



AGH UNIVERSITY OF SCIENCE  
AND TECHNOLOGY



# Overview & Status of PASTTREC submission & production

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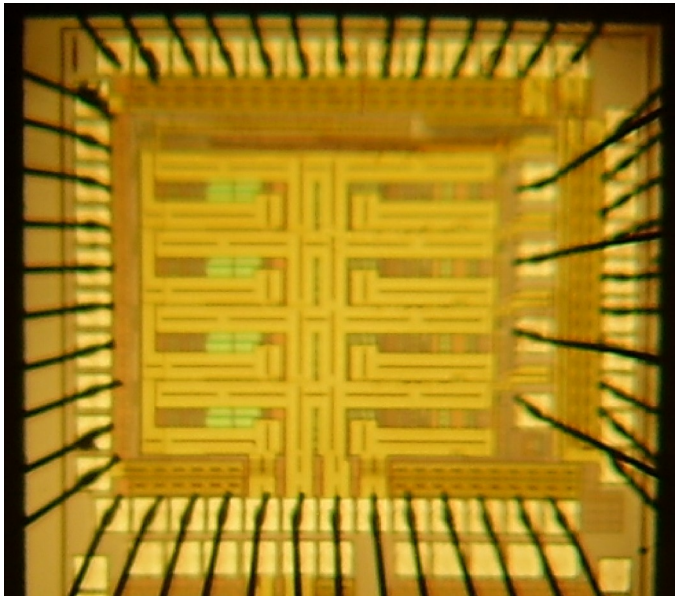
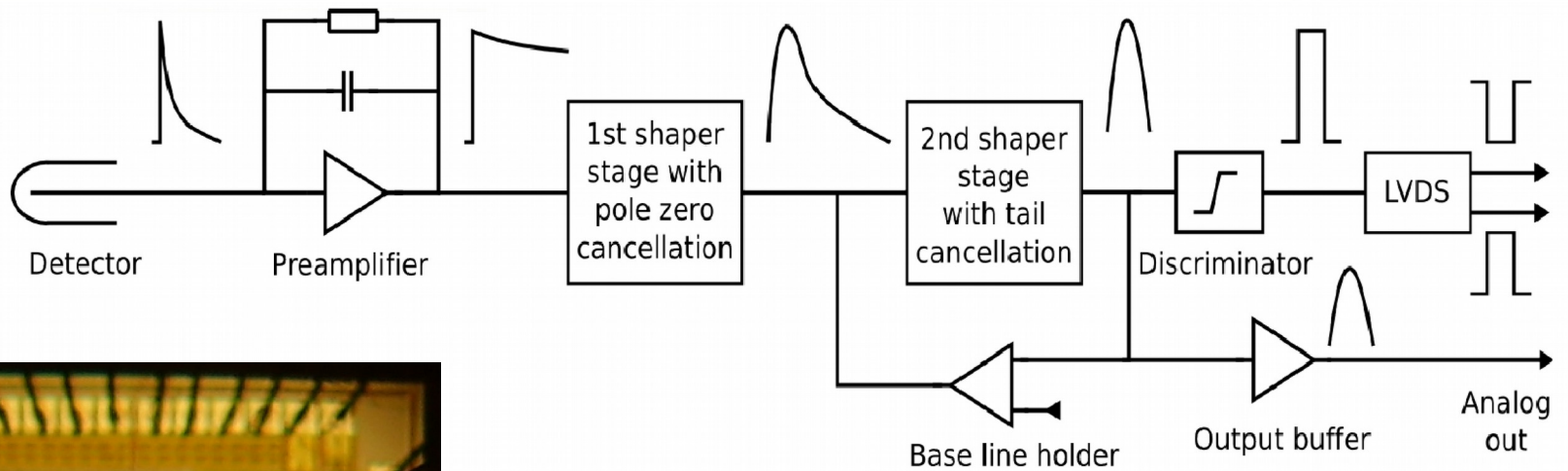
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23 June 2020, PANDA Collaboration Meeting 20/2

- Introduction to PASTTREC
- Verification in Beam-test Measurements
- Contract for FT&STT Readout between FAIR, UJ and AGH
- Synergy with Hades MDC detector
- Submission&Production Status

# Introduction to PASTTREC Front-end for PANDA FT&STT



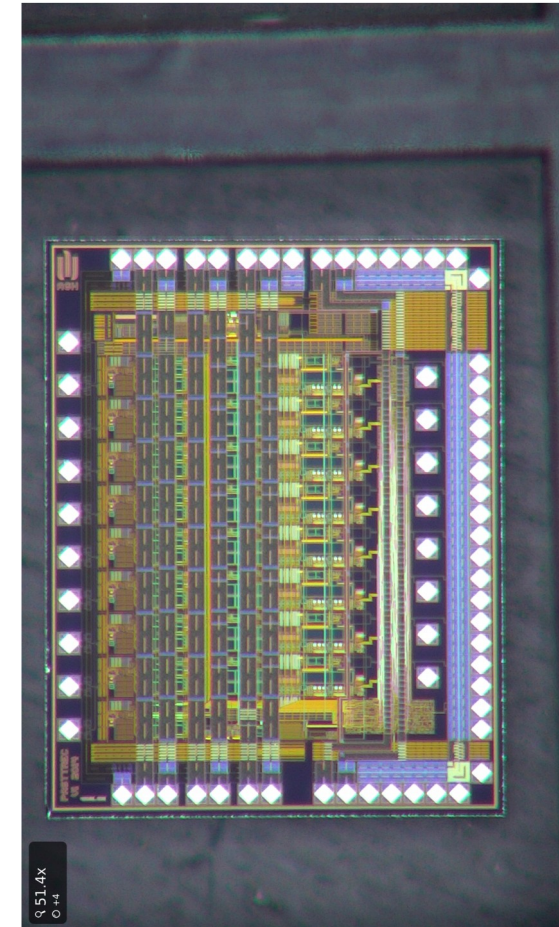
As a first prototype of FT&STT front-end a 4-channel ASIC was developed in AMS CMOS 0.35 $\mu$ m. It consisted of: charge preamplifier, shaper with PZC, ion tail cancellation circuit, baseline holder, discriminator, LVDS output and analog output.

Laboratory tests and first beam-tests confirmed that the chip fulfils the requirements - results published in JINST, TNS.

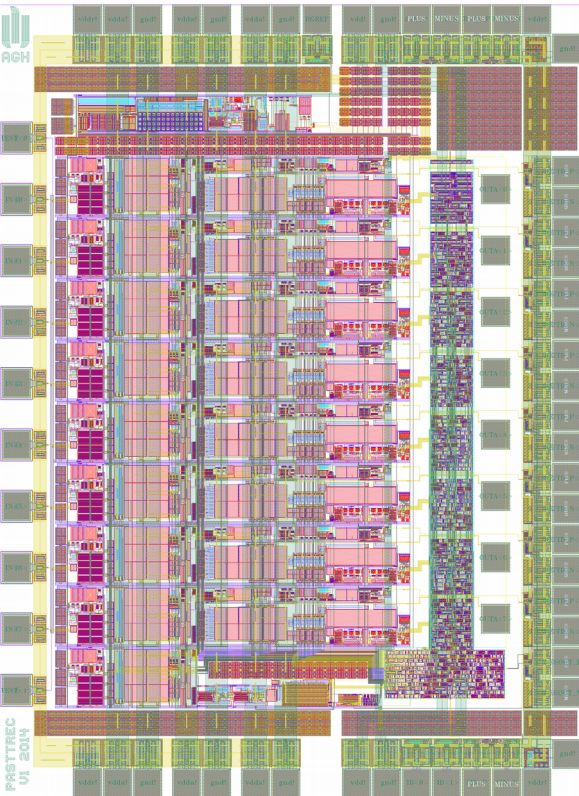
# Introduction to PASTTREC

## 8-channel PASTTREC ASIC

In 2014 an 8-channel improved ASIC called PASTTREC (Panda STraw Tube REad-out asiC) was designed and fabricated. In PASTTREC the core processing blocks were improved and new functionalities/blocks, such as slow control logic or baseline trimming 5-bit DAC in each channel, were added.



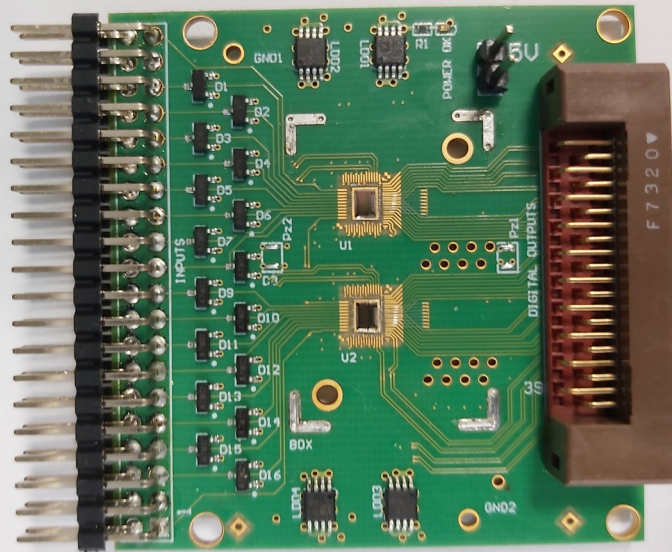
*Photograph of PASTTREC*



*Layout of PASTTREC*

# Verification in Beam-test Measurements

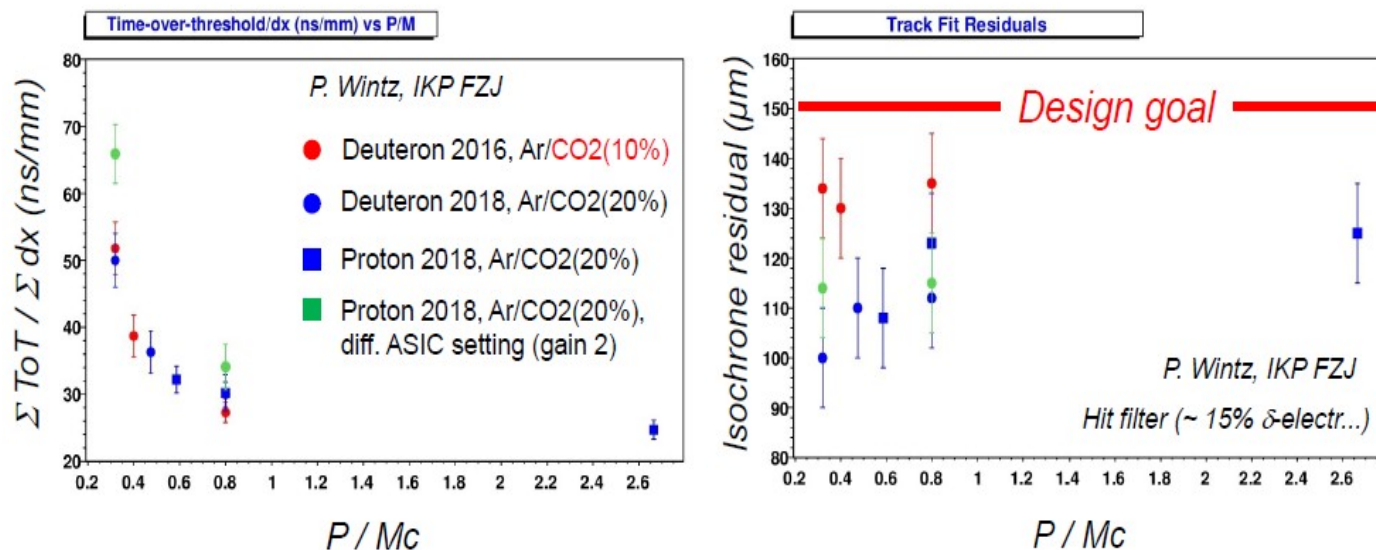
## Front-end boards



- For the readout of the FT and STT detectors several versions of 16-channel front-end boards FEBs (two PASTTRECs per board) were developed. These boards were accepted as the common solution for both tracking systems.
- Using these FEBs several beam-tests with setups containing many hundreds of straw tubes were performed.
- Presently we do not use PASTTREC analog outputs (TOT measurement is enough), saving on number of connections, on power of external buffers, and simplifying readout system.
- Power of front-end board is  $\sim 50\text{mW/channel}$  (4V Power Supply,  $\sim 200\text{mA}$  total current)

# Verification in Beam-test Measurements

## Spatial resolution and TOT



Several beam-tests with setups containing many hundreds of straw tubes were performed to check whether the complete detector system achieves the required by the FT and STT spatial resolution of 150 $\mu\text{m}$ . In addition, for the STT it was studied whether the TOT resolution was sufficient for particle identification, i.e. to separate protons, pions and kaons in a wide momentum range  $200 < p < 1000$  MeV/c, corresponding to the energy deposition in the straw tube in the range between 1-10 MIPs. The results of various experiments were extensively discussed in the PANDA tracking group led by dr. P. Wintz and presented in 2 phd works (JU and KVI-Groningen) and two publications. The test-beams showed that both the spatial resolution and the energy resolution met the requirements.

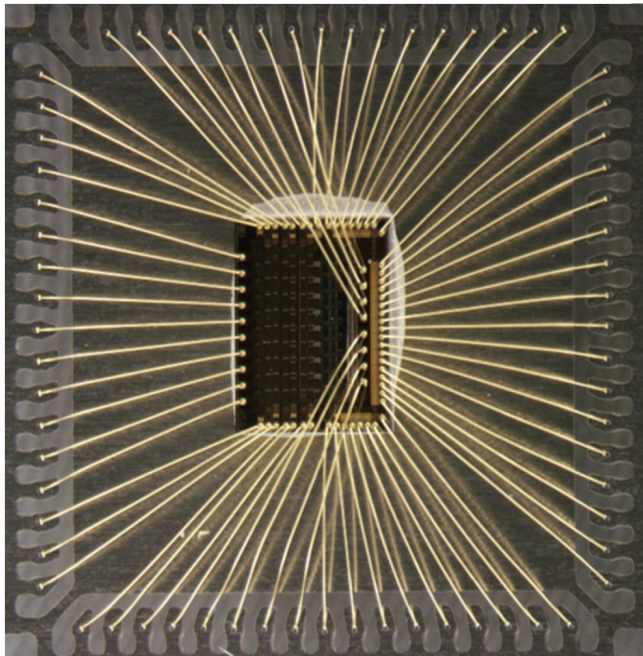
## **Contract for FT&STT Readout Electronics between FAIR, UJ and AGH**

- In December 2019 the In-Kind Contract for the Read-out Electronics for STT and FT in the PANDA Experiment, was signed between the FAIR, UJ and AGH. Within this contract AGH will contribute with “The Design, prototyping, production, testing and delivery of the Read-out Electronics for STT and FT” for the PANDA experiment.
- AGH in collaboration with Jagiellonian University will provide the readout electronics for about  $\sim 5000$  straw tubes in the STT and for  $\sim 15000$  straw tubes in the FT.

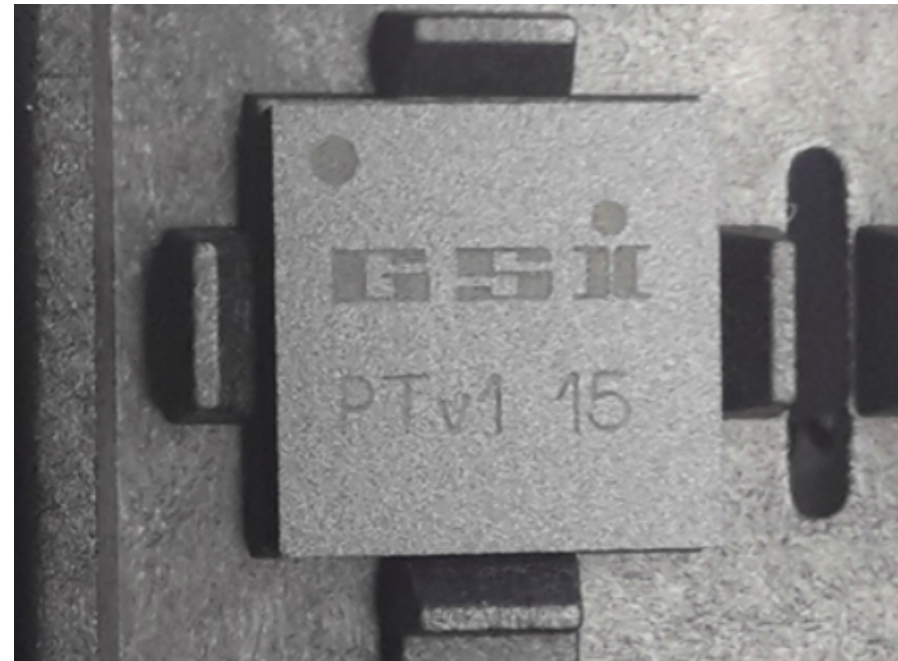
## Synergy with HADES MDC detector

In last years close collaboration between AGH, UJ and HADES MDC detector group has been established, due to the interest of HADES group in using PASTTREC for the MDC detector readout.

- AGH agreed to use PASTTREC in MDC detector
- MDC group initiated very useful works on the performance of packed PASTTREC
- A lot has been done in Frankfurt and Kraków in last two years...



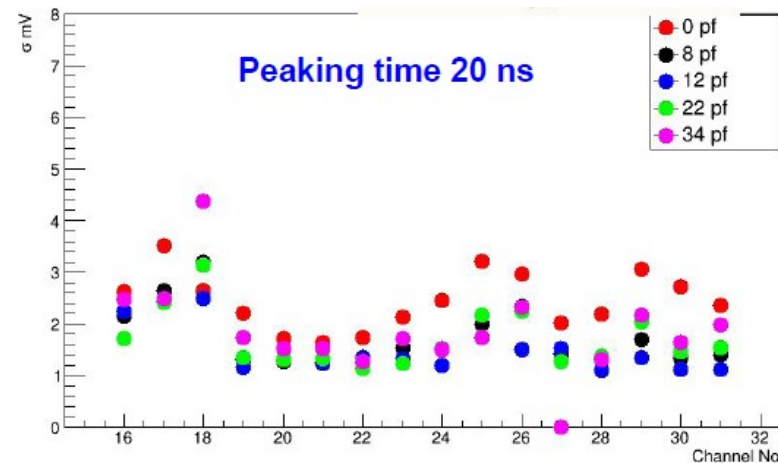
*Photographs  
Of packed  
PASTTREC*





## Synergy with HADES MDC detector proceeding to final solution...

- New front-end boards for packed PASTTREC have been developed in Kraków
- MDC group has been taking care of packaging of PASTTREC chip
- Measurements of new FEBs with packed PASTTRECs are presently performed in parallel in Kraków and Frankfurt
- **For the comparison of packed and bonded PASTTRECs see presentation of Akshay Malige "Status of FEB tests, comparison of packed vs bonded PASTTRECs". These measurements are done using full setup with straw tubes readout by new FEBs with packed PASTTREC**
- Using packed PASTTREC chips will simplify significantly the production of FT&STT readout
- **On the basis of recent measurements we have decided to use packed PASTTRECs in FT&STT readout**



## Submission&Production Status

- We would like to order safe amount (with large margin) of ~5000 PASTTREC chips
- For several reasons (contract delay, coronavirus) PASTTREC production has been delayed significantly
- Within last two months all details regarding PASTTREC production have been agreed with the Fab (AMS). Last two weeks we have been tuning various small details regarding chip dicing etc., in order to pack chips in most efficient way
- We are just waiting for the final offer, to go on with order and production.

*Thank you for attention*