

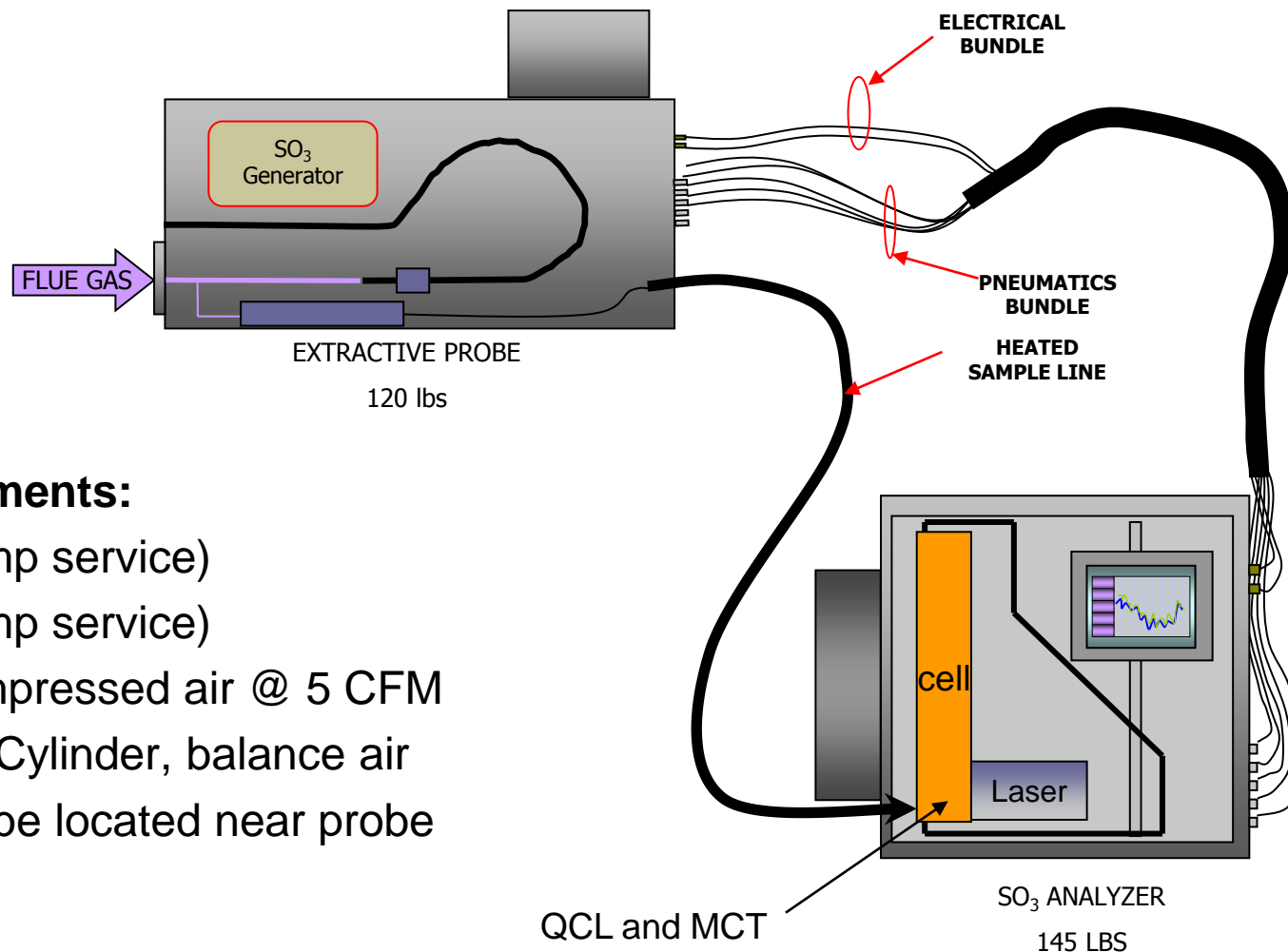
● **REAL-TIME MONITORING OF SO₃ IN FLUE GAS**

Agenda

- SO₃ System Overview
- System Capabilities
- SO₃ Transport / Response
- Field Data
- Summary



SO₃ CEMS Overview



System Requirements:

- 208 VAC (30 amp service)
- 120 VAC (15 amp service)
- 80 PSIG of Compressed air @ 5 CFM
- 1000 PPM SO₂ Cylinder, balance air
- Instrument can be located near probe

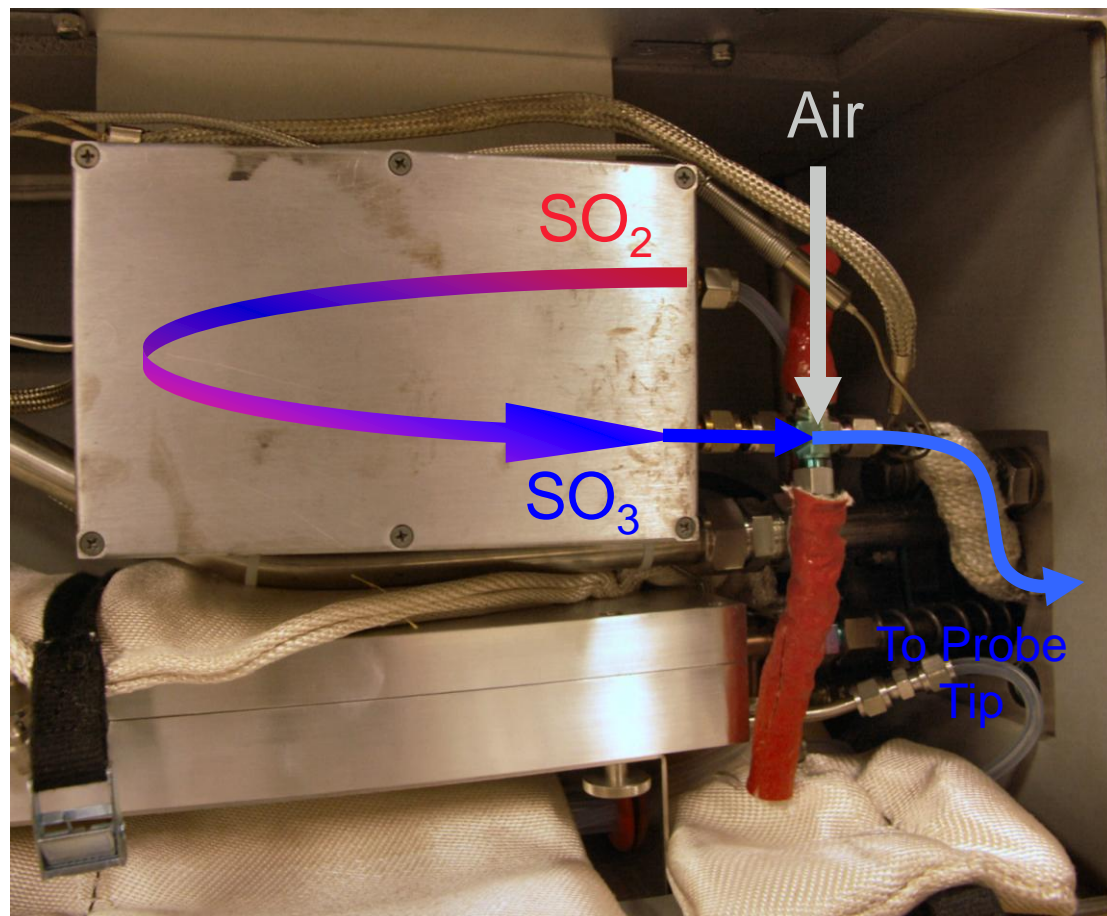
SO₃ System Overview: Probe

- Inertial Filter for “Universal” sample location
- Quick connects for re-location
- Integrated SO₃ Generator

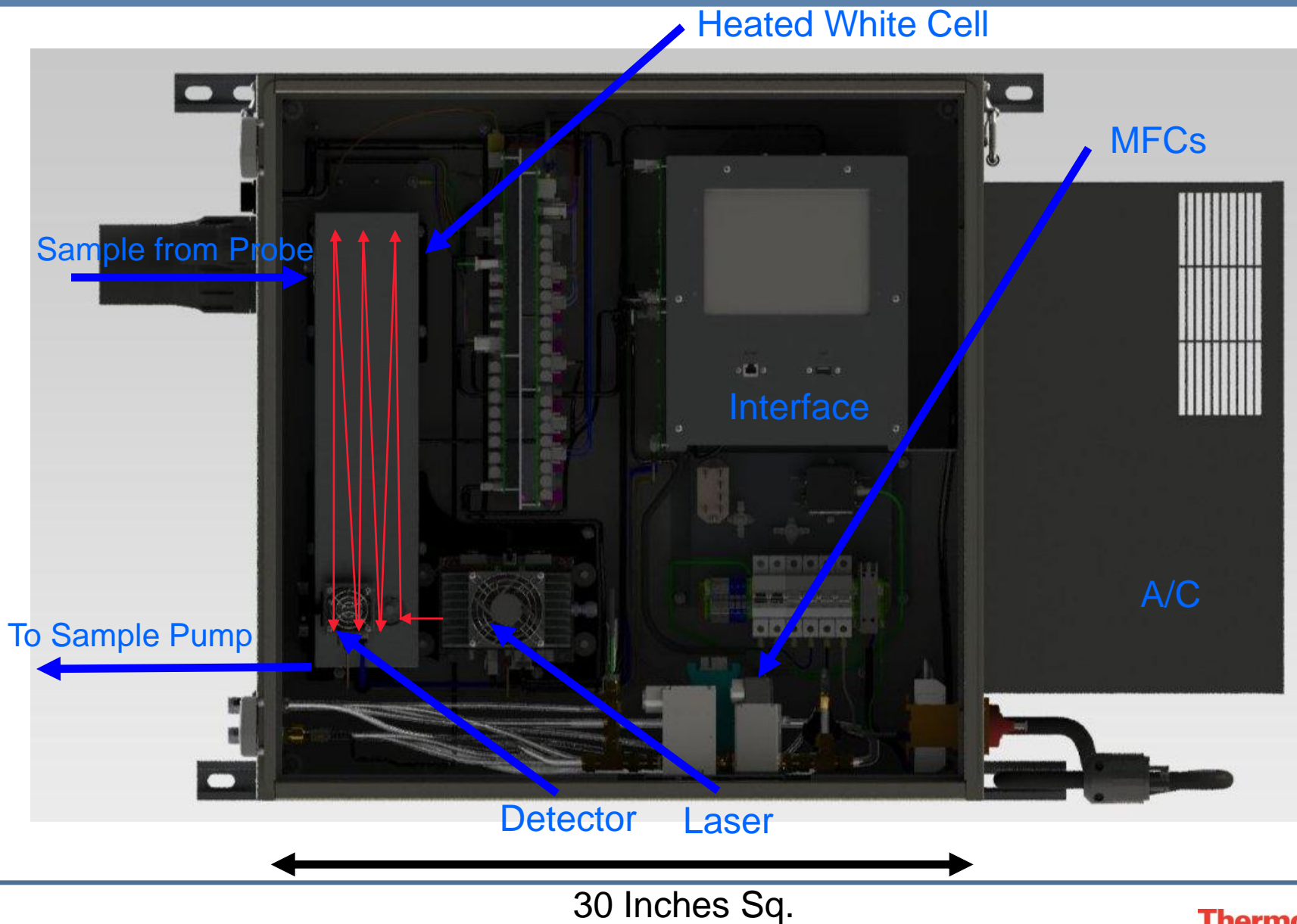


SO₃ System Overview: Generator

- Converts SO₂ cal gas into SO₃
- >98% Conversion efficiency
- Lasts for >1 year
- Calibration Gas injected at probe tip (rule out bias)
- Generator bypass for SO₂ Check



SO₃ System Overview: Analyzer



System Capabilities

- Designed for stand-alone operation
- Automatic System Zero and Span Calibration, or Check
- Automatic Blowback
- Statistical Data
 - Min/Max/Stdev
 - For all parameters

The screenshot displays a software interface for a Thermo Scientific instrument. The main display area shows the concentration of SO₃ as 1.95 ppm. Below this, there is a navigation menu on the left with options: Calibration, Instrument Controls, System Status and Alarms, Data Analysis, and Service. The main content area is titled 'Data Analysis->Calibration Drift' and contains the following information:

Values apply only to Auto Calibrations

Last Two Completed Auto Calibrations

Previous Cal	01-01-70 00:00
Current Cal	06-02-11 13:56

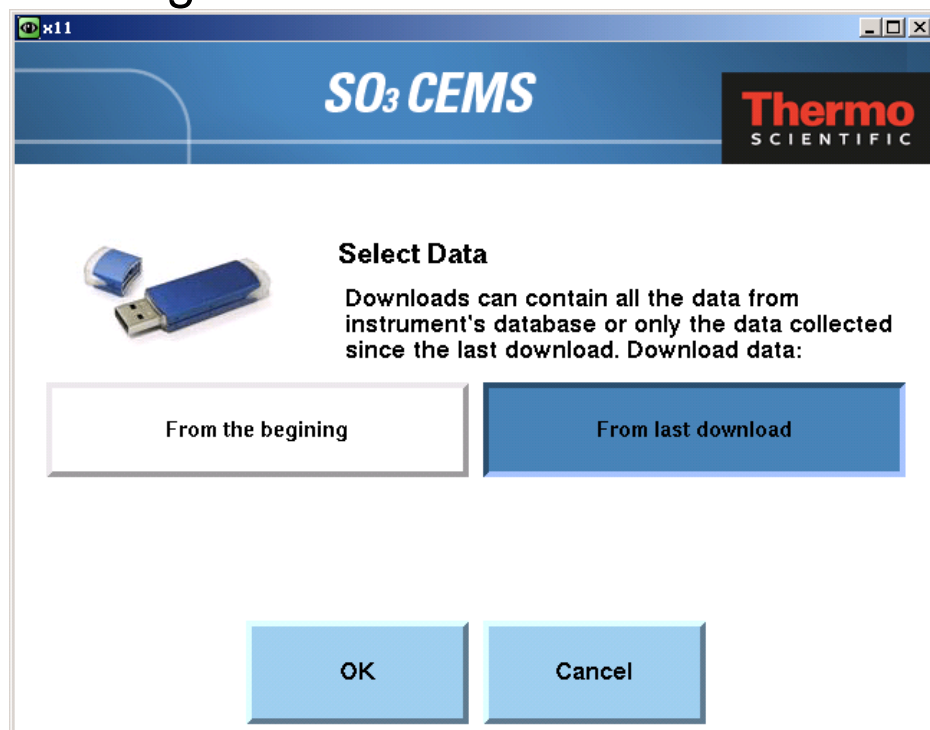
Calibration Drift Values

Zero Drift	3.150 ppm
Span Coefficient Drift	5.0 %

At the bottom of the interface, there are several status indicators: 'Sample', 'Alarms: 0', and the date/time 'June 3, 2011 14:13:02'. A '< Back' button is located in the bottom right corner.

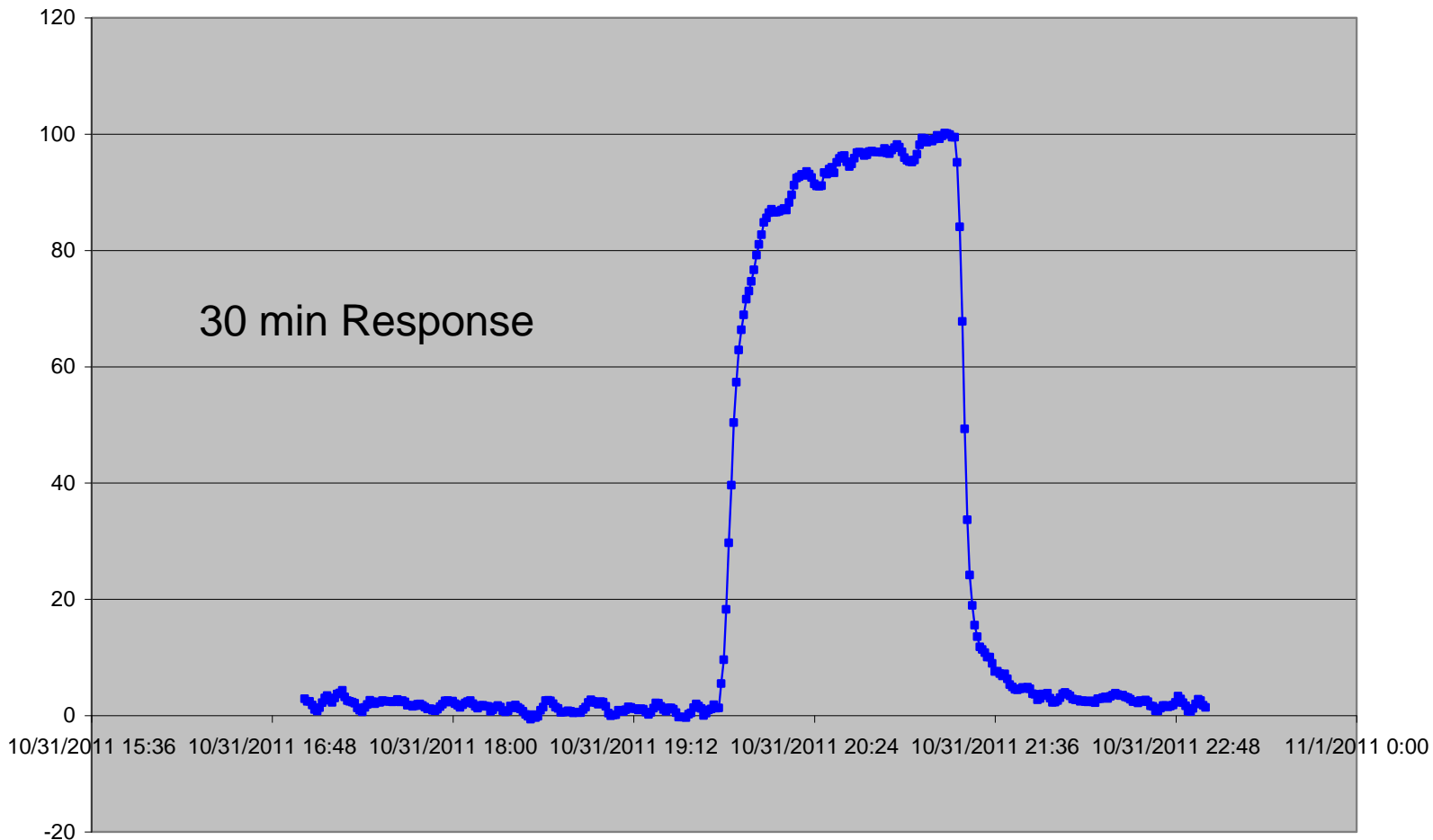
System Capabilities

- Thumb Drive Data Dump (csv format)
- System can hold several months worth of 1 minute data
- Modbus, AK protocol, Digital I/O, Streaming Data
- Remote control via VNC or ePort
- Graphing, View spectrum



Sample Transportation: Unit C in Lab 100 ft Line

SO3 Unit C 11-1-11: 5 min Average
90% Response Time: 30 min



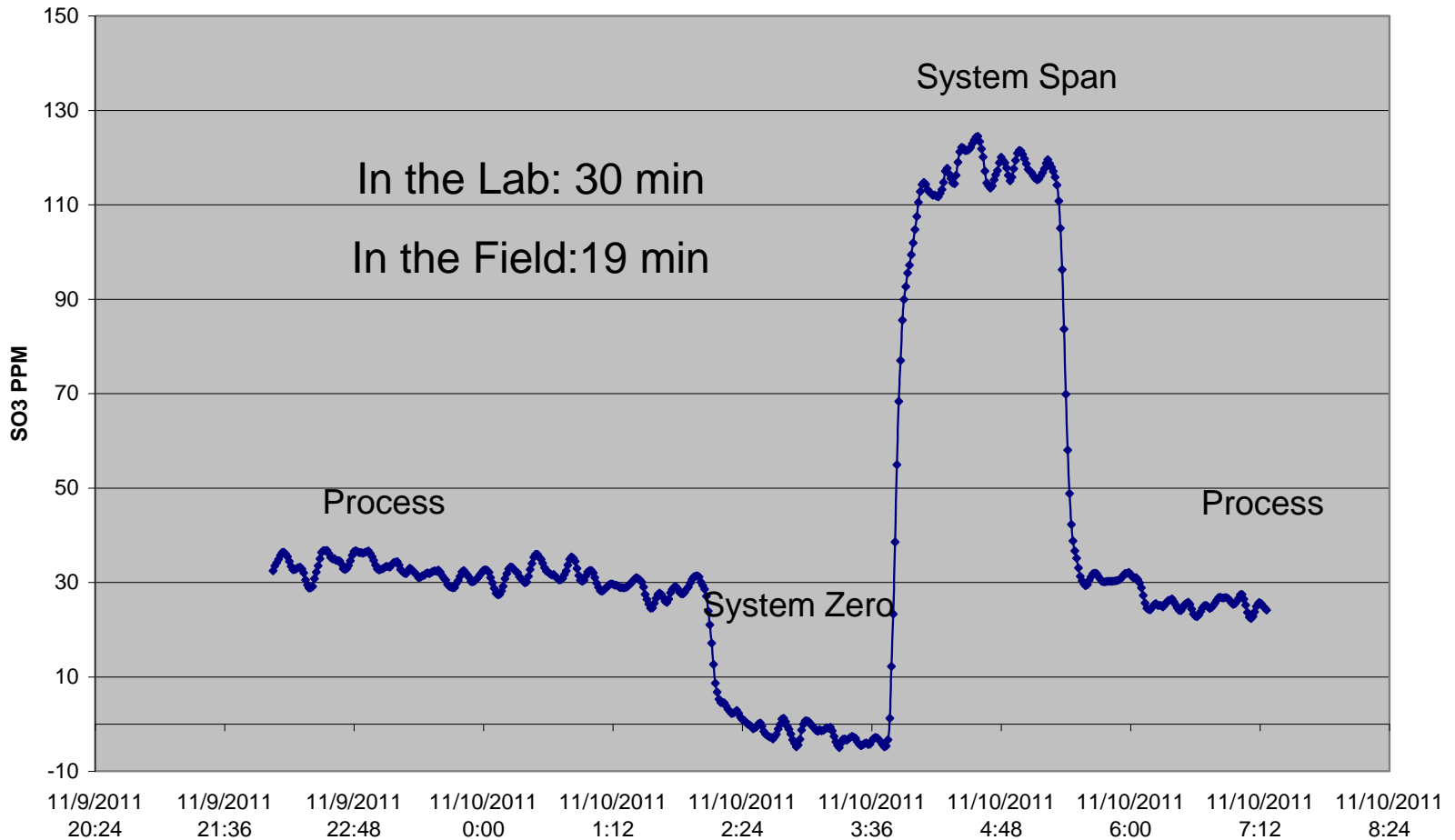
Field Data

- 2 systems are undergoing beta evaluation at 2 power plants
To shake out issues before commercialization
- Site B is downstream of FGD
- Site C is downstream of an ESP



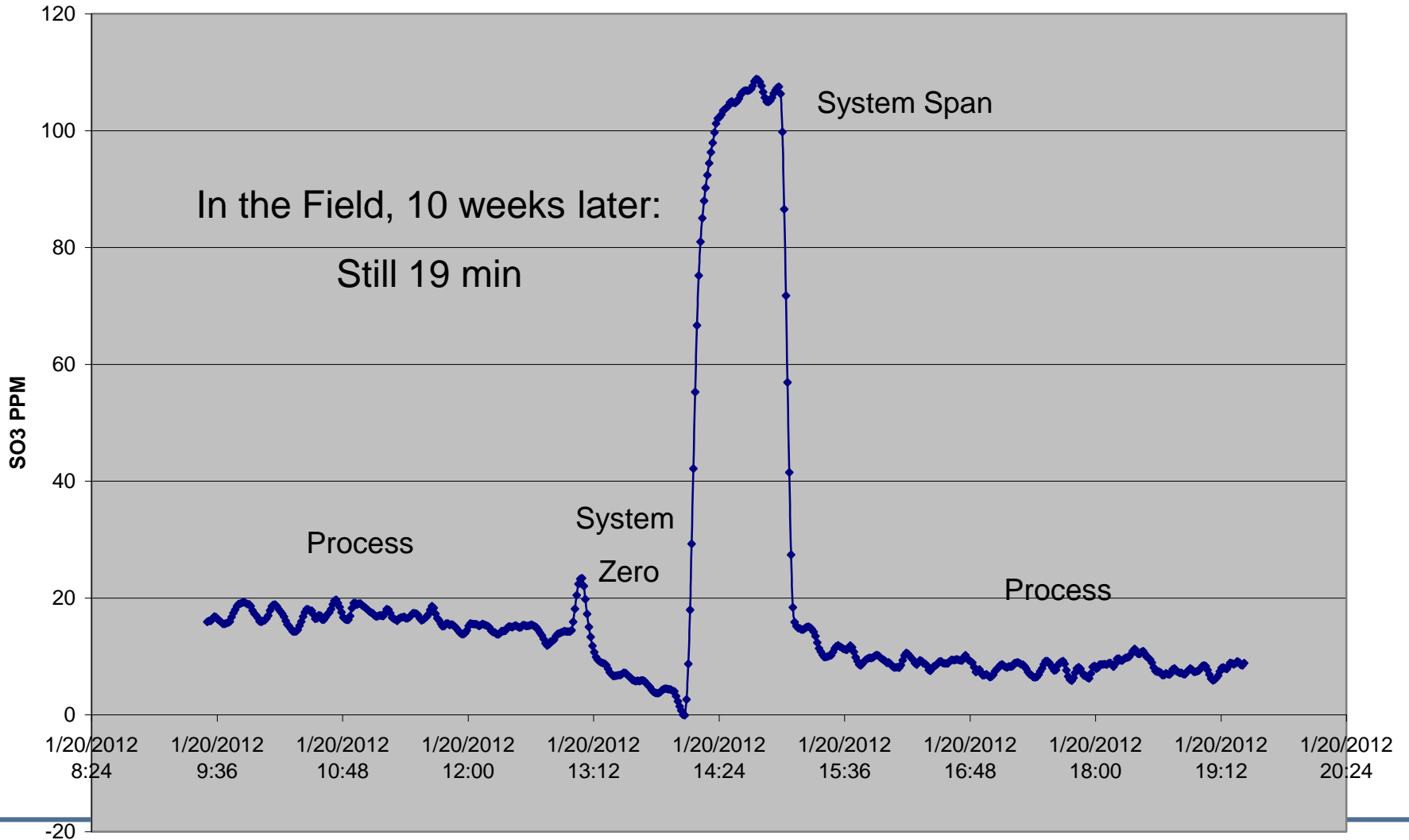
Field Data: Site C

Unit C ESP Outlet
100 Ft, 5 Minute Average



Field Data: Site C

Unit C ESP Outlet
100 Ft Line, 5 Minute Average



Field Data

- System span response time is better in the field
 - Same system / same hot line
 - 30 min response time in lab
 - 19 min response time in field
- Surface passivation or moisture appears improves response time
- Site C sampling location is worst case (*cold ambient*)



Summary / Conclusions

- System Response time is better after the system is exposed to flue gas
- Sample Line length is not the limiting factor of response time (acceptable for process control)
- Dynamic spiking capability can detect measurement bias
- 0.4 ppm **System** Detection Limit
- A known and reliable calibration gas is the difference between trending (other technologies) and measuring
- Test data from FGD in the following weeks



Questions?



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