Minutes of the 13th Meeting of the
COSY Beamtime Advisory Committee (CBAC)

August 26 and 27, 2021
Location: Forschungszentrum Jülich, Institut für Kernphysik, 52425 Jülich, Germany

Participants:

CBAC members:

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Oliver Kester	TRIUMF, CA (digital)
Thomas Stöhlker	GSI, HI Jena, DE
Christian Schmidt	GSI, DE (digital)
Marc Weber	KIT, DE

CBAC Scientific Secretary:

Frank Goldenbaum	(IKP-1)

IKP:

Ulf-G. Meißner	(IKP-3/IAS-4 Director) (excused)
Dieter Prasuhn	(IKP-4)
Ralf Gebel	(IKP-4 Acting and Managing Director)
James Ritman	(IKP-1 Director, Scientific Coordinator COSY)
Hans Ströher	(IKP-2 Director, IKP)

Chairman of the Board of Directors FZJ: Wolfgang Marquardt (digital)
Scientific Managing Director GSI: Paolo Giubellino (digital)

1. General remarks

The 13th CBAC session took place on August 26 and 27, 2021 at Forschungszentrum Jülich.

Due to the ongoing Corona pandemic the meeting is again a hybrid of digital presentations of the proponents while the majority of the CBAC members are physically at FZJ.

The beamtime requests of the individual groups were presented on Thursday in the Open Session of CBAC#13. For the programme and the list of applications see the Addendum.

Closed sessions of the CBAC members were held on Thursday morning 9:00-9:41, on Thursday evening 18:50 - 19:35 and on Friday morning until 11:40.

The **closed session** on Thursday morning is opened by Jim welcoming the participants and CBAC members. Jim stresses that COSY is now entering a new phase of operation and is near the end of its lifetime (end of 2024). Beamtime becomes particularly valuable and limited.

Marc and Jim cite from the letter of Wolfgang Marquardt and Paolo Giubellino from April 30, 2021. Wolfgang and Paolo informed CBAC about the need to reduce beamtime to save costs. This leads to an estimated reduction of beamtime of at least 1200 hours in 2021. For the years 2022 through 2024 a reduction by 2400 hours/a is anticipated. The highest priority should be given to FAIR-related beamtime requests. The second priorities are requests that relate to the other scientific commitments made for PoF IV.

Paolo comments in more detail on this situation. The assessment of the scientific quality of the proposals

and the actual need of beamtime – considering the uniqueness at COSY for any request – becomes extremely important. High quality standards must be applied to all proposals including FAIR-related ones. JEDI and EDM physics are an integral part of the PoF IV science program. While HBS and neutron science are part of the PoF IV program, they are not related to MU or the IKP core business. Rather they are a service for other programs of FZJ. The financing of these experiments needs to be discussed. In contrast to previous COSY practice, it will be difficult to accommodate requests that are neither related to FAIR or PoF in the future.

Marc suggests introducing a new prioritization category "Strategic priority" for this and future CBAC meetings.

Hans comments that CBAC should try and give all proponents, even those which do not request imminent beamtime the opportunity to present.

The assignment of CBAC members to the proposals is confirmed.

Jim Ritman starts the **open session** and mentions that COSY is entering a new phase. Due to the limited lifetime of COSY and a reduction of beamtime hours by roughly 50%, excellent science cannot be the only prioritisation criterium anymore. Approximately 36 weeks of COSY beam time remain. The number of projected requests until the end of 2024, however, is 176 weeks, which represents a much larger discrepancy than usual. Thus, strategic goals of the PoF IV will have to be considered much more strongly by CBAC than previously (see section 2).

Paolo Giubellino welcomes the participants and commends the large number of high-quality proposals. Paolo explains the rationale for the reductions, praises the resilience of the scientists and COSY users, and wishes the participants and CBAC members a fruitful meeting.

Vsevolod (Seva) Kamerdzhiev introduces the COSY accelerator facility, sources, beamlines, etc. and covers their properties and parameters. He addresses the training and education activities and the many BA, MA and PhD theses carried through at and with COSY. He also mentions the recent development and continuous improvements to the machine e.g. the EPICS alarm system, the MAD-X beam model and the automatic measurements and improvement of beam parameters.

The Big Karl Area is being upgraded for the JULIC neutron platform and HBS precursor studies (but also receives high energy beam from COSY). There are various hardware upgrades, for instance, the power converters.

The beamtime schedule 2020-21 and the experiments carried through are discussed in detail. A large number of requests took place successfully (see slide 18 of Seva's presentation). JEDI had an excellent polarized deuteron beamtime of a remarkable 53 days. Only the electron beam cooling request had to be postponed for lack of time; stochastic cooling was used in various experiments.

The staff situation is tense since the machine crew is too small and is shrinking. Replacements are needed. The budget situation is challenging. Corona poses additional challenges. Still, the COSY team remains highly motivated.

CBAC commends the team for the excellent performance but wonders if they will be able to maintain the current level of service in the future years. VS thinks this is possible provided some personnel are replaced and post-docs are hired. Temporary support from GSI staff could be helpful.

At 11:30 Wolfgang Marquardt welcomes CBAC. TransFAIR and the transition of staff from FZJ to GSI is ongoing and remains involved. Unfortunately, the available beamtime must be reduced from 5000 hours/a to approximately 2600 hours/a from 2022 through 2024 since there is an IKP budget deficit. For 2021 there are approximately 1200 hours left for 2021.Wolfgang echoes the comments Paolo made earlier with respect to the importance of priorizations. Given the importance and maturity of requests, now the strategic priorities must be considered. Requests of relevance for FAIR are the highest priority.

Both, EDM physics as well as Neutron Science are important parts of the PoF program. Proposals related to these topics should also be accomodated if possible. Higher priority should be given to EDM-related proposals. It is expected that additional funding for HBS-related experiments is provided by JCNS and/or their industrial partners to cover the related operational cost. Much of the neutron program could be carried through in parallel with COSY experiments provided funding is available. Only if further beamtime slots would remain, other (non-FAIR or non-PoF IV) experiments could be considered.

Sixteen proposals were submitted to CBAC#13, not counting those with requests beyond Q1/2022. The total beamtime requests exceed 21 weeks, excluding machine development (MD). Given the reduction in available user hours, this represents a much larger oversubscription than in previous years. An overview of all the applications and the agenda of the CBAC#13 meeting are given in the Addendum. The electronic versions of all proposals and reports as well as the pdf files of all contributions presented in the open session are located on the web page:
http://www.ikp.fz-juelich.de/CBAC/documents/cbac13.html

2. Summary of the discussion and recommendations

Below we first comment on the ranking procedure, then summarize the recommendations of CBAC, and finally conclude with a detailed report on each proposal.

2a) Procedure

The rating system applied in the past to rank the proposals is felt to be effective and adequate. However, for this meeting - driven by the prioritization of FZJ and GSI management - CBAC introduces a fourth category.

Thus, the requests are rated A (highest rank), B, and C (lowest rank) within the following four categories:

(i) **Feasibility** Here the committee judges the feasibility of the proposed test or measurement based on its expert knowledge and external input or advice. Other assessments from, e.g., a PoF review or accepted proposals may enter. Also, boundary conditions imposed by the facility must be considered.

(ii) **Readiness** The committee assesses the possibility that critical elements or components required for the test are not available in time. It should be noted that CBAC as an external group cannot make a complete assessment of all possible delays. The proponents are asked to comment in detail on the readiness of their proposals.

(iii) **Urgency** may consider the overall schedule projects are embedded on, the timing of available resources and other boundary conditions.

(iv) **Strategic priority** This considers if the beamtime request relates directly to FAIR (A), to other PoF IV goals (B) and otherwise (C).

The recommendations consider the written requests, the oral presentations, and the related questions and answers during the open CBAC session. Following the open session, a detailed comparative discussion takes place in the closed session.

2b) Summary of the Recommendations

The projects presented in the open session on Thursday (see Sec.1 and the addendum) and the recommendations of CBAC are listed in Table 1. Due to the dense agenda, written status reports and requests beyond Q1/2022 could not be included in the agenda but are appreciated by the committee. An

important boundary condition is given by the reduced number of beamtime hours per year and, as always, the six weeks of maintenance required by COSY mid-year. For the next assignment period, ranging from October 2021 through March 2022 approximately 12 weeks of beamtime will be available for users.

CBAC is again acting as an advisory body for requests of support to international users through the EU STRONG-2020 hadron community initiative.

Table 1: *Summary of requests (for details see table in the addendum), ratings and recommendations of CBAC#13.*

Experiment	Recommendation in user beamtime/ likely schedule	Feasibility	Readiness	Urgency	Strategic priority
D004.10 CBM HADES	1 week	A	A	A	A
D009.6 PANDA cluster jet target	1 week in Q1 2022	A	A	B	A
D011.4 PANDA lumin. Detector	1 week try and combine with other requests	A	A	A	A
D014.1 Hades inner TOF	(1 day during MD)	A	A	A	A
D015 Char.part.track-det. R3B/SFRS	1 week	A	A	A	A
D016 Invest. new methods proton-therapy	(2 days parasitically. Report results at CBAC#14)	-	-	A	B
D018 ESS SC Linac	0 weeks	B	B	B	C
D019 HI-MAPS (GSI)	1 week, either deuterons or protons	A	A	A	A
E009.1 JEDI-coherence time	3 weeks	A	A	A	B
E010.1 JEDI-spin tune response	0 week, deferred to CBAC#14	A	A	B	B
A002.8 COSY electron beam cooling	1 week	A	A	A	A
A010.7 Moderator efficiency (HBS)	0 week	A	B	B	B
A013.2 Neutron Platform (HBS)	0 pending finances and long-term strategy	-	-	-	-
A014.4 COSY injection studies	1 week	A	A	A	A
A017.2 Loewe-NP	1 week	A	A	B	B
A018.1 CR Palmer-Pickup	1 week	A	A	A	A

2c) Short reports and recommendations on individual proposals

Proposal D004.10 **CBM-HADES**

The CBM-HADES team had a good beamtime at COSY in May 2021 testing the mini drift chamber MCD and an ultrafast silicon (low-gain avalanche diode) detector combined with a PANDA luminosity monitor prototype system. While the drift chamber is available and well-tested, the MDC system is now being upgraded with new front-end electronics which are needed for high-intensity running at FAIR phases 0 and 1. Similarly, the ultrafast silicon detector showed reasonable results in the aforementioned beamtime, although the full quantum efficiency was not yet reached and the fill factor was not yet optimum. Now new LGAD sensors with the ideal size (20x20 mm^2), thickness and pitch are available from FBK and should be used as the T0 detector for PANDA@HADES run within FAIR phase 0 in spring 2022.

CBAC confirms the relevance, importance, urgency and readiness of the MDC FEE upgrade project and the HADES T0 detector. While the LGAD sensors are mandatory for FAIR phase 0, they are also a most promising novel detector type and represent a highly innovative R&D line. Given the severe beamtime constraints at COSY, the requested MDC and LGAD tests – although requiring somewhat different beam intensities – must be combined as proposed by the team.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week of combined tests of HADES MDC with LGAD

Proposal D009.6 **PANDA Cluster jet target**

The cluster target is a core element of PANDA in its final configuration at FAIR. The device comprises complicated hardware that has been thoroughly and extensively tested in the home lab of the applicant and lately as a fixed installation at COSY. The prudent experimental team has prepared the cluster target in a way that left no doubt about its readiness. In the granted beam times 2018, the complex facility could be shown to operate absolutely to specifications, indeed. The cluster jet target could be fully commissioned, it could be shown to surpass standard technology by at least an order of magnitude and meet the target density of 2 x 10^{15} protons/cm^2 needed for PANDA operation at HESR. This is the final proof of feasibility of the cluster jet, raising the beam operation density by a factor of three.

It is particularly promising that successive beamtimes on beam cooling, using barrier bucket, stochastic cooling as well as electron beam cooling techniques, could successfully be realized with the cluster jet target in operation. The team proved the feasibility of extremely stable beam operation even with such a high-density target.

The requested beam time now aims at fully mapping out beam properties and beam lifetime as function of cluster jet target operational conditions and the interplay with beam cooling mechanisms. To this end the cluster jet beam dump has been modified to integrate diagnostic features. This new beam dump will be taken into operation.

The beam time addresses all the system operational aspects that will be essential for commissioning of the PANDA experiment. It is the first week of a total of four needed for full target characterization, commissioning and preparation in accelerator system operation until 2024 for operation at PANDA.

In this respect we clearly rate the importance as A. However, some of the system characterization might be postponed to the time of PANDA commissioning. The novel beam vertex imaging options, however, appear so valuable that they should be evaluated and brought to maturity soon at COSY. Further, the cluster jet target is available and operational already. The modifications of the beam dump, namely integrating diagnostic features, appear to be ready. Readiness is thus rated A. The team knows very well where to go and what to strive for. Though technically certainly challenging, the proposal´s feasibility is clearly rated A.

Rating: Feasibility A, Readiness A, Urgency B, Strategic priority A
Recommendation: 1 week in Q1 2022

Proposal D011.4 **PANDA luminosity detector**

For refinement of the PANDA luminosity determination, silicon sensors rather than scintillators shall measure elastic low-angle scattering with very high resolution and suppress background reactions. For optimum resolution, a thinned HV-MAPS forward detector shall thus be allocated within the vacuum tube, 11 m downstream of PANDA. HV-MAPS technology is well-established and mature. It has been developed by Ivan Peric of KIT for the Mu3e experiment at PSI as well as for the future ATLAS inner tracker. While the specifications for the PANDA luminosity detector are largely the same, the device has not yet been used in any experiment. Since fall of 2020 a dedicated version of the sensor, namely PandaPix, with higher dynamic range is also available and a veritable option for the PANDA micro vertex detector.

The beam time in spring 2021 could, due Corona Pandemic induced delays, unfortunately not be exploited for a full proof of operation of the DAQ system. Instead, it was used to verify radiation tolerance of various parts.

The beam time currently applied for will then be used to fully verify the entire, newly developed DAQ-chain with MuPix 10 and the Kintex 7 based DAQ board as a full-sized detector system setup in a beamtime environment with four sensors in a beam telescope configuration at the start and a 16 sensor full prototype setup in a second week of beam time.

The intention is to employ the advanced setup also for a physics goal, namely to measure the pp elastic scattering differential cross section for various beam momenta.

The team has spent the past year to fully prepare the hard-, firm- and software. As described convincingly in the proposal readiness can be rated A. The beamtime is definitively prerequisite for the operation of the Panda Luminosity detector at PANDA/FAIR. There is only very little time left before the shutdown of COSY, so that the urgency of the request needs to be rated A as well. Finally, the team has shown in laboratory tests that the experiment is definitively feasible: A.

Thus CBAC ranks the proposal triple A for the one week proposal. The team should definitively strive to be very well prepared for any beamtime granted as only very limited access to COSY is available in the future.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week, try and combine with other requests

Proposal D013.1 **Ay of elastic pp scattering**

CBAC would like to thank the proponents for their thorough and clear status report. We wish the team good success for the replacement of the damaged straw tubes required for the planned experiment and the completion of their setup. CBAC is looking forward to the beamtime request at the coming meeting.

Proposal D014.1 **HADES inner TOF**

To improve the triggering capabilities of HADES, a scintillator TOF system read out by SiPMs has been designed. The inner TOF (i-TOF) will eventually be mounted on the HADES muon detector MDC before the magnet. In contrast to earlier prototypes with 3x3 mm^2 SiPMs that featured a somewhat lowish efficiency of 90%, a modified and even simplified design with 6x6 mm^2 SiPMs without an amplifier on the module was successfully tested with a radioactive source. A final delivery of the full batch of SiPMs is expected in September and the six i-TOF modules (plus 1 spare) for HADES will be available mid-October. The modules are scheduled to be installed at HADES in November 2021.

The request is very reasonable and will provide valuable information and a conclusive functionality test, much superior to source tests. It is excellent value for the very small amount of beamtime required. The modules should be available in time. If needed the tests could be performed during machine development time.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 day during MD

Proposal D015 **Charged particle tracking detector R3B/SFRS**

Silicon strip detectors will be used in the R^3B (Reactions with Relativistic Radioactive Beams) and Super-FRS EXPERT experiment for proton and light ion-tracking. The proponents suggest testing silicon sensors used by FOOT collaboration – together with the L3T detector - for their readiness for physics and their position and energy resolution. The electronics and DAQ for the FOOT sensors are new. COSY offers the advantage of well-defined proton energies and is an ideal location for these tests. Clearly these tests are important for R^3B and EXPERT. Additional experiments are scheduled at Riken. There also is some urgency since the L3T needs run in May 2022, but the set-up must be assembled in spring 22 at GSI. The team is ready for the tests and has operated similar set-ups with AMS rather than FOOT sensors at KVI Groningen.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week

Proposal D016 **Investigation of new methods for proton-therapy**

Proton therapy is an effective irradiation therapy for cancer treatment. The applicant describes the well-known advantage of the Bragg peak when compared to e.g. gamma radiation treatment, which is even accentuated with heavy ion therapy.

The applicant describes two challenges proton therapy currently struggles with: The precise imaging of the delivered beam and dose within the patient on one hand and the compatibility of the method with various drug delivery techniques. The presentation kept it unclear, how the beam time is to serve these two challenges.

CBAC can only envision that the use of polarized protons is intended as a new approach to address the dose delivery imaging challenge. The judgement is backed by the scientific references given. This indeed points to COSY as the only place with polarized protons to do such tests. CBAC values this approach as innovative and explorative, worth to be granted the requested two days of beam time to serve as the proof of principle for the new idea. CBAC requests a report on the findings for this high-risk but exciting proposal.

Further reasoning for the choice of COSY that is explicitly stated is the beam intensity which apparently is much higher than the intensity delivered at dedicated proton therapy facilities. The applicant expects to be able to irradiate a comparatively large number of samples. What exactly is planned is not elaborated in the proposal. As for importance of this part, some doubts appear justified as the most natural test and development environment would clearly be a proton therapy center itself.

Rating:	Feasibility -, Readiness -, Urgency A to allow for proof of principle of the novel imaging method using polarized protons, Strategic priority B
Recommendation:	two parasitic eight-hour shifts in Q1 or Q2 2022, a resulting report on the feasibility of the idea requested

Proposal D017 **PANDA MVD**

CBAC would like to thank the PANDA team for their beamtime request. Since the requested beamtime is beyond April 2022, we postpone the presentation to CBAC#14 when it will be easier to judge the readiness of the experiment. CBAC fully acknowledges the urgency as well as the strategic importance since the MVD is the key instrument for tracking in PANDA. The intended change in technology from silicon strip sensors to pixel sensors introduces fundamental risks to PANDA that need to be addressed and dispelled as soon as possible.

Proposal D018 **ESS SC Linac**

The proposal describes a new configuration of a scintillating detector for beam profile monitoring on the ESS superconducting linac. Whereas standard wire scanning solutions do detect the scintillating light emitted upon detection of the beam induced secondary showers, the proposed solution first converts the scintillation in wavelength shifting fibers and then transfers the resulting signal light over an up to 60 m long fiber to a light detecting device such as an APD or a Silicon diode, in order to make the system less sensitive to the radiation environment. The system appears to be fully assembled and functionally tested. It is the coupling of the scintillator to the showers of secondaries and the reconstruction of the beam profile that is targeted.

Apparently, the applicants have had the chance to test their setup at CERN SPS as well as at COSY in the past in 2018. They have however not been able to extract any meaningful data. In 2021 the team intends to move the detector to the location of the faraday cup and to redo the tests.

The mayor difference compared to the standard beam profiling technique is the transfer of the wavelength shifted scintillation signal via an optical fiber to a remote place. The success of such a

technical improvement may be verified in the lab, using standard techniques. Beamtime, in particular beamtime at COSY, is not essential for the success of the innovation. The verification of system performance on the other hand cannot be rated as urgent and could be done elsewhere.

The team applies for 5 to 6 8-hour shifts for the tests.

Rating:	Feasibility B, Readiness B, Urgency B, Strategic priority C
Recommendation:	0 days

Proposal D019 **HI-MAPS (GSI)**

This request by the HI-MAPS collaboration (Monolithic active pixel sensors for heavy ions) is driven by the desire to fully exploit the potential of MAPS technology for heavy-ion experiments at CERN and FAIR. A combined measurement campaign with both an ALPIDE sensor telescope and a MIMOSIS sensor telescope is proposed.

The ALPIDE telescope will be used to explore the potential of particle identification for light nuclei in the ALICE experiment for one. ALPIDE sensors are also of great interest for the trackers of the Super-FRS and R3B collaborations. While dE/dx cannot be directly measured with ALPIDE, which is a binary chip, dE/dx is strongly correlated with the hit cluster size. Cluster sizes offer particularly good sensitivity if hits from many layers crossed by the same track are combined, possibly exploiting machine-learning techniques. Runs with both protons and deuterons at preferably three different energies will allow the team to improve simulation models and optimize particle identification algorithms. COSY is ideal and offers unique experimental conditions for this study.

This request is justified by its large physics potential. The ALPIDE beam telescope is available. Urgency is high since the suggested technique could be used with the existing ALICE ITS2 detectors as soon as Run 3 starts (2022).

The MIMOSIS-1 MAPS sensor was developed for the CBM experiment and is optimized for high radiation-hardness and high data throughput. It provides an excellent position resolution of approximately 5 µm at a time resolution of 5µs. The MIMOSIS-1 sensor comes in many different flavors and the optimum version for CBM should be identified. Again, the MIMOSIS-1 telescope is available, the request is urgent and important. Ideally, a MIMOSIS-2 sensor could be tested.

Rating:	Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation:	1 week of deuterons or protons, whatever appears more practical

General remark concerning the spin physics experiments

The proponents of the different “spin-experiments” have summarized their wishes for additional beamtime (37 weeks) during the remaining operating life of COSY.
COSY is the only place to perform such experiments for many years to come and the competences and facilities at FZJ are truly outstanding and unique. All experiments have the potential to extend the present knowledge in spin physics considerably. However, given the strong reduction of available beam time – in particular for the upcoming period – only the most promising experiment can be recommended for immediate running. This does not imply that there will be only a single spin experiment to be executed in 2022-24.

Proposal E009.1 **JEDI-coherence time**

The spectacular spin coherence times (SCTs) that were demonstrated with Deuterons cannot easily be reproduced for the proton due to the very close spacing of resonances. It is vital to minimize energy spread related effects by using sextupoles and bunched beams together with reducing emittance by beam cooling. The experimental devices, for instance the JEPO polarimeter and the associated measurement of coherence time and spin tune, are fully functional and have been thoroughly tested. Computer simulation of all phase space variables, including spin, is well developed but needs experimental input to reduce model uncertainties.

The experiment is of extreme importance for the design of dedicated EDM rings. It should be realized as soon as possible since there is a risk of losing expertise.

Our recommendation does not imply that further runtimes of this experiment are guaranteed. CBAC looks forward to a presentation of the results of the upcoming beam time on which further discussions can be based.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority B
Recommendation: 3 weeks beamtime + 2 weeks MD

Proposal E010.1 **Spin tune response to vertical orbit correction**

The EDM precursor experiment has been run successfully and is currently under analysis. Effects that mimic an EDM result from radial fields (leading to vertical beam excursions) and /or from the unavoidable alignment errors. The presence of both effects leads to an ambiguity which limits the control of systematics. They propose to resolve this by comparing spin maps at different decisive positions (Spin rotating solenoids) under different scalings of the orbit correction amplitude which may help to disentangle the effects, leading to a better machine model with reduced systematic errors in consequence.

During the precursor, the group has demonstrated impressive control of orbit/steerer induced spin rotations by spin mapping under controlled orbit bumps. A more exhaustive exploration of these methods will certainly lead to a quantitative improvement of systematic control but the relevance of the suggested experiment for the strategic goals of the collaboration is not yet completely clear. CBAC suggests waiting for a complete analysis of the precursor experiment and to reiterate the expected advantages then.

Rating: Feasibility A, Readiness A, Urgency B, Strategic priority B
Recommendation: no beamtime recommended for the upcoming period, defer to CBAC#14

Proposal E11 **Spin transp. mode**

Spin transparency is an idea to operate storage rings at integer spin tune. Using so-called “spin-navigators” the method promises to achieve stable spin orientation at any desired orbit position. COSY is the only place where this method can be studied for many years to come. CBAC encourages the proponents to present a detailed run-time request within the next session.

Proposal A002.8 **COSY electron beam cooling**

This proposal for beamtime to explore magnetized cooling in this energy range with the 2 MeV electron cooler was already discussed and recommended at CBAC#12. The team wants to explain the unexpected additional transverse heating term that was observed in beam tests with transverse cooling for a 1.67

GeV proton beam. These investigations will be useful for accurate numerical simulations of the cooling process in the effort of identifying the additional heating term and has value for the community employing high energy e-beam cooler.

One week of beam time is well justified to gain full control over various e-beam properties in the future to achieve best possible cooling performance in particular in case of operation of the Panda cluster-jet target.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week (2 days with PANDA cluster target) + MD prior to the run.

Proposals A010.7 and A013.2 Moderator efficiency (HBS)/ JULIC Neutron Platform

A010/A013 addresses the HBS prototype JULIC, in particular the "Moderation efficiency of solid methane at cryogenic temperatures" as well as the midterm plans for the establishment of JULIC in the Big Karl experimental area. The CBAC committee appreciates the quality of the presentation and is aware of the high mid- and long-term strategic relevance of HBS for the Helmholtz Association and the European neutron user community in the field of neutron science.

However, the CBAC committee notes that a judgement about JULIC goes beyond the remit of CBAC. JULIC itself is based on a very substantial mid- and even long-term commitment related to the operation of the proton facilities at Jülich (for sure, stretching out beyond 2024). The presented demand for beam time exceeds by far the available resources of the IKP that runs the accelerator facility.

CBAC also notes that JULIC might be of high strategic relevance for the European neutron user community, but this does not necessarily reflect the strategic priorities for COSY operation for the years to come. CBAC may advise the collaboration to get in contact with the management boards of FZJ and in particular of GSI Darmstadt for a strategic discussion about the realization of the JULIC project including the availability of required resources to run beam for the planned periods.

A010.7 Moderator efficiency (HBS)

With regard to the experiment proposal "Moderation efficiency of solid methane at cryogenic temperatures", CBAC was not convinced that all required hardware components will be available in time. Moreover, the urgency of this very interesting project was questioned since it is closely connected to JULIC. For JULIC a discussion with the management boards of FZJ and in particular of GSI Darmstadt about the mid- and longterm strategy and in particular about the required resources is needed (see above).

Rating: Feasibility A, Readiness B, Urgency B, Strategic priority B
Recommendation: 0 weeks

A13.2 JULIC Neutron Platform (HBS)

For the Neutron Platform no rating and positive recommendation can be provided given the strategy of GSI and Julich for IKP until 2024. Again, CBAC may advise the collaboration to get in contact with the management boards of FZJ and in particular of GSI Darmstadt for a strategic discussion about the realization of the Neutron Platform (HBS).

Proposal A014.4 **COSY injection studies**

For efficient set-up of the COSY injection line, a fast tune and injection optimization is mandatory and reduces set-up time. Therefore, it is timely to spend time to explore a reduction of the setup-period of the IBL and COSY injection. Scientifically it is the correct move to expand the possibilities of machine learning (ML) as a next step. The proposal is based on the successfully completed Orbit feedback studies where the team could achieve closed orbit correction in COSY at different energies using a generic AI algorithm.

The beamtimes could be split, using one week in a first experiment that tunes the Injection Beam Line (ILB) using automatic control of its elements. Prerequisites are the end-to-end model of IBL in MAD-X and integration of IBL into EPICS. The team should report at the next CBAC and present a proposal for application of ML tools based on the results of this beamtime.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week

Proposal A017.2 **Loewe-NP**

Within in the framework of the LOEWE Nuclear Photonics project, the development and design of a laser-driven neutron source by utilizing the TNSA mechanism is one particular goal. For this purpose, the proposed experimental campaign is to benchmark various different MC codes and to determine which is best suited for the simulation of neutron generation by TNSA ion beams of low-energy protons and deuterons.

Based on the recommendation of the CBAC review, the collaboration has elaborated their experiment proposal in more detail and has provided a detailed list of proton beam energies and targets for the measurement of double-differential neutron production cross-sections. In fact, the collaboration has performed a first beam time in 2020 but, unfortunately, bunched beams required for cross-sections measurements (TOF technique) could not be provided.

CBAC recommends one week of beamtime for this program.

Rating: Feasibility A, Readiness A, Urgency B, Strategic priority B
Recommendation: 1 week

Proposal A18.1 **CR Palmer-Pickup**

The final design of the Palmer pickup for the FAIR collector ring (CR) was finished in 2019. The device is now ready for operation. It is dedicated to cool the very hot secondary beams from the Super-FRS. Due to the high charge state of the hot fragments, stochastic cooling is very efficient, and no cryo-modules are needed for the Palmer pickup. The intention is to use the COSY beam for measurement and documentation of the RF response of the Pickup in the 1-2 GHz band with beam. It is very important to gain this information before the Pickup tank moves to GSI.

Rating: Feasibility A, Readiness A, Urgency A, Strategic priority A
Recommendation: 1 week of beam time

3. Summary and Conclusions

We would like to thank all speakers and participants for an inspiring day of scientific presentations. Despite the ongoing COVID restrictions and the hybrid format of the meeting with many online presentations, communication between the committee and the experimental groups again was excellent. Unfortunately, the aforementioned budget restrictions made the priorization of requests even more challenging than for previous meetings and COSY is heavily oversubscribed. Thus, many requests had to be shortened, combined with other proposals with similar requirements or – alas – rejected. To the best of CBAC's understanding, the allocated 12 weeks of beamtime are compatible with the available COSY budget.

This session CBAC received sixteen requests for, in total, more than 21 weeks of user beamtime complemented by several weeks of machine development. Many groups delivered statements of interest beyond this scheduling period, which is particularly important since the end of COSY operation is nigh.

The sixteen requests relate to

- detector tests for FAIR (D004.10, D009.6, D011.4, D014.1, D015, D019),
- accelerator physics experiments, which are driven by either FAIR or EDM (A002.8, A014.4, A018.1),
- R&D for an accelerator-driven (A010.7, A013.2) or laser-driven neutron source (A017.2),
- preparations for the determination of the EDM (E009.1, E010.1),
- various other requests beyond these categories (D016, D018)

Due to the dense schedule of the meeting, three written statements of interest or proposals questioning beamtime beyond Q1/2022 could not present full talks at this meeting but are encouraged to present at CBAC#14.

As always, the detailed scheduling of the prioritized proposals is left to the local COSY coordination committee. Again, special attention should be given to the current COVID related travel constraints.

The two requests related to the high-brilliance neutron source and the JULIC neutron platform could not be granted this time. This is essentially due to the budget constraints and the fact that neutron science is not IKP core business. CBAC would like to note that there is no significant technical constraint for carrying out the HBS request, which mostly relies on JULIC, not COSY. The implementation the JULIC neutron platform on the COSY facility, however, is not compatible with the anticipated end of operations by the end of 2024.

CBAC encourages GSI and FZJ management to clarify their policy and strategy regarding the neutron source proposals.

Finally, CBAC notes that – despite adverse boundary conditions – the commitment and enthusiasm of the COSY operation team remains very strong, the machine is again improving and the delivery of the requested beamtime was excellent.

Next CBAC session

The CBAC#14 meeting is scheduled to take place on April 4th and 5th 2022 at GSI.

Marc Weber (CBAC Chair)

AGENDA

preamble: due to Covid-19 situation, the CBAC#13 is again held as a hybrid meeting, i.e. the committee members meet in person at IKP-Jülich, Experiment speakers contribute via TelCo

Thursday, August 26th, 2021

08:30	(Bus) transfer Stadthotel Jülich to IKP	
09:00 – 09:30	**Closed session**	(IKP, room 311)
	J. Ritman	Welcome
	M. Weber (chair)	Organization, committee work
	Open session	(IKP, room 311/312 and TelCo)
09:30 – 09:40	P. Giubellino, J. Ritman	Welcome
09:40 – 10:00	V. Kamerdzhiev	Status of COSY (TelCo)

Proposals are scheduled for 15' presentation + 10' discussion (TelCo)

10:00 – 10:25	A002.8	COSY e-cool	V. Kamerdzhiev
10:25 – 10:50	A010.7	Moder. Effi.(HBS)	A. Schwab
10:50 – 11:15	A013.2	JULIC neut.-platform	P. Zakalek

11:15 - 11:30 Coffee

11:30 – 12:00	Welcome by Wolfgang Marquardt (VS-FZJ)		
12:00 – 12:25	A014.4	COSY inject.-studies	J. Hetzel
12:25 – 12:50	A017.2	Loewe-NP	B. Schmitz

13:00 – 14:00 Lunch Break

14:00 – 14:25	A018.1	CR Palmer-Pickup	R.Stassen, C.Dimopoulou
14:25 – 14:50	D004.10	CBM-HADES	J. Pietraszko
14:50 – 15:15	D009.6	PANDA Clas.Jet Tg.	A. Khoukaz
15:15 – 15:40	D011.4	Lumi-det.	M. Fritsch
15:40 – 16:05	D014.1	Hades inner_TOF	D. Grzonka
16:05 – 16:30	D015	Track.Det.R3B/SFRS	O. Kiselev

16:30 – 16:45 Coffee

16:45 – 17:10	D016	Proton Therapy	M. Bashkanov
17:10 – 17:35	D018	ESS SC Linac	S. Grishin
17:35 – 18:00	D019	MAPS	B. Blidaru
18:00 – 18:25	E009.1	JEDI Proton SCT	V. Hejny

18:25 – 18:50	E010.1	Spin tune response	P. Lenisa

18:50 – 19:30 Closed session (IKP, room 311)

20:00 – 21:30 Dinner (CBACM)

~21:30 (Bus) transfer to Stadthotel Jülich

Friday, August 27th, 2021

09:00 – 11:45 **CBAC closed session** (IKP, room 311)
representatives of the experiments should be available on call for additional information or questions

Open session (IKP, room 312 and TelCo)

11:45 – 12:15	Summary of CBAC Recommendations	M. Weber

12:30 – 14:00 Lunch (for CBAC members at IKP)

End of meeting