

Efficient Low-Beta H-Mode Accelerating Structures with PMQ Focusing

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We are developing high-efficiency room-temperature RF accelerating structures for beam velocities in the range of a few percent of the speed of light by merging two well-known ideas: H-mode cavities and the transverse beam focusing with permanent-magnet quadrupoles (PMQ). Combining electromagnetic 3-D modeling with beam dynamics simulations and thermal-stress analysis, we have found that the H-mode structures with PMQ focusing provide a very efficient and practical accelerator for light-ion beams of considerable currents. Such accelerating structures following a short RFQ can be used in the front end of ion linacs or in stand-alone applications such as a compact deuteron-beam accelerator up to the energy of a few MeV.

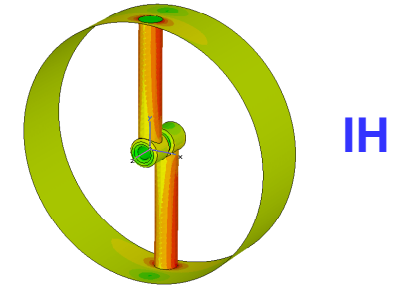
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RT H-PMQ Structures

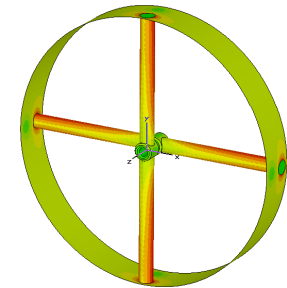
- Very efficient at $\beta \leq 0.1$ (0.4) : 10-20 x DTL
 - **IH** (Inter-digital H-resonator) structure - $TE_{11(0)}$ (dipole) mode.
 - **CH** (Cross-bar H-resonator) structure - $TE_{21(0)}$ (quadrupole) mode.
- Small transverse size : (1/3-1/5) x DTL
- Transverse beam focusing in H-structures:
 - Quad triplet insertions (KONUS BD) interrupt structure $\rightarrow Z_{sh}$ is reduced.
 - Insert PMQ into H-cavity small DT \blacktriangleright H-PMQ.

Results of our combined 3-D EM, beam-dynamics, and engineering analysis of H-PMQ structures will be presented.

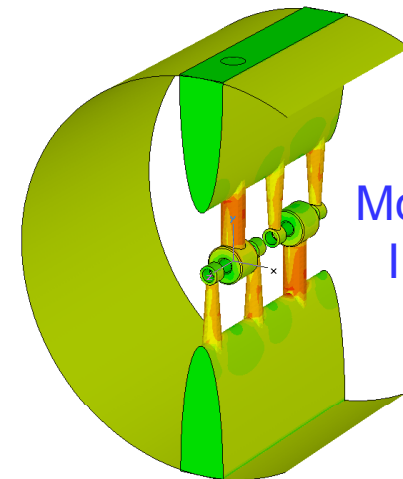
Example: modified IH1-3 structure for $\beta_g = 0.04$ with large DT with PMQ and slim DT without PMQ; $Z_{sh} T^2 = 712 \text{ M}\Omega/\text{m}$. \blacktriangleright



IH



CH

Modified
IH1-3