Beamline Optics, Tuning, and Instrumentation Requirements



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Outline

- Beamline overview
- Scope
- Optics
- Instrumentation

Tuning and interface implications are addressed as we go

Beamline Overview

- Beamline is nominal until tagger, then:

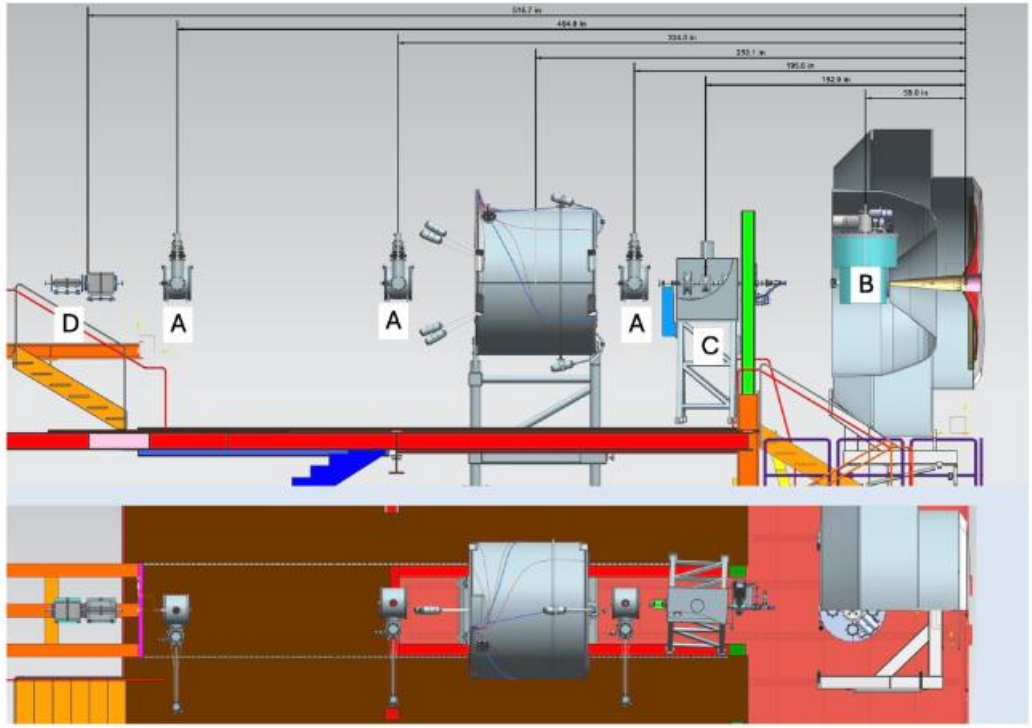


Fig. 25: Preliminary layout of the chicane (A) used to compensate the beam bending of the target holding magnet (B). The second raster pair (D) will be moved upstream to save space for the 2H01 BPM (C).

Scope

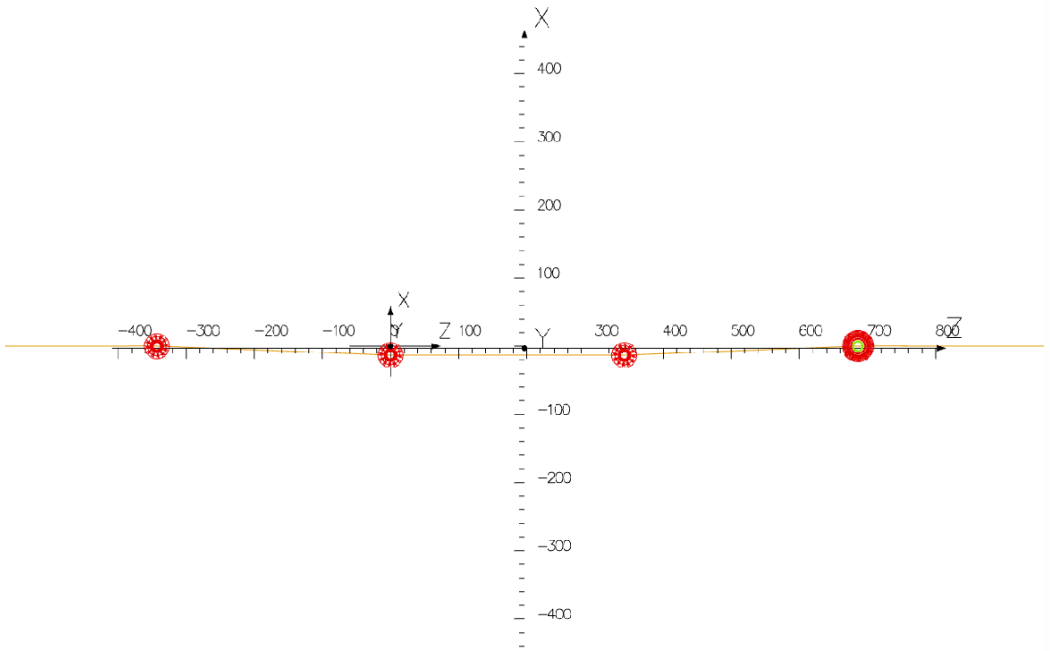
- Accelerator scope is limited to beam dynamics, tuning, and feedback about interface points that have beam dynamics implications

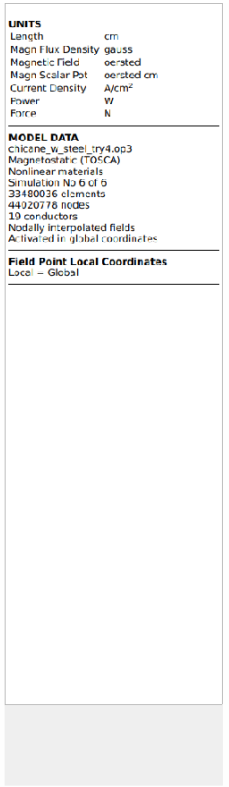
- This includes consequences of specifications for components, but no procurement

- End result is lattice simulating beam dynamics, including field maps (courtesy of Jay Benesch), which will provide initial magnet settings, some diagnostic behavior, set up considerations, validate desired raster is within envelope

Optics

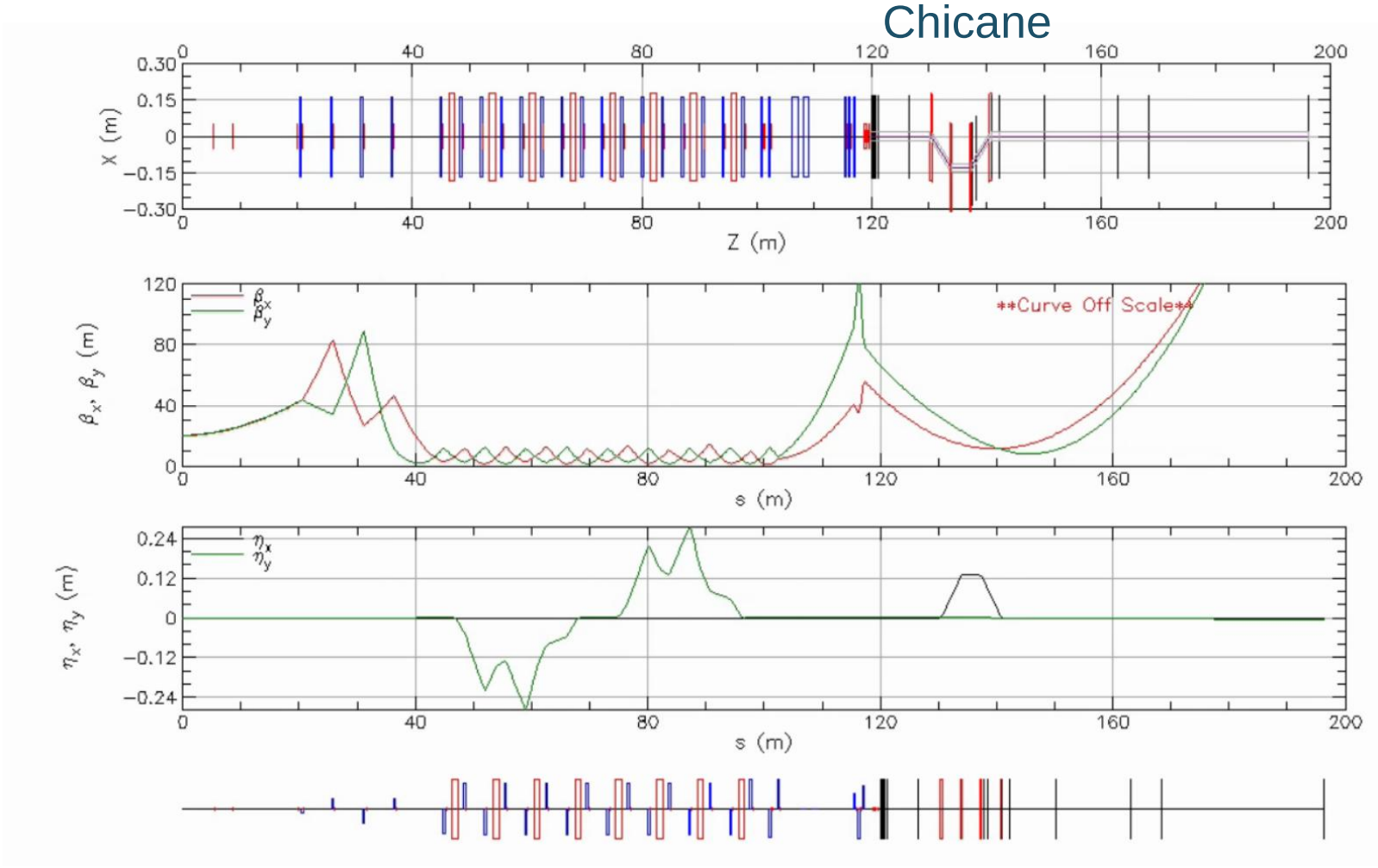
- Preliminary simulations and layout by Jay Benesch:
- Magnets have been adjusted for a fully symmetric chicane, 343 cm separation
- Center magnets offset by 13.1 cm
- 6.885 T in first three magnets for 5 T at target
- Jay's observation: buying higher field magnet with more margin, reducing chance of quench, may be appropriate





Optics

- Using a similar layout…
- Initial beam optics of this experiment, without field maps, final placing to be determined

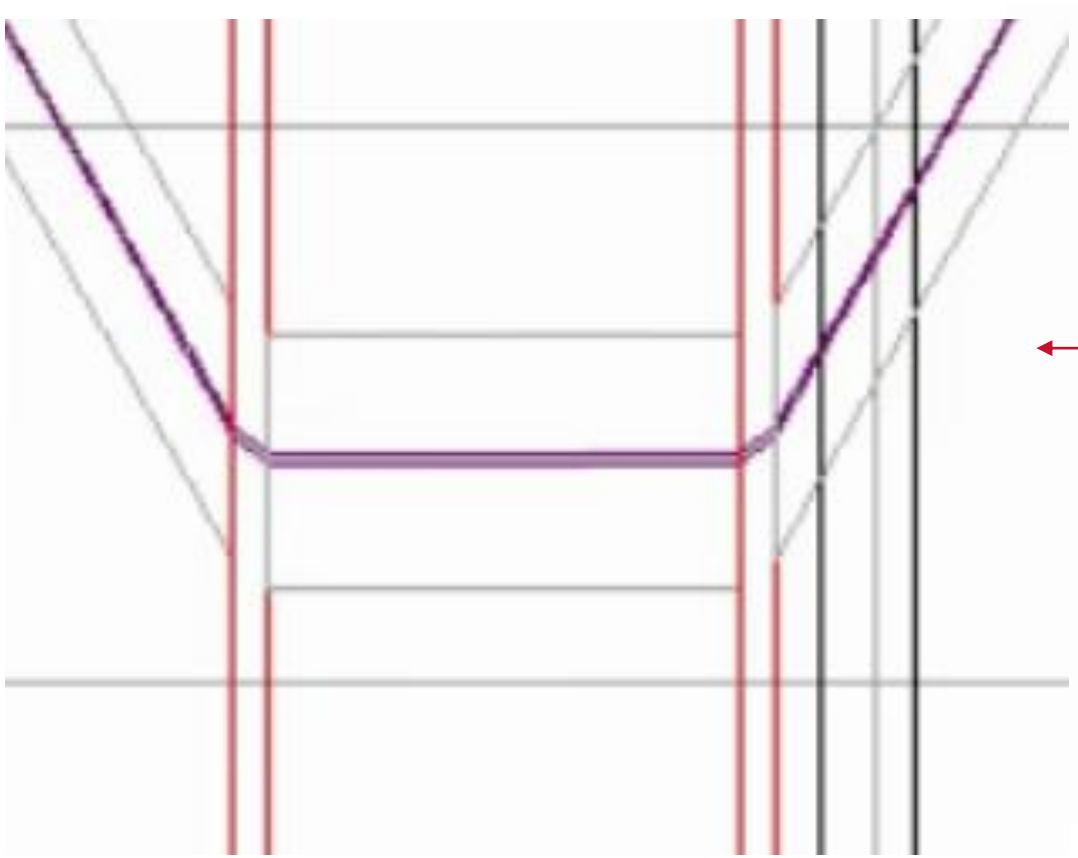


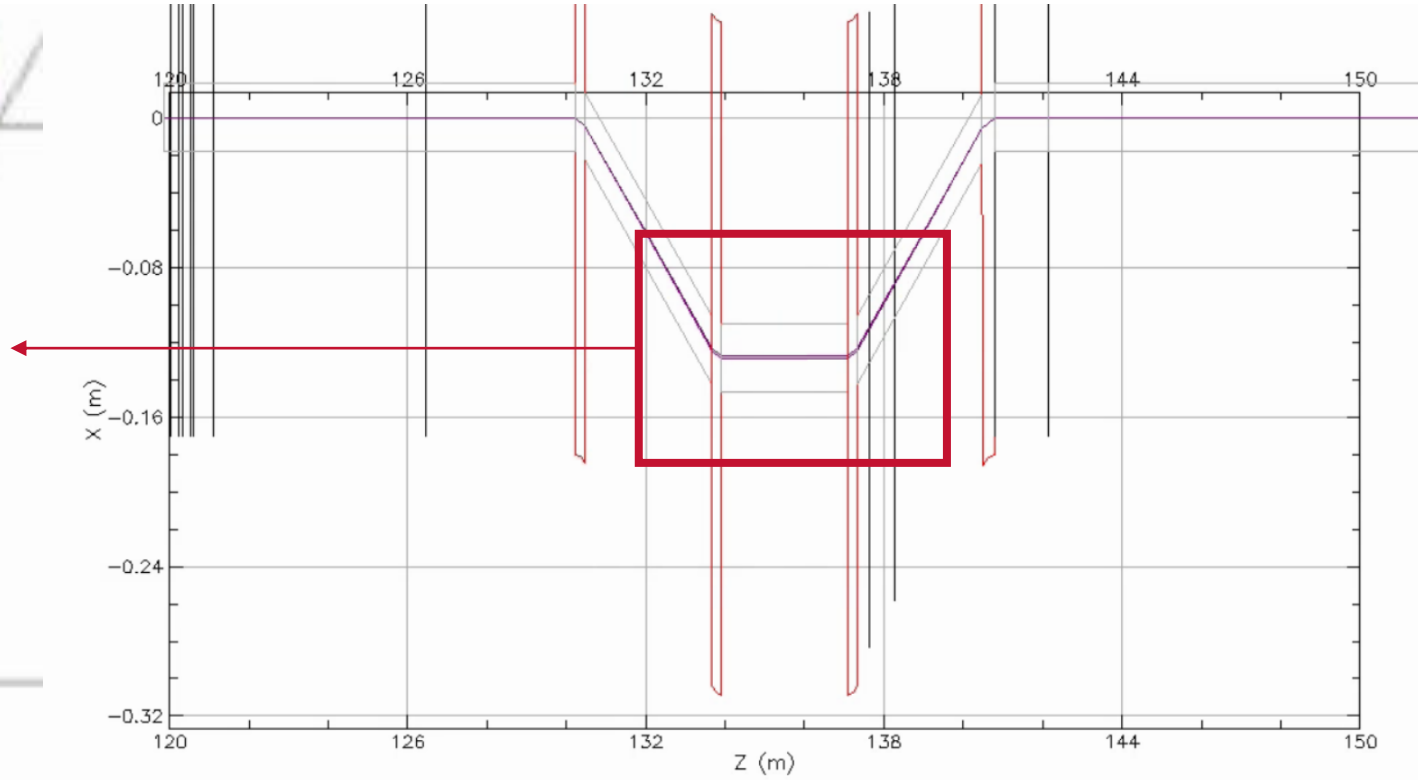
Interface: Chicane Magnet Positions

- Target experts will dictate minimum separation between target and upstream chicane magnet
- Beam dynamics will require first and third separation be identical to keep beam centered in central pipe – second separation may be influenced by facilities/engineering

Optics

- Fixed field implications on beam orbit at different energies:





Interface: Horizontal Offset

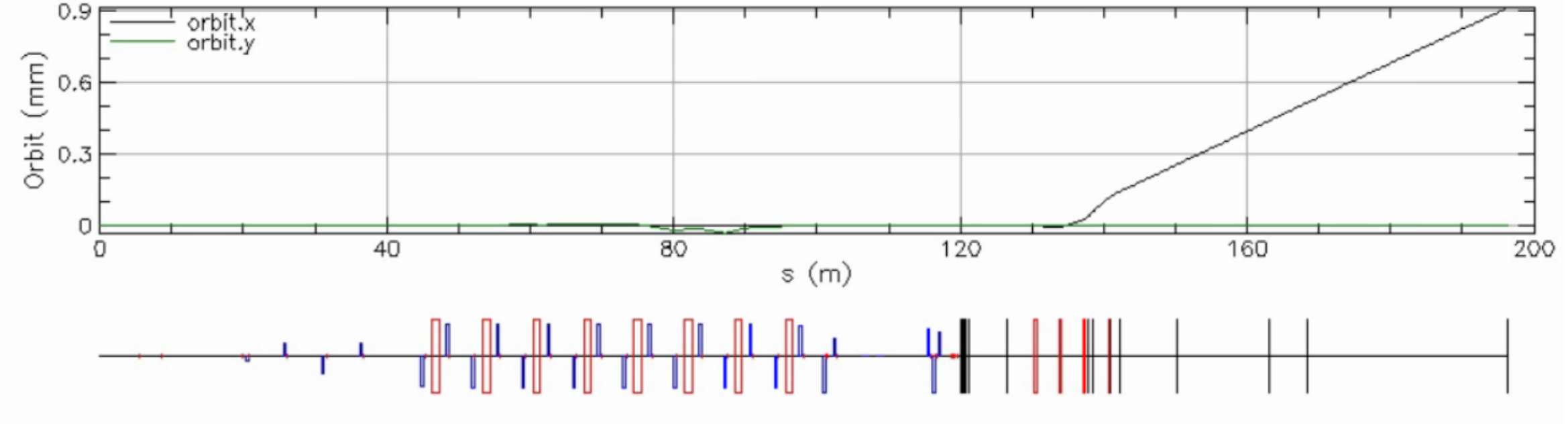
- Because of the energy range that xB will see during this run (10.663 – 10.754 GeV*), the beam will have different positions in the chicane if the target field is held fixed

- Current estimates put this position difference ~1 mm in the center of the chicane, so nothing should need to be moved for a change in energy – this may change

* confirmed with the Moller leader, see JLAB-TN-26-121 by Jay Benesch

Optics

- Worst case of orbit deviation for 1e-4 error on target and all chicane magnets:



Interface: Chicane Power Supplies

- Is 1e-4 a reasonable expectation for the power supply error?
- What is the restriction on orbit control?
- The answers to these questions inform whether the field at the current lock correctors are sufficient, or if additional correctors are needed

Instrumentation

- Current suggestion: 4 BPMs within the chicane, 2 BPMs after the target
- Within chicane: 1 in first and third separations, 2 in the center
- 2H01 harp should be sufficiently close to the target (~2.3 m) to allow for reasonable beam size measurement – current simulations suggest size between harp and target are within a few percent under expected conditions
- Before running begins, guidance from simulations will inform expected beam size at the Tagger harp – it will not be as small as at the beam at the target and the 2H01 harp

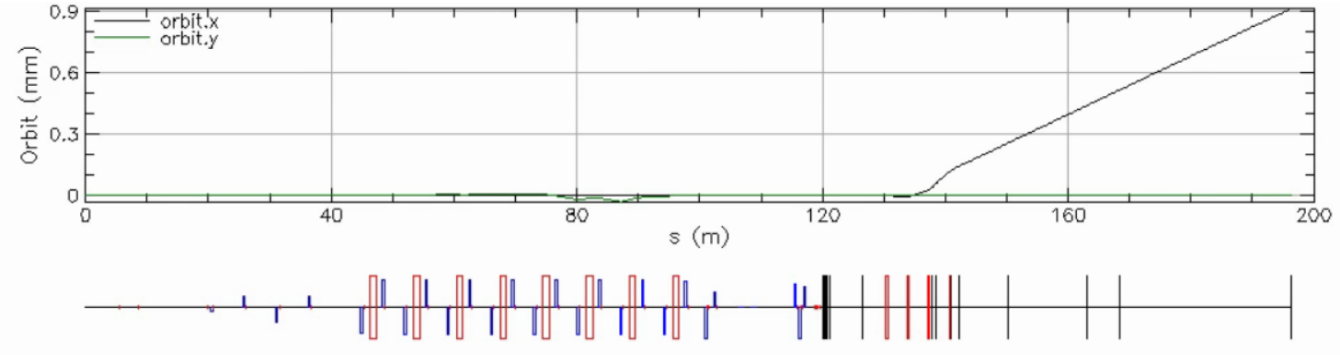
Conclusion

- Preliminary simulations have not found show-stoppers
- Simulations will be refined as field maps are incorporated and positions are finalized by the responsible groups
- As requirements are finalized, all outstanding questions regarding should be addressed well before the experiment begins

Thanks for your attention!

Optics

- Worst case of orbit deviation for 1e-4 error on target and all chicane magnets:



- Fixed by the lock correctors (MBC2C21H and MBC2C22H, 10.6 µrad kick maximum)

