TRIUMF

Poster # WEPCAV009

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Conceptual Design Of Balloon Double Spoke Resonator

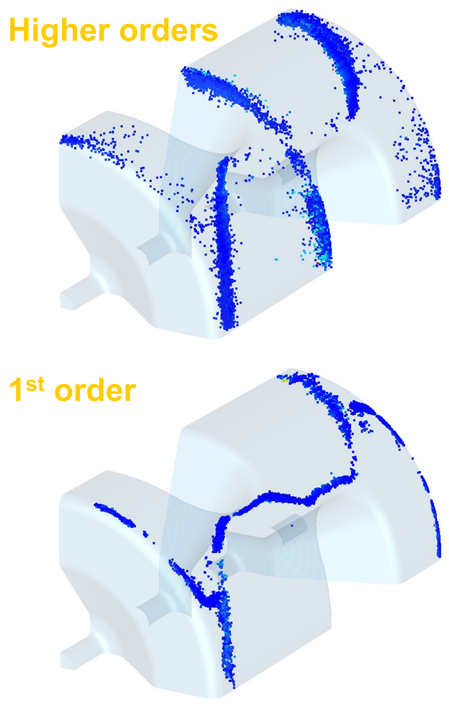
Z. Yao, R. E. Laxdal, TRIUMF, Vancouver, Canada

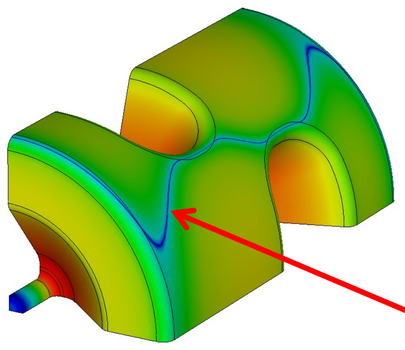
Summary

The balloon variant of the spoke resonator was proposed to eliminate the intensive multipacting barriers around the operating field level by modifying the local electro-magnetic fields. The prototyping of a 325MHz beta=0.3 single spoke resonator (SSR) had demonstrated the principle of the balloon concept. To extend the benefits of the balloon variant to multi-spoke resonators, this poster discusses a conceptual design of a 325MHz beta=0.5 balloon double spoke resonator (DSR).

The geometry features of the balloon SSR are compatible with DSR and move the multipacting barriers to the lower gradient regime. Due to the more complicated structure of DSR, the surface magnetic field uniformity along the null electric field line is required to be optimized. Contrasted with SSR, the balloon DSR can not be optimized on both multipacting and RF aspects. Our discussion ends up with two optimized balloon models. One is designed to constrain MP barriers in the lower field level with degraded RF performance, and the other is optimized to achieve high RF performance with relatively broader MP barriers. Comparing to the conventional DSR, both balloon designs have narrower MP barriers and avoid the operating gradient.

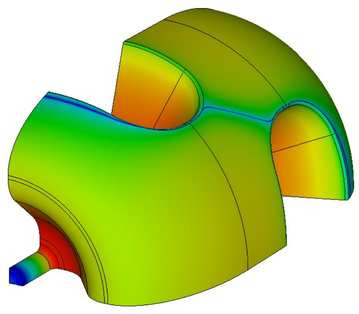
Baseline to Balloon



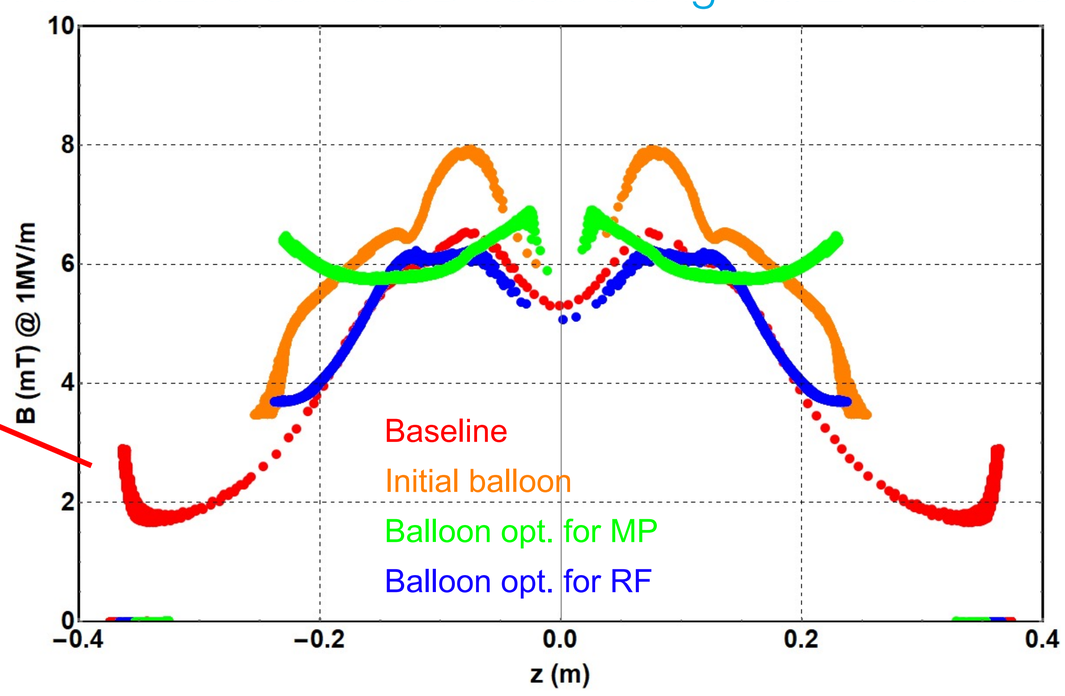


- 1st order barrier locates along the surface null E-field line. Lower gradient part of barrier is accompanied by higher B-field.
- Higher order barriers
  - Central region – 0.5-0.7MV/m
  - End regions – 1.5-3.9MV/m

- Apply balloon concept to baseline
- Geometry modifications
  - Elliptical curved surface for end shells
  - Minimal fillet radius for spoke roots



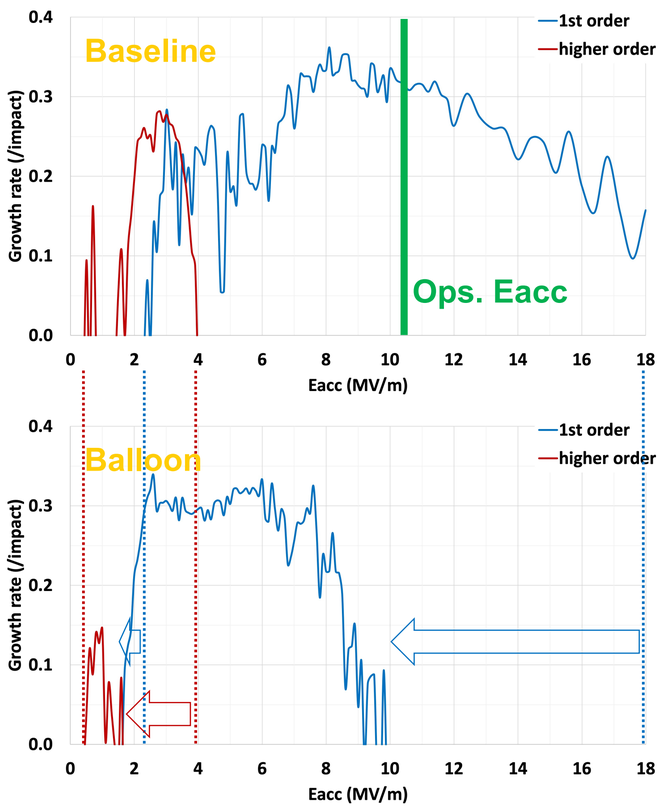
Normalized surface B-fields along null E-field lines



RF Parameters

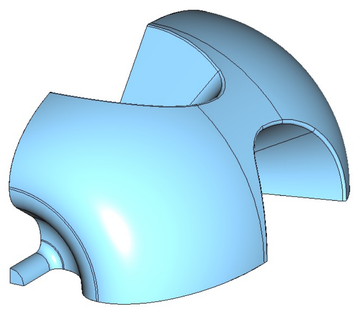
Parameter	Unit	Baseline	Balloon - MP	Balloon - RF
Ep/Eacc		3.35	5.06	3.53
Bp/Eacc	mT/(MV/m)	7.69	7.73	7.05
G	Ohm	123	112	125
R/Q	Ohm	447	382	410

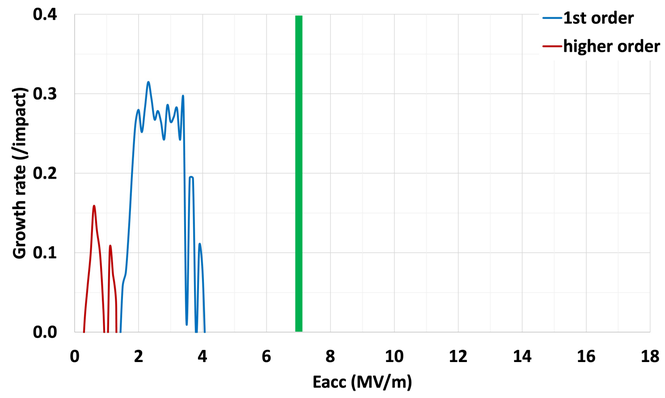
Comparison



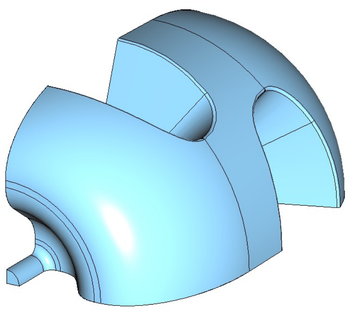
- Higher order barriers in end regions move to 0.5-1.6MV/m, overlap with those in central region
- 1st order barrier
- Null E-field line moves closer to spoke roots (higher B-field)
- Both edges of barrier move to lower field
- Require uniform B-field on null E-field line to further squeeze barrier

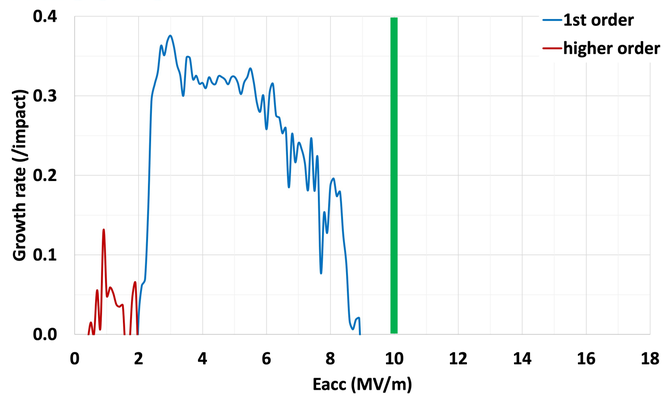
Balloon DSR Optimized for MP





Balloon DSR Optimized for RF





Discovery, accelerated