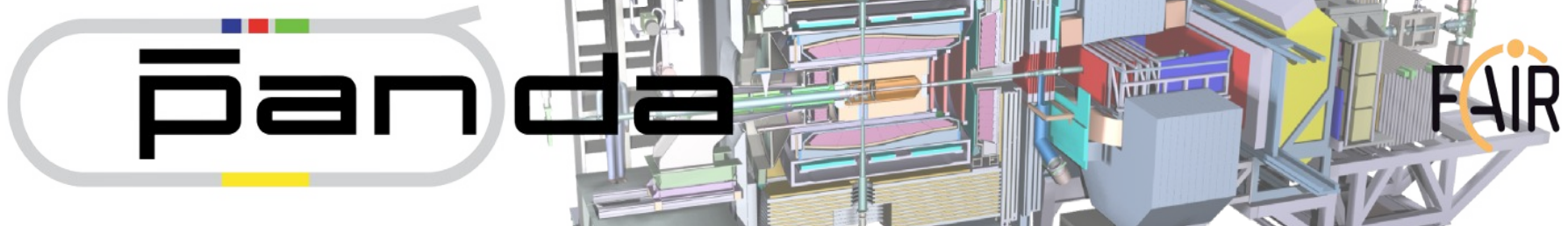


Status Barrel EMC

of the



Target Spectrometer

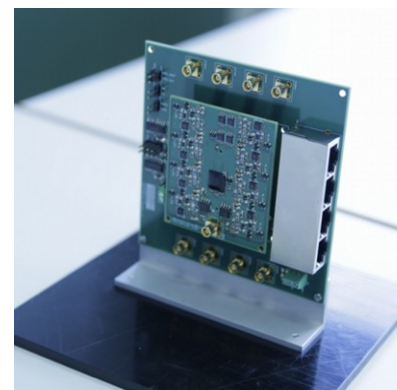
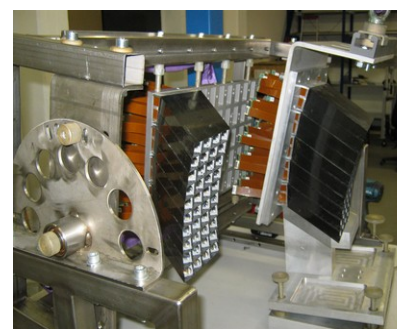
Markus W. H. Moritz

2nd Physics Institute, Giessen University, Germany

PANDA CM, March 2021

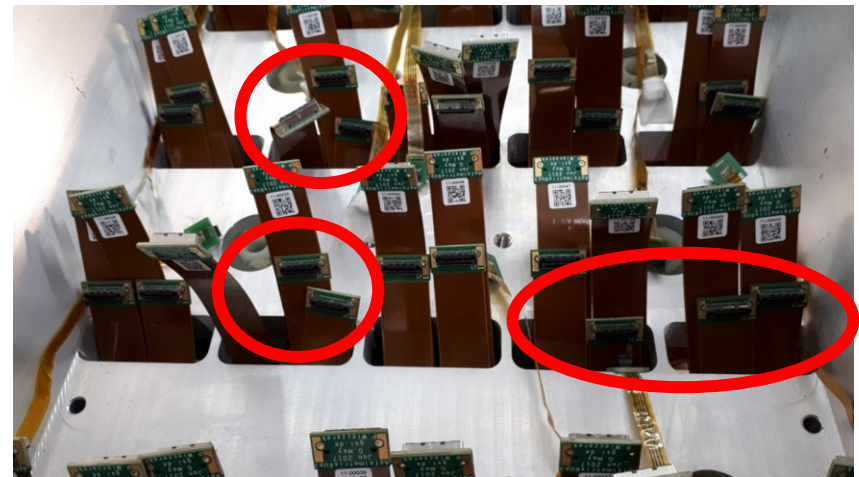
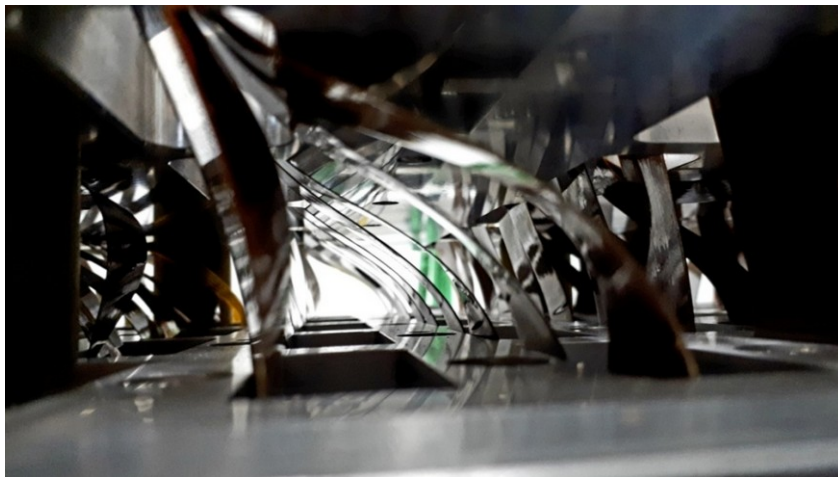
Envisaged milestone (M8): Assembly of 1st full Barrel EMC slice

- Infrastructure ✓
 - Mechanics ✓
 - 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 full 1st slice X
 - (Re-)design supportbeam ✓
 - Mod. preseries supportbeam ✓
 - Cooling & thermal insulation ✓
 - Backplanes ✓
 - Light pulser fiber coupling ✓
- in progress
in progress
in progress

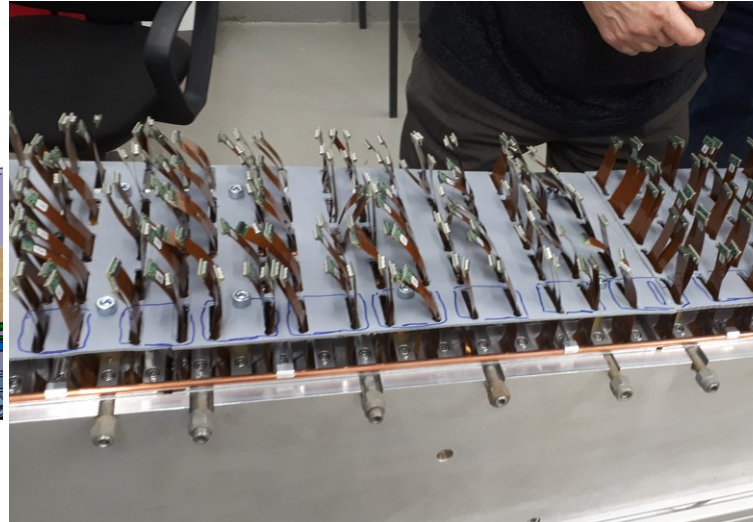
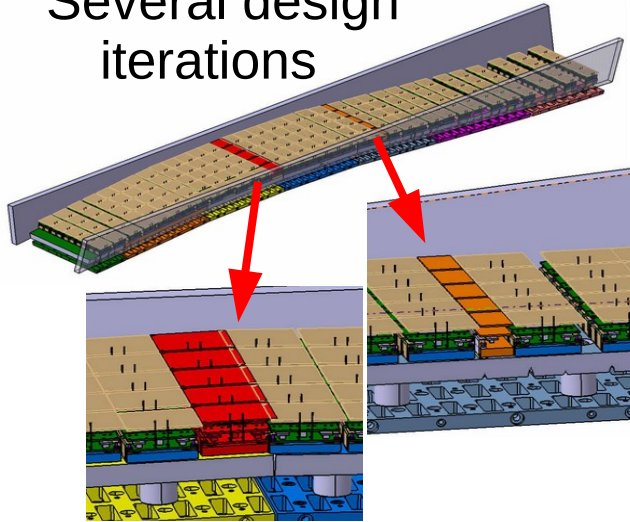


- Thermal insulation difficult
- Routing FlexPCBs difficult, some can not connected to backplanes

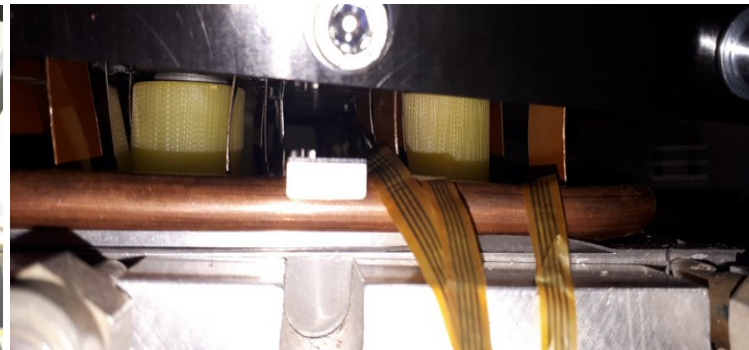
➔ Support beam modification / redesign necessary



Several design iterations



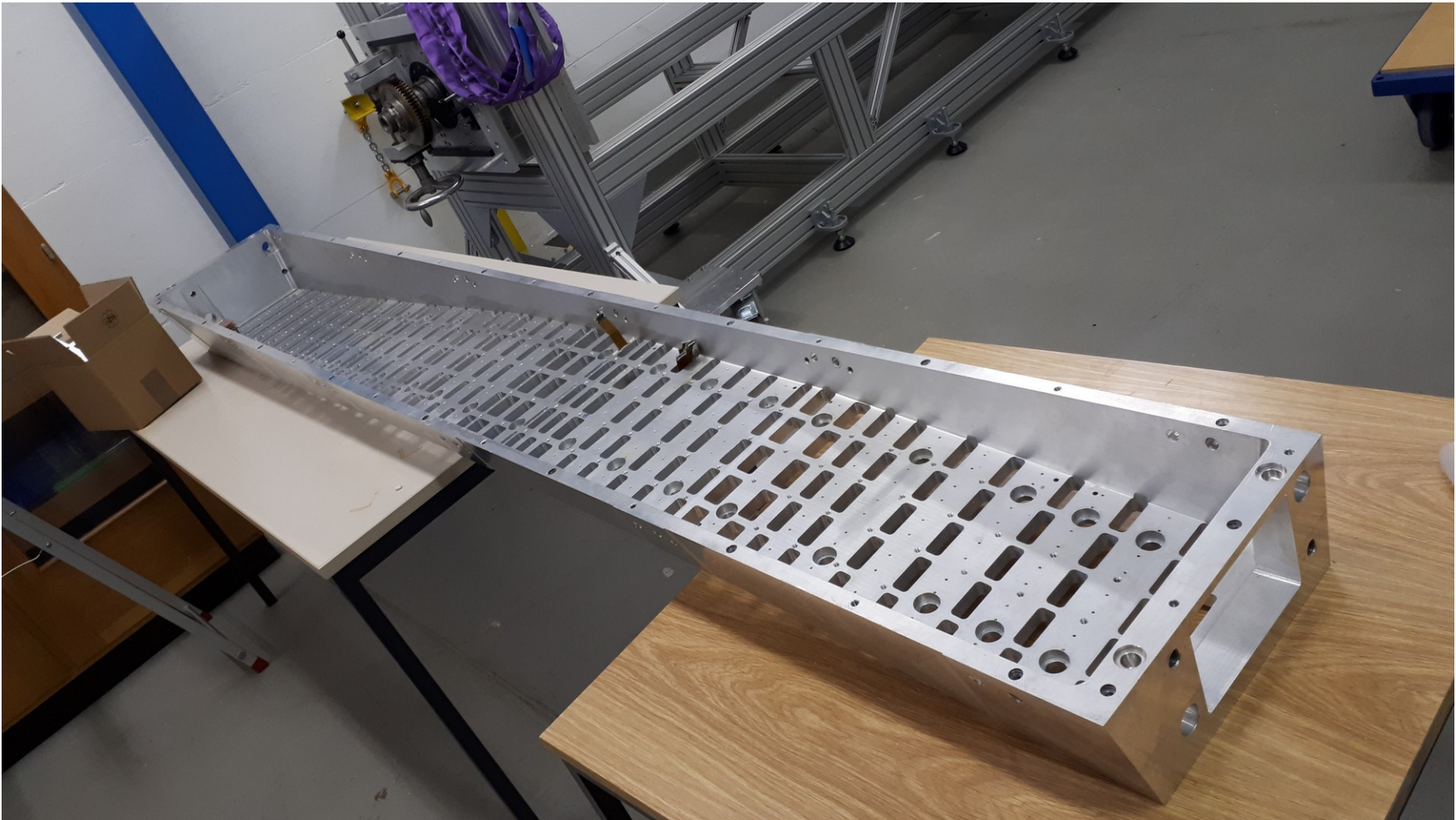
all FlexPCBs can be connected to the backplanes



straight FlexPCB routing possible

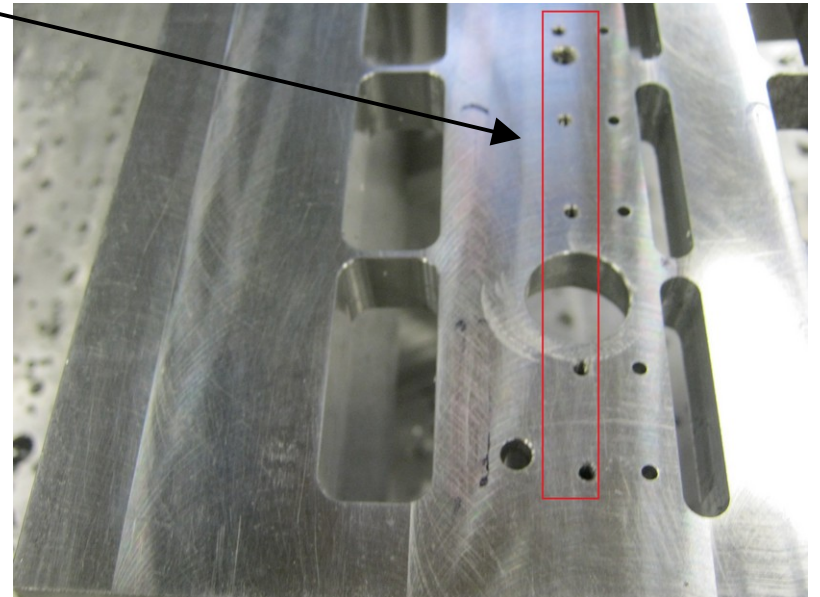
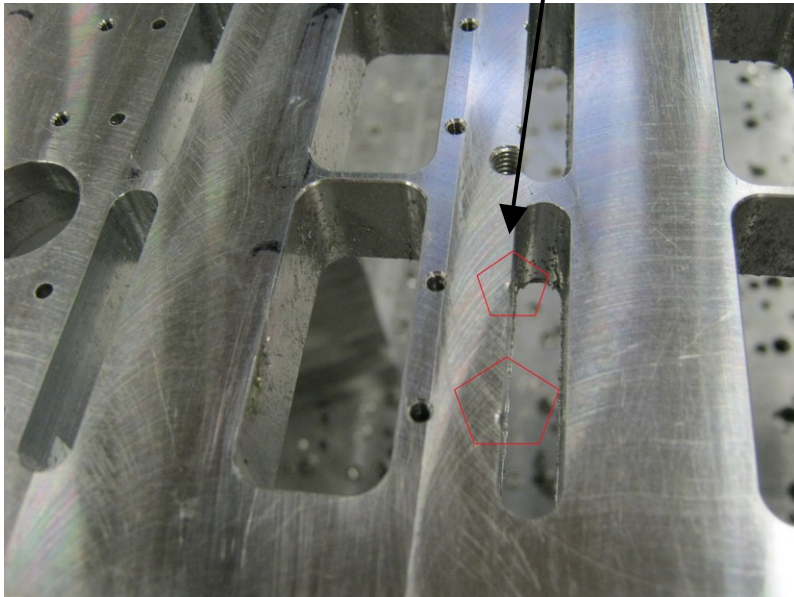
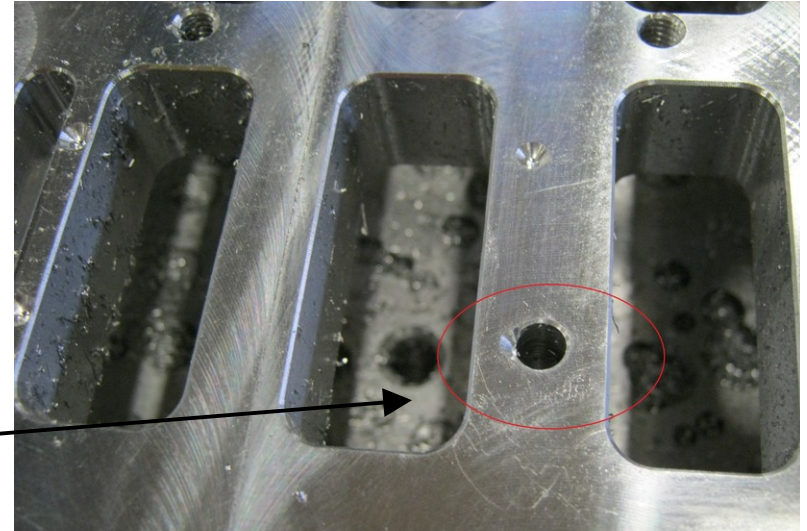
full mock up of final design

- Derived from final series design: additional threads & cable feed-throughs

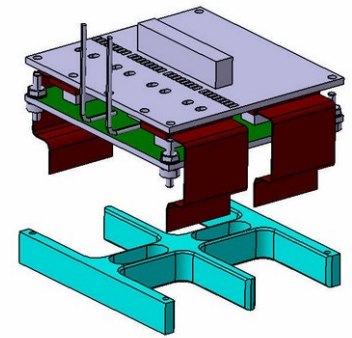


- Some issues occurred during modification
- So far no negative impact known

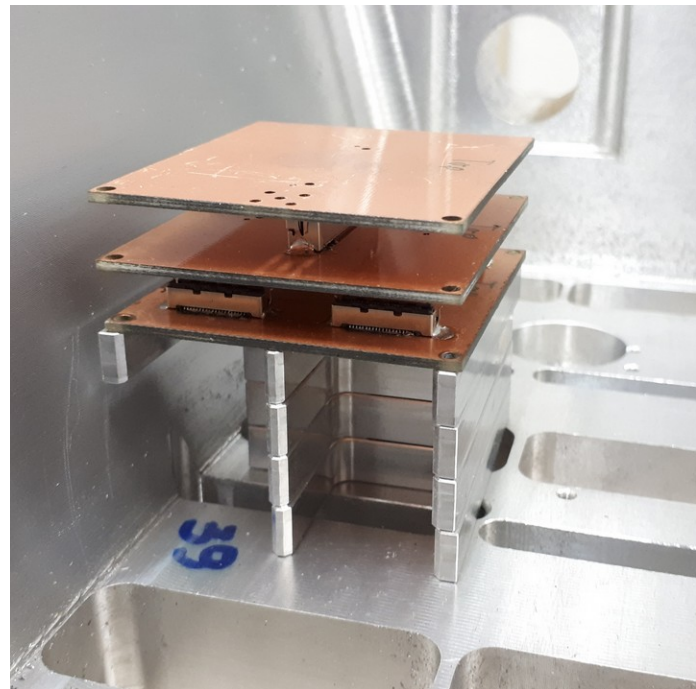
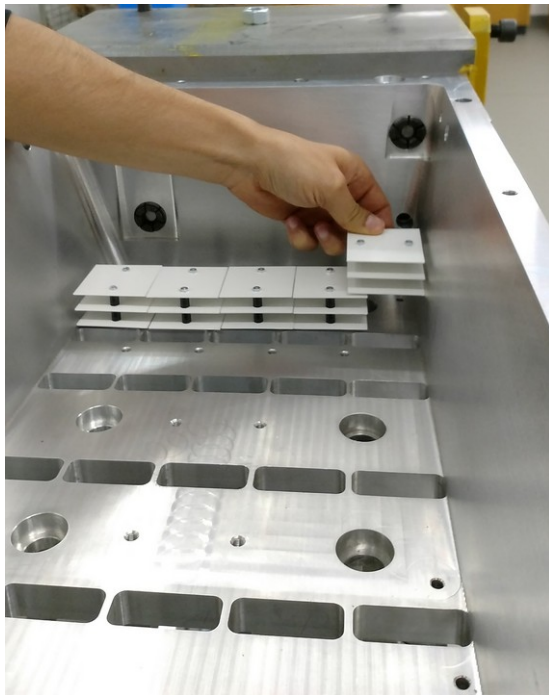
modification errors



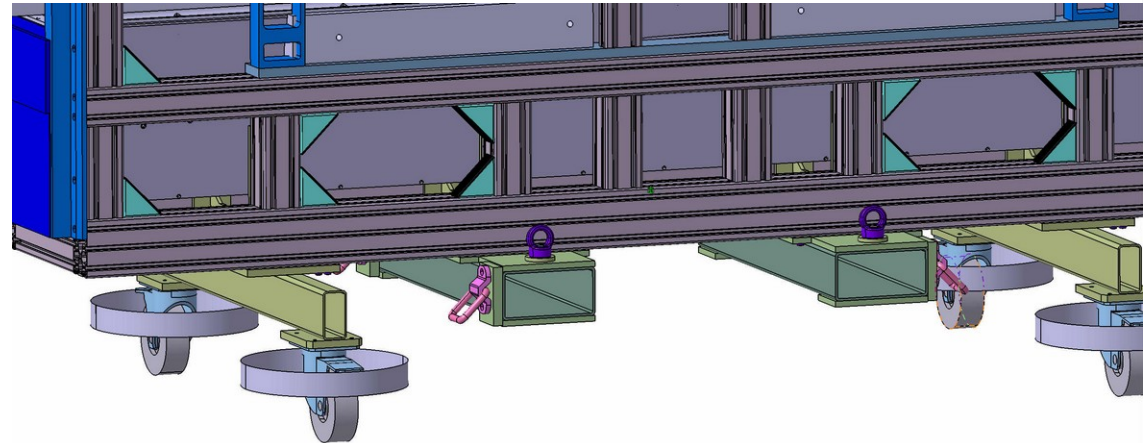
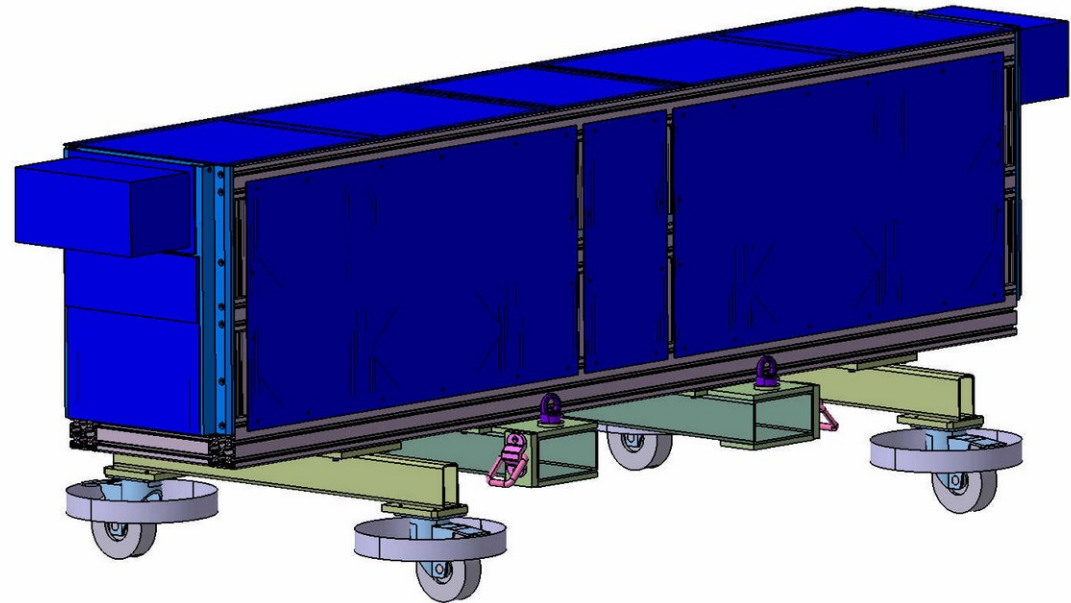
- Trapezoid shape causes space problems
 - ➔ stack backplane adapters
- All adapters for full barrel produced
 - ➔ Mounting with dummy back-plane sandwiches
 - ➔ Optimum APFEL FlexPCB lengths for pre-series slice & series slices will be measured



full mock up of final design



- Limited storage space @ Giessen
 - Max 3 slices
- Storage in Weiterstadt until barrel assembly
 - Up to 4 years for the first slices
- Box specification:
 - Sealing against dust & humidity
 - Mechanical protection (transportation & storage)
 - Lashing points
 - Usable with fork lifter

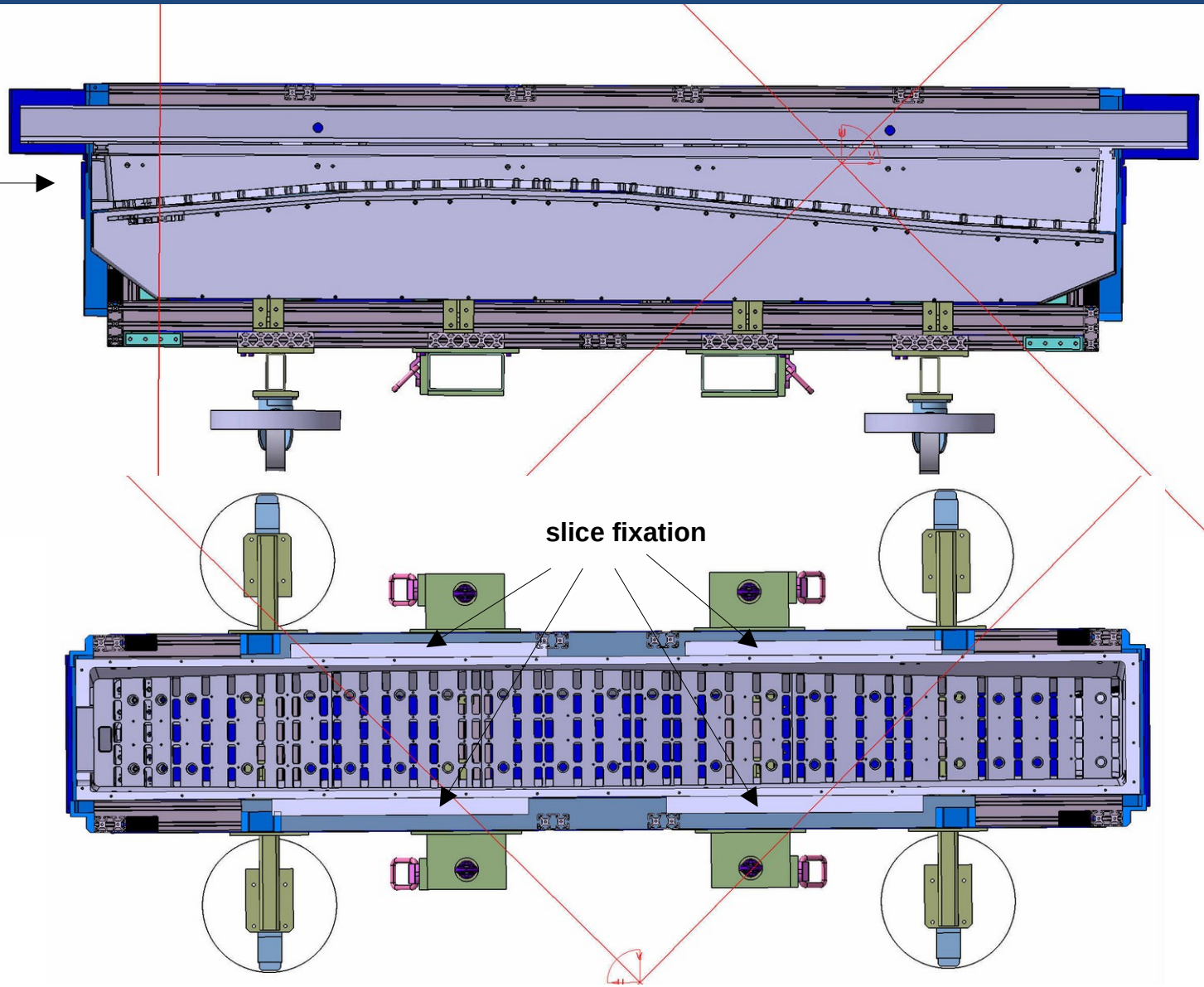


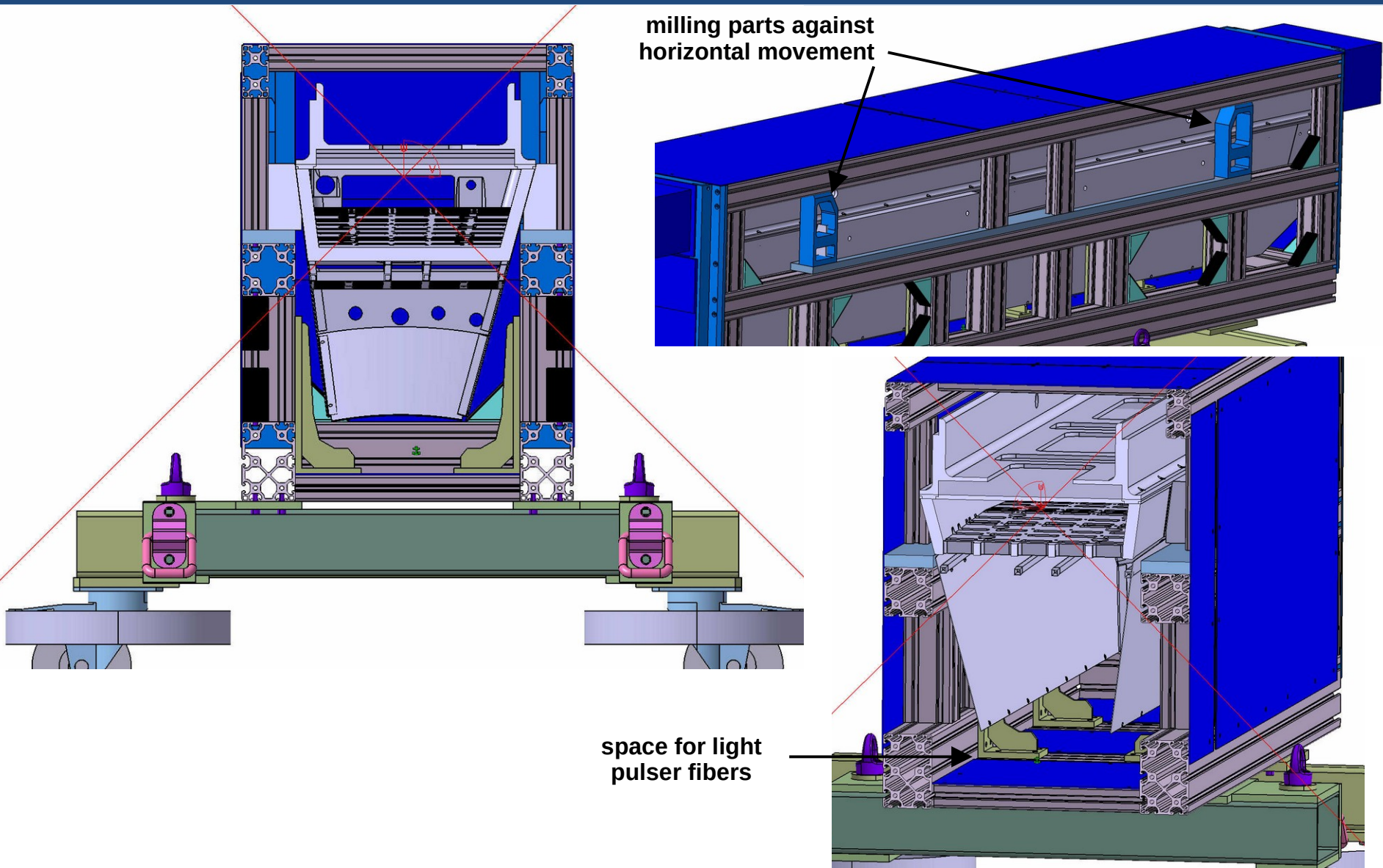
technological beam

support beam

top view

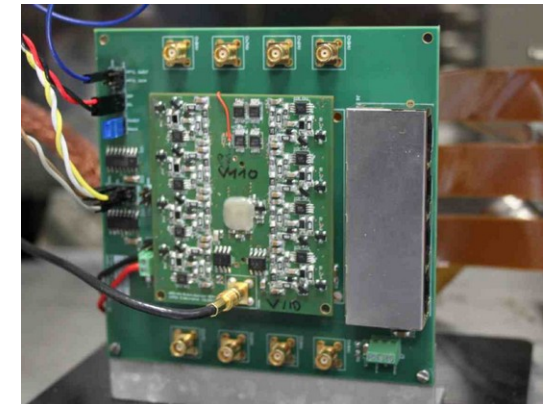
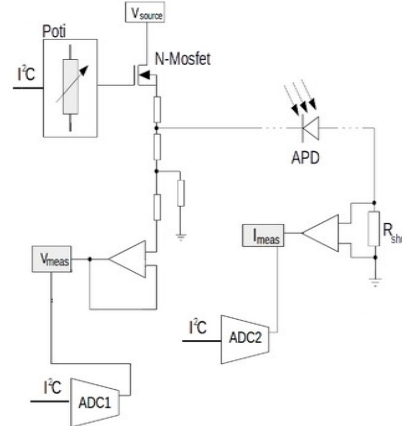
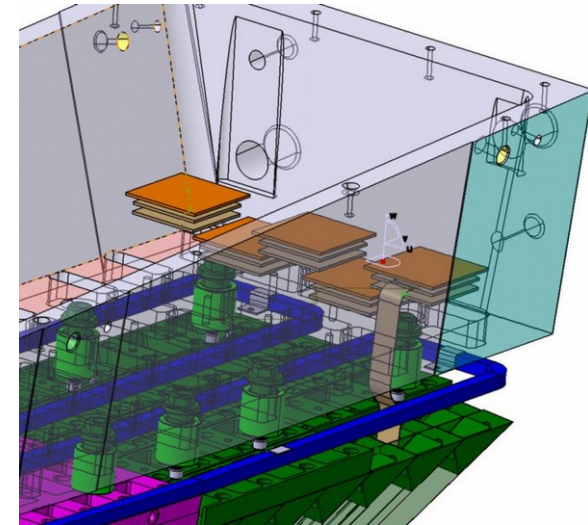
slice fixation





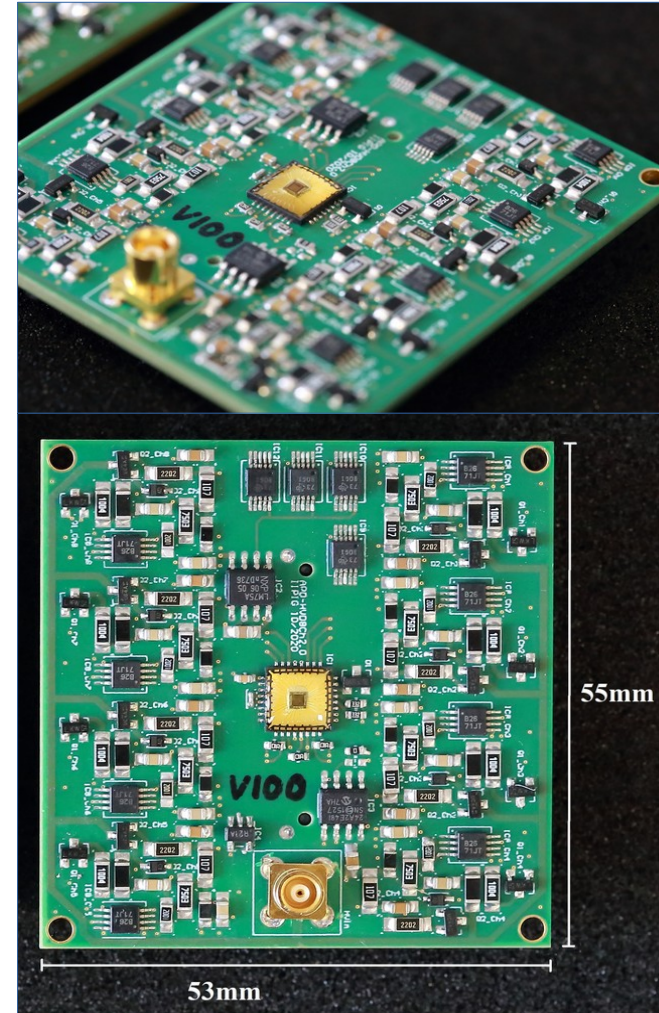
3 Layers

- **Top: HV distribution & regulation**
 - Adjust bias voltage of 8 APDs
 - 50V from HV input downwards in $< 0,1V$ steps
 - All channels fed from the same HV source
→ safes space inside support beam
 - Online measurement of APD voltage and current
- **Middle: Connector board for signal cables**
- **Bottom: Board for FlexPCBs / ASICs**
 - Connectors to FEs
 - 8x2 Diff. Line drivers
 - APFEL I/F buffers
 - Temp/Humidity sensors



HV distribution prototype

- Final Prototype produced in late 2020
 - ➔ Some minor bugs discovered and fixed
 - ➔ Final version can be ordered
- Slow Control Interface and software is under rework
- Calibration and test environment for mass production build up this year
- Most active components have been purchased
- Mass production of the SerialAdapter ASICs got delayed



SLice1			SLice2			SLice3			SLice4			SLice5		
L	R	missed	L	R	missed	L	R	missed	L	R	missed	L	R	missed
1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
2	0	0	2	0	0	2	0	0	2	0	0	2	0	0
3	0	0	3	0	0	3	21	0	3	41	0	3	41	0
4	0	0	4	0	0	4	25	24	4	41	41	4	41	41
5	0	0	5	0	0	5	26	23	5	41	41	5	41	41
6	0	0	6	0	0	6	22	24	6	41	41	6	41	41
7	0	0	7	0	0	7	37	39	7	41	41	7	41	41
8	0	0	8	0	0	8	19	0	8	21	21	8	21	21
9	0	0	9	0	0	9	0	0	9	0	0	9	0	0
10	0	0	10	0	0	10	0	0	10	0	0	10	0	0
11	0	0	11	0	0	11	0	0	11	0	0	11	0	0
tot	0	0	tot	0	0	tot	150	110	tot	226	185	tot	226	185

260

411

411

- Second slice Complete
- Production third slice ongoing

- Additional crystals needed for next slices
- Approx one spare crystal per type and slice

type	total	total+spare	To be ordered	
			Left	Right
1	1280	1310	0	0
2	1280	1310	219	0
3	1280	1310	555	0
4	1280	1310	559	558
5	1280	1310	560	557
6	1280	1310	556	558
7	1280	1310	571	573
8	640	660	288	267
9	640	660	0	0
10	640	660	212	28
11	480	490	80	110
total	11360	11640	3600	2651

day-1: 4199

full barrel: 6215

- **Mechanics**
 - Modification of pre-series support beam done
 - All backplane adapters produced
 - Backplane test assembly soon (pre-series & series slice)
- **Slice transportation & storage**
 - Slices have to be stored in Weiterstadt temporarily
 - Rigid and tight boxes for each slice foreseen
- **HV backplane**
 - Design & test processes finished
 - Mass production can start
- **Crystal status**
 - More than 50% of the crystals for 3rd slice available