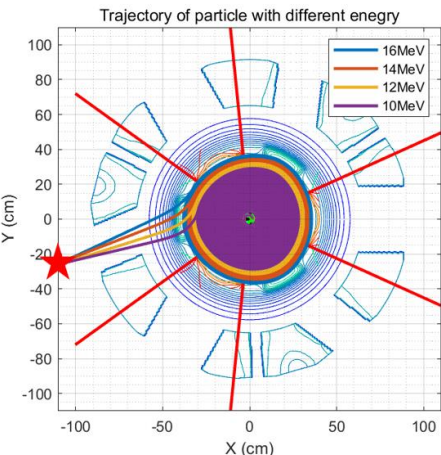


Introduction

- CIMV16, has been designed by HFCIM for widely used isotope production, which can extract proton with variable energy in range of 10~16 MeV.
- the position of the stripping film is simulated and optimized to realize the convergence of the beam in different energy.
- Multi-particle beam dynamics simulation have been down to analyze the efficiency and loss of beam transmission.
- Simulations of some other optimizations have been down.

Varies energy extraction

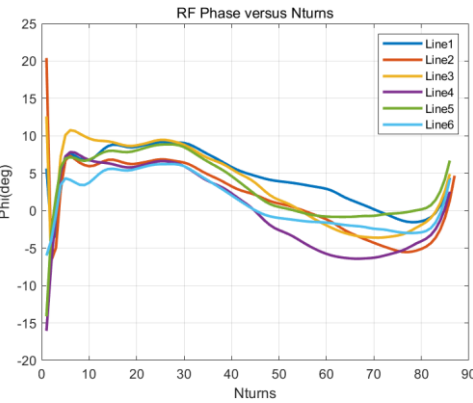
In this cyclotron, H- will be accelerated to 16 MeV, and then stripped out two electrons to become H+ to be extracted. By adjusting the position of the stripping target, H+ of different energies can be extracted. The position of stripping target have been optimized to make the particle with different energy converged at 110 mm.



Trajectory of particles with different energy

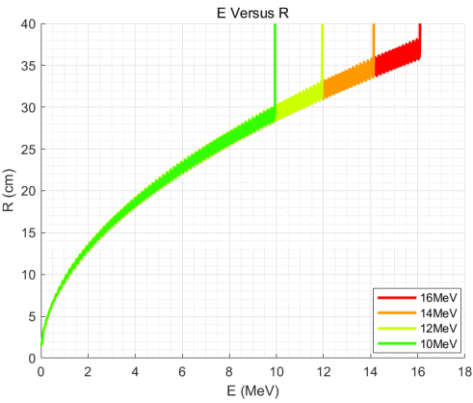
Energy MeV	Radius cm	Azimuth deg
16	37.0	152
14	34.5	157
12	32.5	164
10	30.0	170

Stripping target position in different energy



Phase motion in each gap

The phase motion in beam dynamics simulation is in range of ± 20 deg.



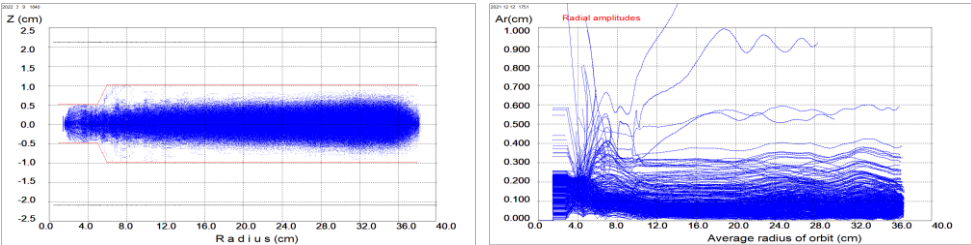
Radius versus Energy

Multi-particle beam dynamics

Multi-particle beam dynamics have been down by the beam dynamics code and 1000 particles have been used. The parameters of initial particles are shown as follow:

Parameters		values
radial	R	$R_c \pm 0.25$ mm
	Pr	$Prc \pm 15^\circ$
axial	Z	0 ± 2 mm
	Pz	$0 \pm 5^\circ$
Phase		$-90^\circ \sim 0^\circ$

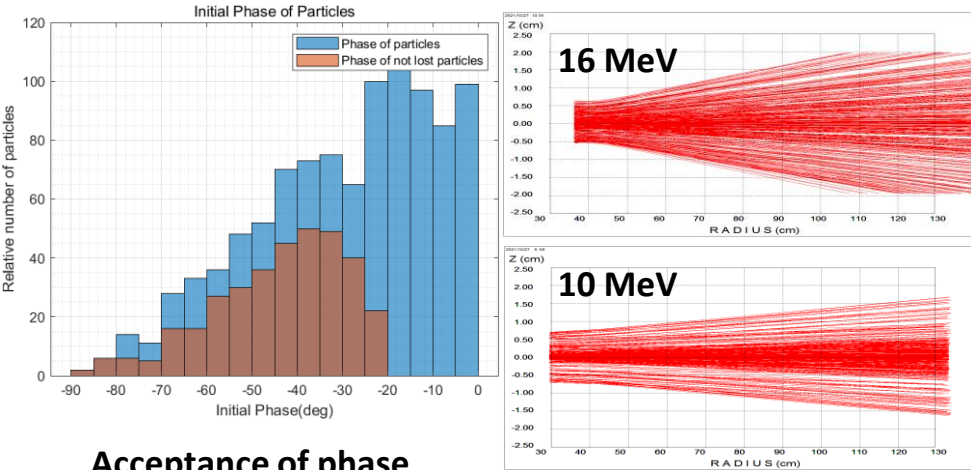
Parameters of initial particles



Axial motion

The axial size of the bunch is in range of ± 7 mm, and the Radial oscillation is smaller than 3 mm.

Radial oscillation



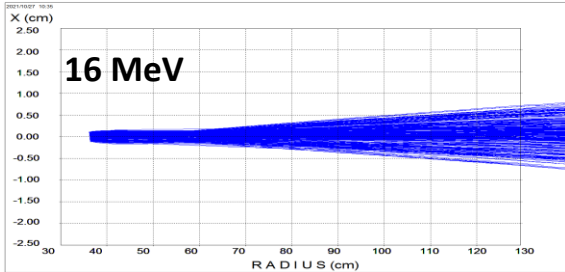
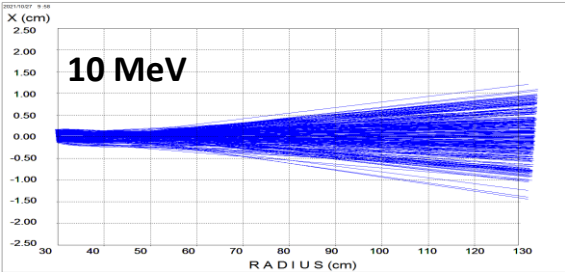
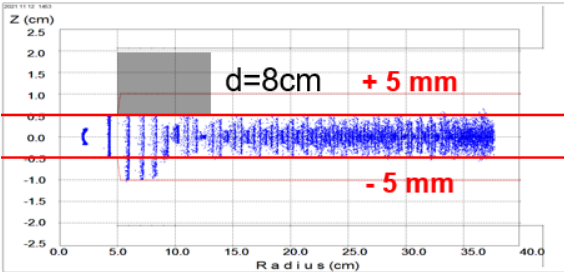
Acceptance of phase

Axial motion after extracted

Acceptance of phase is about 70 deg. The axial size of the 10 MeV particles at 110 cm is ± 1.5 mm and larger than ± 2 mm when the energy is 16 MeV, so the extraction of the particles should be optimized

Some other optimization

In order to control the axial size of the extracted beam, a brick is used in central region, then the axial size of the bunch can ben controlled smaller than ± 1 cm



Conclusions

- The particles with different energy can converge at 110 mm by optimizing the position of the stripping target.
- Transmission efficiency of particles in accelerating region is about 95%, and the acceptance of phase is about 70 deg.
- the axial size of bunch can be controlled smaller than ± 1 cm by a axial brick in central region.