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Status of X-Band LLRF Prototype Development

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EuPRAXIA@SPARC_LAB is the next generation free-electron laser (FEL) aimed at developing a compact, cost-effective particle accelerator based on the wake-field accelerator technology. High-energy physics demands higher acceleration voltages and advancing accelerator technology to higher frequencies enables the achievement of high gradients within shorter accelerating structures. The LINAC injector at EuPRAXIA@SPARC_LAB includes a dedicated X-band section, which contributes to achieving a maximum beam energy of 1 GeV. Low-Level Radio Frequency (LLRF) systems are essential for RF station synchronization and ensuring machine stability with femtosecond precision. This project, in context of the EuPRAXIA-DN, focuses on developing an X-band LLRF prototype tailored to meet the requirements of the EuPRAXIA@SPARC_LAB LINAC. This talk will present the development approach and implementation of the X-band LLRF prototype, covering the prototype requirements, detailed architecture and RF signal distribution. Additionally, a detailed analysis of laboratory results obtained at Instrumentation Technologies will be presented and discussed.

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