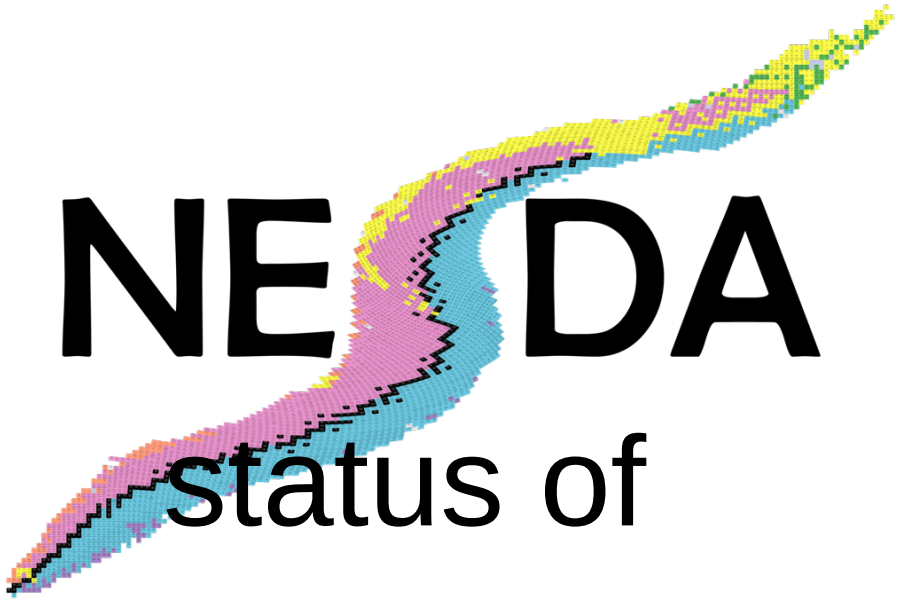


status of

Marcin Palacz
Heavy Ion Laboratory, University of Warsaw

for the NEDA collaboration

NEDA (NEutron Detection Array)

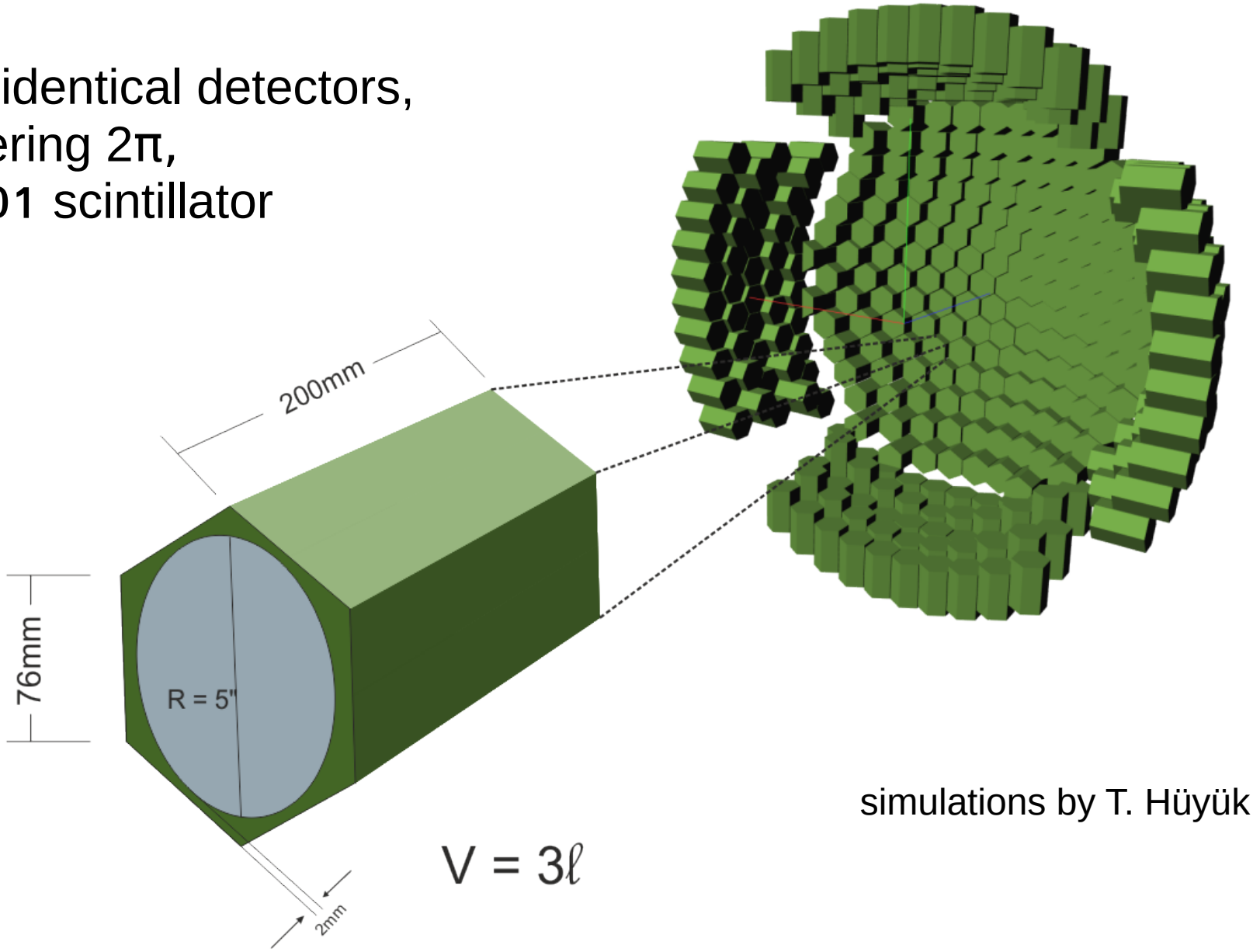
- The primary application of NEDA is to act as neutron multiplicity filter in γ-ray fusion-evaporation studies of very neutron deficient nuclei, close to N=Z, in reactions in which neutron emission is rare.
- NEDA will be used with AGATA, EXOGAM2, GALILEO, PARIS, EAGLE, etc, for experiments with high intensity stable and radioactive ion beams
- The array should have:
  - Increased neutron detection efficiency compared to existing devices (Neutron Wall):
    ε(1n) ≈ 40% (20-25%), ε(2n) ≈ 6% (1-3%) ε(3n) ≈ 1% (0.1 %)
  - **Excellent neutron-gamma and 1n/2n/3n discrimination**
  - Capability to run at high rates (gamma rays).

Strategy

- Optimize size of detector units, distance to target, geometry of the array (also choice of the scintillator).
- Choice of PMT, voltage divider.
- Digital electronics.
- Development of efficient on-line and off-line algorithms for the determination of times, neutron-gamma discrimination, neutron scattering rejection, pile-up rejection/recovery.

Complete array

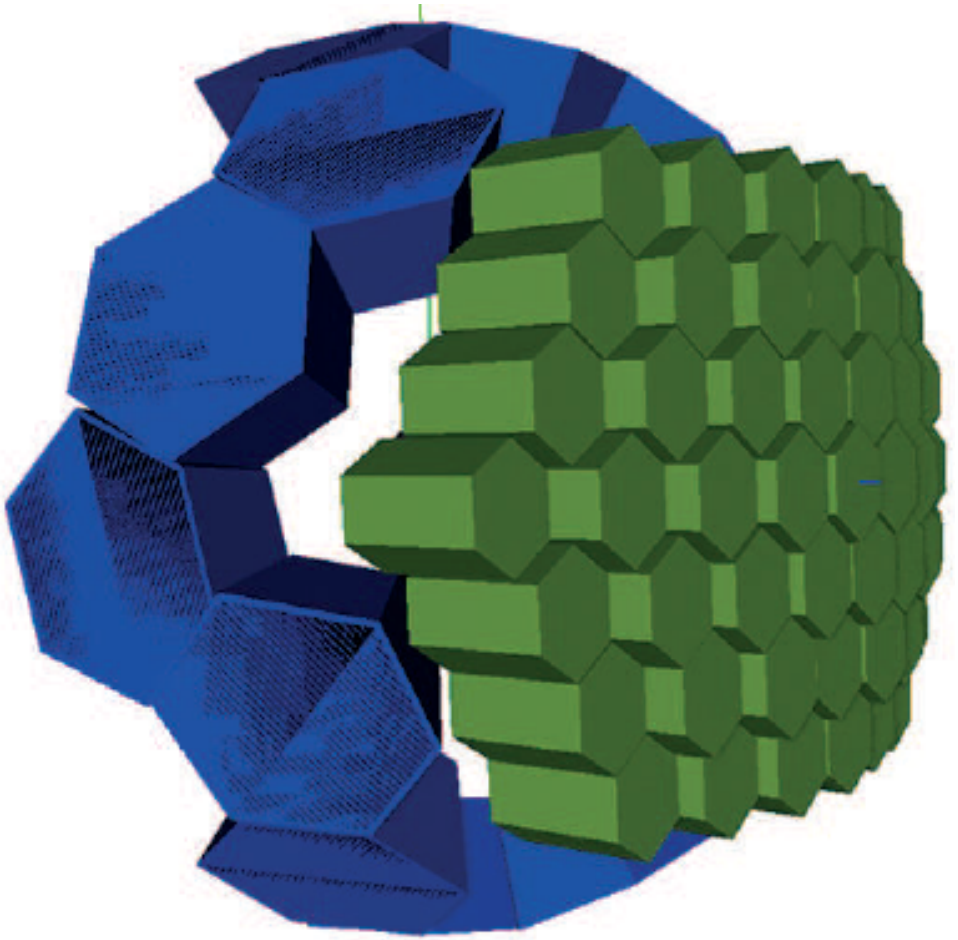
- 355 identical detectors, covering 2π,
  EJ301 scintillator



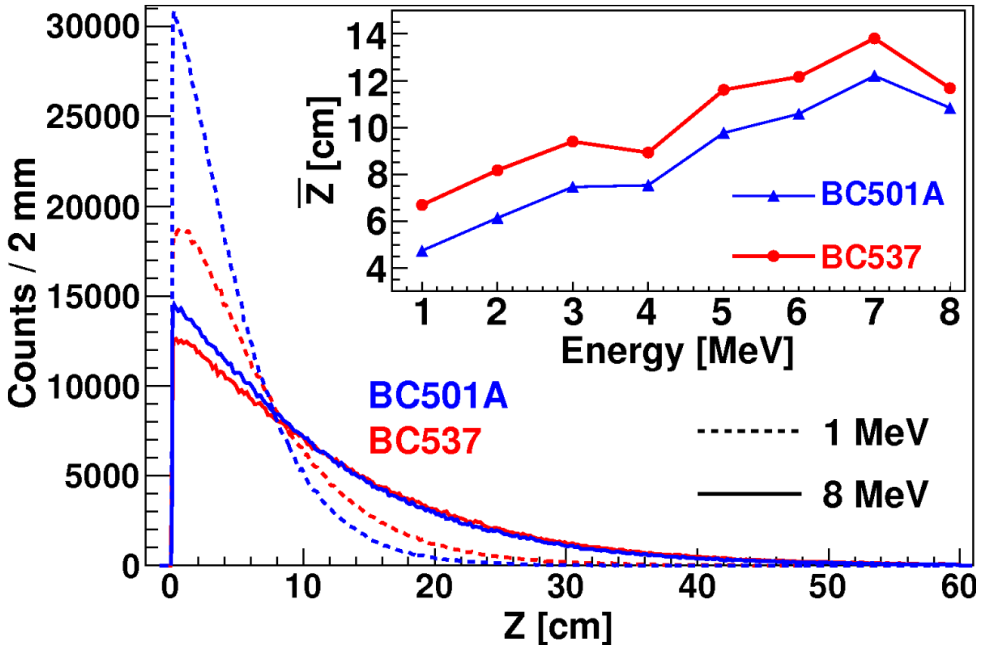
simulations by T. Hüyük

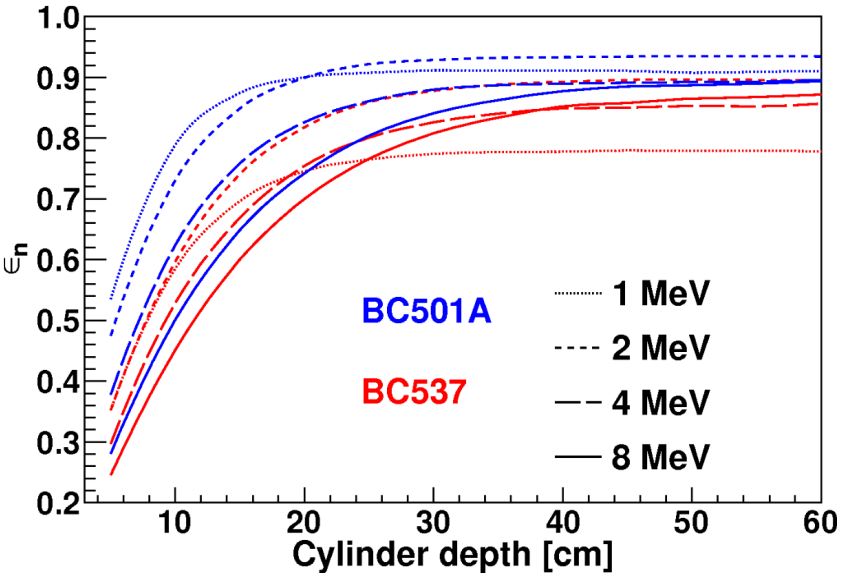
Phase 1

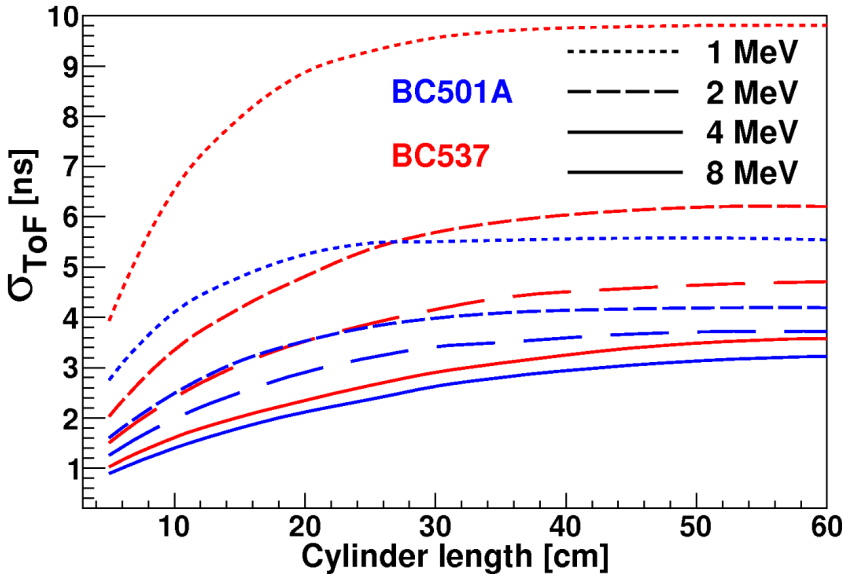
- 1π array (54 detectors)
  combined with 42 Neutron Wall detectors

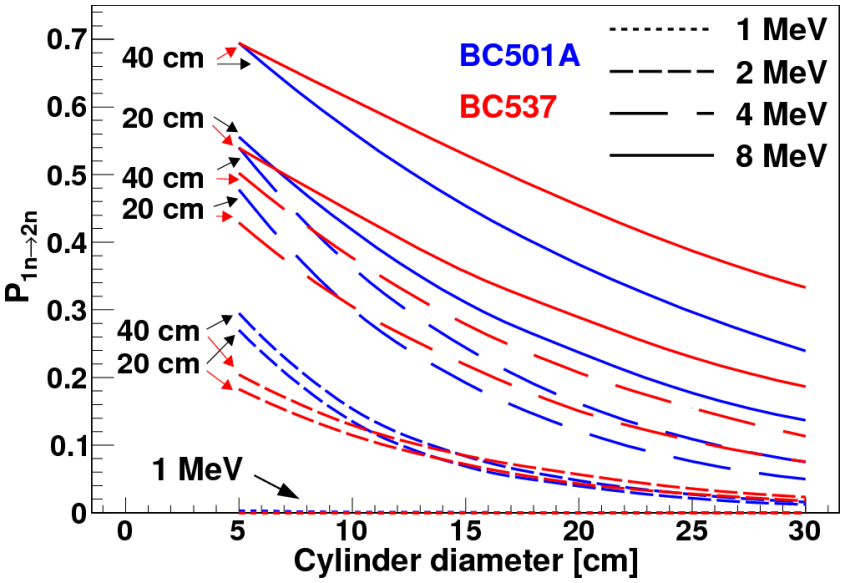


Optimization of a single cell & choice of the scintillator



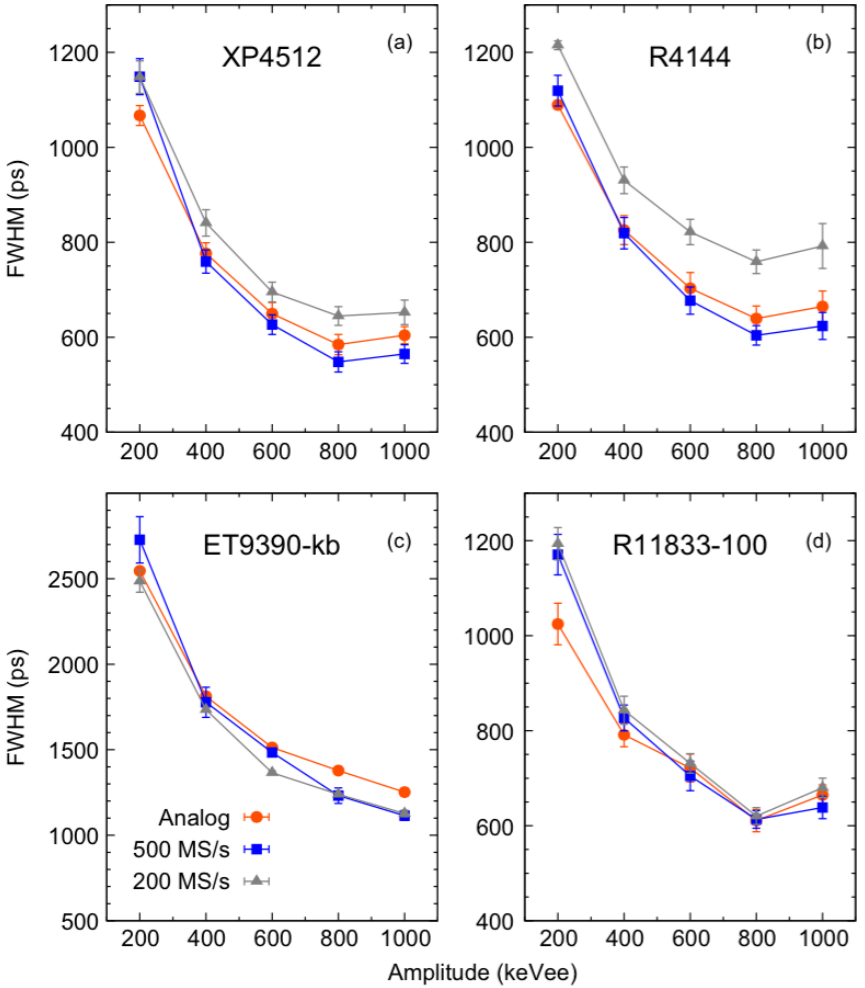






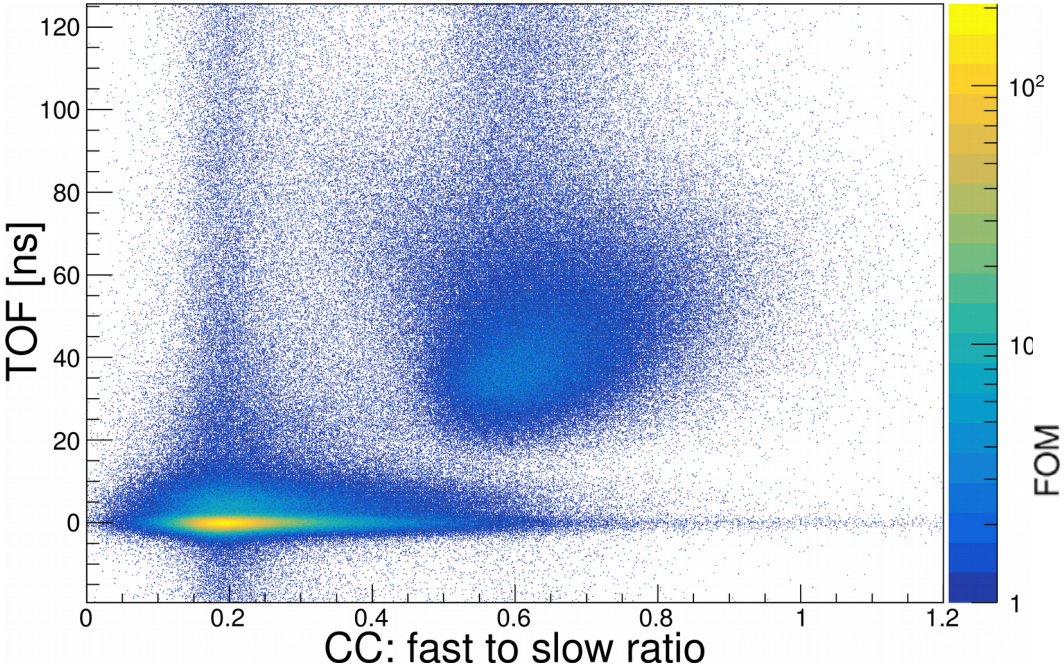
G.Jaworski et al. NIM A673 (2012) 64
G.Jaworski, PhD thesis

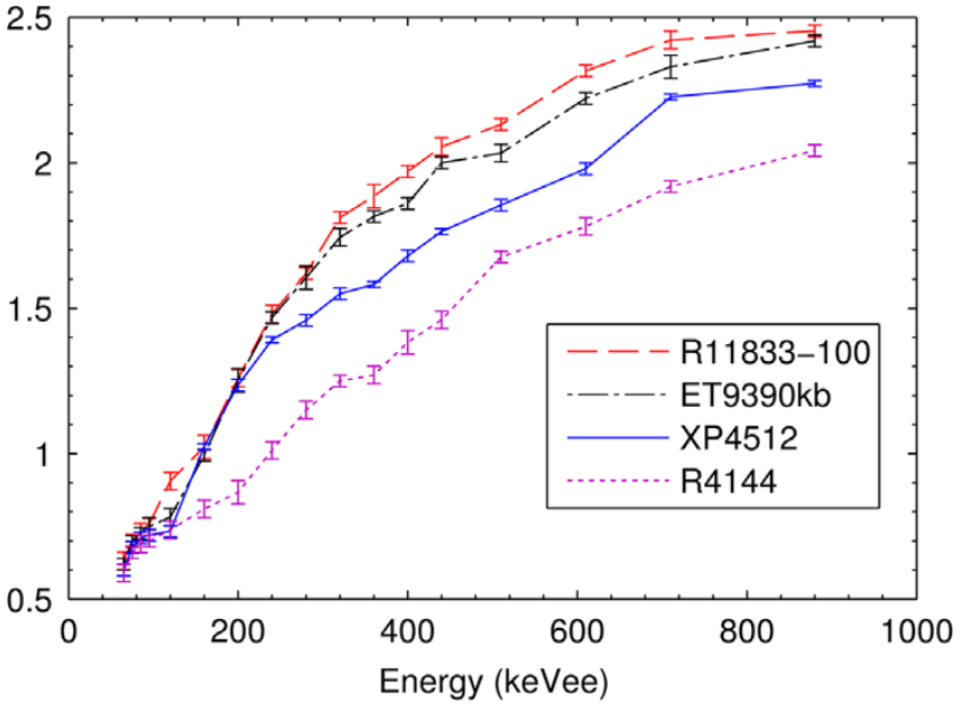
Timing: choice of PMT, digital timing algorithms



V.Modamio et al. NIM A775 (2015) 71

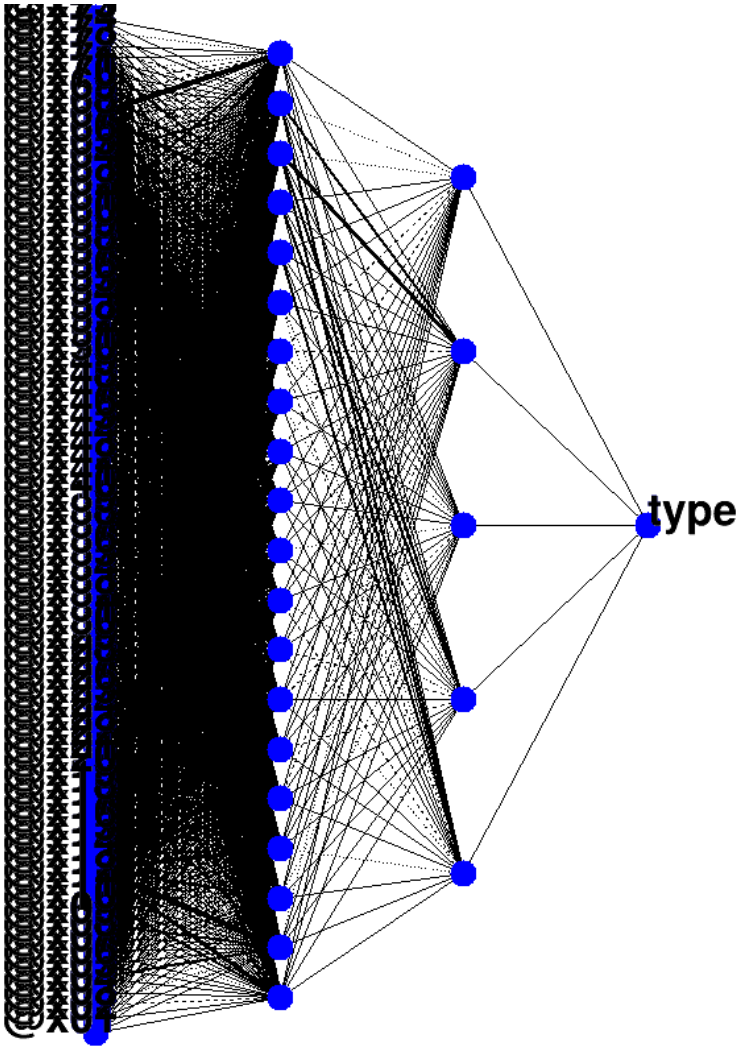
Neutron-gamma discrimination (digital)

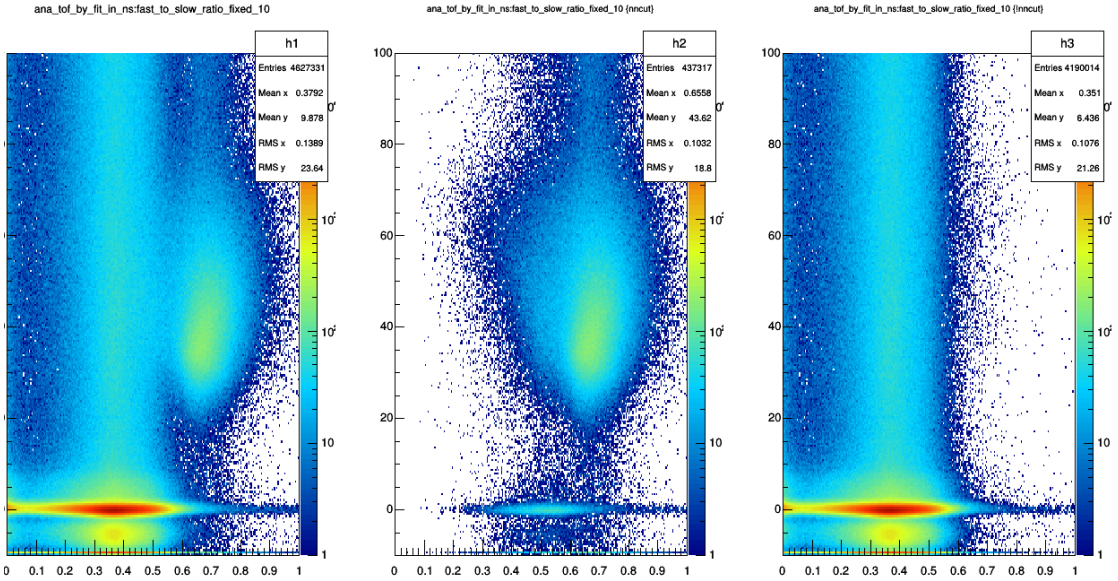




X.L.Luo et al. NIM A767 (2014) 83

NGD Artificial Neural Networks

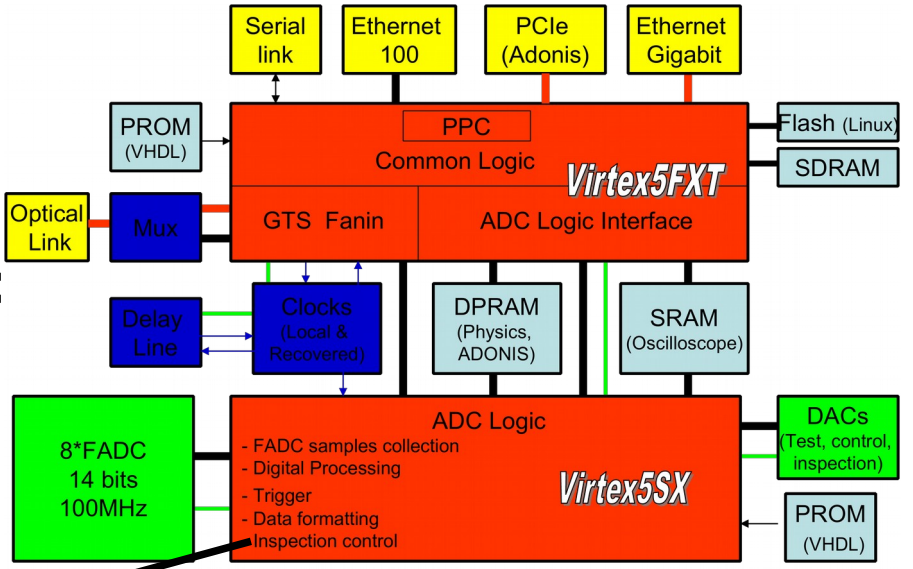


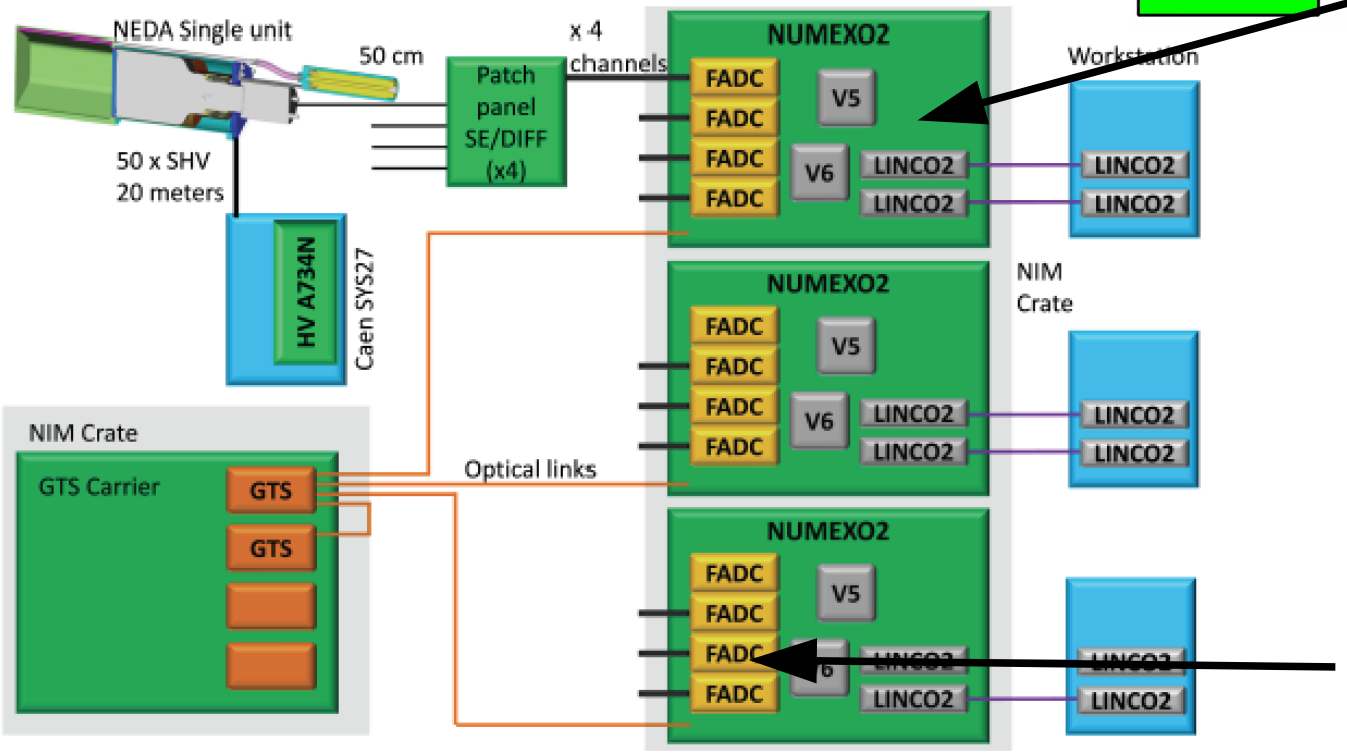


P.-A. Söderström

Electronics

- → NUMEXO2
  - 200 MHz, 14 b (11.3 enob) Mezzanines FADC
- → GTS on board
- → GTS logic trigger tree
- → Trigger Processor





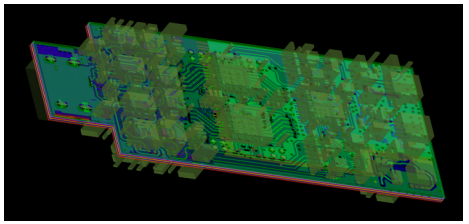


Figure 20: Global electronics layout for 48 NEDA detectors

Production of detectors

60 detectors ready

→ Detector vessels and PMT housings are made by welding flanges to hexagonal profiles

→ EJ520 TiO_2 paint; TorrSeal; 5” 5mm BK7 glass

→ Expansion bellow – ΔT = 40 K.

→ EJ301 (BC501) liquid scintillator

→ SBA R11833-100HA 5” PMT (32% Q.E.)

→ custom transistorized VD provided by Świerk

→ mu-metal shielding (1 mm)

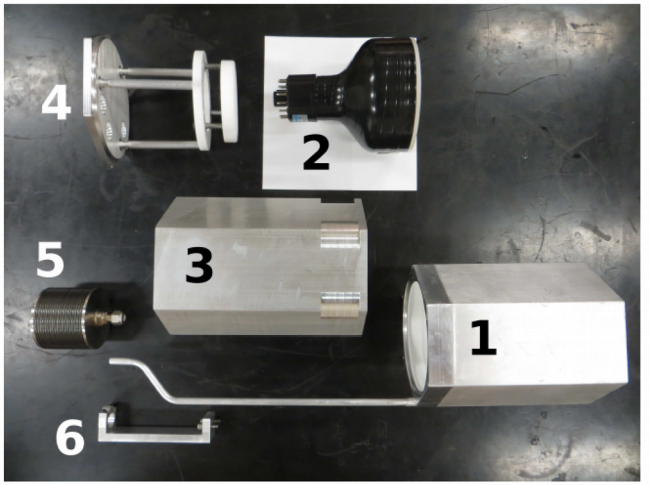
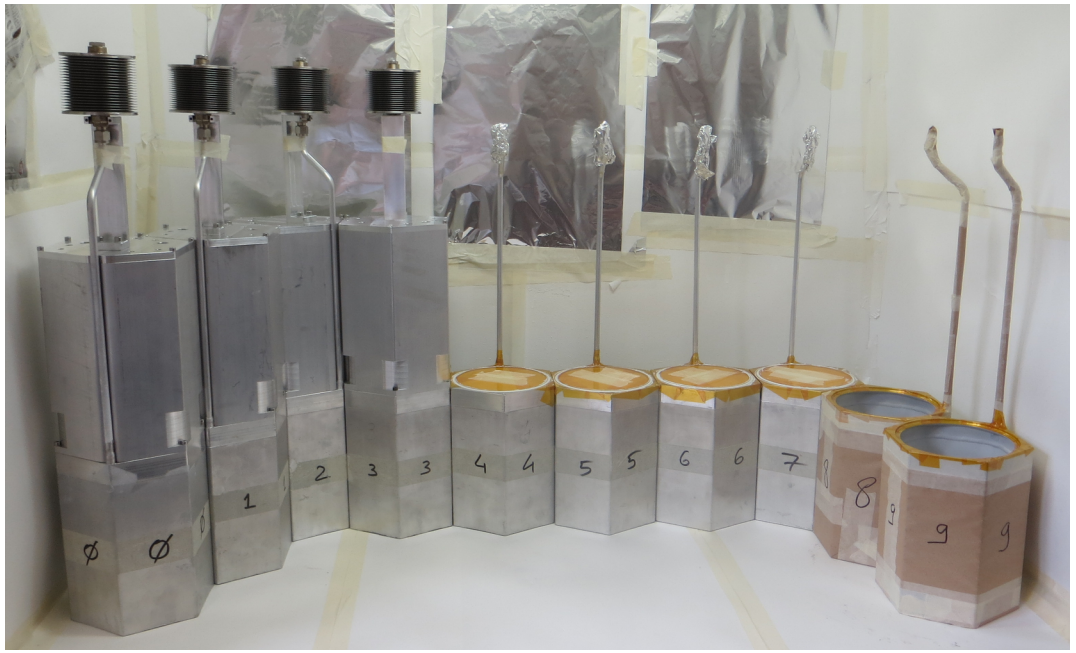
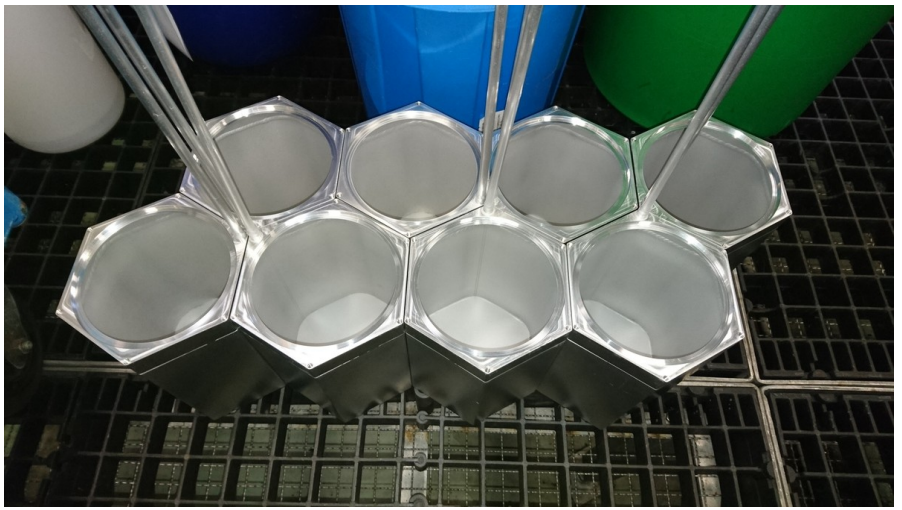


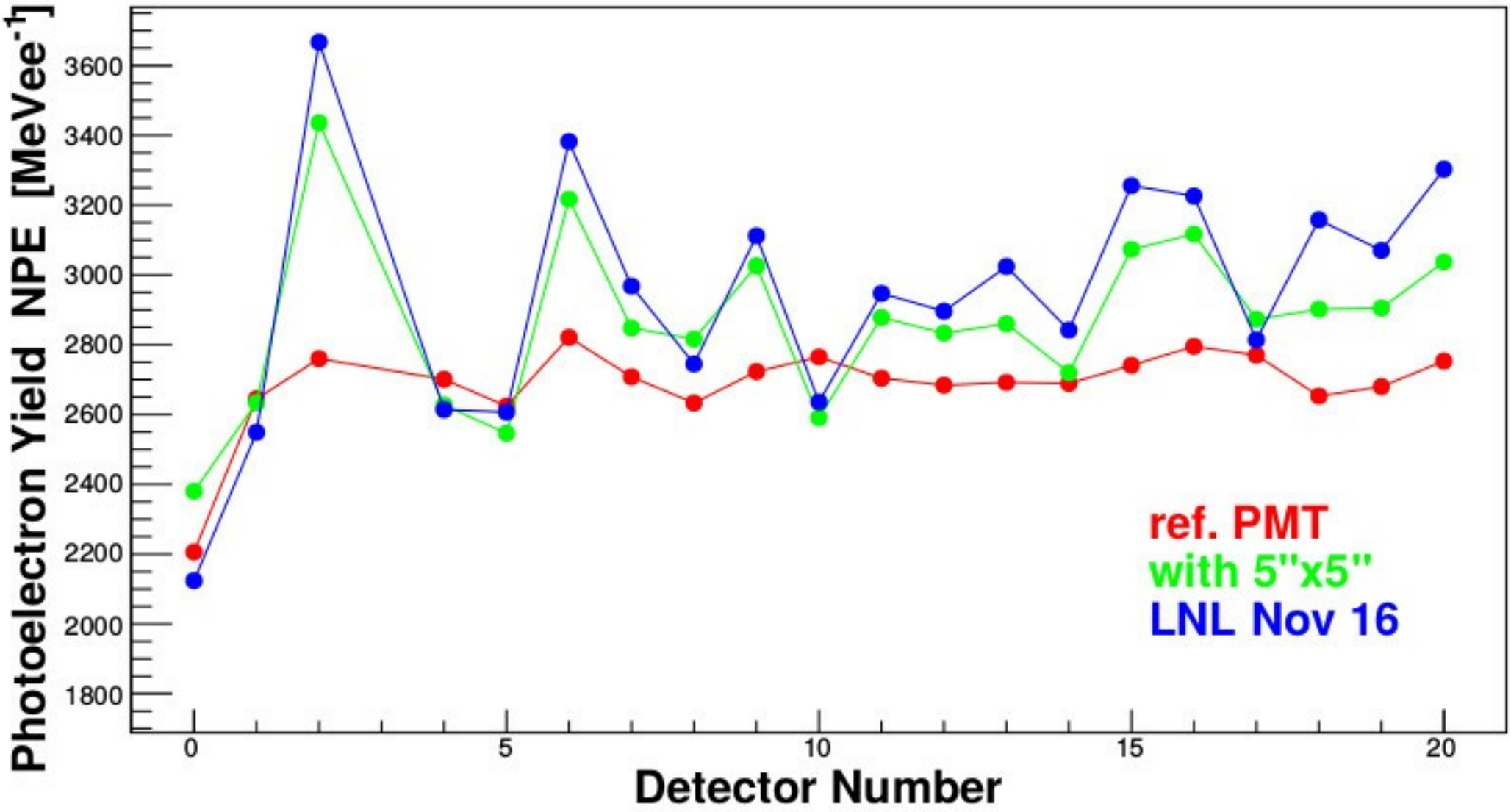
Fig. 1. Elements used for the construction of the NEDA detector: detector cell, with extension pipe (1); PMT (2); PMT housing (3); PMT pusher (4); the bellow (5) and the support for the bellow (6).





G. Jaworski et al, LNL

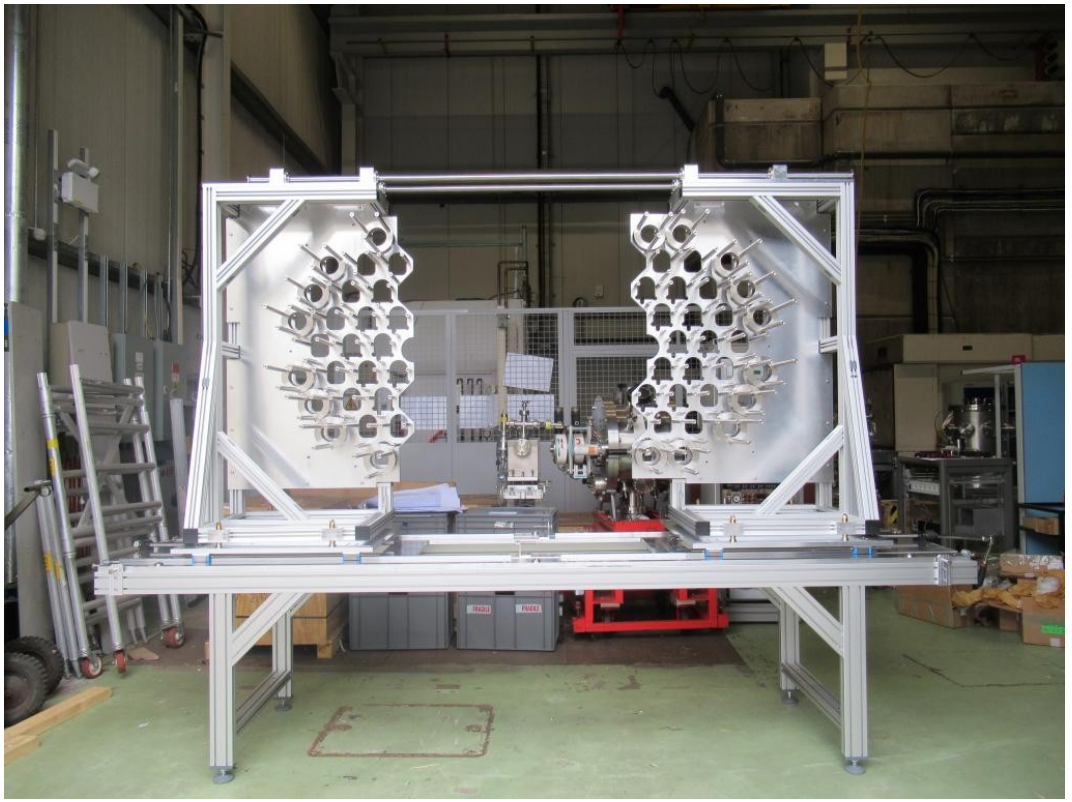
Characterisation of detectors



G. Jaworski et al, LNL

Mechanics

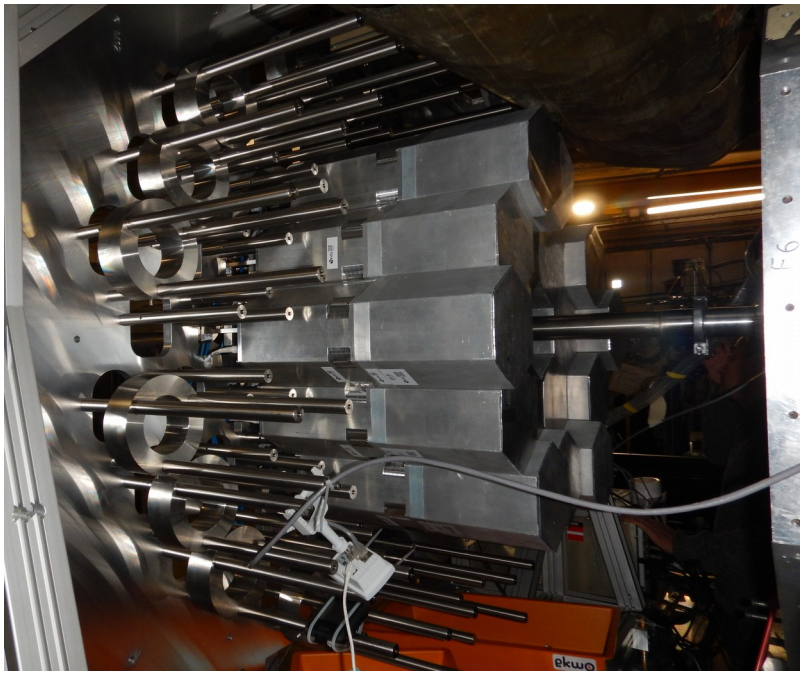
Ian Burrows, Mike Cordwell, Alant Grant

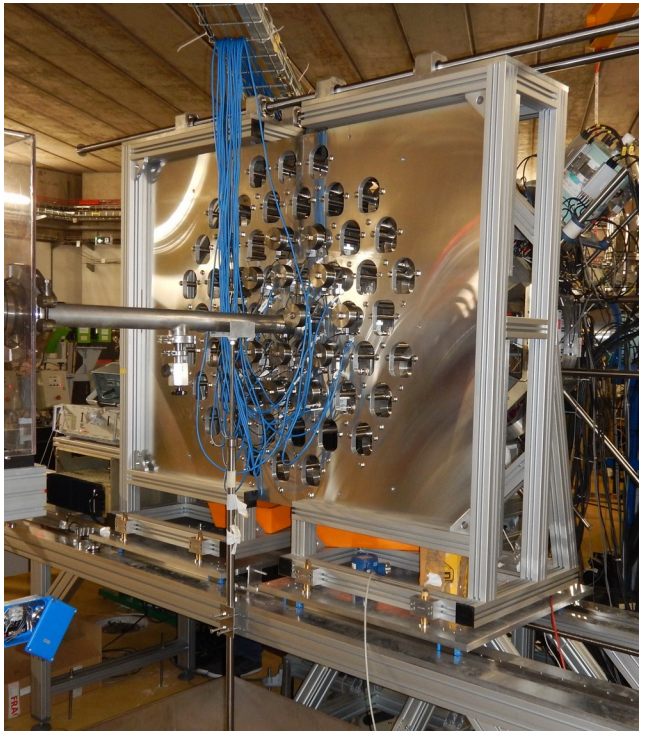


→ NEDA & NW support structures designed in Daresbury
→ NEDA structure machined in UK and tested in Daresbury
→ NWall structure machined in UK, Italy (LNL) and Poland

GANIL 2017

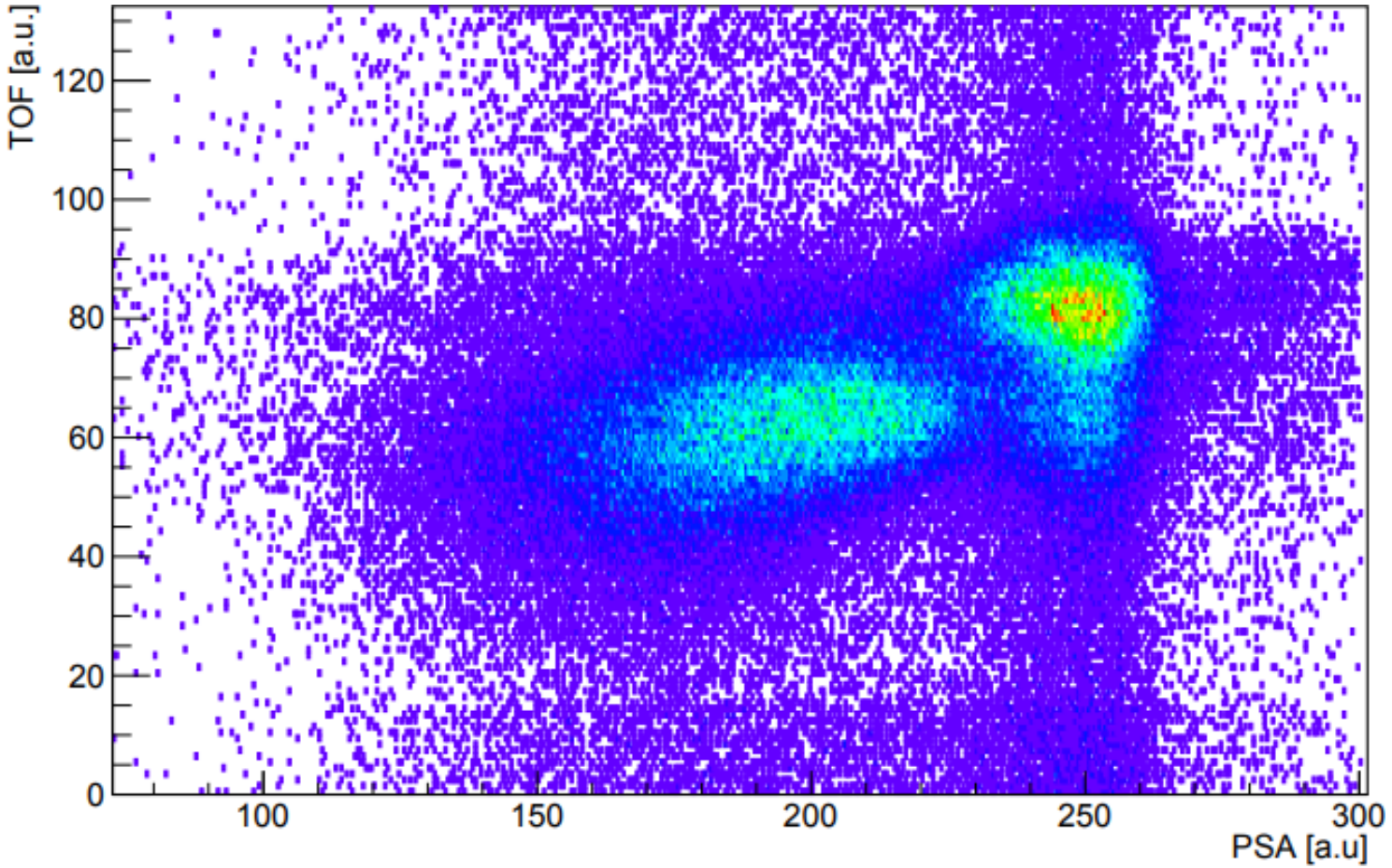
- 16 NEDA detectors mounted in October in at GANIL (G2), with DIAMANT and EXOGAM
- The 3 detector arrays connected to 3 fully digital systems, using NUMEXO2, GTS and the new Trigger Processor
- First source and in-beam tests run in November/December





NEDA tests in November/December

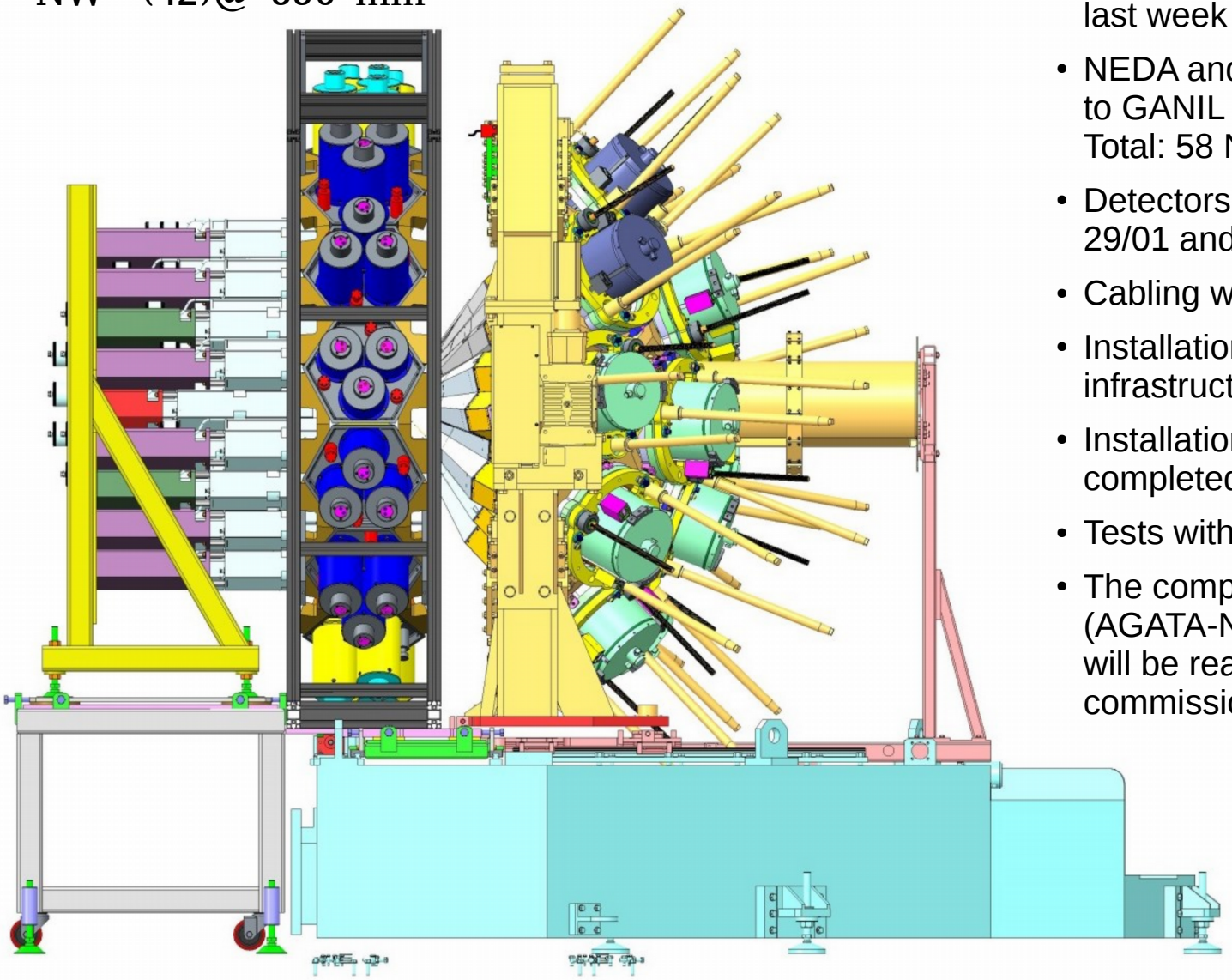
Three short in-beam measurements:
36Ar + 58Ni (2UTs — 16 hours) 5 Nov.
78Kr + 58Ni (3UTs — 24 hours) 11 Nov.
124Xe + 12C (3UTs — 24 hours) 3 Dec.



A GO decision on 11 January

Present (almost)

AGATA @ 145 mm
NEDA(54)@ 510 mm
NW (42)@ 650 mm



- NEDA and NWall frames installed in G1 last week
- NEDA and NWall detectors arrived (?) to GANIL yesterday
  Total: 58 NEDA + 14*3 NWall
- Detectors will be tested starting from 29/01 and will be installed after the tests
- Cabling will follow
- Installation of the electronics and of the infrastructure is in progress
- Installation of NEDA-NWall to be completed in week 6 (5–9 February)
- Tests with sources will start in February
- The complete setup (AGATA-NEDA-NWall-DIAMANT) will be ready for the in-beam commissioning by the end of March

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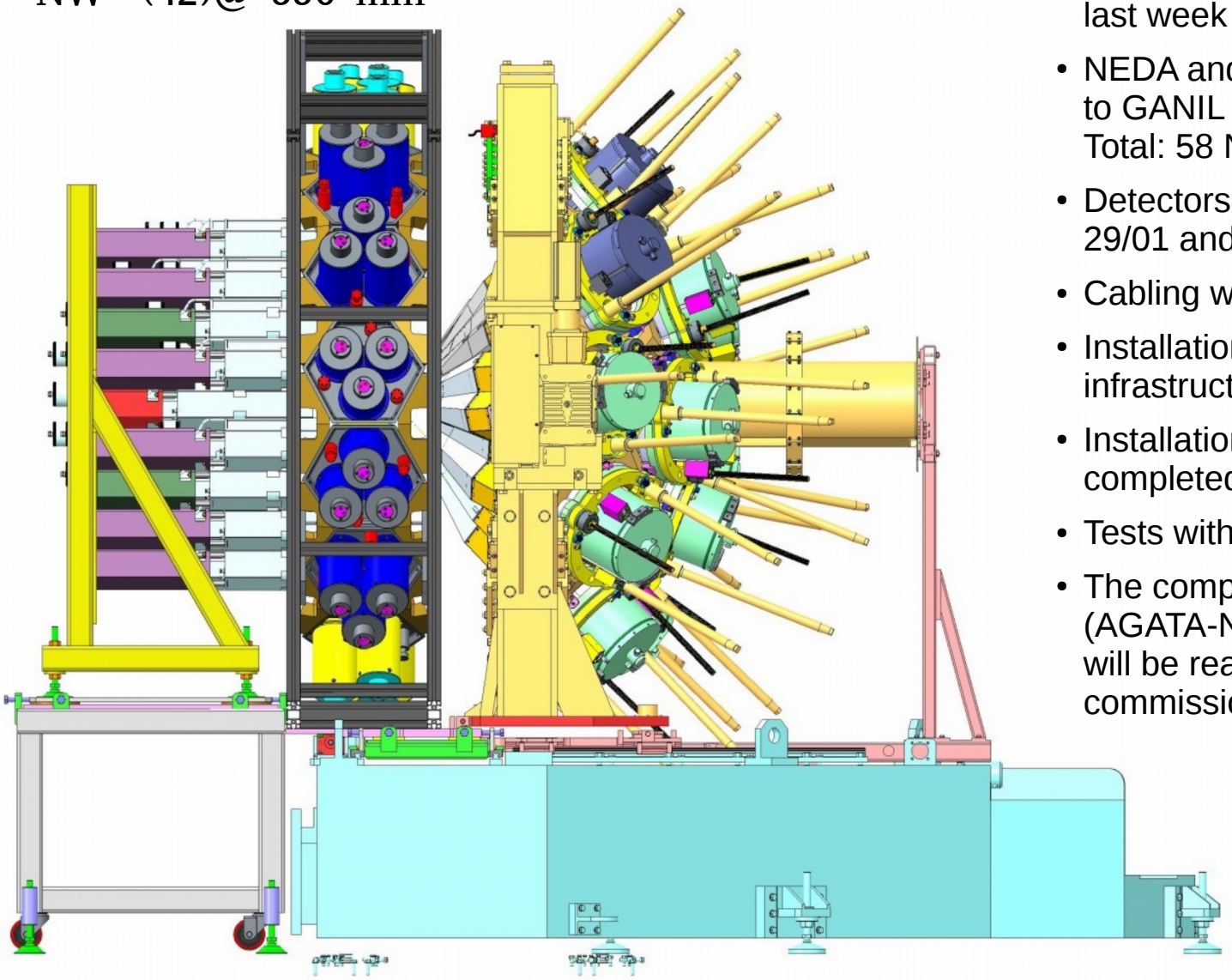

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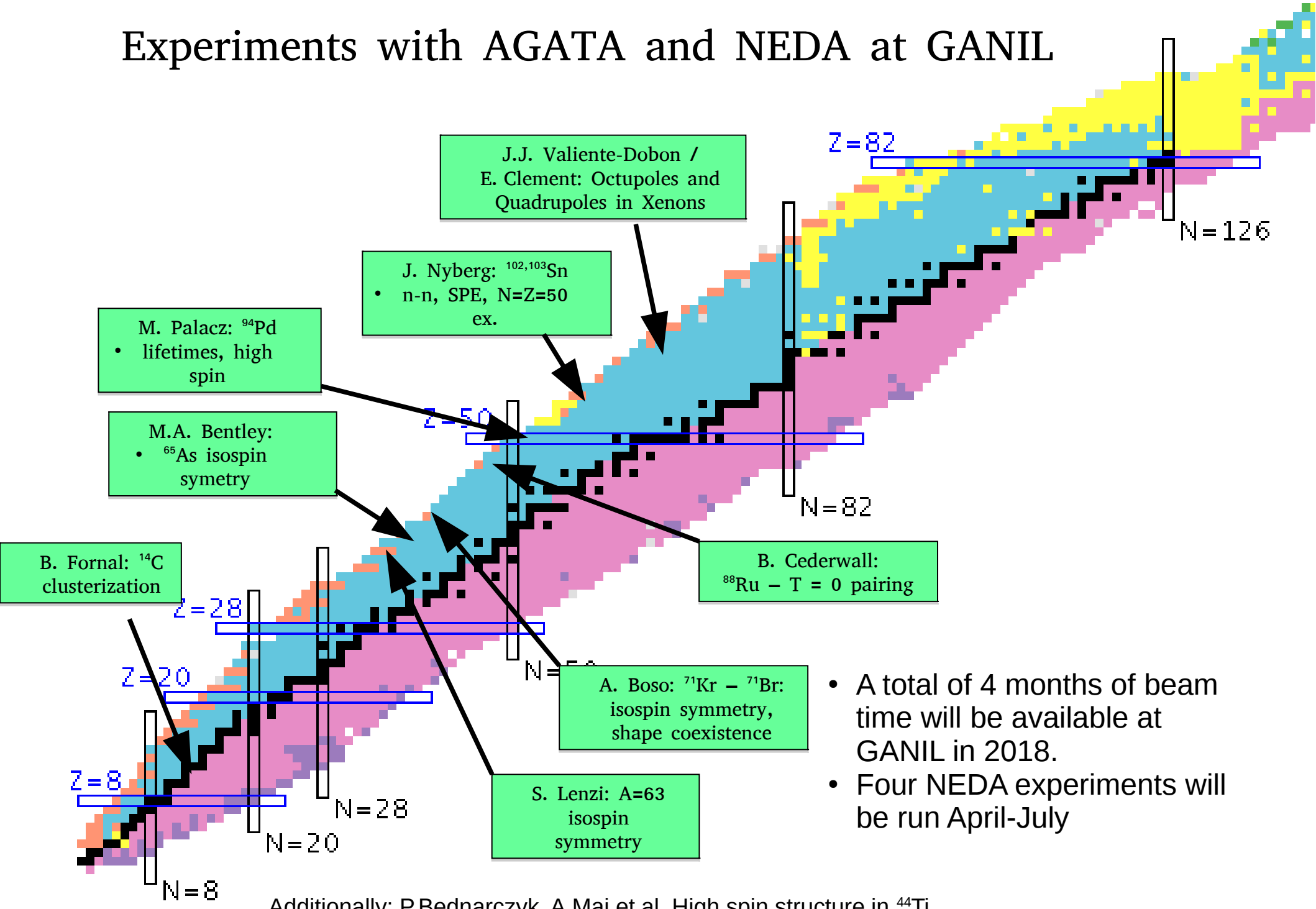
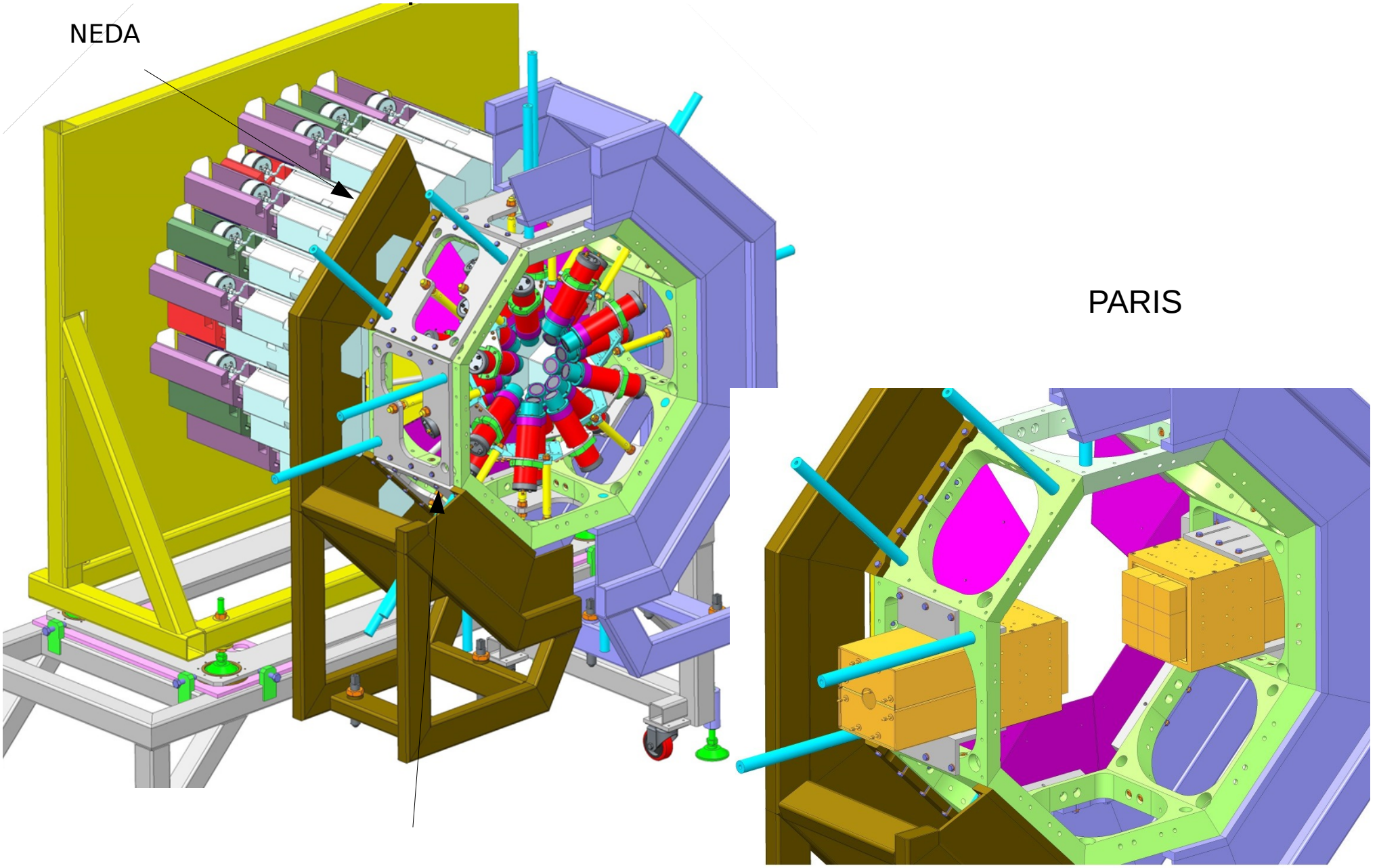
Experiments with AGATA and NEDA at GANIL



- A total of 4 months of beam time will be available at GANIL in 2018.
- Four NEDA experiments will be run April-July

Additionally: P.Bednarczyk, A.Maj et al. High spin structure in ^{44}Ti

NEDA and EXOGAM FRAME



Conclusion

NEDA will soon be ready for experiments

Collaboration

GANIL (G. de France et al.)

Legnaro, Padova (J.J.Valiente-Dobon (PM) et al.)

Uppsala (J. Nyberg et al.)

Valencia (A. Gadea et al.)

Istanbul, Negde (M.N.Erduran et al.)

Warszawa, Kraków, Świerk