

# The OBELIX chip for the Belle II VTX Upgrade

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The proposed upgrade of the Belle II Vertex Detector (VTX) uses the same OBELIX sensor on all its 5 layers. OBELIX is a depleted monolithic active pixel sensor based on the TJ-Monopix2 chip, fabricated in a radiation hard CMOS 180nm process.

The OBELIX pixel-matrix is inherited from its predecessor, in contrast the periphery is entirely reworked. A newly designed 2-stage pixel memory matches Belle II trigger requirements, handling events with hit rates up to 120MHz/cm<sup>2</sup> at a 10us latency without buffer overflow. This logic also handles hit rate spikes of 600MHz/cm<sup>2</sup> and 0.5us duration with less than 0.5% data loss. This tolerance to spikes is necessary to maintain efficiency at the continuous injection scheme of the SuperKEKB collider.

In addition, OBELIX includes LDO regulators for supply voltages intending to simplify the chip integration into the detector system.

To improve track reconstruction performance, an additional high precision timing module is included in the periphery of OBELIX. A resolution of less than 3ns is expected, backed by measurements with TJ-Monopix2. This feature is, however, limited to low hit rates and will only be enabled for the outer 3 layers of the VTX.

A new feature for the vertex detector introduced by OBELIX is the possibility to contribute to the trigger. The chip can provide coarse hit information at low latency to the trigger system in order to build decisions based on VTX tracks. The current implementation is intended as a proof of concept. A transmission time of 200 ns is reached by reducing the matrix granularity to only 8 macropixels.

This poster will focus on the features of the OBELIX-1 chip currently under development. Details on the design and implementation, as well as results of various performance simulations calibrated with real data from TJ-Monopix2 measurements will be presented.

## Collaboration

Belle II VTX Upgrade

## Role of Submitter

I am the presenter

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