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MONOLITH - picosecond time stamping capabilities in fully monolithic highly granular silicon pixel detectors

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The MONOLITH ERC Advanced project aims at producing a monolithic silicon pixel ASIC with $50\mu\text{m}$ pixel pitch and picosecond-level time stamping. The two main ingredients of the project are fast and low-noise SiGe BiCMOS electronics and a novel sensor concept, the Picosecond Avalanche Detector (PicoAD). The PicoAD 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 and highly granular monolithic detector.

Testbeam measurements show that the proof-of-concept PicoAD prototype is fully efficient and achieves time resolutions of 17ps averaged on the pixel surface, with 13ps at the center of the pixel and 25ps at the pixel edge.

A second monolithic prototype with improved electronics, for the moment produced on a $350\Omega\text{cm}$ substrate without internal gain layer, provides 20ps time resolution after a simple data analysis of testbeam data. A version of this second prototype that features special PicoAD wafers is under production.

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