NASPI

Accuracy of line parameters calculation from synchrophasor data in steady state and during contingencies.

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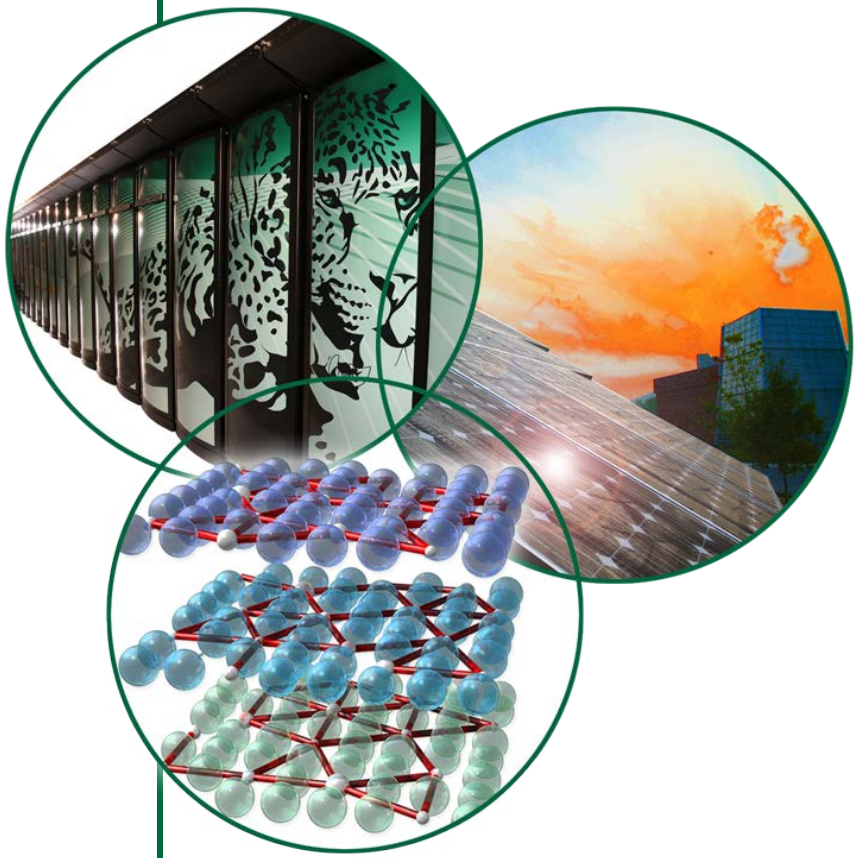

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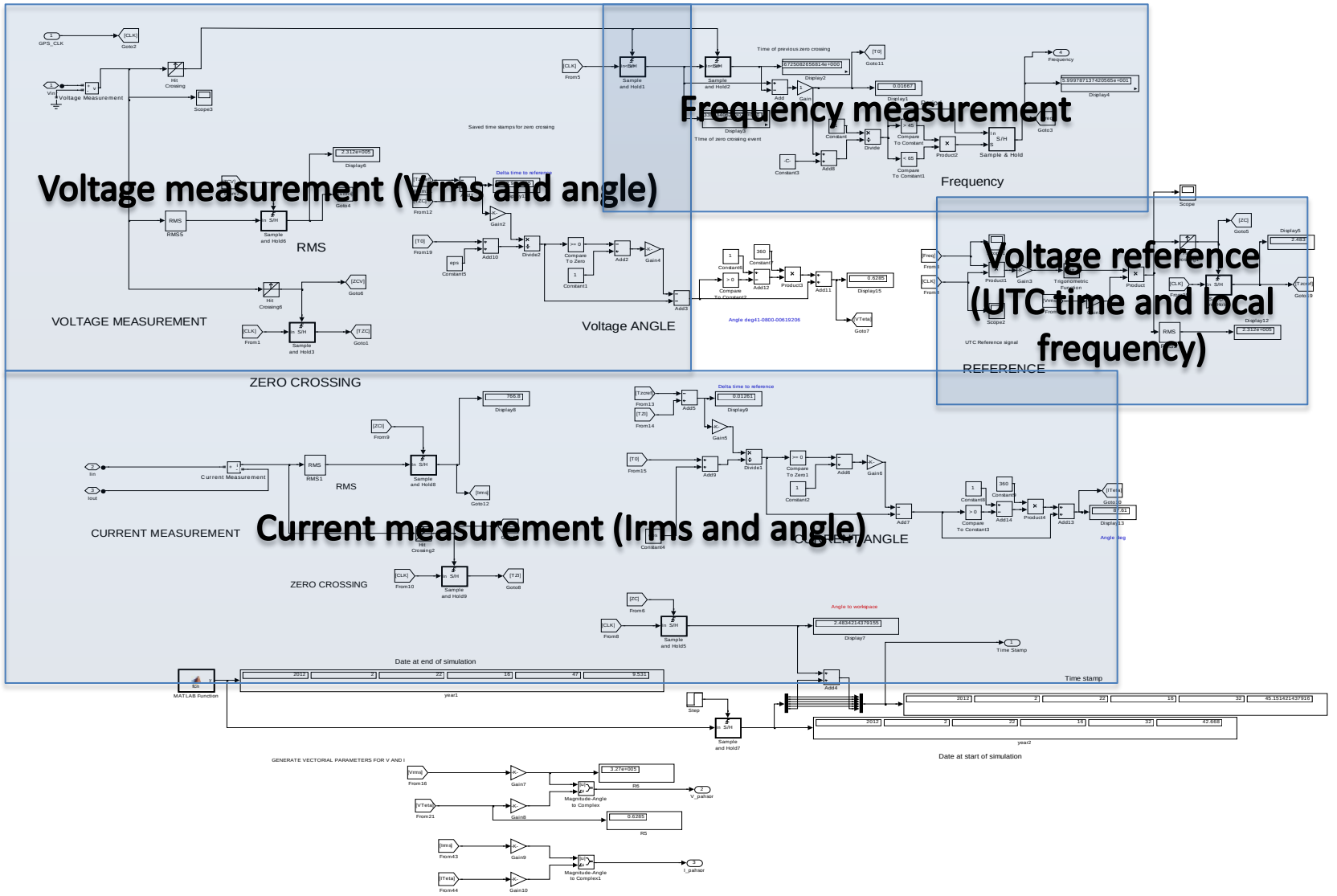
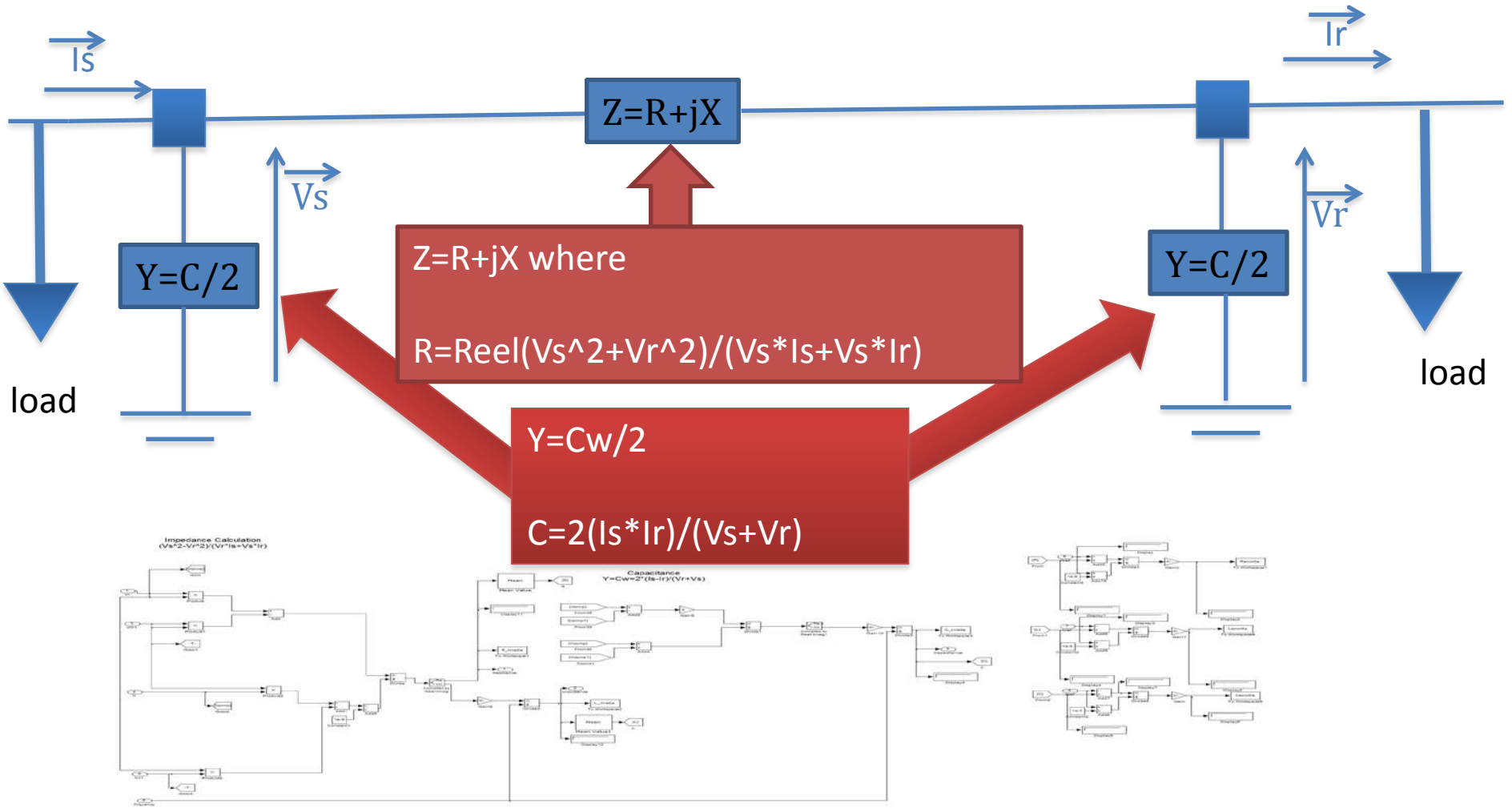
Introduction

- PMUs simulation model description
- Line parameter calculation module
- Impact of PMUs measurement accuracy on line parameters calculation
- Simulation system model
- Fault application and implication on line parameters values
- Field data

PMUs model in Matlab



Impedance calculation from PMUs

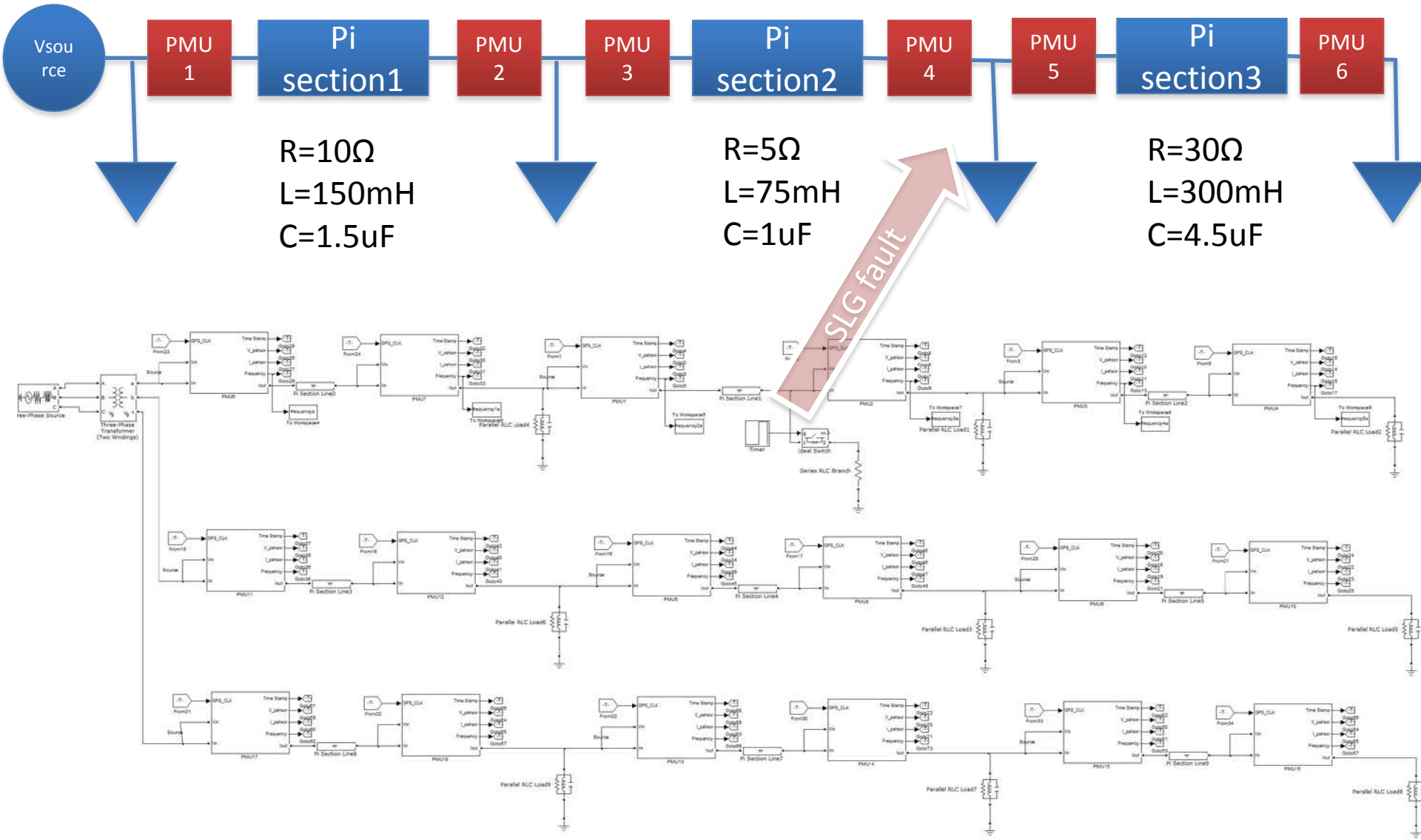


Impact of Phasor measurement on line parameter calculations

Voltage measurement uncertainty	Rerror	Lerror	Cerror
Amplitude between -1% to 1%	70%	2%	0.5%
Angle between -1% to 1%	40%	50%	0.3%

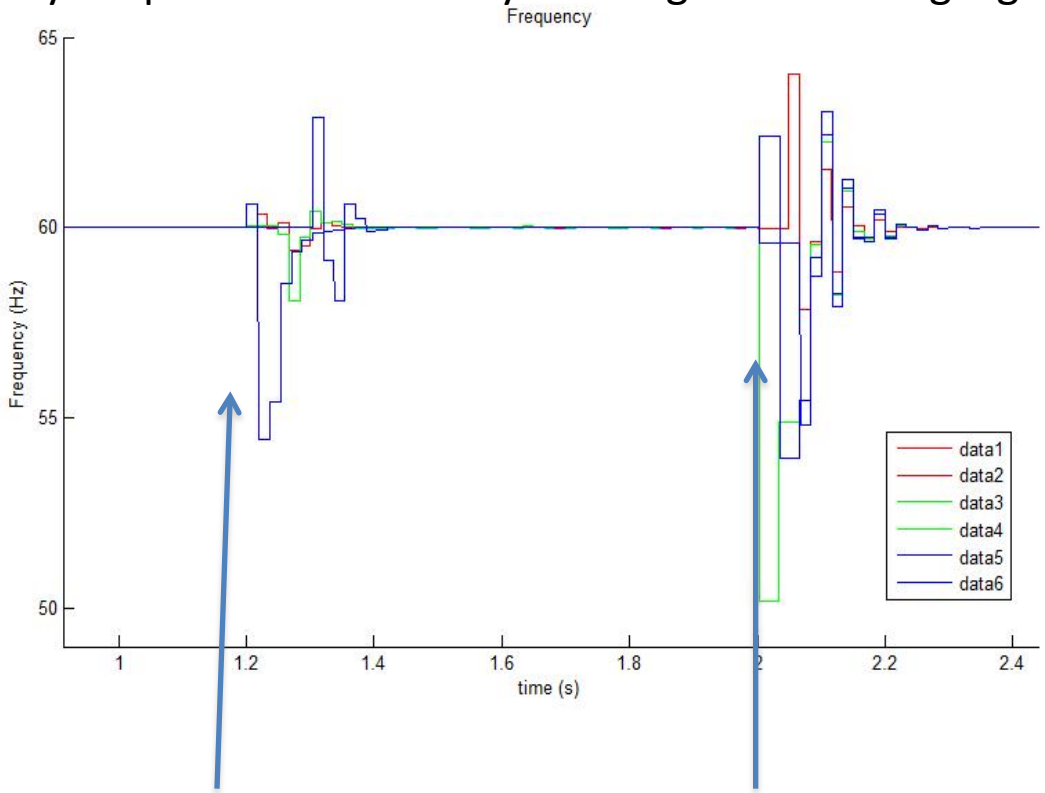
Current measurement uncertainty	Rerror	Lerror	Cerror
Amplitude between -1 and 1%	0.5	0.5%	4%
Angle between -1 and 1%	10%	0.4%	120%

System Model



Frequency during fault

The frequency is updated each line cycle using zero crossing algorithm



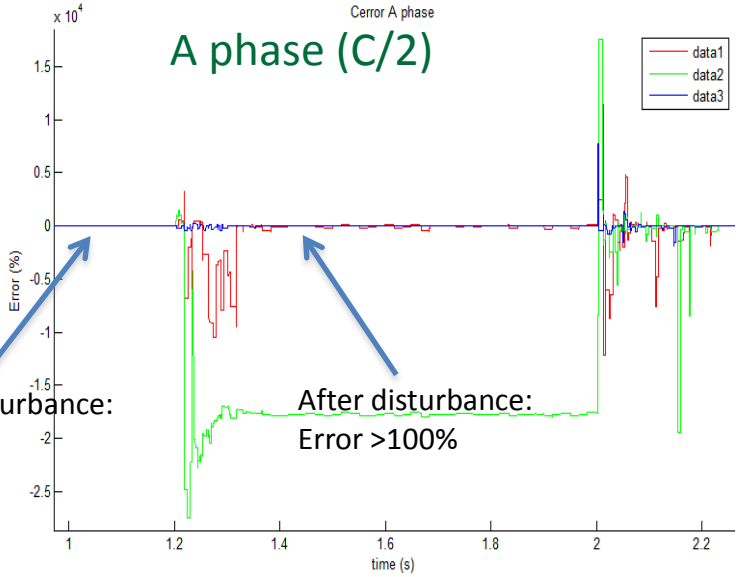
SLG fault

SLG cleared

The variation in frequency will affects the reference waveform generated at the PMU for voltage and current angle measurement

Impedance changes during the fault

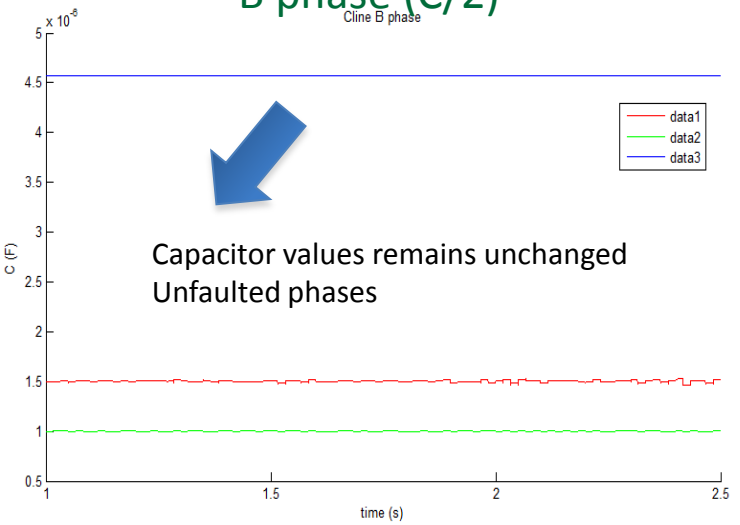
A phase (C/2)



Before disturbance:

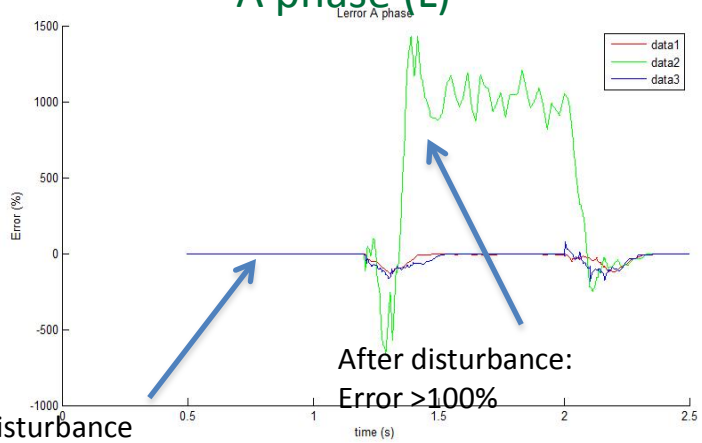
After disturbance:
Error >100%

B phase (C/2)



Capacitor values remains unchanged
Unfaulted phases

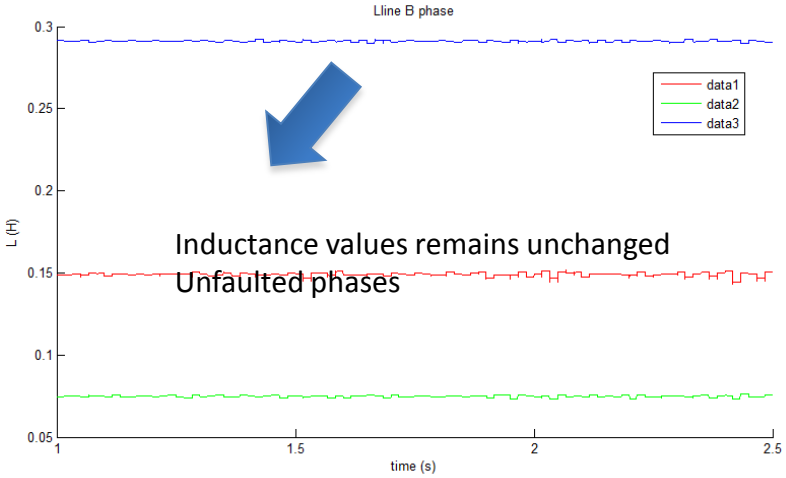
A phase (L)



Before disturbance

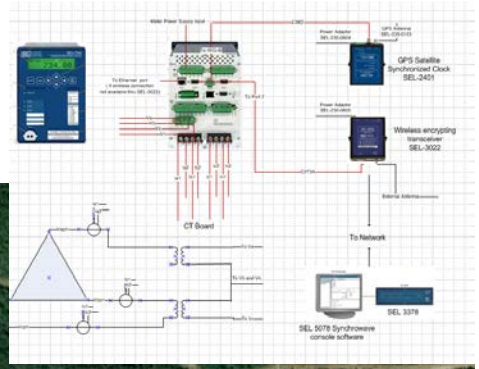
After disturbance:
Error >100%

B phase (L)



Inductance values remains unchanged
Unfaulted phases

PMUs application



- SEL 734P #2 and #3 are at each end of a 2 miles distribution line:

Enable line parameter estimation using synchronized measurements at both ends

ORNL Line parameters from 1s data

time (s)	R(Ω)	L (mH)	C(uF)
0	0.244	3.221	4.032
1	0.2424	3.208	3.99
2	0.2512	3.249	3.997
3	0.2498	3.213	3.984
4	0.2454	3.214	3.902
5	0.2479	3.21	3.937
6	0.2487	3.211	3.877
7	0.2521	3.197	3.956
8	0.2482	3.206	3.941
9	0.2458	3.23	3.967