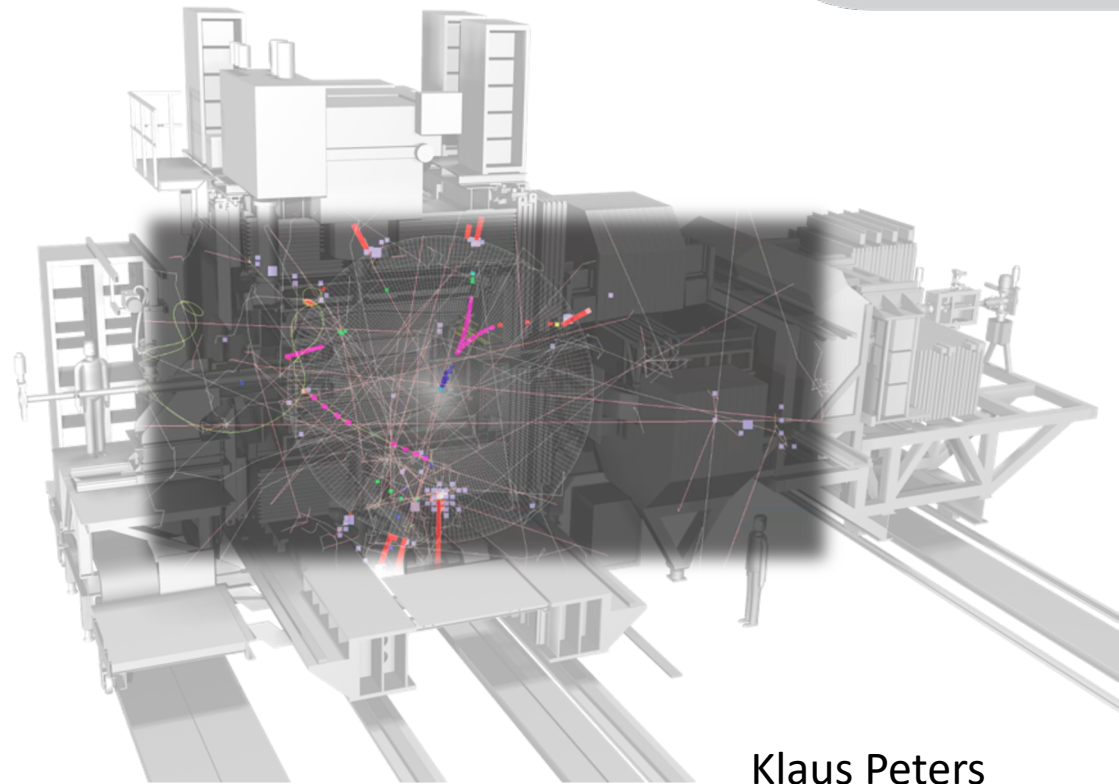


PANDA

KHuK Jahrestagung

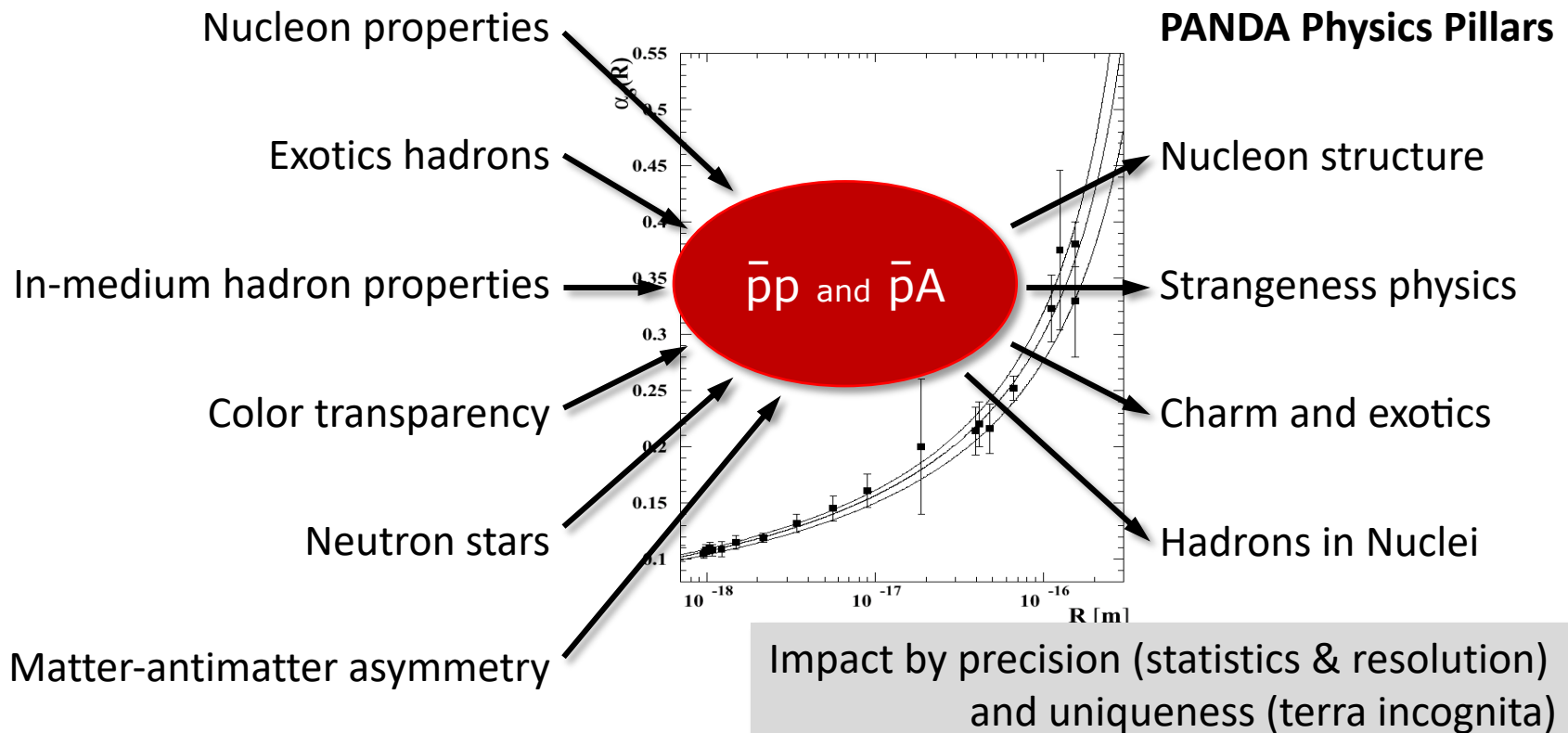
Zoom, Dec 10, 2020



Klaus Peters
GSI/U Frankfurt

Key questions in “strong” QCD

No need for textbook motivations about the non-abelian structure of QCD and its problems



Why Antiprotons



Large mass-scale coverage

- creation of mass rather than momentum
- center-of-mass energies from 2 to 5.5 GeV
- from light, strange, to charm-rich hadrons

Mass scan experiments with beam-resolution

- unique linescans → discovery by precision!

High hadronic production rates

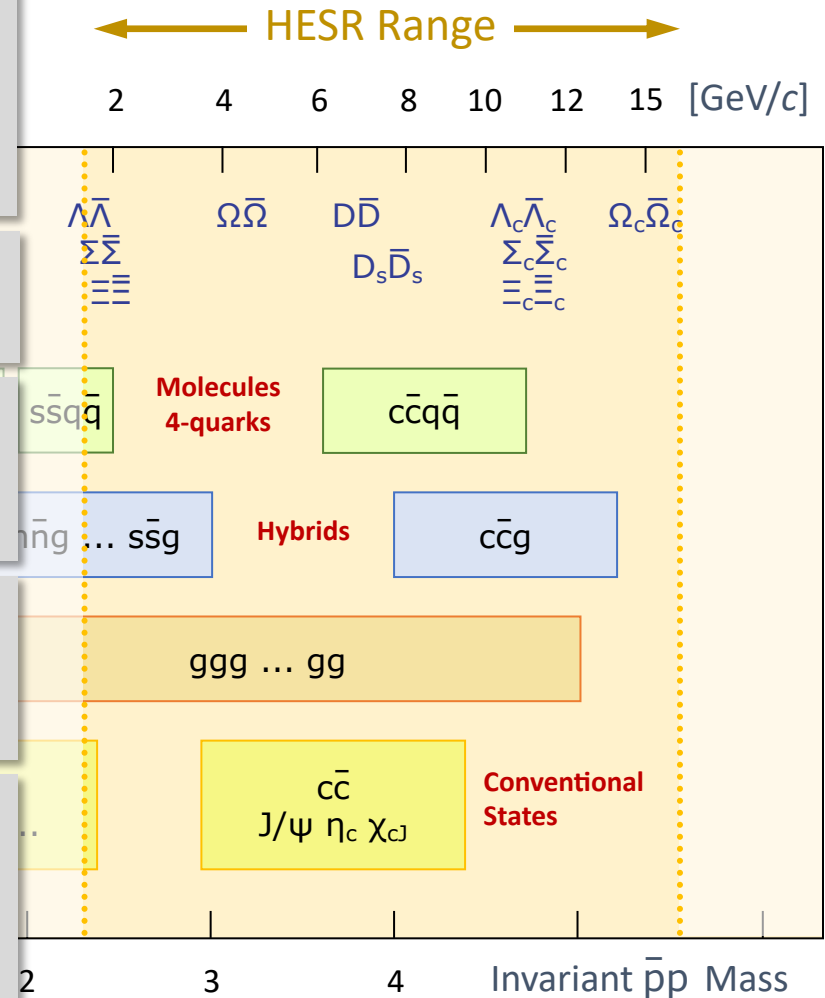
- charm+strange factory → discovery by statistics!
- gluon-rich production → potential for new exotics

Access to large spectrum of J^{PC} states

- direct formation of *all* conventional J^{PC} states
- large sensitivity to high spin states

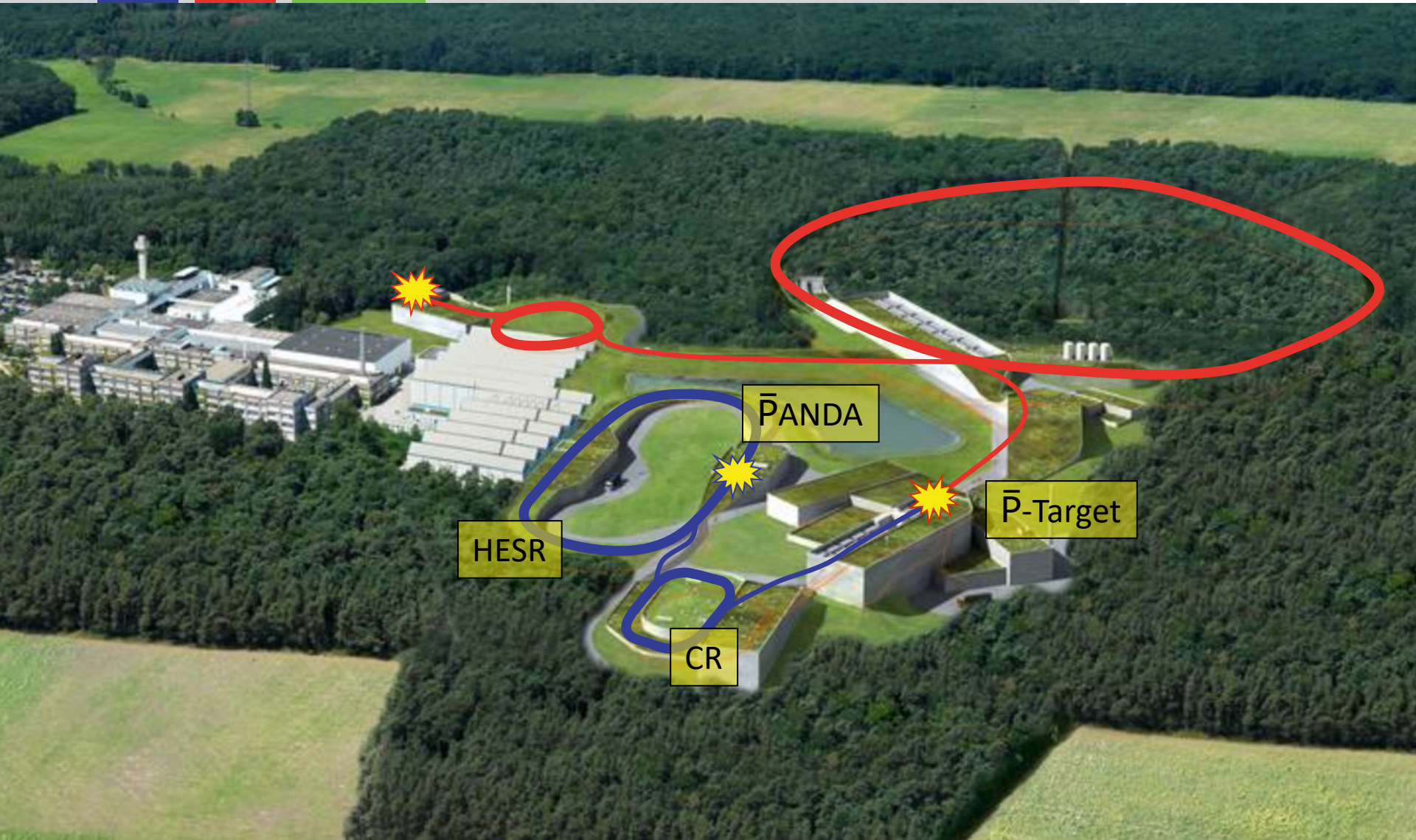
Associated hadron-pair production

- zero net quark content
- access to hidden-strange/charm hadrons
- tagging possibilities
- near threshold: good resolution and low background

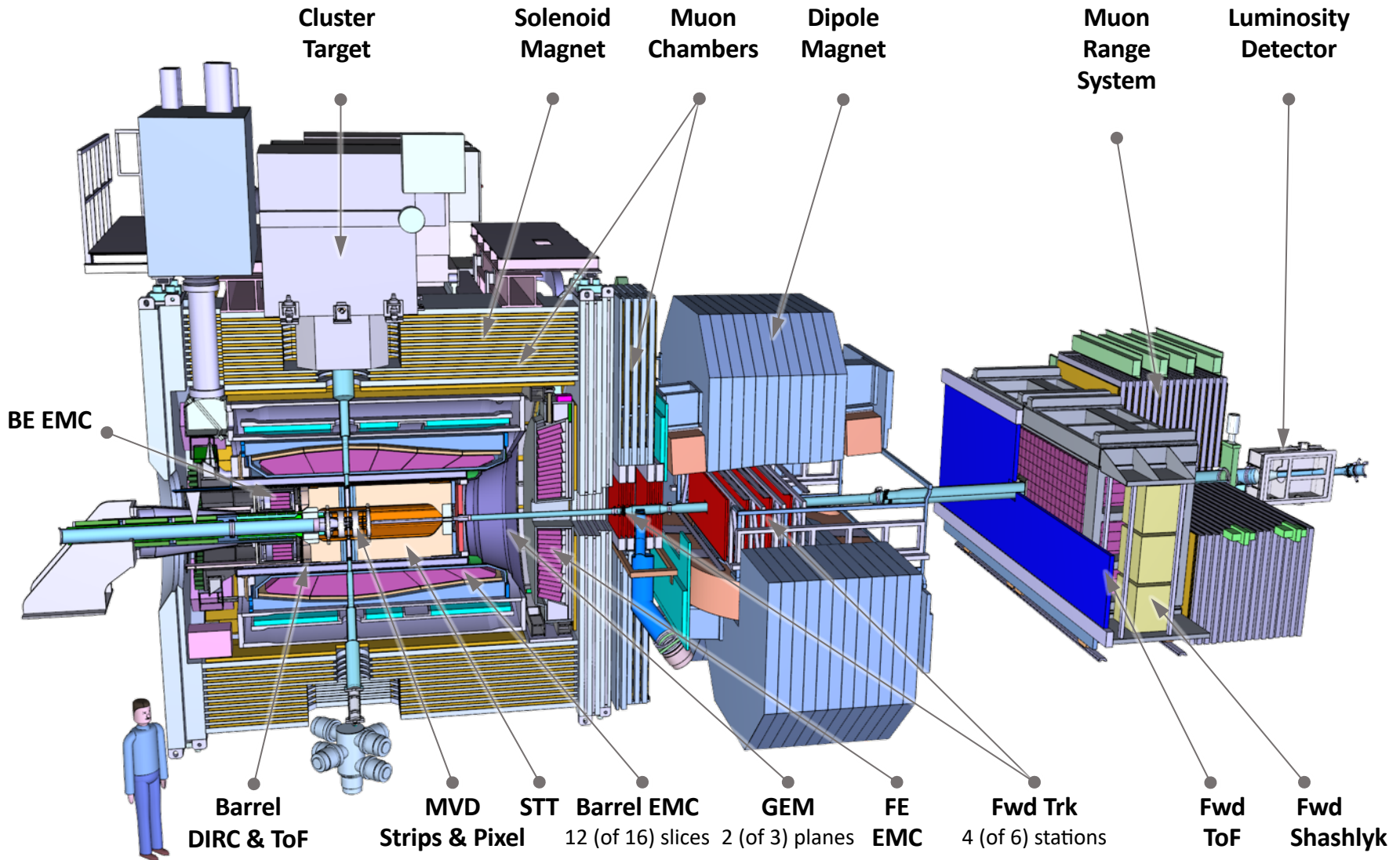


Systematic and precise tool to rigorously study the dynamics of QCD

Antiproton Chain: HESR & PANDA

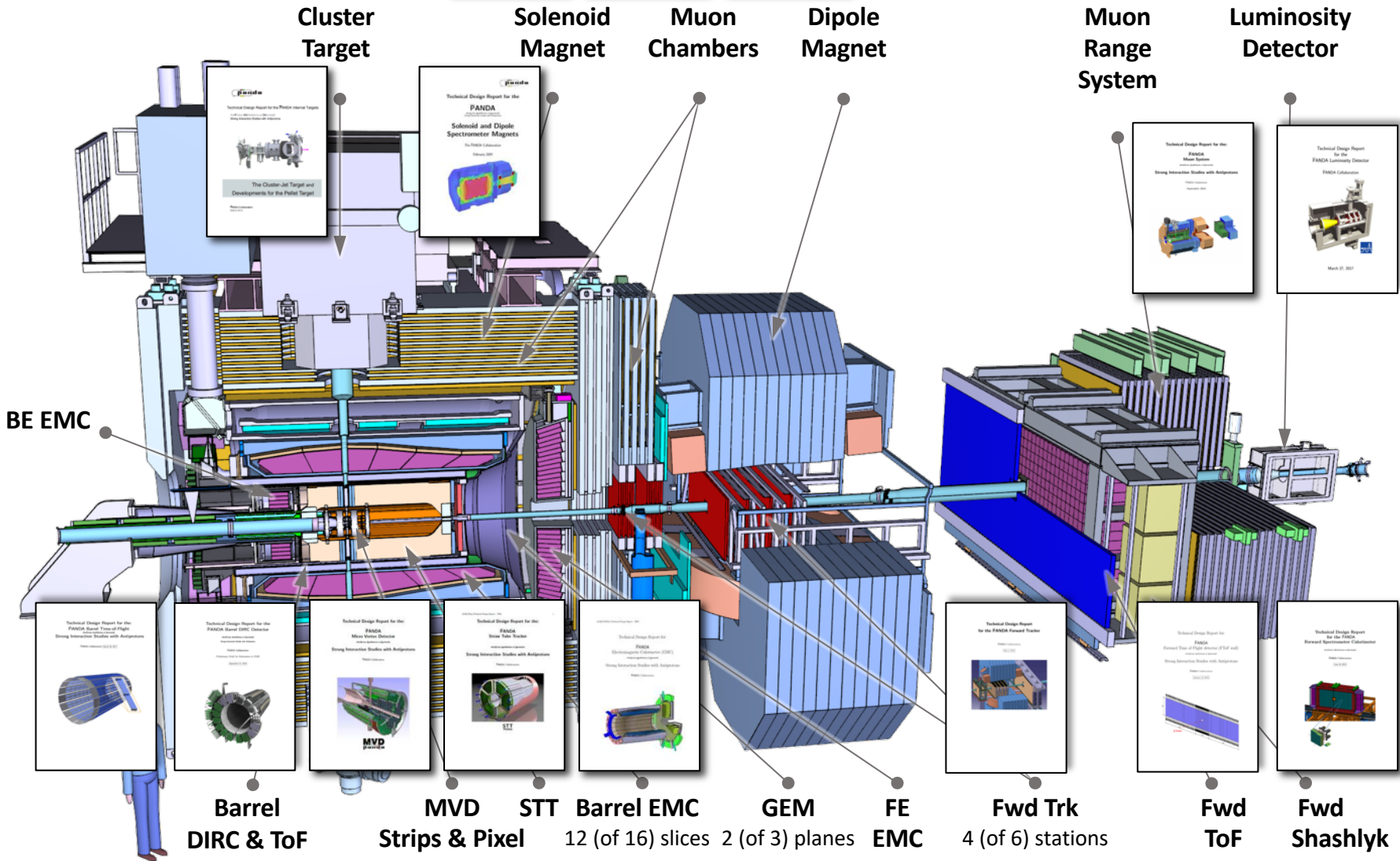
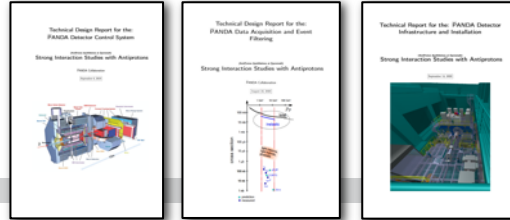


Day-1 Setup



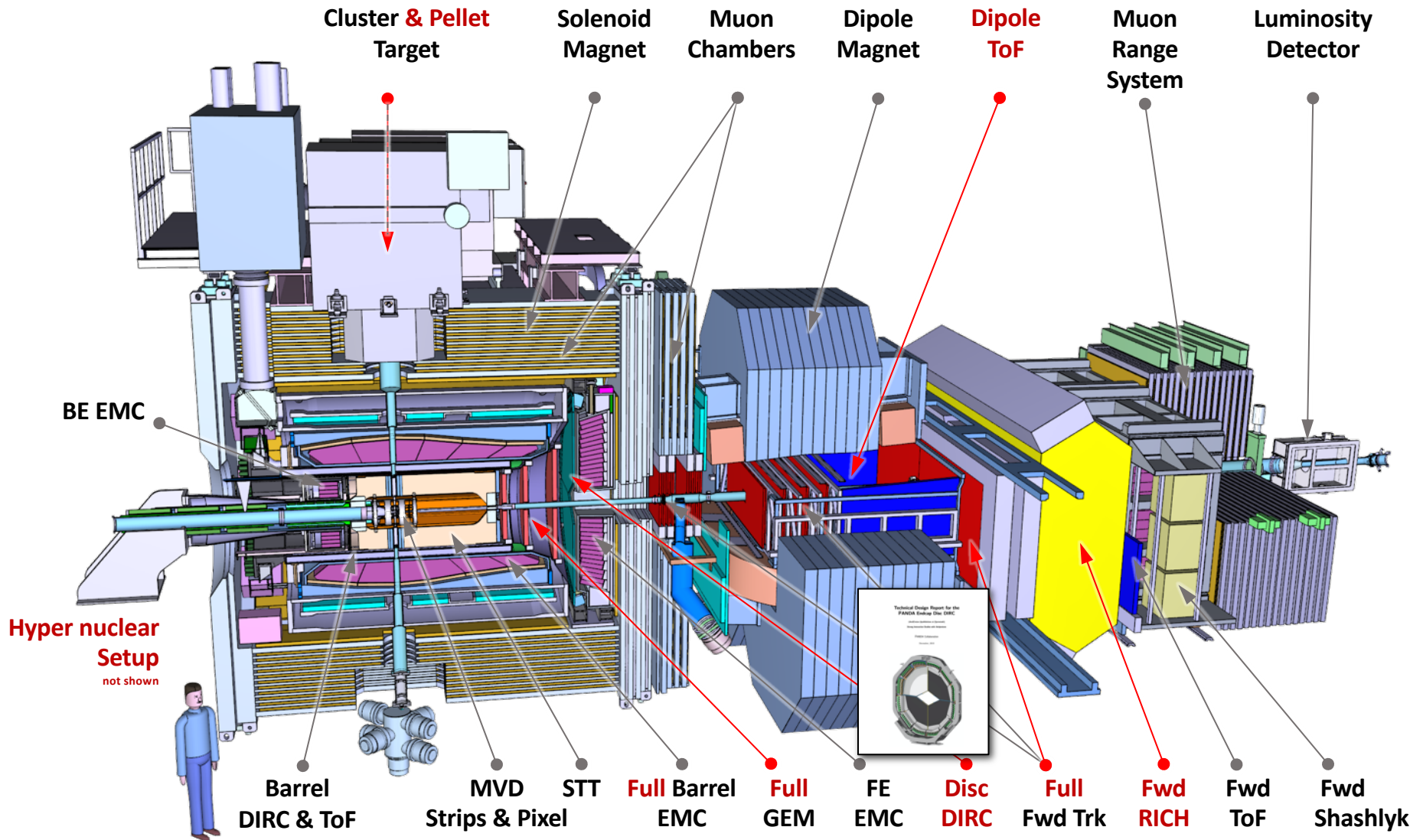
Day-1 Setup

DCS DAQT
Infrastructure



Only 1 TDR missing

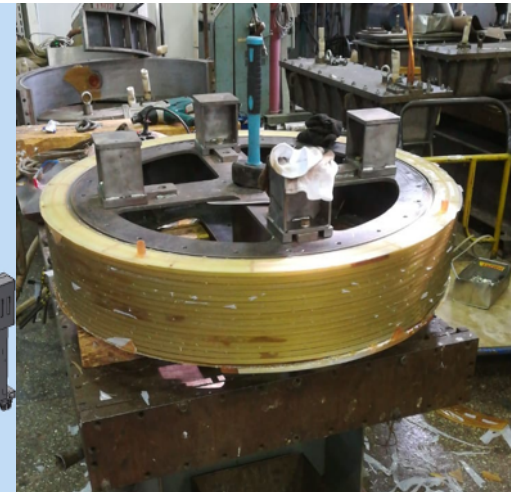
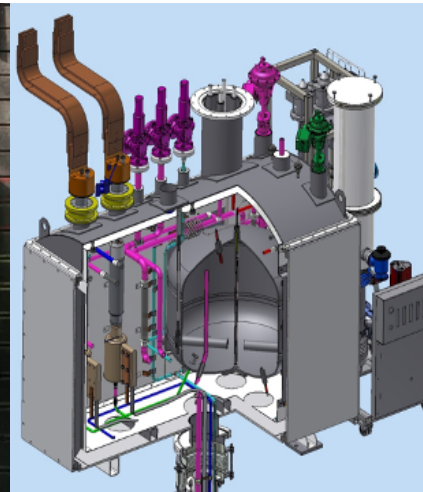
Full Setup



PANDA Selected Highlights - Solenoid



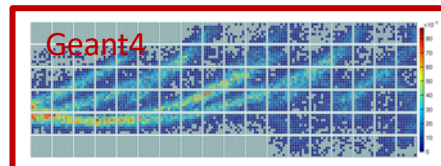
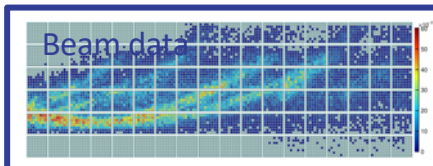
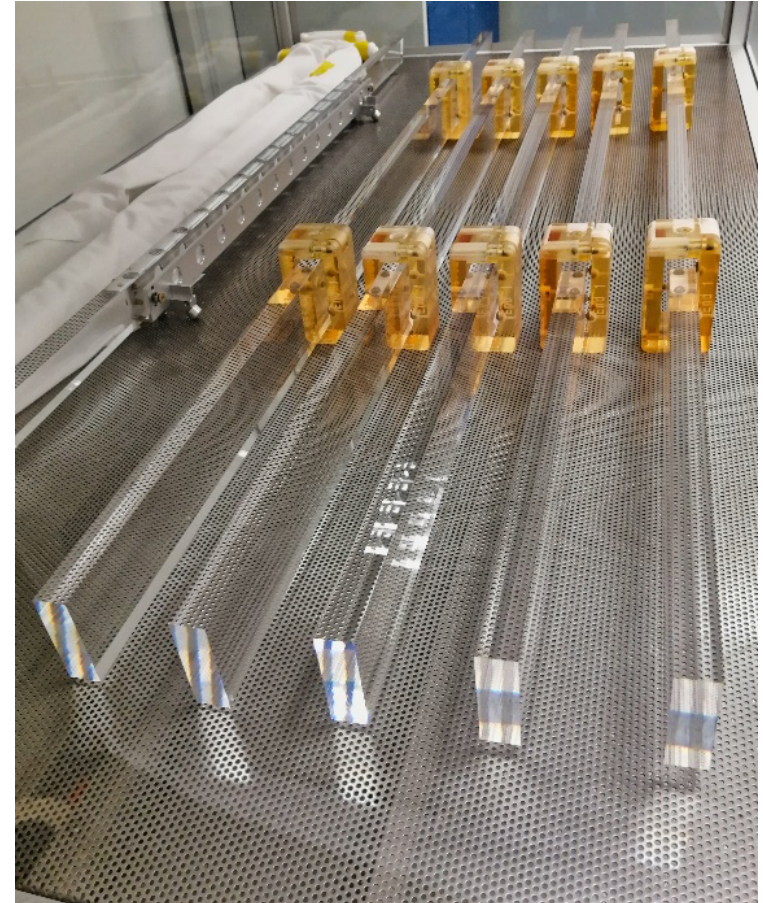
- Project started 2017
- All yoke parts manufactured, and first assembly completed
- Cryostat procurement
- Control Dewar: review by FAIR Cryo and Atlas Magnet Group
- Prototype Coil
- Superconductor: first contracts signed



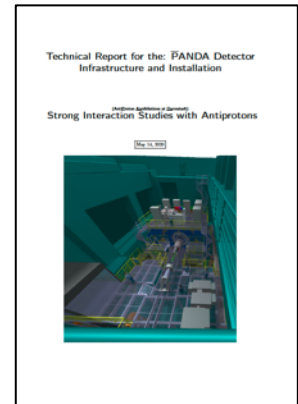
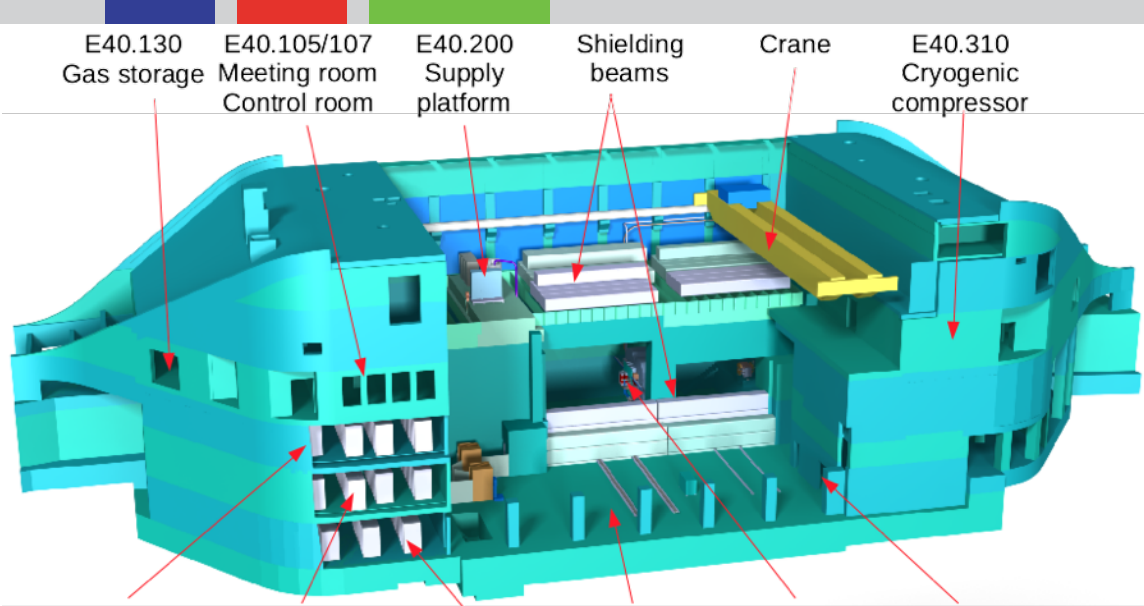
PANDA Selected Highlights - Barrel DIRC



- Key component of the PANDA PID system, innovative design, GSI lead institute
 - all 98 fused silica DIRC radiator bars by Nikon Corp., Japan delivered
- FAIR Phase-0:
 - GSI participation in GlueX DIRC PID upgrade: validation of PANDA Barrel DIRC software
 - Successful commissioning of complete system in Dec. 2019
 - Excellent data quality during Spring 2020 run



PANDA Selected Highlights - Infrastructure

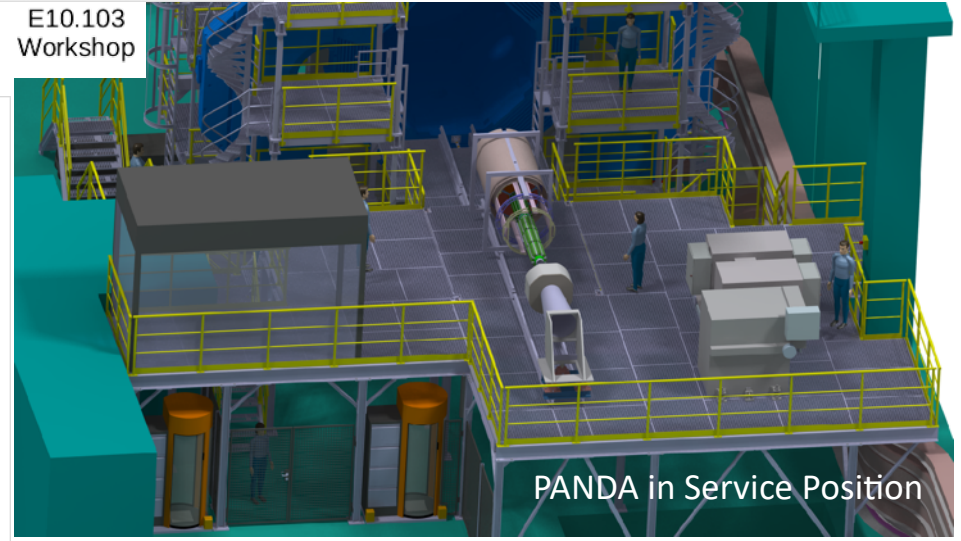
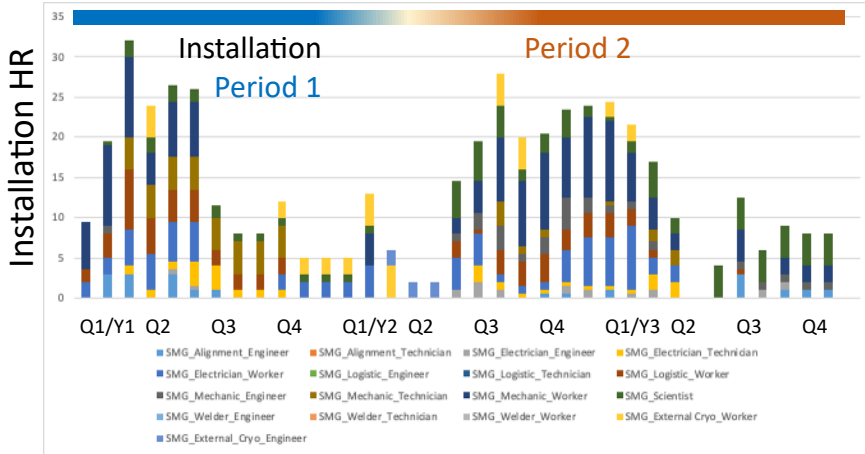
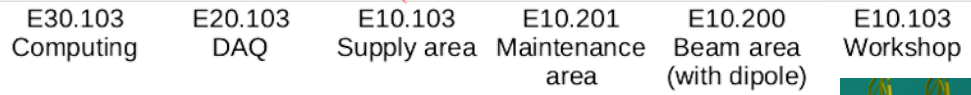


Technical layout and cost assessment

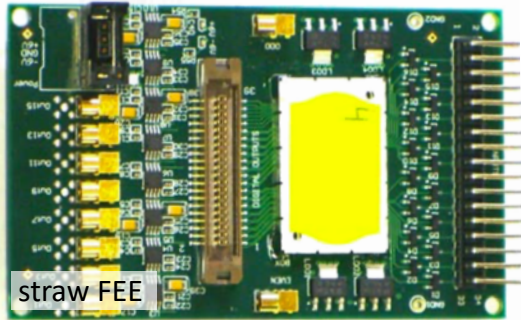
- of infrastructure comprising
- Common supports
 - Supply infrastructure
- in the framework of
- Integration requirements
 - Installation procedures

Status

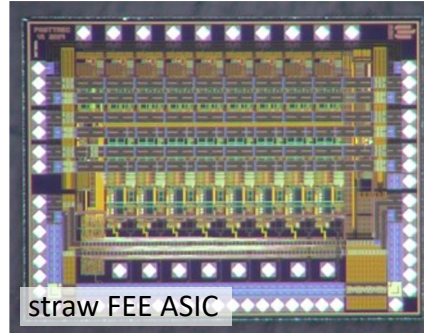
- submitted to ECE/ECSCG
- Basis for CF/MoU



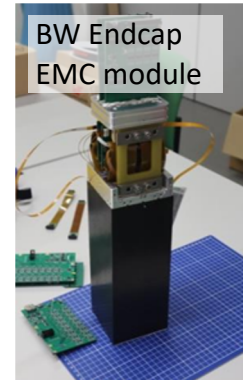
PANDA Technical Progress cont'd



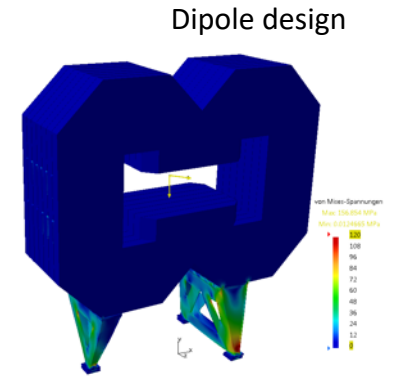
straw FEE



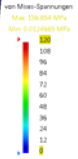
straw FEE ASIC



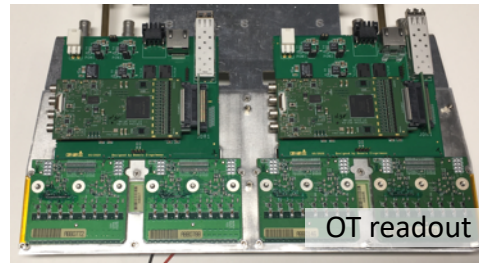
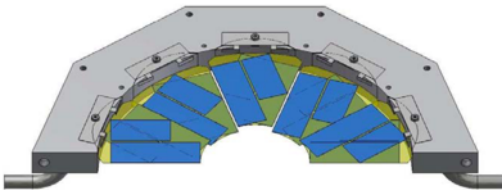
BW Endcap
EMC module



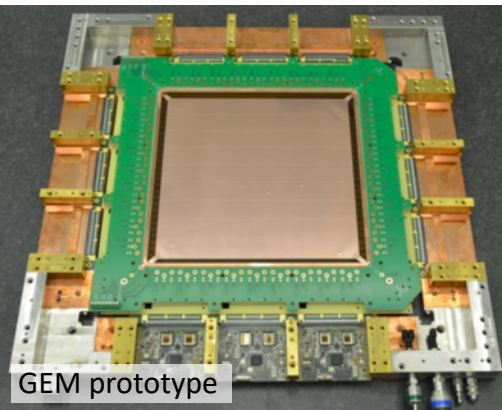
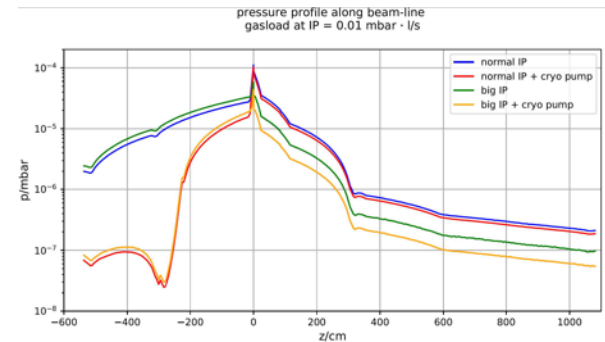
Dipole design



LMD design



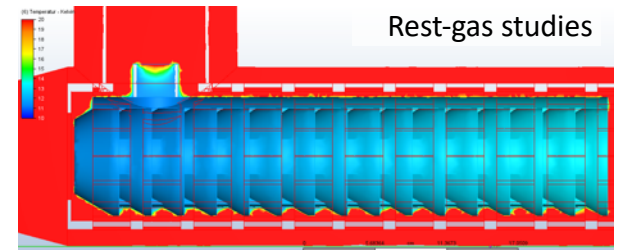
OT readout



GEM prototype

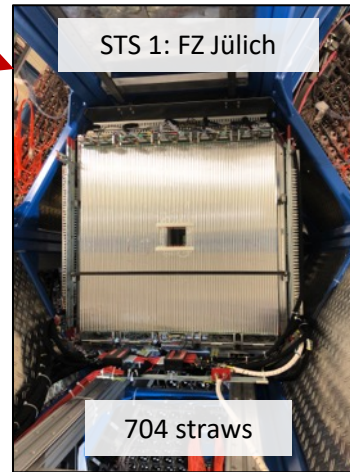
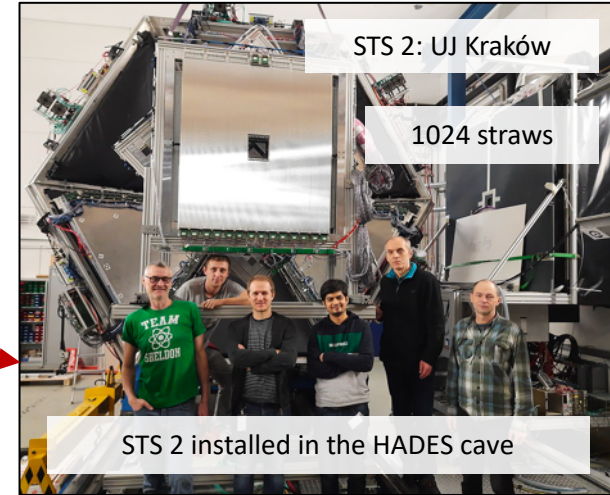
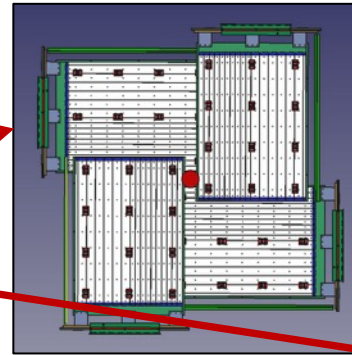
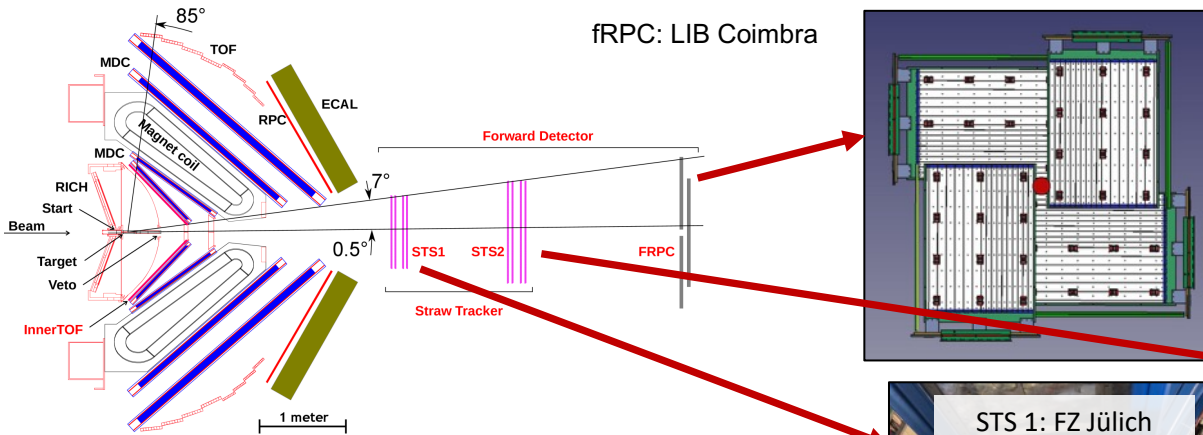


1st of series slice EMC



Rest-gas studies

Phase-0 / PANDA@HADES

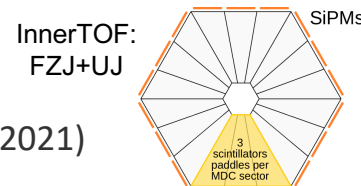


- Instruments the field-free forward hemisphere
- Straw Tube Stations (STS) compatible with Phase-1 PANDA STT and FT
- Boost physics capability for hyperon e/m transition FFs
- STS1 installed in Nov 2020
- STS2 installed in Feb 2020
- fRPC ready for installation in Jan 2021
- Commissioning beam time Feb 2021
- InnerTOF project to improve triggering efficiency (Q2/2021)

The forward detector project is driven by the PANDA-HADES collaboration:

FZ Jülich (STS1),
 IPN Orsay (STS mechanics),
 UJ Kraków (STS2),
 U of Uppsala (tracking software).

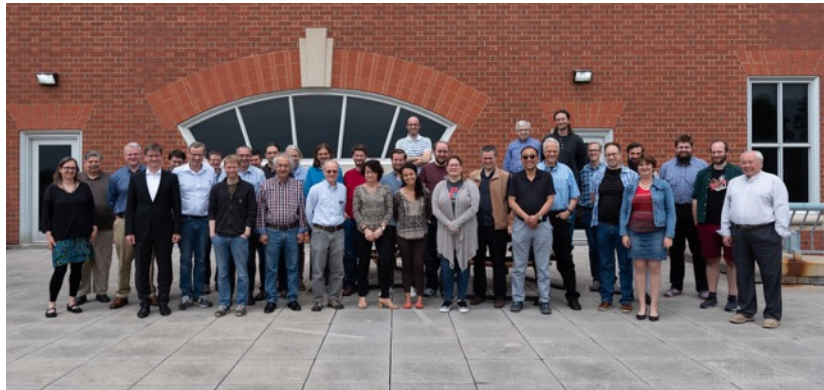
Additional funding for Phase-0



Joint Workshops 2019



Brazil-PANDA, Sao Paolo, Feb 2019
GlueX-PANDA, GWU, May 2019
BES3-PANDA, IHEP/Beijing, Nov 2019



Discussion with additional
- US groups, and
- Chinese groups
are on-going

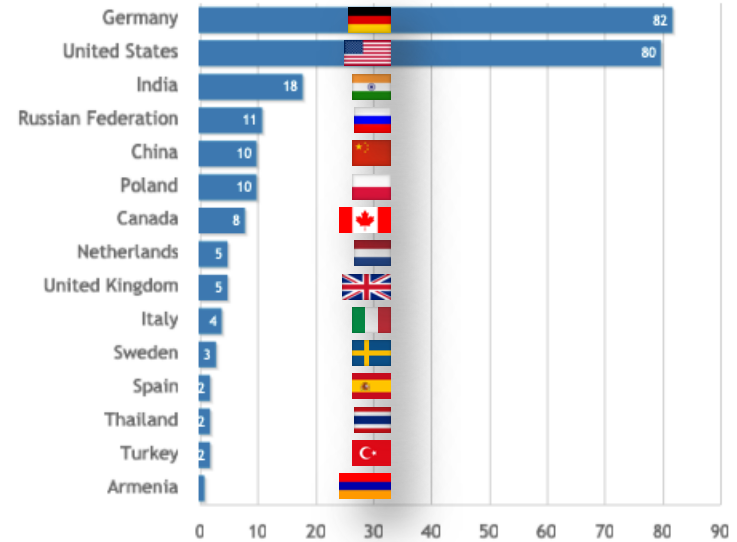


Machine Learning Workshop (virtual)

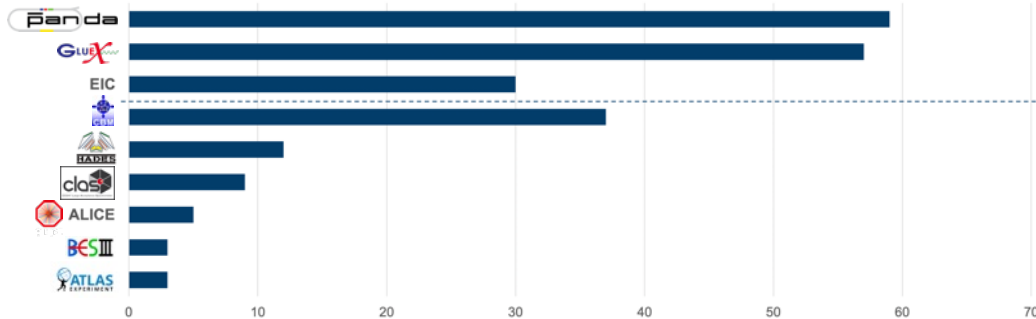


held online Sept 21-25, 2020,
 hosted at GSI, org by PANDA CCs
 In total 254 registrations
 from 26 countries and 48 experiments
 in avg. 150 regularly online

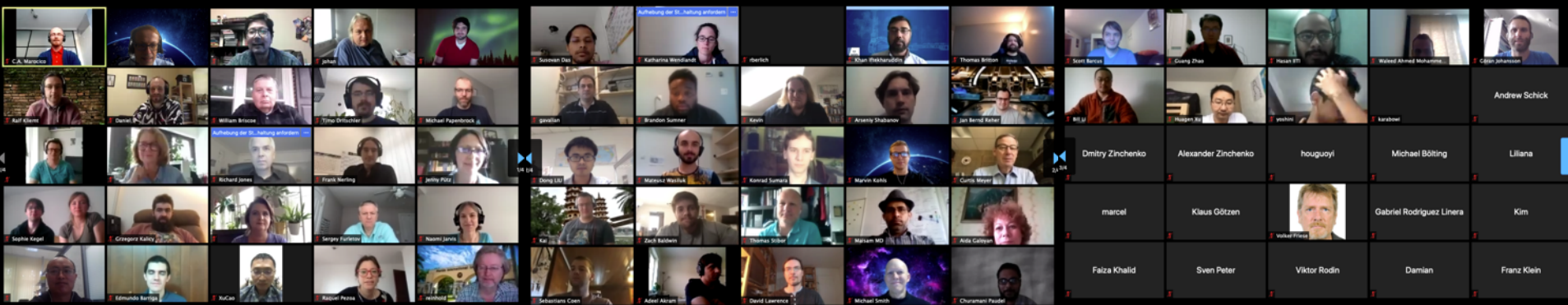
Registrants per country



Participants from Experiment



→ big success





New Member Institutes

SLRI Nakhon Ratchasima/Thailand
U Chiang Mai/Thailand



KIT/Germany



University of South China, Hengyang and soon
Liaoning University Physics School, Shenyang



Giresun University and
Istanbul Okan University



New joint work

- With GlueX and EIC in Machine Learning
- AI/ML in Pattern Recognition/Tracking, Trigger, Selection, Classification ...
- Machine Learning Workshop was kind of kick-off

Experiment

- 2019: **Silke Grieser** – University Münster, Germany,
“Cluster-Jet Targets for the PANDA, MAGIX, and CryoFlash Experiments at Hadron-, Lepton-, and Laser- Facilities”
- 2020: **Walter Ikegami Andersson** - Uppsala University, Sweden
“Exploring the Merits and Challenges of Hyperon Physics with PANDA at FAIR”

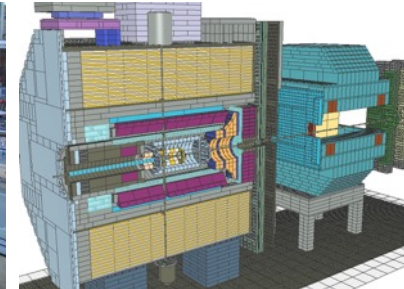
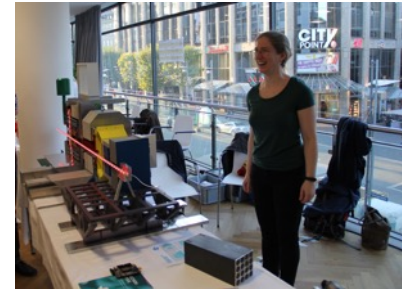


Theory

- 2019/20: **Antoni Woss** – University of Cambridge, UK
“The scattering of spinning hadrons from lattice QCD”

Outreach activities started last year

- Masterclass in preparation
- Models in various sizes (classical and Lego)
- Merchandise articles
- Work on additional completely new concepts will start 2021



Recognition

- Although a lot of recognition measures are in place ...
- PANDA takes active part in WG recognition of NuPECC/APPEC/ECFA

Diversity

- Important issue which needs to be addressed
- Topic for the new leadership next year



Collaboration



UP Marche Ancona
U Basel
IHEP Beijing
U Bochum
Abant Izzet Baysal
U Golkoy, Bolu
U Bonn
U Brescia
IFIN-HH Bucharest
AGH UST Cracow
IFJ PAN Cracow
JU Cracow
Cracow UT
FAIR Darmstadt
GSI Darmstadt
JINR Dubna
U Erlangen
NWU Evanston

U Frankfurt
LNF-INFN Frascati
U & INFN Genova
U Gießen
Giresun U
U Glasgow
KVI-CART Groningen
Gauhati U, Guwahati
USTC Hefei
URZ Heidelberg
USC, Hengyang
Doğuş U, Istanbul
Okan U, Istanbul
FZ Jülich
Karlsruhe Institute of
Technology (KIT)
IMP Lanzhou
INFN Legnaro

Lund U
HI Mainz
U Mainz
RINP Minsk
NRC "Kurchatov Institute"
- ITEP Moscow
MPEI Moscow
U Münster
BINP Novosibirsk
Novosibirsk State U
U Wisconsin, Oshkosh
U & INFN Pavia
PNPI St. Petersburg
West Boh. U, Pilzen
Charles U, Prague
Czech TU, Prague

IHEP Protvino
Irfu Saclay
KTH Stockholm
Stockholm U
SUT, Nakhon Ratchasima
SVNIT Surat-Gujarat
S Gujarat U, Surat-Gujarat
FSU Tallahassee
Nankai U, Tianjin
U & INFN Torino
Politecnico di Torino
U Uppsala
SMI Vienna
NCBJ Warsaw
U York

more than 420 physicists from
from more than 65 institutions in 18 countries



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Thank you