Contribution ID: **69** Type: **Oral or Poster**

Upgrade of the SPARC_LAB LLRF system and recent X-band activities in view of EuPRAXIA@SPARC_LAB project

Wednesday, October 25, 2023 5:55 PM (5 minutes)

SPARC_LAB is a high-brightness photoinjector developed for FEL and research on novel acceleration techniques. It has been in operation at LNF since 2005. It is made of a newly designed brazeless 1.6-cell S-band RF gun, two SLAC type S-band and one C-band accelerating structures. Recently, a plasma chamber was installed to study beam-driven plasma acceleration schemes.
During fall 2023, a major upgrade of the entire low level RF (LLRF) system will take place to consolidate and improve performance in terms of amplitude, phase resolution and stability. The original analog S-band and the digital C-band LLRF systems will be replaced by commercial, temperature-stabilized, FPGA-controlled digital LLRF systems manufactured by Instrumentation Technologies.
In parallel, there is a growing interest in X-band LLRF at LNF due to the EuPRAXIA@SPARC_LAB project. This project aims to build an FEL user facility driven by an X-band linac at LNF in the coming years. To test X-band RF structures and components, a high-power test stand named TEX has been installed and commissioned. The TEX LLRF system, based on a commercial S-band system with a dedicated up/down-converter stage, will be also discussed.

Keyword

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Session Classification: Posters

Track Classification: System and operation