

TRACE

status and perspective

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Università di Padova - Italy

GASPARD-HYDE-TRACE Workshop, Padova - Italy
Oct, 29th ÷ 31st 2012

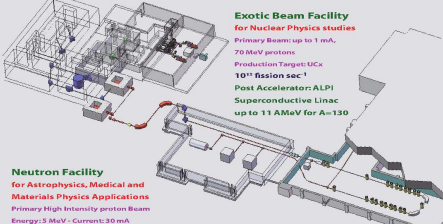


Outline



The future context at LNL

SPES



INFN Istituto Nazionale di Fisica Nucleare

Selective Production of Exotic Species at LNL

SPES exotic beams for science

Exotic Beam Facility for Nuclear Physics studies

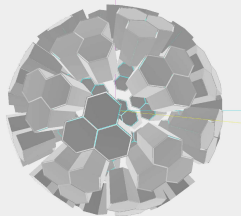
- Primary Beam: up to 1 mA, 70 MeV protons
- Production Target: UCa
- 10^{11} fission sec^{-1}
- Post Accelerator: ALPI Superconductive Linac up to 11 A MeV for A=130

Neutron Facility for Astrophysics, Medical and Materials Physics Applications

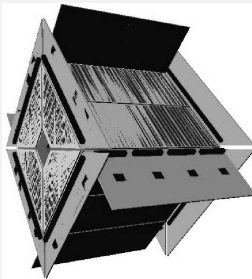
- Primary High Intensity proton Beam
- Energy: 5 MeV - Current: 30 mA
- Thermal neutrons up to $10^9 \text{ n cm}^{-2} \text{ sec}^{-1}$
- Fast neutrons up to $10^{14} \text{ n sec}^{-1}$

Legnaro
www.infn.it
science belongs to our culture

GALILEO



TRACE



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

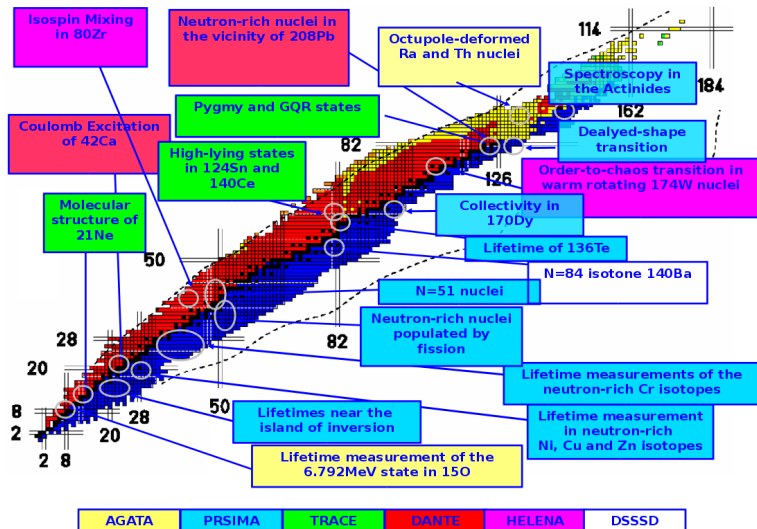
What is new then?

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



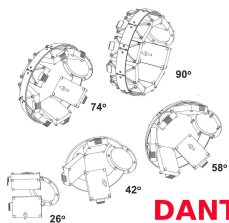
The physics campaign with STABLE beams at LNL

in terms of complementary detectors ...

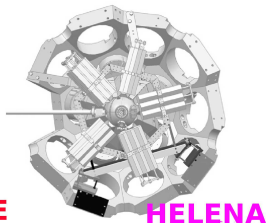


Conceptual design and infrastructure for the installation of the first AGATA sub-array at LNL

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^l, 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},

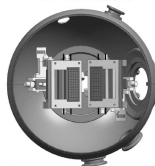


DANTE



HELENA

TRACE



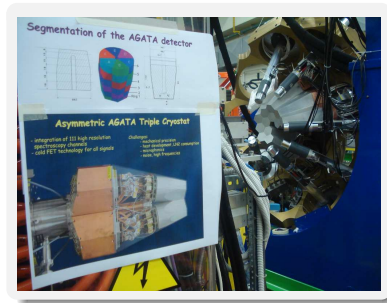
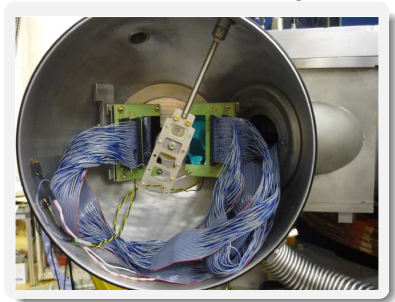
PLUNGER



TRACE+AGATA

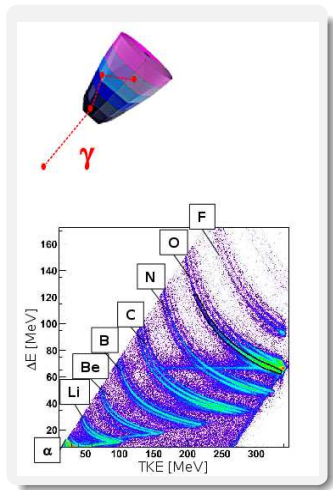
Three in-beam experiments

- 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

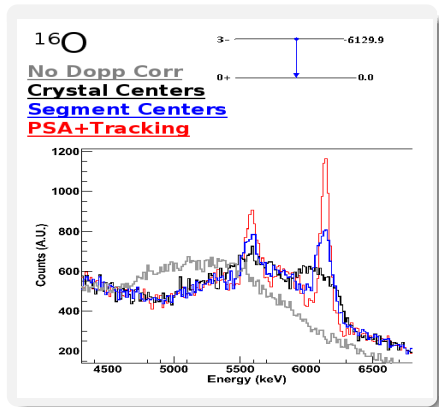


TRACE telescope

Performance of the AGATA-TRACE setup



- Z and M up to Z = 9
- $\beta \sim 20\%$

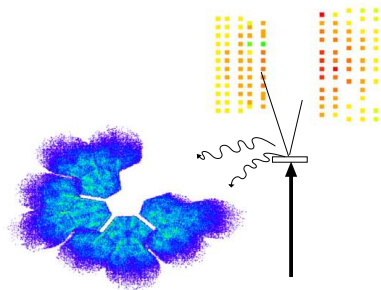


- ^{16}O channel: high energy γ -ray low background from target.....
- FWHM $\sim 0.9\%$
- Good PSA performance

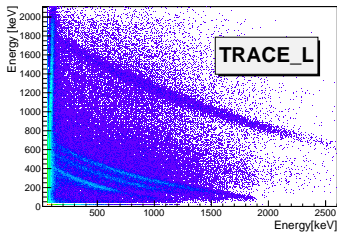
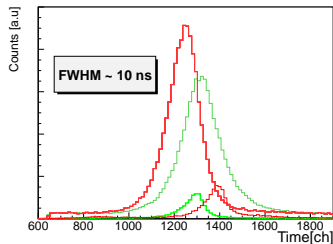


TRACE for light-charged particles

${}^7\text{Li}+{}^{16}\text{O}$ Quasi-fusion reaction for ${}^{21}\text{Ne}$



- TRACE- $\gamma\gamma$
- kinematic reconstruction of the binary partner



PSA campaign

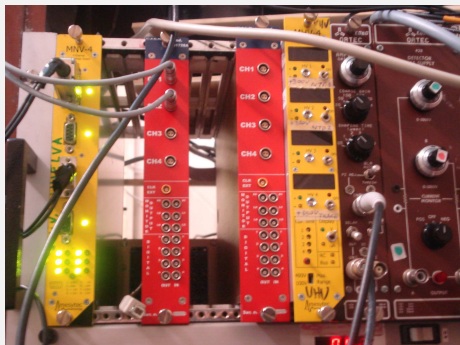
TRACE-GASPARD-HYDE collaboration

- 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

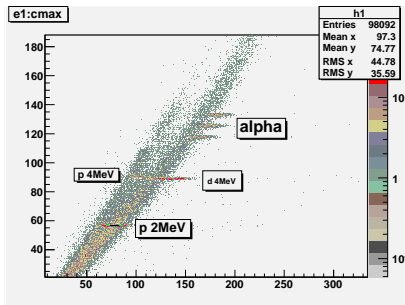
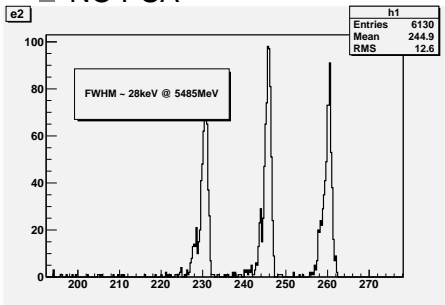
- PSA on light-charged particles
- Increase geometrical resolution via transient signals in neighbouring electrodes



PSA experiment

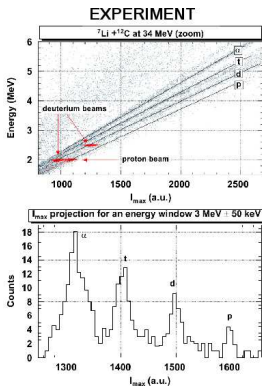
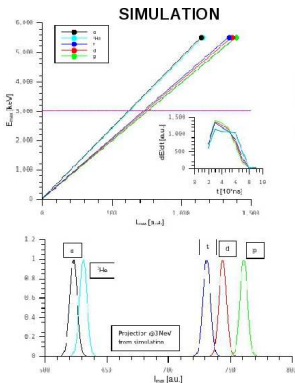
TRACE results - 2nd Orsay test

- 200 μm , 60-pad 4x4 mm^2 , 2nA dark current
- energy resolution 30keV
- NO PSA



PSA limit

trade-off thickness vs threshold

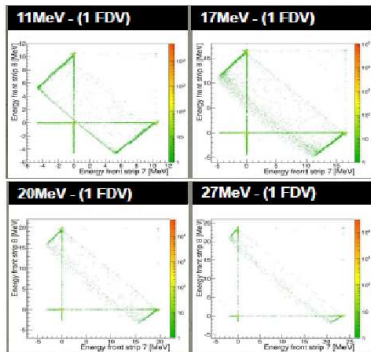
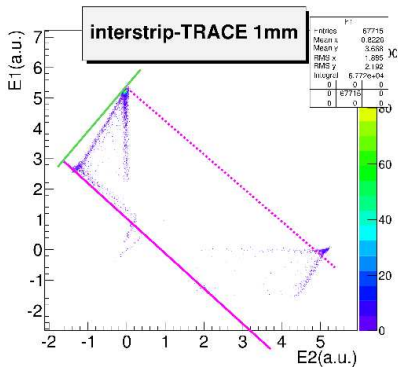


↪ L. Pigatto, tomorrow



Interpad

efficiency loss



↪ M. Gelain tomorrow



Perspective with SPES at LNL



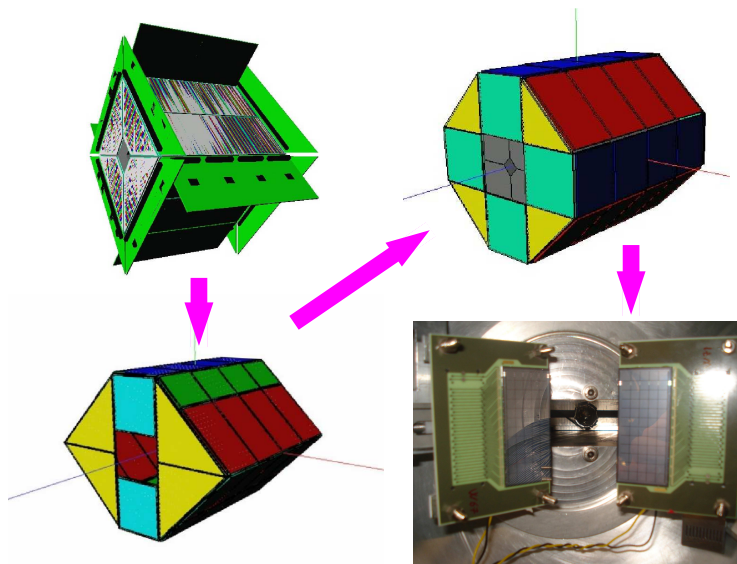
Letters of Intent

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. de Angelis
- 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. de France
- 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

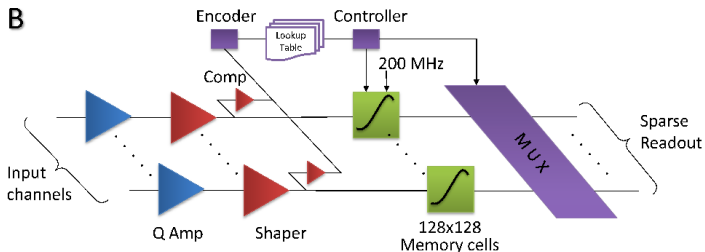
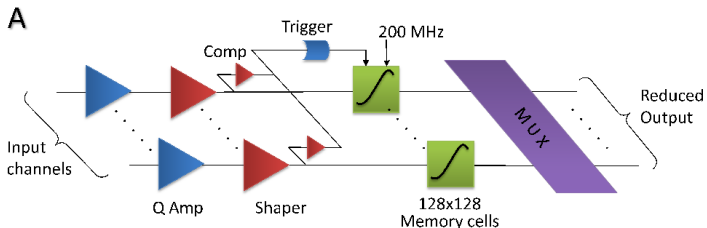


TRACE: the evolution



FEE: Preamp + Analog memories

Solution A MUX: $\sim 5\text{KHz}/128\text{ch}$; Solution B: sparse readout



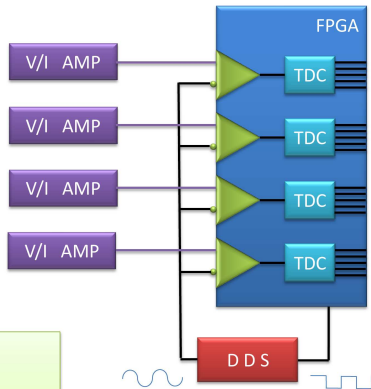
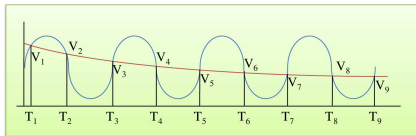
\rightsquigarrow S.Capra on preamps, tomorrow



FPGA as ADC: a local solution for the BEE

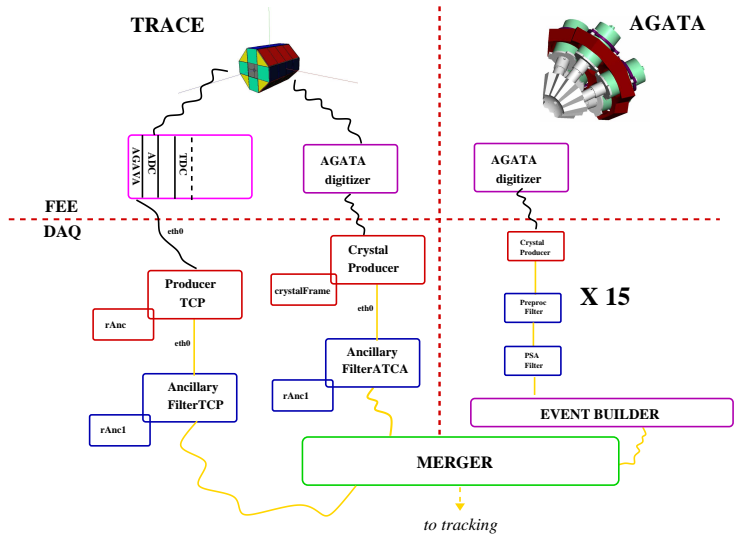
cheaper (and high integration?)

- 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



~> A. Triossi tomorrow





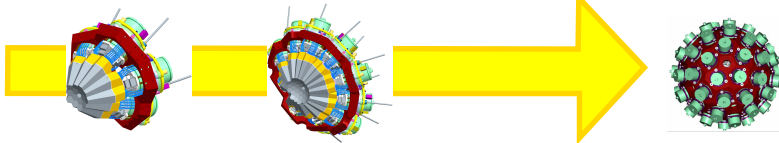
↪ more details on Wednesday



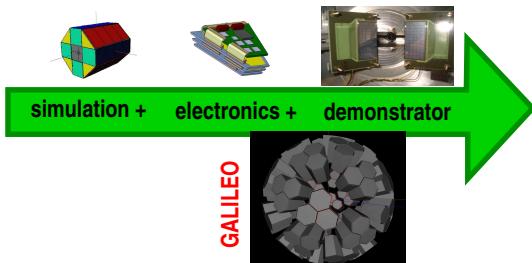
Timeline



AGATA



TRACE



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 revised design for GALILEO and (new) stable beams
- TRACE scaled demonstrator ready for SPES



