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Design and characterization of the FCFD chip for strip AC-LGAD readout

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We present the design and performance of the latest version of the Fermilab Constant Fraction Discriminator (FCFD) readout ASIC, FCFDv1.1. The chip was delivered in May 2025, and results were measured in testbedam in July 2025. We will also present the status of the development of the next version of FCFD readout chip. The FCFD will be used to readout the 1-cm long AC-LGAD strip sensors of the barrel TOF detector at ePIC, and is a candidate readout chip for several other subsystem at ePIC. The ASIC is the first to apply the CFD at the readout level for LGAD sensors, which significantly simplifies detector design and operation. We will show our new method of precise characterization of AC-LGAD RC-network parameters, as these parameters play a critical role in the design of the chip. We present measured performance of the FCFD v1.1 with multi-channel capability using LGAD signals from minimum-ionizing particles produced at the DESY test beam facility. We demonstrate excellent timing performance for 1-cm long AC-LGAD sensors, and characterize the performance of the sensor+readout system, demonstrating performance matching the ePIC bTOF detector specification.

Authors: APRESYAN, Artur (Fermi National Accelerator Lab. (US)); PEÑA, Cristián (Fermi National Accelerator Lab. (US)); WU, Shuoxing (ETH Zurich (CH)); XIE, Si (California Institute of Technology (US)); ZIMMERMAN, Tom (Fermilab)

Presenter: APRESYAN, Artur (Fermi National Accelerator Lab. (US))

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