Injection Line Beam Size

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WP6 Meeting

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ROYAL HOLLOWAY UNIVERSITY OF LONDON

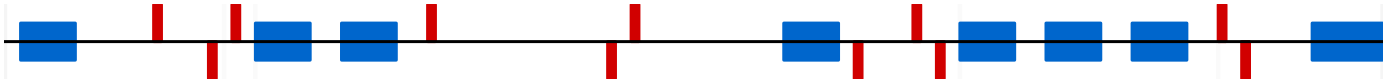
BDSIM

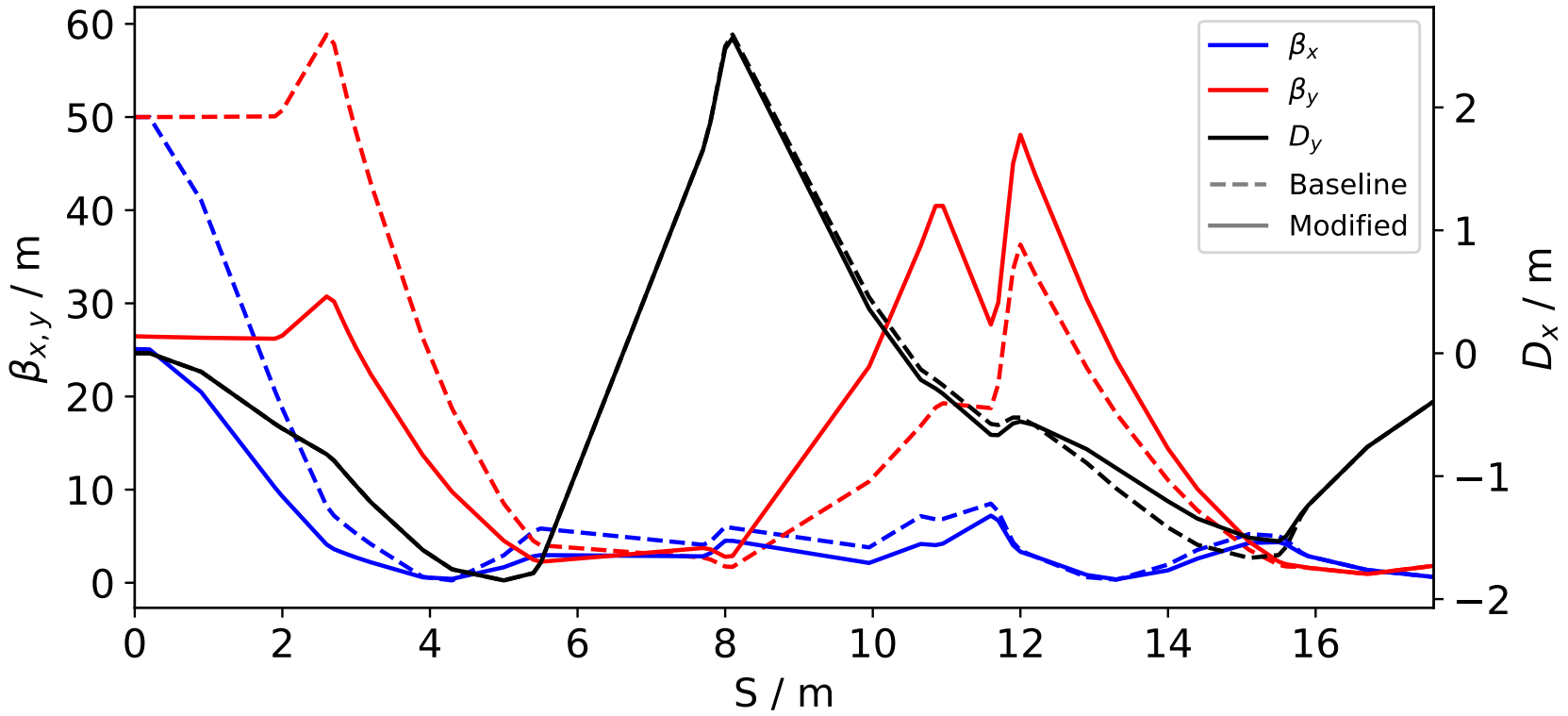
LhARA Laser-hybrid Accelerator for Radiobiological Applications

JAI John Adams Institute for Accelerator Science

Baseline Injection Line

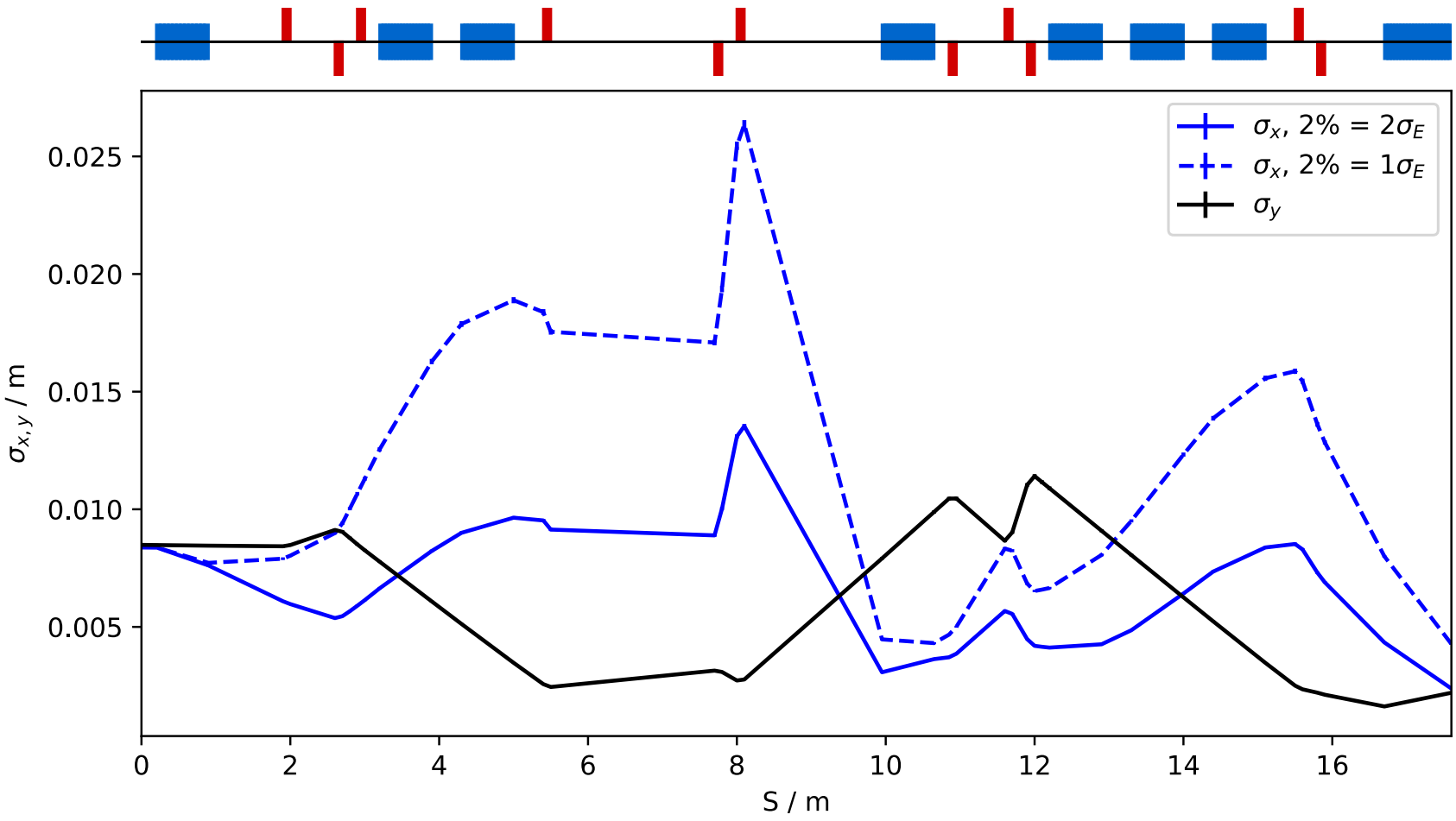
- Reminder – injection line reoptimized as beta=50m condition could not be met
  - Mean RMS emittance ~ 2.45 x 10^{-6} (emittance at target ~ 8.2 x 10^{-8})
  - Solution found with beta ~ 27m (alpha = 0):





Baseline Injection Line: Beam Size

- Beam size strongly dependant on energy spread
  - LhARA energy spread definition of 15 MeV ± 2% - 1σ or 2σ ?



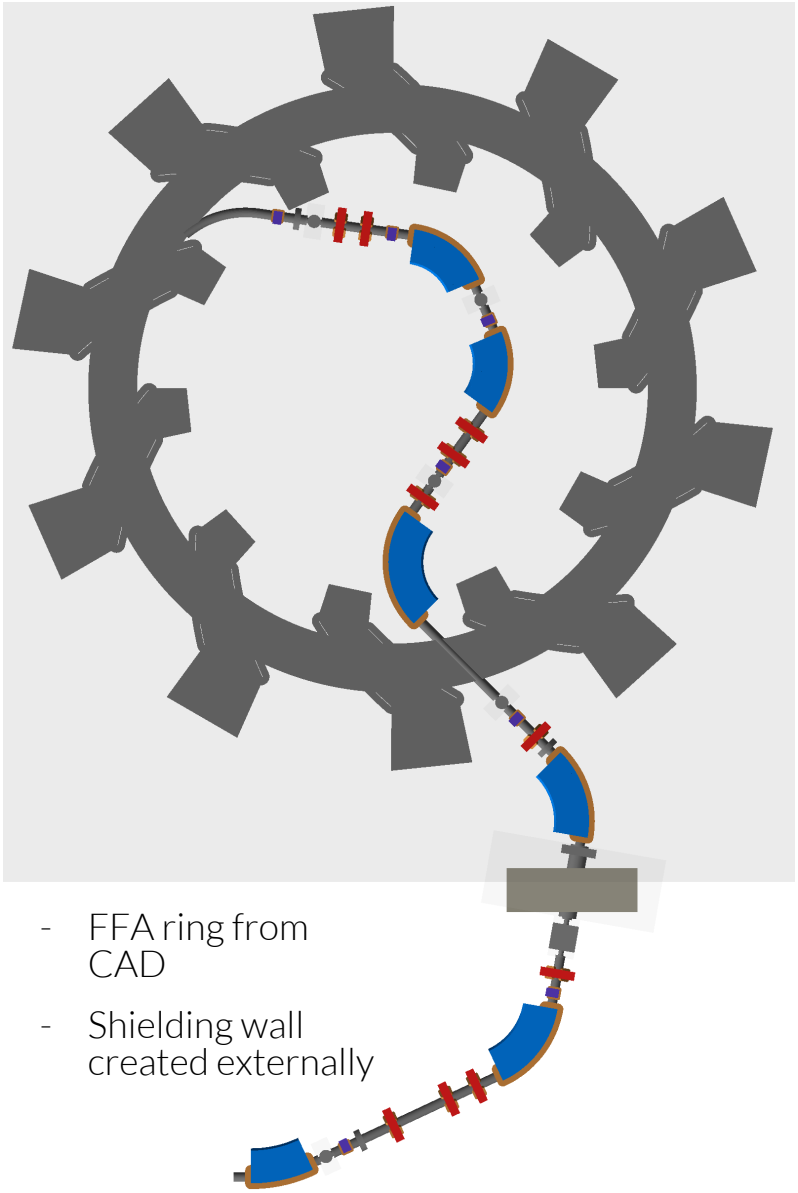
Proposed Injection Line: Overview

- Aim: mitigate injection line engineering challenges
  - FFA crossing too close to magnets
  - Insufficient space for people to work

- New solution found
  - Three unique dipoles (exc. septum & switching magnet)
    - Fields kept < 1T
  - Integrated angle preserved
  - Quad strength constrained to ± 9.55 T/m

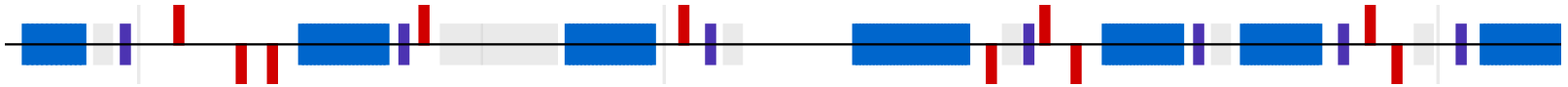
- Space reserved for:
  - Magnet coils - minimum 200mm between magnets
  - Shielding wall + shutter
  - Diagnostics + corrector magnets

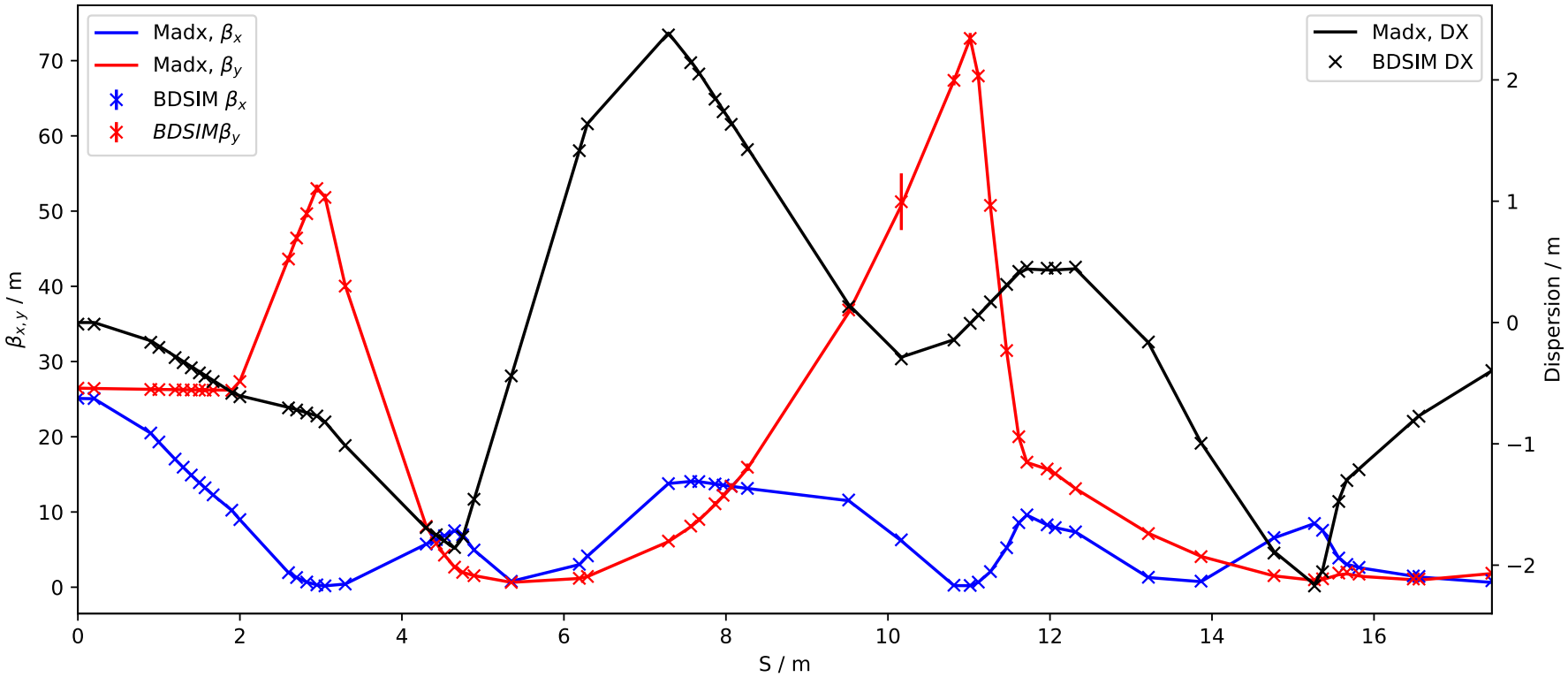
- Limited degree of FFA translation



- FFA ring from CAD
- Shielding wall created externally

Proposed Injection Line: Optics





- Beta, Alpha, Dispersion, and Dispersion' are preserved at the end of the septum magnet
- BDSIM & MADX models in good agreement
  - Small BDSIM losses (~0.2%)

Proposed Injection Line: Beam Size

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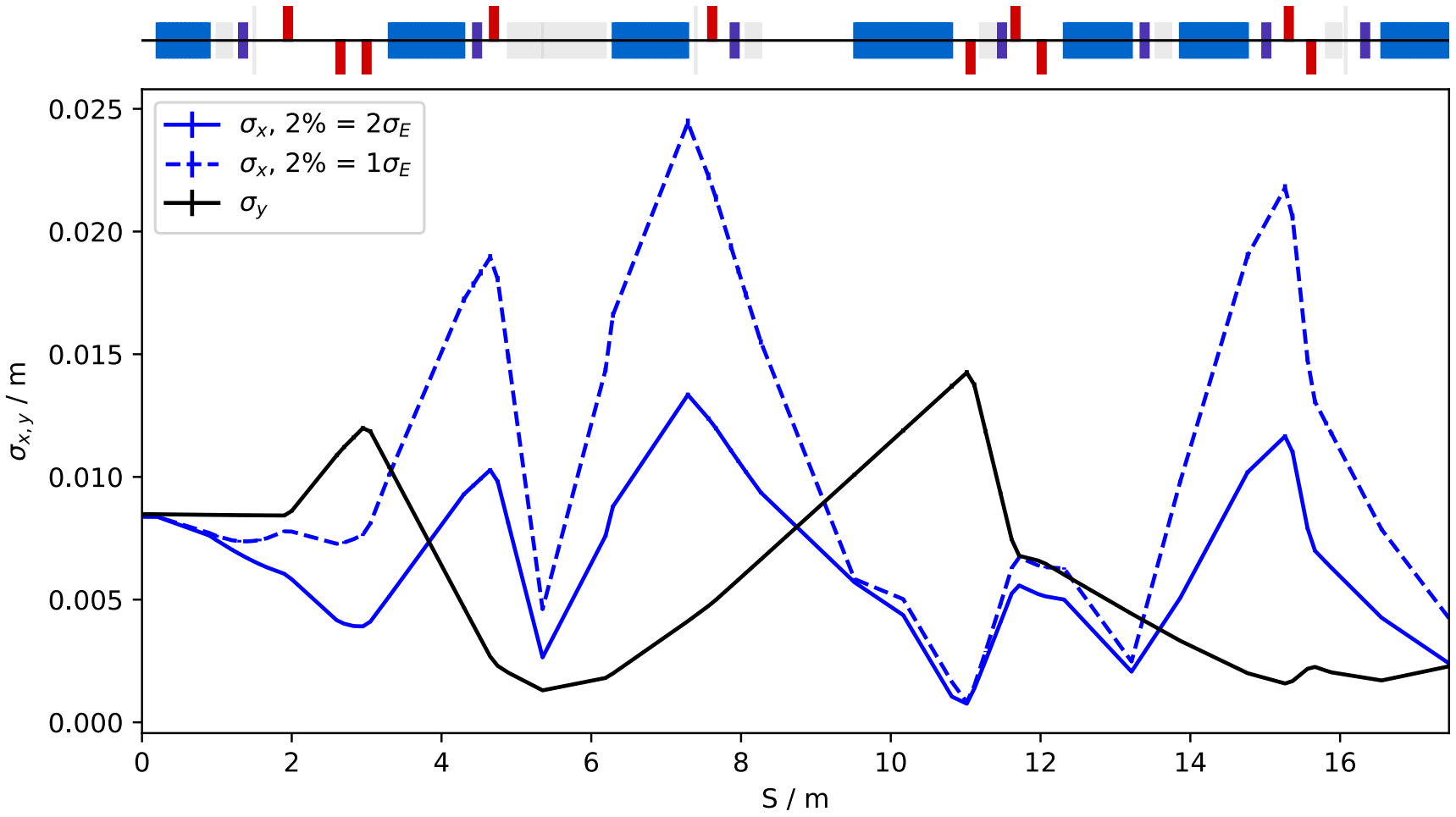
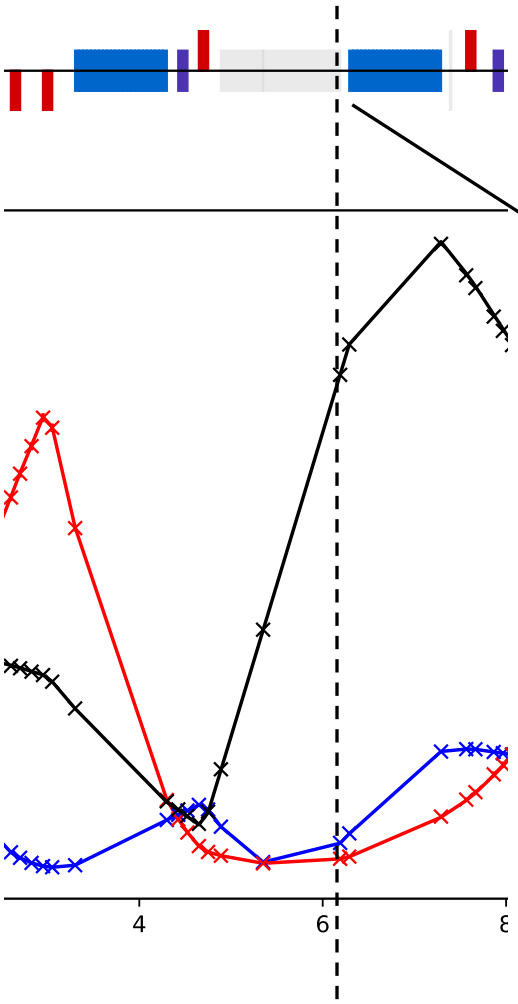
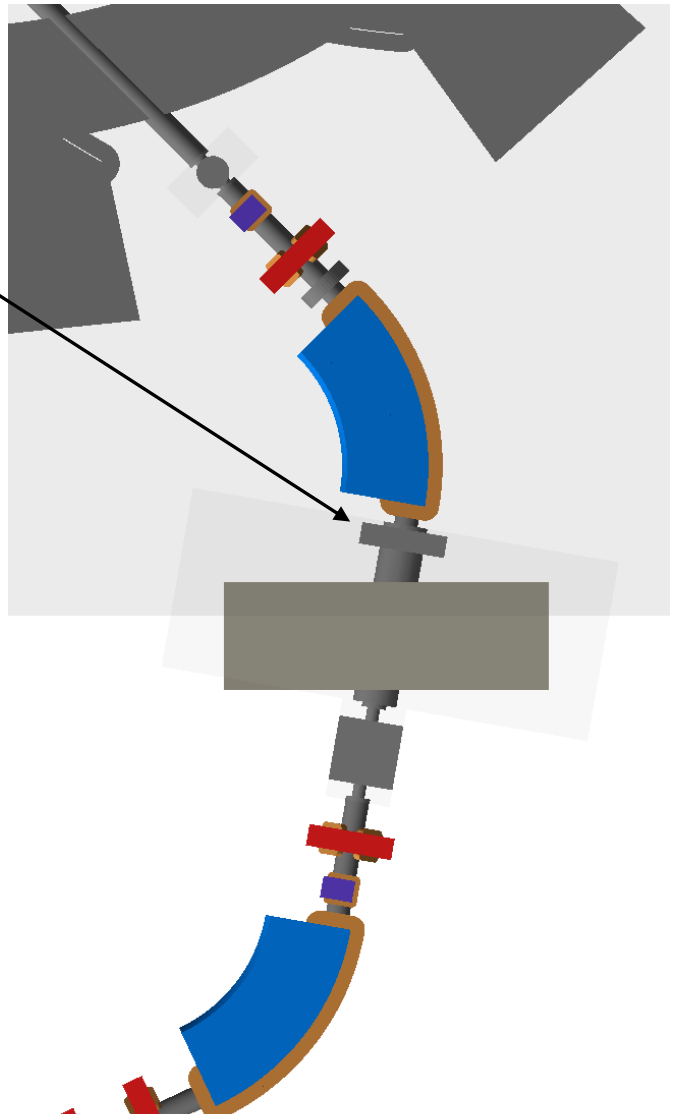


Proposed Injection Line: Collimation

- Space for collimation is tight.
  - Assumed 10cm total device length



- Best location is the FFA side of the shielding wall
  - Scope for wall to be moved
  - Facility design update needed



- Wall 50cm thick
  - Room to thicken pending TUVSUD feedback
  - Thicker wall to handle 127 MeV FFA losses not possible