Novel beam dynamics design using SC QWRs for ANURIB facility

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **16**, 052001 (2013)

Alternate phase focusing in sequence of independent phased resonators as superconducting linac boosters

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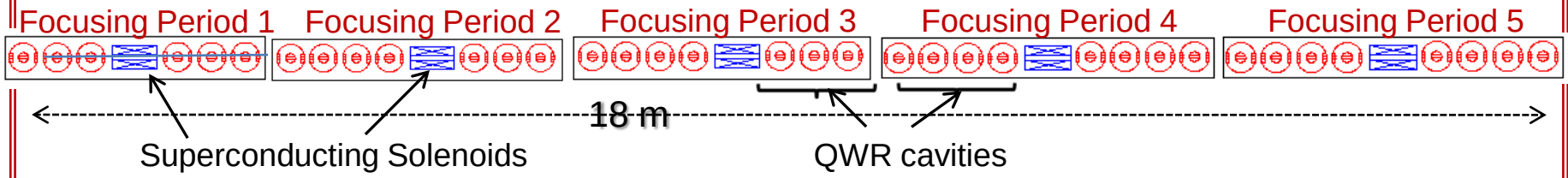
(Received 30 May 2012; published 20 May 2013)

Theoretical study of an alternate phase focusing (APF) structure, realized in a long chain of double gap quarter wave resonators, capable of accelerating heavy ions from 1.3 to 7 MeV/u has been carried out. Mathieu-Hill stability analysis for the focusing periods consisting of independent resonators with phase variation satisfying square-wave law has been used to evaluate parameters such as the electric field and phase for the resonators. Furthermore, a smooth approximation method taking into account the acceleration in the linac has been employed to find out the rf bucket parameters (energy and phase width acceptance) of the focusing periods. Corroborative particle tracking (longitudinal and transverse) has been carried out using simulated 3D fields for double gap quarter wave resonators (QWR). Steering effects in QWRs over the period have also been studied. In one APF period, the individual phase of resonators changes sign resulting in a vertical steering kick in a particular direction, which is less as compared to the case where all the individual resonators operate in the same phase.

DOI: 10.1103/PhysRevSTAB.16.052001 PACS numbers: 29.20.Ej, 29.27.−a



Energy (input–output) MeV/u	1.3–2.06	2.06–2.78	2.78–3.84	3.84–5.08	5.08–7.16
Length (m)	2.1	2.4	3.24	3.66	4.86
Number of QWR/β designed	6/0.06	7/0.06	7/0.1	8/0.1	8/0.15
Phase acceptance (deg)	131	158	117	124	128
Energy width (keV/u)	227	338	353	444	631

Multiple charge acceleration up to 6.2 MeV/u for Uranium

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **17,** 074201 (2014)

Multiple charge beam dynamics in alternate phase focusing structure

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(Received 19 March 2014; published 15 July 2014)

Asymmetrical alternate phase (A-APF) focusing realized in a sequence of 36 superconducting quarter wave resonators (QWRs) has been shown to accelerate almost 81% of input uranium beam before foil stripper to an energy of 6.2 MeV/u from 1.3 MeV/u. Ten charge states from 34+ to 43+ could be simultaneously accelerated with the phase of resonators tuned for 34+. The A-APF structure showed the unique nature of a large potential bucket for charge states higher than that of the tuned one. Steering to QWRs can be mitigated by selecting appropriate phase variation of the APF periods and ion of solenoid field strengths placed in each of the periods. Tl charg

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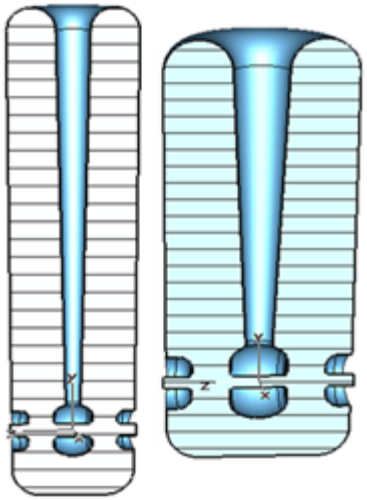

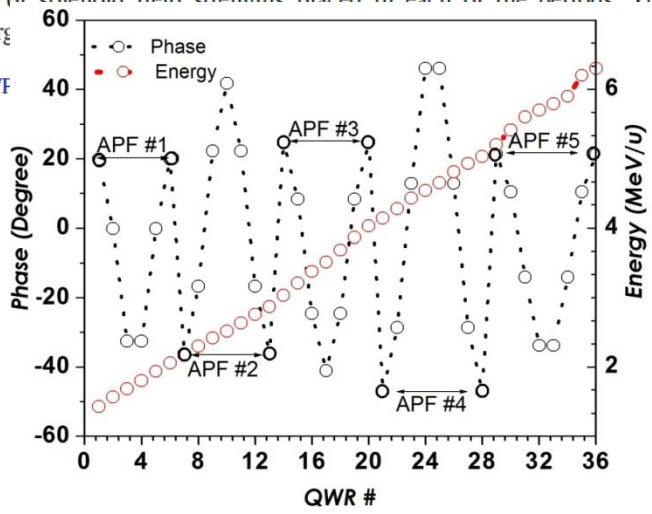

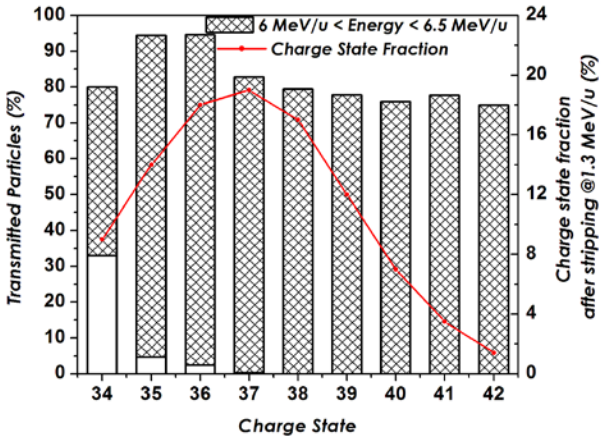

RIB/SIB with high intensity