EIC IR Design Meeting

Draft Minutes for Friday, May 8, 2020

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1 Solenoid compensation schemes—V. Morozov

Title: "Solenoid Compensation Schemes"
File: `solenoid_compensation_08may20.pptx`

1. Baseline Compensation Scheme (Case 6) [slide 2]
   (a) Pros:
      i. No impact on the detector acceptance
      ii. No orbit excursion in the rear, modest orbit excursion in the forward
      iii. Low corrector strength, the strengths are practically independent of energy
      iv. Moderate technical complexity with only one non-conventional y corrector integrated into B0A
   (b) Cons:
      i. Orbit excursion in the forward part of up to 9 mm at 41 GeV but comparable to ∼20 mm horizontal shift of the orbit with energy. Should not impact the dynamic aperture significantly.
      ii. Requires a nested y corrector in B0A but seems technical feasible (see talk by Holger [section 2])
2. Backup Compensation Scheme (Case 7) [slide 3]
   (a) Both forward x/y correctors shifted further downstream to locations after all of the forward IR elements
   (b) Simplifications compared to the baseline scheme:
      i. Conventional correctors only
   (c) Additional complication compared to the baseline scheme:

i. Closed orbit excursion over a wider range

3. Comments [slide 4]
   (a) Chose a baseline solution and a backup solution
   (b) The baseline solution is more technically complicated but feasible
   (c) The backup solution is technically simpler but may be slightly worse for the dynamic aperture
   (d) The final choice depends on the dynamic aperture
   (e) Need to combine solenoid kick and forward quadrupole shifts and rotations
   (f) Need to check the forward acceptance of the combined system
   (g) Continue coupling compensation studies
4. Do not have a final solution for the shifted quadrupoles, but with enough nobs, should be able to correct orbit in the general case.

2 B0ApF corrector—H. Witte

Title: "B0ApF Corrector"
File: `2020-05-07_b0apf_corr.pdf`

1. Integrating B0ApF into what V. Morozov calls "case 6" [slide 2].
2. Change inner radius of coil from 50 mm to 60 mm [slide 4].
3. Corrector coil is 1 mm thick [slide 4].
4. Didn't let the optimization shown on slide 5 finish; so there could be further improvements to harmonics.
5. Integrated corrector field of 67 mT m with a current density of 200 A/mm^2 [slide 6].

3 Update on equal divergence studies—V. Ptitsyn

Title: "Luminosity with equal proton divergencies"
File: `lumi_with_equal_divergencies.pdf`

1. Main constraints used for luminosity optimization [slide 2]
   (a) $I_\mathrm{p} < 1\,\mathrm{A}$, $I_\mathrm{e} < 2.5\,\mathrm{A}$
   (b) $\zeta_\mathrm{p} < 0.015$, $\zeta_\mathrm{e} < 0.1$
   (c) $\sigma'_{x/y\mathrm{e}} < 220\,\mu\mathrm{rad}$
   (d) $\beta^*_{\mathrm{p}x} > 90\,\mathrm{cm}$, $\beta^*_{\mathrm{p}y} > 5\,\mathrm{cm}$
   (e) $\beta^*_{\mathrm{e}x} > 35\,\mathrm{cm}$, $\beta^*_{\mathrm{e}y} > 4\,\mathrm{cm}$
   (f) IBS growth time $> 2\,\mathrm{h}$

2. Beam flatness is the ratio of the vertical to the horizontal beam size at the interaction point.

3. Scan with equal horizontal and vertical divergencies [slide 3]

   (a) Blue curve:

      i. Beam flatness $\sim$ 0.04–0.05

   (b) Yellow curve:

      i. Constant beam flatness = 0.085

4. More detailed scan at lower divergencies [slide 4]

   (a) There is a luminosity maximum
   (b) Left slope: emittance limited (by IBS/beam-beam)
   (c) Right slope: beta-function limited (beta*'s at min)
   (d) Issue: this beam flatness (0.085) may be not acceptable because of emittance deterioration in beam-beam interactions.

5. Equal divergence data, for different beam flatness [slide 5]

   (a) Present recommendation from Beam-beam experts to have the flatness no less than 0.12.
   (b) Although beam-beam studies continue.

6. Luminosity on beam flatness [slide 6]

   (a) Difference between highest luminosity and luminosity with 110 µrad x/y divergence reduces with the flatness increase.

7. Leftmost point on orange ("Highest lumi") curve is preCDR point [slide 6].

8. E.C. Aschenauer: Losses in luminosity are more than compensated for by increases in acceptance.

9. Further possibilities [slide 7]

   (a) In further plans: to see if constraints on min proton beta*'s can be decreased (proposed by R. Palmer), with luminosity improvements. Proton DA studies by Yun Luo will explore these constraints.
   (b) In pCDR the electron current 2.5 A corresponded to 9 MW SR power. Do we have some room for current increase? Vacuum, HOMs.

10. E.C. Aschenauer: If we can do this, it will make a big difference for the forward physics.

11. Parameter files:

   (a) `eq_div_110_flatn_120.txt`
   (b) `eq_div_110_ibs_flatn.txt`

4 All other business

None

5 Draft agenda for Friday, May 15, 2020 from 2:30 to 3:30 p.m.

1. Solution to parameter set with equal β^* for protons and electrons—B. Palmer
2. Physics simulations with collider magnets inside detector region—friends from Physics
3. Status and to-do list for CDR IR section—E.C. Aschenauer, C. Montag, and H. Witte
4. All other business