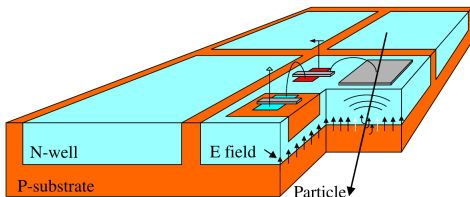# MuPix Sensors for the PANDA Luminosity Detector

Tobias Weber
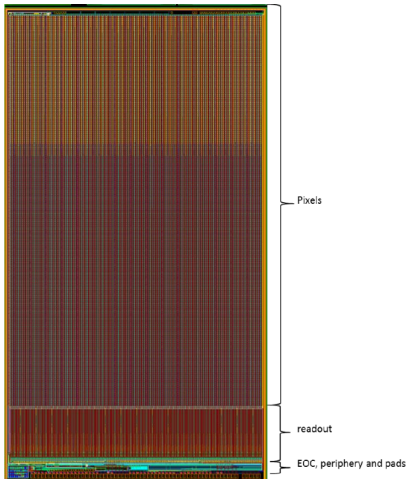
PANDA Collaboration Meeting XVIII
07.03.2018

High Voltage Monolithic Active Pixel Sensors

- design by Ivan Peric for Mu3e collaboration
- AMS aH18 technology
- application of bias voltage
  - formation of depletion layer
  - fast charge collection and radiation tolerance
- thickness less than 50 µm

MuPix 8 Prototype

- size about 2 cm x 1 cm
- production on substrates with different resistivities
- separation of pixel matrix into two different parts
    - voltage signal transmission
    - current mode signal transmission
- **expected** radiation hardness $5 \times 10^{15}\,n_{eq}/cm^2$

MuPix 8 Prototype

- time-over-threshold information part of data stream
  $\Rightarrow$ test of time-walk correction (see talk by Tabea)
- new slow control scheme using two clocks
- four serial readout links with 10b/8b encoding
  - three high speed links
  - transmission of multiplexed data on fourth link
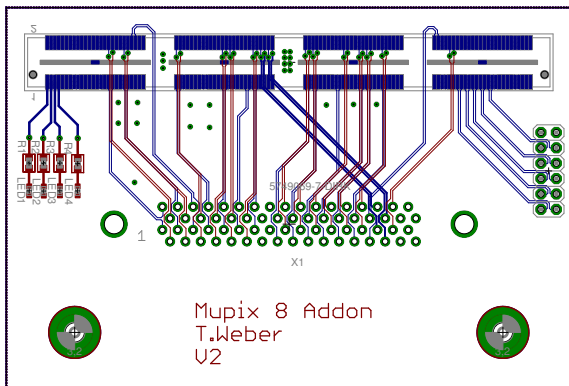- first prototypes expected in Bochum mid of March 2018
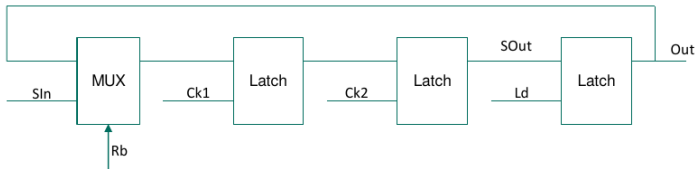
MuPix 8 - Sensorboard
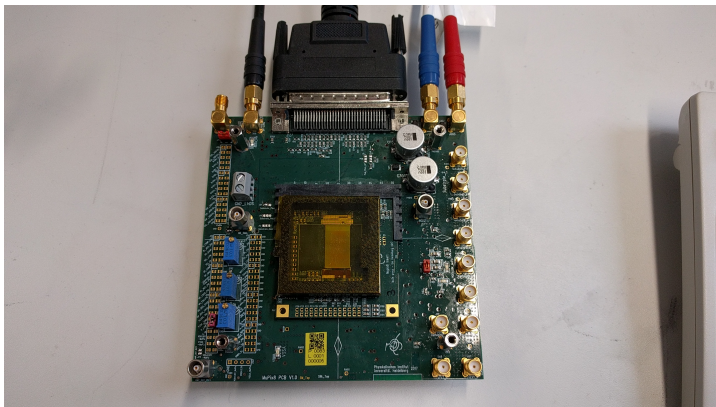
- chip on separate insert-PCB
- additional insert for simulation of chip with FPGA

MuPix 8 - TRB Addon

- new addon board for Hades Trigger and Readout Board
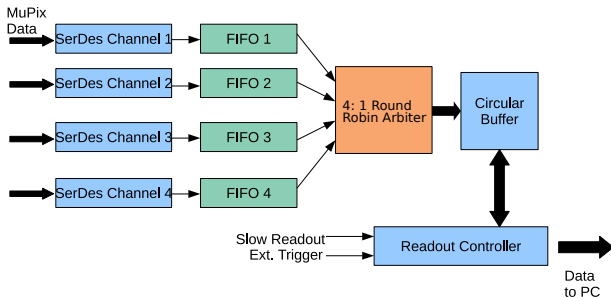- differential transmission of signals

MuPix 8 - Slow Control

- SPI-like slow control
- long shift register for slow control $\Rightarrow$ use two clocks and intermediate latch to keep input capacitance low
- multiplexer and read back signal to read data from shift register output without sending new configuration data

MuPix 8 - Readout

- dedicated SerDes Blocks on TRB
  - Clock Recovery
  - Deserializer and Word Alignment
- storage in FIFOs
- single link to downstream DAQ computer
  - multiplexing of data into circular buffer
  - readout of buffer controlled by dedicated entity

MuPix 8 - Software

- rewrite MuPix 8 DAQ software from scratch
  - where possible replace Qt by C++ standard library/boost
  - Qt only for GUIs
- slow control and user interface (talk by René)
- readout and measurement algorithms need to be implemented

Summary and Outlook

MuPix 8

- MuPix 8 prototype will arrive in Bochum soon
- first testing firmware finished
- work on slow control and readout software in progress
- DEBUGGING!

MuPix Development

- work on MuPix 9 almost finished
    - small prototype to test daisy chaining of power supply and slow control signals
- full size prototype MuPix X to combine all features