

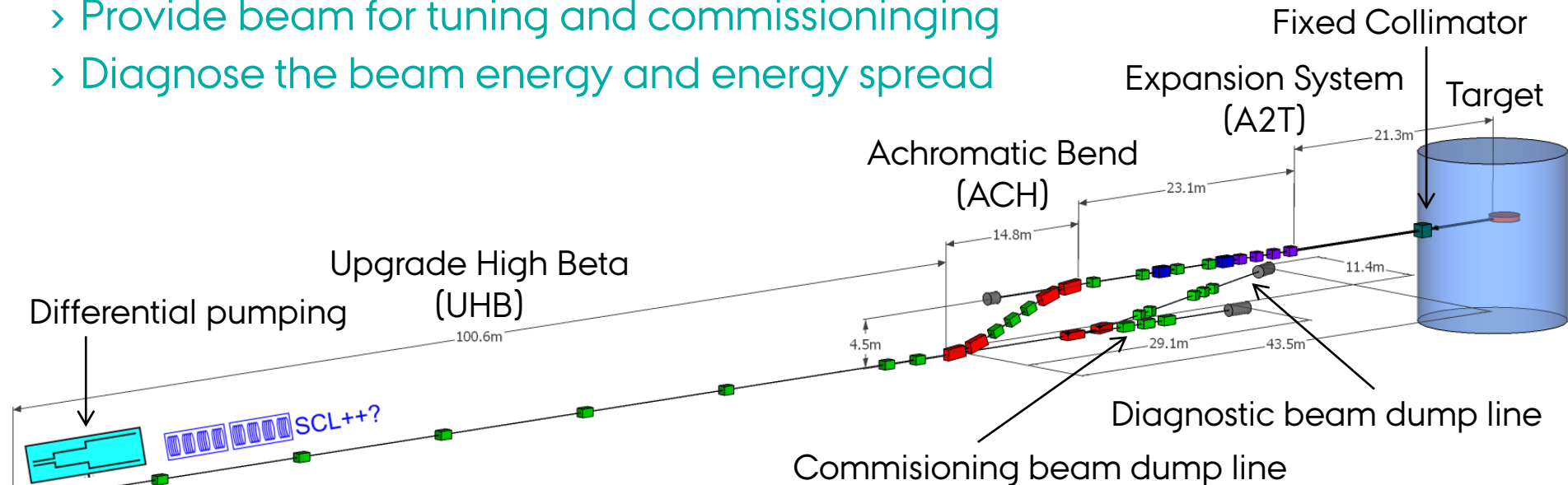


BASELINE DESIGN OF THE ESS HIGH ENERGY BEAM TRANSPORT LINE

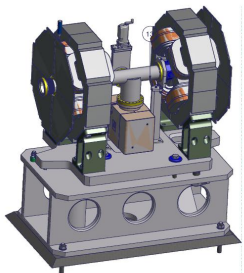
ANNE I. S. HOLM

PURPOSE

- > Transport beam to the target
- > Shape the beam profile and size at target
- > Provide beam for tuning and commissioning
- > Diagnose the beam energy and energy spread

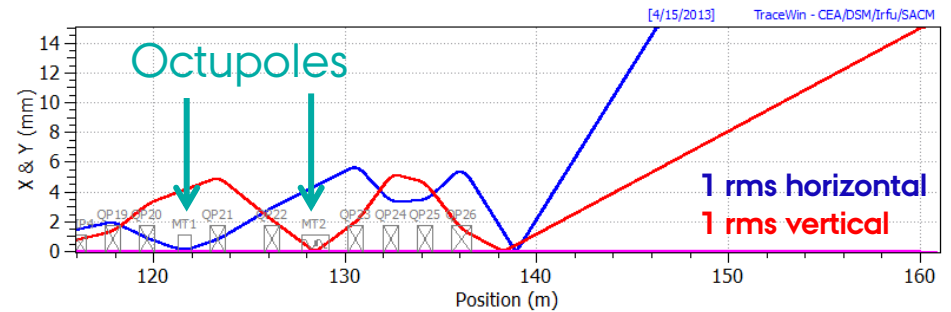
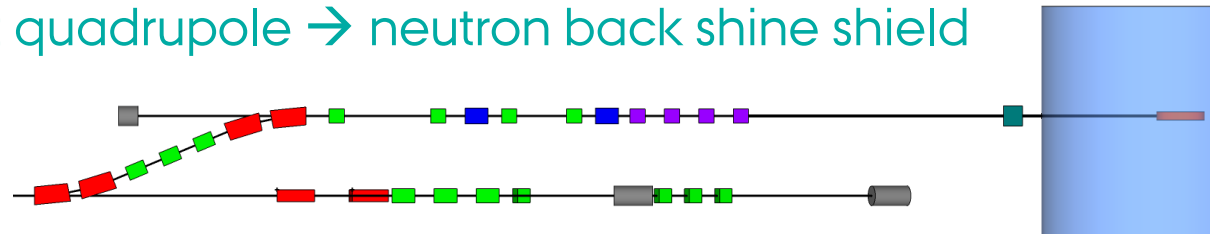


- > Linac focusing structure
→ Linac Warm Unit
- > <Phase advance> = 30 deg
- > Elevation = 4.5 m



EXPANSION SYSTEM (A2T)

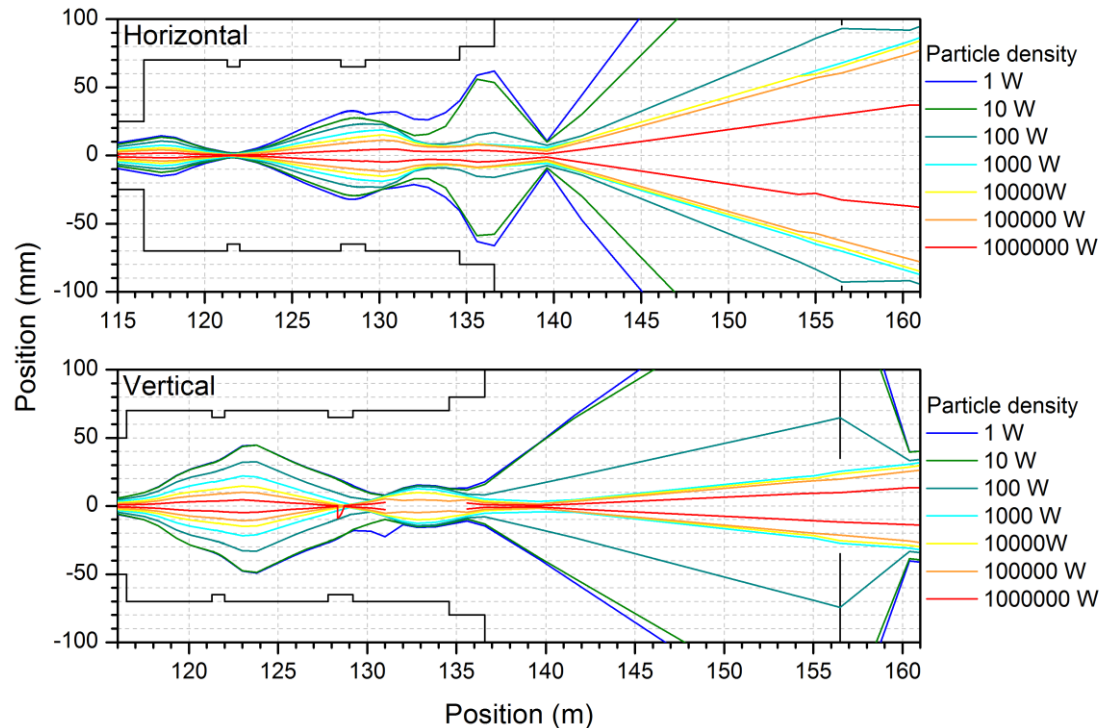
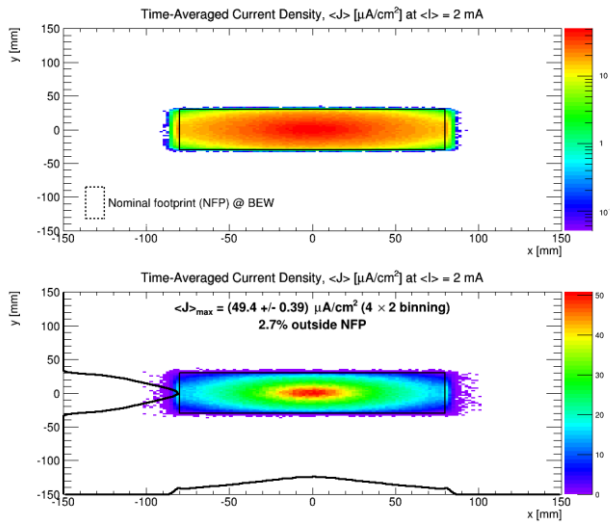
- > Peak current density (PCD) @ target ($< 64 \mu\text{A}/\text{cm}^2$)
- > Power deposit outside footprint (160 mm x 60 mm)
- > Power deposit @ fixed collimator.
- > Beam loss inside A2T elements
- > Double waist after the last quadrupole \rightarrow neutron back shine shield





EXPANSION SYSTEM (A2T)

- > PCD @ target = $49 \mu\text{A}/\text{cm}^2$
- > PCD @ PBW = $77 \mu\text{A}/\text{cm}^2$
- > Power @ Collimator = 602 W

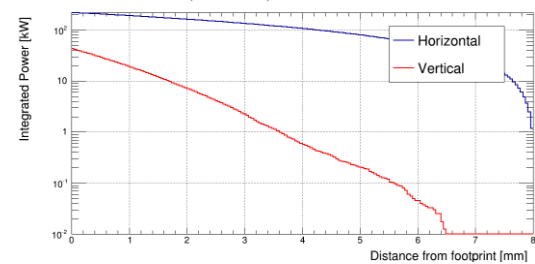
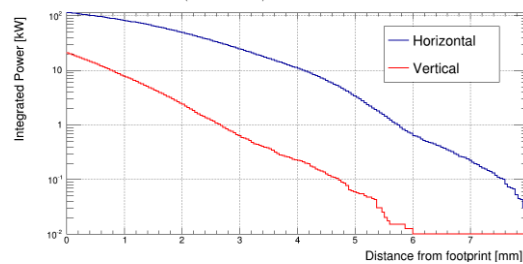
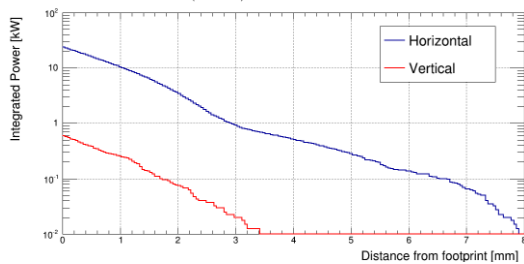
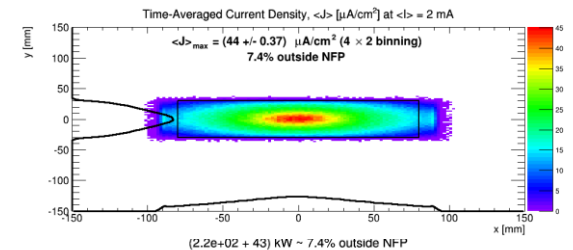
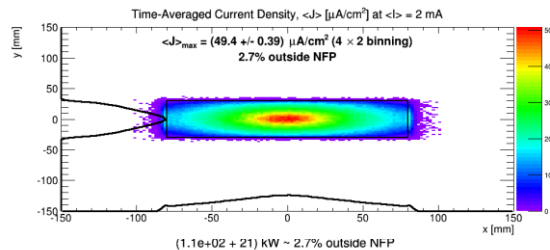
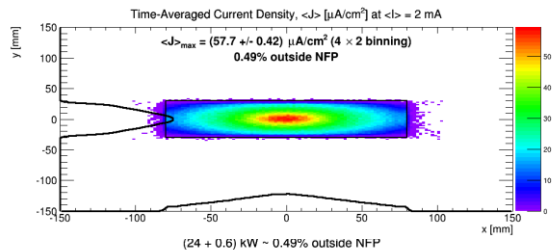
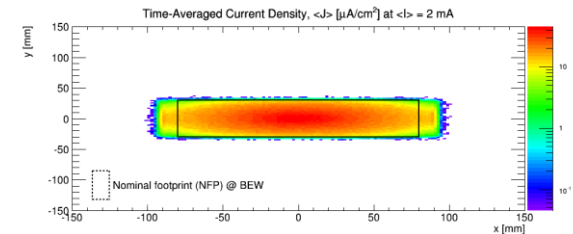
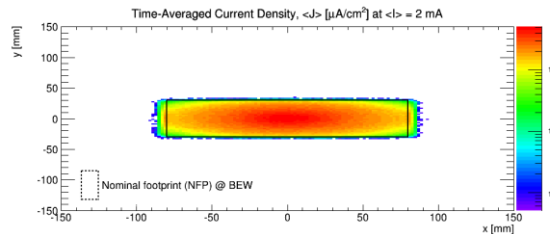
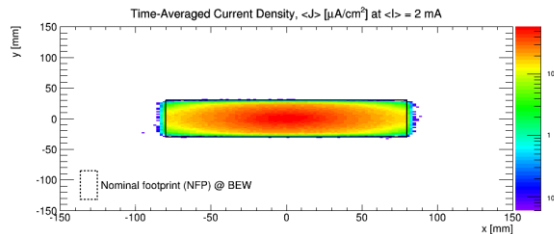


BEAM PROFILES (BP)

Target = $58 \mu\text{A}/\text{cm}^2$
PBW = $90 \mu\text{A}/\text{cm}^2$
Outside = 0.5 %

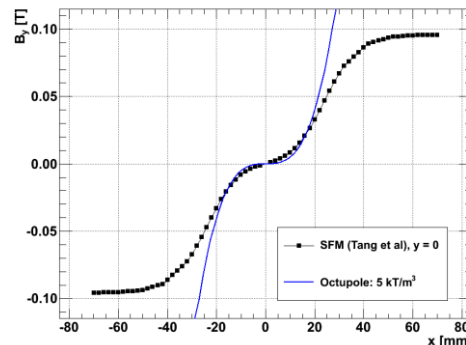
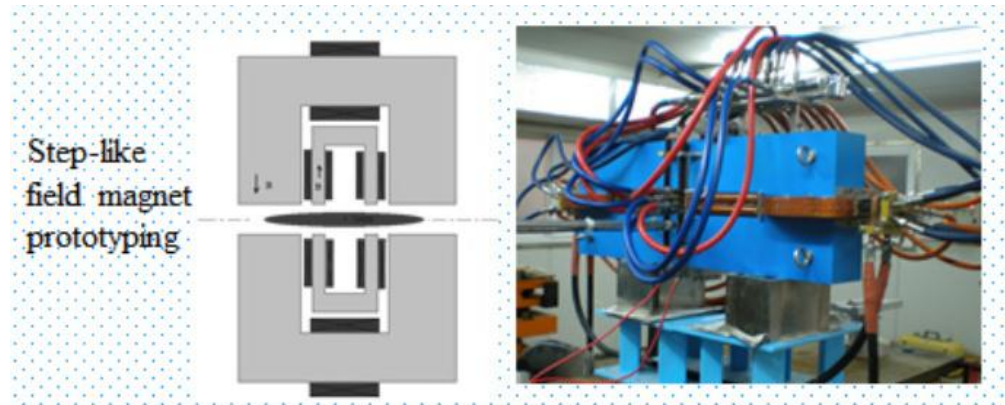
Target = $49 \mu\text{A}/\text{cm}^2$
PBW = $77 \mu\text{A}/\text{cm}^2$
Outside = 2.7 %

Target = $44 \mu\text{A}/\text{cm}^2$
PBW = $68 \mu\text{A}/\text{cm}^2$
Outside = 7.4 %



STEP FIELD MAGNETS – "A DIFFERENT OCTUPOLE"

- › Expected to be used at CADS¹, IFMIF², CSNS¹
- › A prototype has been built at IHEP (Institute for High Energy Physics, Beijing, CN)²
- › Field measurements have been done¹



$$B_y = \frac{B_0}{1 + e^{-b(|x| - x_0)}}$$

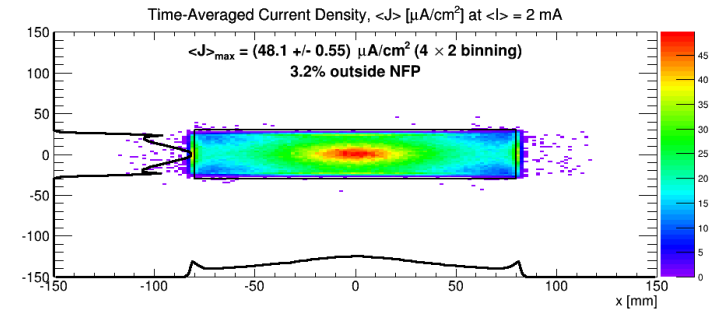
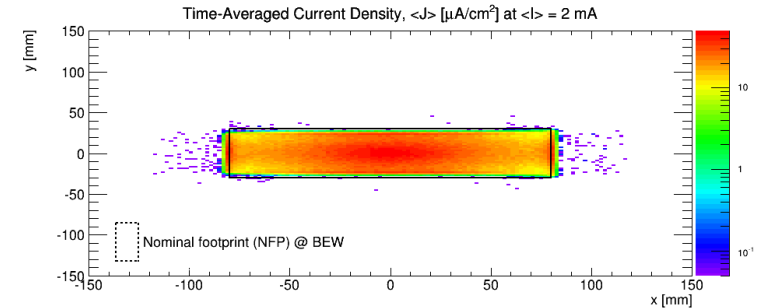
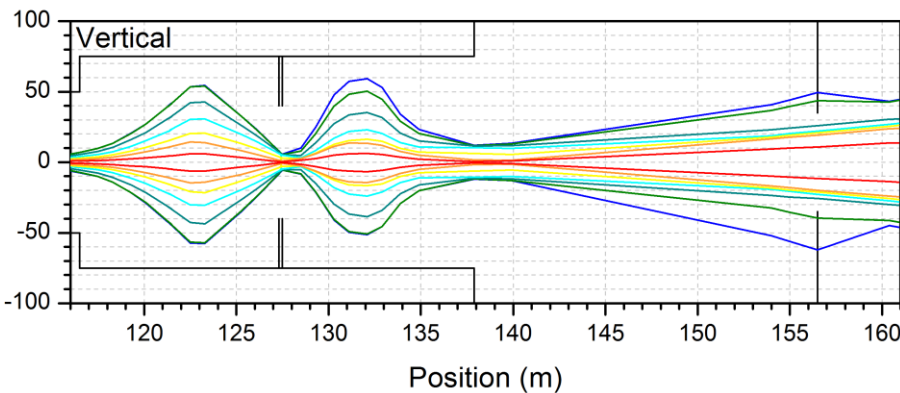
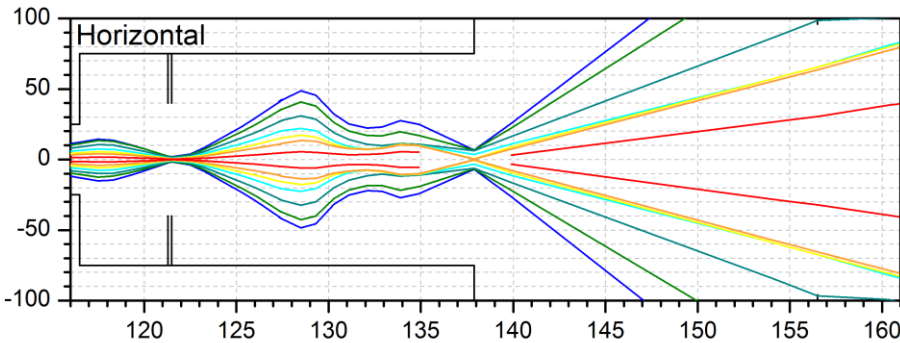
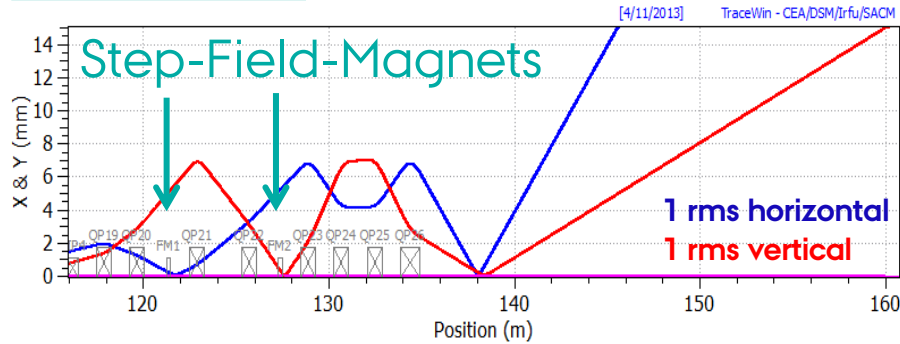
$B_0 = 0.08, x_0 = 15, \text{ and } b = 0.5$

¹ J.Y. Tang, H.H. Li, S.Z. An et al, Distribution transformation by using step-like nonlinear magnets, Nucl. Meth. Phys. Res, A532/3 (2004) 538-547

² Z. Yang, J.Y. Tang, P.A. Phi Ngien, N. Chauvin, HB2012, WEO3B05

A2T WITH SFM

- > Loss @ Collimator = 220 W
- > PCD @ target = $48 \mu\text{A}/\text{cm}^2$
- > PCD @ PBW = $74 \mu\text{A}/\text{cm}^2$



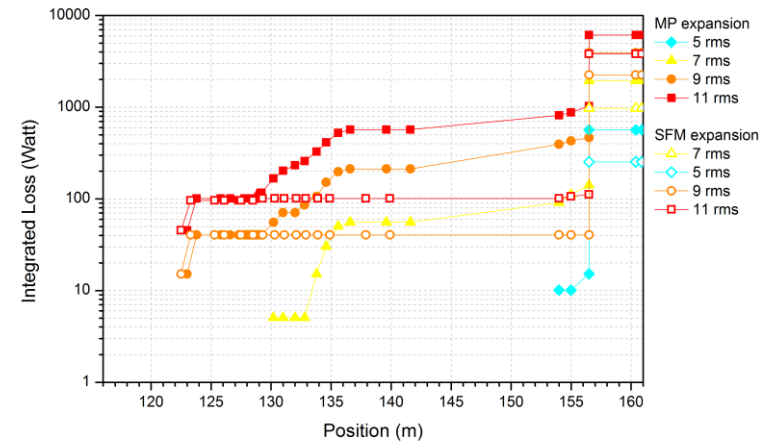
FUTURE STUDIES...

- > Stability of MP *versus* SFM
- > Halo size
- > Emittance
- > Misalignment

Particle Envelopes

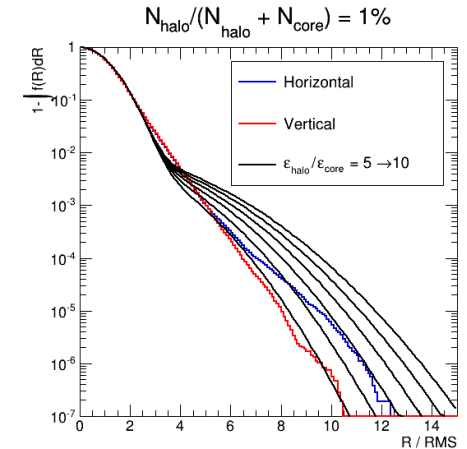
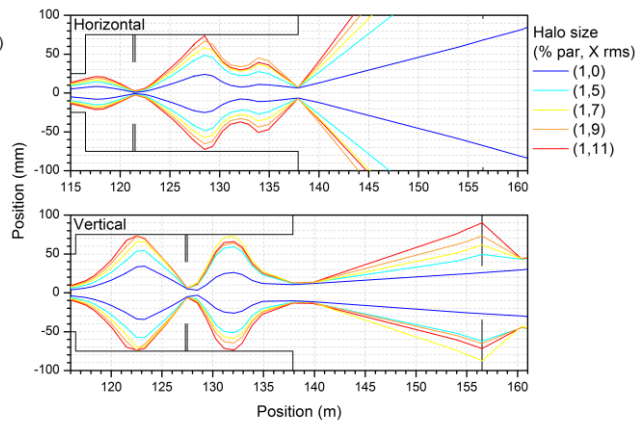
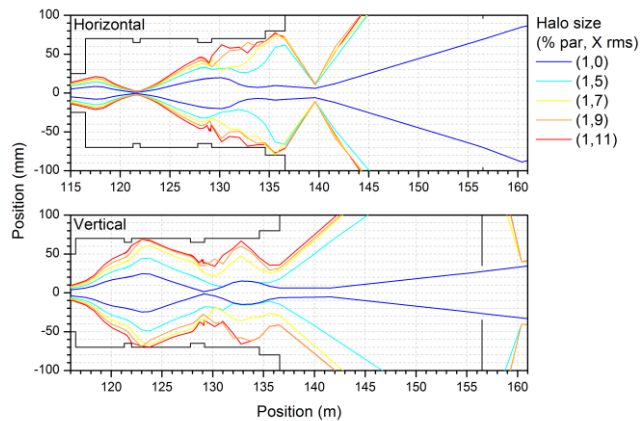
(Multi-particle calculations of 1.000.000 particles)

- > MP: Loss with 7 rms halo
- > SFM: Loss with 9 rms halo



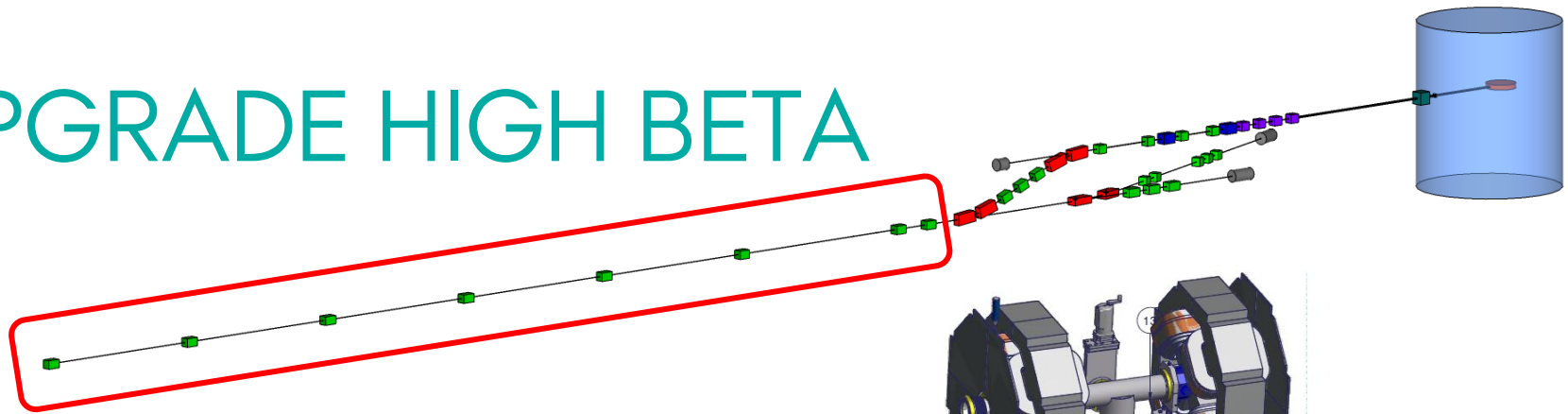
Octupole solution

Step-field magnet solution

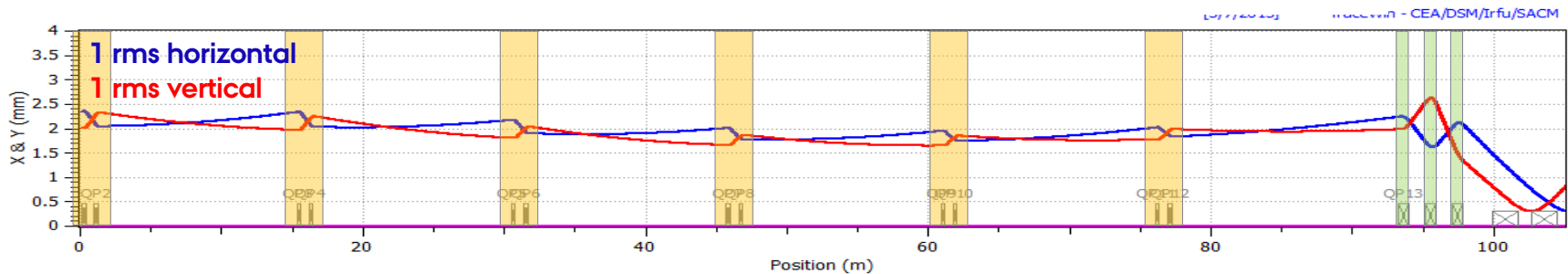
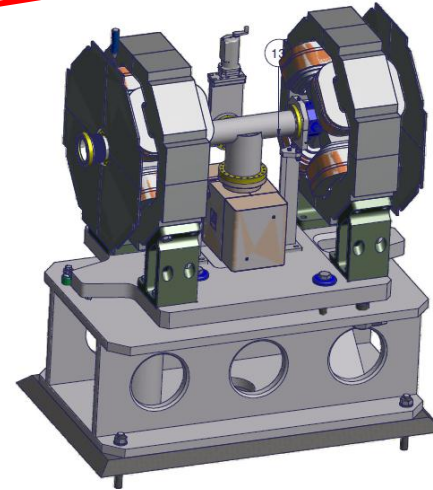


THE END

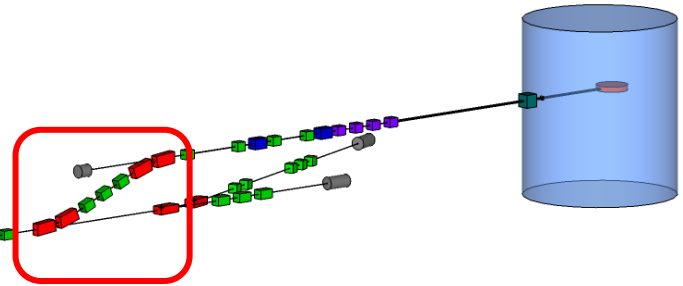
UPGRADE HIGH BETA



- > Linac focusing structure
→ Linac Warm Unit
- > <Phase advance> = 30 deg



UPGRADE HIGH BETA



> Elevation = 4.5 m

[3/7/2013] TraceWin - CEA/DSM/Irfu/SACM

