

PI System Phasor Data - Part III



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- Recap
 - Part I (Oct. 15, 2009)
 - Part II (Dec. 9, 2009)
- Part III
 - Advanced Real-time Analytics
- Questions and Answers

Part I Recap (Oct. 15, 2009)



- Actionable Phasor Data, Not Just Sci-Fi Anymore - Introduction to the C37.118 Interface
http://www.osisoft.com/resources/webinars/Webinars_On_Demand.aspx
- Quick-Win and Value Now
 - Getting Phasor Data into the PI System via C37.118 Interface
 - PI Analytics and Notifications Tools
 - PI Visualization Tools
 - PI DataLink and Reporting Tools
 - Special Considerations
 - Examples
- What's Next? Real-time Analytics!

Part II Recap (Dec. 9, 2009)



- Real-time Analytics
 - http://www.osisoft.com/resources/webinars/Webinars_On_Demand.aspx
- Quick-Win and Value Now
 - Angle difference
 - FFT (Fast Fourier Transform)
 - SQC (Statistical Quality Control)
 - Phase portraits (X-Y charts)
 - Worm charts (X-Y charts)
 - Notifications
 - Event framing (Batch)
 - SISCO UAP (Unified Analytic Platform)
- What's Next? Advanced Real-time Analytics!

- IEEE C37.118 standard
 - Not all PMUs manufacturers interpret the standards the same way
 - OSIsoft C37.118 interface released 2005
- Released enhancements to C37.118
 - Hot and cold failover of the interface (released)
- On going work
 - Server failover
 - Latency instrumentation
 - Auto tag configuration

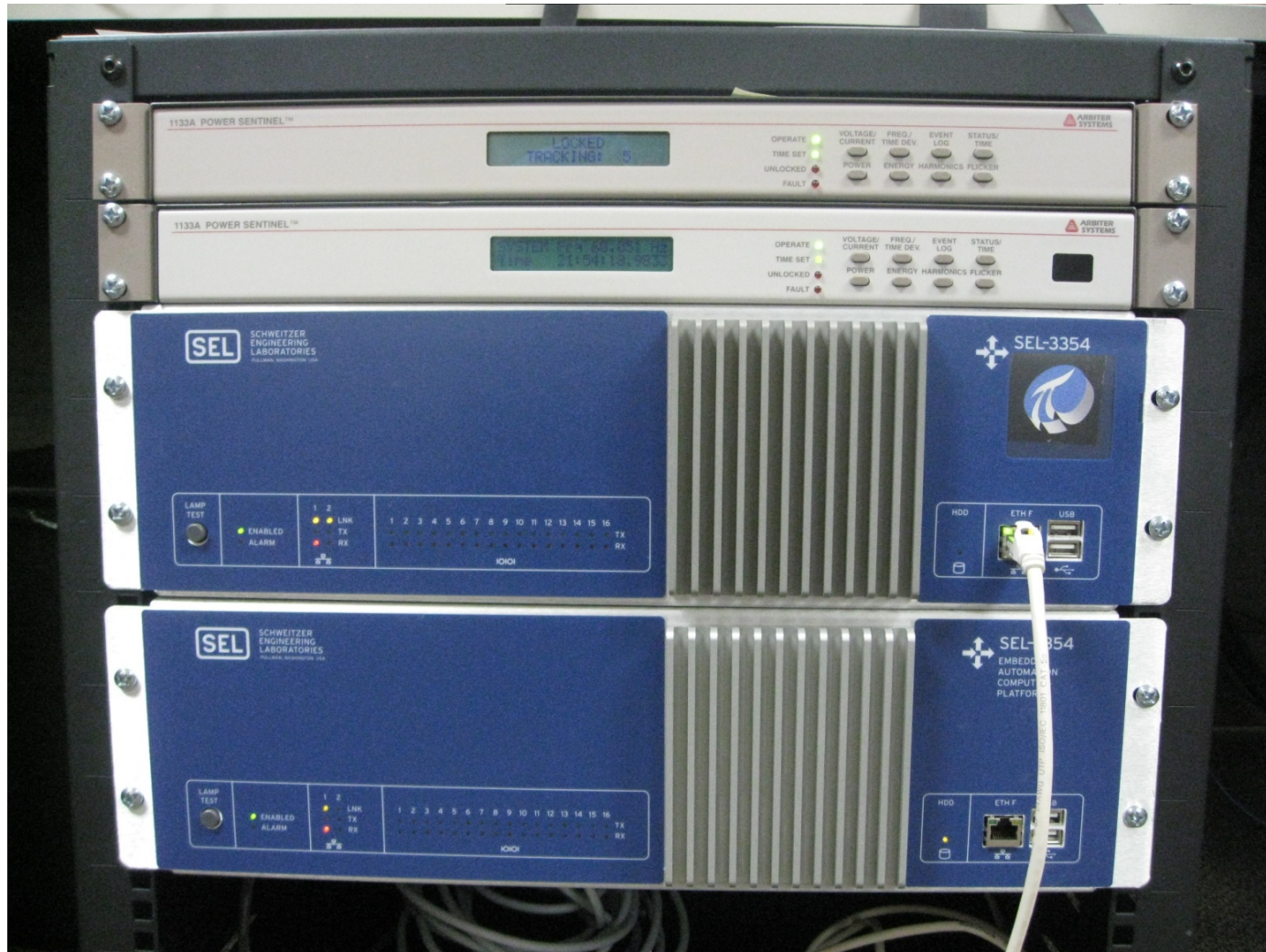
- Separate server for PMU data, with IEEE 1588 Clock
 - One PMU 50 measurements, at 30 Hz = 1500 events per second
 - Assume disk write limit is 125,000 events per second
 - Max number of PMUs per server = 83
 - Plan for 40, headroom and client access response
- Compression and exception setting per manual
 - Do not compress angle measurements
 - The discontinuity must be instantaneous for angle unwrapping to give the correct result

- DOE SGIG's total over US\$400 million
 - Over 1,000 new PMUs will be operating by 2013
 - Many will be installed with wide area protection as a near term application
 - Most are looking at Oscillation Detection
 - Some will have redundant PMUs
 - Cyber and physical security is critical
- What is needed?
 - *High availability*
 - *High accuracy (meet IEEE 37.118 TVE specifications)*
 - *Low latency*
 - *Fast analytics*

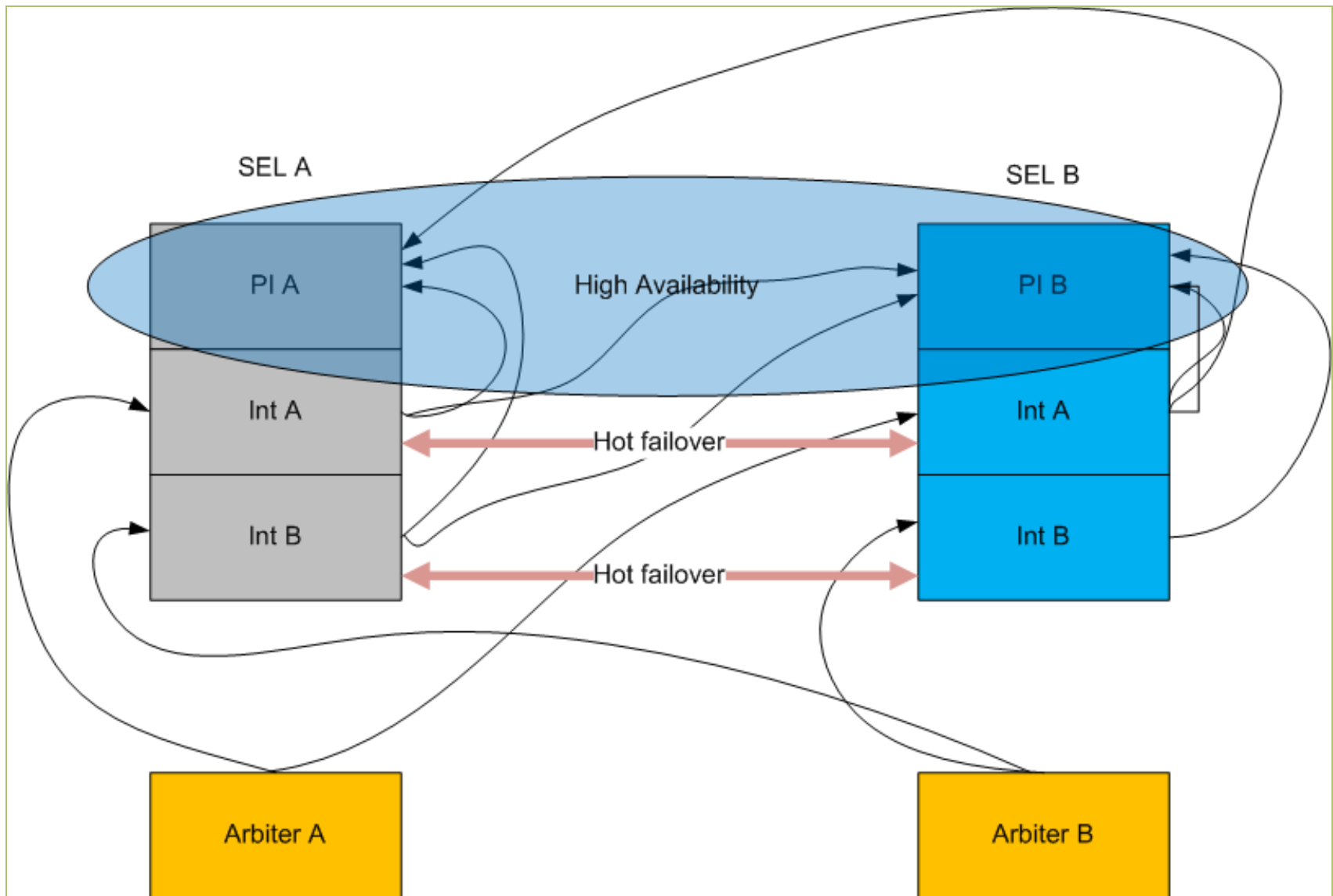
- Reliable measurements
 - Cyber secure synchrophasor platform
 - FFT for oscillation detection
 - Early detection of grid weakness
 - Damping
 - Display of FFT data using PI Profileview
 - Very low latency angle differences

CSSP (Customer Example)

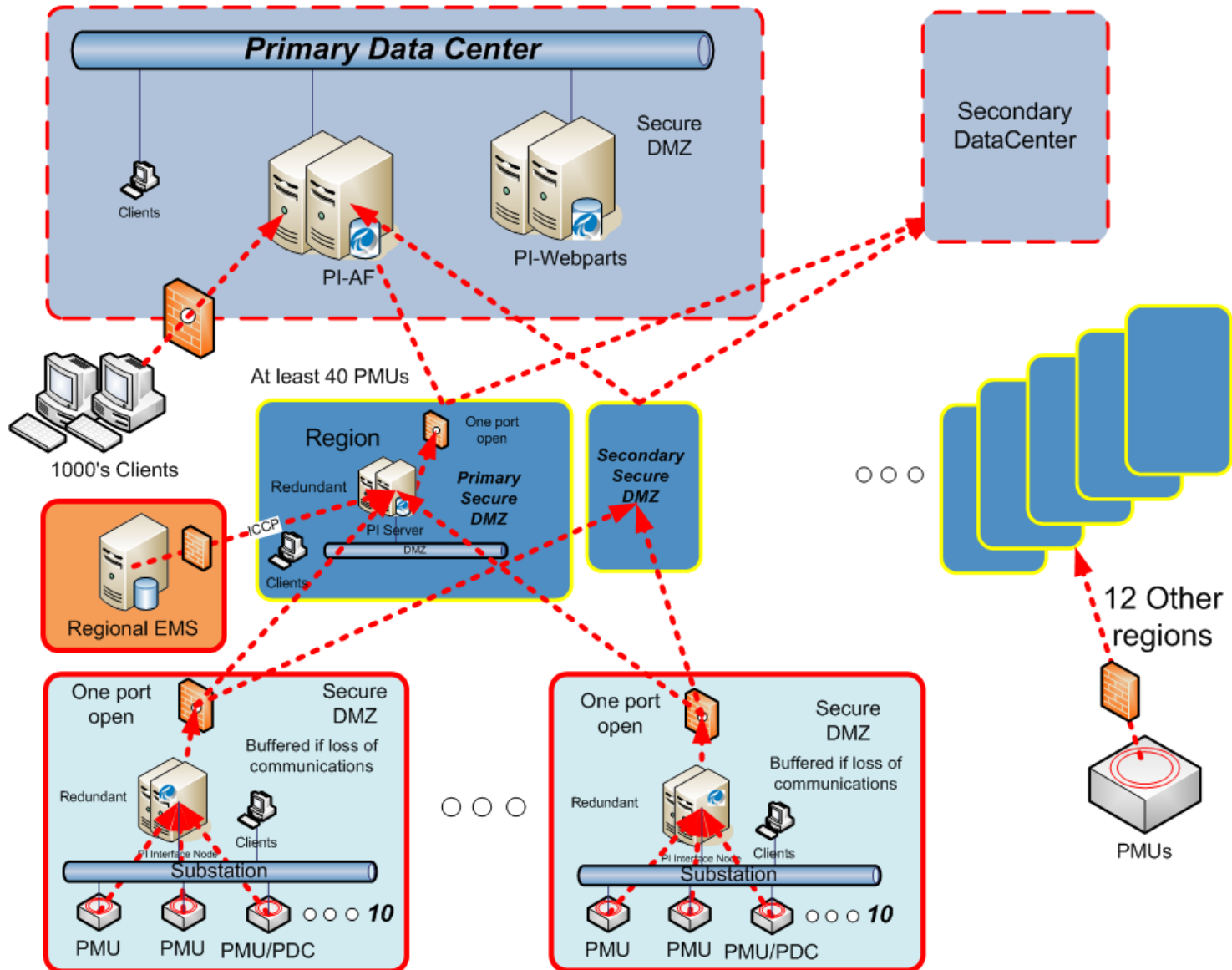
- Cyber Secure Synchrophasor Platform



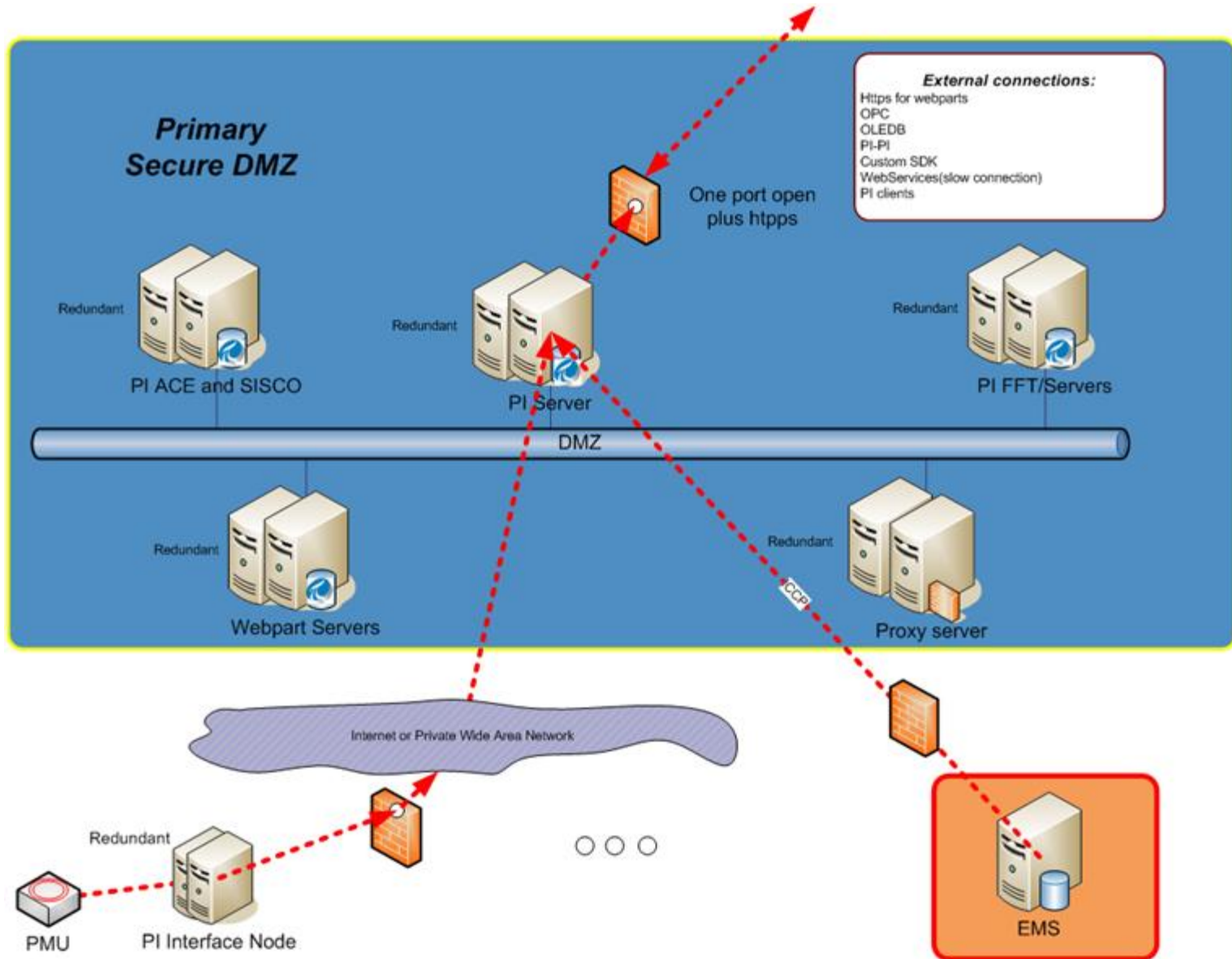
CSSP Software Architecture



Wide Area Architecture

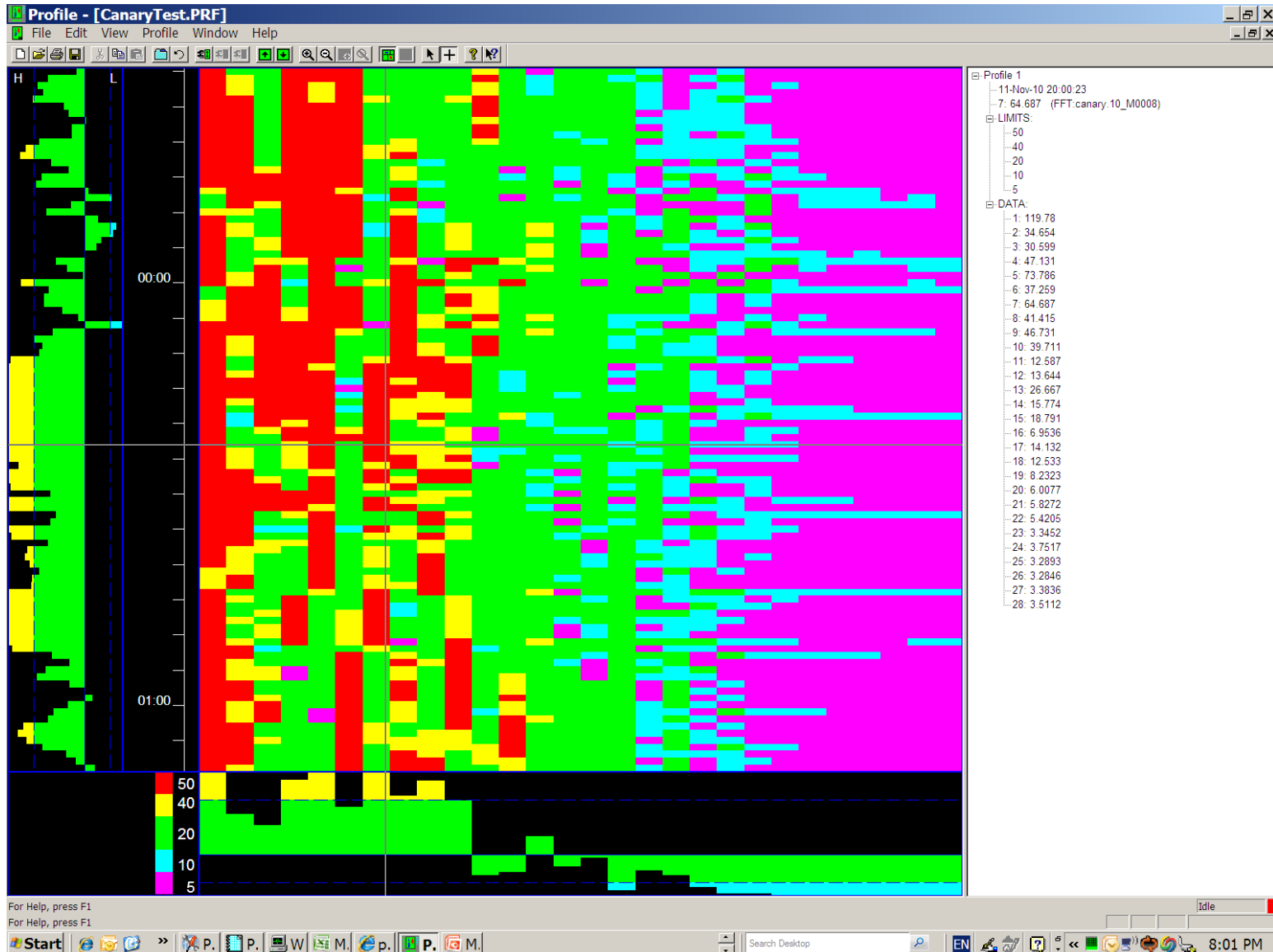


Detailed Architecture

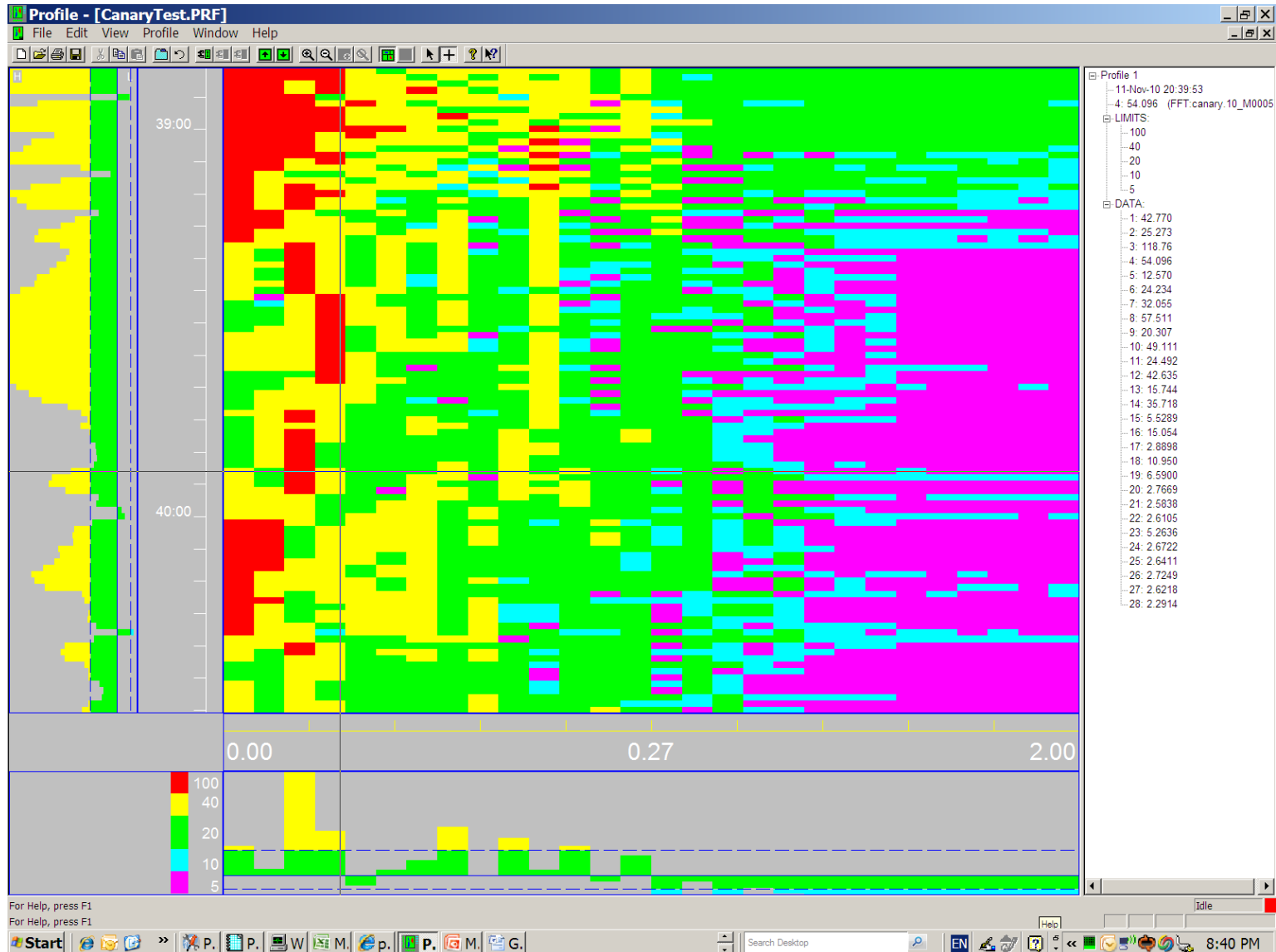


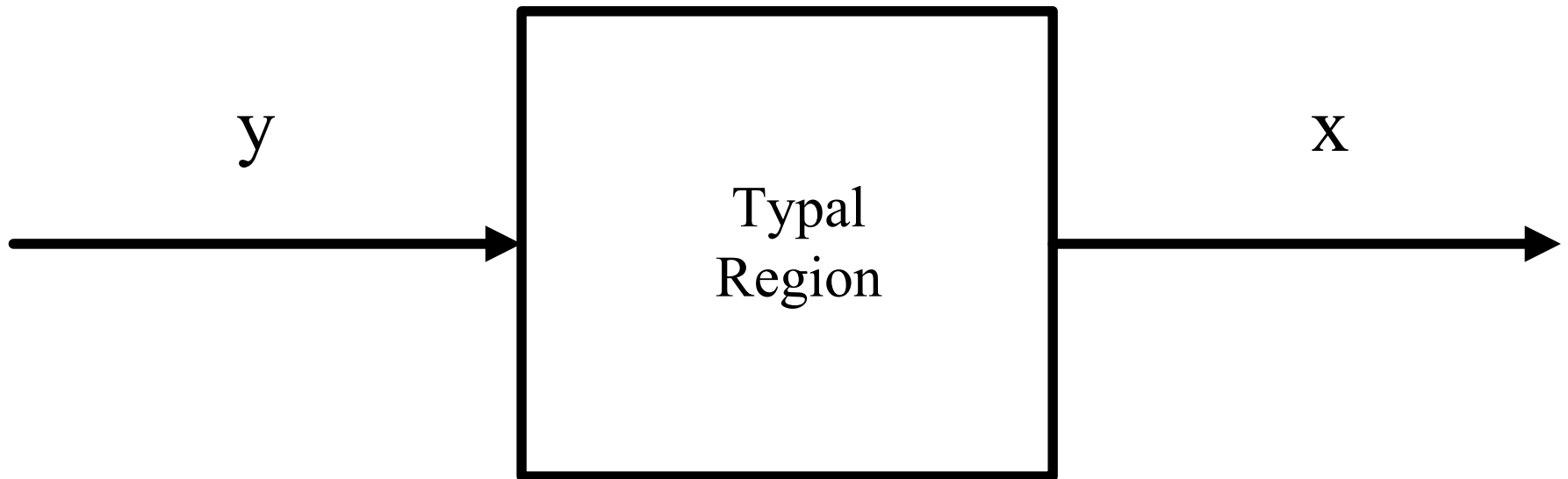
- Running at a utility site using the PI System
 - 256 wide windows (12.8 seconds)
 - 50 mS sampling interval
 - 200 mS computation rate
 - 12 FFTs running in real time on Analytics Machine
 - Results stored to Analytics Server
 - Examples
 - [Worm](#)
 - [FFT](#)

PI ProfileView

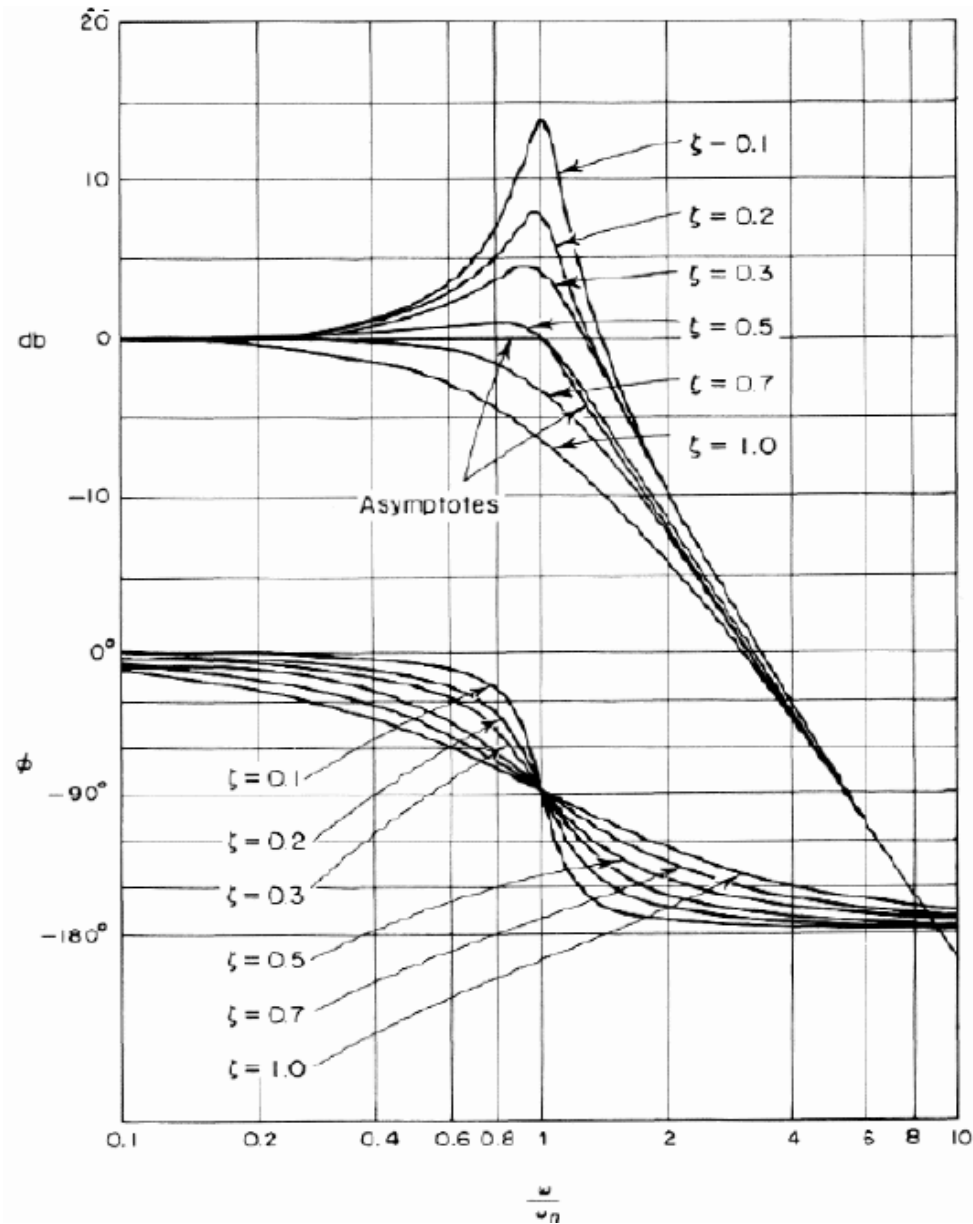


PI ProfileView

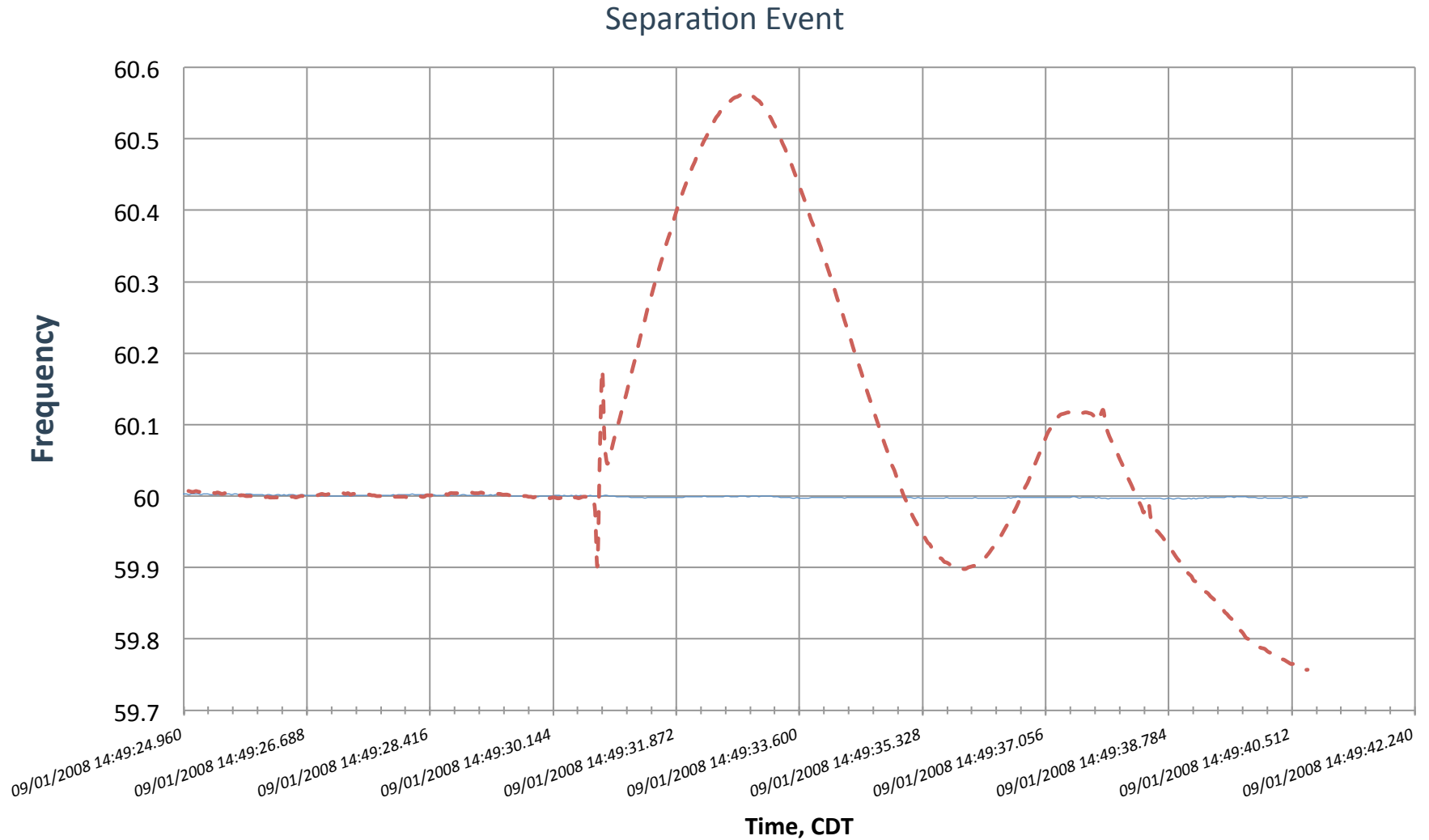




FFTs for Grid Weakness

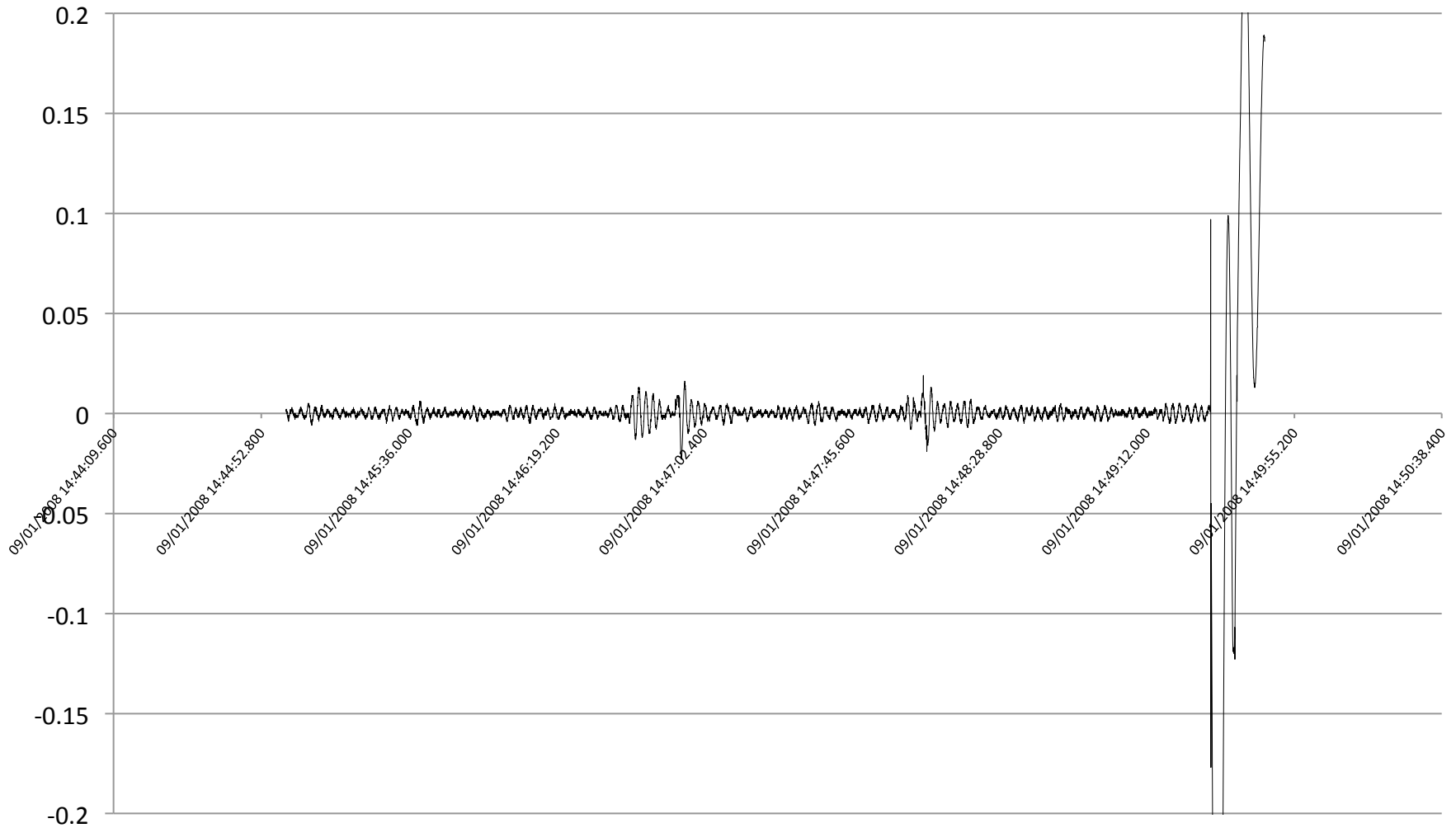


Separation Event

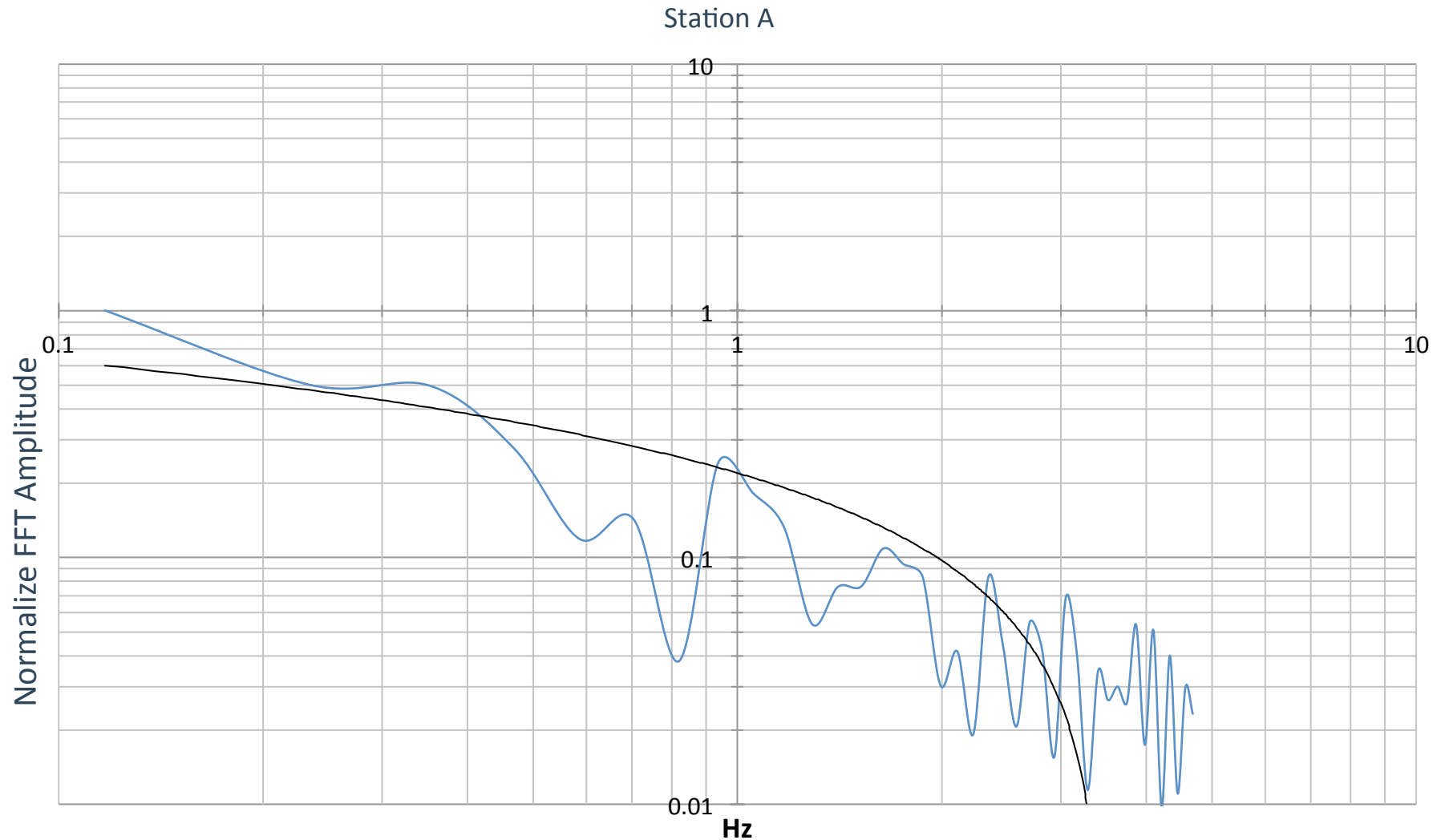


Differences

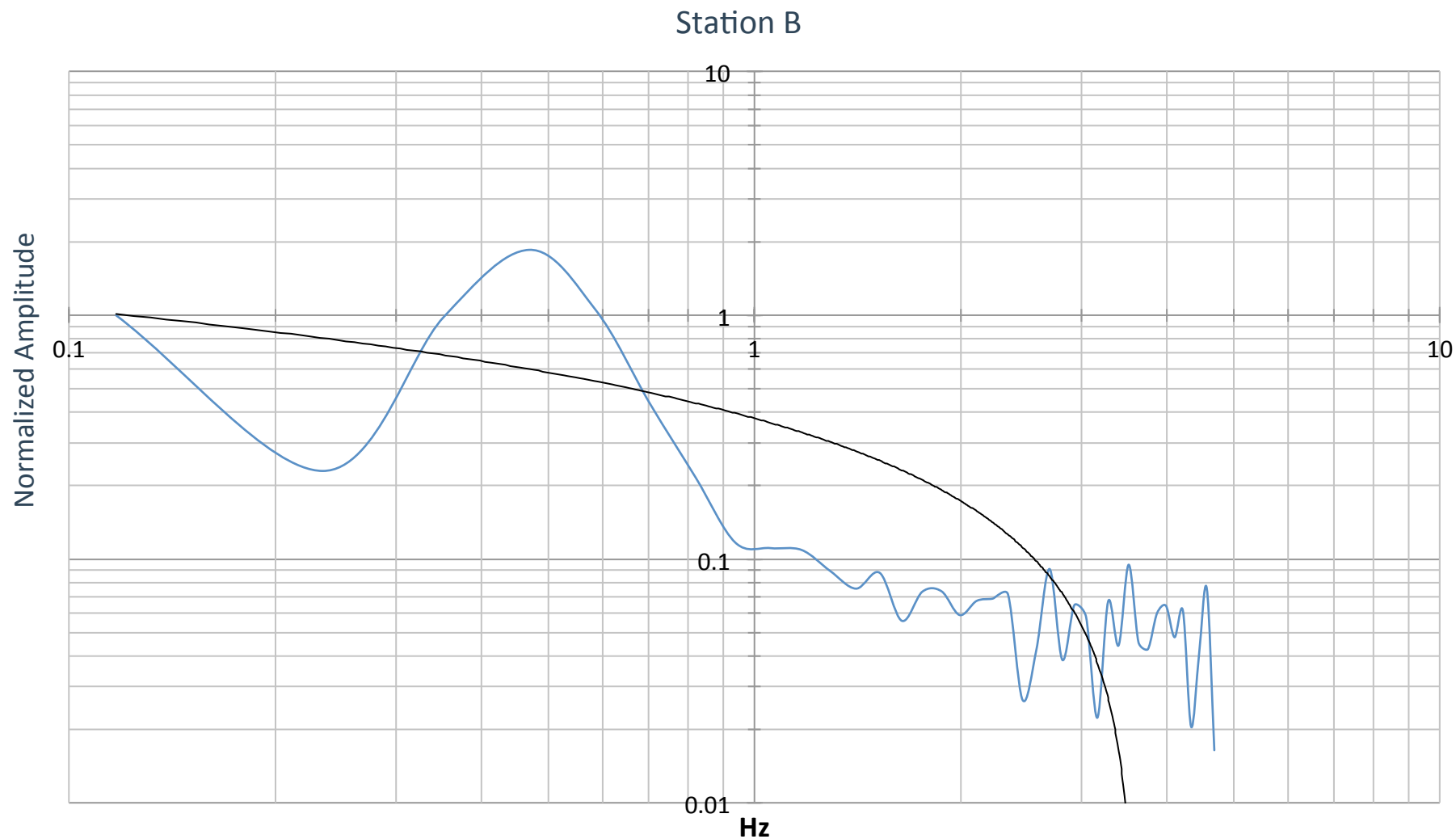
Frequency difference, Station A - Station B



Station A Response

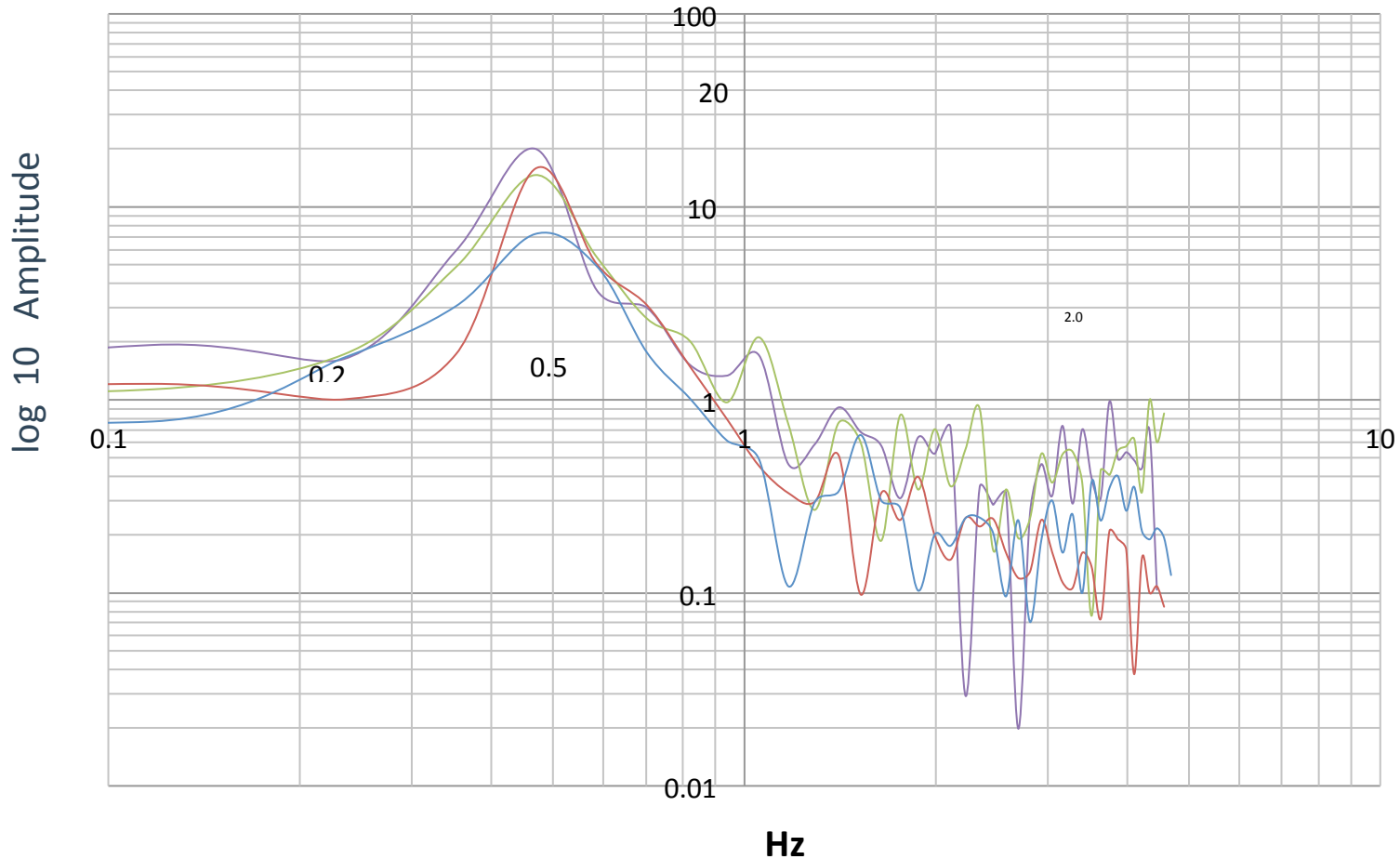


Station B Response

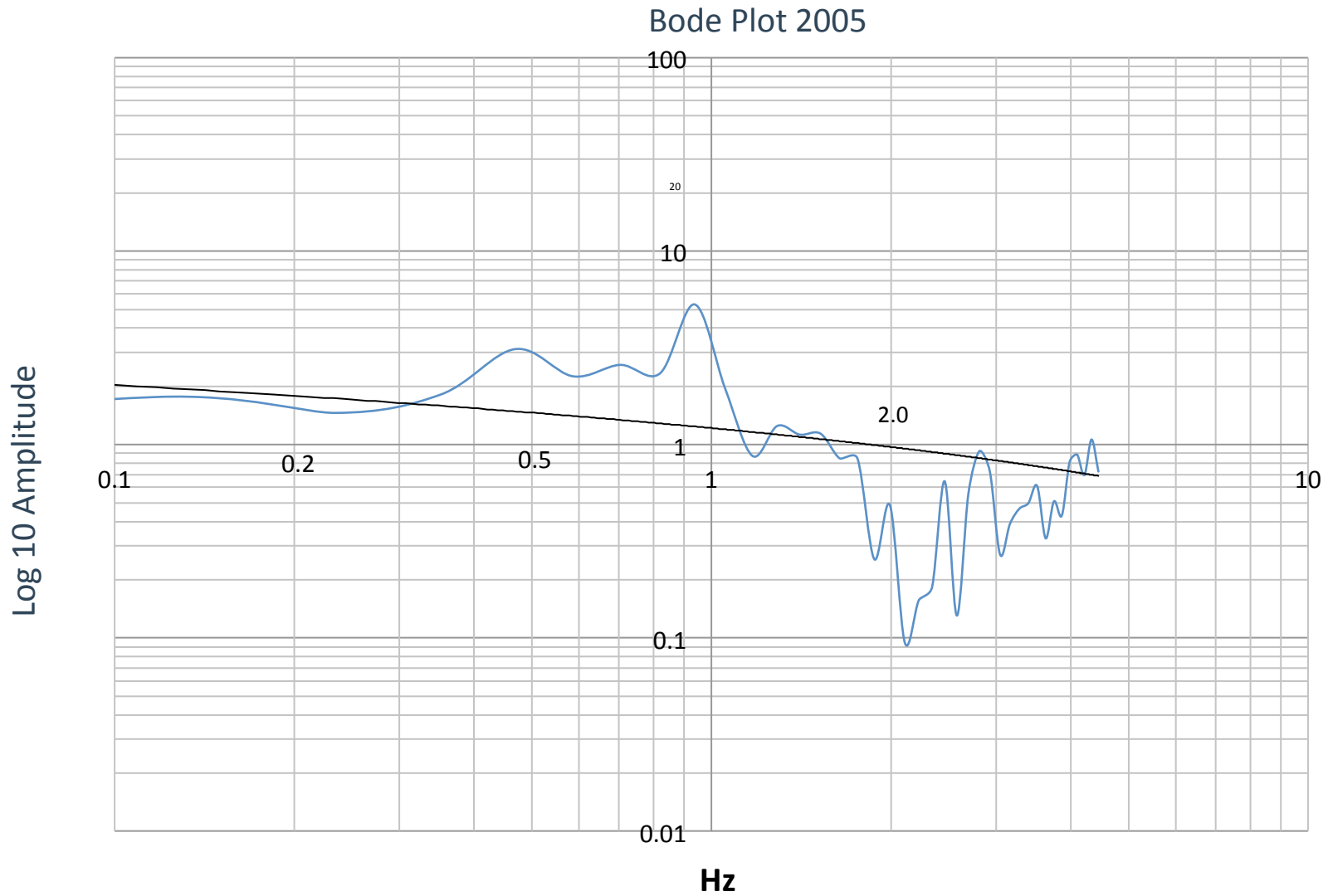


Difference Response

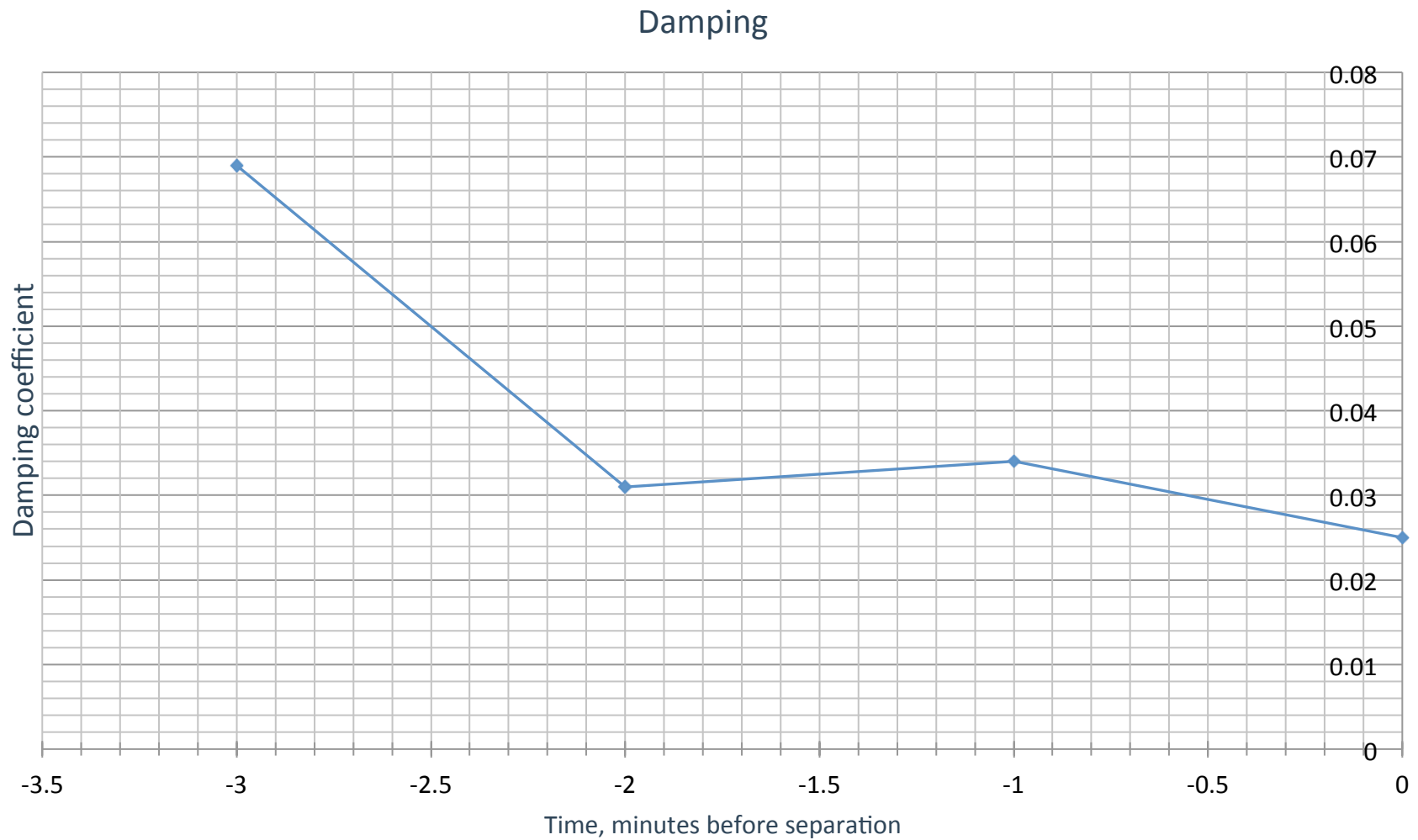
Bode Plots, prior to separation



Ambient Response

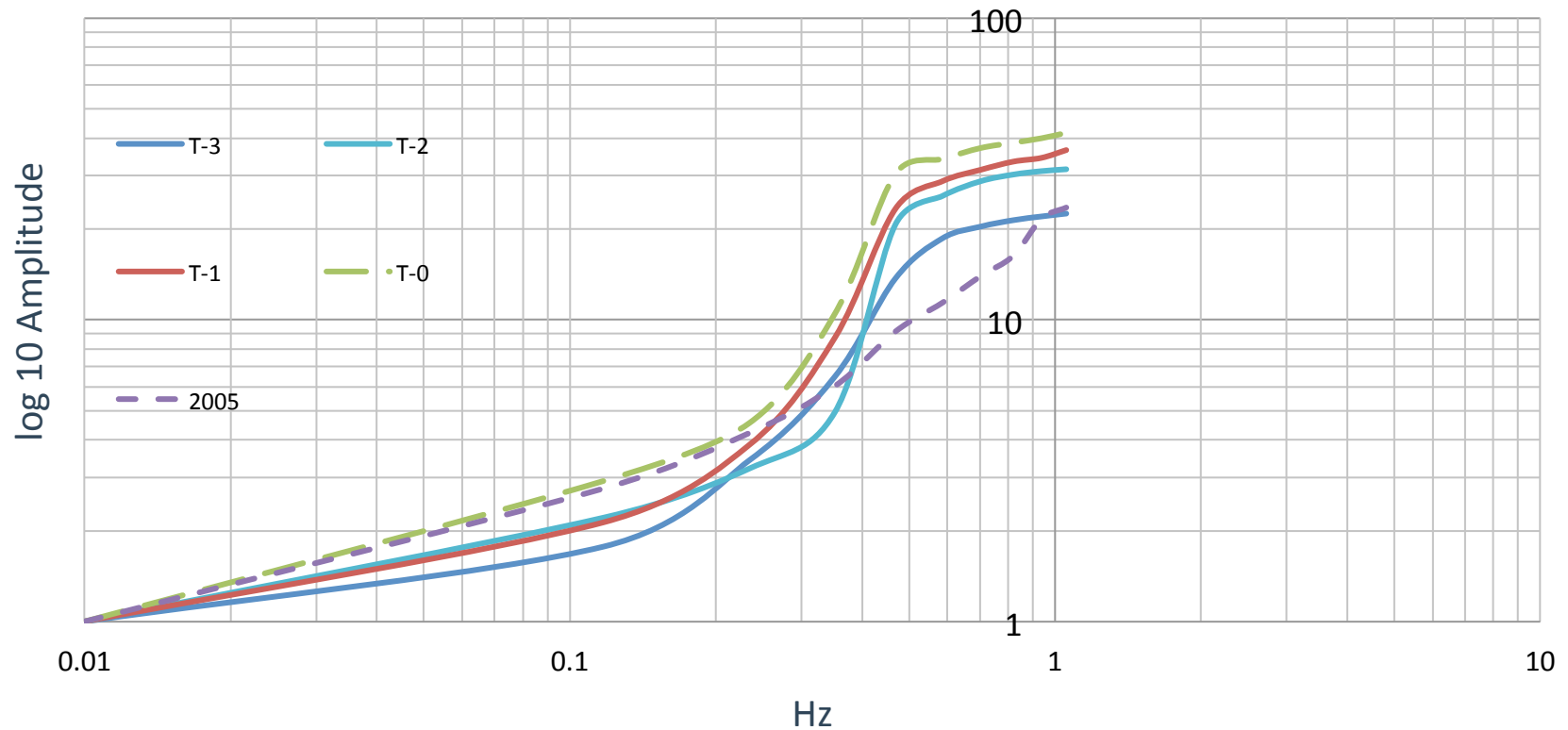


Damping



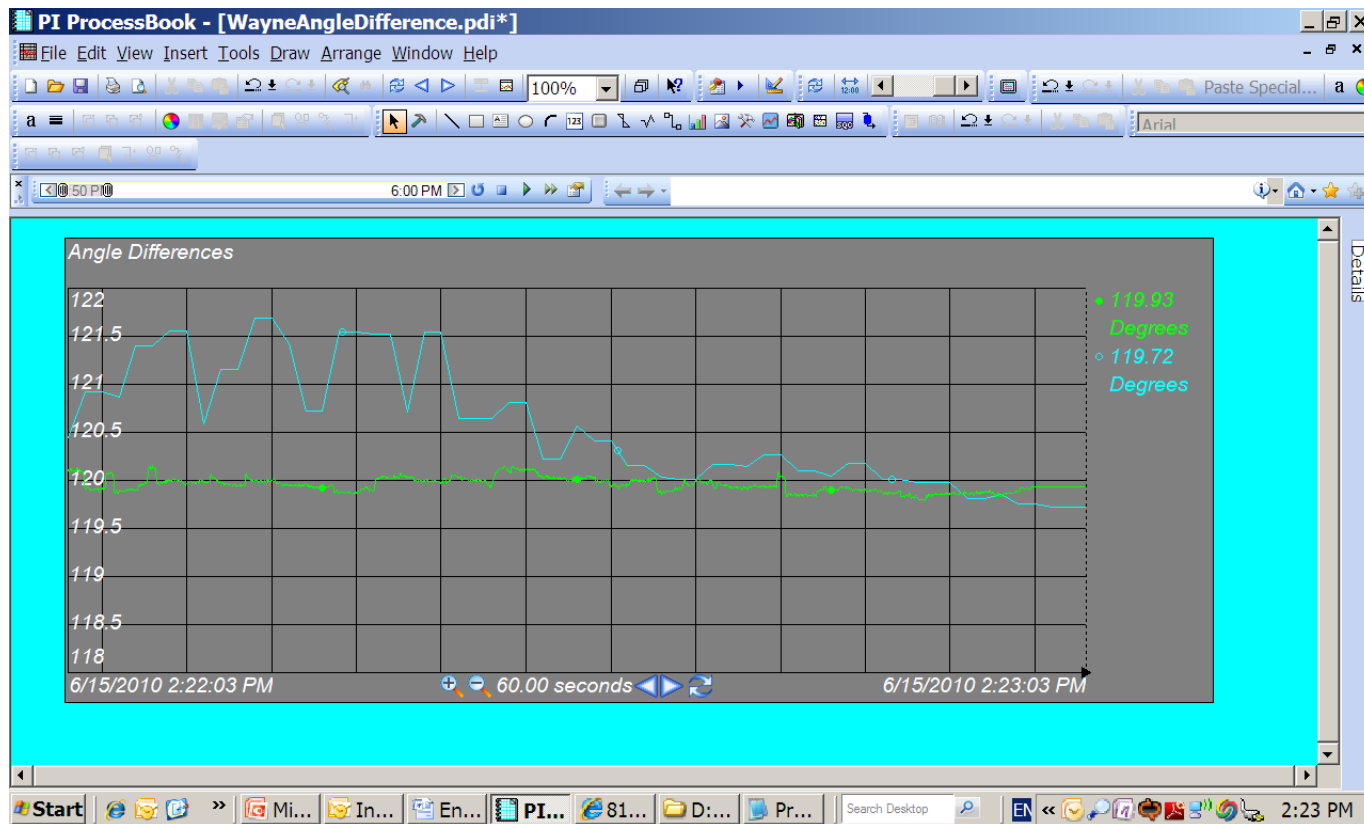
Akaiki Information Criterion

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Very low latency calculations

- Capture and align data before it reaches snapshot
- Align data as needed
- Compute functions as required



- Secure, reliable and highly available PMU measurement data using COTS software
- Out-of-the-box real time analytics tools to compute
 - Angle differences, FFTs, damping, etc.
- Flexible system architectures (i.e. without PDC's)
- Proven analytics
- Very low latency computation is available
- Proven track record

<http://extranet.osisoft.com/sites/SIG/TD/Shared%20Documents/Forms/AllItems.aspx>

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Thank you

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