Zeroth order lattice design for the linac + high energy line -- for comments ! --

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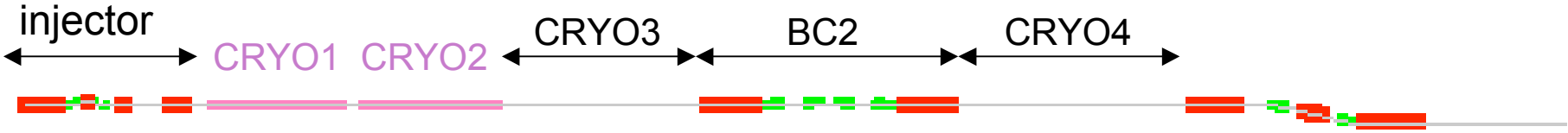
lattice version: V03242010

Requirements/Choices

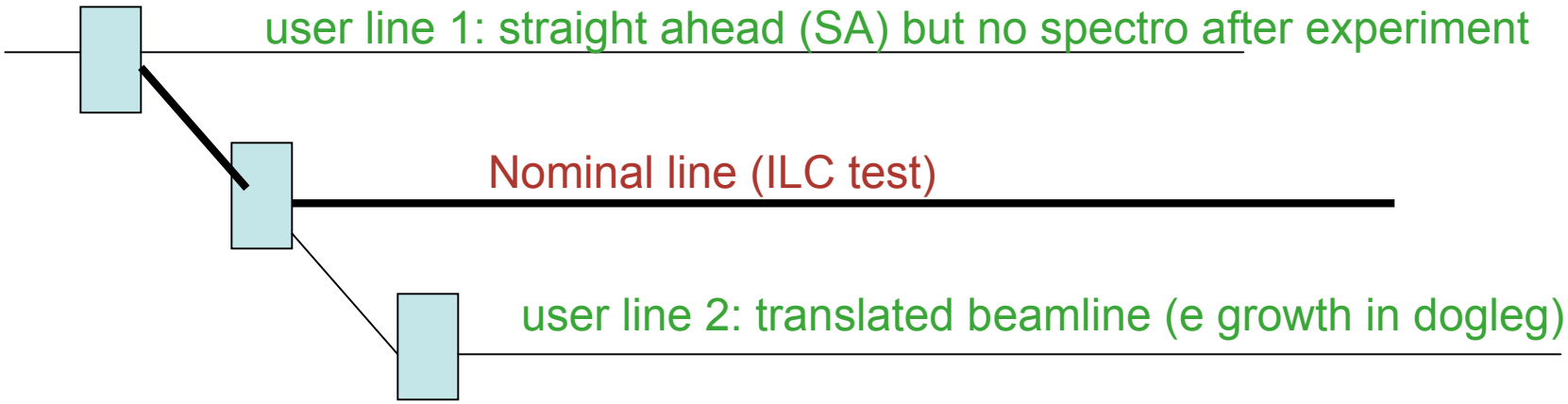
- Injector:
  - Already discussed see talk of FEB 23 2010,
  - 3 matching points: BC1, TDC, and CRYO1 entrance.
- Post crymodules area (assume 2 modules for now):
  - Choose to locate a permanent line at Z=99.98 m from PC
    - This would be permanent
    - It would include the "nominal" spectrometer line.
  - Choose to reserve 2 empty spaces* to accommodate quick installation of CRYO3 and CRYO4 without major alterations of optics design
  - Assume CRYO4 will not be attached to CRYO3 but would be located downstream of a second stage bunch compressor (to be designed)



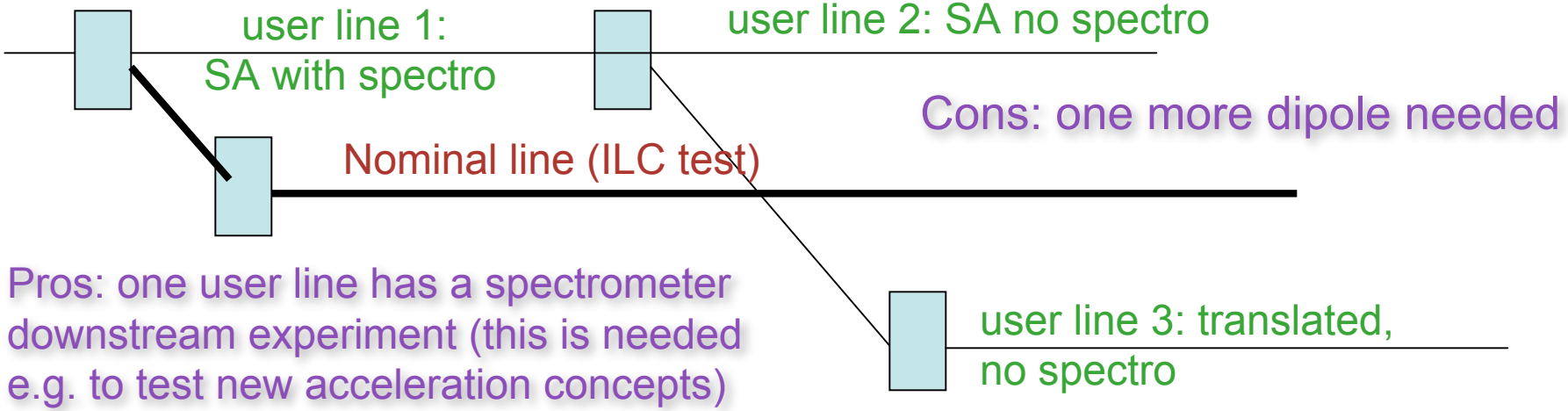
*the empty spaces could temporally accommodate instrumentation and associated optics

Comment: HE dispersive lines configurations

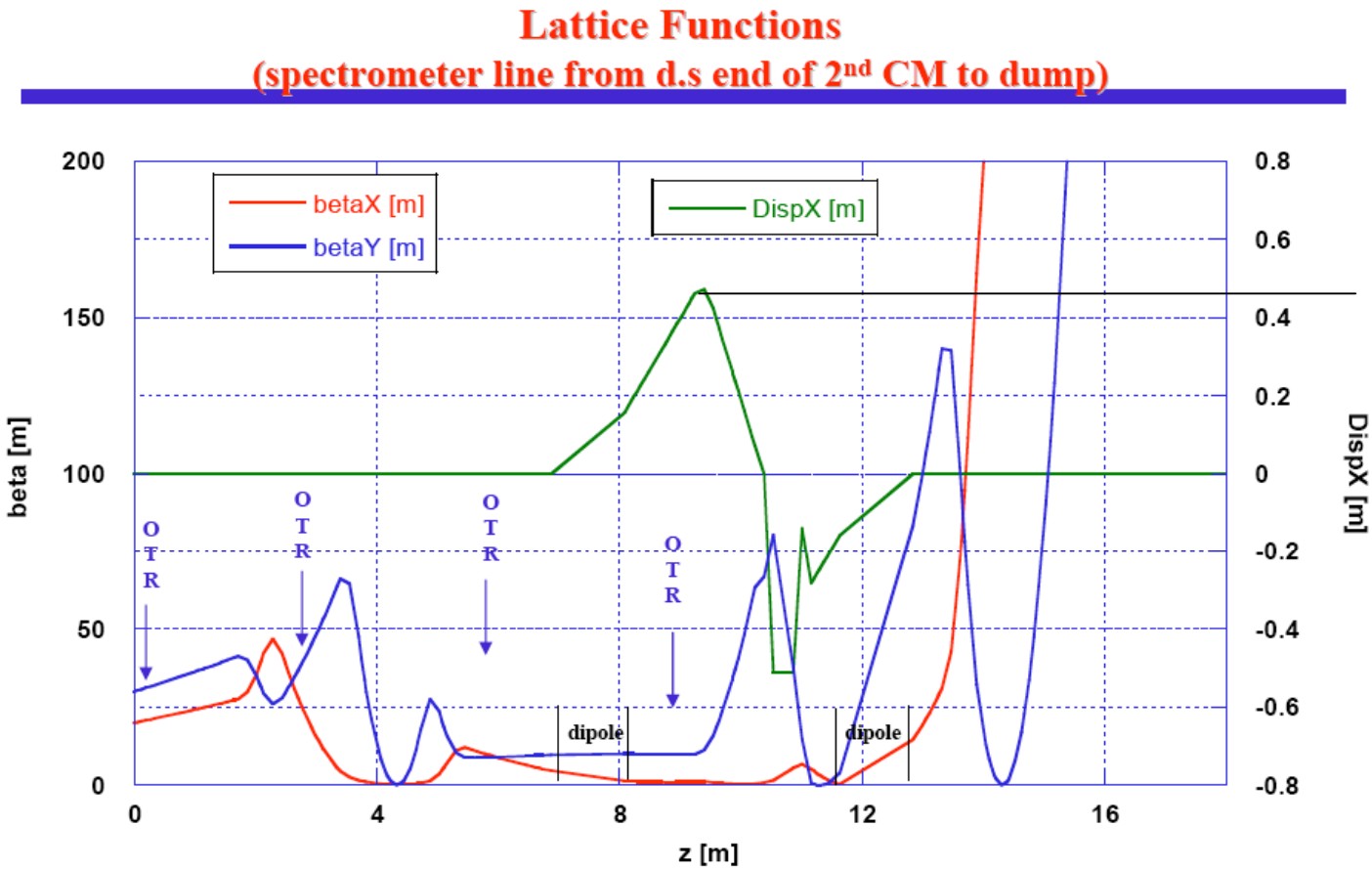
- Design of 2007



- Present thinking (for comments)



HE Nominal line: Mike's design



~0.5 m

NML Downstream Beamline Layout - M Church 8/23/07

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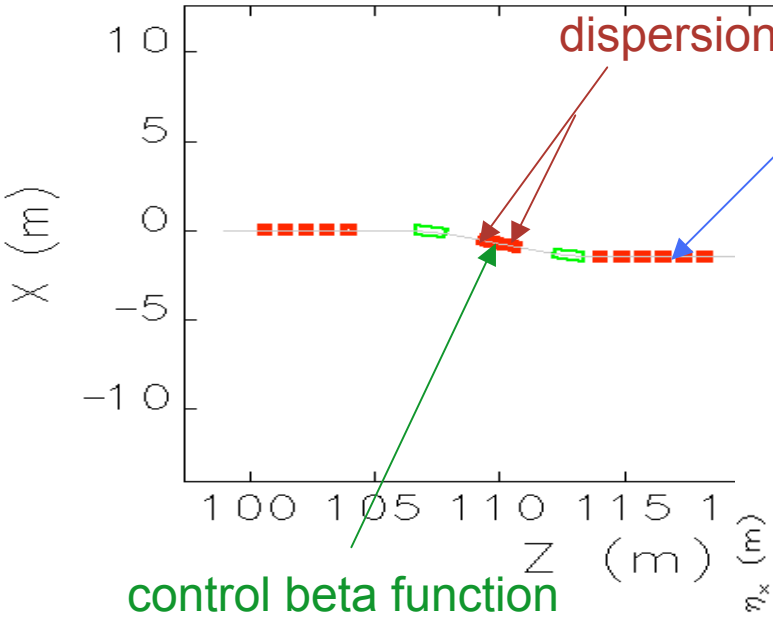
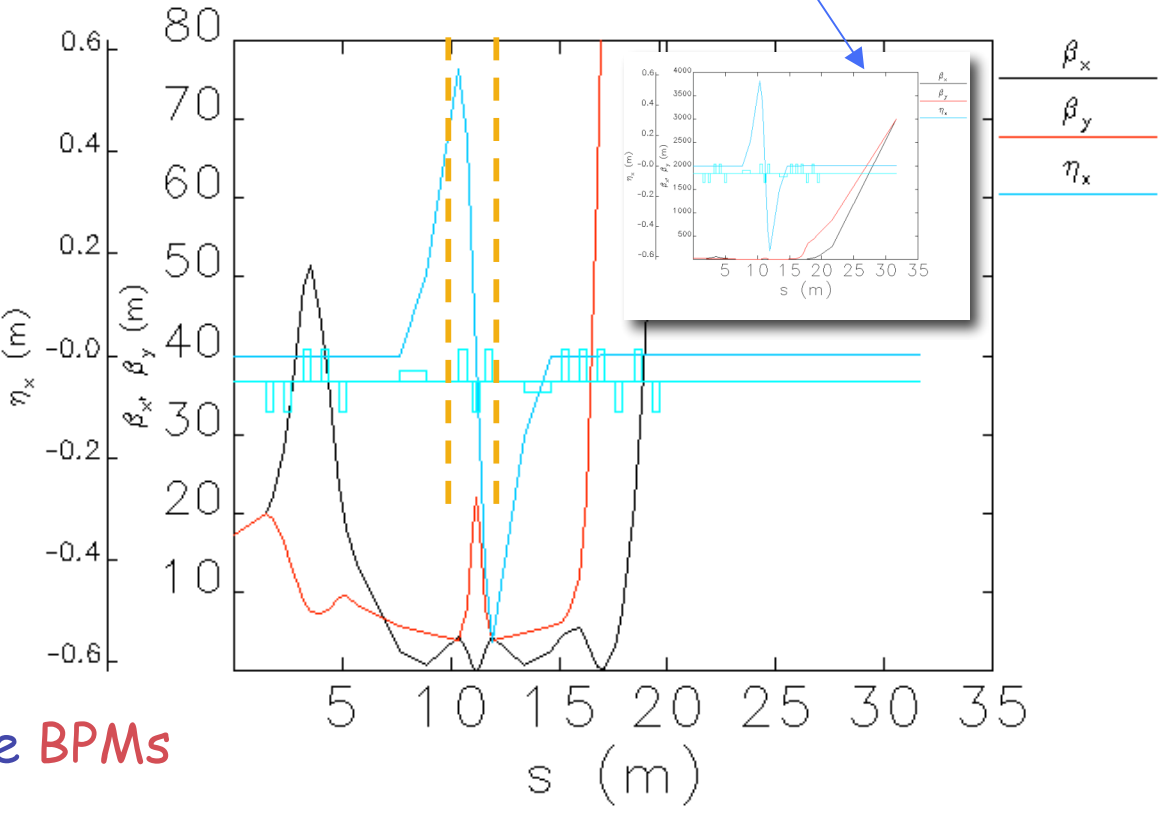
HE Nominal line: design consideration

- Use same approach:
  - Introduce a dispersion bumps in the dogleg only, i.e. between the dipole
  - Downstream of the two dipoles dispersion is suppressed (to 1st order)
  - A set of quadrupole is used to transport the beam and blow the beam envelope in on the dump window (rms beam size larger than 3 mm at 2.08 m downstream of the dump face).

- "Symmetrize" the dogleg design
  - Dogleg: two dipoles with three quadrupoles,
  - two high-dispersion points (with opposite dispersion value -- helpful? Not sure yet)

HE Nominal line: optical functions

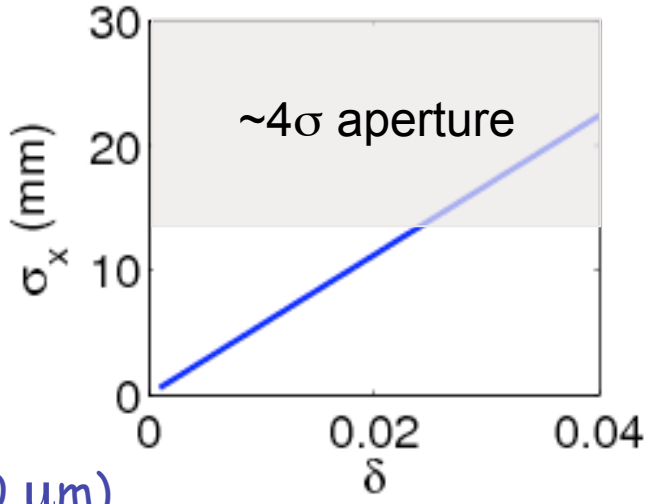


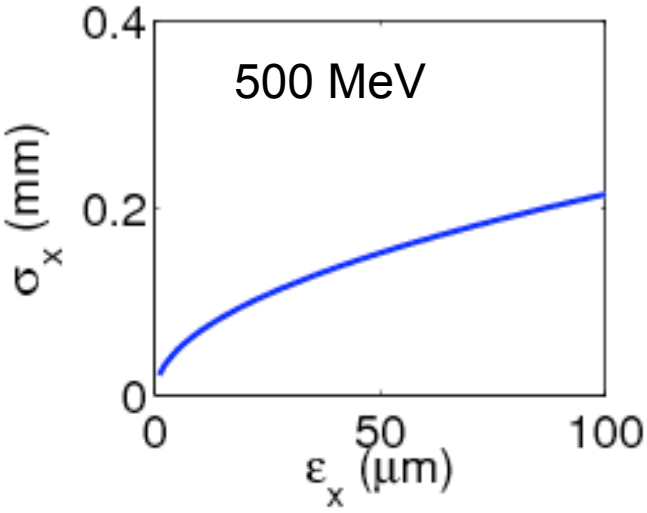


- Offset ~1.5 m from straight-ahead line
- $\beta_{x,y}$ @ dump ~ 3000 m
- Max($|\eta_x|$)~0.6 m, can have BPMs at 0.5 m dispersion points

HE Nominal line: anticipated performances

- High-dispersion points have
  - β_x= 4.385 m
  - η_x= 0.559 m

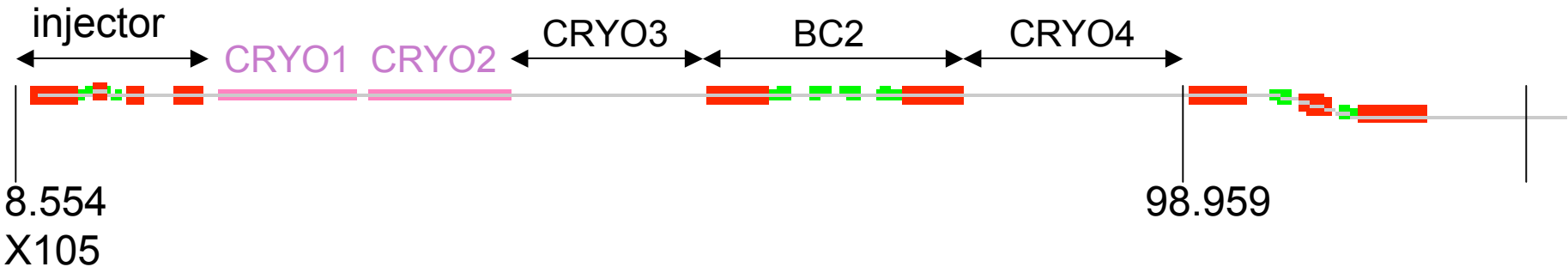




- This implies:
  - An energy spread resolution of ~10^{-4} (for ε=10 μm)
  - Not sure about energy resolution. Assuming a 100 μm (bad?) BPM resolution, we get $\Delta\delta \sim 10^{-4}/0.56 = 2\times10^{-4}$ is this sufficient? (What about BPM resolution?)
  - A maximum tolerable energy spread of 2.5 % assuming a 2" diameter beam pipe (and taking 4σ to fit in 2").

X105-to-dump optics

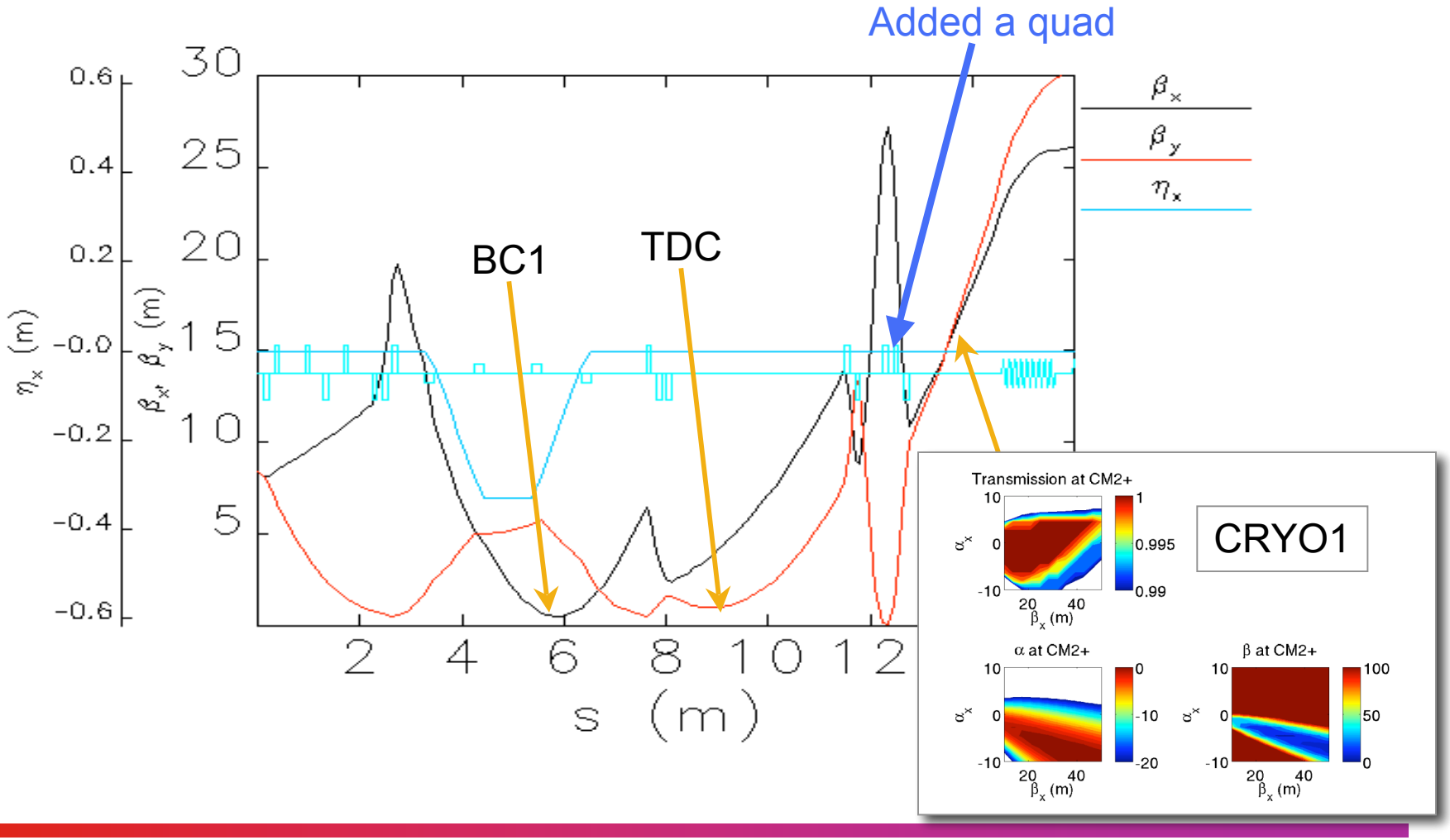
- X105 to dump lattice shown below (only nominal HE disp line shown)



- Currently configuration includes:
  - Two cryomodules (CRYO1 an CRYO2),
  - An empty space for CRYO3,
  - A possible 2nd bunch compressor stage (BC2) not yet designed/optimized,
  - An empty space for CRYO4.

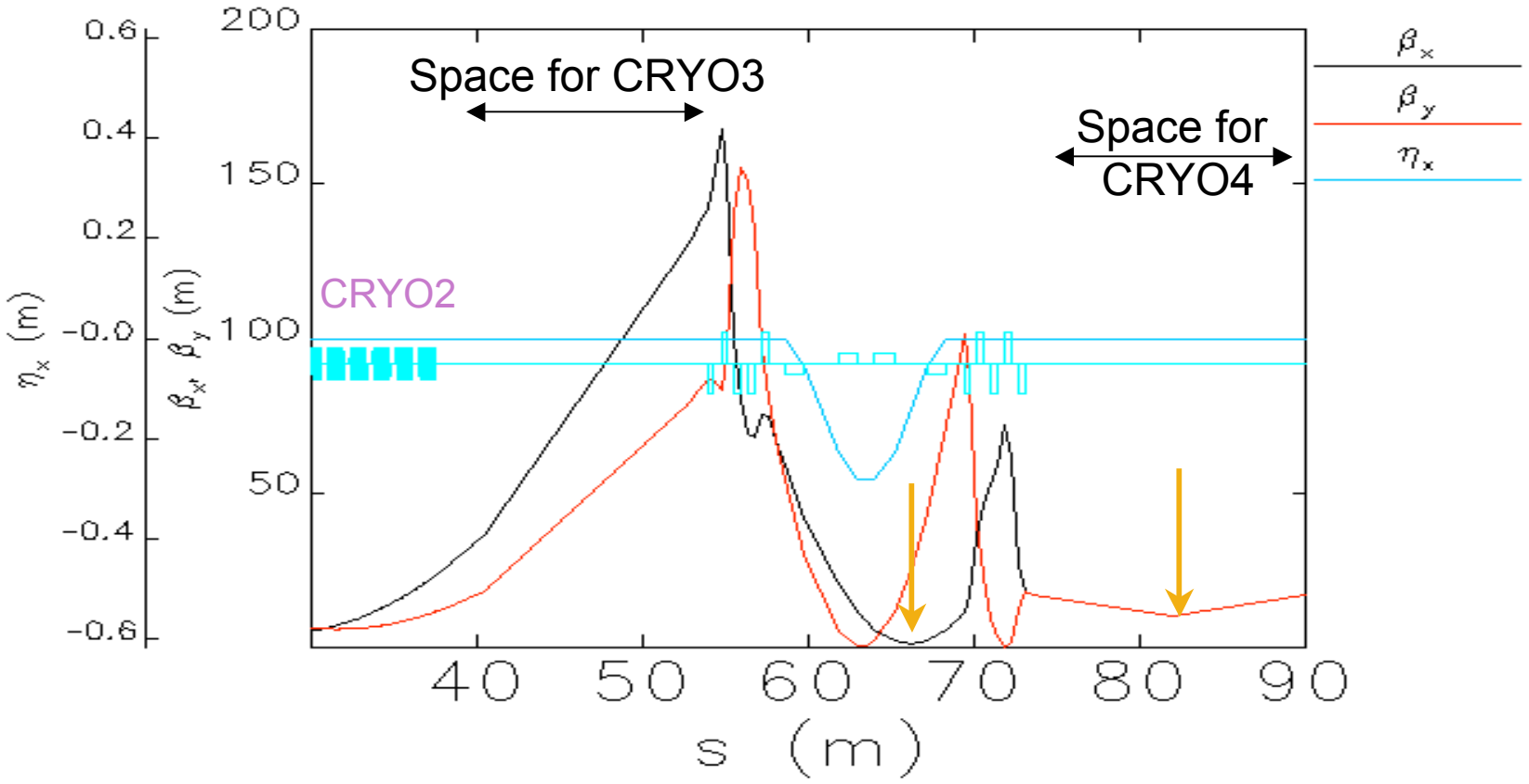
X105 to CRYO1

- Make a defocusing beam at CRYO1 entrance to "bit" strong rf focusing.

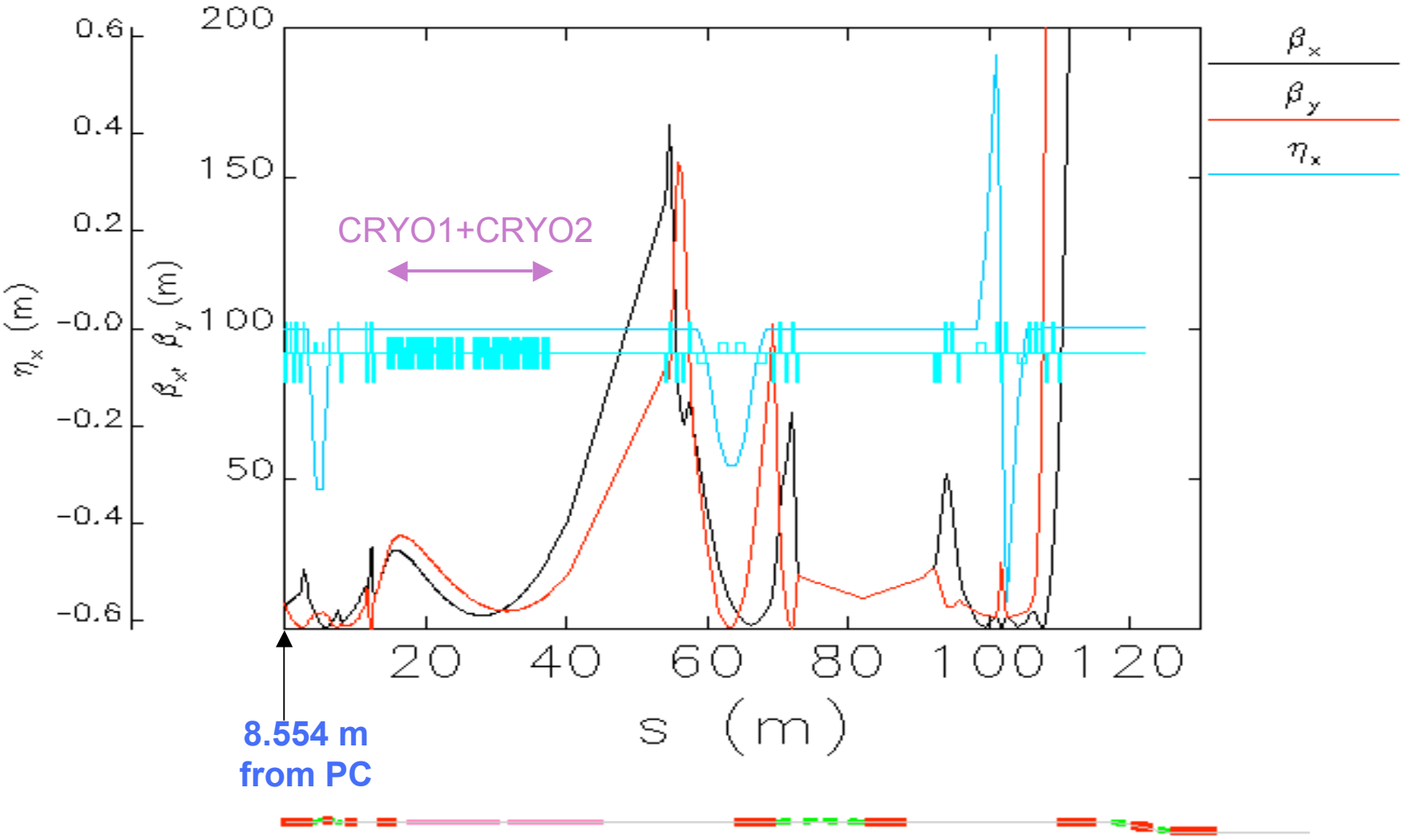


CRYO1 exit to CRYO4 space: SEC300

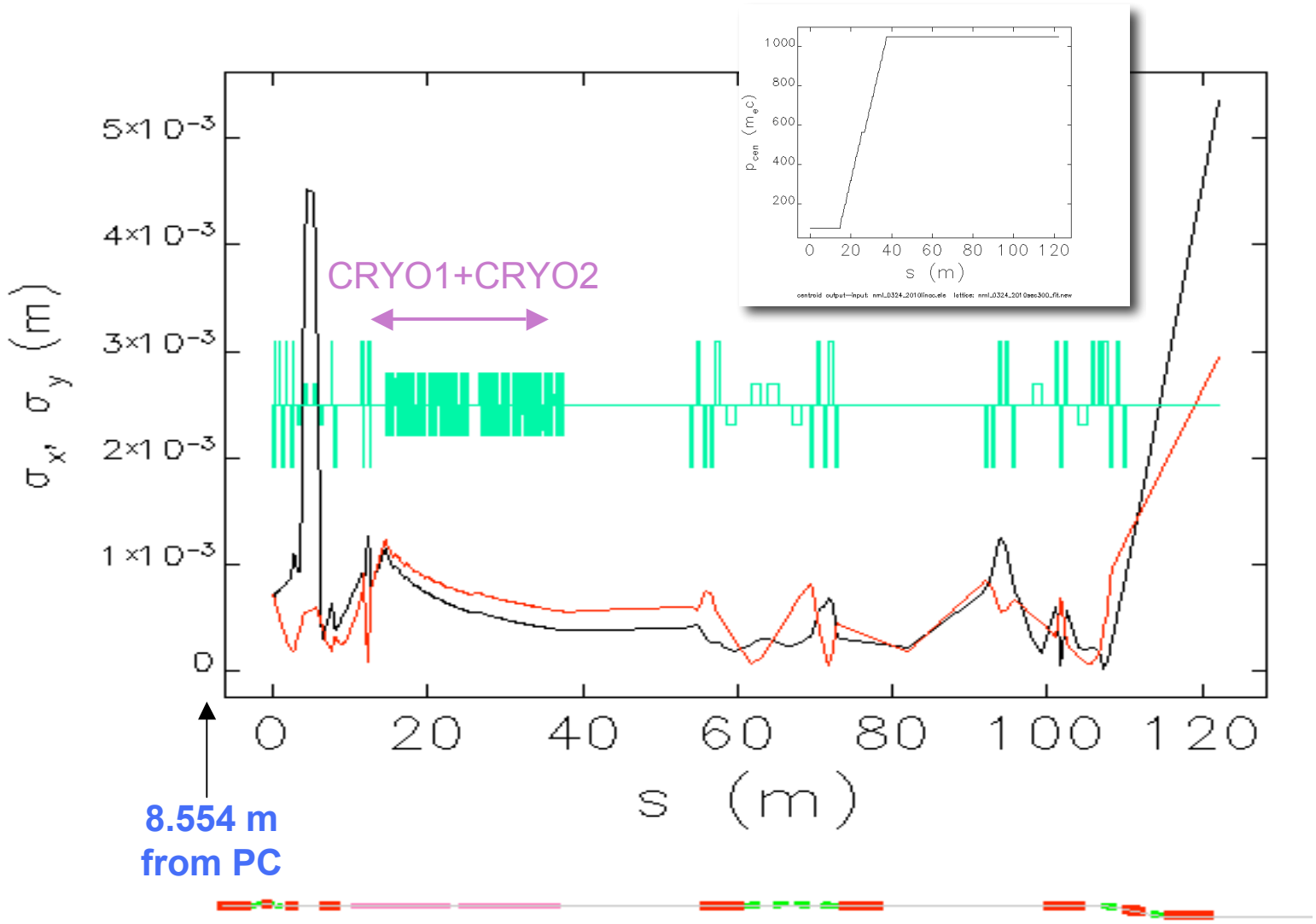
- Matching in BC2 compressor + a matching point in CRYO4 area.



X105 to dump optics (summary)



X105 to dump: 1st ELEGANT tracking



Summary & Next Steps

- 1st order optics in place
  - Need to prove BC2 is viable and optimize the compression scheme [LiTrack studies started (Chris P.)]

- In parallel need to explore/investigate require CS parameters at the BC chicanes (local CSRTrack version running -- now trying to get it up on the FermiGrid)

- Also exploring possible use of GlueTrack (high level python interpreter to "glue" different simulation codes -- nominally Astra and CSRTrack) to perform S2E simulation. [GlueTrack was kindly provided by Igor Zagorodnov from DESY]

- The latter step will enable full optimization of NML for the numerous possible operating scenarii.