IR Considerations

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Outline

- **Starting parameters**
- **Attempts at a head-on collision**
- **Attempt at a crossing angle**
- **New idea?**
- **Summary**

Starting parameters

John Seeman's parameters

- 7 GeV x 4 GeV
- β_x^*, β_y^* 1.3 mm
- ε_x, ε_y 0.5 nm-rad
- I_{HER} = 19 mA, I_{LER} = 38 mA
- Head-on collision
- Disruption angular spread
  - σ_θ = 110 mrad for the LER
  - σ_θ = 38 mrad for the HER

I got an email last night from Pantaleo saying that the angular spread is much smaller by more than a factor of 10. This helps a lot.

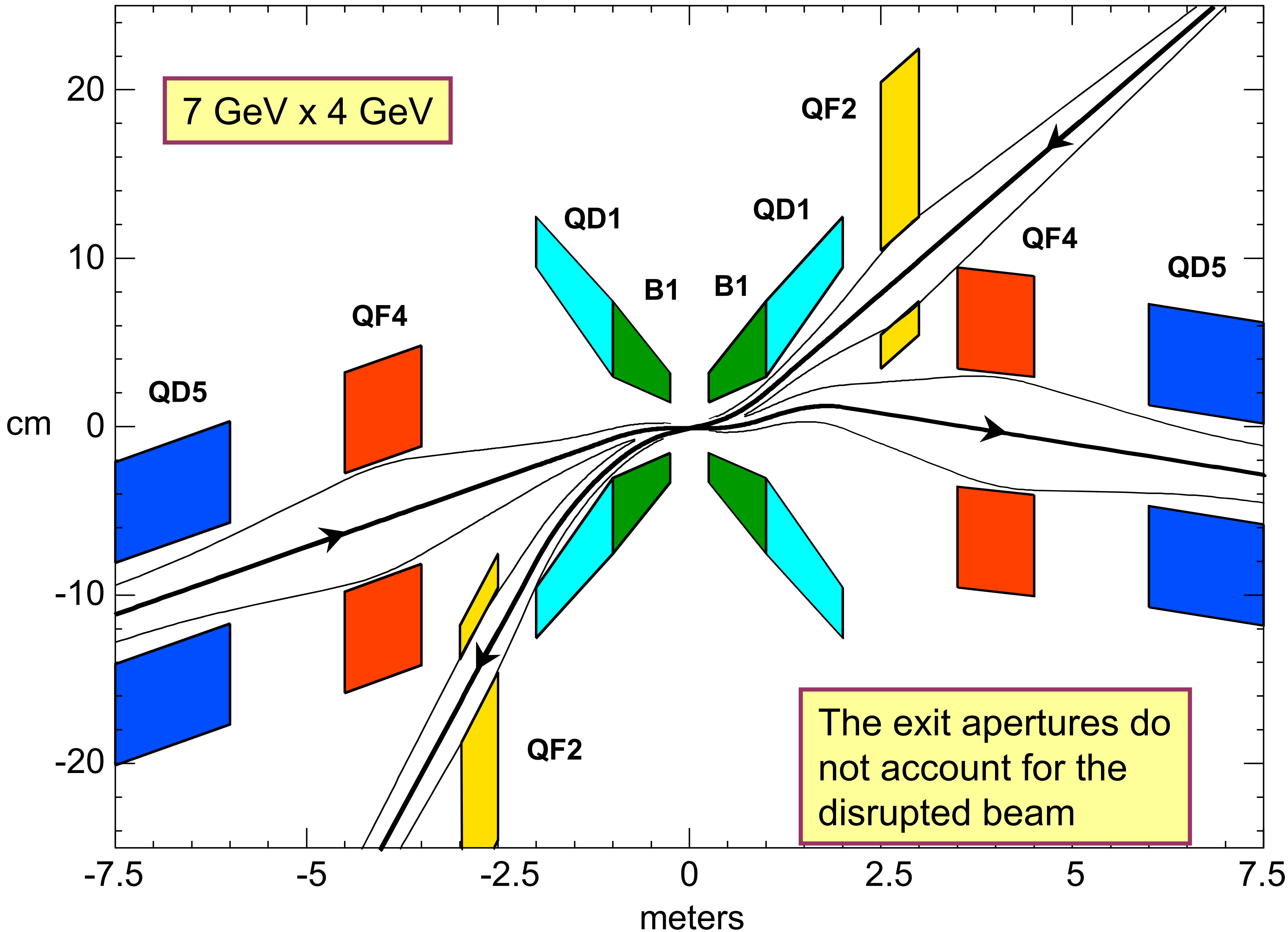
Initial Attempts at Head-on

- Tried to lengthen B1 but could never get enough separation at about 3 m (only 300 mm) Depends on disrupted beam size
- In addition, the SR power coming out of B1 started to get very large (>30 kW)
- Even tried a SC version (2T field 2 m long)
- Conclusion: Energy asymmetry is too small

KEK Crossing angle

- Tried a KEK crossing angle (+/- 11 mrad)
- Still needed a B1 (ended up with a 0.75 m and 1T magnet)
- Also used Q1 as a beam separator
- Can only get about 120 mm separation at 3 m
- Beta max values for the LER are 22 km and 1.3 km
- Beta max values for the HER are 35 km and 9.5 km

SuperB IR with a crossing angle

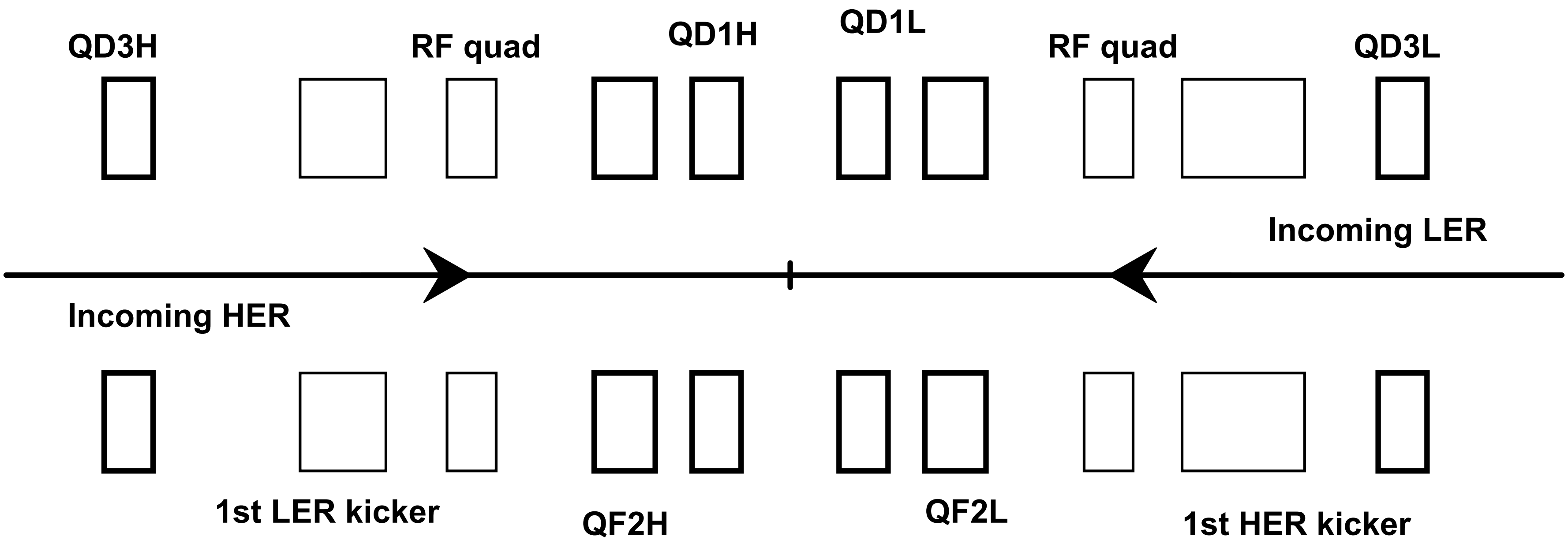


New Idea? (For me anyway)

- If the beam collision frequency is 100 kHz to 1 MHz then there is at least 1 μsec of time between collisions
- Then we have as much as 300 m of possible distance to get the beams separated and to contain and extract the disrupted beam

- Propose **head-on** collisions with **pulsed kickers and RF quads** that are used to contain and extract the disrupted bunch
- The static transport line is optimized for the incoming colliding bunches and the pulsed elements are used after the collision to change the optics for the disrupted bunch and to extract the disrupted bunch
- It is very hard to try to separate the beams shortly after collision with static elements in order to get the disrupted bunches into their own beamline
- This idea favors the lowest energy asymmetry compatible with the detector requirements but it should work at any asymmetry

Cartoon of pulsed IR concept



The RF elements start about 8 m away from the collision. This gives 50 ns for rise times

Summary

- Have not found an IR solution with head-on or crossing angle that quickly separates the beams
  - Energy asymmetry is too small
  - Size of disrupted beam is too big (maybe ok?)
- With the low? crossing frequency perhaps we can use pulsed elements on the beams after the head-on collision to modify the magnetic lattice and accommodate the disrupted bunches as well as separate the outgoing bunches from the incoming bunches (What's wrong with a few more difficult-to-make pulsed elements?)
- Need to develop a magnetic lattice for the outgoing bunches – how different is it from the incoming bunches?
- SR backgrounds would be minimal as would beam-gas backgrounds
- This is only a first glance….