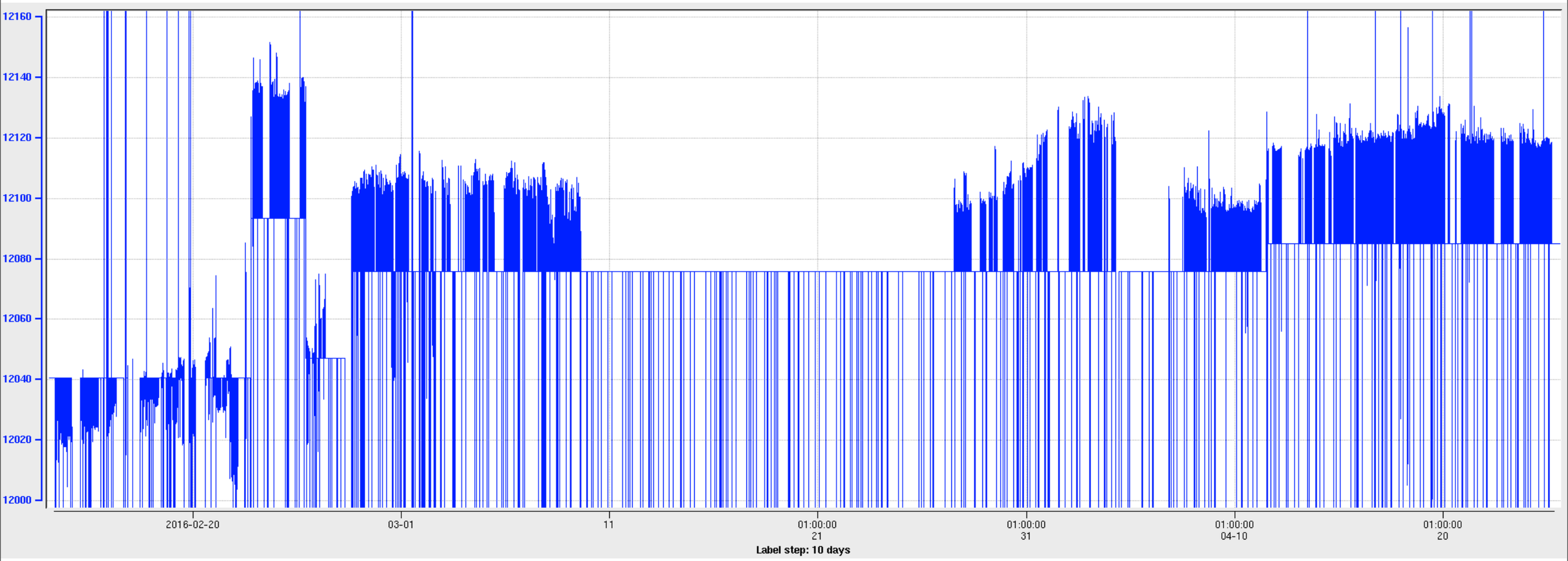
Hall D beam energy during the spring 2016 run

A. Deur

Beam energy stability



Uncorrected Hall D beam energy from MyaViewer.

- Obtained via beam displacement in Hall D ramp (epics name: HALLD:p).
- Large energy variations (up to 140 MeV).
- Some energy variations are genuine. Others are measurement artifacts.
- These data display unexpected correlations.
- Because of these artifacts, HALLD:p cannot be used on (epics) event-per-event basis.

Real energy variations

Energy is measured from the beam position in the Hall D ramp.

Real drifts (typically a few MeV, at worst 10 MeV) criteria :

- Correlate with x-position (and not y) of the beam after tagger magnet (AD00c BPM in the beam dump).
- Correlate with dispersive Hall D ramp BPM 5C02-y (but not x) and not with non-dispersive BPM 5C08-y.
- Correlate with ARC energies and possibly Hall A energy change.

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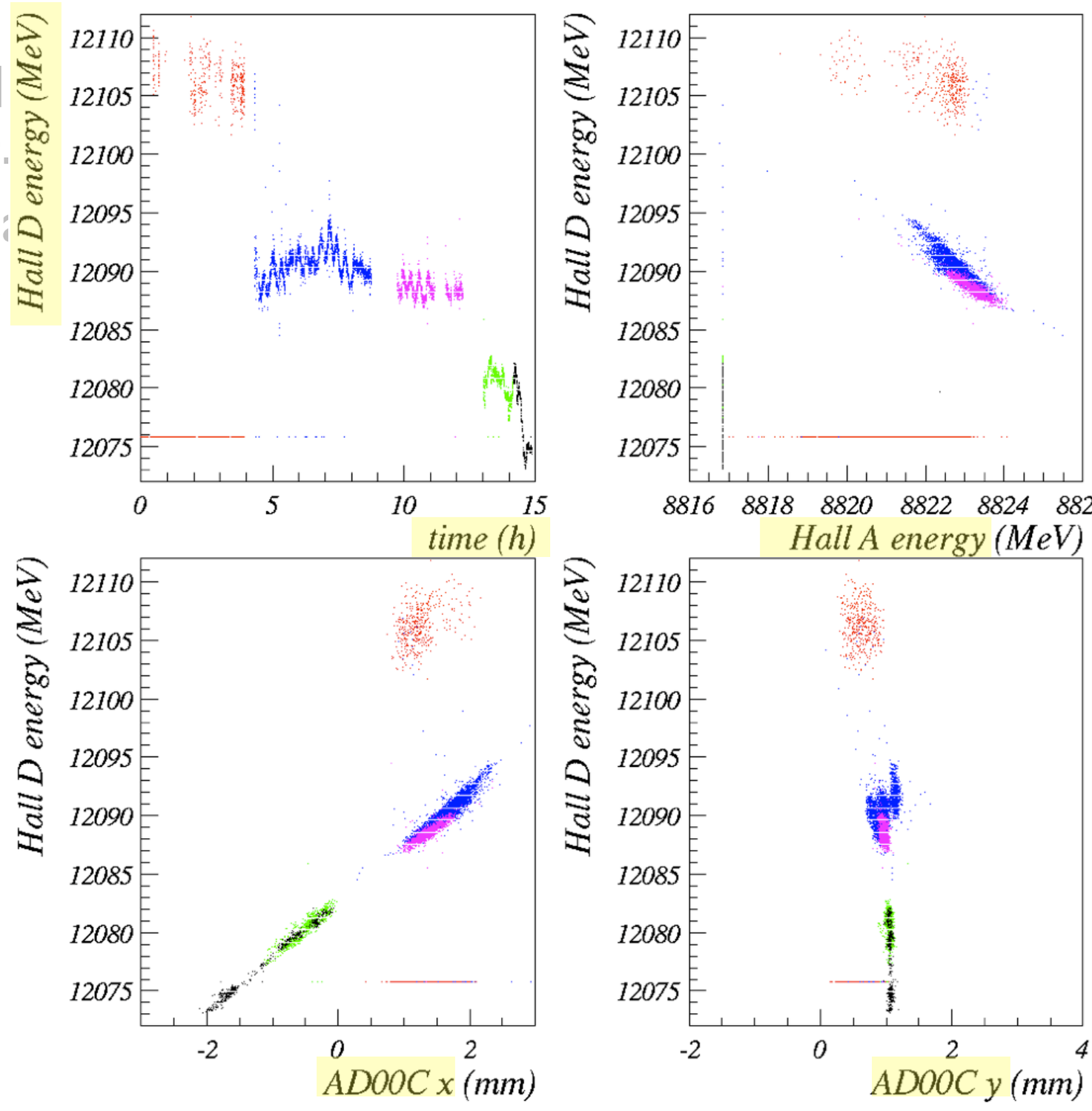
possibly Hall A energy change

Ex. data from Mar 6th - March 7th



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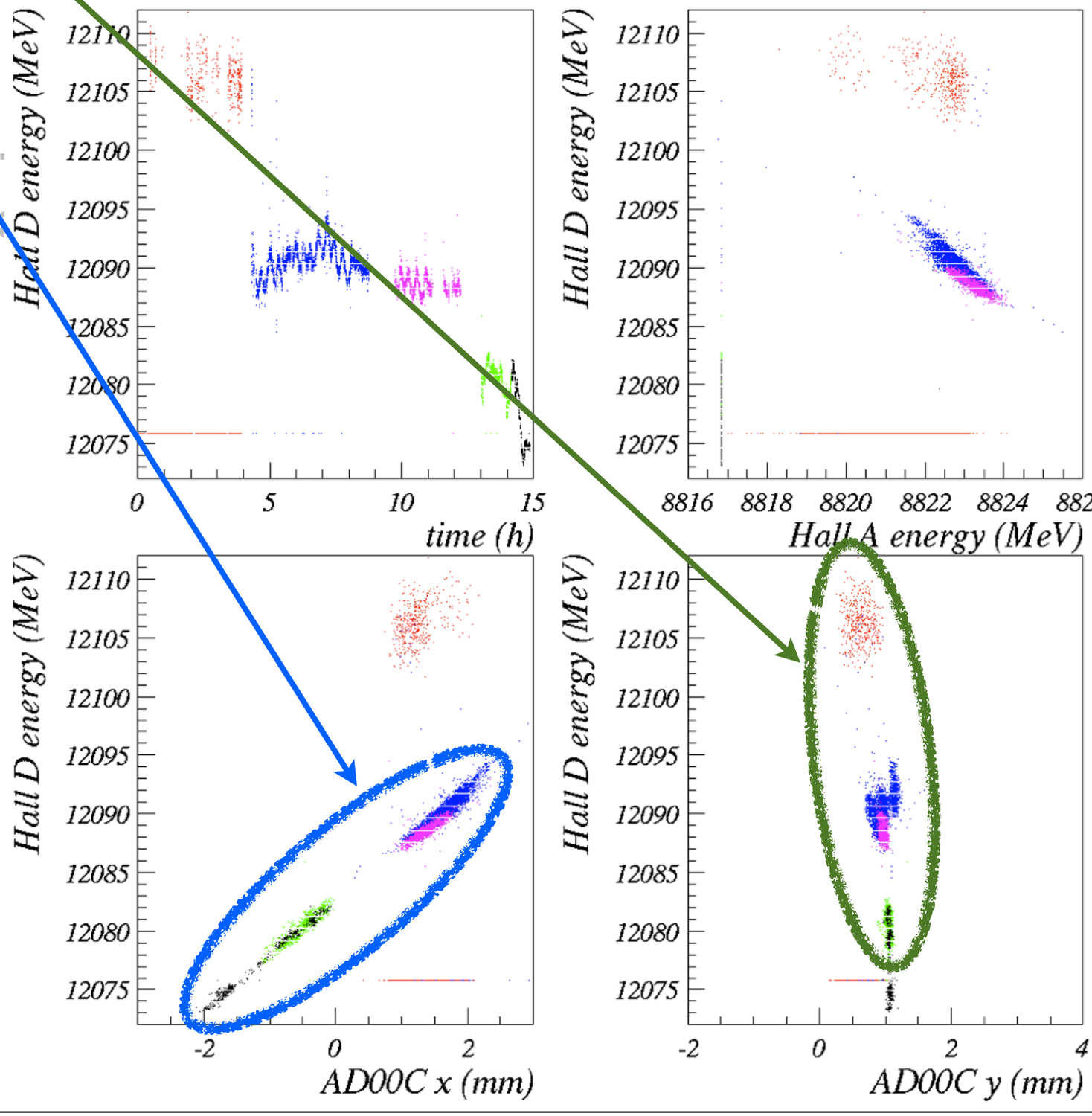

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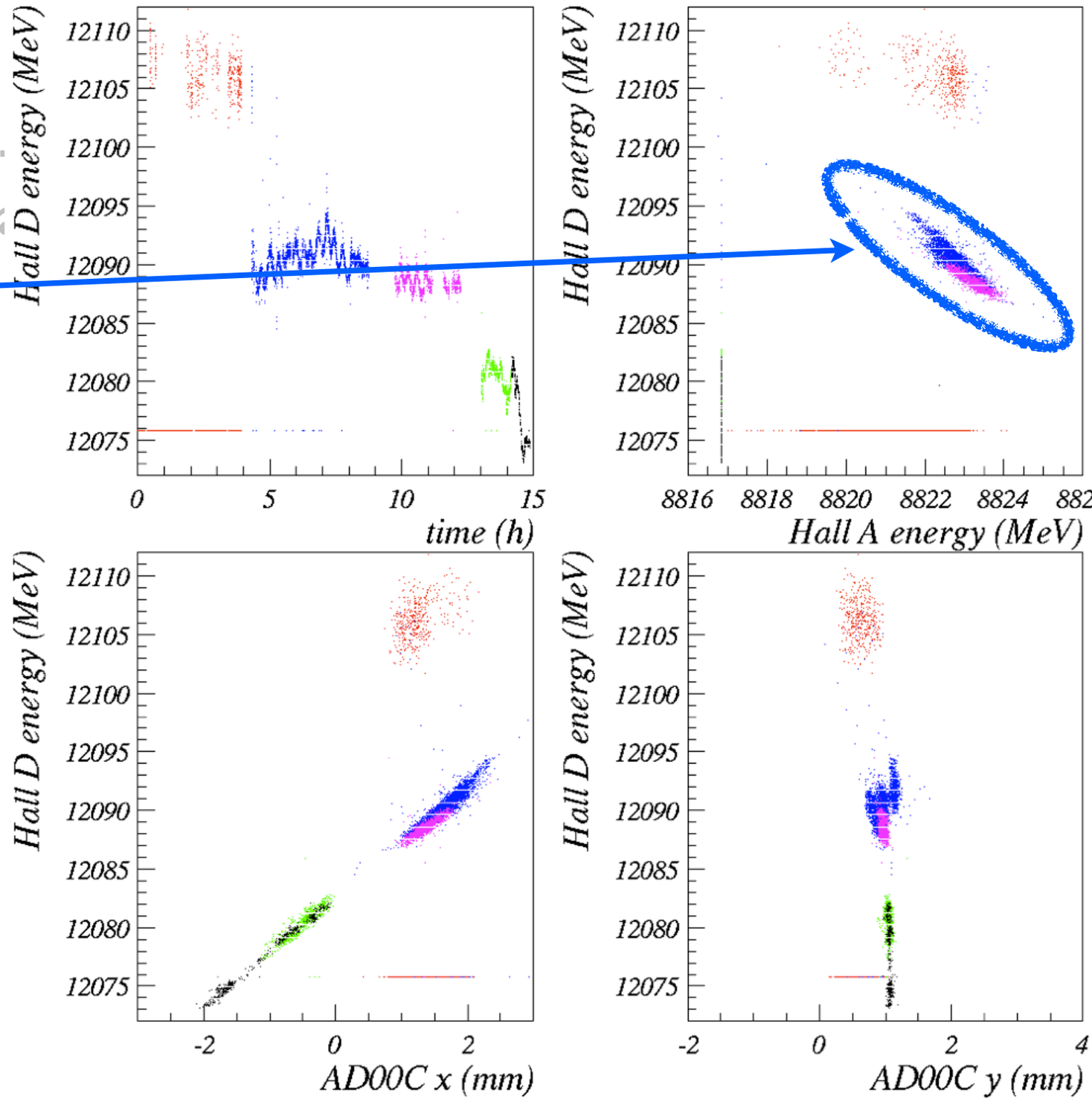

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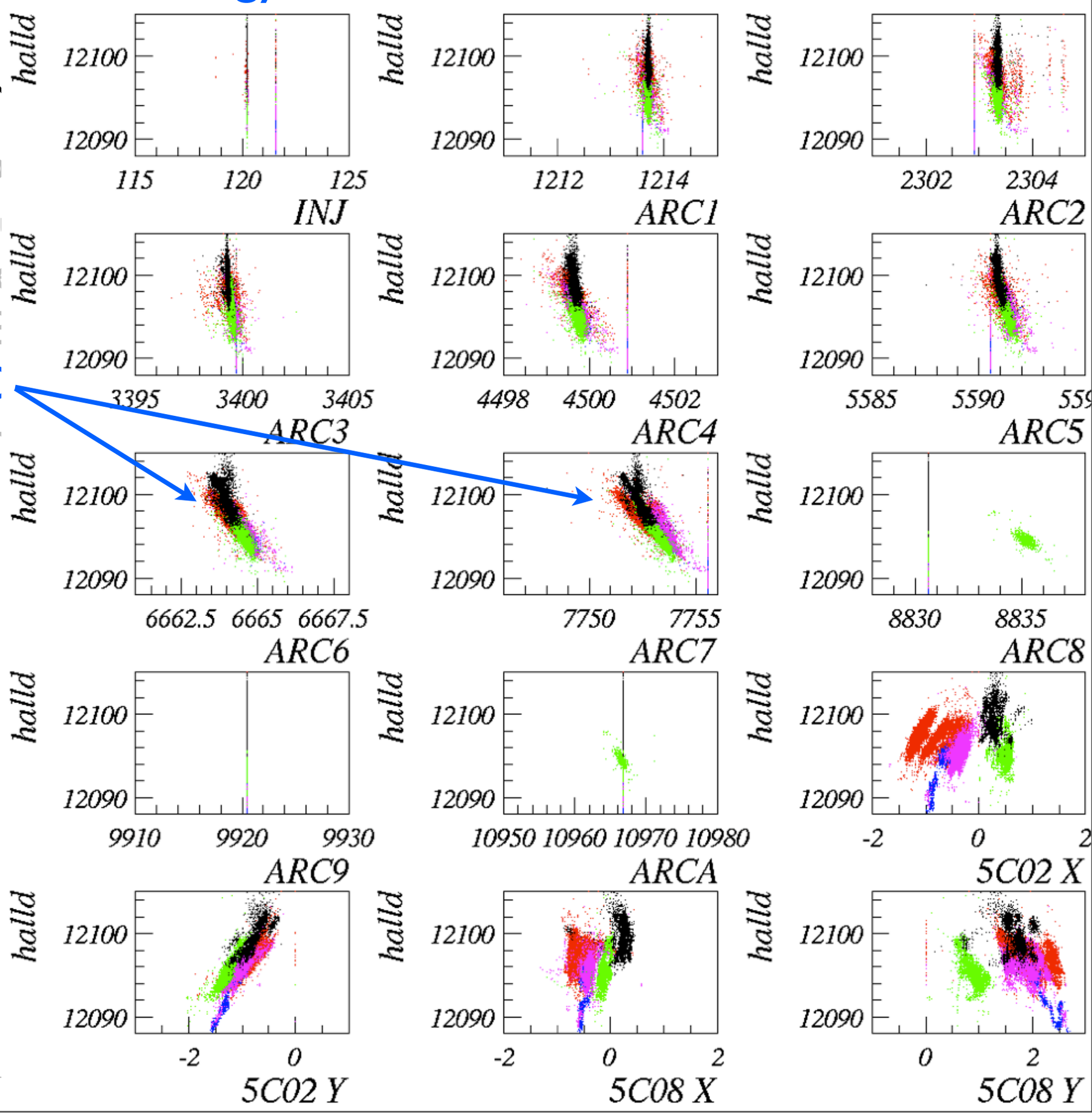

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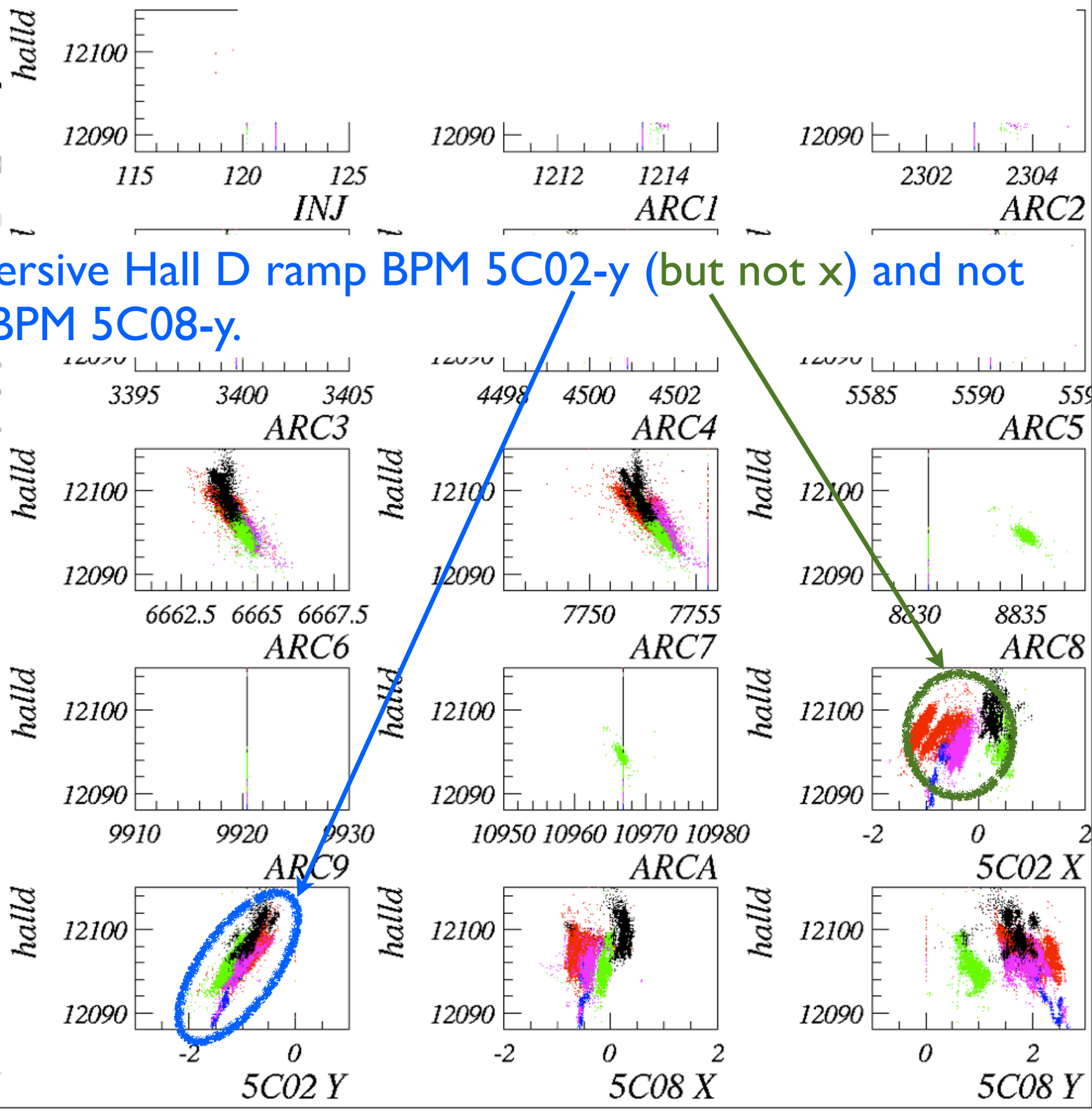
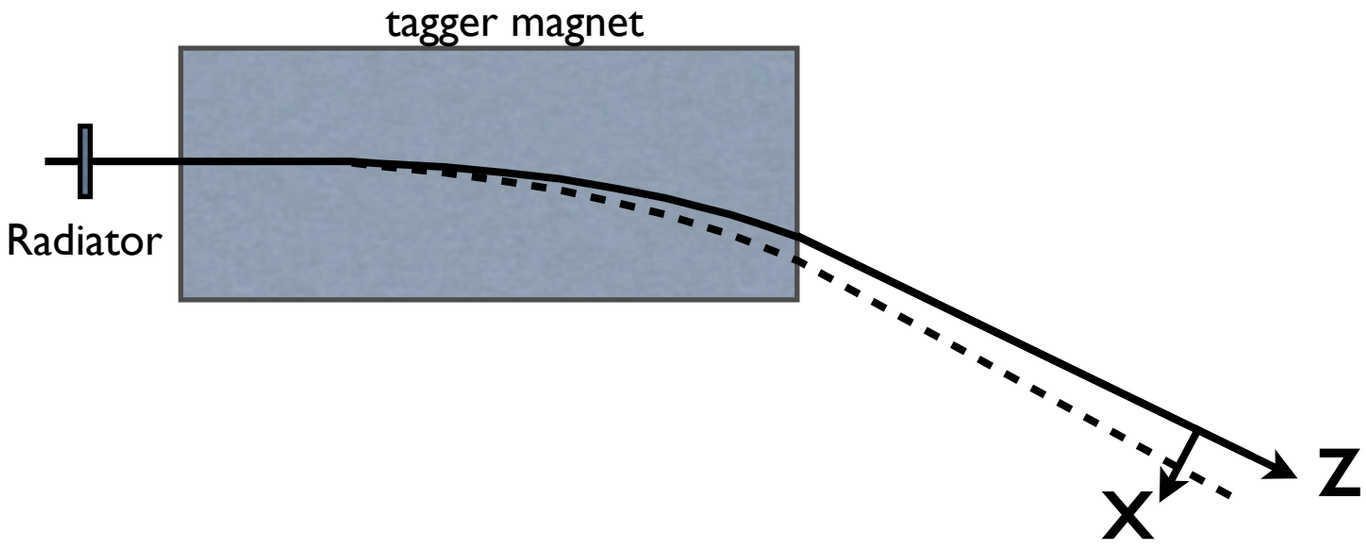


Problems

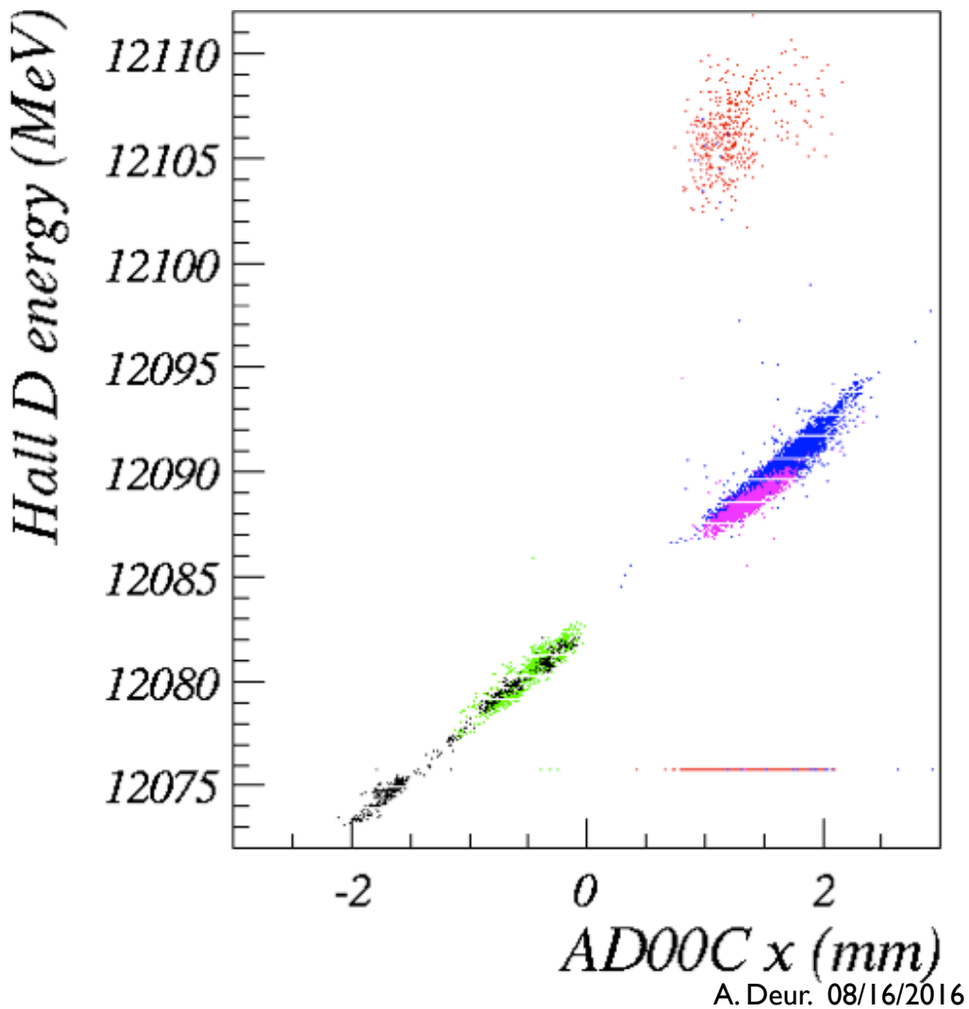
Using tagger magnet as analyzer:



⇒Expect smaller energy at larger x,

Opposit to what we see.

Accelerator systems
use left handed convention.



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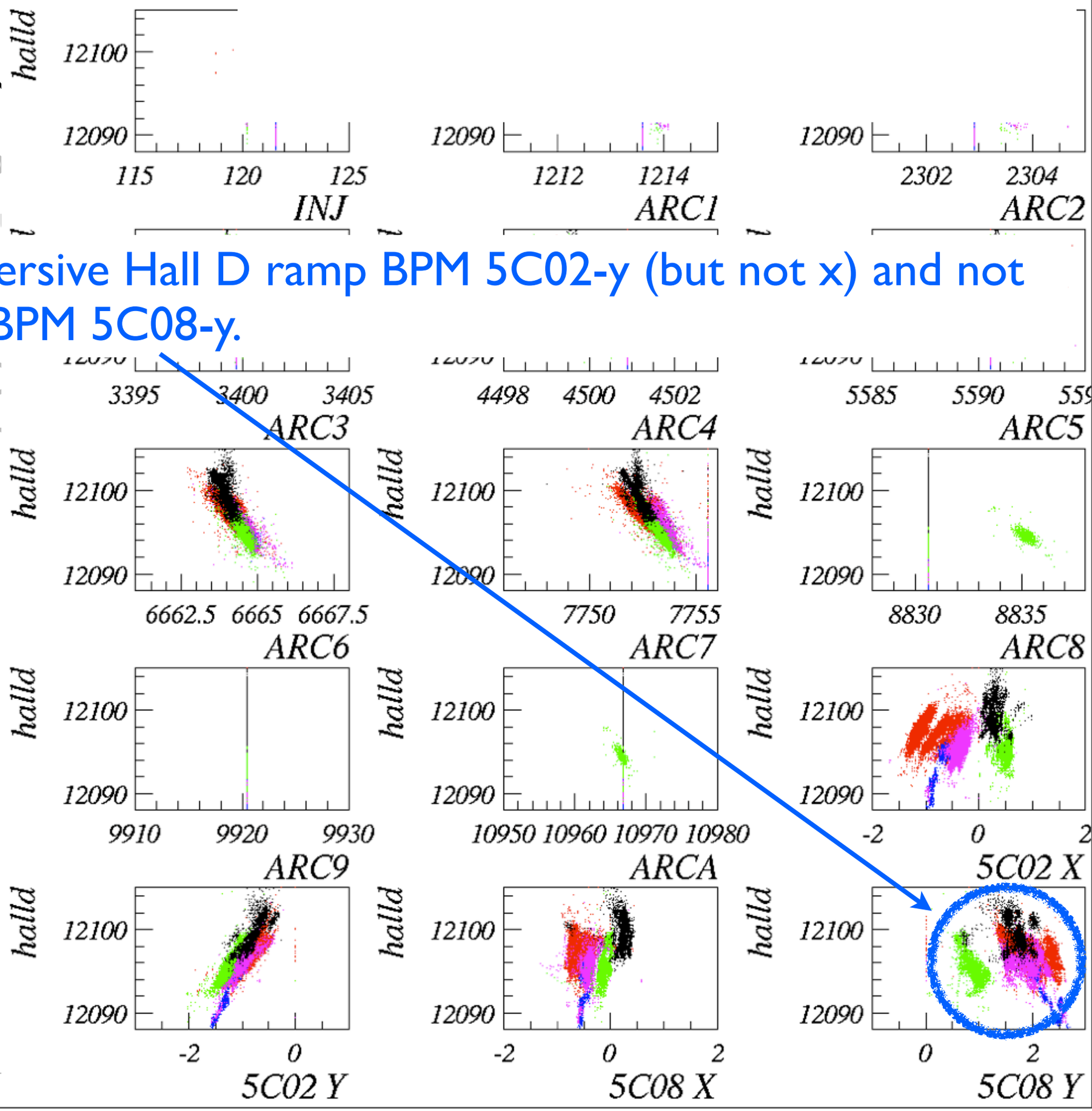
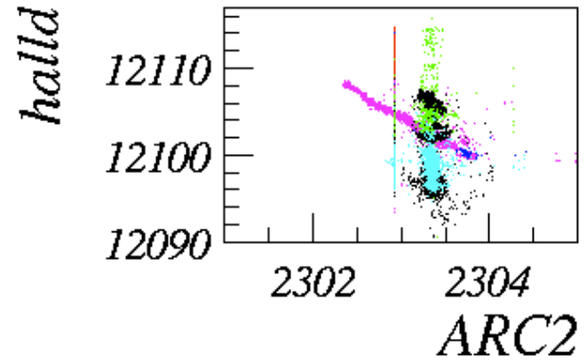
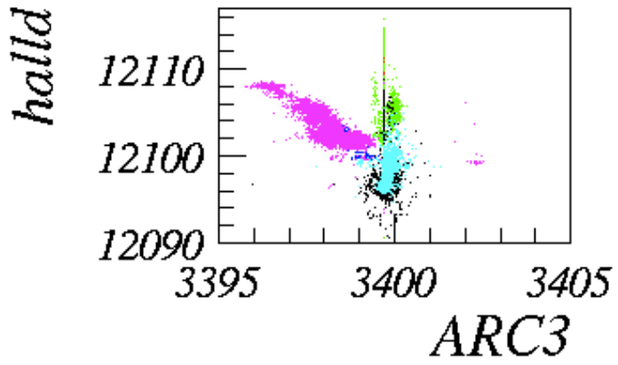
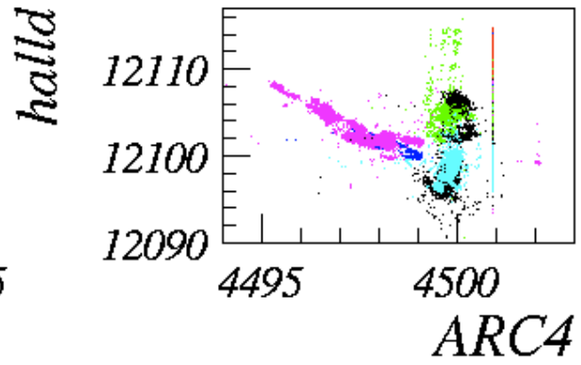


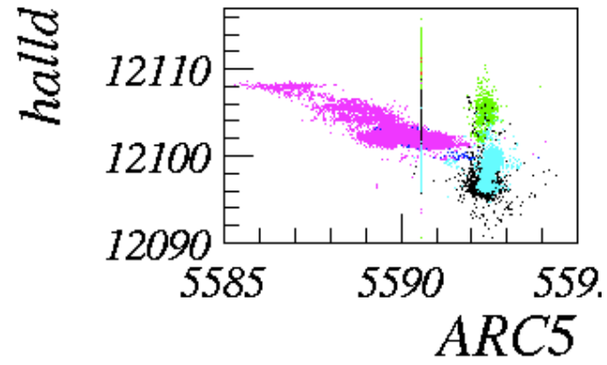
Negative correlations with Hall A energy and ARCs

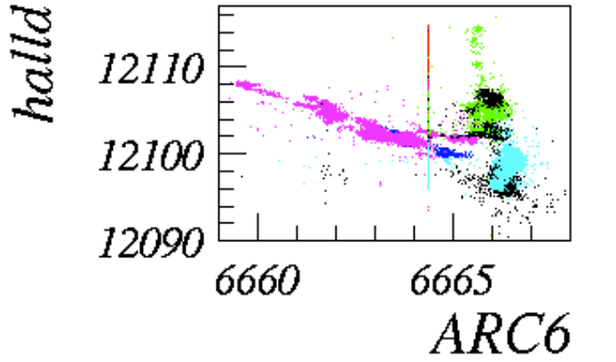
Hall D energy variation is negatively correlated with Hall A and ARCs:

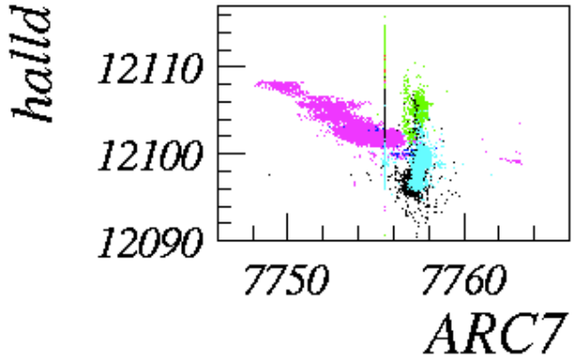




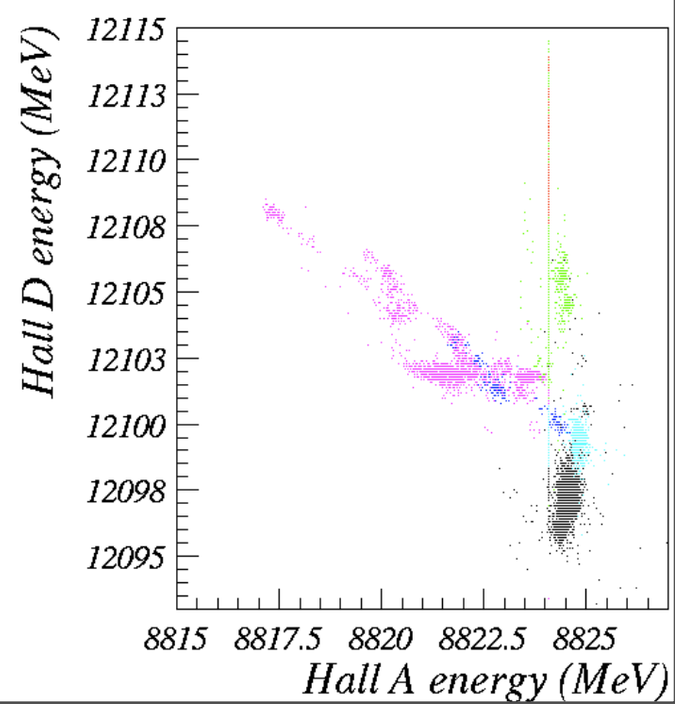








Expect a positive correlation. Wrong sign for Hall D energy variation?

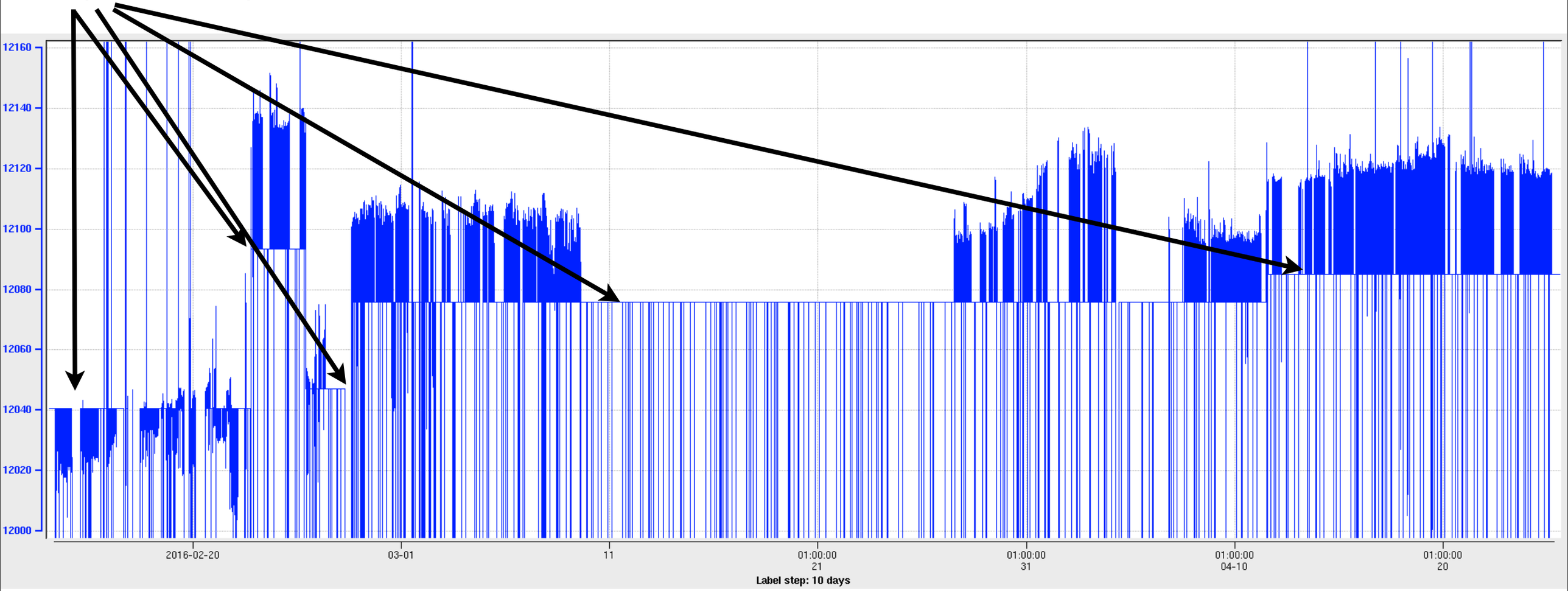


Discussion with accelerator (Mike McCaughan Yves Roblin, Todd Satogata, Mike Tiefenback)

- Bug found in code to get Hall D energy.
  - Energy=$P_0(1+\delta_{steering}+\delta_{orbit})$ but δ_{orbit} had the wrong sign.
  - Accelerator has left-handed convention and model has right-handed. When accounting for the difference (x→-x), mistakingly did y→-y too and since the Hall D ramp bends vertically, δ_{orbit} had the wrong sign.

- This explains:
  - Hall D energy anti-correlation with Hall A and ARC energies;
  - Artificial jumps seen in our energy monitoring (all of them?);
  - "Wrong" sign of AD00c-x after the tagger (bend horizontally).

Spring 16 Uncorrected Hall D beam energy from MyaViewer (epics name: HALLD:p).



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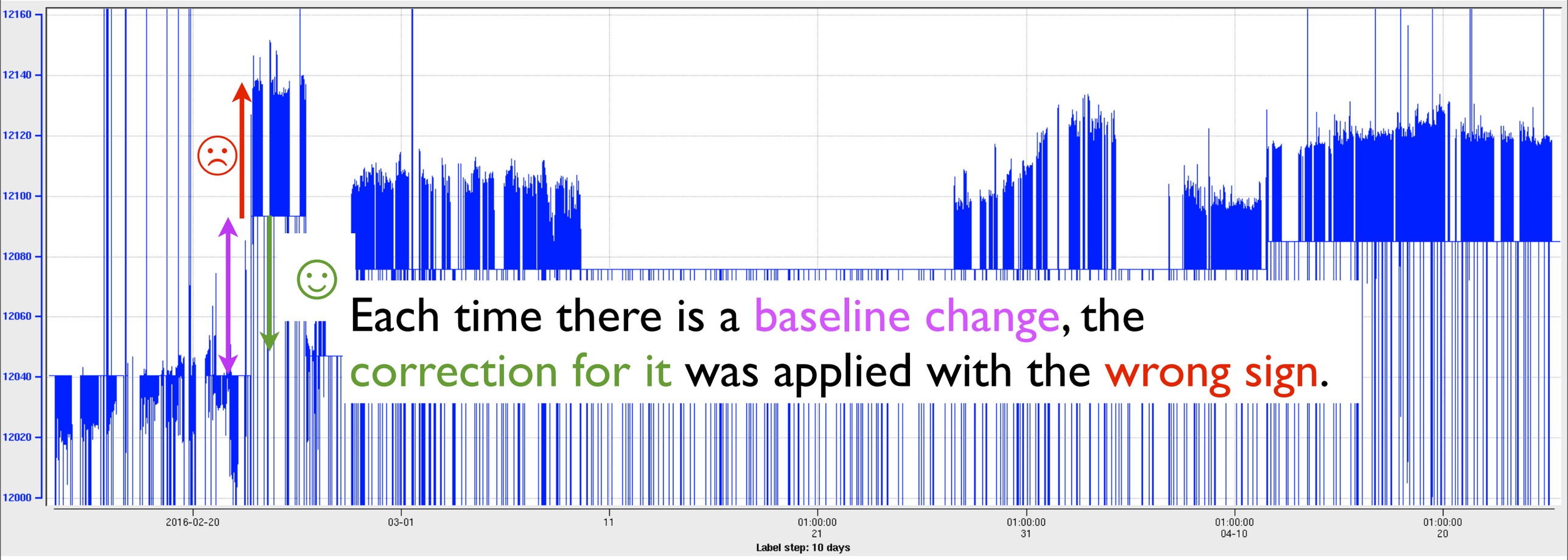

Each time there is a baseline change, the correction for it was applied with the wrong sign.

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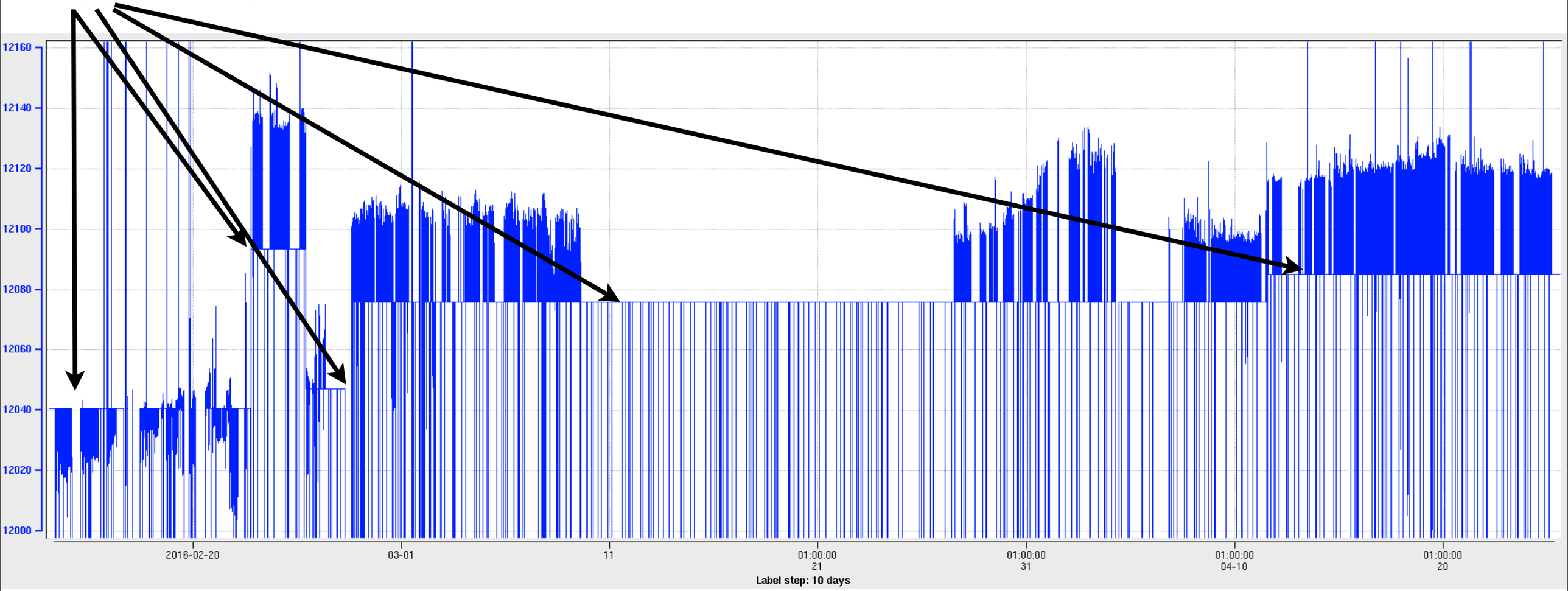

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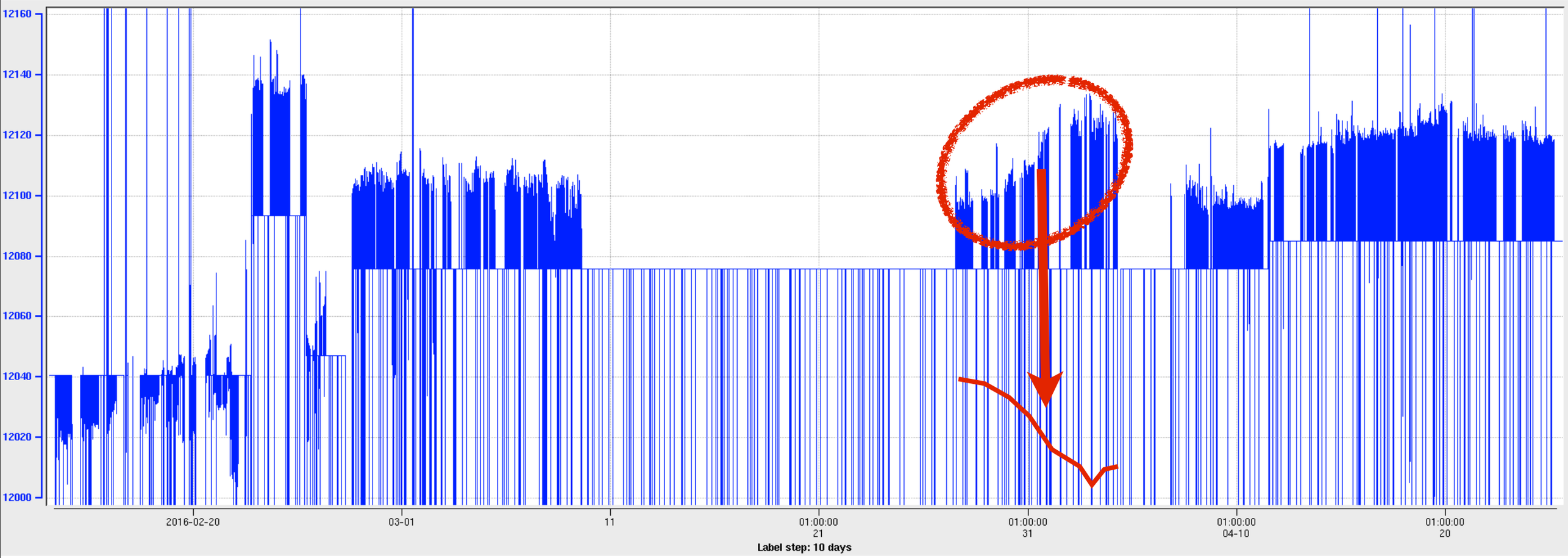

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Summary

- Sign bug seems to explain most of the inconsistencies seen in the Hall D energy analysis.
- Started to re-analyze the data.
- Need to check if all the artificial energy jumps are gone or if some remain.
- Need to provide a new energy table. The energies we are presently using are grossly wrong.