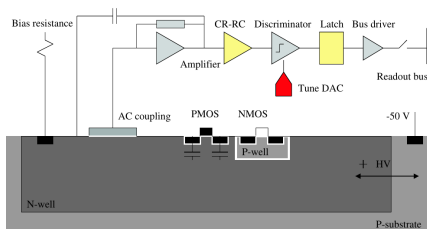


MuPix Test Beam Results and Luminosity Detector Readout

Tobias Weber

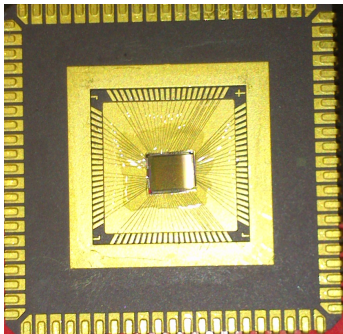
PANDA Collaboration Meeting
Luminosity Detector Session

HV-MAPS



- fast charge collection
- radiation tolerant
- thickness of 50 μm
- LVDS-Link @ 400-800 Mbps
- design by I. Peric

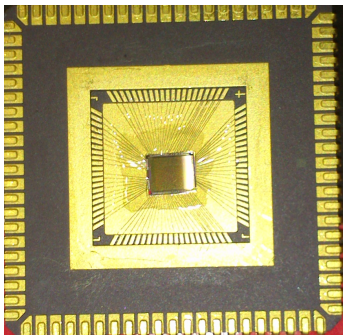
HV-MAPS



Prototype: MuPix 4

- 40x32 pixel with $80\text{ }\mu\text{m} \times 92\text{ }\mu\text{m}$
- column logic on chip
- readout and slow control by FPGA-Board
- implementation of test DAQ in good shape

HV-MAPS

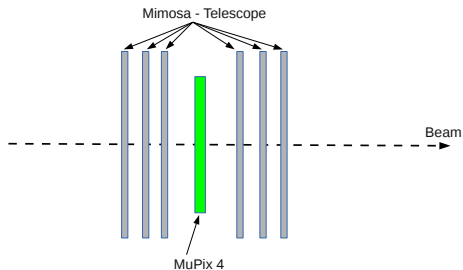


Prototype: MuPix 4

- 40x32 pixel with $80\text{ }\mu\text{m} \times 92\text{ }\mu\text{m}$
- column logic on chip
- readout and slow control by FPGA-Board
- implementation of test DAQ in good shape
- problems with bonding to carriers \Rightarrow only one working MuPix 4 in Heidelberg

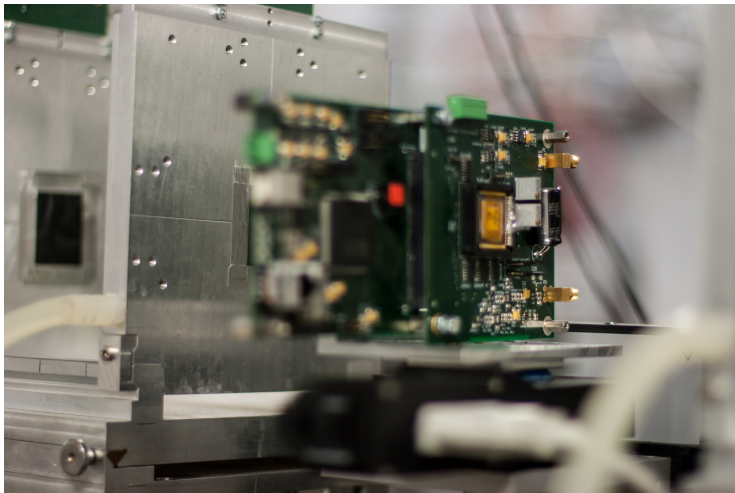
DESY Testbeam

Test beam of Heidelberg group with EUDET telescope

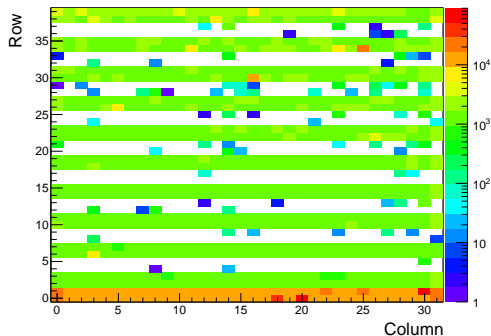


- electron beam with 3-5 GeV
- measurement of timing resolution ≈ 17 ns
- measurement of sensor efficiency

DESY Testbeam

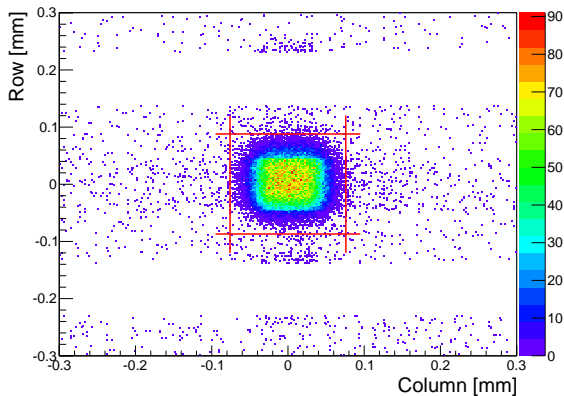


MuPix Hit-Distribution



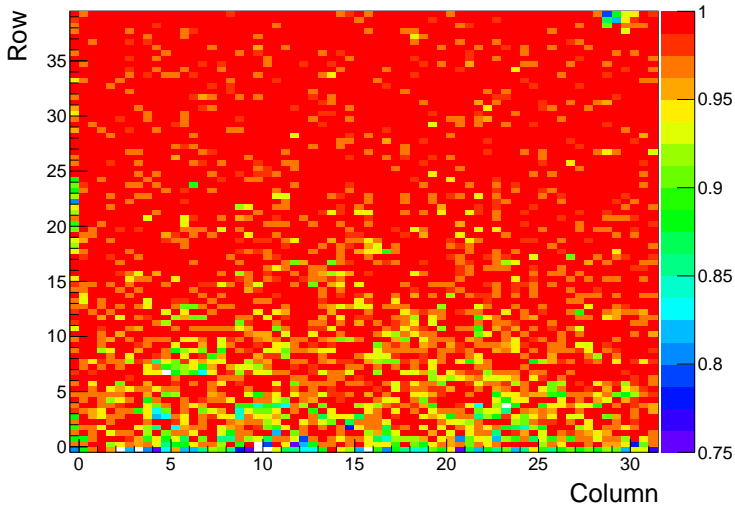
- timing problem in row address readout
⇒ Projection of hits into first two rows
- high noise in some pixels

Hit-Track Cuts

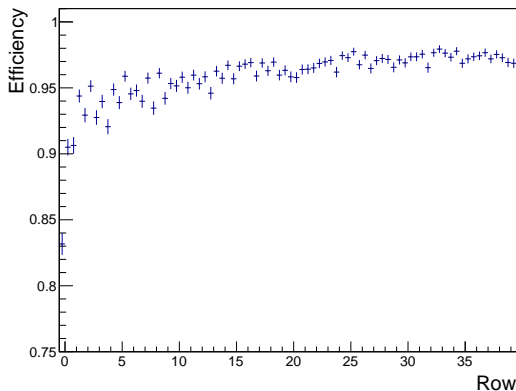


- rectangular cut on hit-track distance:
 $|d_i| < 0.95 \cdot \text{pitch}_i$

Efficiency (Column-Information only)



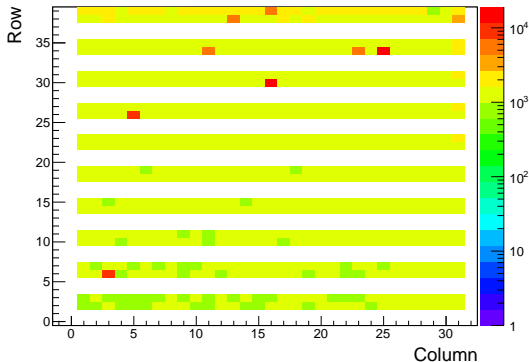
Projected Efficiency (Column-Information only)



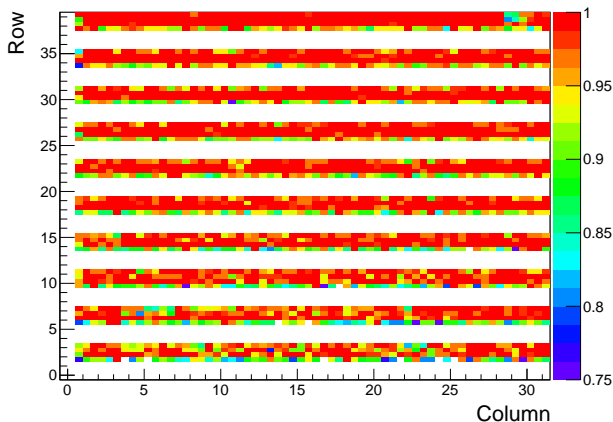
- increase of efficiency with row number
- possibly systematic effect from TDAC tuning algorithm

Additional Cuts

- removal of Hits/Tracks in broken rows
- ignore sensor edges
- discard events with more than 4 hits in MuPix

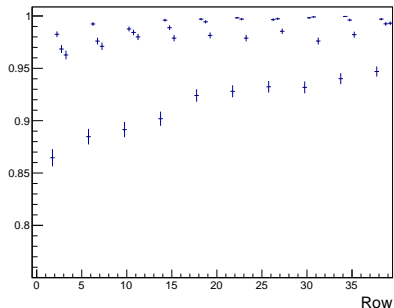
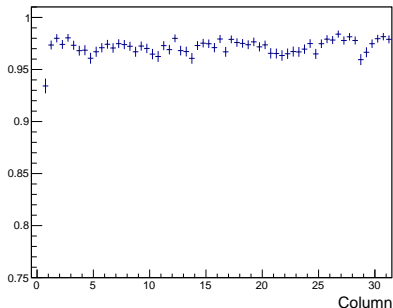


Global Efficiency



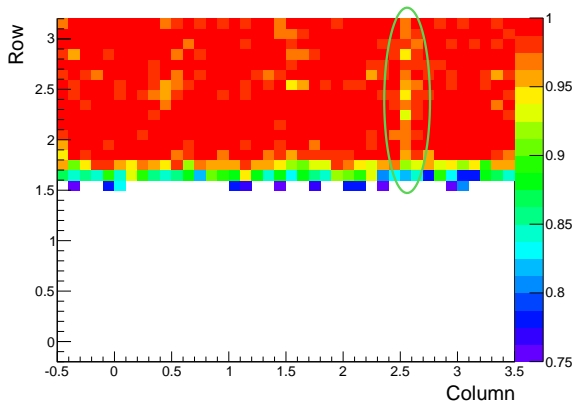
- efficiency between 75-99 %

Projected Efficiency



- average column efficiency above 95%
- increase of efficiency with row number

Folded Efficiency



- structure with reduced efficiency observable
- caused by guard ring (and expected by Ivan)

Summary and Outlook

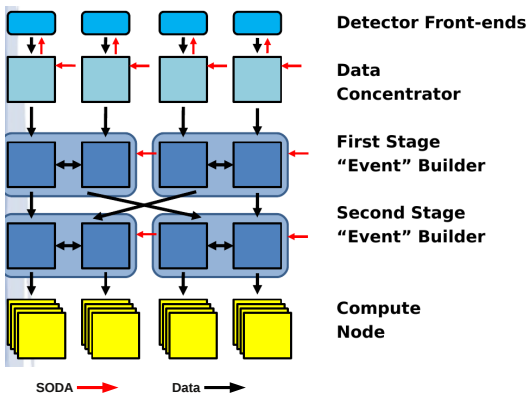
Summary

- test beam with Mu3e Group last October
- problem with row-readout in MuPix 4
- efficiencies look promising

Outlook

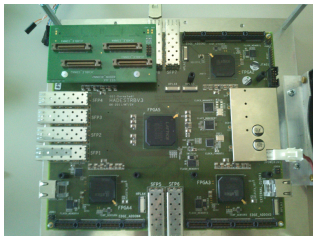
- new MuPix prototype in March
 - additional Amplifier \Rightarrow improved signal-to-noise
 - improved comparator and TDAC handling
 - changed pixel size $103 \times 80 \mu\text{m}$

PANDA DAQ-System



- generation of online-trigger
- time synchronisation of all subdetectors: SODA

TRBv3 as Data Concentrator



Issues (PANDA)

- low optical fiber-speeds
- possibly too slow for SODANET
- bad form factor

Issue (Lumi)

- six free Serdes-circuits per side
FPGA \Rightarrow 24 links/TRB
- to increase links/TRB
 - Serdes and 10b/8b Decoder in FPGA-logic
 - Clock-Data Synchronisation with Delay-IC

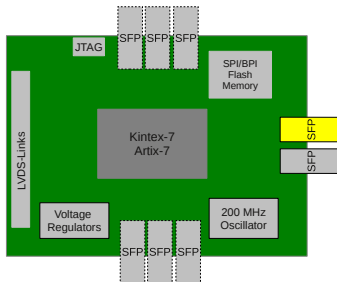
New PANDA Data Concentrator

What we know (before the meeting):

- data distribution over optical fibers
- no additional connectors for sensors (eg. LVDS)

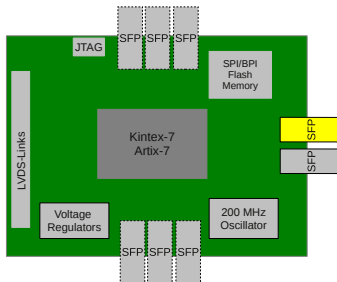
⇒ need to develop own Frontend FPGA-board

Lumi Frontend FPGA-board



- based Xilinx Kintex/Artix-7
- compatible with SODA
- feasibility study by IMM

Lumi Frontend FPGA-board



- time sorting
- multiplexing of sensor data
- generation of SODA-frames

Thank You!