

Minutes of the 5th Meeting of the COSY Beam Time Advisory Committee (CBAC)

December 19 and 20, 2016

Location: Physikzentrum Bad Honnef, 53604 Bad Honnef, Germany

Participants:

CBAC members:

Aulenbacher, Kurt Univ. Mainz, DE
Chao, Alexander W. SLAC, US
Kester, Oliver TRIUMF, CA
Schmidt, Christian Joachim GSI, DE
Steffens, Erhard Univ. Erlangen-Nürnberg, DE (chair)
Trubnikov, Grigory V. JINR Dubna, RU (excused)
Weber, Marc KIT, DE (excused)

CBAC Scientific Secretary:

Frank Goldenbaum (IKP-1)

IKP:

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

Board of Directors FZJ: Sebastian Schmidt (excused)

1. General remarks

The 5th CBAC session took place on December 19-20th in the *Physikzentrum* of the *Deutsche Physikalische Gesellschaft (DPG)* in Bad Honnef, Germany. The beam time requests of the individual groups were presented on Monday in the Open Session of the CBAC#5 meeting (for the programme and the list of applications see the Addendum).

Closed Sessions of the CBAC members were on Monday morning 9:00-9:30 and Tuesday morning until 12:30.

The Closed Session on Monday morning was opened by Hans Ströher (Scientific Coordinator COSY) welcoming the participants (see list above). Grigory Trubnikov, Marc Weber (CBAC members), James Ritman (IKP-1 Director, IKP Managing Director), Ulf-G. Meißner (IKP-3 Director) and Sebastian Schmidt (Board of Directors FZJ) are excused for not being able to participate the CBAC session. Hans Ströher summarized the situation of the IKP and the likely schedule for the next year. These arguments were also presented to the users in the following open session (see below). On Tuesday morning, during the second Closed Session, the basis for the recommendations in view of changing priorities has been discussed (see Sec. 2a), and the opinion of the CBAC members about the individual reports and ratings collected and transformed into a balanced result.

In the Open Session, Hans Ströher gave an overview of the alarming situation of the Institute for Nuclear Physics (IKP). He reported that COSY Legacy paper by Colin Wilkin is in progress (arxiv 1611.07250); comments are welcome. HS also reminded on the POF-3 promises the IKP made. The Helmholtz scientific review for the IKP will take place in a year from now, one year earlier than

planned. This demands for a high priority of the POF-3 related projects. He stated that there is no final decision by the Advisory Committee of the FZJ (*Aufsichtsrat*) yet on closing the IKP, which may be taken in May 2017. The CBAC Chair invited the external users to consult the FZJ Board for additional beam time. COSY Operation is limited to Sept. 2021, the end of the present EDM ERC grant. A ramping down of the activities towards the end of this period will most likely happen.

The status of COSY in 2016, the present beam time schedule until March 2017 and an outlook for the operation of COSY in 2017 were presented in the open session by Dieter Prasuhn. The operation in 2016 included 22 weeks of maintenance/shutdown, 10 weeks of machine development and in total 20 weeks for beam dynamic studies, HESR preparation, FAIR experiments, JEDI/EDM, PAX/TRIC and “external users” like HBS (High Brilliance Source), INM (medical applications) and INT (irradiation experiments by the Institut für Nukleare Trendanalysen). The major activities of the machine group for 2017 will comprise the study of possibilities for higher average currents, an upgrade of the COSY instrumentation and the optimization of the procedures for delivering low energies (~10-100 MeV). In addition to the requests of external users as discussed in detail below, the planned operation of COSY for 2017 includes 18 weeks of maintenance/shutdown, several weeks of machine development, and approximately 25 weeks for FAIR, EDM and external activities.

The twelve proposals submitted to CBAC#5 ask for approximately 31 weeks in 2017, including the substantial back log of the beam time recommended in the CBAC#4 session, but not yet scheduled. These ‘delayed’ proposals (D1.3-MVD, D7-LHCb, D8-Eta’, D9-Cluster Target, and A9-Sib.Snake) were asked to provide a written status report with emphasis on Readiness.

An overview of all the applications to CBAC#5 is given as a table 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 of CBAC#5 are located on the web page

<http://www.ikp.fz-juelich.de/CBAC/documents/cbac05.html>

2. Summary of the discussion and recommendations

2a) Procedure The system of rating was discussed in depth during the closed sessions. As stressed by the IKP Scientific coordinator, COSY is no longer a User Facility since the start of the POF-3 period in 2015 which has resulted in a shortening of the available beam time as projects by external users were officially no longer part of the COSY program. Up to now and as a service to previous users, beam time has been granted to the extent that the IKP program was untouched.

The projects studied at the COSY accelerator complex can be classified into the following groups:

Table 1
Classification of the COSY applications with respect to programs

1	IKP POF-3	EDM, PANDA, HESR, (PAX, Sib. Snake)
2	IKP non-POF-3	TRIC
3	Non-IKP POF-3	CBM
4	Non-IKP non-POF-3	INT, Tb-cross sections, HBS, η'

Table 2: Summary of Evaluation and Recommendations of CBAC#5 for 1st and 2nd half of 2017. Items are: Experiment, number of weeks requested in I and II/2017; and the three partial ratings. In the last two columns, the number of weeks recommended for every application, based on the discussion in the closed session.

I^* = 1 wk recomm. by CBAC#4; I/2017 and II/2017: half years Q_i ($i = 1-4$): quarter years.

Rating in brackets []: CBAC#4; The 'delayed proposals' are also listed in Table 2.

Experiment	Request I/2017 [weeks]	Request II/2017 [weeks]	Feasibility	Readiness	Importance	Recomm. I/2017	Recomm. II/2017
D1.4 PANDA MVD	1	1	A -	A -	A -	1	CBAC#6
D2 PANDA STT	Status	report					
D4.4 CBM	1* 2		A A	A A	A A	1 Febr. 2 May	
D6.3 INT Irradiation	17 shifts = 6d	-	B	B	C		
D7 LHCb Irradiation	2d* Status	report	[B]	A ≥ March	C	2d	
D8.1 Eta' Det. test	4d* Status	report	[A]	A confirmed	C	4d	
D9 PANDA Cluster target	- Status	1* report	[A]	[A]	[A]		1* Readiness: CBAC#6
D10 Tb Cross section	15 shifts		A	A	C	15 shifts = 5d	
A1.4 Stoch. Cooling	1*	1	A	A	A	1	1
A2.4 Electron Cooling	2	-	A	A	A		(2) With ST-C
A5.3 COSY Beam studies	2*	2	A	A	A	2	CBAC#6
A7.2 COSY Instr.	1*	1 "new"	A	A	A	1	-> CBAC#6
A9 Siberian snake	2* Status	report	[A]	A confirmed	B	2*	
A10.1 HBS	1 p 1 d	-	B B	B B	C C		
E2.3 JEDI Polarimeter	1	-	A	A	A	1	
E5 JEDI RF-WiFi	2 (Q2)	2 (Q3) 2 (Q4)	A A	A A	A A	2	2 -> CBAC#6
E6.1 PAX / TRIC	1		A	A	A	1 March	
SUM	21	10				16	3 (+ 9)

In the discussion, the committee came to the conclusion that in future the following categories should be used, modified with respect to earlier CBAC sessions. Items (i) – *Feasibility* - and (ii) – *Readiness* - are basically unchanged. In view of the short time of about one year to the final POF-3 scientific review, the priorities expressed in category (iii) – *Importance* - had to be modified in order to give high priority to the POF-3 goals. As before, the proposals were presented in the open session and questions were posed to the proponents from the audience and by CBAC members. Then a comparative discussion took place in the closed session. In particular, those proposals were scrutinized with special emphasis on

- (i) **Feasibility** Here the committee judges with its expert’s knowledge and other advice on the feasibility of the proposed test or measurement. Other assessments, like from a POF review or accepted proposals may enter; also boundary conditions imposed by the facility have to be considered.
- (ii) **Readiness** Assessment of possible risks that elements required for the test are not available in time. It should be noted that CBAC as external group cannot make a complete assessment of possible delays. The proponents are asked to give in their application a detailed account of the readiness of the instrumental requisites necessary for the requested test.
- (iii) **Importance** IKP-based projects of group 1 and 2 (see Table 1), and non-IKP but POF-3 projects from another Helmholtz center (group 3) should get the highest rating **A** (should be done), or **B** (nice to have); group-4 projects from external users should be rated **C** (lower priority).

All these considerations lead to a Rating A, B, C as explained above. As in the previous recommendations, there is no total rating given, because the committee felt that the set of the three partial ratings represents in the best way the message the committee wants to convey to the Laboratory. - The result of the discussion is summarized in Table 2, shown above.

2b) Comments to Table 2

Projects presented in the Open Session on Monday (see table in the addendum) are listed in Table 2. In addition, the following projects are included: two status reports that were given orally (D2, A9), as well as written status reports of the ‘delayed proposals’ contributed to the meeting. For all these projects, the relevant figures are listed in the table.

For 2017, 19 weeks of beam time were recommended, and 9 weeks are pending, subject to a decision by CBAC#6. Compared with the approximate number of 25 weeks of available beam time in 2017, a slight overbooking can be noted, which may grow with new applications to CBAC#6, e.g. if currently not available functions like higher energies or low-energy extraction are enabled. Requests from non-IKP groups will persist because of their high importance for the proponents and the missing alternatives within the accelerator landscape. The committee expects a further increase of the requested beam time for detector and accelerator tests towards the end of the operation time of COSY, announced by the Chair of the FZJ Board.

2c) Short reports and recommendations on individual proposals

Proposal D001.4 *Detector Tests for the PANDA Microvertex-Detector*

The PANDA-MVD developments are in a state that full system tests with the detectors and the complete data driven readout chain may be performed. In view of the lengthy ASIC development cycles, particular urgency is seen in the evaluation of system performance of both, the Pixel-readout ASIC ToPix and the entirely novel strip readout ASIC PASTA. Availability of these devices clearly defines the critical path for the MVD. With the previous beam time first scheduled to Q2/2016,

cancelled due to technical issues at COSY first and due to personal illness on a re-scheduled beam-time, this necessity prevails. We recommend to test the newest device PASTA in its performance first and re-apply for the study of the ToPix chain in CBAC 6.

The proposal is fully supported, the amount and allocation of beam time fully justified. A merged beam-time together with the CBM-FAIR detector tests envisioned should be considered.

Ratings: Feasibility A Readiness A Importance A

Recommendation: 1 week in I/17, decision on 2nd week in II/17 by CBAC#6

Proposal D004.4 *CBM Detector and Electronics Tests at COSY*

The CBM experiment requests two beam tests in 2017. The first request is for 7 days of high-intensity testing of electronics in February 2017. This request supersedes a previous request for a full detector campaign, which was endorsed by CBAC last year. The second request is for two weeks of detector testing in May 2017.

First off, the panel would like to thank the CBM team for a successful campaign in 2016 and the encouraging preliminary results in all areas. The panel is curious to learn more about specific aspects like the performance of polycrystalline diamonds or the microcontroller SEU cross-section for individual error mechanisms.

The panel endorses the proposed electronics tests for February 2017. The duration of 7 days is adequate. The second version of the STS-XYTER ASIC is available and functional. The setup for the beam test will be similar to the 2015 campaign and is available too. It is of extreme importance to confirm the anticipated improvements built into the STS-XYTER, which is used for both the STS and MUCH subsystems. - The panel also endorses the proposed detector test of 2 weeks in May 2017. This is an extremely rich campaign involving many subsystems and promises a wealth of important results regarding the STS sensors, RICH MAPMT electronics, the new MUCH GEM detectors, diamond sensor timing system, etc. The combined new data acquisition alone with the new boards FLIB and FLES and more requires thorough testing and fully justifies the request.

Ratings: Feasibility A Readiness A Importance A

Recommendation: One week in February 2017, two weeks in May 2017.

Proposal D006.3 *Investigating p- Induced SEE in modern Microelectronics @ COSY*

INT has so far spent four beam-times on the investigation of SEE in modern SRAMs as well as the particular system on a chip device P4080 that is intended to be employed in space applications. In review of the activities apparently most of the time was spent on practical dosimetry issues. The unfortunate breakdown of the septum at COSY and the corresponding limitation to proton energies below 1 GeV impeded finishing even a single full energy scan up to 2 GeV as proposed. When concentrating on low energies the experimental setup resulted inadequate to deal with very inhomogeneous beam densities delivered. The team now plans to complete the previously proposed measurements of the SRAM SEU cross-section as well as the P4080 SEE cross section over the full energy range.

At this point, neither the accelerator COSY appears to be ready to deliver beam energies up to 2 GeV, nor does the proposal convincingly promise that the dosimetry issues will be resolved and managed. Too much beam-time has been spent in learning about dosimetry, aiming for none motivated very high precision with an apparently inadequate setup. The following suggestions should be addressed before being granted another beam-time:

- Measurement of the dose downstream the degrader includes all the debris and introduces systematic effects.

- Cross calibration of the three different types of Gafchromic® films may be achieved by simultaneous irradiation. This should not be considered rocket science.
- The targeted precision in dose should be determined and motivated prior to the experiment, so that adequate methods may be employed. These standard techniques, when employed correctly, should give consistent results.
- Inhomogeneous beam structure may be addressed by wobbling the target device with Gafchromic® films attached across the beam.

Ratings: Feasibility B Readiness B Importance C

Recommendation: Delay tests until full energy available, improve precision of dosimetry.

Proposal D010 *Tb-cross section measurements at COSY*

The consortium of principal investigators from five institutions is proposing a measurement of the Terbium-149, Terbium-152 and Cerium-149m production cross section (excitation function) in (p,*) reactions at COSY as a function of proton energy. The request comprises 12 different proton energies and would last about a week, not considering setup time.

This request is motivated by the rising field of theranostics, in which chemically identical radionuclides are used for both diagnostics and therapy. The element Terbium offers a particularly promising matched-pair of isotopes. In order to understand the efficiency of terbium sample production and chemical separation processes, the excitation function must be known precisely. So far it is not with previous measurements experiments differing by factors of two.

This is a novel request and an exciting use of COSY which is in a unique position to perform the measurements, as is convincingly laid out in the proposal. The presence of the local FZJ radiochemistry group is a further asset. The PI team is experienced and the proposed experimental setup is understood well and is mature. The purpose of the measurement is very worthwhile. From the scientific point of view, the panel fully endorses the request. Unfortunately, studies on novel Radioisotopes for medical applications are not, although an extremely promising field, part of the official COSY program.

Ratings: Feasibility A Readiness A Importance C

Recommendation: Request fully endorsed by the panel.

Proposal A001.4 *Stochastic Cooling: Commissioning of new HESR stochastic cooling tanks*

The proposal is the continuation of A001.3 with the goal to perform tests for the HESR stochastic cooling system. The kicker tank has been installed as recommended in the last CBAC meeting. It is proposed for the week in I/2017 to investigate cooling only in one plane, due to the limited numbers of available high power amplifiers. In the next summer shutdown, all amplifier for one Kicker will be installed. An additional beam-time of one week in II/2017 is then required to get the whole stochastic cooling running in all three dimensions. So far only longitudinal cooling has been demonstrated at the Nuclotron in Dubna.

After the stochastic cooling system using the HESR system is fully equipped, electron cooling and stochastic cooling will be applied at the same time. This is in general of great interest for different experiments. Therefore, in the beam time in 2017 stochastic cooling in combination with the 2MeV electron cooler is foreseen to explore the common operation.

The board recognizes the progress and recommends the requested beam time.

Rating Feasibility A Readiness A Importance A

Recommendation: The 1 wk already recommended by CBAC#4, plus 1 week in II/2017

Proposals A002.4 *Electron Cooling*

The 2 MeV electron cooler at COSY is a unique device as it represents the highest energy magnetized beam available. Analysis of the beam time in May/June 2016 is completed and impressive results have been obtained. Transverse and longitudinal cooling was successfully demonstrated at electron energies of 0.9 and 1.25 MeV. E-cooling in the presence of heating by the Cluster Jet target was investigated with encouraging results. In the transverse case the cooling times were surprisingly long and cooling had to counteract a so far un-identified source of emittance growth.

During II/2016 a runtime without ion beam was executed that was devoted to the commissioning and optimization of the electron beam and to test a model based optimization of electron beam parameters. This allows easier and more precise compensation of Larmor oscillation and of the beam galloping.

It is believed that this optimized model based beam set-up will lead to better reproducibility and higher flexibility. It seems that these are preconditions for a successful, investigation of the scaling effects of cooling power wrt to energy and field strength in the cooling section which will therefore allow a conclusive interpretation of result.

Two more weeks of beam time in I/2017 are requested. Moreover 3 days are requested for generation of input data with the goal to optimize the COSY machine model with operation at a high field of the cooling section. The CBAC endorses these studies at this unique machine. We express our hope that with the implementation of the new set up procedures a conclusive interpretation of relativistic magnetized cooling in the hitherto unexplored energy regime will soon become available. In particular, a statement of the achievable energy definition of the antiproton beam at HESR could become of particular importance for the physics program at PANDA.

The panel strongly recommends to perform a combined run of A2-Electron and A1-Stochastic Cooling once the Kicker is fully equipped (in II/2017 ?).

Ratings: Feasibility A Readiness A Importance A

Recommendation: 2 weeks in II/2017 in combination with Stochastic cooling.

Proposal A005.3 *COSY Beam Studies*

The effort to improve the injection efficiency continued in 2016. The 2 weeks machine time recommended in CBAC#4 did not occur. In a routine operation of proton beams, several strong beam losses occur during injection capture and the subsequent beam manipulation and resonance extraction stages, losing 80% of the beam. A careful walk through of the beam losses is planned. The committee has a few comments:

- It could be useful to calculate the space charge tune shift to see how it might play a role in limiting the operation. It should be noted that the space charge tune shift ($\sim 1/\beta$) is especially critical at low energies.
- Choice of working point could be explored, although the need of resonance extraction might limit its flexibility.
- Detailed study will be needed. Some of these efforts will require hardware upgrades, particularly the instrumentation and control systems.

A request was made to provide high current low energy ion beam for the application to neutron production. The envisioned deuteron beam has 10 MeV kinetic energy and 5 nA peak current. Studies are proposed to investigate this possibility at COSY. Other options are also being considered. One example is to use directly the DC beam from the cyclotron. The other is to use a degrader right

upstream of the target. These studies require careful systematic and detailed efforts on a number of fronts. Space charge effect should be evaluated (note the earlier comment that it scales $\sim 1/\beta$.)

Another request was made to provide a large uniform beam spot size at the target. It was found that when the beam spot size was increased, the extracted beam has a time dependent behavior that traces out a x-y coupled pattern. Whether this is due to a static optics deformation or a dynamic effect during the resonant extraction process is to be determined.

The committee supports these efforts proposed in A005.3 and suggests that, although not directly yielding its own science, this is a necessary step to enable other precision research efforts. It further suggests to spell out the planned studies explicitly based on accelerator physics principles – the proposal has been not clear – to guide the study beyond an empirical approach.

Rating: Feasibility Importance Readiness

Recommendation: 2 wks (already recomm.) in I/2017; 2 new wks: Decision moved to CBAC#6 (June 2017).

Proposal A007.2 *COSY Beam Instrumentation*

The COSY accelerator is undergoing a significant upgrade in the beam instrumentation, control and timing systems. The BPM system upgrade is planned for installation in the winter shutdown. Part of the requested beam time is for the commissioning of the system. The tests will include the new pre-amplifier setup and the interaction with the control system. A correct function of the pre-amplifier system has to be tested and the correct function of the BPM readout system as well. During this phase no BPM system for regular operation is available. In addition frequent access to the COSY ring is expected. Therefore the possibility to do this commissioning on the side of another beam time seems unreasonable. As plan B the old system is kept and can be re-connected within ½ day.

Along with the BPM upgrade the control system is undergoing a major upgrade to a modern system used by a lot of other accelerators, based on EPICS and Control System Studio. This upgrade is done to control the new BPM system and prepare COSY for a slow beam orbit feedback system. With this the beam orbit should be automated shifted to the wanted orbit within an uncertainty of 100 μ m RMS. The functionality of BPM readout and control of the steering magnets within COSY has to be tested as well.

As the operation of COSY becomes more demanding for running test beam times, an upgrade of the timing system is planned, as the old system is at the end of its lifetime and new hardware will be required. Therefore the testing of new Hardware in real-live conditions is necessary, also to decide on the platform to be chosen. In addition, Beam Loss monitors (BLM), which are available will be included in the controls for very sensitive beam optics optimization.

The panel recognizes the need of the test on the beam instrumentation system and recommends 1+1 week, with the first test early after the upcoming shut down.

Ratings: Feasibility A Readiness A Importance A

Recommendation: 1 week in I/2017; 1 week: decision moved to CBAC#6.

Proposal A010.1 *HBS --- Comparison of neutron fluxes produced by proton and deuteron beams on a thick Be target*

The experiment aims at clarifying contradictory results on thick-target yields of Be(p,n) reactions in the range 10 – 50 MeV, needed for the design of a set of medium-sized accelerator-based Neutron sources. These sources are required in order to fill the gap after the shutting-down of fission reactors in Europe. The method to measure the yield via prompt γ 's from the Polyethylen moderator has been confirmed in a previous beam time. It is proposed to extract 100 MeV protons and degrade their

energy down to 50 – 10 MeV. In the previous run, the degradation resulted in a beam blow-up inhibiting normalization of the applied beam current. The committee is convinced that the runs should be delayed until a better extraction mode at low energies has been developed.

Ratings: Readiness: B Feasibility: B Importance: C

Recommendation: Delay until low energy extraction is available

Proposal E002.3 *JEDI: Towards EDM Polarimetry*

This request is part of the program to develop a polarimeter for the EDM precursor, based on radiation-hard LYSO crystals. A beam time for testing an almost complete chain/system of hardware and software components for the polarimeter just ended at the morning of the CBAC session. .

Impressive results of the run with polarized deuterons were presented, including spectra and dE vs E plots of the scattered deuterons and other break-up products at $T_d = 100\text{--}270$ MeV. The preliminary results indicate that the detector system and the DAQ have improved to a level which could allow reliable physics data. One week of runtime in I/2017 plus adequate machine development time is requested. The intention is to obtain cross sections and analyzing powers for four different target nuclei at several extracted energies.

CBAC commends the polarimeter team for the progress that has been achieved since the last meeting. Making use of the physics potential of the polarimeter with external beam is certainly a very good next step before the device will go into storage ring operation. Nevertheless, we recommend to provide more than the preliminary analysis in order to prepare for a run which shall obtain publication data. CBAC conditionally approves the request if a short (~ 2 page) report is provided in January which draws conclusions from the last run and addresses the readiness of the experiment.

Ratings: Feasibility A Readiness A (cond. to report) Importance A

Recommendation: One week in I/2017, plus MD

Proposal E005.2 *JEDI: Waveguide RF Wien Filter - Commissioning and initial investigations*

Good progress continued since CBAC#4. All hardware components are completed. Assembly has started in ZEA clean room. Installation in PAX low-beta section is planned April-May 2017. The target aimed is to reach EDM detection down to the level of $5 \cdot 10^{-20}$ e-cm. The integrated field is designed to reach 0.2 T-mm at 4 kW RF power. Even at this high power, temperature control is not expected to be an issue.

Rotation of the Wien filter by 90 degrees, required to allow switching between the MDM to the EDM modes, is designed to be accurate down to 0.01 degree. This means a residual of the MDM signal remains at a 10^{-4} level when trying to detect the EDM signal. It is suggested to evaluate what upper bound of the EDM signal can be detected due to this interference contribution from MDM.

The proposal requests three rounds of two weeks, each preceded by one week of MD, till end of 2017. It is expected that the first experiment would be carried out at that time. The Committee considers the proposal well thought over and looks forward to its successful first experimental results by the JEDI collaboration. The committee wishes to re-iterate that in order to perform the first experiment, a few efforts other than the Wien filter will also have to be accomplished in time, e.g. more COSY machine studies, implementation of the new BPM electronics, electron cooling studies, and the COSY realignment plan mentioned during CBAC#5). The committee recommends timely allocation of machine time to this proposal.

Ratings: Feasibility A Readiness A(?) Importance A

Recommendation: 2wks each in Q2 and Q3/2017; 2wks in Q4: Decision moved to CBAC#6.

The detector is the missing part of the PAX target set-up developed for PAX and plays an important role for TRIC, too. PAX will probably be a future option for the FAIR antiproton program. – The detector was developed and built by INFN Ferrara and FZJ. The lab tests have been completed at Ferrara, and all features incl. polarized target would be available at the PAX place until the installation of the RF Wien-Filter which is foreseen for the 2nd quarter of 2017. Commissioning in early 2017 could enable, apart from the detector test, the measurement of the target polarization and calibration of the BR polarimeter. The committee recommends to utilize this time slot for a detector and target test. This would help in preparing the target set-up for a future running of TRIC after completion of the precursor experiment. TRIC is a symmetry violation test which cannot be done in the foreseeable future elsewhere. We recommend two weeks in March 2017.

Ratings: Feasibility A Importance A Readiness A

Recommendation: Two weeks in March 2017

3. Conclusions

The COSY facility is a testing ground for FAIR, a place for future precision experiments and – with lower priority – for other applications. *Twelve* new requests for beam time at COSY for the period I-II/2017 have been presented to CBAC#5 (number in brackets: CBAC#4):

- *two* (3) on detector tests for FAIR (D1, D4),
- *three* (3) on irradiation and isotope production (D6, D10, A10),
- *four* (6) on machine studies for COSY, HESR and ESS (A1, A2, A5, A7),
- *two* (3) on preparations of the JEDI experiments (E2, E5),
- *one* (-) on preparations for PAX/TRIC (E6).

Among those, several requests recommended by CBAC#4 have been confirmed (D4, D7, D8, A1, A5, A7) and partly extended.

A total of about 19 weeks of beam time were recommended by CBAC#5 for scheduling in 2017. From FAIR, there are, besides two detector applications (D1 and D4) and the machine-related experiments, the broad test program of the PANDA Cluster target (D9) in 2017/18 with one week in I/2017 (shifted to II/2017, see below) already approved at CBAC#4, and confirmed by CBAC#5 on the basis of the written report which states readiness for autumn 2017. In addition, the decision for one week for D1 (MVD), one week for D9 (Cluster T.), two weeks for A2 (Ecool), two weeks for A5 (COSY mach.optics), one week for A7 (COSY Instr.) and two weeks for E5 (RF-WiFi) have been moved to CBAC#6, in total nine weeks, for a final review of Readiness. Again, the Committee stresses the importance that the RF-Wien-Filter, which is time-critical for the precursor experiment, will be assembled, installed and tested with beam soon. Two times two weeks in Q2 and Q3 of 2017 are recommended, and two more weeks in Q4, subject to a final review of readiness at CBAC#6 in June.

Increasing demand on beam time for studies of radiation hardness and isotope production is continuing which cannot be covered because of the new priority rules imposed by the upcoming scientific POF-3 review. The committee recommended to those group, FZJ-internal and external, to approach the FZJ Board for providing more beam time for the COSY accelerator complex.

The beam time recommendations for the period II/2017 and beyond will be subject of a detailed evaluation of CBAC#6 in mid 2017, i.e. well in advance of the period II/2017, in particular Q4, and the start of the period I/2018.

4. Comment on the future of the Institute of Nuclear Physics (IKP)

In addition to our Comment as part of the CBAC#3 and #4 minutes to which we refer, we note that the FZJ Strategy process still includes the closure of the IKP with all the adverse consequences outlined in our previous comments. The present round of requests of beam time at the COSY facility illustrates again that COSY is a unique place within basic and applied science performed with Nuclear Physics methods. The panel reminds the FZJ Board of the following consequences of the present strategy:

1. COSY is a unique energy-variable accelerator for protons and light nuclei in the range of about 40 to 2880 MeV in energy (protons) and as such an indispensable part of the research infrastructure in Germany and Europe which should be provided by Research Centers. As an example of the importance of such a facility, the measurement of effective neutron production cross sections on a thick Be target (HBS-A10) is planned at COSY. The results are needed for the lay-out of the HBS project (FZJ with external collaboration). Although beam time for HBS at COSY is not covered by the present mandate of the IKP, it has been made possible in the past, illustrating intense cooperation on an informal level within the FZJ on nuclear methods.
2. Other ongoing applications of COSY beams are (i) INT-D6 (Irradiations tests of electronics for applications in Space – full COSY energy range!), and, very importantly, (ii) the study of Terbium cross sections (D10): *“This request is motivated by the rising field of Theranostics, in which chemically identical radionuclides are used for both diagnostics and therapy. The element Terbium offers a particularly promising matched-pair of isotopes. In order to understand the efficiency of terbium sample production and chemical separation processes, the excitation function must be known precisely. So far it is not with previous measurements experiments differing by factors of two. - This is a novel request and an exciting use of COSY which is in a unique position to perform the measurements, as is convincingly laid out in the proposal. The presence of the local FZJ radiochemistry group is a further asset. The PI team is experienced and the proposed experimental setup is understood well and is mature.”* (cited from the referee report p.6). This is another promising field of research where the high beam energy of COSY for the production of heavy Radio-isotopes is important, and which would be given up if COSY is shut down.
3. Within the accelerator activities of the FAIR project, the IKP at FZJ leads the consortium to build and operate the High Energy Storage Ring (HESR). The HESR is a central component of the FAIR accelerator facility that will be used by three (of the four) pillars for scientific research. Any concept to install, commission and operate HESR without including the IKP will take longer and demand more resources at GSI. The staff of IKP has furthermore been key in redesigning the HESR so that it can not only accommodate antiprotons but heavy ions as well.

IKP has also been instrumental in adjusting the operating mode of HESR after the Modularized Start Version of FAIR was announced, delaying the construction of the RESR ring. Both of these points indicate how crucial it is to have the original designers remain involved in the project. The importance of IKP to remain in charge of HESR is also seen in the usage of COSY to perform precision accelerator physics experiments that will enable HESR to swiftly come into operation. Even after HESR begins operation, COSY will be able to provide an important and more economical platform than the HESR for investigations needed to maximize the operational performance of HESR. COSY is also an important facility to test and optimize detector setups for several of the FAIR experimental pillars.

The Committee hopes that these arguments may persuade the decision making bodies of the FZJ to support the IKP also in future that it can continue its major and successful contribution to FAIR, that it may conduct its unique searches for the EDM of ions and support other disciplines with nuclear methods indispensable for modern science and development.

Next CBAC session

The CBAC#6 session is tentatively scheduled to take place on June 26th - 27th, 2017 in the IKP of Forschungszentrum Juelich GmbH. The final date will be communicated in due time.

E. Steffens

Erhard Steffens (CBAC Chair)

AGENDA

Tuesday, December 20th, 2016

09:00 – 12:30 **CBAC closed session** (room tba)
representatives of the experiments should be available for
additional information or questions

in parallel:

09:00 – 12:30 **Open session** (lecture hall PBH)

09:00 – 09:30	Advances of TRIC	D. Eversheim
09:30 – 10:00	Dalitz Plot of the η' Decay into $\eta\pi^+\pi^-$	S. Gosh
10:00 – 10:30	Developments for the PANDA Microvertex Detector	K. Brinkmann
10:30 – 11:00	Readout system development for JEDI polarimeter at COSY (COSY-080, Tbilisi)	D. Mchedlishvili

11:00 - 11:30 Coffee

11:30 – 12:00	Coherent pion production in p-p collisions at ANKE/COSY (FAIR-010, Dubna)	S. Dymov
12:00 – 12:30	A Secure Remote Access System with Strong Two-factor Authentication Mechanism	Qinwei He

12:30 – 12:45	Summary of CBAC Recommendations	E. Steffens
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12:45 – 14:00 Lunch

End of meeting