STOCHASTIC COOLING DEVELOPMENTS FOR THE SPECTROMETER RING (SRING) IN THE HIAF PROJECT AT IMP

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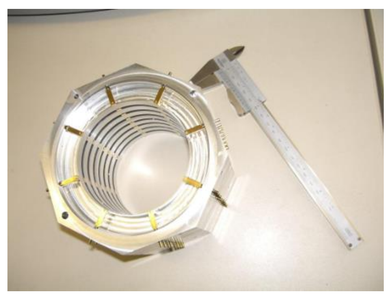
We report on the preliminary design of Slot-ring and Faltin type pickups and kickers for stochastic pre-cooling of rare isotope beams from 625 MeV/u to 840 MeV/u (beta: 0.80-0.85), or from 400 MeV/u to 625 MeV/u (beta: 0.71-0.80), using a bandwidth of 1-2 GHz (or 0.6-1.2 GHz) for Spectrometer ring (Sring) in the HIAF project at IMP. The kicker shunt impedance and signal output phase of Slot-ring and Faltin type are calculated by HFSS. From the simulation results, Slot-ring structure is better for higher beta (0.80-0.85), and Faltin type will be a better choice for beta from 0.71 to 0.80, if the beam aperture is 200 mm*120 mm.

Slot-ring structure (bandwidth: 1-2 GHz, 0.6-1.2 GHz)



(a)

Ceramic thickness 5 mm

(b)

Figure 1: (a) : 8 slot-rings prototype from FZJ; (b): one slot-ring HFSS model with 8 electrodes , cell length=13.5 mm.

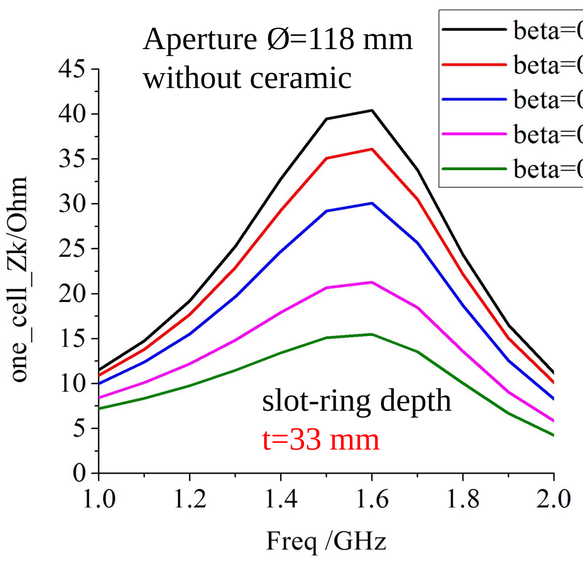


Figure 2: Slot-ring kicker longitudinal shunt impedance per cell when cell length is 13.5 mm.

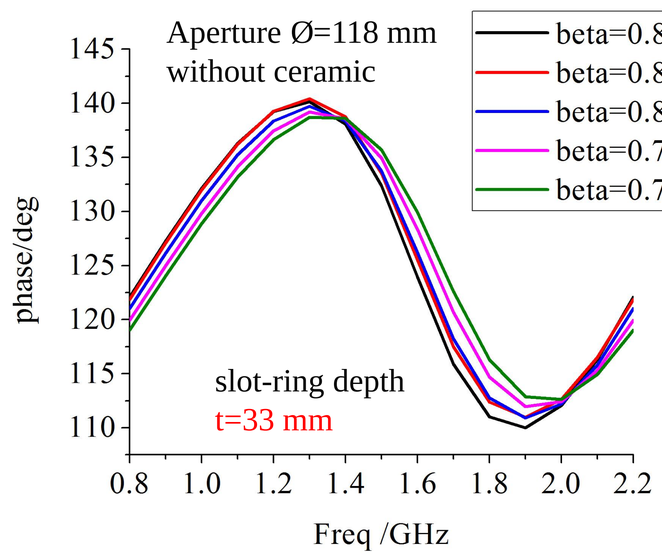


Figure 3: Nonlinear phase deviation when cell length is 13.5 mm.

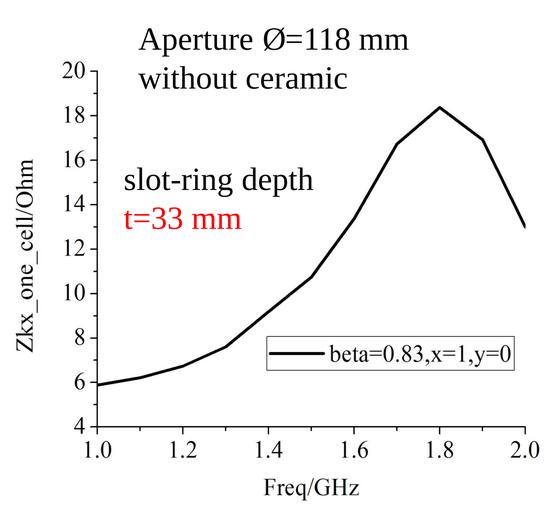


Figure 4: Slot-ring kicker transverse shunt impedance per cell when cell length is 13.5 mm.

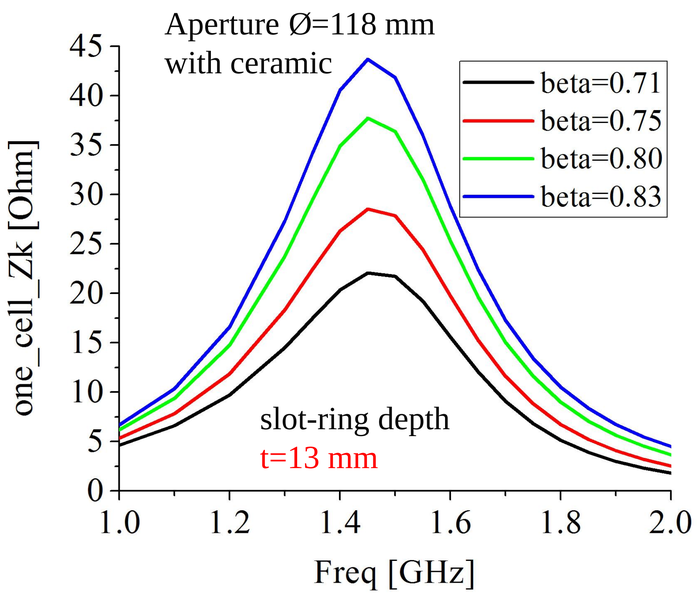


Figure 5: Slot-ring kicker longitudinal shunt impedance per cell with ceramic Ø=118 mm when cell length is 13.5 mm.

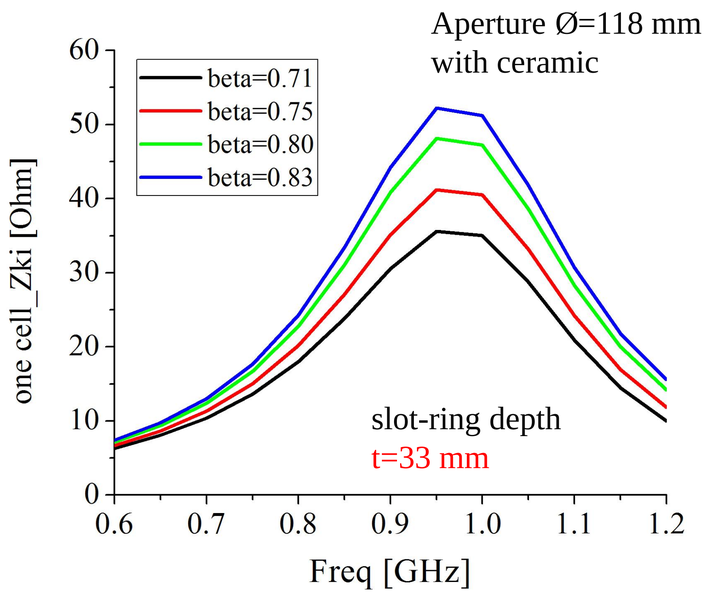


Figure 6: Slot-ring kicker longitudinal shunt impedance per cell with ceramic Ø=118 mm when cell length is 13.5 mm.

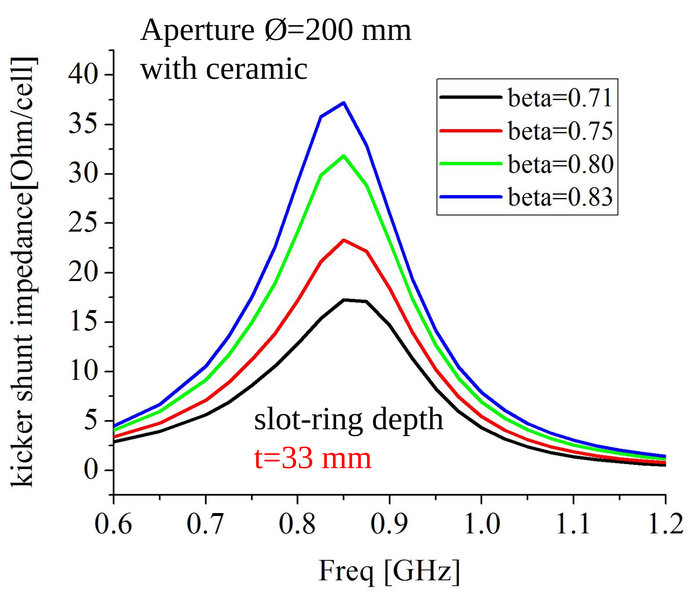


Figure 7: Slot-ring kicker longitudinal shunt impedance per cell with ceramic Ø=200 mm when cell length is 13.5 mm.

Faltin structure (bandwidth: 1-2 GHz, 0.6-1.2 GHz)

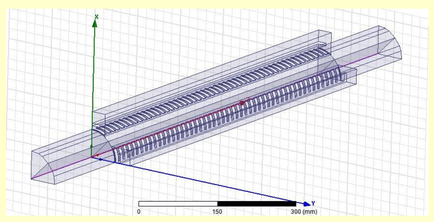


Figure 8: A quarter HFSS simulation model with circular aperture Ø=118 mm, slot section=0.75m.

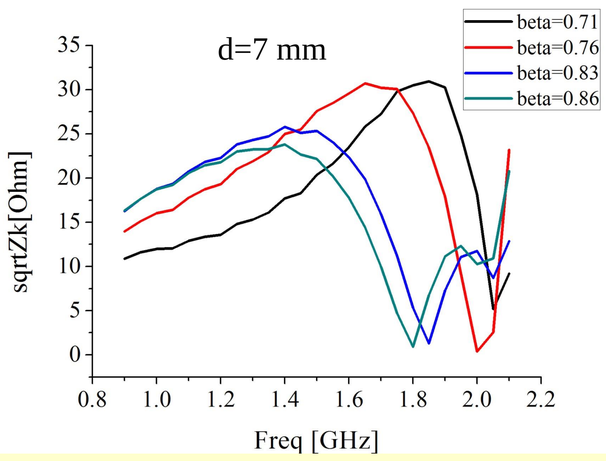


Figure 9: kicker longitudinal shunt impedance of Faltin type ,when the distance from electrode to slot is 7 mm.

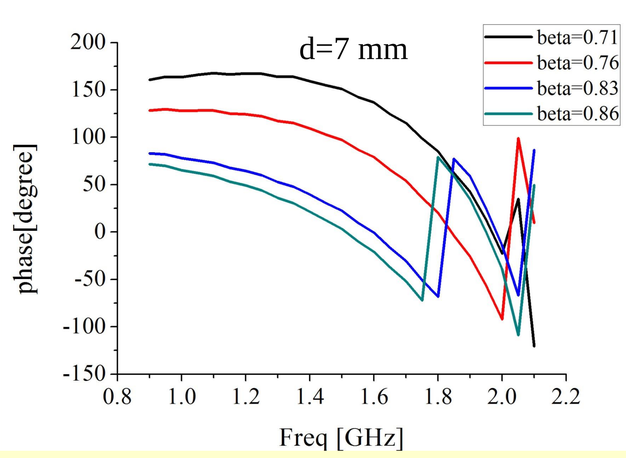


Figure 10: Nonlinear phase deviation when d=7 mm.

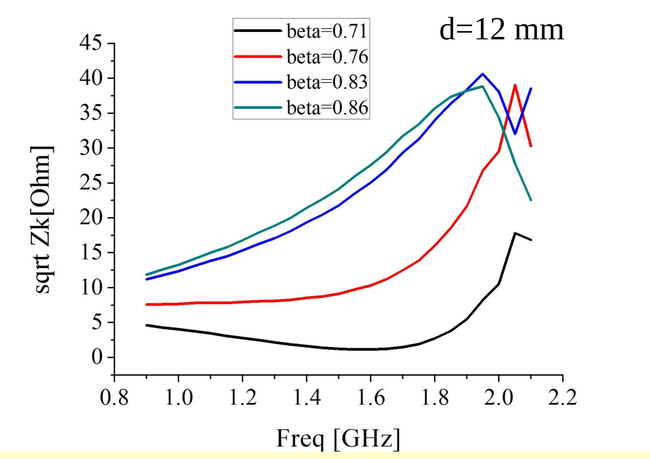
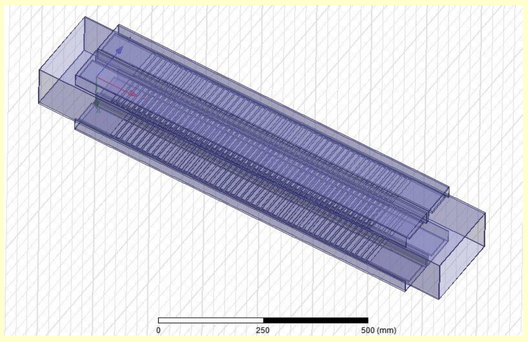
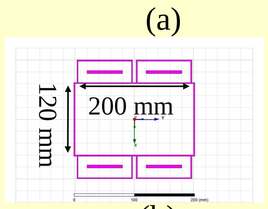


Figure 11: kicker longitudinal shunt impedance of Faltin type, when the distance from electrode to slot is 12 mm.



(a)



(b)

Figure 12 (a): A full HFSS simulation model with rectangular aperture 200*120 mm, slot section=0.75 m; (b): cross section.

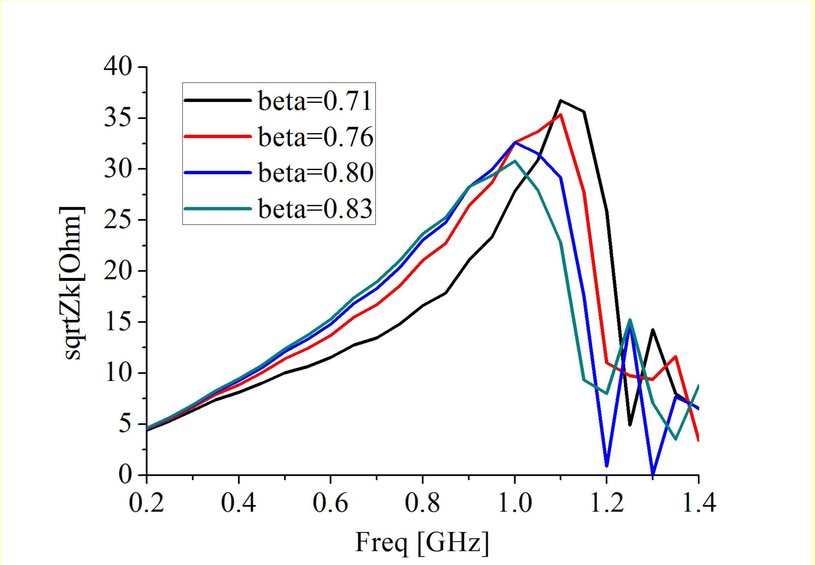


Figure 13: kicker longitudinal shunt impedance of Faltin type with 0.75 m, when rectangular aperture is 200*120 mm.

Conclusion:

- **If aperture diameter is 118 mm, slot-ring structure will be better for HIAF (see Fig. 6).**
- **If aperture size is 200mm*120mm, and beam energy is from 400 MeV/u to 625 MeV/u (beta: 0.71-0.80), probably Faltin structure will be chosen (see Fig. 13).**

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