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TESTS AT 2K OF THE BETA 0.35 SPOKE CRYOMODULE PROTOTYPE WITH THE MTCA.4-BASED LOW LEVEL RF SYSTEM PROTOTYPE FOR THE MYRRHA R&D

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Within the framework of the first phase of MYRRHA (Multi-purpose hYbrid Research Reactor for High-tech Applications) project, called MINERVA, IJCLab was in charge of a fully equipped Spoke cryomodule prototype development, tested at 2K. It integrates two superconducting single spoke cavities, the RF power couplers and the Cold Tuning Systems associated. On the control side, a MTCA.4-based Low Level Radio Frequency (LLRF) system prototype and the Software/EPICS developments has been realized by IJCLab and the SCK CEN in collaboration with the company IOxOS Technologies. The final version of the global system and the results of the tests at 2K will show with some perspectives.

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LLRF control system architecture

Cryomodule test area





The solid-state amplifiers (SSA) are synchronized via the PTP protocol. The data of SSMs will be directly pulled through Modbus communication by the IOC, whereas the remaining data will be pulled from the amplifier PLC through Ethercat bus RF signals to scope

communication.

MTCA architecture





Channel Access (Switch 1 Gbps)

Preliminary RF results@352.2MHz (Cryomodule @2K)



RF power conditioning results of one of the two couplers used, at 300K into the cryomodule lasted 4 days until ~15kW CW (pulsed RF before CW), out the bandwidth of the cavity.



Our MTCA.4 LLRF system, already validated in operation at 176.1MHz with beam on the MYRRHA injector prototype, is well on the way to being validated at 352.2MHz with superconducting cavities at 2K before the end of this year. Improvements are planned concerning the firmware and software to make it easier to use and integrate more functions. For example, a second version of the RF-Front board prototype, more efficient in terms of frequency Sampling and Local Oscillator frequency range, will be used. Meanwhile R&D is continuing, in particular with developments of a White Rabbit-based Timing system, following the common effort of the community to develop high performance timing protocol, also with respect to producing accelerator references with it.

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