

PANDA

Ulrich Wiedner
(Ruhr-Universität Bochum)

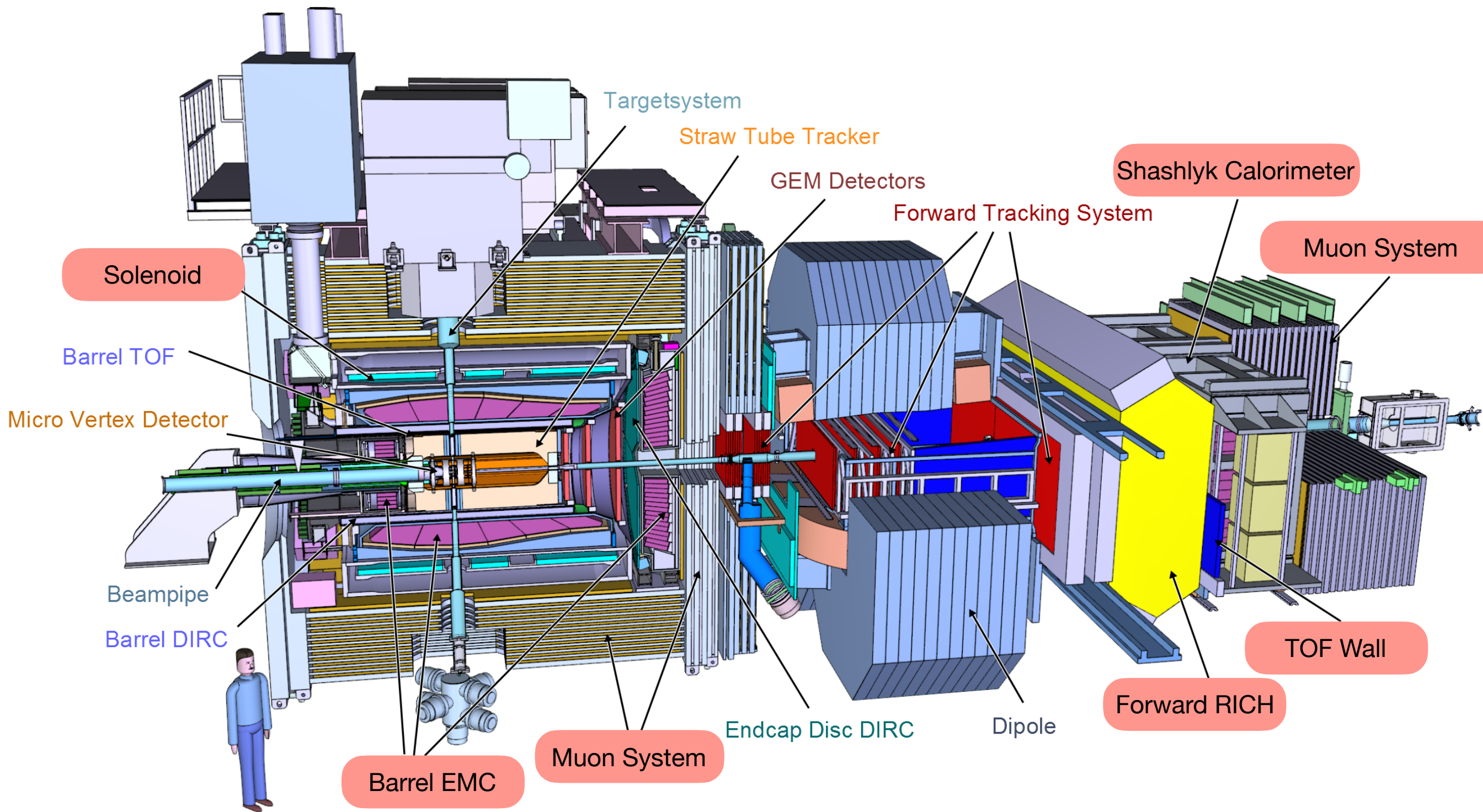
Der FAIR Science-Review 2022

“With its use of a stored anti-proton beam, PANDA is unique and is the only experiment in the world that can definitely answer the question as to whether or not the states under study are new, ‘exotic’, forms of hadronic matter. PANDA’s unique glueball discovery program will provide the critical tests of strong interaction theory that predict masses of the only particles with mass generated entirely through the strong interaction.

Yifang Wang (Director, Institute of High Energy Physics, Beijing):

“It is clear to us that PANDA is the killer of the field. Without PANDA, this field will remain to be open with many questions unanswered, and someone else will come up with a new facility in the future.”

The PANDA detector and Russian Contributions (in red)



Statements by and at FAIR bodies

Project scope:

Council Decision XXXVIII.6.1

(1) The Council states that the realisation of the Modularized Start Version, as described in the Convention, remains the aim of the FAIR-Project.

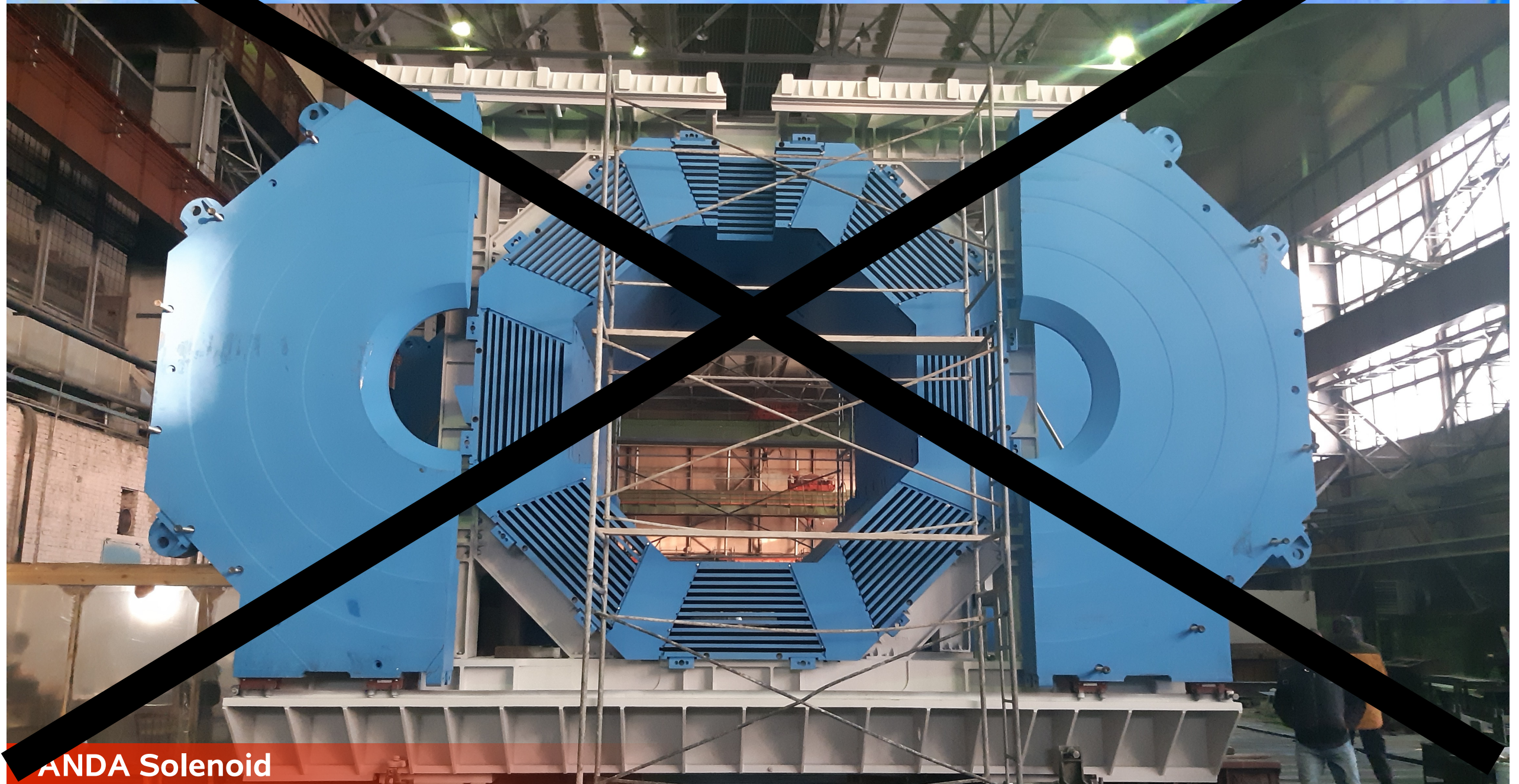
Timeline presented by the Project Management at recent AFC

...we should ensure keeping the project organisation in place in 2026, to allow for a project continuation towards the Modularized Start Version. If we can do this and continue, the Modularized Start Version might be ready in the range of 2026 plus 5 – 6 years, i.e., around 2032. This would be a cost-effective and reasonable scheme to be supported by the shareholders. It is not only a decision required to have the money invested, it is also important to have an organisation in place being able to do this.

Given this boundary conditions we need a bridge:

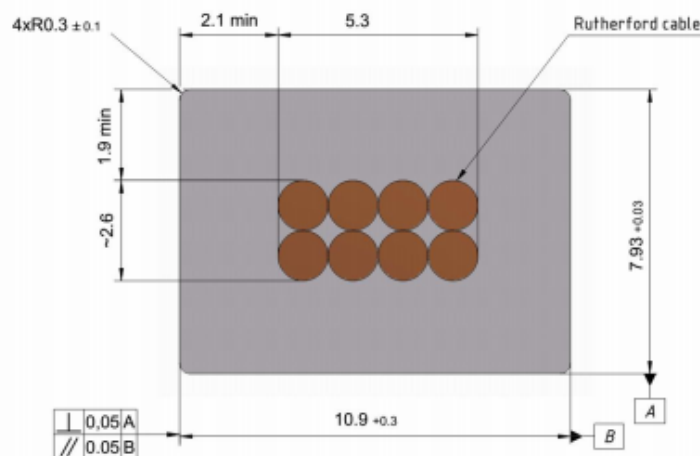
- for the detector development
- for maintaining the expertise with existing detectors
- for the career of young scientists in hadron physics
- for the preparation of physics analysis

Solenoid Magnet: Russian Contribution



ANDA Solenoid

PANDA Superconductor

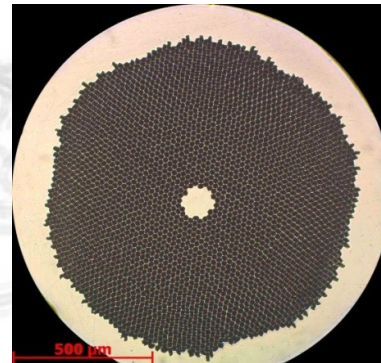


Superconductor Layout

- Nb/Ti in Cu strands
- Rutherford cable 2x8
- Co-extrusion in pure Al

Status of Production

- Joint venture with BINP: coordination, tooling
VNIINM: SC strands, Al wire
VNIKP: Rutherford cable
SARKO: extrusion
- Production was to be completed in 2022

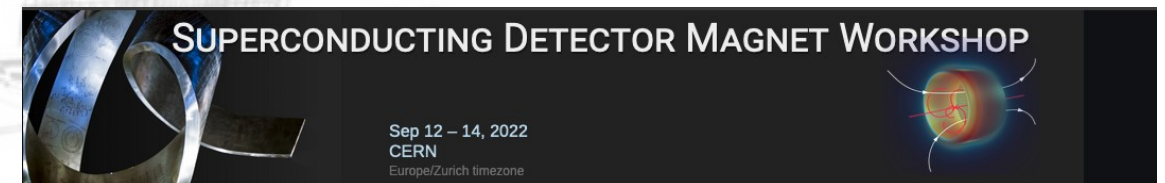


SC Strands

- 1600m sample tested
- All parameters to specs
- High quality of conductor shown by x2 RRR and n

Aluminum Extrusion

- Wire production optimal at 350 – 380°C: RRR > 10³
- First 1000m A95 Cu cable
- SC 80m sample A995
- PANDA conductor 8km



Workshop on Superconducting Detector Magnets
CERN, September 12-14, 2022

Conductors for Detector Magnets

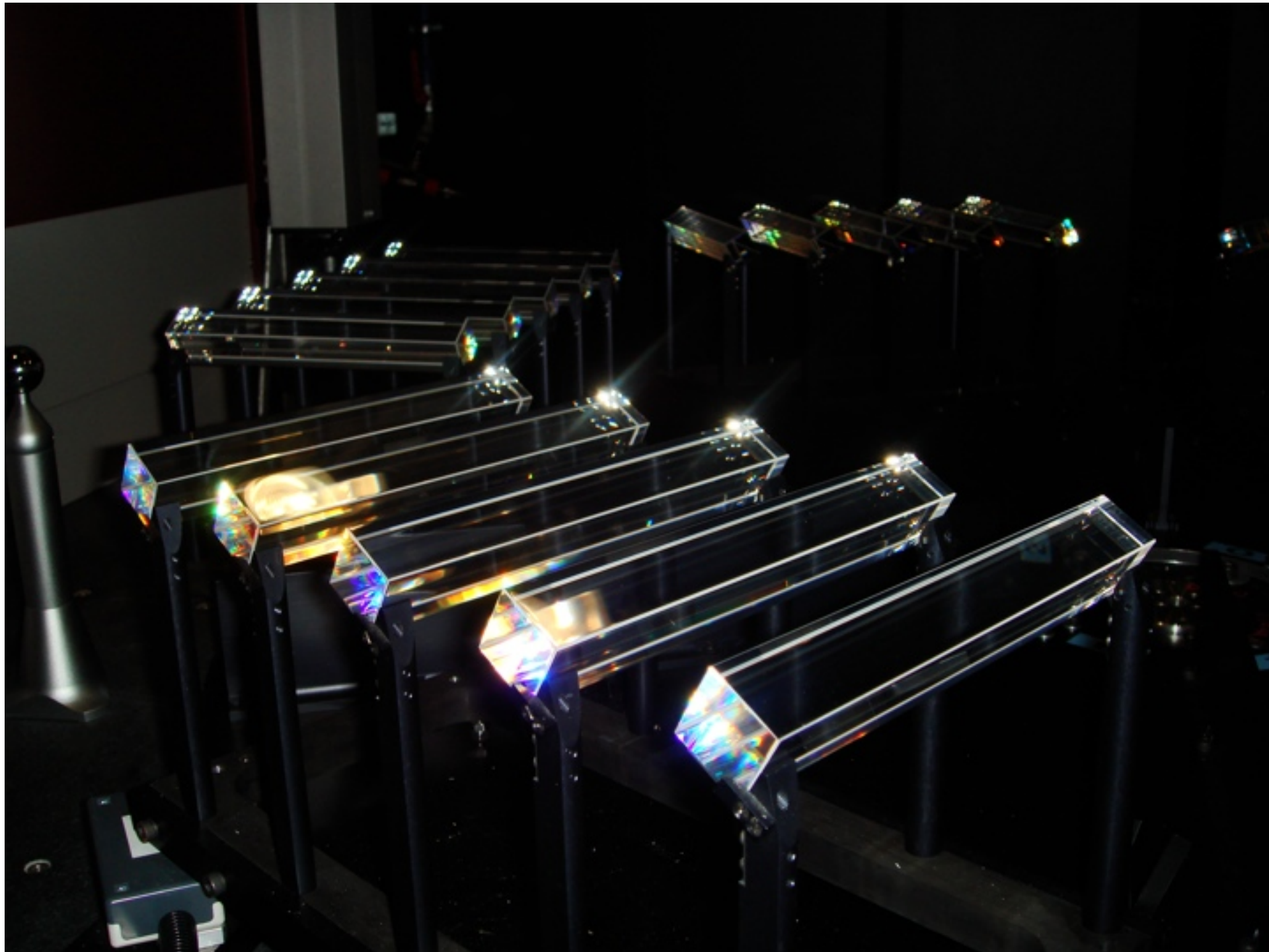
- Al stabilised conductors are still state-of-art for safe operation
- Currently no commercial producer
- One Chinese company makes trials for CEPC

Strategy on Aluminum Extrusion

- Contact to producer of machinery
- Establish knowhow at extrusion lab
- Cooperation for nearest projects (PANDA, EIC, BabyIAXO)

Low level support required to participate in the consortium.

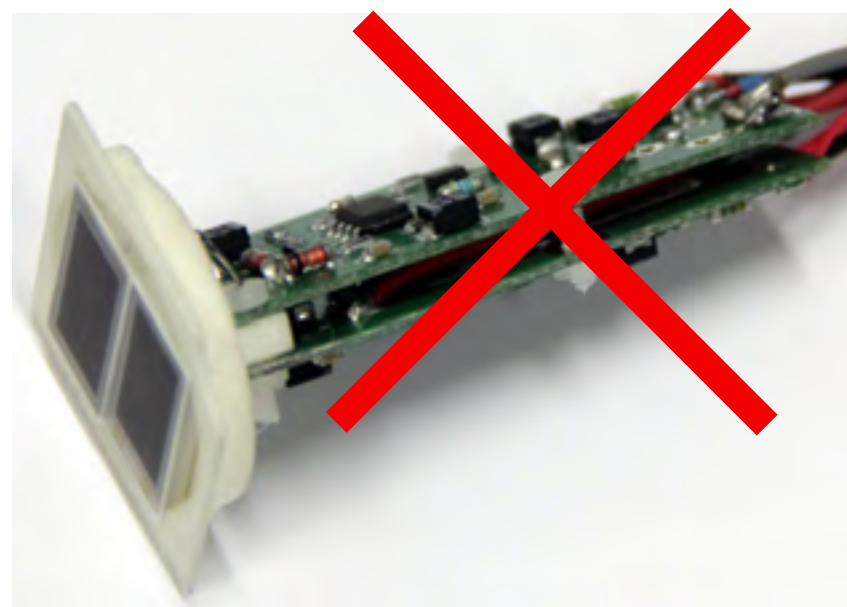
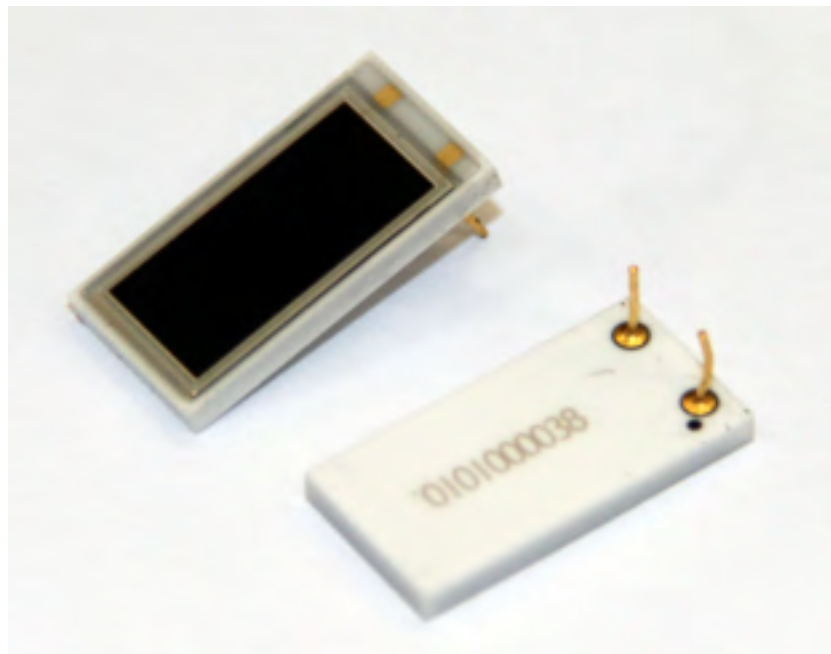
Lead-tungstate crystals for the EMC (Russian in-kind contribution)



The world's only producer (Crytur in the Czech Republic) is currently almost without orders and will probably stop production without any perspective.

Readout electronics of the EMC

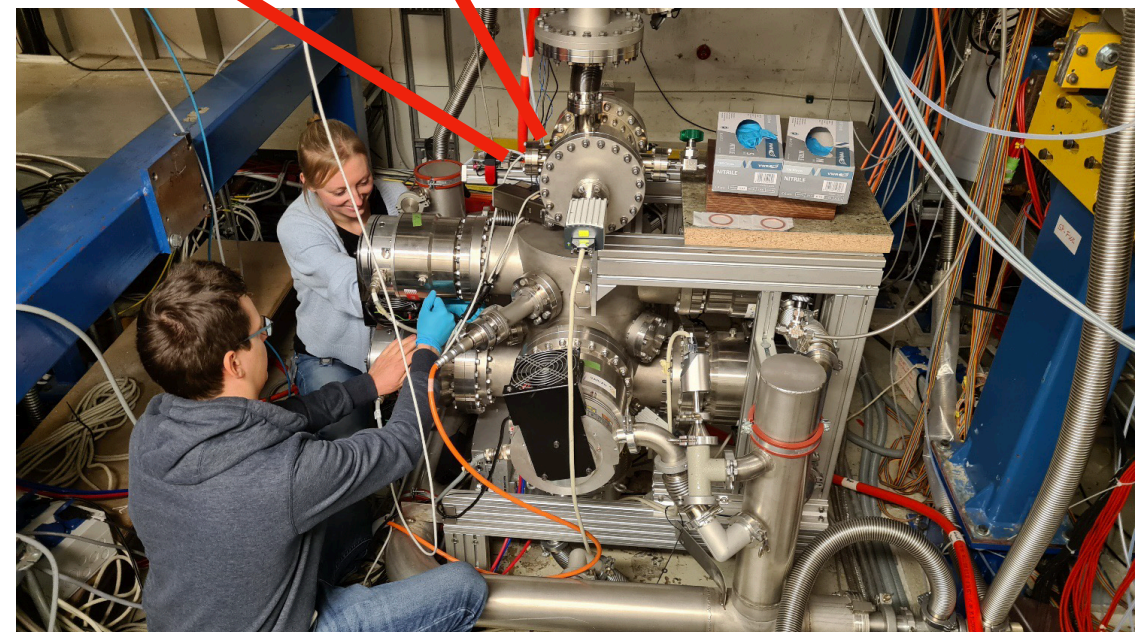
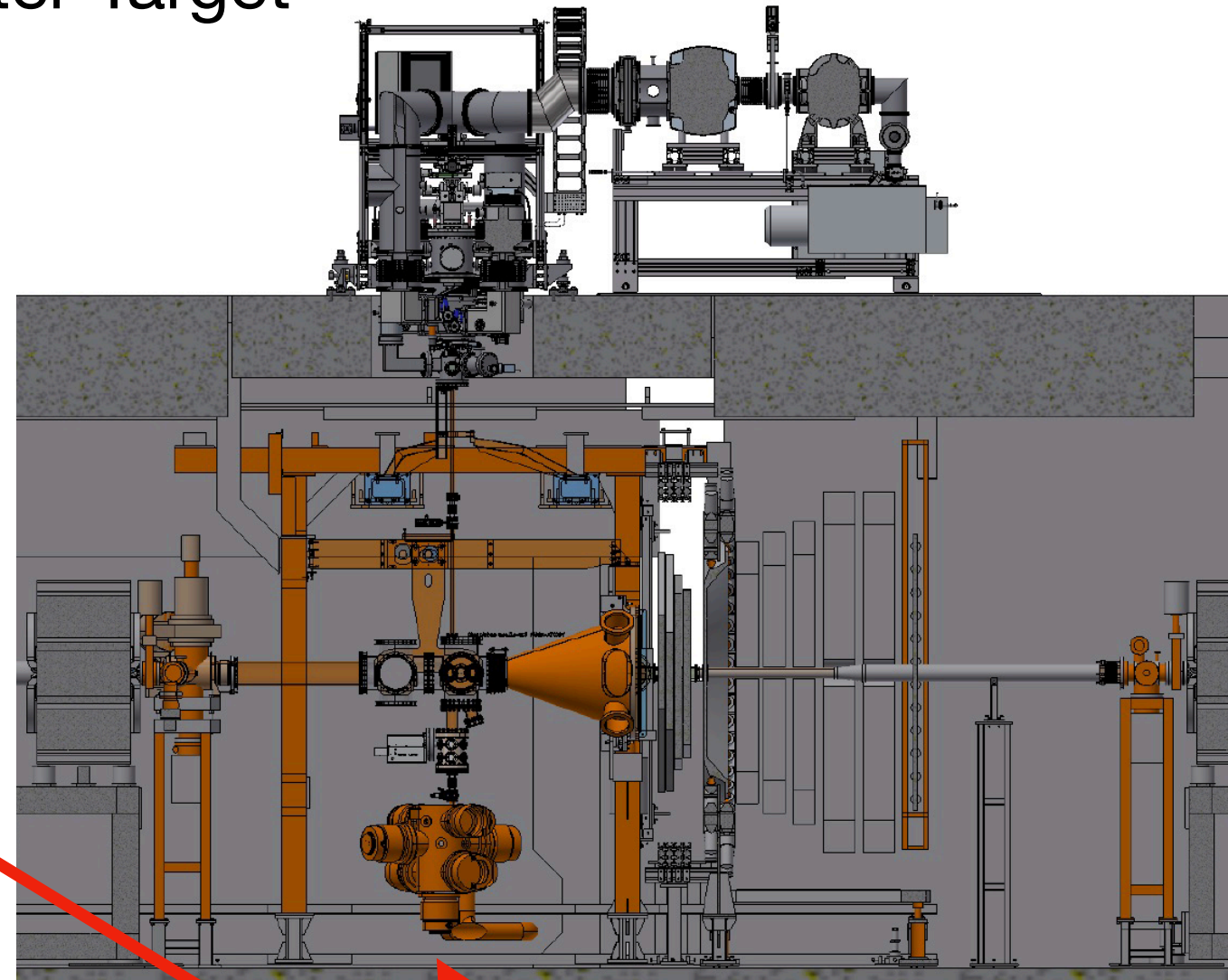
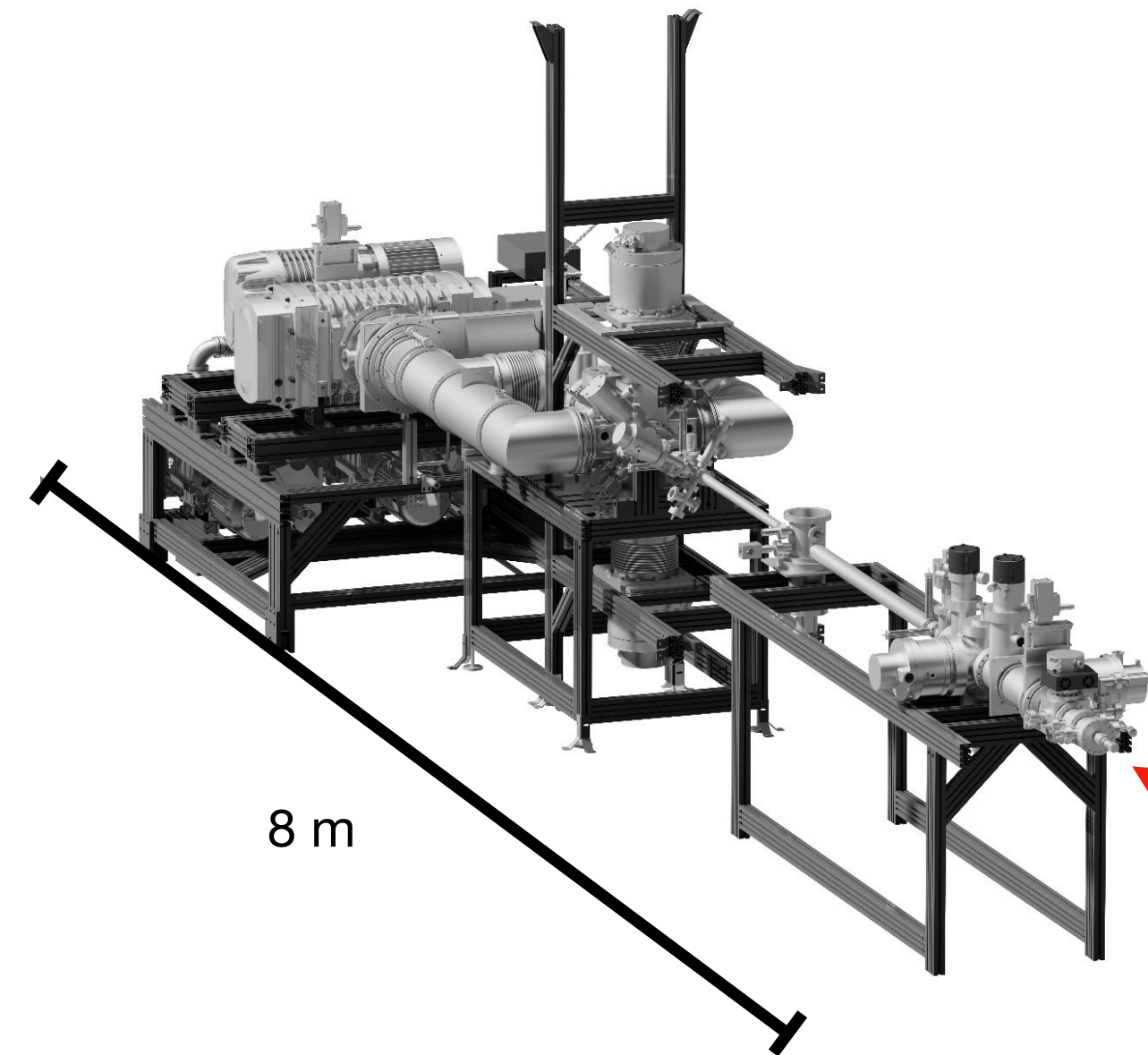
Top priority APDs co-developed by us.

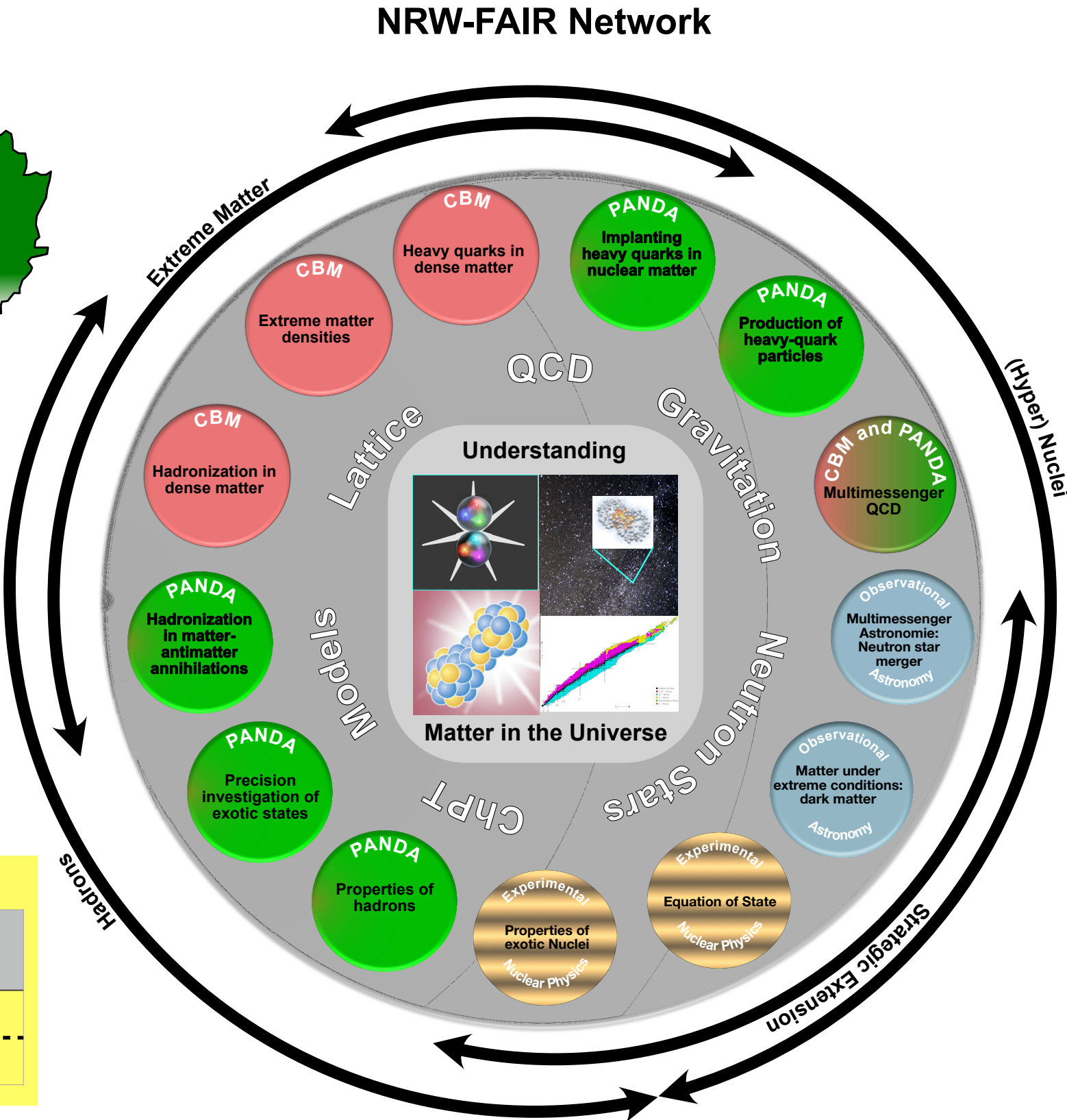
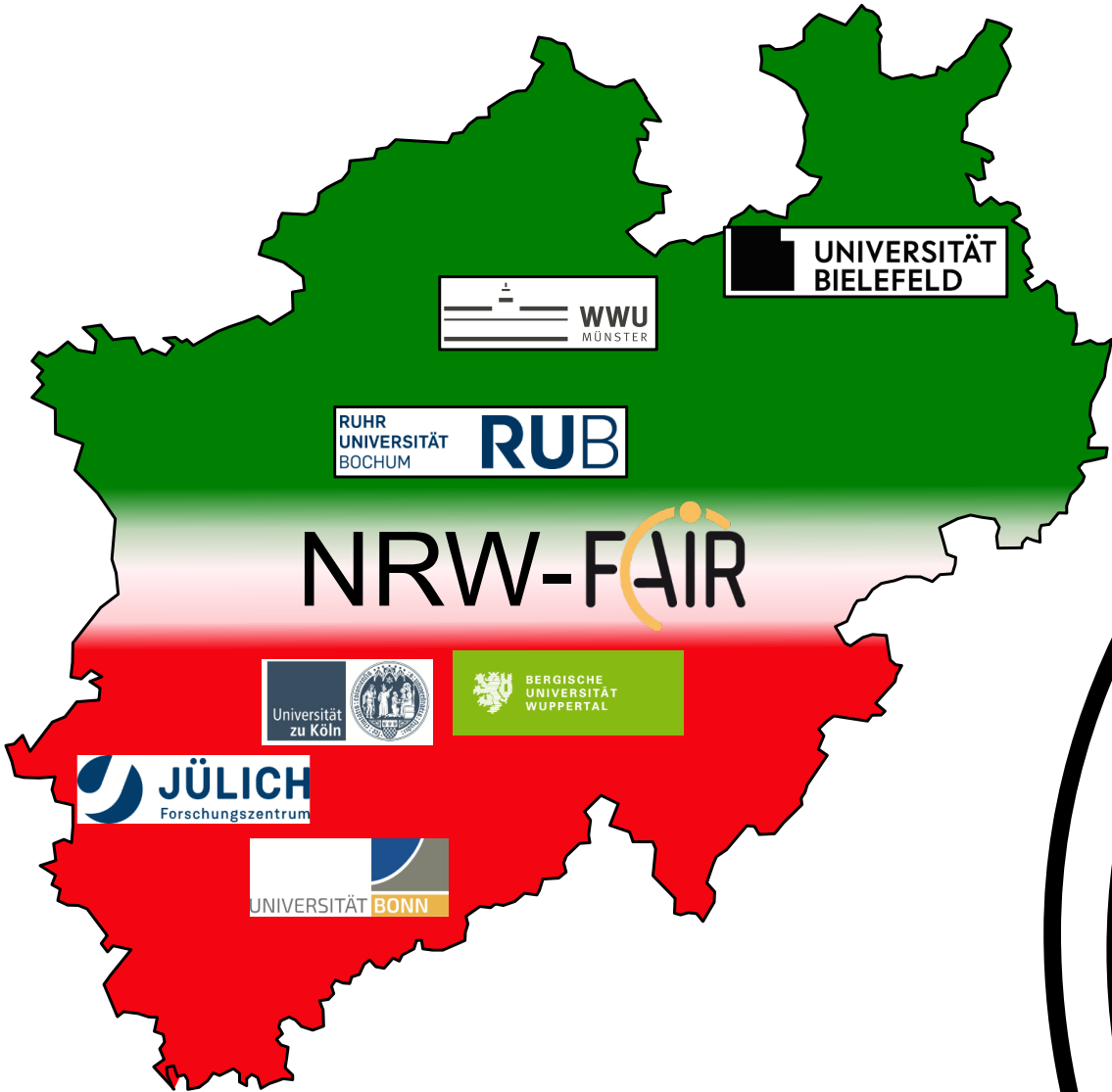


How long still available?

If the production process is changed and the characteristics of the semiconductor are altered, the entire readout chain may be invalidated.

The Cluster Target

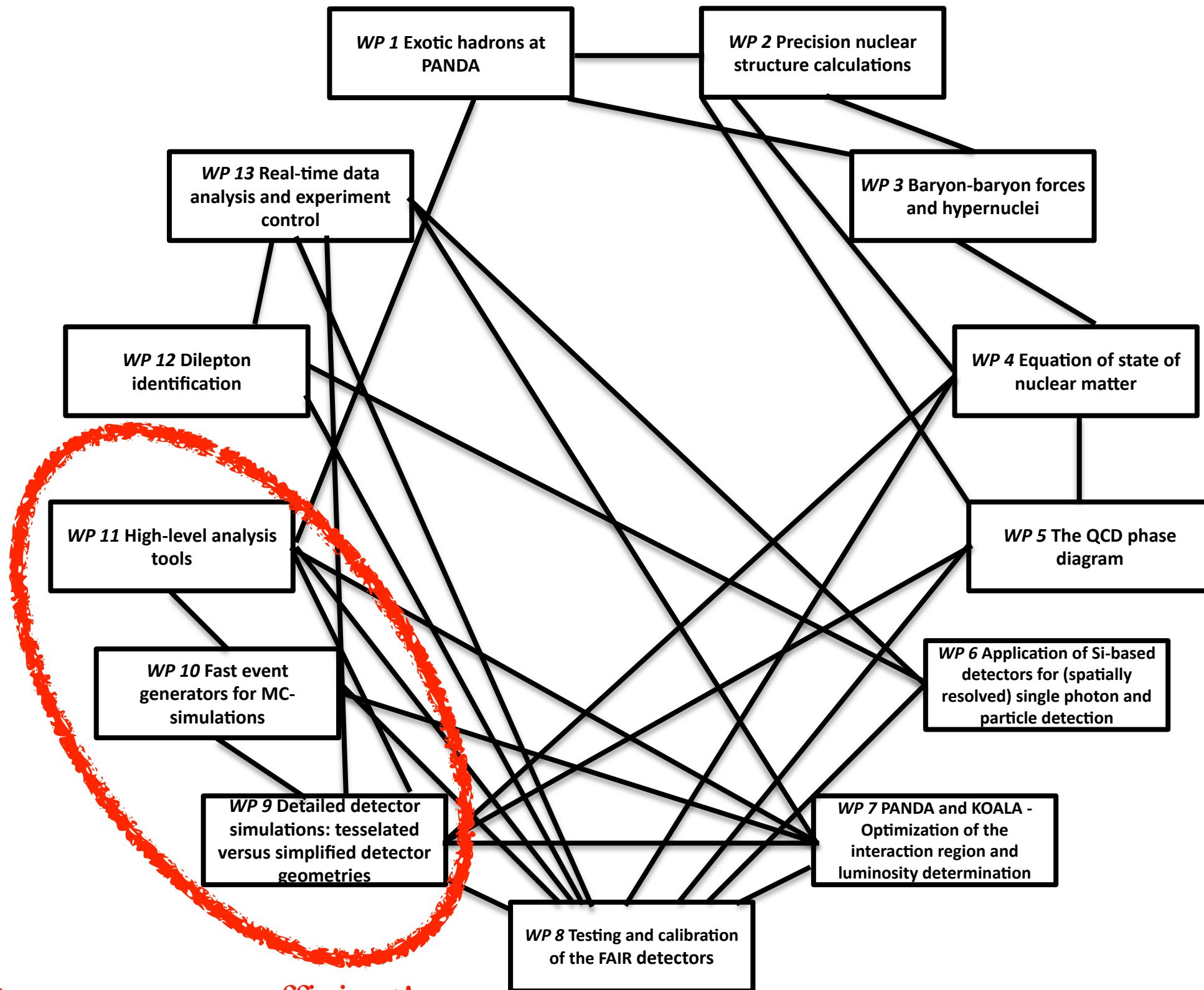




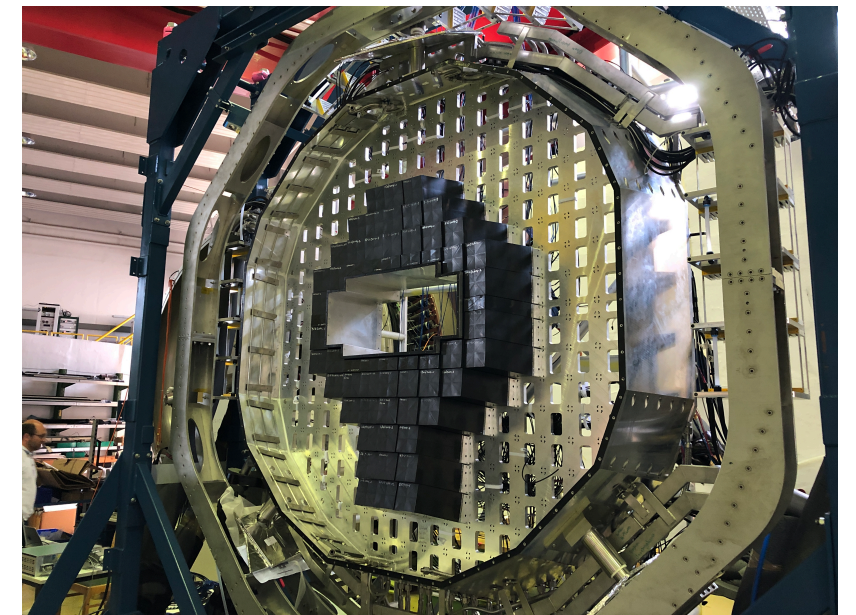
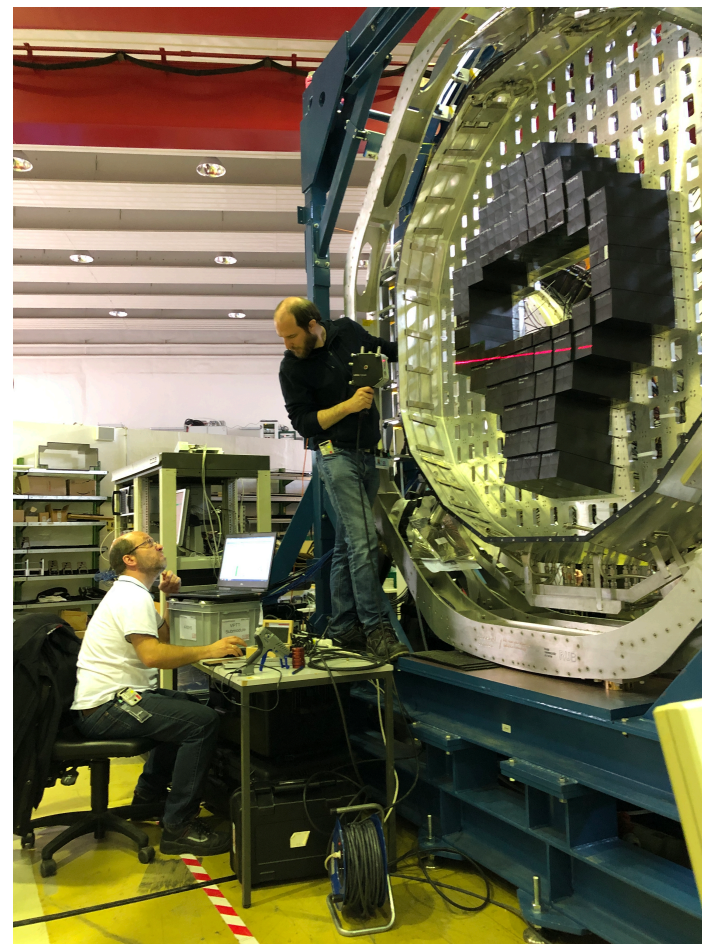
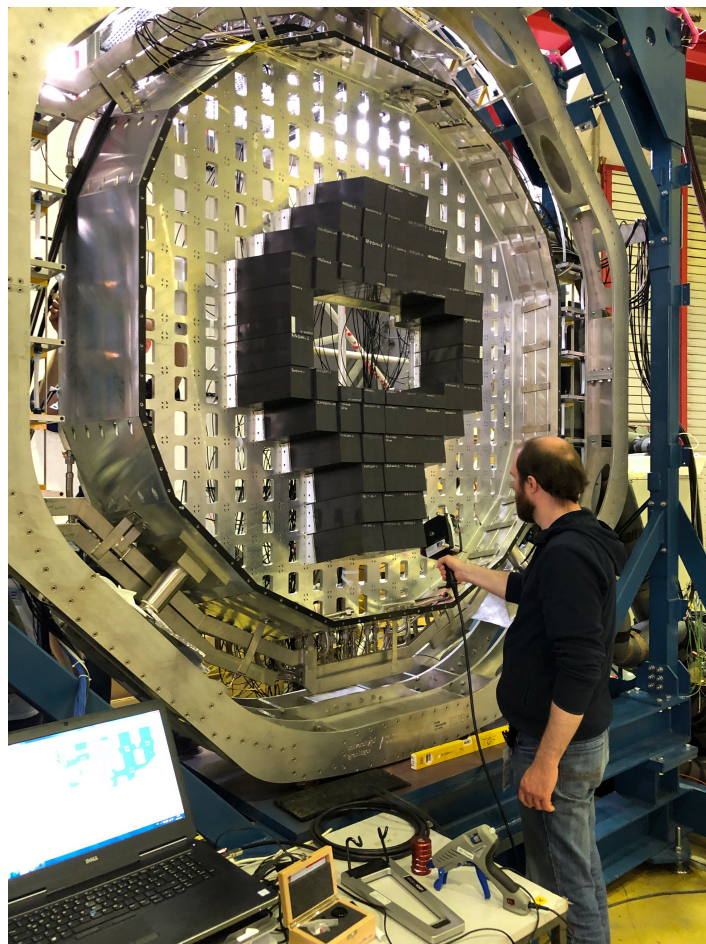
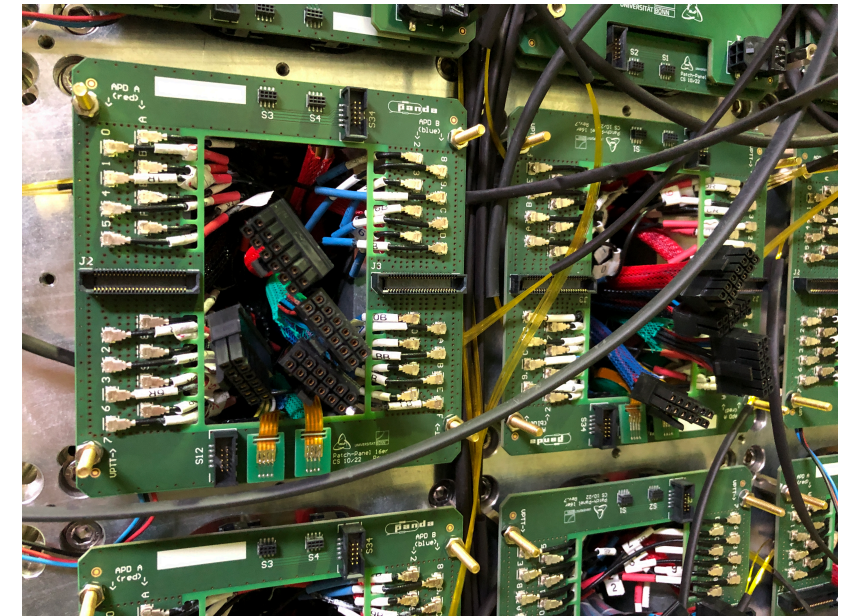
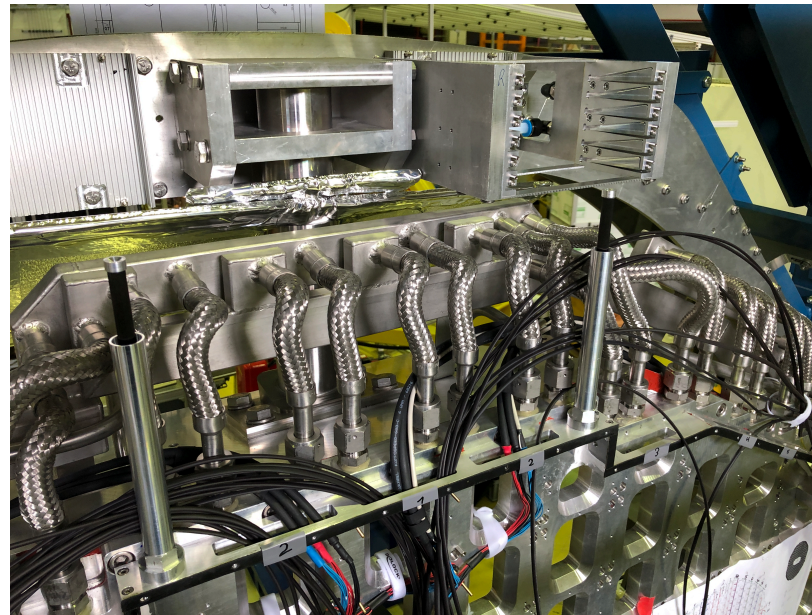
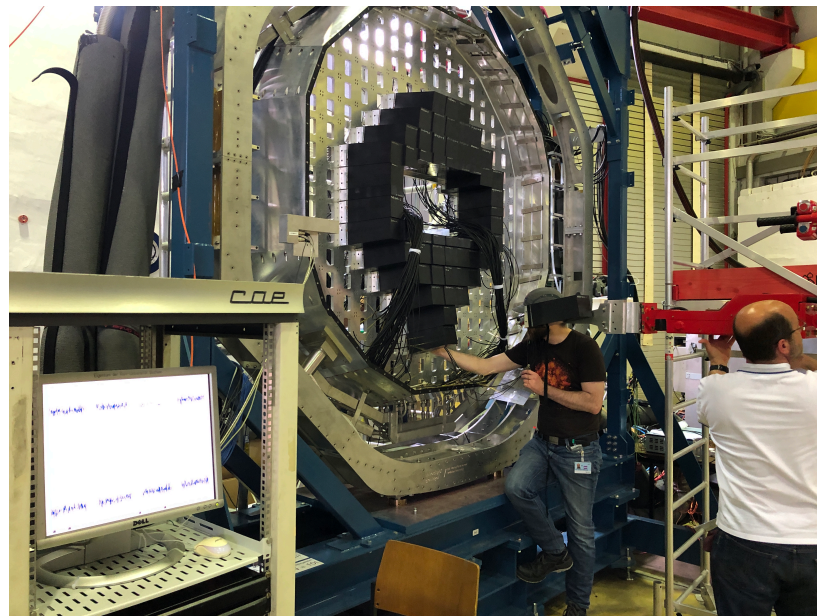
Scientists in NRW-FAIR

	PostDoc positions	PhD student positions
Total	28	20
Professor / PI	27	

Computing work packages in NRW-FAIR



Become energy efficient!



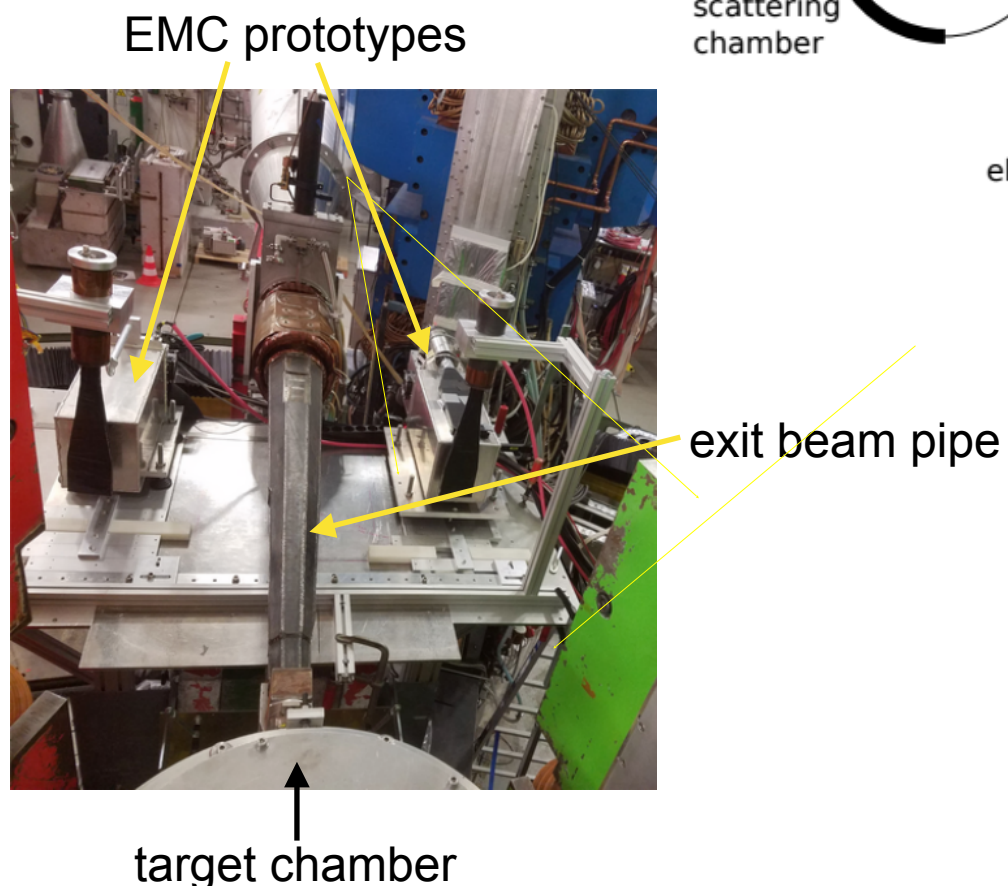
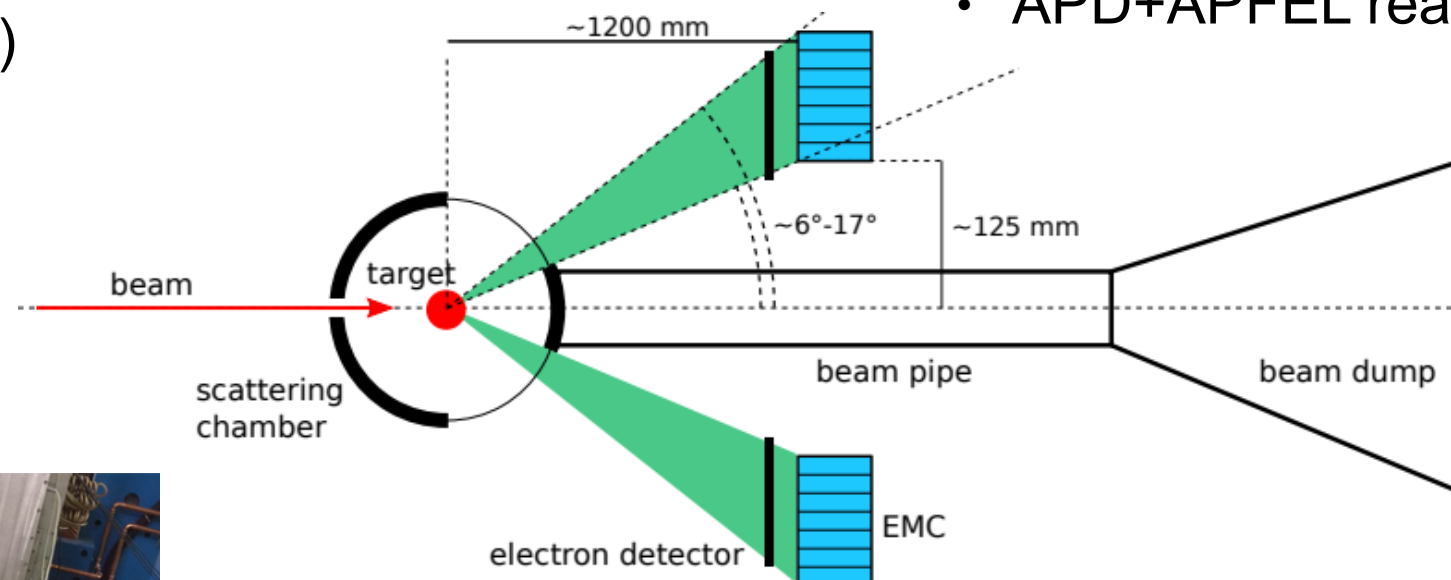
Build up, tests and **physics** $\Rightarrow$ Continued program at MAMI

The experimental setup at MAMI

- at A1 electron scattering facility
- beam energy: 1.5 GeV
- Ta target ($Z=73$)

Modified version of PANDA backward EMC

- 640 PbWO_4 crystals
- APD+APFEL readout



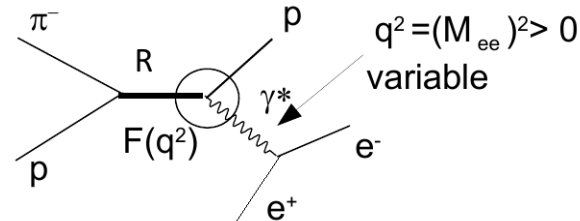
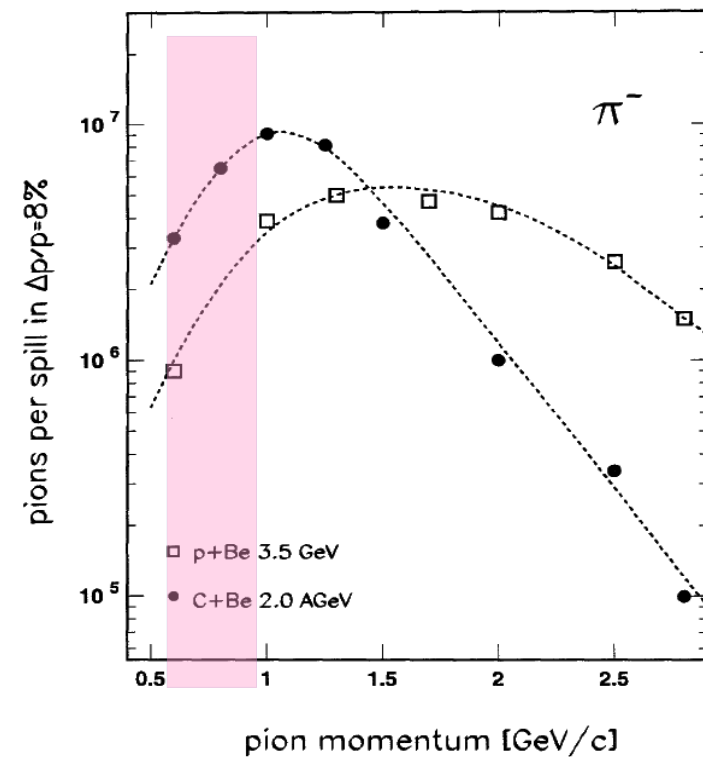
Test measurements with prototypes

- real experimental condition
- measurement of total detector rates
- $\Rightarrow$ determination of feasible luminosity
- measurement of energy spectra

Build up, tests and **physics** $\Rightarrow$ Continued Collaboration with HADES

Pion Beam @ GSI

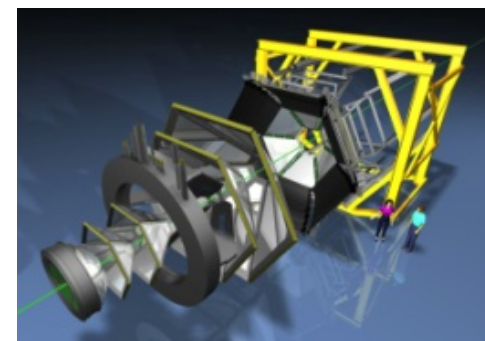
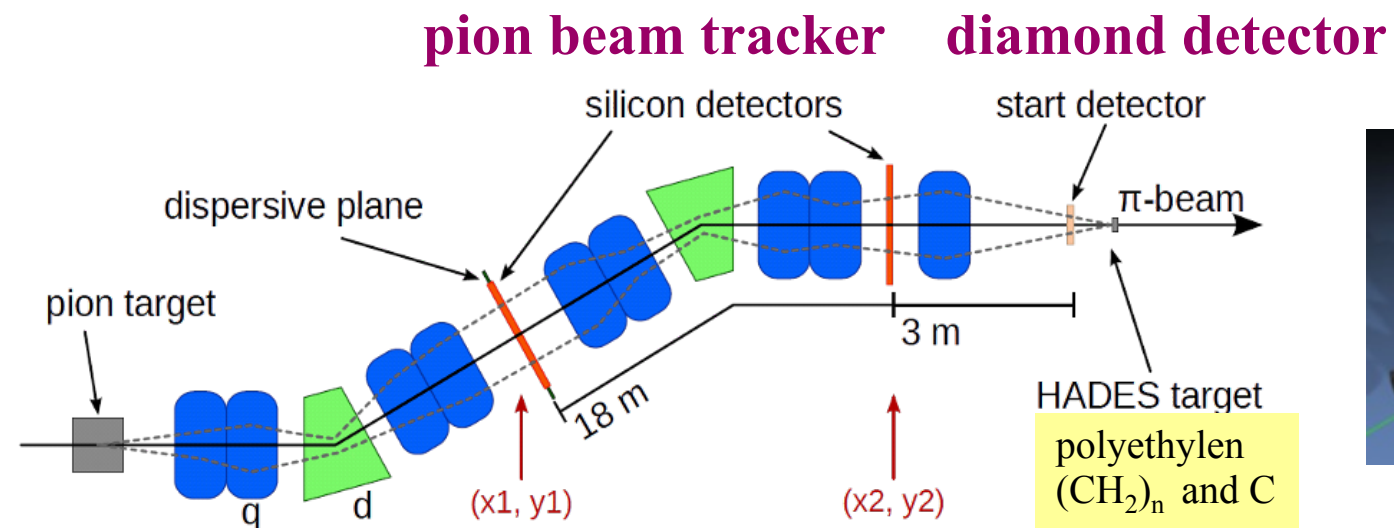
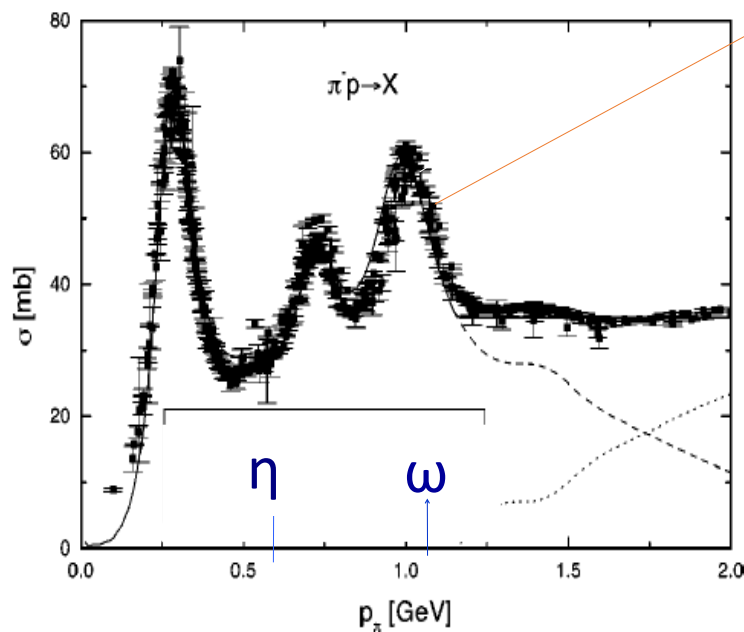
Eur. Phys. J. A (2017) 53: 188



- reaction **N+Be**, 6×10^{10} N_2 ions/spill (4s)
- secondary π^- with **$I \sim 2-3 \cdot 10^5/s$**
- pion momentum $\Delta p/p = 2.2\%$ (σ)
- 50% acceptance of pion beam line

First run:

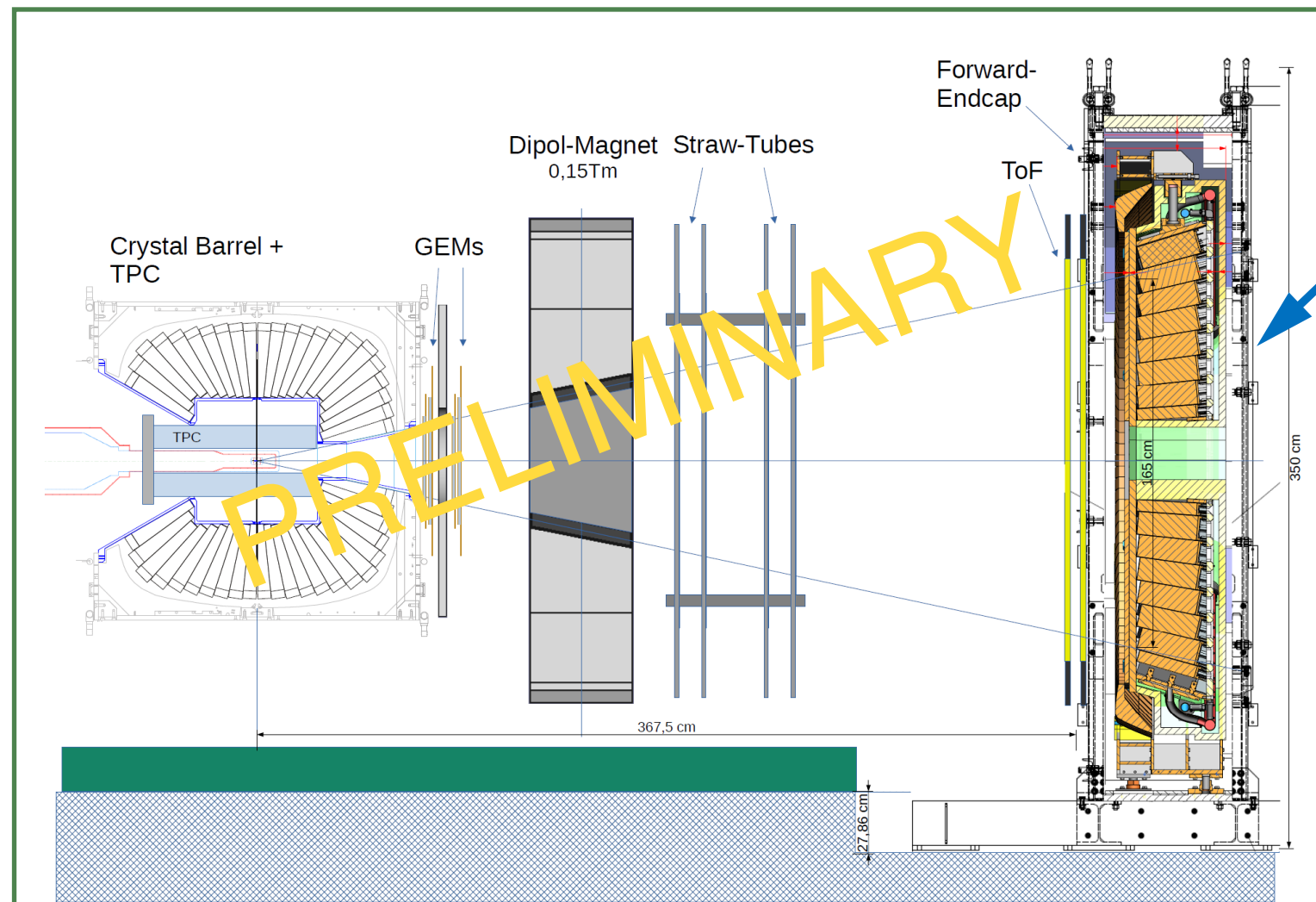
- **$\sqrt{s} = 1.46-1.55$ GeV (4 points)**
- **PE $(CH_2)_n$ and C targets** : 2-pion and $e+e^-$ production



Build up, tests and **physics** $\Rightarrow$ New program at ELSA ?

Photoproduction off the neutron + strange baryon spectroscopy:

$\Leftrightarrow$ Upgrade of the detector system: New detectors for charged particle detection (TPC/Pixel/Strips, GEM, Straws, TOF)



+

Panda FWEC
(with closed
inner hole)

$\Rightarrow$ $\sim 4\pi$ for photons
and for charged
particles
+ polarized target

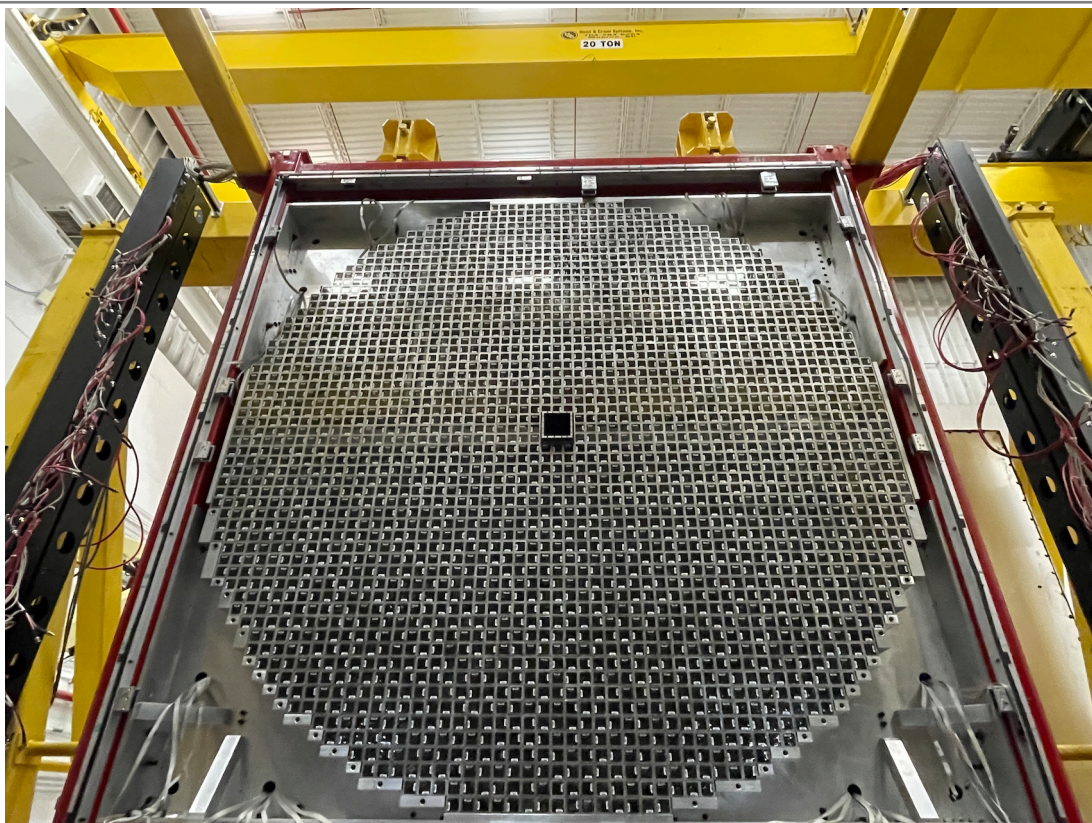
$\Leftrightarrow$ **new final states including strange baryons!**

$\Leftrightarrow$ Polarized photoproduction off proton and neutron in the non-strange and strange baryon sector

Build up and **physics** $\Rightarrow$ New program at GlueX @ JLAB?

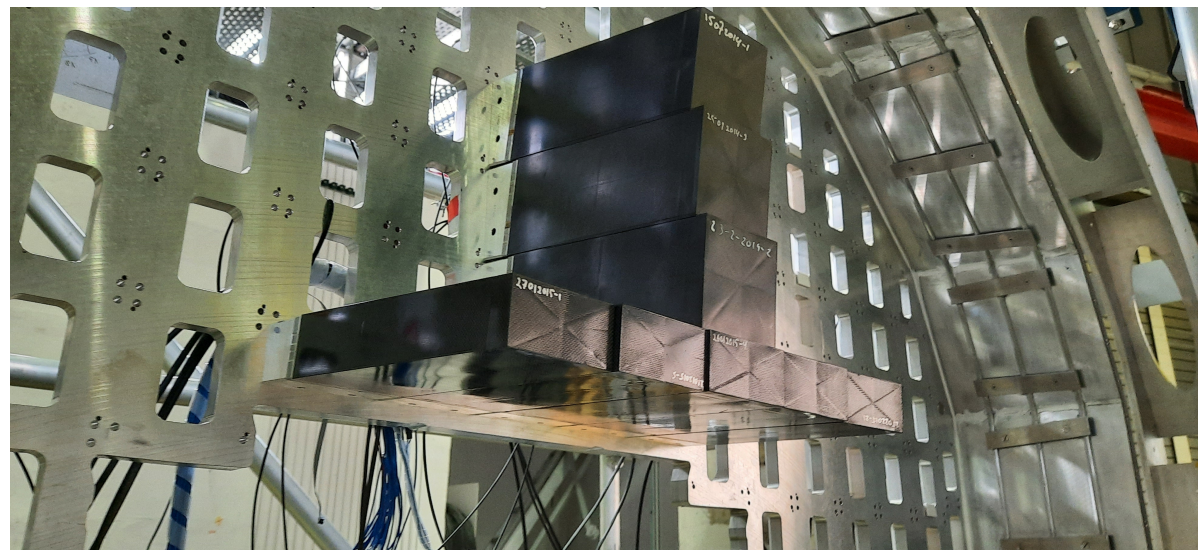
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Proton physics program at SIS18/100 ?

Exploratory studies ongoing
on a possible physics
program with protons

and

test beam studies in CAVE C
to help detector
development for PANDA



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25. April 2023

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BIC COBADEFF508

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Amtsgericht Darmstadt HRB 1528
USt-IdNr.: DE 111 671 917

Landesbank Hessen/Thüringen
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BIC HELADEF3

Sehr geehrter Herr Professor Wiedner,

mit diesem Schreiben teilen wir Ihnen mit, dass sich die GSI bereit erklärt, der PANDA-Kollaboration dedizierte und garantierte Strahlzeit und Flächen für die Durchführung der PANDA-Detektortests zur Verfügung zu stellen, die aufgrund der Absage der Strahlperiode 2024 nicht bei COSY durchgeführt werden können.

Wir beabsichtigen, ein Kontingent an Strahlzeit zur Verfügung zu stellen, das mit dem vergleichbar ist, das bei COSY hätte bereitgestellt werden können, und wir beabsichtigen, Flächen für vorbereitende Arbeiten in 2026/2027 zur Verfügung zu stellen; es wird nicht möglich sein, Flächen und Strahlzeit schon in der bereits ausgearbeiteten Kampagne 2024/2025 bereitzustellen.

Der genaue Umfang der Flächen sowie die Dauer der Strahlzeit werden von der GSI Geschäftsführung nach Erhalt eines detaillierten Vorschlags der PANDA-Kollaboration diskutiert.

Mit freundlichen Grüßen


Prof. Dr. Paolo Giubellino


Dr. Ulrich Breuer


Jörg Blaurock

cc: Prof. Wolfgang Marquardt, Forschungszentrum Jülich
Karsten Beneke, Forschungszentrum Jülich
Dr. Ralf Dieter, Bundesministerium für Bildung und Forschung
Hendrik Grote, Bundesministerium für Bildung und Forschung

HELMHOLTZ

We would like to ask the funding agencies for continued support mainly for

Personnel

- to keep the expertise for finished equipment and detectors
- for giving young scientists a future and training ground in hadron physics
- secure the field of hadron physics in Germany and elsewhere

Help in setting up finished detectors in experiments at laboratories.

Moderate amounts for consumables and R&D.

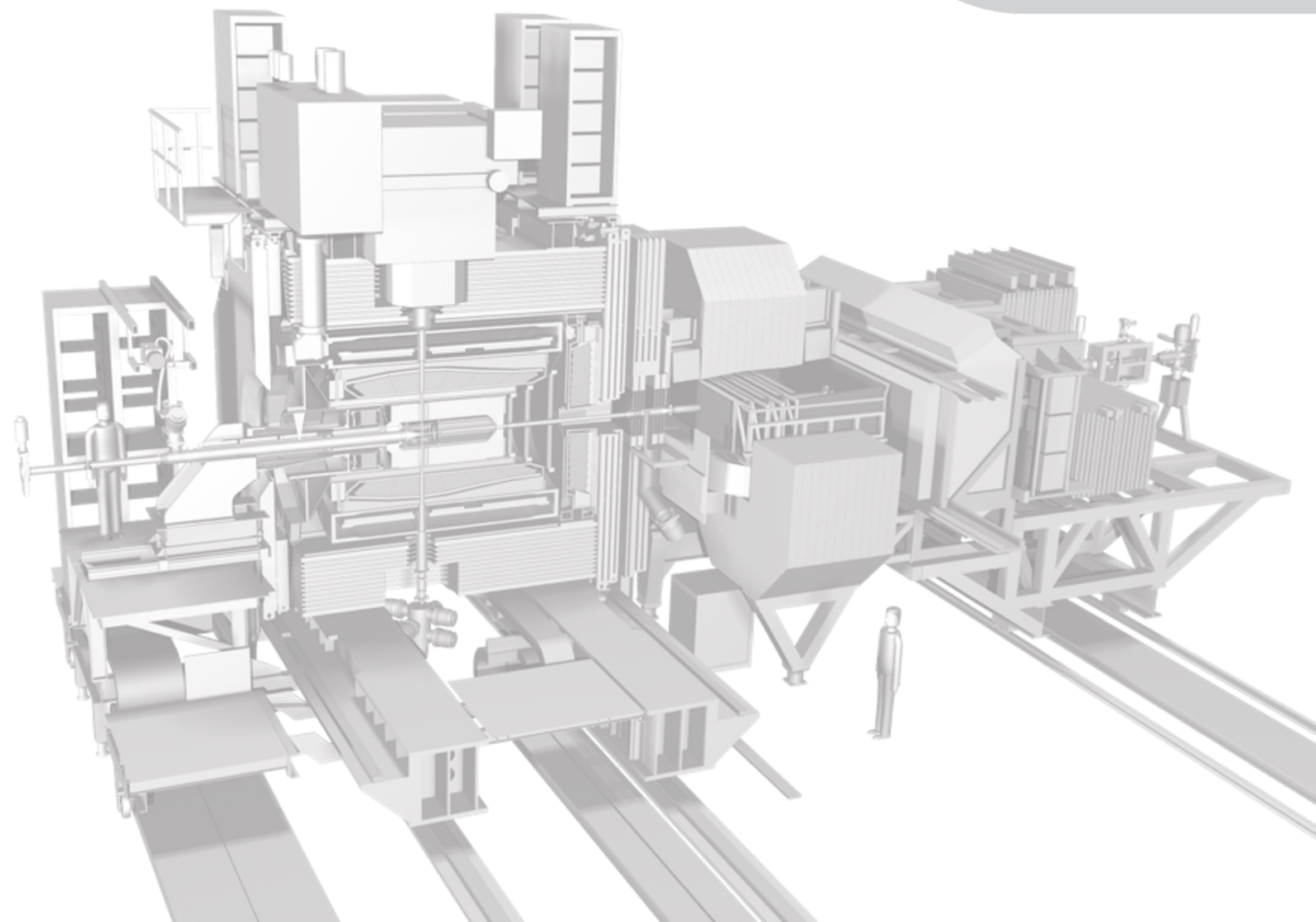
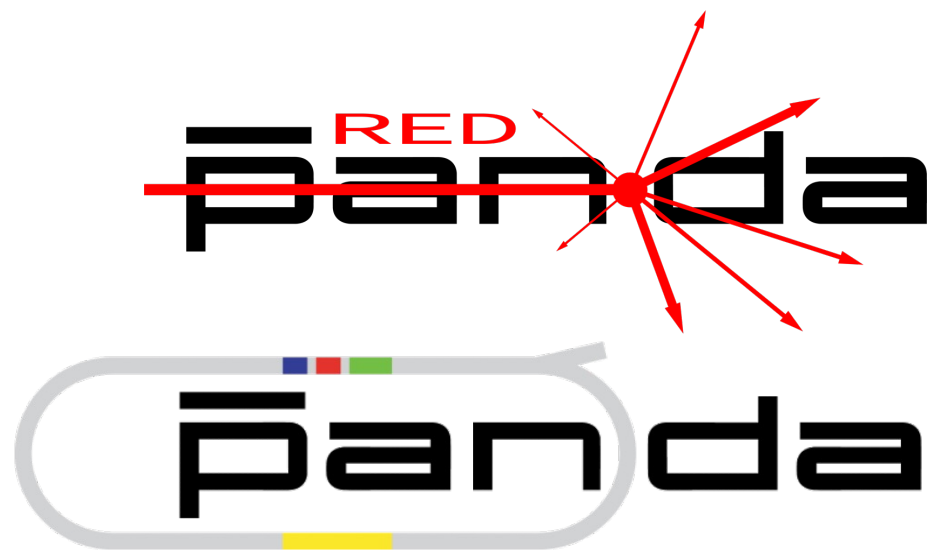
Thank you for your attention!

Future PANDA Plans

Klaus Peters

Spokesperson-elect

GSI Darmstadt / Goethe U Frankfurt



12th FAIR RRB, GSI, June 5/6, 2023

In order to maintain the PANDA Collaboration as it is now
and to prepare for the availability of antiprotons in MSVc
→ an interim PANDA setup is investigated

This setup (aka RedPANDA)

- could comprise all already existing detectors and those being in construction right now
- could be erected at CaveC at GSI after 2026
- would be housed for the tests by the ZEUS magnet

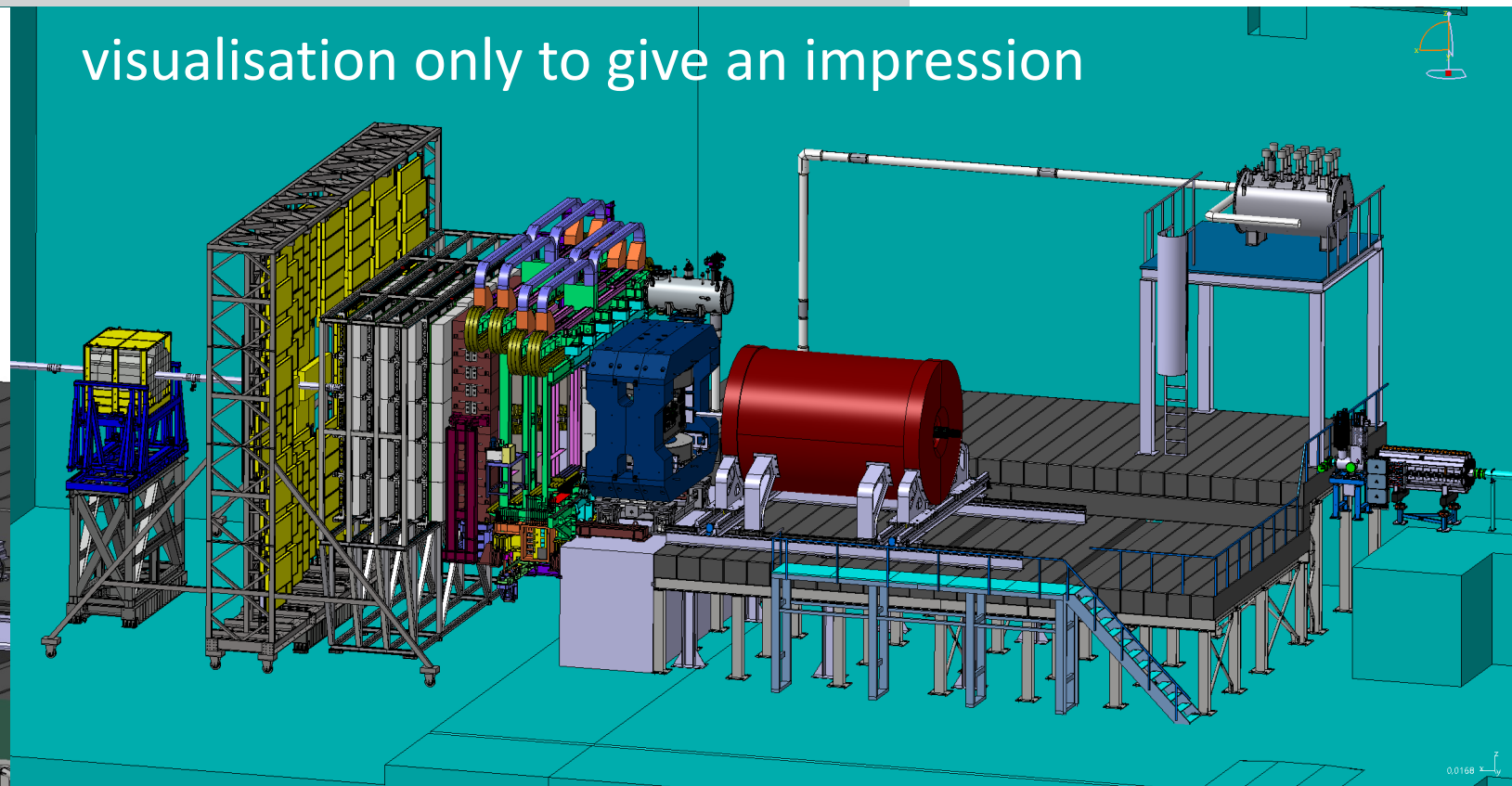
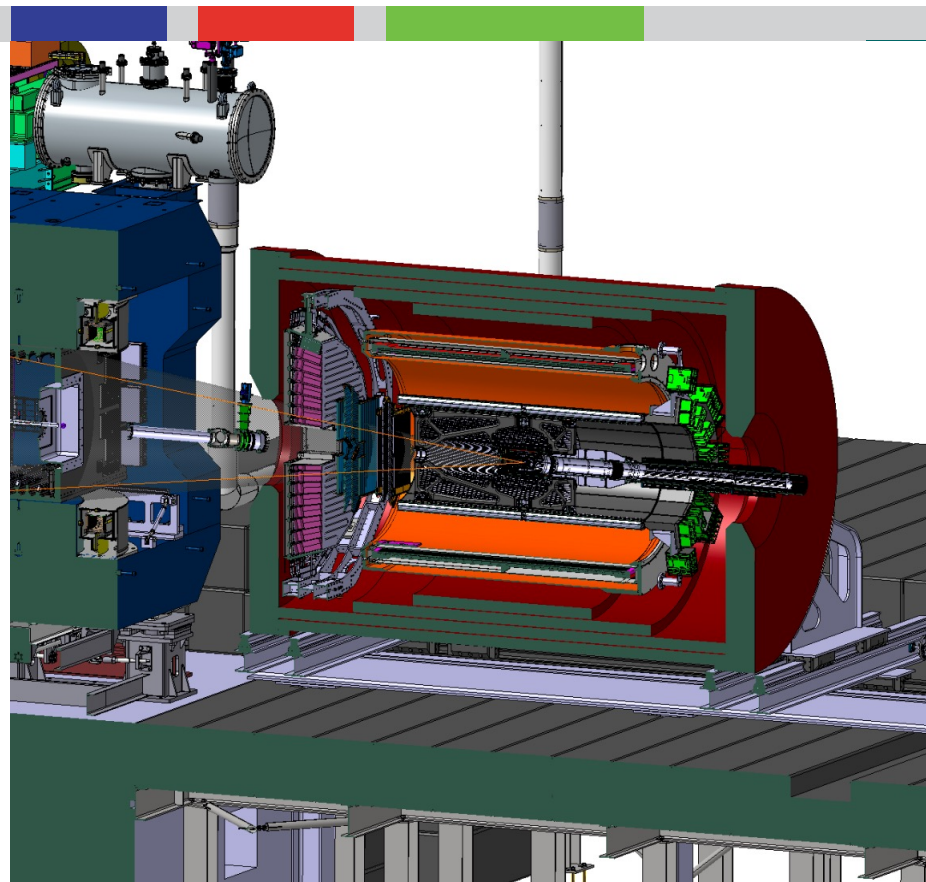
Schedule

- the interim setup would come first
- while other components are scrutinized and are developed in parallel for availability at MSVc



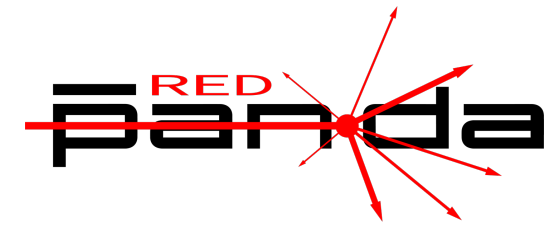
ZEUS solenoid @ DESY

RedPANDA at NCC @ FAIR being investigated



- we investigate a physics driven option once FS+ is operational but MSVc is not
- project depends on the timelines of FAIR and the availability of funds
- RedPANDA would be located in front of CBM in the Nuclear Collision Cave
- common operation w/CBM – but not only for proton-beam !
- physics groups of CBM-HADES-PANDA start discussion
- submit Lol when vibrant and unique physics cases can be demonstrated

A possible PANDA Strategy



2023
now

MSVc

