

Neutron and X-ray detectors developed at SSPD

All the neutron detectors including position sensitive detectors (PSD) and beam monitors used in the neutron scattering instruments under National Facility for Neutron Beam Research, Dhruva are developed in-house in SSPD. The facility to design, fabricate and characterize neutron and X-ray detectors in BARC is available only with SSPD. These detectors have been provided to several other divisions of BARC, showing long life and stability over decades. The ^3He filled neutron detectors are the backbone of neutron beam research in BARC and other neutron-related experimental programmes of DAE.

Various neutron and X-ray detectors developed in our detector laboratory:



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| A) Multiwire 2D PSD for X-Rays | H) 1D PSDs (^3He filled) for neutron Spectrometers |
| B) X ray Proportional counter | I) Microstrip based neutron PSD |
| C) X ray 1D PSD | J) Neutron flux monitor counters |
| D) Neutron Beam Monitor (Counting) | K) Neutron Proportional counters |
| E) Neutron Beam Imaging Monitor (delay line based PSD) | L) ^{10}B coating based Multigrid neutron PSD |
| F) 1D PSD neutron detector for Reflectometer | M) Multitube Neutron PSD (BF_3 filled) |
| G) 1D PSDs (BF_3 filled) for neutron Spectrometers | N) 2π counting chamber for large area α - β coated sources. |

Other highlights of the activity are:

- Up gradation of neutron instruments at Dhruva with indigenously built high efficiency PSDs. It resulted in enhanced data collection efficiency and throughput of the instruments.
- The know-how (development of BF_3 gas based detectors, including gas generation and distillation process) was transferred to Electronics Corporation of India Limited (ECIL).

- Training of staff of Applied Physics Division, BARC in detector fabrication.
- Quantifying ^{10}B enrichment for production of $\text{CaF}_2(\text{BF}_3)$ complex at Heavy Water Board, Talcher, Odisha.
- Development of ^{10}B based multigrid PSD and BF_3 based multitube, as an alternative to ^3He gas.
- Fabrication of 40 neutron PSDs for a multiPSD array at neutron Time of Flight Spectrometer at Dhruva.
- Miniature neutron detectors for Accelerator Driven Sub-Critical Assembly with core BRAHMMA of Neutron and X-ray Physics Division, BARC.
- 2π - β chamber for calibration of large area coated sources for Radiological Physics and Advisory Division, BARC, which is established as a national primary standard of calibration of sources.

Facilities supporting detector development

Our expertise on BF_3 gas based neutron detectors has helped us to survive even in the crisis of non-availability (very high cost) of ^3He gas. We have successfully made several PSDs with BF_3 gas.



a)

a) System for generation and distillation of BF_3 gas from $\text{CaF}_2(\text{BF}_3)$ complex

b)

b) Evacuation and gas filling system for ^3He gas based detectors

Detectors developed at SSPD are used for various applications:

- Neutron scattering experiments
- Area monitoring at nuclear facilities
- Coincident detection of neutron for study of nuclear reaction
- Measurement of residual activity from nuclear waste and spent fuel
- Measurement of cosmic neutrons at High Altitude Research Laboratory, Gulmarg
- X ray detectors for Mossbauer experiments at SSPD and various universities.