

# Design of the first full-scale HYLITE, a charge integration pixel detector readout chip for XFEL

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The HYLITE (High dYnamic range free electron Laser Imaging deTEctor) is a charge-integration pixel detector readout chip specifically designed for SHINE (Shanghai High repetition rate XFEL aNd Extreme light facility). To meet the dynamic range requirement of  $1 \sim 10000$  photons/pixel/pulse at 12 keV, each pixel incorporates a Charge Sensitive Amplifier (CSA) with an automatic gain-switching function. Additionally, to enable high-speed readout in a successive mode, an Analog-to-Digital Converter (ADC) is integrated into each pixel, ensuring that the pixel outputs are in digital format.

The initial phase of HYLITE development focuses on creating a  $64 \times 64$ -pixel chip with a  $200\text{-}\mu\text{m}$  pixel pitch. HYLITE200F, the first full-scale chip in the HYLITE series, was manufactured using a 130 nm CMOS process. The frame rate of HYLITE200F is 6.3 kHz in successive readout mode, with plans to enhance it to 10 kHz in the final version. Moreover, HYLITE200F is bump-bonded with a specially designed PIN sensor for module joint debugging. In this paper, we will focus on introducing the design details of the HYLITE200F chip. The test results of the chip and the module will be shown in the other paper.

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