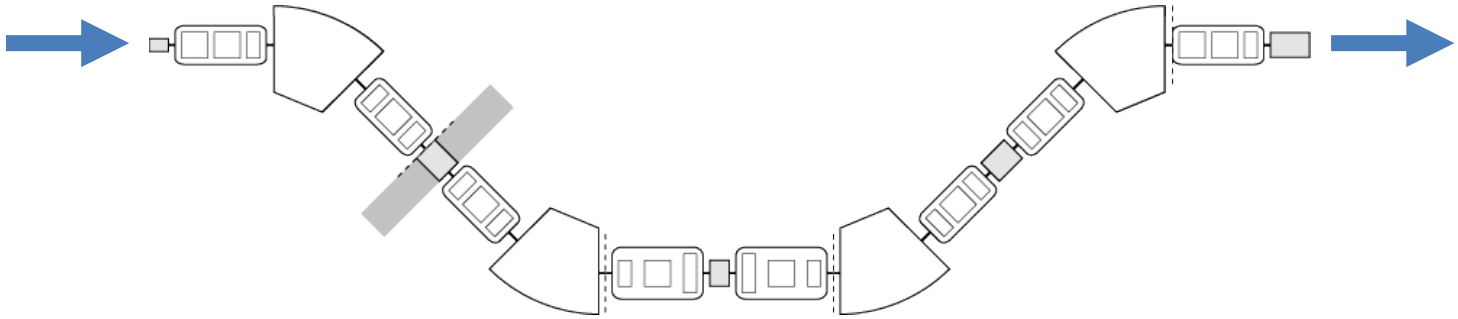
A1900 Operation & Controls



Better Living through Controls: Two examples

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High-Level Controls

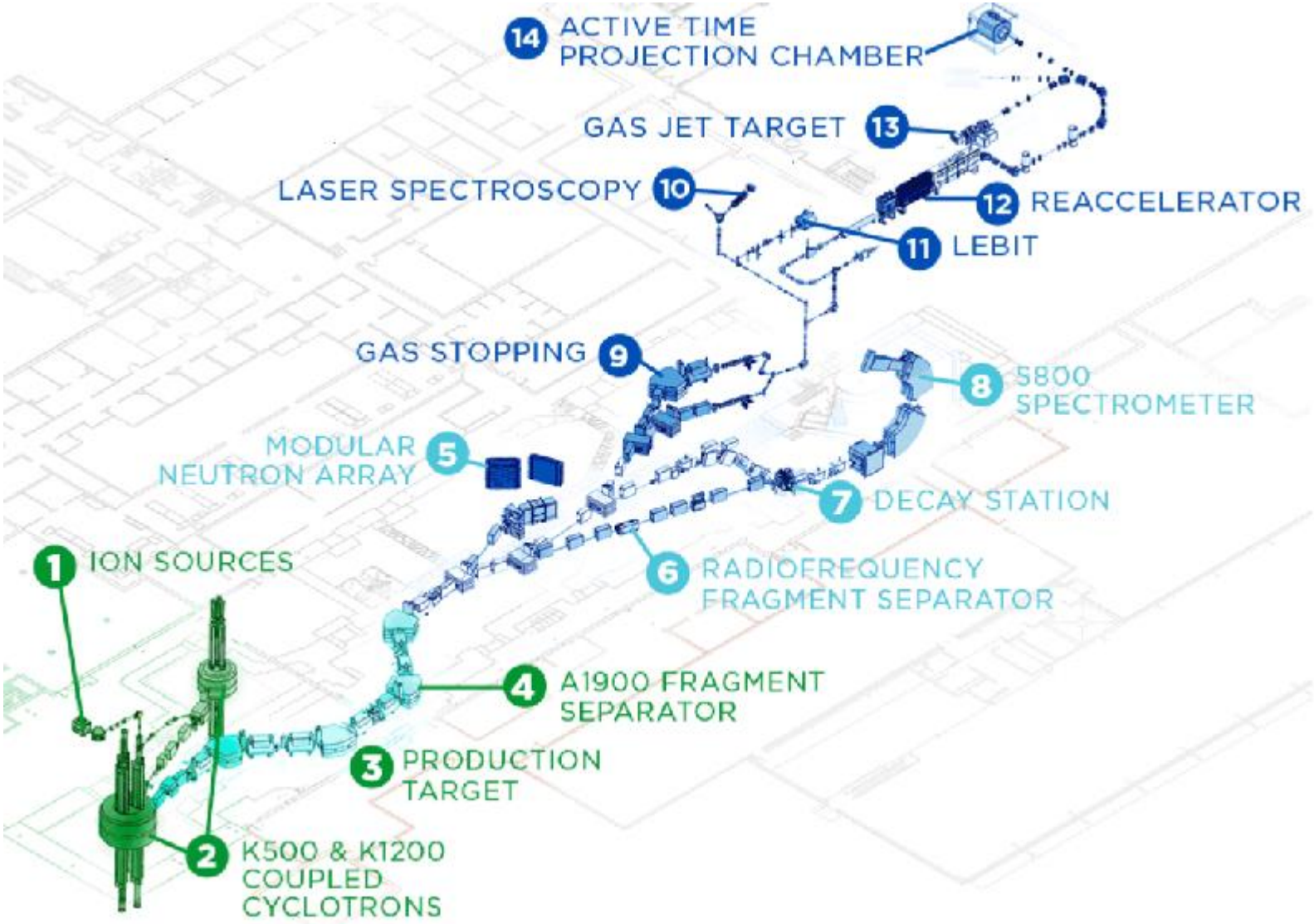
- **Anything above the hardware & p/s level**
- **Applications that provide physics parameters: Optics, Mass, Charge, Rigidity….**
- **Automation [Amthor?]**

Spreadsheets, Calculators, LISE,…

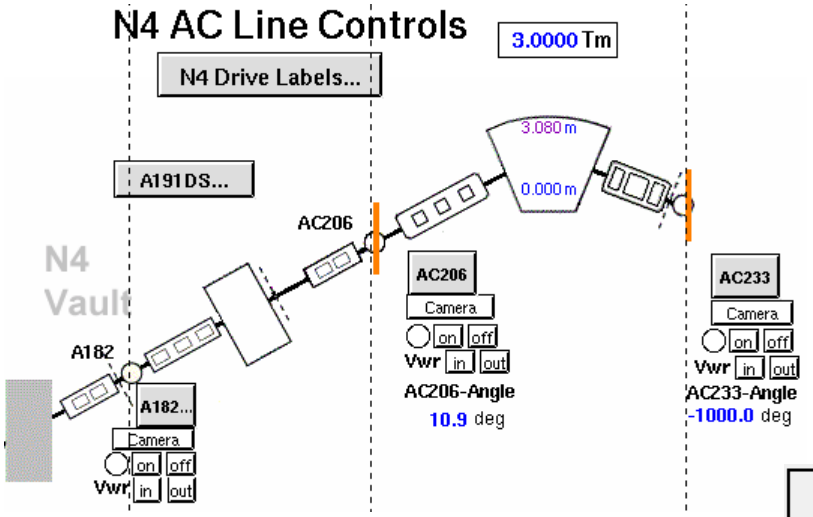
Two Examples:

- (i) Gas Cell Degrader Scan
- (ii) Predictive Dipole Matching

Gas Cell Degrader Angle = Rigidity Scan



Gas Cell Degrader Angle = Rigidity Scan



	B_set
AC209TA	9.566 kG
AC211TB	12.274 kG
AC213TC	5.292 kG
AC219DS	8.293 kG
AC227TA	0.434 kG
AC229TB	1.785 kG
AC231TC	-0.131 kG

Rigidity Scan with LISE

[Python code interfacing with LISE API]

LISE Parameters

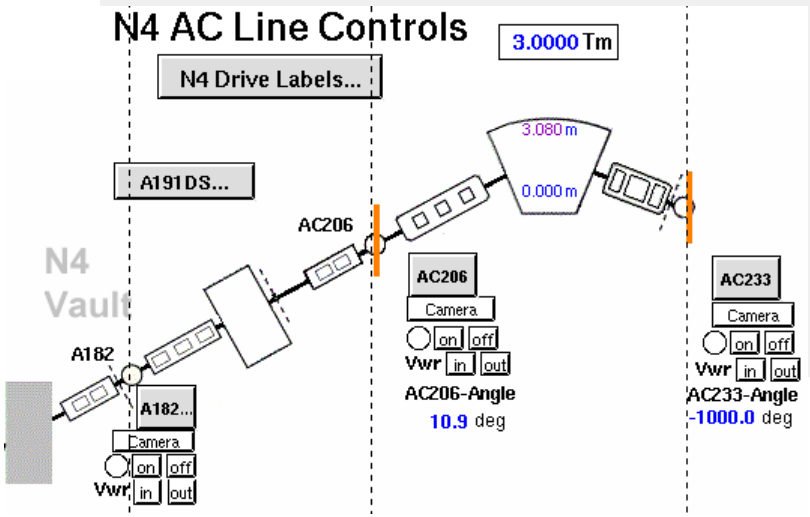
A	34	Brho	3.000000 Tm
Z	17	Energy	103.017 MeV/u
q	17	Degrader	Al
m	33.973762	Thick0	123.000 mg/cm2

AC206ANG-R 10.8715 Deg

Set Point: 11.0000 Deg → ANG-R.SETV -> Inclination → Inclination 11.00 degree

Effective Thickness	125.302 mg/cm2
Energy Loss	96.966 MeV/u
Brho7 [LISE]	2.906081 Tm

(automatic) → BRhoScan 2.9061 Tm



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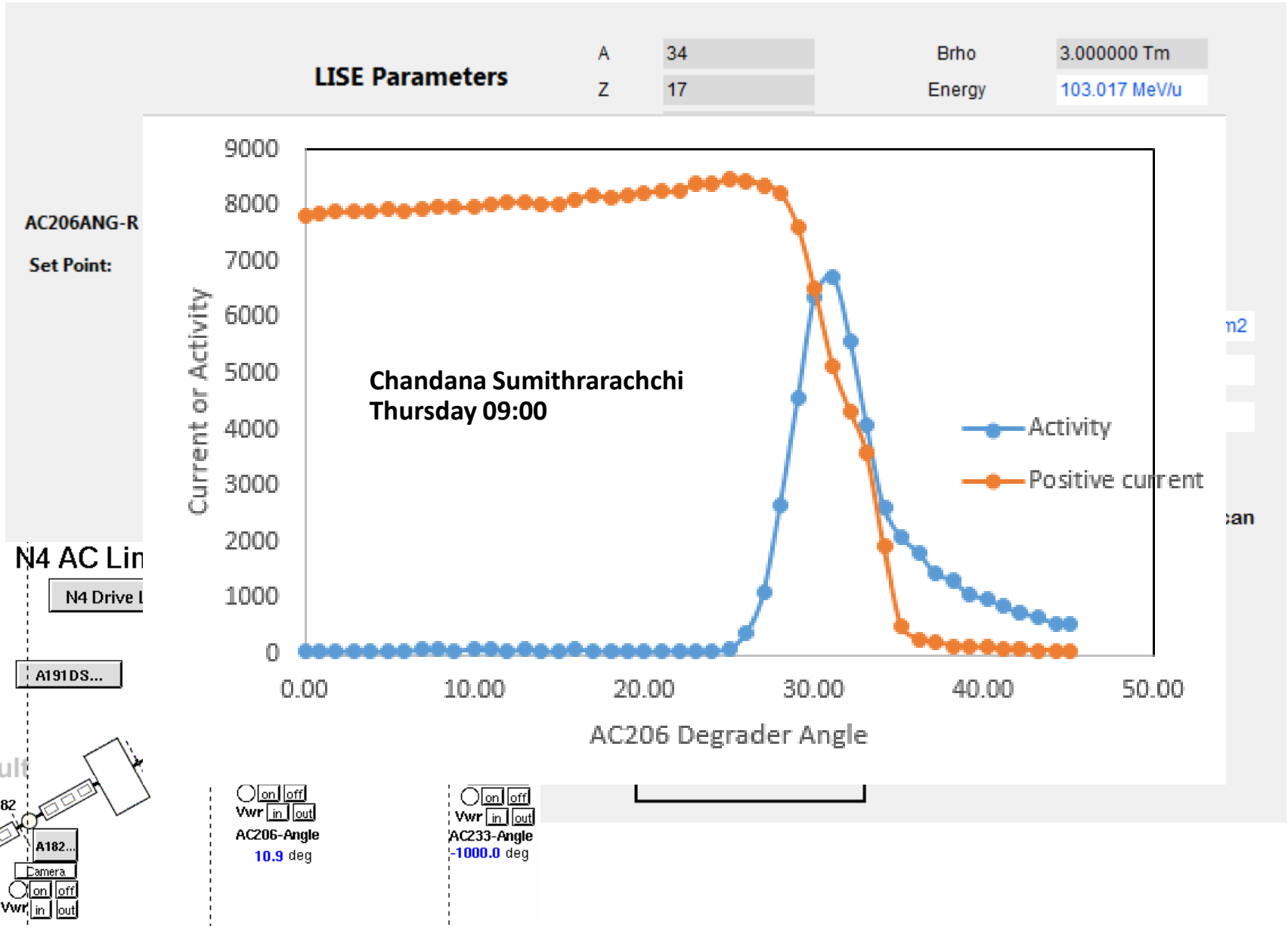
AC231TC	-0.131 kG

If "Enabled," changing BRhoScan will set magnets.

Disabled

If "Disabled,"magnets cannot be set from this page

Rigidity Scan with LISE



Predictive Dipole Matching

A1900 Dipoles are large, superconducting, & slow.

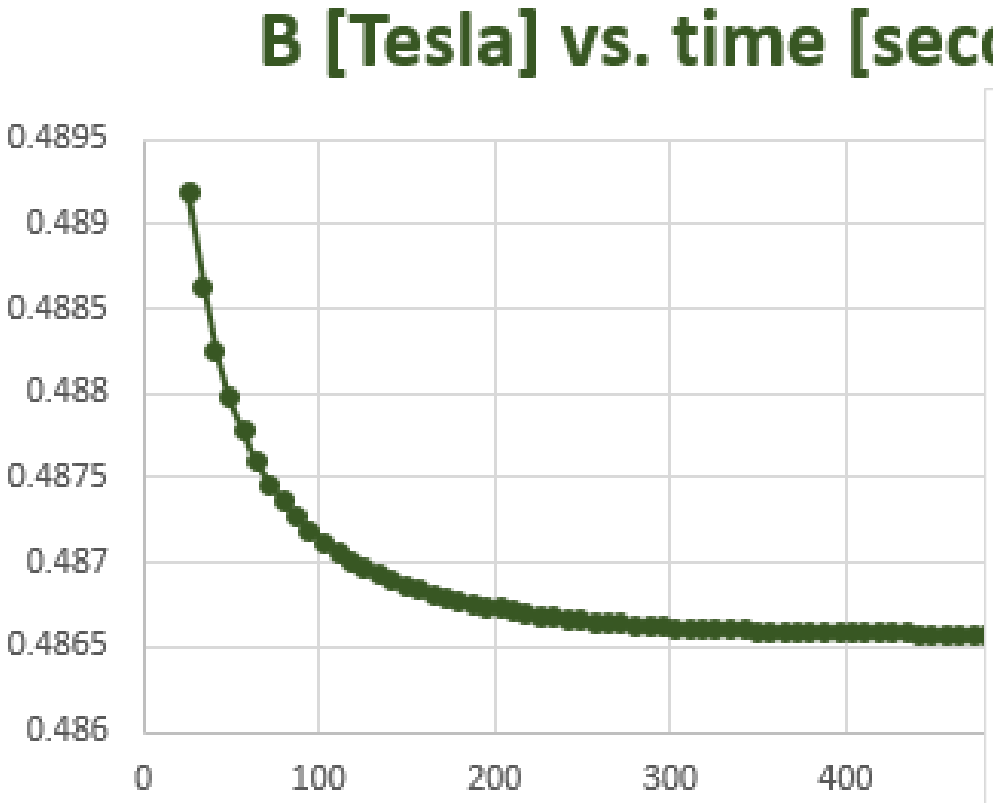
Equipped with NMR probes

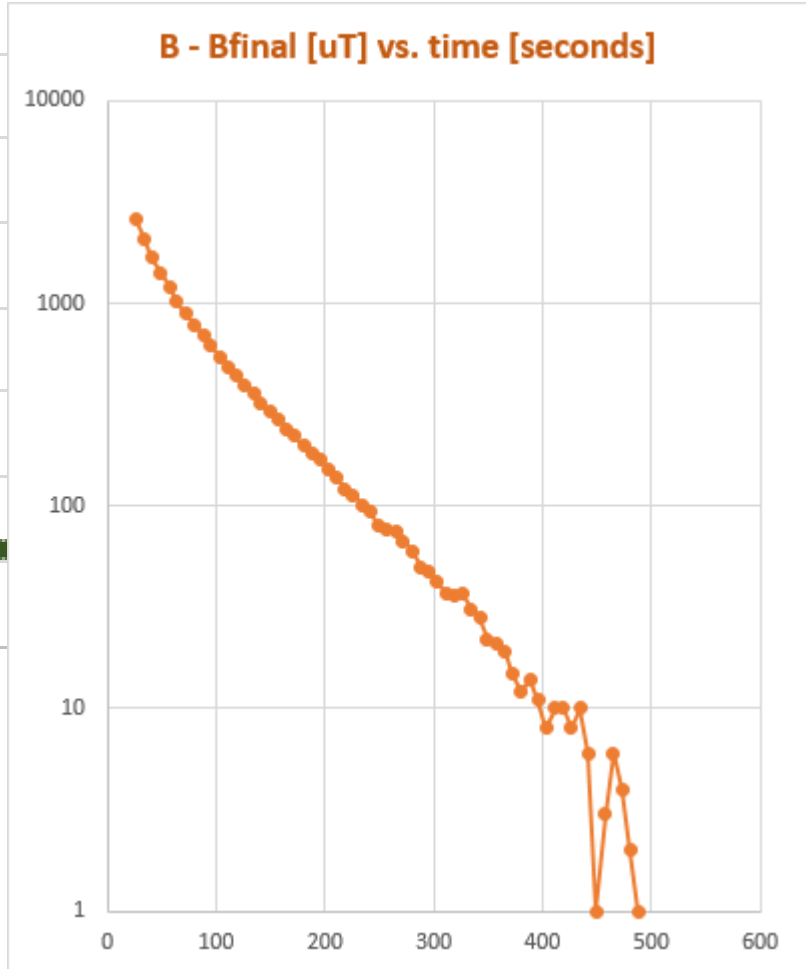
Hysteresis effects are important: Approach field from above.

Simple tool:
Push-button matching.

Takes a long time, takes attention away from other tasks.

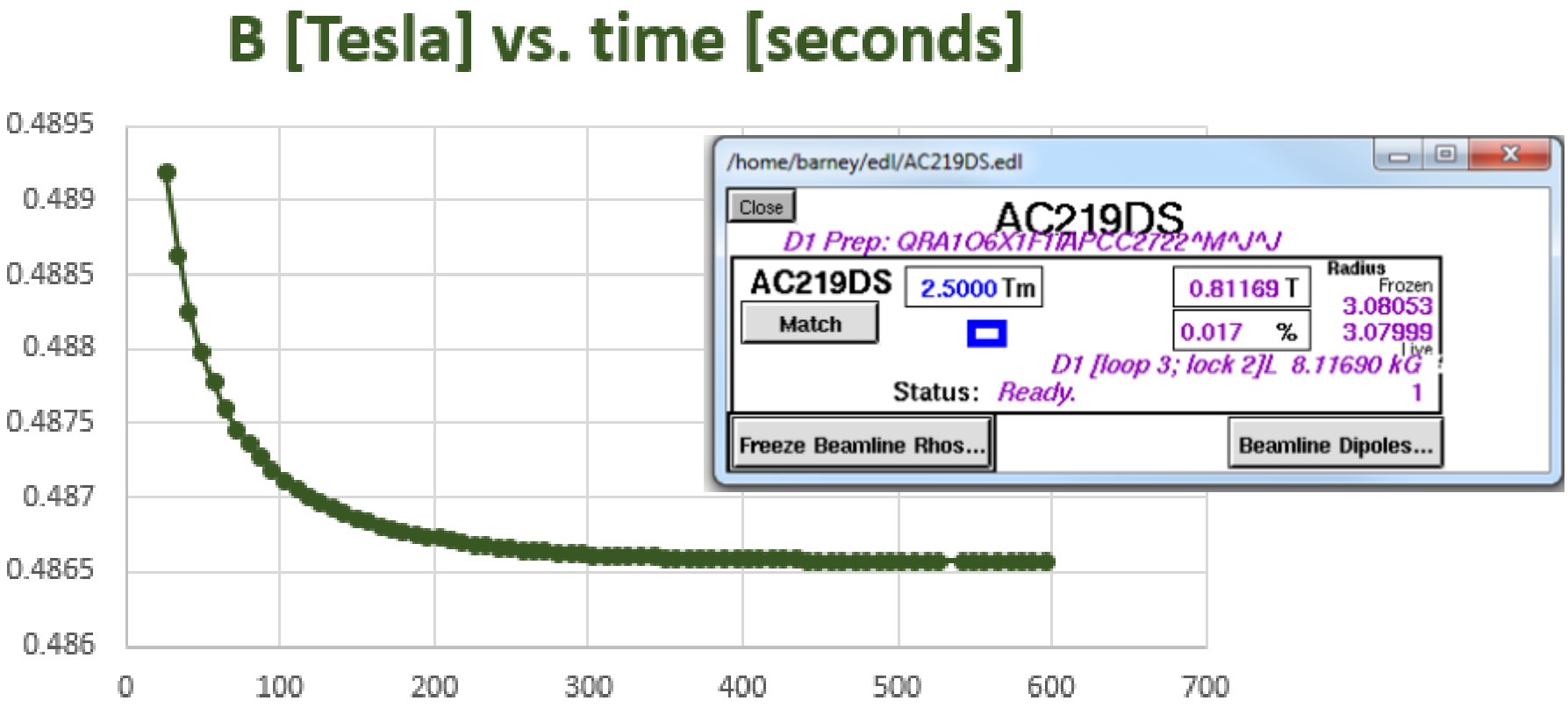
A1900 Dipoles take long time to ramp *and* a long time to settle.





Rigidity: 1.5 Tm

Simple Tool: Push-button Matching



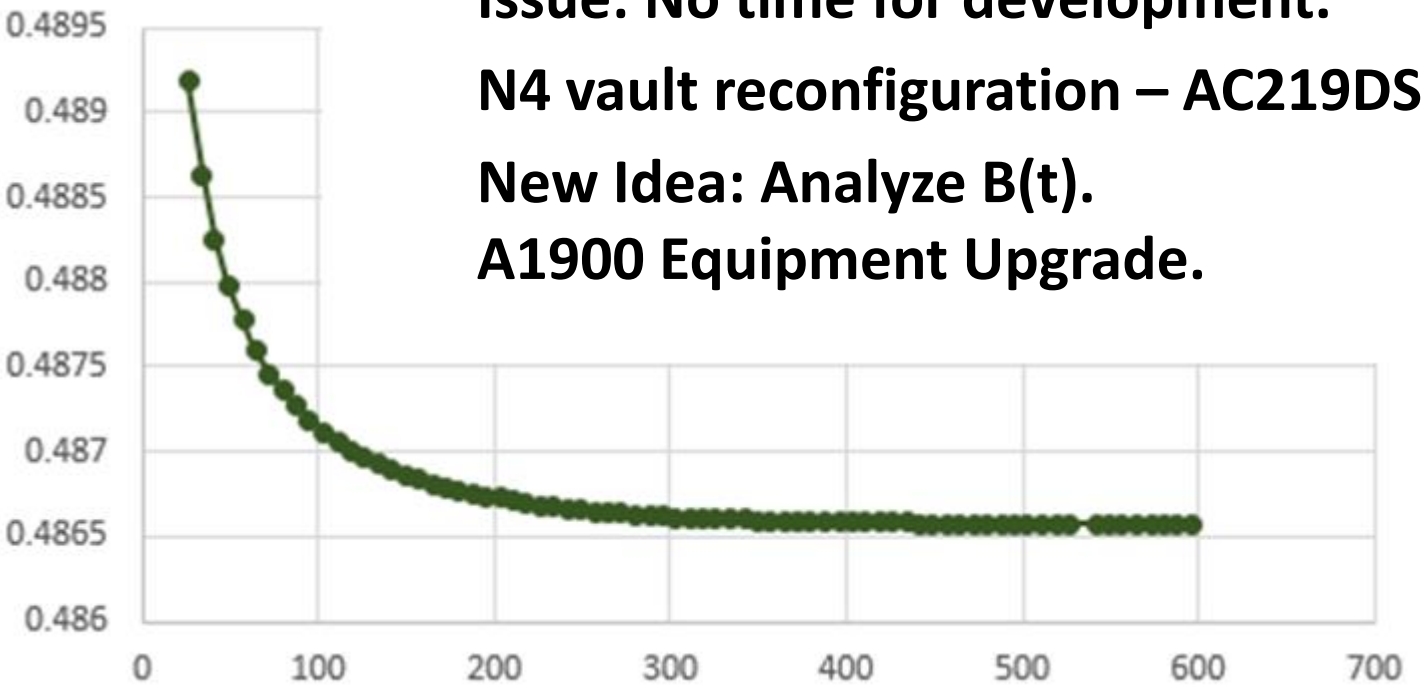
Automatic Matching

First attempt (2012):
Based on time & partial correction.
Not successful.

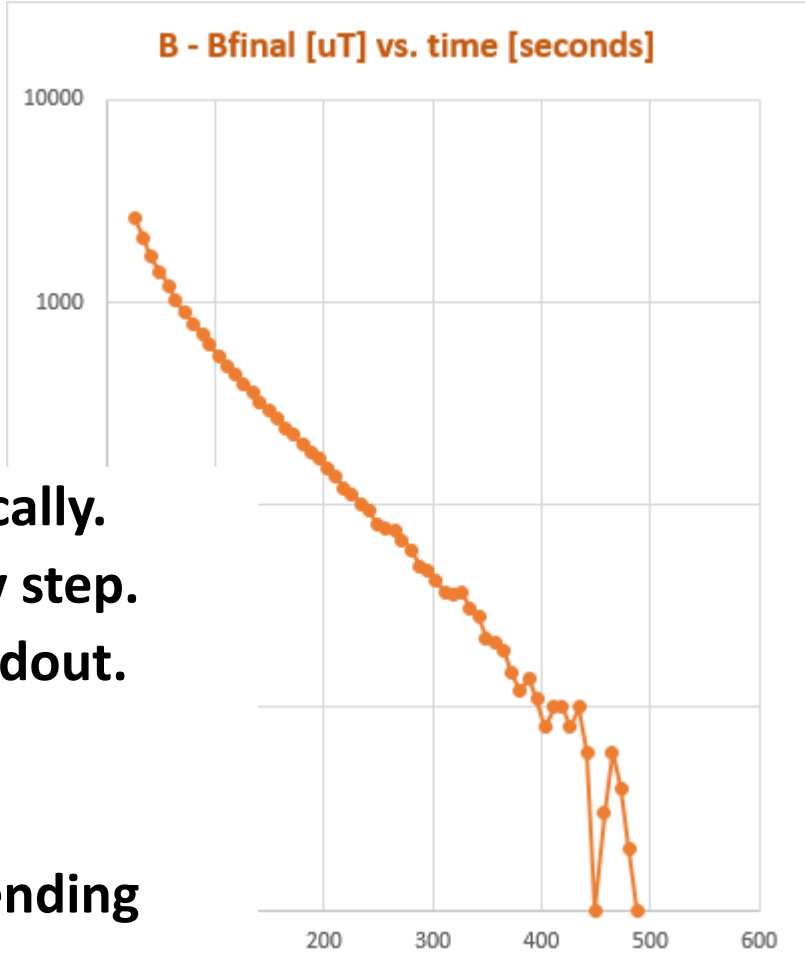
Issue: No time for development.

N4 vault reconfiguration – AC219DS.

New Idea: Analyze B(t).
A1900 Equipment Upgrade.



B(t) Analysis – Predictive Matching



Pragmatic Approach: Get close, automatically.

Analyze evolution of B(n) – B(n+1) step by step.

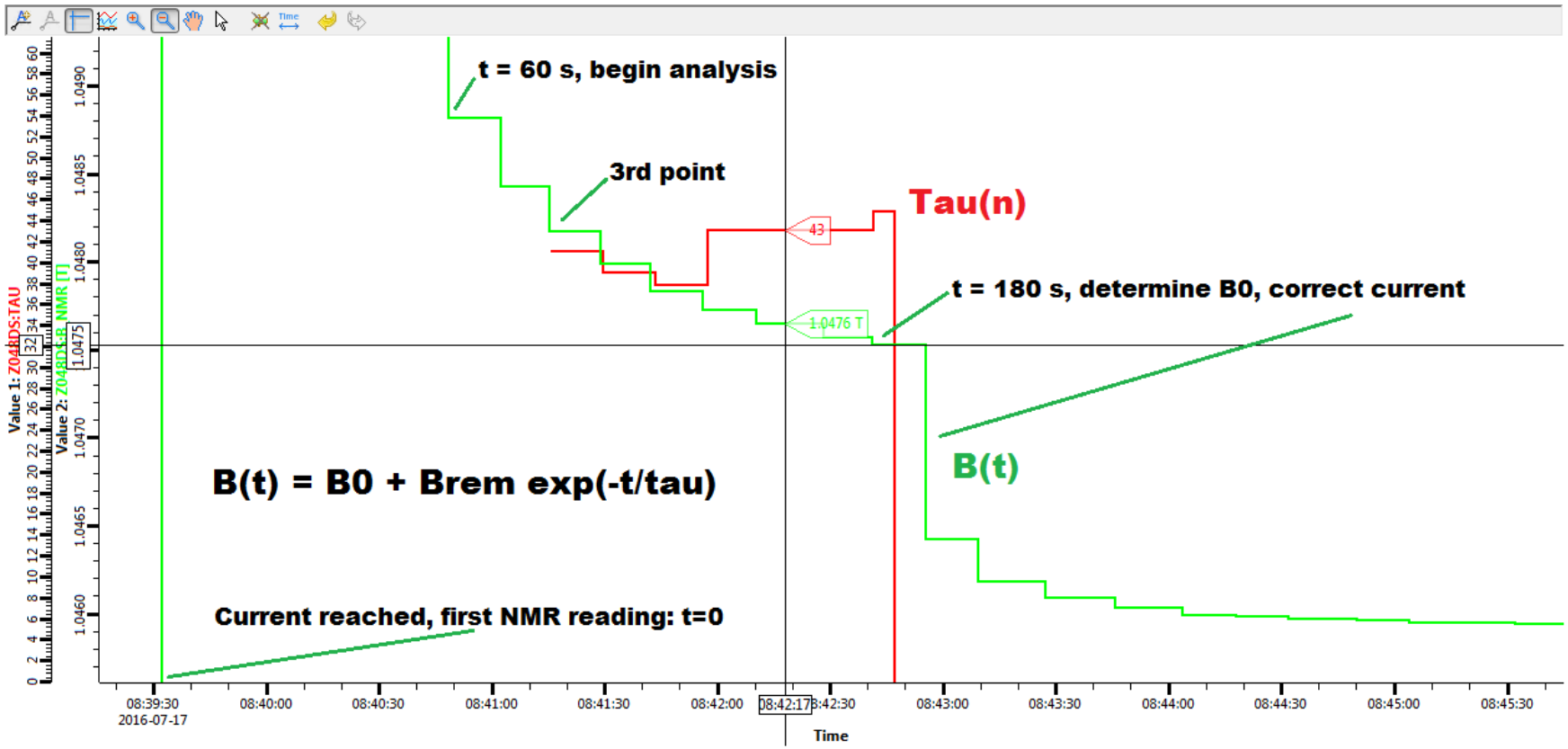
Use spare NMR controller & speed up readout.

Assume B(t) ~ B_0 + B(rem)exp (-t/tau).

Found tau varies from ~ 30 to 80 sec depending on field strength & history.

Big help: Excel with introduced noise.

B(t) Analysis – Predictive Matching

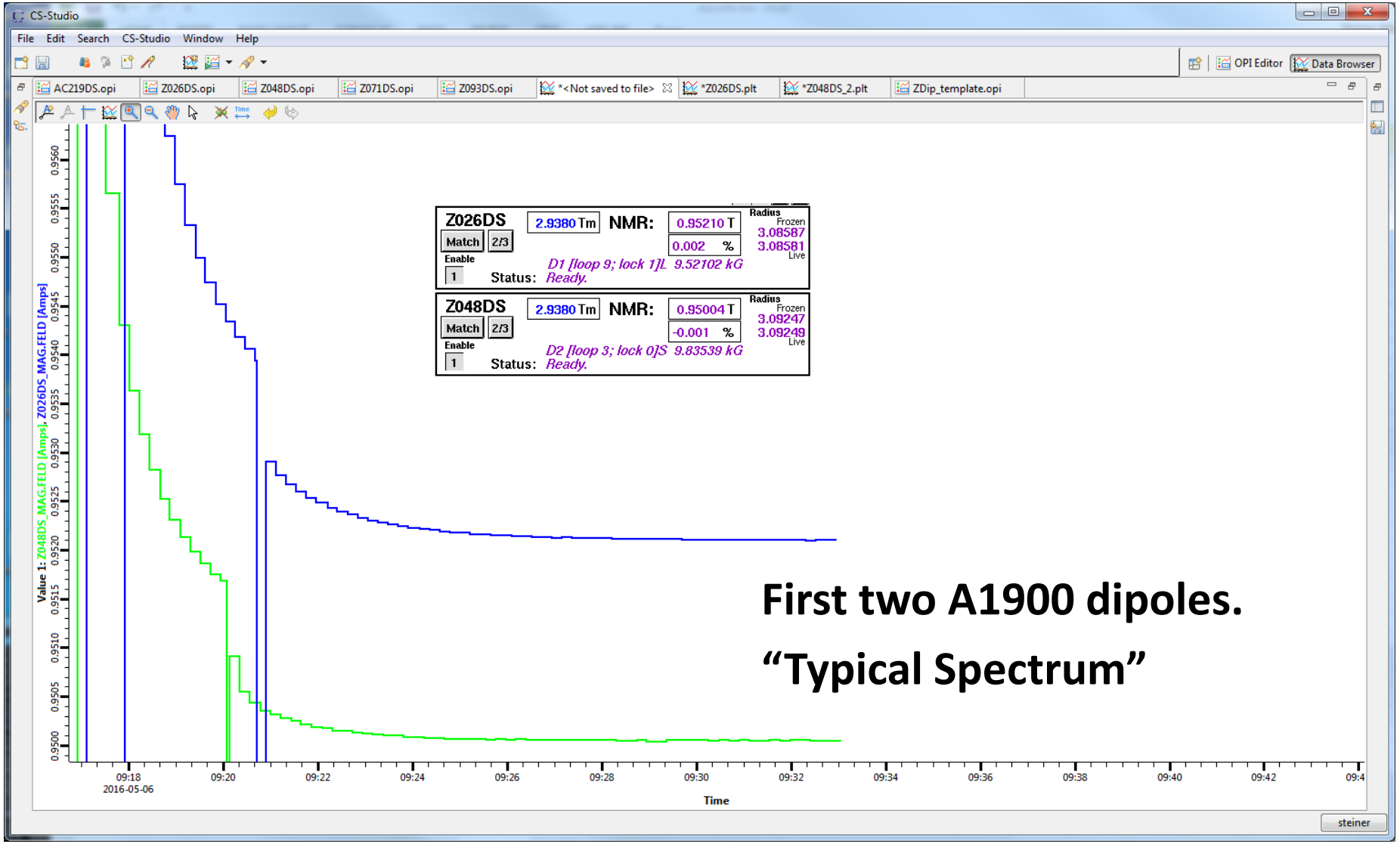


Recipe: Take NMR readings when current has reached final value.

Ignore first minute.

Match after three minutes.

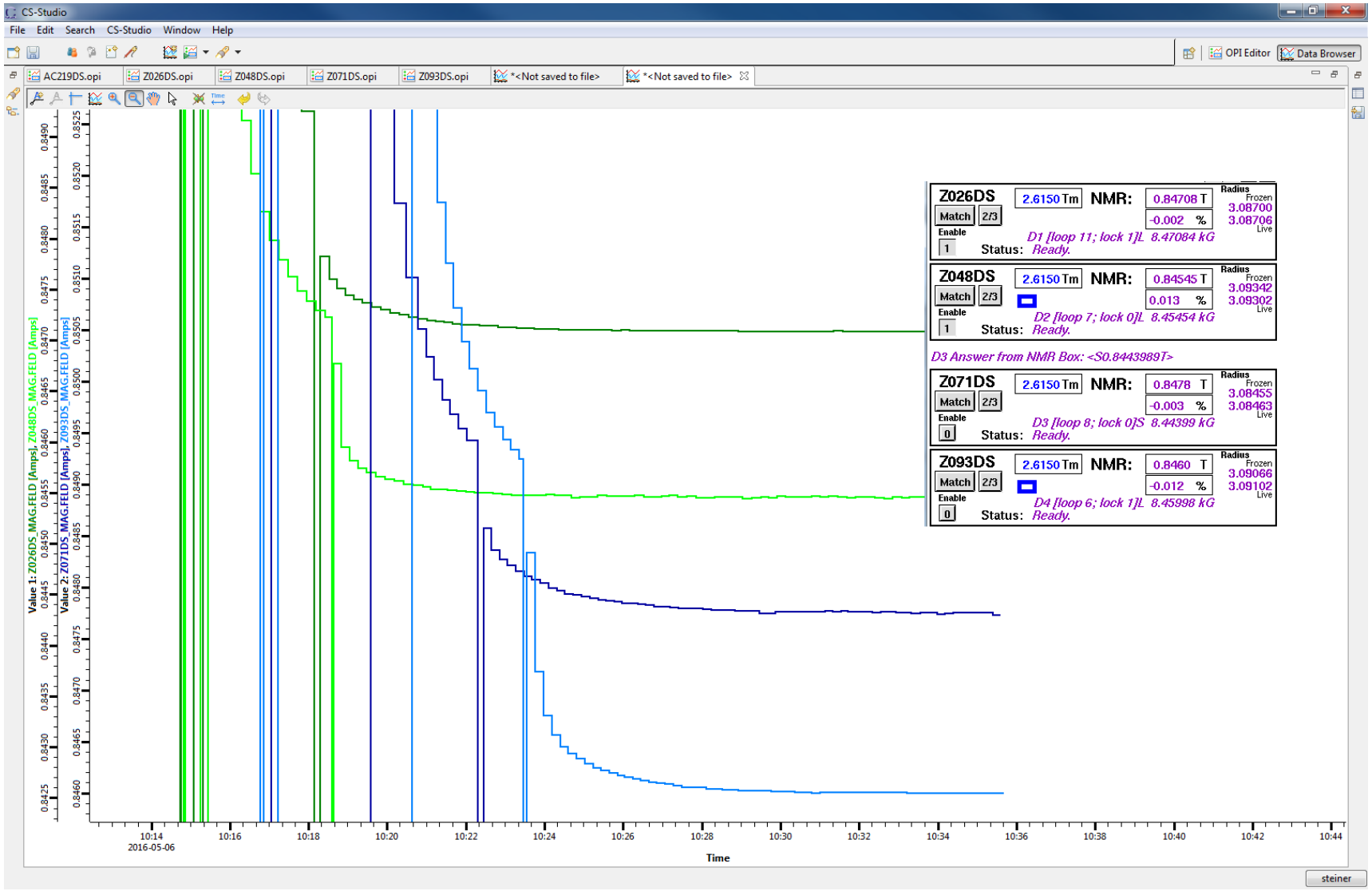
B(t) Analysis – Predictive Matching



First two A1900 dipoles.

“Typical Spectrum”

B(t) Analysis – Predictive Matching



Tuning secondary beams is hugely expensive in terms of manpower. Saving even minutes is worthwhile.

There is much that can be done to improve the operation of our separators. Both in the big picture, and in the automation of tedious tasks.

TALK TO YOUR CONTROLS PEOPLE.

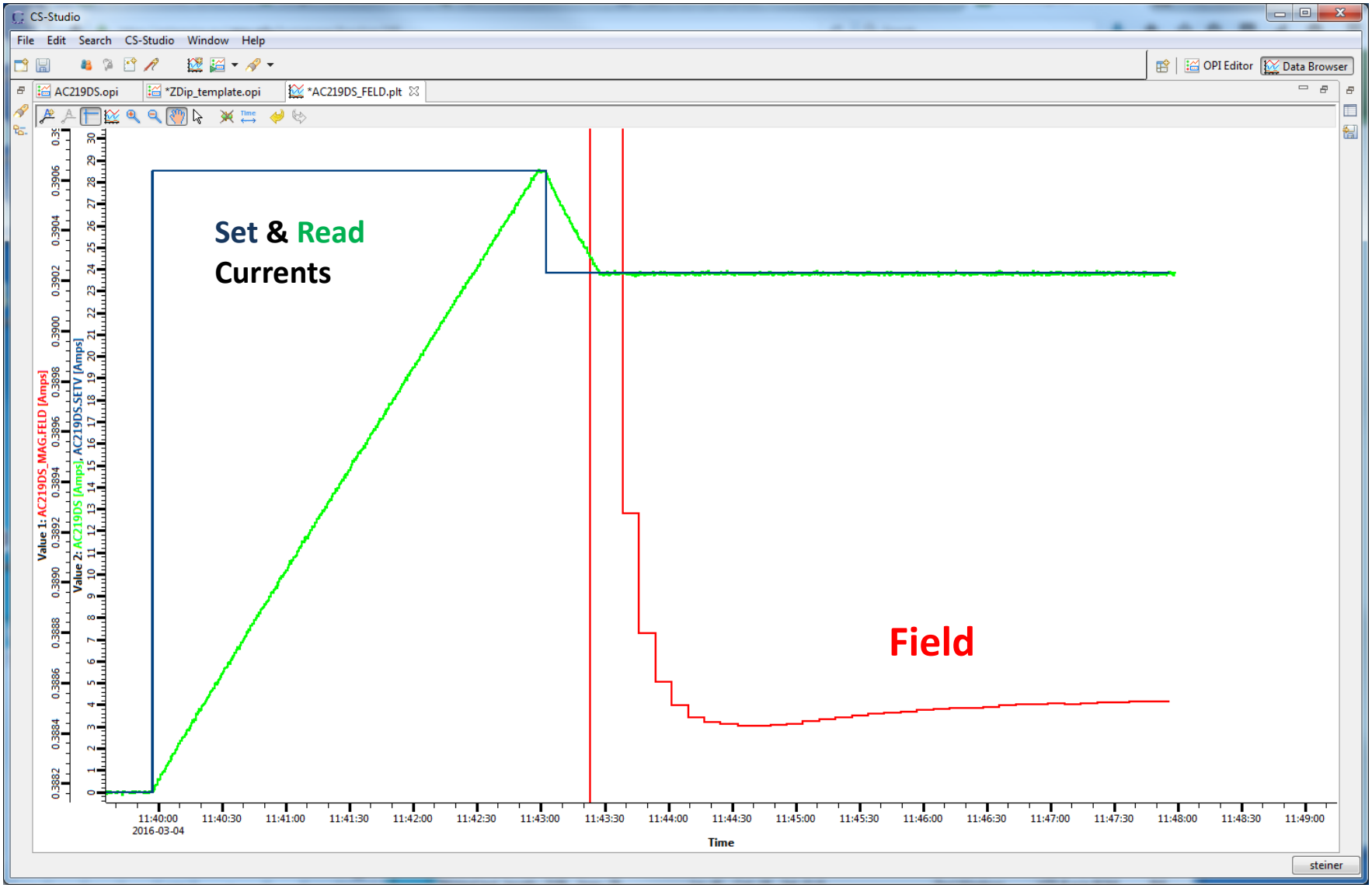
Or become one yourself.

Mathias Steiner

Michigan State University

Extra Slides

Pragmatic Approach



Simple Tool: Push-button Matching

Difficult to get the timing right.

Automation would be nice…