



2021 run: Installation plans and the beamline

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HPS collaboration meeting, Jefferson Lab,
November 18-20, 2020



HPS 2021

- ❑ Per experimental schedule, CEBAF beam restoration starts on June 14 (after a significant repair work), machine setup – 1.8 GeV/pass
- ❑ Beam to physics is on June 21, first with halls B(2), C(5), D(5). Hall A will join few weeks later (5 pass) – 2021 run ends on 10/19 per current schedule
- ❑ HPS in Hall-B will be on the floor for 55 days
- ❑ Schedule has a single energy for the whole run, 3.7 GeV (2nd pass)

Note: We were thinking to switch places with the next run in Hall-B (RG-M scheduled for 8/18) if HPS will be late for June 21 startup (experimental scheduling committee was notified). However, things are very complicated now:

1. CEBAF energy will change after HPS to 1.96 GeV/pass
2. Hall A takes 2nd pass for ½ of the available beam time in that period (~60 days)
3. HPS can only have 1.96 GeV (1st pass) or 6 GeV (3rd pass), unless major schedule changes will take place , including in Hall-A

We should make all the efforts to be on-time for June 21 – we will know more on the machine restoration schedule in December-January



Hall-B engineering plans, including HPS installation

161	✈	Install HPS	22 days	Mon 5/3/21 8:00 AM	Tue 6/1/21 5:00 PM		
162	✈	remove and transport SVT to clean room for repair	3 days	Thu 4/1/21 8:00 AM	Mon 4/5/21 5:00 PM	PPE	HPS, Calvin, Bob
173	✈	Align PairSpec and DS Frascatti , measure height of I-beams on platform	2 days	Tue 5/11/21 8:00 AM	Wed 5/12/21 5:00 PM		Survey
180	✈	Align HPS components	2 days	Mon 5/17/21 8:00 AM	Tue 5/18/21 5:00 PM		Survey
188	✈	Align US Frascatti, 2H02 girder, 2H03 girder, and beam tube to forward carriage	3 days	Mon 5/24/21 8:00 AM	Wed 5/26/21 5:00 PM		Survey
163	✈	Bleed up downstream beamline					Bob
164	✈	Remove downstream beampipe (MARK FOR REASSEMBLY)					Morgan, Calvin
165	✈	Disconnect and move HPS chillers					HPS, Calvin, Morgan
166	✈	remove DS frascatti flange				PPE	Morgan, Calvin
167	✈	install new DS flange on frascatti vacuum box				PPE	Morgan, Calvin
168	✈	Mount DS frascatti on table				PPE	Calvin, Morgan
169	✈	connect and connect hoses to DS Frascatti					Krister
170	✈	move HPS calorimeter on rails as needed to move PairSpec magnet				PPE	Calvin, Morgan
171	✈	move pair spec magnet to beamline position				PPE	Calvin, Bob, Morgan
172	✈	install and level I-beams on platform					Calvin
174	✈	install beam tube from HTCC to forward carriage apex (must be done before scheduled to connect to upstream beam tube)					Morgan, Bob
175	✈	Test PairSpec to full field					Krister
176	✈	install power to HPS chillers					Calvin, Morgan
177	✈	Install HPS chillers, purge calorimeter with N2 first					Calvin, Morgan
178	✈	Install downstream HPS SVT and hodoscope				PPE	HPS, Calvin, Bob
179	✈	install upstream HPS SVT				PPE	HPS, Calvin, Bob
181	✈	install US Frascatti				PPE	Calvin, Morgan
182	✈	connect and connect hoses to US Frascatti					Krister
183	✈	test Frascatti US and DS to full field					Krister
184	✈	install 2H03 and 2H02 girders					Calvin, Bob
185	✈	install beam tube from HPS SVT to 2H03 girder					Morgan, Calvin
186	✈	install bellows between 2H02 and 2H03 girders (beam line components set the Z location of girders)					Morgan, Calvin
187	✈	install beam tube from FC apex to 2H02					Morgan, Calvin
189	✈	establish vacuum from 2H02 to downstream					Bob
190	✈	establish vacuum from 2H02 to upstream					Bob

***HPS should be ready
with detectors at the
beginning of May, 2021****

- ❑ The whole installation, corrected for Covid-19, is 1 month long
- ❑ HPS should be closed up and ready around June 14, HCO completed



HB engineering SAD list for HPS

Must be done (without details, does not include detector work and the installation)

- Repair or replace mini-T power supply for HPS chicane (frascaties)
- New tungsten collimator for HPS
- Clean-up the cable trays in alcove
- Make hard supports for SVT inside the vacuum chamber
- Add a vacuum gauge at the upstream end of the scattering chamber
- Chillers – repair/check/test
- Cooling of the alcove – air conditioning, air flow

Less of a priority

- Add a turbo at the upstream end of the scattering chamber
- Design a new neutron shield upstream of HPS magnet
- A new, light-weight (Al) vacuum chamber for the downstream frascati magnet

Hall-B setup a task force to aid run groups in preparations and installation of the experiment in the hall. The RG-I (HPS) TF – Stepan, Rafo, Bob, meeting ~monthly. HPS collaborators are encouraged to participate – see wiki

https://clasweb.jlab.org/wiki/index.php/Template:Hall-B_Run_Group_Task_Forces:_RG-I



Expected beam parameters for 2021 run

At some point we will submit requested beam parameters/conditions together with updated procedures to the accelerator OPS

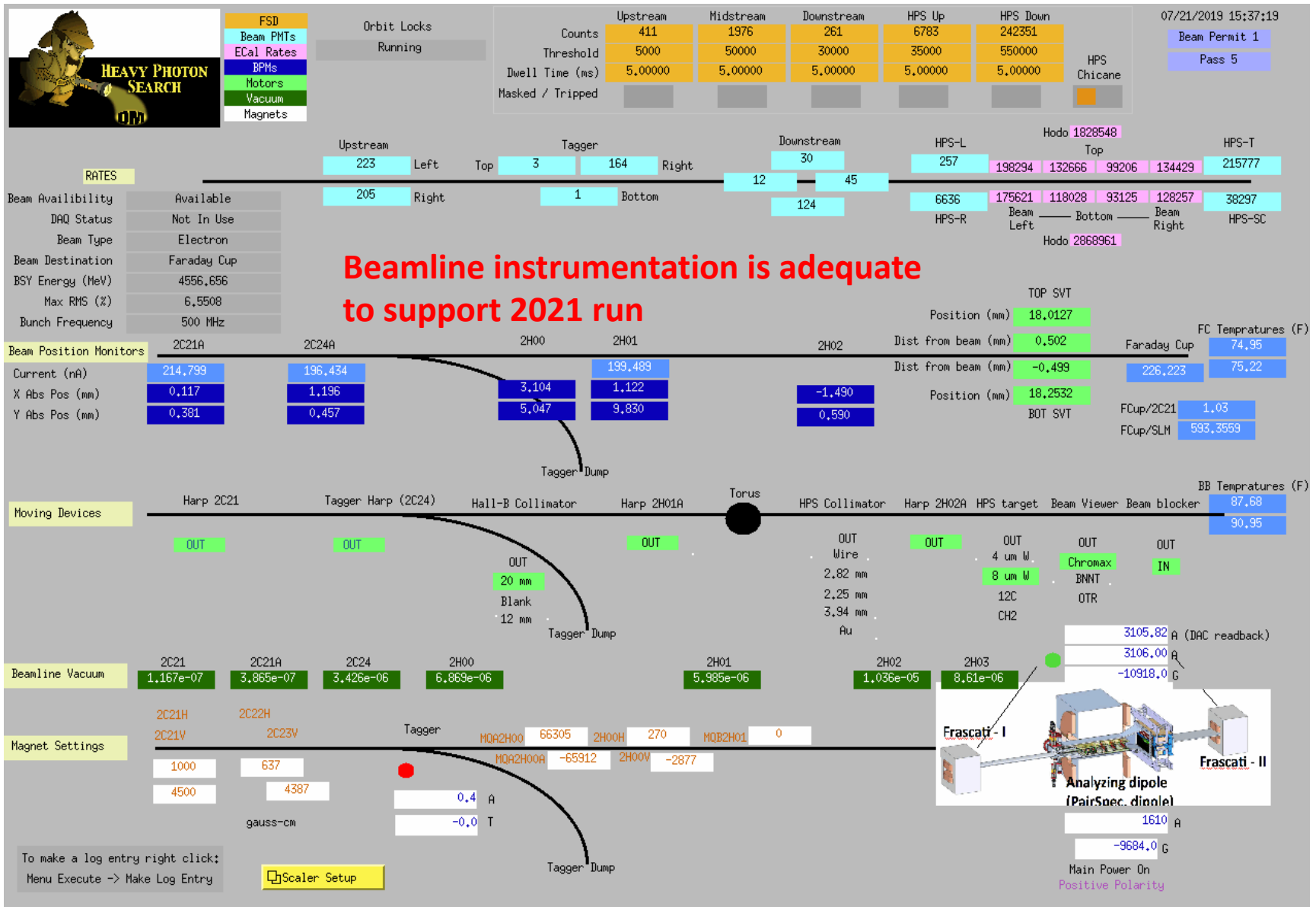
Parameter	Value
Beam energy (2 pass)	3.7 GeV
Beam current	< 200 nA
Current stability	< 10%
Beam bunch Frequency	499 MHz
Beam profile at the target	
σ_x	< 50 μm
σ_y	< 50 μm
Halo	< 10^{-5} @ 5 σ
Beam position stability	
in x	< 50 μm
in y	< 50 μm

1-pass beam is also available (for Mollers?)

Should decide on the target, 20 μm ?

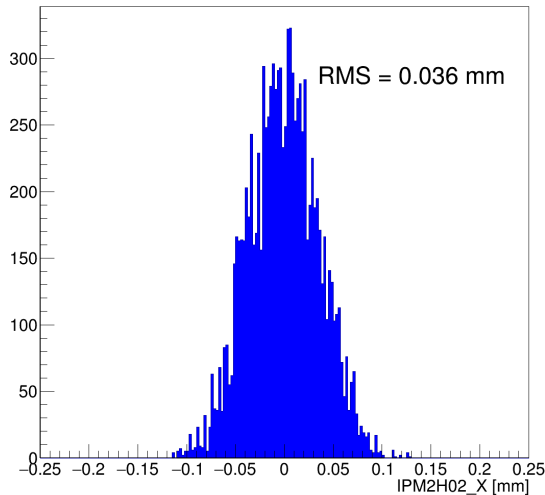
Should start discussions of the run plan.
Especially possible calibration runs –
other beam energies, targets, target
positions?





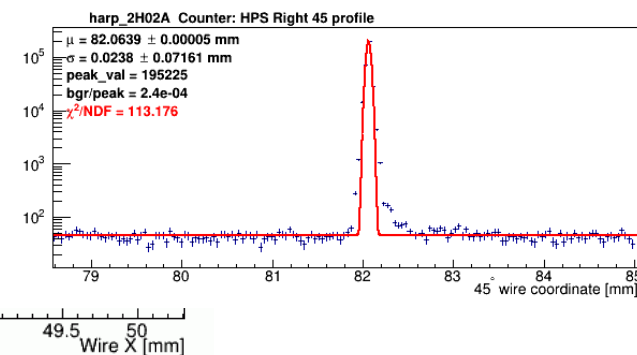
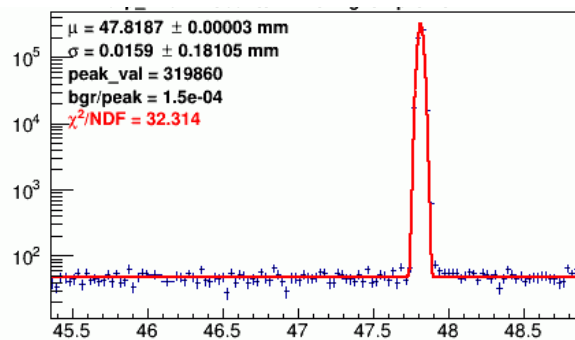
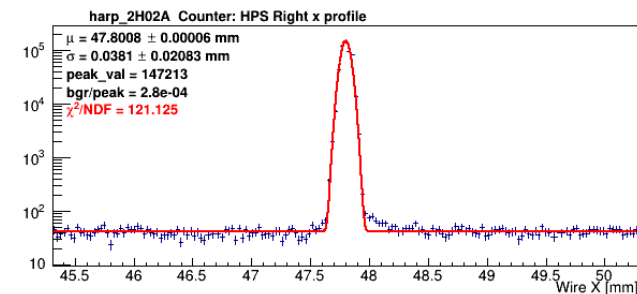
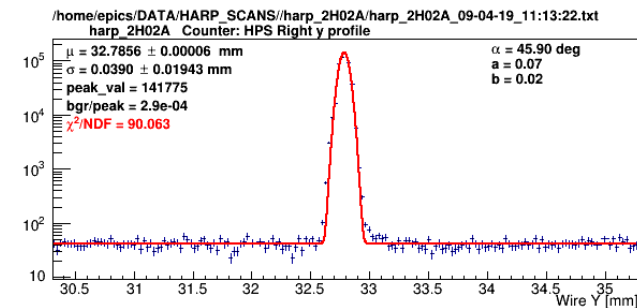
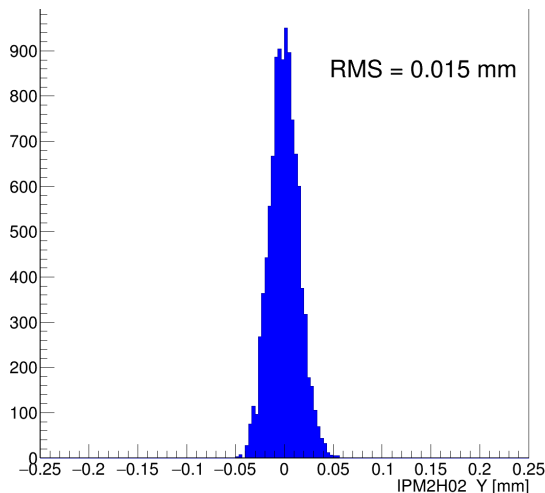
Beamline performance during 2019 run

Beam position stability



Should expect similar performance in 2021.

The biggest issue in 2019 was machine setup and beam tuning to Hall-B - there is no parity experiments this time.



R. Paremuzyan

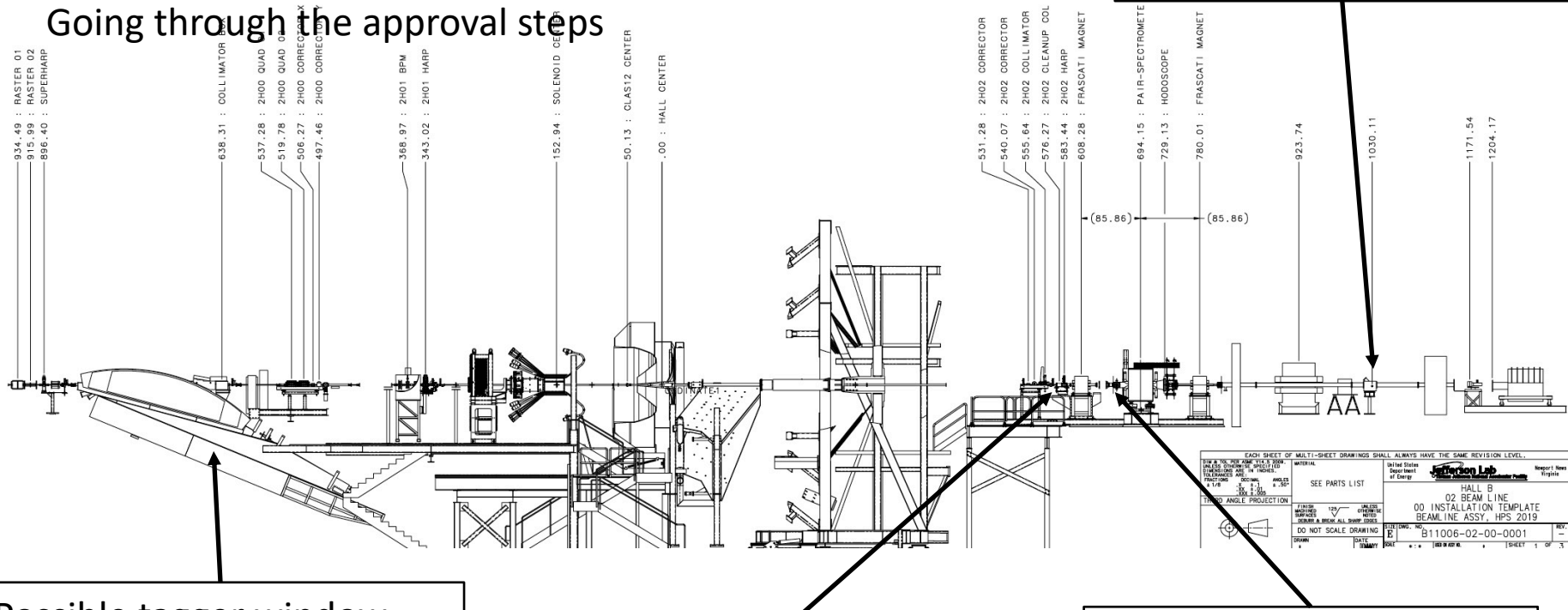
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Beamline – anticipating some changes

Preliminary drawings for installation have been released.
Going through the approval steps

Modified beam viewer



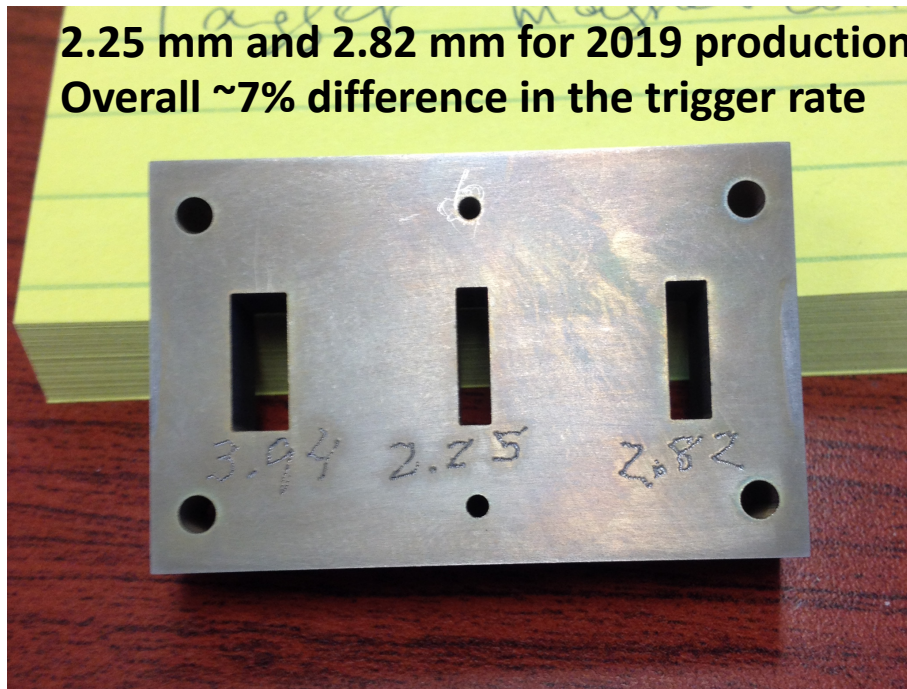
Possible tagger window
change – will help with
better vacuum at
2C24/2H00 area

A new or modified collimator, need a bigger hole for beam tuning

Another vacuum gauge
upstream of the target.
Not much room on the
scattering chamber.

SVT protection collimator

2.25 mm and 2.82 mm for 2019 production
Overall ~7% difference in the trigger rate



- Add a new, bigger slot to mitigate difficulties for initial beam tuning
- The smallest opening in SVT with layers 1-4 retracted is at L4 or L5?
- If it is somewhere in between 6 mm collimator should work
- Are we going to ever use 3.94 mm? If not, we can resize the 3.94 mm hole

No target

<https://logbooks.jlab.org/entry/3710740> 2.25 mm – Singles-3 t/b =8/7

<https://logbooks.jlab.org/entry/3710736> 2.82 mm – Singles-3 t/b =5/3

Target 8 um

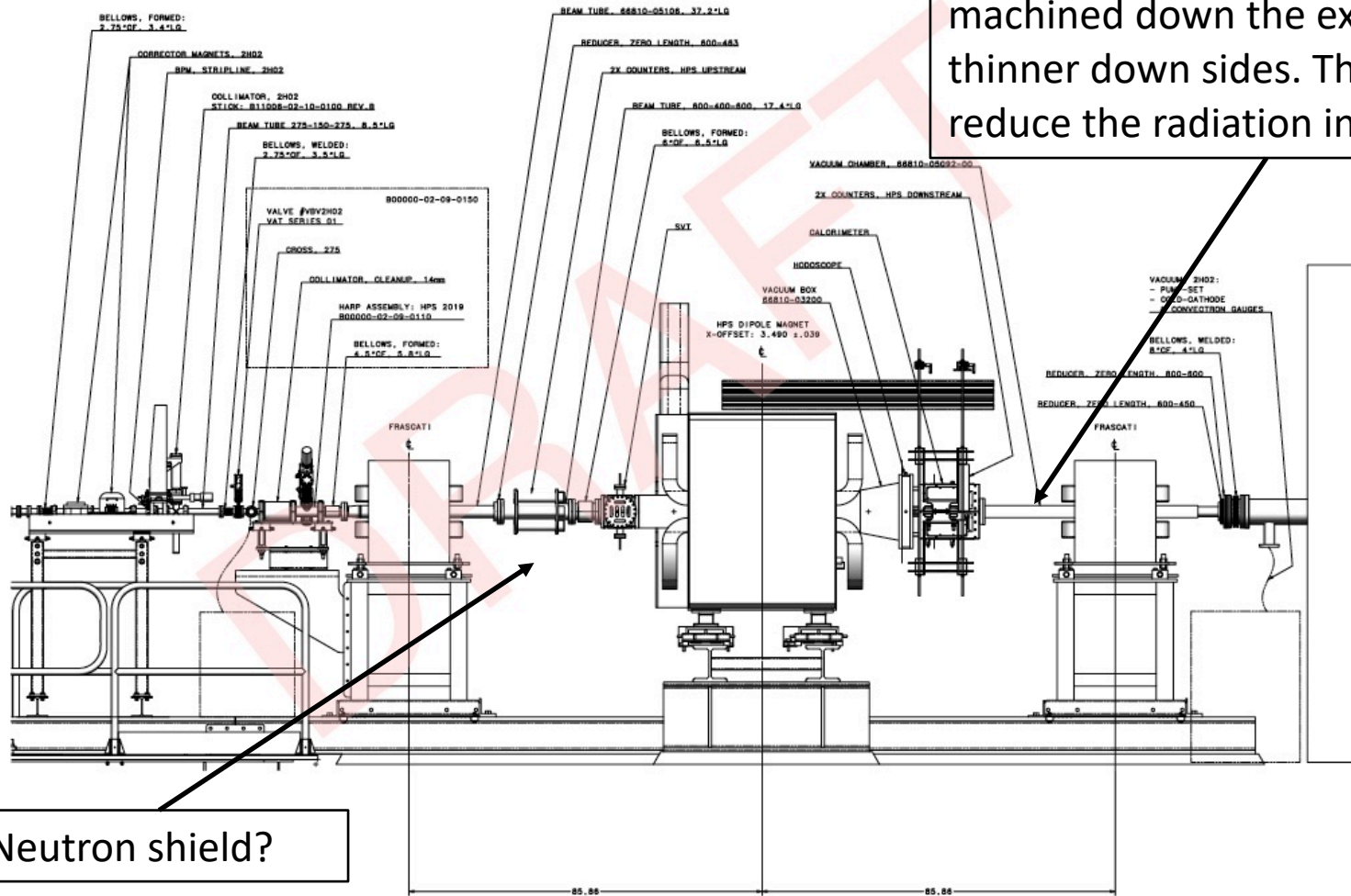
<https://logbooks.jlab.org/entry/3707879> 2.82 mm 150 nA, t/b= 3514/3640

<https://logbooks.jlab.org/entry/3707900> 2.25 mm 200 nA, t/b= 5002/5187
→ 3750/3890 (corr.)



Other possible changes – under discussion

Light weight vacuum chamber or machined down the existing one to thinner down sides. The aim is to reduce the radiation in the alcove.



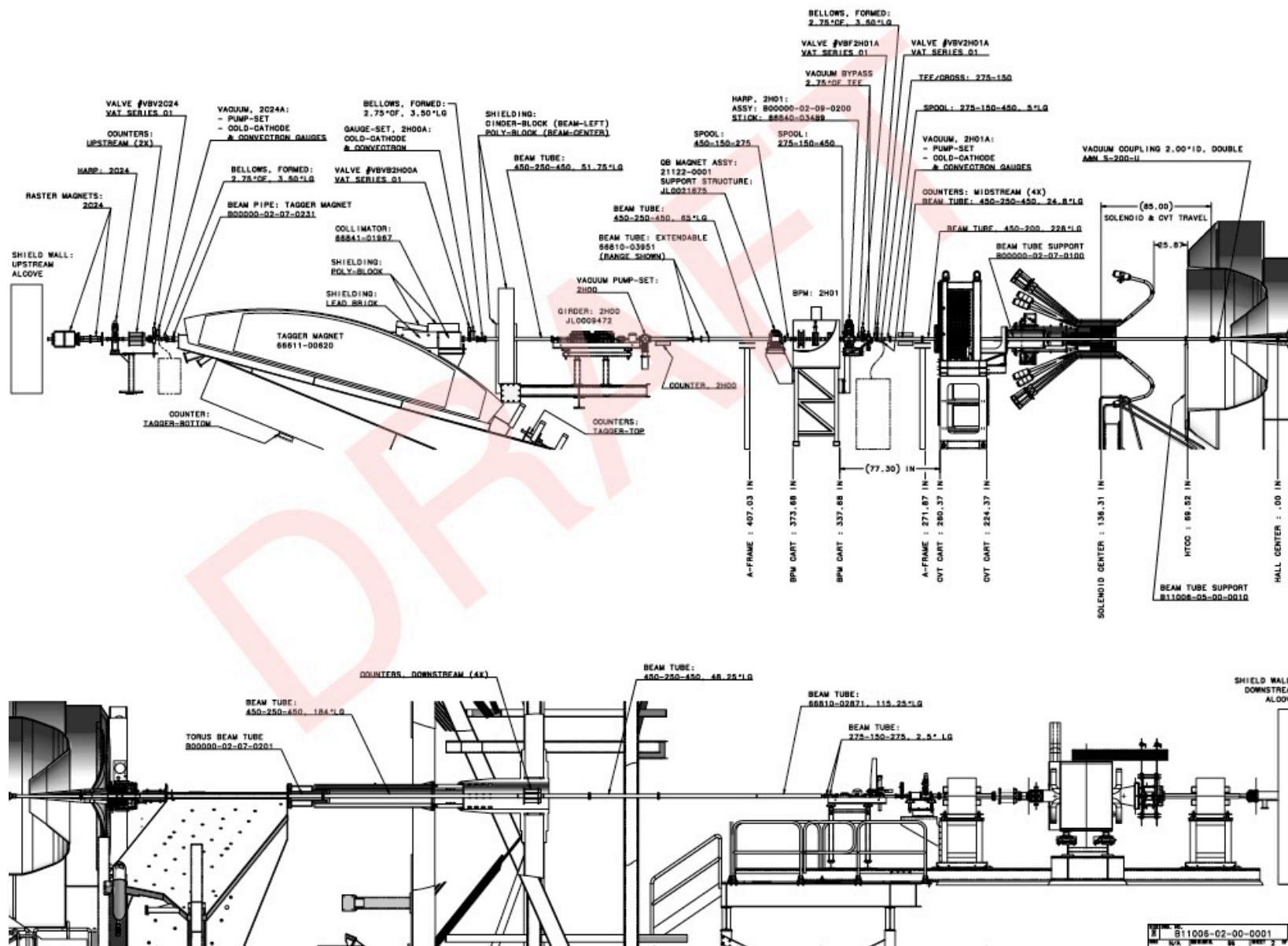
Neutron shield?



To summarize

- The schedule is very tight, a little over 6 months before installation starts
- Not much changes to the beamline are needed, overall existing beamline instrumentation is adequate to support the 2021 run
- One of the biggest issues in 2019 was the beam tune to FC, going through the SVT collimator. A larger slot will help – can resize one of the slots on the existing collimator or build a new one
- When machine performance after the ongoing repairs will be better know, we must start discussions with accelerator colleagues to define procedures for beam delivery to HPS
- Ad hoc “neutron shield” installed during the run between the 1st frascati and the analyzing magnet seems did not help. If we needed it, a better stand must be designed and the composition of the shield defined
- Should decide on the run plan, do we need low energy for Moller calibration
 - 1-pass beam (1.87 GeV) is available for Hall-B





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