EIC IR Design Meeting

Draft Minutes for Friday, May 29, 2020

Agenda

1 Luminosity dependence of proton β-function—V. Ptitsyn

Title: "Achieving Luminosity 10^{34} with equal proton divergencies"
File: lumi_vs_divergence_3_VP.pdf

1. For $10\,\mathrm{GeV}$ electron beams.

2. Can we get to $L = 10^{34}$? [slide 8]

    (a) For proton horizontal beta-star $= 60\,\mathrm{cm}$:

        i. Two factos in IR design have to be evaluate:
            A. Crab-cavity voltage needs to increase by factor 1.22
            B. Stronger IR proton quads
        ii. Also, chromatic correction and acceptable dynamic aperture have to be shown.
        (Yun Luo studies)

    (b) For electron emittance $\sim 17.5\,\mathrm{nm}$:

        i. Possibility of achieving this emittance with radial shift in present ESR lattice should be verified

3. Beam-beam group will study.

4. Possible additional resource: increasing electron current [slide 10]

    (a) Present ESR lattice has energy loss per turn due to SR: $3.5\,\mathrm{MeV/turn}$

    (b) This, with present $2.5\,\mathrm{A}$ beam current, gives $8.75\,\mathrm{MW}$ SR power.

    (c) Thus, we could consider a possibility of the current increase by about $300\,\mathrm{mA}$ (still staying within our $10\,\mathrm{MW}$ limit).

    (d) With $I_\mathrm{e} = 2.8\,\mathrm{A}$ the same calculation as on slide 7 (with beam flatness $= 0.12$) gives $12\,\%$ luminosity gain

5. C. Wu: Will need space for additional crab cavity.

6. F. Willeke: It isn't certain that the stronger quads will be needed.

7. R. Palmer: The 220 µrad electron divergence limit isn't really an coming into play because of the pinch effect.

2 Proton IR Matching—J.S. Berg

Title: "Proton IR Matching"
File: JSBerg-200529-00.pdf

1. Crab cavity length of 15.2 m is assuming we don't increase the voltage by 20 % [slide 3].

2. Solution optimized for some, but not all, constraints.

    (a) Ignoring geometric angle request for rotators and snakes.

3. Want rear dipoles toward ark and forward dipoles near IP.

4. 17 mrad bend angle between rear rotator and IP.

5. Not enough space on proton forward side to use double DX magnets, hence need for stronger magnets to be made.

6. Other Configurations [slide 9]

    (a) Get snake and rotator in desired positions.
        i. Barely possible
        ii. Dispersion will be worse at the crab. But probably within bounds.
        iii. Difficult to get dispersion amplitude back down
        iv. More new bends
    (b) Switch snake to rear. But need less bend at arc end of forward anyhow.
    (c) Optimize for less bend on proton forward
        i. Will free up space
    (d) Looking for input on which requirements are most important

7. V. Ptitsyn: Full energy injection doesn't need snake by IP. Rotators are very flexible, so the angular deviation can probably be accommodated. Snake can be moved to other side of IP if that makes it easier.

8. H. Lovelace: How flexible is β-function at the IP?

    (a) This design is probably more flexible than the current design.

9. E.C. Aschenauer: Has it been checked if the IR-6 design can fit at IR-8?

(a) It can't be dropped in due to differences in configuration, but it is on the to-do list for once IR-6 is satisfactory.

10. H. Lovelace: How much does this design lengthen the ring?

    (a) Will check.

11. G. Robert-Demolaize: This is the end-to-end new IR?

    (a) Yes.

12. G. Robert-Demolaize: Is there unoccupied space in the rear (for absorbers)?

    (a) Yes, the space around the quads would be perfect for that.

3 All other business

None

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

1. Pinch effect on electron beam—R. Palmer

2. All other business

Contact H. Witte or W. Christie to be added to the agenda.