

**DOE Sensors & Automation
2005 Annual Portfolio Review**

**In-Situ Real Time Measurement of
Melt Constituents in the Aluminum,
Glass, and Steel Industries**

**Robert De Saro
Energy Research Company
Staten Island, NY**

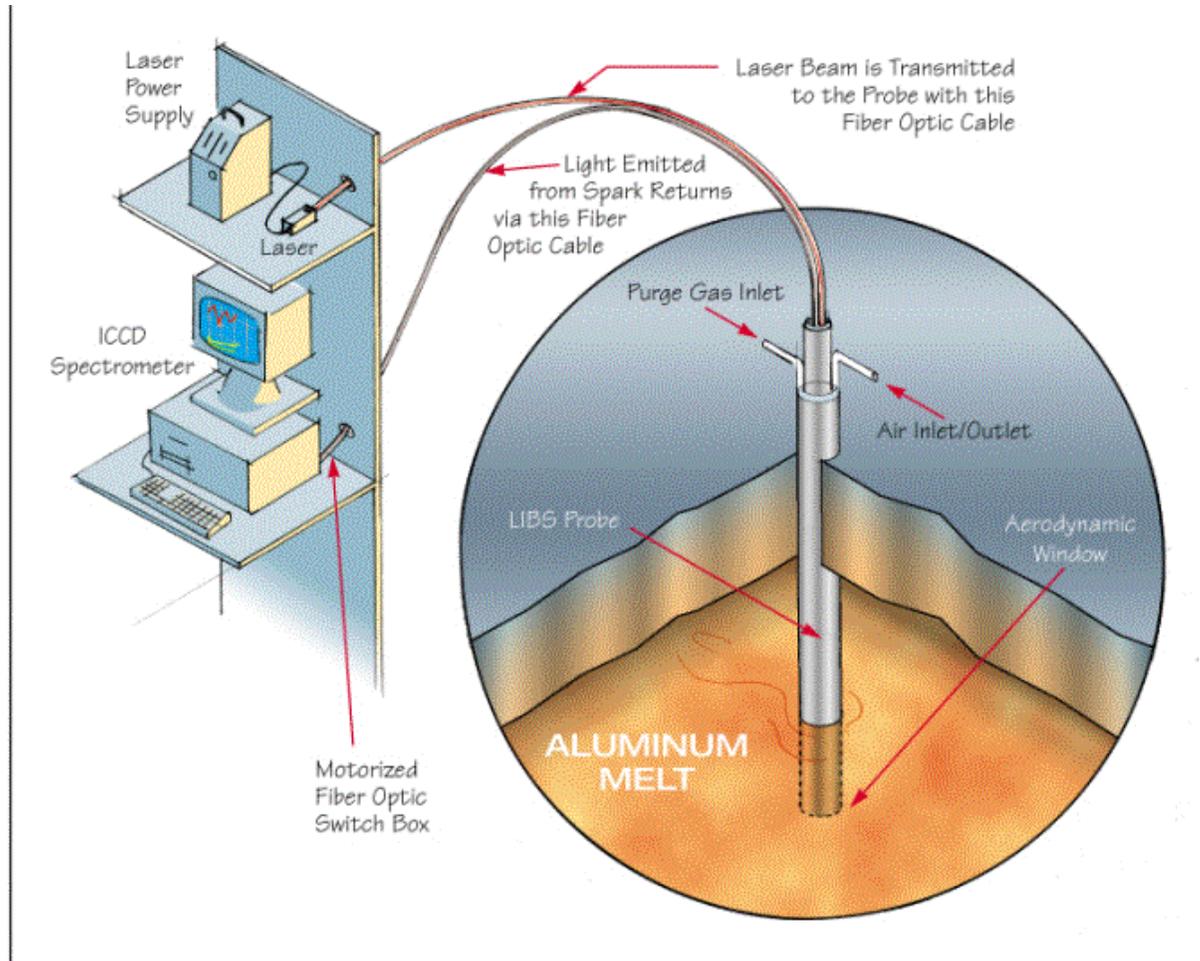
Need

Measure in the chemistry of industrial melts for real time process control

Goals

- **Demonstrate the Technology at Industrial Site**
- **Achieve Industry Accepted Accuracies, with Minimal Operator Training, and Minimal Maintenance**

Core Technology



Novel/Transformational Elements

- **C-LESS™ – Calibration Not Needed**
- **Molten Metal Probe**
- **Single Push Button Operation**
- **No Operator Training Required**
- **Eye Safe**

Initial Industry for Application

Installation at Commonwealth

- **Industrial Cabinet**



- **Sealed, Air Conditioned, EMI Shielded**

Installation at Commonwealth



Installation at Commonwealth





Alloy

Alloy5052

READY ■ ■ ABORT

Start Measurement

Stop ■ Go ●

1 Repetitions
1 (0 = continuous)

Acquisition Status
Done

Analysis Status
Fitting region 11

Clear Print

Concentrations

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*** MEASUREMENT STARTED ***
Thu Jun 05 21:42:32 2003
Al 97.36%
Cr 0.29%
Fe 472.08ppm
Mg 2.10% ***LOW***
Si 0.21%

Thu Jun 05 21:46:55 2003
Al 97.62%
Cr 0.28%
Fe 479.11ppm
Mg 1.83% ***LOW***
Si 0.23%

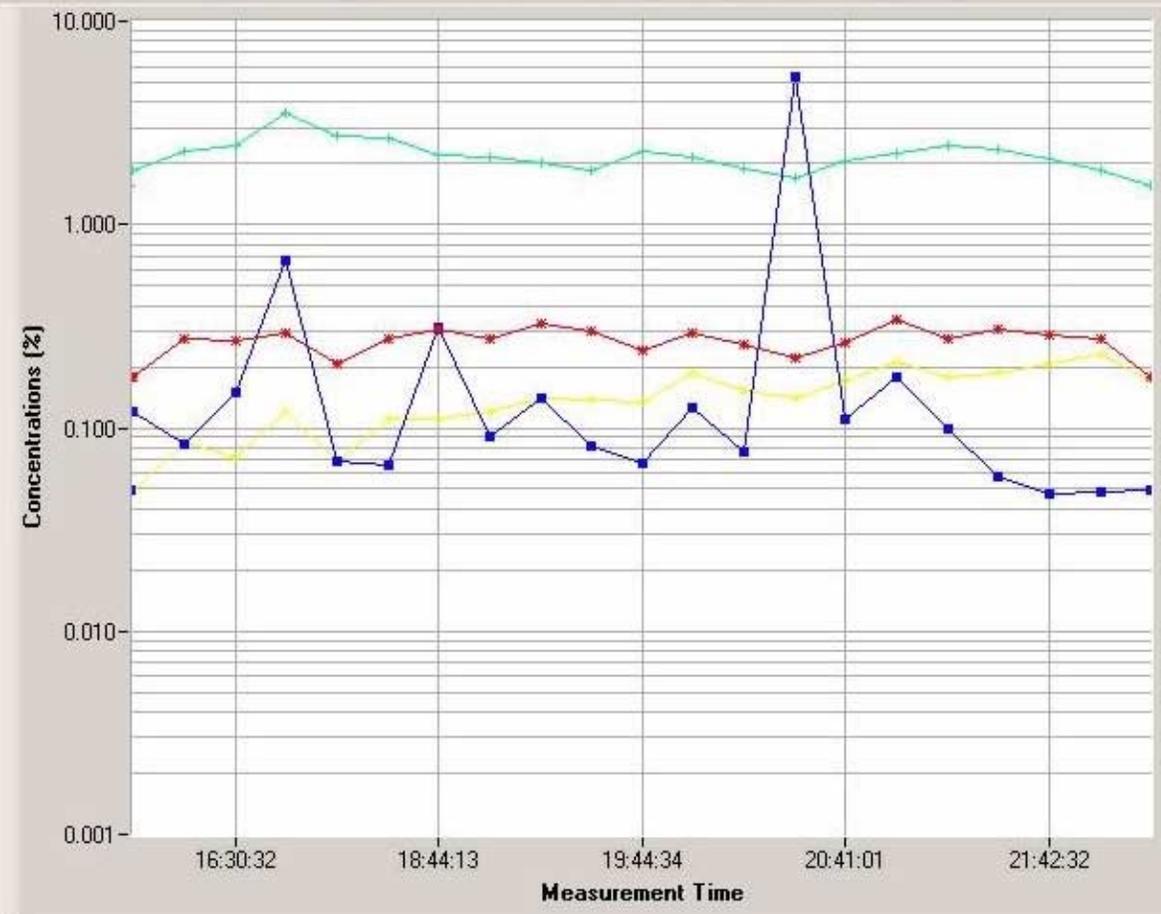
*** MEASUREMENT STARTED ***
Thu Jun 05 21:52:34 2003
Al 98.07%
Cr 0.18%
Fe 493.59ppm
Mg 1.54% ***LOW***
Si 0.17%

*** MEASUREMENT STARTED ***
    
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ERCo ENERGY RESEARCH COMPANY
Automated LIBS measurements

2571A Arthur Kill Road
Staten Island, NY, 10309
(718) 608-8788

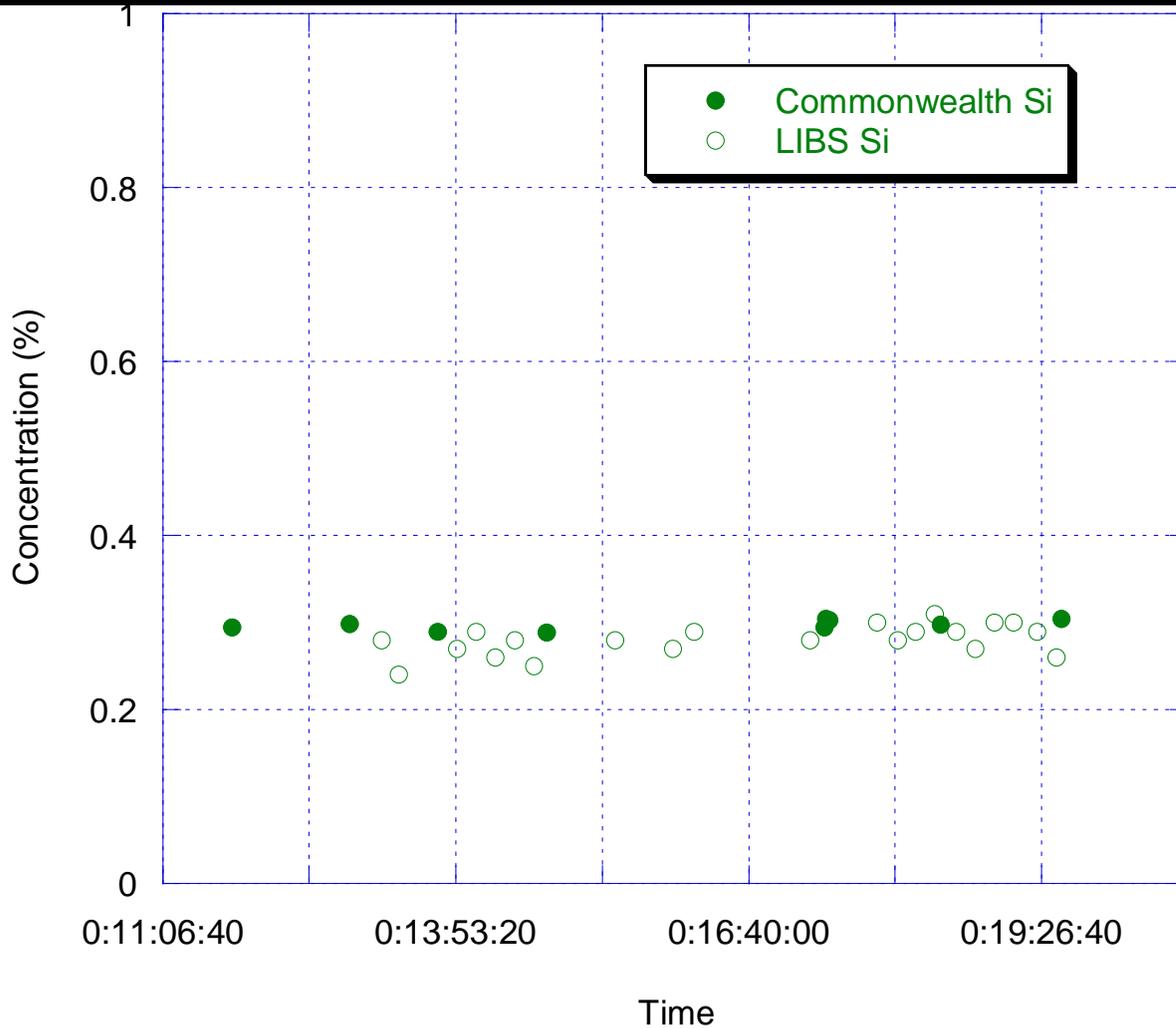
Full Scale 3.50 Rescale Log/Linear All Cr Cu Fe Mg Mn Si Clear



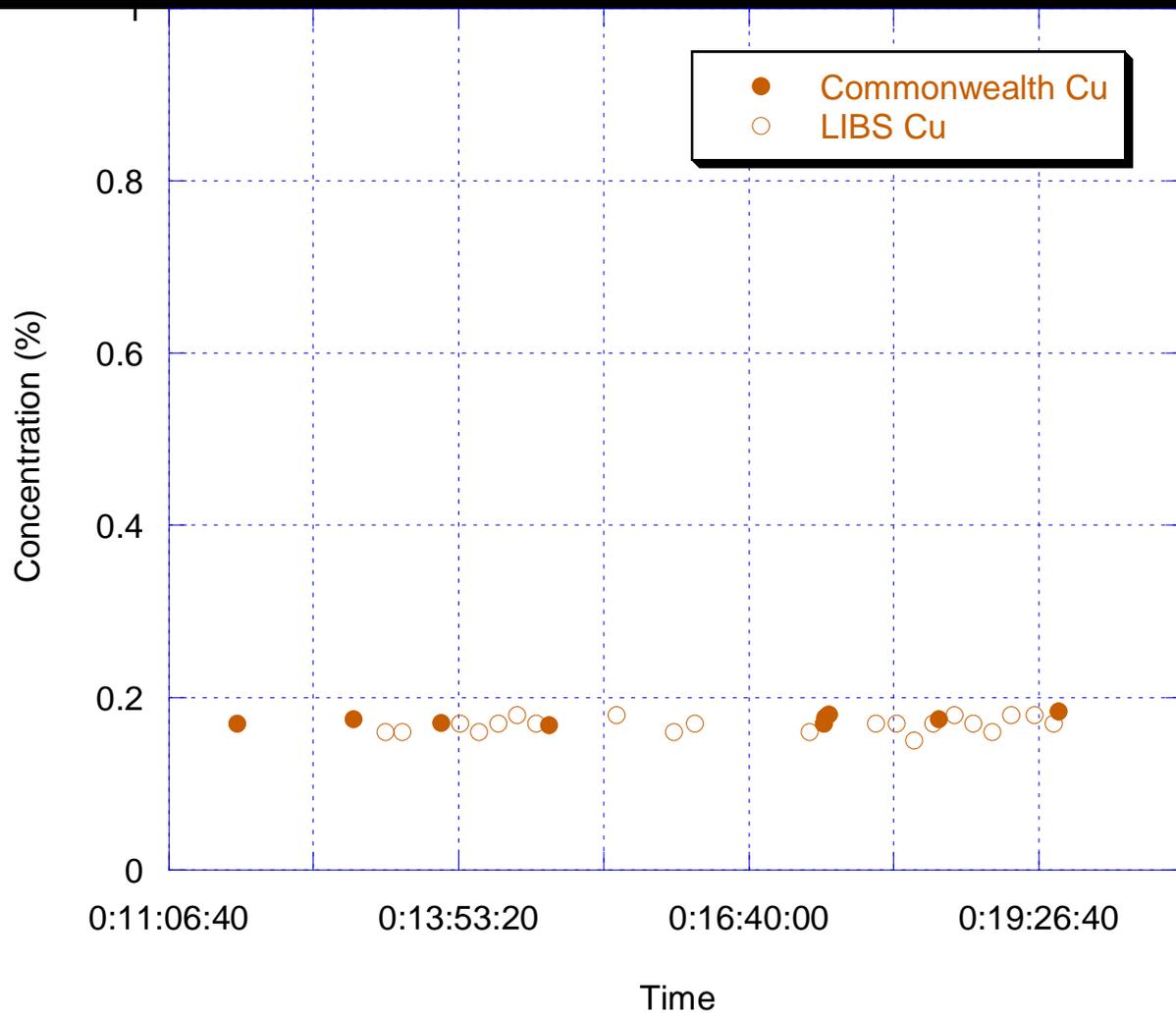
Summary of Commonwealth Data for 3105 Alloy

	Al	Cu	Fe	Mg	Mn	Si	Cr
LIBS Average	97.87	0.17	0.65	0.47	0.52	0.28	0.04
Commonwealth Average	97.56	0.18	0.65	0.49	0.56	0.30	0.05
% Difference	0.32	5.6	0.0	4.1	7.1	6.7	20.0
LIBS RSD	0.09	5.0	4.87	11.61	4.54	6.29	5.52
Commonwealth RSD	0.03	3.51	3.65	1.53	3.57	2.25	2.17

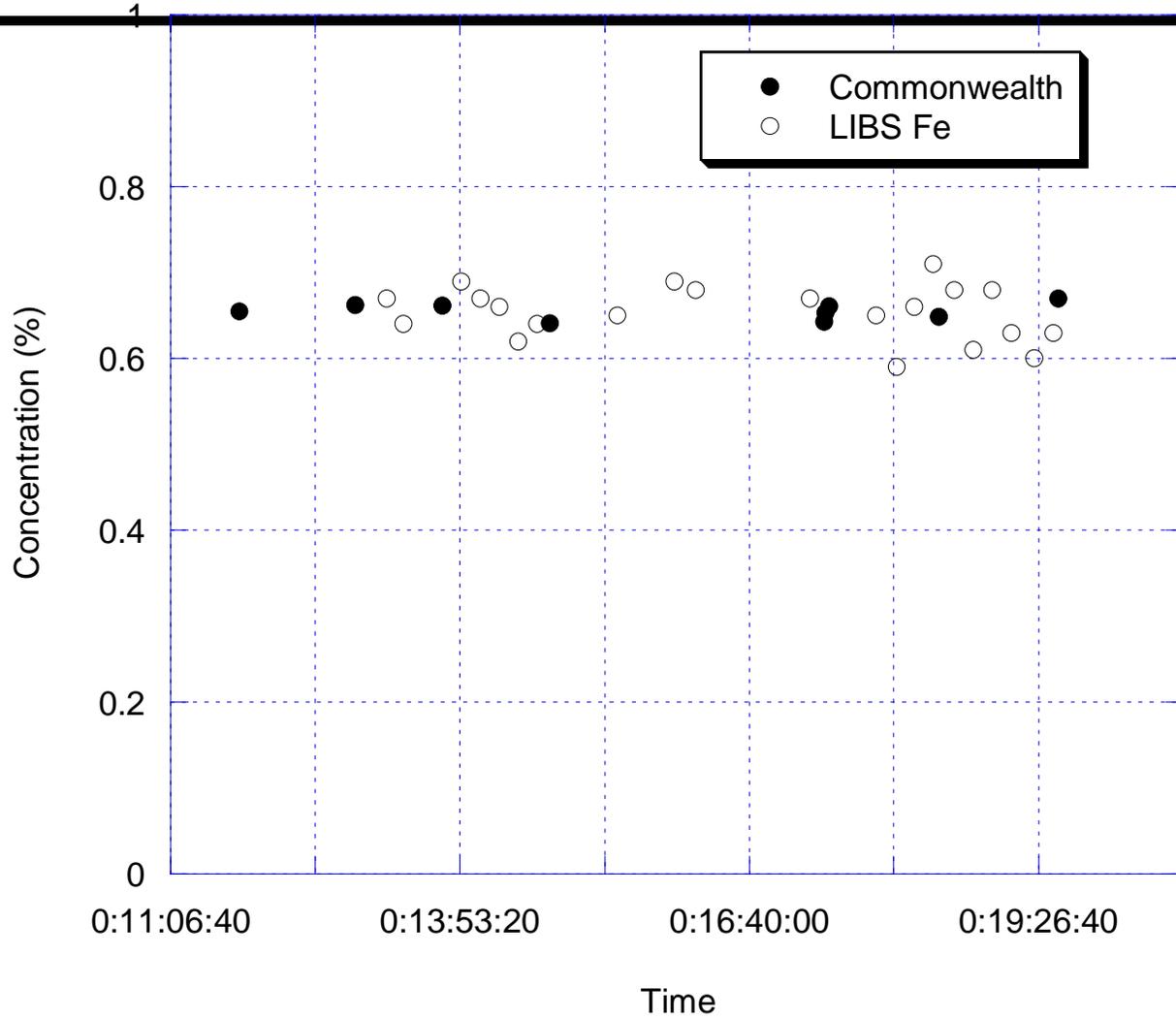
November 6, 2003 Data



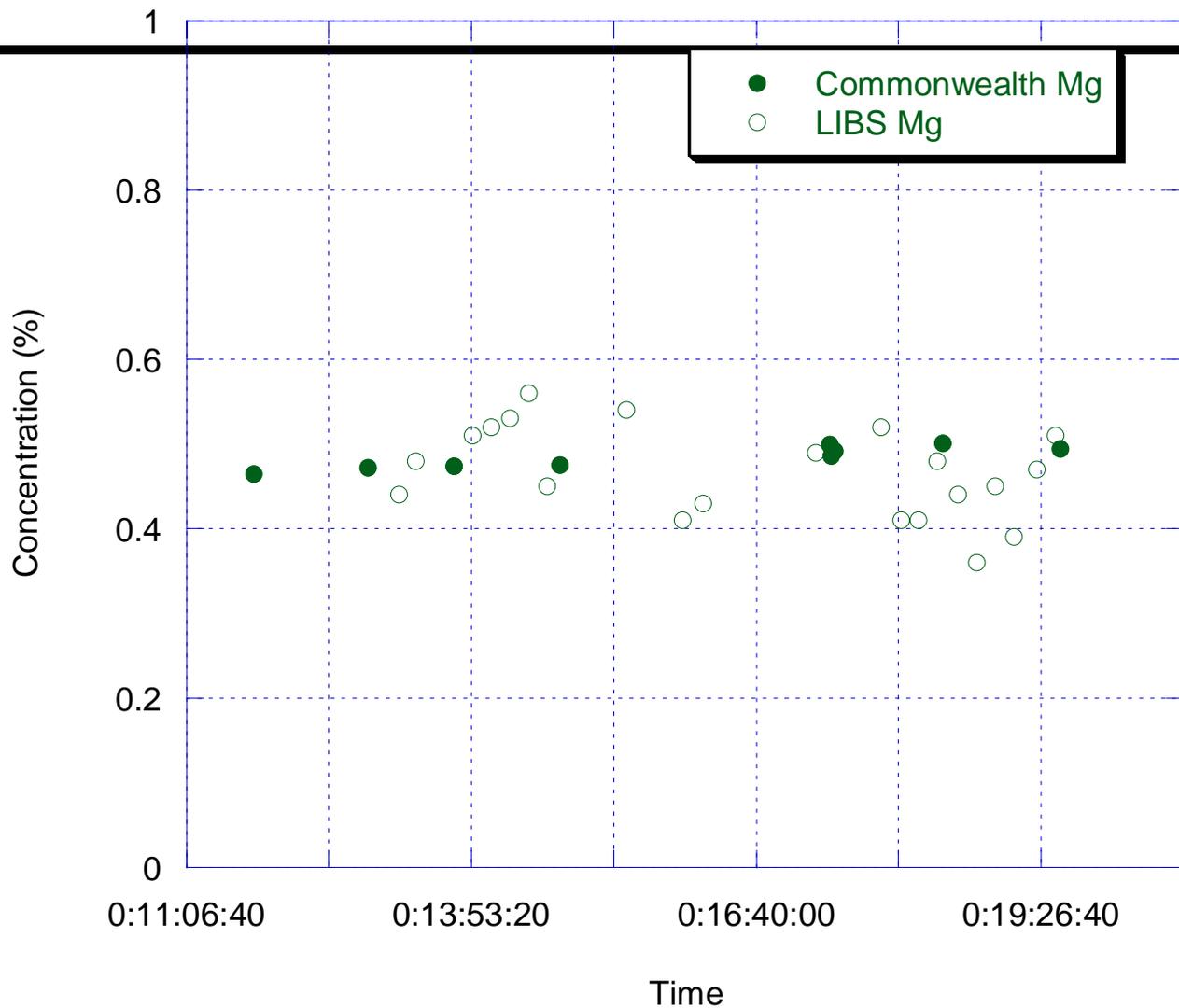
November 6, 2003 Data



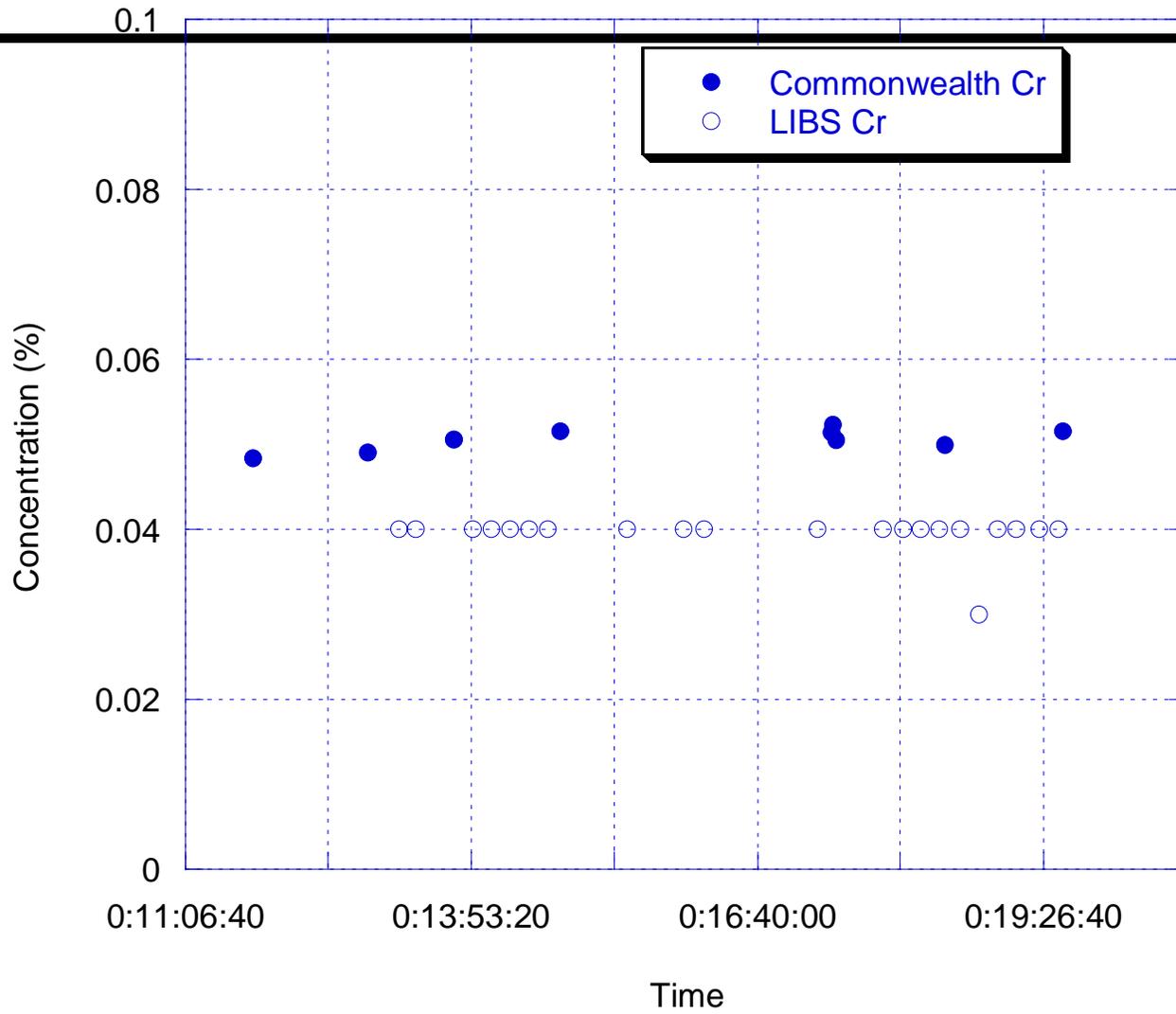
November 6, 2003 Data



November 6, 2003 Data



November 6, 2003 Data



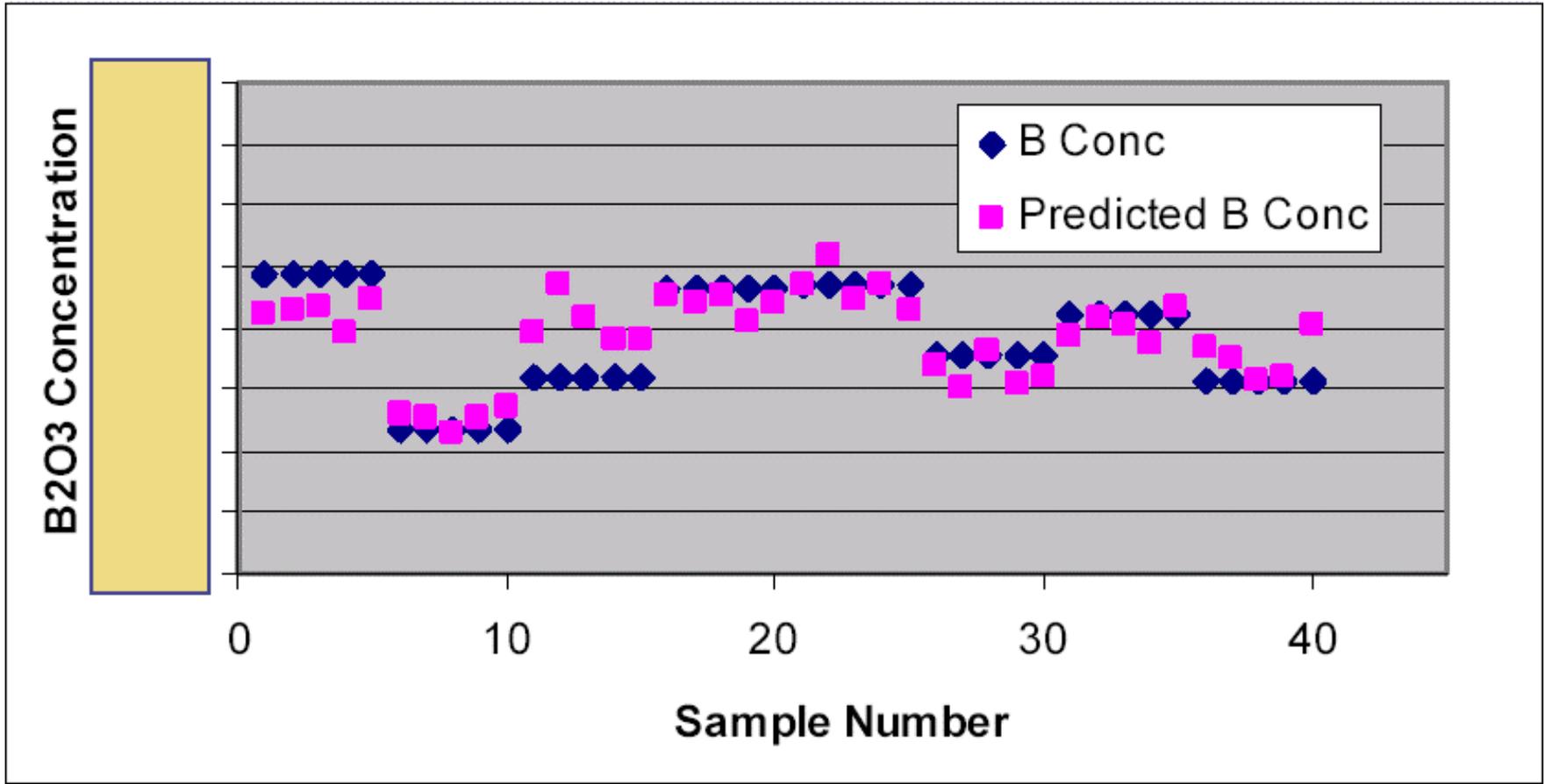
Installation at PPG



Installation at PPG



Boron Measurements



Results

Element	Ulexite Component	Average Difference Between Reported and Measured Values
Boron	Major	0.35%
Calcium	Major	0.50%
Sodium	Major	1.83%
Silicon	Minor	4.03%
Magnesium	Minor	2.52%
Strontium	Trace	0.027%
Aluminum	Trace	0.007%
Iron	Trace	0.002%

Key Project Deliverables

- **Project Complete.**
- **Final Report Delivered**

Energy Saved:

- **In the aluminum industry by reducing the time needed to alloy**
- **In the glass industry by reducing manufacturing defects**
- **In the steel industry by reducing furnace time to achieve desired chemistry (i.e. carbon content)**

Energy Savings

- **Secondary Aluminum – 1.44 trillion Btu's**
- **Glass – 17 to 45 trillion Btu's**
- **Steel – Up to 26 trillion Btu's**

Accomplishments to Date

- **The LIBS System has been developed for industrial applications for the first time**
- **Two commercial installations have been completed; one at Commonwealth and another at PPG**
- **Calibration free techniques have been developed such that instrument calibration is not required.**
- **The systems have been certified to be eye safe.**
- **Software has been developed to operate each system.**
- **The system is easy to operate and requires no operator training.**

Anticipated Economic Impact

- **Savings to industry substantial. \$500 million per year on energy savings alone.**
- **Increased production will vary by industry, but will dwarf the energy savings**

Continuation after ITP-Sponsored Project

- **Currently marketing to the glass and aluminum industry. Other markets will require additional R&D funding**

Value Proposition for End User

- **The LIBS System allows industrial end users to increase their production with existing equipment by being able to alloy to desired tolerances quicker than is now possible.**
- **It also allows them to reduce wasted product before a part is made.**
- **Combined, this results in substantial cost savings and revenue increases**

Commercialization Plan

- **Business Plan is now being completed. ERCo will spin-off new company that will sell and market to the aluminum and glass industries initially. ERCo will support this affiliate by continuing its R&D development. Investors will provide cash flow.**
- **Revenue, market penetration, etc. proprietary.**

Commercial/Technical Risks Remaining

- **New technology acceptance**
- **Overseas markets important**

Conclusions

- **Concentration Measurements Demonstrated**
- **Probe Design Completed.**
- **Calibration Free Technique Developed.**
- **Patent Issued (US, Europe, Japan, Canada)**
- **Certified as Class 1 – Eye Safe**
- **Single Push Button Software Developed**
- **No Operator Training Required**
- **Industrial Installation at Commonwealth Aluminum Successful**
- **Industrial Installation at PPG Successful**