LHeC IR status update

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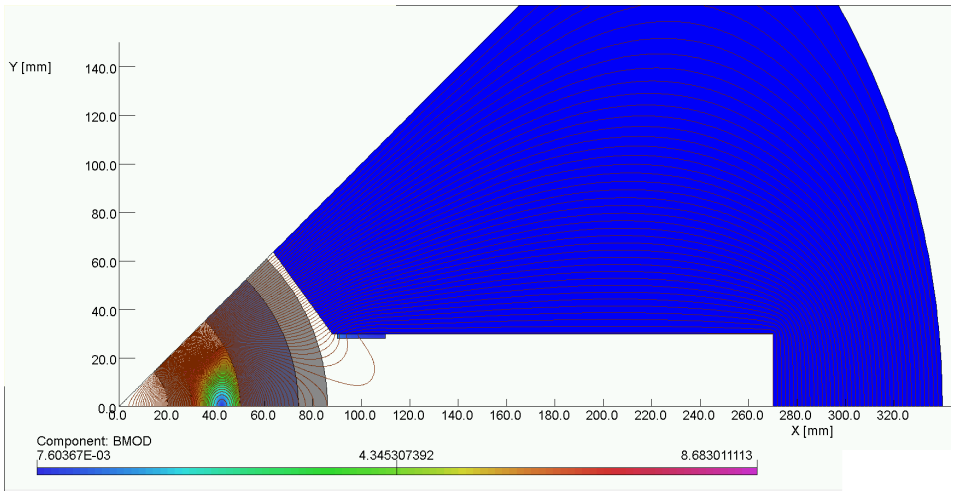
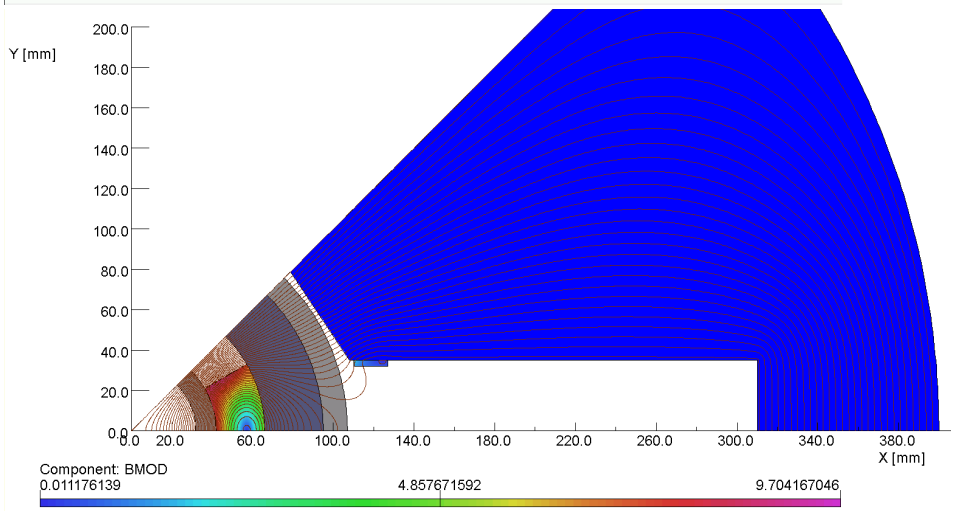
New Magnets (May 2018)

Magnet	Gradient [T/m]	Aperture radius [mm]
Q1a	252	20
Q1b	164	32
Q2	186	40
Q3	175	45

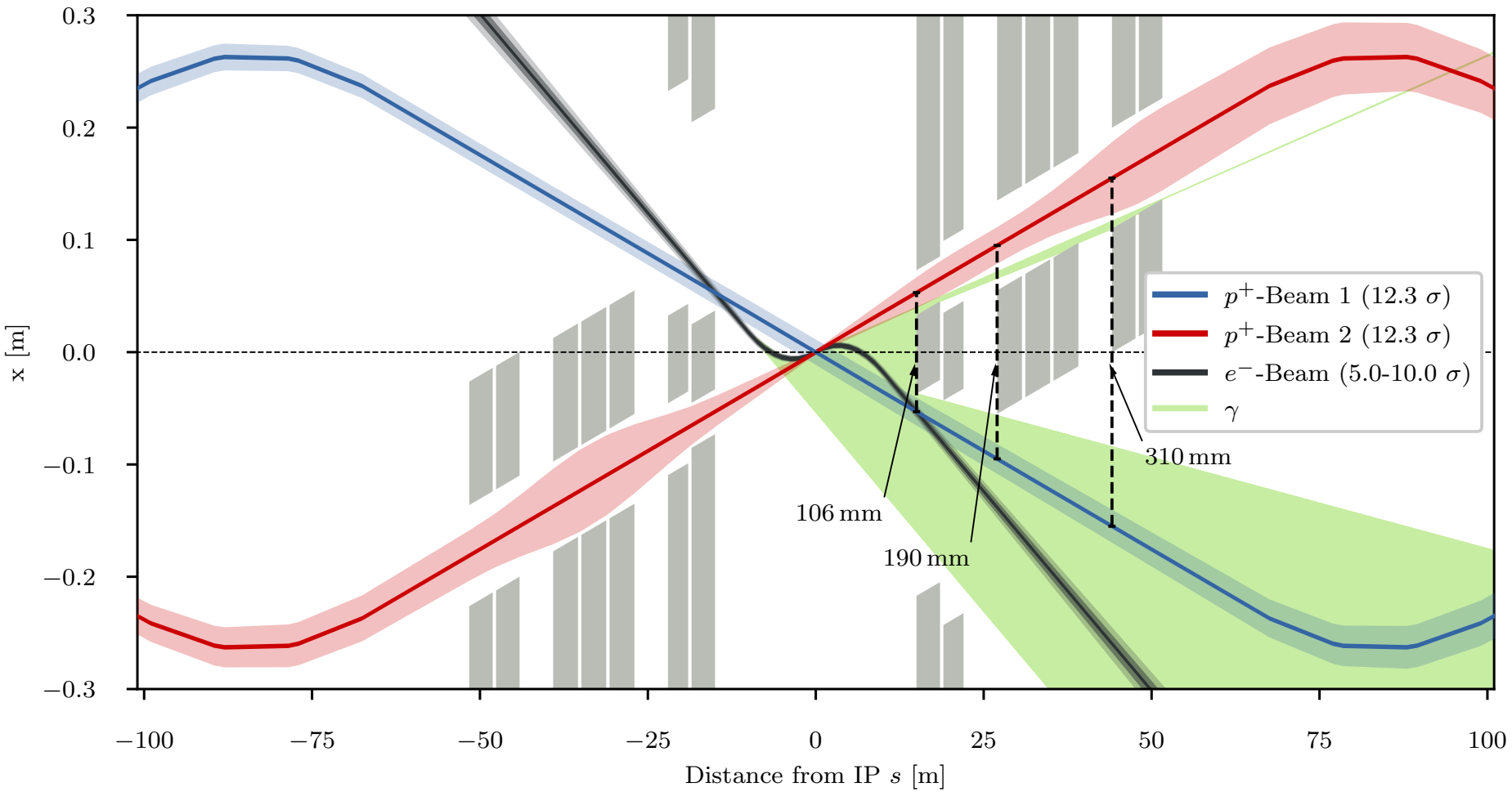
- Larger beam separation in Q1a ⇒ Synchrotron radiation increases
- Increase L^* to 15 m to keep Synchrotron radiation low





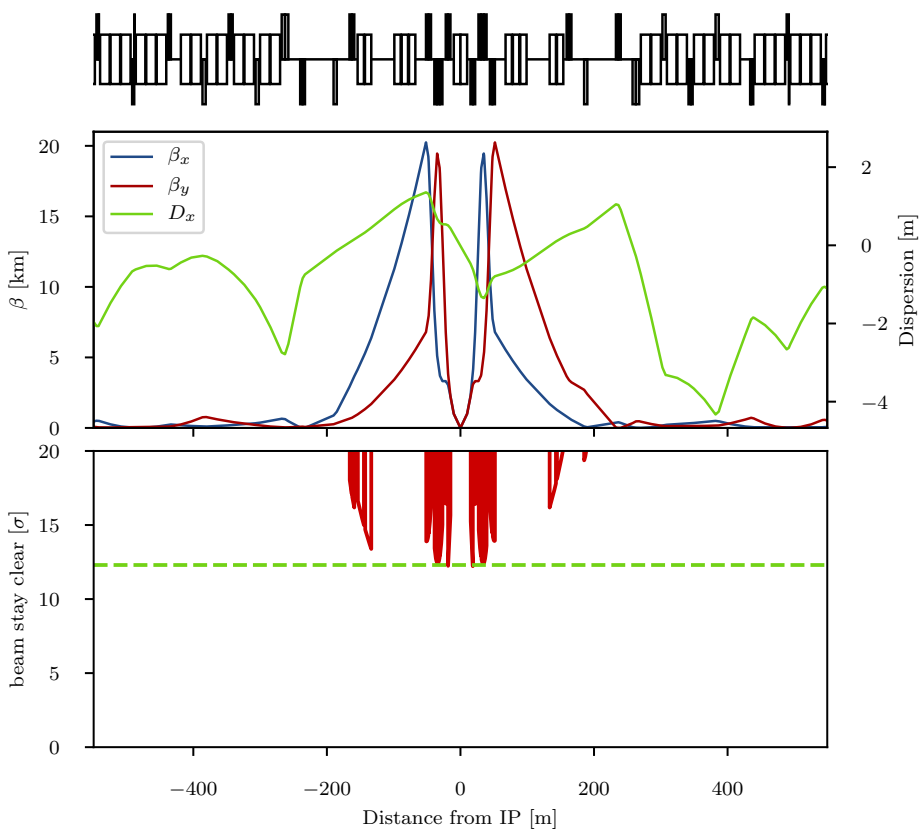
Magnet designs for Q1a and Q1b by B. Parker.

LHeC interaction region design: $\beta^* = 10\,\text{cm}$



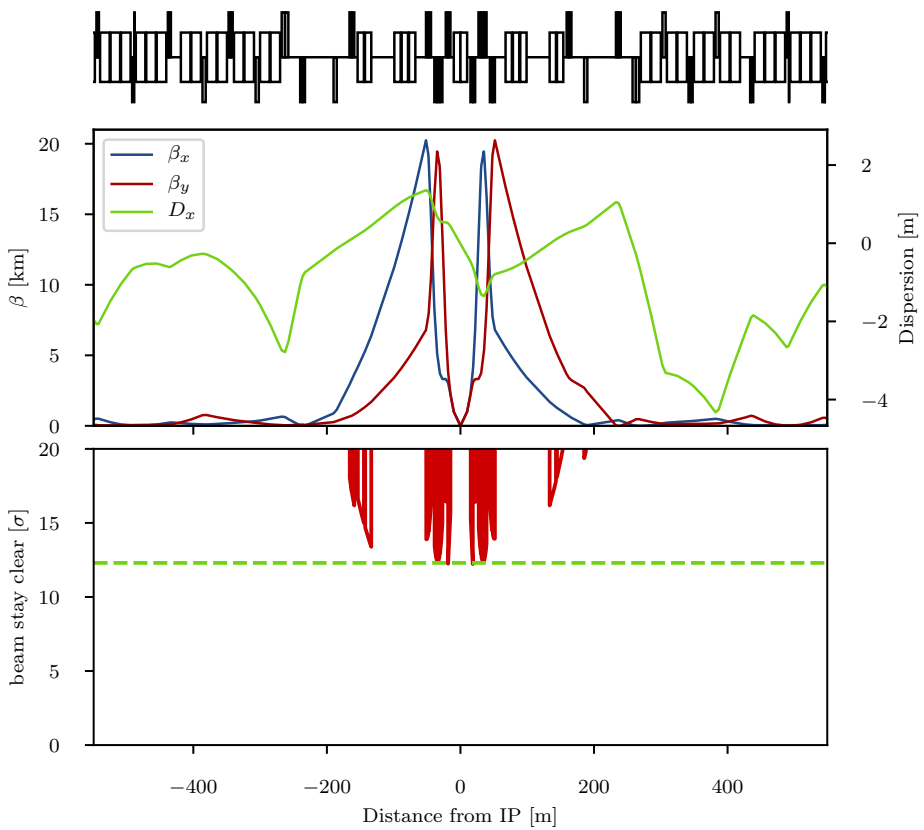
	50 GeV, 6.4 mA	50 GeV, 20 mA	60 GeV, 6.4 mA	60 GeV, 20 mA
P_{synch}	13 kW	40 kW	27 kW	83 kW
E_{crit}	296 keV		513 keV	

Beam optics: colliding beam with $\beta^* = 10\,\mathrm{cm}$



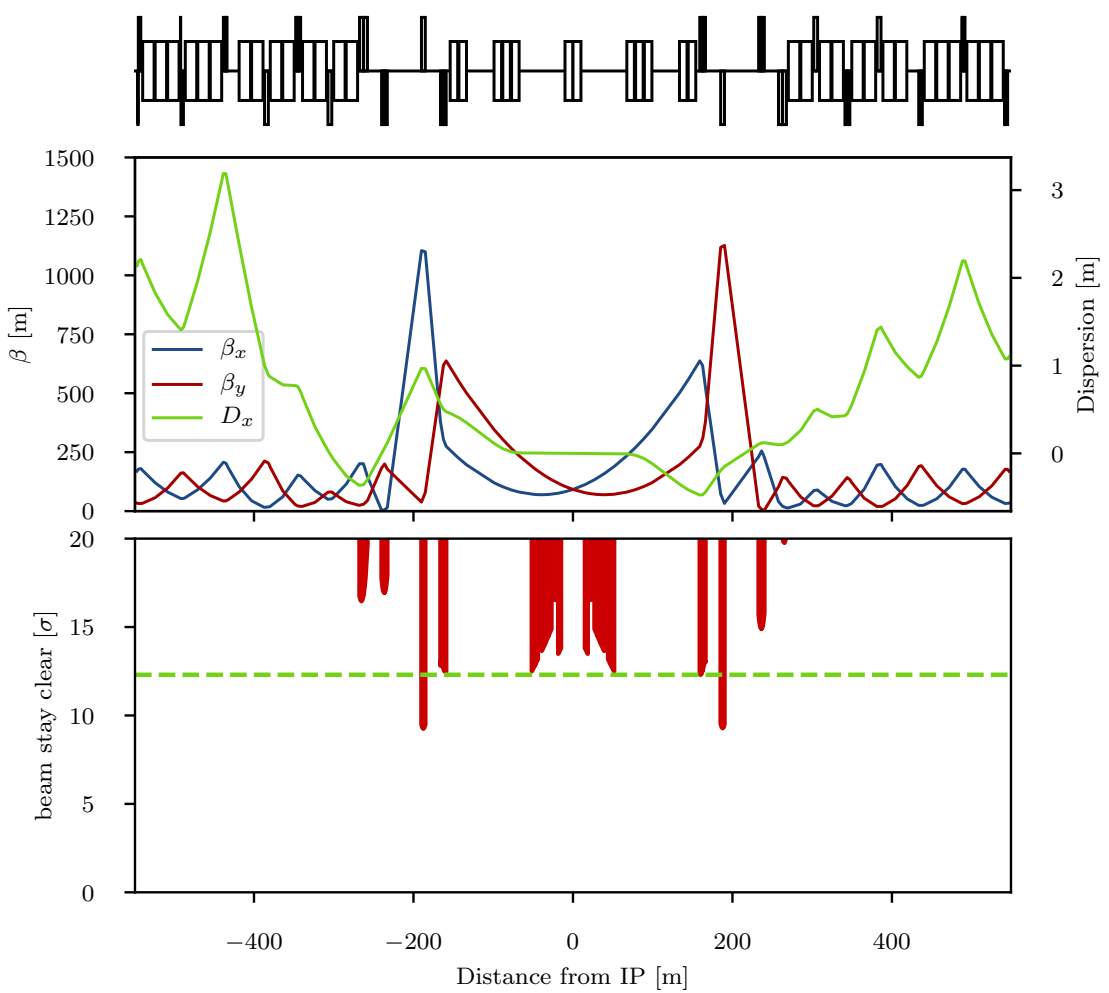
- June workshop: Assumed beam stay clear of 12.3 σ will require local protection and specific phase advances in the ring
- Specifically between extraction kicker and EVERY IP
- More difficult than expected since ATS locks phases between IP1 and LHeC
- $\Rightarrow$ Reintegrated in HL-LHC (V1.3) lattice, extending ATS to another arc
- **Chromaticity correction and dynamic aperture studies** presented by E. Cruz-Alaniz

Colliding beam: Issues



- Q6 needs more strength AND aperture
- Some tuning quadrupoles in dispersion suppressor too strong
- Polarity of left Q4-Q5 $\Rightarrow$ compatible with injection optics?
- 15 mm residual dispersion at IP $\Rightarrow$ can maybe be reduced with better correction macros

Beam optics: non-colliding beam



- Unchanged since June workshop
- Optics for injection and collision energy exist
- Aperture bottleneck in Q6 (reminder: Q6 on colliding beam is also too strong)
- Reintegration in new lattice neccessary
- To be adressed: Arc 2-3 optics at collision $\Rightarrow$ ATS? Chromaticity correction?

Next steps beyond CDR

- $\beta^* = 7\,\text{cm}$? $\Rightarrow$ new triplet, larger apertures, larger separation $\Rightarrow$ **more synchrotron radiation**
- **Recombination dipole design** $\Rightarrow$ escape line for neutral particles?
- Rematch and reintegrate **non-colliding beam**
- **Injection and collision optics** (very different because of ATS)
- Solution for aperture/strength/polarity **issue** of quadrupoles
- Address **unbalanced chromaticity** in both beams $\Rightarrow$ ATS in both cases? Asymmetric sextupoles?
- **Electron IR**