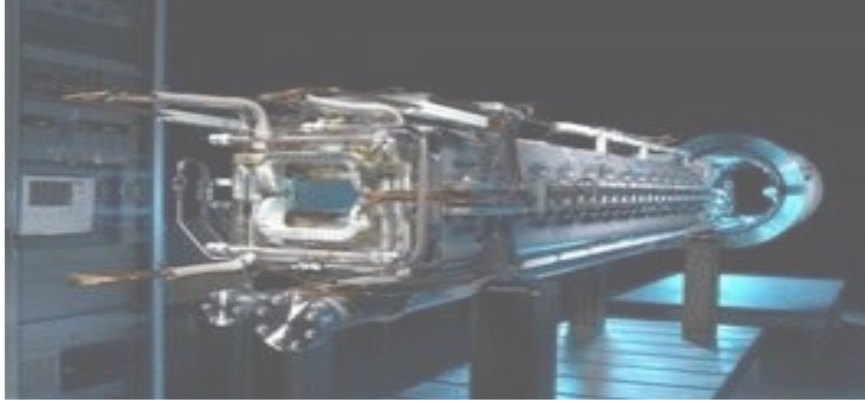




Report on the Joint FAIR ECE 17 and ECSG 08 Meeting

Chairs: Christos Touramanis & Jens Dilling

4,5 May 2023

FAIR RRBs, 5 June 2023

Finland France Germany India Poland Romania Russia Slovenia Sweden UK Czech R

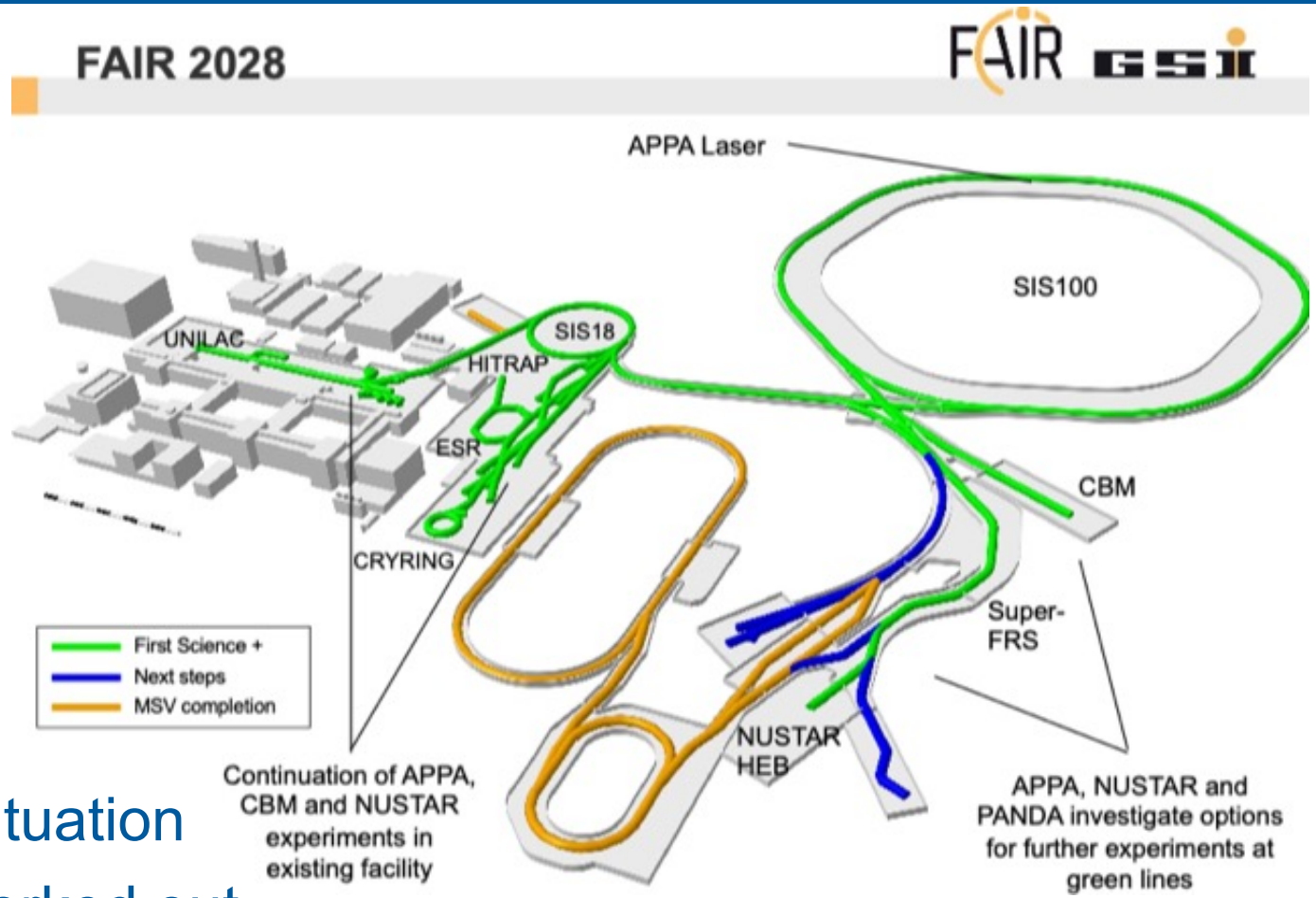
General comments and findings

We heard about:

- Science review.
- Science Council.

We note:

- Clear plan how to move forward.
- Congratulations to FAIR team on securing funding for FS: a big step forward and very important.
- Some issues remain connected to funding and technical expertise due to situation with Russia, but mitigations are being worked out.
- Excellent construction progress.
- Excellent Phase-0 program.



General Comments

Steps (defined by Review/Council)

- **Early Science (ES):** FAIR pre-cursor programme at the Super-Fragment-Separator (S-FRS) und NUSTAR High-Energy Branch (HEB) served by beams from SIS18.
- **First Science (FS):** first science at the Super-Fragment-Separator (S-FRS) und NUSTAR High-Energy Branch (HEB) served by beams from SIS100.
- **First Science + (FS+):** in addition to FS the CBM branch served by beams from SIS100.
- **First Science ++ (FS++):** in addition to FS+:
  - the branch into the APPA cave, and
  - the NUSTAR Low-Energy Branch (LEB)
- **MSV completion (MSVc):** Completion of the Modularised Start Version.

The steps are incremental, i.e. earlier steps are completely subsumed in the later steps.

- **We appreciate the careful evaluation and consensus and endorse the plan to maintain all four science pillars in MSVc.**
- **Phase-0: very important and successful; we encourage to continue this vital program.**
- **Exploring additional opportunities to remove uncertainties as soon as possible are encouraged.**

General comments

Thanks to all the collaborations:

- Nice progress and good science in Phase-0.
- Compliments to the collaborations for reacting so creatively and swiftly to the evolving landscape and managing uncertainty as much as possible.
- This is also an opportunity to ‘think outside the box’ to maximize science and keep the science communities engaged.

NUSTAR breakout session

13:00 **NUSTAR Overview**

(25 min. + 10 min. discussion)

Speaker: Andreas Heinz (CUT) (Chalmers University of Technology(CUT))

ECE17-ECSG08_Hei...

13:35 **NUSTAR Project Status**

(25 min. + 10 min. discussion)

Speaker: Helena May Albers (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

NUSTAR_ECE_4-5M...

14:10 **NUSTAR Finances**

(25 min. + 10 min. discussion)

Speaker: Alexander Herlert (FAIR)

ECE17_ECSG8_NUS...

Panel:

J. Dilling, K. Hahn,

A. Gade, T. Motobayashi,

P. Bednarczyk, A. Roy

NUSTAR

- The committee was very impressed with the excellent progress that the NUSTAR collaboration has made in their technical developments and science programs. In particular, the Phase 0 experiments have been very successful and contributed to a better technical system as well as a vibrant community, including education and training of next generation researchers.

- The committee has no concerns for technical readiness. The committee finds the collaboration and systems to be ready for Early Science with NUSTAR HEB (2027).

- The committee compliments the collaboration for the excellent planning and initial consideration of resources towards the Early Science (ES) and First Science (FS) phases but urges the collaboration to consider a thoughtful process to finalizing the concrete experiment plans for Early Science. This process should include considerations to maximize both science impact as well as the number of scientists and science areas within the collaboration, and to be cognizant of resource limitations. This planning should take into account human factors and expectations given the topical diversity of NUSTAR.

NUSTAR

- The process towards signing the MoU for Common Funds of the Construction Phase is nearing completion. The committee complements the collaboration for the steps taken so far.
- There is room to optimize this by by considering:
  - should construction and operation be treated as two separate MoUs or should this be combined (perhaps consider best practices from other collaborations across funding agencies),
  - can the MoU scope be expanded to include other aspects of the collaboration's science portfolio outside ES and FS.
- For this, a more detailed cost analysis is suggested, including considerations for labor cost. This is particularly interesting for expansions towards FLF2, and unique and important aspects of the science portfolio with storage rings, and utilization of the ESR for ILIMA-type research in the intermediate phase.

NUSTAR

- The committee recognizes the need and great potential for experiments at the ESR in light of the delay of ILIMA and appreciates the importance of this program for the affected part of the NUSTAR community. NUSTAR is encouraged to explore enabling such a program within their resources in light of FAIR resource constraints we heard about.

- The committee appreciated the thoughtful opportunities presented for going beyond the one-branch solution. However, with the financial information at hand we suggest for NUSTAR to explore opportunities for further funding to better/fully exploit the SFRS already in ES/FS up to FLF3, for ex. via common-fund extension.

APPA breakout session

Break out session APPA Hörsaal, SB1 1.201

13:00 **Welcome & Introduction**

13:10 **SPARC Report**

(15 min. + 10 min. discussion)

Speaker: Angela Bräuning-Demian (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

SPARC_ECE_20230...

13:35 **HED Report**

(15 min. + 10 min. discussion)

Speaker: Stephan Neff (Facility for Antiproton and Ion Research in Europe GmbH(FAIR))

StatusReport-HEDat...

14:00 **Biophysics for BIOMAT**

(30 min. + 10 min. discussion)

Speaker: Marco Durante (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

BIO-ECE-May 2023....

14:40 **Materials for BIOMAT**

(30 min. + 10 min. discussion)

Speaker: Maria Eugenia Toimil Molares (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

MAT-ECE-presentati...

Panel:

Marc Weber, Ladislav Půst,
Henning Schmidt, Paul Scheier

APPA

- APPA is coping very well with challenging boundary conditions.
- Teams came with a clear vision and strong spirit to adapt and mitigate.
- They found interesting (alternative) scenarios to maximize science.

- APPA has a lot of science to offer early on, and strong user communities.
- The available beam time is considerably oversubscribed.
- Early science and large user community will be very beneficial for FAIR.
- Successful third-party funding through ESA, ERC, BMBF, YIG, and industry.
- Some scenarios need (much) more detailed planning (costs, access to beamlines, extraction of beam, mutual use of single beamlines).

APPA

- Funding from the upcoming “Verbundforschung” grants round will be critical (for laser but also ES/FS and next generation of scientists).

- CRYRING is in good shape and a most valuable asset, however, it needs to be ensured that systems are ready for beamtime in early 2024.

- Vibrant community, significant interest, and exciting science associated with HITRAP.

- Congratulations to new Helmholtz Young Investigator Group of P. Micke.

APPA: HED

- HED is strongly affected by latest re-prioritisation.
- The lack of SC final focusing magnets is a significant concern.
- The complete experimental system might be only available beyond 2030.

- The prospects of collaboration with Spanish theory groups is exciting.
- EU THRILL funding is very welcomed.

APPA: BIO

- Strong collaboration partners and high international visibility.
- Strong interest in beamtime and large user over-subscription (above factor 3).
- Very successful in third-party funding.
- Galactic cosmic radiation simulation is a very unique tool and is much sought after, specifically going beyond 1 GeV.

- Very strong science case for BIO at S-FRS.
- Clear vision for early science at S-FRS, mitigating the late realisation of the APPA cave.

- We note synergies and a good collaboration between BIO and MAT. More information and planning is needed to better understand the logistics of sharing a single beamline.

APPA: MAT

- MAT has a very strong user community, and FAIR will offer unique opportunities and a rich spectrum of beams.
- Successful third-party funding.
- MAT is currently limited by the intensities and beam energies.
- MAT takes full and unique advantage of access to both SIS-18 and SIS-100 beams.

- We note synergies and a good collaboration between BIO and MAT. More information and planning is needed to better understand the logistics of sharing a single beamline.

APPA recommendations

To HED

- The enhanced collaboration with a fusion-energy startup on high-power laser systems should be pursued vigorously.
- We encourage HED to present a (technical) mitigation plan.

To Bio and MAT

- We encourage working out the ring branch concept in detail w.r.t. costs, installation, beam extraction, shielding and access to the ring and request a TDR as a priority.
- The alternative scenario of using the CBM cave should be explored rigorously and considered in the TDR.

PANDA breakout session

May 4, 2023 - meeting agenda

13:00 → 17:00 Break out session PANDA, KBW 2.27 — 2.27 (KBW)

13:00 **PANDA News & Update** — 40m

(30 min. + 10 min. discussion)

Speaker: Ulrich Wiedner (Ruhr-Universität Bochum(RUB))

PANDA_ECE.pdf

13:40 **RedPANDA** — 40m

(30 min. + 10 min. discussion)

Speaker: Klaus Peters (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

RedPANDA_Concep...

14:20 **PANDA Technical Status** — 40m

(30 min. + 10 min. discussion)

Speaker: Lars Schmitt (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

lschmitt_panda_tec...

Restricted | Europe/Berlin | English

15:00 **Break** — 30m

15:30 **Closed session** — 45m

Panel

Frank Hartmann
Eugenio Nappi (co-chair)
Catarina Quintans
Ewa Rondio
Christos Touramanis (co-chair)
Craig Woody

PANDA findings: strengths

- The 2022 FAIR Science Review reaffirmed the uniqueness, internationally, of the PANDA program in terms of its “discovery potential… and …ability to test strong interaction theory”.
- FAIR Council (03/23) stated “the realization of the MSV… …remains the aim of the FAIR project”.
- The HESR magnets are already in storage.
- MAC 25 recommended the construction of the CR with the CERN AA magnets stored at KEK, followed by COSY as RESR. This could yield a higher luminosity compared to the baseline design.
- Construction and testing of a number of PANDA detector systems is advancing well, and two systems are being constructed in Poland and will be delivered as in-kind contribution.

PANDA findings: challenges

- The recently imposed spending freeze is a uniquely challenging crisis situation for the collaboration.

- A number of systems remain orphaned following the termination of Russian participation. The most critical ones are the superconducting magnet and the crystals for the Barrel EMC.

- Civil construction for the CR and HESR buildings and the required beamlines will require further decisions at the highest levels.

PANDA findings: collaboration actions

- The PANDA collaboration presented the committees with concepts that could maintain the integrity of (most of) the collaboration and provide a path to completion.

- They propose to use the already completed Forward and Backward ECALs to augment the physics at existing facilities (ELSA, JLAB …).

- They propose RedPANDA, a subset of the full PANDA detectors in the ZEUS magnet in front of CBM.

PANDA comments

- The committees concur with the outcome from the 2022 FAIR Science Review that the science case for the antiproton program with PANDA at FAIR remains compelling and stresses the importance of keeping the collaboration together in view of realizing the project as part of MSV completion.

- The funding freeze stops the ongoing construction of a number of systems, which could lead to significant loss of previous intellectual and financial investment.

- Not supporting the PANDA collaboration could have significant negative repercussions for the internationally leading German hadron physics community.

PANDA comments

- The presented concepts for mitigating the situation are very preliminary and at this point insufficient for review.
- The PANDA collaboration will meet in June to discuss the ideas for the future and take decisions.
- Taking the ECALs to existing facilities will enable physics studies and strengthen/maintain the future PANDA program.
- There is an opportunity for PANDA to explore and existing ZEUS magnet to be used in a PANDA configuration.

PANDA recommendations

- We encourage the collaboration to discuss and develop a concrete plan towards the PANDA future including potential new partners.
- The committees invite the collaboration to continue development of the presented ideas and present material covering the following points:
  - The achievable physics and its international competitiveness at the expected timescale, based on realistic simulations.
  - An implementation plan outlining existing and missing components (infrastructure, detectors, designs etc.), with cost estimates and identifying institutes responsible for delivery.
  - Discuss, clarify, and agree with CBM on all technical, scientific and organizational aspects of the proposed RedPANDA plan. This could benefit from FAIR management facilitating.
  - Present a time-line towards an LOI (or similar) document for the new program

PANDA recommendations

- ECE and ECSG recommend to FAIR management to investigate the machine options suggested by MAC 25 (AA, COSY), in particular to see if the COSY ring can be saved and stored, or not.
- The committees suggest to the management to investigate ways to allow completion of subsystems already partially ordered or delivered, which may become impossible to continue construction in the future (e.g. chips availability).

CBM breakout session

Break out session CBM, BK1, 4.019 & 4.020

13:00 **Update on FAIR/CBM status**

(25 min. + 10 min. discussion)

Speaker: Norbert Herrmann (Ruprecht-Karls-Universität Heidelberg)

ECE-ECSG_May202...

13:35 **CBM Technical status**

(25 min. + 10 min. discussion)

Speaker: Piotr Gasik (GSI/FAIR)

gasik_ECE05-2023_...

14:10 **Forward Spectator Detector - status and plans**

(15 min. + 10 min. discussion)

Speaker: Petr Chaloupka (Czech Technical University of Prague (CTU)(CTU))

FSD.pdf

CBM Panel:

Archana Sharma, Crispin Williams, Gines Martinez, Luciano Musa, Taku Gunji

CBM

- The CBM program is in a unique position to unravel the structure of the QCD phase diagram. Given its scientific significance and weight in contributing to FAIR's overall scientific impact, the additional resources required to start seem comparatively small.

- The current uncertainty regarding the timeline for "First Science+" are disappointing for the CBM Collaboration. Furthermore, given this situation, the access of university groups to the necessary funding to continue their R&D and construction activities, are in jeopardy.

- We encourage the management of FAIR and the Collaboration to explore independently and coordinated all possibilities to ensuring the required CBM's support, incl. additional resources beyond the FAIR funding, to complete infrastructure needed for the science programme scheduled to begin in 2029.

- We encourage the CBM Collaboration to continue their discussions with the PANDA Collaboration on opportunities to incorporate in the CBM program a portion of the scientific program on hadronic physics from PANDA. This could benefit from FAIR management facilitating.

CBM

- The Committee praises the CBM Collaboration for its swift response to an unprecedented and challenging situation. They are successful in identifying mitigation measures and viable alternatives to reassign most of the tasks previously under the responsibility of Russian Institutes. Additional efforts are necessary for the RICH and MUCH detectors.

- After the cancellation of the PSD detector project under the responsibility of the Russian Federation, the panel was delighted to receive a proposal for a new Forward Spectator Detector (FSD) capable of determination of event centrality and reaction plane. The initial design concept for the detector layout, main components, and technologies, along with a tentative timeline and resource plan, was presented. The goal of completing the detector construction is by 2027. The majority of resources for the detector's research and development and construction are expected to be provided by the Czech Republic. For completion, additional funds from other partners will be required.

- A re-baselining of the project is ongoing and is expected to be concluded by mid of May 2023. The current assumption is that SIS100 and CBM will be ready for commissioning with beams in Q1 2028 and be ready for the start of First Science+ in Q1 2029.

CBM

- The Committee congratulates CBM on the overall progress made on detector development in the past 6 months.
- Good progress on the data analysis of the 2022 mCBM test campaign (Phase 0), with the delivery of first physics results expected soon. Good progress on the FLES/DAQ system and on all detector systems (BMON, MVD, STS, TRD, RICH, MUCH and TOF).
- Following a market survey, a tendering for the procurement of the SC dipole magnet is ongoing with closing date in June. If the funding for the procurement is approved timely, the production could start in September 2023 and be ready for operation by December 26, after the site acceptance test.
- The committee emphasize the opportunity to proceed with the highest priority with the procurement of the SC magnet. It was reported, that delays with respect to the start of production in September 2023 will shift linearly the readiness of the experiment.
- **The Panel recommends the approval and publication**
  - the Online Systems Part 1TDR
  - TRD TDR

Back-up material : CBM TDR approvals

TRD TDR Addendum

- A **TRD TDR Addendum** was submitted to the panel in June 2021. It presents an alternative design for the detector inner region. The new system, TRD Two Dimensional (TRD-2D), has an optimized and elegant segmentation and geometry of the readout plane for the areas exposed to very high counting rates, which enable an improvement of the TRD performance at low p_T. The proposed alternative design leads to cost increase of the order of few hundred kEUR, which is covered by the funding and resources pledged by Romania.
- The TDR was reviewed by the referee panel in summer 2021. The panel **requested the TRD project to substantiate the physics performance enhancement by including in the TDR a few benchmark studies**. The CBM collaboration carried out further physics performance studies, which addressed satisfactorily all questions and comments raised by the panel. The new physics studies were properly documented in a new version of the TDR submitted to the panel on 17 Feb 2023.
- **The Panel recommends the approval of the TRD TDR Addendum and its publication.**

Online Systems Part 1 TDR

- A TDR on the Online Systems (Part 1) was submitted to the panel in November 2022. This TDR presents the general architecture of the hardware system. It includes the First-level Event Selector entry stage (FLES), the Common Readout Interface card (CRI), and the Timing and Fast Control System (TFC). The software systems used for online data analysis and the operation of the experiment will be presented in the Online Systems Part 2 TDR which is planned for 2025.
- The panel congratulates the CBM collaboration for all the work related to the studies, R&D, prototyping, and measurements carried out for the preparation of this TDR. The Panel is impressed by the quality of the document, in terms of content, structure and clarity . The hardware architecture, the specifications of the key systems and their components are convincedly meeting system requirements, including an adequate safety margin. The detailed analysis and discussion of the system critical aspects show also the advanced maturity of the proposed free-streaming readout and the underlying R&D activities.
- **The Panel recommends the approval of the Online Systems Part 1TDR and its publication.**