eRHIC IR Design Meeting

Minutes for Friday, May 31, 2019

Agenda

1 Holger: Updates

File: 2019-05-31_IRMeeting_Updates.pdf

1. Holger has compared the simulation results from his Bmad implementation of Bob's design with Bob's simulation results. They match for all 3 proton energies.
2. Proton matching for dispersion and dispersion prime performed: Holger and Guillaume agree on results.
3. Proton forward:
   (a) 3 new dipoles: 6 T, 5.7 m
      i. two are at 6 T, one is at ∼1.5 T
   (b) 8 new quads: 1.5 m long, ∼99 T/m (Q5/Q6)
   (c) Optical functions: Guillaume had to rematch, because something changes when he pulls parameters into MAD-X from Bmad.
4. Proton rear matching
   (a) 3 new dipoles: 6 T, 5.7 m
   (b) 9 new quads: 1.5 m long, ∼75 T/m (Q5/Q6)
   (c) Slight mismatch in dispersion, but this can be fixed.
5. B0aPF design meets Bob's $R = 23$ cm "good field" region requirements. It "should be good enough for preCDR to show that it isn't crazy."
6. Independent Cost Review (ICR)
   (a) The IR was chosen for the drill down session.

(b) The review committee seemed to be very happy with the provided answers.

(c) Generally, the review committee seemed to be very satisfied with the provided costing.

7. LDRD–Tapered Double Helix

   (a) Progressing well – first three milestones complete

      i. Code development, control program modification and magnet design complete

   (b) Mechanical structure to register coil position accurately is complete

   (c) Test patterns being wound

8. Elke: Wants PR, EF, and ER geometry.

   (a) Note: Steve's and Bob's IRs differ.

   (b) Steve will update to Bob's design and rematch

2 Mike: Preliminary Look at SR Backgrounds for the eRHIC

File: SR Backgrounds for eRHIC.pptx

1. "Preliminary [first order] calculation of SR Background" [slide 3].
2. Needs actual beam parameters for 18 GeV. Those shown on slide 4 are a guess.
3. Has focused on rearward side, will add forward electron section in next iteration.
4. Beam tails are higher than one would want. (Due to gas and inter beam scattering.)

   (a) x: $\sim 18\,\sigma_x$

   (b) y: $\sim 54\,\sigma_y$

   (c) Ferdinand: We need to do dynamic aperture.

   (d) Ferdinand: $10\,\sigma$ is absolute minimum acceptance. We will take whatever much above $10\,\sigma$ we can get.

5. Results from 10 GeV Beam [slide 11]

   (a) $\sim 2 \times 10^5$ γ per bunch (>10 keV) incident on beam pipe between 0.5 m and 2.4 m on forward side.

   (b) 2.6×10^5 γ per bunch (>10 keV) incident on "central beam pipe" (± 0.5 m around IP).

   (c) Increasing the beam pipe radius from 3 cm to 4 cm decreases synchrotron radiation incident on central beam pipe to 1988 γ per bunch (>10 keV) and eliminates synchrotron radiation incident on "forward chamber" (0.5 m to 5.3 m).

   (d) Elke: need to look at whether there are still too many indirect hits to MAPS detector.

6. Luminosity detector window will have to be slanted because power per length of 100 W/mm is too high (max of 20 W/mm) [slides 12, 20].
7. Backscatter Results (preliminary) [slide 14]
   (a) Use one-third the number of γ incident on the high power beam wall (>1 keV) as estimate for backscatter rate.
   (b) 2616 γ per bunch scattered back into central detector region.
8. Direct background will be much higher during initial commissioning (will take ∼6 months). Subsequent scrubbing will take on the order of the amount of time the detector is open/exposed to air for. [slide 18]
9. May be able to reduce direct hit rate with a small mask at $z \sim 5$ m [slide 19].
10. "A lot of the photon energy (∼2 %) from the long slanted beam pipe will scatter across the beam pipe and may cause issues with the low angle electron tagger" [slide 20].
11. Still need to check 18 GeV case with actual beam parameters [slide 21].
12. "Plenty more to do. . . " [slide 21].

3 Guillaume: [Proton Matching]

File: twiss-full.ps

1. Ignore the title of the graph.
2. BPM 10 in sector 5 ($s = 0$ m) to BPM 10 in sector 6 shown.
3. Trajectories have been checked down to 41 GeV. Has anyone checked the injection trajectories?
4. $\beta \approx 750$ m in forward snake and $\beta \approx 1000$ m in rear snake.
5. Cost wise, can the straight section quads be rewired (so that they can be controlled independently)?
   (a) Possibly

4 Bob: IR Vacuum design for Version 6.3

File: 190531-ir7.pdf

1. Sharp edge crossing problem and droplet solution [slide 4]
   (a) Bob had previously suggested rounding the sharp edges where the beam pipes cross as a means of reducing impedance. He is now suggesting a tear/water drop shape as a means of further reducing the impedance created by the beam pipe intersection.

2. Brett: Need to make sure synchrotron radiation from the dipole doesn't hit the crab cavity.

3. Use wires to smooth over notch-out for e Tagger.

5 Next Meeting: Friday, June 14, 2019, 2:30–"3:30" p.m.

1. Update from Steve on electron matching with Bob's parameters

2. Updated magnets for p[re]CDR (Holger)