

Preliminary dynamic results

- § Preliminary dynamic simulations were performed on cases of EIRGRID+SONI for 2020 with and without planned wind generation
- § Simulations of characteristic disturbances were compared in order to assess the impact of high penetration of wind generation:
 - § **System frequency**
 - § **Power system total generation and losses**
 - § **Voltages of 400 kV, 220kV and 110 kV**

Introduction

§ Simulated disturbances:

§ Outage of 132 MW steam unit in Tynagh

§ Three phase fault in S/S 400 kV Woodland (100 ms duration) followed by outage of 400 kV line Woodland – Oldstree

§ Three phase fault in S/S 220 kV Maynooth (100 ms duration) followed by outage of 220 kV line Maynooth – Finnstown

§ Three phase fault in S/S 110 kV Cathleens Fall (100 ms duration) followed by outage of 110 kV line Cathleens Fall – Srananagh

Introduction

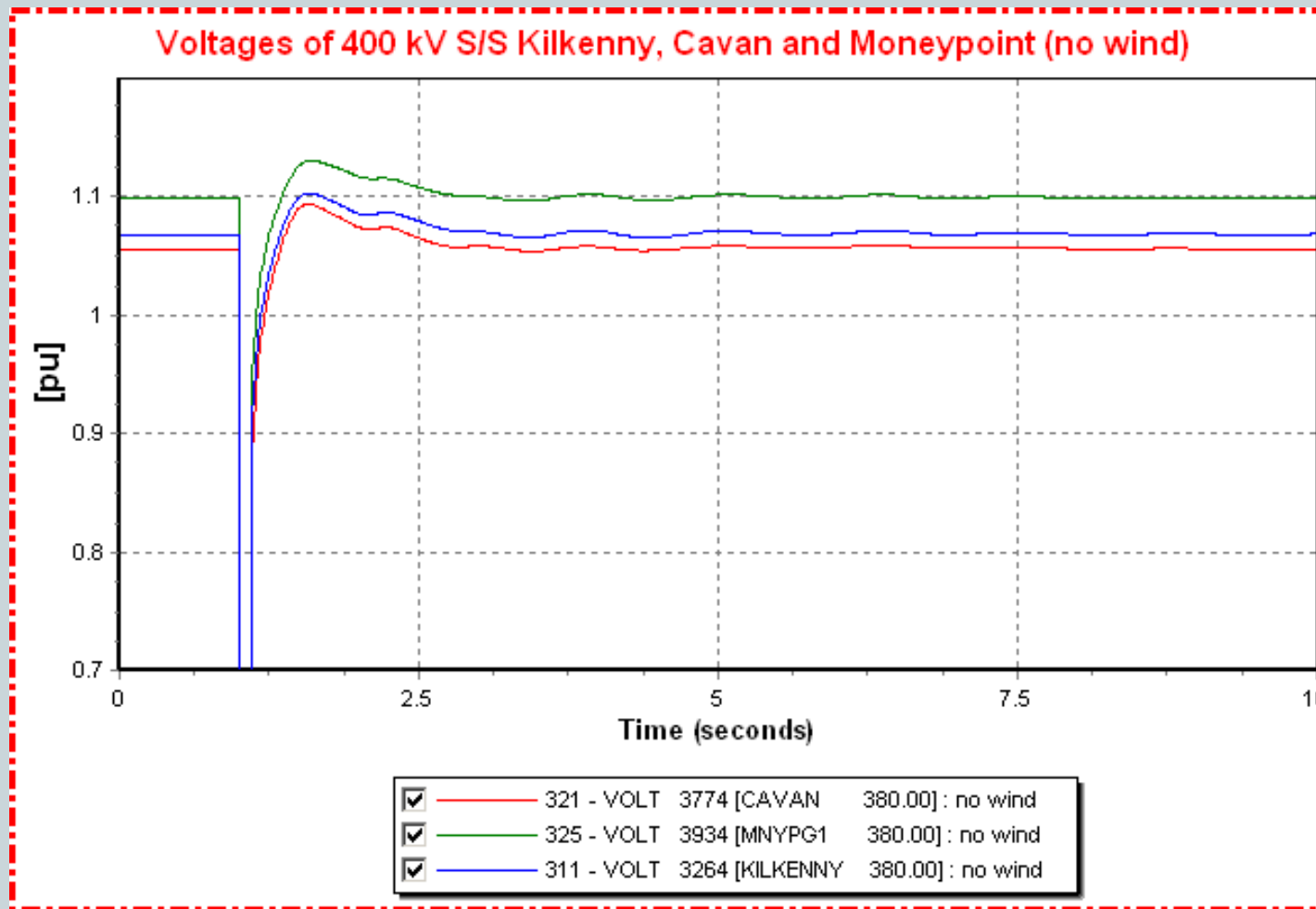
§ In case of connected wind generation:

§ Fully rated converter wind generators (Type D) were included only

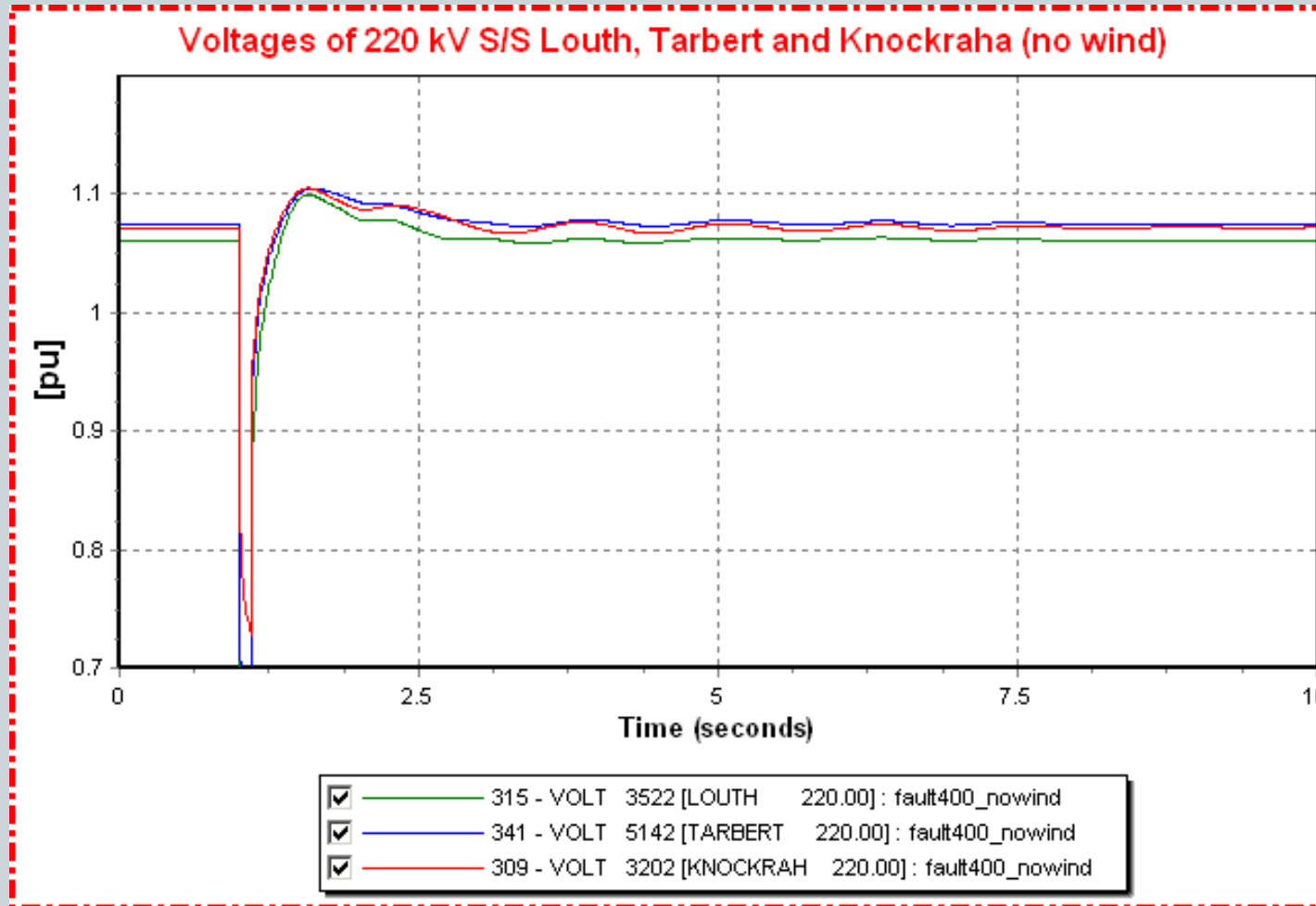
§ Total wind power generation is 50% of planned installed wind power or 3775MW

§ That is 48.5% of total generation (7768 MW) from all power sources

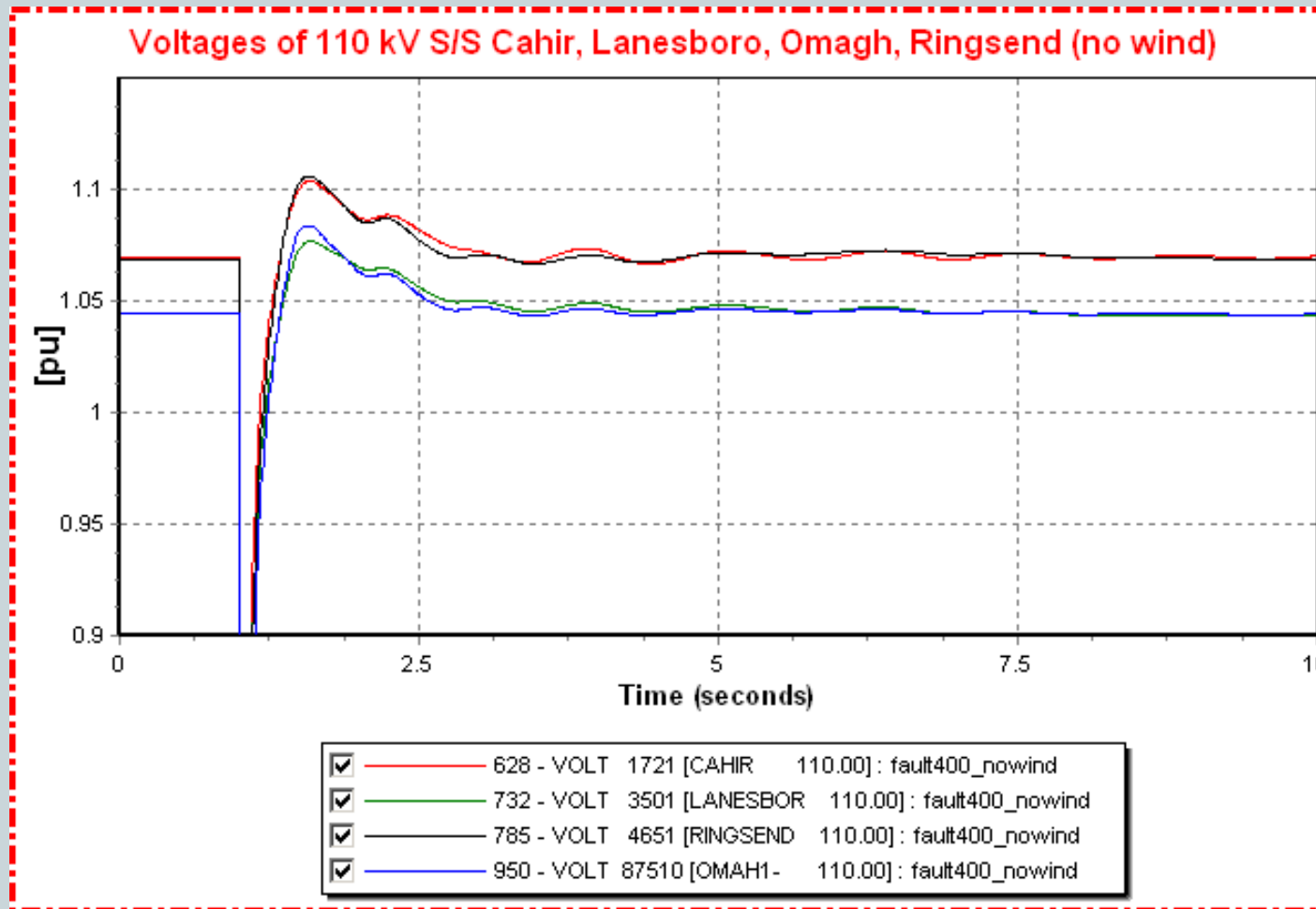
Fault on 400 kV level : 400 kV bus voltages in “no wind” case



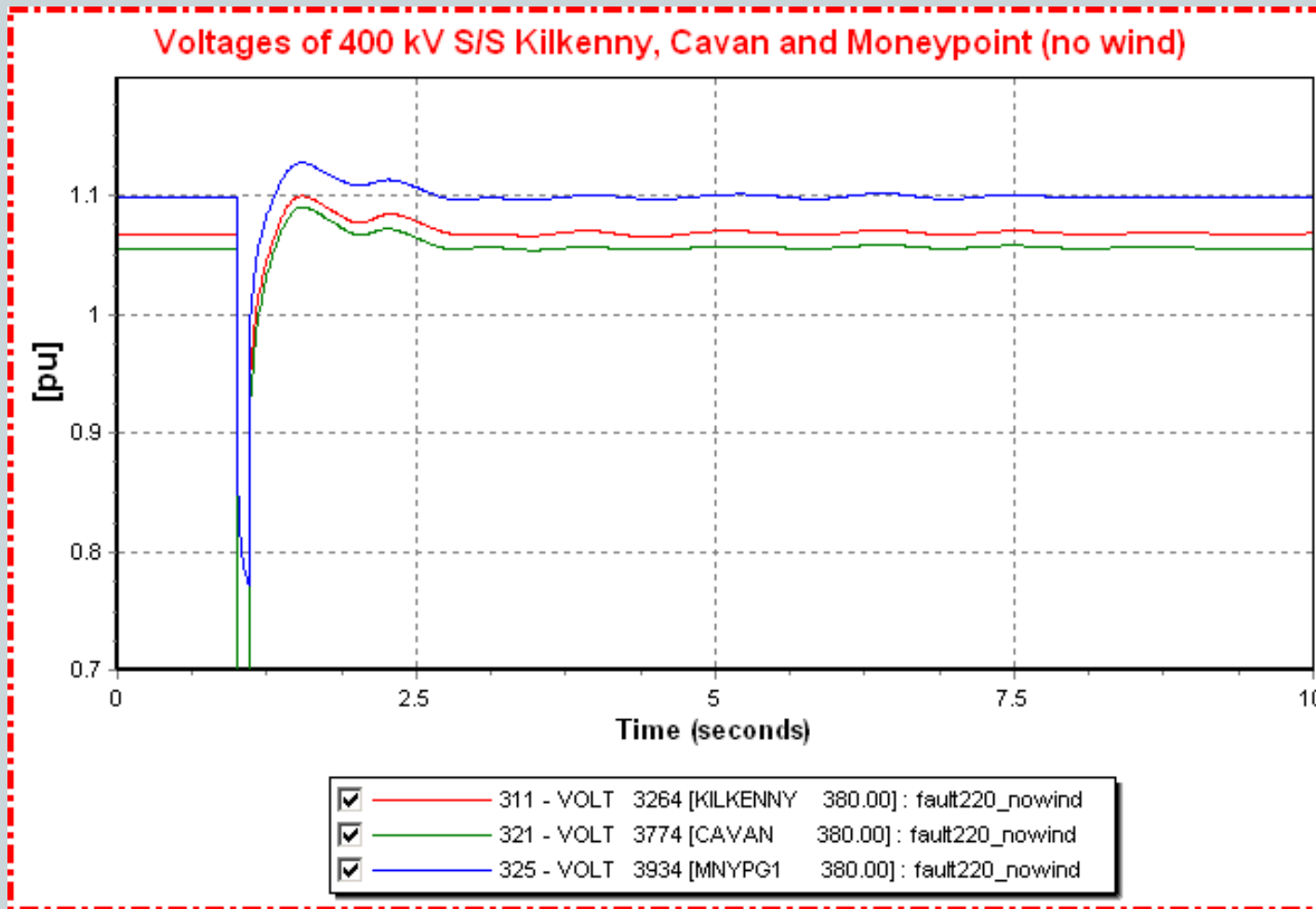
Fault on 400 kV level : 220 kV bus voltages in “no wind” case



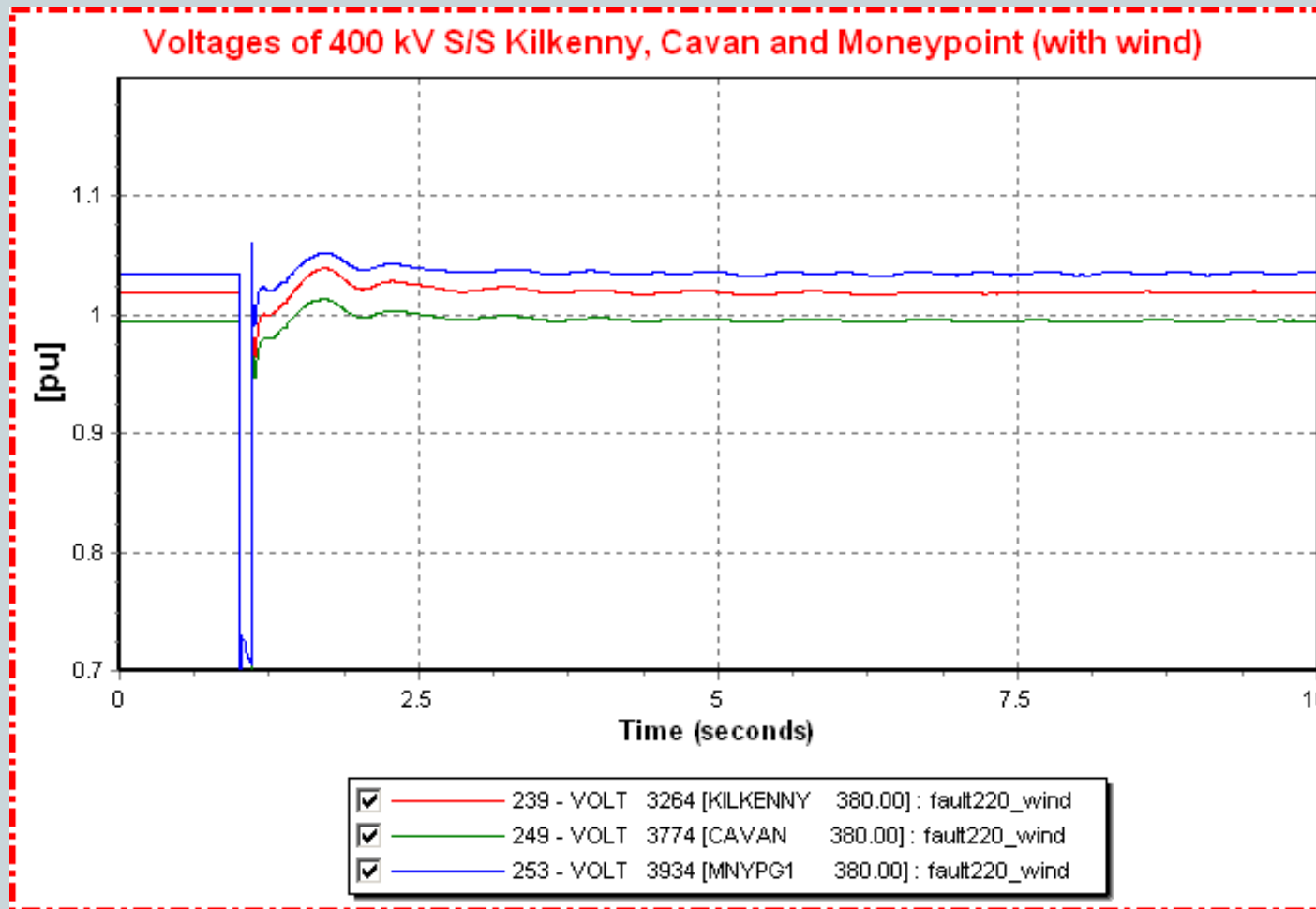
Fault on 400 kV level : 110 kV bus voltages in “no wind” case



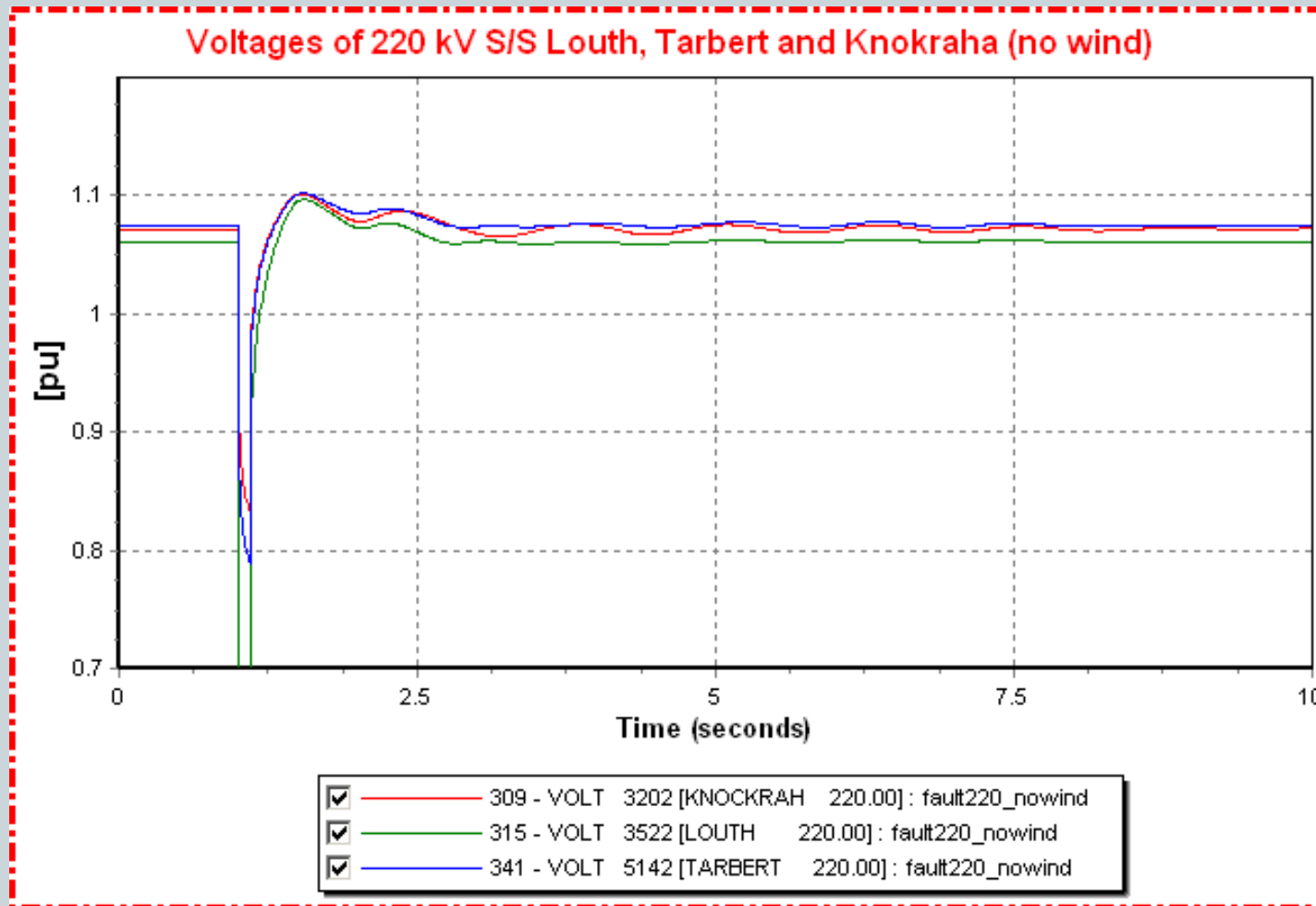
Fault on 220 kV level : 400 kV bus voltages in “no wind” case



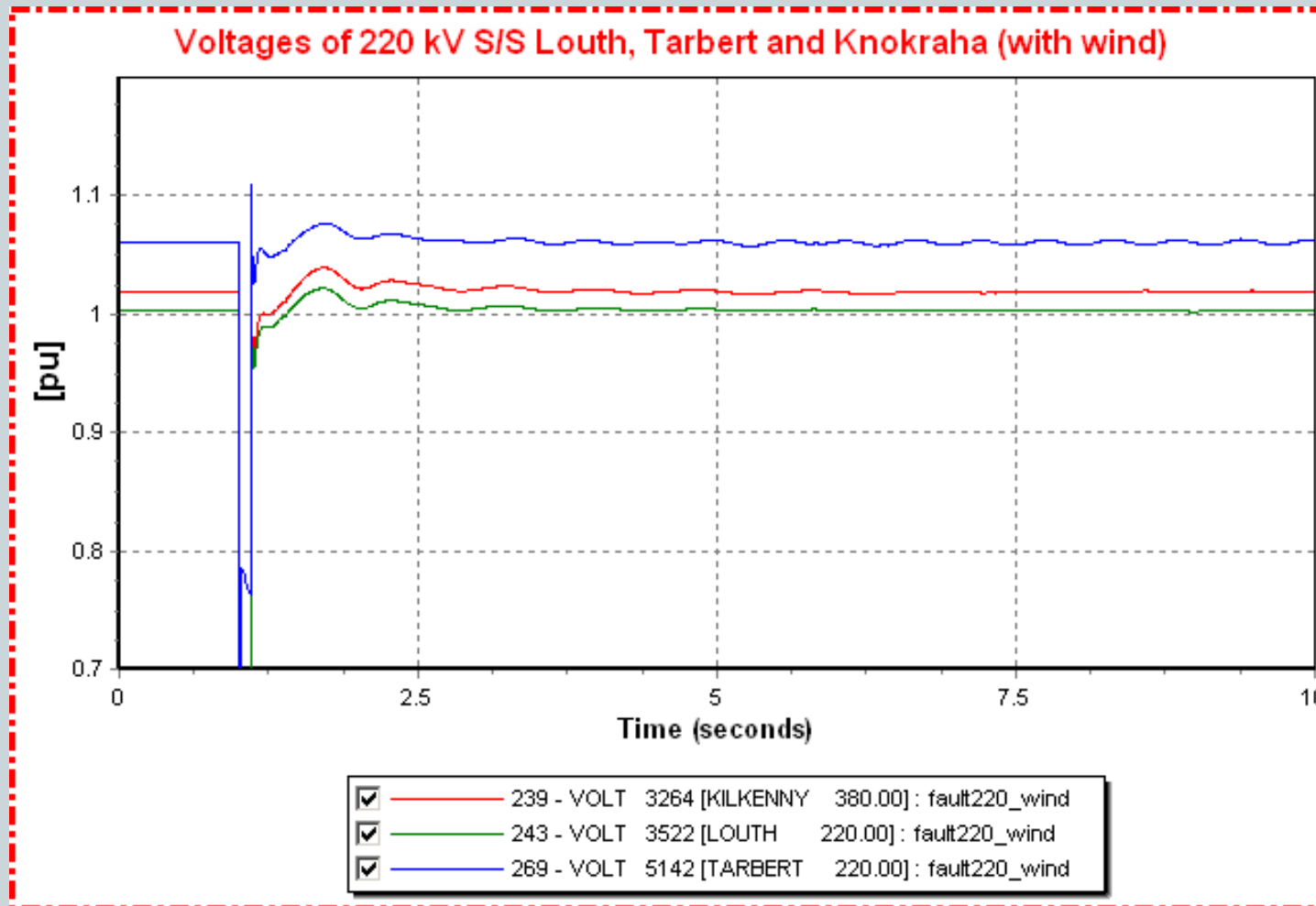
Fault on 220 kV level : 400 kV bus voltages in “with wind” case



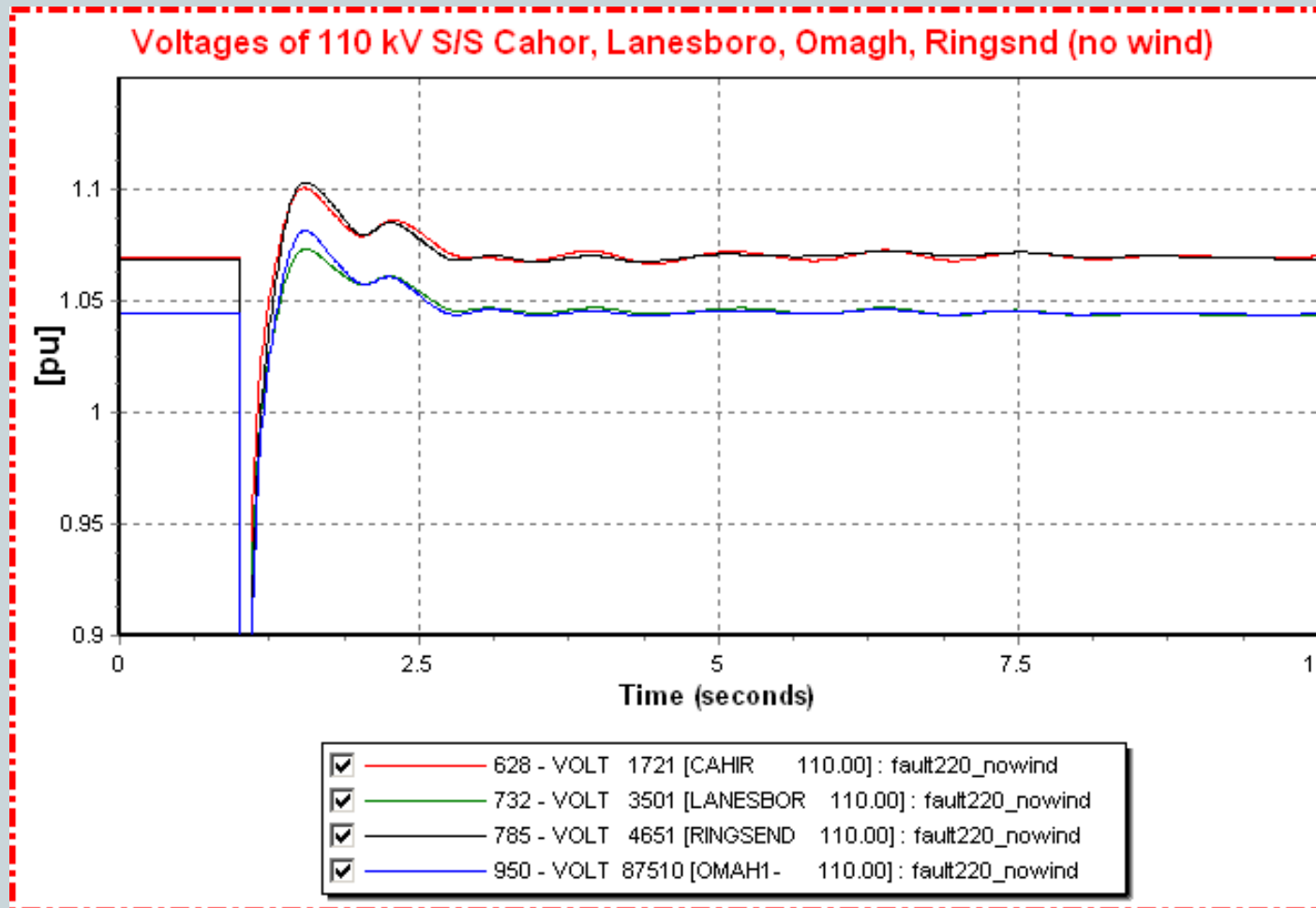
Fault on 220 kV level : 220 kV bus voltages in “no wind” case



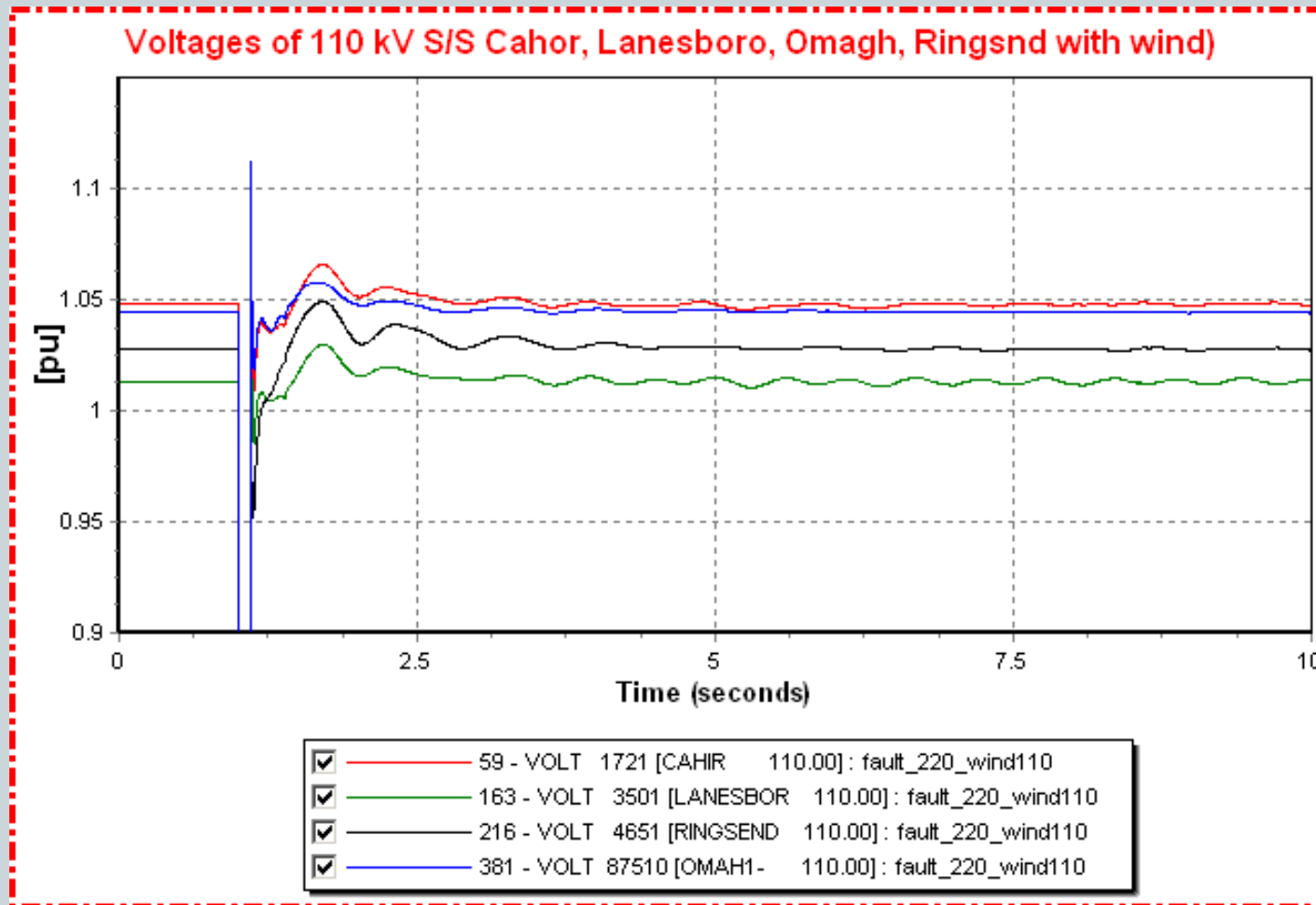
Fault on 220 kV level : 220 kV bus voltages in “with wind” case



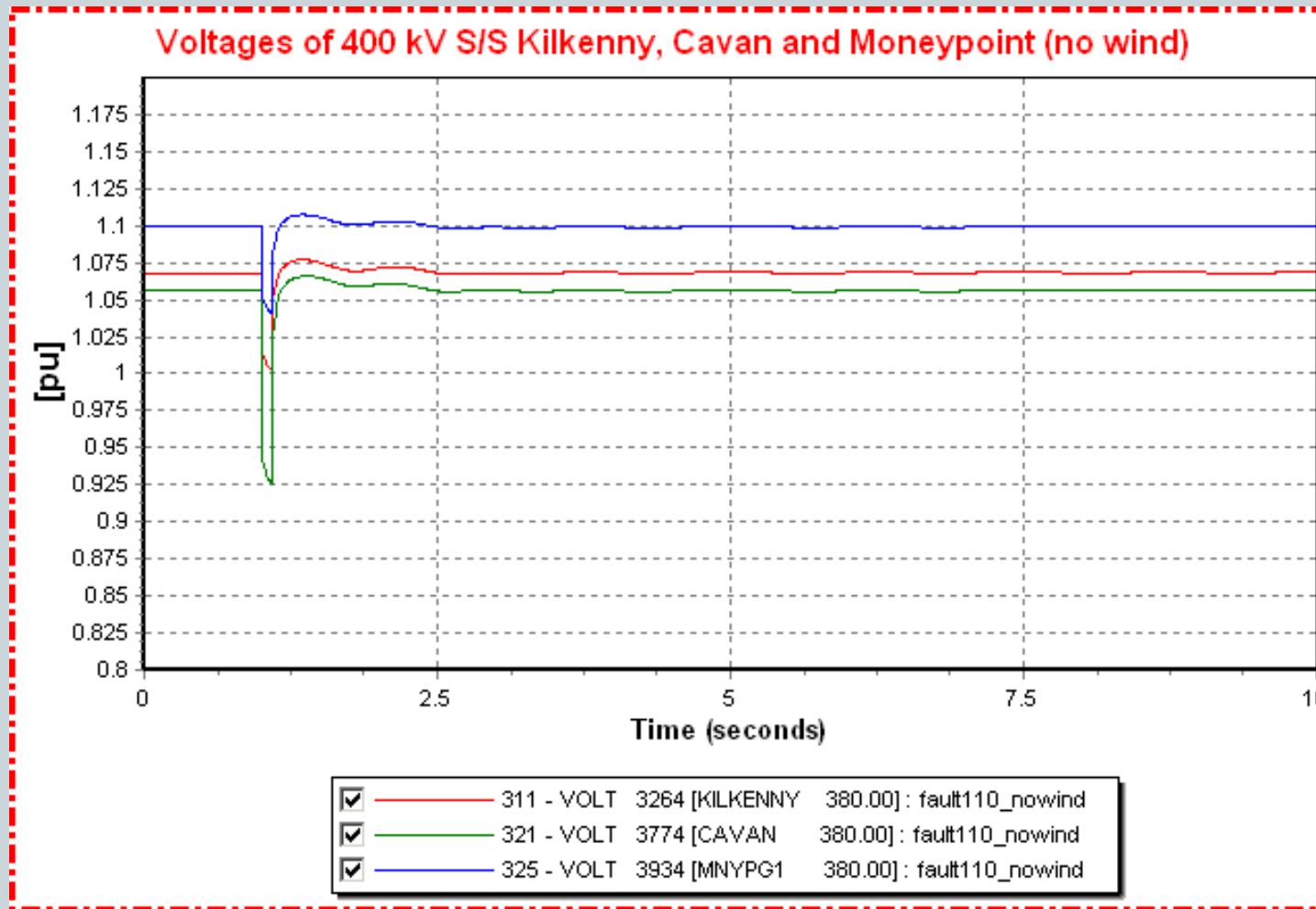
Fault on 220 kV level : 110 kV bus voltages in “no wind” case



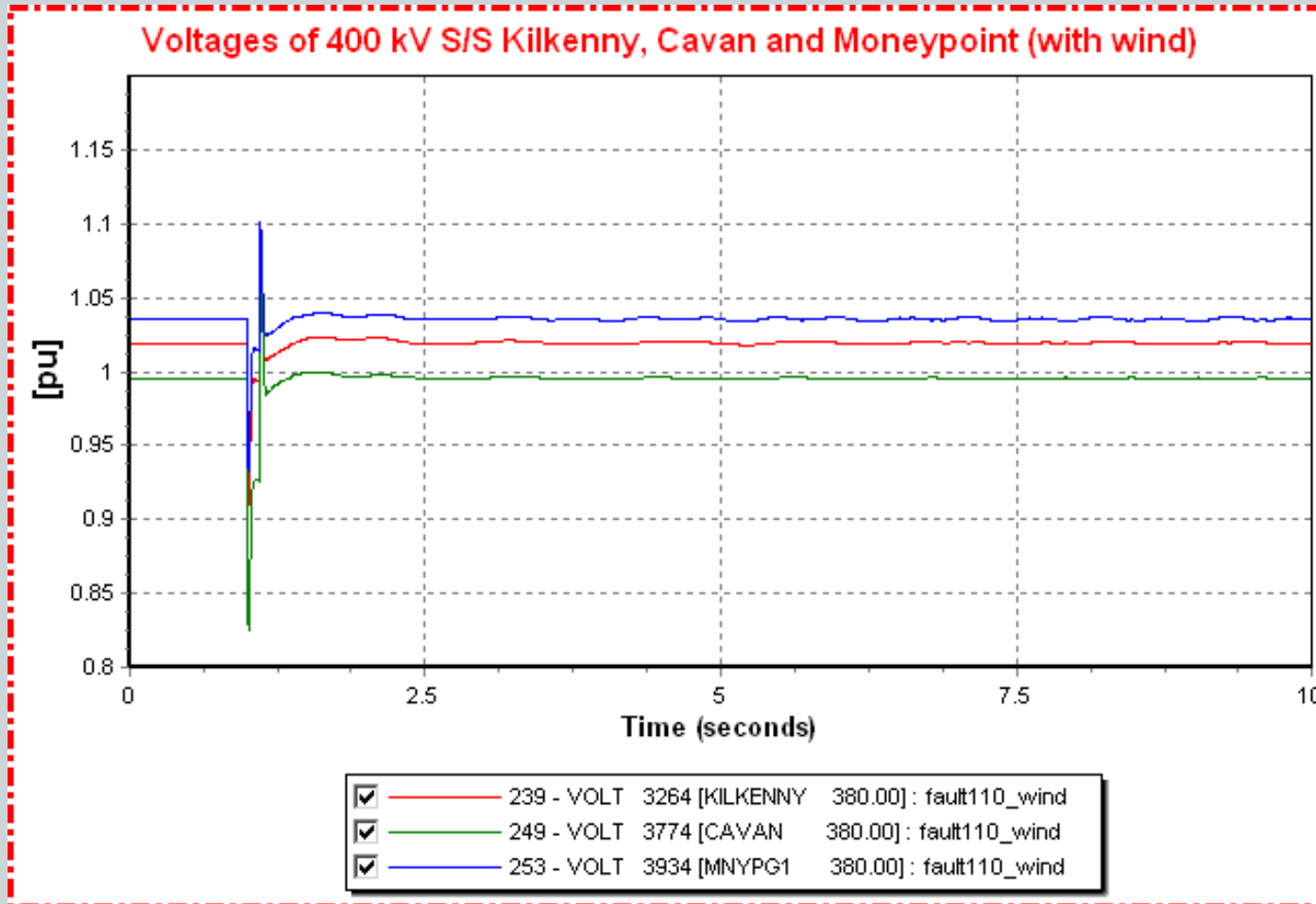
Fault on 220 kV level : 220 kV bus voltages in “with wind” case



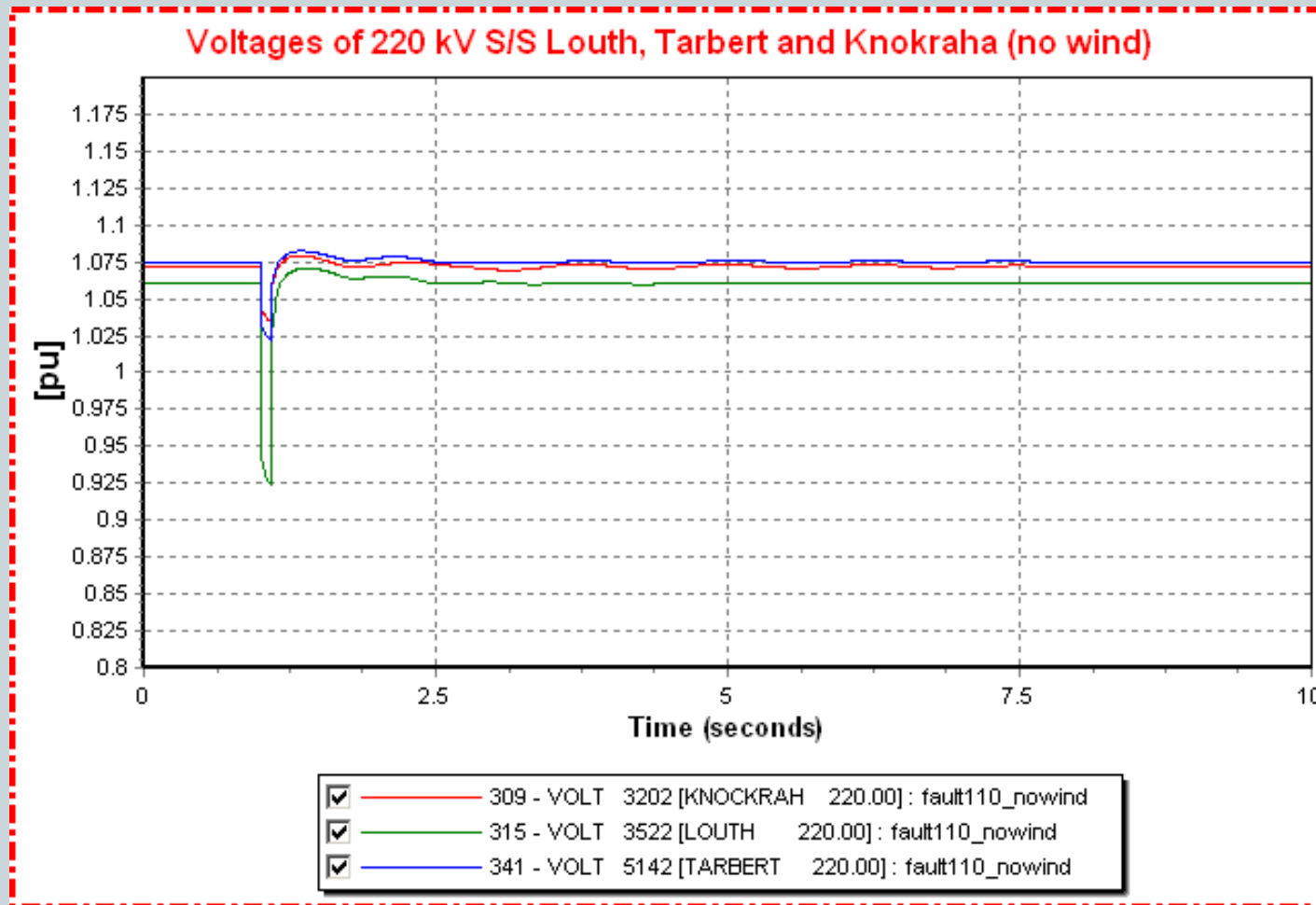
Fault on 110 kV level : 400 kV bus voltages in “no wind” case



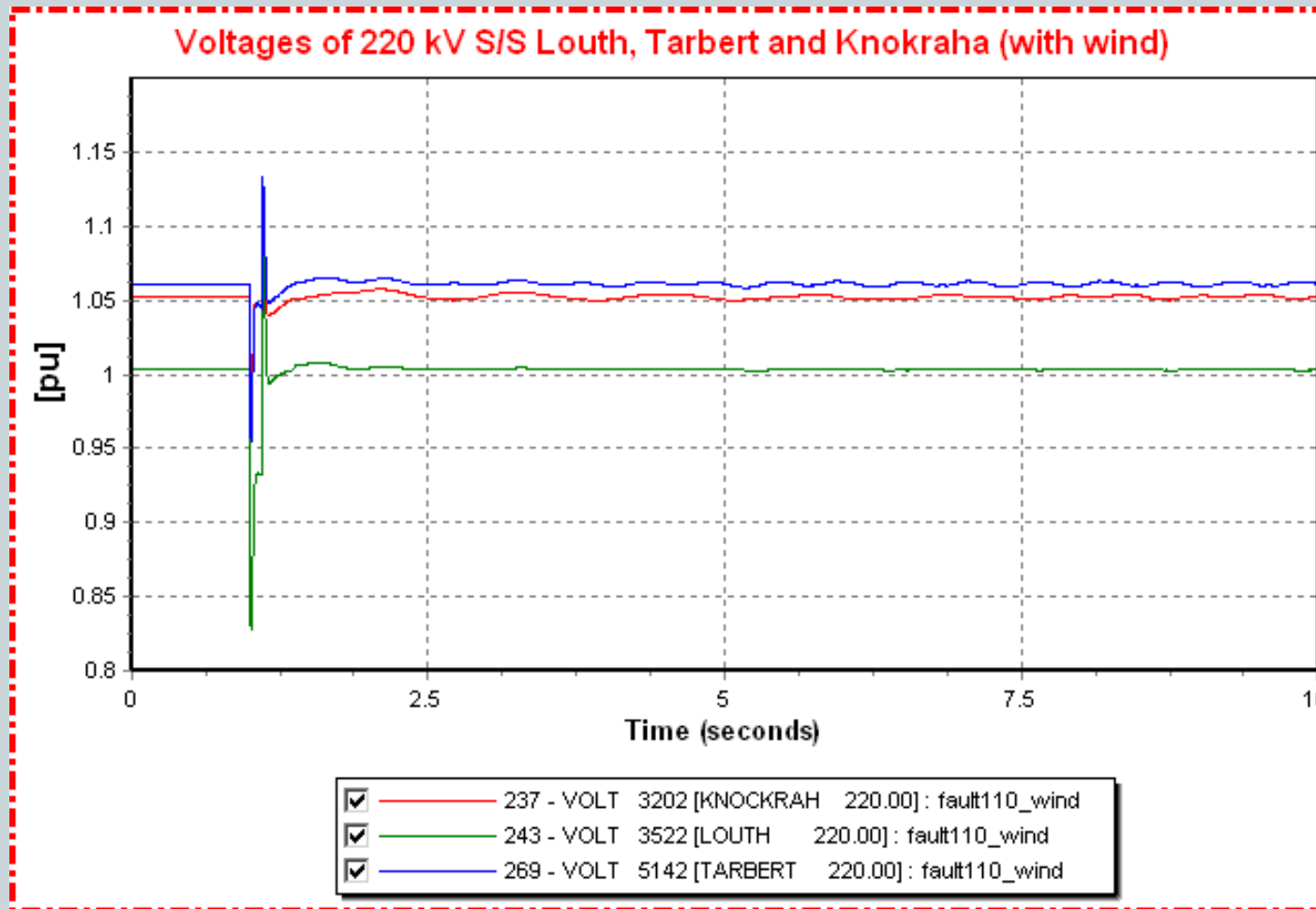
Fault on 110 kV level : 400 kV bus voltages in “with wind” case



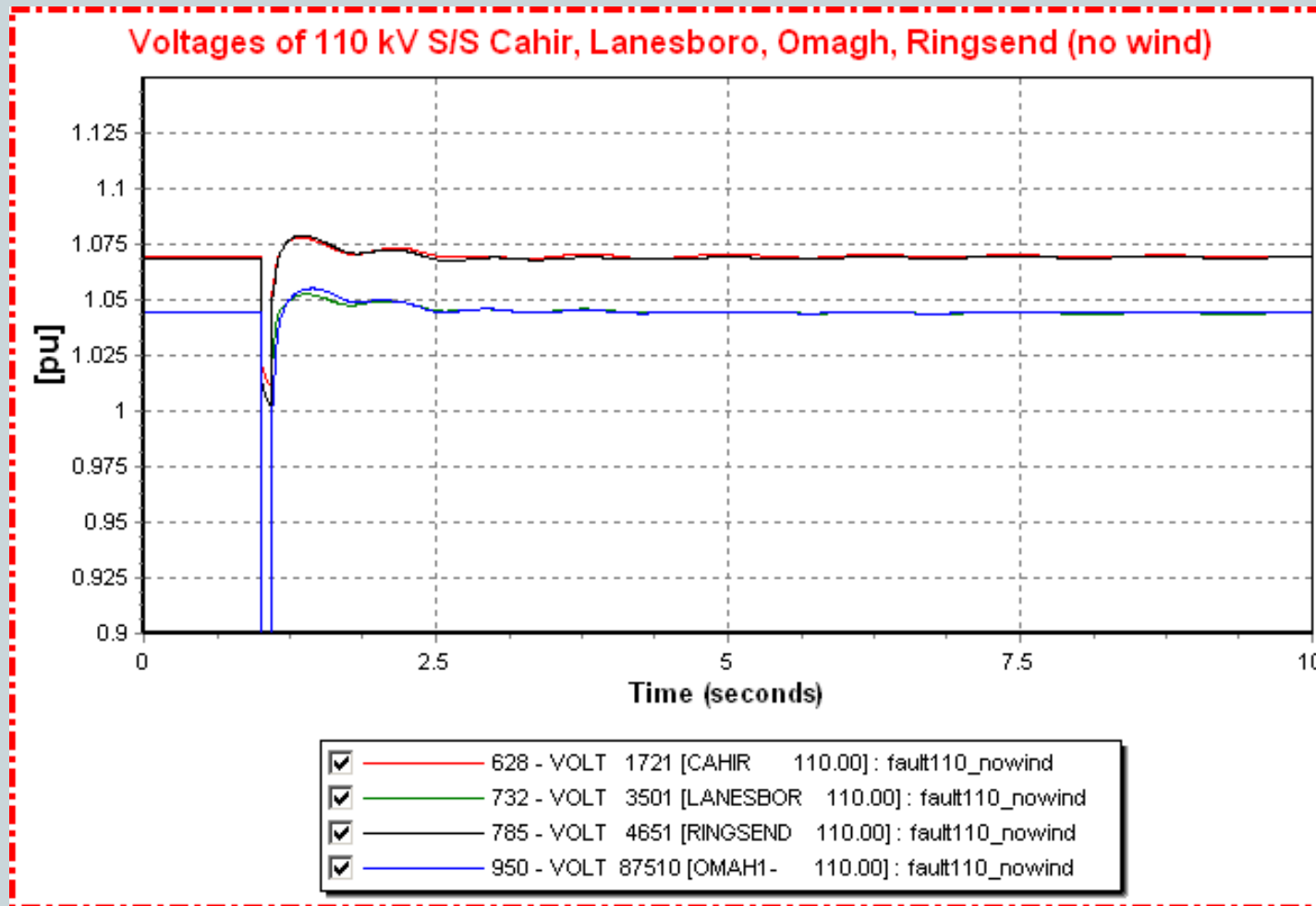
Fault on 110 kV level : 220 kV bus voltages in “no wind” case



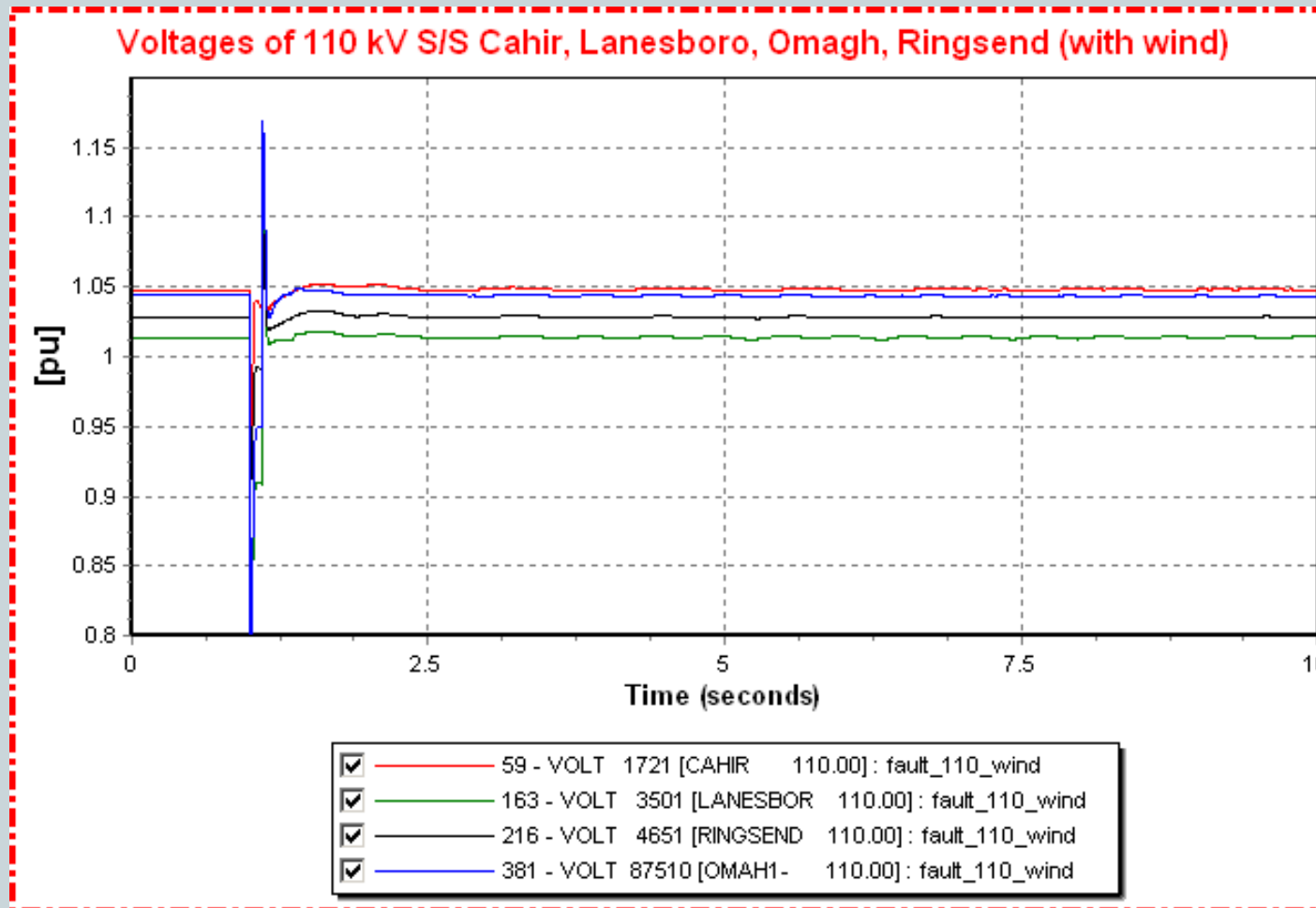
Fault on 110 kV level : 220 kV bus voltages in “with wind” case



Fault on 110 kV level : 110 kV bus voltages in “no wind” case



Fault on 110 kV level : 110 kV bus voltages in “with wind” case



Conclusions

- § Engagement of 3775 MW of wind generation decreases power system control reserve of Ireland almost two times
- § Power system is more vulnerable to active power imbalances caused by generation/load outages (restoration of system frequency to 50Hz is more difficult)
- § Bus/line faults are causing voltage drops on all voltage levels. Less conventional generation in favour of wind, means less capability to support voltage
- § Voltage drops can cause further frequency drops due to the reaction of converters (fault ride through mode decreases active power flow)