OLD DOMINION UNIVERSITY

EPFL Framework for EIC

Leon van Riesen-Haupt, Tirsi Prebibaj, Lara Sievert, Tatiana Pieloni

EPFL Framework

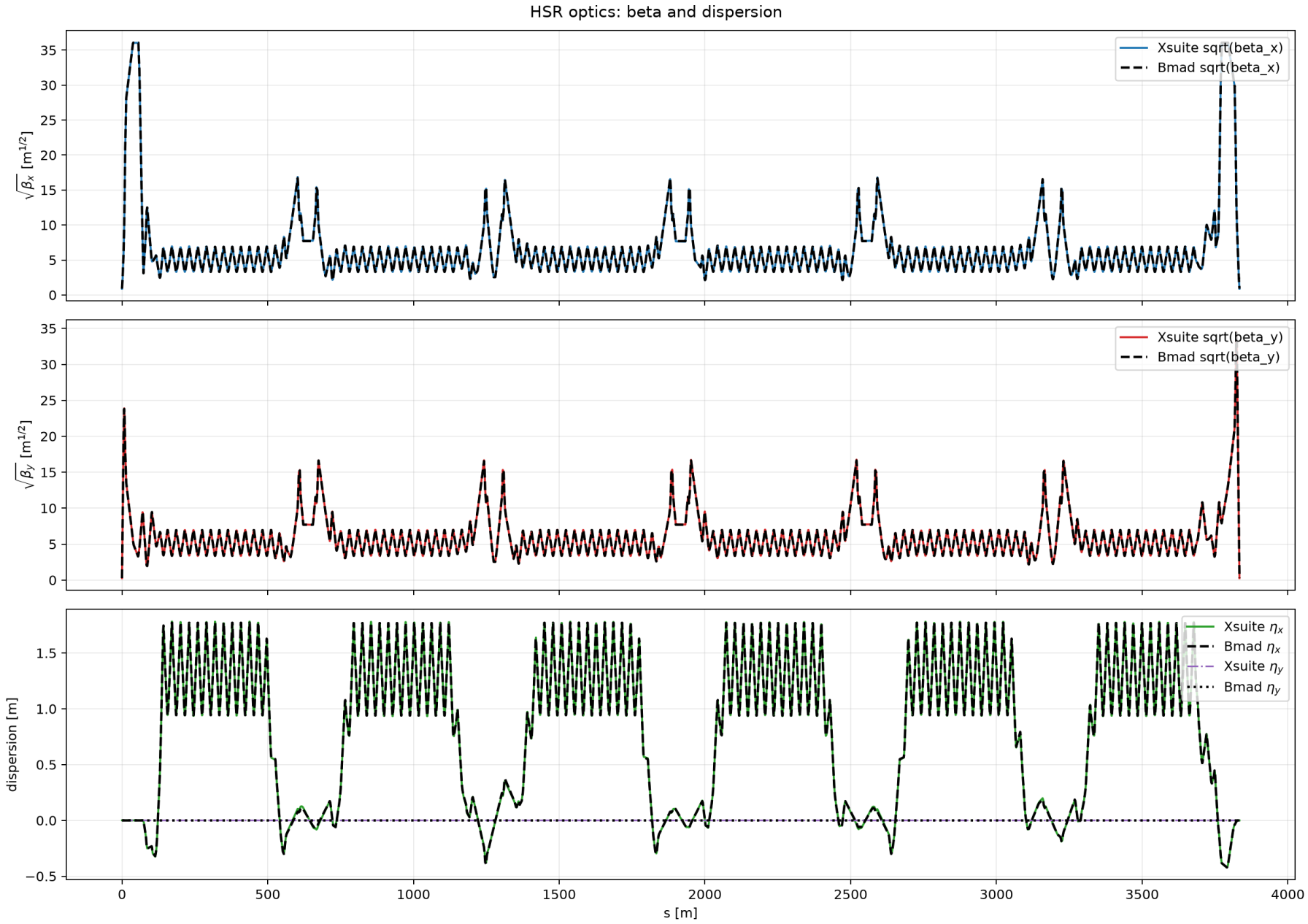
- Xsuite workflow that
  - Applies user specified field errors and misalignments
  - Runs global orbit and optics correction algorithms
- More details in Tirsi's slides
- Xsuite allows for
  - Readily install other perturbations including beam-beam effects, electron cloud, impedance and space charge
  - Spin tracking
  - Accessibility for other European collaborators – HL-LHC control room tool
  - Complement and strengthen BMAD results

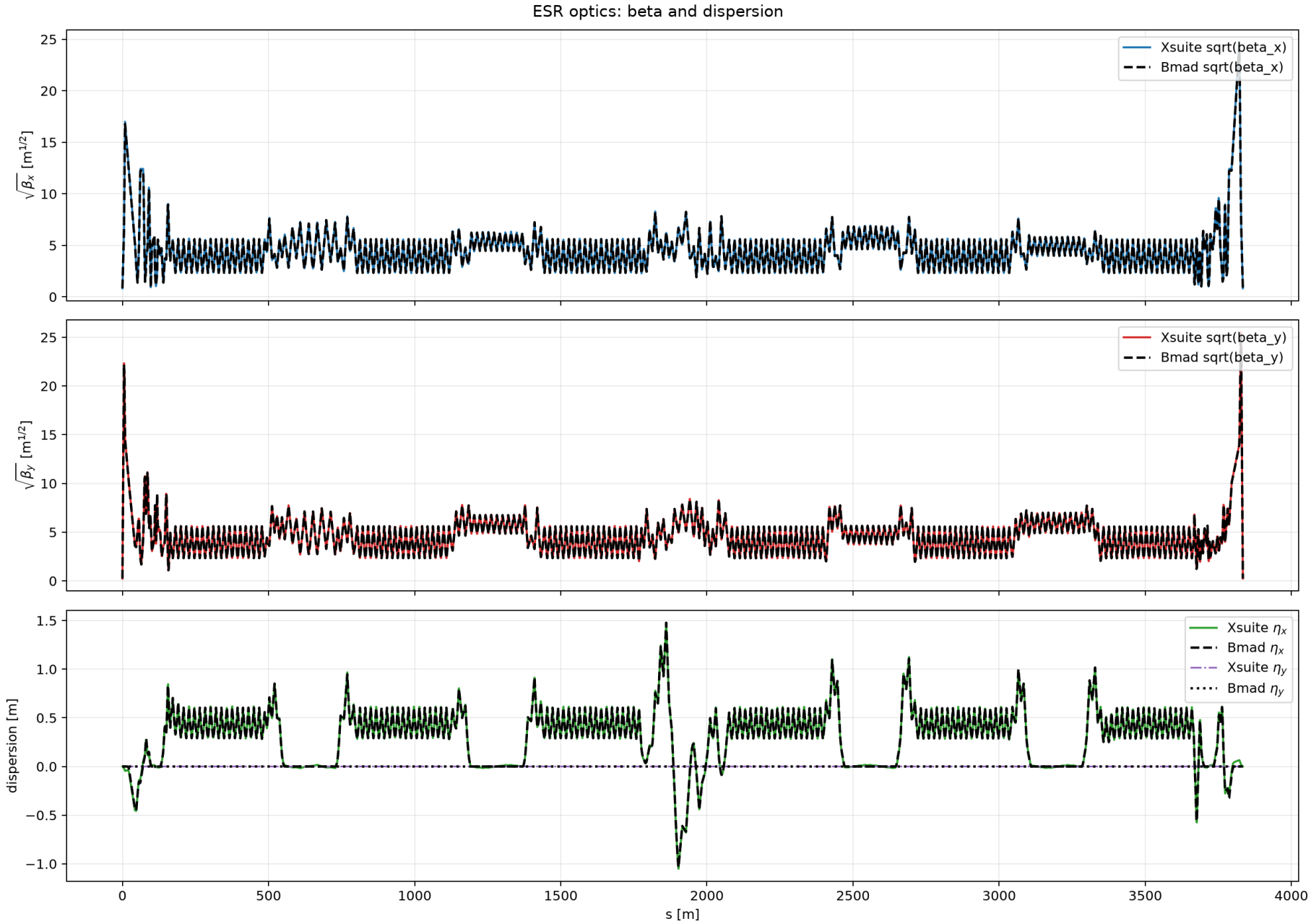
Requirements

- Lattices in Xsuite
  - Conversion from MADX built in but needs to be tested
- Magnet errors
  - Do EIC estimates exist?
  - Adapt from other large colliders LHC, FCC, RHIC?
- BPMs, correctors and optics tuning knobs
  - Either installed in lattice or locations for thin kicks/markers
  - Multiple approaches possible

Xsuite Lattices

- All MADX elements recognized by Xsuite
  - Need to make sure this is the case when more details added e.g. complicated solenoid geometries
- Most robust test – compare Xsuite optics to BMAD
  - Beta functions and dispersion
  - Both HSR and ESR
  - Check geometry


HSR optics: beta and dispersion
Xsuite sqrt(beta_x)
Bmad sqrt(beta_x)
$\sqrt{\beta_x}$ [m$^{1/2}$]
Xsuite sqrt(beta_y)
Bmad sqrt(beta_y)
$\sqrt{\beta_y}$ [m$^{1/2}$]
Xsuite η_x
Bmad η_x
Xsuite η_y
Bmad η_y
dispersion [m]
s [m]


ESR optics: beta and dispersion
Xsuite sqrt(beta_x)
Bmad sqrt(beta_x)
$\sqrt{\beta_x}$ [m$^{1/2}$]
Xsuite sqrt(beta_y)
Bmad sqrt(beta_y)
$\sqrt{\beta_y}$ [m$^{1/2}$]
Xsuite η_x
Bmad η_x
Xsuite η_y
Bmad η_y
dispersion [m]
s [m]

Correctors and BPMs

- Could place correctors and BPMs manually
  - Start with conservative approach next to every quadrupole
  - Remove systematically and observe change in beam quality
- Implement baseline scheme once available
- Ability to evaluate efficacy of different designs including
  - Different error seeds and distributions
  - BPM tolerances
  - Other effects in the long run
- Also indication of space requirements and radiation