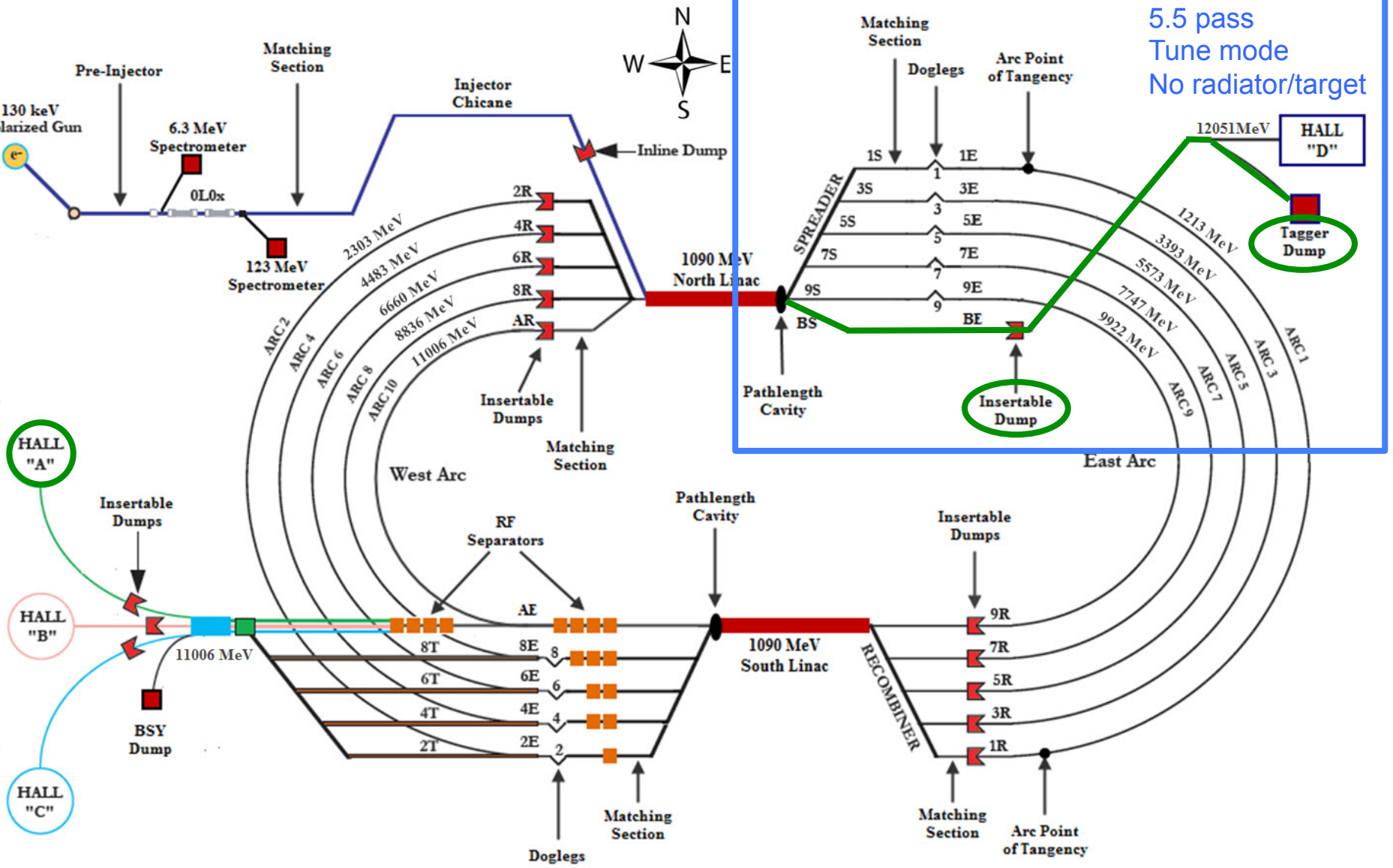
Accelerator Update
GlueX Collaboration Meeting

Todd Satogata / Hall D Accelerator Physics Liaison
Mike McCaughan / Hall D Accelerator Operations Liaison

May 12, 2014

CEBAF Accelerator Overview To Hall D



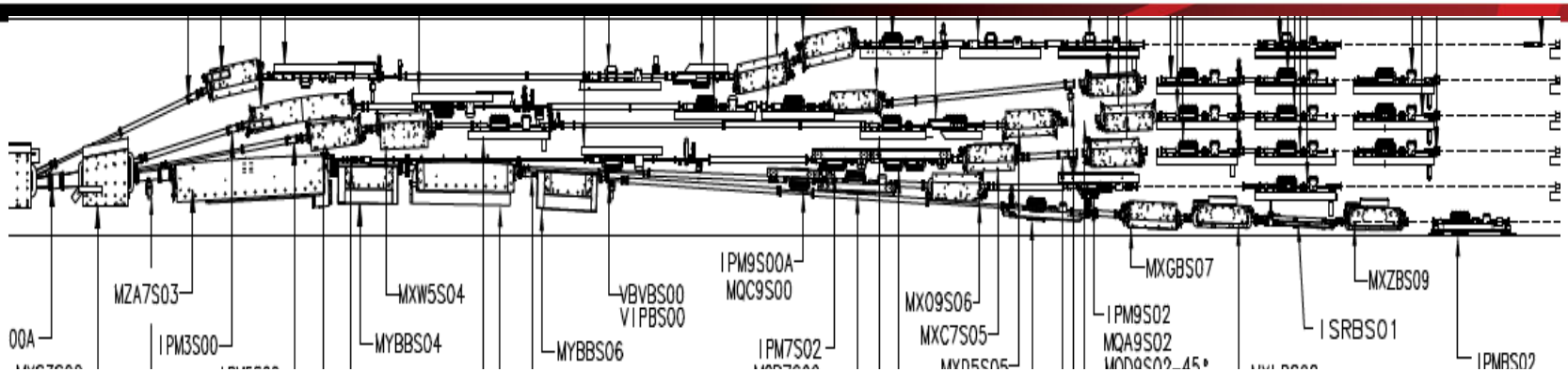
Hall D Beam Delivery Objectives

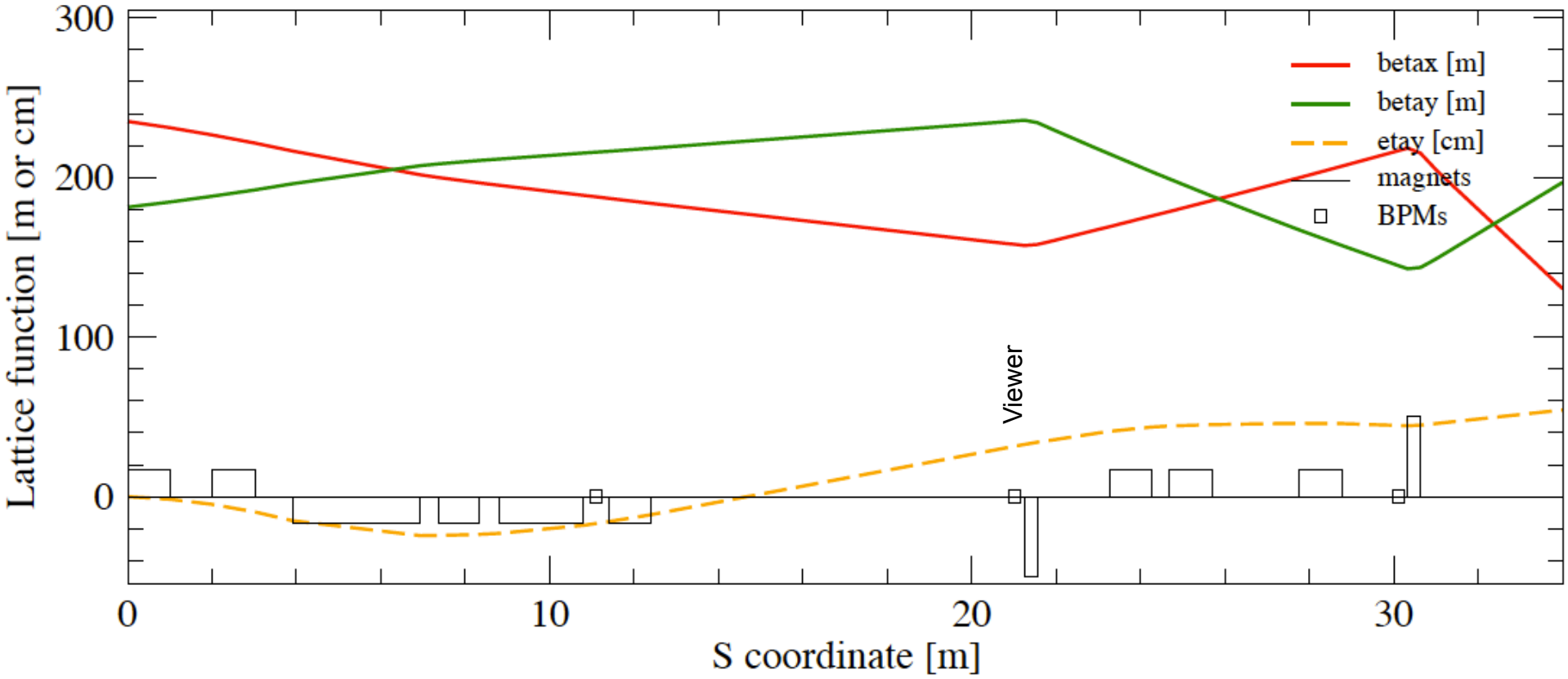
- Run 2: Just finished 12 hours ago!
  - Spring 2014
  - 5.5-pass **tune beam**, >10 GeV
  - Commission new beamline to 5C00 dumplette
  - Commission new beamline to AD00 tagger dump (stretch)
- Run 3
  - Late fall 2014
  - 5.5-pass tune and **CW beam**
  - Commission/checkout new GlueX detector systems
  - Commission instrumentation installed summer 2014
    - nA BPMs, fast feedback (w/active collimator integration)
- 12 GeV project level 2 milestone
  - Hall D beam commissioning completed: Dec 31 2014

Achieved! 02:50-04:30
Wed Mar 7 2014 e3285450

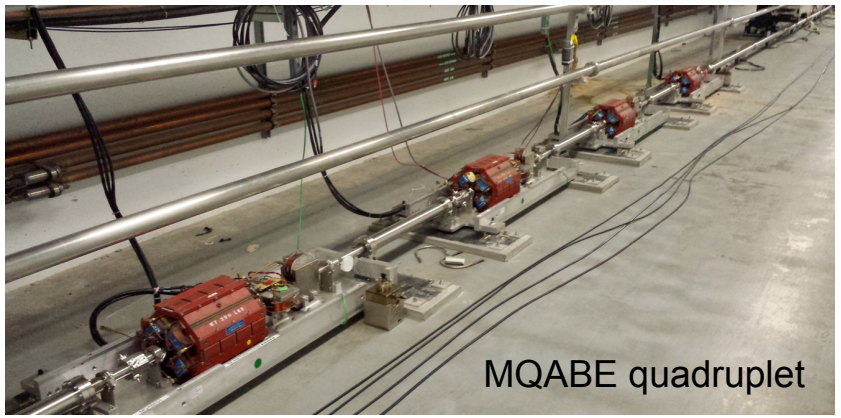
Achieved! 23:40-01:50
Wed Mar 7 2014 e3285622

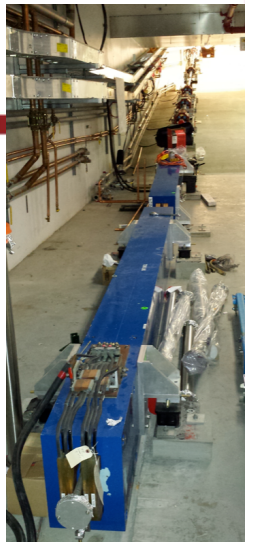
Hall D Extraction Line (Spreader)



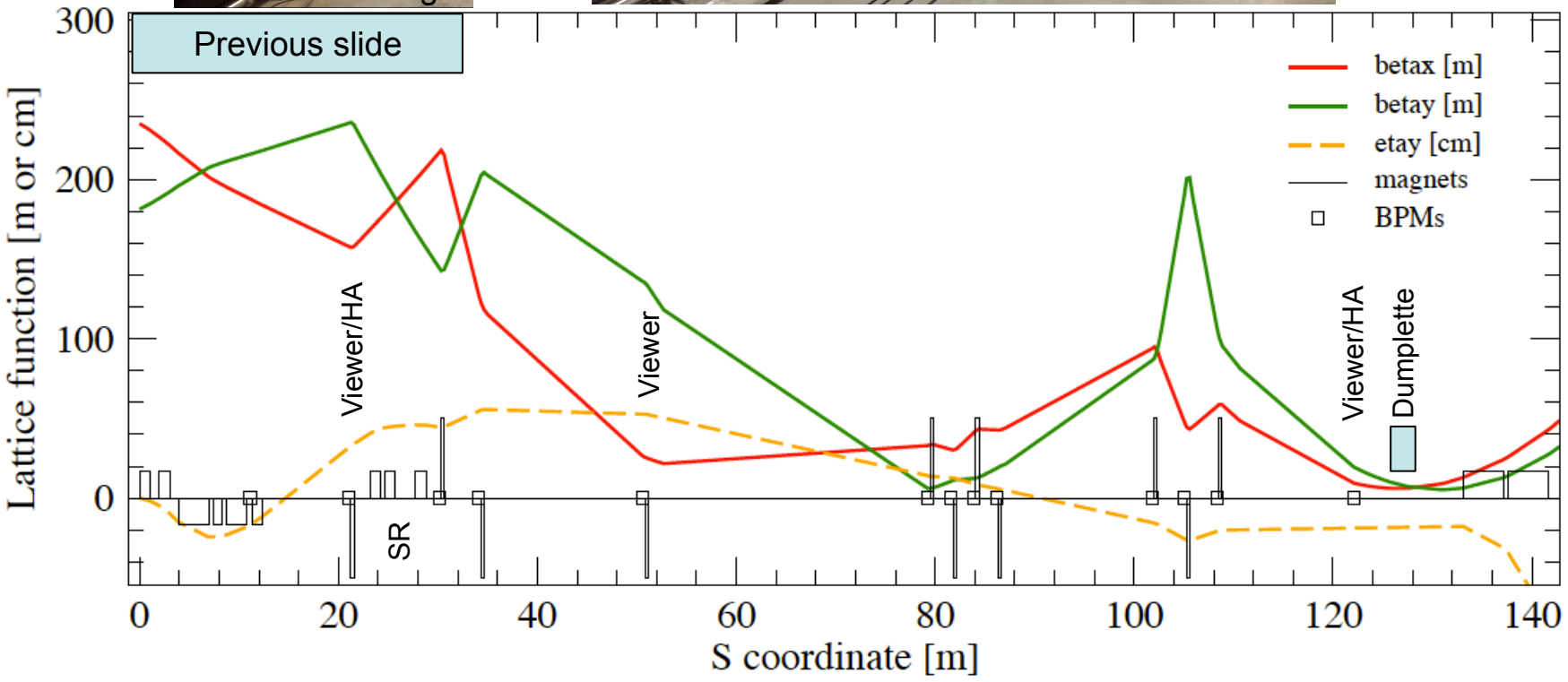


Hall D Transport Line (to insertable dump)

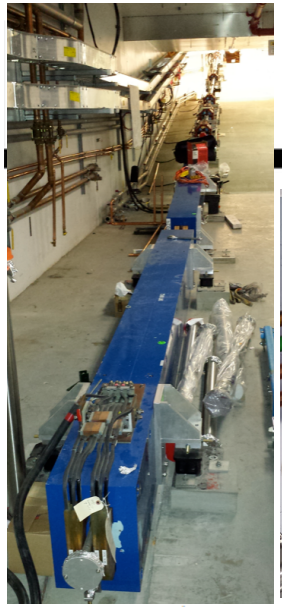


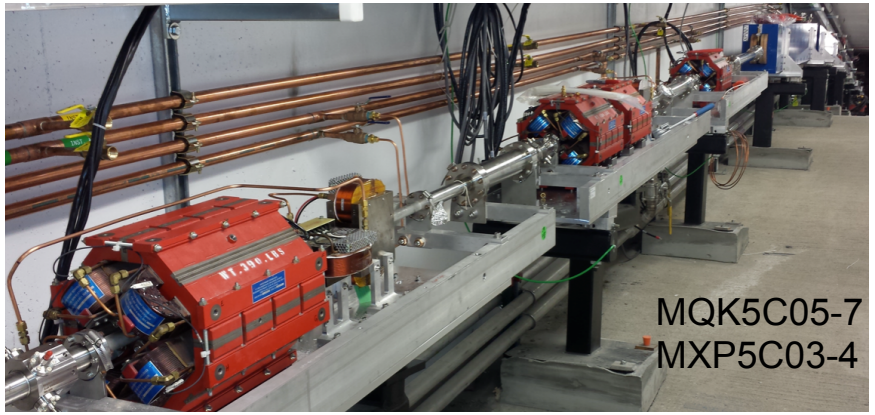


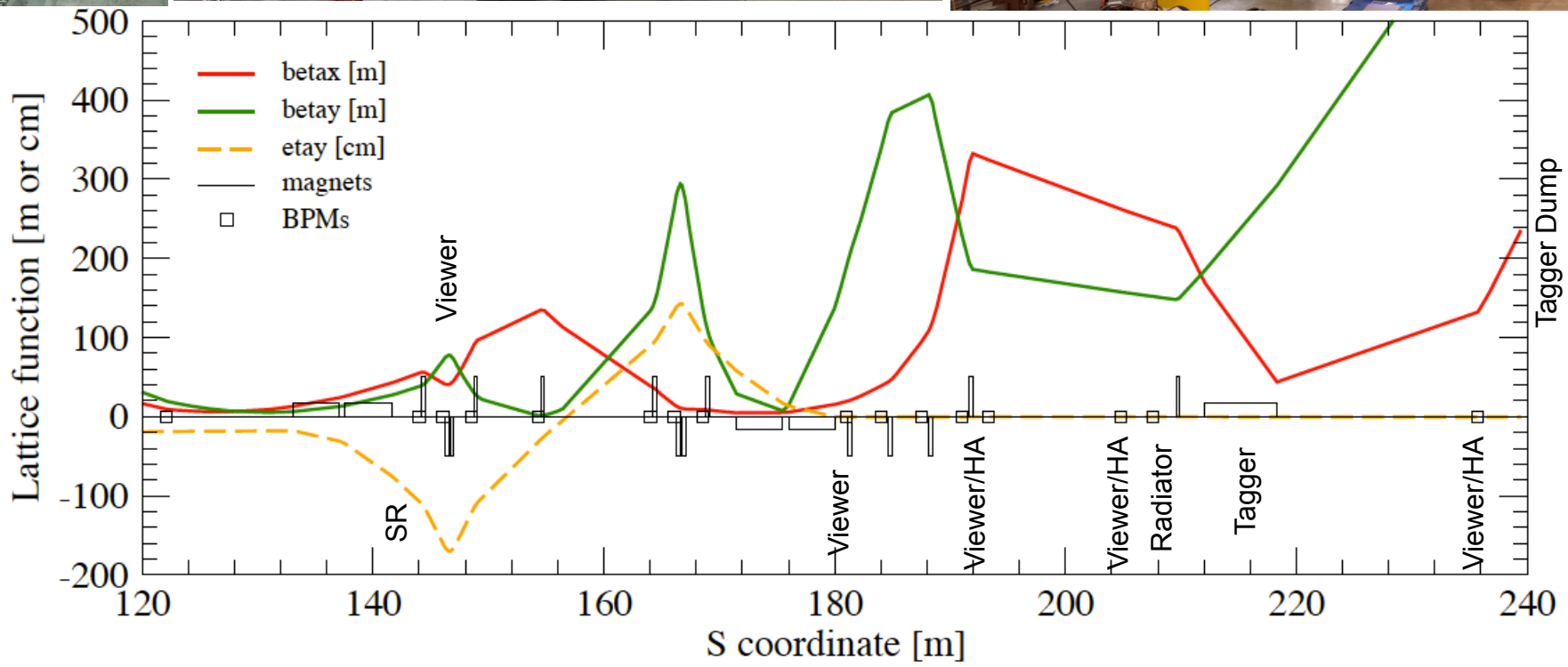
Previous slide



Hall D Transport Line (to tagger dump)







Beam to 5C00 at 10.5 GeV: Wed May 7

Hour of tune beam on 5C00 @ ~10GeV

Lognumber 3285450. Submitted by mmerz on Wed, 05/07/2014 - 04:41.

Last updated on Wed, 05/07/2014 - 04:41

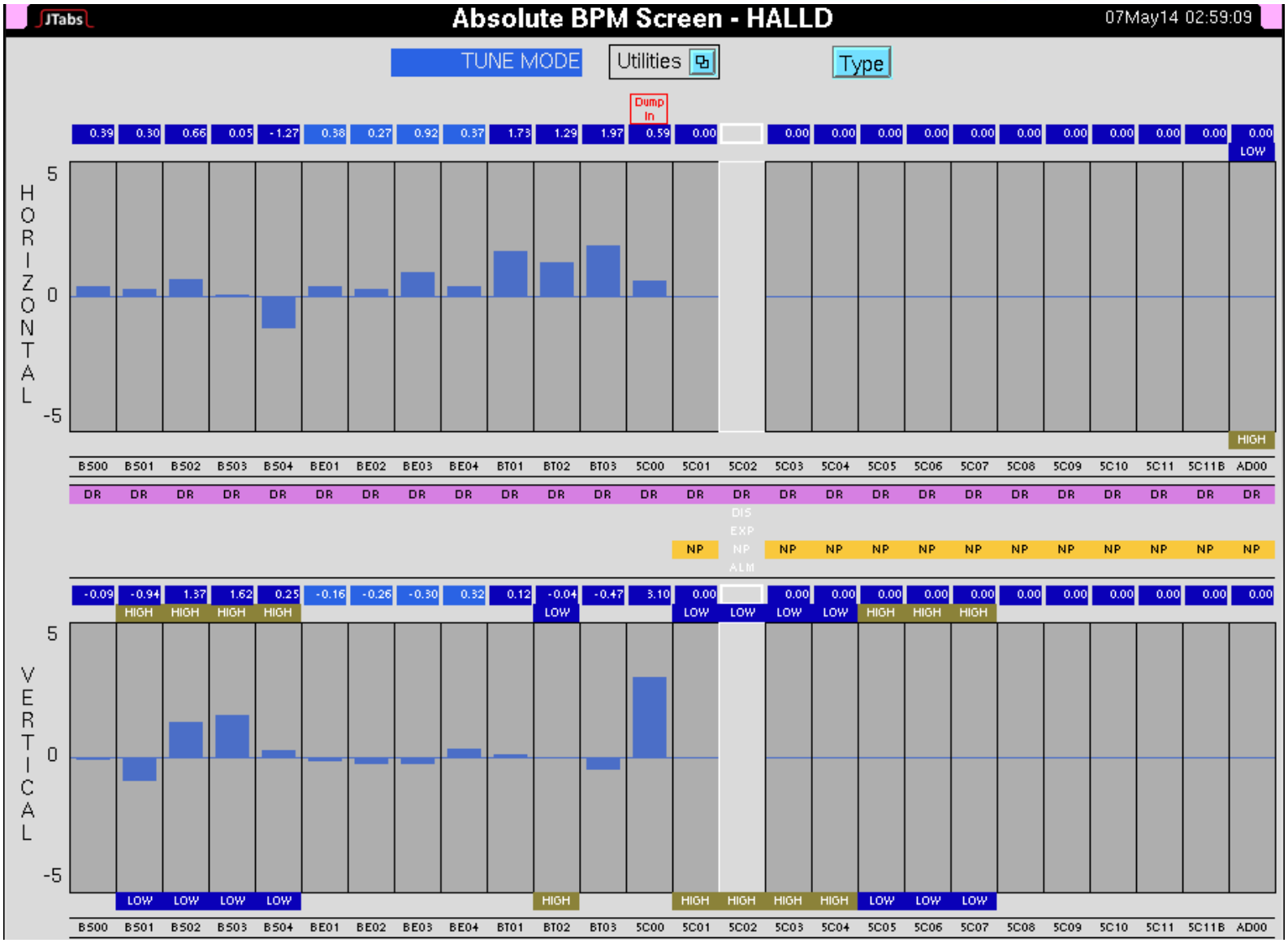
Logbooks:	ELOG
Entry Makers:	mmerz

0307-0435:
-2 min for four 5-cell trips
-4 min for two (non-2L24) C-100 trips
-18 min for 2L24 trip

Hall D transport line tuned up very quickly (hours)
Stripline BPMs worked “out of the box”
No magnet miswirings observed

Fig. 1 [05/07/2014 04:38:14]

Beam to 5C00 at 10.5 GeV: Wed May 7



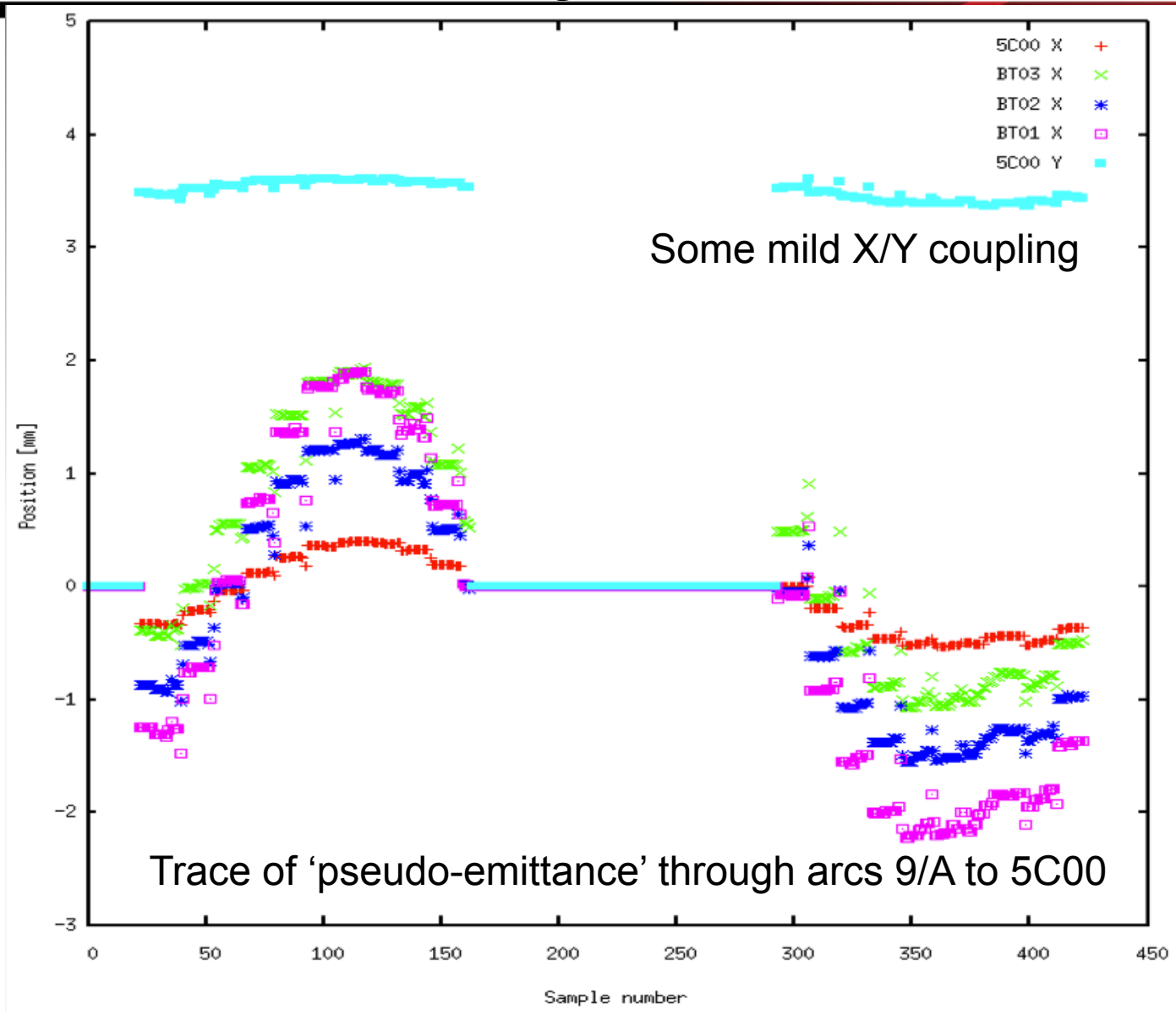
Beam to 5C00 at 10.5 GeV: Wed May 7

Viewer diameter 1.125”

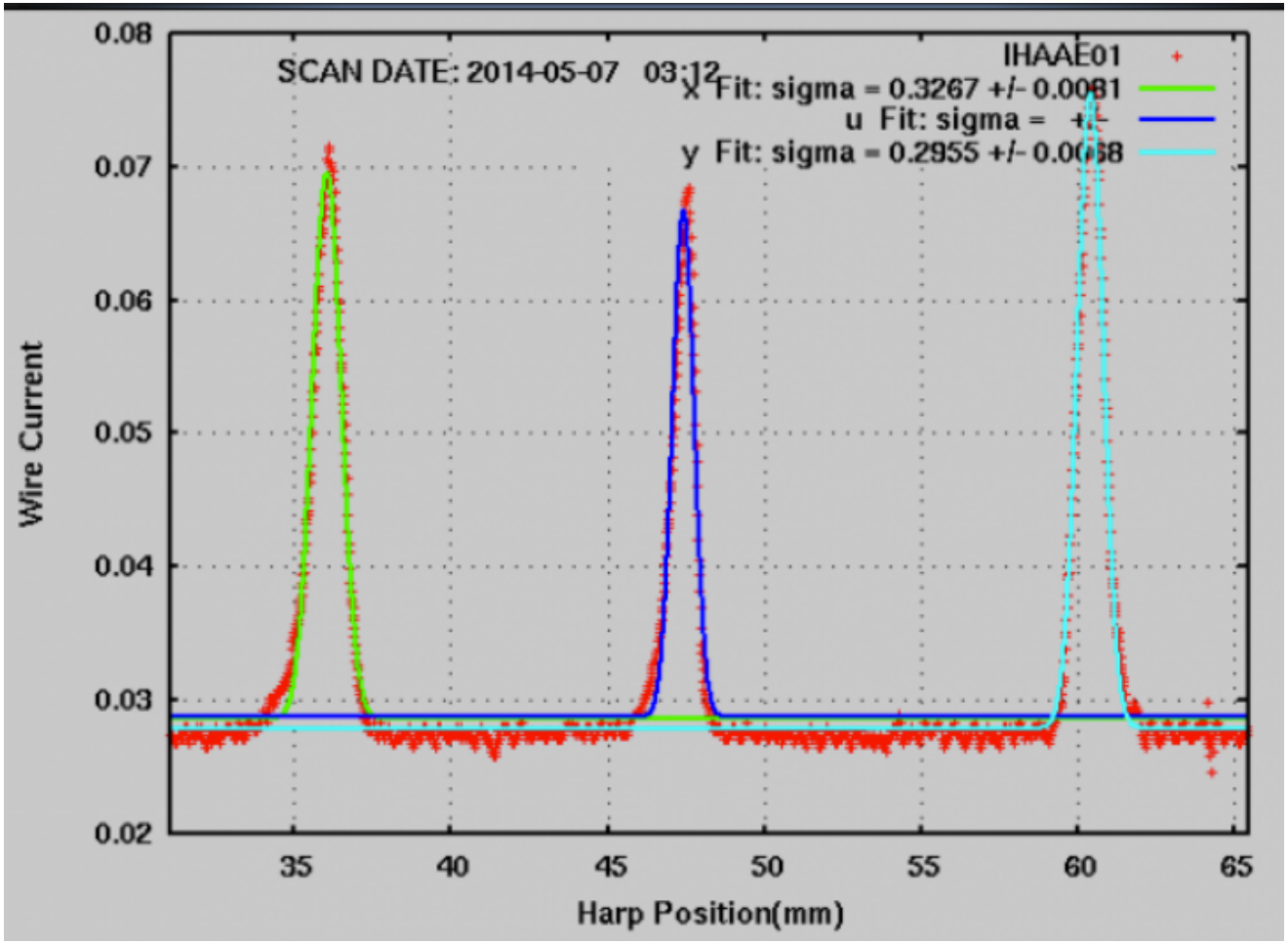
Beam diameter about 330 um

Normalized emittance very roughly on order of 2 um

Beam to 5C00: rayTrace Orbit Optics

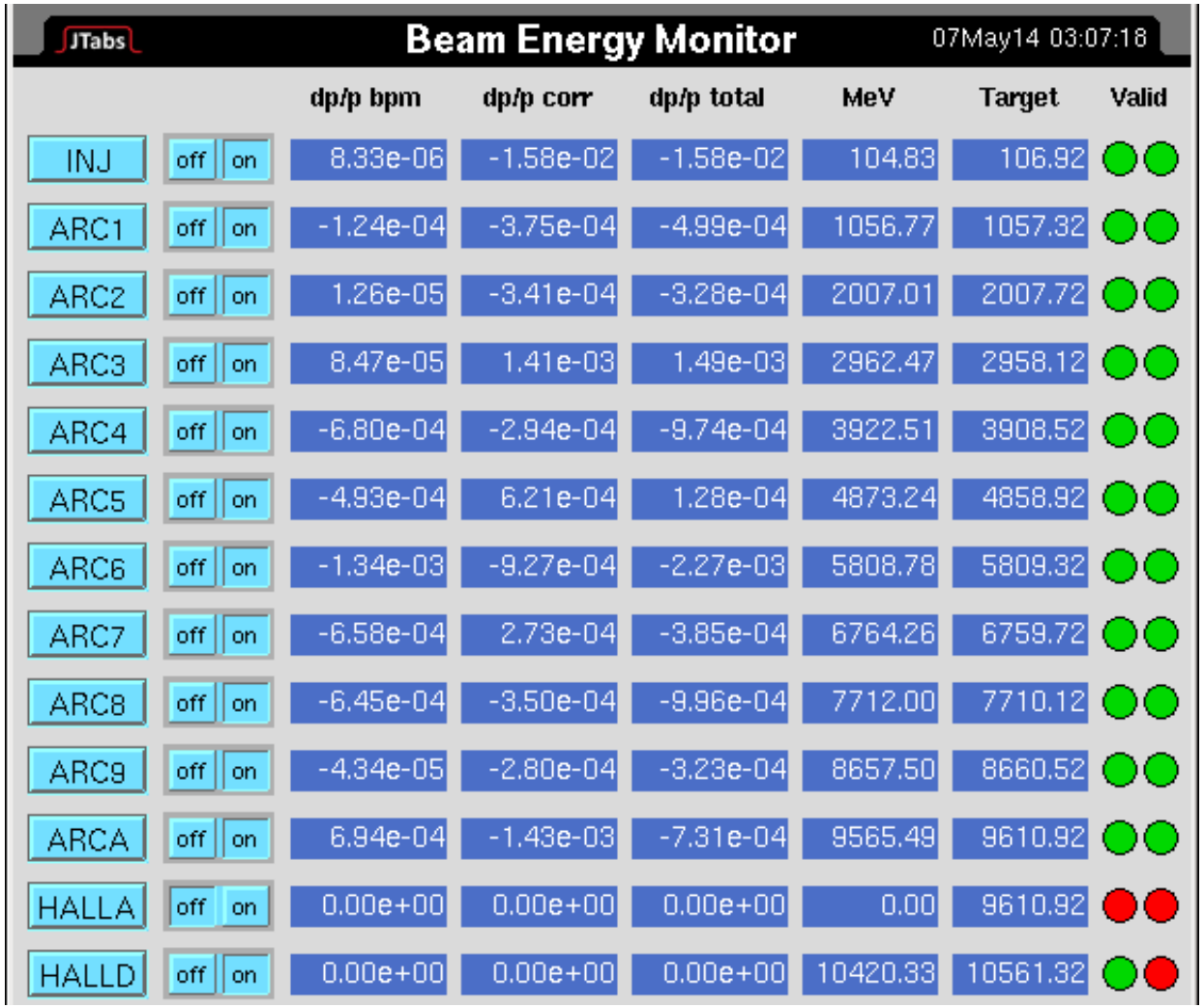


Harp Scan at IHAAE01 (Arc 10)



All important instrumentation working
Optics and emittance data acquired for CEBAF over weekend for summer analysis
Will directly feed into tuning procedures in future (include fall run)

Beam to 5C00 at 10.5 GeV: Wed May 7

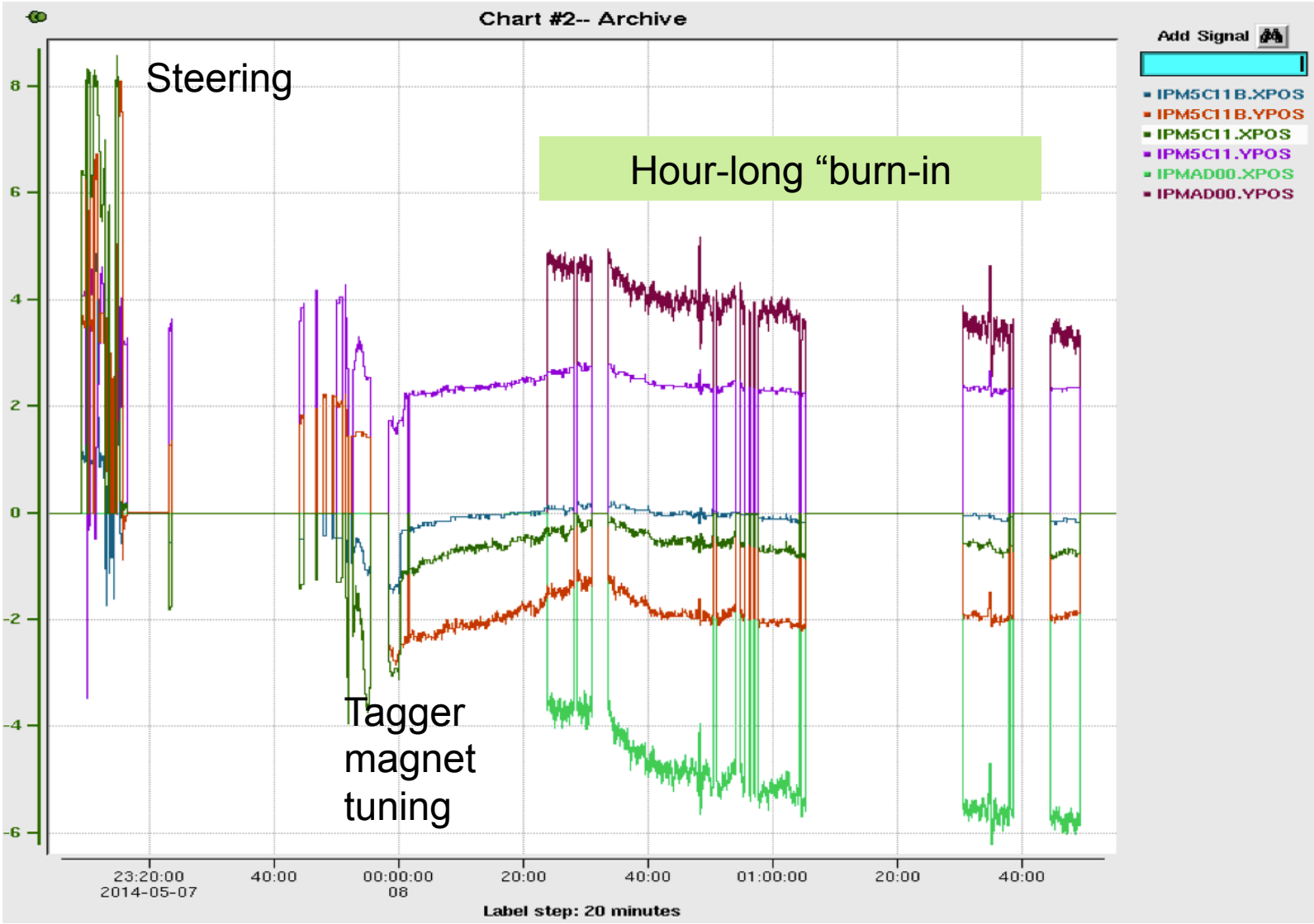


JTabs **Beam Energy Monitor** 07May14 03:07:18

		dp/p bpm	dp/p corr	dp/p total	MeV	Target	Valid
INJ	off on	8.33e-06	-1.58e-02	-1.58e-02	104.83	106.92	● ●
ARC1	off on	-1.24e-04	-3.75e-04	-4.99e-04	1056.77	1057.32	● ●
ARC2	off on	1.26e-05	-3.41e-04	-3.28e-04	2007.01	2007.72	● ●
ARC3	off on	8.47e-05	1.41e-03	1.49e-03	2962.47	2958.12	● ●
ARC4	off on	-6.80e-04	-2.94e-04	-9.74e-04	3922.51	3908.52	● ●
ARC5	off on	-4.93e-04	6.21e-04	1.28e-04	4873.24	4858.92	● ●
ARC6	off on	-1.34e-03	-9.27e-04	-2.27e-03	5808.78	5809.32	● ●
ARC7	off on	-6.58e-04	2.73e-04	-3.85e-04	6764.26	6759.72	● ●
ARC8	off on	-6.45e-04	-3.50e-04	-9.96e-04	7712.00	7710.12	● ●
ARC9	off on	-4.34e-05	-2.80e-04	-3.23e-04	8657.50	8660.52	● ●
ARCA	off on	6.94e-04	-1.43e-03	-7.31e-04	9565.49	9610.92	● ●
HALLA	off on	0.00e+00	0.00e+00	0.00e+00	0.00	9610.92	● ●
HALLD	off on	0.00e+00	0.00e+00	0.00e+00	10420.33	10561.32	● ●

- Beam energy monitor: uses CEBAF arcs as energy spectrometers
- 113 MeV injector + 950 MeV linacs
- All consistent with 10.5 MeV beam delivery to 5C00, AD00 dumps

Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8



Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8

QuickPic - BEAM ON HALL D TAGGER DUMP!

Lognumber 3285622. Submitted by eforman on Wed, 05/07/2014 - 23:41.

Last updated on Wed, 05/07/2014 - 23:42

Logbooks:	ELOG
Tags:	Readme
Entry Makers:	eforman

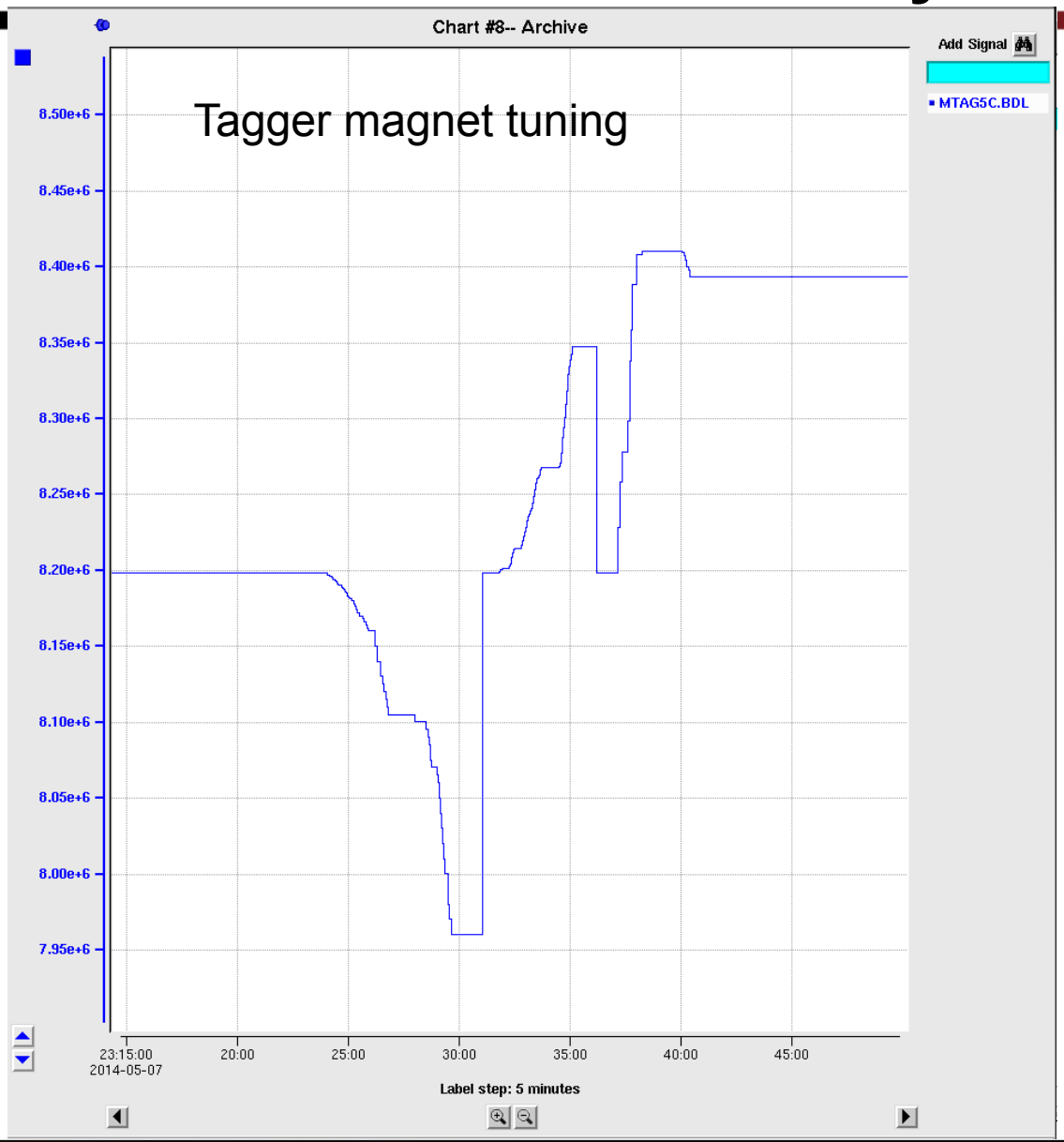
Fig. 2 [05/07/2014 23:41:27]

Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8

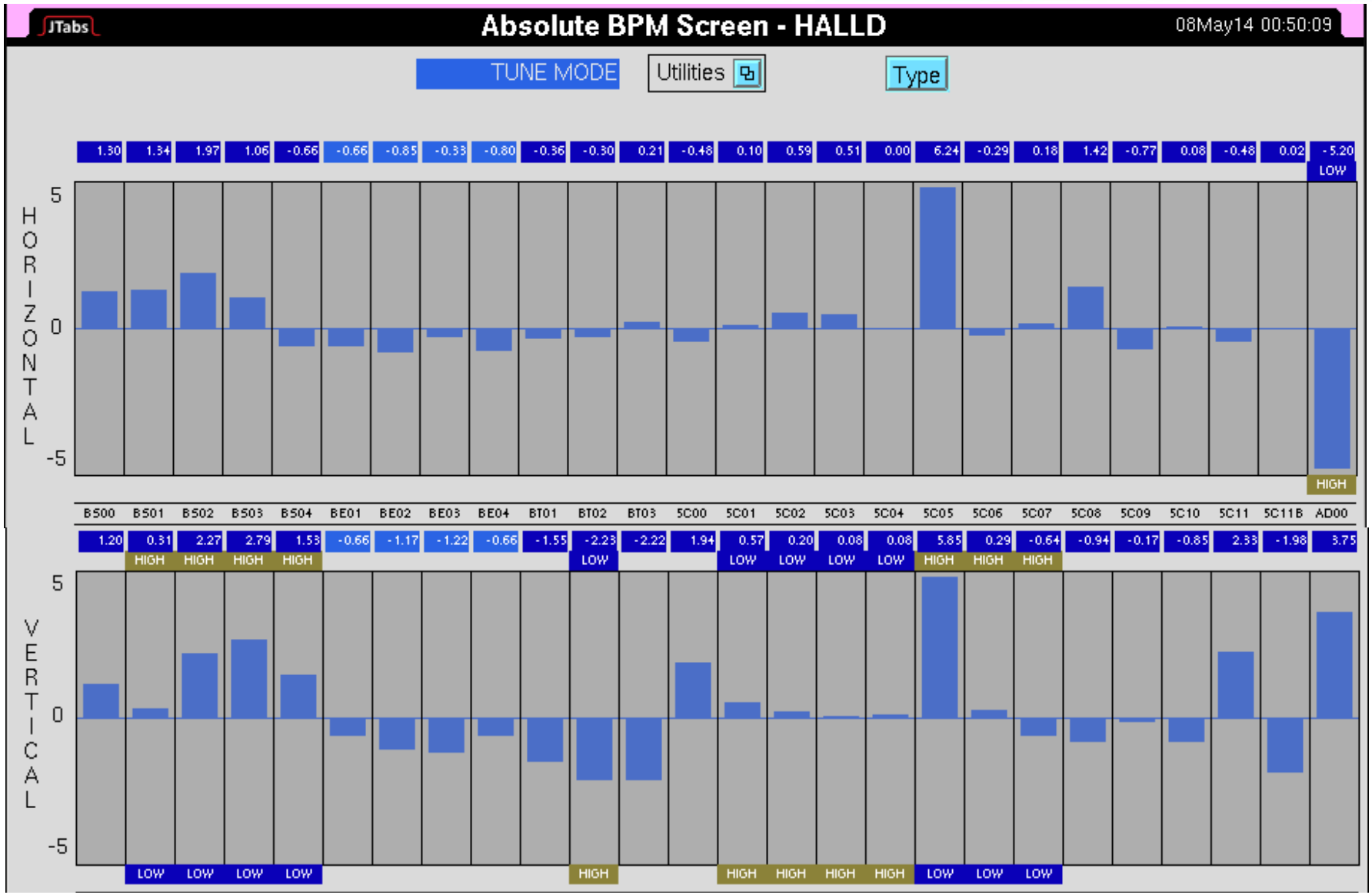
8.50 T-m

6% tuning range!!

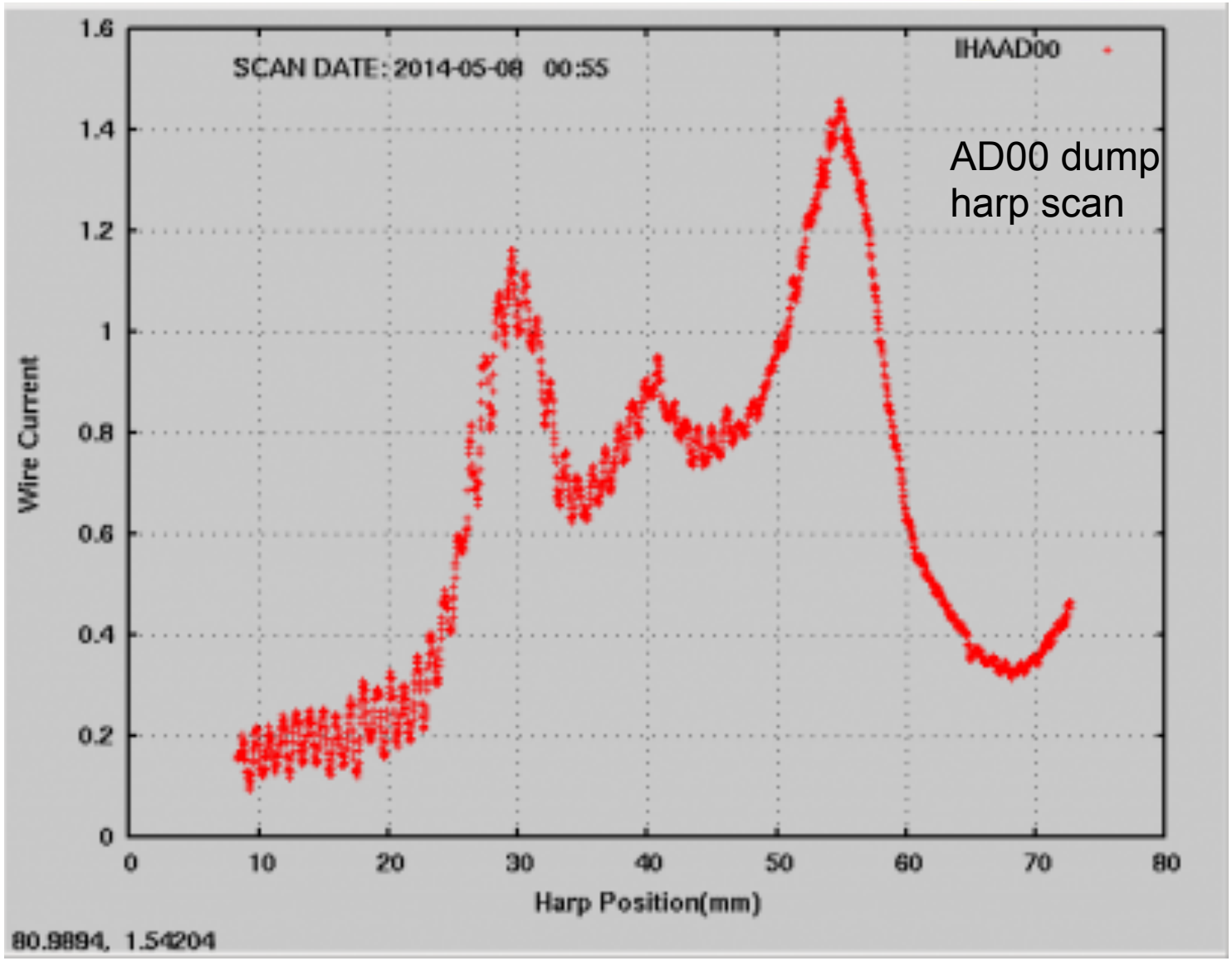
8.0e6 T-m



Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8



Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8



Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8

HPF-SUR-001 Rev: 4 07/16/2012 | RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM | Page 1 of 1

Location	Accelerator Operating Conditions	Instrument: ① mcRADREM / NG-2 Serial #: 2174 / NG-9845a' Calibration Due: 9-28-14 / 11-7-14	Survey Number	RWP
Hall D Tagger	55 pass 10GeV 3uA pulse		N/A	2014-5002

Reason for Survey: Verification of Dose Rates during Hall D Tagger Commissioning

LEGEND
All readings in mR/hr whole body (unless annotated otherwise)

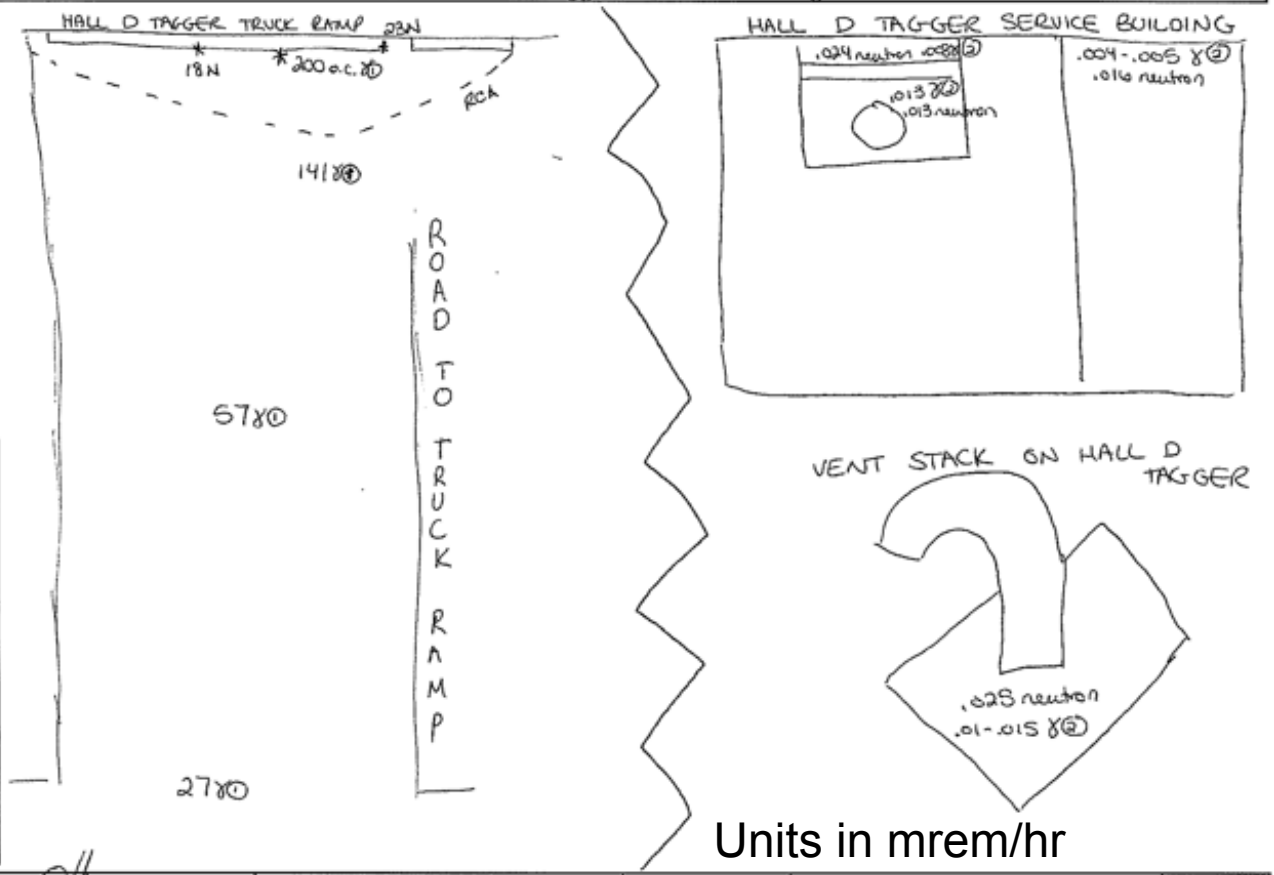
- Denotes posted area & instrument used
- (#) Denotes smear location (refer to page 3 for results)
- Contact dose rate / Whole Body dose rate / Item description
- Denotes area not surveyed

Approved Abbreviations
RA – Radiation Area
HRA – High Radiation Area
CA – Contamination Area

For Beam Enclosure Entry Surveys

- ☐ Full survey, all areas posted
- ☐ Partial survey with continuous surveillance
- ☐ Partial survey with exclusion zone(s) posted

Comments:
① 6150 AD S(BASE UNIT) S/N 152113 CAL DUE 10/17/14



Units in mrem/hr

Performed By (Print): DAVID HAMLETT / HALL SANDERLIN	Date: 5/8/14	Crew Chief Review (Print): N/A	Date: N/A	RCD Review (Print): DAVID HAMLETT	Date
Sign:	Time: 0130	Sign: N/A	Time: N/A	Sign:	5/8/14

Beam to AD00 at 10.5 GeV: Wed May 7-Thu May 8

Commissioning surveys @ Hall D tagger

Lognumber 3285647. Submitted by hamlette on Thu, 05/08/2014 - 02:21.

Logbooks:	ELOG
Backlinks:	No More Beam to Hall D Tagger Per Radcon Follow-up Re: Commissioning surveys @ Hall D tagger

Hali Sanderlin came to site to perform verification surveys during commissioning of Hall D tagger. Beam was not energized until Hali arrived. Upon beam on, Hali proceeded to Hall D tagger to perform survey. At the roll-up door, Hali saw 23 mrem/hr neutron and pegged the highest range of the bicron (greater than 200 mrem/hr). She immediately called me to inform me of the condition. At that point, we requested the MCC to terminate beam so we could re-group and access the situation with proper equipment to include SRPDs and teletector. I arrived at site and we returned to the Hall D tagger. While in communication with the MCC, we directed them to turn the beam on as we had instruments set up at the door. When beam was energized, we verified the 212 mrem/hr gamma at the roll-up door and 18 mrem/hr neutron. Twenty-five feet back up the road, from the roll-up door, we saw 27 mrem/hr gamma; neutron readings at that location, as well as the CARM outside the door were negligible. After conferring with LASO and Crew Chief, we agreed that there would be no more beam delivered to the Hall D tagger.

Hall D Beam Delivery ATLis

- In development since early 2013
  - Michael McCaughan, Hall D Operations Liaison
  - Todd Satogata, Hall D Accelerator Physics Liaison
- Sections include
  - Establishing and optimizing beam transport
  - Normalization and aspect ratio on diamond radiator
  - Establishing active collimator neutral axis
  - Maintaining beam delivery to required specifications
- Operations training sessions for Run 2
  - Wed Feb 12 2014: relevant sections finalized
  - Wed Feb 26 2014: operations training session

- **Worked very well for beamline commissioning**

Hall D Beam Delivery Procedure

Hall D Beam Delivery Procedure

Document Number: MCC-PR-##-###

Revision Number: DRAFT

Technical Custodian: Mike McCaughan

Estimated Time to Perform: # hours for initial se

Procedure Overview

The goal of the Glue-X experiment is to provide
outstanding and fundamental challenges in physi
confinement of quarks and gluons in quantum ch
property of QCD and understanding confinement
field responsible for binding quarks in hadrons. I
mesons, provide the ideal laboratory for testing Q
mesons explicitly manifest the gluonic degrees o
particularly effective in producing exotic hybrids
of light mesons. GlueX will use the coherent bre
polarized photon beam. A solenoid-based hermet
production and decays with statistics after the fir
photo-production data in hand by several orders
study the spectrum of conventional mesons, inclu
mesons. In order to reach the ideal photon energy
spectrum, 12 GeV electrons are required.

The general steps this procedure will go through

- Establish a robust well matched beam wit
possible to the Hall D retractable dump.
- Perform rough energy/momentum correct
- Establish beam to the Tagger dump and v
- Perform fine energy/momentum correctio
changes remain in the accelerator.
- Establish the functionality of the ion chambers in the hall and calibrate them.
- Maximize beam transmission through the chopper slit for the Hall.
- Establish active feedback on the beam through a variety of orbit, energy, and current locks and adjust the beam's aspect ratio on the goniometer / radiative foils.

The general steps this procedure will go through are as follows:

- Establish a robust well matched beam with as little coupling, M_{56}, and dispersion as possible to the Hall D retractable dump.
- Perform rough energy/momentum correction to that beam.
- Establish beam to the Tagger dump and verify its existence there with a viewer
- Perform fine energy/momentum correction to the beam and take steps to ensure those changes remain in the accelerator.
- Establish the functionality of the ion chambers in the hall and calibrate them.
- Maximize beam transmission through the chopper slit for the Hall.
- Establish active feedback on the beam through a variety of orbit, energy, and current locks and adjust the beam's aspect ratio on the goniometer / radiative foils.
- Optimize beam transport and detector rates in hall detectors.

This procedure describes the protocol for establishing beam delivery to Hall D. The procedure is divided into sections as follows:

Hall D Beamline: Nov 2013

Hall D Tagger Magnet/Hall, Nov 2013

Tagger Magnet and Active Collimation

- Tagger magnet mapped by Hall D personnel
  - December 2013-January 2014 (reviewed Dec 2013)
  - Data delivered to APEL for inclusion in CED
  - Consistent with magnet modeling from Hall D
  - Tagger magnet controlled from MCC

- Hall D active collimator integration with orbit locks
  - Driven by tight steering specification on radiator
  - Collaboration between JLab, Univ. of Connecticut
  - Electronics delivery consistent with schedule
  - Not required for commissioning
  - Scheduled for installation summer 2014

Summary

- Staged Hall D beamline commissioning
  - Spring 2014, tune beam to inline and tagger dumps (DONE!)
  - Fall 2014, 5.5-pass tune/CW beam, detector commissioning
  - Beamline and enclosures are new
  - Beamline and instrumentation working well!
- Procedures and tuning plans in place
  - Delivery procedure, 12 GeV commissioning plan
  - Will want integration with Hall D personnel summer 2014
- Active collaboration with Hall D personnel
  - Tagger magnet, active collimator, radiator beam requirements
  - Exciting times ahead to make the next milestone by the end of 2014!

=== Extra Slides ===

Hall D Extraction Line (labeled)