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MONOLITH - picosecond capability in a high granularity monolithic silicon pixel detector

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The MONOLITH H2020 ERC Advanced project aims at producing a high-granularity monolithic silicon pixel detector with picosecond-level time stamping. Such extreme timing exploits: i) fast and low-noise SiGe BiCMOS electronics; ii) a novel sensor concept: the Picosecond Avalanche Detector (PicoAD), that uses a patented multi-PN junction to engineer the electric field and produce a continuous gain layer deep in the sensor volume. The result is an ultra-fast current signal with low intrinsic jitter in a full fill factor sensor.

In 2024, a testbeam with minimum-ionising particles of the monolithic PicoAD prototype provided full efficiency and 11.5 ps time resolution.

In addition, a prototype without internal gain layer was produced featuring the same SiGe HBT electronics. Testbeam measurements showed full efficiency and 20 ps time resolution at a power consumption of 0.9 W/cm² and a sensor bias voltage HV = 200 V. This prototype after being irradiated up to 1x10¹⁶ neq/cm², still provides an efficiency of 99.7% and 45 ps at HV = 300 V.

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