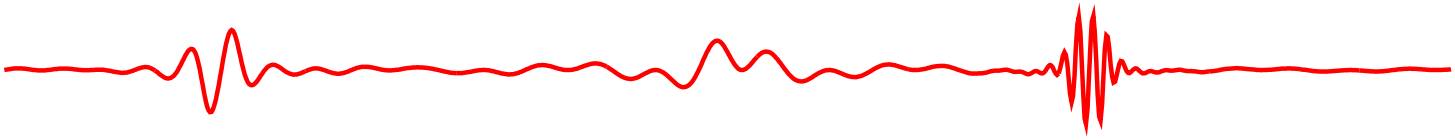
First thoughts on IR optics for the FCC-hh



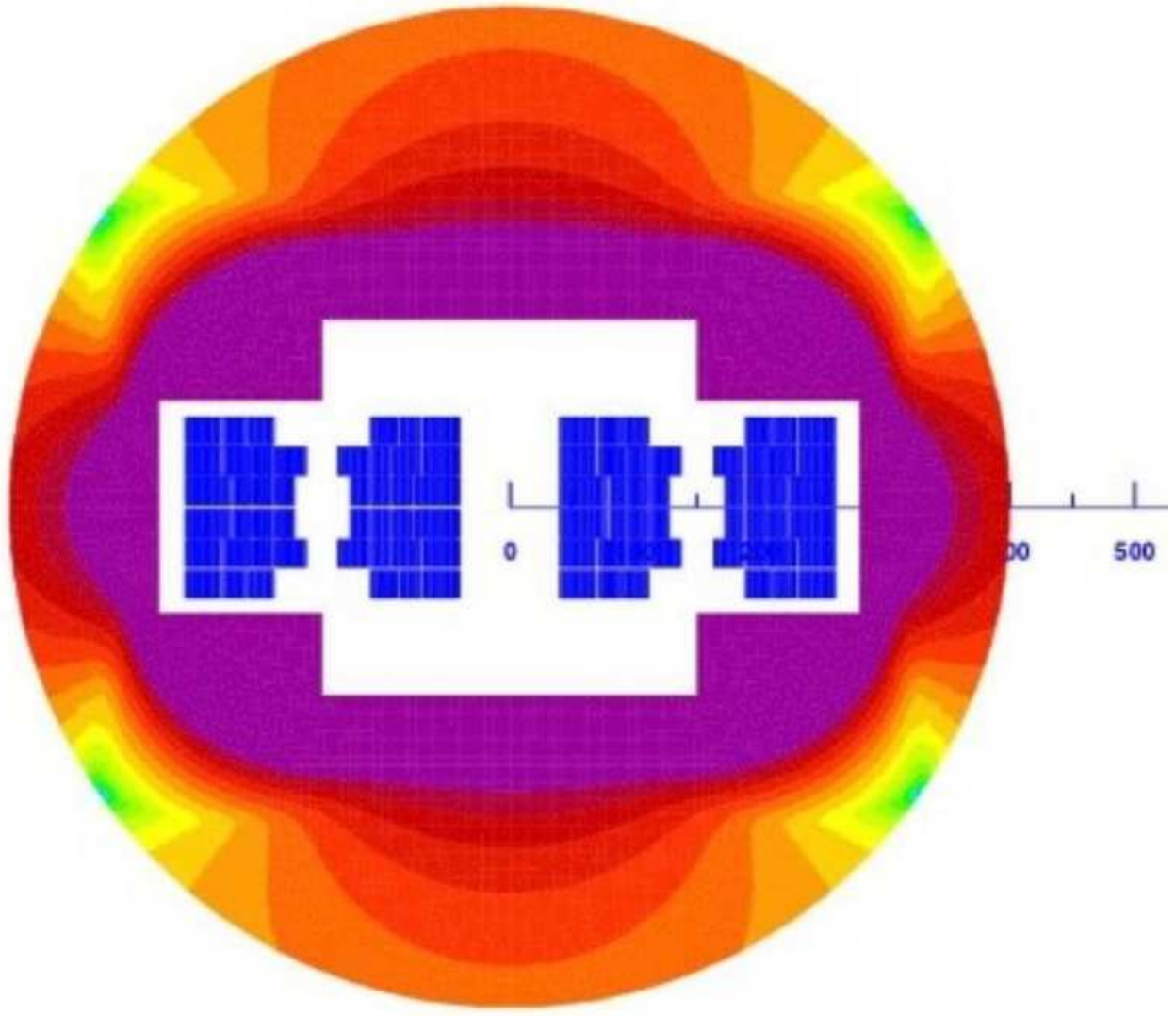
R. Tomás

FCC kick-off meeting, February, 2014

Contents

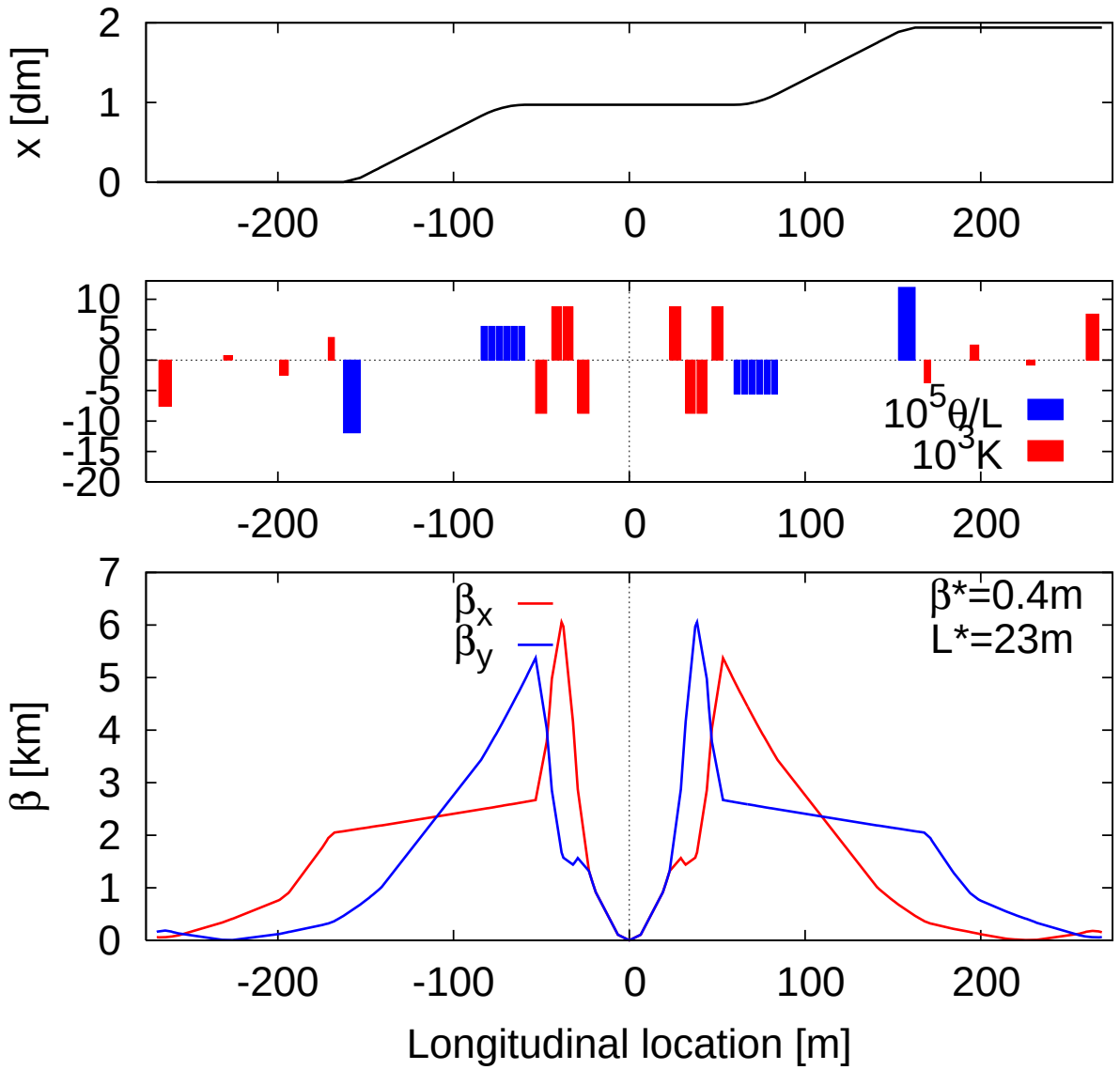
- Nominal LHC IR optics
- Scaling rules
- FCC-hh IR optics from Nominal LHC
- FCC-hh IR optics from HL-LHC
- Summary and outlook

Magnet design

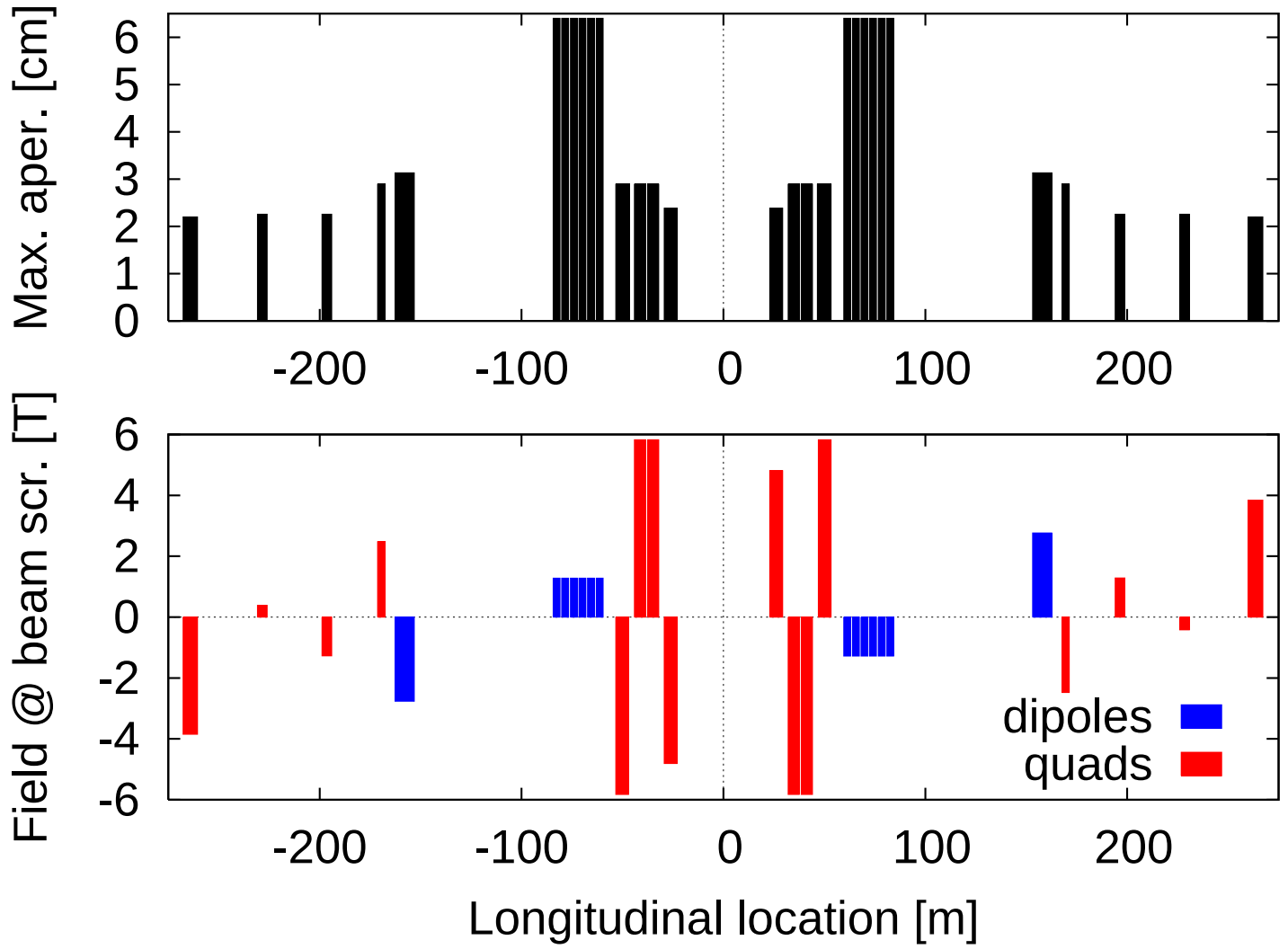


Important: beam separation 30 cm (bs_{50}).

Starting point: LHC IR optics I



Starting point: LHC IR optics II

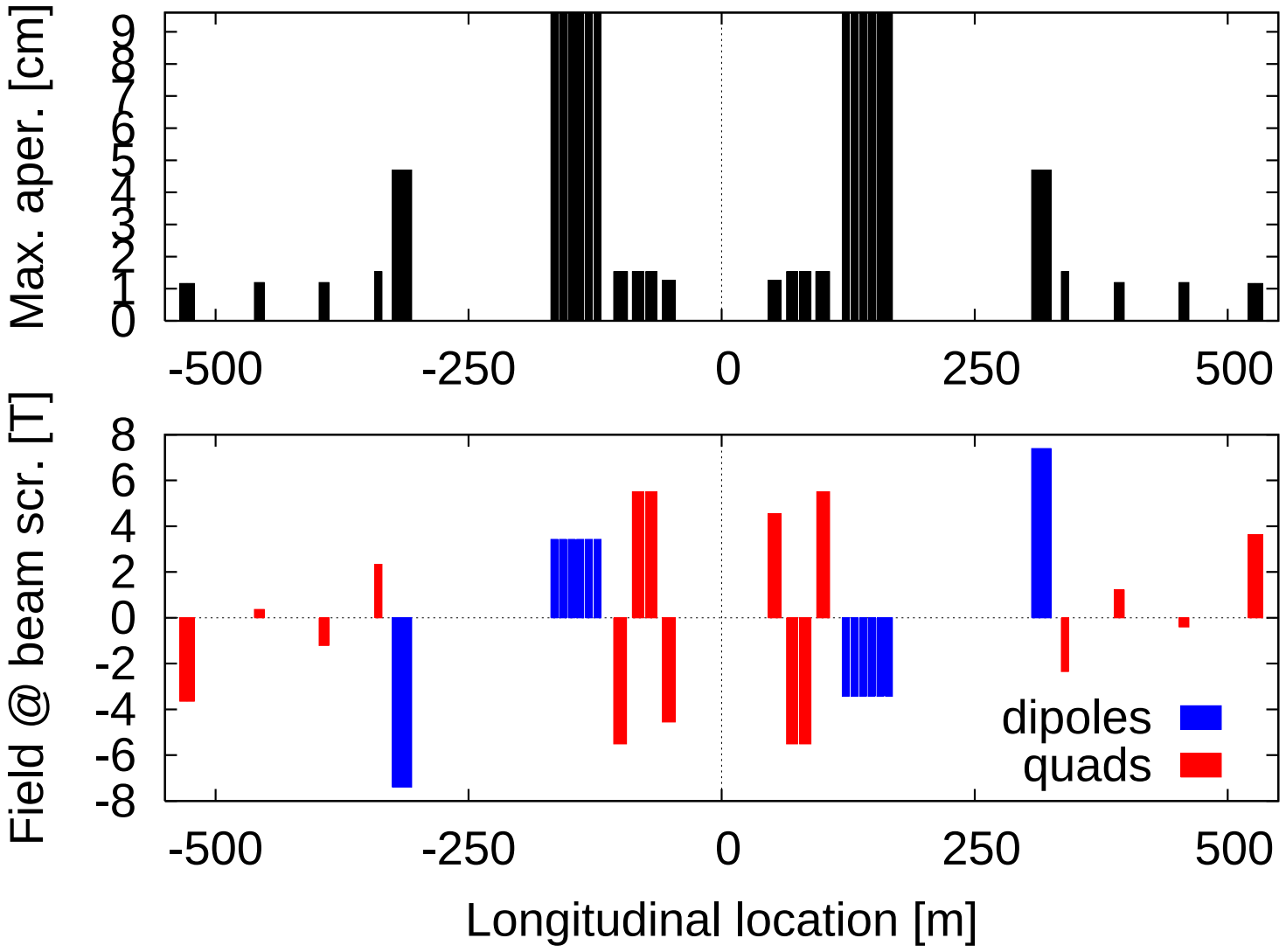


Note first dipole is normal conducting.

Scaling

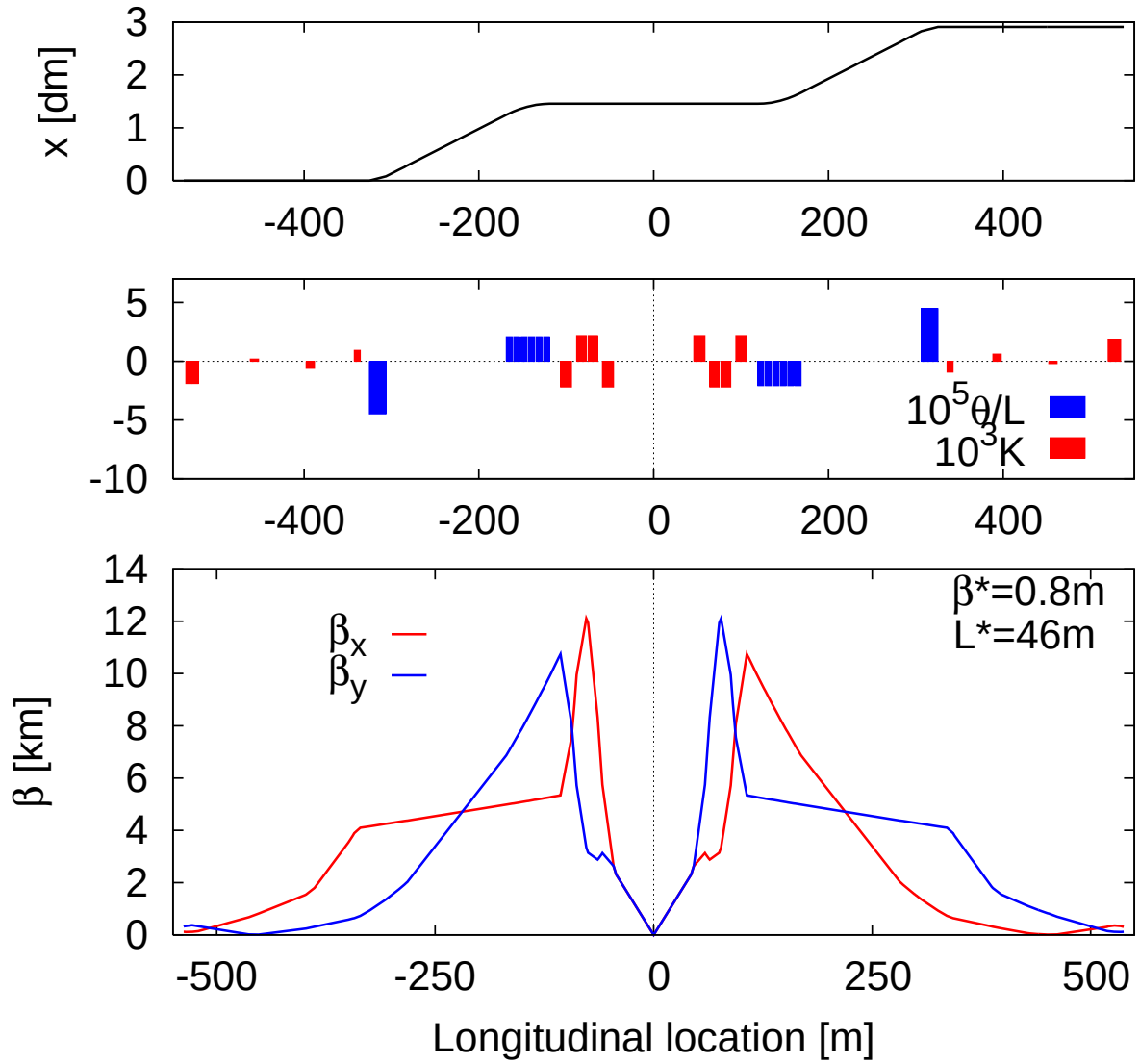
- Scale all lengths by factor f,
- all quadrupole gradients by $f^{-2}50/7$,
- quadrupole apertures by $\sqrt{f7/50}$
- peak quadrupole field $f^{-3/4}\sqrt{50/7}$
- dipole angles strongly dependend on beam1-beam2 separation (bs_{50})
- dipole field scales with $f^{-2}50/7 \times bs_{50}/bs_7$
- reasonable range for $f \in [1.5,\ 3]$

FCC-hh IR from LHC $f = 2$

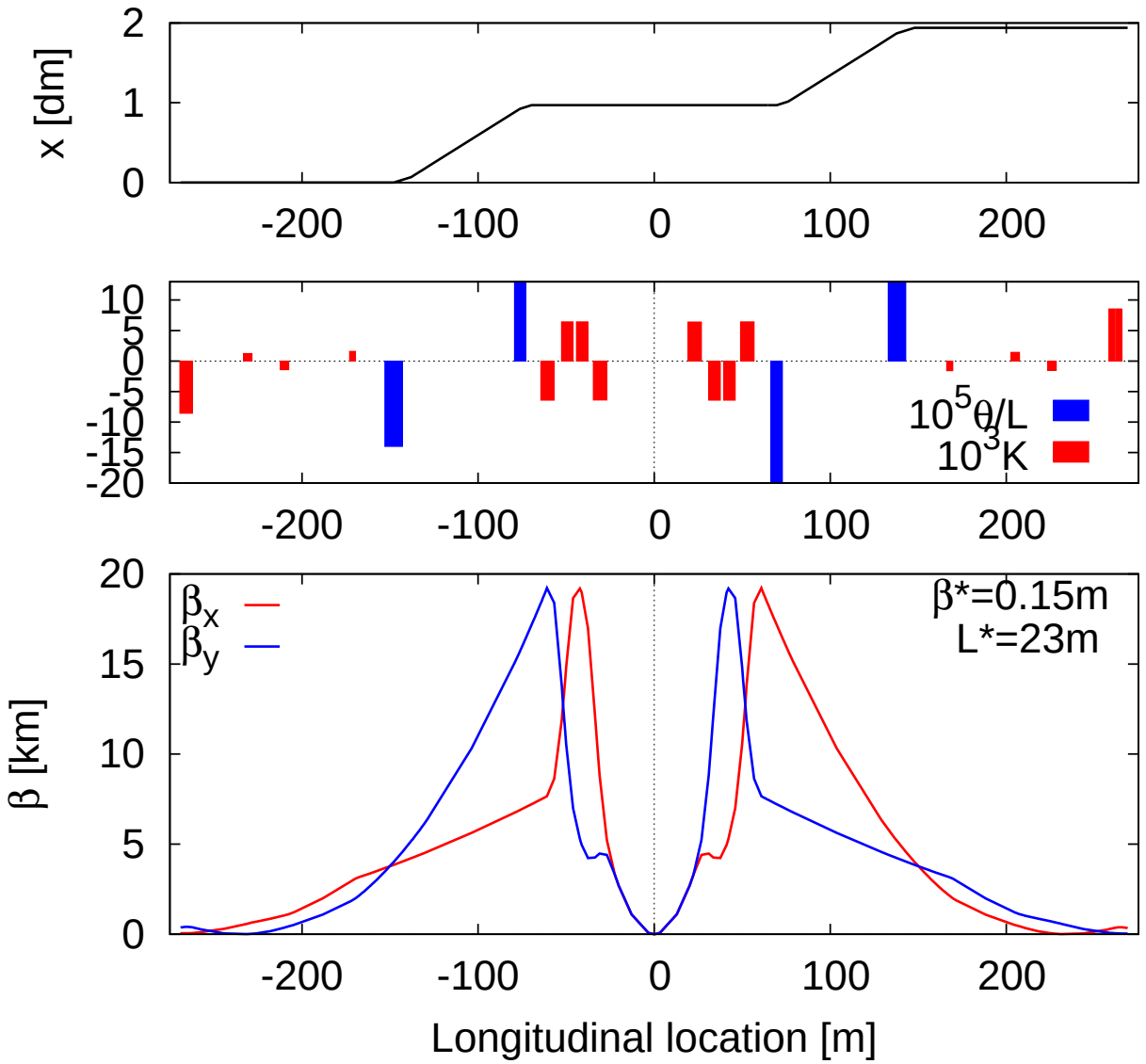


Technology of first dipole?

FCC-hh IR from LHC, $f = 2$

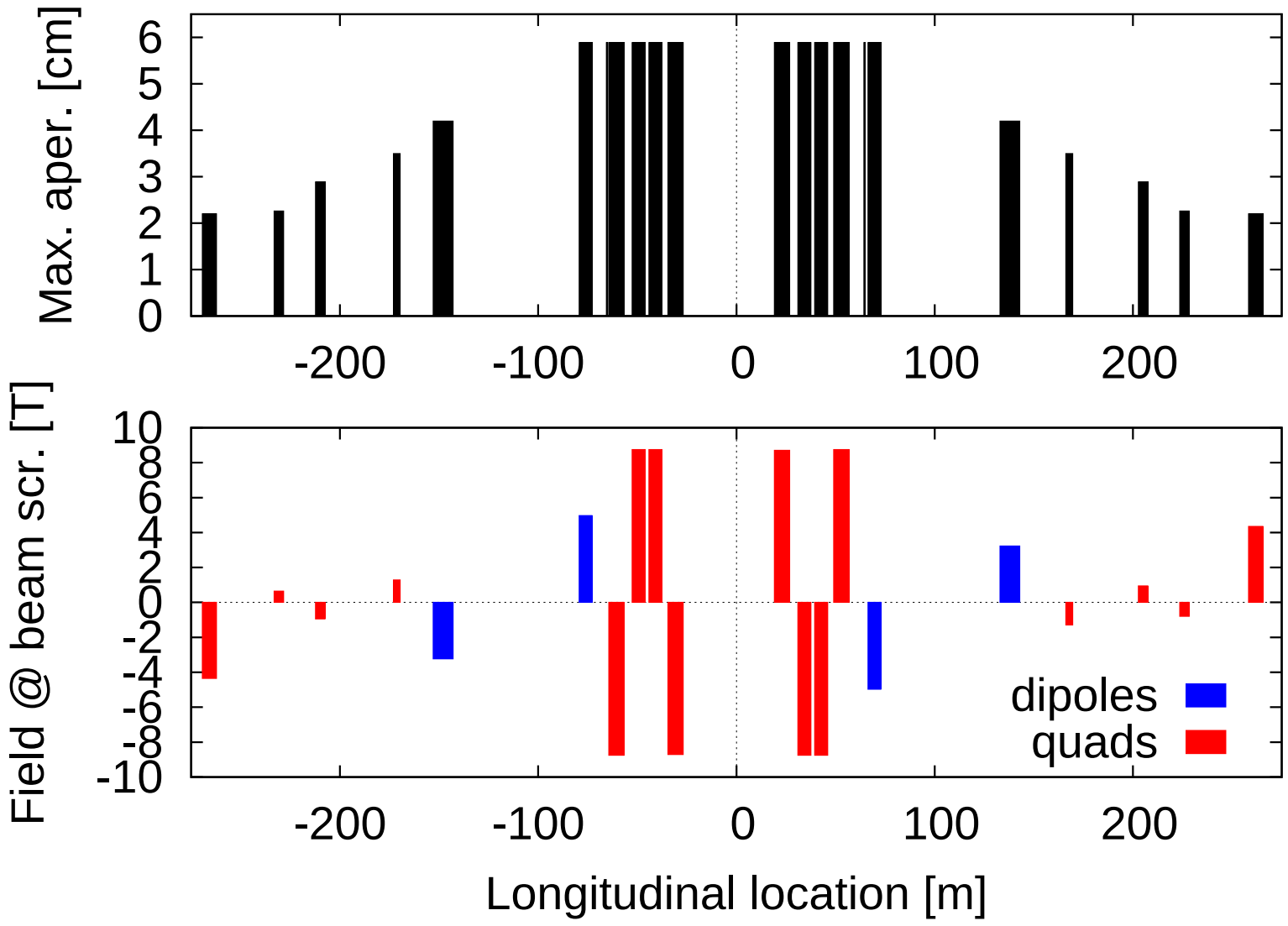


Starting point: HL-LHC IR optics I

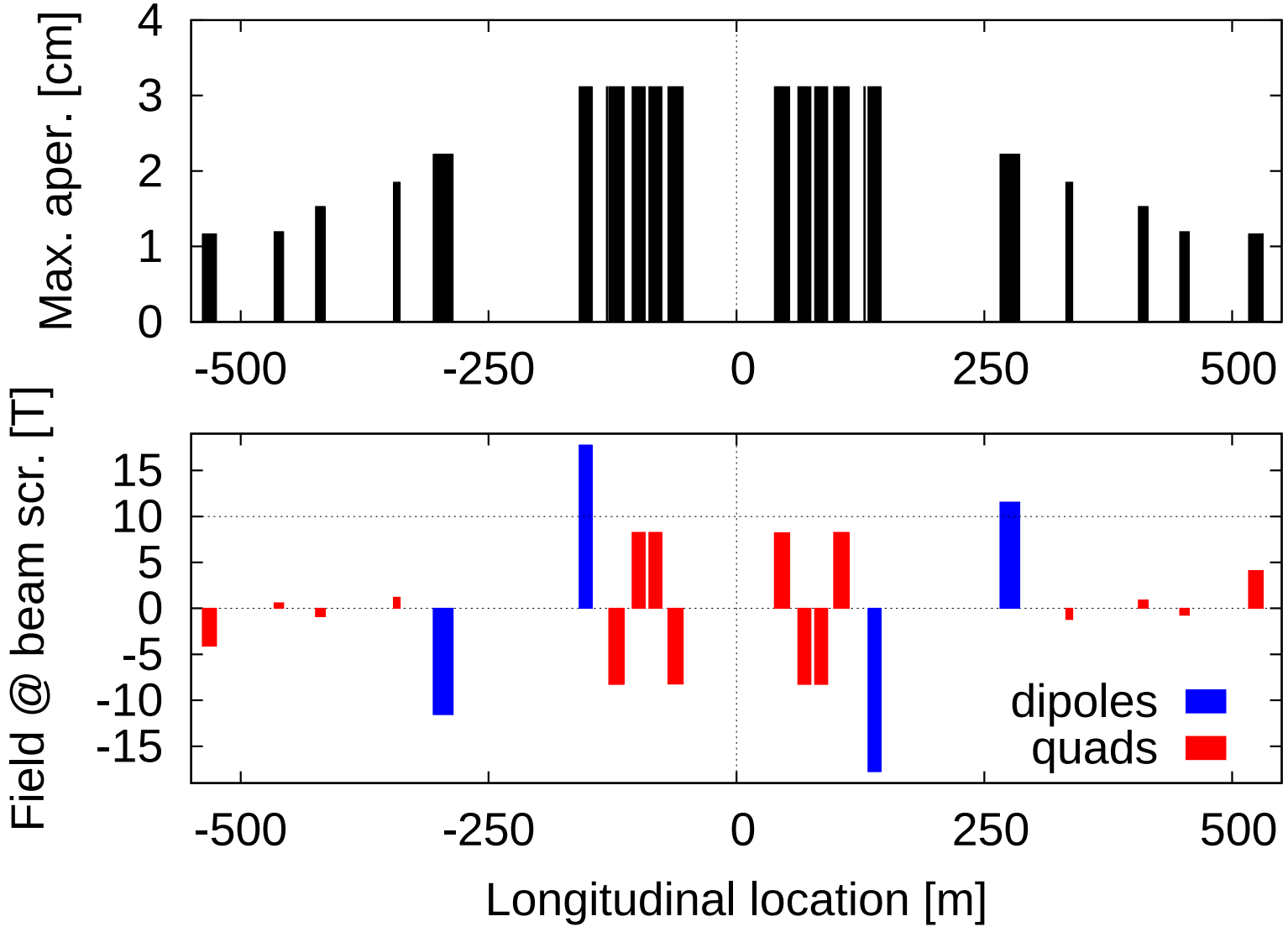


ATS optics, S. Fartoukh, Phys. Rev. ST Accel. Beams **16**

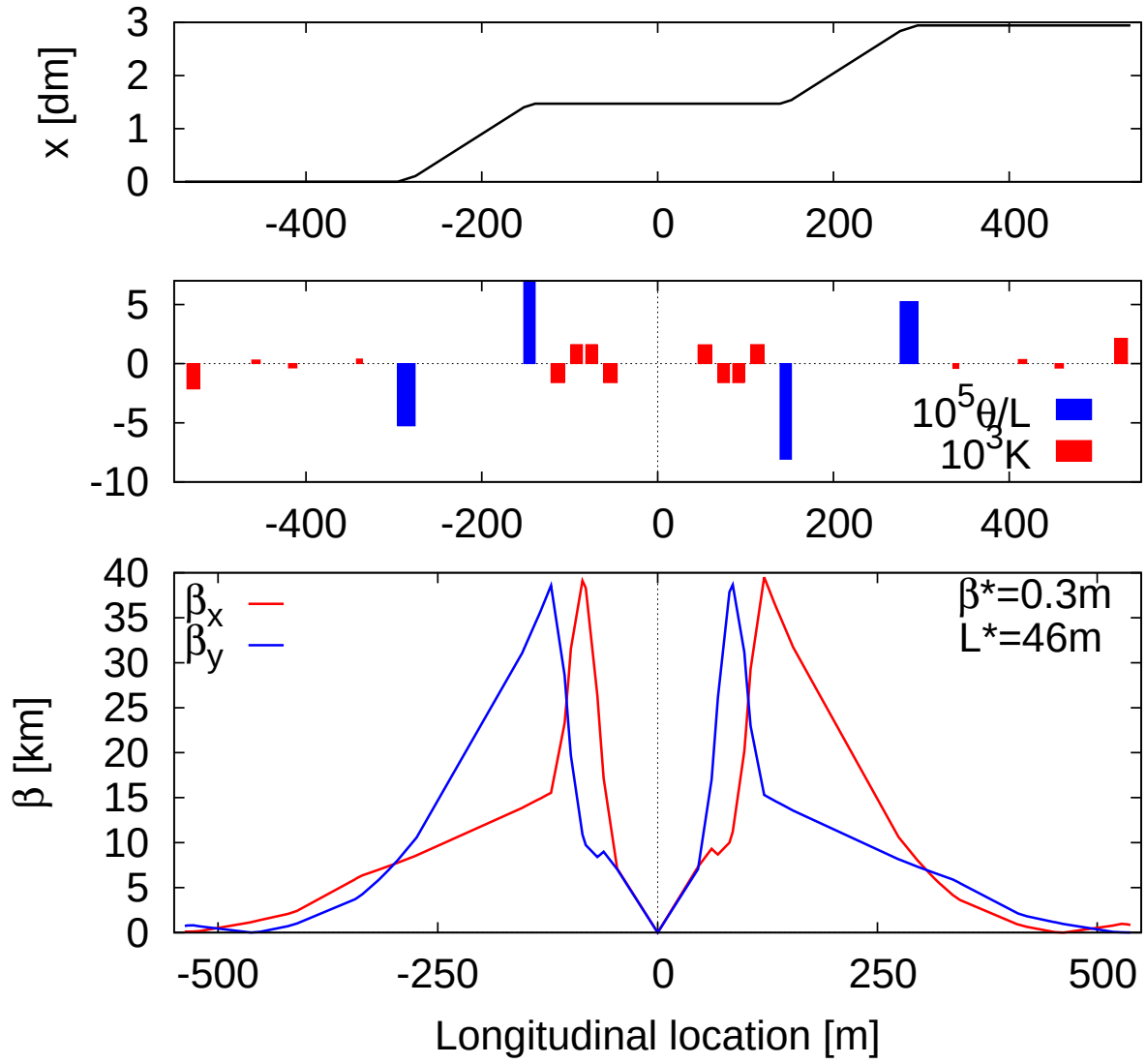
Starting point: HL-LHC IR optics II



FCC-hh IR from HL-LHC $f = 2$



FCC-hh IR from HL-LHC, $f = 2$



Summary and outlook

- ⋆ Direct scalings from LHC or HL-LHC between a factor $[1.5, 3]$ produce reasonable starting points.
- ⋆ Many critical R&D tasks: magnet feasibility, beams separation, energy deposition from IP debris, technology choice, e-cloud, beam-beam long-range, synchrotron radiation, beam emittances, flat beams, crab cavities, wire compensation, e-lens, etc.
- ⋆ A factor of 2 produces β^* of 0.8 m or 0.3 m, already challenging but
- ⋆ *let's target β^*=0.1 m to explore alternative operational modes with reduced SR power!*