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Summary

- A real-time, low-cost, and accurate monitoring system is developed to quantify system effective inertia based on PSH plant operation signature from PMU measurements.
- The real-time system inertia estimation approach is developed using pump turn-off events, along with techniques for improving RoCoF calculation in event-based inertia. By partnering with NERC, TVA, and Dominion Energy.
- This work will address one of the key challenges for operating the high-renewable low inertia grid and pave the way for the development of a U.S. carbon-free power sector.

Process of the PSH Turn-off Based Inertia Estimation

- PSH turn-off event signatures. Appropriate event signatures and proper threshold settings are determined based on the confirmed WECC pump turn-off events.
- Event Trigger design. A two-step event trigger is designed. The first step is to quickly detect event and the second step is to filter out false alarms with fine rules.
- Inertia estimation. The inertia is estimated with the proposed Long-Window-RoCoF-Based inertia estimation method to avoid system random noise affect.
- Real-time inertia estimation. Implement the whole process into the FNET/GridEye monitoring system.

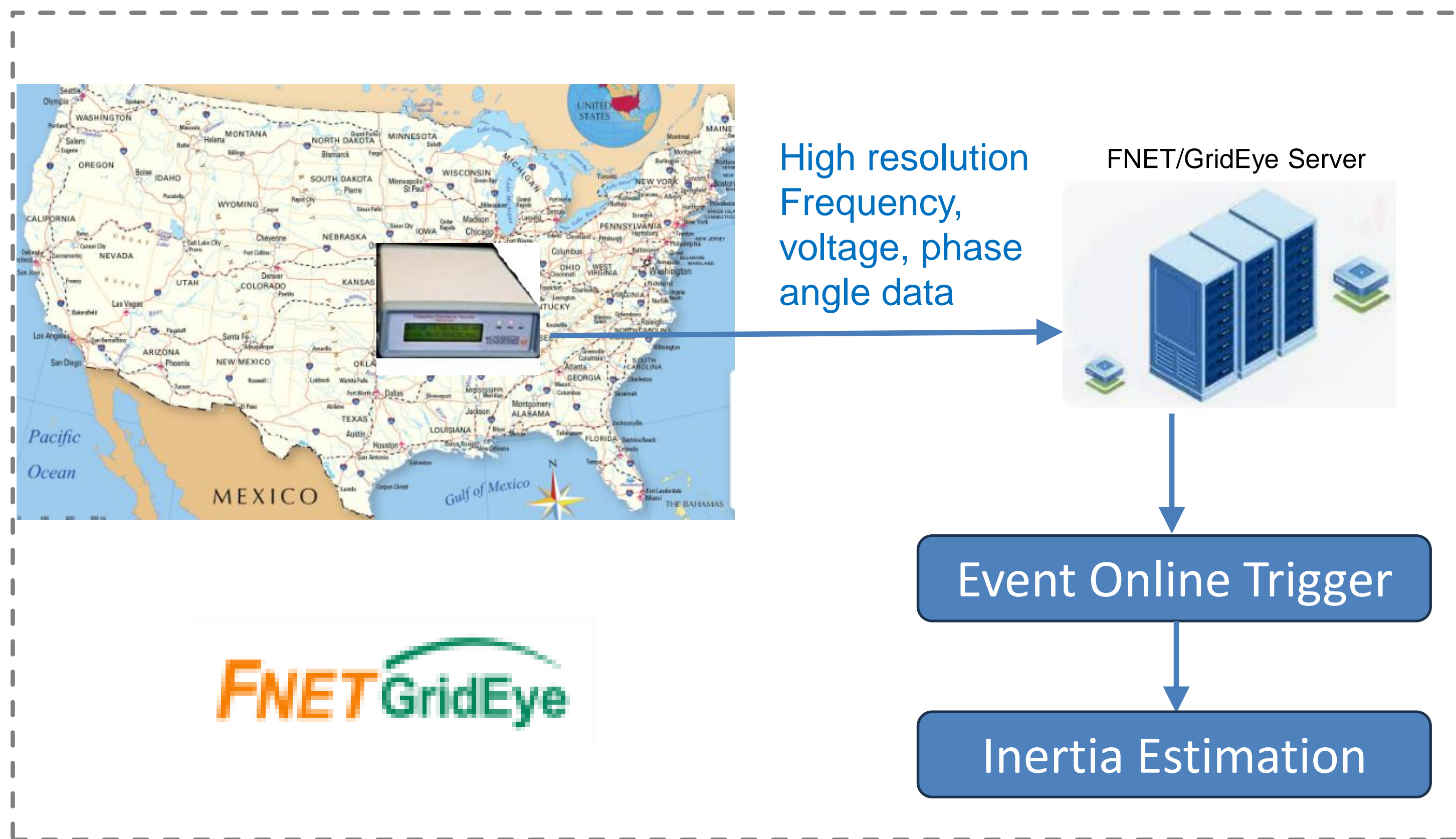


Figure 1. PSH Turn-off event monitoring system in FNET/GridEye

Performance and Conclusion

- The designed PSH turn-off event trigger can detect events for the WECC system correctly, with an accuracy of 100%.
- Tests has been carried out on the WECC system with simulations. The test result shows an absolute estimation error of 7.7% for the proposed method.
- The estimated inertia are displayed in the FNET/GridEye public website, which includes a plot chart, a table, and a video with the most recent month inertia trend.

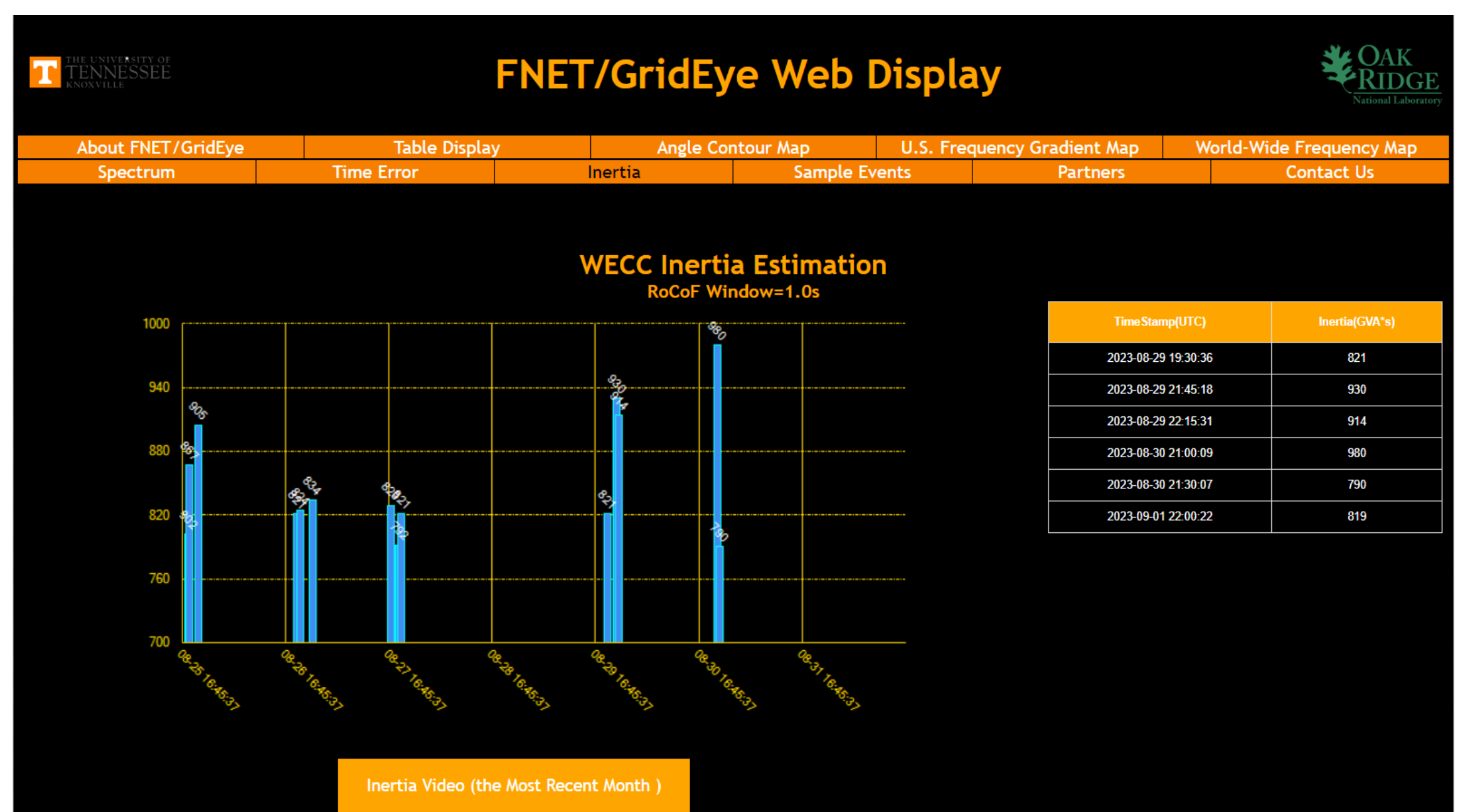


Figure 2 FNET/GridEye inertia online estimation visualization

