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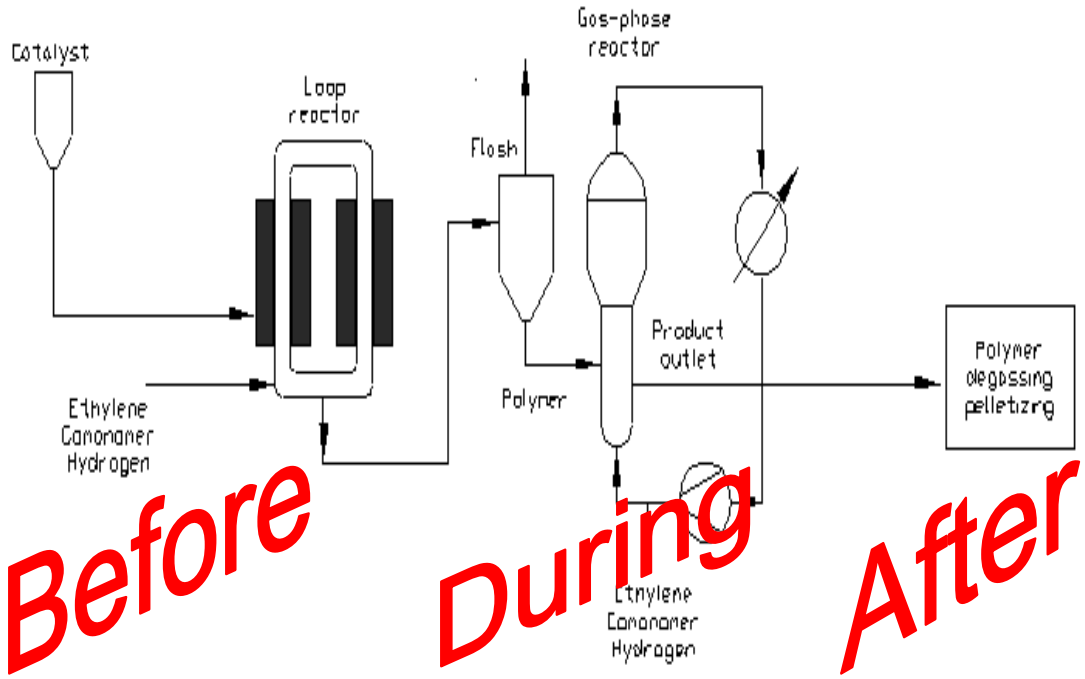
Analyze with Integrity®

Polyolefin Reaction Monitoring: Before, During and After

Eric Ziskend – Vice President of Sales, Petrochemicals

Presentation Overview

- Before Reaction
  - Catalyst feed monitoring
- During Reaction
  - Electrostatic analyses
- After Reaction
  - Resin property analyses
- Summary



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Partial List of Customers

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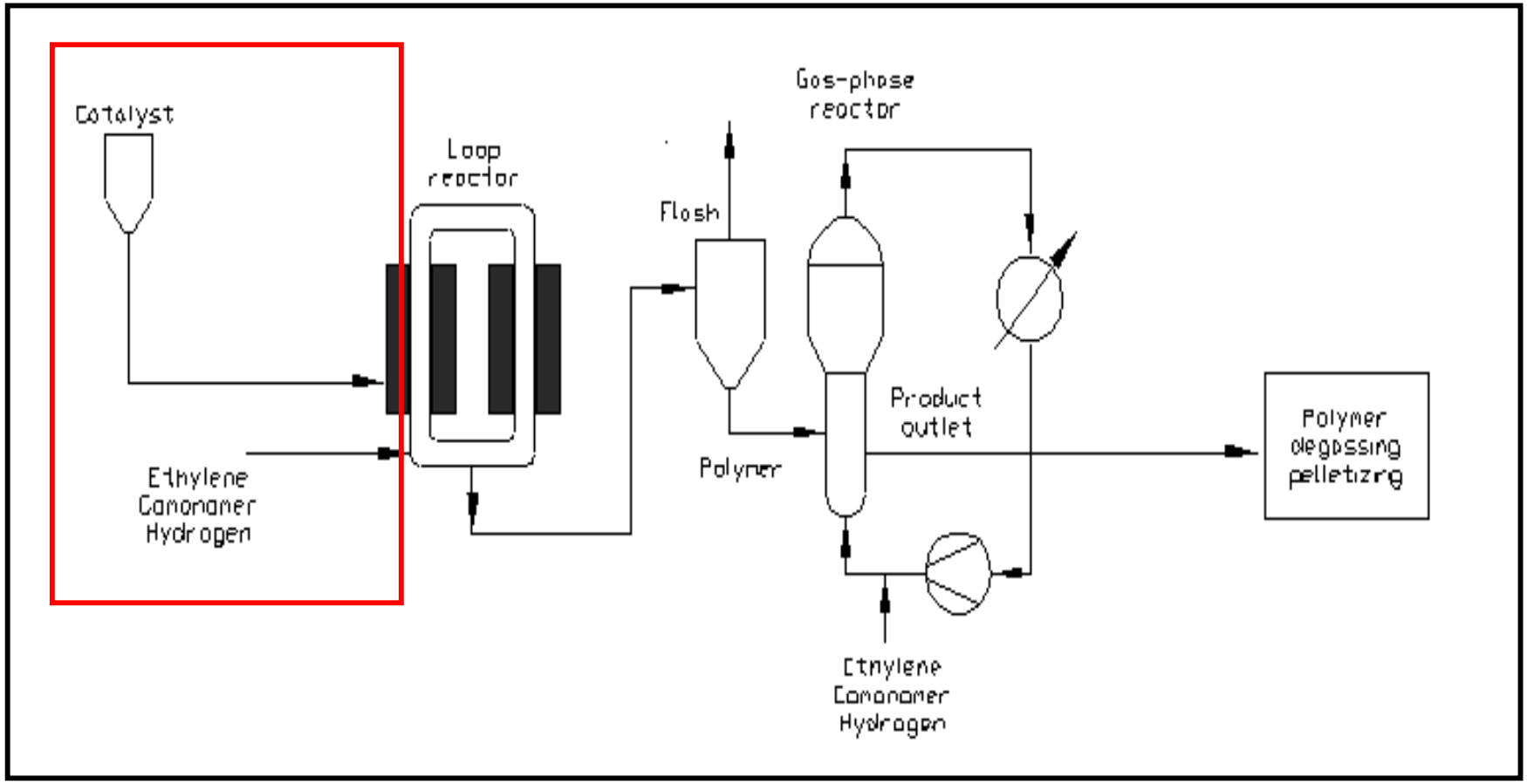
Before Reaction



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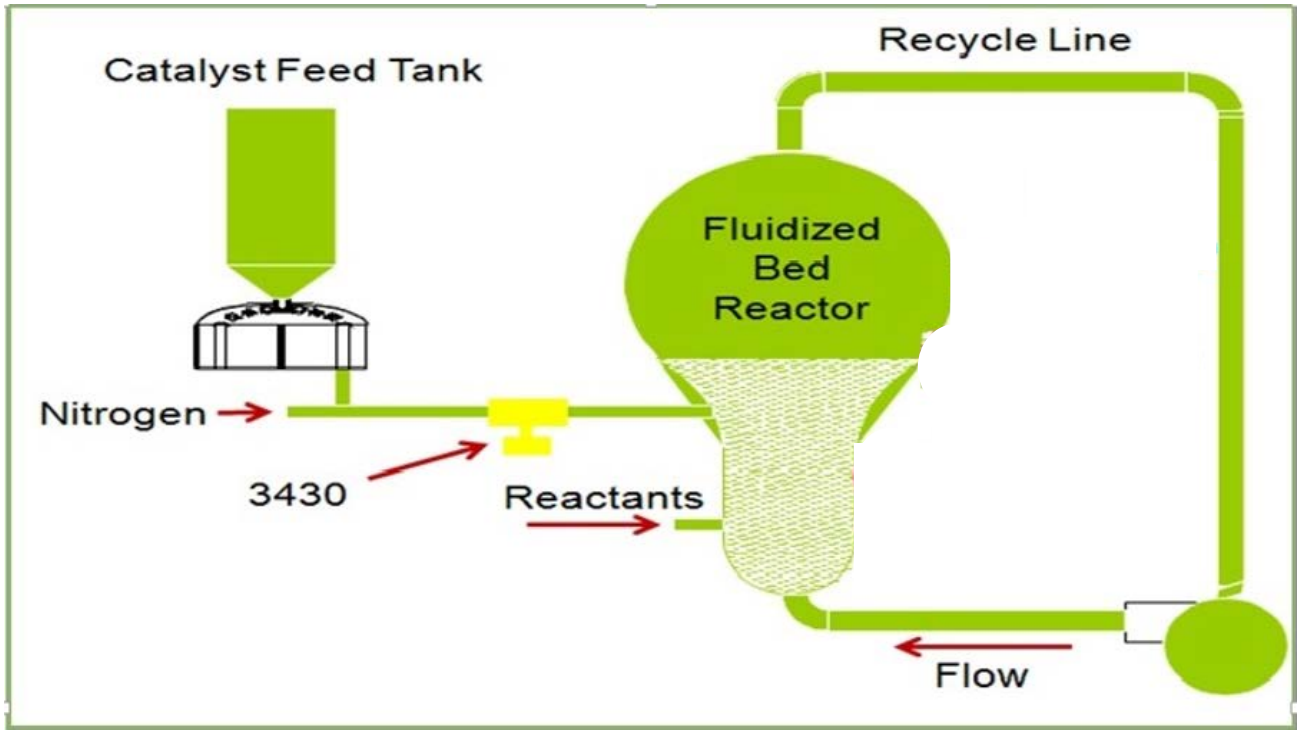
Catalyst Ring Sensor - 3430

- Suitable for both liquid and gas phase reactors
- No obstructions to flow, no additional pressure drop
- Ruggedized for the factory environment



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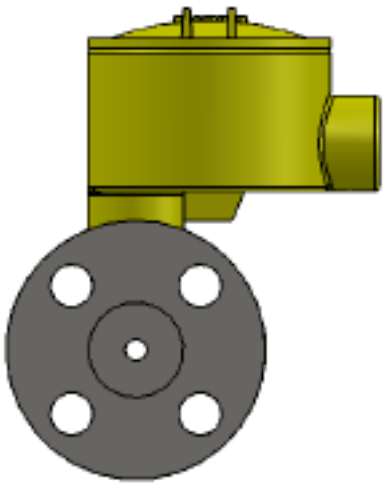
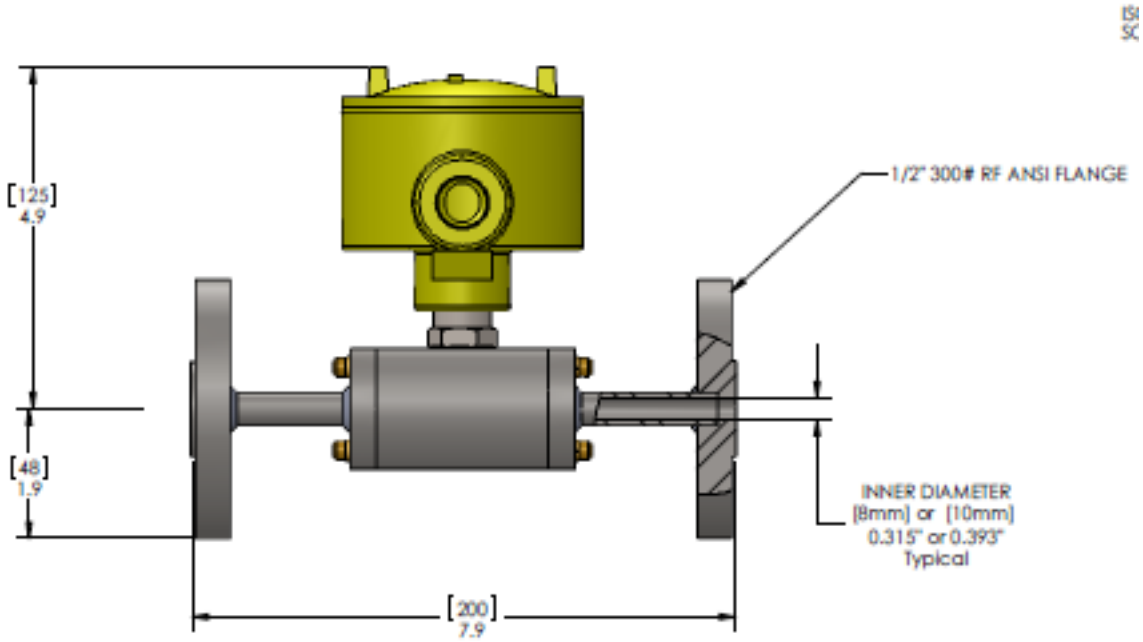
3430 Layout Drawing





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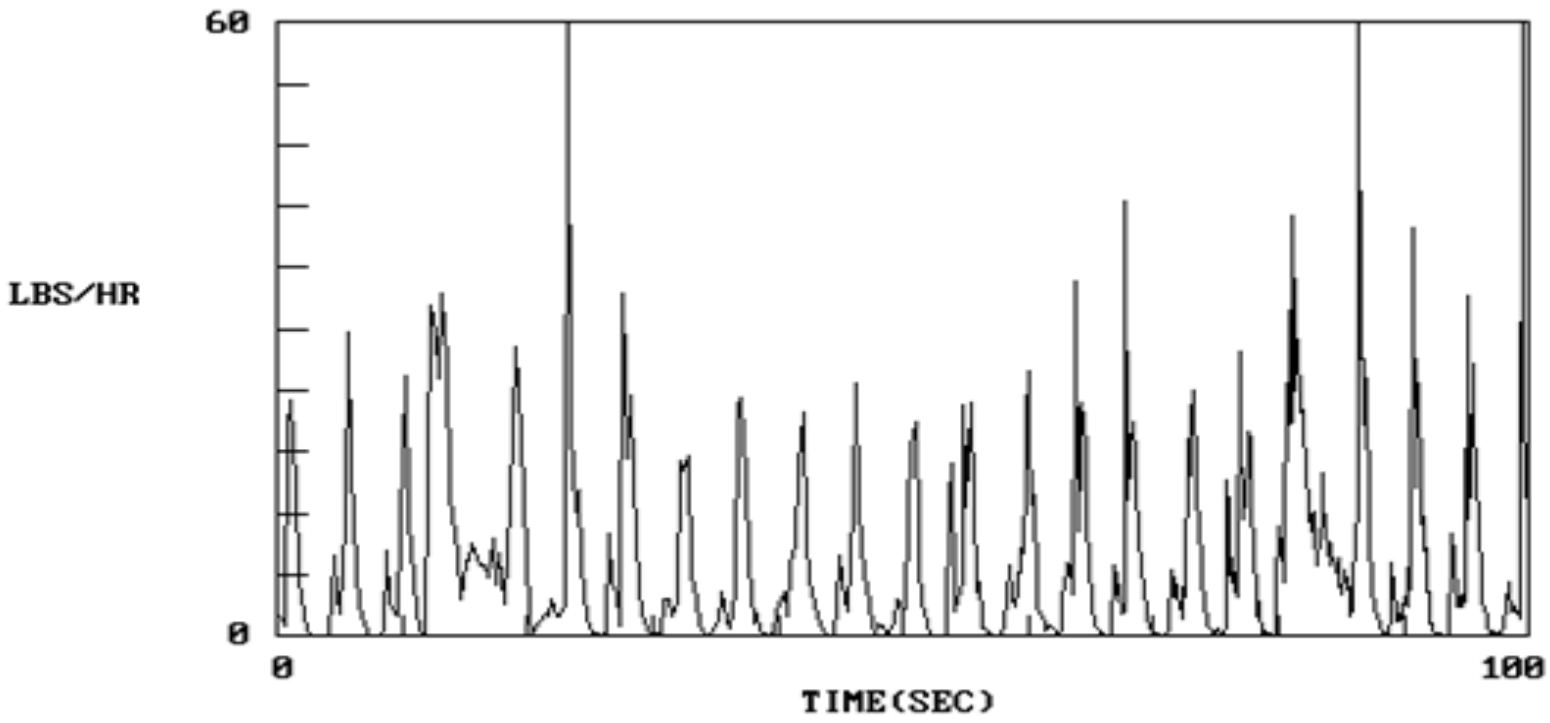
Catalyst Data Graph



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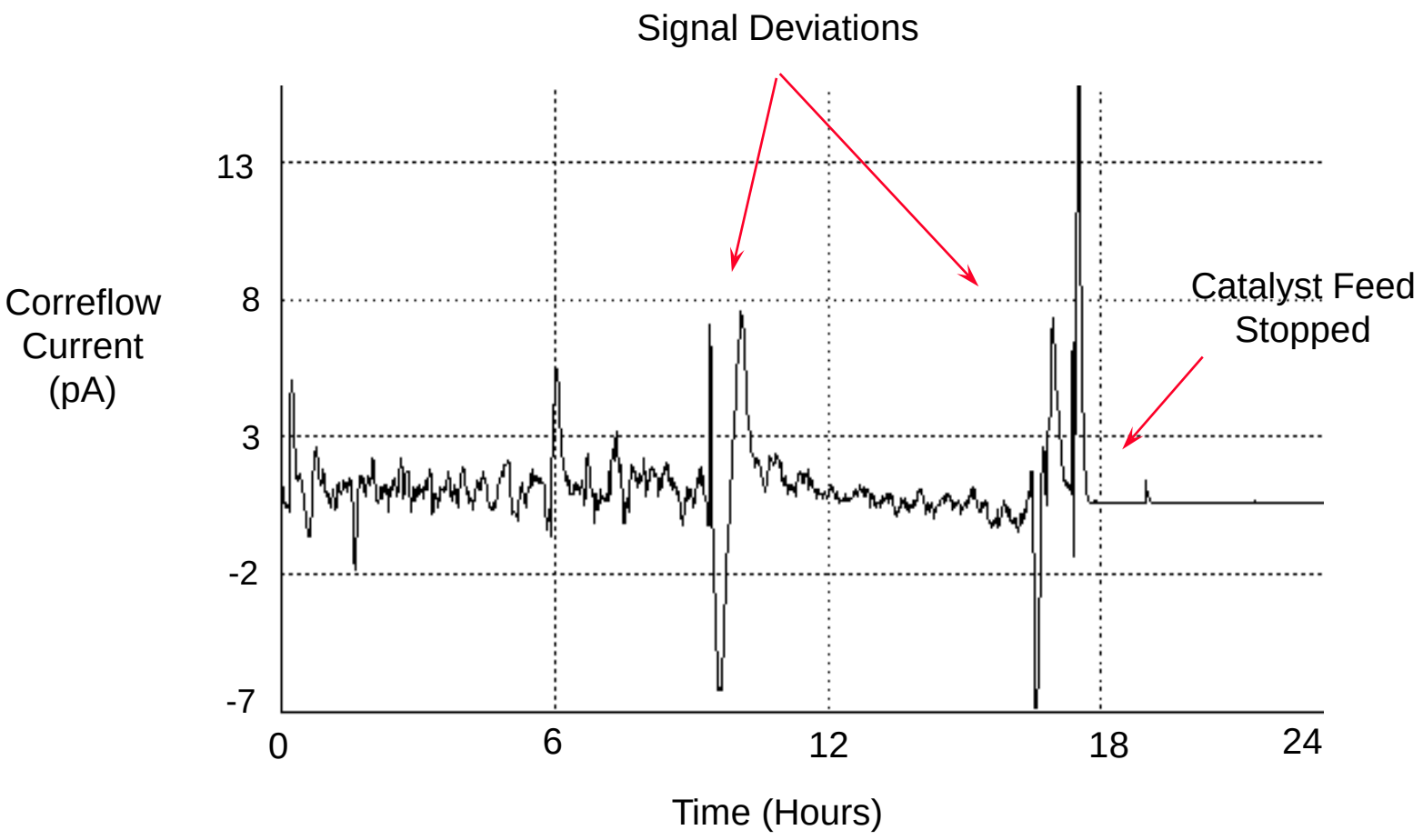
Catalyst Data Graph



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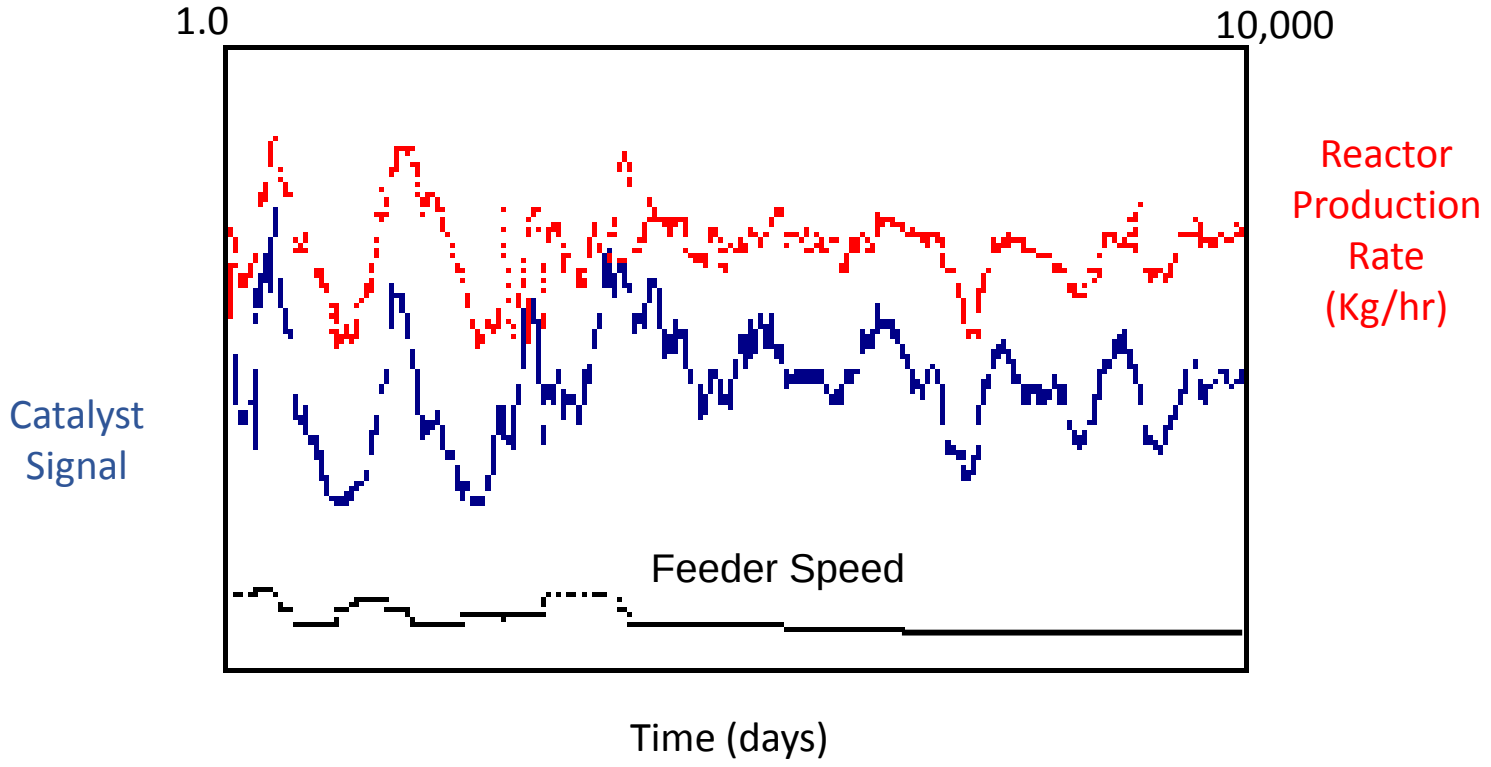
Influence of Catalyst Feed on Production



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Catalyst Ring Sensor Benefits

- Real-time flow indication
- Early warning of process upsets
- Diagnose feeder problems
- No moving parts

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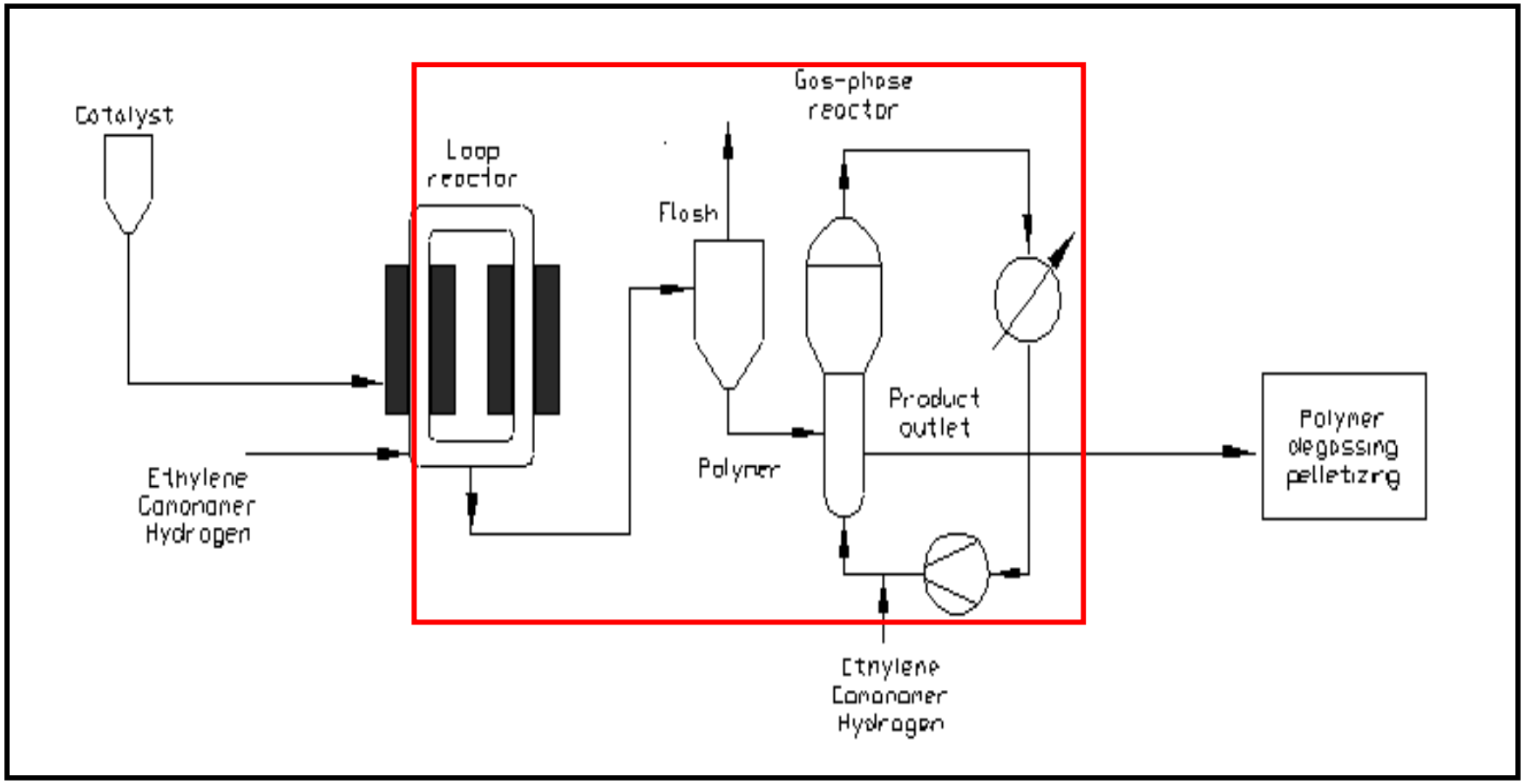
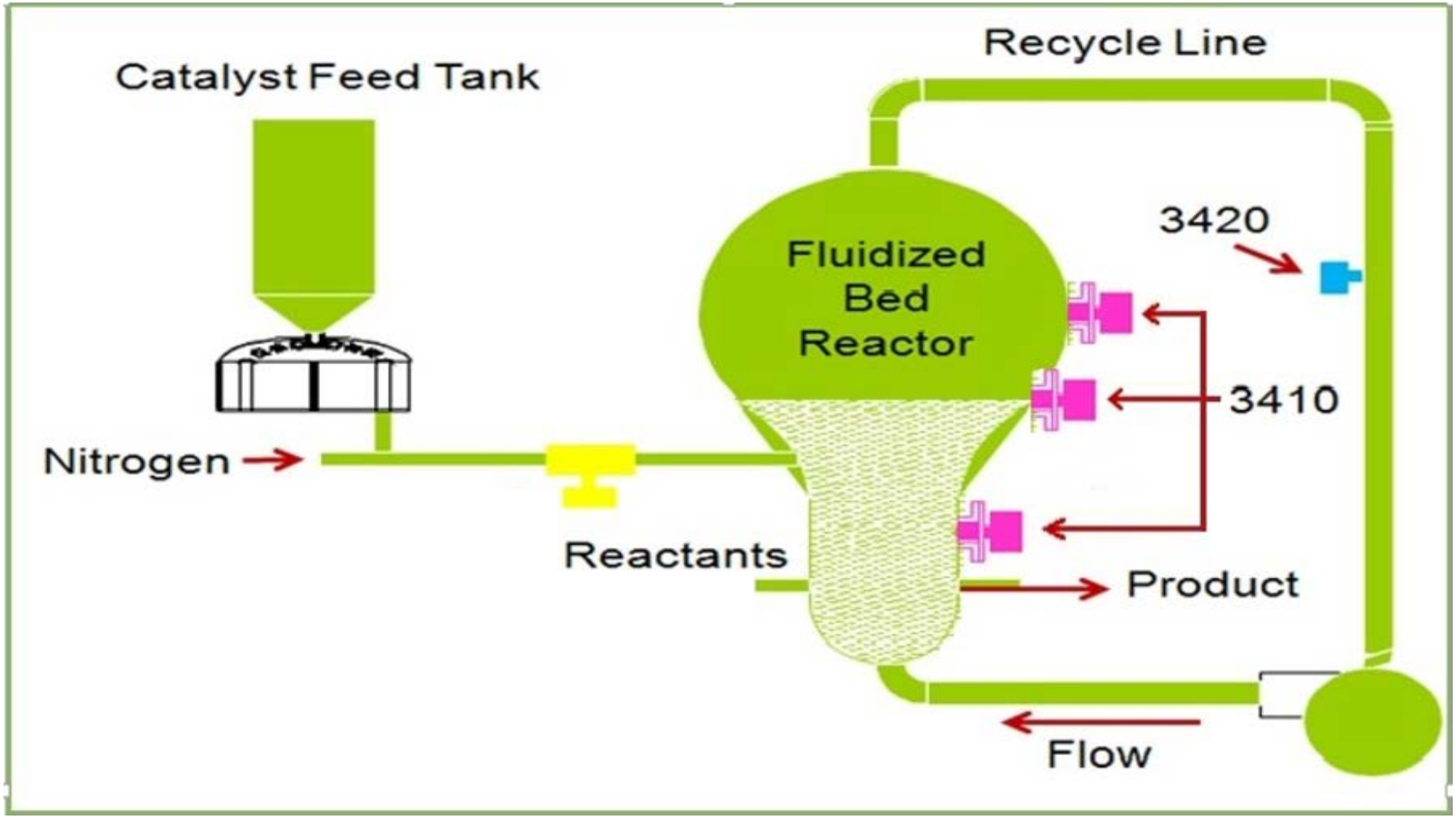
During Reaction



Electrostatic Monitoring Probes



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Electrostatic Probes

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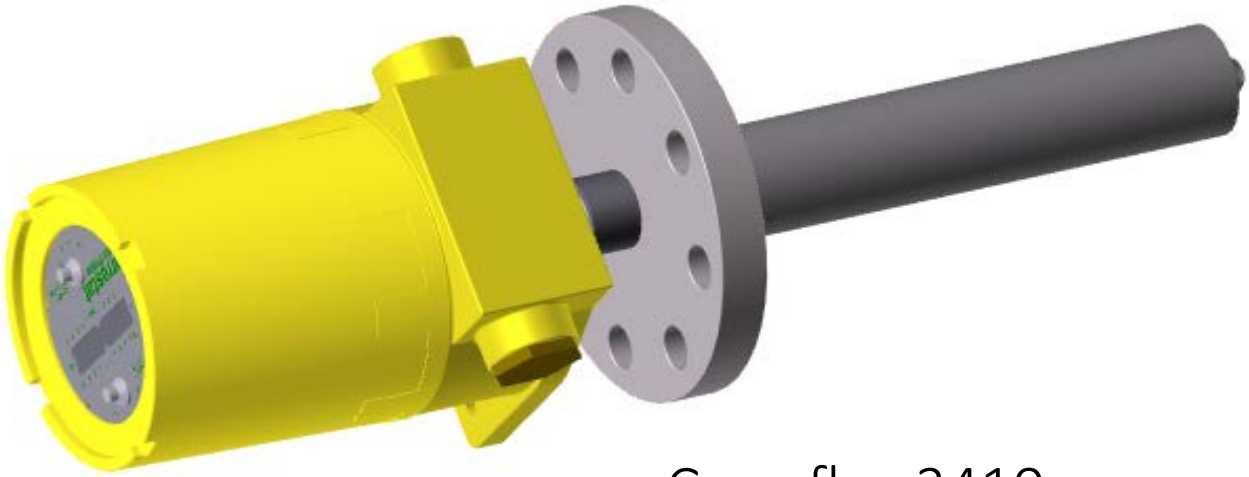

Correflux 3410

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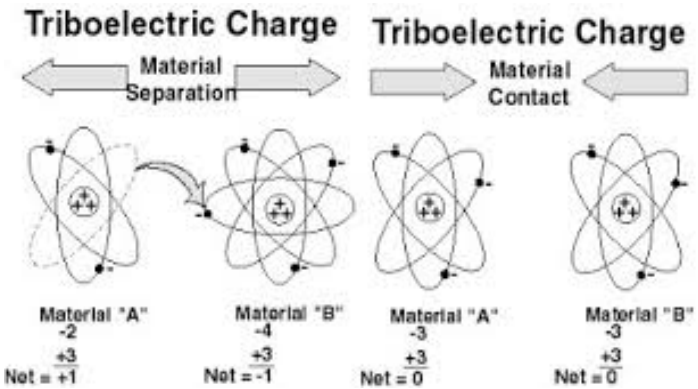
Triboelectric effect



triboelectricity

(trī'bō-ĭ-lĕk-trĭs'ĭ-tē, trĭb'ō-)

An electrical charge produced by friction between two objects that are nonconductive. Rubbing glass with fur, or a comb through the hair, can build up triboelectricity. Most everyday static electricity is triboelectric.

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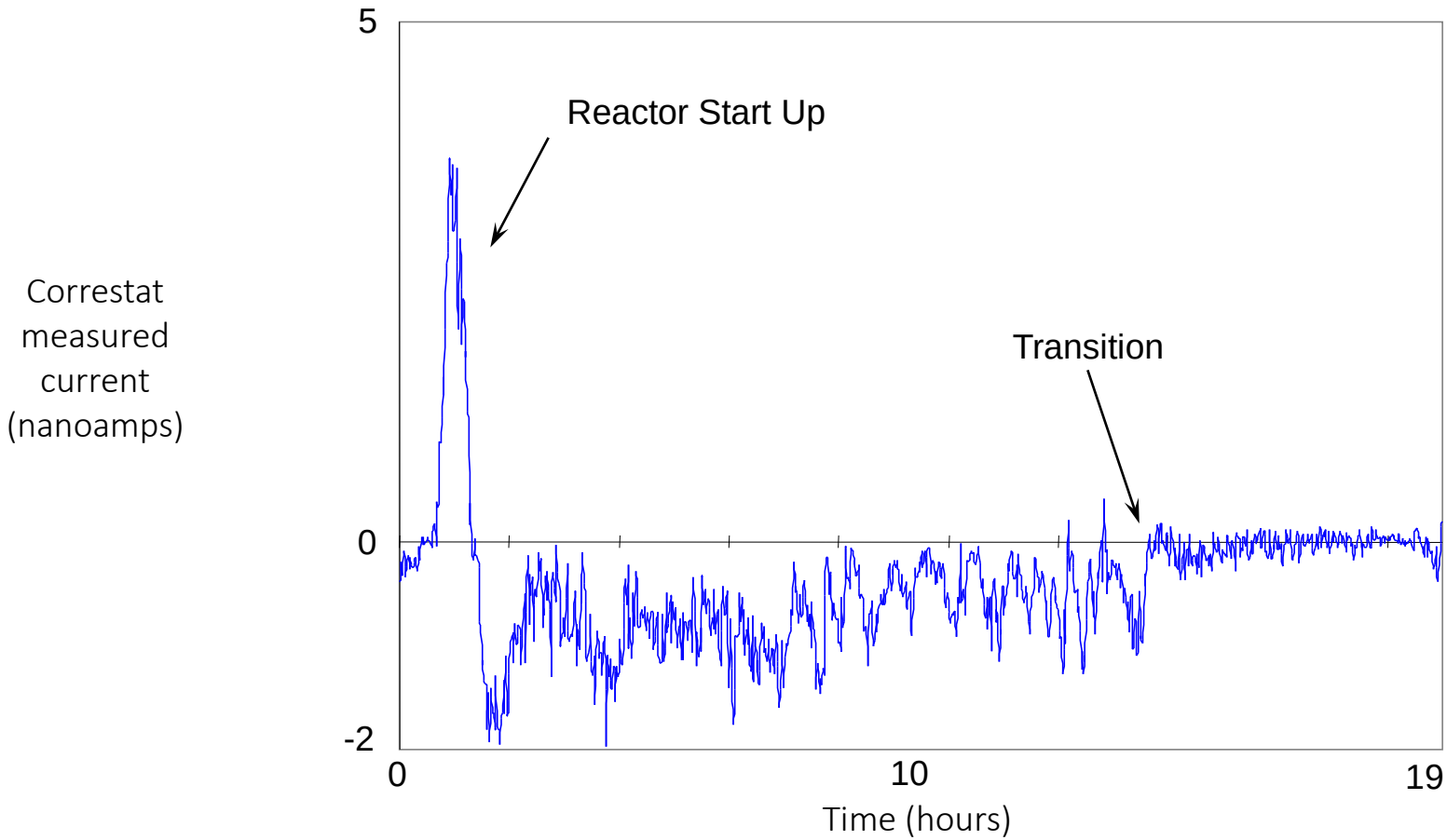
Reactor Electrostatic Measurements



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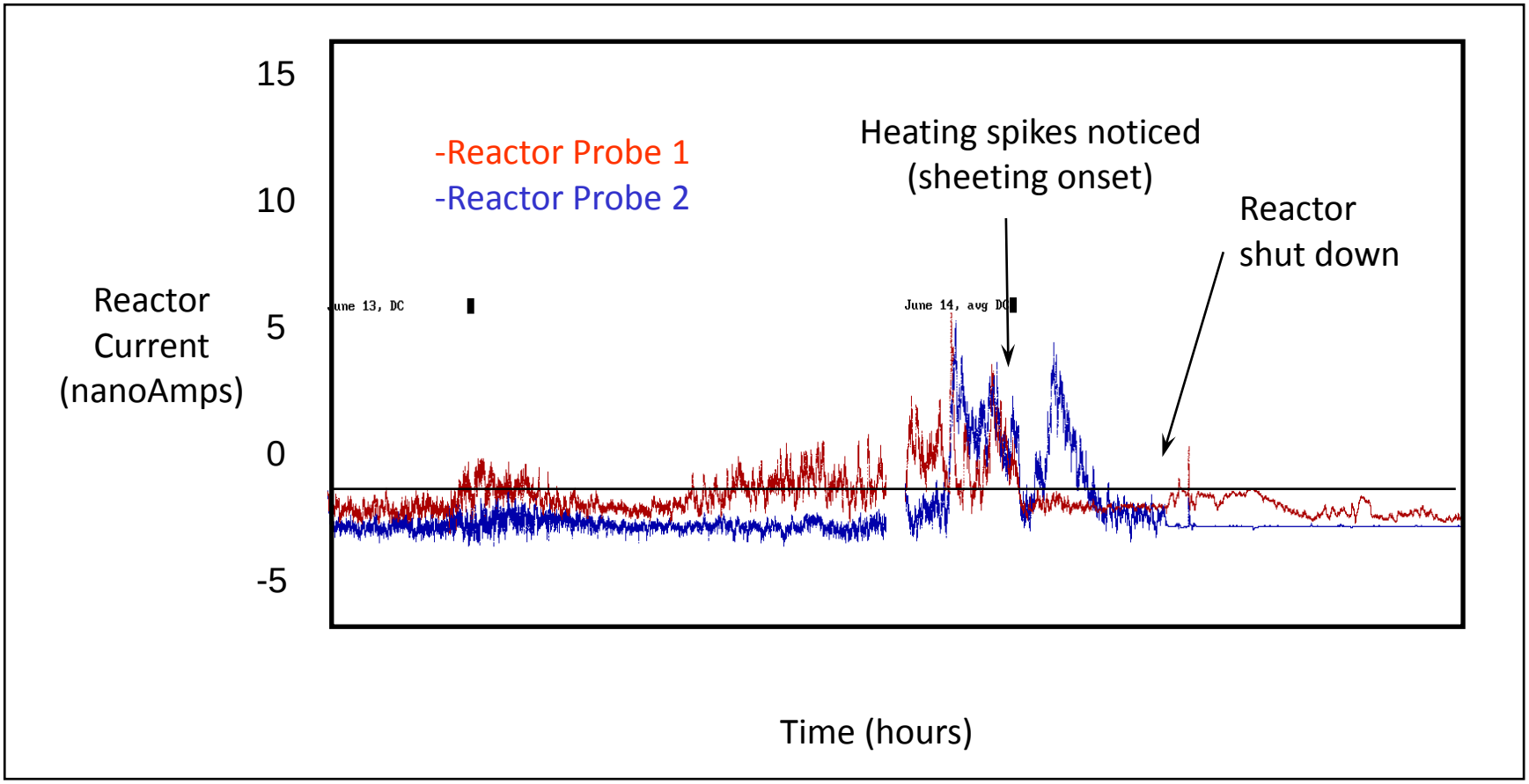
Reactor Probe Data – Sheeting Event



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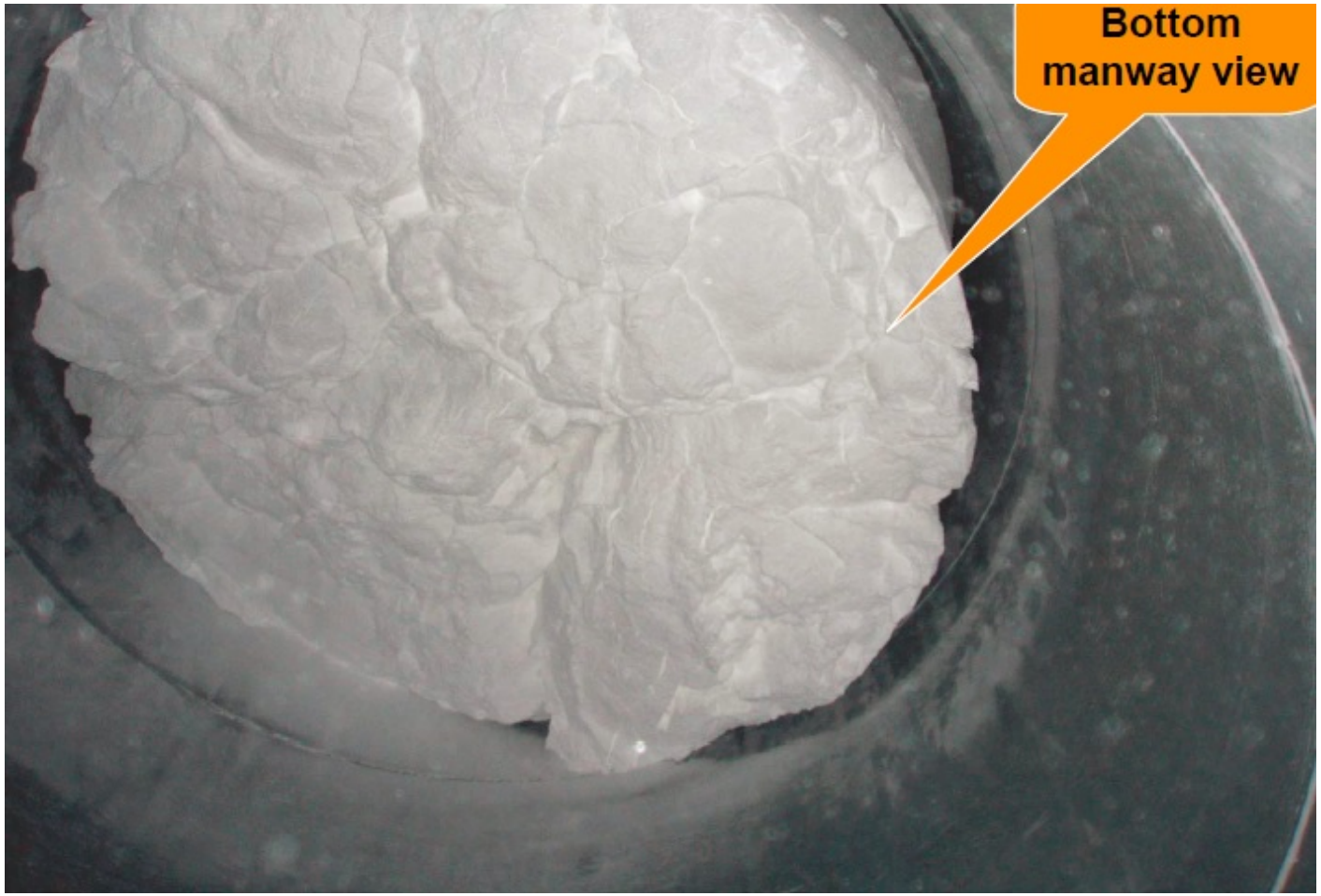
Expansion chamber chunk



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Actual Event

- **Reactor was shutdown due to elevated electrostatic activity**
- **25 ton polymer chunk was formed in the expansion section**
- **Chain saws were required for the removal process**
- **22 day shut down!**

Unscheduled shutdown costs

57,320 Lbs./Hr. (26MT) x 24 Hr./Day = 1,375,670 Lbs. (624MT)

$.75/Lb. x 1,375,670 Lbs. = $1,031,753 Sales

$.06 margin x 1,375,670 Lbs. = $82,540 Profits

22 days = $22.7 million / $1.8 million

<u>Upset and angry customers = Priceless!</u>

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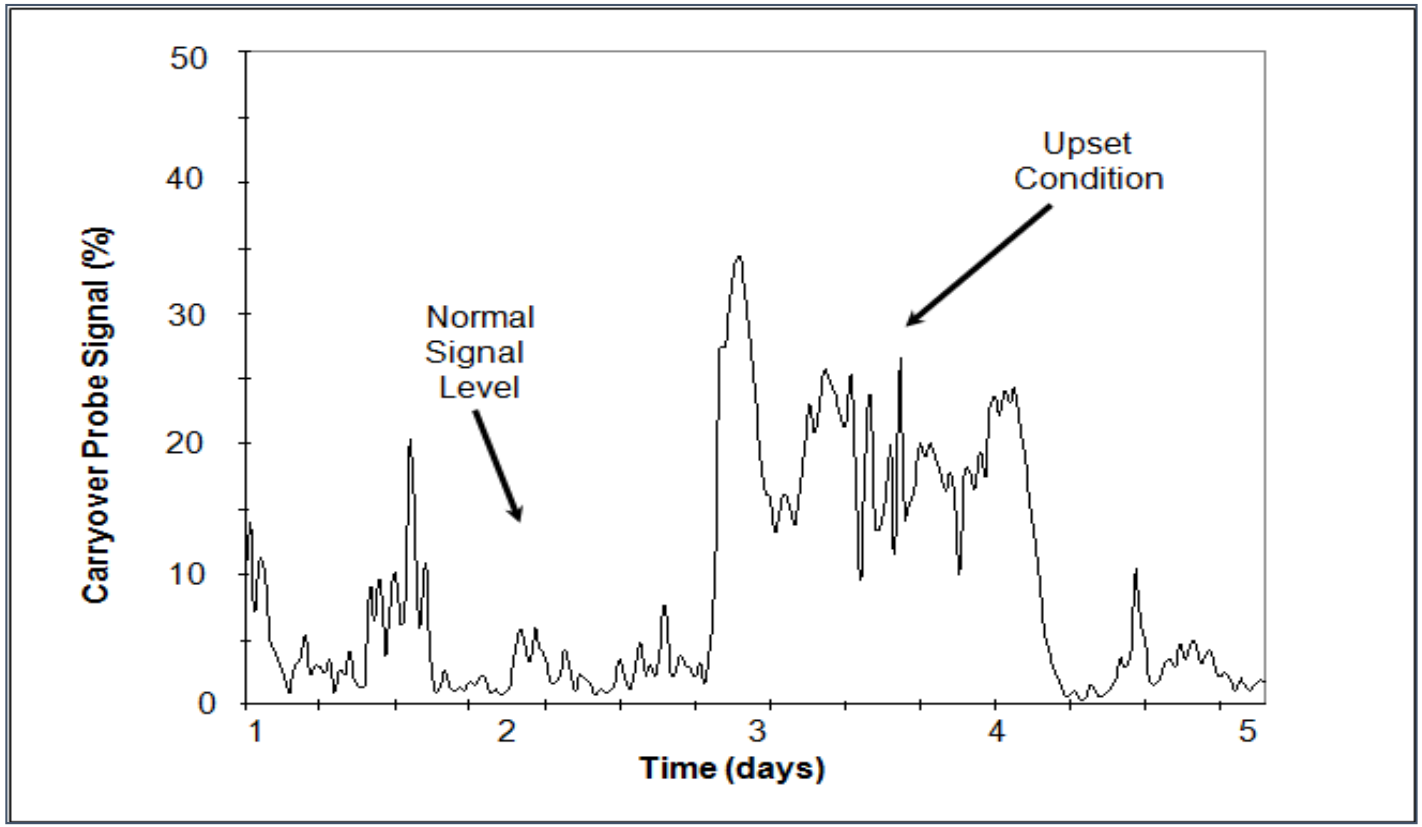
Correflux 3420 – Carryover Probe Data



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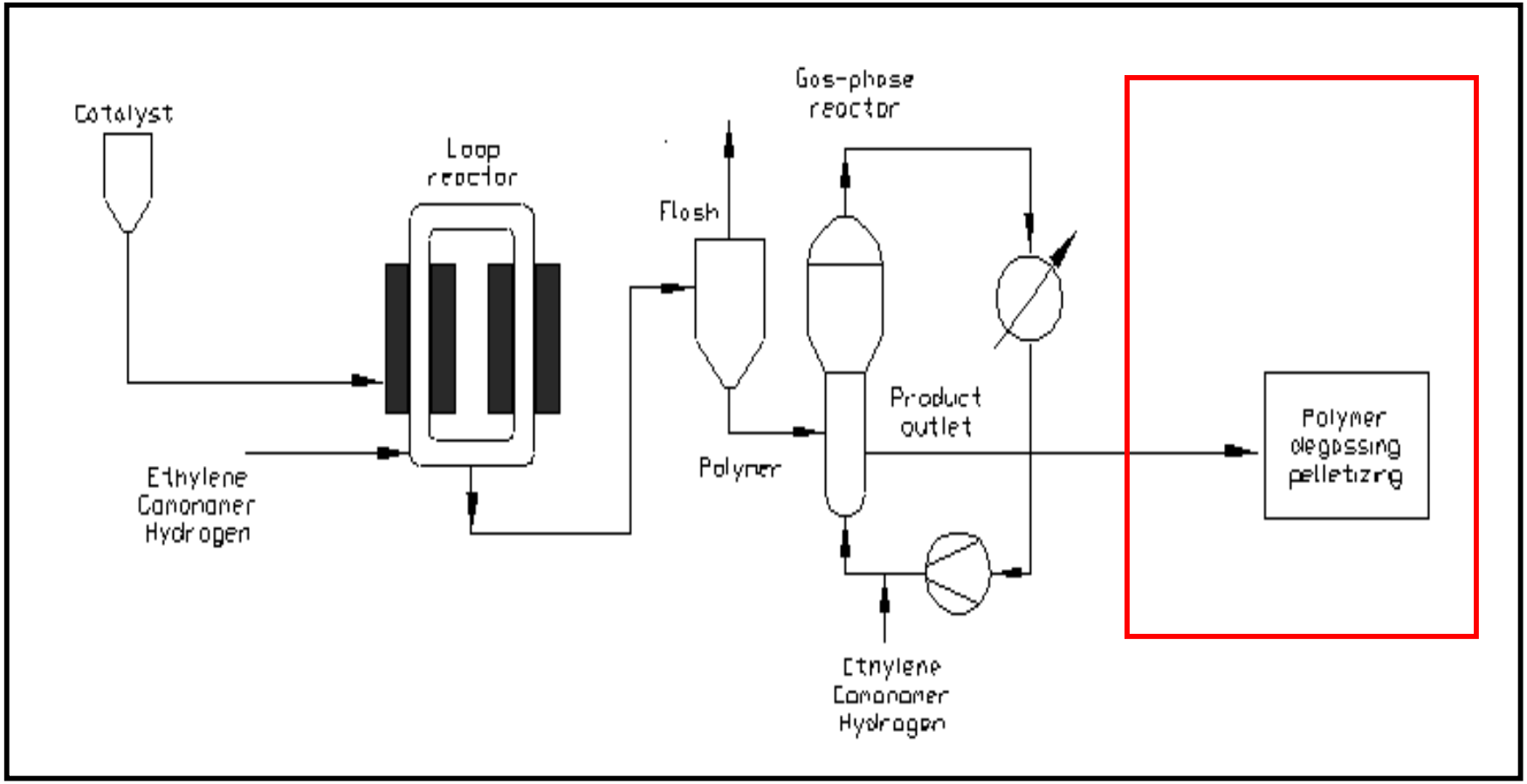
After Reaction



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MagModule II Installation - Unipol PP Plant

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Powder NMR Cabinet and Sampler

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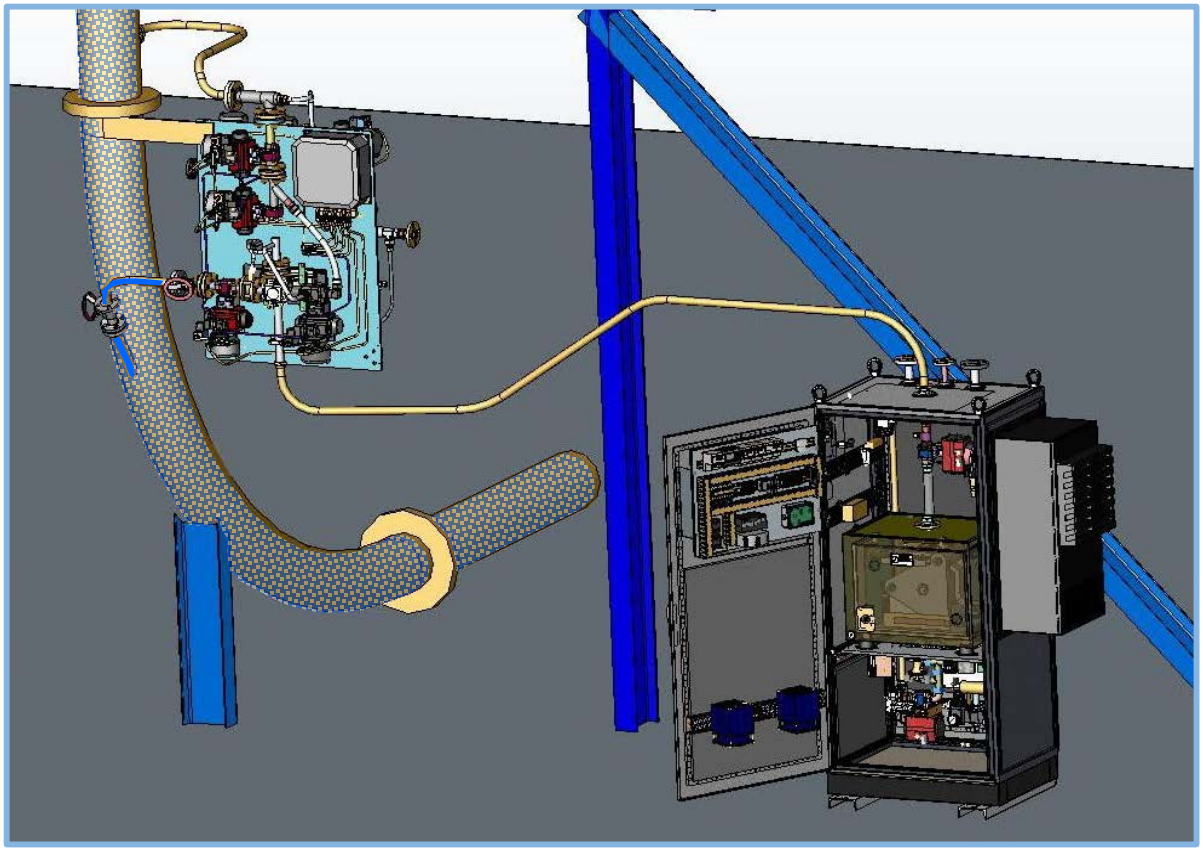
Process NMR Sampling Sequence



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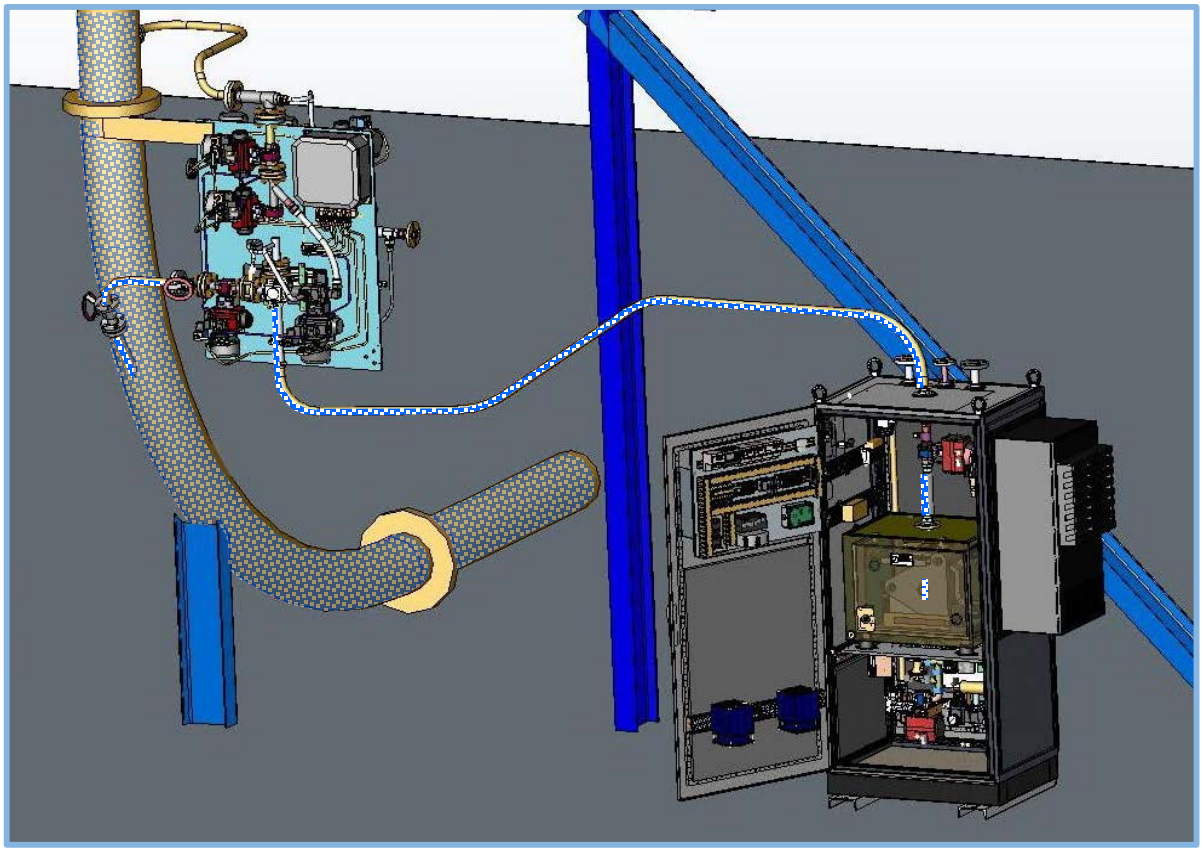
Process NMR Sampling Sequence



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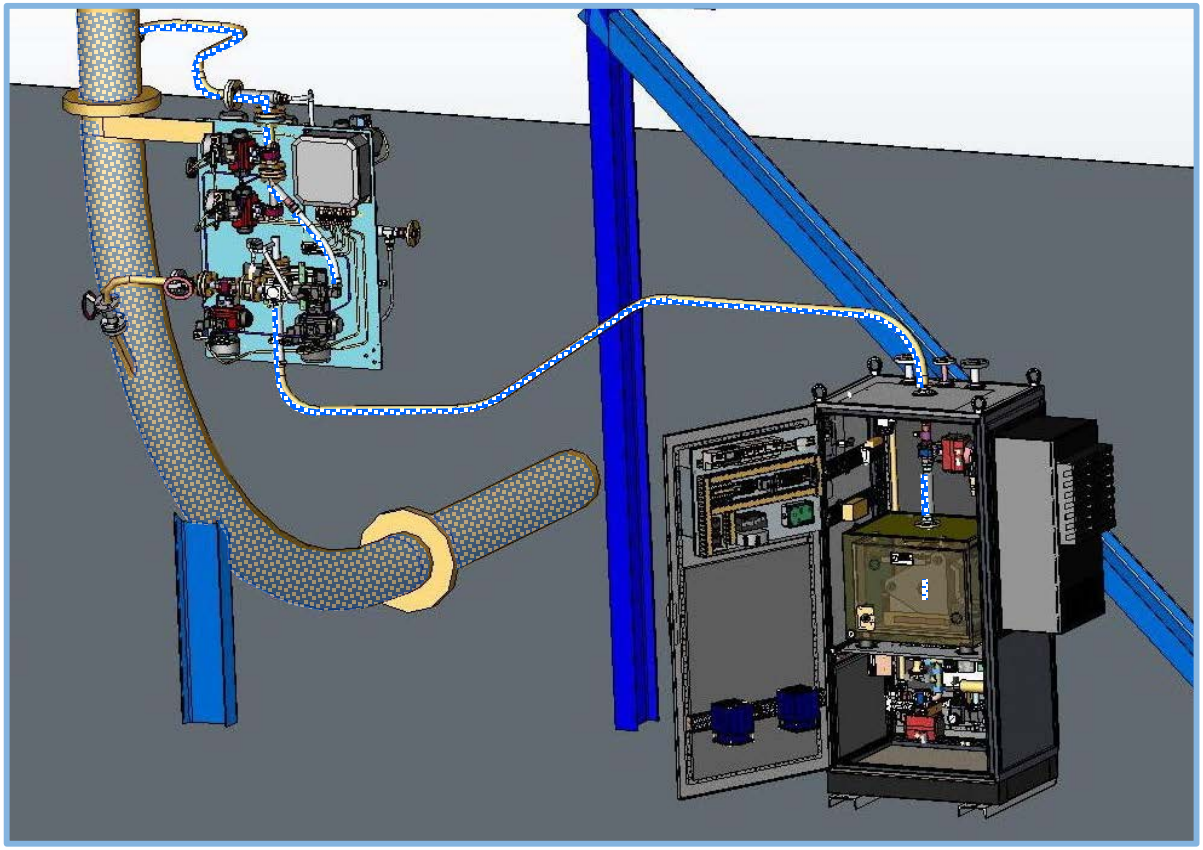
Process NMR Sampling Sequence



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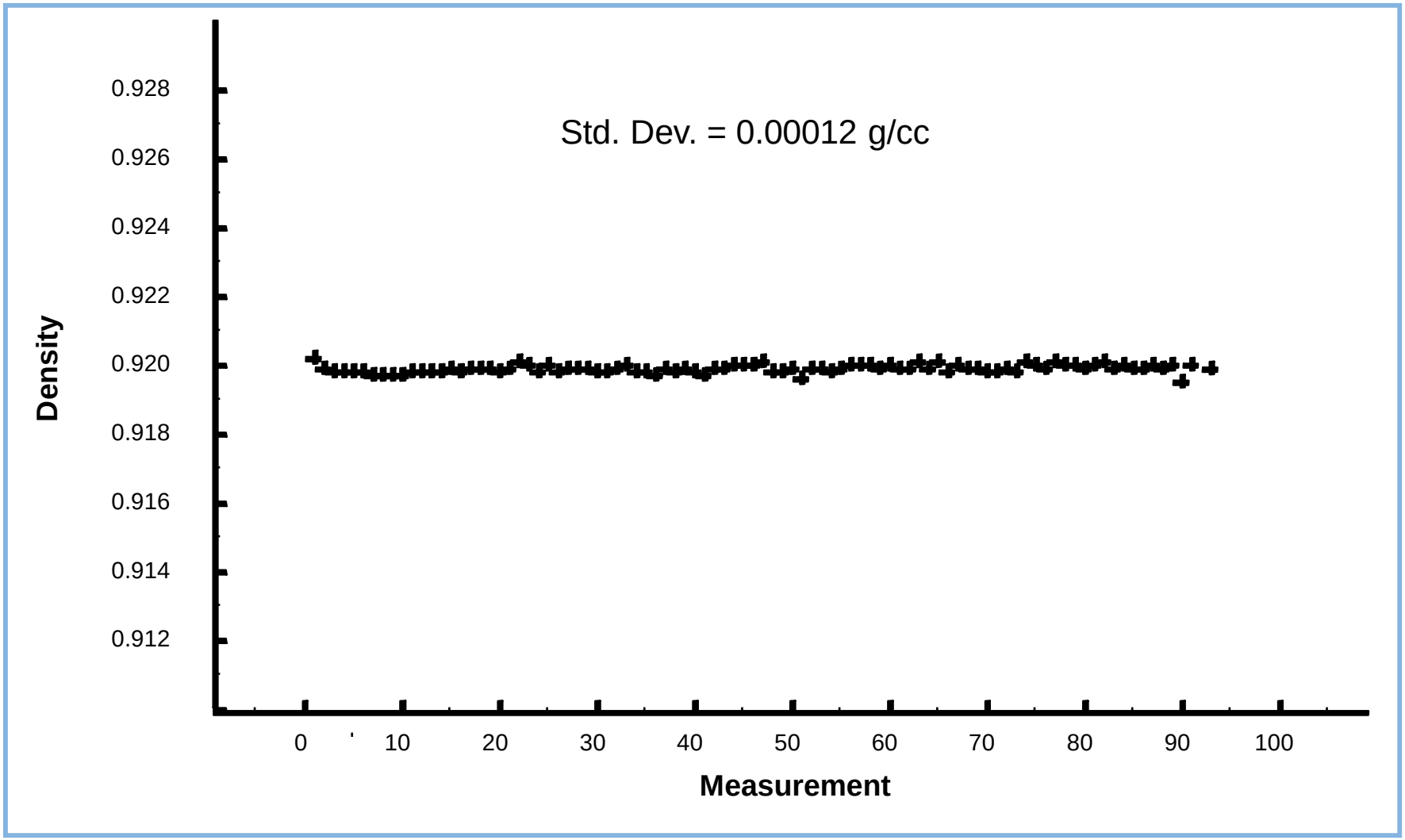
NMR Measurement Stabilities



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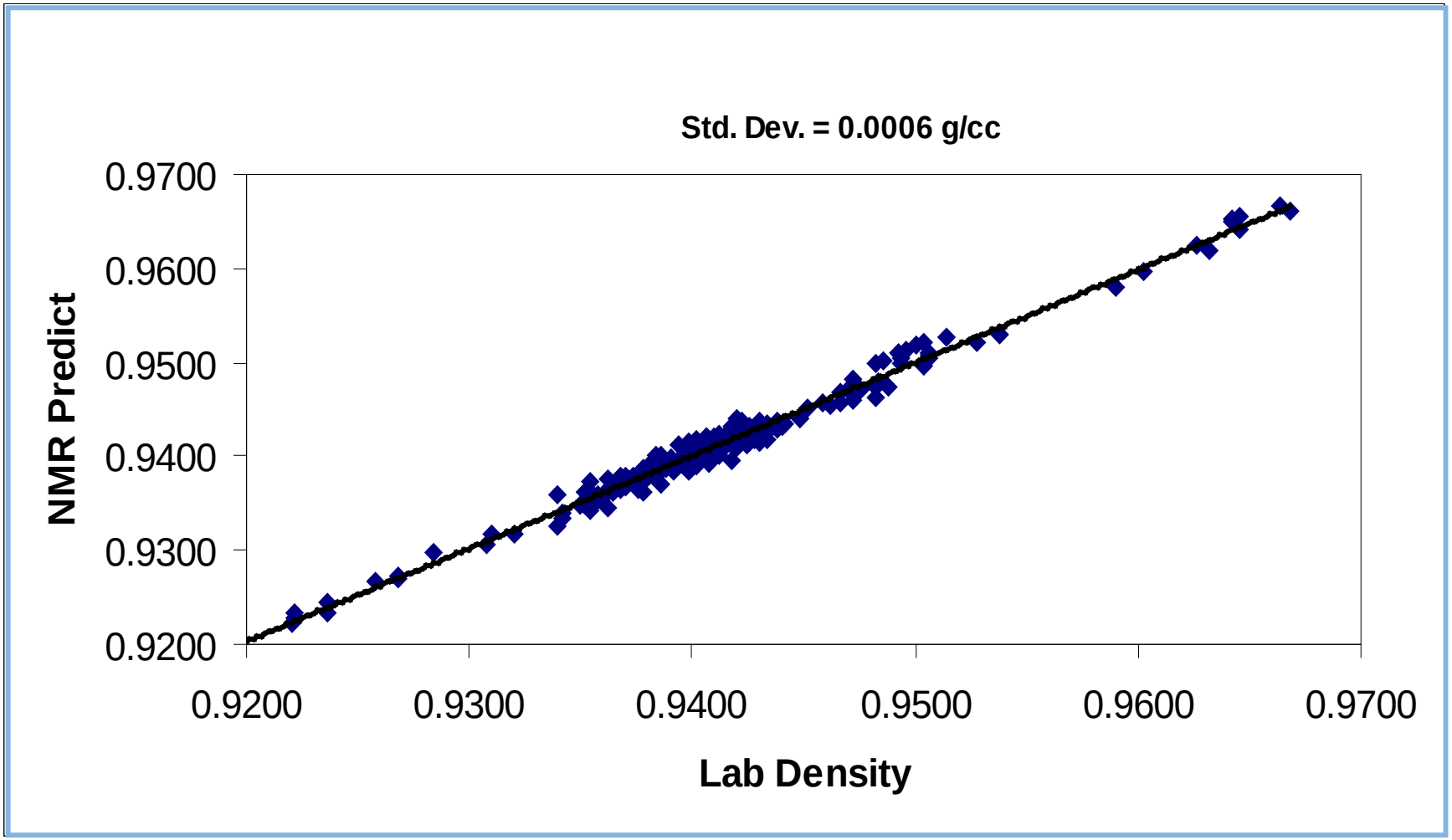
PE Density Calibration by NMR



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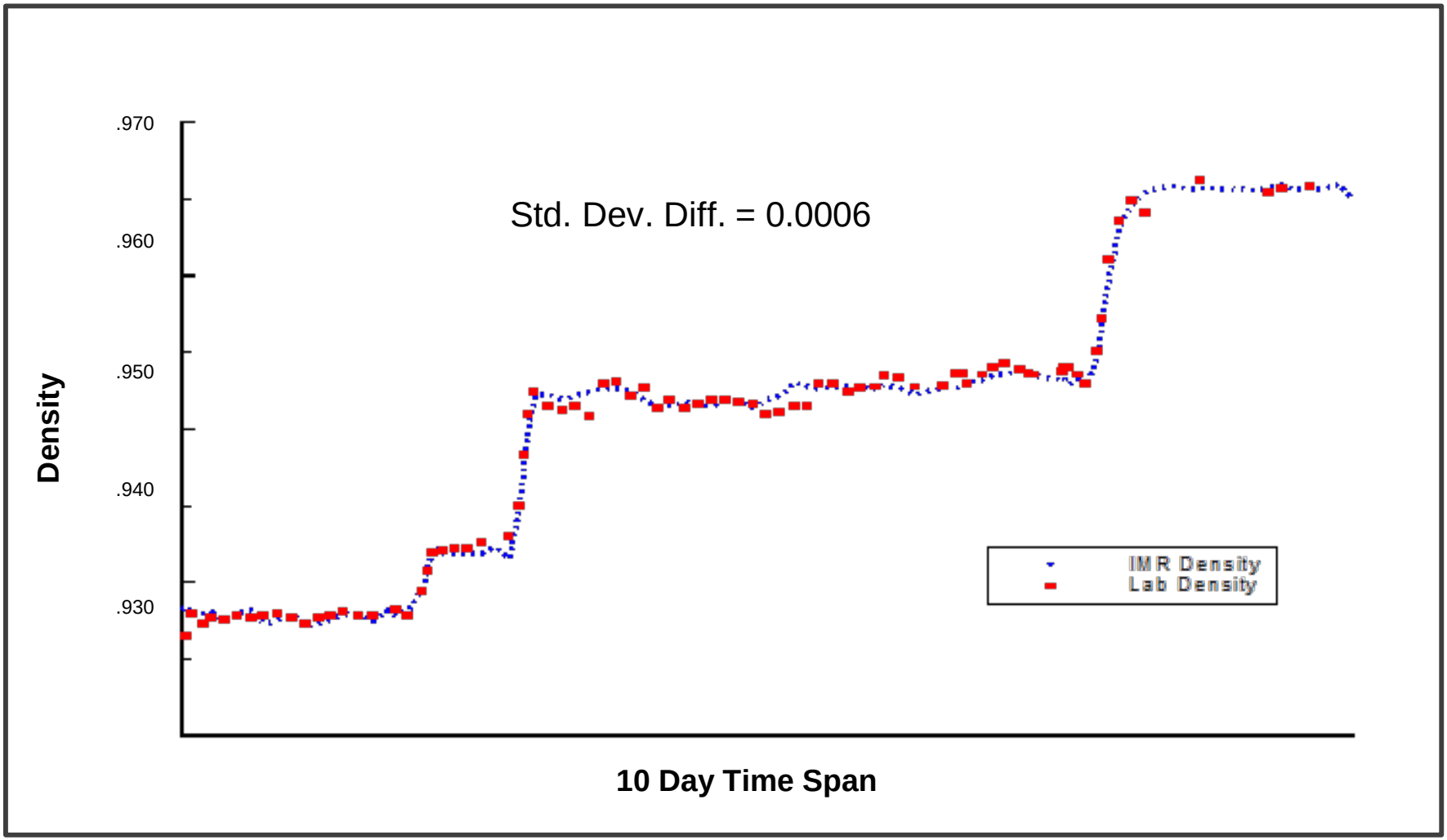
On-line Process NMR Data



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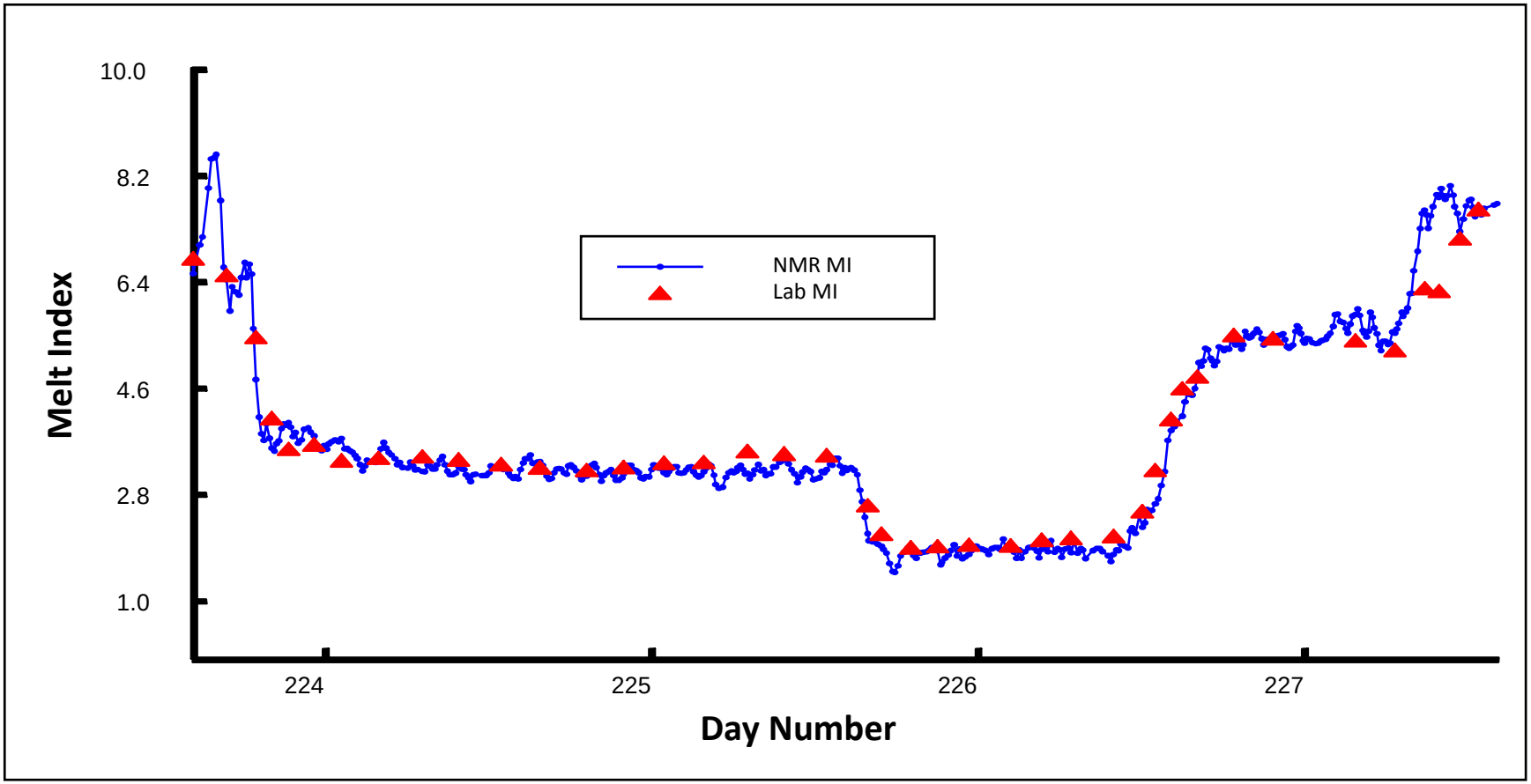
On-Line Process NMR Results Vs. Lab



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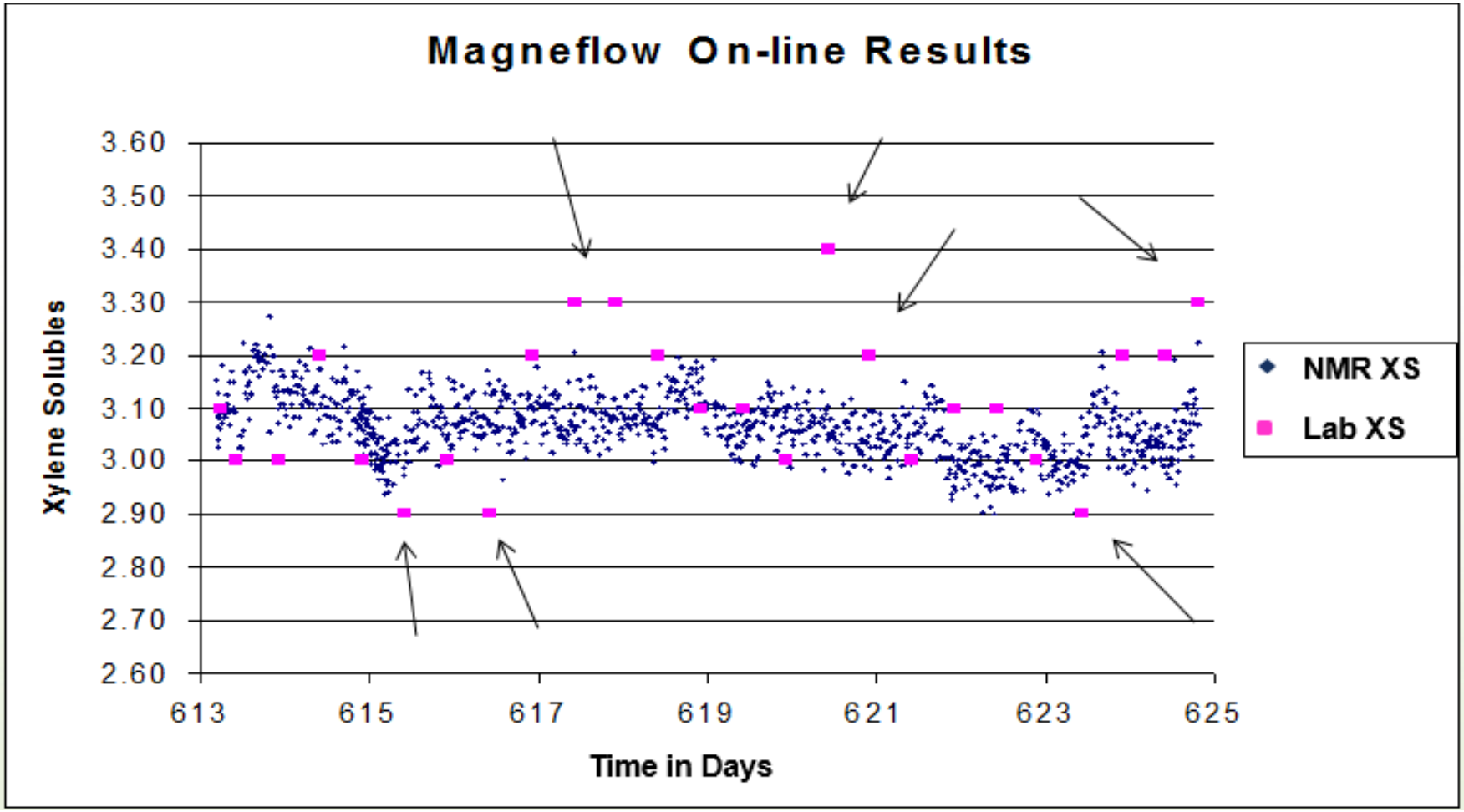
NMR Xylene Solubles Results



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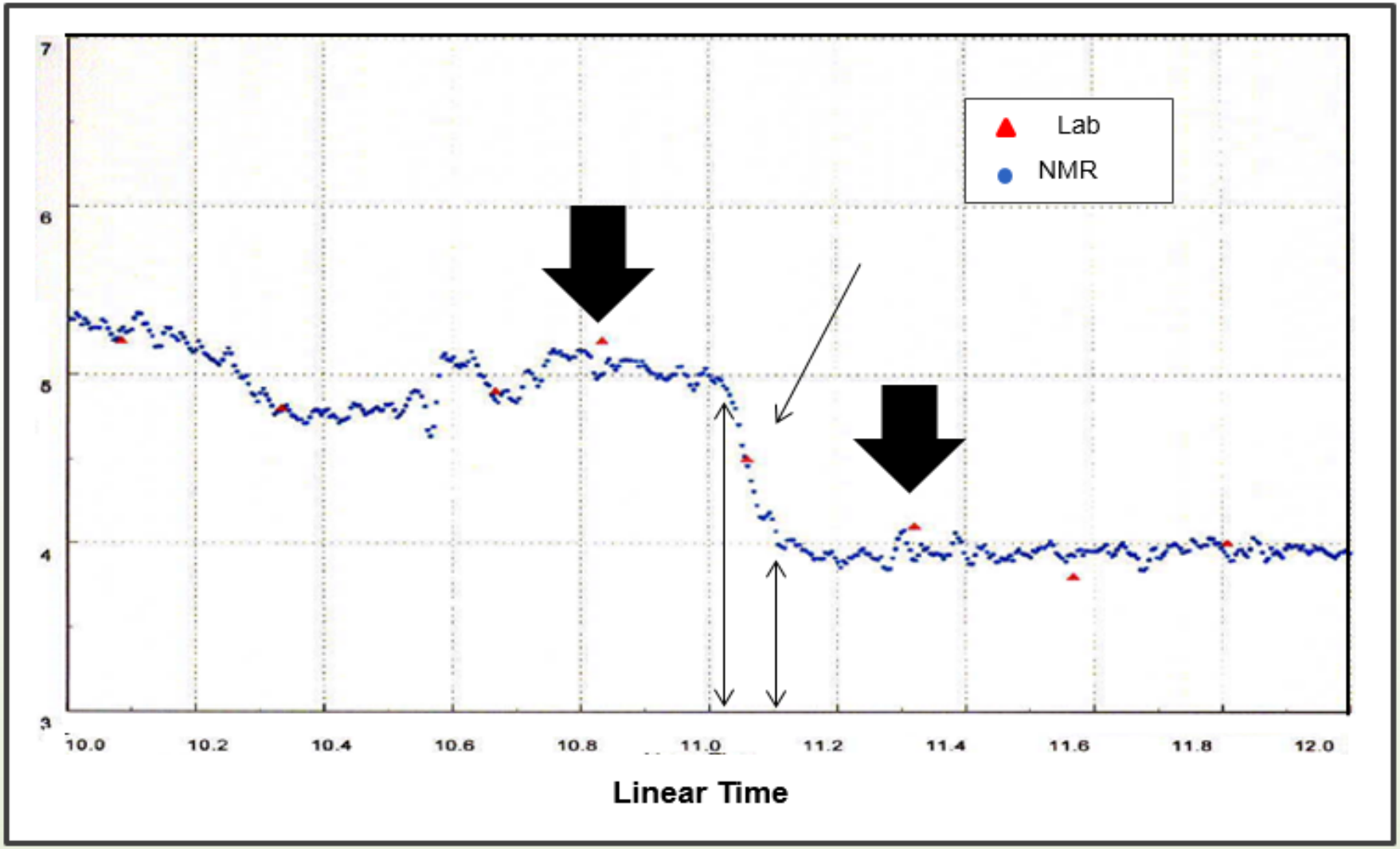
Xylene Solubles Transition



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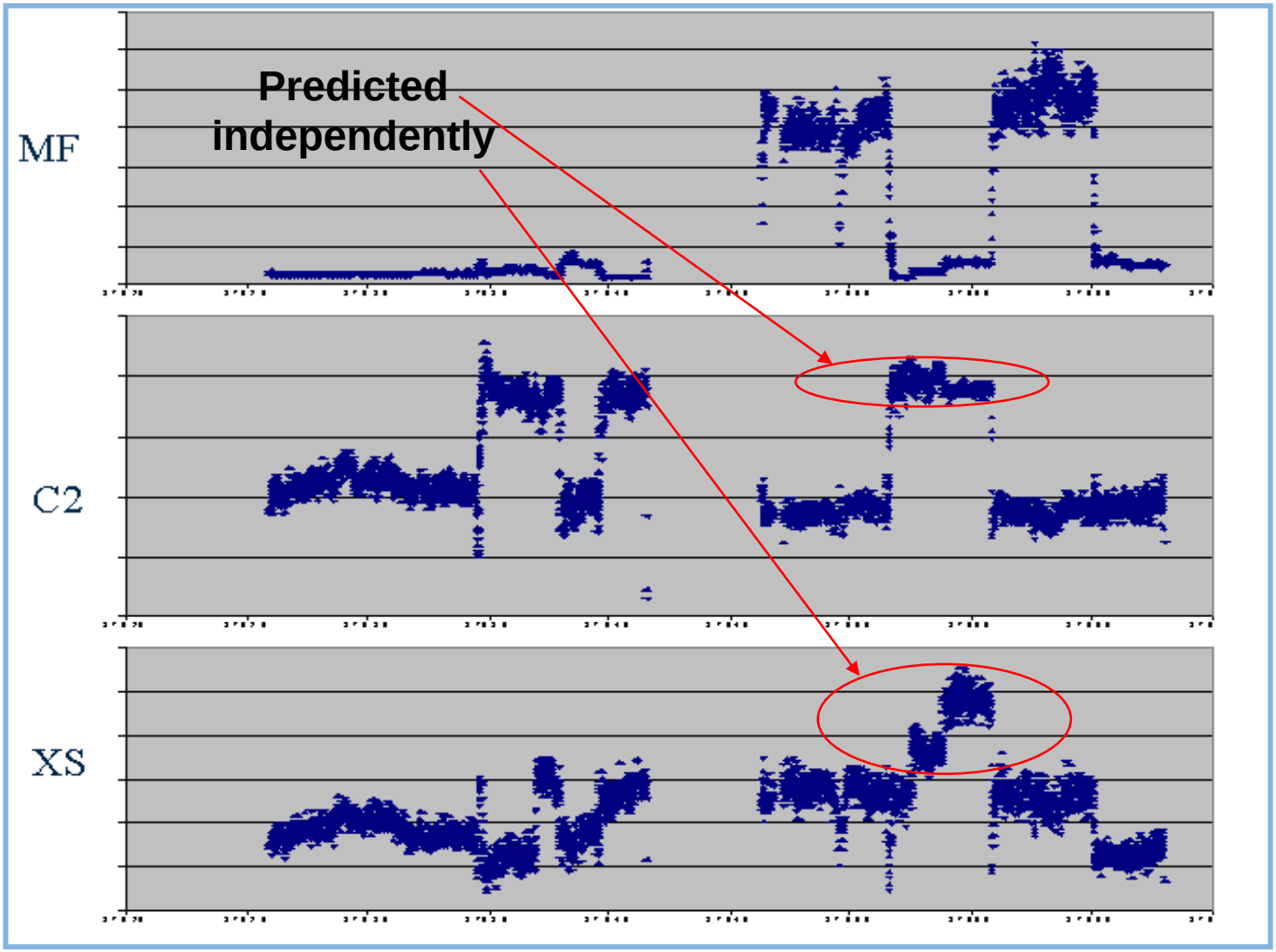
MagModule II Results



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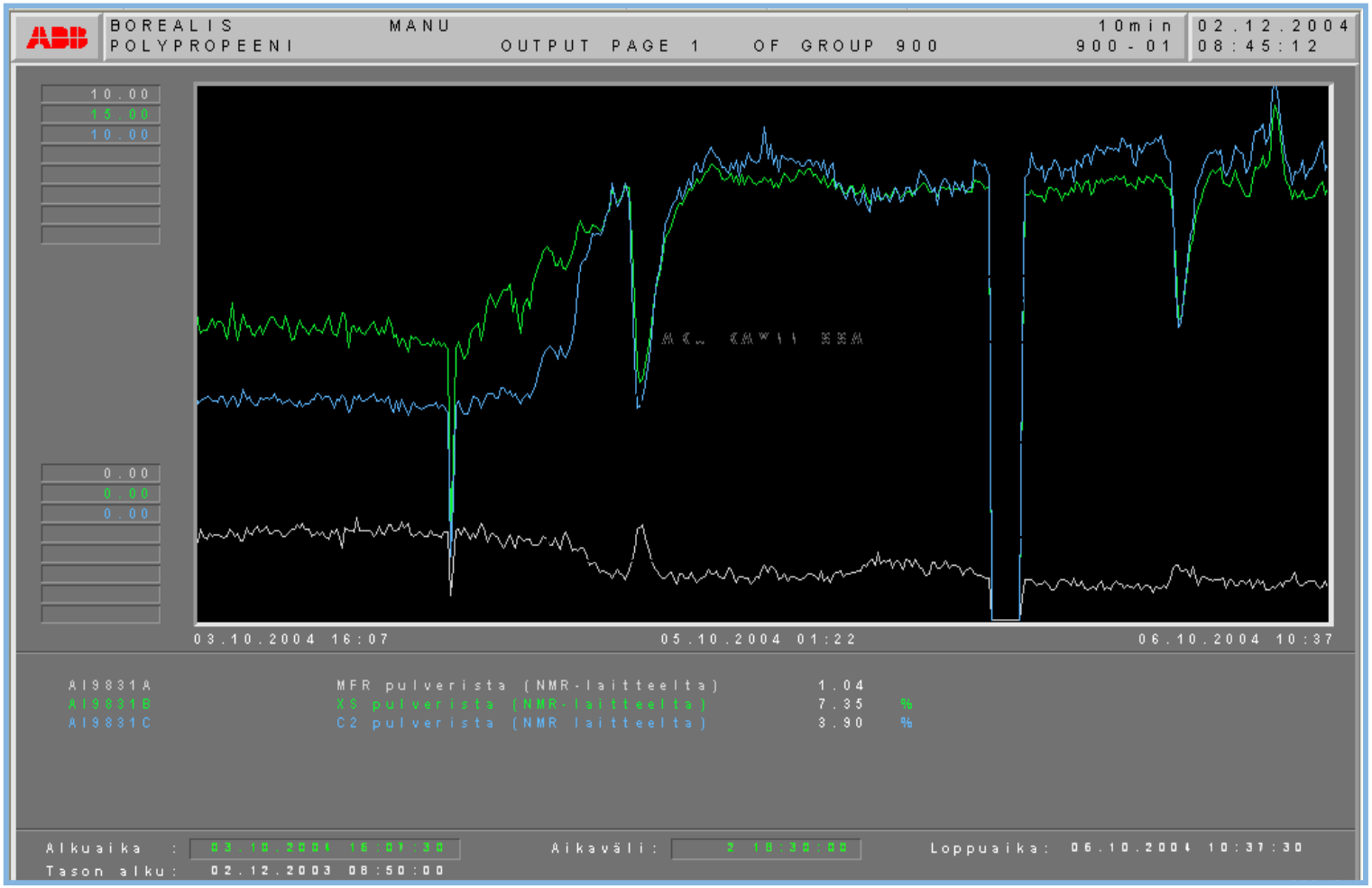
NMR In A Plant



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Avoid The Laboratory Meetings

- On-line real-time process information will stop lab meetings
- Stop choosing which data will be placed on the C of A
- Insufficient data for good decision making in the meeting
- Customers expect and require consistency
- Discontinue the guessing game; satisfy customers
- Rejects affect short and long term profit margins
- Rejects result in customers switching supplier
- Rejects are more expensive than plants realize due to hidden fees

Cost Savings Analysis

Transitions

5 transitions/month x 5 Hours/transition x 45,000 Lbs. = 1,125,000 Lbs.

1,125,000 x 30% (NMR reduction) = 337,500 Lbs.

337,500 x $.15 = $50,625 Monthly savings

$50,625 x 12 = $607,500 Annual Savings!

Unscheduled Shut Downs

45,000 x 24 x 4 days = 4,320,000 lost Lbs.

4,320,000 x $.12 margin = $518,400 / occurrence

The indirect expense related to goodwill loss, shipments missed, customer retention issues and lost opportunities is much greater. (Millions $$)

The 1% Shift

45,000 Lbs. /Hr. x 24 x 365 = 394,200,000 annual production x 1% shift = 3,942,000 wide spec Lbs. being re-classified as prime. (One hopper car & truck load/month)

3,942,000 x $.15 = **$591,300 Annual Savings**

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Summary

- Olefin manufacturers looking to improve margin must look to lower costs
- Direct measurement and analyses of key process parameters is the most valuable feedback
- Multiple proven technologies that can yield benefits before, during and after polymer reaction.
- The international team at LexMar Global is an experienced and capable partner.

Thank You

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Eric Ziskend
eziskend@lexmarglobal.com
+1.617.281.4001