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Evaluation of an X-band LLRF prototype for the EuPRAXIA@SPARC_LAB LINAC

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EuPRAXIA, the "European Plasma Research Accelerator with eXcellence In Applications," represents the next generation of free-electron lasers (FEL). It aims to develop a compact, cost-efficient particle accelerator using innovative wake-field accelerator technology. High-energy physics often demands higher acceleration voltages, and X-band technology offers high gradients in compact structures. The EuPRAXIA@SPARC_LAB LINAC injector, featuring an S-band RF gun, four S-band structures, and sixteen X-band structures, achieves a maximum beam energy of 1 GeV. For femtosecond-level synchronization and stability, Low-Level Radio Frequency (LLRF) systems are essential. However, commercial X-band LLRF solutions for 100 ns pulse processing are unavailable. This project, in context of the EuPRAXIA - Doctoral Network, develops an X-band LLRF prototype tailored to meet the EuPRAXIA@SPARC_LAB LINAC's stringent requirements. After validation on a testbench, the prototype will enable industrial production and commercialization. This paper presents the Front-End, Back-End analysis, and further evaluation of the prototype.

Footnotes

Paper preparation format

Word

Region represented

Europe

Funding Agency

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