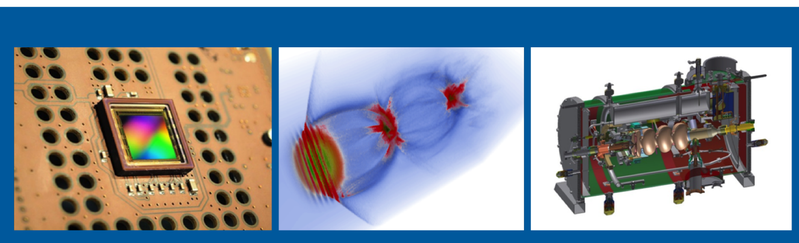
Matter and Technologies

Free-Running Readout ASIC for Microstrip Sensors

Topic 2: Detector Technology and System



André Goerres (FZJ)

A Fast and Low Power Readout ASIC

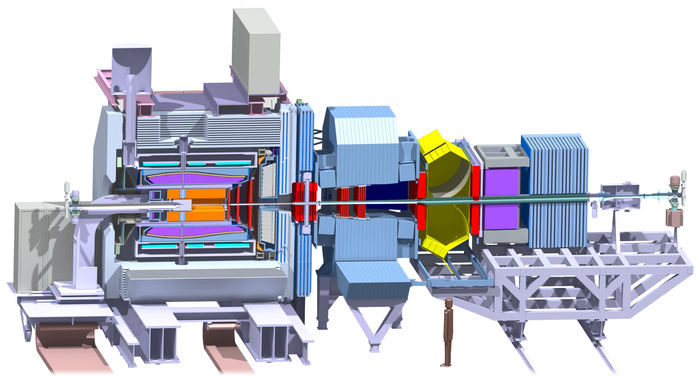
Front-End Performance

• High rate	100,000 /s/ch
• Time binning	50-200 ps
• Charge resol.	8 bit (dyn. range) *
• Low power	< 4 mW/ch *
• Pitch	60 µm/ch
• Radiation dose	100 kGy *

* Design Goal

Close cooperation with INFN Torino

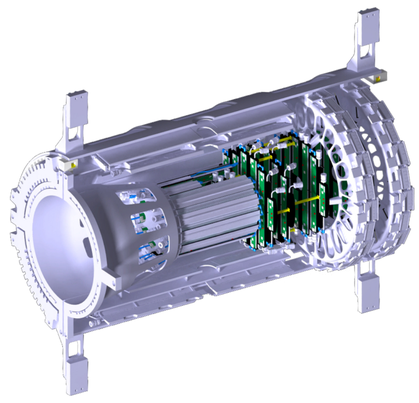
Possible Application

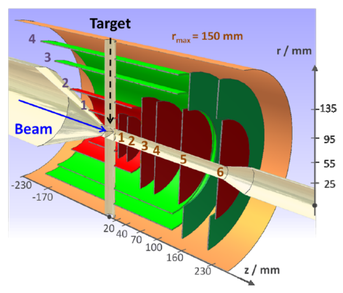


PANDA

Antiproton **An**nihilation **Da**rmstadt

Micro Vertex Detector (MVD)





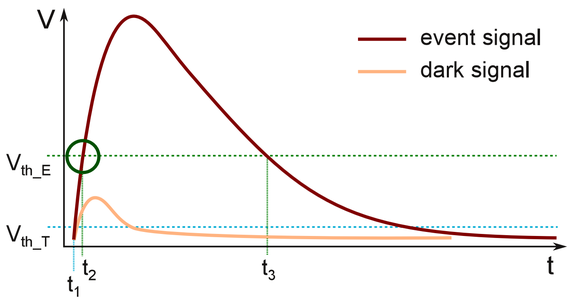
Innermost detector for vertex tracking

pixel: 10^7 ch

strips: $2 \cdot 10^5$ ch

The PANDA Strip ASIC (PASTA)

Measurement Concept



Readout

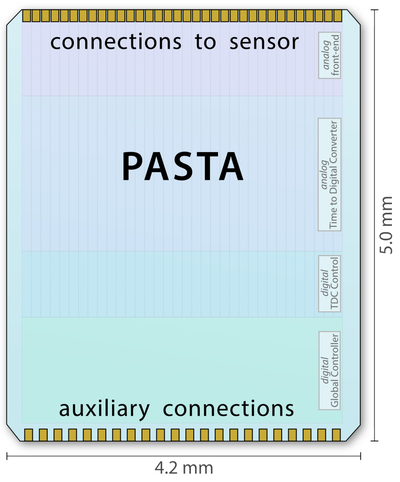
Timestamps (50 ps res.)

Time over threshold

Data driven (no LVL1-Trig.)

Concept based on TOFPET ASIC

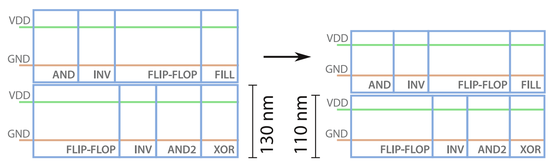
Components in the ASIC



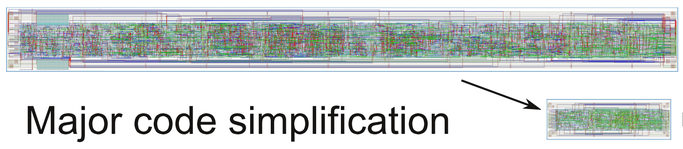
1. Amplification & discrimination
2. Time interpolation, Wilkinson ADC
3. Control charging, initiate storing
4. Handling config. & channel data

From TOFPET to PASTA

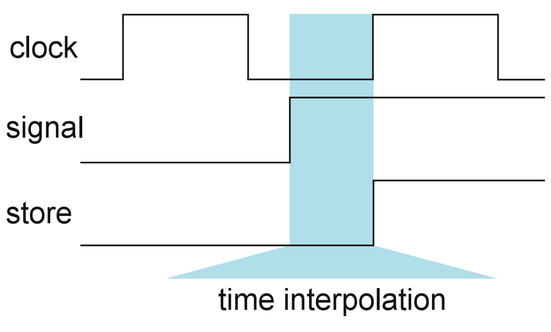
Technology Change



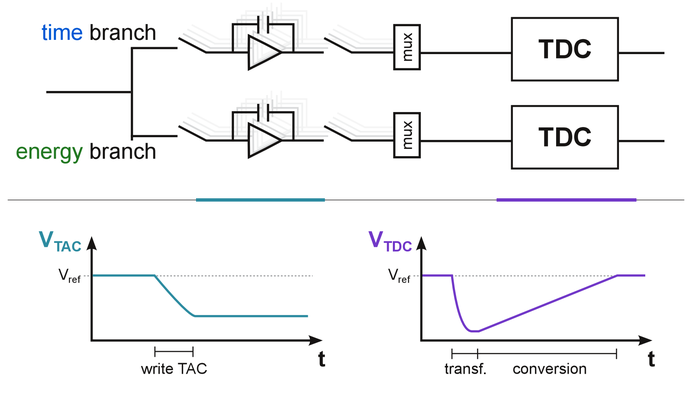
New TDC Control



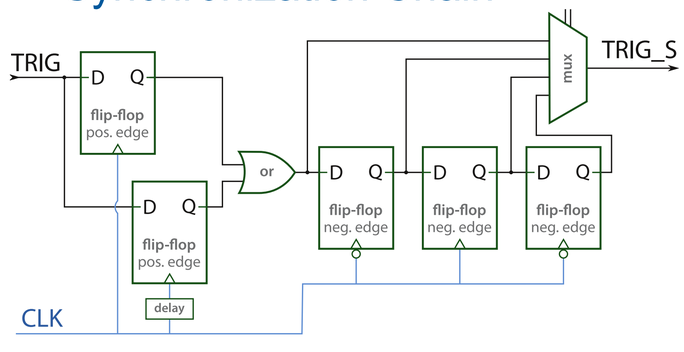
Time Interpolation



Time Interpolation in TDC



Synchronization Chain



Current Status

TDC Controller

- Second version finished
  - All improvments implemented
  - New code fully functional
- Single Event Upset protection of operation critical components

Global Controller

- Adapted to TDC control v2
- Implementation of Single Event Upset protection started

TDC Parameter:

Area Occupation

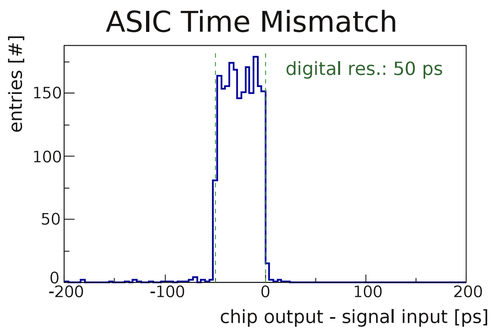
84.8% → **6.5%**

Power [mW/ch]

1.57 → **0.07**

Complete TOFPET: ~8 mW/ch

ASIC Time Mismatch



Conclusions & Outlook

Conclusion

- PASTA in development
- Time-based readout (based on TOFPET)
- Fast, simple, and low power consumption
- Adapted to microstrip readout
- New TDC controller, radiation protection

Outlook

- Combine analog and digital designs
- Submit design (summer 2014)
- Test first PASTA chip

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