

# Minutes of the 3<sup>rd</sup> Meeting of the COSY Beam Time Advisory Committee (CBAC)

December 17-18, 2015

Location: Physikzentrum der DPG, Bad Honnef

## Participants:

### *CBAC members:*

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

### *CBAC secretary:*

Frank Goldenbaum (IKP-1)

### *IKP:*

Mei Bai (IKP-4 Director)  
Ulf-G. Meißner (IKP-3 Director) (excused)  
Dieter Prasuhn (IKP-4, representative of the IKP staff)  
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

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The 3<sup>rd</sup> CBAC session took place on December 17-18<sup>th</sup> in the Physikzentrum of the German Physical Society (DPG) in Bad Honnef, Germany. The meeting was held in combination with the annual COSY-FFE workshop and the 33<sup>rd</sup> CANU meeting. The beam requests of the individual groups were given in the open session of the CBAC#3 meeting (for the programme and the list of applications see the Addendum).

Closed sessions of the CBAC members took place on Thursday evening 16:00-19:10 and Friday until 12:00. The closed session was opened by Hans Ströher (Scientific Coordinator COSY) welcoming the participants listed above. Grigory V. Trubnikov (*CBAC member*), 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 in the CBAC session.

Hans Ströher summarized the status and strategy of the Research Center Juelich and the IKP in the framework of the POF-3 period (2015-2019) with emphasis on the adverse prospects of the IKP caused by a recent proposal of the Board of Directors of the FZJ in the course of the ongoing strategy discussion of FZJ. The IKP is in danger of liquidation end of 2019 including termination of future activities for the JEDI and FAIR (HESR, PANDA) programs and other activities of the IKP being part of international cooperation. However, such a decision would still need to obtain approval from the advisory committee of FZJ (Aufsichtsrat) which will meet mid March and in May 2016. In his report, Hans Ströher mentioned the new activities on neutrino physics, put forward by W2-Prof. Livia Ludova in her new W2 position at the IKP-2. After removal of the BIG KARL experiment, a new area became available for external experiments at COSY.

During the closed sessions, the CBAC discussed the situation of the institute and possible consequences for the affected communities and for the experiments and projects on which a large number of students, postdocs and scientific and technical staff have worked with great dedication over many years. Because of their intimate insight of the role of the IKP in science, the external CBAC members feel responsible to express their concern that the planned strategy may endanger the results of previous and ongoing efforts, and may damage the reputation of FZJ of attempting world class research and being a reliable partner. This is outlined in more detail in Sec. 4.

The directors of IKP were invited to join the closed sessions on Thursday evening and Friday morning. The beam time schedule and operation of COSY in 2015 as well as a tentative beam time schedule until April 2016 along with a skeleton for the available weeks in 2016 was presented in the open session by Dieter Prasuhn. In addition to requests of external users, the planned operation of COSY for 2016 includes 22 weeks of maintenance/shutdown, 8 weeks of machine development, and approximately 10 weeks both for FAIR and EDM activities.

An overview of all the applications to CBAC#3 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#3 are located on the web page

<http://www.ikp.fz-juelich.de/CBAC/documents/cbac03.html>

## **2. Summary of the discussion and recommendations**

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**2a) Procedure** For the sake of completeness, our system of rating is outlined as it was done in the previous recommendations. - After the proposals had been presented in talks in the open session and questions had been posed to the proponents from the audience and by CBAC members, a comparative discussion took place in the closed session. In particular, the proposals were scrutinized with special emphasis on

- (i) **Feasibility** (here other assessments, like POF review or accepted proposals, may enter; also boundary conditions imposed by the facility have to be considered)
- (ii) **Importance** (e.g. how important is it that this particular test needs to be done in this period)
- (iii) **Readiness** (e.g. an assessment of possible risks that elements required for the test are not available in time). It should be noted that the CBAC as external group can not make a complete assessment of possible delays. In his summary, the CBAC chair asked the proponents to put in there application more emphasis on a detailed validation on the readiness of the instrumental requisites necessary for the requested test.

All these considerations lead to a Rating A, B, C as explained above. As in the previous report, there is no total rating given at this time, 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 1.

**2b) Comments to Table 1** The relevant figures are listed for all 13 applications (Note that the one JEDI request E1 in period I/2015 is now split into three separate requests E 2, 3 and 5).

For the applications related to FAIR (D1, 2, 4; A 1, 2), the start of the installation of HESR and the time of first beam are decisive for the COSY schedule. In addition, one external irradiation proposal (D6) and one (A 5) on COSY Optics were submitted. All applications are supported by the committee,

including the past-deadline application A7+8 (tests of new COSY BPM electronics, and of loss monitors for ESS). For the other pillar of the program, preparations for the Search of the EDM of Ions (JEDI), a successful ‘Precursor experiment’, demonstrating the feasibility of this new method within the POF-3 period is of highest importance. Again, the proposals were ranked with high priority, but delaying some of the decisions to CBAC#4 in order to consider future progress.

Experiment	Request II/2015 [weeks]	Request 2016* [weeks]	Feasibility	Importance	Readiness	Recomm. 2016* [weeks]
D1 PANDA MVD	1	2	A	A	A	2
D2 PANDA STT	1	2	A	A (1 wk) B (2 <sup>nd</sup> wk)	A	1 (+1)
D4 CBM	1 (+1 in 1/16)	2.5	A	A	A	2.5
D6 INT Irradiation	2	18 shifts = 6 d	A	A	A	18 shifts = 6 d
A1 Machine Stochastic Cooling	1	1 mid 16	A	A	A	1
A2 Machine Electron Cooling	2	2	A	A (2 wks)	A	2
A3/5 Machine COSY Optics	3x3 shifts	1	A	A	A	1
A6 Med. Radionucl. development	-	1-2 shifts occasionally	A	A	A	As requested
A7 + A8 COSY-BPM & Loss-Monit. ESS	-	2	A	A	A	2 (for both requests)
E2 JEDI Polarimeter	1		A	A	→CBAC#4	(1)
E4 JEDI Pol Database	-	2	A	A	A	2
E5 JEDI RF-WiFi	-	2	A	A	→CBAC#4	(2) <b>Commissioning in 2016!</b>
E6 PAX TRIC	-	1+1	A	A	A	1+1
<b>SUM</b>	<b>14</b> (in 2015)	<b>20</b>				<b>16 (+4)</b>

**Table 1:** Summary of Evaluation and Recommendations of CBAC#3 for 2<sup>nd</sup> half of 2016. Items are: Experiment, number of weeks requested in rest of 2016, for comparison also for II/2015; and the three partial ratings. In the last column, a number of weeks for 2016\* is recommended for every application, based on the discussion in the closed session.

2016\* = remaining period in 2016; last column, in brackets: conditionally recommended.

A comparison of the requested (20/23 weeks) with the available weeks (19 weeks in the remaining period of 2016) shows that they are in reasonable proportion. The committee expects an increase of the requested beam time for detector and accelerator tests in future. A reliable prediction depends on the final FAIR timelines.

## 2c) Short reports and recommendations on individual proposals:

### Proposal D001.2      *Detector Tests for 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 as well as the entirely novel strip readout ASIC PASTA. Availability of these devices clearly defines the critical path for the MVD.

The proposal is fully supported, the amount of beam time fully justified.

*Ratings:*      Feasibility A                      Importance A                      Readiness A

*Recommendation:* 2 weeks in II/2016.

### Proposal D002.2      *Beam Request for STT Tests with dE/dx Readout for PID*

The PANDA-STT has grown quite mature. The entirely new ASIC-based front-end readout does however need to be evaluated in a realistic beam environment and full system setup as soon as possible in order not to cause project delays and proceed towards production readiness. A full scan over six beam energies appears not essential to this end.

CBAC recommends to realize this beam time request, advises however that one week should be sufficient to achieve the desired goals.

*Ratings:*      Feasibility A                      Importance A (1<sup>st</sup> wk)/ B (2<sup>nd</sup> wk)                      Readiness A

*Recommendation:* 1 week in II/2016.

### Proposal D004.2      *CBM Detector and Electronics Tests at COSY*

The CBM experiment has made significant progress in the past six months and presented valuable and encouraging beam test results on SEE effects for the STS-XYTER and on SEU mitigation techniques for FPGAs. The beam time requests for 2016 are well-founded and both relate to Production Readiness Reviews (PRRs) of critical detector components like the STS silicon sensors and readout chips. The committee is impressed by the scope and coherence of the proposed 2016 test beam campaign. Operating and reading out STS and GEM modules as a system will provide optimum tracking information and a stringent test of the DAQ system.

The requested amount of beam time is fully justified.

*Ratings:*      Feasibility A      Importance A                      Readiness A

*Recommendation:* 10 days in II/2016 (plus 1 week in II/2016).

Proposal D006.1      *Investigating Proton Induced SEE in Modern Microelectronics @ COSY*

While the past and first investigation of single event effects (SEE) at COSY by the Fraunhofer Institut für Naturwissenschaftlich-Technische Trendanalysen (INT) was plagued by experimental challenges, valuable experience was gained. The instrumental requirements for precision studies of radiation effects in space are now much better understood.

CBAC strongly encourages COSY and INT to continue their collaboration and endorses the beam time request for 2016.

*Ratings:*                      Feasibility A                      Importance A                      Readiness A

*Recommendation:* the requested 18 shifts.

Proposals A001.2      *Stochastic Cooling*

The proposal is to commission the kicker tank and pickup hardware and to explore the operational issues facing the cooling operation. Longitudinal Schottky band and betatron side bands and beam transfer functions will be measured. Operation of the notch filter will be optimized.

A potential issue with impedance is of concern. It is expected that a way to deal with interference from impedance can be specified after the upcoming beam time run.

Beam time request endorsed by CBAC

*Ratings:*                      Feasibility A                      Importance A                      Readiness A

*Recommendation:* 1 week in II/2016 (Stochastic. Cooling)

Proposals A002.1      *Electron Cooling*

The 2 MeV electron cooler at COSY remains a worldwide unique device as it combines high energy and a magnetized e-beam transport, which motivated a recommendation of a 2 weeks experiment run by CBAC#2. This run had to be canceled due to organizational problems. Additional studies are outlined in the new request. In particular, a beam dynamic model of the cooler is currently being worked out, which shall be tested and which is expected to be expedient for all kinds of further systematic explorations. Moreover, new experiments like interaction with the internal cluster target and operation with a modulated beam have been proposed. The CBAC endorses these studies and would be pleased to see new results at the time of CBAC#4.

*Ratings:*                      Feasibility A                      Importance A                      Readiness A

*Recommendation:* 2 weeks in 2016

Proposal A005.1      *Beam Study Topics: Precise COSY OPTICS Measurement and Modelling*

The goal is to determine precisely the linear optics of COSY using turn-by-turn BPMs. This allows to determine the Orbit Response Matrix and to compare with simulations. First encouraging results on such a procedure with the present BPM readouts obtained in an automatic procedure were shown. The project is important for precision studies and high intensity operation of COSY.

Beam time request endorsed by CBAC

*Rating:*                      Feasibility A                      Importance A                      Readiness A .

*Recommendation:* 1 week in 2016.

Proposal A006

*Medical Radionuclide Development*

The proposal aims at a continuation of the long-standing cooperation between the IMN-5 (Inst. für Neurowissenschaften und Medizin, FZJ) on radio-isotope production, but with beams from COSY of higher energy (100 – 250 MeV) for radio-isotopes not accessible with Cyclotrons. The task would be to explore isotope production for Imaging, Therapy and Isotope-Generators in a systematic way in a campaign of at least five years. This includes to measure excitation functions of production rates in order to find the best beam production conditions. Initial request: p (high int.) at JESSICA, momentum ~ 120 MeV/c. The requested beam times are strongly endorsed by CBAC.

*Ratings:* Feasibility A Importance A Readiness A

*Recommendation:* occasionally 1-2 shifts in 2016

Proposals A007/A008

*BPM Instrumentation for COSY and Beam Monitoring for ESS*

CBAC considers all experiments which serve to improve the beam diagnostics and the related feedback with the beam control system as very important. The installation of new BPM electronics will provide indispensable improvement for the EDM precursor, since it allows much better control of the closed orbit.

The activities related to the ESS (BIF monitor for internal, luminescent monitor for external beam) intensify the long standing, extremely useful output IKP is providing for other communities.

We recommend to investigate how these different projects can be organized in the most efficient way, probably several activities can be handled in parallel, including also the beam dynamics investigation (A.005).

*Ratings:* Feasibility A Importance A Readiness A

*Recommendation:* 2 weeks in 2016

JEDI general remark:

The Committee is pleased with the steady progress of the JEDI collaboration. We acknowledge that JEDI has laid down their strategy in a recent document which should be kept up to date. For the beam time requested here for the last period in 2016, we expect to hear a progress report at the next CBAC in June 2016.

Proposal E002.1

*JEDI: LYSO Crystal Testing for an EDM Polarimeter*

The request is part of the program to develop a polarimeter for stable beam rates, based on radiation-hard LYSO crystals. A test bench for in-beam tests has been set up at the BIG-Karl area of COSY. A first test is shifted into March 2016 because of machine problems in the planned Dec. 2015 run. In the new request aiming at beam time in Nov. 2016, it is planned to test a system of movable forward detectors with polarized deuterons. Stable polarization during the extraction is required. Lab spectra with Co source and internal radiation indicate very good resolution at higher energies.

*Ratings:* Feasibility A Importance A Readiness?

*Recommendation:* Move decision to CBAC#4 (June 2016), when the results of the March run will be available.

Proposal E004                      *JEDI: Polarization Database*

The experiment will measure effective Vector and Tensor analyzing powers needed to make a predictable modelling of polarimeter efficiencies for EDM measurements. The group has mastered sophisticated polarimetry experiments with similar hardware before, so the feasibility of this important experiment is given. An addendum (V. Hejny et al., Dec.19, 2015) requested by CBAC has clarified in detail status and schedule of re-building of the WASA site into a multi-purpose experimental area for R&D. The local coordinator, V. Hejny, is confident that the area is ready at the time of the fall 2016 maintenance period. The requested beam time in fall 2016 is 2 weeks deuterons and subject of these recommendations. A similar proton run is envisaged for early 2017.

*Ratings:*                      Feasibility A                      Importance A                      Readiness A

*Recommendation:* two weeks in 2016 - Progress report at CBAC#4 (June 2016).

Proposal E005                      *JEDI: RF Wien Filter*

This new instrument would enable to perform the so-called precursor experiment, i.e. to produce a vertical polarization build-up by the ion's EDM. For deuterium ions it would set the first EDM limit. A prototype has been commissioned, with separate generation of the RF E- and B-fields. A new design is ready for production, based on a parallel-plate wave guide to generate the appropriate field components.

It is recommended to shift the final decision to CBAC#4 (June 2016) when the date of completion can be estimated more reliably. Commissioning before installation should include Lab tests on all electrical and other properties. The committee stresses the importance of a test of the new device with beam before the end of 2016.

*Ratings:*                      Feasibility A                      Importance A                      Readiness?

*Recommendation:* Progress report and decision at CBAC#4 (June 2016).

Proposal E006                      *PAX/TRIC*

The experiment aims at detecting a T-reversal-violating observable in the double-polarized p-d scattering, measured by spin-dependent attenuation of the stored polarized proton beam in the tensor-polarized PAX deuterium target. A first positive test whether the beam life times are sufficiently long, has been conducted at COSY in 2012. Two weeks with polarized protons are requested for commissioning the polarized proton beam and the new beam current measurement system for TRIC.

*Ratings:*                      Feasibility A                      Importance A                      Readiness A

*Recommendation:* 2 weeks in 2016

### 3. Conclusions

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Beam time has been allocated including February and March 2016. The next available time slots for experiments are in May.

*Twelve* (plus two post-deadline) applications for beam time at COSY - in its role as testing ground for FAIR and place for future precision experiments - for the period II/2016 have been presented to CBAC#3, some of them with overlap to I/2017:

- *three* on detector tests for FAIR,
- *two* on irradiation and Isotope production,
- *three* on machine studies for COSY and HESR; here a post-deadline submission has also been discussed; see presentation on Electron cooling incl. post-deadline A007/BI & A008/ESS,
- *four* on preparations of the JEDI and the PAX/TRIC experiments.

A total of 16 weeks of beam time were recommended by CBAC#3 for scheduling after April 2016. In addition, the decision for 3 JEDI weeks (E002 and E005) has been shifted to CBAC#4 in June for a final review of Readiness. One out of two weeks of beam time for D2 was recommended with lower priority. The Committee stresses the importance that the RF Wien-Filter, which is time-critical for the precursor experiment, will be finished, installed and tested with beam by the end of 2016. The total sum of 19 weeks is about equal to the available beam time according to the present planning. Also, one week of beam time has been recommended for an external application of studying radiation hardness of semiconductor circuits, and for occasional short runs for medical radio-nuclides development. The committee is concerned that, compared with last time, no request have been put forward for short accelerator sessions for training students in accelerator science and technology. CBAC proposes that such training sessions are organized during setting-up and MD sessions.

The beam time recommendations for the period I/2017 are subject of a detailed evaluation of a CBAC session taking place 27-28 June 2016, i.e. well in advance of the period in fall 2016 and the start of the period I/2017.

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

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At the time of CBAC#1, a new role of COSY began

- (i) as Testing Facility for FAIR key technologies required to finalize the components for the HESR antiproton storage and the Detectors for the PANDA experiment the FZJ is responsible for, and -
- (ii) for conducting preparatory investigations on *srEDM* – a new method to measure the EDM of ions with unprecedented precision which is important for understanding the baryon-antibaryon asymmetry in the universe.

The committee is deeply concerned about the adverse consequences of the present FZJ strategy discussion on the future of IKP, as reported by the IKP scientific coordinator, Hans Ströher. The FZJ as Nuclear Research Center goes back to the year 1956 and was formally established in 1967. Later with the decline of Nuclear Power it diversified into several disciplines, in particular physics,



medicine, engineering and super-computing with applications in health, information, environment and energy. The proposed closure of the IKP after 2019 would severely contradict the current POF-3 program which became effective just a year ago introducing precision experiments at storage rings related to Cosmology as a new field. The committee asks the FZJ Board to consider the following arguments:

The COSY storage ring has evolved in the last two decades into a world-leading storage ring for spin-polarized light ions (p, d) of up to several GeV in energy, with a team of well-known experts, recently complemented by the new Chair of IKP-4, Professor Mei Bai, formerly at RHIC (BNL). COSY has been equipped with a powerful instrumentation for manipulating and detecting the spin of the stored particles. The recent result that the spins of stored bunches precess coherently over  $10^{10}$  turns is ground-breaking and enables novel precision experiments. Closing down COSY would delay such experiments for decades as the necessary research infrastructure can not be transferred to other places without severe damage. Chances for spectacular results with world-wide attention would be lost, devaluating the effort of researchers at FZJ and their partner institutions, and Hadron and Nuclear Science would disappear as a basic competence of the center.

COSY is in addition a test bench for FAIR equipment and storage ring operation in particular for the FAIR High Energy Storage Ring (HESR). In addition, tests of experimental equipment for PANDA and CBM are planned at COSY prior to the beam commissioning in the HESR at least until 2022. The preparation of HESR operation using COSY is essential, as beam commissioning time at FAIR will be quite short and must be very efficient. Closing down COSY far before the HESR commissioning will start, will be a massive hit of FAIR.

The Committee hopes that these and other arguments may persuade the decision making bodies of the FZJ to continue supporting the IKP so that it can continue its major and successful contribution to FAIR and realize its unique and important searches for the EDM of ions.

#### **Next CBAC session**

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The CBAC#4 session is scheduled to take place on June 27<sup>th</sup> - 28<sup>th</sup>, 2016 in the Forschungszentrum Jülich.



Erhard Steffens (CBAC Chair)

## AGENDA

### CBAC#3 2015 Meeting, December 17 and 18, 2015

#### Thursday, December 17<sup>th</sup>, 2015

Session Chair: Mai Bai

09:00 – 09:20 Hans Ströher  
*Status of Tests and Measurements at COSY*

09:20 – 09:40 Dieter Prasuhn  
*Status of COSY*

09:40 – 10:00 CBAC D001.2 MVD Kai-Thomas Brinkmann

10:00 – 10:20 CBAC D002.2 STT P. Wintz

10:20 – 10:40 CBAC D004.2 CBM J. Heuser

#### **10:40 - 11:10 Coffee**

11:10 – 11:30 CBAC D006.1 INT St. Höffgen

11:30 – 11:50 CBAC A001.2 St. Cooling R. Stassen

11:50 – 12:10 CBAC A005.1 Beam Study topics B. Lorentz

12:10 – 12:30 CBAC A006 Medical radionucl. S.M. Qaim/I. Spahn

#### **12:30 – 14:00 Lunch**

Session Chair: Hans Ströher

14:00 – 14:25 JEDI Achievements and Strategy A. Lehrach

14:25 – 14:40 CBAC E002.1 Polarimeter I. Keshelashvili

14:40 – 15:00 CBAC E004 Pol. Database E. Stephenson

15:00 – 15:20 CBAC E005 Wien-Filter F. Rathmann

15:20 – 15:40 CBAC E006 TRIC Y. Valdau

15:40 – 16:00 CBAC A002.2 e-cooling V. Kamerdzhev

#### **16:00 – 16:30 Coffee**

16:30 – 17:00 Gogi Macharashvili (FAIR-010)  
*Polarimetry development for EDM search: MC simulation for conceptual design*

17:00 – 17:30 Artem Saleev (COSY-125)  
*Progress in the understanding of systematic limitations of EDM searches at COSY*

17:30 – 18:00 Maria Zurek  
*Charge Symmetry Breaking with the WASA-at-COSY experiment*

18:00 – 18:30 Oleksandr Rundel (COSY-130)  
*Search for the eta-mesic helium with WASA-at-COSY*

18:30 – 19:00 Daniel Lersch  
*The eta-Meson Decay program at WASA-at-COSY*

#### **19:00 - Dinner**

## Friday, December 18<sup>th</sup>, 2015

- Session Chair: Kai-Thomas Brinkmann
- 09:00 – 09:40 Livia Ludova  
*JUNO*
- 09:40 – 10:10 Krzysztof Pysz (FAIR-023)  
*FEE-free readout system for time and energy determination in the Straw Tube Tracker*
- 10:10 – 10:40 Daniel Schröder (COSY-054)  
*Production of eta mesons in the quasi-free reaction  $p+d \rightarrow d+\eta+p_{sp}$  at ANKE*
- 10:40 - 11:10 Coffee**
- 11:10 – 11:40 Christopher Fritsch (COSY-054)  
*Studies on the reaction  $d+p \rightarrow {}^3\text{He}+\eta$  at the ANKE spectrometer*
- 11:40 – 12:10 Sergey Barsov (COSY-064)  
*Measurement of the analysing power in quasi-elastic pn-scattering at ANKE*
- 12:10 – 12:30 Summary of CBAC Recommendations
- 12:30 – 14:00 Lunch**
- Session Chair: Alfons Khoukaz
- 14:00 – 14:30 Yuri Valdau (COSY-124)  
*Preparation for the TRIC experiment*
- 14:30 – 15:00 Nils Hüsken (COSY-054)  
*Light meson production in pd-fusion at beam momenta between 1.60 GeV/c and 1.74 GeV/c*
- 15:00 – 15:30 Kay Demmich (COSY-054)  
*The decay  $\eta \rightarrow \pi^0 e^+ e^-$ : Current status of the analysis*
- 15:30 – 16:00 Coffee**