MULTI-HARMONIC BUNCHER (MHB) STUDIES FOR PROTONS AND IONS IN ESS-BILBAO

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MHB INTRODUCTION

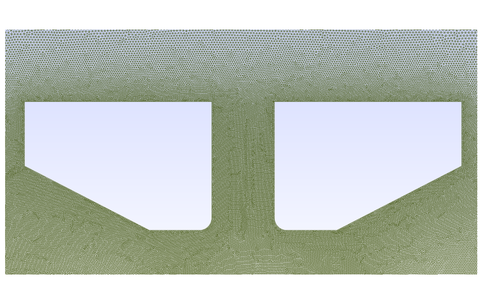
- HIE-ISOLDE RF frequency is f_0 =101.28 MHz (bunch separation of 9.87 ns). To increase bunch spacing, a MHB is proposed(*) with a frequency of 1/10th of the RF frequency, f =10.128 MHz, that will result in a bunch separation of 98.7 ns.
- A preliminary study of the MHB (geometry, electromagnetics and beam dynamics) is presented, and its possible testing at ESS-Bilbao injector is studied

Table 1: Beam characteristics for simulations

	ISOLDE beam	ESS-Bilbao beam
A/q	4.5	1
β	0.003 28	0.0098
ϵ_x, ϵ_y	0.62 mm mrad	0.25 π mm mrad
Intensity	1 mA	45 mA

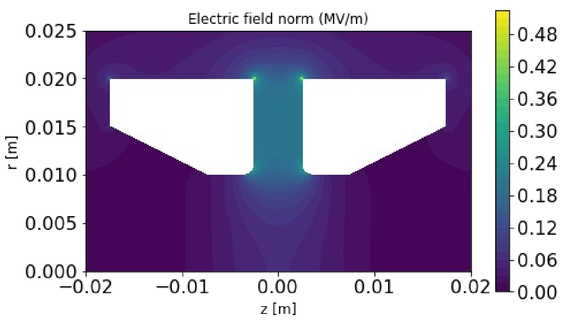
INTEGRATED SIMULATION PLATFORM

GEOM & MESH



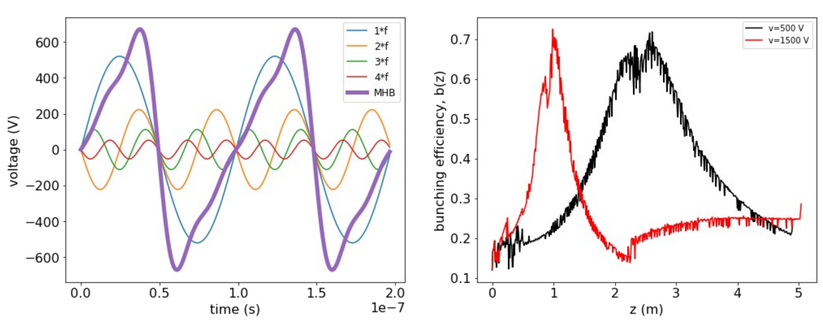
- Python-driven + GMSH

EM SIMULATION



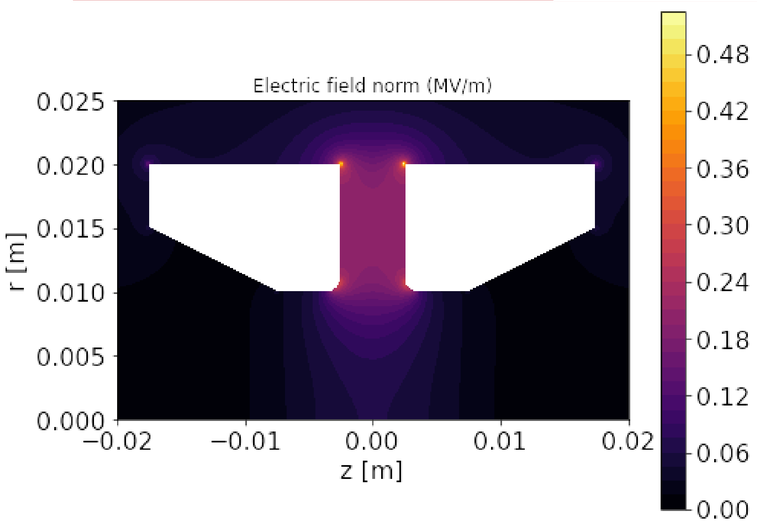
- ELCANO (FeniCS python based)

BEAM DYNAMICS

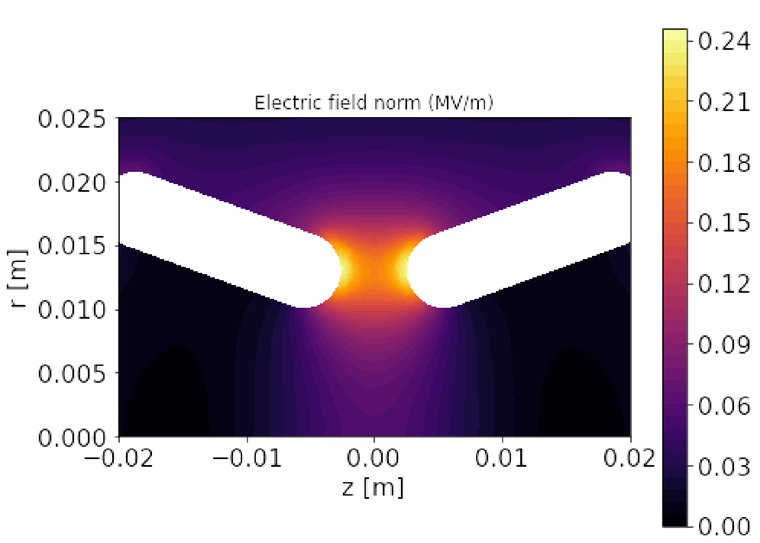


- Beam dynamics (GPT)
  - (*b(z)*: # of particles that arrive at *z* within a time window 10 ns)

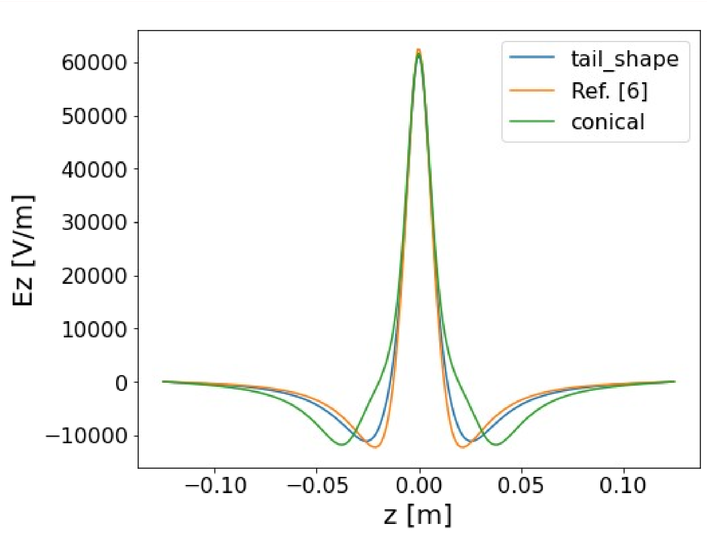
GEOMETRIES



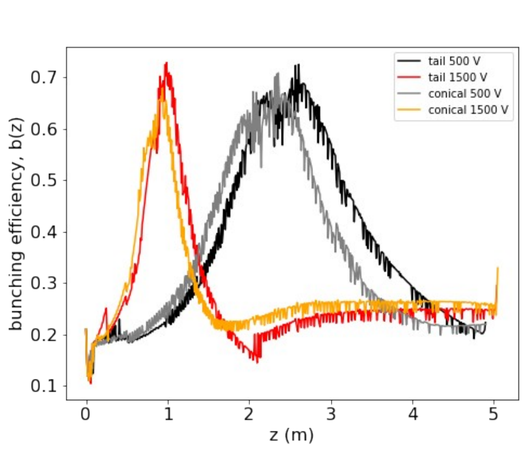
- Wedge shape

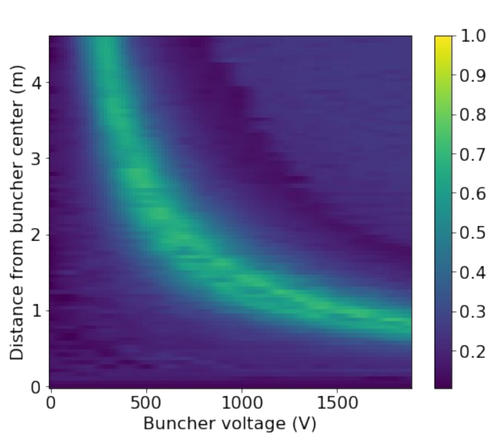


- Conical shape

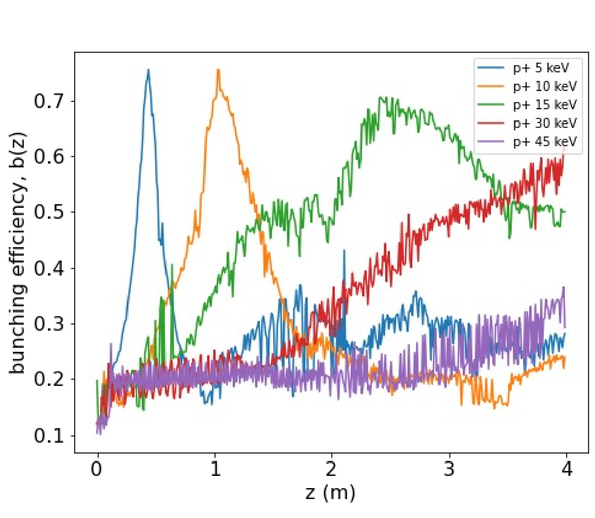


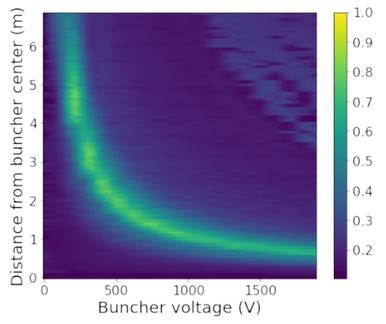
RESULTS

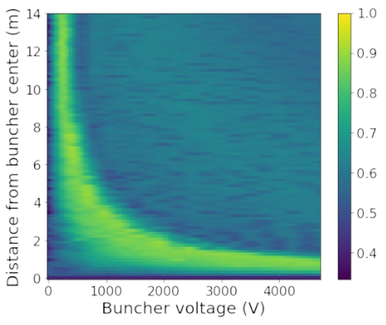




- HIE-ISOLDE beam







- ESS-Bilbao p^+ beam

CONCLUSIONS

- Different MHB designs have been explored for HIE-ISOLDE beam
- A MHB prototype could be tested at ESS-Bilbao injector after modifications in extraction voltage or RF frequency.

- (*) This work is presented in the framework of the “Agreement for the Spanish Contribution to the Upgrade of the ATLAS, CMS and LHCb Experiments and the new Projects for ISOLDE and n_TOF”