3rd BRIKEN Collaboration Workshop
IFIC-Valencia, 22-24 July, 2015
*** Workshop Minutes ***

Participants (27):

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Event webpage: http://indico.ific.uv.es/indico/event/briken3

Introduction

The workshop was divided in four sessions. The first session was dedicated to present and discuss the status of the facility and opportunities at RIKEN (K.Gabor), the status of the instrumentation (A.Estrade for AIDA, K. Rykaczewski, A. Svirikhin and P. Calviño for the 3He tubes) and to introduce and summarize the two approved experiments in the 78Ni (K.Rykaczewscki) and 132Sn (G.Lorusso) regions. The second session (1st day PM) was devoted to discuss the detector geometry after results from MC-simulations by the RIKEN group (P.Vi), UPC (G. Cortés) and IFIC (A.Tarifeño). The third session (2nd day) was dedicated to summarize the status of the data-acquisition system (J.Agramunt), to review the status of the available resources, electronics, human-power (J.L.Tain) and to plan the commissioning and approved experiments. The last session (3rd day) was dedicated to present new experiment proposals and to summarize the main conclusions of the workshop.

Setup and location

The first aspect discussed during K.Gabor presentation was the location of the BRIKEN setup. There are two possibilities, F11 and F12.

F11 has the drawback that EURICA is placed in its focal plane, and will remain there until summer 2016. There seems to be a decision to remove EURICA by summer 2016, which would allow us to set-up BRIKEN at the F11 focal plane, in case that the experiments are scheduled after summer. Otherwise, putting BRIKEN beyond (downstream from) EURICA/F11 nominal position may lead to worse beam conditions (broader beam) and probably larger beam-induced backgrounds.

The alternative position is F12. However, the total space available here seems too short (3.4 m along the beam-line) to accommodate both BRIKEN+AIDA and has the additional drawbacks that i) one needs to remove two pieces of beam-pipe (which seems to be an issue) and ii) there may be direct neutrons coming from the production target.

→It was agreed that **F11 is the preferred option**. The **access period of F11 is from November 2015 until April 2016**. The beam-height at F11 is 200 cm.

Regarding the availability of Clover detectors, K.Gabor reported that 5 units are at RIKEN, however 2 of them are being used and the other 3 units are damaged and need to be repaired.

K.Gabor also reported that the measured (black) PE density was of 0.938 (3.3%). This is the material that will be used to produce the full matrix.

Worth to mention the **limited manpower available at RIKEN** for BRIKEN: S.Nishimura, K.Gabor and P.Vi. Has to be considered in the planning of the set-up, commissioning, experiments, etc.

Calibration neutron sources

For the neutron efficiency calibration of the BRIKEN detector a 252Cf source is being calibrated using the EURICA array. K.Gabor and the local team are taking care of this. K.Gabor to report on the progress of this.

G.Lorusso reported about several calibrated neutron sources that may be available from NPL (UK). In particular G.Lorusso will explore the possibility to ship calibrated Cf and AmLi sources to RIKEN, which will be good to calibrate the detector efficiency over a broad neutron energy range.

AIDA status and proposal with WASABI

A.Estrade reported on the status of the AIDA detector and showed latest results from a test carried out at BigRIPS F11 using 3 DSSDS (BB18). These results demonstrate the successful DAQ integration and synchronization and capability to do time-correlations and get beta-decay half-lives (examples were shown for 88Ge, 100Sr and 99Rb).

K.Gabor reported on behalf of Shunji Nishimura, that it is his aim to present a proposal at the next NP-PAC which includes the use of WASABI or WASABI&AIDA. It was thoroughly discussed on the advantages and disadvantages of WASABI versus AIDA. Whereas the low beta-threshold achieved with WASABI (100 keV versus 160keV for AIDA) is a clear advantage in terms of efficiency, the main drawback seems to be the relatively large dead-time (in previous experiments the dead-time was of 25% already at trigger-rates of 500 Hz). There was a **clear consensus by the representatives of the two approved experiments, that at the expected trigger rates of 2-3 kHz, it is clearly better to use AIDA** owing to its low dead-time (about 10 mu-s).

Further advantages of using AIDA comprise the large area of its Si-sensors (64 cm2 (8x8) versus 24 cm2 (6x4) of WASABI) and the large number of DSSDs (8 mm versus 3 mm). In addition, work is ongoing in order to attain a lower threshold with AIDA by implementing new kapton cables. The idea is to have some results before December 2015. TDavinson to report on the progress of this. The use of WASABI with the present PE-matrix design, will also imply a refurbishment of its housing. The new WASABI enclosure could have a size of 130mm x 130mm, which is not compatible with present PE-matrix designs (a new PE-matrix will be needed if WASABI is used).

3He tubes status and Clover detectors

ORNL: K.Rykaczewski reported that the 64 (2 inch) plus 17 (1 inch) tubes from ORNL are readily available at RIKEN together with preamps, power supply and cables. In addition he mentioned the possibility to ship two EXOGAM clover detectors from USA, which were already included in the MTA (should be straightforward shipment and not expensive). Another options (for an hybrid geometry, see below) would be to use CAGRA Clover detectors available at Osaka (however required for an experiment in April).

JINR: A.Svirikhin reported that 20 tubes are available from JINR. Here one has to consider the following aspects: 1) the tubes have a different diameter (30mm) than the rest of tubes in the setup (one or two inches) and therefore cannot be exchanged, 2) a preamplifier bias supply of 5-to-6V is needed , 3) cable connectors are not standard connectors (one needs to adapt them to make them compatible with the frontend electronics and HV-supply) and 4) no additional electronics for High-Voltage or Preamp Bias Supply are available (just the tubes). The plan reported by A.Svirikhin is to have an agreement between JINR and RIKEN signed by September 2015, get the export permission by December 2015 and proceed with the shipment by January 2016. A. Svirikhin to report on the progress of the shipment.

UPC+GSI: P.Calviño reported that he will ship two 3He-tubes to RIKEN ASAP in order to test the procedure. If successful, the other 40 tubes will be shipped by the end of this year. P.Calviño to clarify with I.Dillmann permission to send the 10 GSI tubes together with the UPC tubes. P.Calviño to report on the progress of the shipment to RIKEN.

BRIKEN MC Simulations

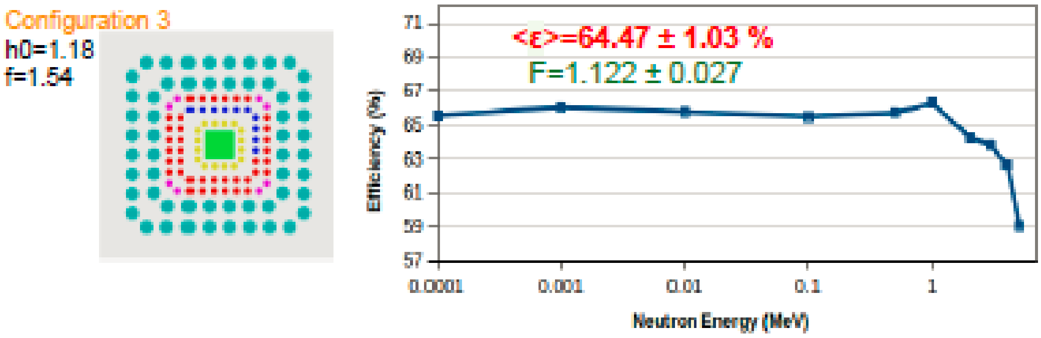
The second session comprised the presentation of the latest results by the groups of RIKEN (P.Vi), UPC (G.Cortés) and IFIC (A.Tarifeño). First, AT reported on the results of the benchmark simulations carried out by the three groups using Geant4 and MCNPX. This work was triggered after discrepancies found in the past for BRIKEN geometries simulated by different teams/codes. The conclusion is that only **small discrepancies in the neutron efficiency, of less than 2%, were found between the different teams/codes**. Previous discrepancies have to be ascribed mostly to differences in modeling the details of the detector geometry and probably to some other parameters in the simulation such as the temperature of the PE.

The results of the BRIKEN simulations made by the three different teams can be found in the slides available in the workshop website.

A summary is reported in the following. In principle all simulations include the same geometry constraints (same hole size for AIDA, min. 4mm distance between tube-holes, etc). Performance values have been calculated for the same energy grid and up to neutron energies of 5 MeV.

RIKEN Geant4 (P.Vi) MC Simulations:

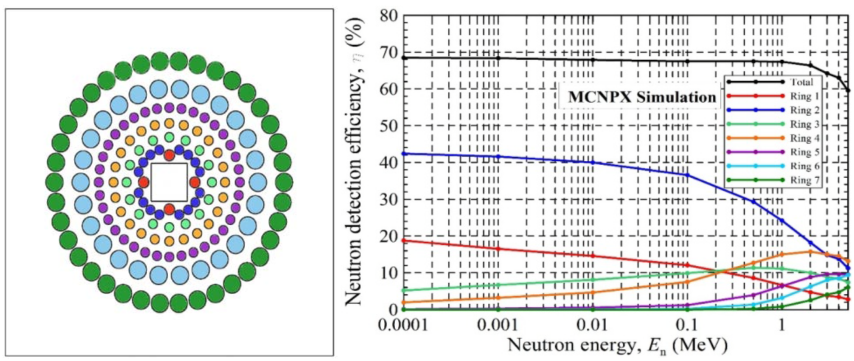
A compact geometry (136 tubes) was proposed showing 64% average efficiency and a flatness of 1.12 up to 5 MeV.



Several hybrid-geometry configurations were also calculated, such as the one with 136 tubes and ONE HPGe EXOGAM Clover detector, which shows 60.96% efficiency and 1.12 flatness.

UPC MCNPX (A.Riego/G.Cortes) MC Simulations:

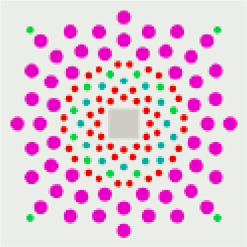
Compact geometry simulations were carried out for 172 tubes yielding a mean efficiency of 66% and a flatness of 1.15.



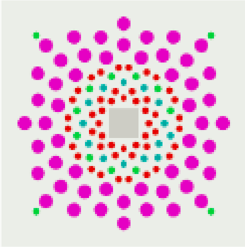
IFIC Geant4 (A. Tarifeño Saldivia) MC Simulations:

Results were presented for compact and an hybrid geometries, all of them with 138 tubes.

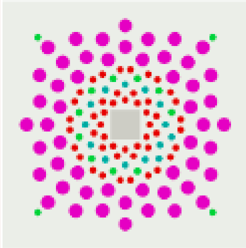
The performance of the compact geometries show average efficiencies between 65% and 77% and flatness-factors between 1.09 and 1.4.



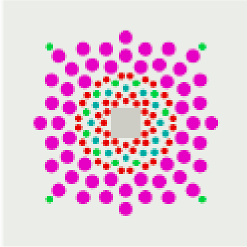
Maximum flatness:
F = 1.088 ± 0.019
$\langle\eta\rangle$ = 65.5% ± 0.7 %



Flatness around 1.12:
F = 1.116 ± 0.02
$\langle\eta\rangle$ = 69.4% ± 0.8 %



Flatness around 1.15:
F = 1.145 ± 0.02
$\langle\eta\rangle$ = 70.9% ± 0.8 %



Max. aver. efficiency:
F = 1.409 ± 0.024
$\langle\eta\rangle$ = 77.4% ± 3 %

The hybrid configurations for two exogam clover detectors show average efficiencies between 50% and 63% and flatness-factors between 1.037 and 1.3.

More results about an hybrid-flexible configuration and the flatness-impact in the Pn-value for realistic hard/soft neutron energy spectra can be found in the presentation by A.Tarifeño.

→After the simulations session and during the following day discussion session the “best geometry option” was discussed. On one hand, the “78Ni region team” prefers the hybrid configuration to have the possibility to get a deeper insight into the nuclear structure aspects by means of g-ray detection and to check systematic effects. On the other hand, the “132Sn-region team” rather prefers a highest-possible efficiency in order to access multiple n-emitters and low-yield n-emitting isotopes. Finally, **it was agreed that we will start with an hybrid BRIKEN setup, such as the one shown by A.Tarifeño (Eff_n = 63% / F=1.3, 2xHPGe) and we will prepare and implement this setup in the commissioning and in the first experiment (78Ni-region). Afterwards, depending on the performance of the system, and the usefulness of the HPGe detectors, the “132Sn-region team” will decide whether they use such hybrid geometry for their experiment, or if they better construct a compact geometry with higher neutron efficiency and no gamma detection.**

Another aspects discussed concern:

- the possibility to implement a shorter moderator (in the beam direction) of e.g. 70cm instead of 80cm, a feature which will help to shorten the Kapton-cables of AIDA, thus leading to lower noise and lower thresholds. ATarifeño to check this point in his MC-simulation.
- considering A.Tarifeño’s hybrid geometry, one could try to see if the Flatness improves by adding e.g. JINR tubes at large radii. ATarifeño to check this point in his MC-simulation.

Data acquisition

J. Agramunt presented an overview of the activities carried out so far by the three teams involved: AIDA-DAQ, BRIKEN-DAQ and BigRIPS-DAQ.

The milestones achieved so far comprise first pulser-tests at Daresbury (Dec.2014), Pulser tests of the three systems at RIKEN (Feb. 2015) and parasitic test at RIKEN (May 2015).

Here it was concluded that a DAQ-Team, to clarify online/offline of the three systems is really needed. A DAQ working group which includes J.Agramunt, A.Estrade, BigRIPS (P.Vi) and experiments representatives, etc has to start working on this topic.

Planning of commissioning and experiments

We discussed and agreed to:

1) **set-up the full system**: AIDA + BRIKEN Hybrid in B3F (third floor underground) starting set-up, cabling, dacq, etc starting latest on **January/February 2016**.

2) carry out a **pre-commissioning with calibrated sources** at B3F during **February-March 2016**. The availability of B3F for this purpose has to be checked with S. Nishimura and the local responsibles.

3) run a **commissioning** with dedicated beam-time (BigRIPS setting) using the full system. The aim is to run it early in the first beam-block **(> April 1st)** if the commissioning proposal is approved at the MT-meeting and if 238U-beam is available.

To run a commissioning with dedicated beam-time implies that we must: 1) fill several forms (K.Rykaczewski) which are kind of complicated and for which the help of the local group will be very welcome (S.Nishimura, K.Gabor, G.Lorusso,…), and 2) to do a short presentation at the machine-time meeting (S.Nishimura, K.Gabor).

In the short MT-meeting presentation we must **clearly justify which are the reasons to perform a commissioning.** The main points argued here are the following:

- a large beam-induced neutron background (up to 5 n/s/counter !) was registered during the test carried out in May using few counters around the EURICA set-up. In order to evaluate the impact of the beam-induced background in our planned experiments, we therefore need to measure a high-yield and well known neutron emitter (such as 85As) in order to determine to which extent the neutron background at F11 may influence the proposed measurements.

- test the correct performance under realistic experimental conditions (system stability, DAQ integration, synchronization and time-correlation) of a very complex system, which includes more than 100 3He tubes of different types and AIDA which features 4096 readout channels.

Regarding the available hardware and electronics JL Tain made an exhaustive summary of all the instrumentation available. This list (excel sheet) will be made available in the elog:

elog.ph.ed.ac.uk/BRIKEN/

At present, the only concern is the number of preamplifier modules available (12 units with 16ch/unit), which means that we have only one spare unit. In this respect P.Calviño offered to purchase one additional preamplifier in order to have two backup units.

K.Rykaczewski reported that additional menpower from UKT and ORNL will be available from late April 2016.

Technical issues:

- Table for BRIKEN and table for PE-shielding. It was decided that UPC, IFIC and RIKEN teams will propose a schematic design for both tables and then we will discuss how to proceed with its construction.
- JINR electronics and connectors. Can the JINR-group take care of adapting the connectors in case that the JINR tubes are used in the final setup?.

New proposals

There were three proposals presented in the “next proposals” session and in addition there is another proposal by S.Nishimura to measure (what is left) of the 2nd r-process peak around A=110-125.

- P. Ascher/S.Grevy (CENBG) presented a new proposal to measure two-neutron radioactivity from the potential candidates 31F and 34Ne.
- Algora (IFIC) presented a proposal to measure Pn-values to determine/constrain nuclear shapes in the A=110 region. This proposal may be combined with S.Nishimura’s astrophysics proposal. AA to contact SN and explore the possibility to join efforts.
- C.Domingo (IFIC) presented a proposal to measure the r-process precursor nuclei of the Rare Earth Peak in the mass region A=150-170.

It was discussed on the conveniency of presenting all or several of these proposals at the next NP-PAC meeting. In this respect, the best strategy needs to be discussed among the spokespersons, the local team (S.Nishimura) and the BRIKEN Scientific Board.

BRIKEN Project Schedule

A time-schedule including actions and actors was elaborated towards the preparation of the set-up, pre-commissioning, commissioning and experiments. This timetable is summarized in the following:

August:

(AT) Final MC simulations with more tubes up and down and shorter (in z) moderator (70cm).

(KR, JLT, ID, RG, FM, GL, AE) Check results of AT's MC-simulations: agree on final Hybrid geometry. (GL) Proceed with the machining/holes drilling.

(GK) Check if there is EURICA + 238U beam and run a parasitic test if possible. Done, there is no U-beam during this year.

October-November:

(GL) Prepare and ship to RIKEN both 252Cf and AmLi sources.

(KR, SN, GL, KG) Fill forms for commissioning BT-request.

(AA, PA, CDP, SN) Submit new proposals (?).

December:

(AA, PA, CDP, SN) Present new proposals (?).

January:

- (SN, KG) Request at the Machine-Time-Meeting of two days of dedicated beam-time for BRIKEN commissioning for a reference isotope measurement (north/near 78Ni).

- (all) Setup full system: X tubes + 2 HPGe Clover detectors + PE-matrix + Table + DACQ + AIDA at B3F in RIKEN.

February:

- (all) Pre-Commissioning with Sources and pulser

April:

- (all) Commissioning with 238U-beam setting nearby 78Ni region (85As) to produce a high Pn reference emitter nucleus (85As).

Workshop minutes written by C. Domingo-Pardo and sent to all participants on August 26th, 2015.