

# IFMIF原型加速器LIPAcの現状と計画 Status and Future Commissioning Plan of Linear IFMIF Prototype Accelerator (LIPAc)

増田 開<sup>1,6</sup>、LIPAcユニット<sup>1-6</sup>  
Kai Masuda<sup>1,6</sup>, on behalf of LIPAc Unit<sup>1-6</sup>

- 1) QST六ヶ所研、2) Fusion for Energy、3) CIEMAT、4) CEA、5) INFN、  
6) IFMIF/EVEDA Project Team  
1) QST Rokkasho Fusion Inst, 2) Fusion for Energy, 3) CIEMAT, 4) CEA, 5) INFN,  
6) IFMIF/EVEDA Project Team

Construction and validation of Linear IFMIF Prototype Accelerator (LIPAc) have been and are being conducted in Rokkasho, Aomori, under the EU-JA collaborative framework of the IFMIF/EVEDA project [1]. The LIPAc is to consist, in its final configuration in Phase C (see Fig. 1), of a 100 keV deuteron beam Injector incorporating an ECR ion source, the world longest RFQ that accelerates the beam up to 5 MeV, followed by a Medium Energy Beam Transport (MEBT) with highly space charged and beam loaded buncher cavities, a superconducting RF (SRF) linac, a High Energy Beam Transport (HEBT) with a Diagnostic Plate (D-Plate), ending in a Beam Dump (BD) designed to stop the world highest deuteron beam current of 125 mA CW at 9 MeV.

A stepwise strategy has been and will be applied to the installation and commissioning of LIPAc as shown in Fig. 1. The beam commissioning in Phase B at a low duty cycle of  $\sim 0.1\%$  has led to a successful acceleration of 125 mA deuteron beam up to 5 MeV at the exit of RFQ [2], without significant trace of unexpected beam loss [3]. Confirmation of the designed beam dynamics has been conducted successfully in terms of the beam transmission through the RFQ [4]. Following these milestones achieved in the earlier phase, the beam commissioning in Phase B+ was initiated in July 2021 in a configuration where a beam transport line (MEBT Extension Line; MEL) takes temporarily the position of the SRF linac. The major goals of Phase B+ are to validate the RFQ, MEBT and BD performances up to CW and to characterize the beam properties in preparation to the final configuration with the SRF linac.

The first stage in Phase B+ has been completed with successful transport of a low current beam of 20 mA down to BD and validation of newly installed components with the low current beam. In preparation to the next stages towards the nominal beam current of 125 mA in CW mode, RF conditioning of the RFQ and

commissioning of the RF power source system are being conducted intensively aiming at CW. So far, 25 % duty at the nominal RFQ voltage and 100 % duty (CW) at 80 % of the nominal RFQ voltage have been reached. In parallel, an intensive beam commissioning of the Injector has been conducted, which has led to a successful CW operation with an extraction current of  $\sim 137$  mA D+.

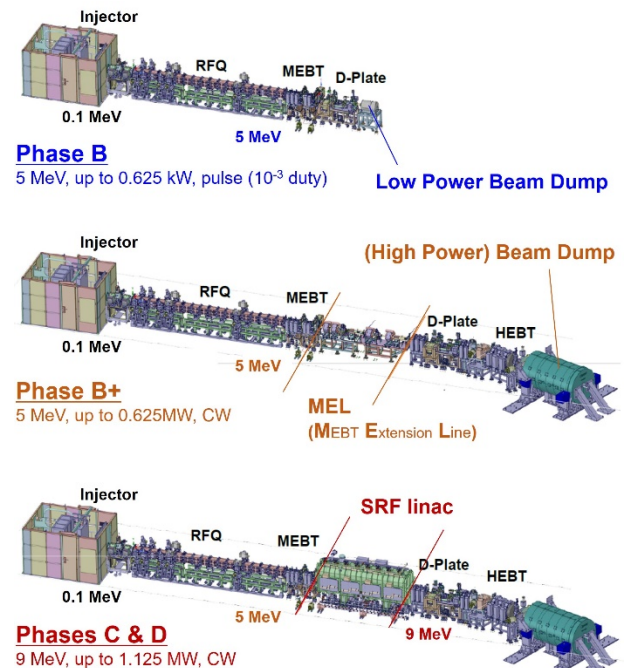


Figure 1: Three different layouts for the stepwise installation and commissioning of LIPAc.

## References

- [1] H. Dzitko et al., *Fusion Eng. Des.* **168** (2021) 112621.
- [2] K. Kondo et al., *Fusion Eng. Des.* **153** (2020) 111503.
- [3] K. Kondo et al., *Nucl. Fusion* **61** (2021) 116002.
- [4] L. Bellan et al., *Proc. ICFA HB 2021* (2021); doi:10.18429/JACoW-HB2021-WEDC2.