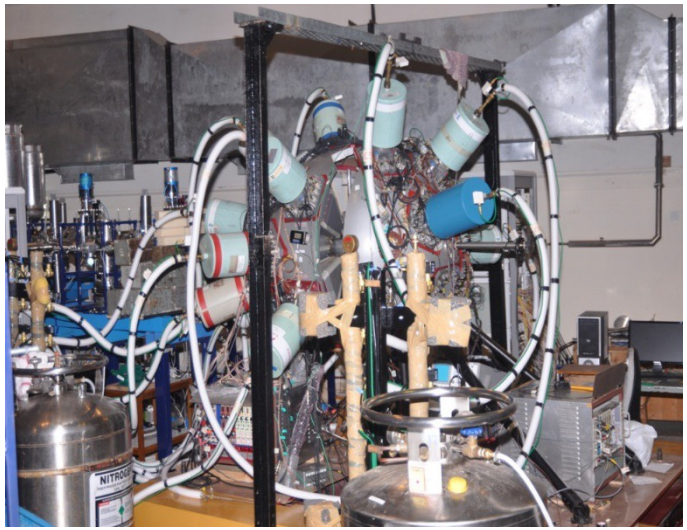
PARIS in India at PLF, Mumbai



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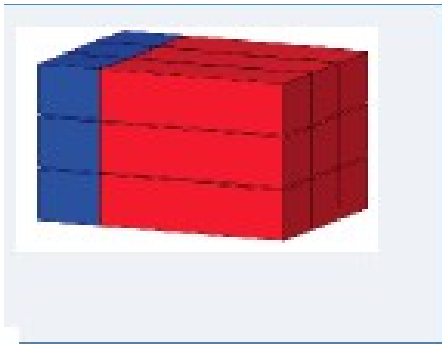
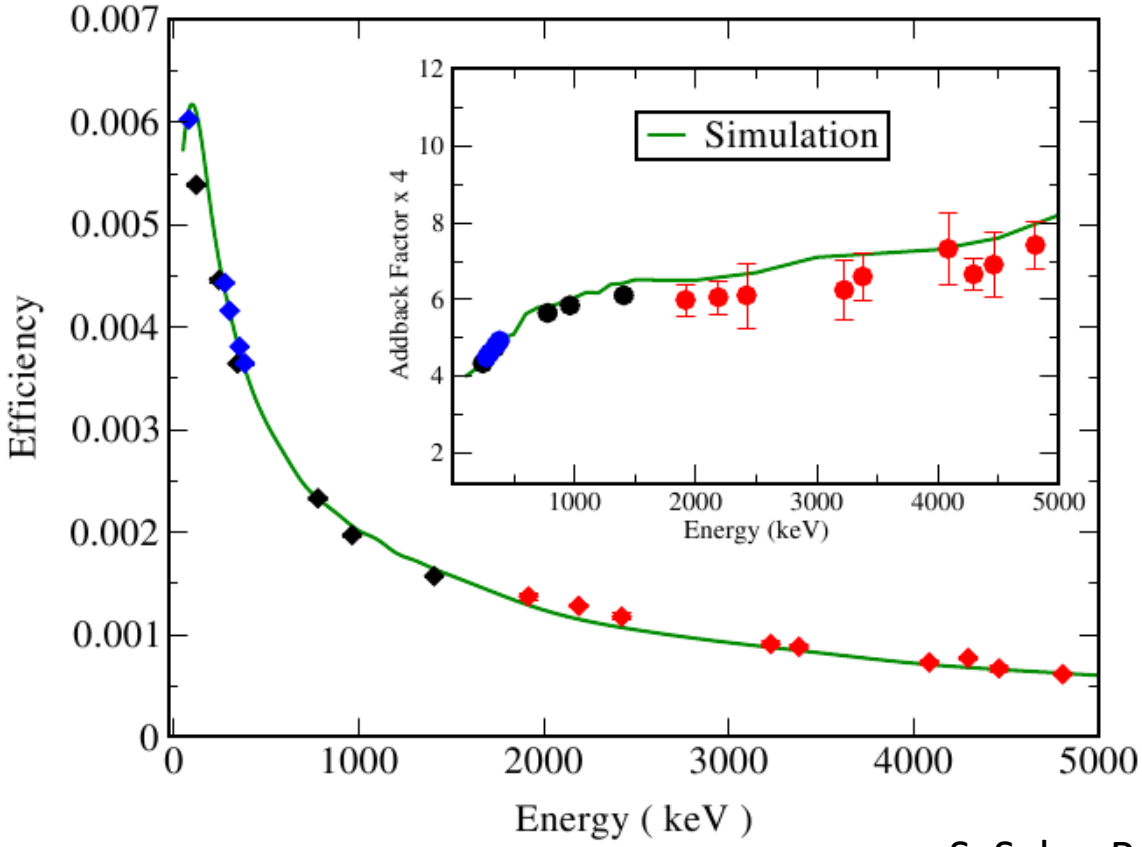
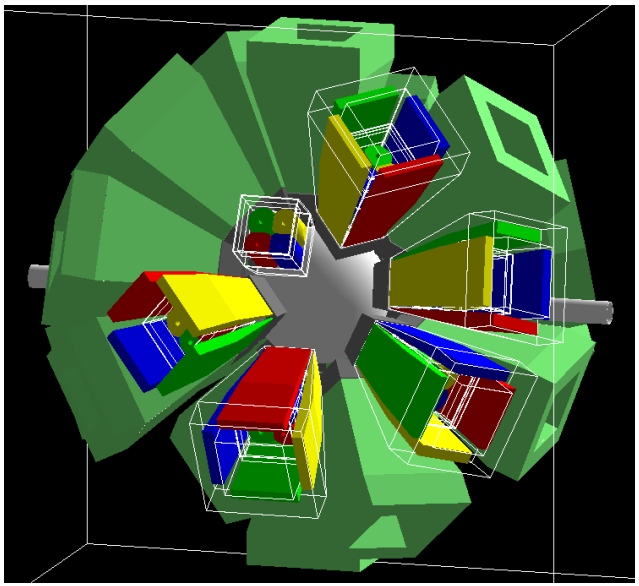


Efficiency and addback factor: Experiment and Simulation



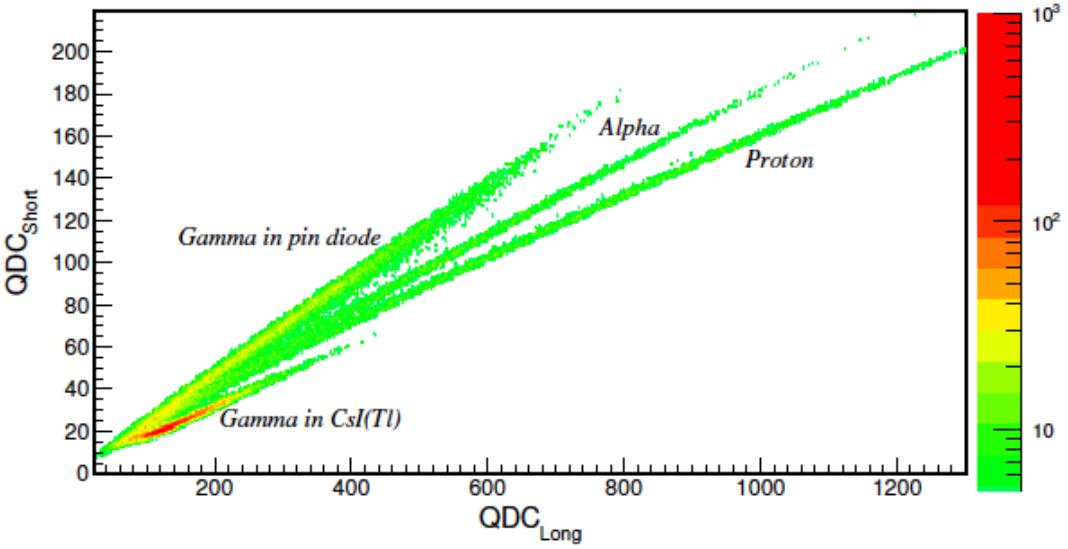


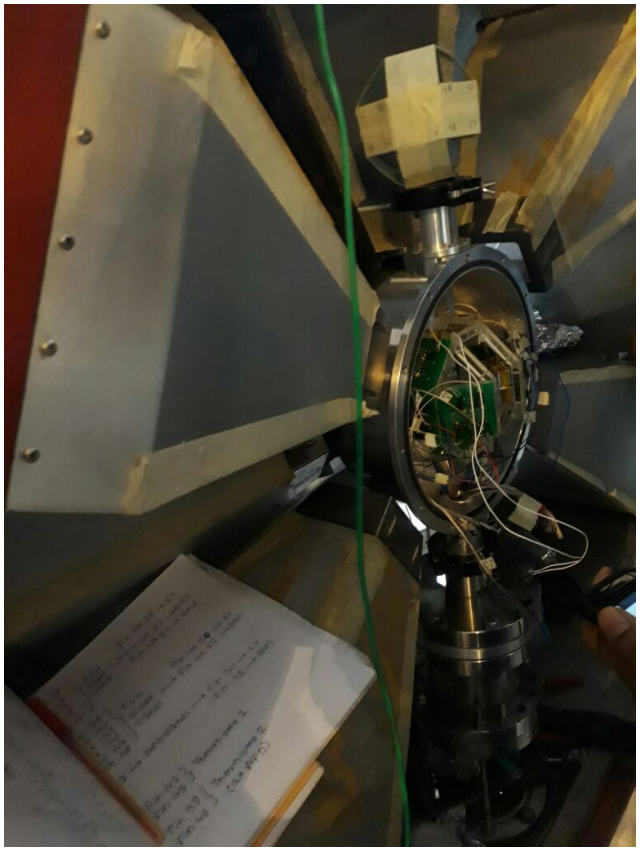
S. Saha, R. Palit, et al. JINST 11 P03030 (2016)

Measured efficiencies in the range of 80 keV to 4.8 MeV are from 152Eu, 133Ba and 66Ga sources. Simulation shows good agreement with the experimental data.

Spectroscopy near 90Zr using CPDA coupled to INGA

13C+82Se @60 MeV at TIFR (2017)
Au backed target
11 CS-Clover + 24 CsI(Tl)





Md. S. R. Laskar, R. Palit, Proceedings of the DAE-BRNS Symp. on Nucl. Phys. 62, 1058 (2017).

DSP based DAQ for INGA at TIFR

Technical specifications

- 100 MHz & 12-bit ADC's
- Data rate: 80 MB/sec
- Particle ID using digital pulse shaping

H. Tan et l., NSS 08, IEEE (2008) p 3196

PARIS minicluster with V1730 Caen digitizer (500 MHz, 14 bit)

Implementation for INGA

- Modular so easily expandable
- Versatile with complex trigger
- High count rate
- High stability
- Zero dead-time
- Long lived isomer measurements

R. Palit Pramana (2014) 719

High energy gamma-ray set-up

Two possible configurations for PARIS@ INDIA

Phase 1 : 2 PARIS clusters

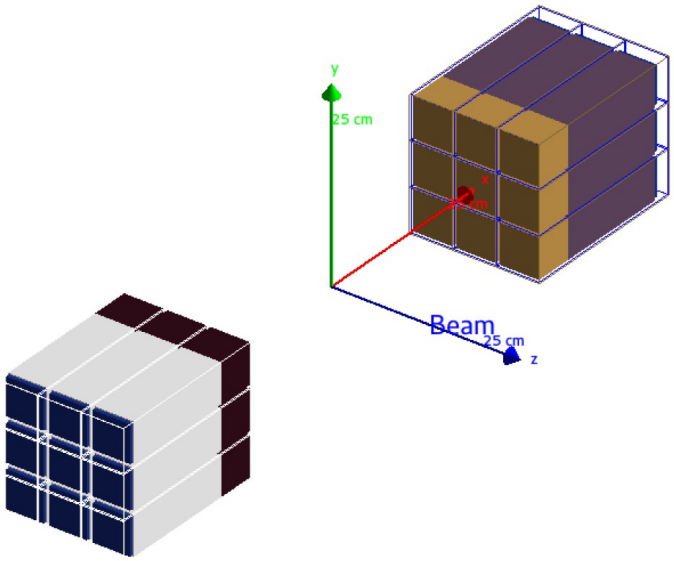
Configuration 1: 9+9 (2 clusters) + multiplicity filter

Configuration 2 : 18 clovers + 4 mini-clusters of 2x2

DAQ: INGA (XIA)+ V1730 ??

XIA based digital DAQ - tested at 100-200- 500 MHz

LaBr3 spectra taken, isomer lifetimes measured



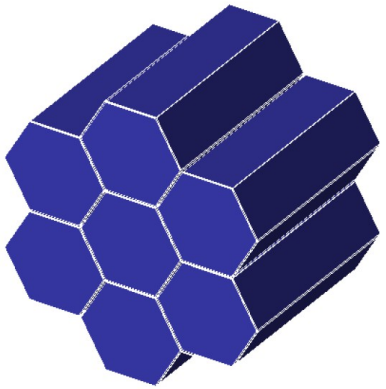


Figure 2: Array of seven hexagonal BaF_2 detector place in close-packed geometry.

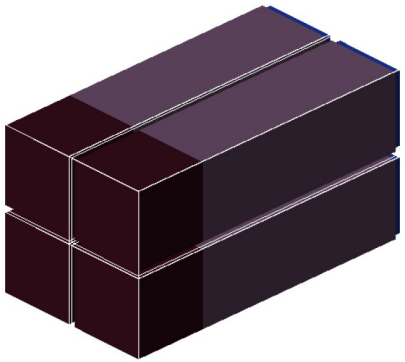
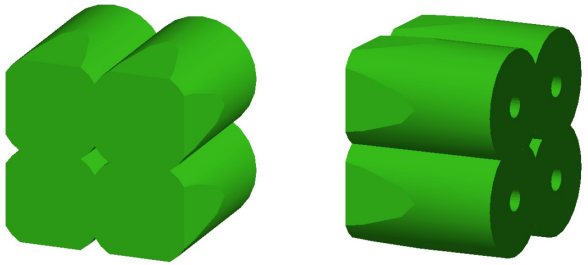


Figure 3: 2×2 cluster of $CeBr_3$-NaI(Tl) phoswich elements placed at a distance of 25 cm from the source position.



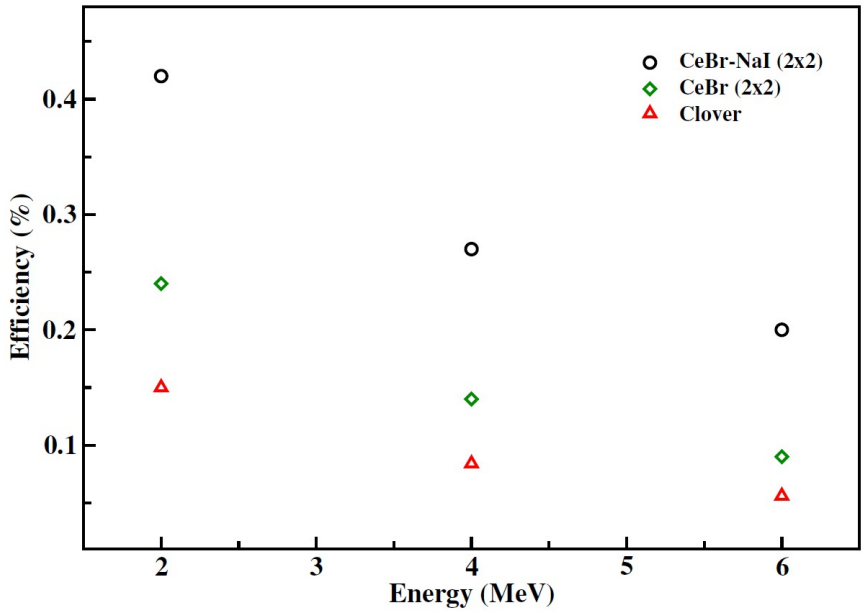
(a) Front view. (b) Rear view.

Figure 4: HPGe clover detector.

Table 2: Photo-peak efficiencies of 3×3 clusters of $LaBr_3$(Ce)-NaI(Tl) and $CeBr_3$-NaI(Tl), 2×2 cluster of $CeBr_3$-NaI(Tl) and BaF_2 array for three different energies.

Energy (MeV)	**Efficiency (%) of**			
	$LaBr_3$-NaI (3×3)	**$CeBr_3$-NaI (3×3)**	**$CeBr_3$-NaI (2×2)**	**BaF_2 (7)**
4.439	0.70	0.71	0.25	0.50
11.680	0.33	0.33	0.10	0.32
22.557	0.10	0.11	0.03	0.17

Energy (MeV)	Efficiency (%) of		
	$CeBr_3$-NaI (2×2)	$CeBr_3$ (2×2)	HPGe clover
2.0	0.42	0.24	0.15
4.0	0.27	0.14	0.08
6.0	0.20	0.09	0.06



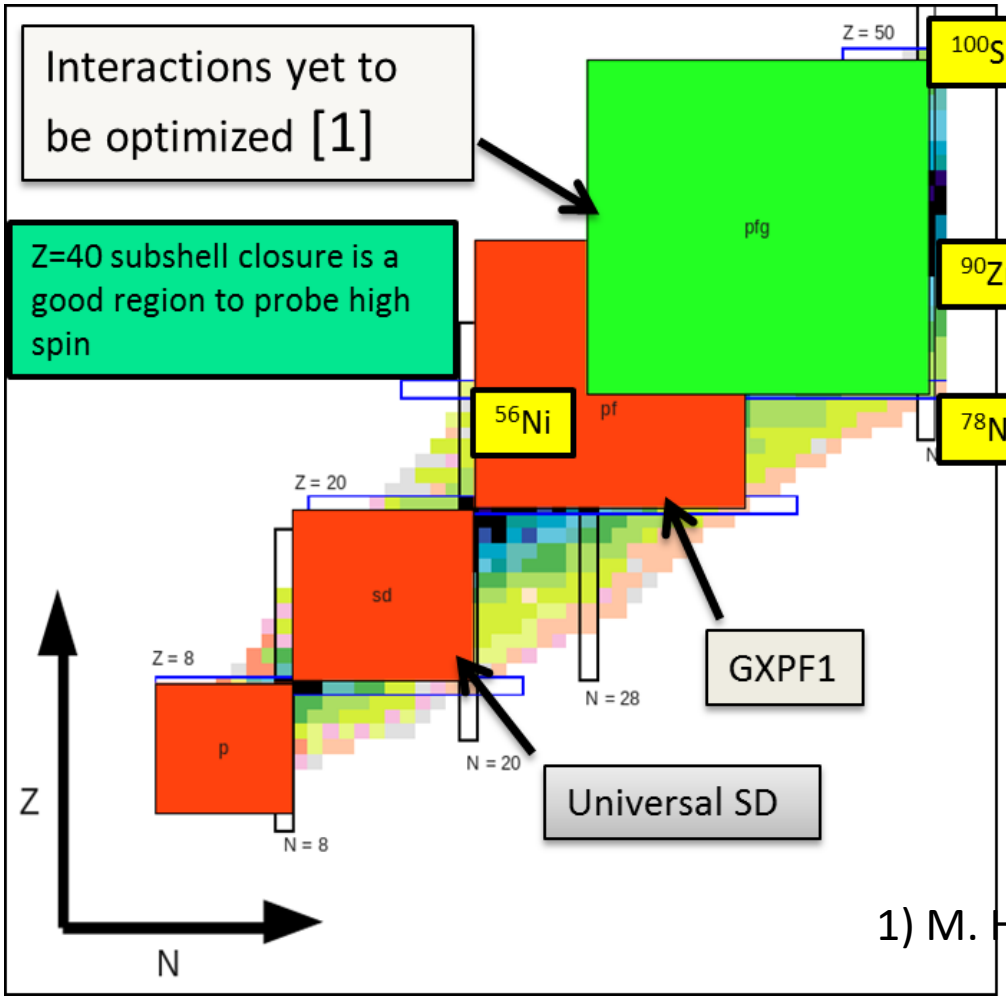
Test of shell model interactions for high spin states near 90Zr

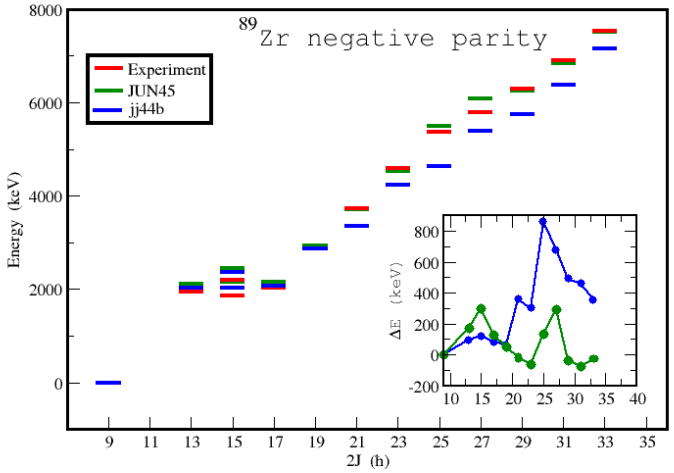
R. Palit
(TIFR –PARIS group)

HPGe array coupled to PARIS will help in search for high energy transitions feeding the low spin states.

- With the increased detection efficiency of the modern state of the art large detector arrays and the upcoming RIB facilities around the world, it is now possible to investigate nuclei at high J, high E* and high isospin.
- In order to explain the spectroscopic findings of these exotic nuclei, recently, a lot of major developments have happened in the theory of large scale shell model calculation in different mass regions spanning the nuclear chart.
- New interactions have been developed to take into account the shell evolution observed in nuclei far away from the stability line.
- However, one of the major focus remains to find an interaction universally valid for the entire model space. For example, Cohen-Kuratch for p shell and Universal SD interaction for sd shell, p+sd shell SFO interaction for p+sd shell and GXPF1 for fp shell.

No interaction has yet been optimized for the f-p-g orbitals





- S. Saha, R. Palit et al., PRC 86 (2012)
- S. Saha, R. Palit et al., PRC 89 (2014)
- P. Singh, R. Palit et al., PRC 90 (2014)

Difficult to extend the level scheme beyond spin 25ħ.

1) M. Honma et. al. Phys. Rev. C 80, 064323 (2009)

Essential for understanding the decay of hot and rotating nuclei near 90Zr.

89Nb : 28Si +65Cu (2p,2n) (105 MeV)
88,89Zr : 13C+80Se (50 MeV)

Some of the Physics problems

- Study of high energy discrete gamma-ray transitions in coincidence with CLOVER array
- Isomer lifetime studies
- Jacobi shape transitions
- GDR studies
- ….

Possible to couple with other auxiliary detectors like neutron array, annular PPAC for residue gating

Tentative timeline ---- Invite proposals for experiments in 2019