TRACE-GASPARD for SPES: status and perspectives

Daniele Mengoni

for the GHT collaboration

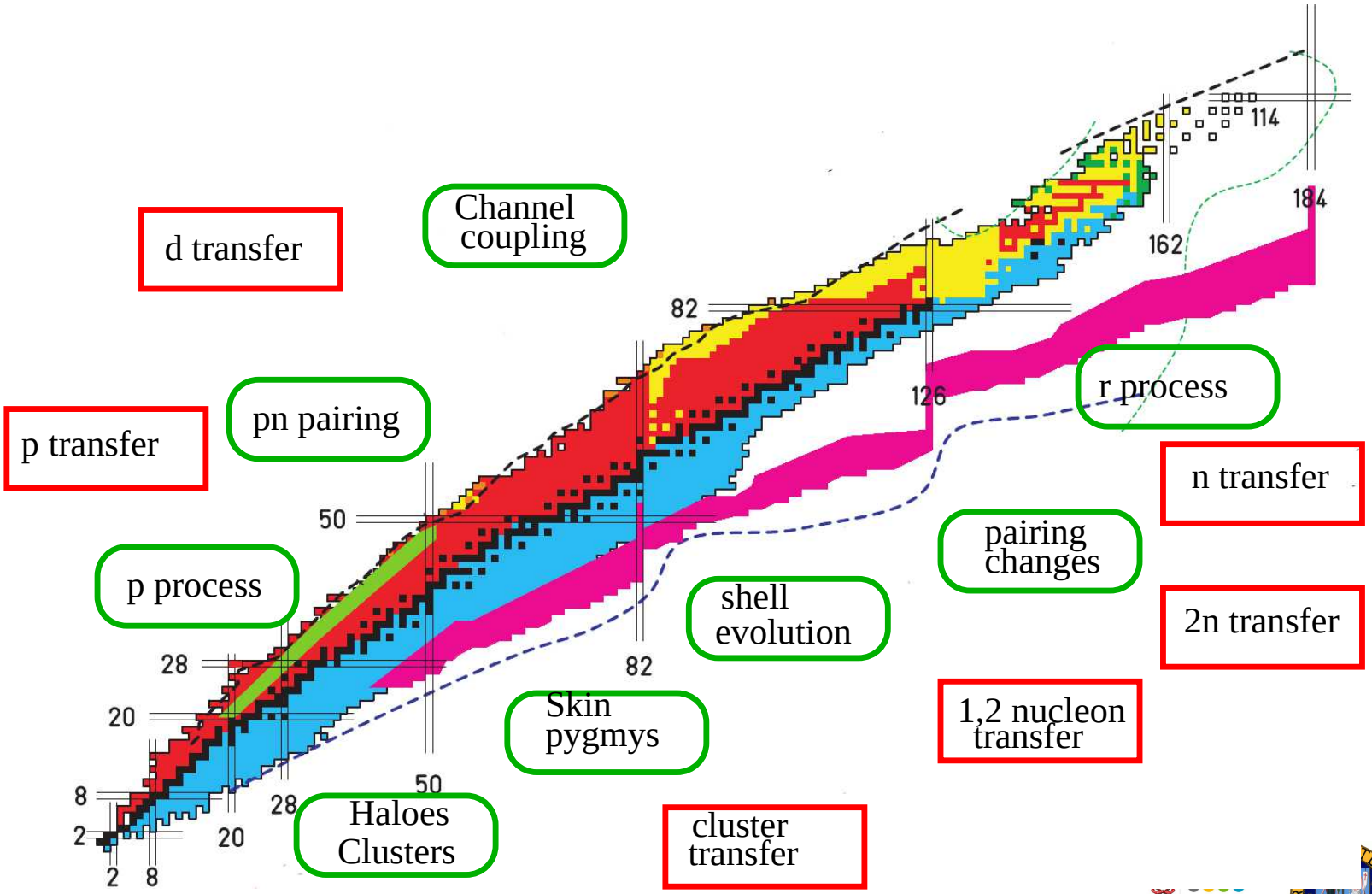
Università and INFN - Padova

2nd SPES workshop, LNL
26-28 May 2014

Outline

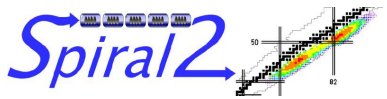
Transfer and binary reactions with RIB

high angular resolution and coverage



Ambit of the new silicon-based array

- emerging RIB facilities



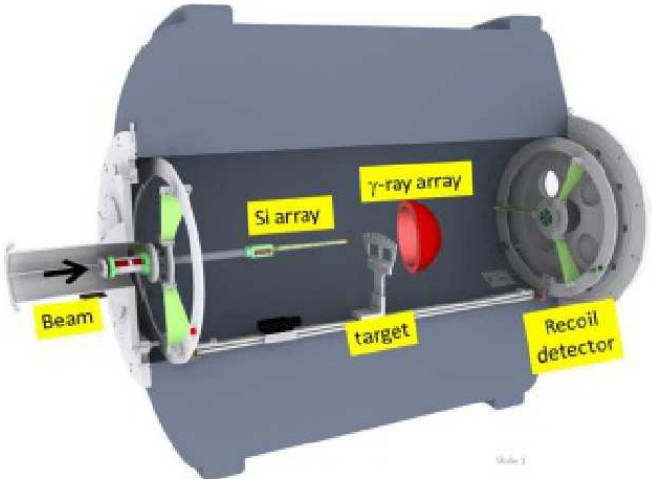
- Energy regime
  few MeV $\rightarrow$ tens of MeV/u
  Discrimination
  PSA, EΔE
- Special targets
  cryogenic:H_2, He_2, film (Chymene), etc.
- Flexibility
  coupling with others detectors

LCP Complementary/Stand-alone detectors

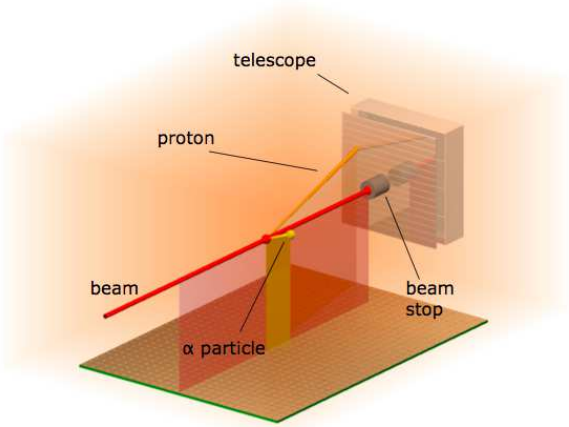
- Silicon based array

TRACE GASPARD HYDE

- Solenoid



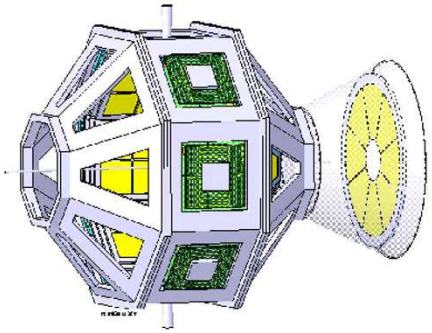
- Active target



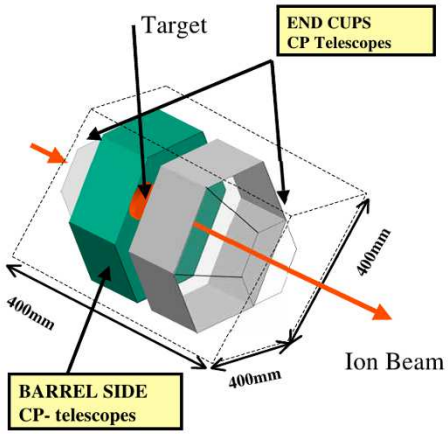
Si-based arrays

panorama

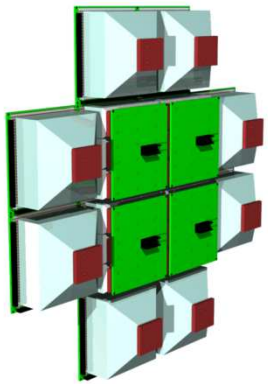
TRACE



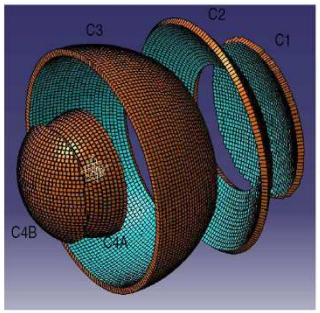
GASPARD



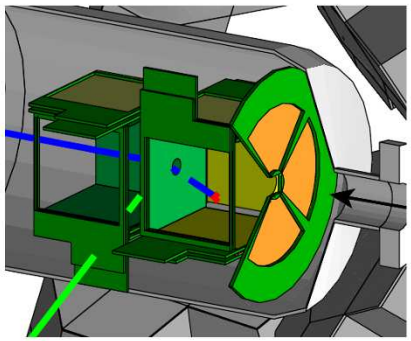
HYDE



LYCCA



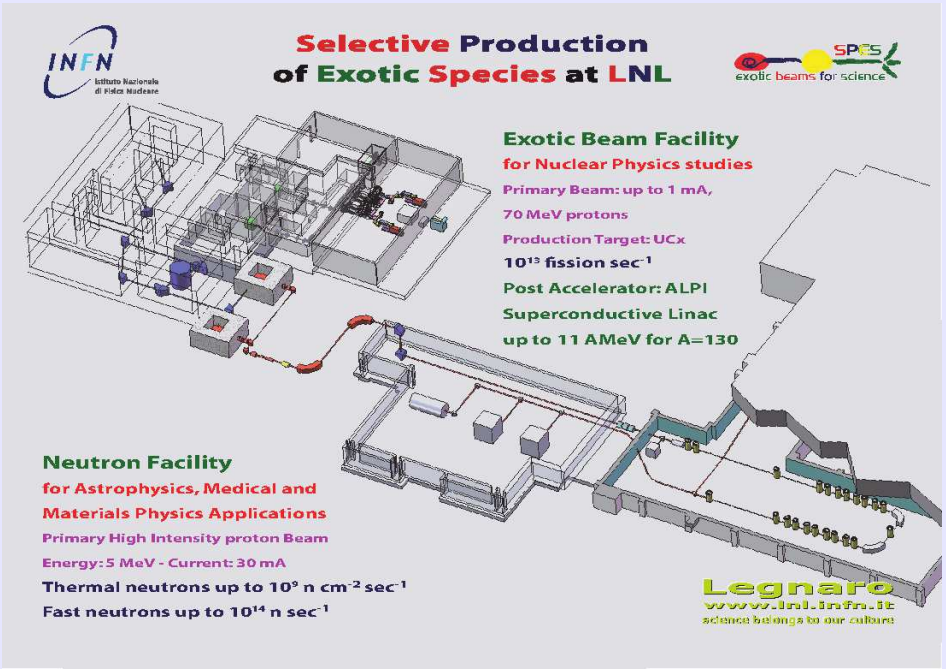
FAZIA



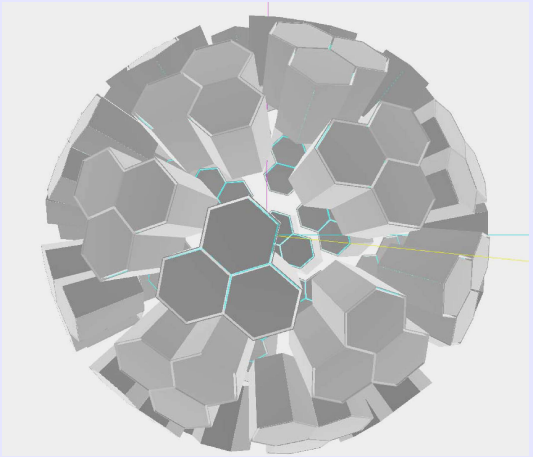
T-REX

The future context at LNL

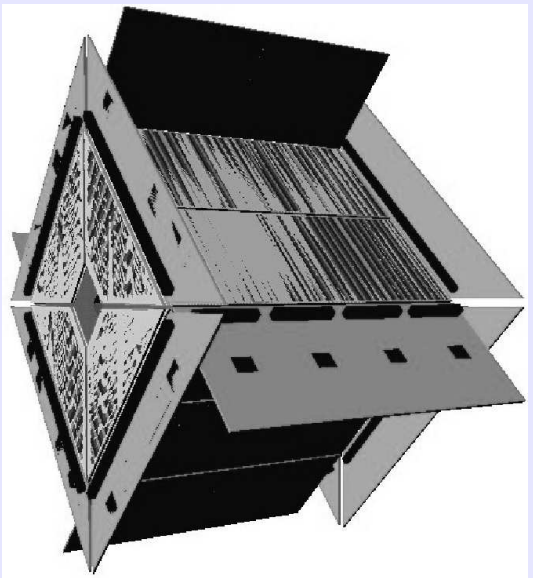
SPES



GALILEO



TRACE



TRACE-GASPARD

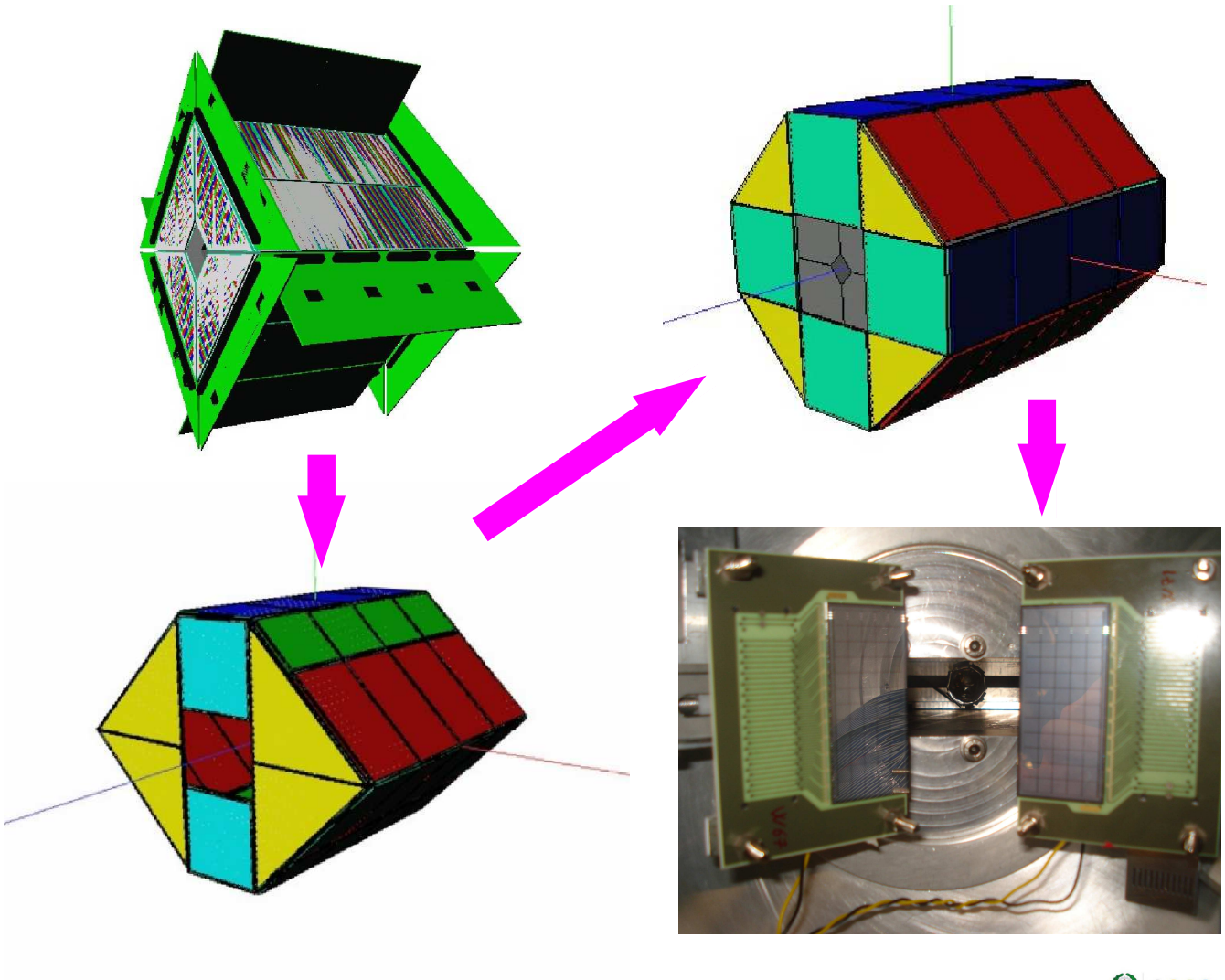
Highly-segmented silicon detectors for particles and light ions detection.

- Silicon-telescope array for direct reactions $\rightarrow$ neutron-rich nuclei delivered at the new facilities.

Novelty

- Highly-uniform nT detectors
- Digital electronics to embed PSA capability
- Trigger-less system

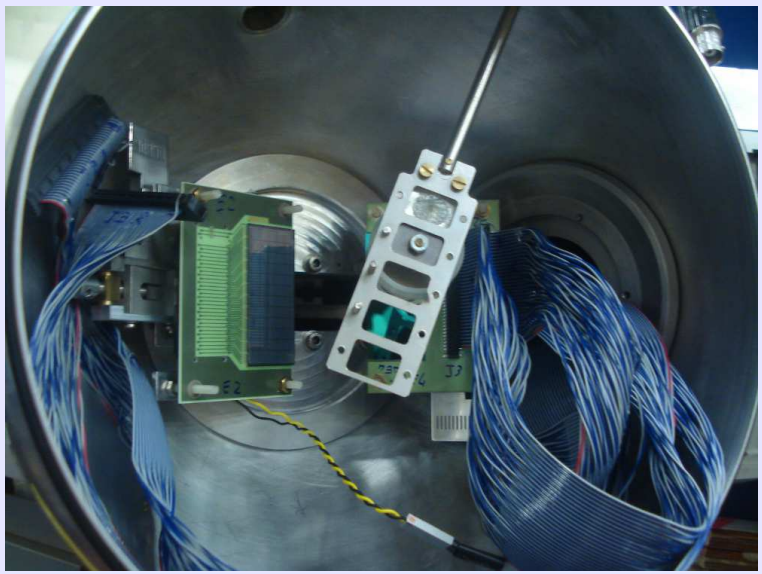
TRACEx: the genesis

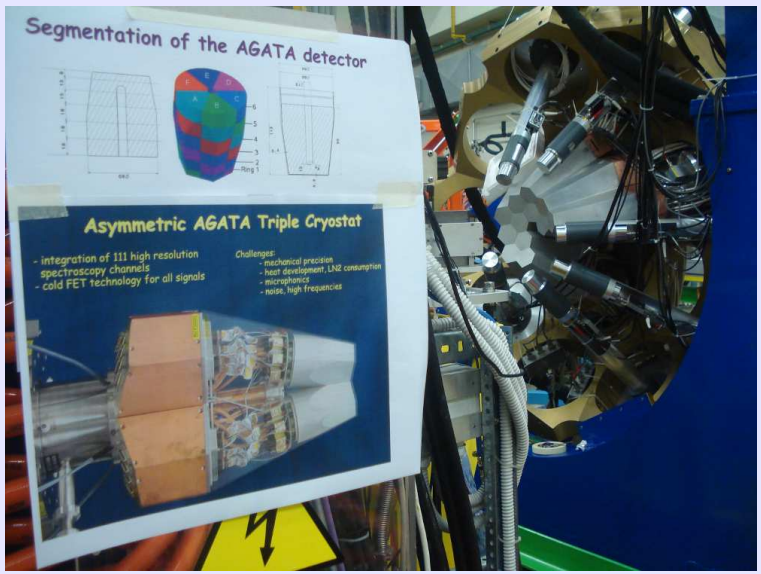


TRACE+AGATA

Three in-beam experiments

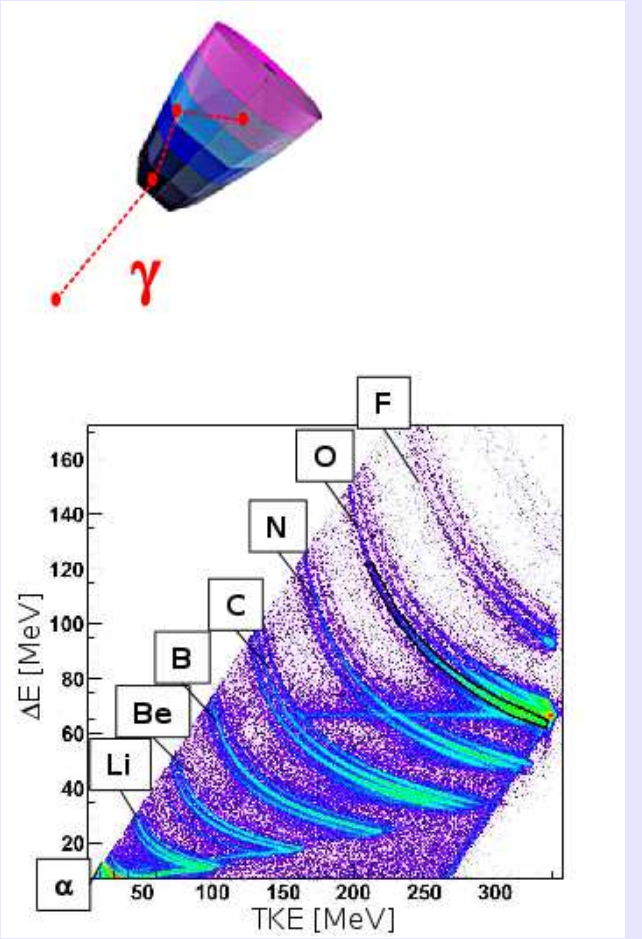
- Study of High-Lying States in ^{208}Pb with the AGATA Demonstrator
- Confirmation of the molecular structure of excited bands in ^{21}Ne
- Study of high-lying bound and unbound states in ^{124}Sn and ^{140}Ce via inelastic scattering of ^{17}O ions



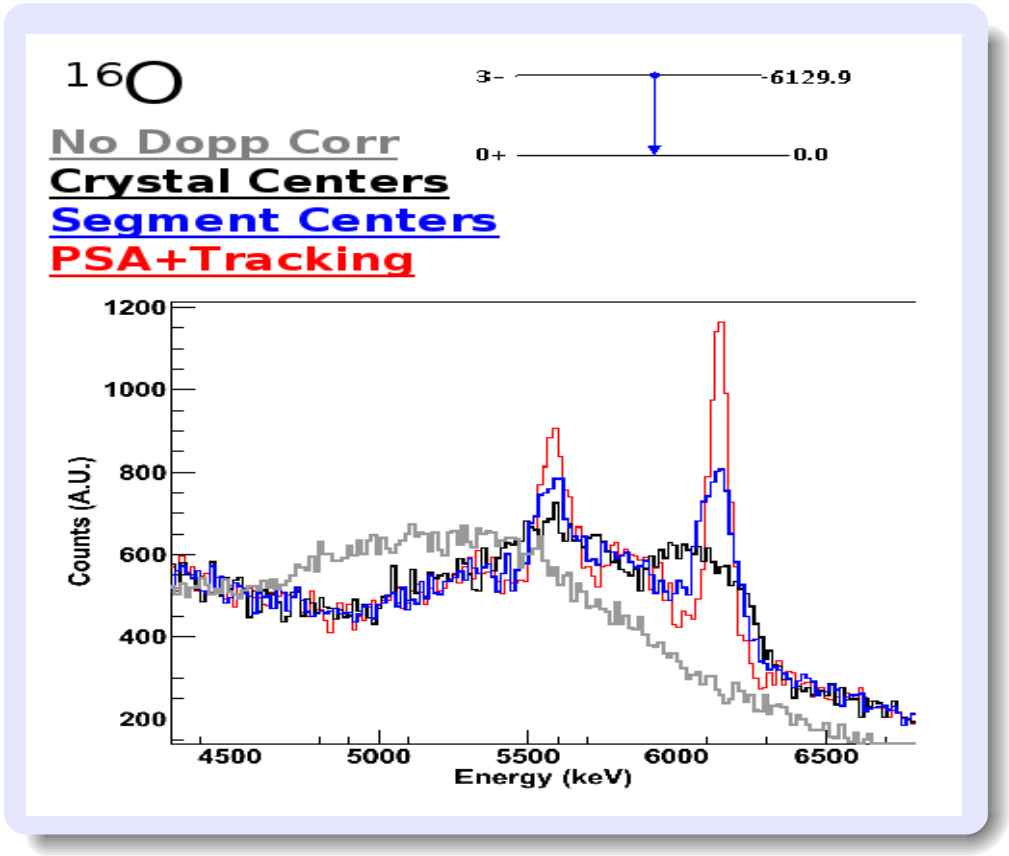


TRACE telescope

Performance of the AGATA-TRACE setup, binary reaction



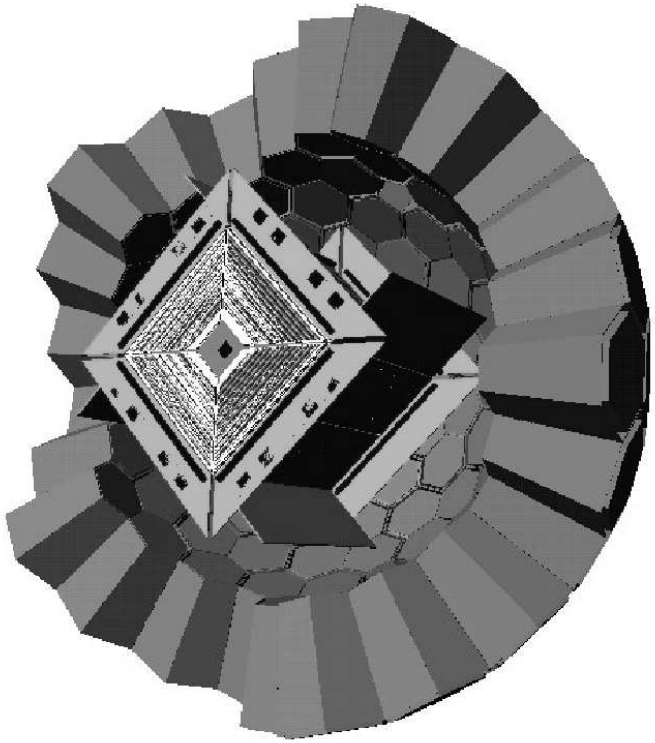
- Z and M up to Z = 9
- β ∼20%

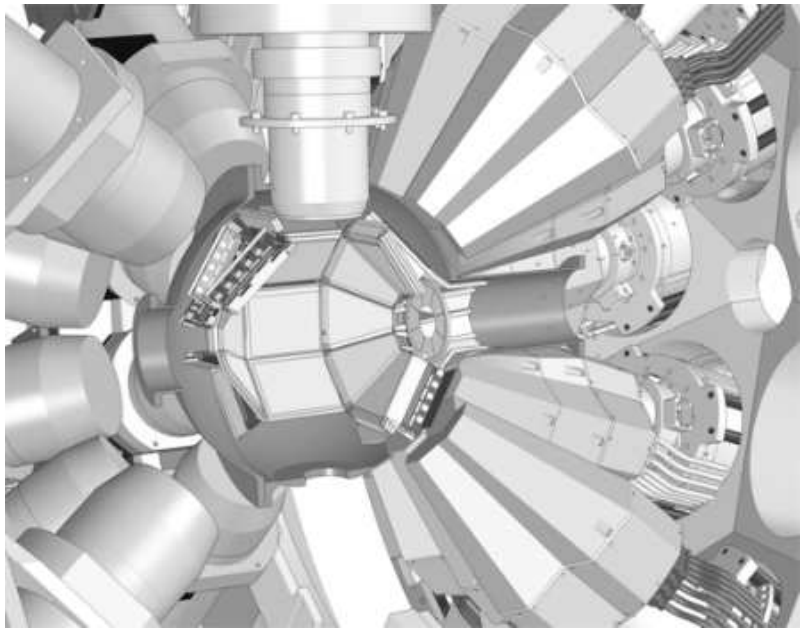


- ^{16}O channel: high energy γ-ray low background from target.....
- FWHM ∼ 0.9%
- Good PSA performance

Project and collaboration

TRACE-GASPARD collaboration agreement





GHT Collaboration Agreement

- **Introduction**

GHT (acronym for GASPARD, HYDE and TRACE, in reference to the corresponding initial projects) is an international collaboration aimed to develop a new detector for optimal study of reactions using low and intermediate energy beams at existing and forthcoming radioactive ion beam facilities. It consists in a new type of compact, highly segmented, silicon array, fully integrable within next generation gamma detectors such as AGATA and PARIS. Such new type of Silicon-based array is also meant to offer state-of-the art particle identification to improve separation of the various reaction channels and reduce the physical

Collaboration agreement

IPN Orsay, GANIL, CEA Saclay

INFN (LNL-Pd-Mi), University of Padova, Milano

University of Valencia, University of Huelva

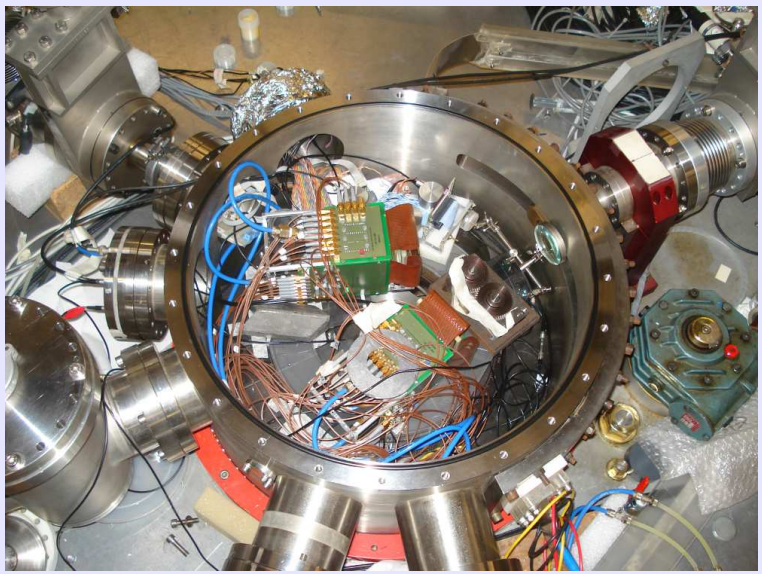
- Digital PSA for LCP discrimination
- nT Detectors [Micron SC, FBK]
- Integrated Electronics
- Physics

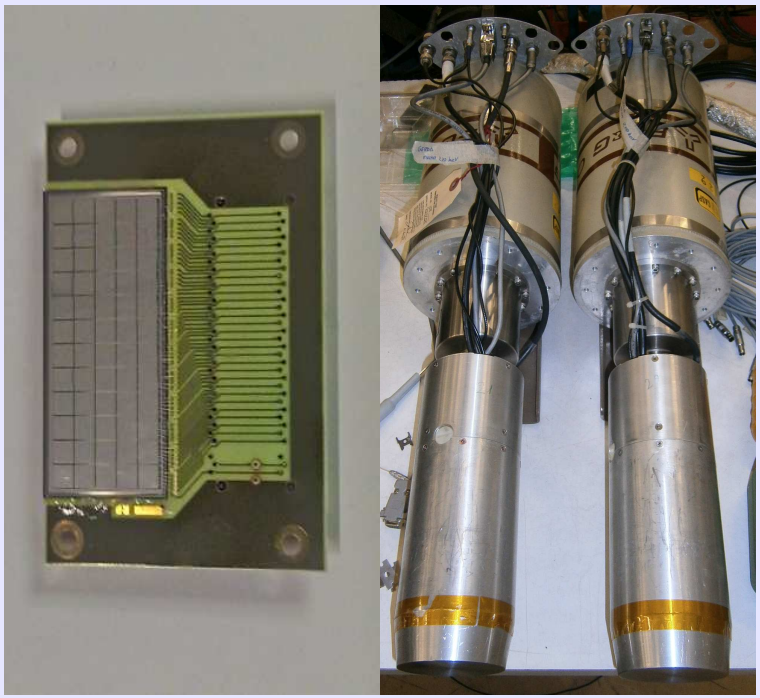
PSA setup,Nov 2012 @ LNL

TRACE Si + GASP HPGe

Goals

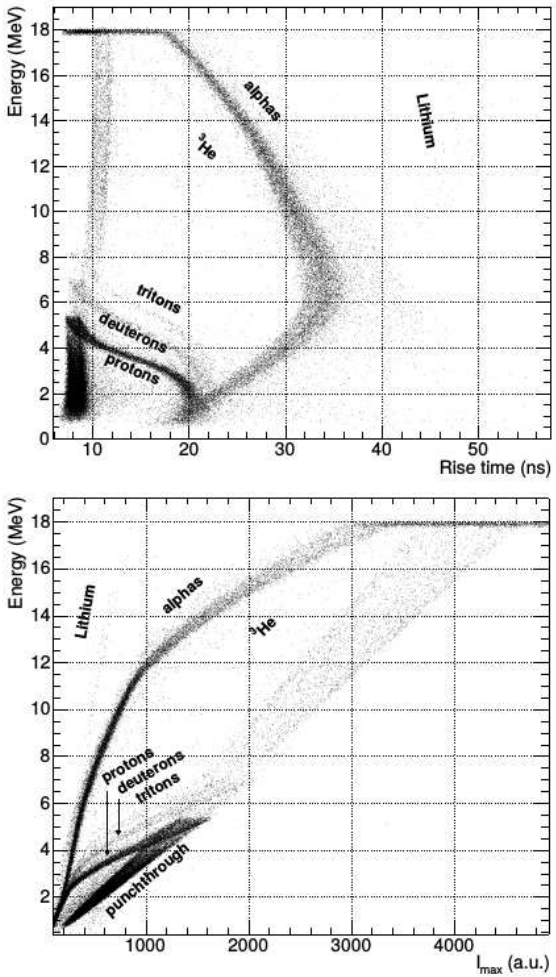
- PSA on FZ 200 μm-thin detectors
- 100 MHz sampling frequency

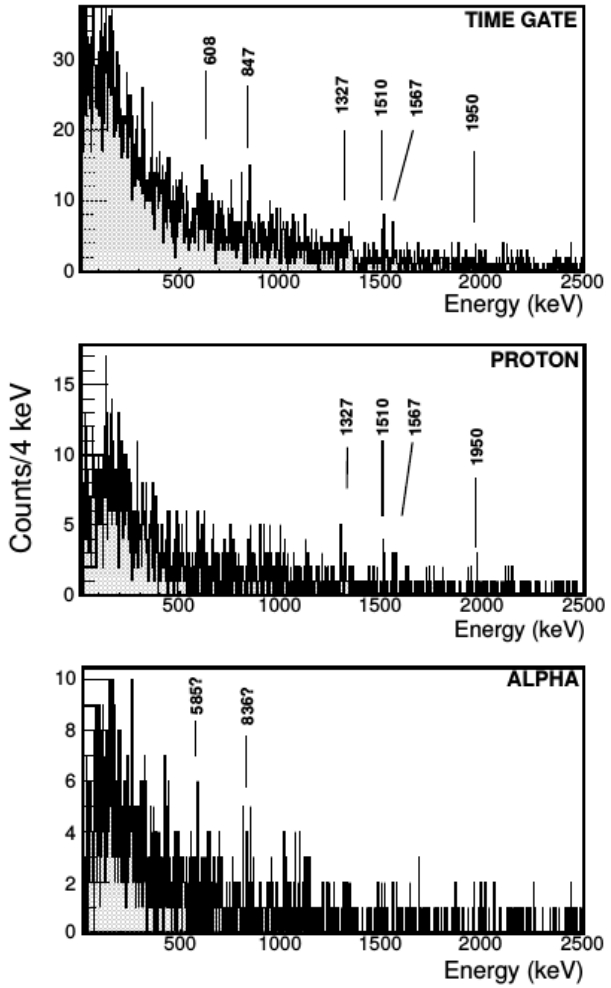




PSA experiment

results

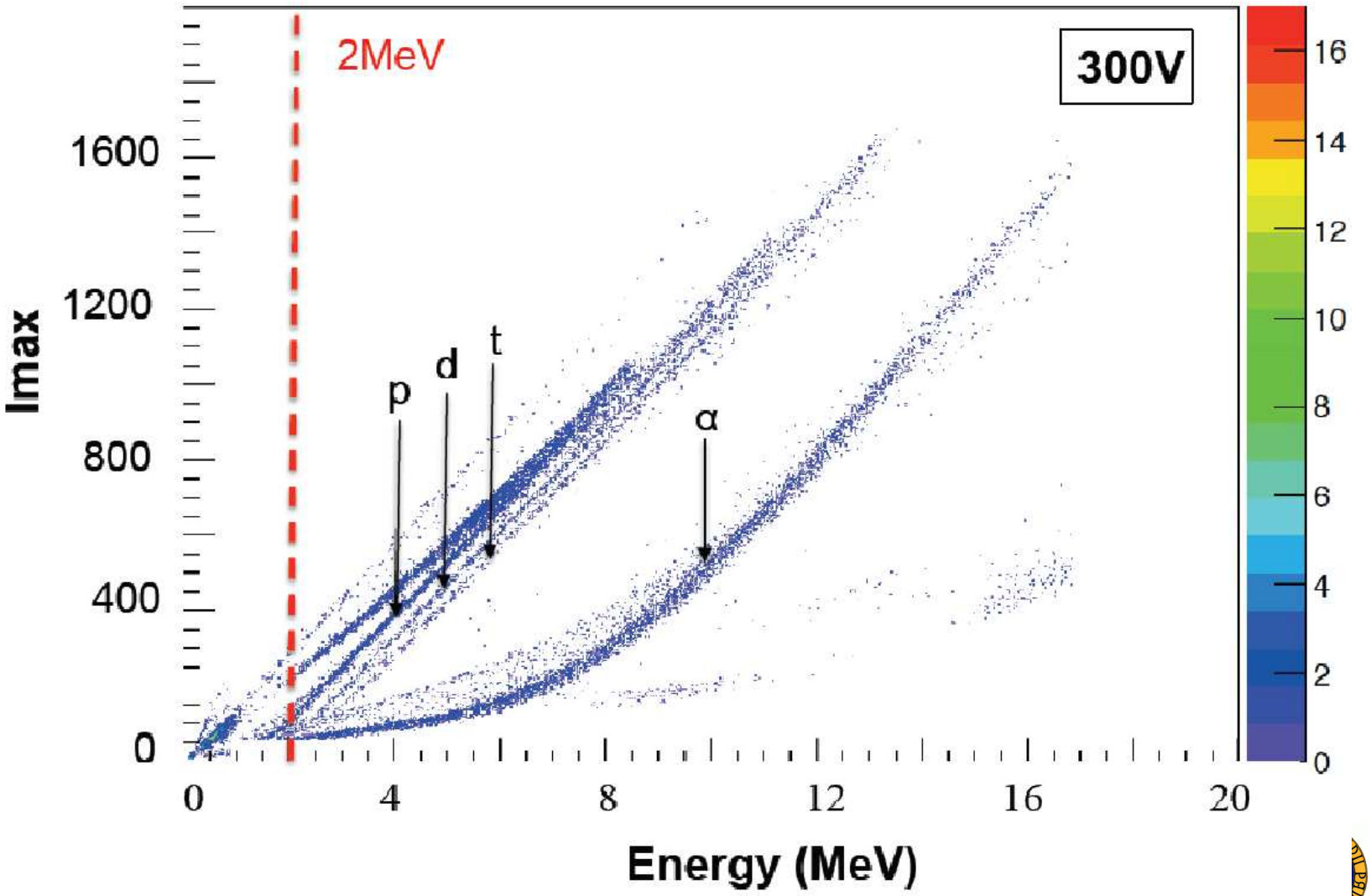




D.Mengoni et al., submitted to NIMA

Separation

Best result - slightly underdepletion



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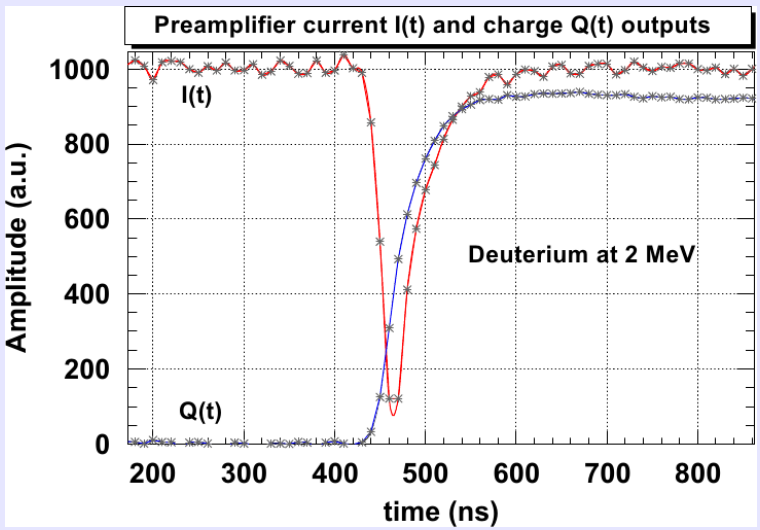
Contents lists available at SciVerse ScienceDirect

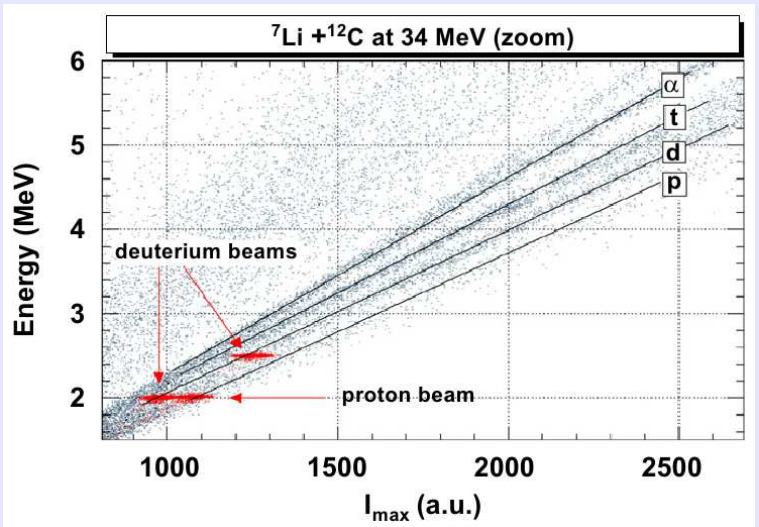
Nuclear Instruments and Methods in Physics Research A

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

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

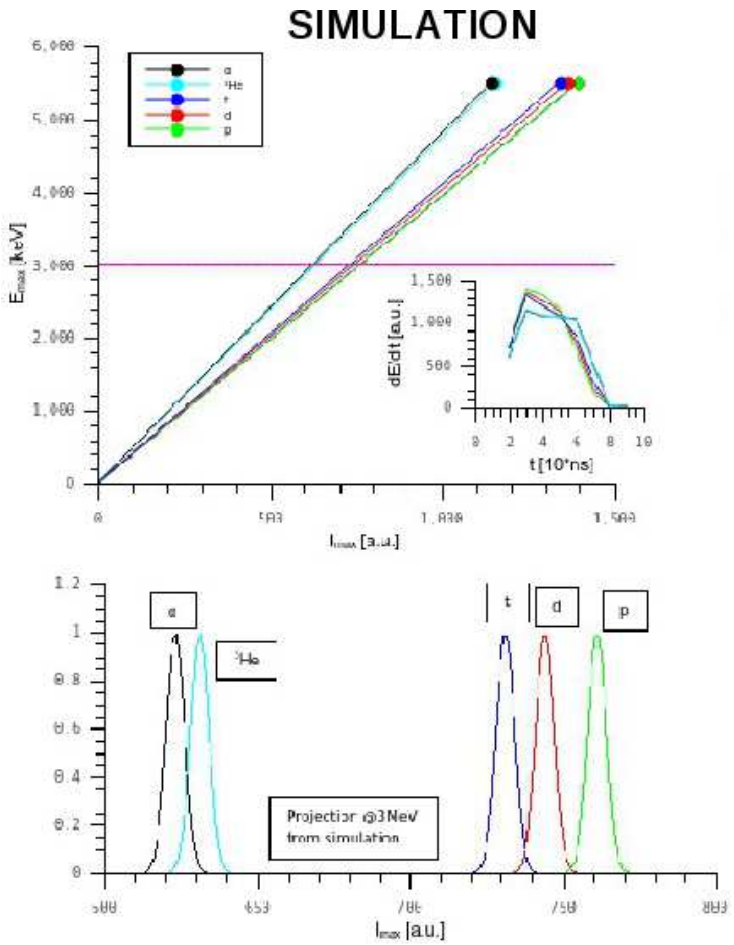
J.A. Dueñas [a,*], D. Mengoni [b], V.V. Parkar [a], R. Berjillos [a], M. Assie [c], D. Beaumel [c], A.M. Sánchez-Benítez [a], I. Martel [a]

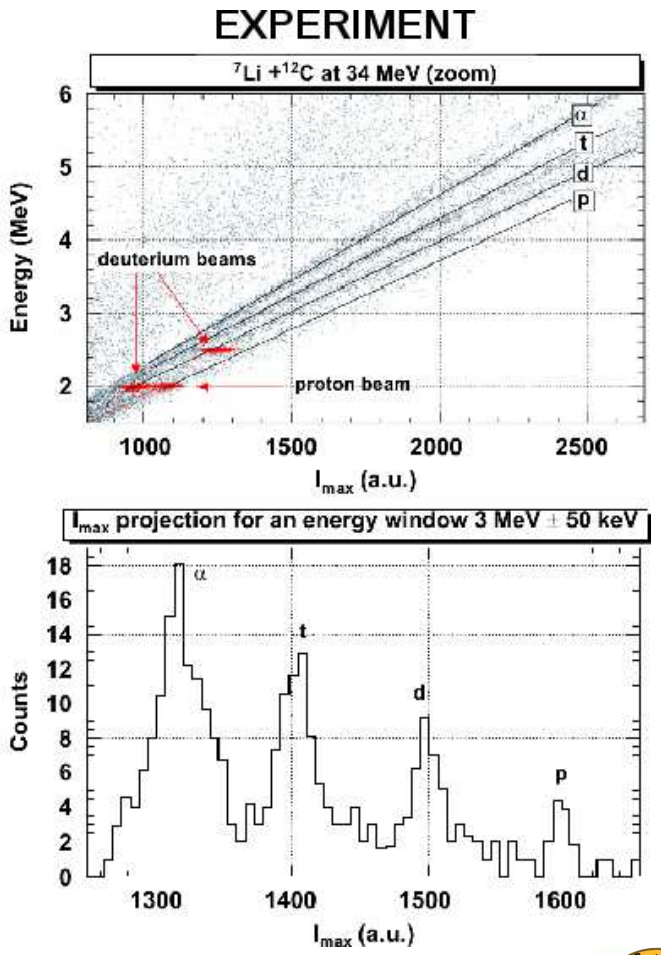




Signal Simulations

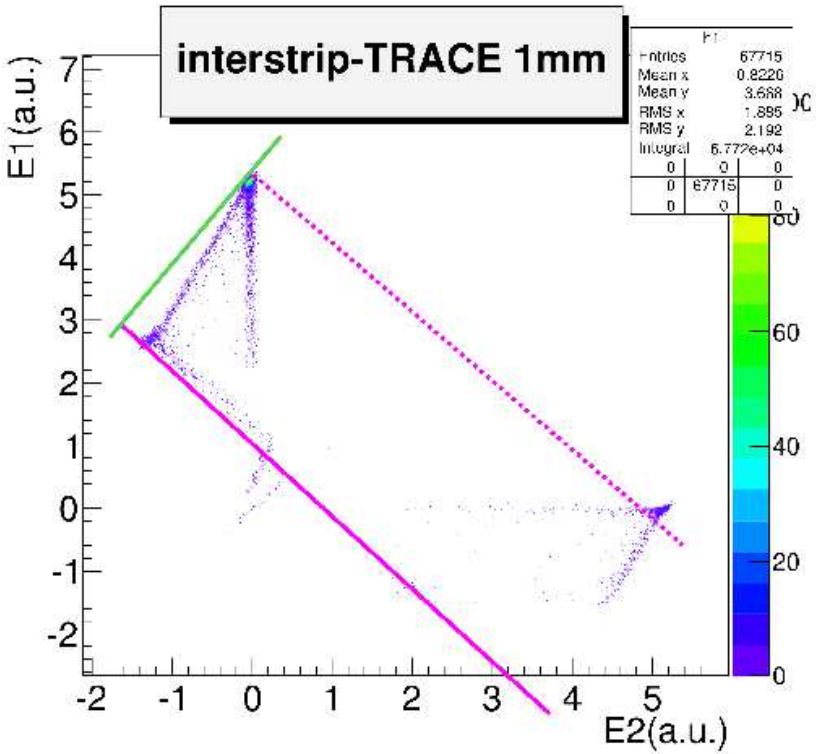
trade-off thickness *vs* threshold. Results obtained using ADL from B.Bruynel

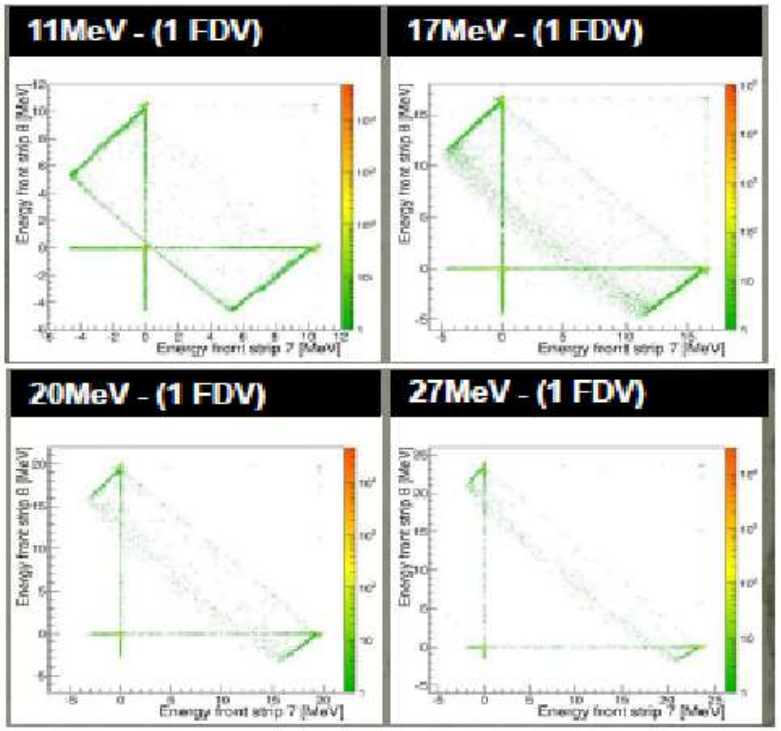




Interpad

efficiency loss

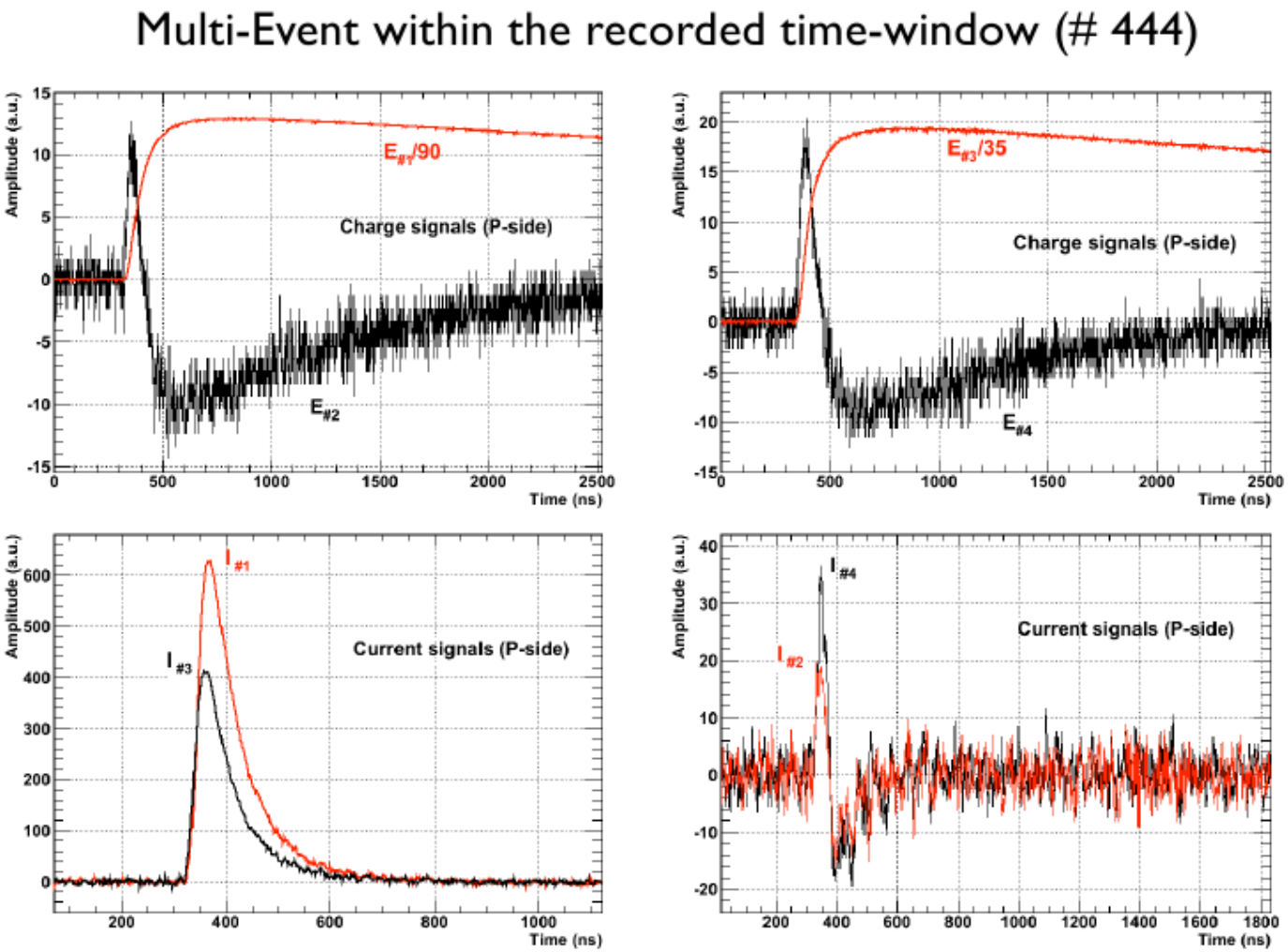




M.Gelain et al., EPJ WoC, INPC2013

TRANSIENT + XT SIGNALS

Interstrip nT dets. New test envisaged with microbeam



J.Duenas, D Mengoni, M.Assie et al., NIMA 2014

FEE/BEE/DAQ TRACE-GASPARD

bottleneck

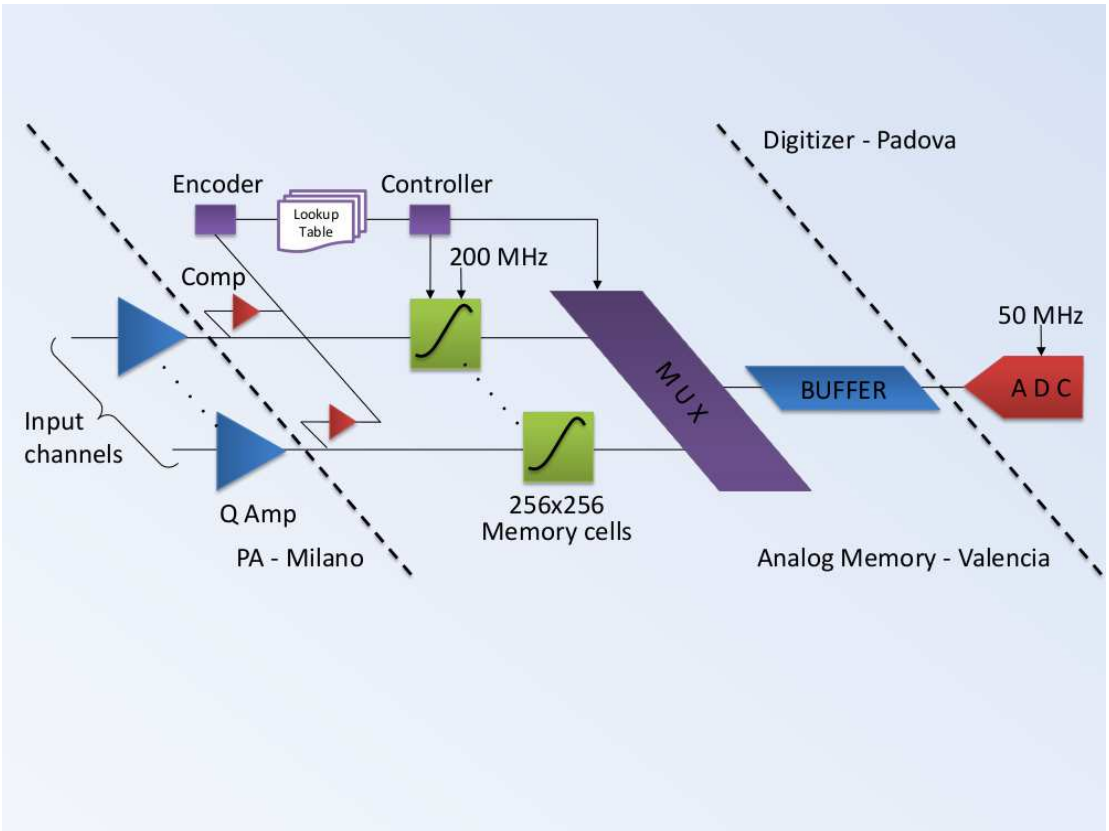
COMPACT INTEGRATED ELECTRONICS

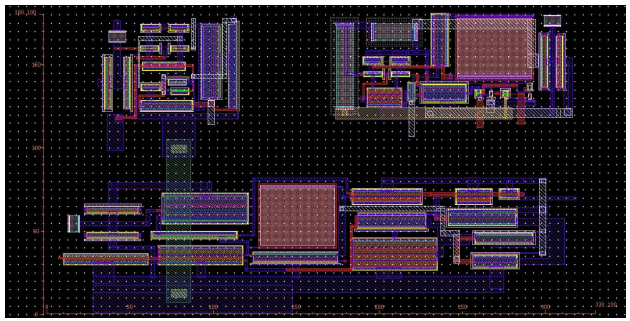
- PREAMPLIFIER: IPACI (Orsay), ToT preamp (Milano)
- FEE sync and trigger array of analog memories (Valencia)
- BEE slow rate ADC: Padova

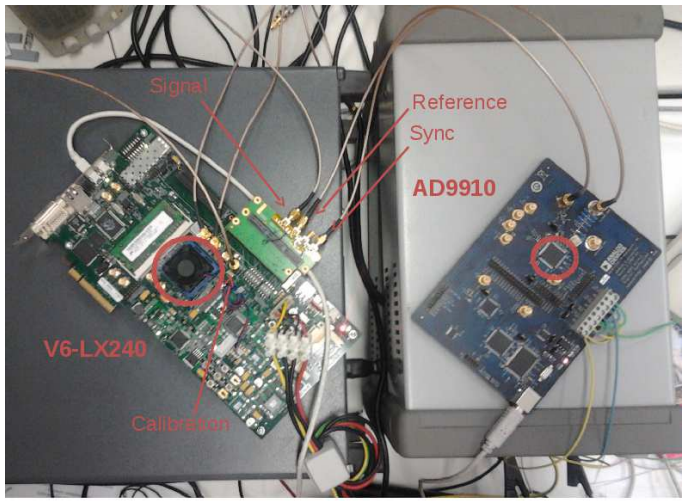
- working principle
- sustainable rate
- noise and energy resolution

FEE: Preamp + Analog memories

sparse readout and capacitance array

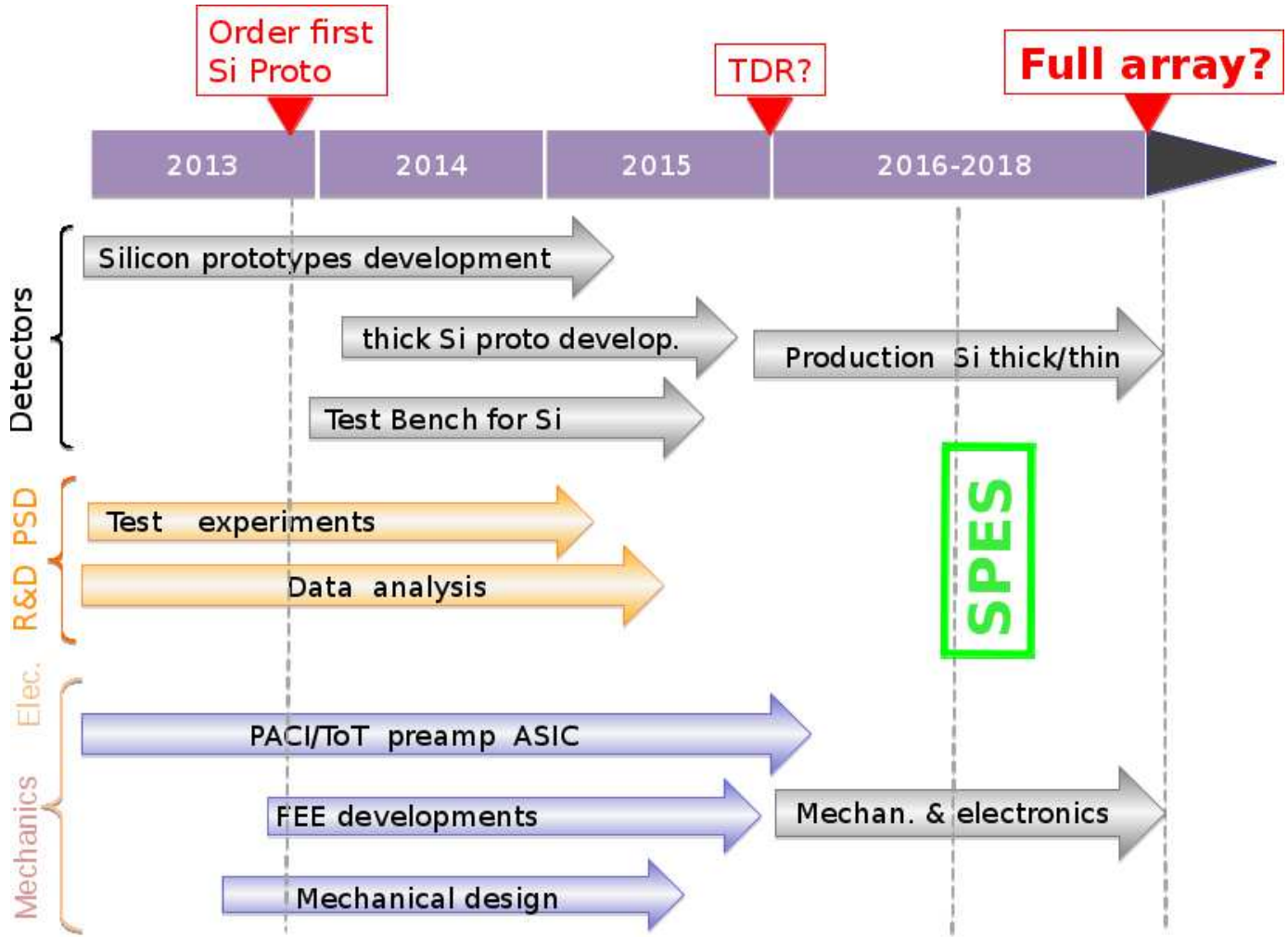






Perspective

Work plan



Summary & Conclusions

- FZ Detectors existing and in nTD in ordering
- PSA achieved under testing conditions (radiation hardness?)
- FEE/BEE/DAQ on their way, slowly
- Successful experimental activity pursued with AGATA and stable beam at LNL

- promising results within the GHT collaboration
- huge work to be done on the electronics