

First Experimental Results on Ignite0: a prototype Pixel Front-End ASIC with Timing in 28 nm

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In this contribution are presented the results on the test activity on the Ignite-0 ASIC.

The IGNITE project (INFN Ground-up INITiative-on micro-Electronics developments) aims to develop integrated micro-systems suitable for particle tracking in the next generation of high-luminosity experiment at the LHC. This objective involves the following system level requirements: a pixel pitch of $\sim 50 \mu\text{m}$, a time resolution of at least 50 ps and a sustainable event rate up to 10 GHz/cm². These specifications must be met within specific constraints: a $\sim 1 \text{ W/cm}^2$ power consumption, a radiation tolerance to TID up to 1 Grad, and a material budget of 0.5 % Xo at most. The investigated system-level technological solutions include: a 28 nm CMOS front-end chip coupled with a silicon 3D sensor, a system assembly leveraging 3D integration technologies and an integrated optical read-out.

Ignite-0 has been developed during 2023 in order to test individually the building blocks for the future developments on the front-end ASIC. It contains mainly the pixel front-end electronics such as the Analog Front-End (AFE) and the TDC, but it also integrates various service blocks such as a $\Sigma\Delta$ DAC and two different PLL architectures. All the integrated blocks have been designed to satisfy the desired requirements and constraints both in terms of power, performance and form-factor.

Both in terms of the AFE and the TDC, the implemented architectures were developed on the basis of the ones of the Timespot1 front-end ASIC in order to improve their performance and reliability. Moreover, six different AFE architectures were investigated in order to test different combinations of the preamplifier and discriminator.

This contribution will discuss the viability of the implemented solutions in terms of their performance and robustness by comparing experimental results and circuit simulations.

Collaboration

IGNITE

Role of Submitter

I am the presenter

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