Synchronized Measurement Based Applications

Make Power System Operations Simpler, Better, and More Reliable

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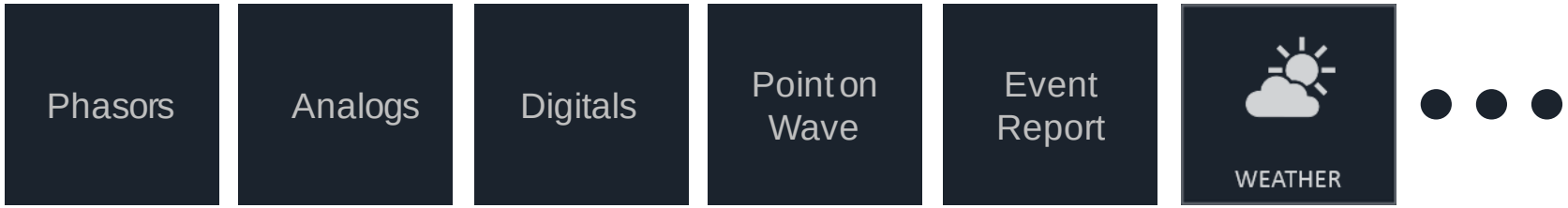
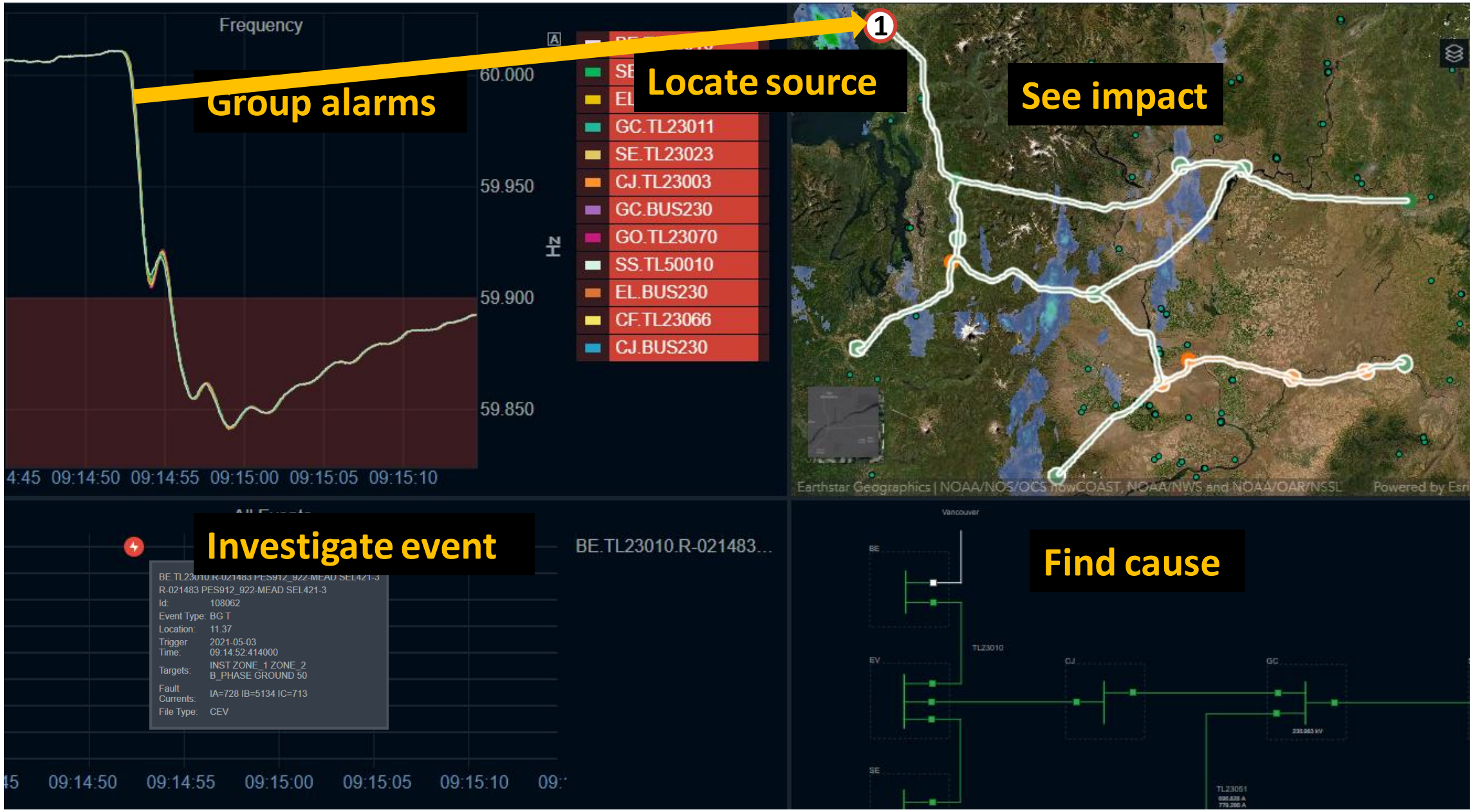
Synchronized Measurements

There's only so much a human can handle – Operators are human!

Synchronized Measurements can bring **SIMPLICITY** and **INNOVATIONS** into control rooms



Synchronized Information- Make Operator's Life Easier



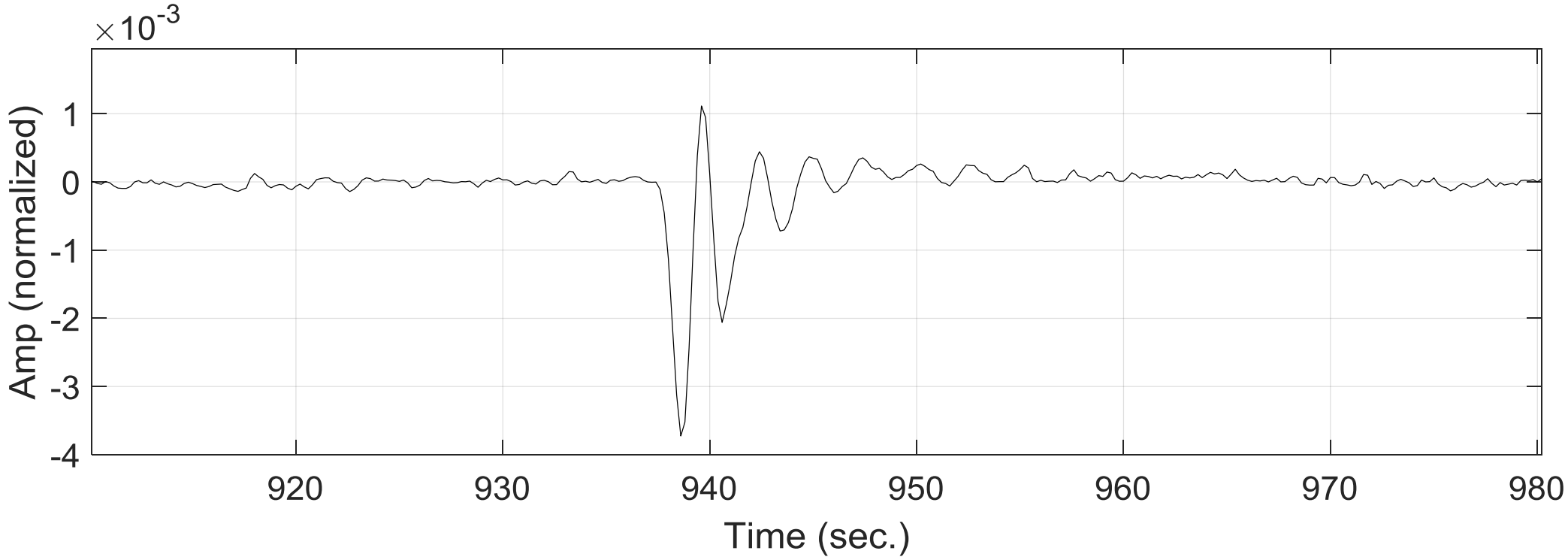
Event Based Modal Analysis

PMU measurements:

$$\hat{y}[n], \qquad \mathrm{n} = 0,1,\dots,\boldsymbol{n_s, n_s+1, n_s+2, \dots, n_s+N-1},\dots$$

Ringdown event:

$$y[n] = \sum_{i=1}^{n_\lambda} B_i Z_i^{n-n_s}, \qquad \boldsymbol{n = n_s, n_s+1, n_s+2, \dots, n_s+N-1}$$



Event Based Modal Analysis

Oscillation Event Detection

PMU measurements (Frequency Domain):

$$\hat{Y}(f) \Leftrightarrow \hat{y}[n]$$

Energy in a Frequency Band:

$$\hat{E} = \sum_{f=f_{min}}^{f_{max}} \left|\hat{Y}(f)\right|^2$$

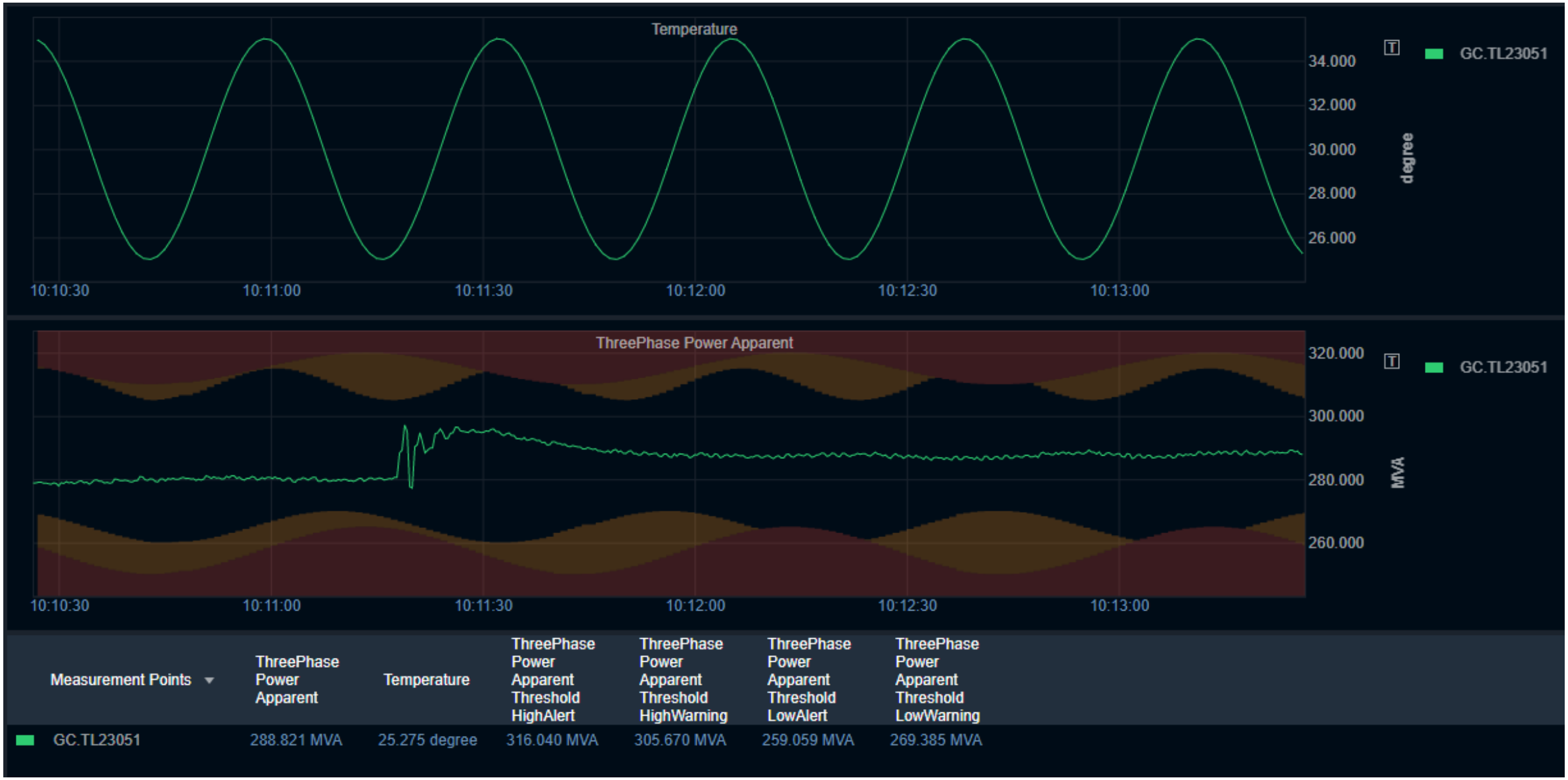
Statistical anomaly:

$$Z = \frac{\hat{E} - \hat{\mu}_E}{\hat{\sigma}_E}$$

Band Name	Start Frequency (Hz)	Stop Frequency (Hz)
Band1_(0.01_0.15)Hz	0.01	0.15
Band2_(0.15_1)Hz	0.15	1
Band3_(1_5)Hz	1	5
Band4_(5_14)Hz	5	14

Oscillation Event Detection

Dynamic Line Rating



Measurement Points	ThreePhase Power Apparent	Temperature	ThreePhase Power Apparent Threshold HighAlert	ThreePhase Power Apparent Threshold HighWarning	ThreePhase Power Apparent Threshold LowAlert	ThreePhase Power Apparent Threshold LowWarning
GC.TL23051	288.821 MVA	25.275 degree	316.040 MVA	305.670 MVA	259.059 MVA	269.385 MVA