On rf issues of LHC Phase II Rotary Collimator

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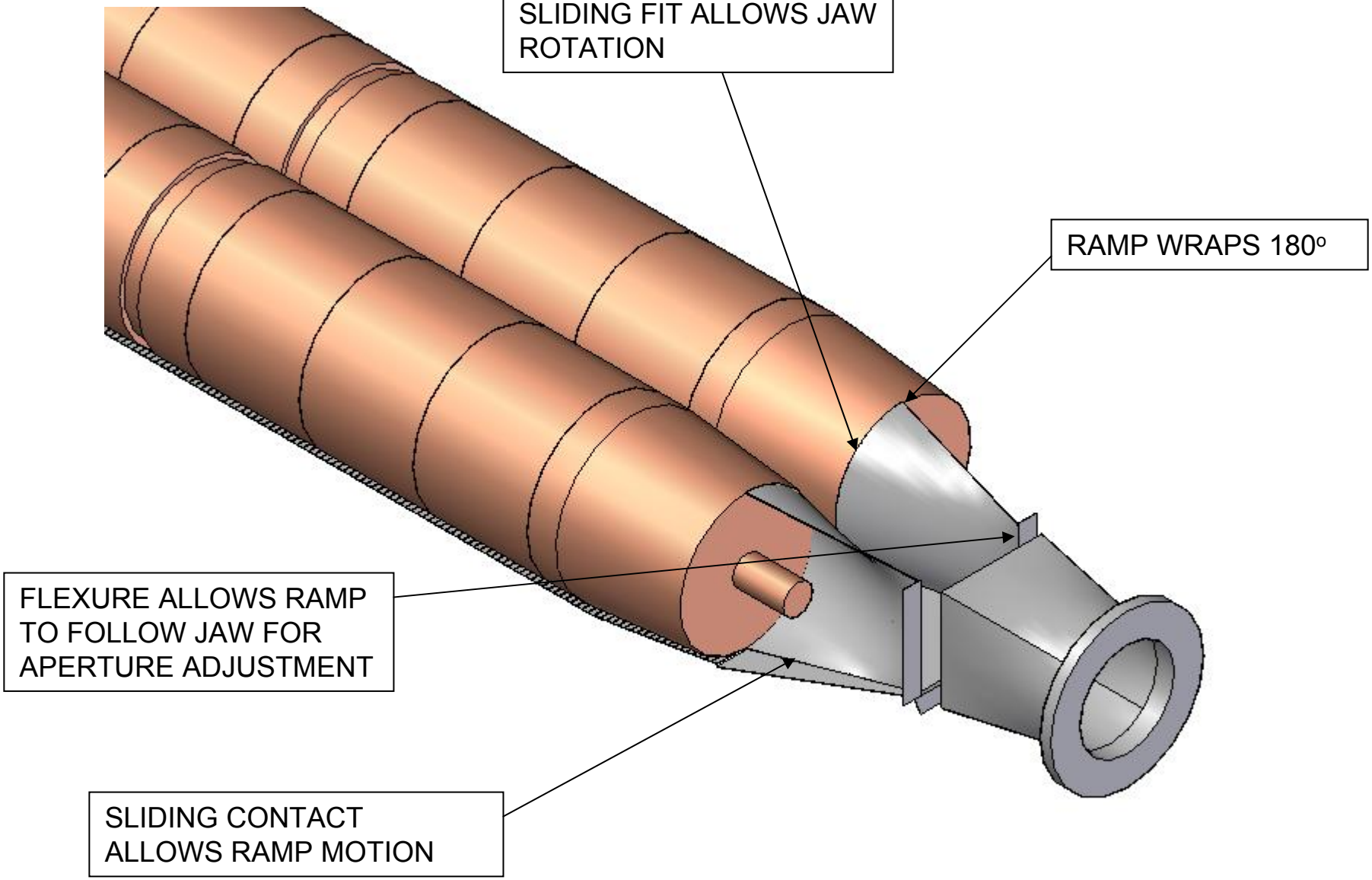
Outline

- Rough estimates based on simple formula and/or experience with LHC Phase I collimator is given on following issues:
- BB impedance of the grooves
- Monopole modes (rf heating)
- Dipole modes (transverse beam stability)

Detailed study is necessary to give numbers.


SLIDING FIT ALLOWS JAW ROTATION
RAMP WRAPS 180°
FLEXURE ALLOWS RAMP TO FOLLOW JAW FOR APERTURE ADJUSTMENT
SLIDING CONTACT ALLOWS RAMP MOTION

BB impedance of the grooves

- There are 8 grooves g x d = 0.5x6mm
  and one groove g x d = 16x4.1mm.
  Minimum gap 2*b = 1 mm. (0.5 mm in CDR)
- Longitudinal BB impedance of 1mm gap in TSDQ:
  $Z/n \sim 30\mu\Omega$ for b = 5mm. (from GdfidL)
  Estimate for one groove $Z/n \sim 100\ \mu\Omega$.
- Estimates based on A.Chao's book formula for circular pipe
  $Z/n = f_0 Z_0 gd/bc = 86\ \mu\Omega$ per groove
  $Z_1 = Z_0 gd/b^3\pi = 2.88\ M\Omega/m$ per groove
- Above formula hold only if g<d<b which is not true but it probably gives an order of magnitude estimates.
- GdfidL simulation can give exact numbers.

Trapped modes

- Monopole modes lowest frequency is cutoff frequency of TM_{11} mode of square waveguide 84x84mm: 1.78 GHz

  - well outside of bunch spectrum: ~0.5 GHz

  - probably less rf heating than in LHC Phase I collimator
- Dipole modes lowest frequency is cutoff frequency of TE_{10} mode of double ridged waveguide (hourglass cross-section) : ~0.4 GHz

  - within bunch spectrum

  - probably the same r/Q as for Phase 1 Collimator but certainly higher Q (Cu) and lower frequency.

  - may have stronger influence on transverse beam stability than Phase I collimator
- HFSS simulations are necessary to give numbers