TRACE
status and perspective for the new RIB facilities

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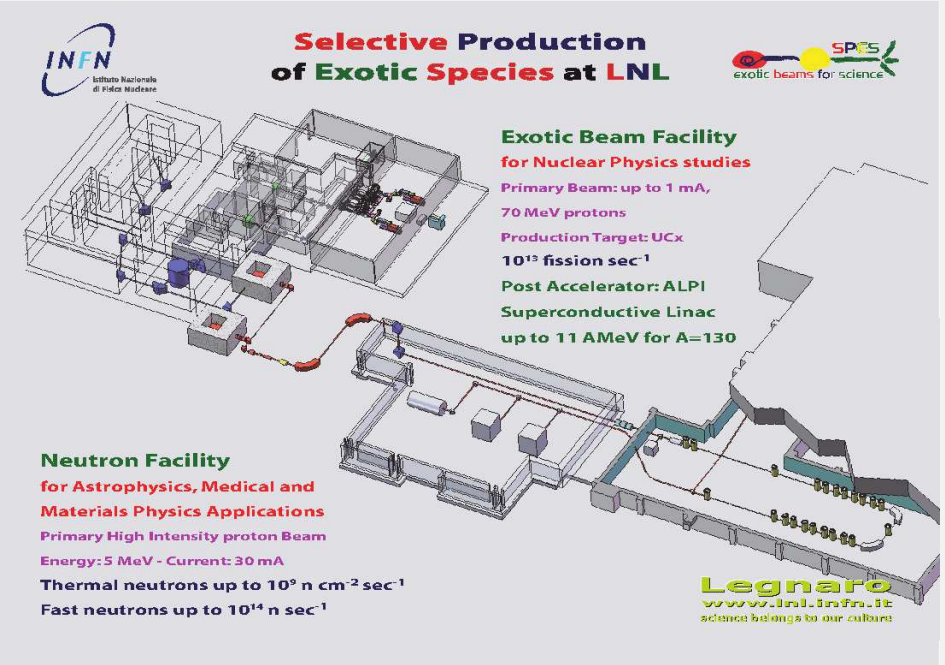
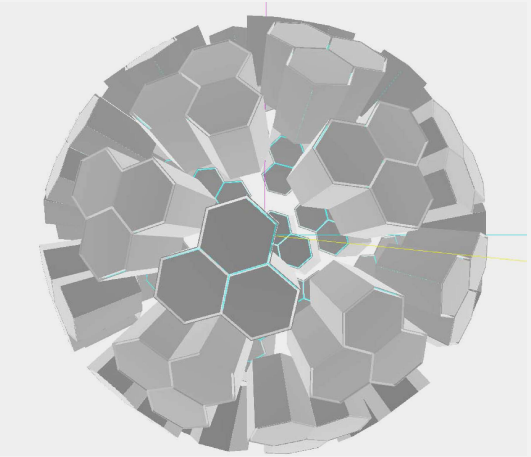
Outline

The future context at LNL

SPES



GALILEO



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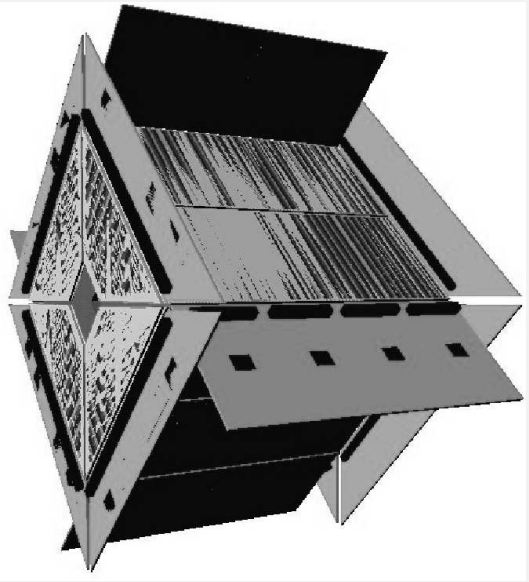


TRACE

Highly-segmented silicon-pad detector for particles and light ions detection.

- Two-layer silicon-telescope array to be used as an ANCILLARY of large gamma-ray spectrometers

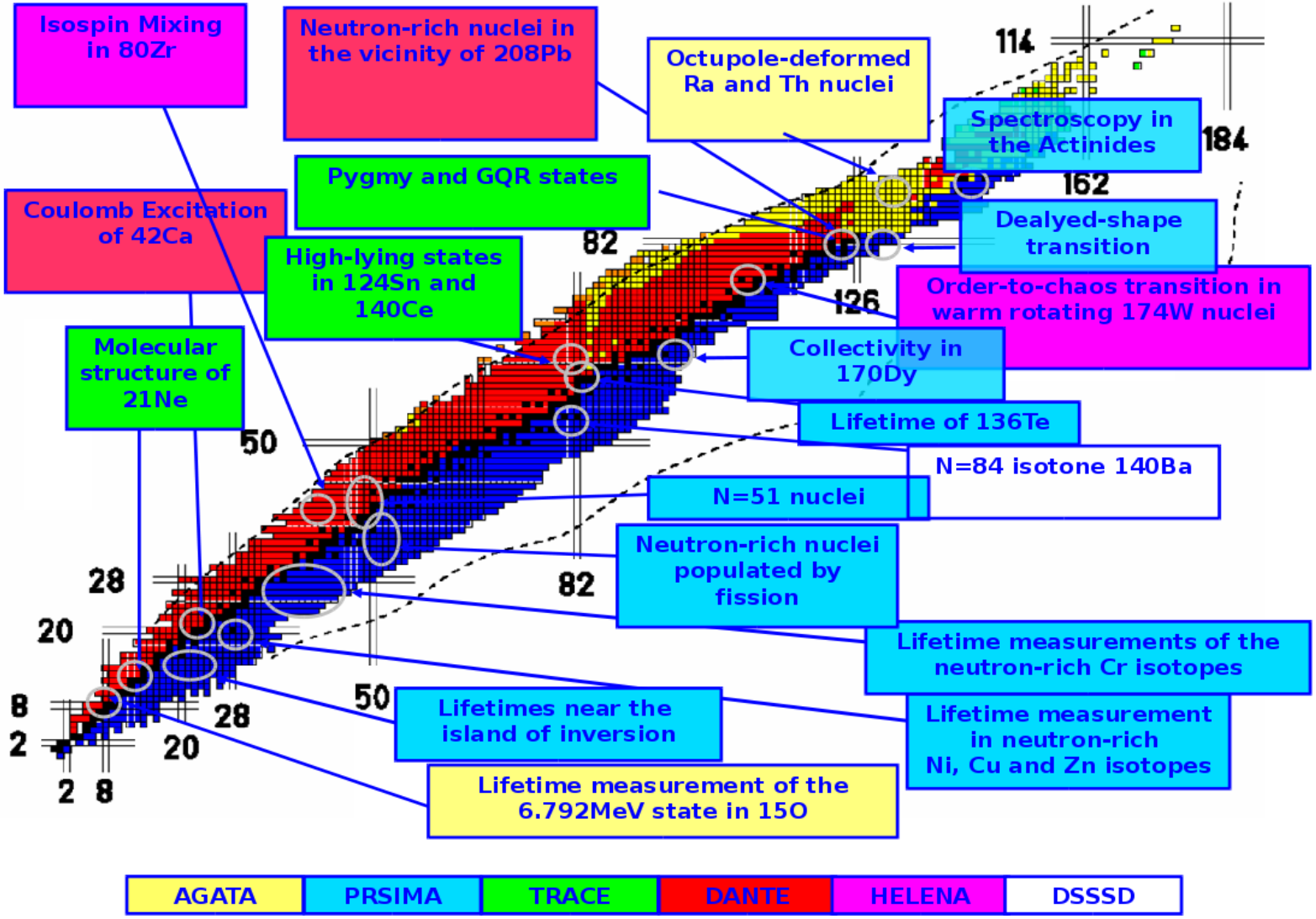
- Direct (TRANSFER and COULEX) $\rightarrow$ neutron-rich nuclei delivered at the new facilities.
- FE reaction $\rightarrow$ proton-rich nuclei

What is new then?

- Digital electronics with embedded PSA capability
- Trigger-less system

The physics campaign with STABLE beams at LNL

in terms of complementary detectors ...



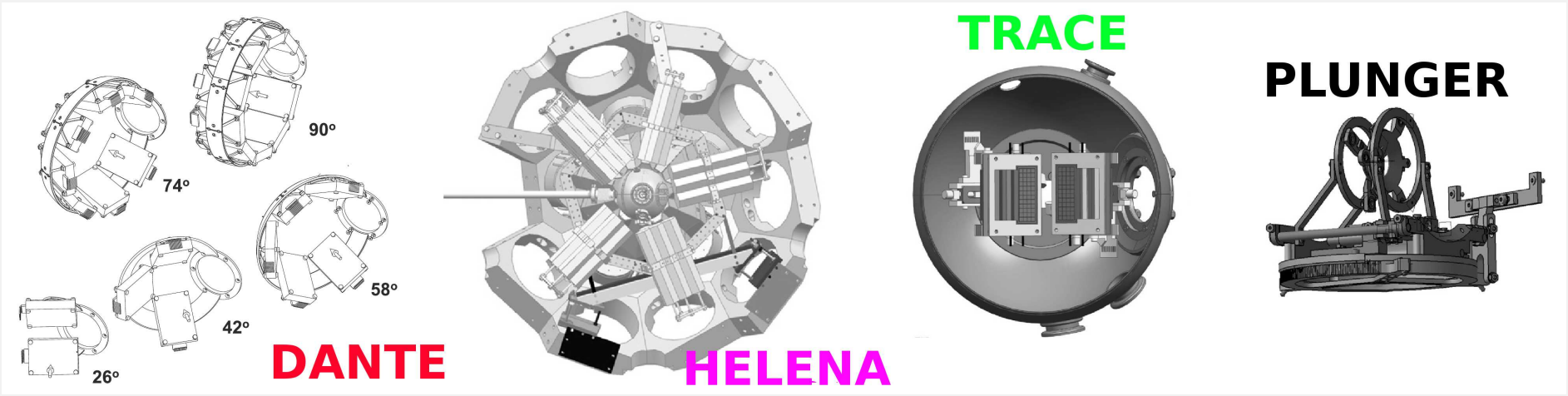
Contents lists available at ScienceDirect

Nuclear Instruments and Methods in Physics Research A

journal homepage: www.elsevier.com/locate/nima

Conceptual design and infrastructure for the installation of the first AGATA sub-array at LNL

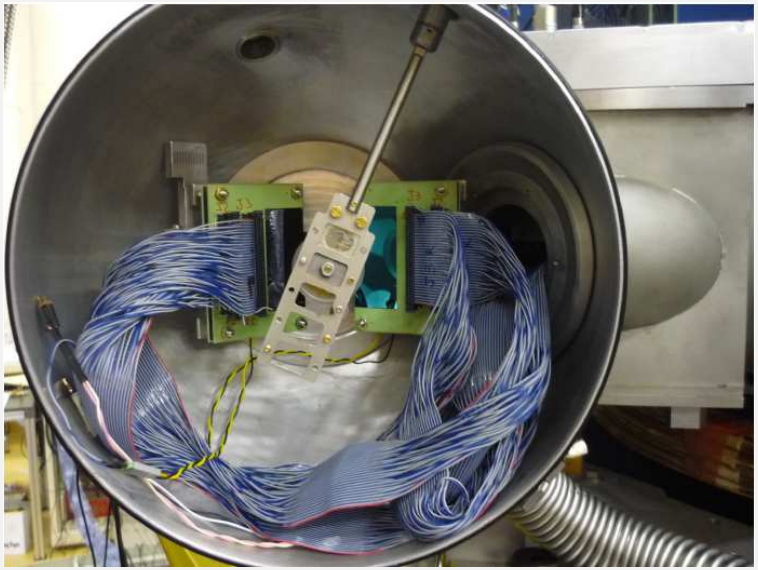
A. Gadea [a,h,*], E. Farnea [b], J.J. Valiente-Dobón [a], B. Million [c], D. Mengoni [d,b,j], D. Bazzacco [b], F. Recchia [b], A. Dewald [e], Th. Pissulla [e], W. Rother [e], G. de Angelis [a], A. Austin [f], S. Aydin [b,t], S. Badoer [a], M. Bellato [b], G. Benzoni [c], L. Berti [a], R. Beunard [i], B. Birkenbach [e], E. Bissiato [a], N. Blasi [c], C. Boiano [c], D. Bortolato [b], A. Bracco [g,c], S. Brambilla [c], B. Bruyneel [e], E. Calore [a], F. Camera [g,c], A. Capsoni [c], J. Chavas [b], P. Cocconi [a], S. Coelli [c], A. Colombo [b], D. Conventi [a], L. Costa [a], L. Corradi [a], A. Corsi [g,c], A. Cortesi [c], F.C.L. Crespi [g,c], N. Dosme [o], J. Eberth [e], S. Fantinel [a], C. Fanin [b], E. Fioretto [a], Ch. Fransen [e], A. Giaz [g,c], A. Gottardo [d,b],

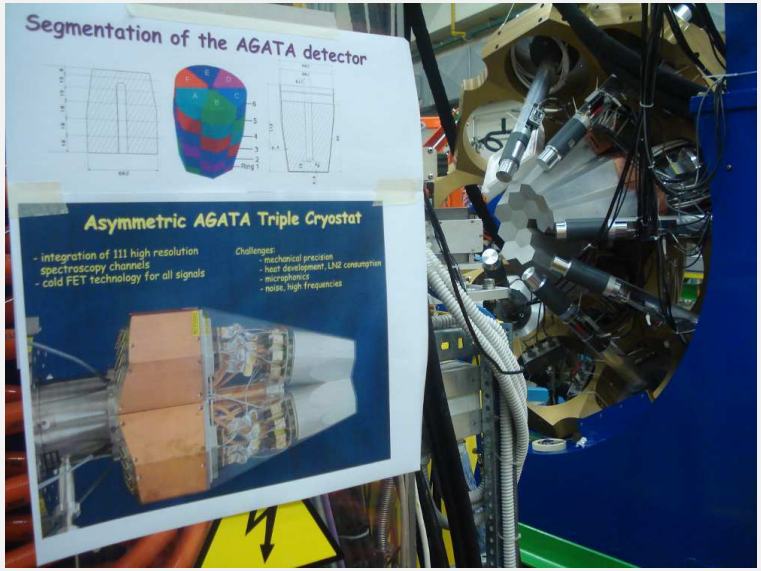


TRACE+AGATA

Three in-beam experiments

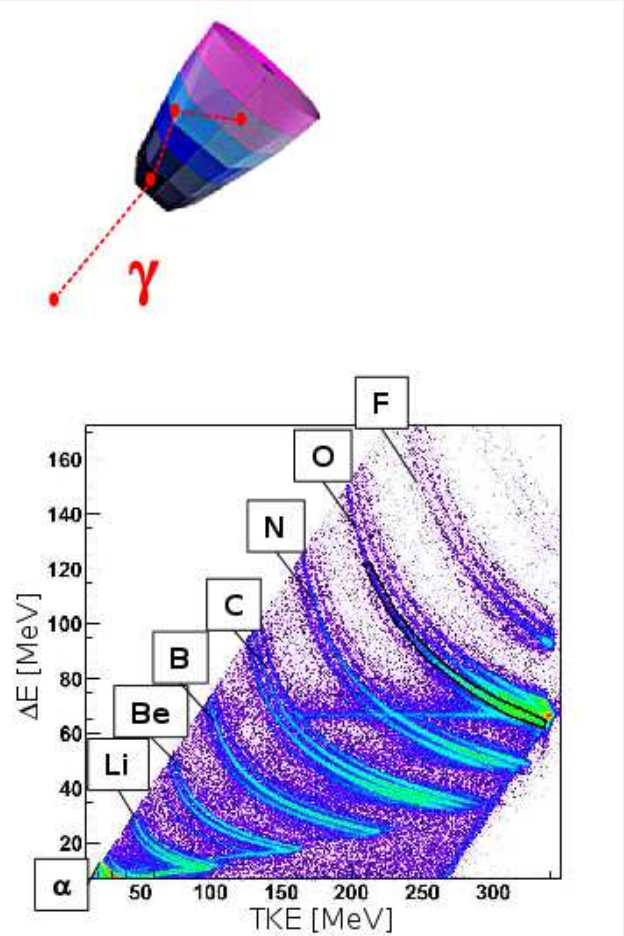
- Study of High-Lying States in ^{208}Pb with the AGATA Demonstrator
- Confirmation of the molecular structure of excited bands in ^{21}Ne
- Study of high-lying bound and unbound states in ^{124}Sn and ^{140}Ce via inelastic scattering of ^{17}O ions

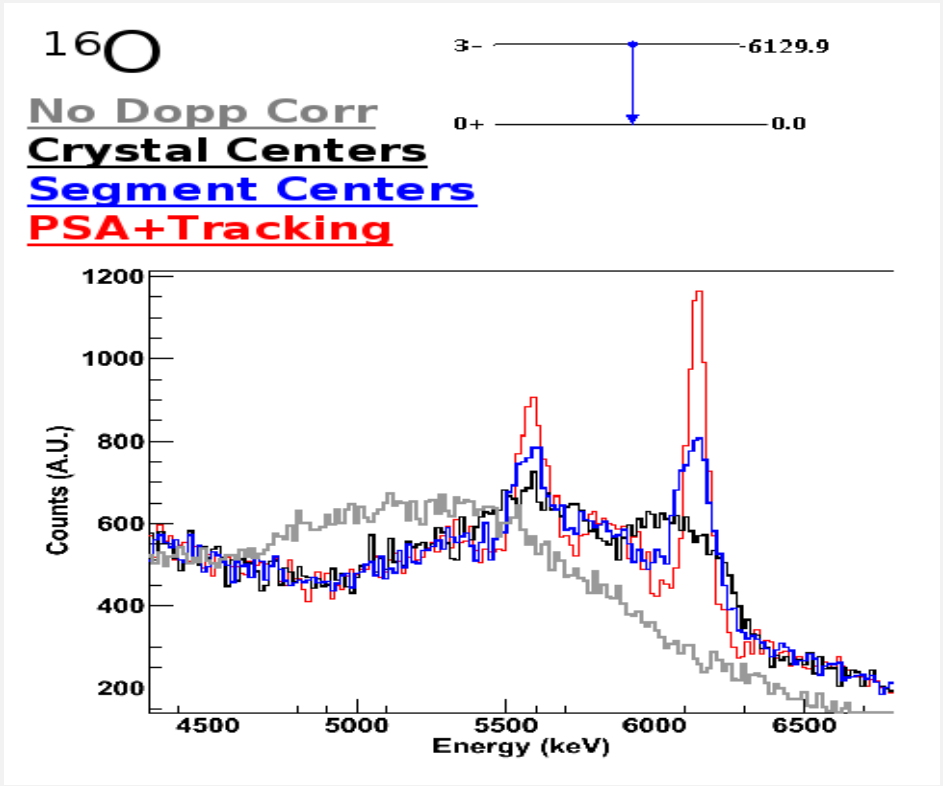




TRACE telescope

Performance of the AGATA-TRACE setup





- Z and M up to Z = 9
- β ∼20%

- ^{16}O channel: high energy γ-ray low background from target.....
- FWHM ∼ 0.9%
- Good PSA performance

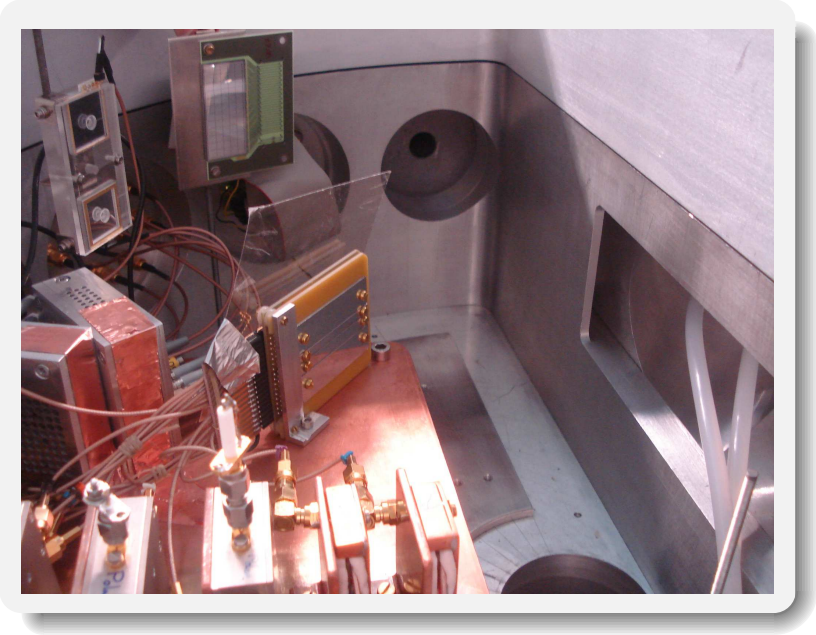
PSA campaign

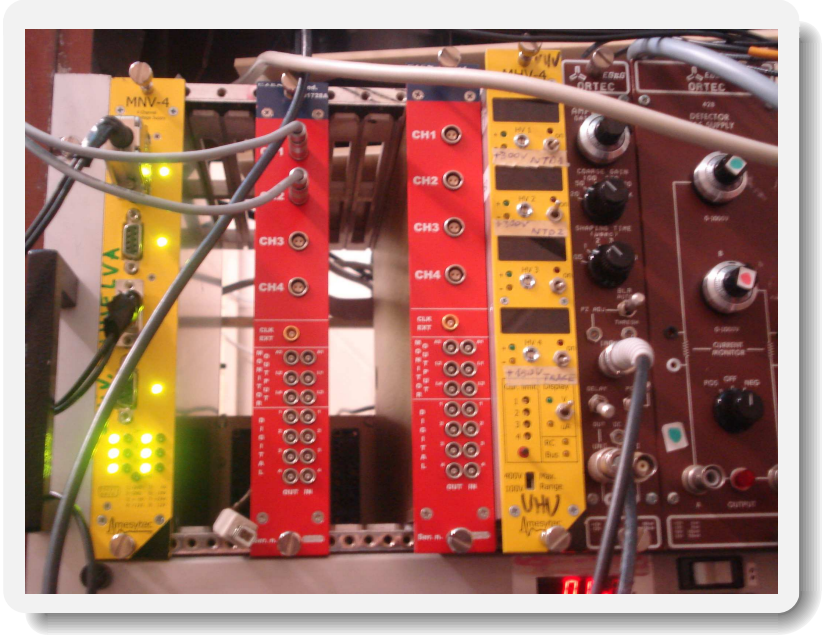
TRACE-GASPARD-HYDE collaboration

- Orsay: proof of principle for the discrimination of light charged particles with single-pad NTD det.
- Orsay: test for segmented DSSSDs
- LNL: test for higher Z,A and coupling with a tracking array

PSA experiment at the ORSAY tandem accelerator

- PSA on light-charged particles
- Increase geometrical resolution via transient signals in neighbouring electrodes





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Nuclear Instruments and Methods in Physics Research A

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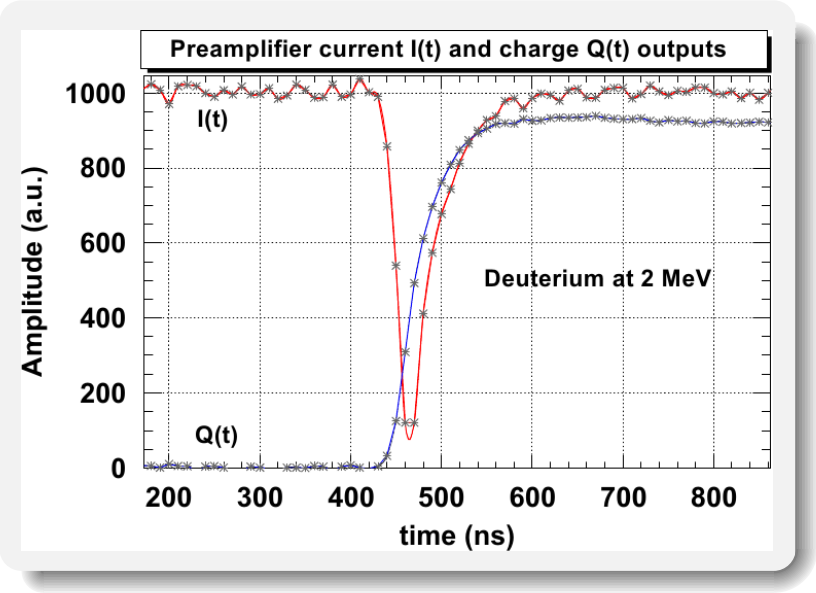
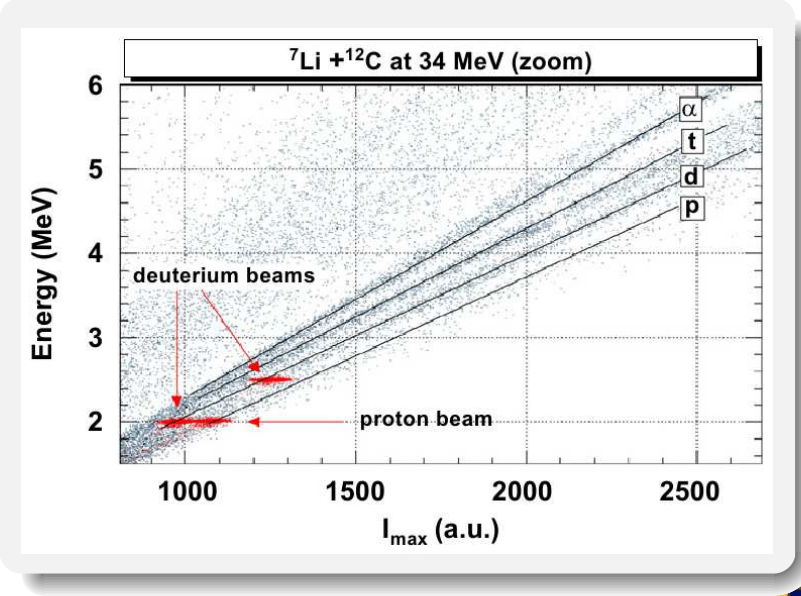
Identification of light particles by means of pulse shape analysis with silicon detector at low energy

J.A. Dueñas [a,*], D. Mengoni [b], V.V. Parkar [a], R. Berjillos [a], M. Assie [c], D. Beaumel [c], A.M. Sánchez-Benítez [a], I. Martel [a]





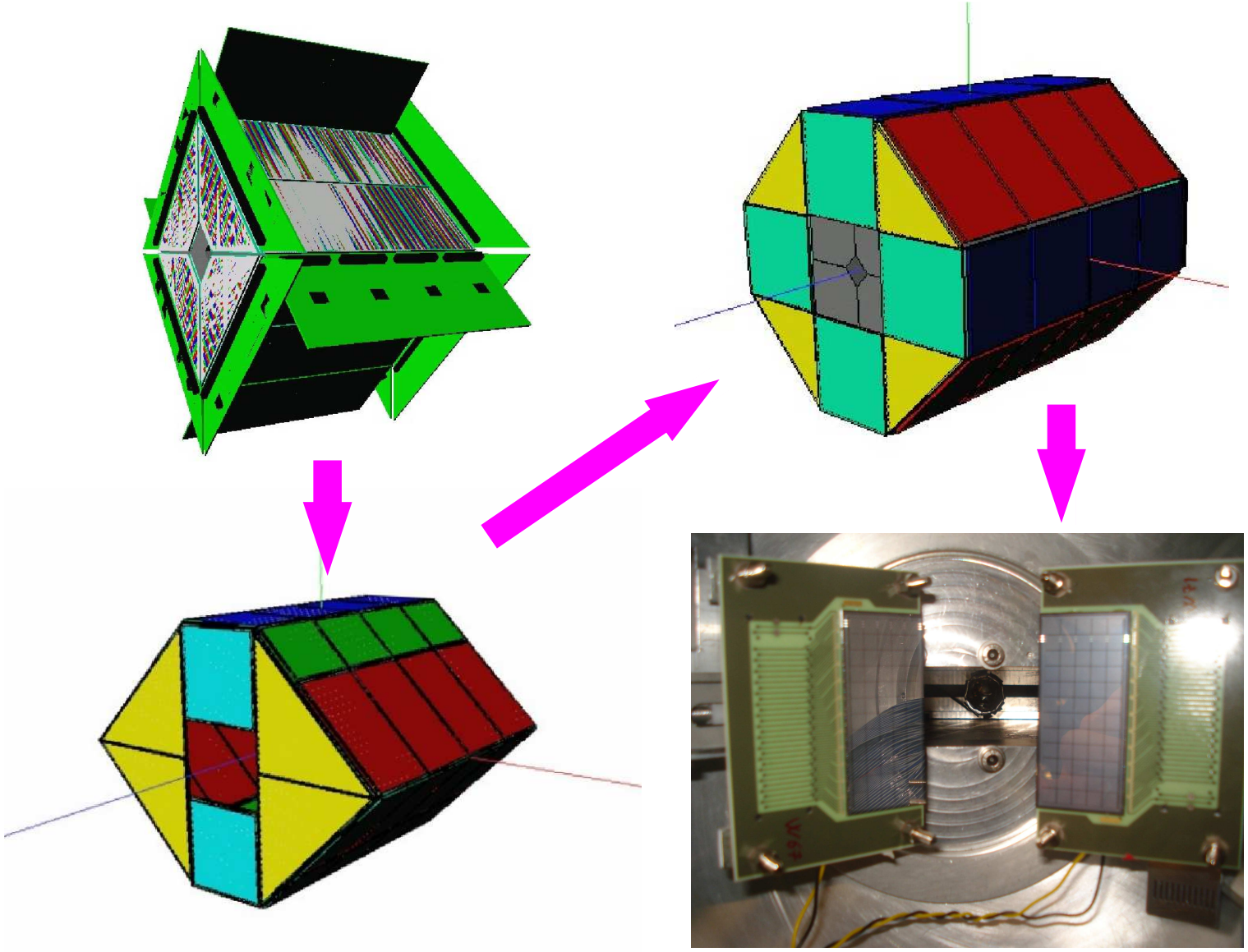
Perspective with SPES at LNL

Letters of Intent

SPES workshop

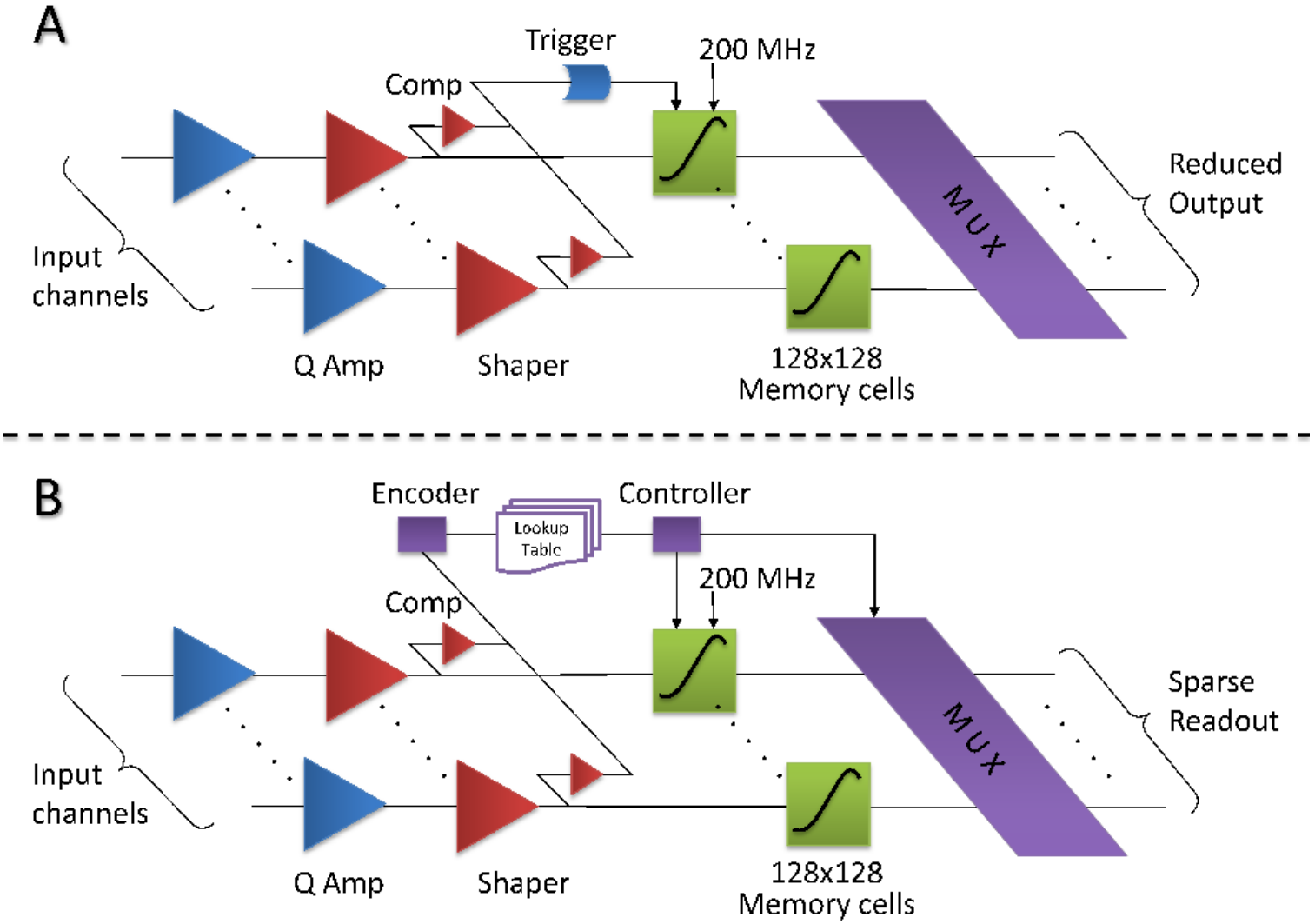
- Spectroscopy studies around 78Ni and beyond N = 50 via transfer and Coulomb excitation reactions.
  J.J. Valiente-Dobon, A. Gadea, R. Orlandi, E. Clement
- Nuclear magicity at Z 50 N 82. Neutron capture cross section via the surrogate method.
  E.Farnea, D.Mengoni, G.deAngelis
- Investigation of critical point symmetries in neutron rich nuclei.
  D. Tonev
- Structure of Sb nuclei around 132Sn as a testing ground for realistic shell model interactions.
  B.Fornal, S.Lunardi, G.deFrance
- Search for Exotic-Octupole deformation effects in n-rich Ce-Xe-Ba Nuclei.
  E.Sahin
- Coulomb Excitation measurements of Radioactive Ions: N$\geq$82 and Z$\geq$50
  B.Melon

TRACE: the evolution



FEE: Preamp + Analog memories

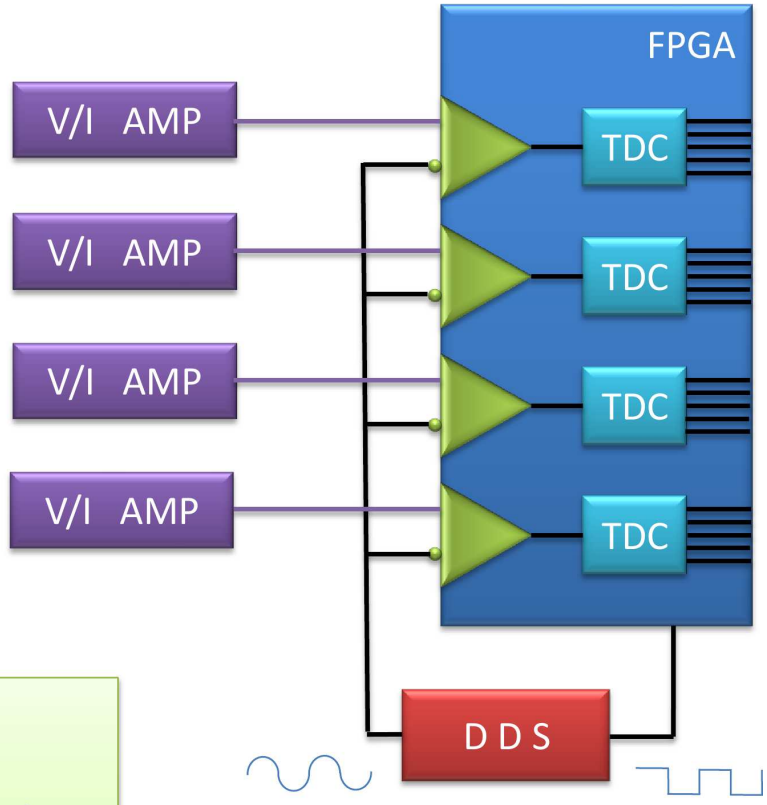
Solution **A** MUX: ∼5Khz/128ch; Solution **B**: sparse readout

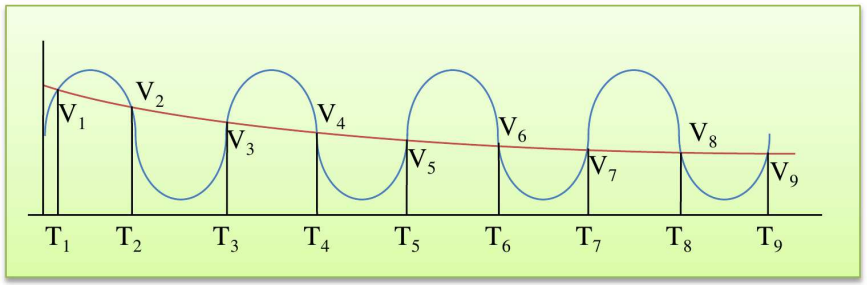


FPGA as ADC: a local solution for the BEE

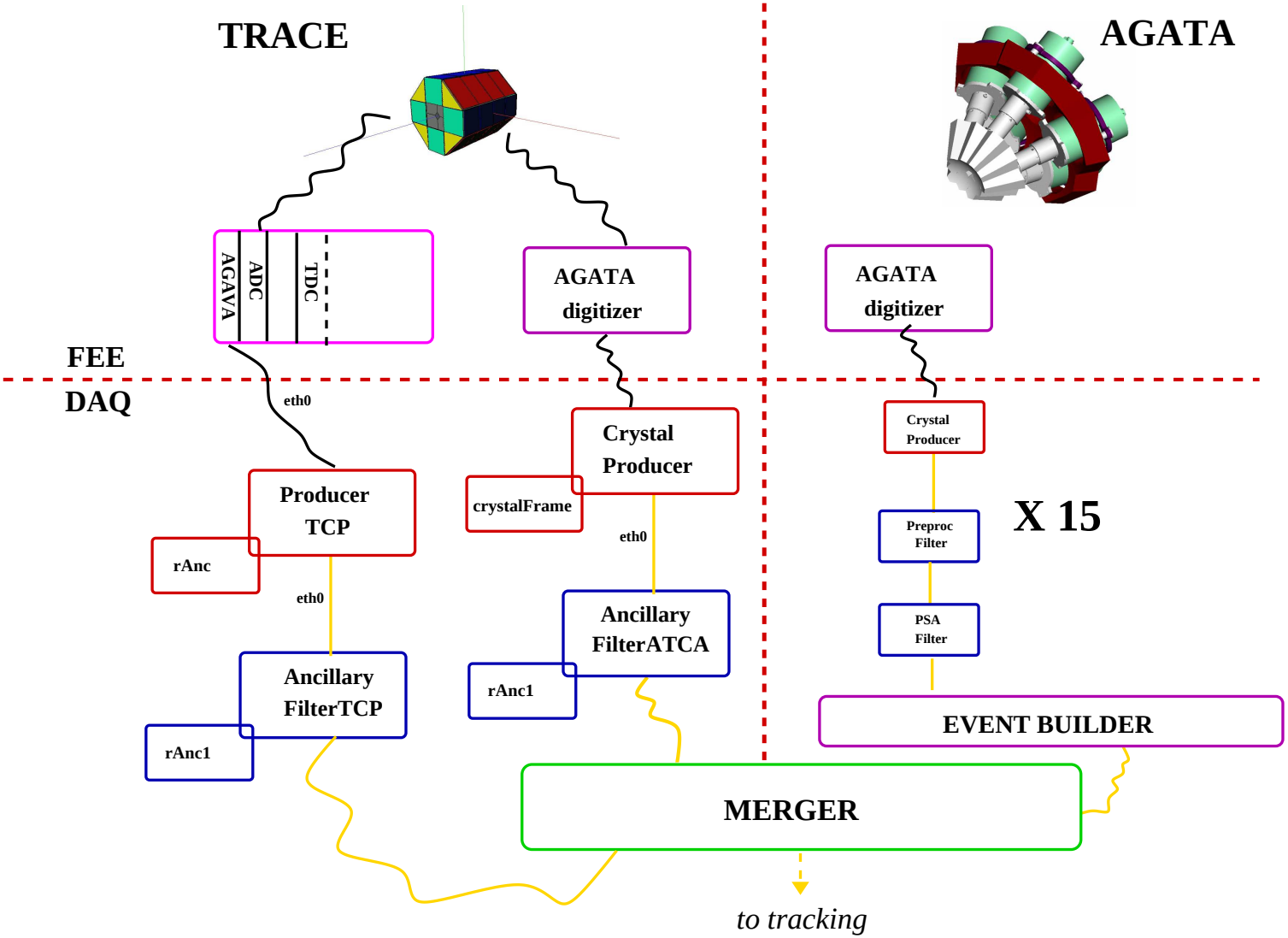
cheaper (and high integration?)

- From PA directly to FPGA differential inputs
- External digital synthesizer used to produce a V_{REF} sinusoid
- TDCs measure time differences further converted to voltage

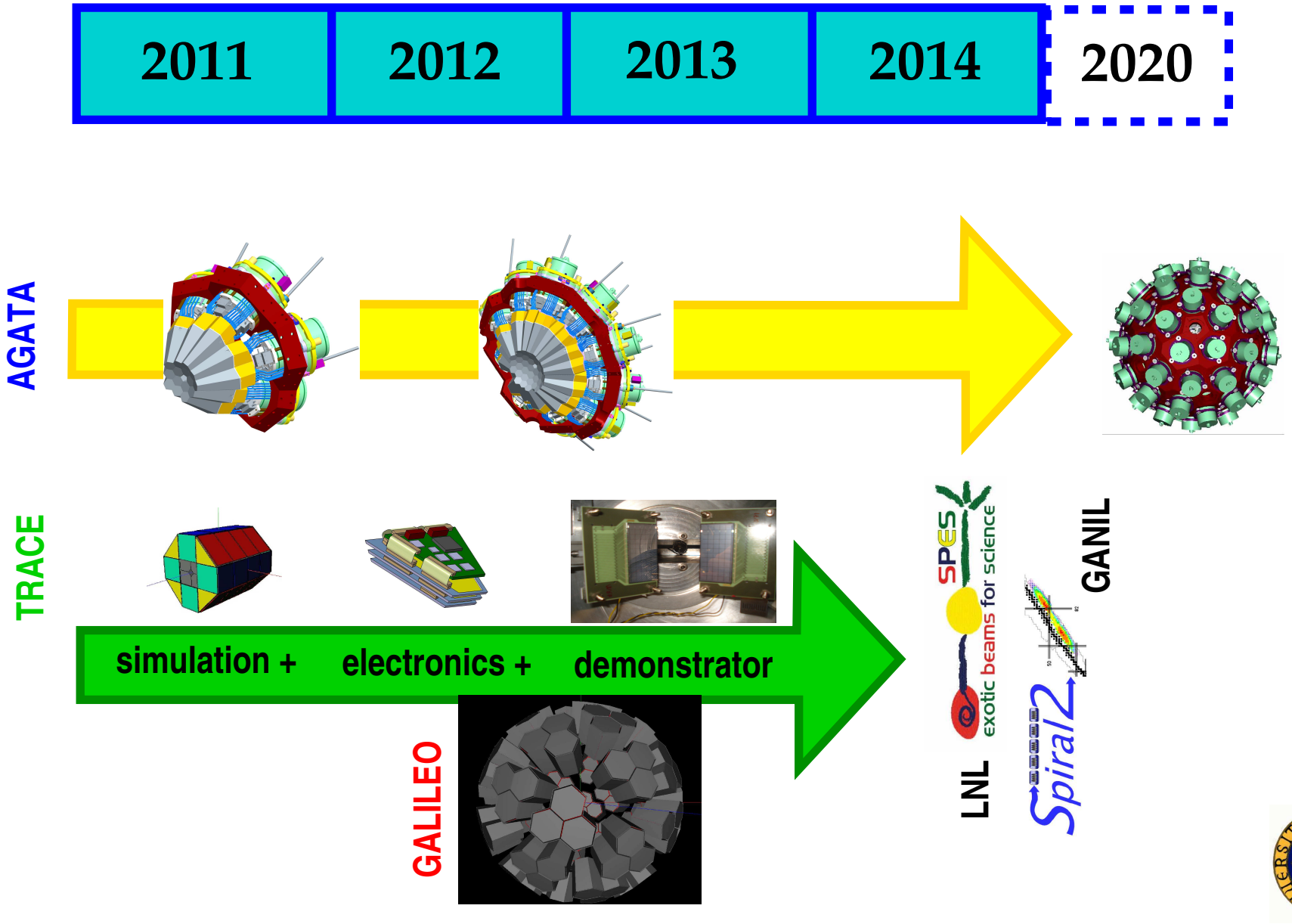




DAQ


TRACE
AGATA
AGAVA
ADC
TDC
AGATA digitizer
AGATA digitizer
FEE
DAQ
eth0
Crystal Producer
Crystal Producer
Producer TCP
crystalFrame
eth0
Preproc Filter
X 15
rAnc
eth0
Ancillary FilterATCA
PSA Filter
Ancillary FilterTCP
rAnc1
EVENT BUILDER
rAnc1
MERGER
to tracking

Timeline


2011
2012
2013
2014
2020
AGATA
TRACE
simulation +
electronics +
demonstrator
GALILEO
LNL
exotic beams for science
SPES
Spiral2
GANIL

Summary and conclusions

- Ancillary detector during the successful AGATA campaign at LNL
- On-going PSA campaign within the GASPARD-HYDE-TRACE collaboration
- Construction of the detector(FEE,BEE,DAQ) on going.

- TRACE scaled demonstrator ready for SPES