



## EDITORIAL BY OLIVER KESTER

The FAIR project is in a critical phase, because of the delay and a significant cost overrun in civil construction. In February 2015 a review chaired by Rolf Heuer, CERN director general, took place and revealed massive issues concerning the project management and structure. "The project is not in a status to be reviewed and is drifting and need to be driven". Even if FAIR@GSI has most ducks in a row, it does not alter the critical situation of the project. An important statement of the review is "the science case of FAIR is and will be world class", even if the operation starts beyond 2020. However, the review ranked the scientific pillars as a basis for considerations. Meanwhile a new management has been set in place that has to propose

a strategy for the FAIR project to the boards and needs to adjust the structure of GSI and FAIR according to the project requirements. A new project leader has been appointed with Dr. Jürgen Henschel who is filling a long lasting vacancy. The strategy process is presently ongoing and will lead to a change of the structure of FAIR@GSI as well. It will be important that all people support this process and the FAIR project, irrespective of the outcome of this change process. We have the qualified personnel on campus and need to set the conditions to lead the project to its success. We are supported by external expert boards. The new Machine Advisory Committee (MAC) chaired now by Thomas Roser, Brookhaven National Laboratory, did

confirm the excellent scientific and technical work of FAIR@GSI, but did recommend also required changes.

I am convinced that the people of GSI and FAIR together with our international partners will be able to conduct the required work to complete a world class accelerator facility.

I want to thank all people for their excellent work and want to motivate all of you to support the FAIR project with most diligence and drive as in the past.



FAIR@GSI Project leader  
Oliver Kester

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## INTRODUCTION

Today I would like to introduce our sixth issue of the FAIR@GSI-Newsletter. I would like to open this issue with a citation from the founder of the automobile manufacturer Ford Motor Company. Henry Ford I. once said: **"Coming together is a beginning; keeping together is progress; working together is success."**

I believe in these words, we only can successfully complete this project and achieve our goals together. Similar words also chose our new Scientific Director ad interim, K.-H. Langanke, in the last employee meeting. It is important that all of us are working

together. We would like to welcome Prof. Dr. Langanke and Dr.-Ing. Jürgen Henschel in their new positions and we are looking forward to a good and fruitful cooperation.

You may look forward to a report on the FAIR Research collaboration NUSTAR and the 35th HESR consortium meeting, which took place at the FZJ as well as other interesting articles. Your comments and contributions are always welcome. I am looking forward to hearing from you. Please enjoy the read!

Best regards,  
Nuray Simoes



## STORING OR TO BE STORED – THE FATE OF FAIR STORAGE RINGS

Recently Dieter Prasuhn, the machine project leader of the HESR, gave an additional sense to the term „storage ring“: a ring which will be stored!

The reason for this statement became obvious during the 35th HESR consortium meeting which took place at the Forschungszentrum Jülich from January, 26th to January, 27th. The HESR component productions progresses so well that most of them will be ready for installation before the HESR building will be ready to accommodate them. The delivery of the last of the 84th quadrupole magnets, for example, is expected for the second quarter of 2016. The totality of components of the HESR is scheduled to be „ready to move into tunnel“ latest in 2017. Therefore the HESR will very likely experience the same fate as its smaller brother – the CRYRING – who had to be patient for the clearance of Cave B. Given the well advanced project status the discussion of the thirty experts from Jülich, Darmstadt, Bonn and Romania focused on quality assurance issues like magnet testing, maximum bake out temperature for components and the different test stands. Given the dense package of components within the arcs of the HESR the assembly and alignment of a full cell was proposed and discussed. Another significant part of the

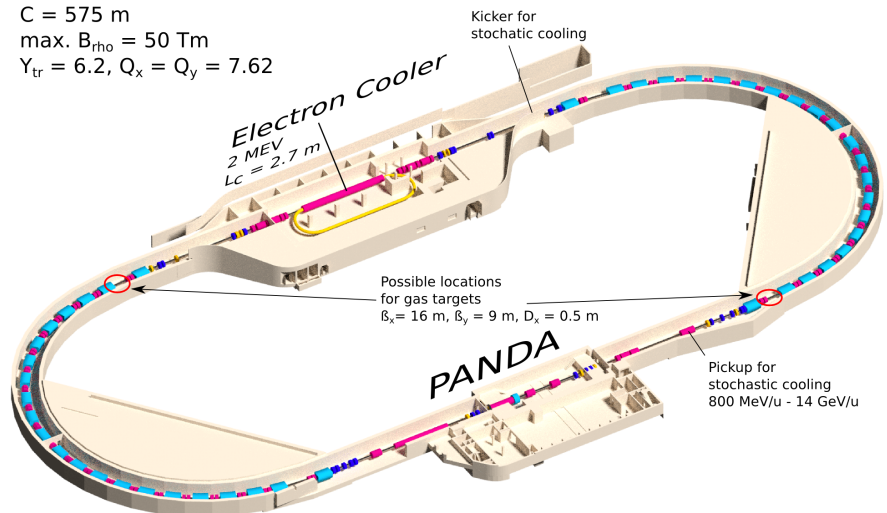
meeting was dedicated to beam commissioning issues. Momentum spread versus momentum acceptance, impedance budget and ion trapping are examples. Again it was made clear that the HESR will only accept beam pulses from the CR at best every 10 seconds and for pulse lengths not longer than 500 ns. An interesting feature of the HESR will be to shape with the barrier bucket RF system an user optimized potential and then use the stochastic cooling to „drive“ the beam into it. Also the different operation modes were presented and discussed together with the experimen-

talists from the PANDA and SPARC collaborations. This included the actual view on achievable luminosities, vacuum windows for laser beams, control of PANDA magnets, shutdown periods and fast vacuum valves for protection. Last but not least Prof. Mei Bai was welcomed as successor of Prof. Rudolf Maier. The meeting was considered by all participants to be very fruitful. It was agreed to meet again in autumn 2015 at FAIR/GSI.

Written by  
Udo Weinrich

### HESR

$C = 575 \text{ m}$   
 $\text{max. } B_{\text{rho}} = 50 \text{ Tm}$   
 $Y_{\text{tr}} = 6.2, Q_x = Q_y = 7.62$



## OPERATIONS

**Peak Chaos** – We are looking back on a challenging operation year 2014. After the long shutdown, in January 2014 the re-commissioning began under special conditions, as the focus should be on accelerator experiments, which are challenging already under normal circumstances. Many special settings were needed and the experiment and setting change cycles, increased from few times a week to several times a day, or in some cases,

even per hour. Since the operating team was strongly reduced in forecast of the large break in operation before the FAIR-commissioning, it was no longer possible to fill a continuous 3-shift operation workplace with experienced operators and so substitutes had to be provided by other departments. But the gaps could be closed only partially. Taking this into account, the accelerator experiments were scheduled only in the day shifts and

the experts themselves exceptionally became shift participants. This in turn led to a very complex beam time schedule, as the experiment program was similar to that of 2012 in every way. Several times a day the whole setup was changed and both, operators and experts from the specific groups did a great job. Because of performance issues and the obvious misalignment of the ring, the SIS shutdown was brought forward to



May 2nd and the break was used to realign the SIS completely. The beam time was interrupted, moved and extended several times. In the 2nd beam time block several cases of illness of the operating personnel led to acute staff shortages and to top it all, in October our operation head Uwe Scheeler left GSI for MIT and with him a man of enormous experience in accelerator operation. On this path we wish him again good luck with the commissioning of the ion therapy facility in Marburg.

In comparison to 2012 the total downtime increased by 47%, as it could be expected under this circumstances. However, almost the entire experiment program could be processed successfully. So, thanks again to all involved who made this possible.

#### *After the beam time is before the beam time*

In contrast to the conditions during the last beam time, the perspective for the current year is much less critical. Since the SIS18 cannot be operated and serviced in 2016 because of the construction work for GaF, important maintenance work must be scheduled this year. For this reason, in 2015 experiments can take place only at the UNILAC. Additionally, the UNILAC will not reach its full performance, so the experimental options are limited this

beam time. Not everything will be possible. But nevertheless experiments are being planned for material research, the super heavy elements program, biophysics and of course many UNILAC accelerator experiments. Due to the limited program, only 2 operators on shift will be needed and for this reason the shift personnel is likely to be sufficient this year. Bottlenecks are actually to be expected only during the holiday period, but we are going to manage this.

After extensive work on the UNILAC-RF and other systems, the commissioning is again a challenge, especially since the control system has reached the end of its service life. Immediately after the beam time, VMS is to be switched off forever.

The beam time has now been confirmed by the GSI Management (GF) and starts on 06/07 2015 with the commissioning and ends on 11/12 2015. A detailed beam time schedule is being planned at the moment and will be communicated as soon as possible.

#### *Quo Vadis operating*

... and the future? Well, until mid-2017, there will be no more operation on the current state of planning. The freed resources will be delegated back to other departments and beside the coordination of GSI-wide shutdown

work, the reduced operations department will extensively focus on preparations of the FAIR operation. This includes creating an operational concept for FAIR, planning the re-commissioning after the long shutdown in 2017 and the FAIR commissioning itself. Associated with this, another focus lies on planning and designing the new FAIR main control room. Of course our new workplace is very important to us, because here we will spend most of our time in the next decades of GSI/FAIR operation.

As things stand, in 2017 we will have a lack of at least 15 operators and we will not have much time to build a powerful new operating team. At the end they must be set and ready for their new job. Since the operation of FAIR will fundamentally change, also experienced GSI operators must deal early with the new tools and machines. So the most important point, with which the operation department is going to be busy in the next 2 years, will be the recruitment and training of future shift personnel. The small CRYRING will play an important role in this subject, as it will be the first accelerator at GSI to be driven by the new FAIR-accelerator control system.

*Written by  
Stephan Reimann*

## **GSI VISITED INDIA (PUNE/DELHI)**

The Bose Institute in Calcutta is the in-kind partner of GSI for the beam diagnostic vacuum chamber for the high energy beam line transport (HEBT). The Bose Institute remits the production to subcontractors. The selection process is supported by GSI. In 2014 a preselection took place and two companies were identified as appropriate.

In January 2015, the two companies were audited to determine the commissioning partner. For support and advice to the Committee of the Bose Institute, Detlef Grünberg (QA)

and Lukas Urban (CSVS) were resent at the audits.

The two-week visit was the assessment and evaluation of both companies regarding the presentations of the manufacturing and testing processes, documentation and process flow and descriptions, as well as the manufacturing facilities of the company and its principal subcontractors. The presentations of both companies were good and comprehensive, the discussions, in particular on technical issues, were always compartmental-

ized and fruitful. The other aspect of this visit was to strengthen cooperation with Mr. Barua from IUAC in Delhi. Mr. Barua has been commissioned to carry out the QA activities in India. He is an excellent vacuum expert and is excellent prepared due to his previous activities in the topics production, welding, cleaning and transport. A common Factory Acceptance Test for prototype and FoS is intended.

*Written by  
Detlef Grünberg*



## STORI`14 – 9TH INTERNATIONAL CONFERENCE ON NUCLEAR PHYSICS AT STORAGE RINGS

The STORI`14 conference was held from September 29 to October 3, 2014 at Sankt Goar, Germany, a picturesque little town, located at the Rhine river close to the famous “Loreley” within the UNESCO world heritage “Mittleres Rheintal”. It was hosted by the GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany. The conference was the 9<sup>th</sup> of its kind, and followed the previous conferences held at Lund, St. Petersburg, Bernkastel-Kues, Bloomington, Uppsala, Jülich, Lanzhou and Frascati. The purpose of the conference was to provide a forum for the international research community, including accelerator experts as well as experimentalists working at storage rings and theoreticians, for the presentation and discussion of all aspects of nuclear physics at storage rings and related fields. In this spirit the topics covered:

- a large variety of physics experiments concerning not only nuclear physics, but also atomic physics, hadron physics, fundamental symmetries and interactions, sub-nucleonic degrees of freedom, and accelerator physics,
- technologies for providing cooled, stored, stable and radioactive beams and their diagnostics, and
- instrumentation for various in-ring experiments.

Special emphasis was also put on perspectives at future facilities, presently under construction or planned. In addition, some related fields, like physics and techniques of ion traps and electrostatic rings, were also featured.

In spite of the variety of the physics questions addressed, which often are quite diverse, it was realized that the common basis is the research instrument used: all experiments benefit from the unrivalled potential provided by using stored and cooled beams. In this spirit the conference offered the

opportunity for a lively discussion on common (not only technical) problems, and for exchanging new and challenging ideas.

The conference was received with significant interest amongst the community with an all-time record of 120 participants from 20 countries all over the world. The scientific program consisted of 68 plenary oral presentations, including 9 invited review talks, 25 invited topical talks, and 33 contributed talks, as well as 45 poster presentations.

The conference opened with two review talks, one by I. Meshkov, covering various aspects of storage ring operation and beam cooling, and the other by K. Langanke, who gave an impressive overview on modern quests in nuclear astrophysics from the theoretical point of view. The field of physics experiments at storage rings was covered by two review talks given by P. Woods on nuclear structure and nuclear astrophysics experiments, and by A. Khoukaz on hadron physics experiments. All aspects of atomic physics with highly charged heavy ions at storage rings were covered by a review presented by A. Surzhykov, whereas review talks by K. Blaum and H. Schmidt covered the fields of ion traps, and electrostatic storage rings, respectively. The series of review talks was continued by impressive presentations on fundamental symmetries and interactions by K. Jungmann, and on future radioactive beam facilities by S. Gales. The conference program was completed by a number of topical invited talks and contributed presentations, covering all aspects and topics of the conference discussed above. In particular, the major new facilities which offer great perspectives for the field were also discussed. These are the HIAF project in China, the NICA project in Russia, the RIKEN Rare-Ring in Japan, the TSR@ISOLDE pro-

ject at CERN and the international FAIR project in Germany.

One evening was devoted to the well-attended poster session, which opened the opportunity to discuss a good number of interesting topics in a relaxed atmosphere. In the closing session a summary of the conference was presented. For this purpose the organizers had invited three young scientists who actively participated in the conference to present their point of view of the conference week, instead of inviting an experienced senior scientist for this duty. S. Kraft-Bermuth, D. Doherty and S. Litvinov presented impressive summaries covering the three fields of atomic physics, nuclear physics, and accelerator physics, and there was a common agreement, that this “experiment” was a full success.

Throughout the conference, active discussions during the sessions were continued during coffee and lunch breaks for which sunny weather and the garden of the conference location Schloss Rheinfels provided a spectacular ambience. The participants also enjoyed the conference excursion which introduced them to the UNESCO world heritage “Mittleres Rheintal” and its world famous collection of castles by a boat trip along the Rhine river from Sankt Goar to Rudesheim. After a short hike at Rudesheim with spectacular views on the Rhine valley the boat trip was continued with a stop at Bacharach for a wine tasting in the yards of a winery.

During the conference dinner, held at the Rheinfels Castle, the three best poster presentations were awarded. The winners were M. Dolinska, M. von Schmid and F. Suzaki. The awards were sponsored by the representatives of the journal *Physica Scripta* which was also chosen to publish the proceedings of the STORI`14 conference.



On the meeting of the International Advisory Committee it was decided that the next STORI conference STORI`17 will be organized by the RIKEN Nishina Center, Tokio, and will be held at Kazawa in Japan. Having in mind that within the next three years a number of new storage ring facilities will come into operation, providing a lot of interesting experimental opportunities for our community, we are looking forward to an interesting conference program of the next STORI conference in 2017.

*Written by Peter Egelhof,  
Yuri Litvinov and Markus Steck*



## FAIR RESEARCH COLLABORATION NUSTAR – FAIR MAGNET COMPLETED IN FRANCE

The GLAD magnet – a totally new development weighing in at 60 tonnes – has now been completed in Saclay, France. The magnet will separate charged particles from uncharged neutrons for the NUSTAR experiment at FAIR. The NUSTAR researchers intend to examine the characteristics of rare and extremely unstable atomic nuclei with large numbers of neutrons and how they are created in supernovae. In this manner the scientists would ultimately like to find out how our elements have been created in such massive starbursts.

Some 50 engineers and scientists at the French technology research center CEA in Saclay – with the support of industry partners – have, over a period of many years, developed a superconducting magnet for the R3B experiment in the NUSTAR collaboration at FAIR, the GLAD magnet (GSI Large Acceptance Dipole). In the R3B experiment NUSTAR scientists will examine extremely rare and highly neutron-rich nuclei, which for the first time may now be created at the FAIR complex in sufficient amounts as a secondary beam. If such neutron-rich atomic

nuclei fly close to other atomic nuclei of the so-called target, they are excited, oscillate and collapse, by emitting neutrons for example. Thus they reveal to scientists something about their structure, for instance the formation of neutron skins. Thus they can possibly answer the fundamental question of why uncharged neutrons in certain numbers can stabilize atomic nuclei such that it was possible for all the heavy elements such as lead, gold and uranium which we now find on earth to be formed in supernovae (starbursts).

The GLAD magnet separates the charged particles from the uncharged neutrons directly behind the target and thus allows for their analysis. The particular technological challenge: the magnet has a large horizontal and a large vertical angular aperture so as to measure both charged particles and nuclear fragments. At the same time it creates a strong, highly homogenous magnetic field. This is necessary because the particles have a large momentum. In addition, the superconducting magnet coils do not have an iron core to amplify the magnetic

field, thus making the magnet an overall “lightweight” of merely 60 tonnes. For this reason it can be transported by road as a heavy load from France to Darmstadt.

### Further information:

<http://www.fair-center.de>

<http://irfu.cea.fr>

*Written by  
Markus Bernards  
FAIR GmbH*



**In the French Technology Research Center CEA Saclay the superconducting coils of GLAD were inserted into the cryostat, with which the magnet can be cooled down to 4.5 Kelvin**



## COMPUTER-AIDED OPTIMIZATION OF ACCELERATORS

GSI Helmholtz Centre for Heavy Ion Research has hosted a three-day long workshop on Computer-Aided optimization of Accelerators (CAoPAC) organized by the fellows of the [oPAC](#) network from 10 – 13 March 2015.

The workshop was attended by more than 50 delegates from all across Europe. It included sessions about modelling of optics and beam dynamics, control systems and data analysis, generation and propagation of synchrotron light, and particle physics simulations for accelerators.



The workshop was opened by the project coordinator, [Prof. Carsten Welsch](#) from the [University of Liverpool](#), with a talk about the oPAC project and the use of numerical tools for accelerator optimization. Two beam dynamics experts from CERN then covered commonly used accelerator design codes and how frequency maps can help understand and optimize beam dynamics in accelerators. Their talks were followed by several contributions about tracking codes that allow taking more complex effects such as space charge or fringe fields into account to yield a detailed understanding of beam motion. Monday afternoon then focused on beam life time and dynamic aperture studies with emphasis on third generation synchrotron light sources where this problem is of particular concern.

A special highlight was a guided tour of the GSI experimental facilities on Thursday morning. In the afternoon workshop participants had the opportunity to present and discuss

their research in a dedicated poster session.



The last day focused on light generation processes and how this can be adequately modelled with advanced simulation tools, such as the commercial ZEMAX software. The event concluded with a presentation by oPAC Fellow Manuel Cargnelutti from Instrumentation Technologies about the actual organization of this particular event. He highlighted how the idea for this topical workshop was developed by the oPAC fellows who were in charge of event planning and execution with the support of the [EU Project TEAM](#) based at University of Liverpool. He said: “Organizing this workshop provided us with the unique opportunity to be in charge of a whole event from scratch, with a limited time-frame, limited resources, and the challenge of offering an interesting event to attract a good number of participants. We started more than a year ago with our preparations and are delighted that we succeeded in putting together such an excellent workshop, attracting 51 participants from 18 institutions across Europe.”

The oPAC fellow at GSI, Xiangcheng Cheng, did a splendid job acting as a host and organizing the local arrangements.



Further information about the event and all presentations can be found on the [workshop Indico page](#). The network is much obliged to all the fellows who contributed to the success of the event.



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 289485.



*Marie Curie International Training Networks aim to improve career perspectives of early-stage researchers in both public and private sectors, thereby making research careers more attractive to young people. This will be achieved through a trans-national networking mechanism, aimed at structuring the existing high quality initial research training capacity throughout Member States and associated countries. In particular, they aim to add to the employability of the recruited researchers through exposure to both academia and enterprise, thus extending the traditional academic research training setting and eliminating cultural and other barriers to mobility. Grants are awarded through a highly competitive process.*

Written by  
Ricardo Torres  
EU Project Manager - oPAC



## THE CALENDAR

## MAY 2015

M	D	M	D	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

- 04.05. - 08.05.2015 **IPAC 2015 in Richmond, USA**  
 13.05.2015 **AAB-OB** (More info: Frank Becker)  
 27.05.2015 **GSI Machine Meeting** (More info: Natalya Winters)  
 28.05.2015 **In-kind Meeting** (More info: Peter Busch)

## JUNE 2015

M	D	M	D	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

- 08.06. - 12.06.2015 **CRC 634 concluding conference, Darmstadt**  
 10.06.2015 **AAB-OB** (More info: Frank Becker)  
 11.06.2015 **In-kind Meeting** (More info: Peter Busch)  
 22.06.2015 **93. GSI-Aufsichtsratssitzung**  
 24.06.2015 **GSI Machine Meeting** (More info: Natalya Winters)  
 25.06.2015 **In-kind Meeting** (More info: Peter Busch)

## JULY 2015

M	D	M	D	F	S	S
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

- 08.07.2015 **AAB-OB** (More info: Frank Becker)  
 09.07.2015 **In-kind Meeting** (More info: Peter Busch)  
 22.07.2015 **GSI Machine Meeting** (More info: Natalya Winters)  
 23.07.2015 **In-kind Meeting** (More info: Peter Busch)  
 29.07. - 31.07.2015 **HIC4FAIR-Workshop Detectors & Accelerators**  
 (More info: Paola Lindenberg)

## AUGUST 2015

M	D	M	D	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

- 05.08.2015 **AAB-OB** (More info: Frank Becker)  
 06.08.2015 **In-kind Meeting** (More info: Peter Busch)  
 19.08.2015 **GSI Machine Meeting** (More info: Natalya Winters)  
 20.08.2015 **In-kind Meeting** (More info: Peter Busch)



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Much appreciated contributions by:

Markus Bernards, Peter Egelhof, Detlef  
Grünberg, Paola Lindenberg, Yuri Litvinov,  
Stephan Reimann, Markus Steck, Antje Stohl,  
Ricardo Torres, Lukas Urban, Udo Weinrich  
and Lea Wunderlich.

We would like to extend a warm  
welcome to all new colleagues  
at FAIR@GSI.



We congratulate Christian Brabetz, Anton Belousov,  
Klaus Klopfer, Jochen Grieser and Xinliang Yan for their  
recently passed PhD Defenses!



## OUR FUNNY SIDE

We welcome any contributions to the  
comic section. Whether they are jokes,  
cartoons, funny pictures, etc. They will  
all be considered for publishing in the  
next issue.

We look forward to getting to know  
your funny side!

