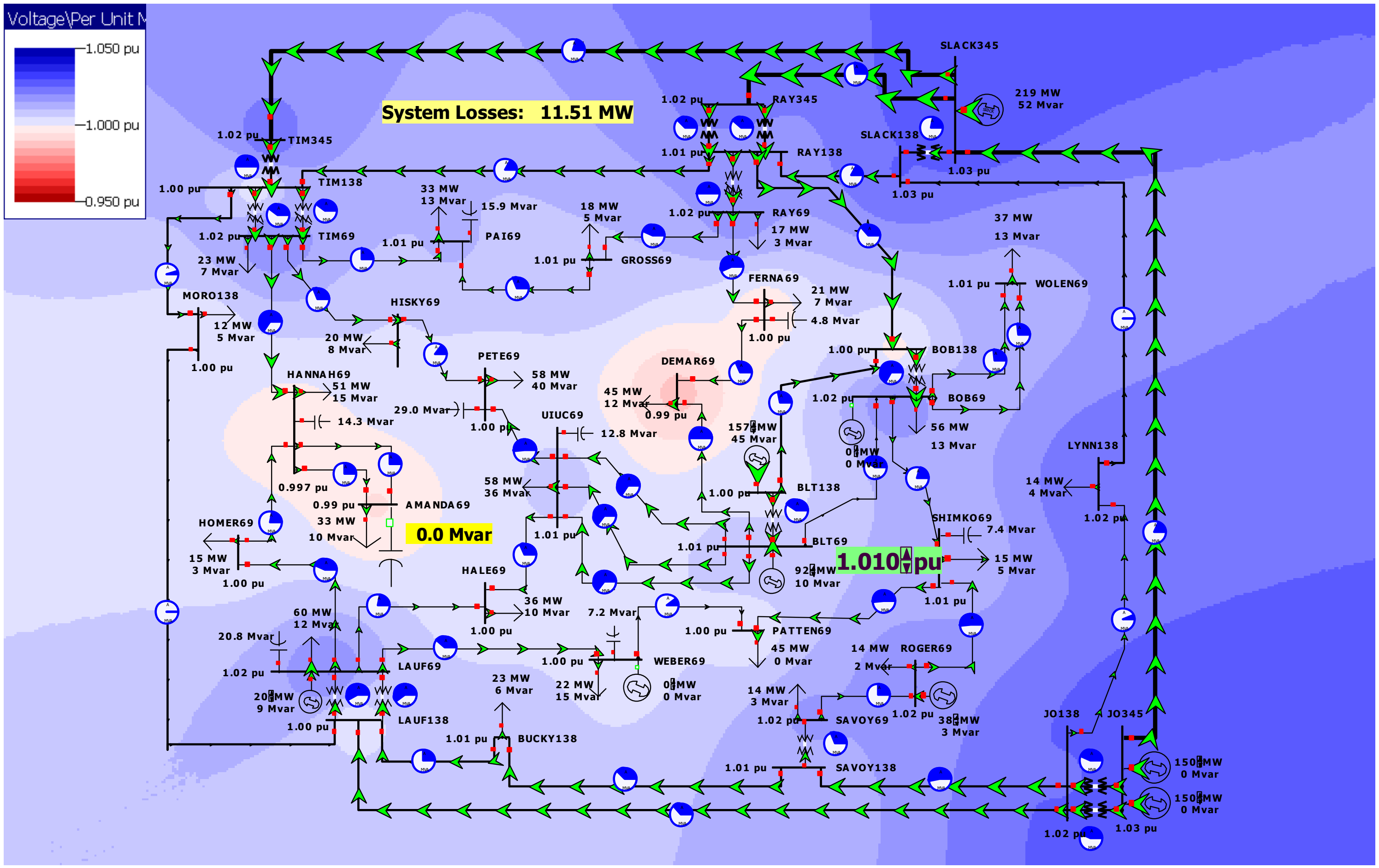
Lecture 4

Voltage Regulation Example: 37 Buses

Automatic voltage regulation system controls voltages.



Display shows voltage contour of the power system

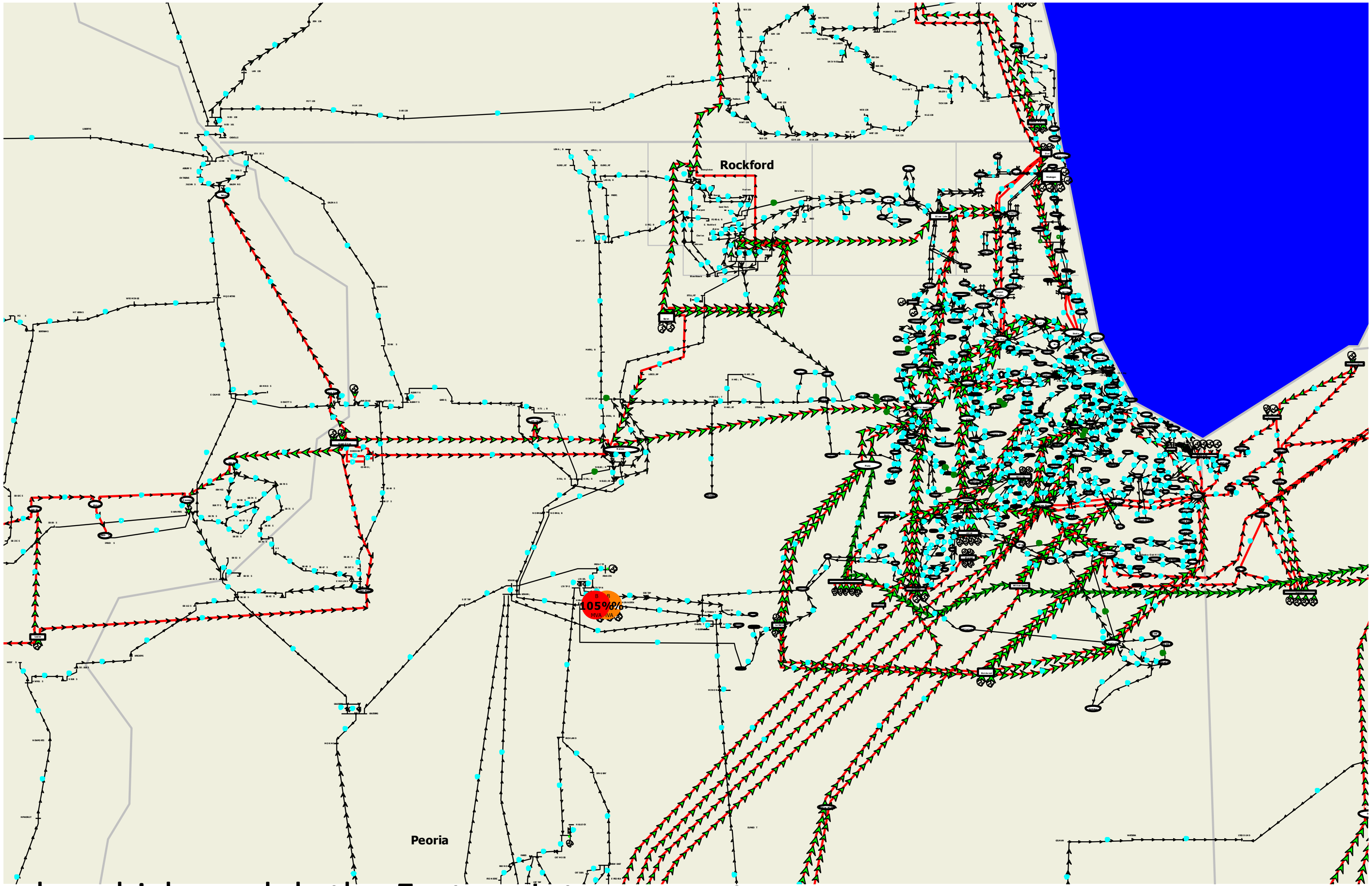
Real-sized Power Flow Cases

- Real power flow studies are usually done with cases with many thousands of buses
  - Outside of ERCOT, buses are usually grouped into various balancing authority areas, with each area doing its own interchange control.
- Cases also model a variety of different automatic control devices, such as generator reactive power limits, load tap changing transformers, phase shifting transformers, switched capacitors, HVDC transmission lines, and (potentially) FACTS devices.

Sparse Matrices and Large Systems

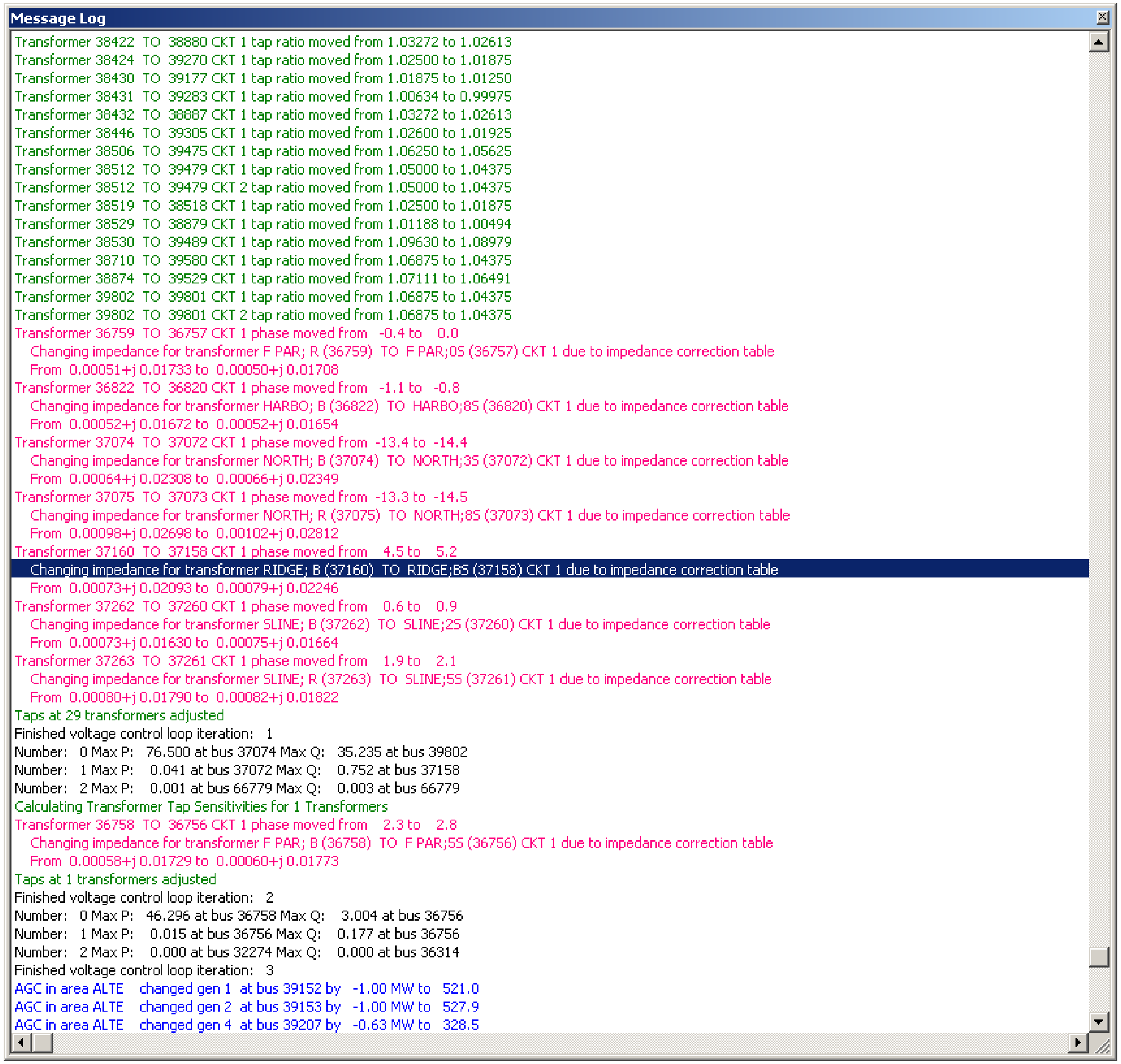
- Since for realistic power systems the model sizes are quite large, this means the Y_{bus} and Jacobian matrices are also large.
- However, most elements in these matrices are zero, therefore special techniques, sparse matrix/vector methods, are used to store the values and solve the power flow:
    - Without these techniques large systems would be essentially unsolvable.

Eastern Interconnect Example



Example, which models the Eastern Interconnect contains about 43,000 buses.

Solution Log for 1200 MW Outage



In this example the losss of a 1200 MW generator in Northern Illinois was simulated. This caused a generation imbalance in the associated balancing authority area, which was corrected by a redispatch of local generation.