

FRENA User Committee Meeting Minutes

Date: 19th-20th October 2022

Venue: FRENA Conference Room (1st floor)

Attendees: Ajit Kumar Mohanty (Director, BARC), Gautam Bhattacharyya (Director, SINP); Amit Ghosh, Chinmay Basu, Anjali Mukherjee, Maitreyee Nandy, Ushasi Datta, Akashrup Banerjee and Chandan Ghosh from SINP; Gopal Mukherjee and Tilak Kumar Ghosh from VECC; Satyaranjan Santra and Aradhana Srivastava from BARC, Rudrajyoti Palit from TIFR; Samit Kumar Mandal from University of Delhi; and Sugathan Pullanhiotan from IUAC.

Executive Summary

The machine status, in-house-development status, and possible future experiments are discussed. The user committee has emphasized the new facilities development (Target chamber, target cooling, detectors, data acquisitions systems). A new committee has been formed to review the scattering chamber design (with one person from BARC and another from VECC). It is emphasized for a dedicated person (preferably from a chemistry background) for the target lab. A few day-1 experimental proposals (that can be performed with minimum additional instrumentations) are requested from the user committee.

Day - 19th Oct 2022

Chinmay Basu:

- Talked about machine status and its report to the DAE symposium.
- Showed the design and update about the 1 m scattering chamber and its ordering procedure. A committee will review the design and the committee's remark will be amended with the existing tender.

Satyaranjan Santra:

- A new beamline (for the 0-degree line), a windowless gas jet target, a low-background gamma detector with charge particle detection provision, and a data acquisition (DAQ) system are proposed from the BARC side.
- A preliminary design exists for the gas-jet target, detector, and DAQ systems.
- A few possible experiments have been proposed.

Tilak Kumar Ghosh:

- Discussed the possibility to carry out a few sub-barrier fission experiments using FRENA and the requirements for associate developments (scattering chamber,

and cooling target mechanism).

- Developing an e^+e^- spectrometer for search physics beyond the standard model using low-energy reaction using FRENA. It was emphasized that the spectrometer can also be used to carry out physics of fundamental interest.

Akashrup Banerjee:

- Four different projects (data cabling from the beam hall to the counting room, Liquid nitrogen cooling system, rotating target for heat dissipation, and DAQ system) are initiated to support users' requirements.
- The status and their criticality are discussed.

A facility visit was organized for all participants of the FRENA User Committee meeting, at the conclusion of the first day.

Day - 20th Oct 2022

Gopal Mukherjee:

- Discussed discrete and sum-peak gamma ray spectroscopies using HPGe and inorganic scintillators.
- Emphasized hardware development for the mechanical structure to use the existing detectors at VECC.

Rudrajyoti Palit:

- Discussed possible rare-decay experiments and gamma strength measurements.
- Requirements: pulsed proton beam and a detector array with good time resolution and efficiency.

Sugathan Pullanhiotan:

- A few possible experiments that can be done with FRENA are discussed. As a future plan, it was proposed to explore the feasibility of doing deep sub-barrier cross-section measurement by combining FRENA with an underground ultra-low background counting Lab at Jaduguda mine, for long-lived radio-isotopes.
- Emphasized an upgraded target lab, inventory of existing facilities, and their characterizations.

Samit Kumar Mandal:

- Discussed the “Atomki anomaly” and the possibility of performing this experiment at FRENA and its associated required development.
- Discussed ion-atom collisions, material characterization, and mass spectrometry.

Aradhana Shrivastava:

- Discussed the experiment to measure fusion cross-section at deep sub-barrier energies, of astrophysical interest. The beam of alpha particles on different targets in the beginning and then beam of heavier ions (as and when available), was proposed.
- Requirement of irradiation chamber with provision for faraday cup (and/or monitor detector) for measurement of beam current and off-beam counting set up for coincidence measurement using HPGe/Clover detectors were highlighted.

Chandan Ghosh:

- Target lab upgradation with a new roller setup. Refurbishment of XRF setup.
 - R. Palit: A dedicated (preferably with a Chemistry background) target lab person is desired.
 - C. Basu: We already have a dedicated person in the FRENA target laboratory who has gained sufficient experience in making targets regularly. Targets have been made satisfactorily for both SINP and VECC scientists.
- Detector development for online and offline measurements in a dedicated detector lab is proposed.
- For better documentation, an electronic logbook is proposed.

Ushasi Datta:

- The possibilities of studying capture cross-sections and measurements at FRENA are discussed.
- A status update of a new scattering chamber is presented. It was emphasized that this chamber could be used for irradiation purposes.
- A proposal for a recoil spectrometer is discussed.
- New facilities: Exotic- and polarized beam and ion trap.
- Development of composite photon spectrometer using high resolution HpGe and high efficiency scintillator has been discussed and purchase procedure of electrically cooled CLOVER detector has been initiated.
- For verification of X17 discovery, experiment of $3\text{H}(p, e+e-)^4\text{He}$ (Atomki results) will be repeated in a different way of measurement using FRENA facility.

Anjali Mukherjee:

- A new target chamber design with liquid nitrogen cold-trap and chilled-water target cooling options is ready for floating tender.
- A design review request for this chamber is initiated.
- A 100% (relative) efficient HPGe detector is proposed for a precise counting setup.

A general opinion of all members is that other beam species in addition to protons also need to be extracted and tuned to the target station. For beam focusing, the ion optics of the beamline are to be studied with help from the VECC beam optics group.

Minutes prepared and circulated by:

Chandan Ghosh

Akashrup Banerjee
