

# Barrel slice assembly

-Present status and ongoing preparations-

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PANDA CM, November 2018

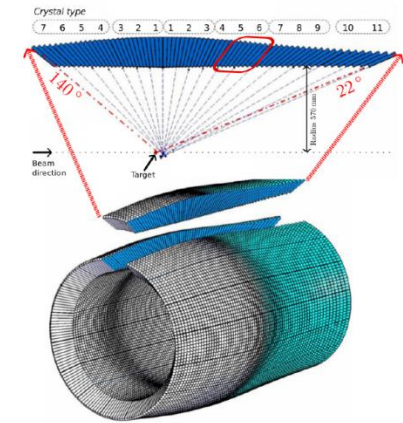


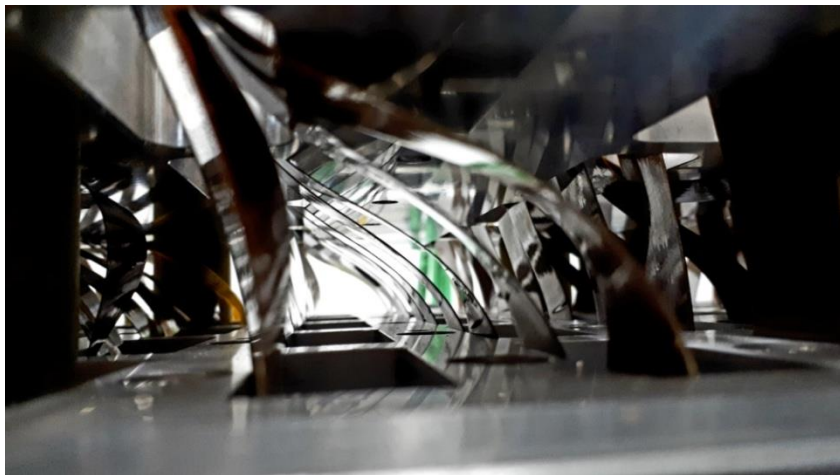
## •Envisaged milestones:

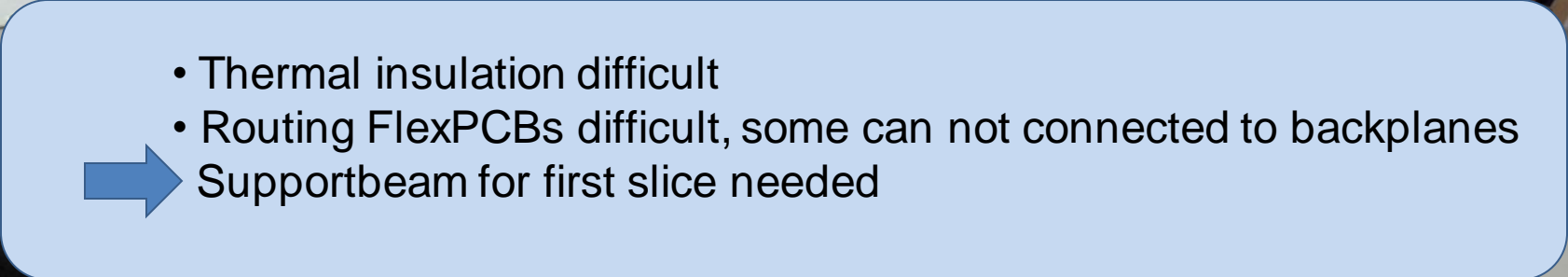
### Assembly of 1<sup>st</sup> full Barrel EMC slice

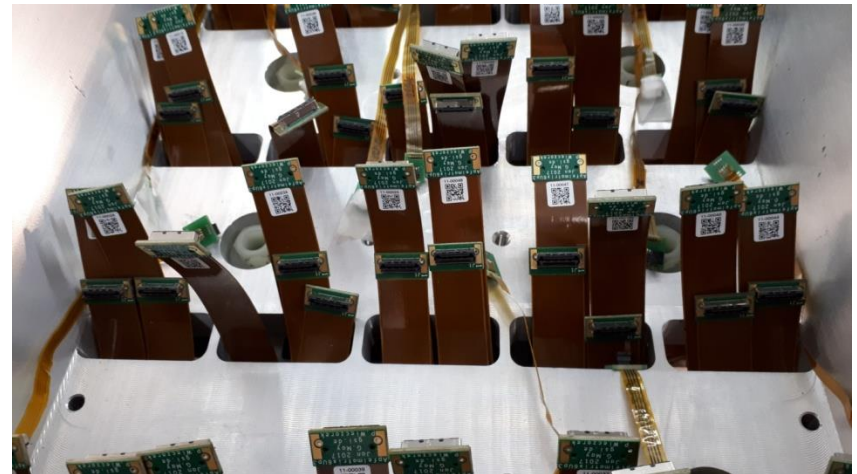
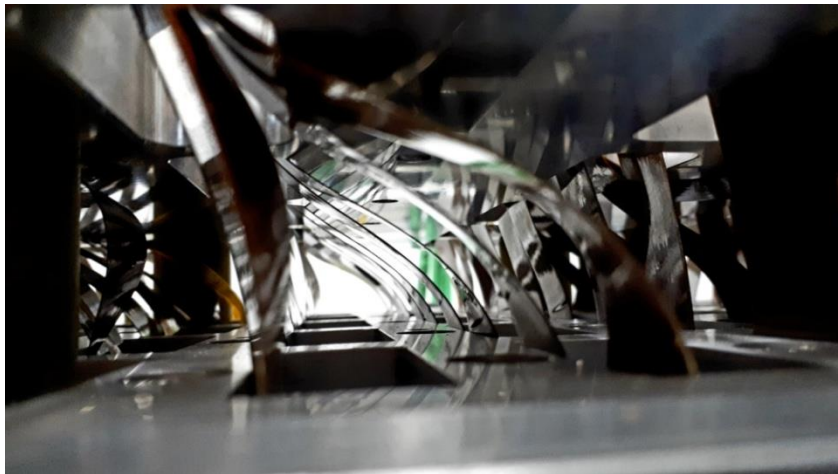
- Infrastructure ✓
- Mechanics (not approved yet) ✓
- 710 detectors ✓
  - 710 crystals in 11 different geometries ✓
  - 1420 APDS ✓
    - Screening including irradiation ✓
    - Matching ✓
    - Glueing ✓
- Capsules ✓
- Wrapping ✓
- Assembly of 18 modules ✓
- Assembly of Supermodules ✓
  - 360 left and 360 right handed APFEL-ASIC with flex PCBs ✓
  - ASIC housing or fixtures ✓
- Assembly of slice (✓)
  - Cooling
  - Isolation
  - Backplanes
  - Cables
  - Light pulser fiber coupling

in progress  
 in progress  
 in progress  
 in progress  
 in progress





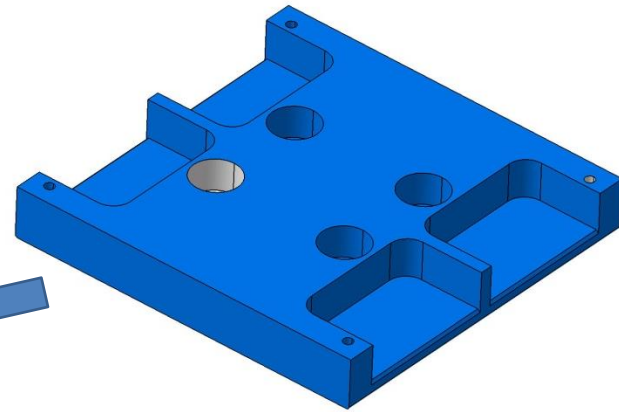
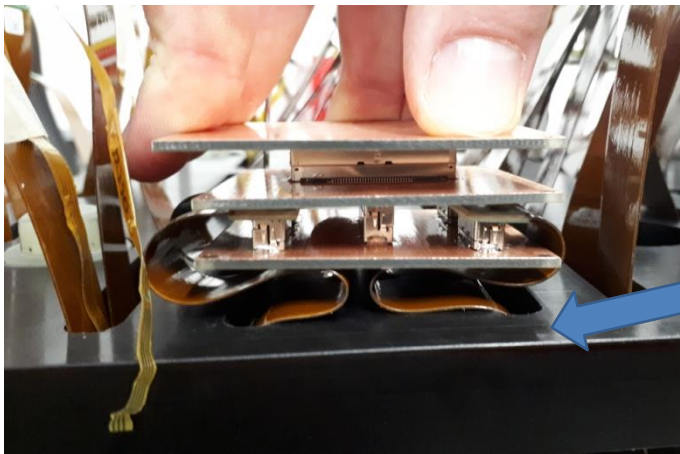
- 
- Thermal insulation difficult
  - Routing FlexPCBs difficult, some can not connected to backplanes
  - ➔ Supportbeam for first slice needed



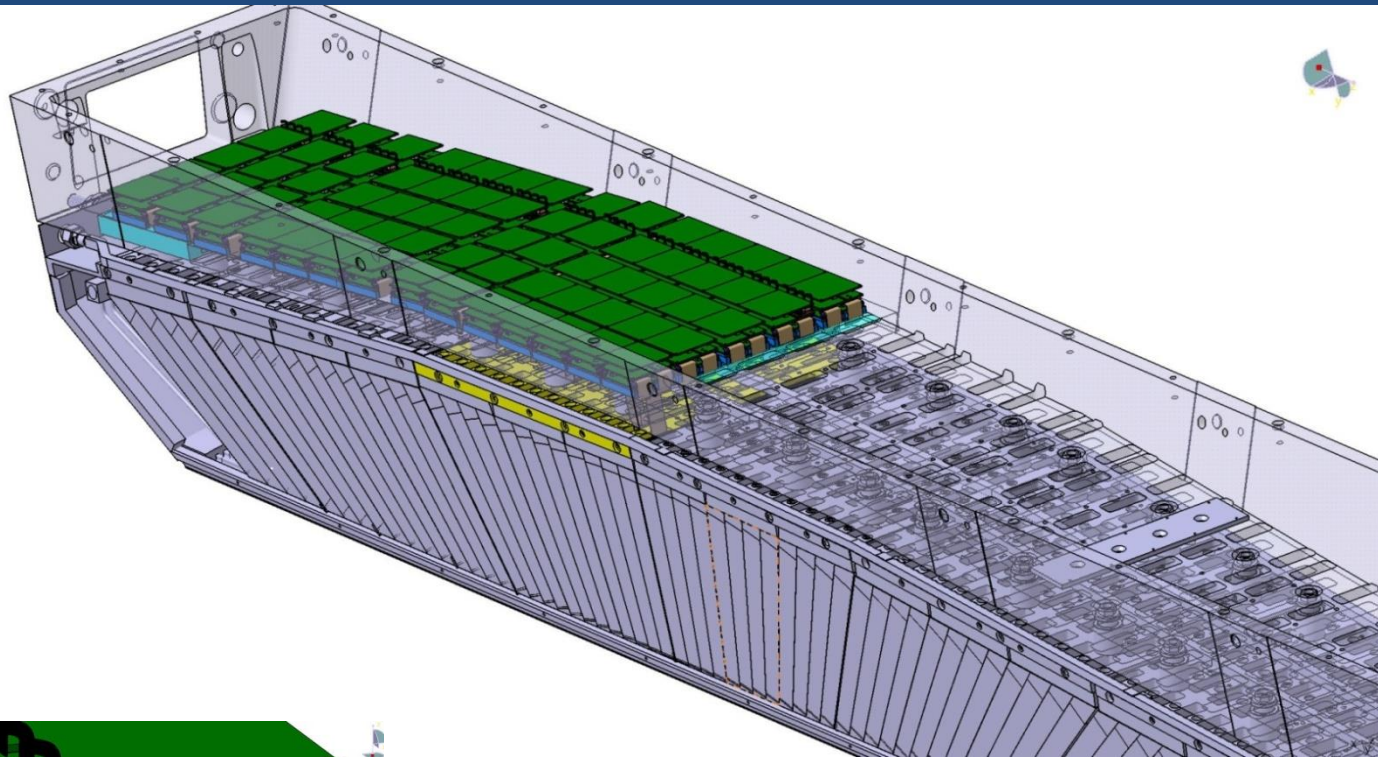
Test segment



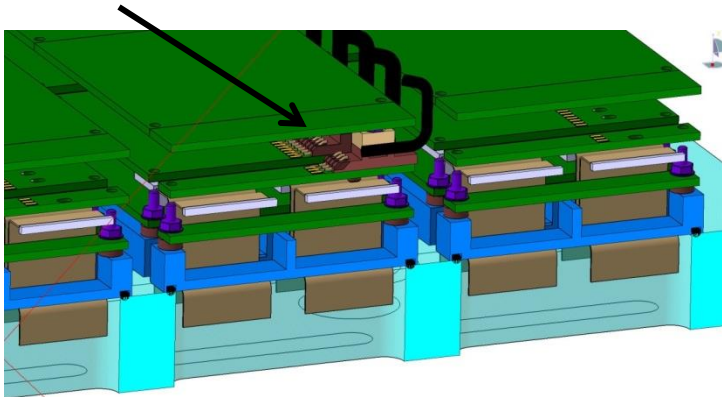
- Design proposal seems promising
- All FlexPCBs have nearly the shortest way trough the thermal insulation



suitable backplane fixture design



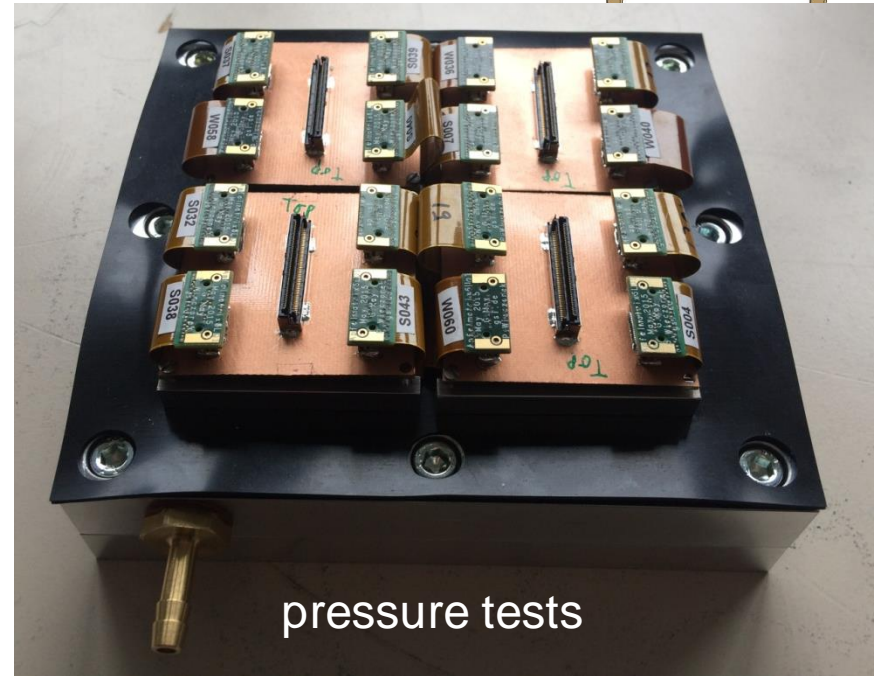
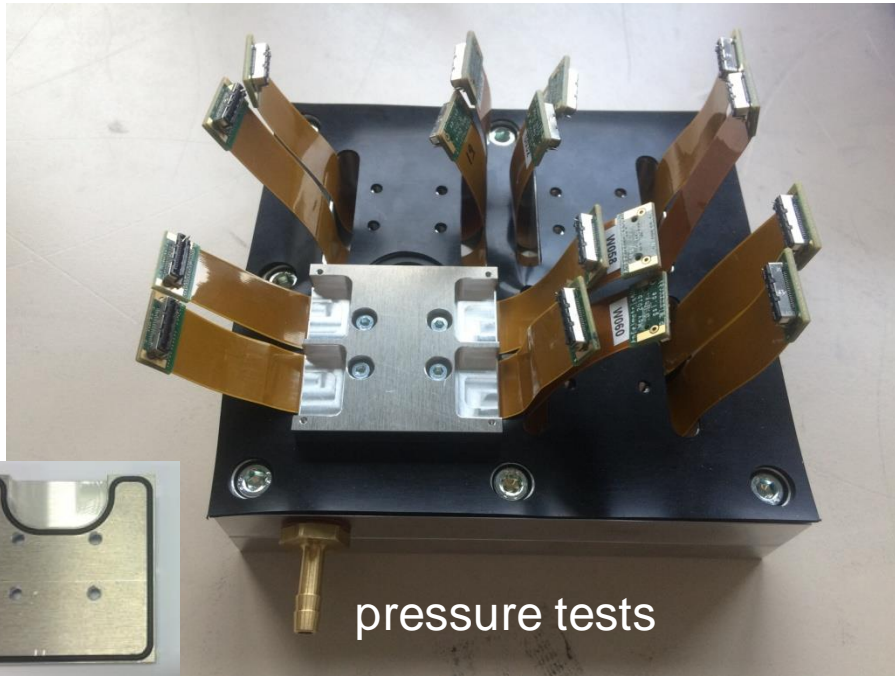
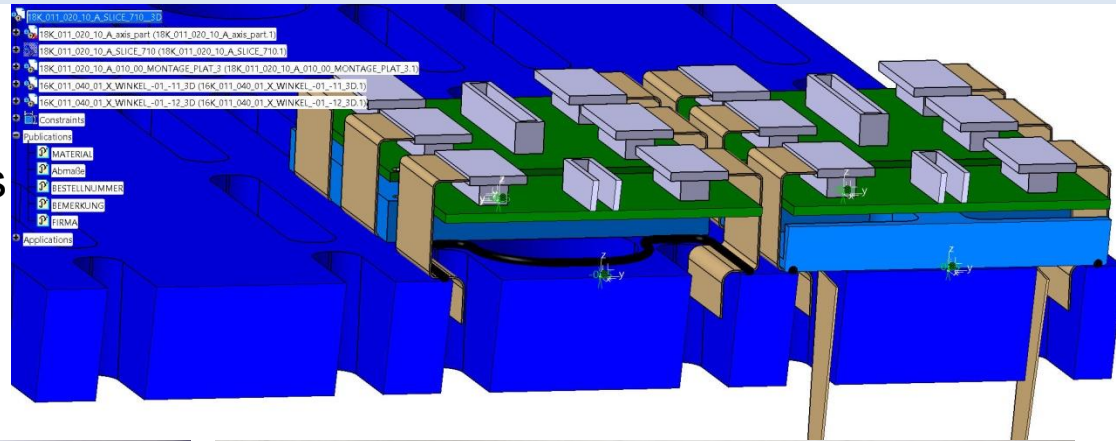
pull relief  
signal cables



- Design work needs to be done for whole beam
  - Position openings
  - Space for backplanes
  - Space for cables
  - ....
- Has to be tested and modified with further plastic segments

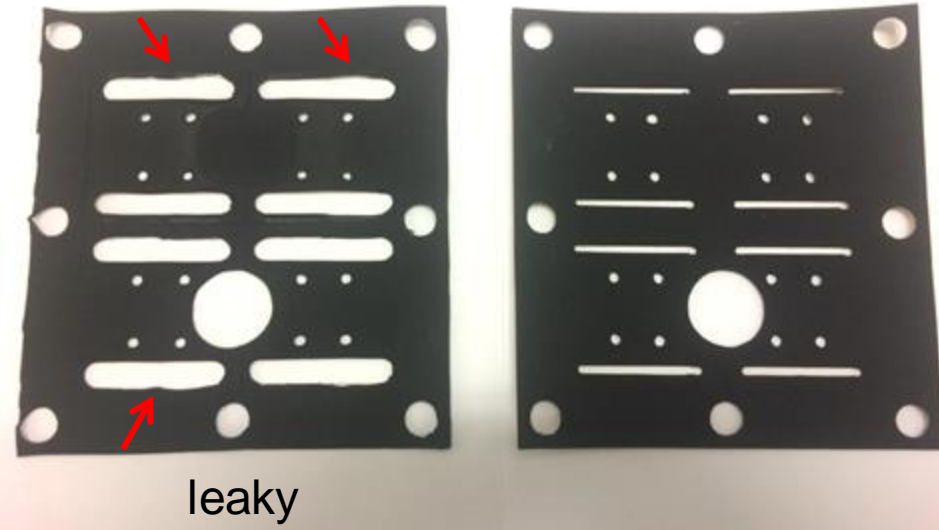
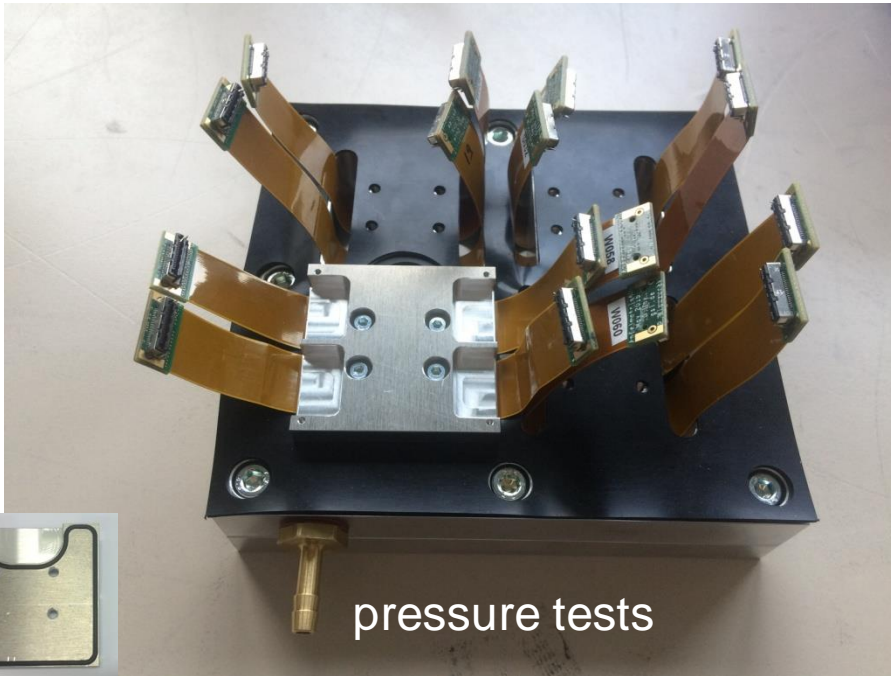
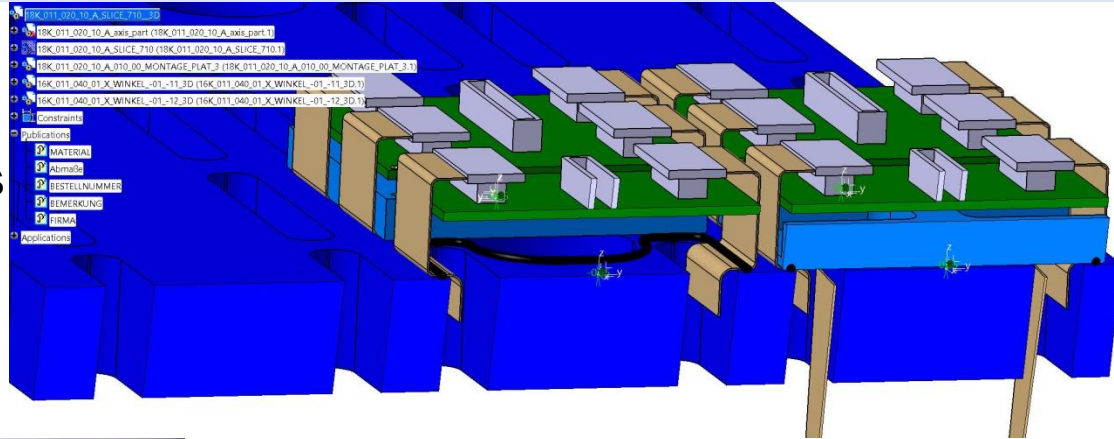
## Proposal:

- Support beam sealing via fixations
- Different materials currently investigated



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- Support beam sealing via fixations
- Different materials currently investigated







## Solution for first Slice?



SAMTEC FireFly

- Significant cross-section reduction
- Mechanic locked connectors
- Offer requested



forward region

100 % efficiency

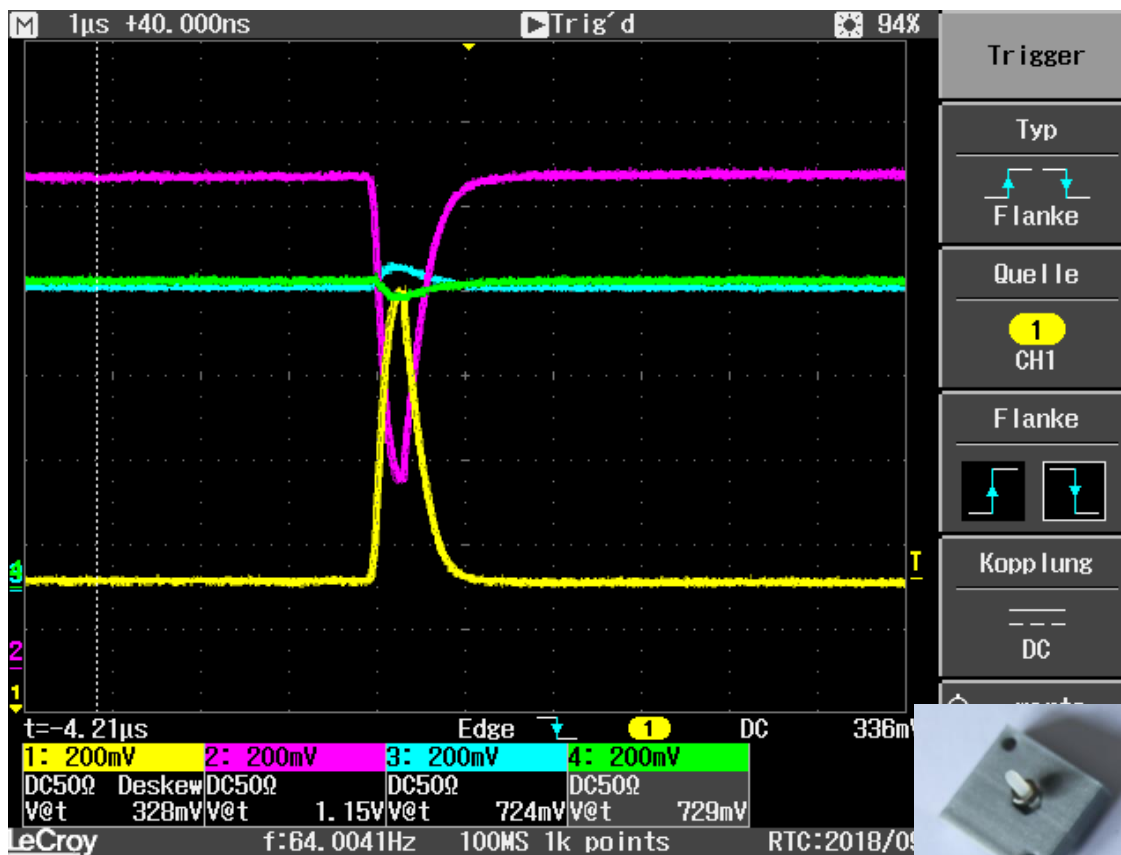
backward region

0.5 % efficiency

## Proposal

- 10 mm
- Rad. hard. quartz
- Housing and size for proof of principle only

Prism

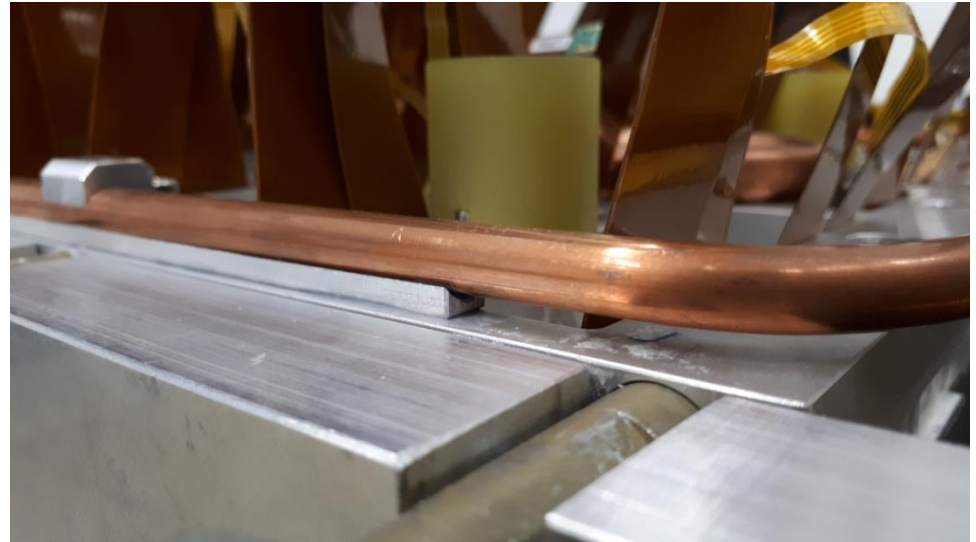
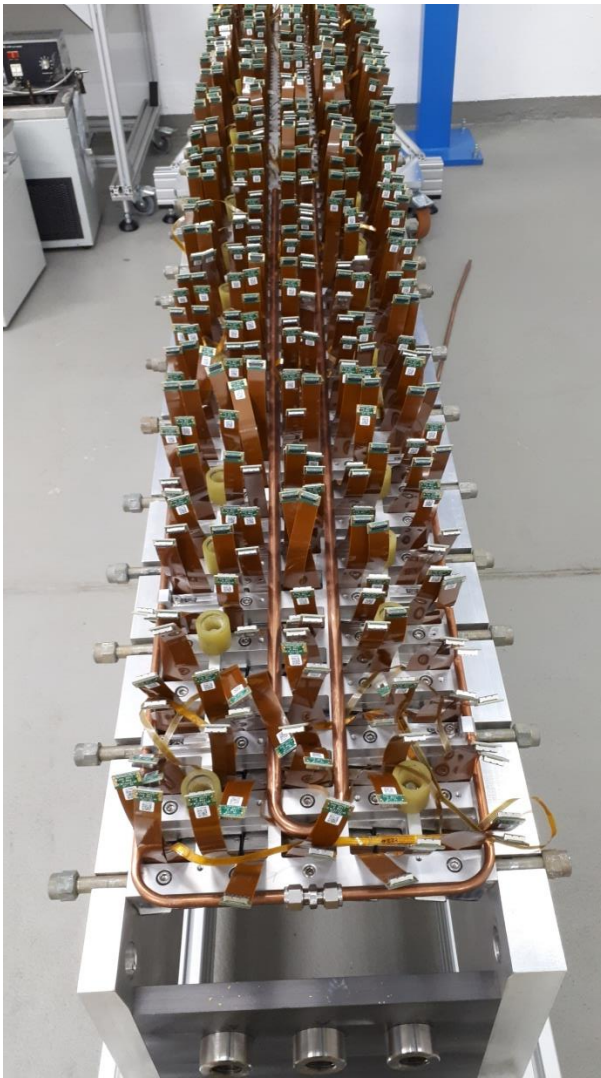


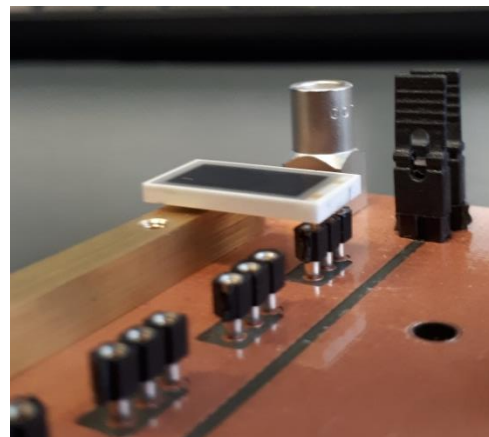
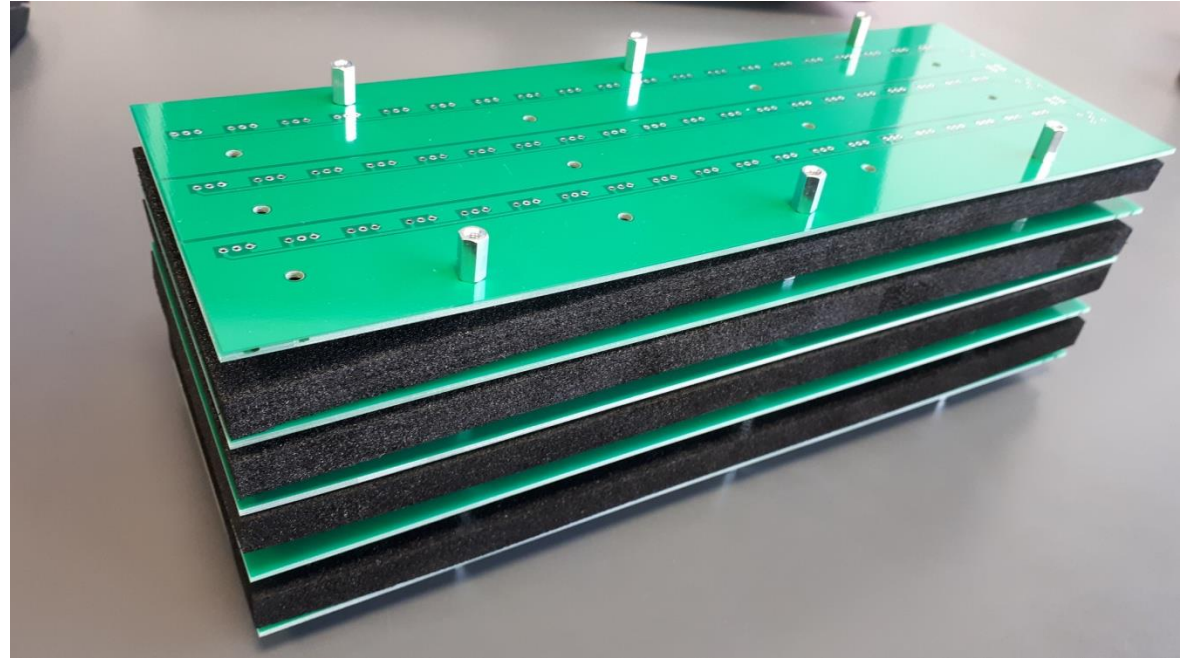
- First simple measurements indicating 80% efficiency (preliminary statement).
- Precise energy equivalent per fiber will be determined.
- Smaller prisms requested

## Proposal

- 10 mm
- Rad. hard. quartz
- Housing and size for proof of principle only







- PCBs can be used for
  - Irradiation
  - Annealing
  - Shipping
- 60 APDs each

- Three Layers:
  1. HV distribution & regulation
  2. Connector board for signal Cables
  3. Board for

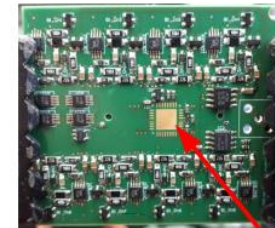
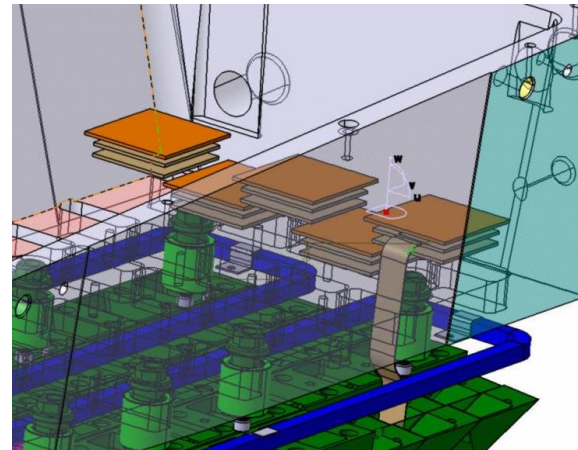
FlexPCBs / ASICS

Connectors to FEs

8x2 Diff. Line drivers

APFEL I/F buffers

Temp/Humidity sensors

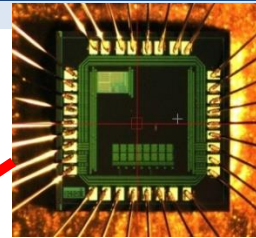


8-ch HVD final prototype  
size: 6 x 5.5 cm<sup>2</sup>

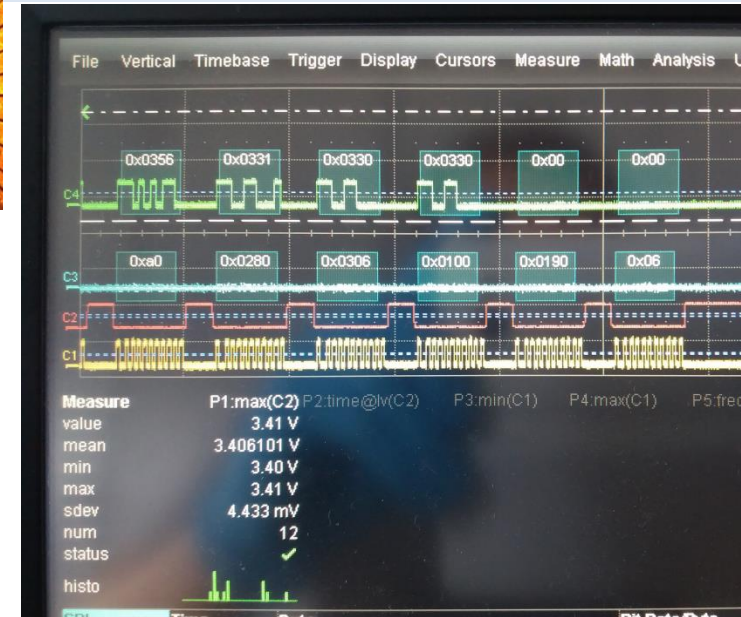
- Two different busses for FE and HV-board -> Serial Adapter ASIC Serial Adapter ASIC  
(next slide)
  - Daisy chaining saves 4/5 of Slow Control Cables (36 vs. 180)

Voltage Regulators

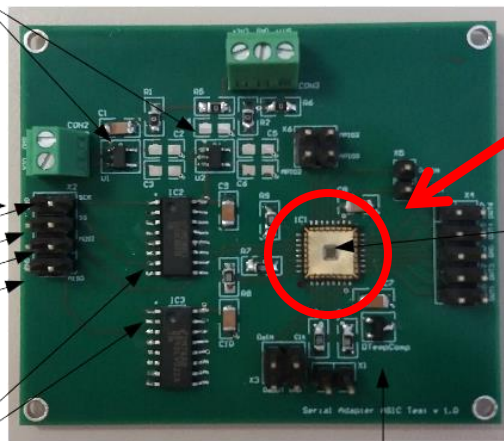
## Test Board



Serial Adapter ASIC



Serial Peripheral Interface lines  
Clock  
SlaveSelect  
MOSI  
MISO



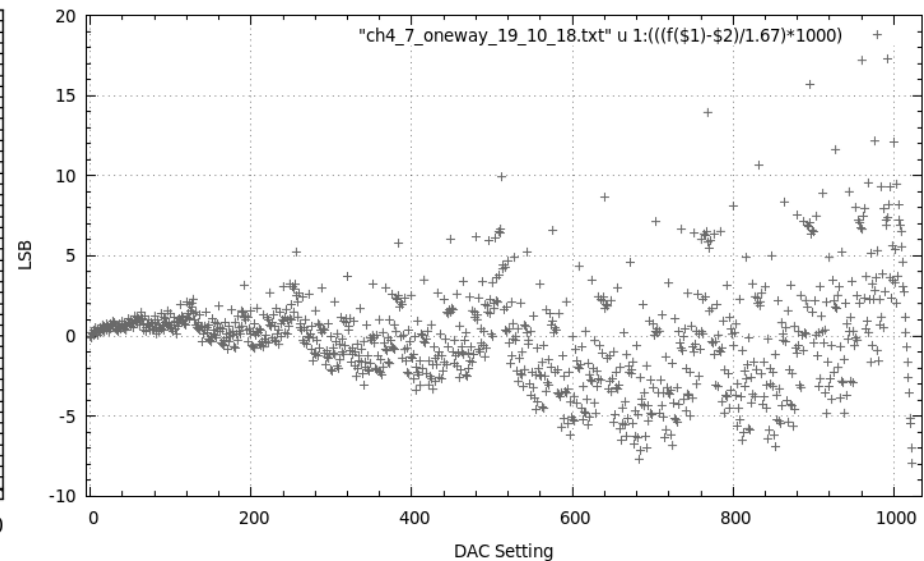
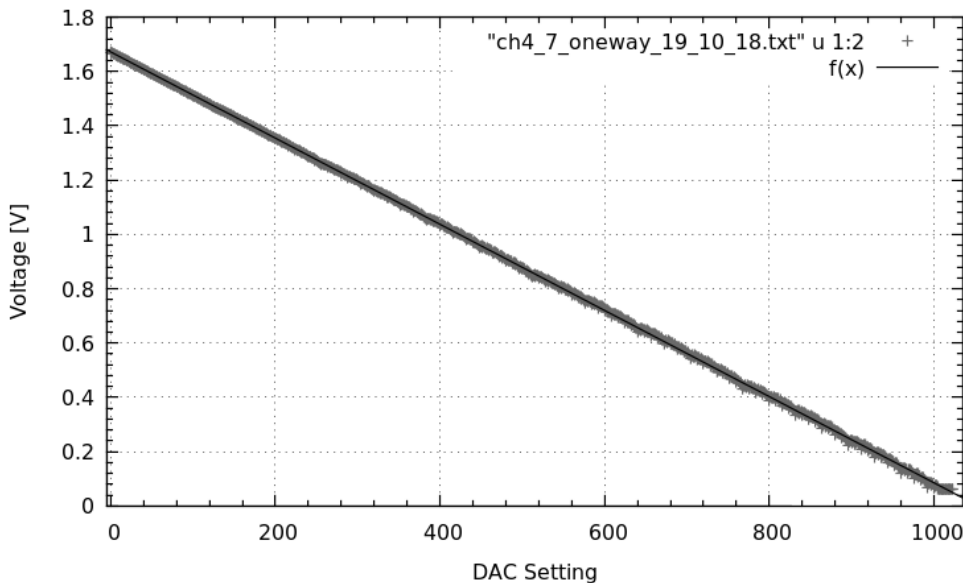
Line Converters

Temperature Diode

Name	Adress	SPI Response	Signal Measured
Chip version register	0xff	✓	-
I2C Master Interface	0x00-0x23	✓	first tests ✓
DAC Control	0x40-0x47	✓	✓
APFEL Interface mode	0x48	✓	pending
APFEL Interface data	0x49	✓	pending
Hamming Error Counter	0x4a	pending	pending
Parallel IO Config Register	0x4c	✓	✓
Parallel IO Data Register	0x4d	✓	✓

**Communication successful**

**DAC register settings indicate a problem with linearity (in current state)**  
→ designer is looking for suitable solutions



residual

*More detailed information: Christopher Hahn, FEE Session.*



- **Support-beam**
  - **Openings in test-beam for FlexPCBs not optimal**
    - Routing difficult
    - Thermal insulation difficult
  - **Proposal for first slice support-beam promising**
    - Manpower for complete beam design needed
    - Further plastic test-segments before machining final version
  - **Solutions for space problem inside support beam:**
    - HitDetASIC
    - Serial Adapter ASIC
    - Samtec FireFly signal cables
- **Backplanes**
  - Serial Adapter ASIC communicates, DAC will be revised
  - Backplane fixture used for sealing the support beam currently investigated
- **Crystals**
  - Second slice under production