

CO  EX 7

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Collective Motion in Nuclei under Extreme Conditions**  
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Istituto Nazionale di Fisica Nucleare

*Latest results on NArCoS: a new correlator for neutrons and  
charged particles with high angular and energy resolution  
(Neutron Array for Correlation Studies)*

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# NArCoS (Neutron Array for Correlation Studies)

## Idea for a new Neutron Hodoscope

**To realize a prototype of detector able to detect at the same time charged particles and neutrons with high energy and angular resolution for reaction studies and applications**

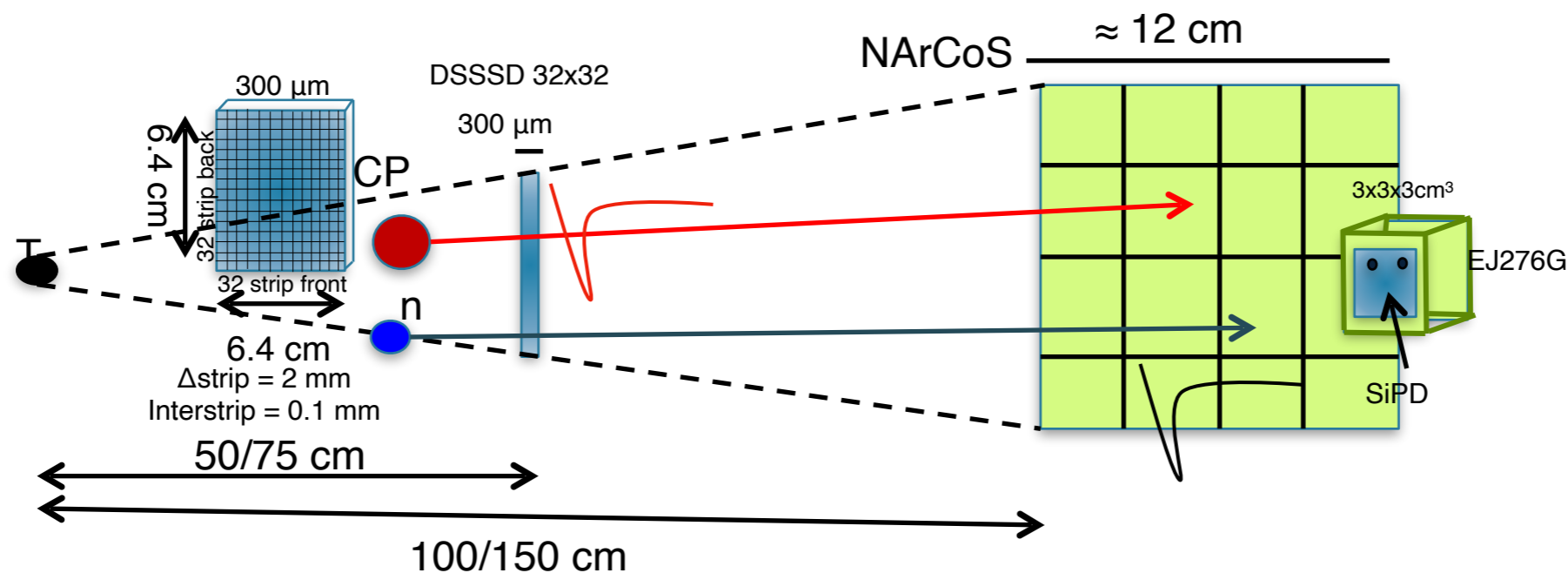
### Detector

- Candidate: The plastic scintillator EJ276-Green Type (ex EJ299-33) (3x3x3cm<sup>3</sup>)
- 1 cluster: 4 consecutively cubes -> 3x3x12 cm<sup>3</sup>
- Neutron detection efficiency  $\approx 50\%$  for the prototype (16 clusters)
- Reading the light signal: Si-PM and digitalization
- Modular, reconfigurable (in mechanic and electronic)
- Discrimination of n/ $\gamma$  from PSD (but also light charged particles)
- Energy measurement from ToF ( $\Delta t \leq 0.5$  ns with  $L_{\text{ToF}} \approx 1 \div 1.5$  m)

TOF measured using the RF of the CS or with an ancillary MCP (low intensity exotic beams)

### Physic cases

- Neutron-particles correlations (HBT)
- Reaction Dynamics and time scale
- Symmetry Energy in EoS of nuclear matter
- Nuclear structure of unbound exotic nuclei
- In medium nuclear interaction
- Nuclear astrophysics (neutron stars and nucleosynthesis processes)
- Medical application (neutron production cross section, differential cross sections)



# PSD studies using sources

*E.V.Pagano, G. Politi, A. Simancas et al., in preparation*

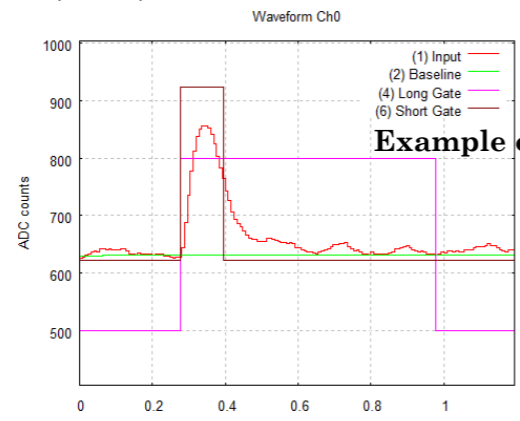
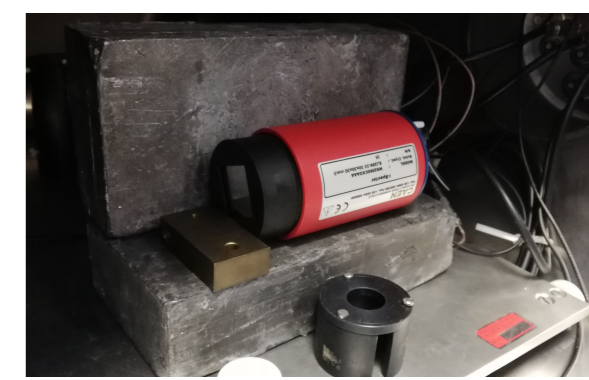
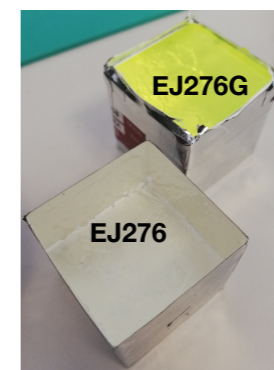


## Detector Configurations:

- EJ-276G + PMT
- EJ-276 + i-Spector
- EJ-276G + i-Spector

## Lab measurements with radioactive sources:

- Vacuum Chamber
- Pb shield
- Gamma sources:  $^{133}\text{Ba}$ ,  $^{137}\text{Cs}$ ,  $^{60}\text{Co}$ ,  $^{152}\text{Eu}$
- Alpha source:  $^{241}\text{Am}$
- Digitizer from CAEN

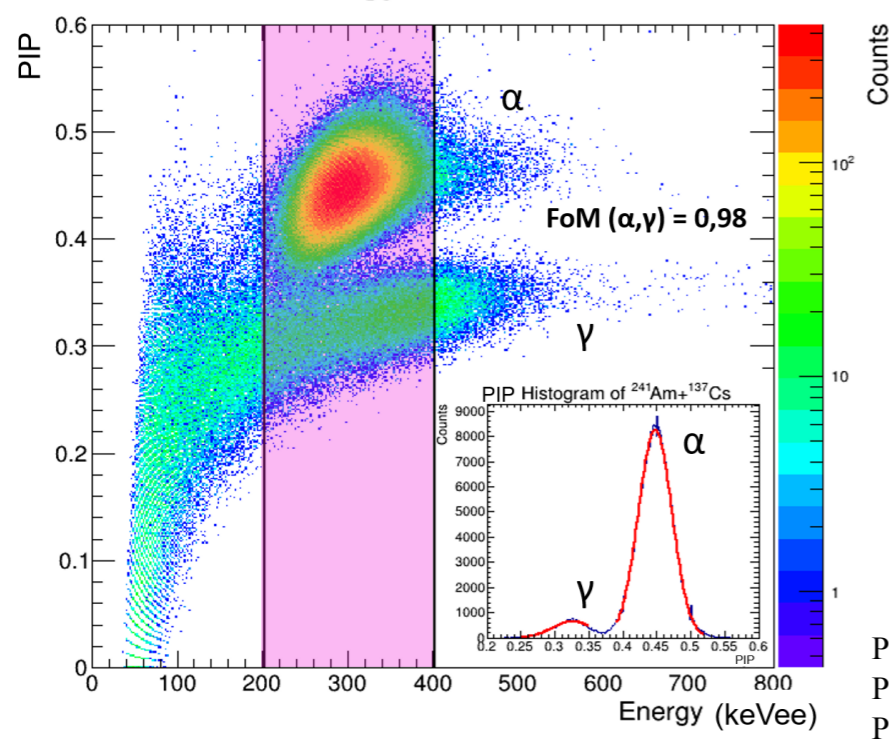


Example of signal and integration windows

Particle Identification Parameter

$$PIP = 1 - \frac{Q_{fast}}{Q_{tot}} = \frac{Q_{slow}}{Q_{tot}}$$

PIP vs. Energy of  $^{241}\text{Am} + ^{137}\text{Cs}$  002

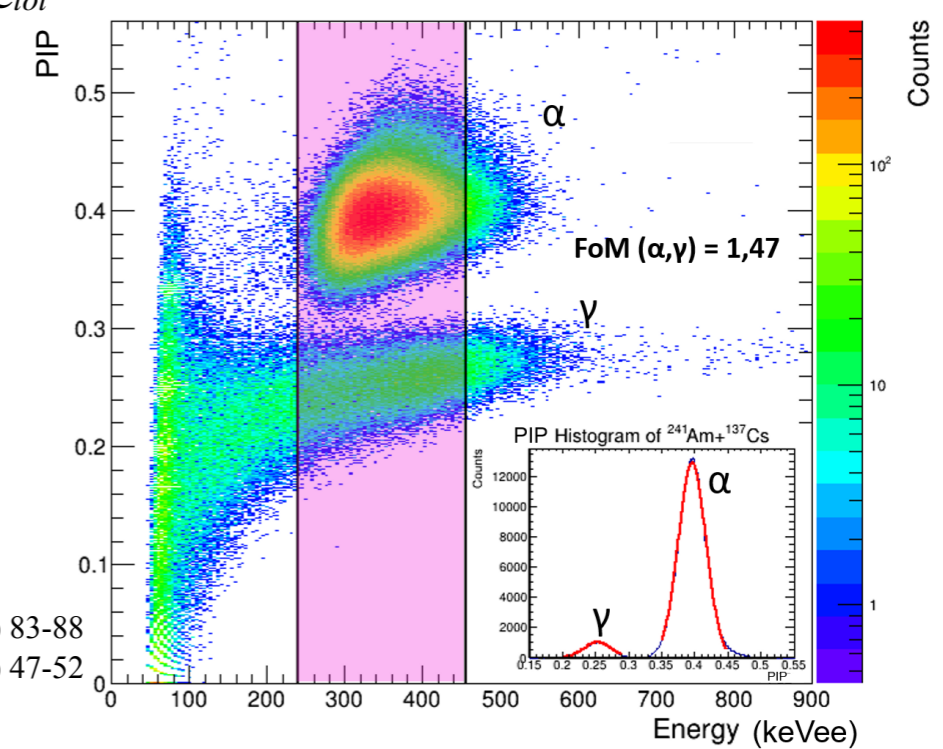


**EJ-276 + i-Spector**

### Results

Detector	FoM
i-Spector + EJ-276	0.98
i-Spector + EJ-276G	1.47
PMT + EJ-276G	1.03

PIP vs. Energy of  $^{241}\text{Am} + ^{137}\text{Cs}$  001



**EJ-276G + i-Spector**

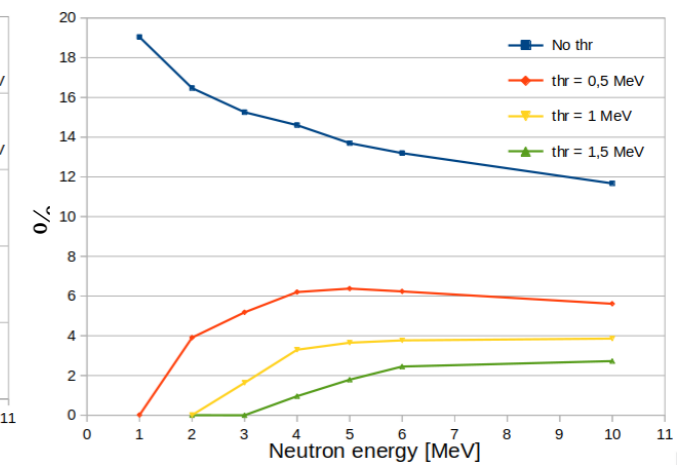
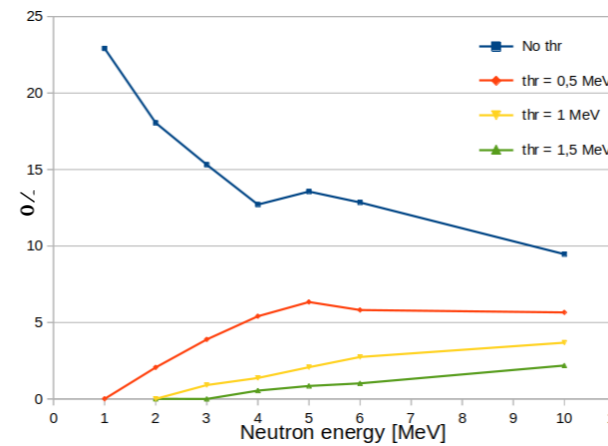
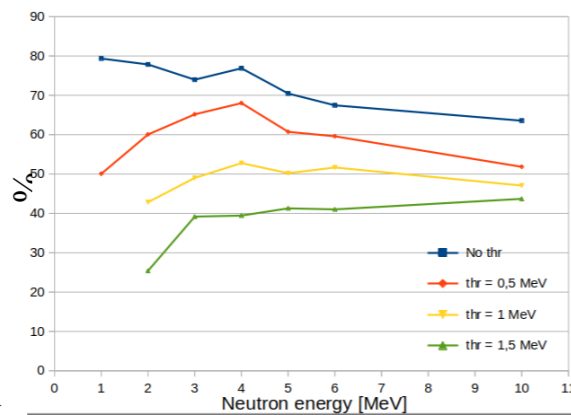
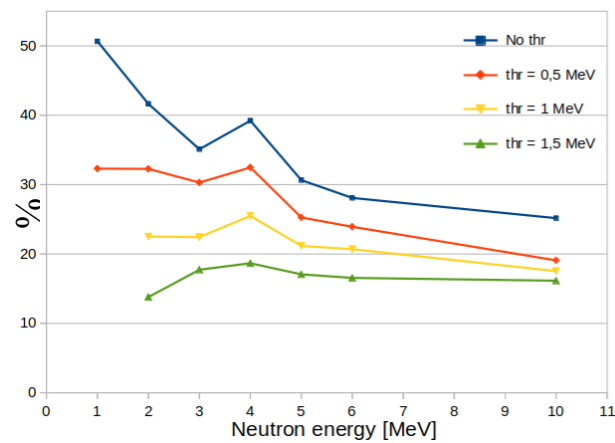
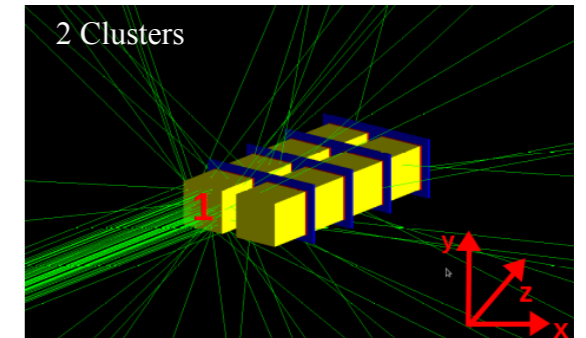
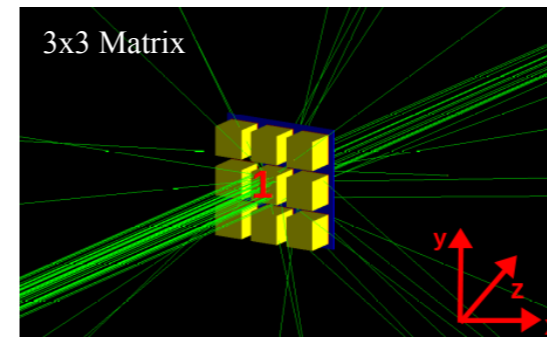
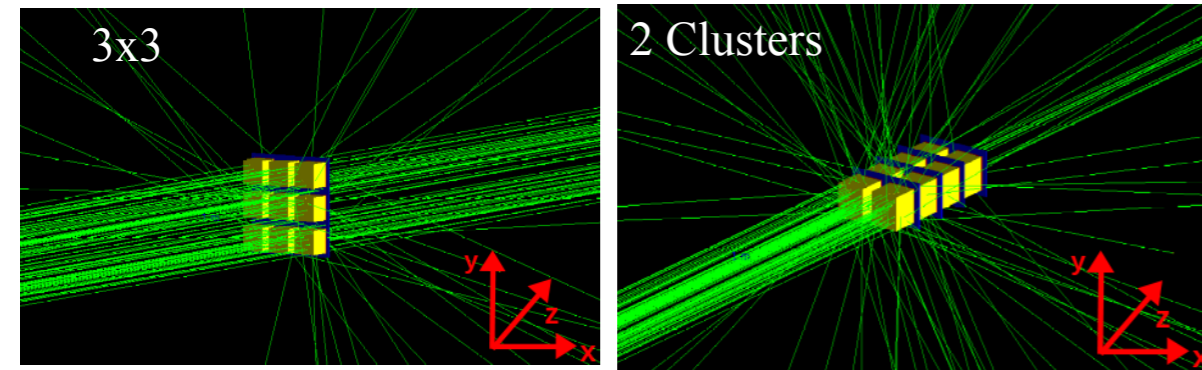
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# preparation of the CROSSTEST exp at LNL (end of 2023)

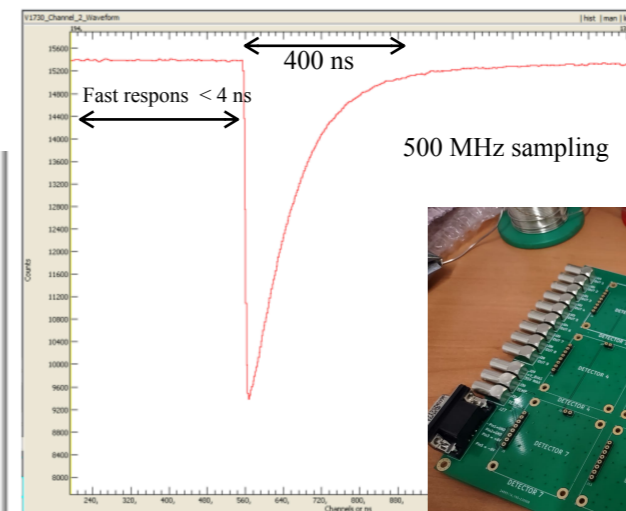
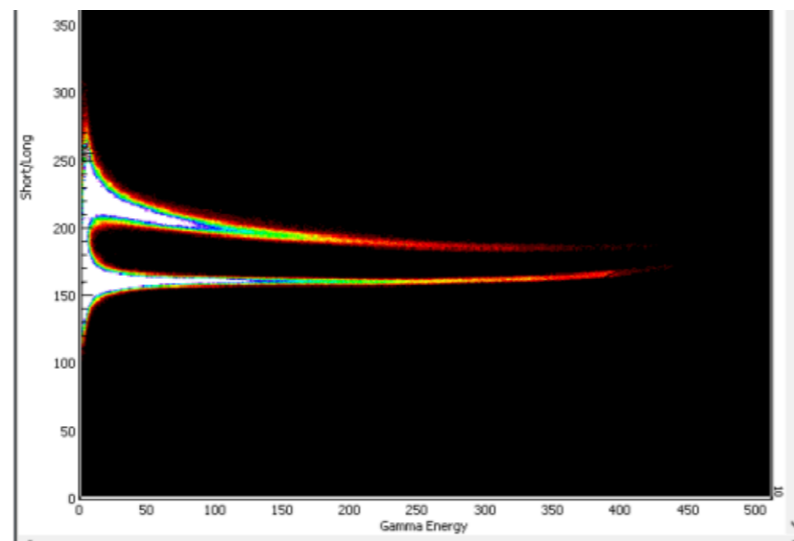
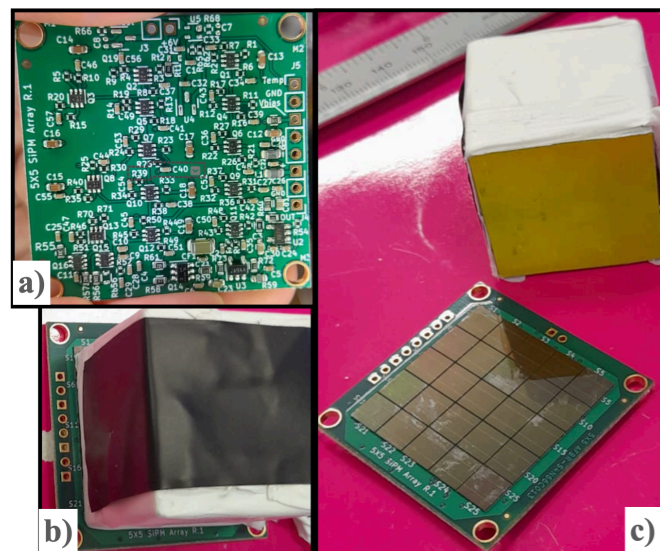
Two configurations will be tested

## Efficiency calculation (GEANT4)

## Crosstalk problem study (GEANT4)



## Prototypal electronics



For more information, let's visit the poster

Thanks