Minutes of the IFMIF/ELAMAT Science Committee Kick-Off Meeting (draft)

February 6, 2015, Institute of Nuclear Physics PAN, Kraków

List of participants:

Members of the Scientific Committee

1. Nicolas Alamanos, IRFU CEA Saclay. France
2. Faical Azaiez, IPN Orsay, France
3. Maciej Chorowski, Wrocław University of Technology, Poland
4. Łukasz Ciupiński, Technical University of Warsaw, Poland
5. Władysław Dąbrowski, AGH University of Science and Technology, Kraków, Poland
6. Giovanni Fiorentini, Legnaro National Laboratory INFN, Italy
7. Zsolt Fülöp, ATOMKI Debrecen, Hungary
8. Sydney Gales, ELI-NP Bucharest, Romania
9. Roland Heidinger, Fusion for Energy, IFMIF section
10. Angel Ibarra Sanchez, CIEMAT and Eurofusion, ENS work package, Spain
11. Lesław Karpiński, Rzeszów University of Technology, Poland
12. Stanisław Kistryn, Jagiellonian University, Kraków, Poland
13. Marek Lewitowicz, GANIL, France
14. Adam Maj (chair), IFJ PAN Kraków, Poland
15. Tomasz Matulewicz, Warsaw University, Poland
16. Grzegorz Wrochna, National Center for Nuclear Research, Świerk, Poland
17. Błażej Skoczeń, Kraków University of Technology, Poland

Excused: Dr. Alain Becoulet - IRFM CEA Saclay, France

Per invitation:

18. Jerzy Kwieciński, European Center for Enterprise, Warszawa
19. Sławomir Wronka, National Center for Nuclear Research, Świerk
20. Marek Jeżabek, IFJ PAN Kraków
21. Marek Scholz, IFJ PAN Kraków
22. Urszula Woźnicka, IFJ PAN Kraków
23. Wojciech Królas, IFJ PAN Kraków
24. Fabiana Gramegna, Legnaro National Laboratory INFN, Italy

Opening by Adam Maj, chairman of the meeting.

Welcome address by Marek Jeżabek, Director of IFJ PAN. Emphasized the importance of the meeting to gather essential support for the project from scientists from different domains outside of the fusion community. IFJ PAN supports the development of future IFMIF facility in Europe, but is especially interested and involved in the application of the Polish Consortium and the Podkarpackie region to host it.

Introduction of participants.

Roland Heidinger, Fusion for Energy

Introduction into the status of IFMIF/EVEDA project and plans for the IFMIF/DONES. Pointed out the role of material studies and its position on the fusion road map consisting of ITER / EU-DEMO and JP-DEMO fusion reactors. IFMIF mission is to qualify candidate materials for fusion reactors, important especially for the backing design, licensing and safety of operation of the reactors. For that, materials databases must be created and validated. A deep understanding of radiation response of those materials is needed.

IFMIF/EVEDA accelerator prototype installation and commissioning at Rokkasho site in Japan will go on untill 2017. It consists of LIPAc accelerator of deutrons up to 9 MeV, 125 mA beam current, ELTL liquid lithium test loop (100 mm width vs. 260 mm envisaged for full IFMIF) and high flux test module prototype.

Presentation of IFMIF options in comparison with the currently commissioned IFMIF/EVEDA: IFMIF-full, IFMIF/DONES, IFMIF-Proto (Elementary NS), FAFNIR, SORGENTINA. A TAP Ad-Hoc Group on Accelerator Driven Neutron Sources for Materials Irradiation reviewed those options for F4E and recommended the IFMIF/DONES which is just one accelerator instead of two, still maintaining reasonable times of measurement and reasonable dpa rate parameters.

IFMIF/DONES will consist of one full energy accelerator (d beam up to 40 MeV energy, 125 mA beam current), full size Li loop and full size test cell. There are no plans to have irradiated modules manipulation at IFMIF site, irradiated materials will be transferred to an external facility in order to keep waste management at minimum. IFMIF/DONES cost estimated at 380 MEuro, 340 MEuro if parts of EVEDA can be reused. The ENS work package at Eurofusion will work further on technical design to be ready for construction start in 2018/2020. Site decision is to be made in 2015, early 2016 at the latest.

Q: What's the position of Japan on DONES?

A: Japan wants to investigate the tritium breading, not a point of interest for Europe, nevertheless, upgrade of the LIPAc accelerator is being discussed in Japan.

Q: What are the key steps for the political decision to build IFMIF?

A: Fusion community and the European Commission agrees that a neutron facility must be built. How money will be found is not clear.

Q: What will be the running costs?

A: Running costs estimated at 55 MEuro / year (11 month operation).

Urszula Woźnicka, IFJ PAN Kraków

Presentation of the initiative to host IFMIF facility in Poland. The idea was started in 2013 by Rzeszów University of Technology now called IFMIF/ELAMAT. ELAMAT acronym stands for Joint European Laboratory for Advanced Materials Testing. A consortium was established, coordinated by Rzeszów University of Technology, its members are three national universities, three research institutes and business environement institutions.

Green field location is 15 km north of Rzeszów, in Podkarpackie region.

Jerzy Kwieciński, European Center for Enterprise Warszawa

Representing the IFMIF/ELAMAT Organizational Task Force. Presented basic information about Poland, Polish economy and the Research and Development sector in Poland. The support and commertialisation of R&D results is the key priority for Poland for the 2014-2020 perspective. Although Poland has plenty of scientists, no major R&D infrastructure. Spending on R&D is 0,90% of the GDP, growing, mostly due to the increase in private sector expenditures.

Why Rzeszów proposed as site: good location, regional research potential, strong support from regional authorities. Proposed location close to the airport and the A4 motorway (Dresden – Wrocław – Kraków – Rzeszów – Lviv). The proposed site is on the Podkarpackie Scientific – Technological Park "Aeropolis". High Technology Center "AERONET – Aviation Valley".

The project coordinated by the IFMIF/ELAMAT scientific-industrial consortium is on the list of key projects in the Territorial Contract for Podkarpackie region. Regional authorities (Urząd Marszałkowski) are ready to run a promotional campaign. Its representatives are ready to prepare and implement the project. In particular, the authorities are willing to contribute the plot of land needed for construction and, if necessary, to take an active part in closing the financing of the project.

Q/Comment: Training potential is one of the key points to host the facility in Poland.

Q/Comment: The interest of the business community is much broader than preparing materials for DEMO. Other spheres of economy: materials, medicine, safety, aviation.

Q/Comment: Construction phase: local contribution is possible, e.g. civil engineering but also scientific equipment can be subcontracted, as for other projects realized outside Poland.

Sławomir Wronka, NCBJ Świerk

Information that a local Technical Committee of IFMIF/ELAMAT was formed.

Open discussion

Leading motive: to secure Polish national support and approval one needs to demonstrate that the project is of interest also for scientists outside of the fusion community.

A round table discussion was started and moderated by Adam Maj to identify topics and appoint topical leaders. The next step was proposed to be creating working groups and inviting additional experts if necessary to prepare science cases. In the future a meeting should take place to discuss the science cases and write a "white book" recommendation of the Science Committee.

Ibarra: conceptual design to be closed in one year from now, so the process should be fast in case any modifications of the desing become necessary. Fusion will take 100% of the time of the facility, thus additional program must be run as parallel experiments. Also, IFMIF materials facility was planned for 30 years because this is how much time is needed to obtain necessary data (running 100% of the beam time for the fusion program).

Gales, Azaiez: what are the parameters of the neutron flux behind the fusion material samples? One can use the remaining neutron flux as it is or moderated. One has to compare it to the characteristics of the neutron flux from a reactor. It is important to have a specialist simulate it. People working in the reactor physics have the necessary tools and knowledge.

Maj: do not exclude using the deutron beam or a fraction of it.

Ibarra/Heidinger: Neutron spectrum with a maximum at 14-20 MeV, up to 10^{14} neutrons / s cm^2 after the samples irradiation station. An energy spectrum plot of the neutrons will be provided by the IFMIF design team.

Alamanos: Pharmaceuticals / radioisotopes production is certainly a possibility.

Since the energy of neutrons will be different from a reactor one should investigate which other, new isotopes can be bread. Check the intensities. Any radioisotope production with the deutron beam will be difficult due to its intensity. Check the ^{99m}Tc which is produced in reactors with highly enriched uranium. Can it be done with fast neutrons? Recommend Ulli Köster (ILL Grenoble) to joint the team as he is knowledgeable on radioisotopes and reactor neutron physics.

Jeżabek: how does the NFS (Neutrons for Science) facility at GANIL compare to IFMIF/DONES?

Lewitowicz: Time-of-Flight method will be used to measure energy of neutrons, also, lower fluxes compared to IFMIF/DONES. Beam will be pulsed, selected pulses of the deutron beam will be sent to the converter.

Ibarra: In IFMIF the natural frequency of the deutron beam will be 175 MHz which translates into 5.7 ns pulsing. It could be discussed if the science program can take 1 pulse in 100/1000. It is not sure that this is technically feasible – fast switching magnets for beams of very high current needed.

Lewitowicz: If neutrons can be bunched NFS physics possible with neutrons over 10 MeV. For NFS physcis see e.g. http://pro.ganil-spiral2.eu/spiral2/instrumentation/nfs/lois

Skoczeń: Investigation of the lifetime of components, such as spacers, superinsulators, superconductors is a key subject for materials science.

Ciupiński: Next step could be industrial material testing. It is much easier to put things into the beam than into fission reactors. Testing of radiation resistant electronics should be part of this package.

Gales: Neutron imaging and neutron tomography could be considered within the same topic.

Lewitowicz: One could use neutrons to produce radioactive targets for nuclear physics experiments.

Fulop: If a Time-of-Flight system is developped neutrons could also be used for direct reations which are of interest for astrophysics. However, this neutron energy range might not be very useful, this needs to be investigated.

Heidinger: Doping materials and developping homogeniously doped materials, e.g. silicon. Also, study of color centers in doped materials.

Matulewicz: Irradiation of cells with fast neutrons (biology studies).

Wrochna: Boron neutron capture therapy is a topic which was not developed in reactors for obvious reasons but perhaps could be done with neutron sources from reactions.

Fiorentini: There have been activities along this line at Legnaro, but interest from medical community appears limited.

Lewitowicz: One should not exclude considering a radioactive ion-beam facility at IFMIF. It could be either on-line or off-line (irradiate and produce RIBs in batch mode). The comparison between IFMIF and SPIRAL2 deutron beams: 125 mA vs. 5 mA. Radioactive ion beams produced with deutrons could be reaccelerated but also used at low energy, e.g. produced on a high-voltage platform at 100-150 kV. This is enough for extraction, separation and decay spectroscopy of exotic fragments.

One could also consider studying some very rare phenomena. Taking advantage of high neutron flux one could perhaps find a way to study neutrino-less double beta decay.

During the discussion following **working groups** and the SC liaisons were established:

WG Topic	SC liaisons	Proposed members
Applications of medical interest (radiopharmaceutricals, BCNT, …)	Alamanos, Wrochna	Adriano Duatti Renata Mikołajczak, Heidinger, Ibarra
Neutrons-for-Science physics (or nuclear physics with neutrons)	Lewitowicz, Matulewicz	Urszula Woznicka, Krzysztof Drozdowicz, Heidinger, Ibarra
Lifetime of components	Skoczeń, Becoulet	Chorowski, Dąbrowski, Heidinger, Ibarra
Industrial material testing (incl. neutron imaging, tomography,…)	Ciupiński, Gales	Heidinger, Ibarra
Radioactive targets	Azaiez, Maj	Heidinger, Ibarra
Astrophysics, reactions with neutrons	Fulop, Kistryn	Heidinger, Ibarra
Material doping	Heidinger, Karpinski	Parlińska, Parliński (?), Heidinger, Ibarra
Radioactive ion facility	Lewitowicz, Maj	Królas, Fornal, Gramegna, Heidinger, Ibarra
Nuclear waste transmutation (new)	Lewitowicz, Wochna	Scholz , Heidinger, Ibarra
Neutron oscillations (new)	Fiorentini, Maj	Fornal, Bodek, Heidinger, Ibarra

The liaisons shall find 2 coordinators, being the experts in the field, and help to set-up the working groups.

As a general conclusion: parameters of the neutron beam after the target are essential to review options. Also, it is important to know what are the degrees of freedom in terms of space arrangement and parameters. A one page information on this will be prepared by Ibarra and the WPENS team.

It was agreed that the Scientific Committee will have the next meeting in end of June, proposed date is 29-30 June in Warszawa. At that meeting preliminary analysis should be shown identifying which topics are promising and which are not. It is suggested to have an open meeting to advertise the opportunities and gather more support.