ECS recap. and stability studies

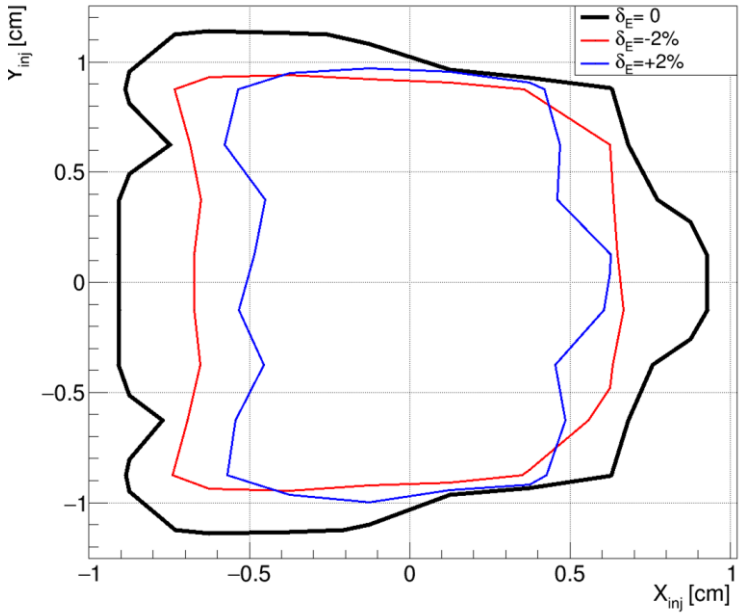
Simone Spampinati

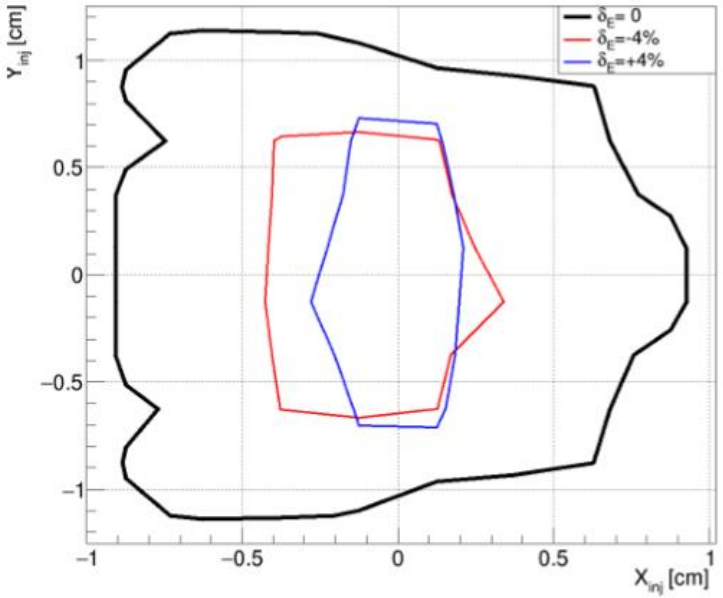
On Behalf of WP4

29/05/24

DR dynamical aperture

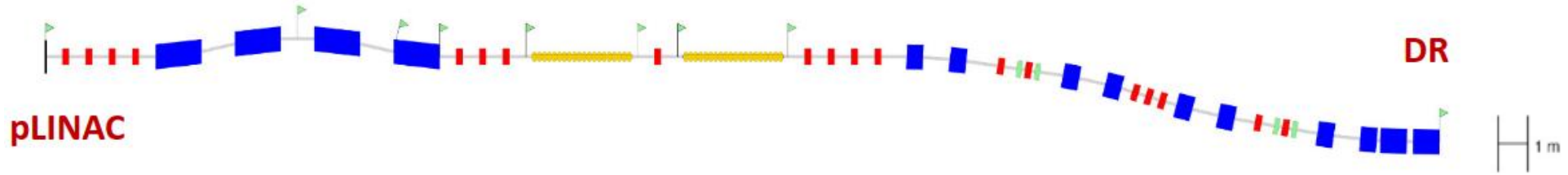
Tracking has been performed with PTC (MAD-X interface) over ~15% damping time neglecting radiation damping. The estimated loss of accuracy is below 1% at the nominal energy.

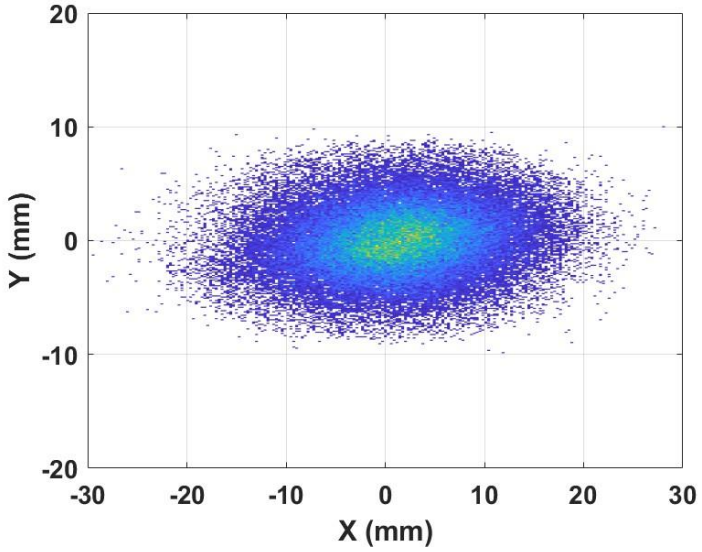


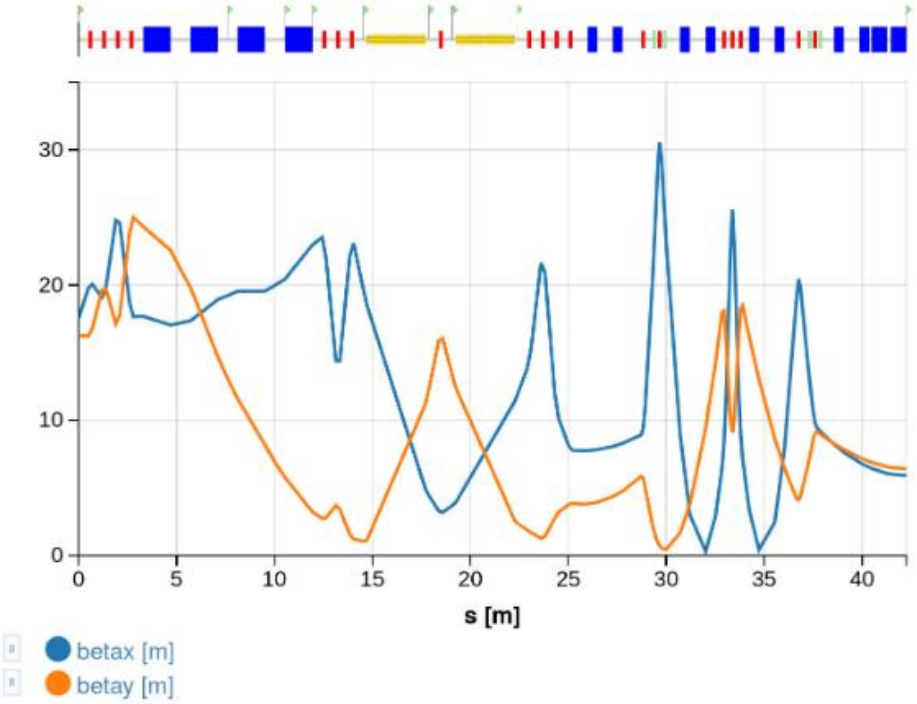


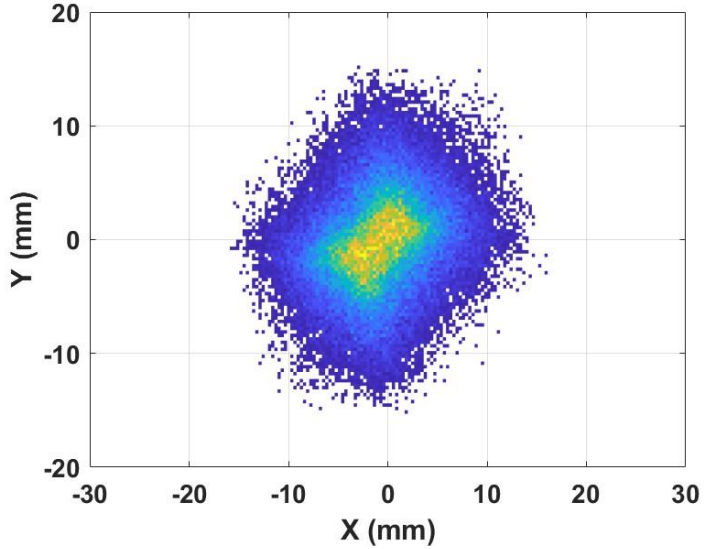
- The stability region in the transverse plane has been evaluated for different energy deviations. Contours represent regions where >90% of the initial conditions lead to successful tracking
- The transverse stable region is shown for the nominal beam energy (1.54 GeV - black) and for ±2%(left), ±4%(right) energy relative deviation (blue and blue). The stable region is kept quite constant within 2% energy spread. It shrinks significantly for higher deviations

Transfer lines pLINAC - DR



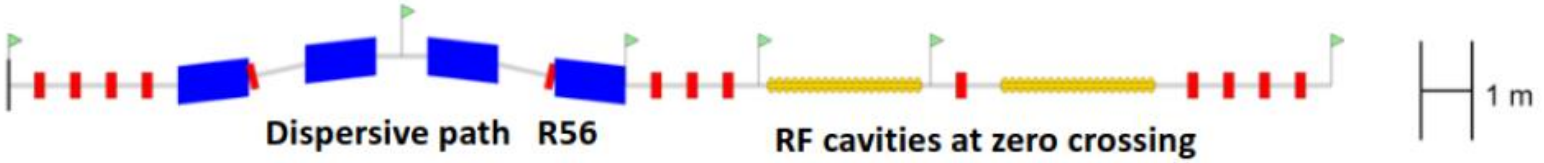






- Transverse emittance is preserved in both planes

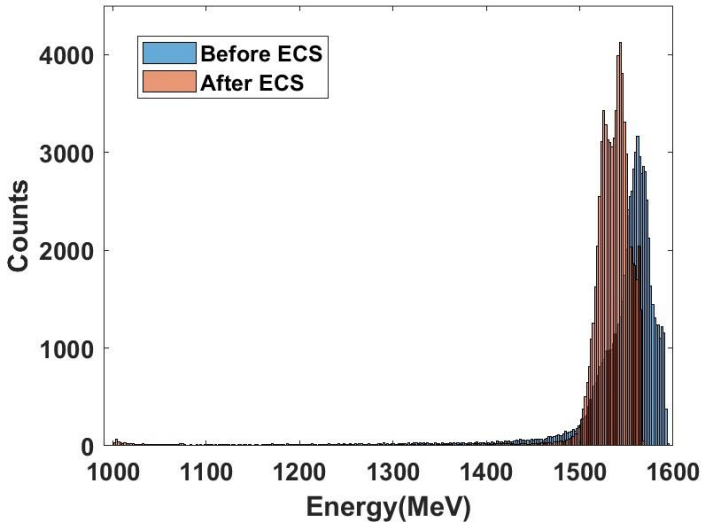
Energy compressor



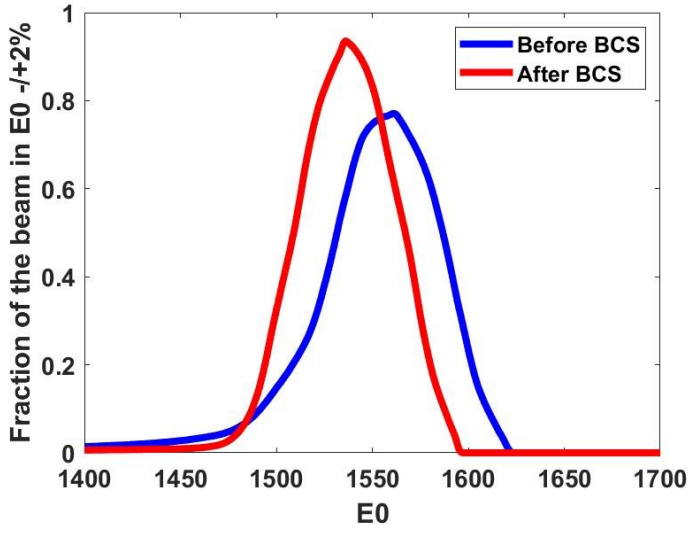
- The aim of the energy compressor is to maximize the number of particles accepted in energy by the DR (1.54 -/+ 2%)
- A four-bending C-shape chicane. Dispersion and second order dispersion closed by symmetry.
- Two cavities of the type used for the positron LINAC **(LINAC 2022) THPOJO08)**
- Distribution at the end of the pLINAC provided by M. Schaer

Parameters	Value	Unit
Dipole Bending angle	0.2256 (12.9)	rad (deg)
Dipole Magnetic length	1.395	m
Distance between dipoles	1	m
R56	0.205	m
Max dispersion	0.56	m
Number of Cavities	2	
RF frequency	2	GHz
Accelerating Gradient	20	MV/m
Accelerating Voltage	99	MV

Energy distribution

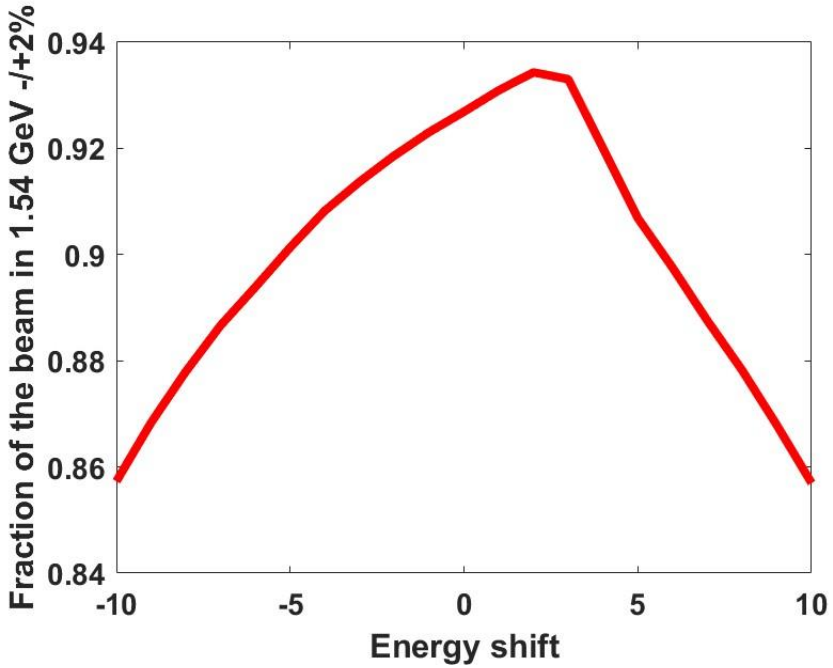


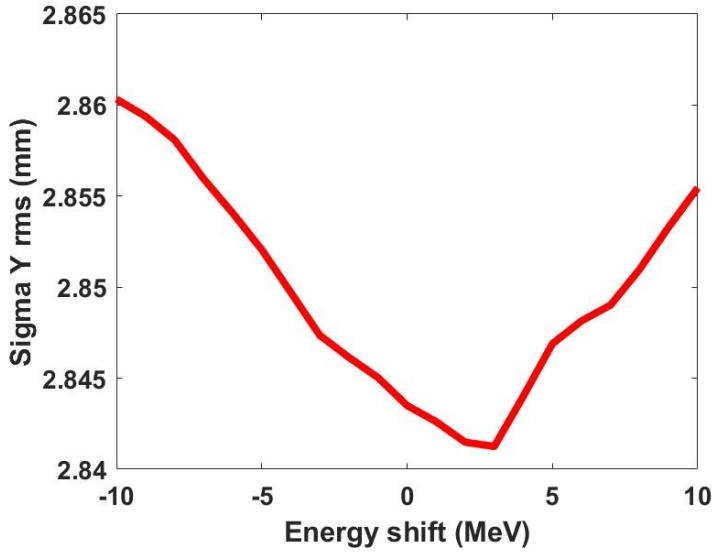
Beam fraction in E0-/+2%

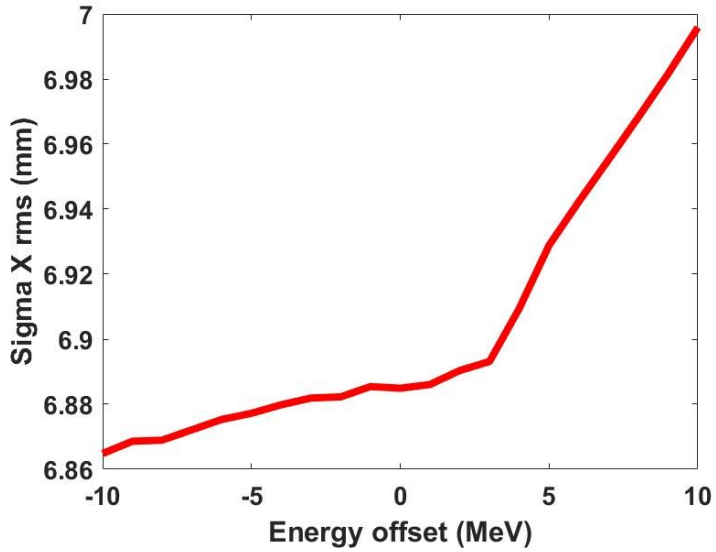


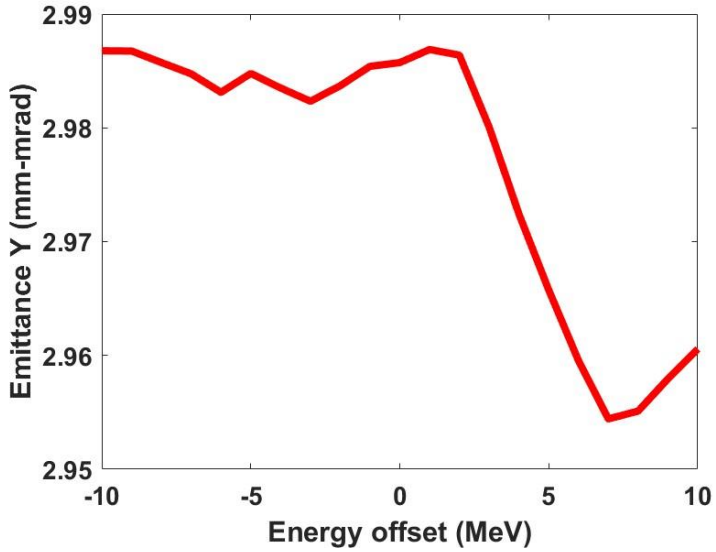
Tolerance on E0

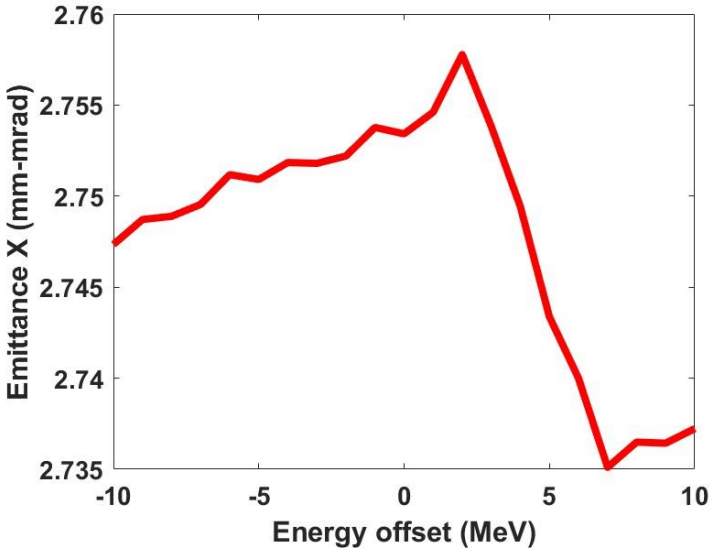
- Distribution at the end of the pLINAC provided by M. Schaer
- Rigid shift applied



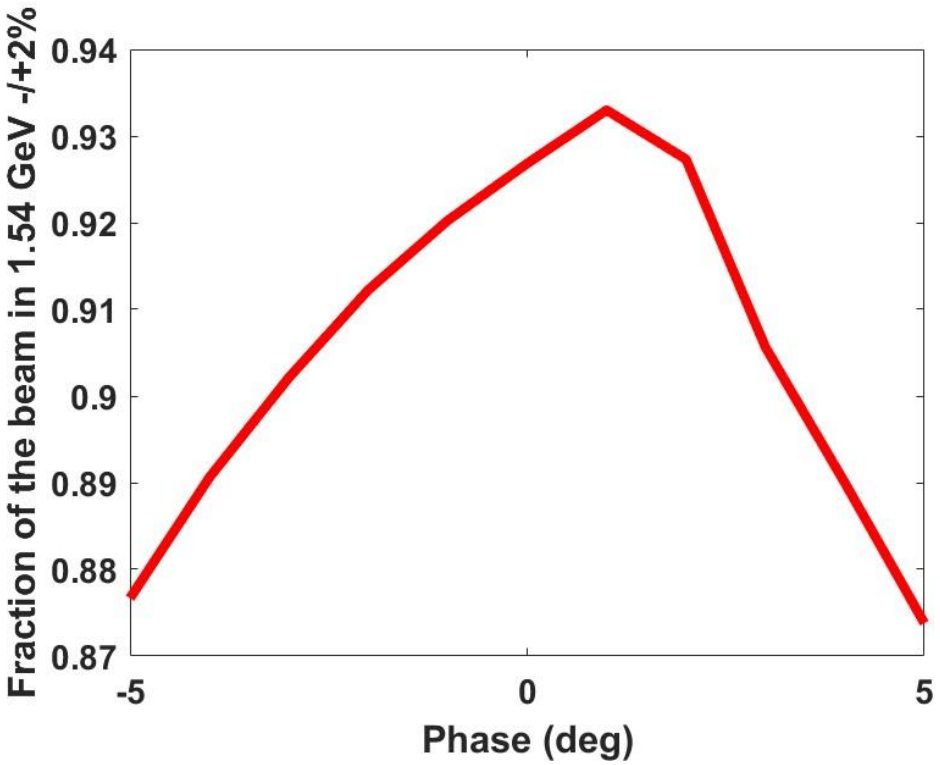


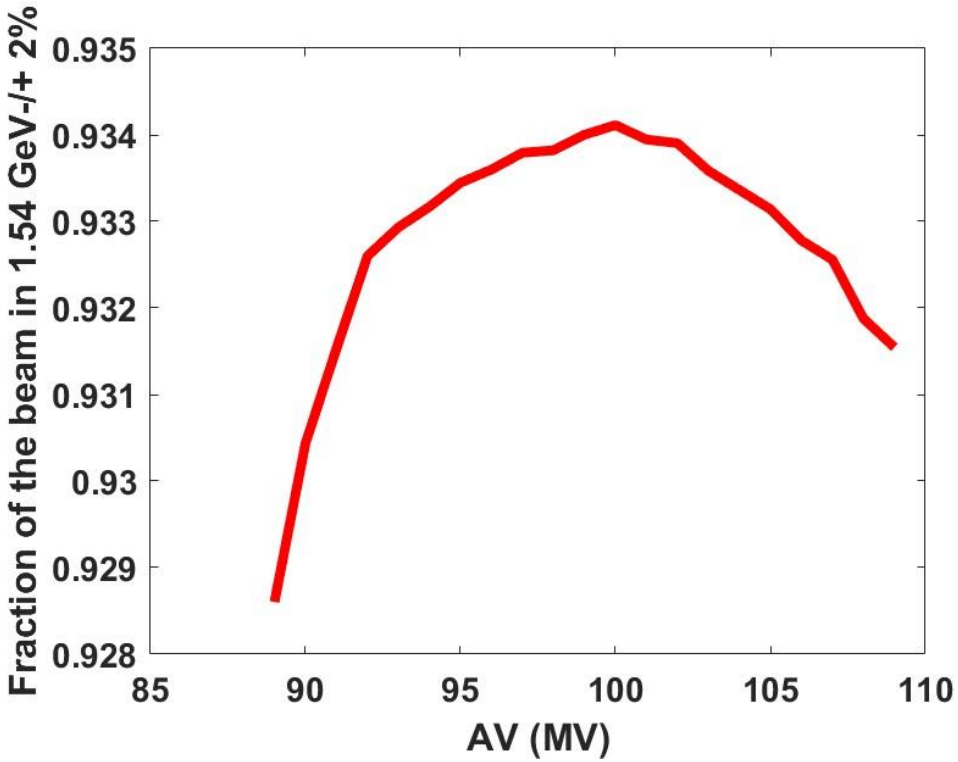






Tolerance on RF





- Tolerance of Amplitude and phase variation relaxed

pDR acceptance of the pLINAC particles

- Particle beam beam prepared with a start-to-end simulation. Positron linac simulated with RF_TRACK. Energy compressor and injection TF are simulated with elegant
- DR acceptance: Survived particles at 10k turns (PTC-MADX): 59794/71800 = 83%
- The picture shows the transverse distribution of the survived particles according to their positions at e+ linac exit.
- The coordinate of the dead particles can be used to study a possible reduction and collimation of the positron beam coming from the source