

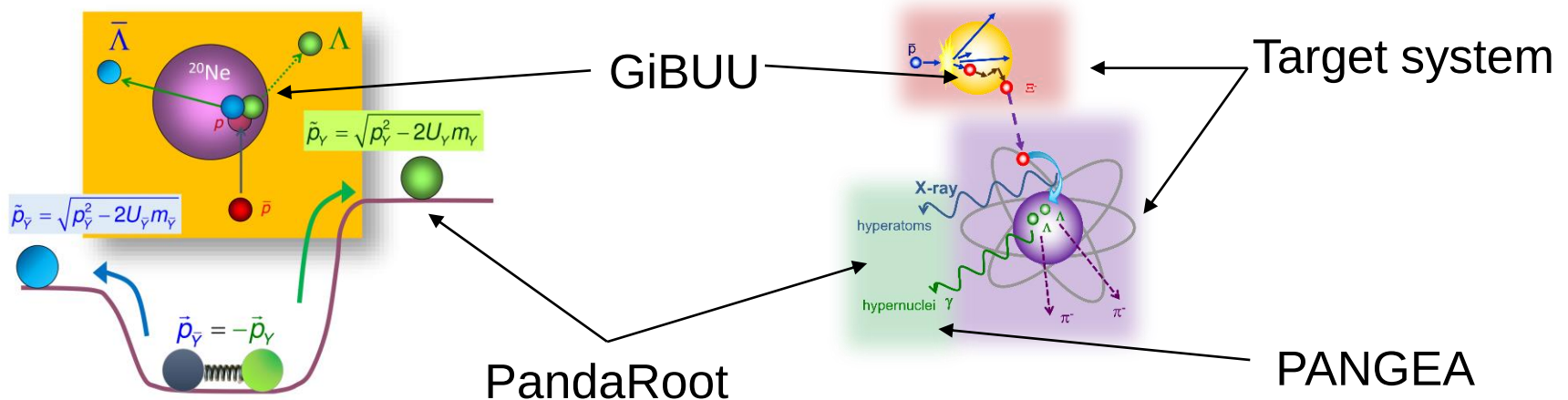
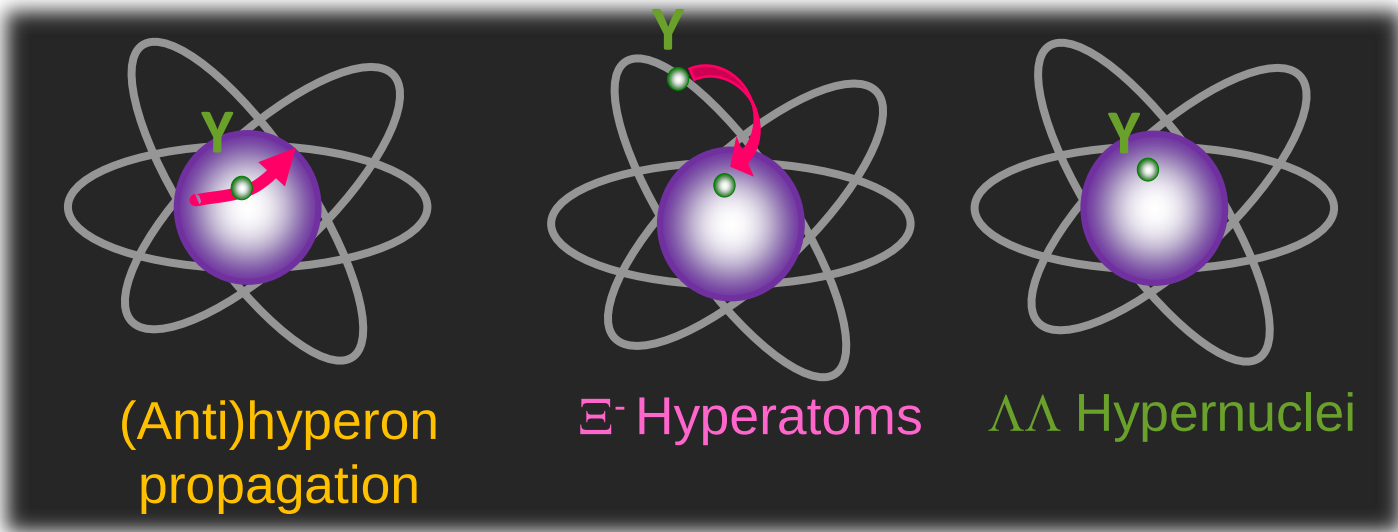
Progress of the Hyperatom and Hypernuclei experiments

Marcell Steinen, Patrick Achenbach, Michael Bölting, Martin Christiansen, Ivan Kojouharov, Josef Pochodzalla, Falk Schupp

Helmholtz-Institut Mainz

Panda Meeting 21-3 26/10/21

Outline

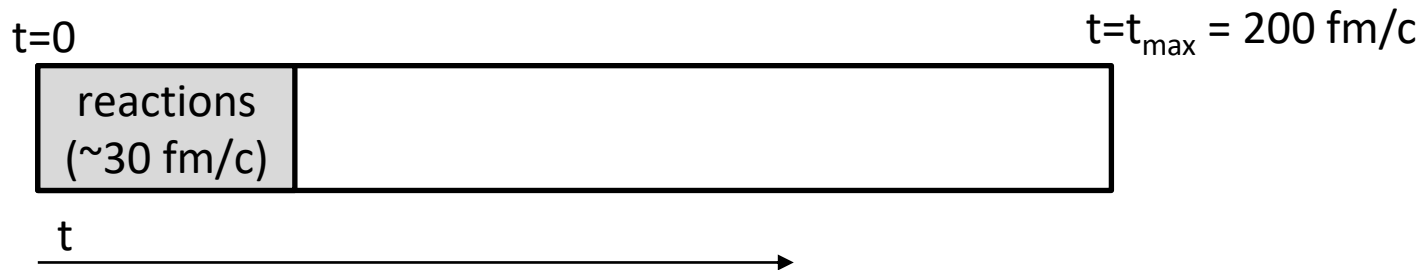


$\Upsilon\bar{\Upsilon}$ - GiBUU – Status

- GiBUU framework used to simulate nuclear interaction in primary $\bar{p}A$ reaction
- Himster2 HPC (1800 parallel jobs)
- Very time consuming!
 - 1.52 GeV/c, 1.64 GeV/c, ~2.9 GeV/c
 - multiple potential settings
 - Neon, Carbon
 - Total: ~9 months of computing time
→ ~ 6 days of PANDA

$\Upsilon\bar{\Upsilon}$ - GiBUU – Progress

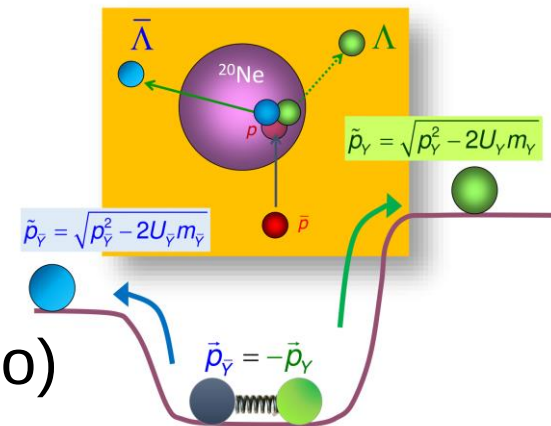
- New bachelor student: Martin Christiansen
 - Study possible speed up of GiBUU simulations:
 - Improves GiBUU settings and check impact on $\Upsilon\bar{\Upsilon}$ distributions
 - maximum event time: $t_{\max}$
 - time steps



- Studies the required time to simulate heavier targets
 - Xenon, Argon

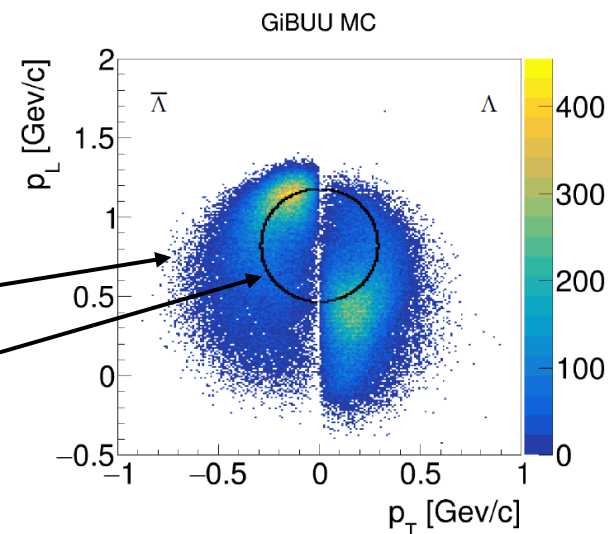
$\Upsilon\bar{\Upsilon}$ - PandaRoot – Status

- Simulation of $\Lambda\bar{\Lambda}$ pairs in PandaRoot
- GiBUU as event generator
- Preliminary results with oct19 (IdealReco)



Hyperon	MC Events	Ideal reco efficiency	Efficiency after Fits
Λ	$3,9 \cdot 10^5$	60,7%	37,1%
$\bar{\Lambda}$	$3,9 \cdot 10^5$	59,1%	46,7%

- Pair reco efficiency charged decay: $\sim 17\%$
- **Total reco efficiency:** $\sim 6\%$
- Compared to $p\bar{p} \rightarrow \Lambda\bar{\Lambda}$: 15,7%
Eur. Phys. J. A 57, 184 (2021), p. 17

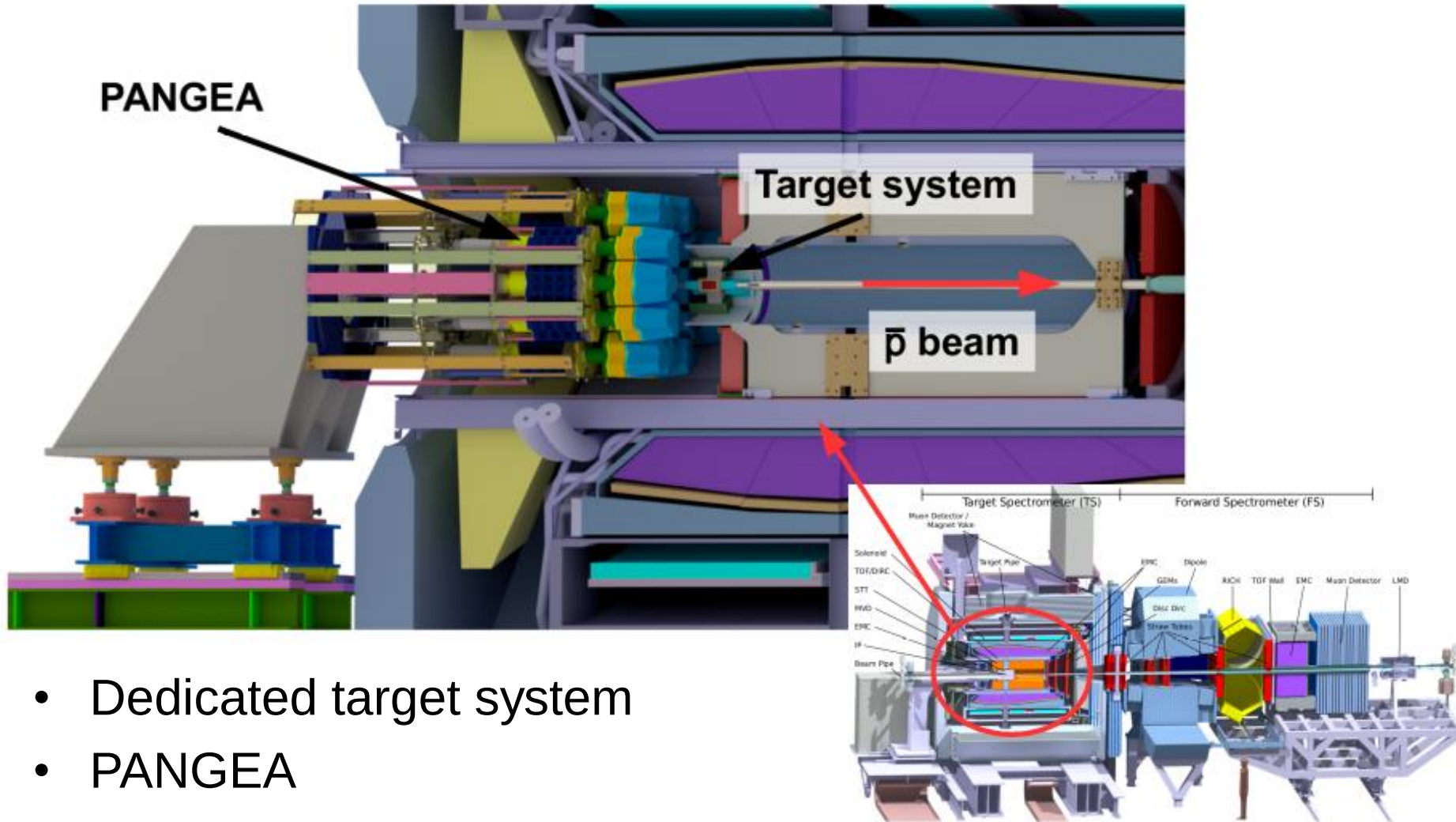


YY - PandaRoot – Progress

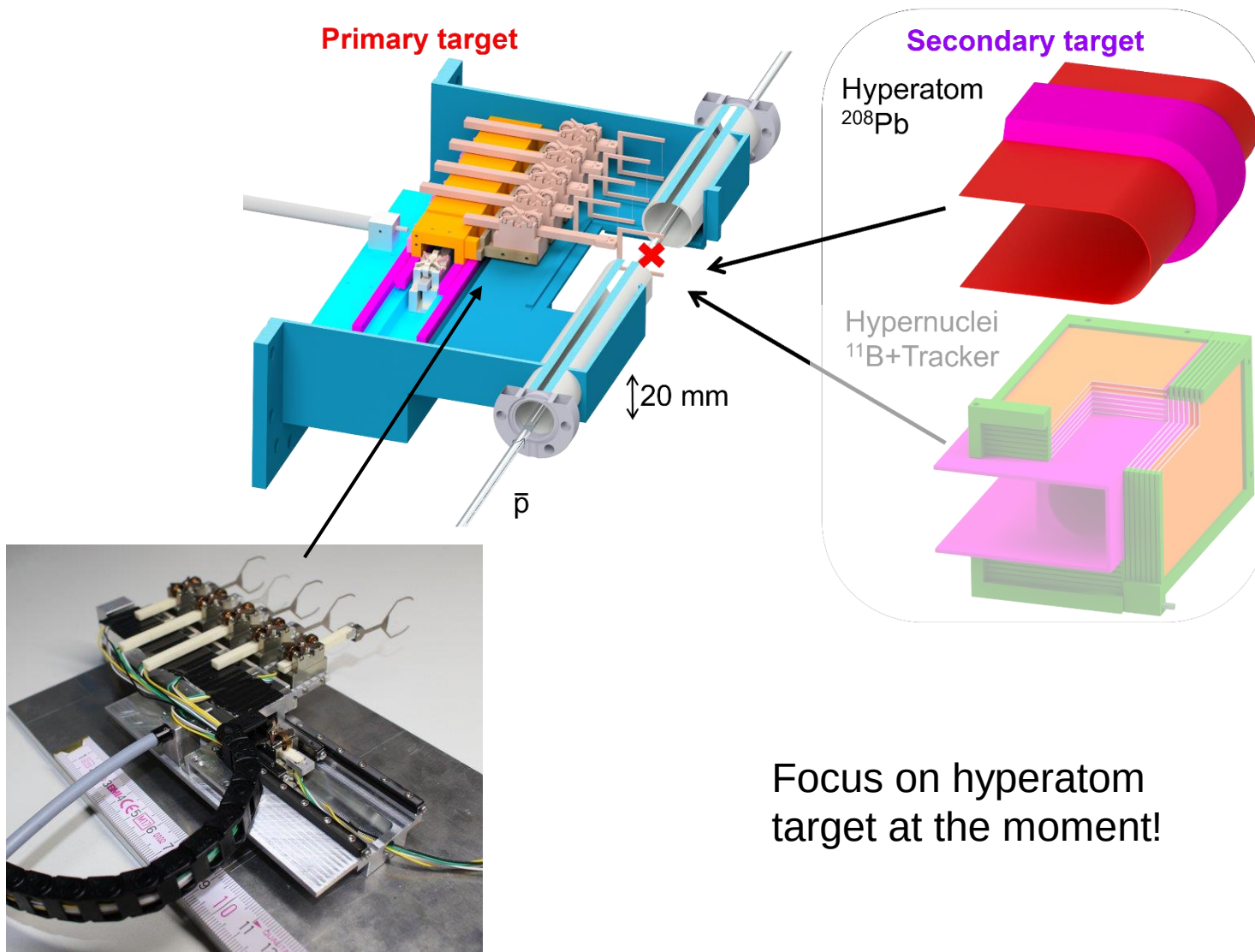
- Major issues with newer versions of PandaRoot on Himster2
 - FairSoft + FairRoot: missing dependencies
 - IT@HIMSTER unable/unwilling to fix this (security)
- new solution, use **Singularity** to run FairSoft/FairRoot from cvmfs
 - First test run successful but still some (major) issues
 - Instability of Himster2 due to overflowing /tmp folder
 - IdealReco in Day1 not yet working
 - StdReco: very low reconstruction rates right now



Hyperatom/hypernuclei setup

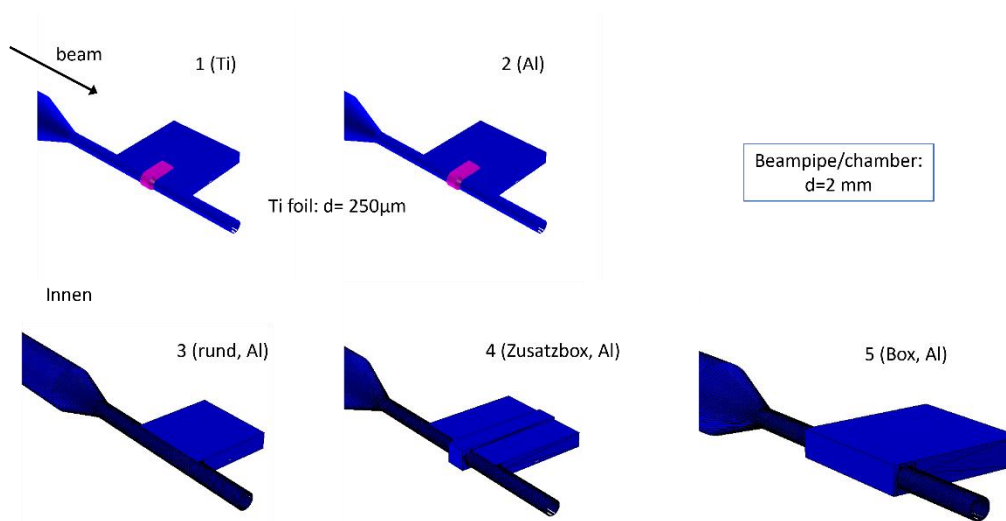
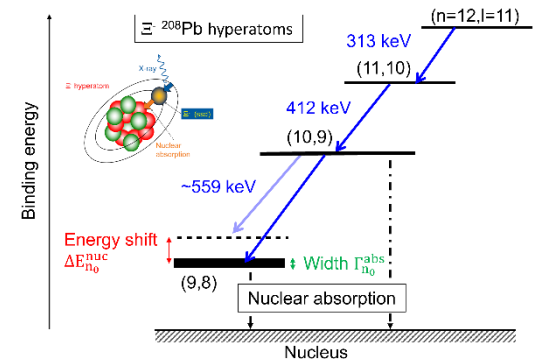


Target system – Status



Target system – Progress

- Secondary target (hyperatoms):
 - Absorber within target chamber could ease the mechanics
 - Simulations: Ξ^- stopping and X-ray coincidence efficiency

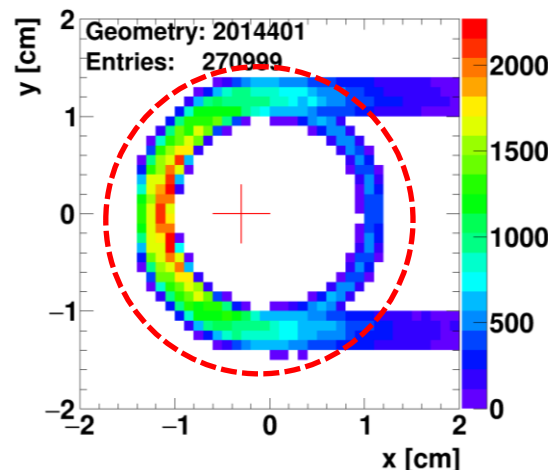
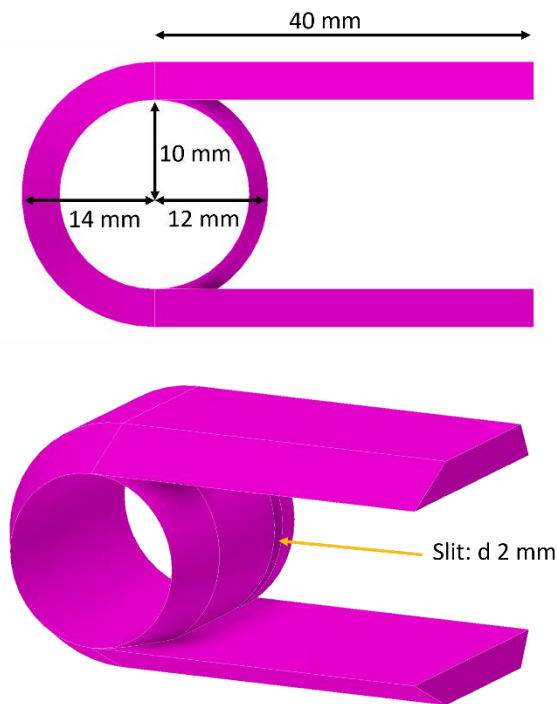


Geo	Xi Stop eff	X-ray eff	F.o.M.
1	0,53	0,231	0,122
2	0,53	0,236	0,125
3	0,57	0,217	0,124
4	0,57	0,211	0,120
5	0,57	0,215	0,123

Basically the same F.o.M.!

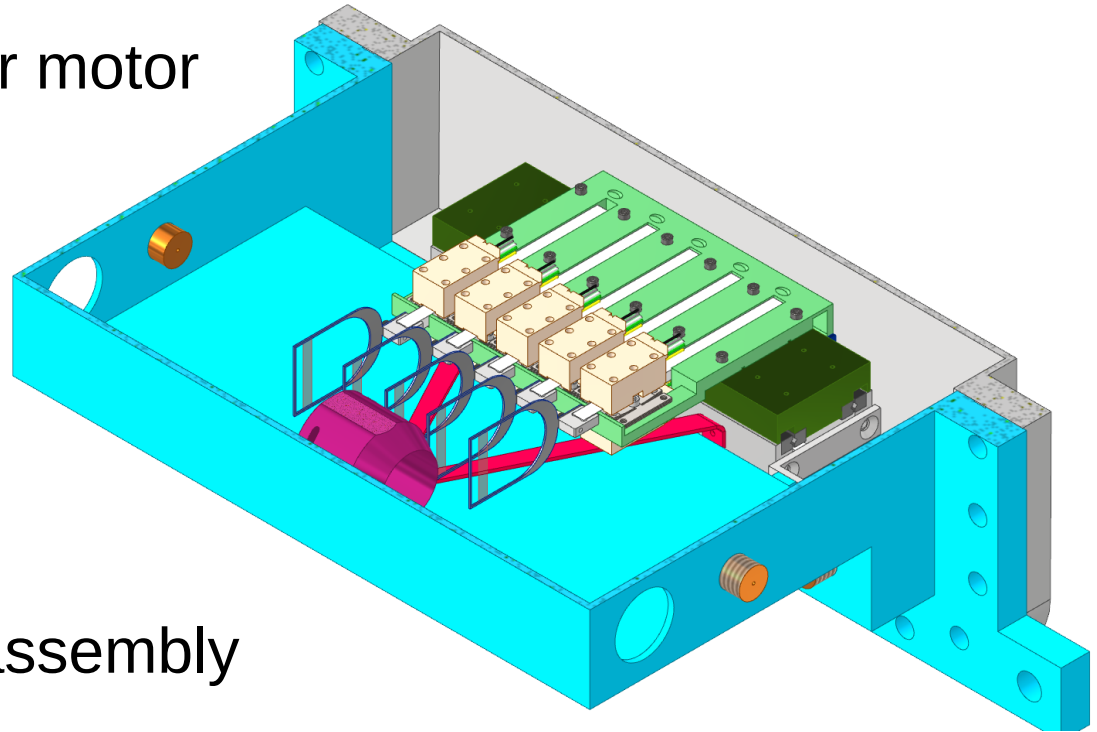
Target system – Progress

- Reduction of the absorber shape (hyperatom)
 - Less absorption
 - Less background



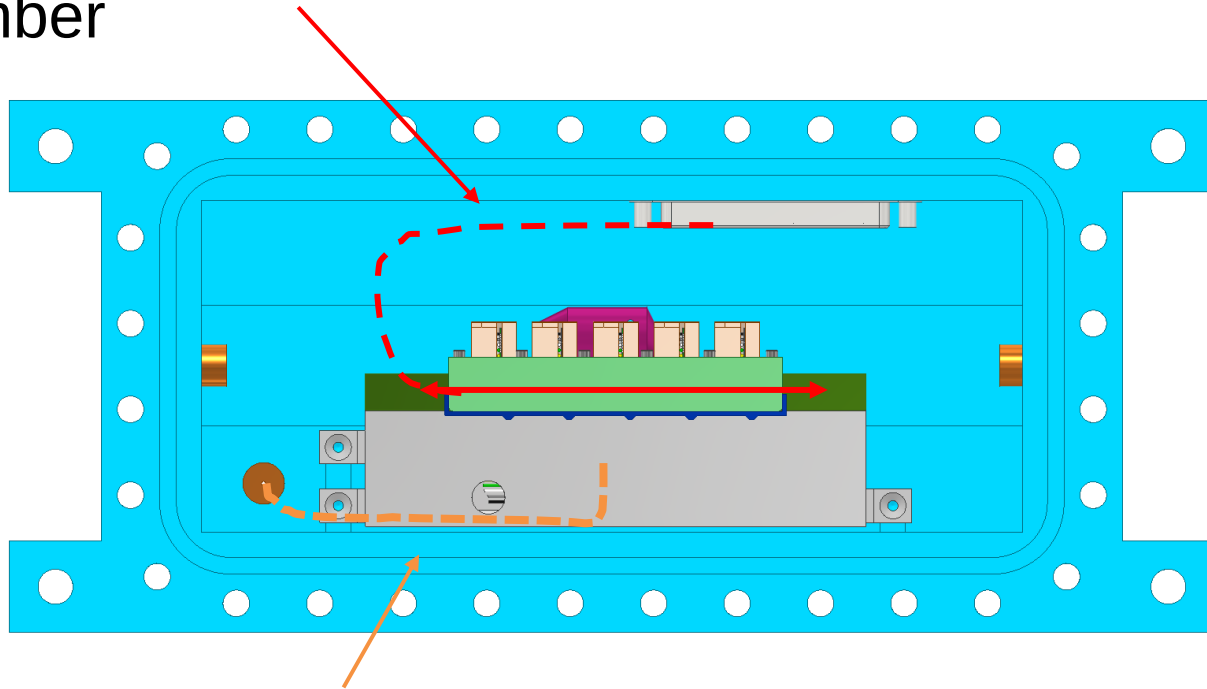
Target system – Progress

- Redesign of the secondary target
 - Updated piezo motors require slight redesign of moving system
 - Guiding frame for motor bars
 - Primary target frame updated
- Most parts for first assembly ordered



Target system – Open questions

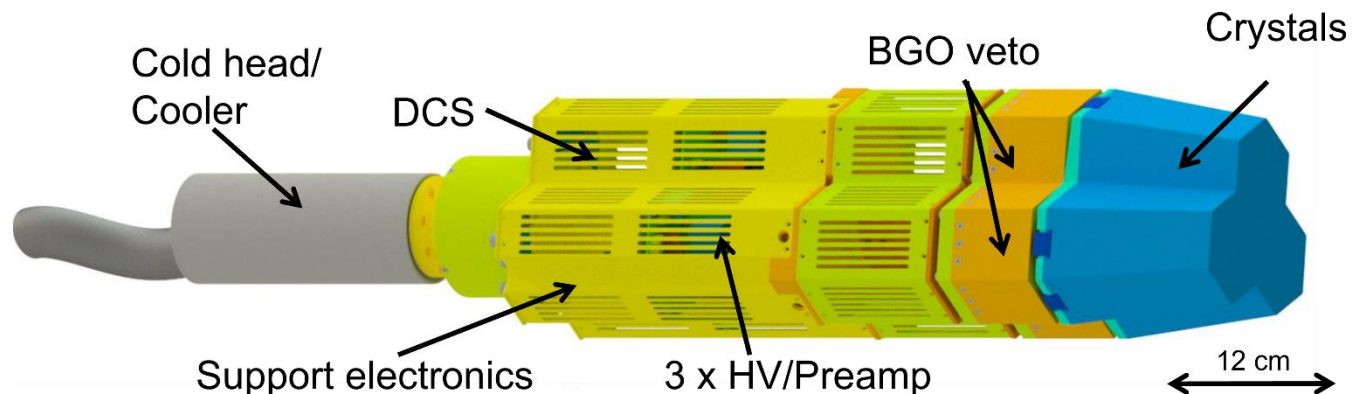
- Cabling of movable carriage to the outside of the target chamber



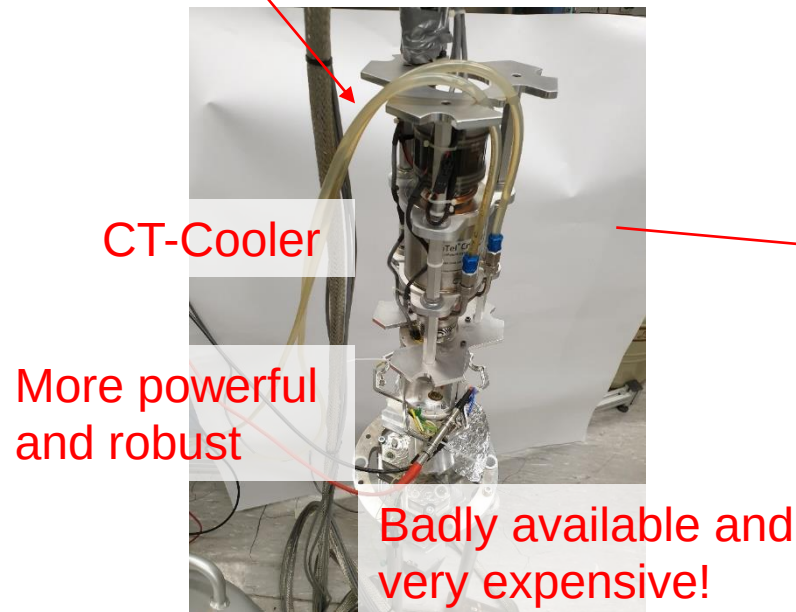
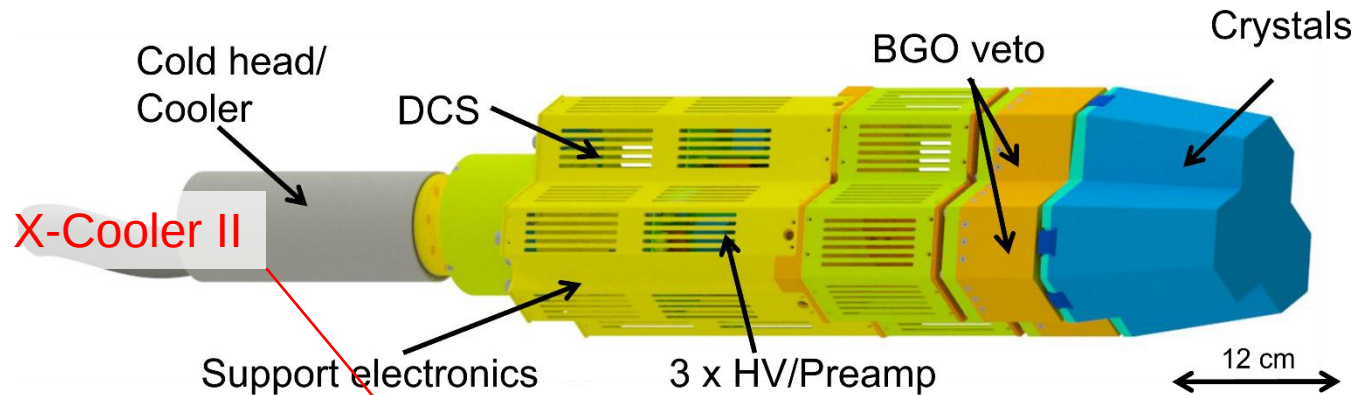
- Radiation hardness of optical fiber of positioning system
- Beam pipe and holding frame must be adapted

PANGEA – Disclaimer

- PANGEA shared development with DEGAS (NuSTAR)
- Cost are shared – otherwise impossible to construct such a detector for our experiments!
- 28 detectors required in 2022 for DESPEC experiment!
 - PANDA needs only 20 in ~2027



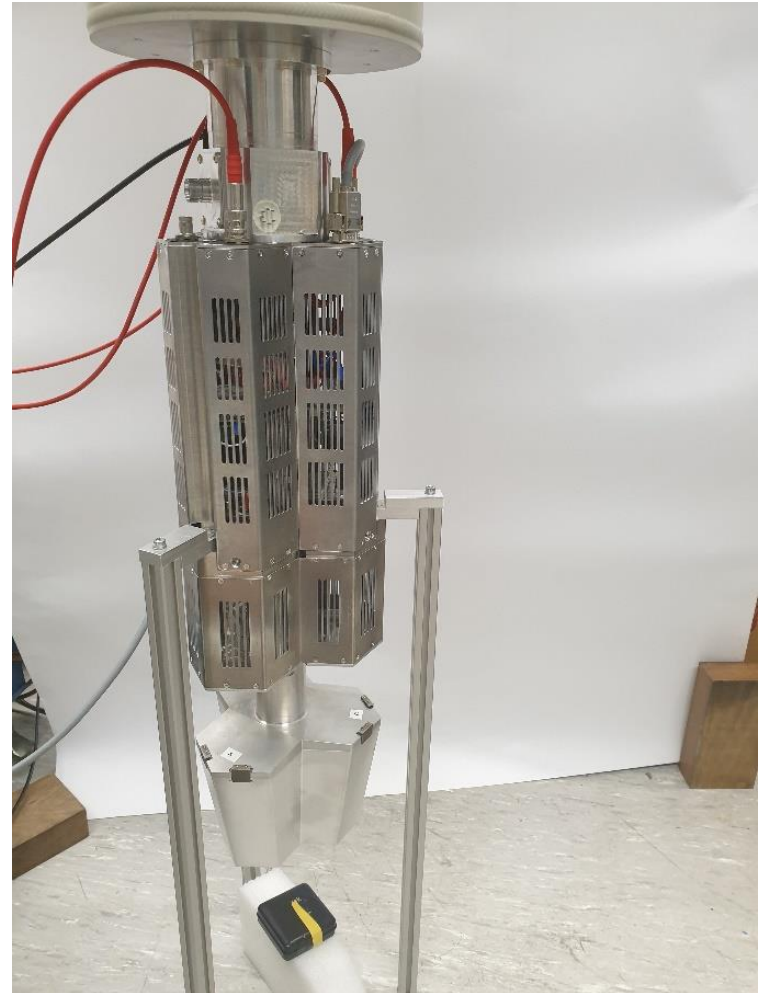
PANGEA – Progress



PANGEA – Progress

- DG-01: first LN2 prototype
 - Very good temperatures
 - Very good resolution (preliminary electronics!)

Ch.	HEX	Bias [V]	FWHM [keV]
A	152	3000	2.02
B	163	3000	1.96
C	39	3500	2.18



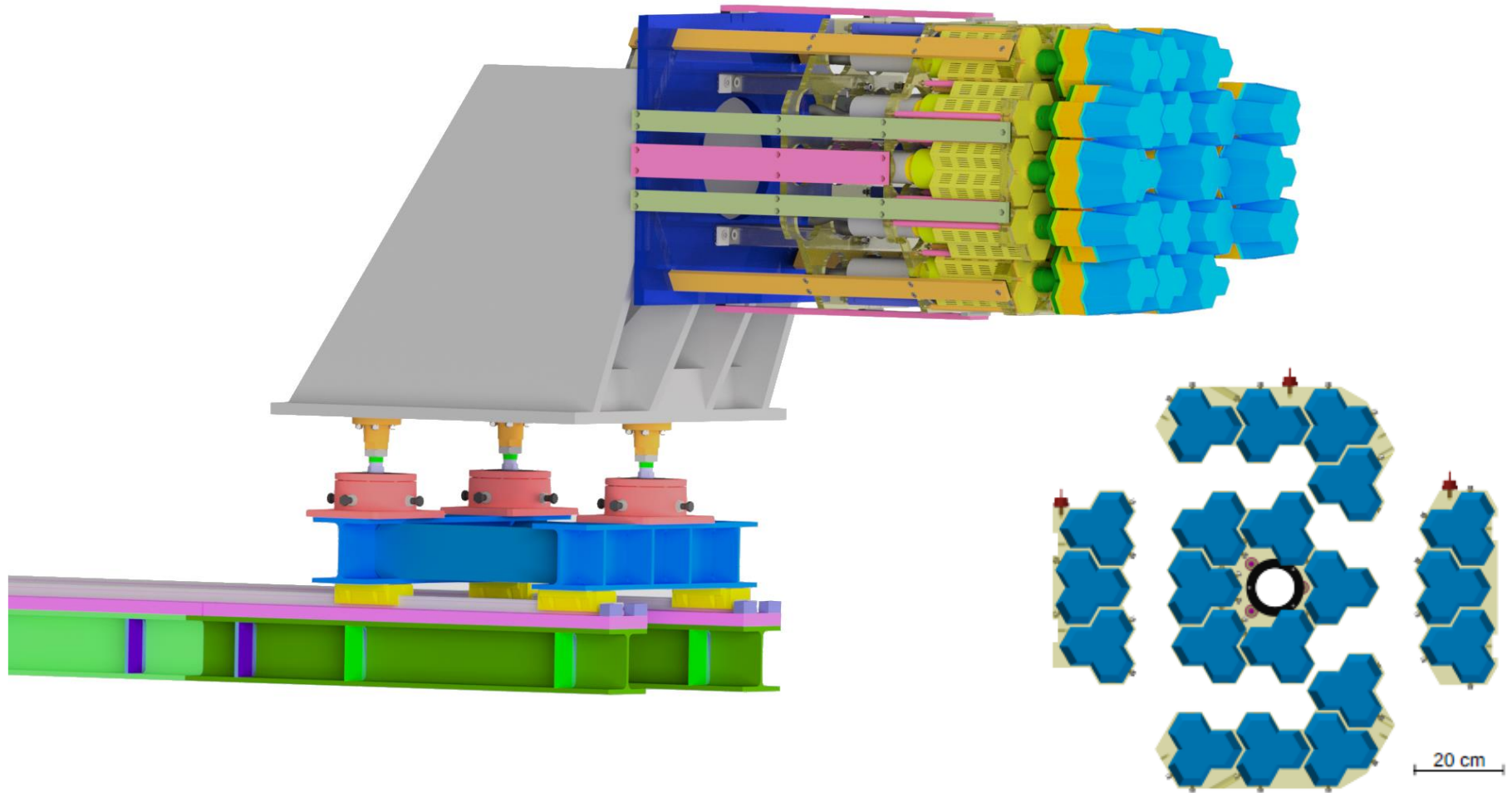
PANGEA – Progress

- Components fully available:
25 detectors
- Partly available/ordered:
5 detectors
- fully assembled:
3 detectors
- Assembly in progress
- TBD:
 - final preamplifier
 - Integrate supply electronics
 - Slow control



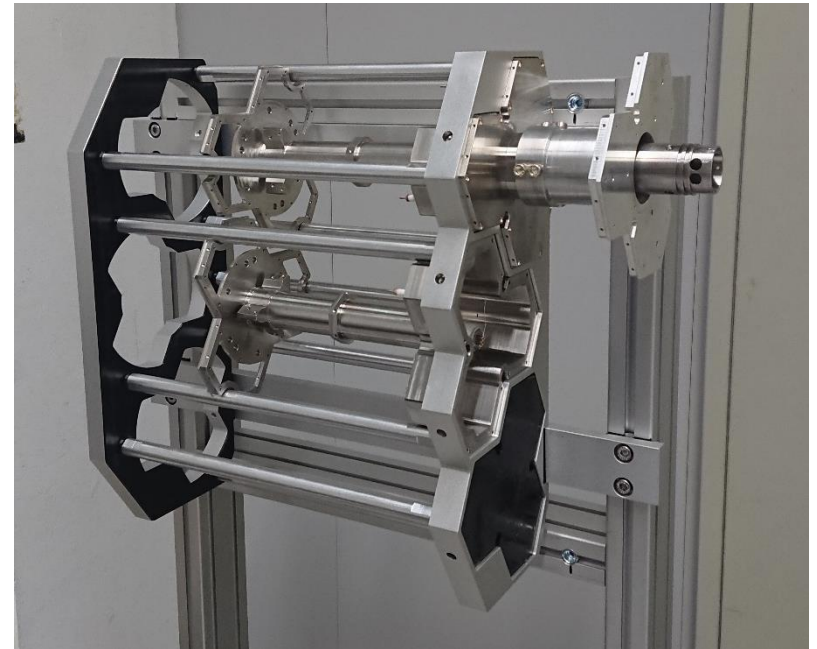
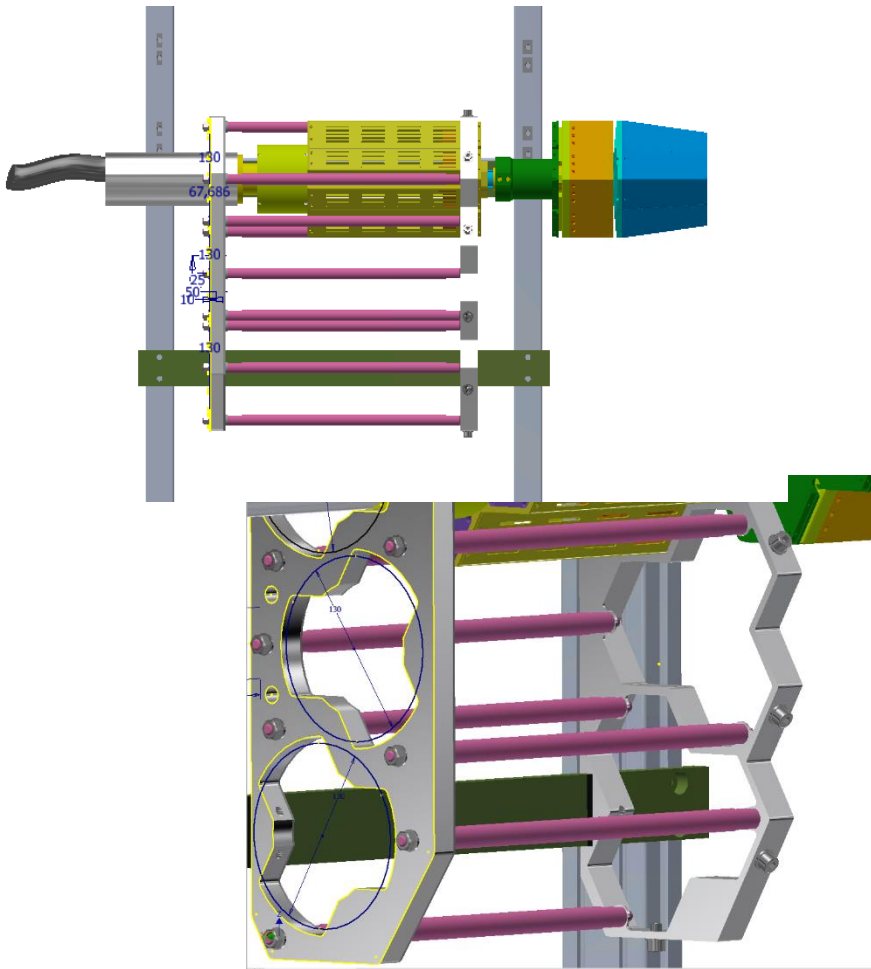
Components delivered from TIFR-Mumbai.

PANGEA – Frame – Status



PANGEA – Frame – Progress

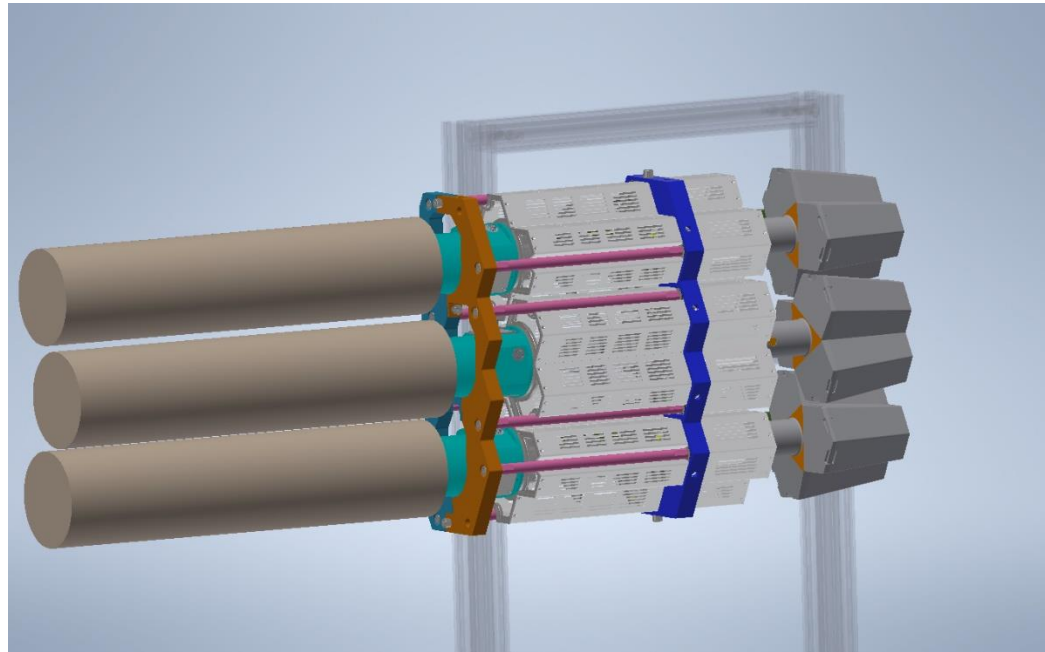
- Ordered and tested parts of first submodule



Issues:
Not compatible with
LN2 Dewars!

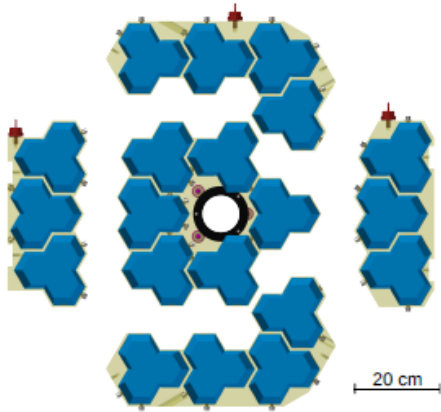
PANGEA – Frame – Progress

- Updated design compatible with LN2 cooled detectors

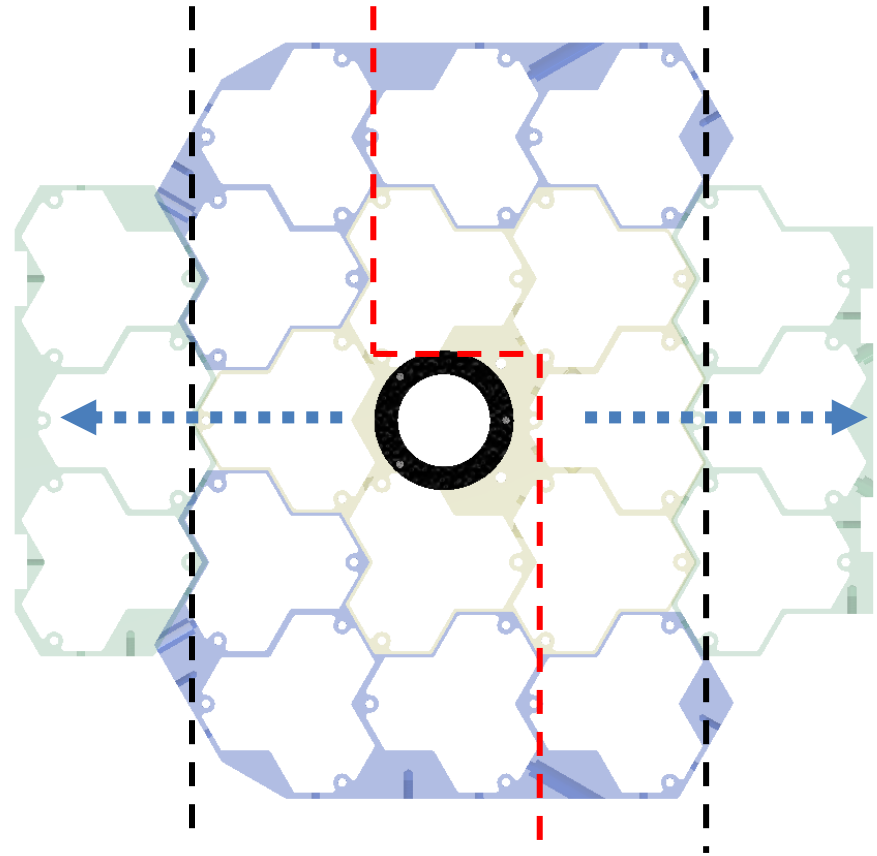


- Parts ordered

PANGEA – Frame – Progress



- Switch to 4 modules:
 - Left and right half
 - Completely separable
 - > no interference with flanges/pumps of the beam pipe while mounting
- Redesign of the frame in progress
- Detectors need automatic LN2 supply



Summary and Outlook

- GiBUU:
 - Speed up tests and heavier nuclei
- PandaRoot:
 - Singularity with some slight issues on Himster2
 - Promising reconstruction efficiency in first test of $\Lambda\bar{\Lambda}$
- Target system (hyperatom):
 - Redesign in progress
 - Part for first prototype ordered
- PANGAEA
 - Switch to LN2 cooling (automatic refilling!)
 - Good performance of LN2 prototypes
 - Redesign of frame ongoing
- Hyperatoms:
 - Expand program to Σ^- , $\bar{\Sigma}^-$

Thank you for
your attention

