eRHIC IR Design Meeting

Draft Minutes for Friday, March 8, 2019

1 Agenda

1. ~~Brett: Process Moving Forward.~~
2. Guillaume: Hadron Geometry Matching (section 4 on the following page)
3. Dave: Beam Position Monitors (section 3)
4. ~~Mike (Sullivan, SLAC): Feedback/Progress Report~~ (see section 2, "Elke: Mike Sullivan (SLAC)" instead)

2 Elke: Mike Sullivan (SLAC)

1. Has been in touch with Mike.
2. Added him to the mailing list.
3. Mike had a family matter that kept him from joining us for the this meeting, but he'll be back the following week.

3 Dave: Beam Position Monitors

See table 1 on page 3.

1. Number BPMs needed has doubled since **January?** (from **28?** to 68).
2. Not sure if BPM in liquid helium has been done before. Could be a risk.
3. Number BPMs needed seems reasonable.
4. Numbers:
   (a) Total e-BPMs: 36
   (b) Total h-BPMs: 32
   (c) Total BPMs: 68
5. Have a nominal cost of $4000 for BPM chamber.
6. Can "see" tilts using equivalent of wave form digitizer. (IP Tilt BPM)
7. Electro-optical wall current monitor

4 Guillaume: Hadron Geometry Matching

See fig. 1 on page 4.

1. Limits of RHIC magnets need to be lowered for 133 GeV.
2. Using DXs and D5s.
3. Can only make it match if electron changed from 8 mrad to 11 mrad (proton changed from 17 mrad to 13 mrad). Otherwise need to cost for new magnets.
4. Using 2 DXs at $z \sim 25$ m (green) gets rid of D5 at $z \sim 75$ m (green)
   Difference in green and red at spin rotators is 11 mrad.
5. We need to go to the D8. Need same amount of space for snake as for spin rotators ($\sim$11 m).
   (a) Could spin rotators and snake be combined? Maybe.
   (b) Need 2 rotators and 1 snake.
6. Haven't started optics matching.
7. First 40 m in forward direction is set in stone. The same for 15 m in rearwards direction. (I.e. $z \in [-15\,\text{m}, 40\,\text{m}]$ is fixed.)
8. Will give Elke geometry from inside crab cavities for simulations
9. This version will be saved and timestamped (for version control) as solution that works, even though we don't have magnet for $z \sim 75$ m (green).
10. Needs list of elements between D6 and D8.
11. Ferdinand: (IR 8 for June document)
    (a) As long as there's no IR there, make it as simple and cheap as possible.
    (b) For now, we need the geometry of the ring with one IR.

5 Other Matters

1. Ferdinand: Why 80 cm ——? Need Charley for this.

6 Next Meeting: Friday, March 22, 2019 from 2:30 to 3:30 p.m.

1. Brett: Process Moving Forward
2. Bob: Q2B1 Problem
3. Mike (Sullivan, SLAC): Introduction to Group
4. Steve: Electron Geometry Matching

IR BPM Count & Locations

D. Gassner 8Mar19

Notes:
General BPM placement philosophy:
- One dual plane BPM at every quad.
- BPMs also located near other important devices/locations

New Cold BPMs will have new cryo BPM cables and feedthroughs.
Comment from Brett: Some BPM pick-ups may need to be located in the helium cooling liquid region, not sure this has ever been done before. This could be a high risk item.
Assume cold BPM pick-up housing has beam pipe flanges. All warm BPMs have beam pipe flanges, except the IP BPMs & the hadron tilt BPM (integrated into beam pipe.
Assume for cable lengths that all cables come to the same location (racks), with an estimated average length of 137m

Beam Position Monitors

	Warm	Cold	New Pick-up	Standard Electronics	Fast Scope	Location/description/comment
IP BPMs	4		4	4		BPMs on the inner boundaries of the IP region, two for each beam, incoming & outgoing. BPM pick-up flanges are integrated into beampipe.
IP Tilt BPM	1		1		1	Hadron Crab tilt BPM near IP (pair of 10mm buttons, horizontal position measurement. BPM pick-up flanges are integrated into beampipe. Very close to the ones listed above.
Forward E		14	14	14		Forward electron BPMs, one at each quad.
Rear E		14	14	14		Rear electron BPMs, one at each quad.
Forward H		12	3	12		Forward hadron BPMs, one at each quad. Assume all but 3 hadron quads are re-used and cold from RHIC and already have BPMs installed that can be reused.
Rear H		9	3	9		Rear hadron BPMs, one at each quad. Assume all but 3 hadron quads are re-used and cold from RHIC and already have BPMs installed that can be reused.
Crab H	4		4	4		Crab cavity, hadron BPMs. One on either side of the incoming and outgoing crab cavities
Crab E	4		4	4		Crab cavity, electron BPMs. One on either side of the incoming and outgoing crab cavities
	2		2	2		Roman Pot BPMs, one BPM on either side of the group of Roman Pots in the forward hadron transport.
	2		2	2		Spin Rotator, electron BPMs, one BPM on either side
	2		2	2		Spin Rotator, hadron BPMs, one BPM on either side
Sub totals	**19**	**49**	**53**	**67**	**1**	

Total e-BPMs	**36**
Total h-BPMs	**32**
Total BPMs	**68**

Do not need to include housing
Need to include housing
Include only Cables and Electronics... NOTE: 6 of the 21 pick-ups need the full boat assuming COLD

Table 1: `IR BPM Count Location 8Mar19 DMG_MP.xlsx`

Sheet `IR BPM Count & Location` is shown above, while sheet `IR e-xport quads 28 pic`, which was not refered to during the meeting, is ommitted from this figure.

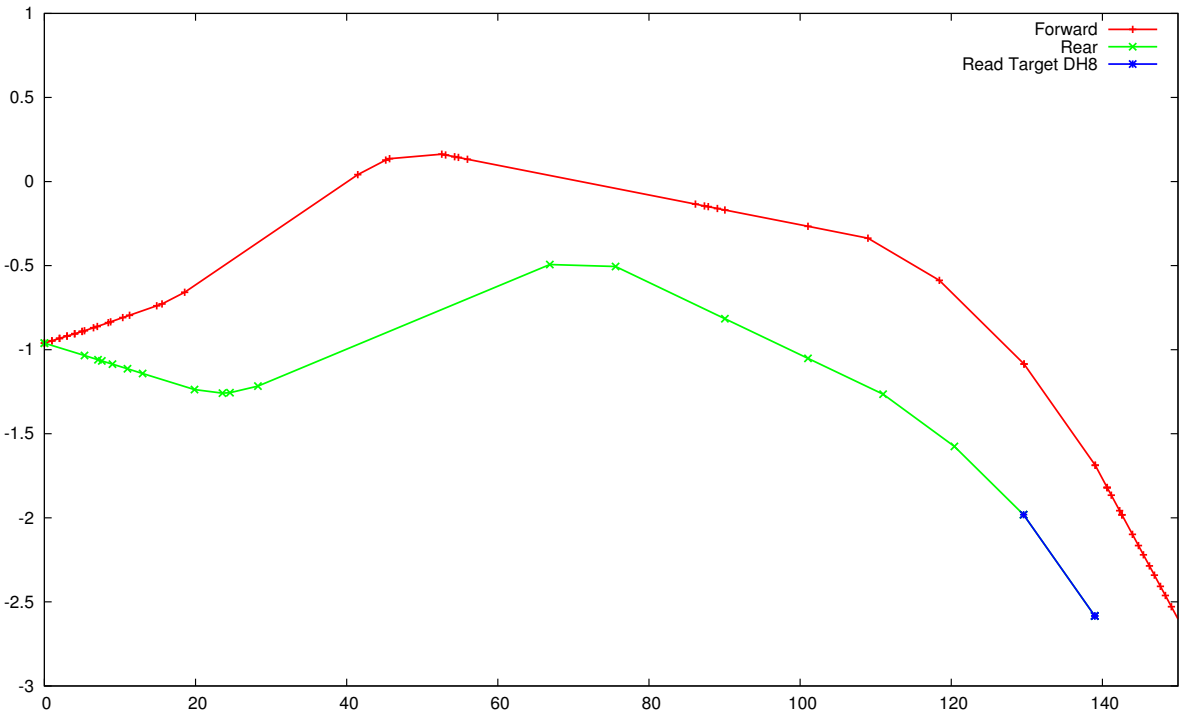

Figure 1: `eRHIC-Hadron.eps`

The z-coordinate is displayed along the horizantle axis while the x-coordinate is displayed along the vertical; both ar labled in m. The current STAR IP is located at origin; the eRHIC IP is offset by $\approx -1\,\mathrm{m}$ in x. The red (forward) and green (readward) curvs indicate the location of the hadron beamline elements with crosses indicating the beginings and ends of those elements.