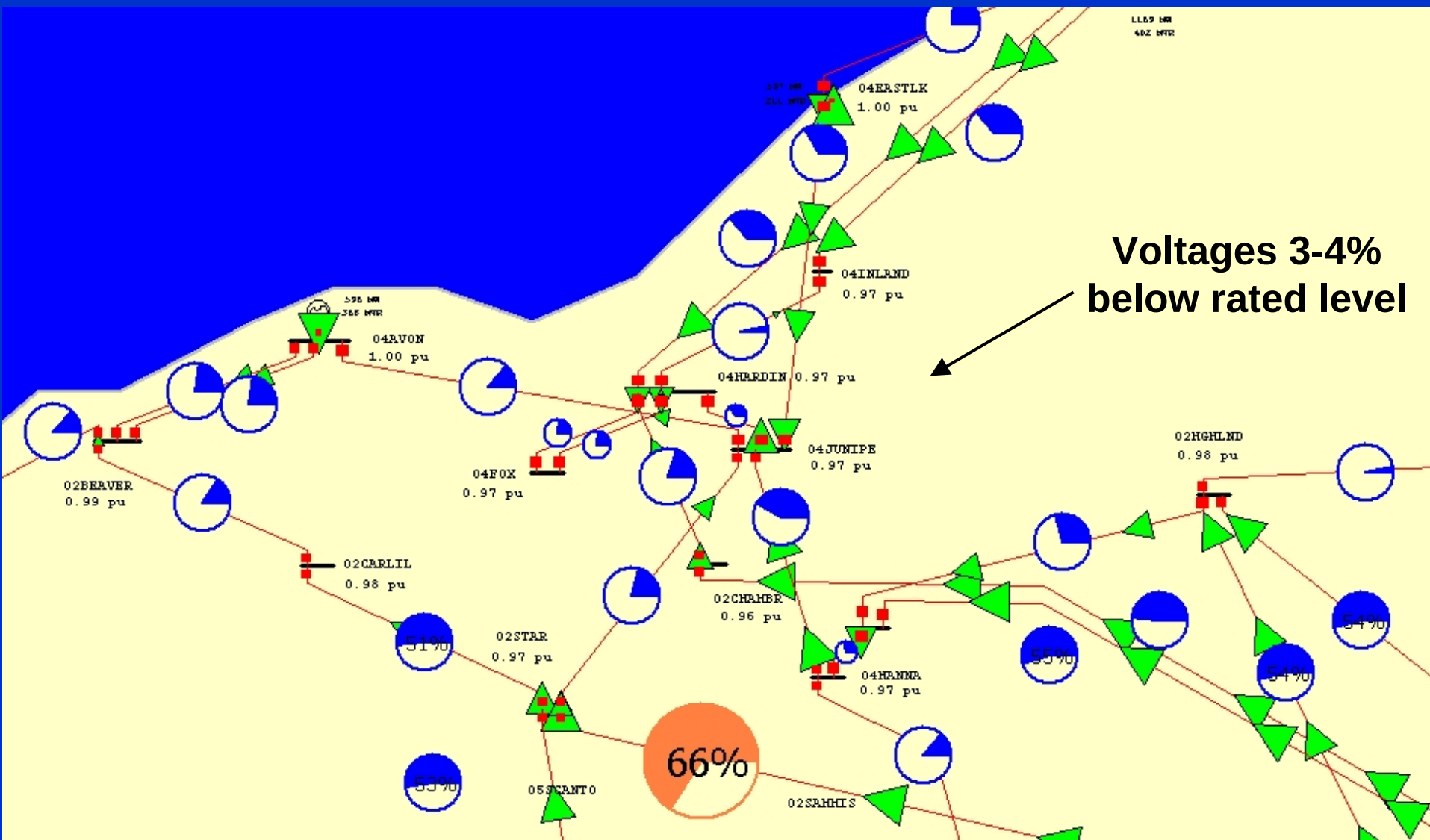
- Buses: heavy dark lines where the generators, loads and transmission lines interconnect
- Transmission lines: red lines connecting the two buses
(All the lines shown are 345 kV.)
- Generators: circles with “dog bone rotors”
- Loads: arrows connected to the buses
- Circuit breakers: red boxes
- Line flows: arrows on the transmission lines indicate the direction and magnitude of power flow
- Bus voltage: measured relative to rated voltage of 1.0 pu.
(Example: a bus voltage of 0.96 is 4% below the rated voltage.)
- Pie chart: gives percent power flow is of the line's rating

Base Case Voltage Contours

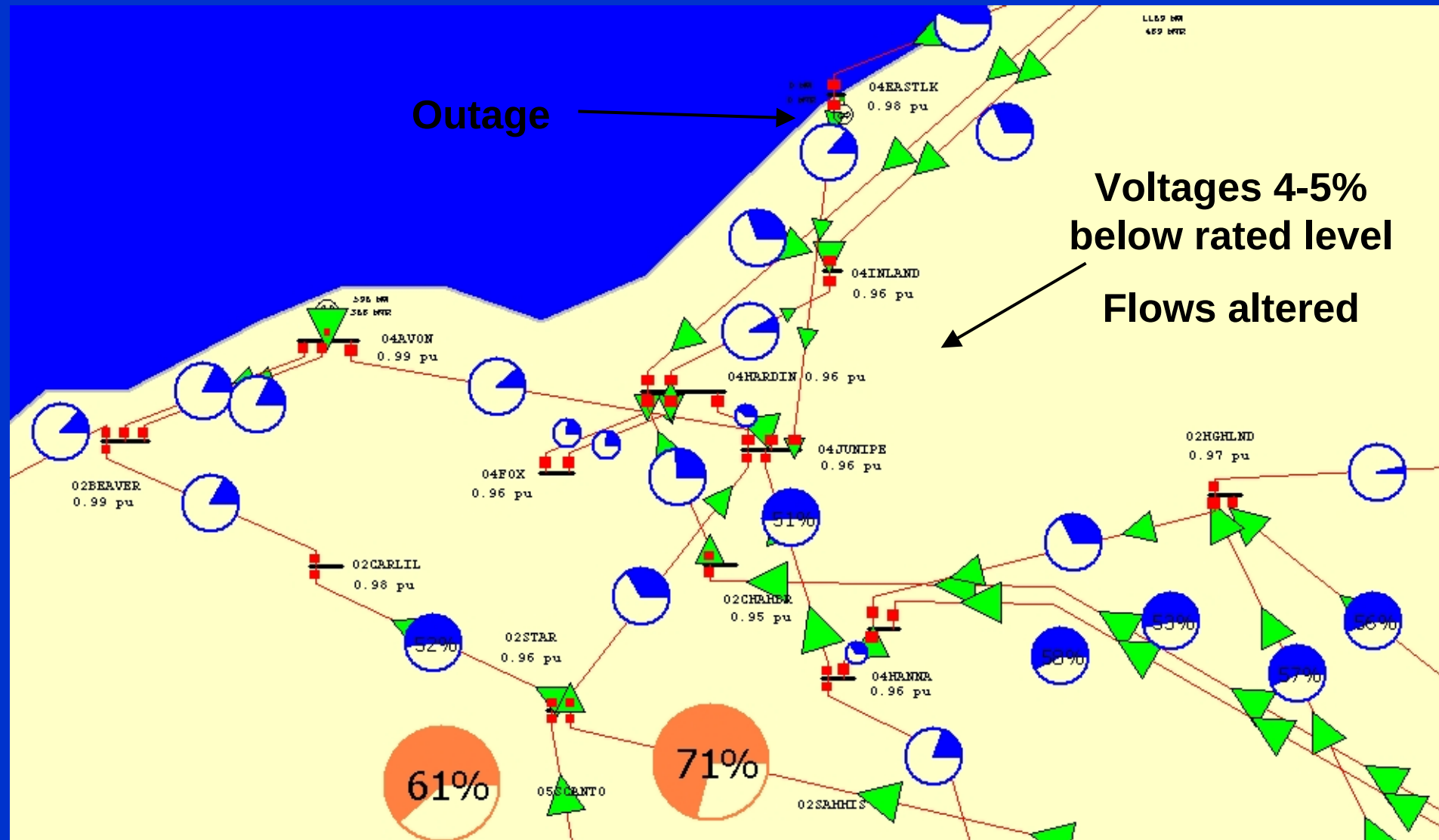


Area where selected generator and line outages occur in this scenario.

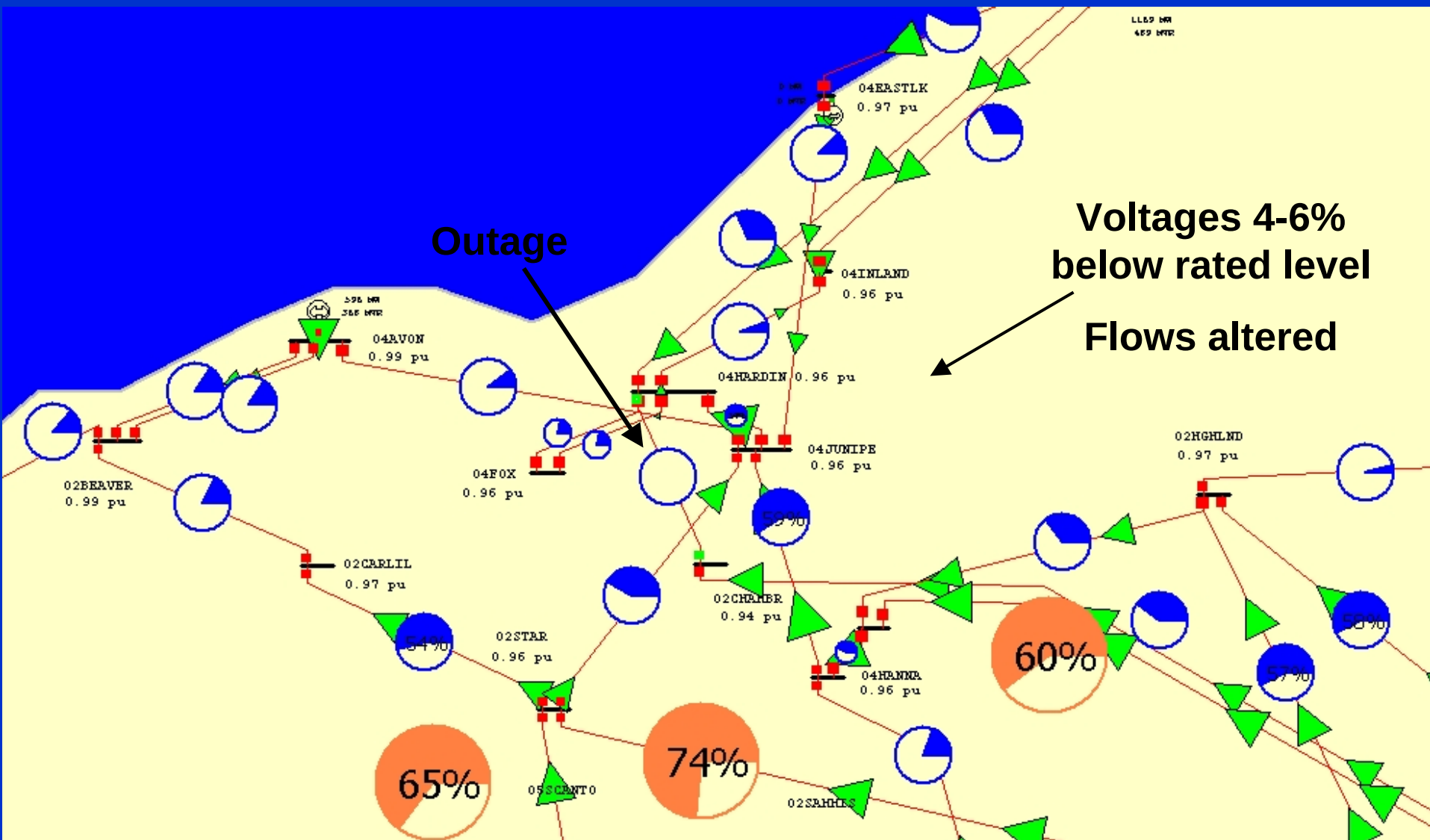
Case 1: All Generators and Lines In-Service



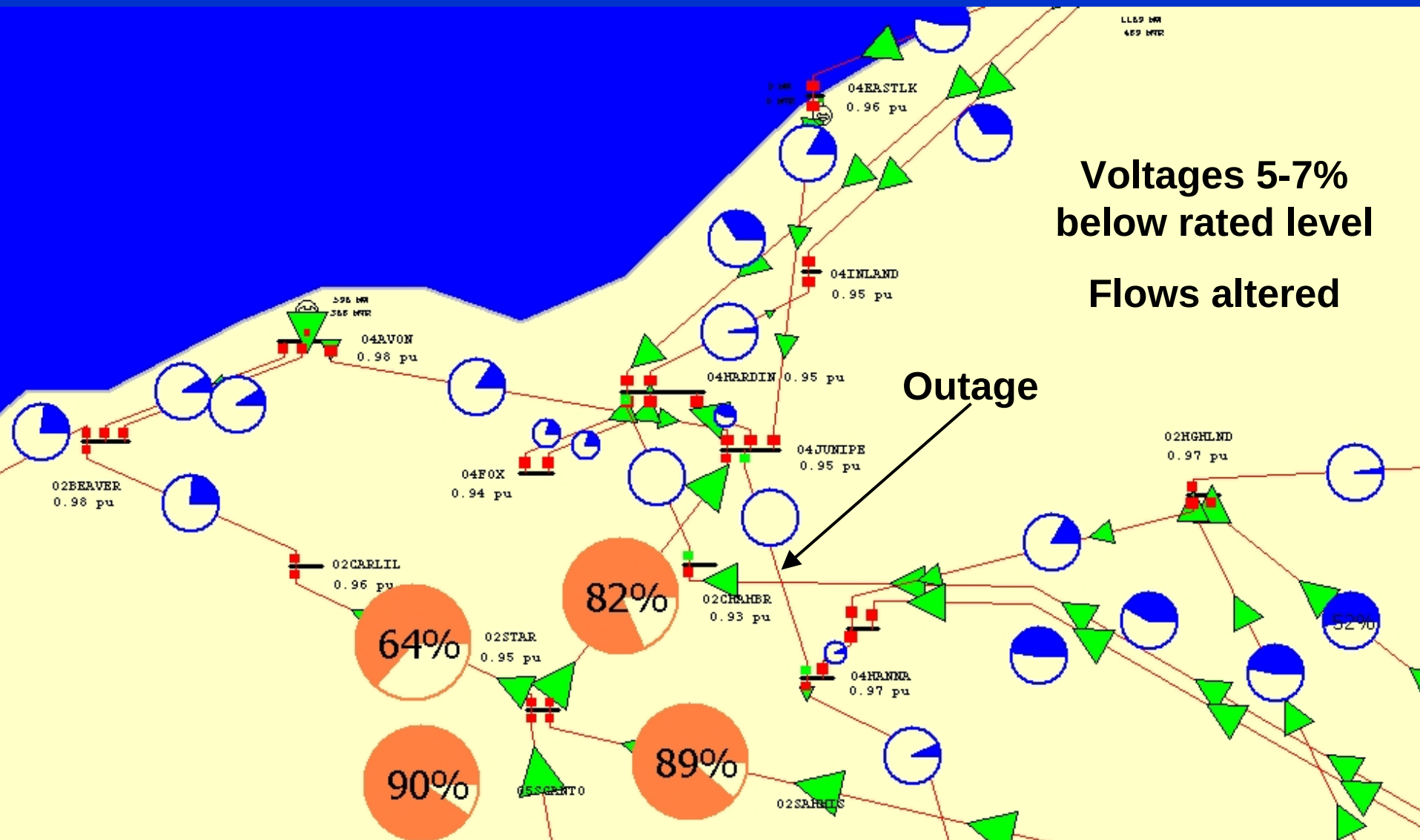
Case 2: East Lake Generating Unit Trips (loss of 592 MW and 200 Mvars in this scenario)



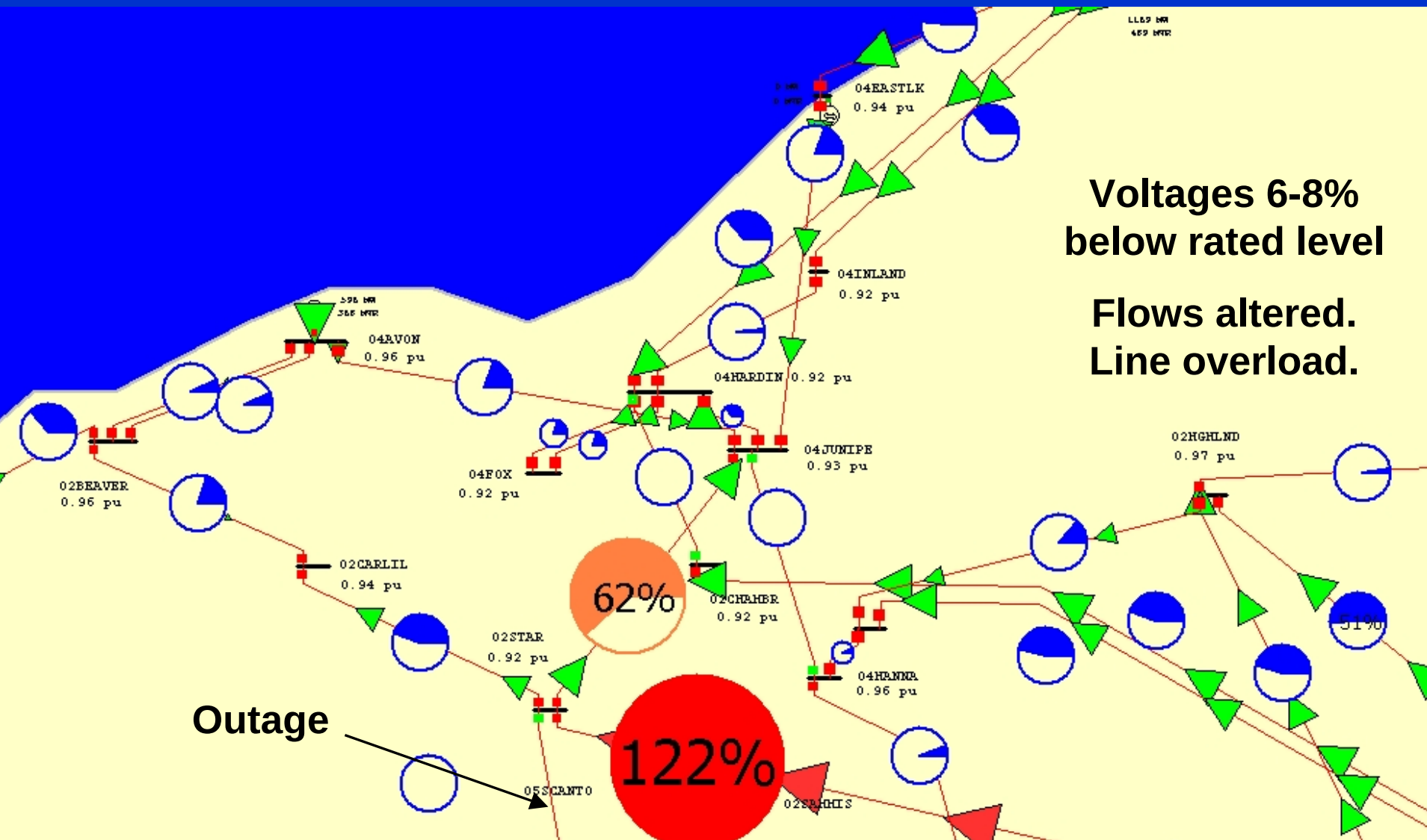
Case 3: 345 kV Harding-Chamberlain Line Trips



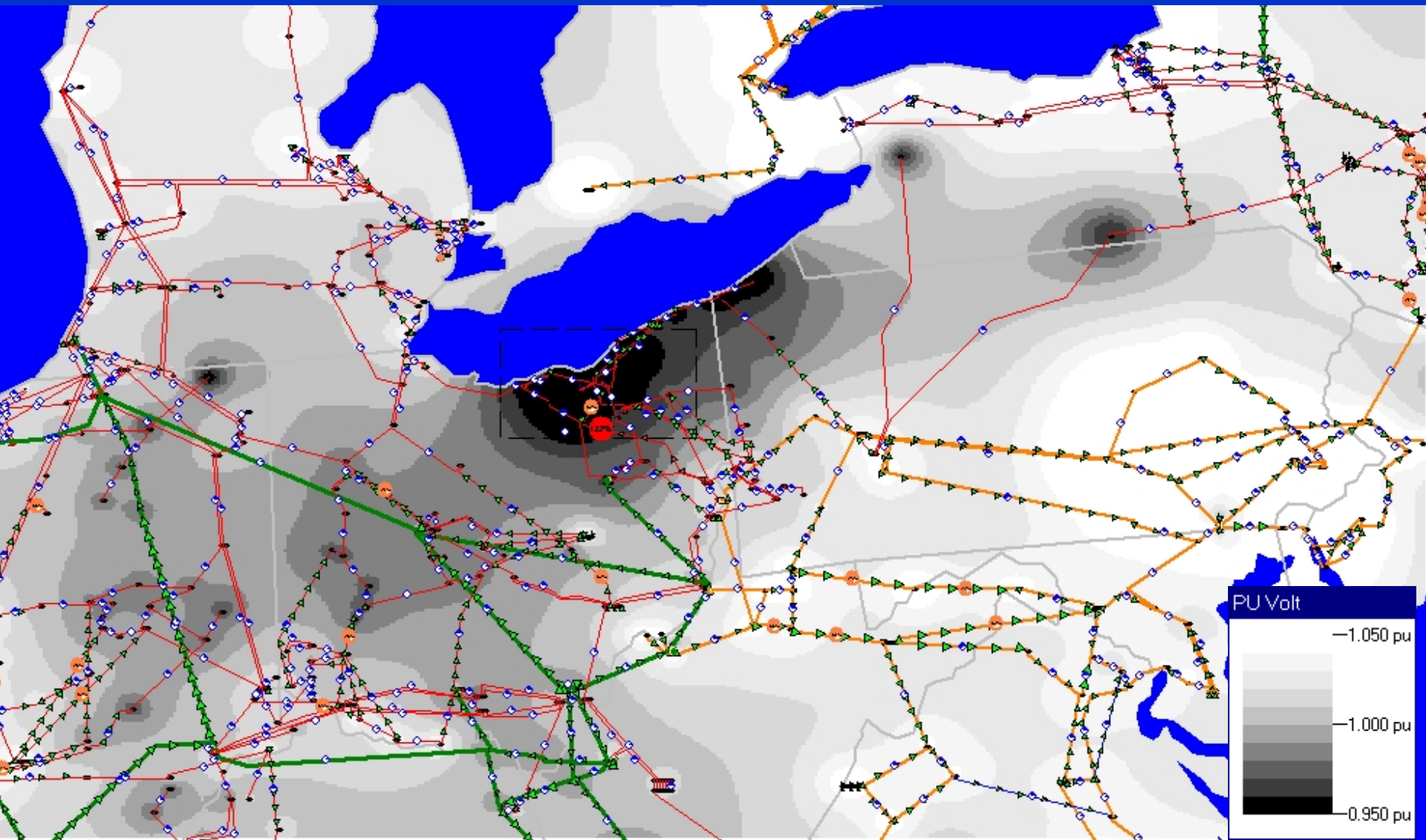
Case 4: 345 kV Hanna-Juniper Line Trips



Case 5: 345 kV Star-South Canton Line Trips



Voltage Contours before the Sammis-Star Line Trips



Case 6: 345 kV Sammis-Star Line Trips

Voltage Collapse. The simulation could not solve. Numbers shown are from the last iteration of the search for a solution.

