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## Beam test results of an SOI monolithic pixel sensor SOFIST for the ILC vertex detector

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The ILC experiment needs a vertex detector with satisfactory space and time resolutions to reconstruct decays of heavy flavor quarks and tau leptons for precise measurement of the Higgs boson and search for physics beyond the Standard Model. We have been developing a monolithic pixel detector for the ILC, SOFIST, with Silicon-on-Insulator technology; this is fabricated using a 200 nm FD-SOI CMOS process developed by LAPIS Semiconductor Co., Ltd. We aim to achieve a  $3\ \mu\text{m}$  single-point resolution required for the ILC with a  $20\times 20\ \mu\text{m}^2$  pixel size. Each pixel is to record the charge and time stamp of a hit to identify a collision bunch for event reconstruction. Necessary functions include the amplifier, comparator, shift register (memory sequencer) and multiple analog and time stamp memories implementation in each pixel, and column ADCs and Zero-suppression logic per chip.

Our second prototype sensor, SOFIST ver.2 has the analog memories and the time stamps but in separate pixels of  $25\times 25\ \mu\text{m}^2$  to evaluate the functions individually. We tested SOFIST ver.2 with 120 GeV proton beam at Fermilab Test Beam Facility in February 2018. An array of  $64\times 80$  pixels has about  $2\ \text{mm}^2$  active area in an overall chip size of  $4.45\ \text{mm}$  square. Preliminary result of timing resolution better than  $2\ \mu\text{s}$  has been obtained. We report the results of the beam test and recent status of the third and fourth SOFIST developments.

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