

DYNAMICS STUDY OF A DRIFT TUBE LINAC FOR BOTH HEAVY IONS AND PROTON*

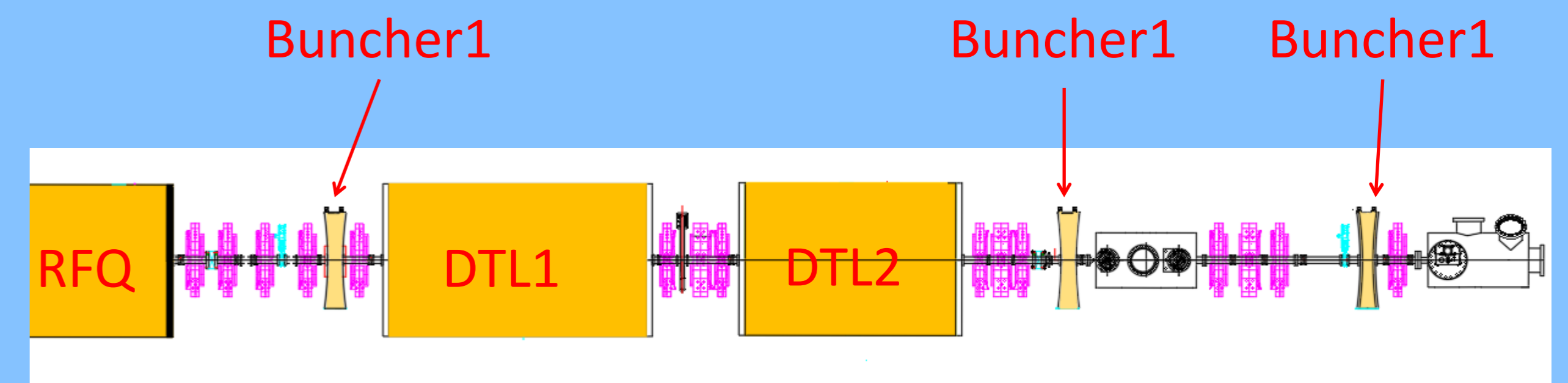
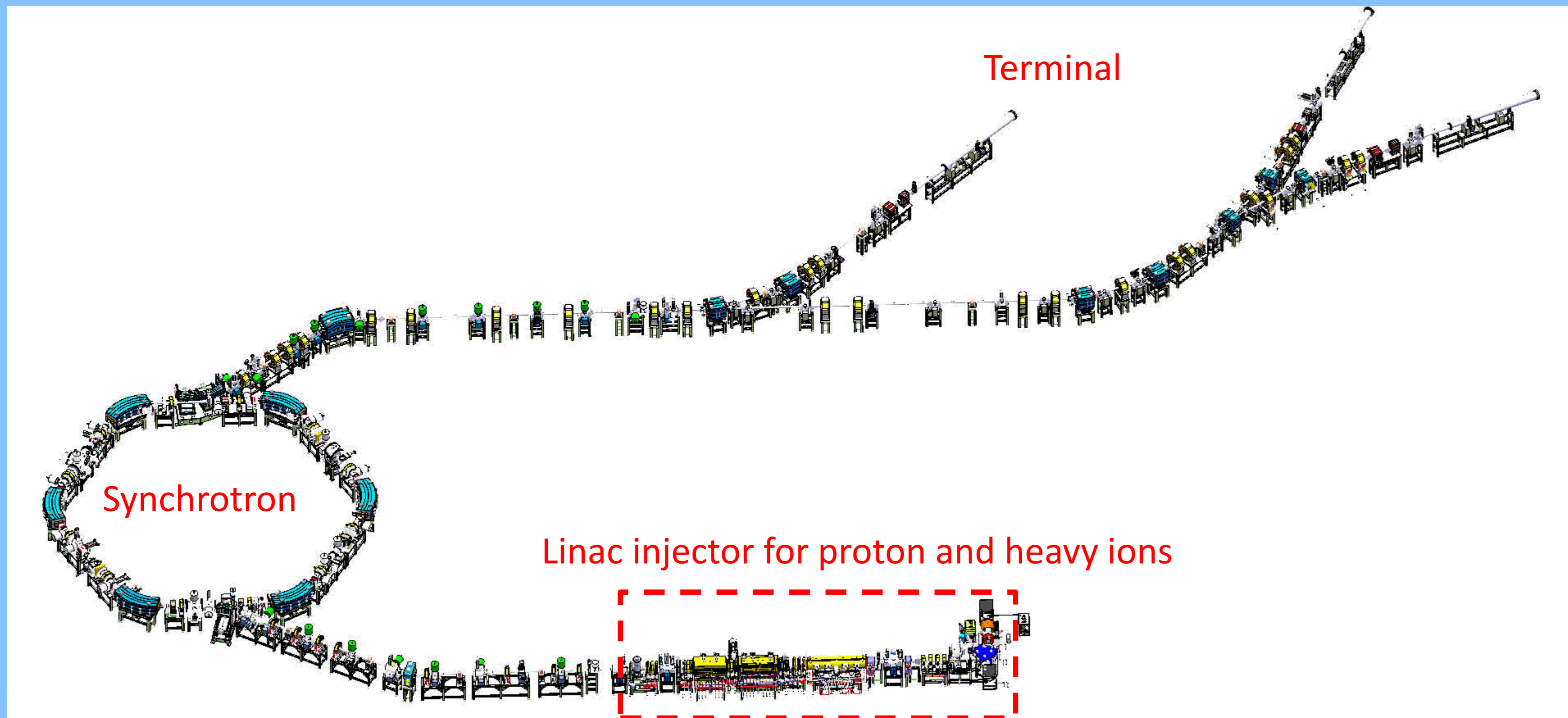


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Abstract

An accelerator complex for Space Environment Simulation and Research Infrastructure (SESRI) has been designed by Institute of Modern Physics (IMP) and will be constructed in Harbin Institute of Technology (HIT). This accelerator consists of an ECR ion source, a linac injector, a synchrotron and 3 research terminals. As an important part of the complex, the linac injector should provide both proton and different kinds of heavy ions, from helium to bismuth, with energy of 5 MeV and 1 MeV/u respectively for the synchrotron. In order to provide beams with the mass to charge ratio (A/Q) range from 1 – 6.5 (for proton to $^{209}\text{Bi}^{32+}$) by only one linac injector, a special solution of the main acceleration section DTL is carried out. The relevant dynamics calculations, such as beam matching, stripping process of the hydrogen molecule ion and beam energy spread reducing, are performed by Particle in Cell (PIC) method.

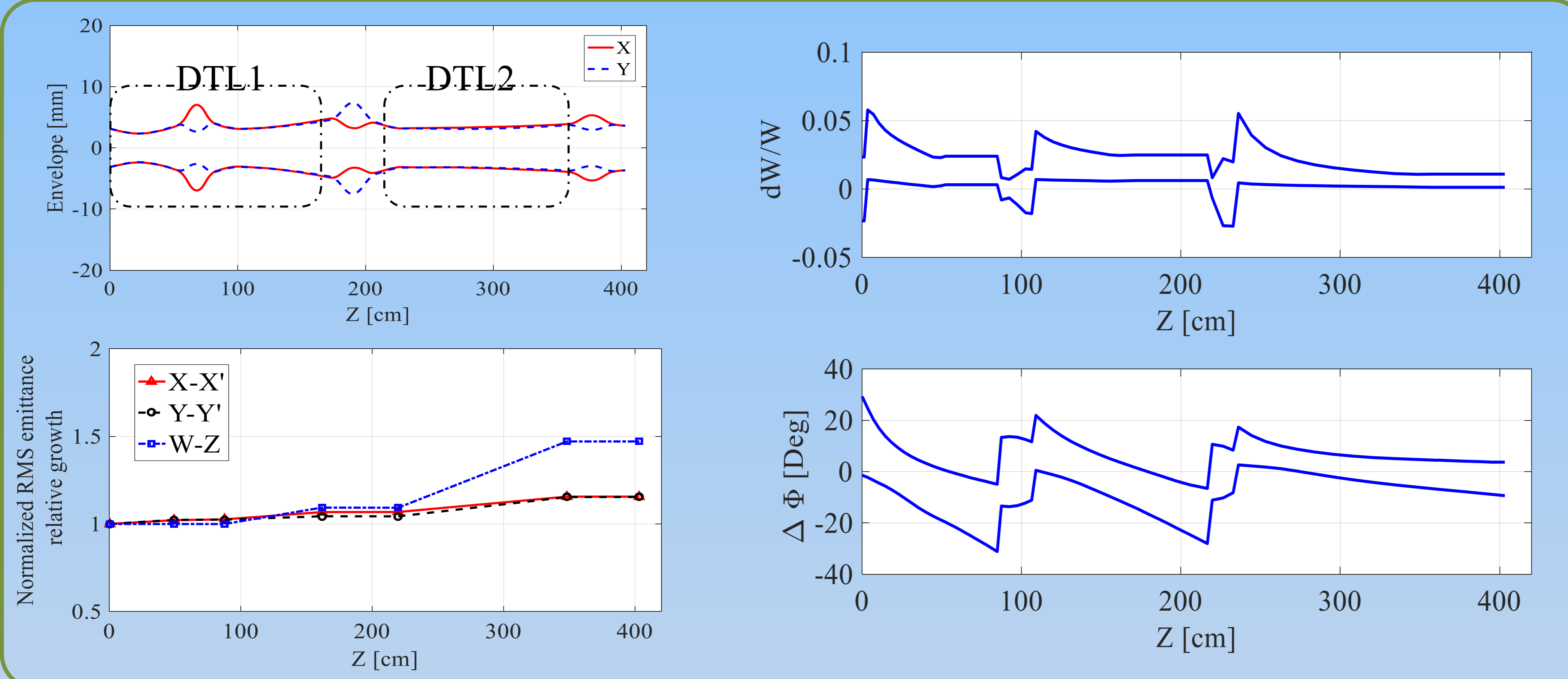
Facility introduction



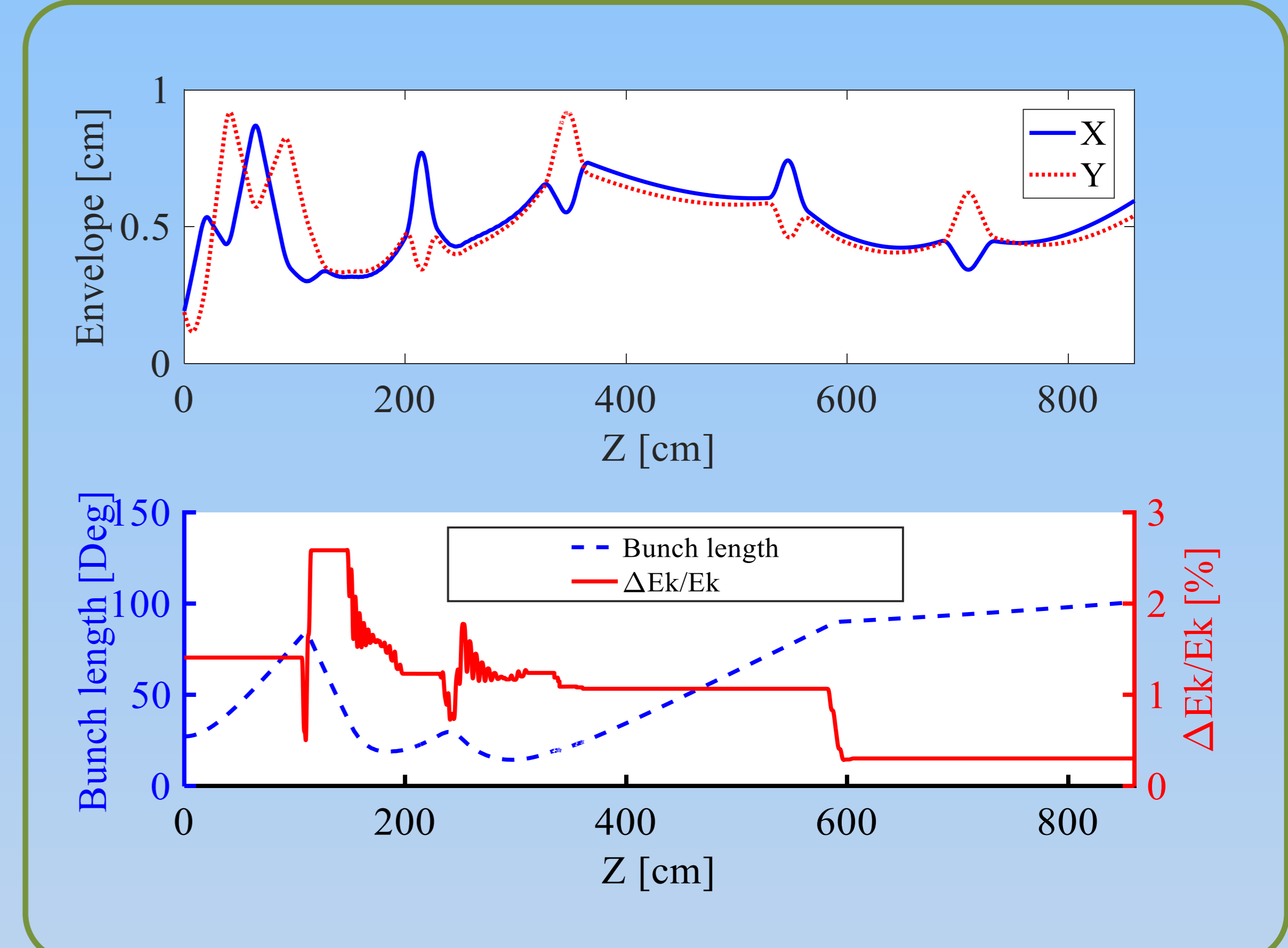
Inject beam parameters of the synchrotron

Parameter	Value
Beam energy	1 MeV/u ($^{209}\text{Bi}^{32+}$), 5 MeV (proton)
Energy spread	$\pm 0.3\%$
Transverse emittance	$\leq 13\pi\text{mm mrad}$
Beam current	30 μA ($^{209}\text{Bi}^{32+}$), 300 μA (proton)

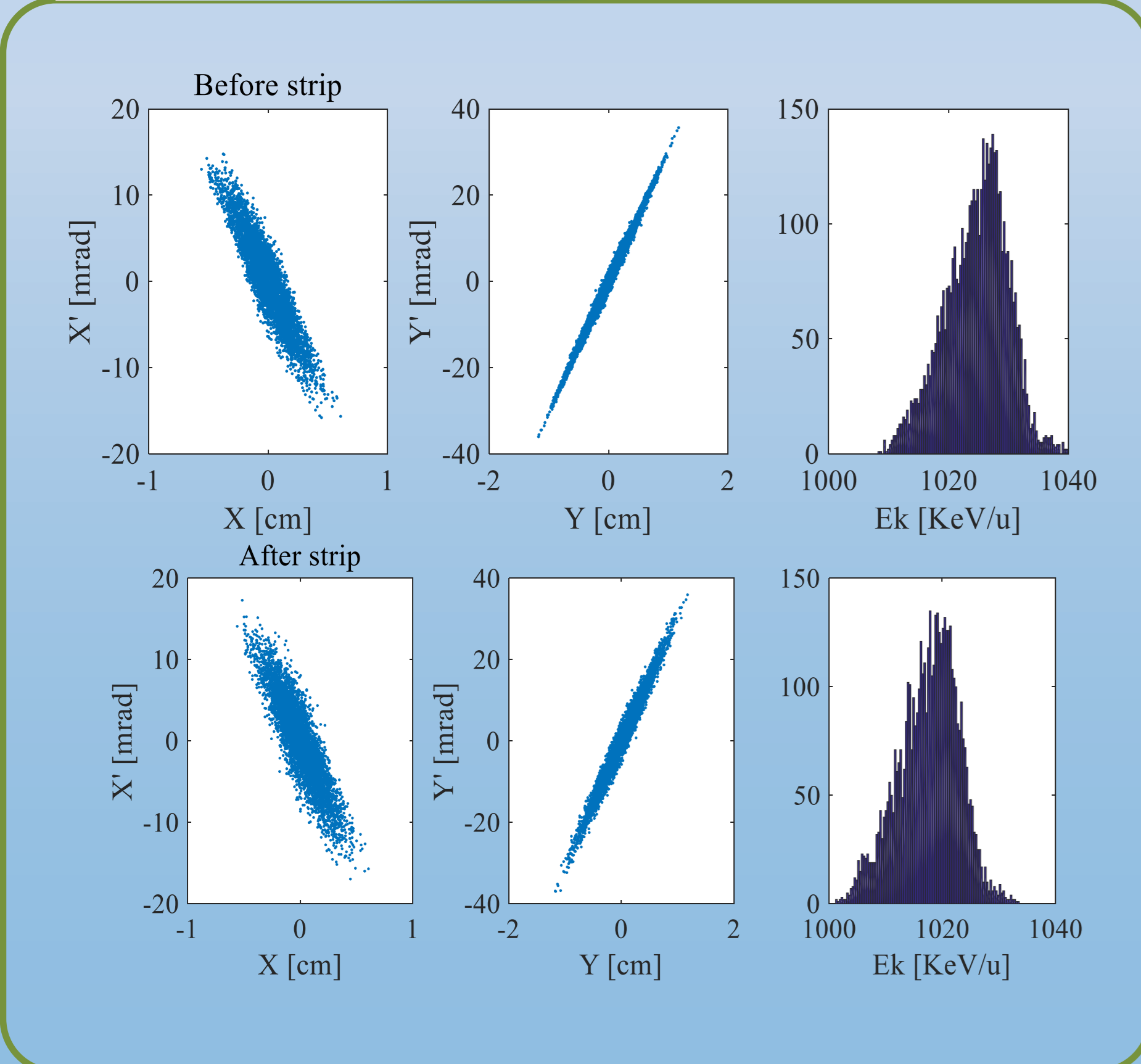
Preliminary dynamics design of the DTL by LORASR



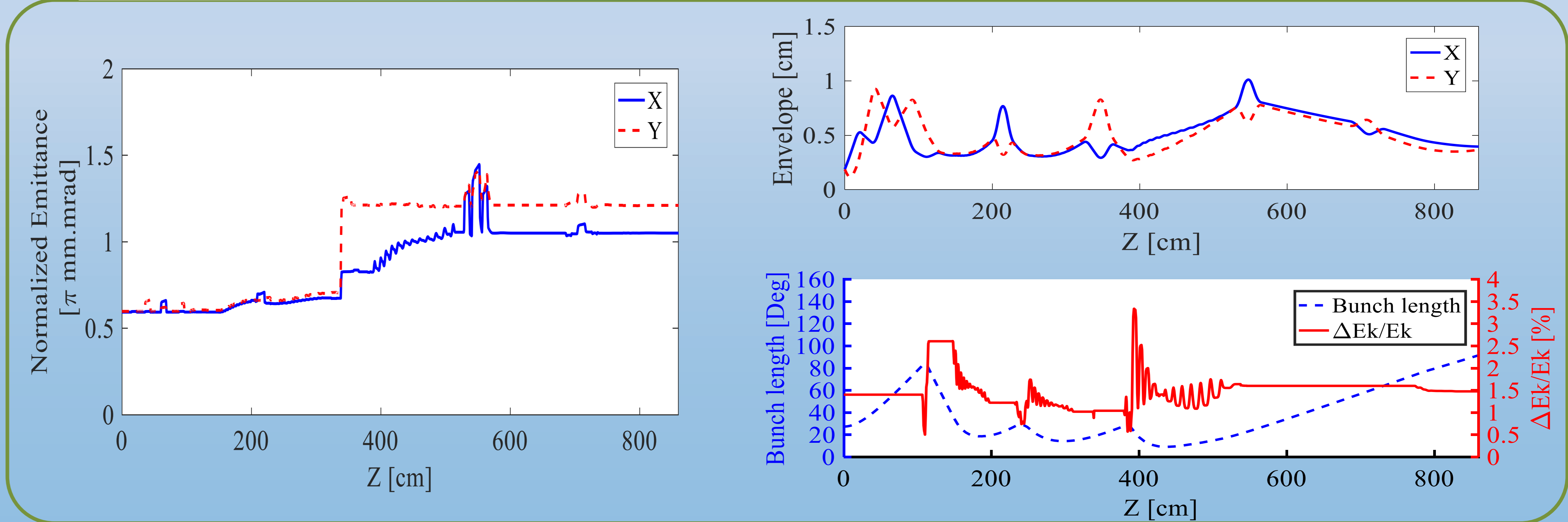
Beam dynamics tracking for $^{209}\text{Bi}^{32+}$ by Beampath



Strip H_2^+ to proton



Beam dynamics tracking for H_2^+ /proton



Conclusion

Preliminary design of the DTL for the linac injector of SESRI complex has been finished. Beam matching section between RFQ and DTL1, stripping foil and energy spread reducing section are design and simulated. The transverse emittance and energy spread of extraction beam of this linac injector meet the requirements of synchrotron basically. Formal design scheme and the RF structure design are in the optimization.

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