

# Indian plans at ISOLDE and HIE-ISOLDE

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(India)**



**ISCC, ISOLDE, CERN, 3<sup>rd</sup> July., 2012**



# International Workshop on Future Plan with Radioactive Ion Beams, 16-18<sup>th</sup> April, 2012 (Kolkata)



**ISOLDE, CERN**

**SINP, BARC, VECC, Bose Institute, IUAC(Delhi),  
IUAC(Kolkata), PRL,DU, PU, BESU, CU etc.**

# Indian plans at ISOLDE and HIE-ISOLDE

- **Infrastructure development, Experiments**

## **Accelerating structures (BARC++, DISCUSSION !!!!!)**

SRF cavity R&D with the possibility of having a high-beta cavity substrate being manufactured at BARC and sputtered at CERN

## **Target Technology (SINP ++, BARC++, CAT (Indore) !!**

Radiochemical nuclides of interest in Pb-Bi irradiated targets

**Decay scheme studies using radiochemical methods**

**Bk isotopes,  $^{194}\text{Th}^g$**

**Detector systems: Future photon spectrometer →**

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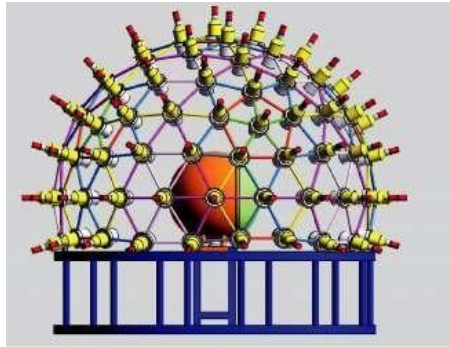
**LaBr3 array+ Charge particle (?) + .....**

**Secured funds (2012-2017, XIIth plan DAE) (Discussion started in June, 2011)**

**SINP++, BARC, DU, PU + others welcome to join  
Experiment or facility!!**

**Experiments:**

**Nuclear Physics, Atomic Physics, Condensed matter,  
Chemical science, Bio physics**



Bivash Behera (Punjab University)

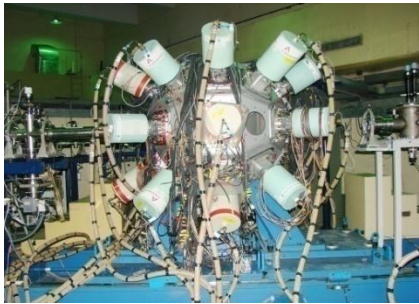
Dissipation, neutron multiplicities

S.Roy: Reaction mechanism around Coulomb barrier

B.K.Nayak: Surrogate reactions

**Suggestion: Lanthanum Bromide with n-array setup at ISOLDE for studies such as  $^{233}\text{Th}(d,p)^{234}\text{Th}$  and other reactions relevant to the r-process**

**BARC. P.U., Delhi, SINP, TIFR and others**



Ajit Sinha (IUC) Barrier distribution for  $^{30,32}\text{Mg}$  on  $^{40}\text{Ca}$  using quasi elastic scattering

Arun Jain (BARC) Knockout reactions

Core knockout of a halo nucleus (making it hollow!)

Samit Mandal (Delhi University) Multi-nucleon transfer reactions

Sarmistha Bhattacharya: Spectroscopy using VAMOS SPIRAL, GANIL

S.Saha: Exploring nuclear structure of neutron deficient heavy nuclei at ISOLDE

Aradhana Shrivastava Fusion and transfer  $^{6,8}\text{He}$  SPIRAL, GANIL

Nuclear structure theory: V.K.B.Kota, Sukhendu Sarkar

**Summary talk by A.Chatterjee, BARC**

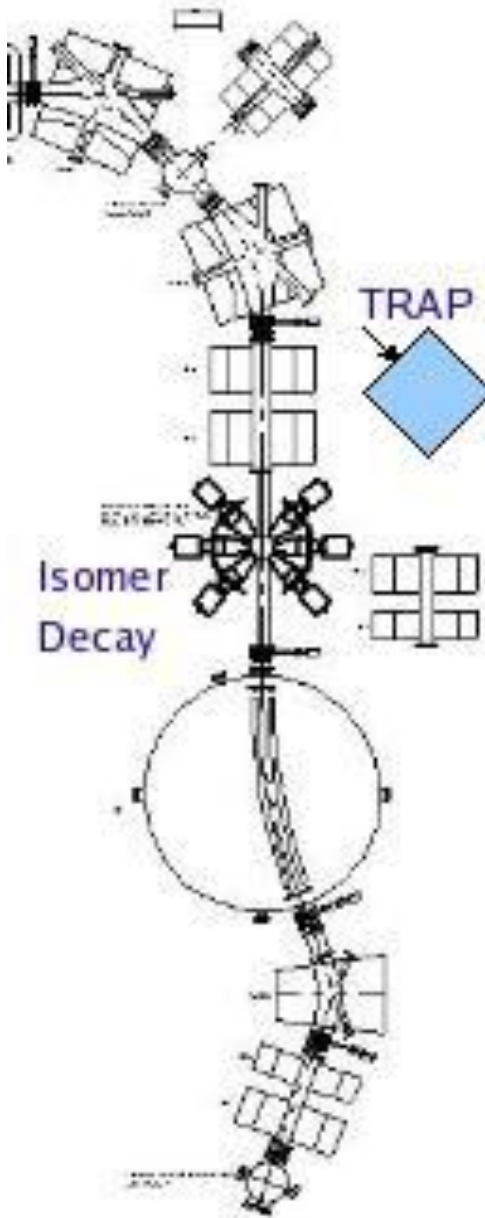
N.Madhavan (IUAC, New Delhi)

HIRA and HYRA spectrometers at IUAC

$^7\text{Be}$  RIB beams from HIRA

HIMALAY - Heavy Ion Mass Analyzer coupled to  
Large gAmma arraY (!)

Samit Mandal (Delhi Univ) Multinucleon Transfer



Tilak Ghosh (SINP)

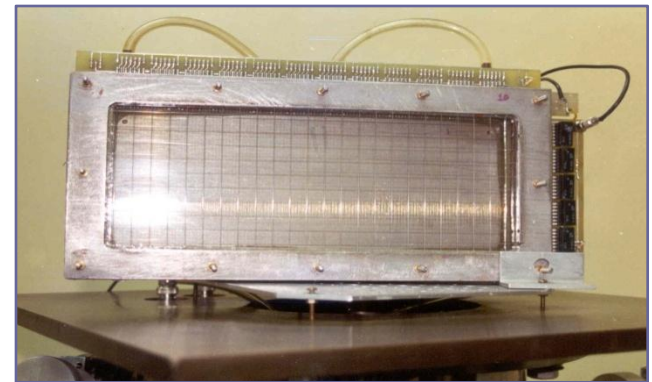
Width of Fission Mass

Distribution

Fission Angular

Distribution

Quasi fission



Rahul Tripathi (Radiochemistry Divn., BARC)

**Fission studies**

**Decay scheme studies using radiochemical methods**

**Bk isotopes,  $^{194}\text{Th}$**

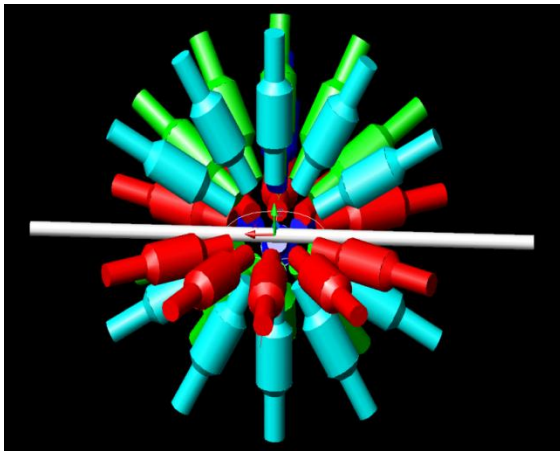
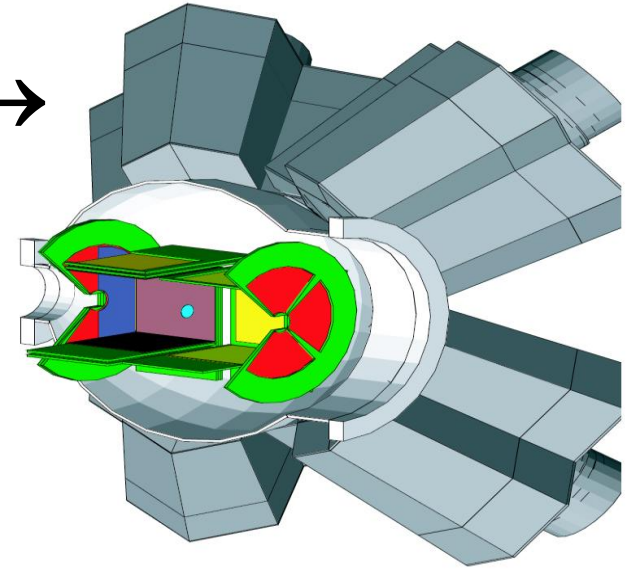
**Proposed decay scheme studies at ISOLDE**

# New scintillator array at ISOLDE, CERN

Present photon spectrometer →

## MINIBALL

- 24 HPGe
- 6-fold segmented
- $\varepsilon \approx 3\%$  @ 1.3 MeV
- $\forall \varepsilon \approx 1\%$  @  $E_{\gamma} > 3$  MeV



**Future photon spectrometer**

➤ **Original contribution  
at ISOLDE-CERN**

# Developed laboratory at SINP

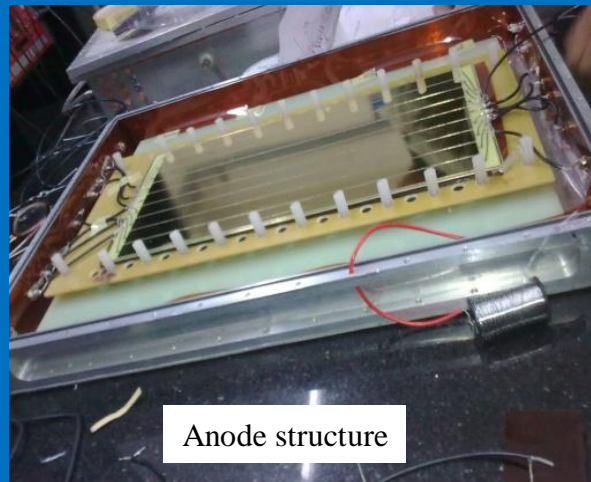




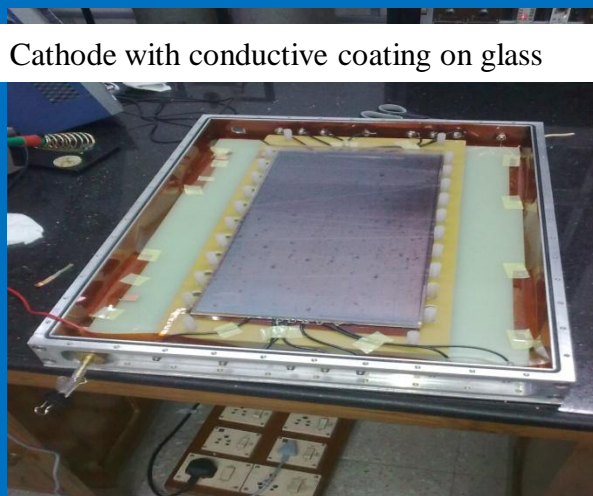
# Development of MMRPC at SINP, Kolkata for R3B neutron TOF detector



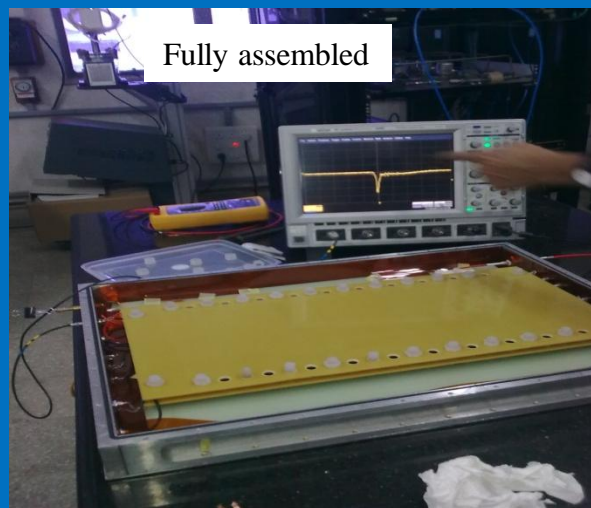
At SINP, workshop



Anode structure



Cathode with conductive coating on glass



Fully assembled

✓ Double stack glass MMRPC.

✓ 1<sup>st</sup> prototype active dimension  $20 \times 40\text{cm}^2$

✓ Anode: PCB with strip 2cm wide.

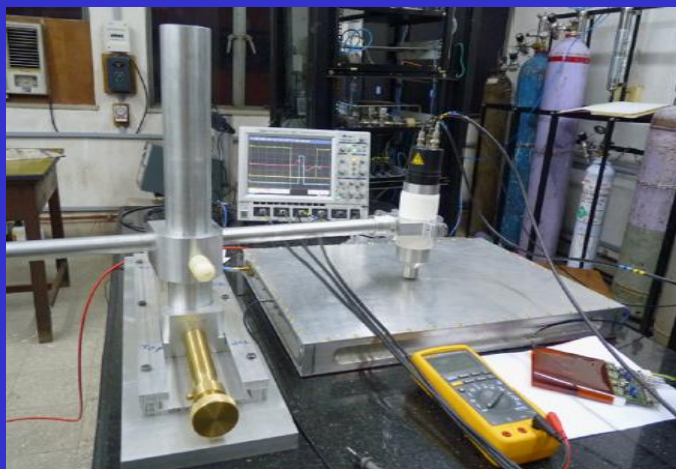
✓ Gas mixture used: R134a(88%), SF6(5%), Isobutene

(7%)

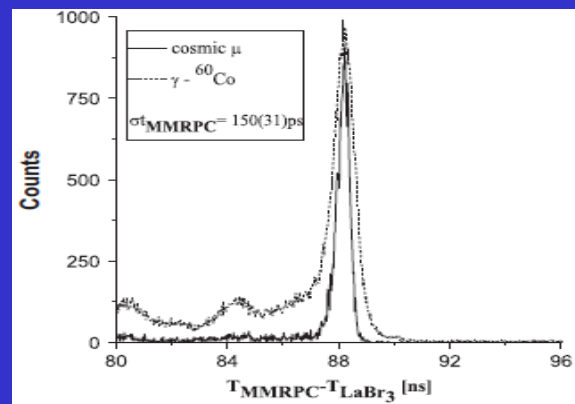
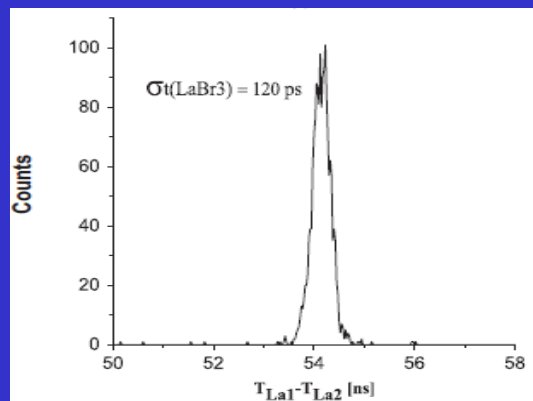
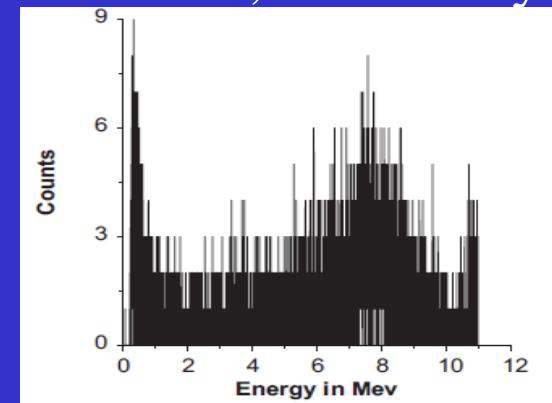
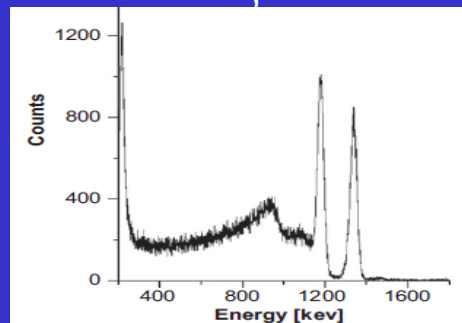
MMRPC with gas system



# Response of developed MMRPC for cosmic muons and $\gamma$ -rays



❖ Coincidence measurement of MMRPC with  $\text{LaBr}_3:\text{Ce}$  detector at SINP, laboratory.

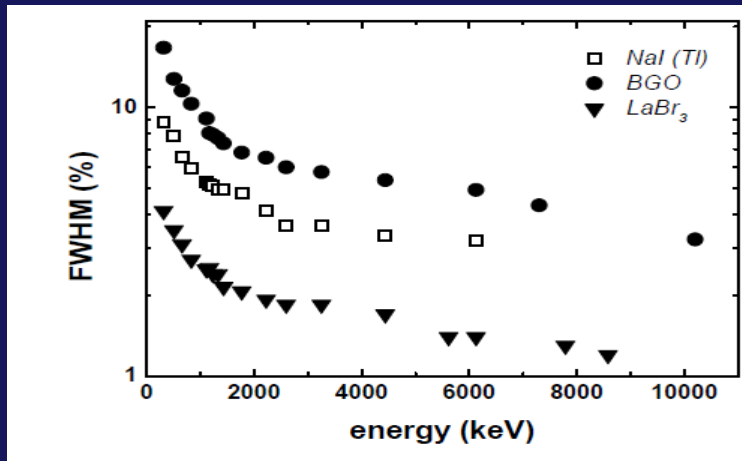


❖ Extensive testing  
✓ cosmic muons,  $\gamma$ -rays ( ${}^{60}\text{Co}$ , etc.)  
✓ MMRPC time resolution,  $\sigma_t < 150 \text{ ps}$ .

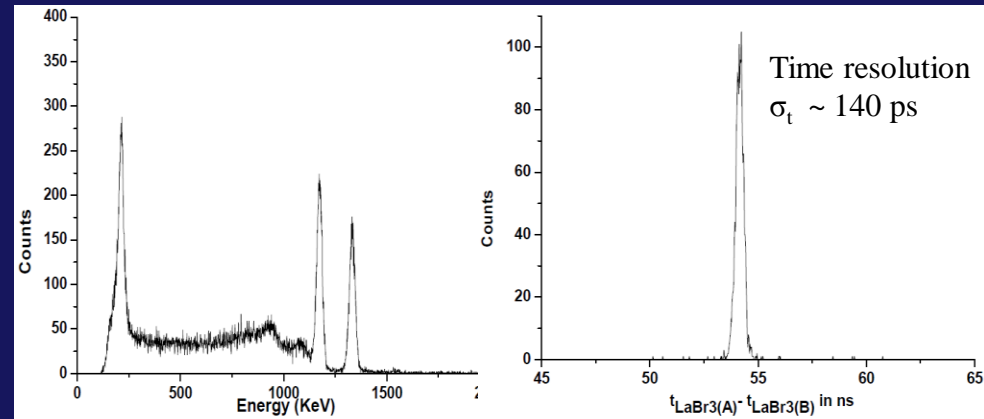
# Response of different LaBr<sub>3</sub>(Ce) detectors for <sup>60</sup>Co



Big crystal size LaBr<sub>3</sub> detectors :  
Dimension: 7.6 cm (dia) and 15cm (length)

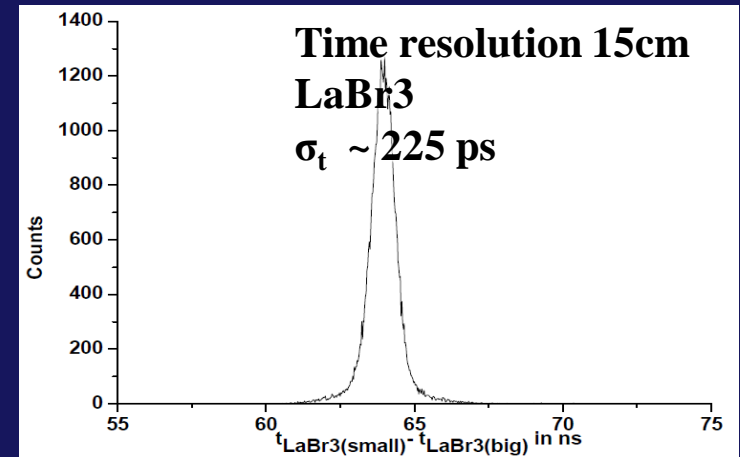


Medium crystal size LaBr<sub>3</sub> detectors :  
Dimension: 3.5 cm (dia) and 3.5cm (length)



Energy spectra of two medium LaBr<sub>3</sub> in coincidence

TAC spectra between two medium LaBr<sub>3</sub> detectors

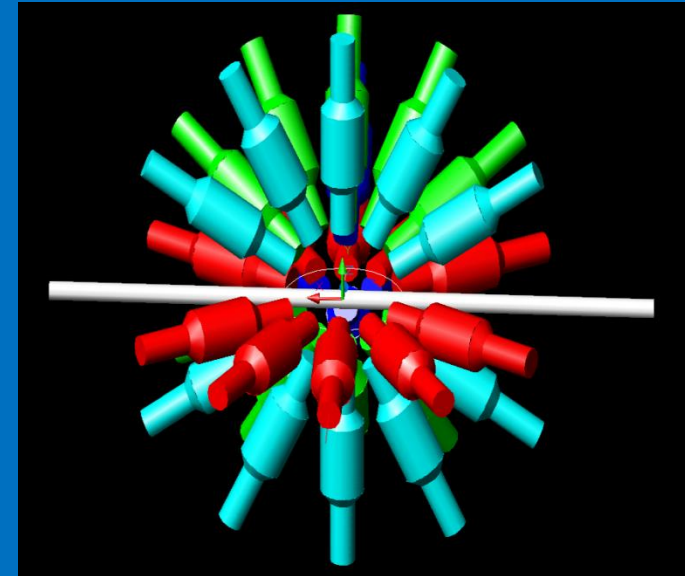
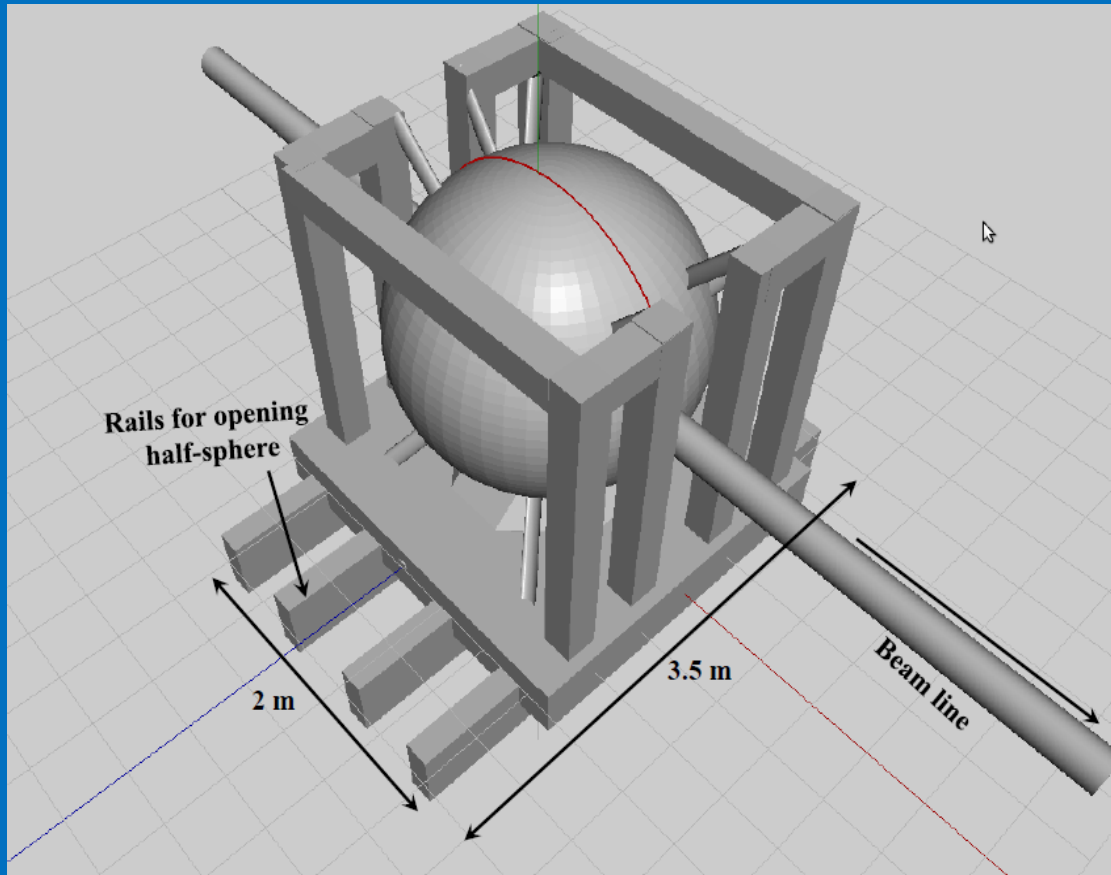


TAC spectra for Big and small LaBr<sub>3</sub> detectors

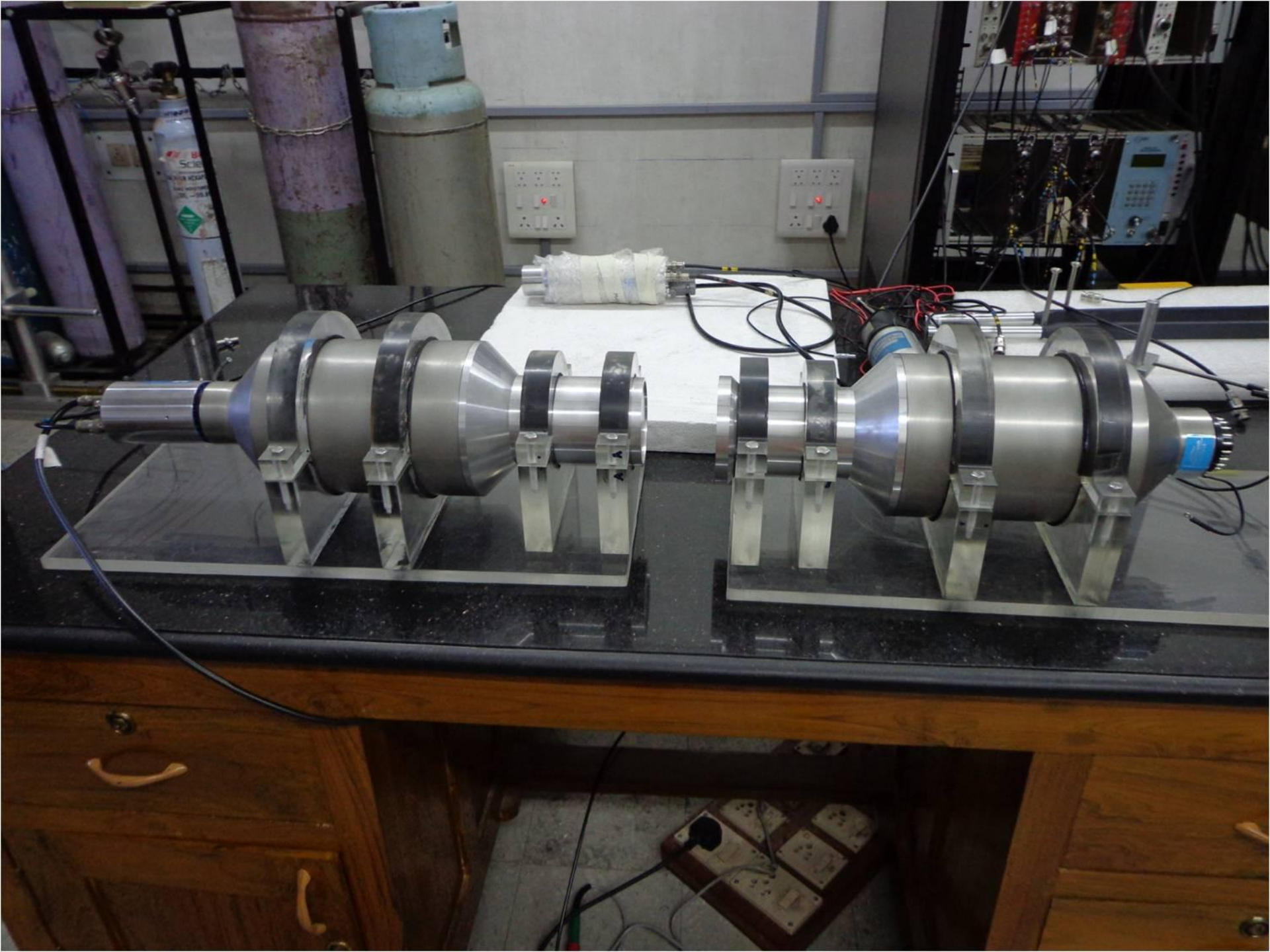
# LaBr<sub>3</sub> array at HIE-ISOLDE

## LaBr<sub>3</sub> scintillator array

- $\epsilon \approx 40\%$  @ 1.3 MeV,  $dE \sim 3\%$ ,  $\ggggg$
- $\epsilon \approx 20\%$  @  $E_\gamma \sim 10\text{-}20$  MeV,  $dE \sim 1\%$ ,  $\sigma t \sim 225$  ps  $\gggggg$



Will be one of the most advanced, most efficient gamma-ray spectrometer in the world



A night photograph of the Taha Institute of Nuclear Physics building. The building is a multi-story structure with a light-colored facade and dark window frames. A large banner is stretched across the front of the building, displaying the text "TAHA INSTITUTE OF NUCLEAR PHYSICS" in bold, capital letters. In the foreground, there is a fountain with water spraying upwards in a dome shape. To the left of the fountain, there is a small statue on a pedestal. The scene is illuminated by warm lights, and there are palm trees and other foliage in the foreground and background.

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