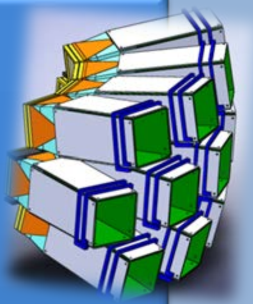
*Enrico De Filippo (INFN Catania) for the **NEWCHIM** collaboration*

Results and recent advances with the CHIMERA and FARCOS detectors

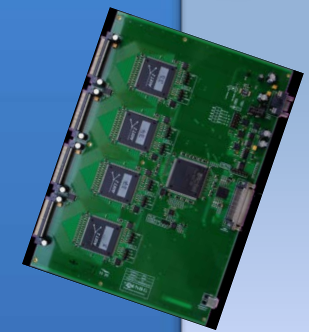
IWM-EC2018

Physics cases: Working with Chimera + Farcos array (examples with stable and exotic beams)



A the new front-end electronic and hybrid-DAQ

GET: generic electronics for TPC: a compact system going from front-end electronic to data readout. FARCOS status



Recent results: PYGMY and Gamma-Hoyle experiments

Recent results: Isospin influence on dynamical production of IMFs in ^{124}Xe+^{64}Ni,^{64}Zn, ^{124}Sn+^{64}Ni isobaric systems

Asy-Eos II: Plans for high density symmetry energy studies at GSI

Physical cases:

Upgrades: pulse shape, digital electronics, Coupling of 4π detectors with ancillary arrays (correlators), Neutron detection signal (see E.V. Pagano talk).

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Why?

Physical cases:

Upgrades: pulse shape, digital electronics, Coupling of 4π detectors with ancillary arrays (correlators), Neutron detection signal (see E.V. Pagano talk).

Why?

Nuclear Equation of State and Symmetry energy of asymmetric nuclear matter: Symmetry energy parametrization at **low** and **high** densities.

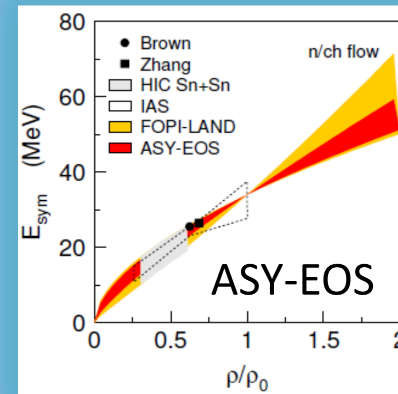
Dynamics and thermodynamics in heavy ion-reactions: time scale of particles and cluster emission, neck emission: fragment-fragment and particle correlations. Dynamical fission.

Multi-particle correlations. Alpha particle clustering (*see L. Quattrocchi talk)*. IMF-IMF correlations.

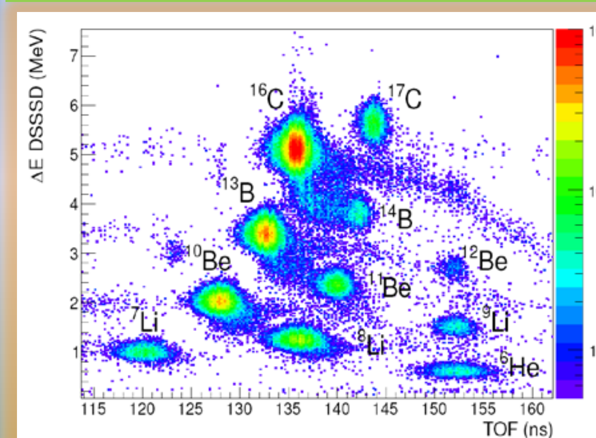
Correlations of light particles from break-up reactions in neutron rich nuclei. Isoscalar excitations of PDR (FRIBs beams, CLIR, PYGMY). (*see N. Martorana poster)*.

Isospin dependence of compound nucleus formation and decay: study of the isospin influence on the reaction dynamics and competition between different decay modes (ISODEC) at 10 MeV/A. (*see B. Gnoffo talk*)

PRC **94**, 034608 (2016)

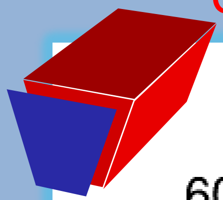


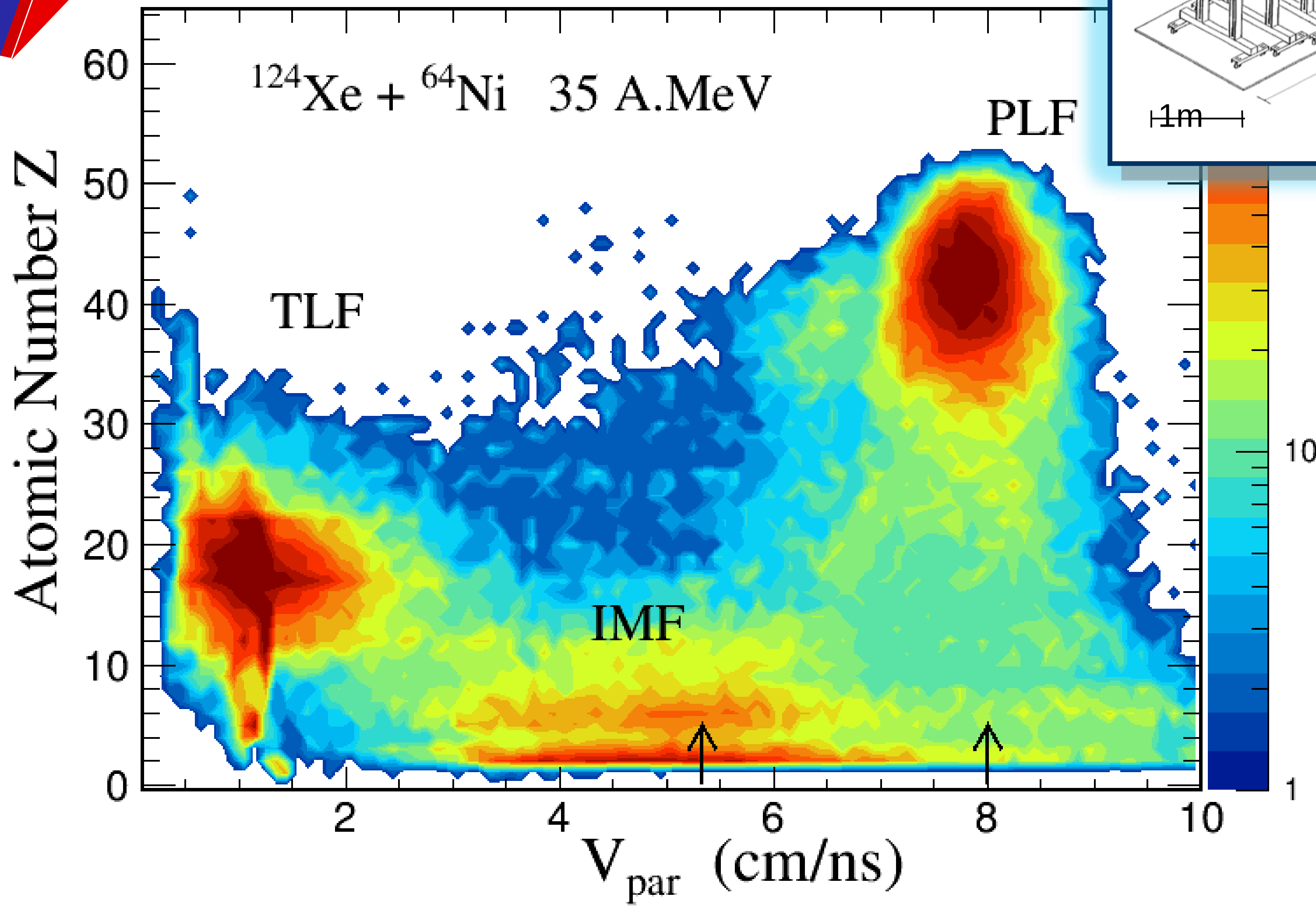
FRIBs cocktail beams from ^{18}O 55 A.MeV primary beam, as seen by the Chimera tagging system

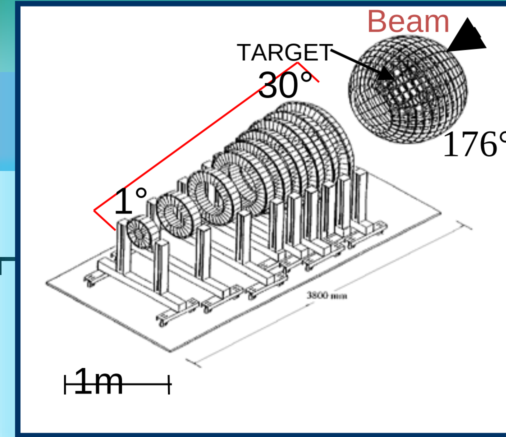


D. Dell'Aquila et al., Phys. Rev. **C93**, 024611 (2016). L. Acosta et al. NIM A715, 56 (2013).

An example: three body analysis of fragments







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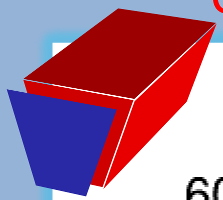

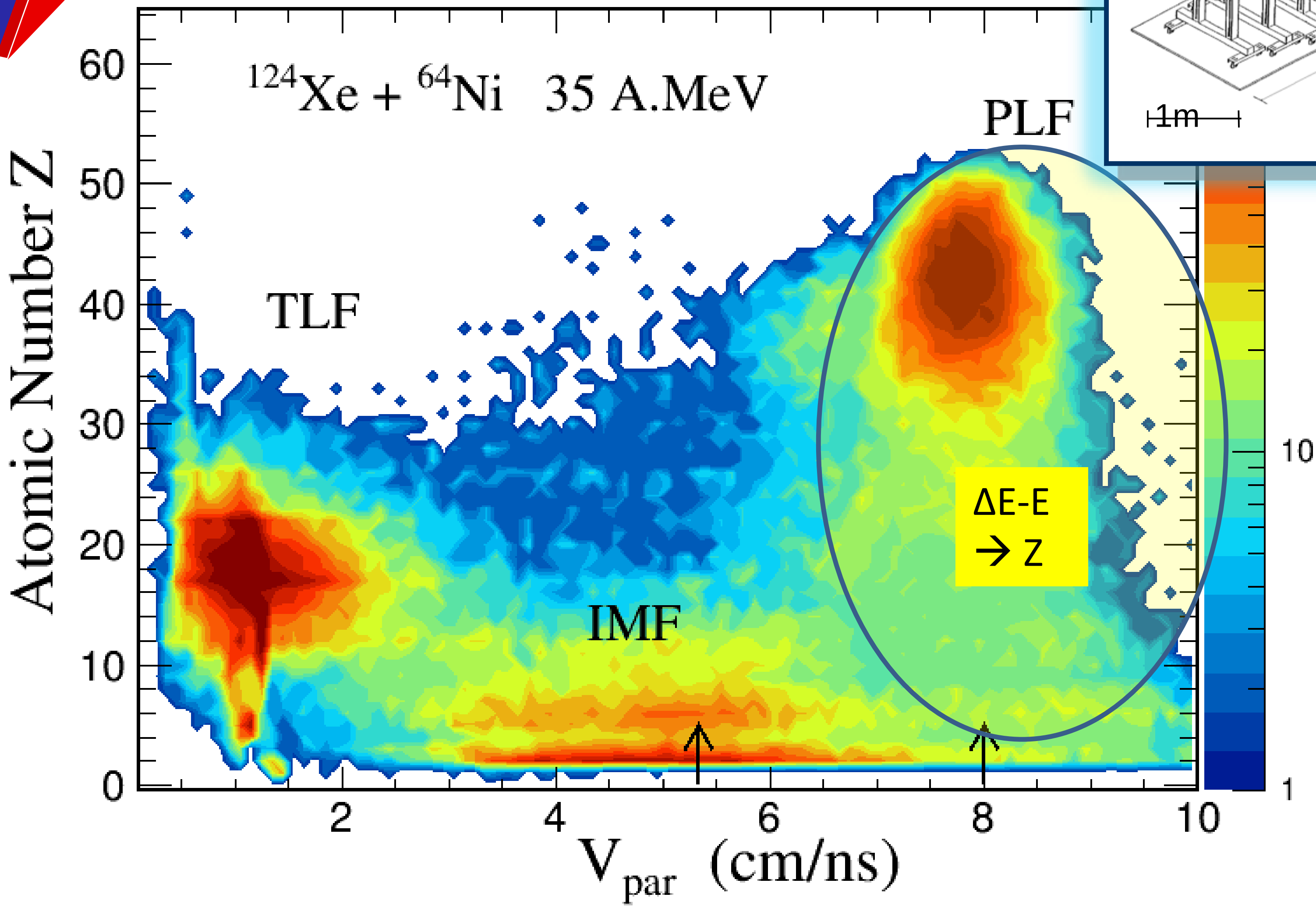

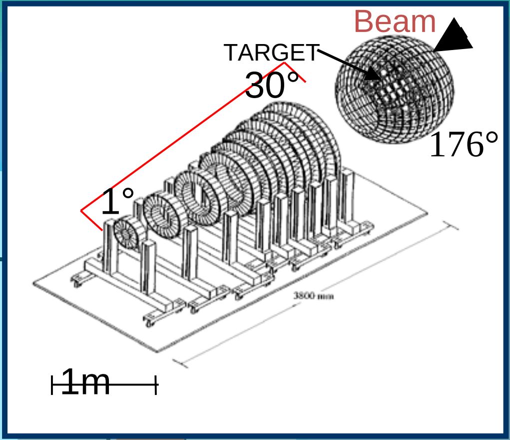

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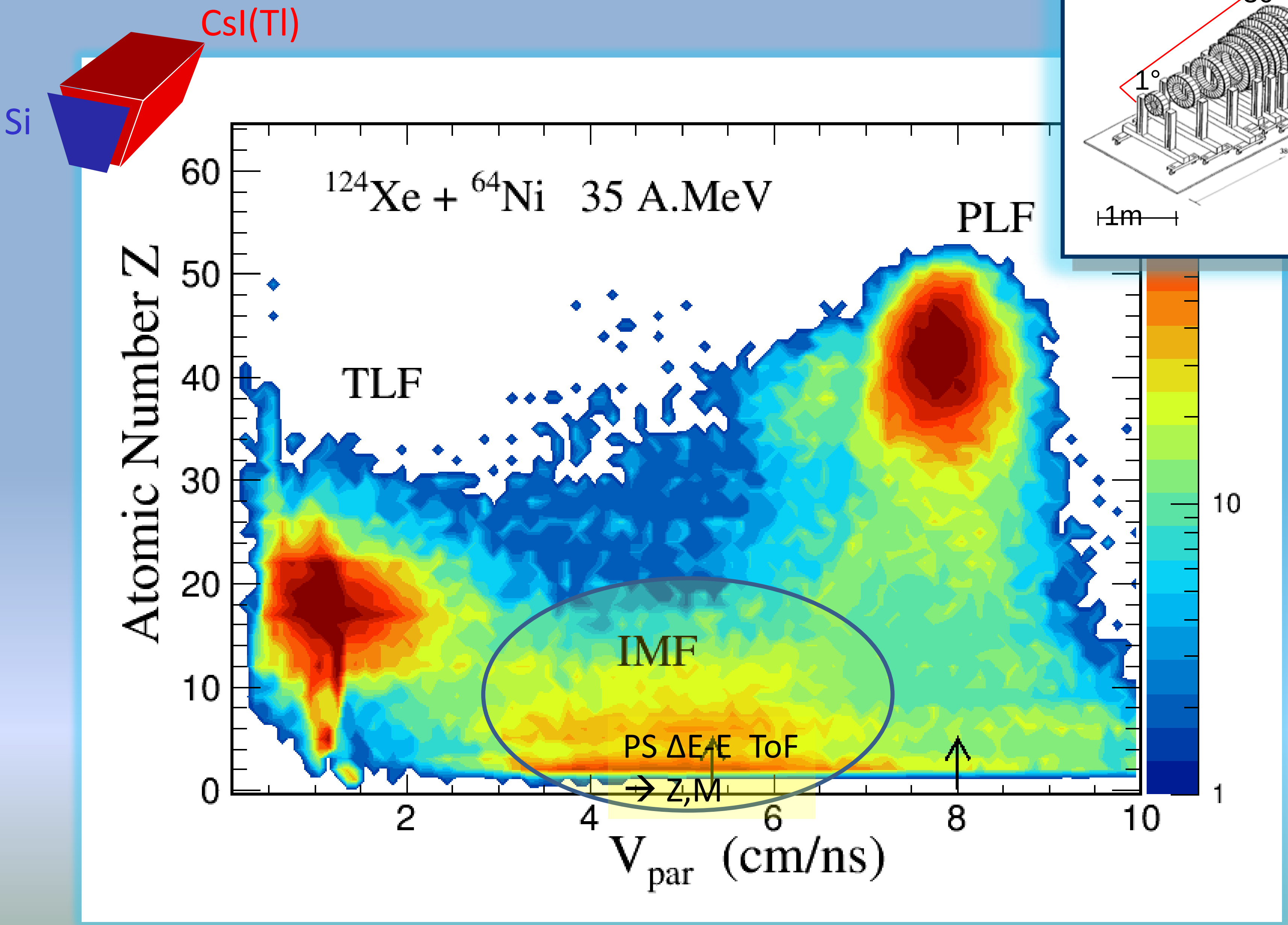

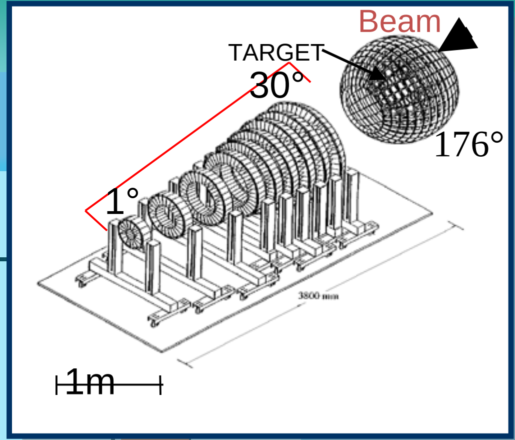

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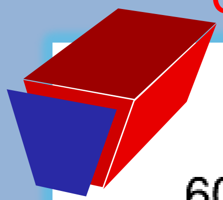

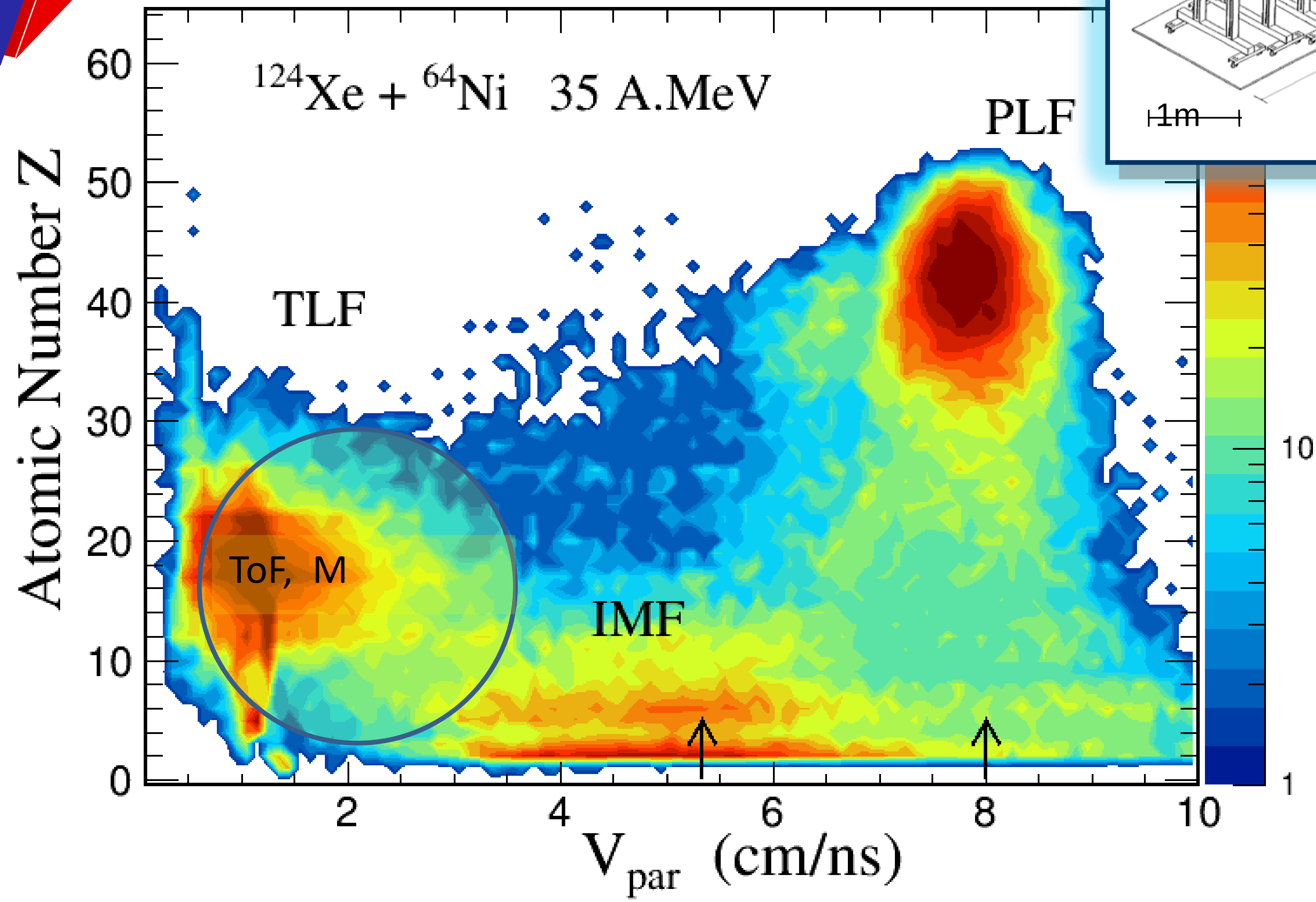

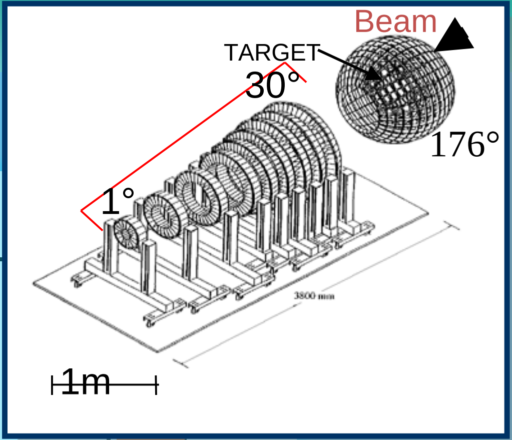

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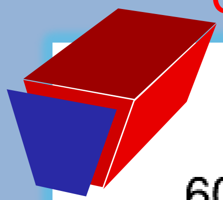

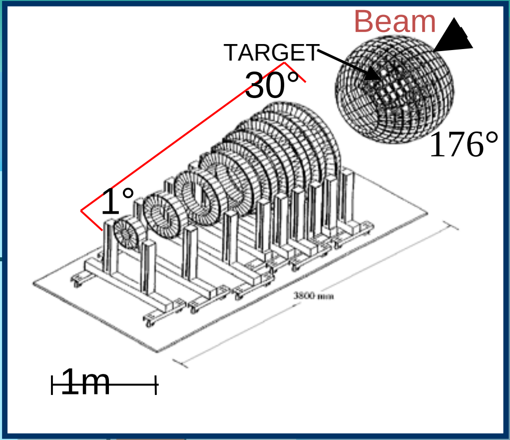

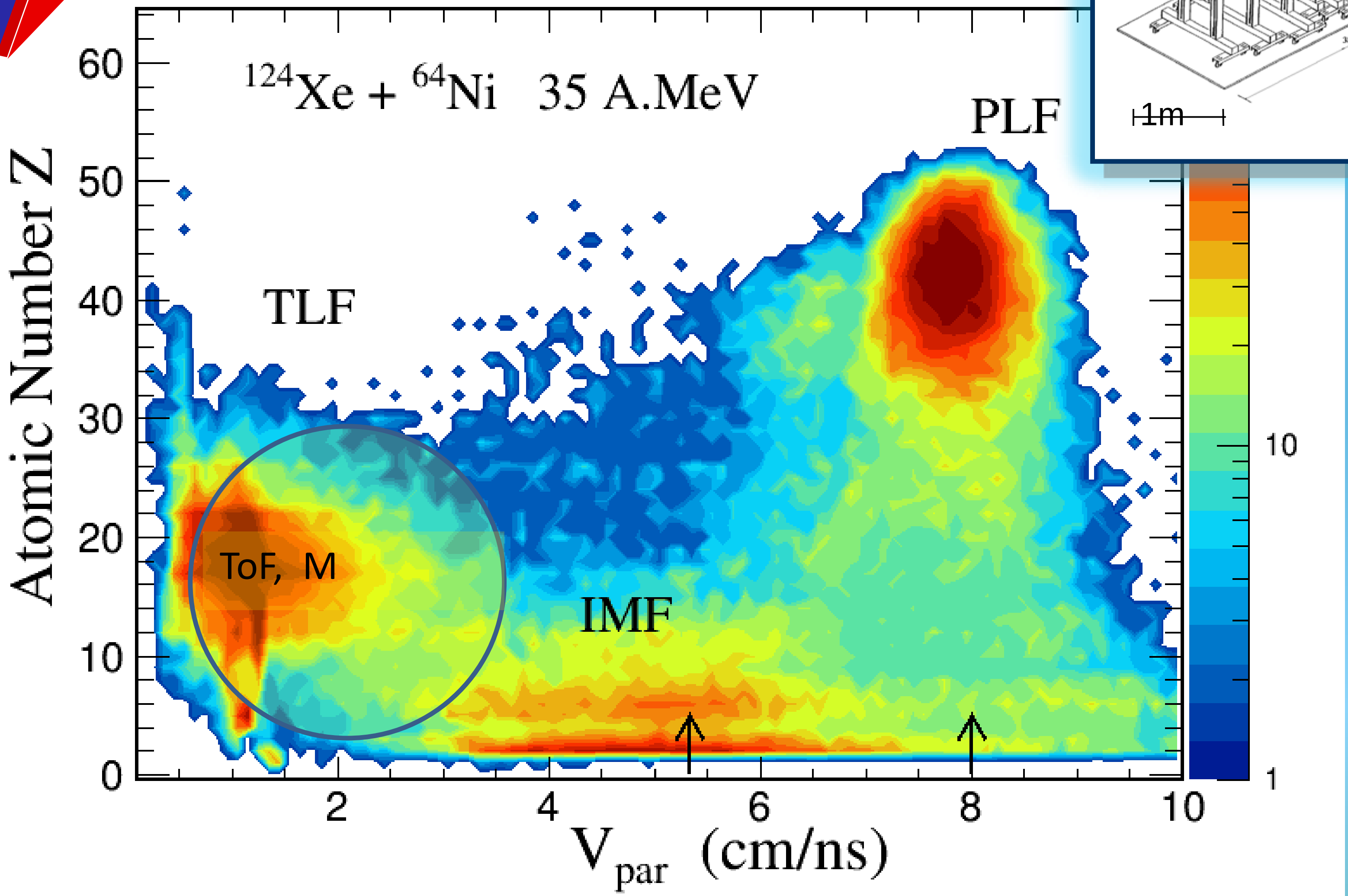

What is FARCOS and **why** we need it ?

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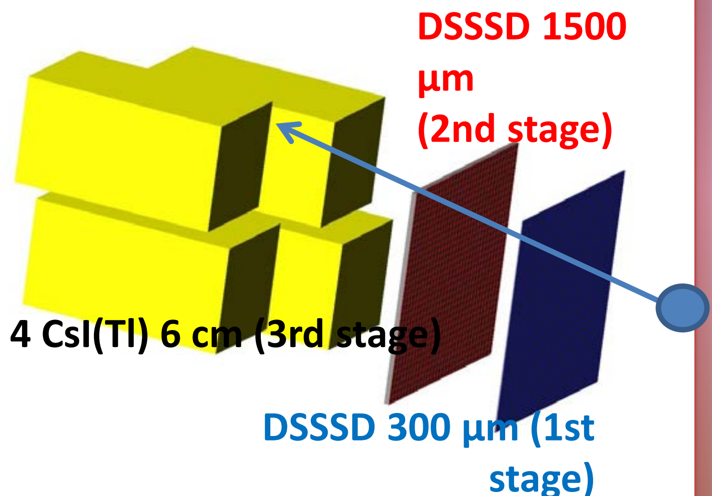
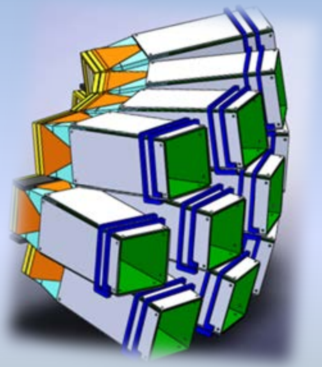
High energy and angular resolution ($\Delta\vartheta<1°$)
Low thresholds (<1 MeV/A):
Pulse-shape on first Si layer for low energy experiments
High counting rate (1KHz)
Large Dynamic range (1 MeV to 2GeV)
Flexibility, Modularity, Trasportability
Easy coupling to 4π detectors or spectrometers
Integrated Electronics (GET)

132 channels by each cluster

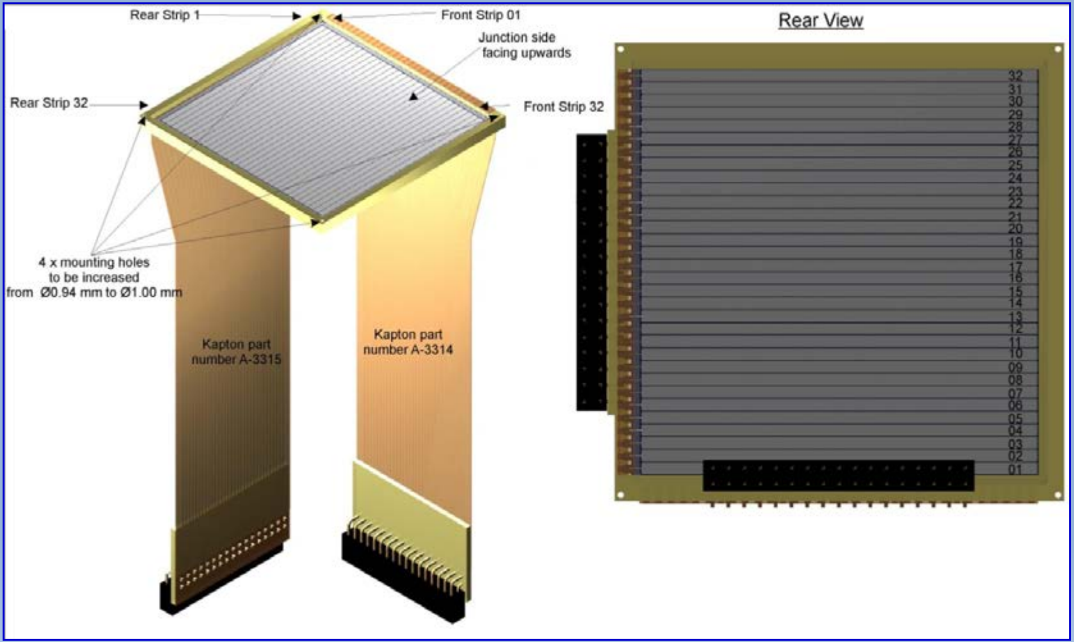




Farcos:
a 3 stage telescope

FARCOS: Femtoscope Array for COrrelations and Spectroscopy

Technical Design Report (TDR): https://drive.google.com/file/d/0B5CgGWz8LpOOc3pGTWdOcDBoWFE/view



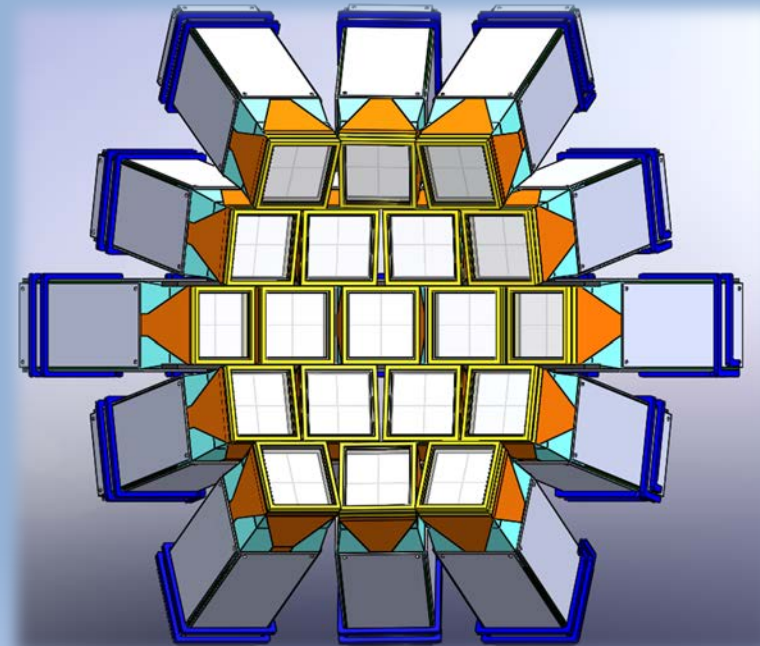
Highly homogeneous CsI(Tl) crystals produced by SCIONIX.
Wrapped with 0.12 mm thick white reflector +50 μm aluminized mylar. Aluminized mylar window 2 μm thick (0.29 gr/cm²). Read by Photodiode Hamamatsu 300 μm
ΔE/E=2-3% (α 5.48 MeV)

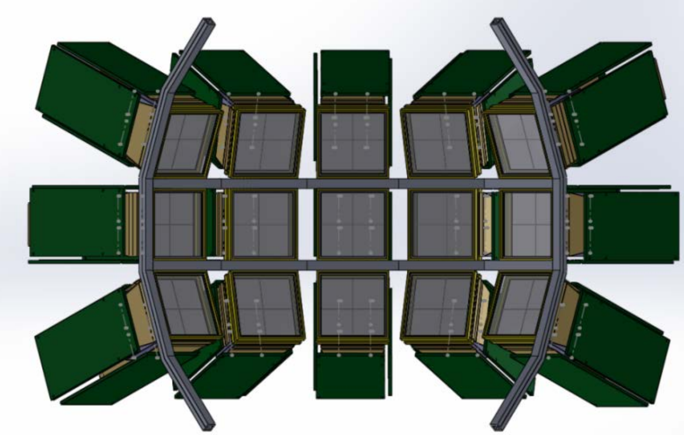
64 mm, 32 strips, Double-Sided Silicon Strip Detectors
produced by Micron Semiconductor.
(300 and 1500 μm / C= 25pF and 5pF)
Capton cable 2x32pin connectors
Minimum PCB
frame-area thick, 4 mm,
frame-thick 6.5 mm
ΔE= 20KeV (α 5.48 MeV) **ΔE/E (elastic)=0.2-0.3%**
Rise time<20ns

Assembling of the «real» FARCOS: high modularity

Starting prototype: 4 telescopes : NEWCHIM (2015-2019 final planning 20 telescopes)

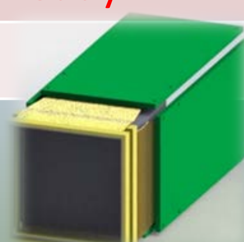
Year	Tel.	Operation
2015	6	test acq. GET for FARCOS construction of 2 telescopes purchase of final GET electronics
2016	10	test dual gain module test GET electronic +DAQ Study of alignment system
2017	10(14)	test new asic pre-amplifiars final design modular support implementation asic pre-amplifier new DAQ VME+ GET running
2018	14	First experiments with new Chimera+Farcos front-end Construction of new telescopes
2019	20+2	20 telescopes ready
. . . . .		



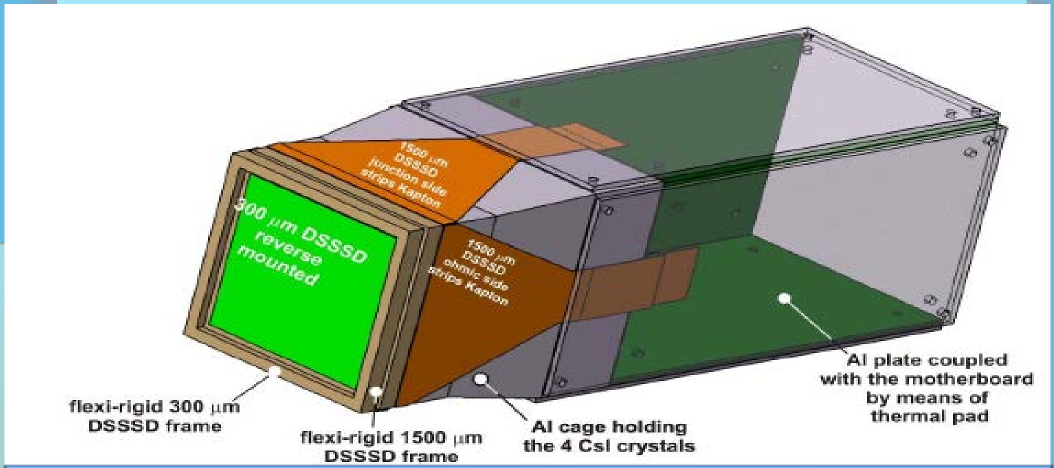


Design simulation: Luis Acosta

Final cost prediction: ≈< 1 M€



Selectable-Gain CMOS Charge Preamplifier for Pulse Shape Analysis in Double Sided Silicon Microstrip Detectors for FARCOS



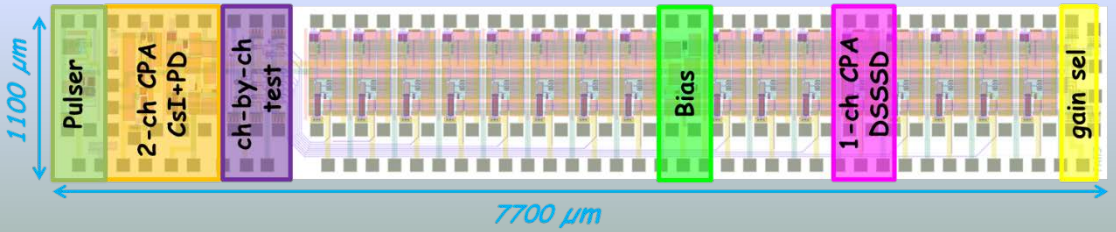
A Kapton cable connects each face of each DSSSC to a custom PCB motherboard housing the front-end ASIC (2x(16+1) channels.

- ✓ single design for both thicknesses and of both polarities
- ✓ strip capacitance about 65 pF (300 µm) and 35 pF (1500 µm)
- ✓ strip leakage current ~5 nA (300 µm) and ~25 nA (1500 µm)
- ✓ target dynamic ranges: 90 MeV, 200 MeV, 350 MeV and 500 MeV.
- ✓ static power consumption ~10 mW/channel
- ✓ Selectable gain

See Chiara Guazzoni talk

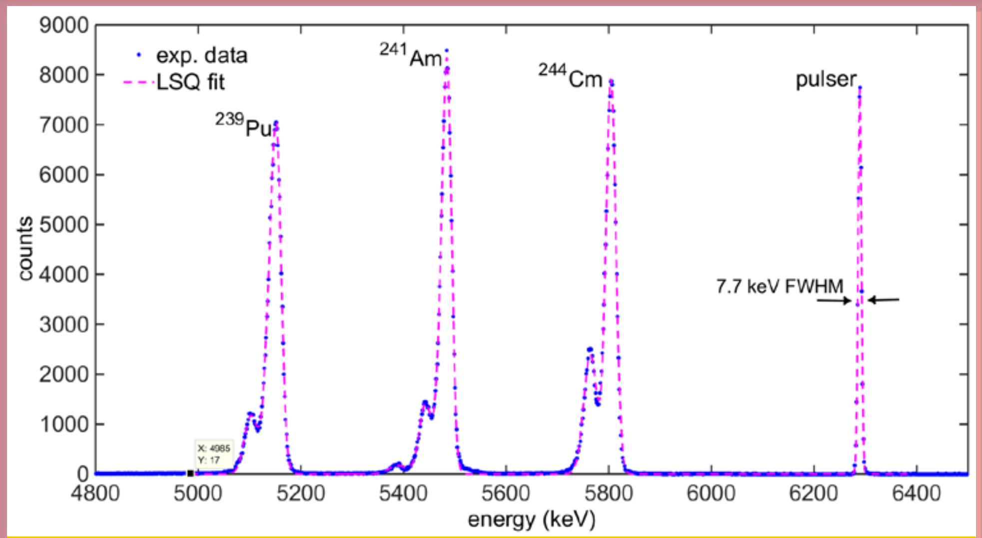
❑ 16-ch ASIC layout

0.35 µm C35B4C3 AMS tech



- ✓ 16-ch CPA for DSSSD
- ✓ 2-ch CPA for CsI(Tl) + PD readout
- ✓ on-chip pulser
- ✓ channel-by-channel test signal injection
- ✓ temperature monitor

Selectable-Gain CMOS Charge Preamplifier for Pulse Shape Analysis in Double Sided Silicon Microstrip Detectors for FARCOS



Alpha source with FARCOS DSSSD, 300 mm thick

- ✓ single design for both thicknesses and of both polarities
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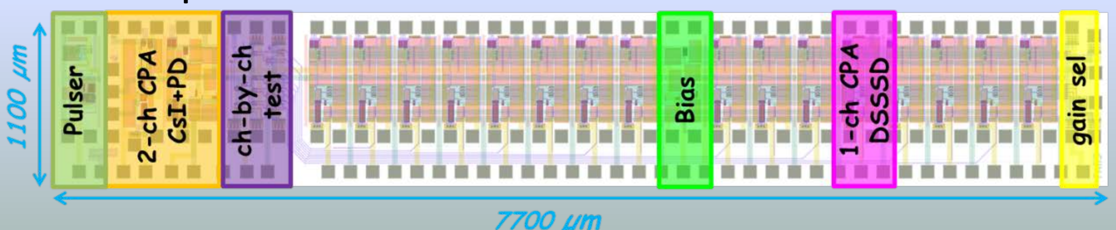

- ✓ 16-ch CPA for DSSSD
- ✓ 2-ch CPA for CsI(Tl) + PD readout
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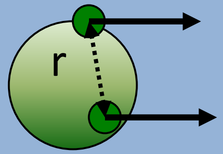
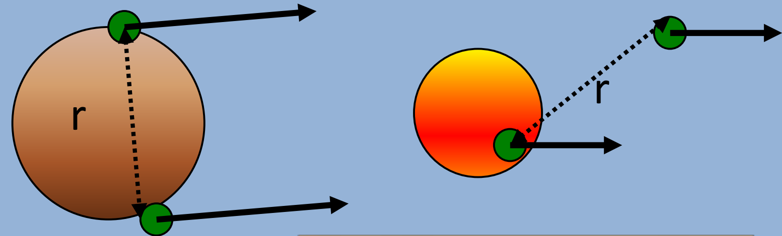
- ✓ temperature monitor

CORRELATORS: physics case

HBT interferometry:
particle correlations at small relative momentum;
nuclear dynamics;
Space-time characterization of the emitting source;
Emission time: from pre-equilibrium emission to secondary decay
Information on reaction mechanism and time-scales

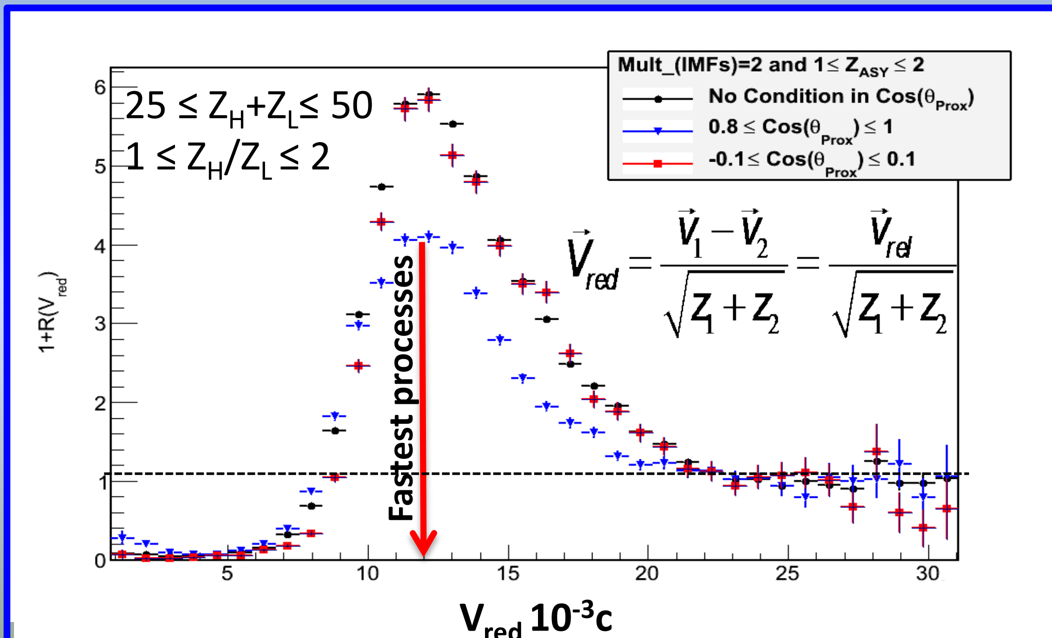


more correlation if source is smaller in **SPACE**



more correlation if source is smaller in **TIME**

Multi particle correlations:
Spectroscopy of unbound states;
Cluster structures, IMF-IMF correlations (example for $^{124}Sn+^{64}Ni$@35 A.MeV reaction, E.V. Pagano, PoS, Bormio 2017)



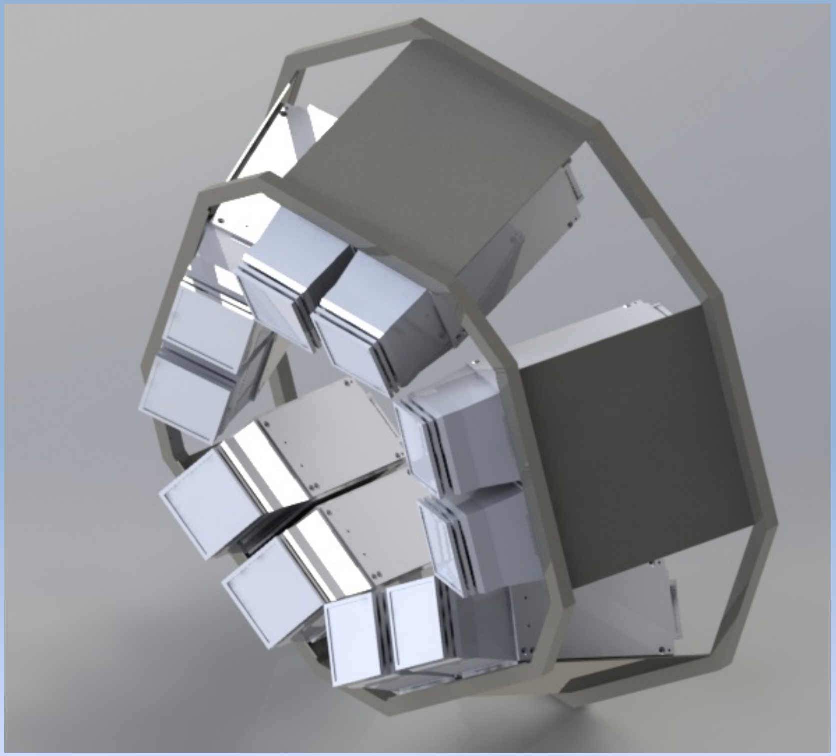
Dynamical processes in projectile break-up and IMF production at 20 A.MeV studied with the CHIMERA and FARCOS devices. CHIFAR: CHImera-FARcos (approved LNS-PAC proposal) **spokes: E.V. Pagano, E.d.F., P. Russotto**

Dynamical processes in projectile break-up and Intermediate Mass Fragments production at 20 **A.MeV** beam incident energy studied with the CHIMERA and **FARCOS** devices

CHIMERA + 10 FARCOS telescopes in a "quasi"-ring configuration

^{124}Xe, ^{124}Sn + ^{64}Ni, ^{64}Zn

^{112}Sn+^{58}Ni @ 20A.MeV



Configuration CAD study for 10 FARCOS telescopes between the sphere and ring 9; Luis Acosta group, Mexico

The CLIR experiment (clustering phenomena in exotic nuclei)

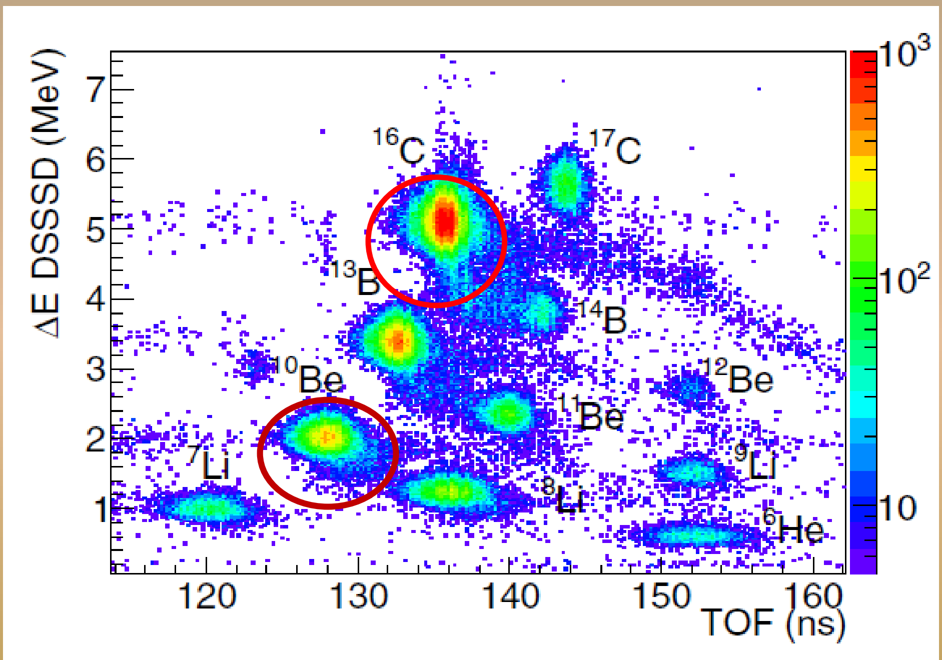
Study of the structure of $^{10}Be^*$ ($^{4}He + {}^{6}He$) and $^{16}C^*$ ($^{10}Be + {}^{6}He$ or $^{4}He + {}^{6}He + {}^{6}He$) by means of sequential break-up at intermediate energy

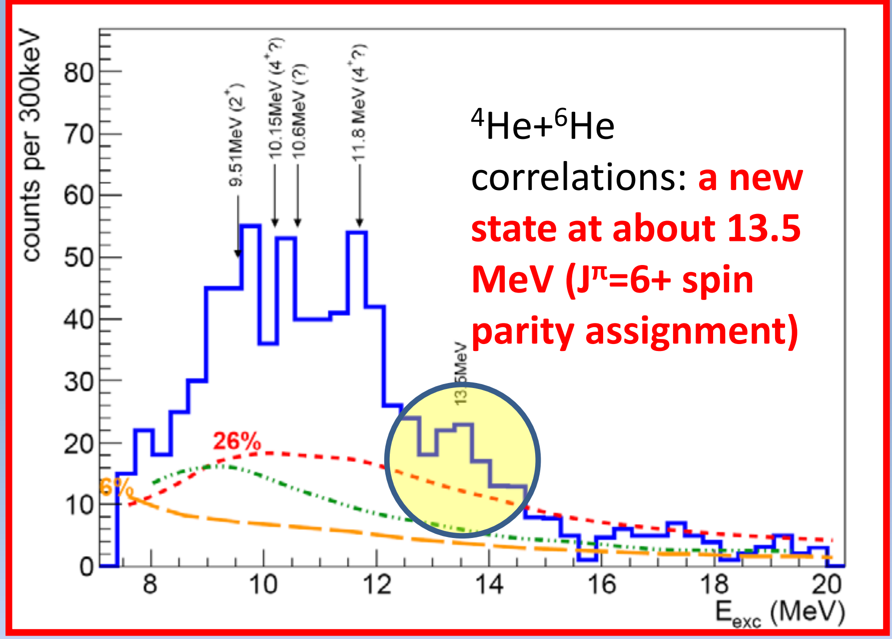
FRIBs cocktail beams from ^{18}O + 1.5 mm Be target, 55 A.MeV primary beam, as seen by the Chimera tagging system

^{16}C $(49{,}5\ MeV/u)\ 10^{5}\ pps;$

^{13}B $(49{,}5\ MeV/u)\ 5 \cdot 10^{4}\ pps;$

^{10}Be $(56{,}0\ MeV/u)\ 4 \cdot 10^{4}\ pps;$





D. Dell'Aquila et al., Phys. Rev. C93, 024611 (2016) and A. Phys Pol. 48,499 (2017).

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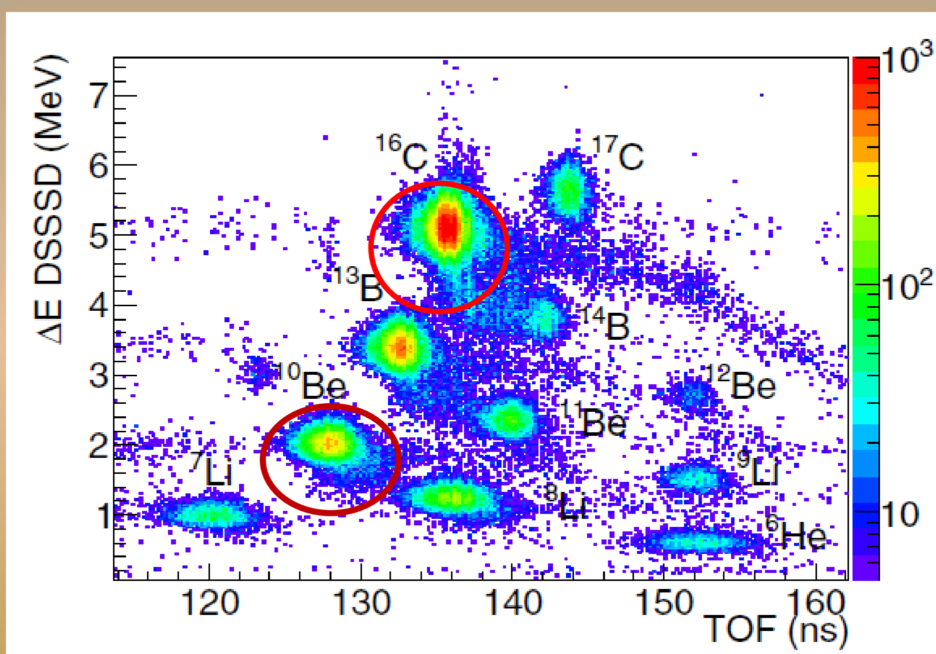
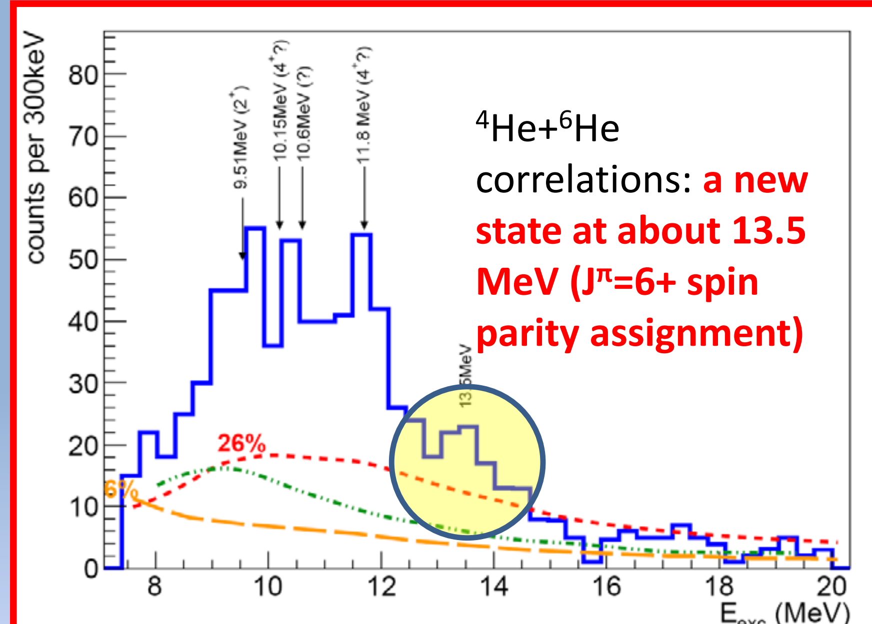
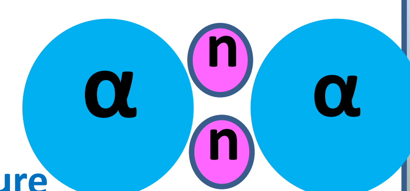




D. Dell'Aquila et al., Phys. Rev. C93, 024611 (2016) and A. Phys Pol. 48,499 (2017).

^{10}**Be**:

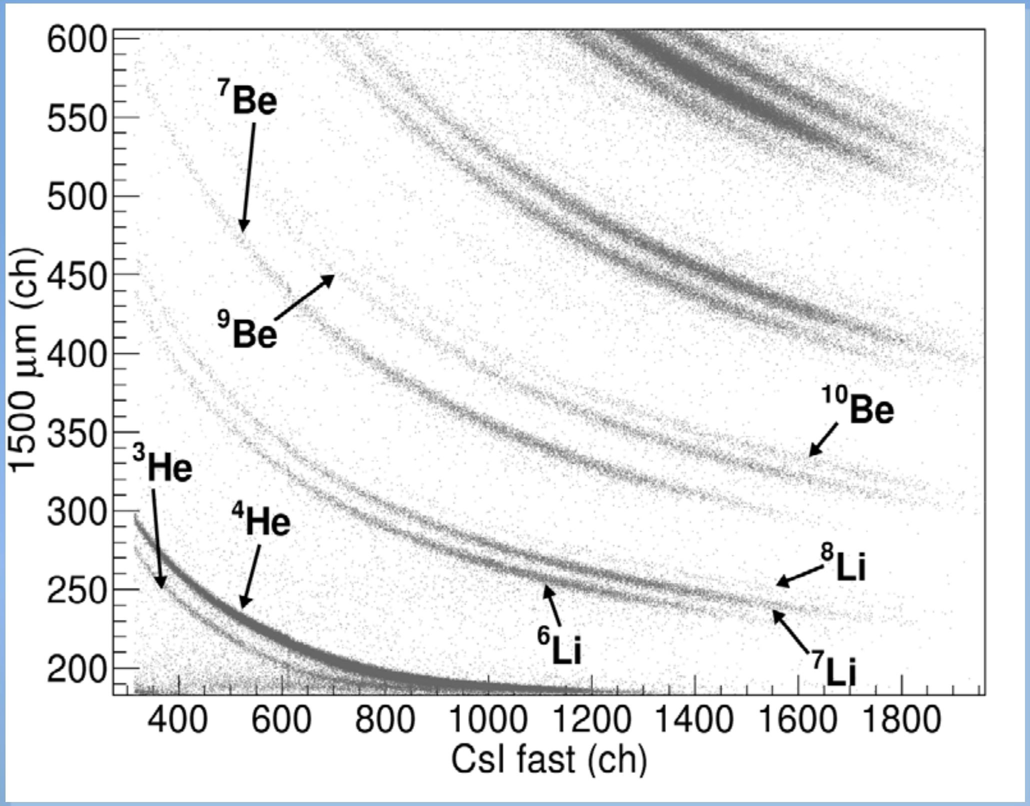
Signals of molecular structure



M. Freer et al. PRL 96, 042501 (2006)

The CLIR-II experiment (clustering phenomena in exotic nuclei)

4 FARCOS telescopes placed symmetrically around the beam axis)

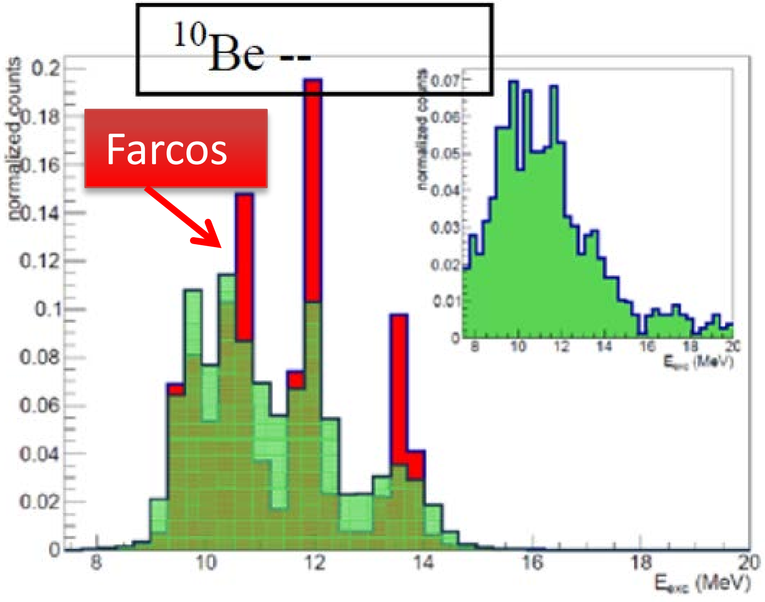


exp CLIR-II: CHIMERA + FARCOS prototype

Analysis in progress …

The CLIR-II experiment (clustering phenomena in exotic nuclei)

MonteCarlo simulations for the $^{10}Be^*$ decay (α+^6He channel)



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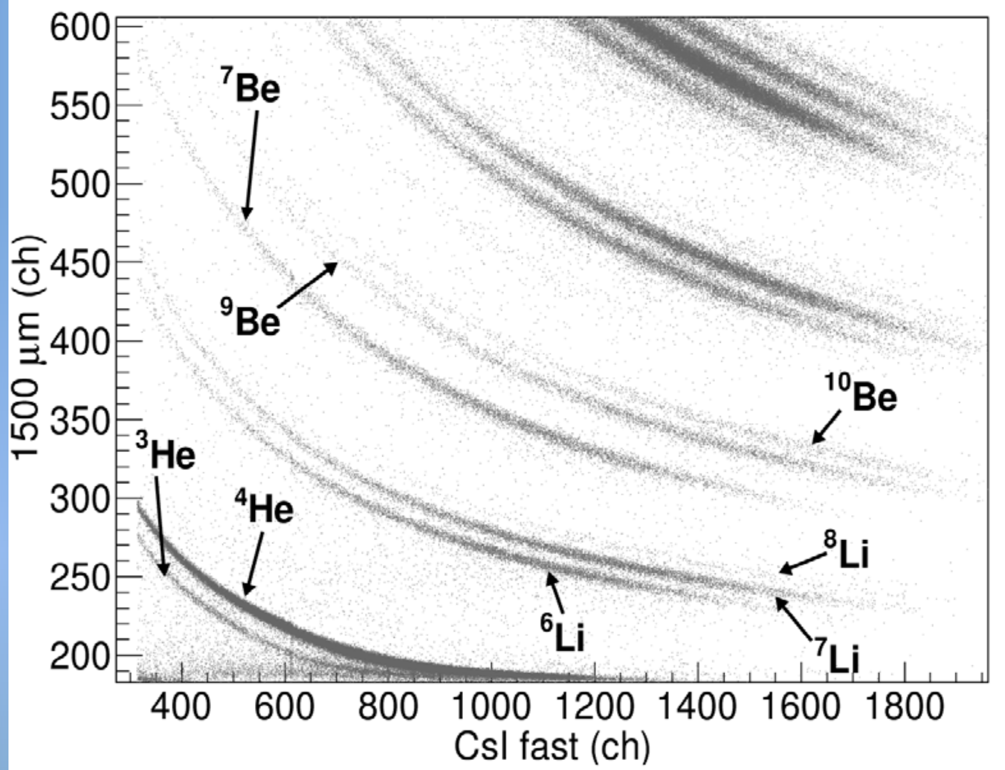
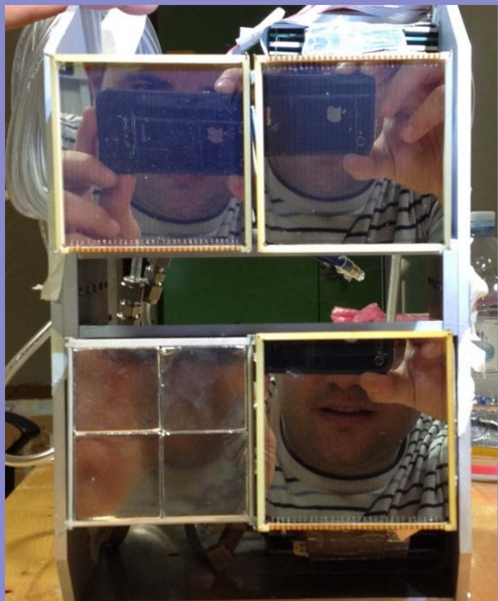
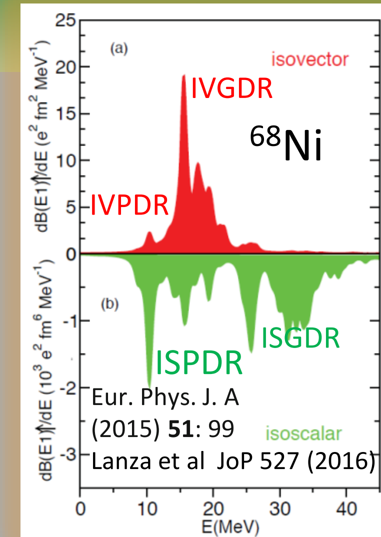


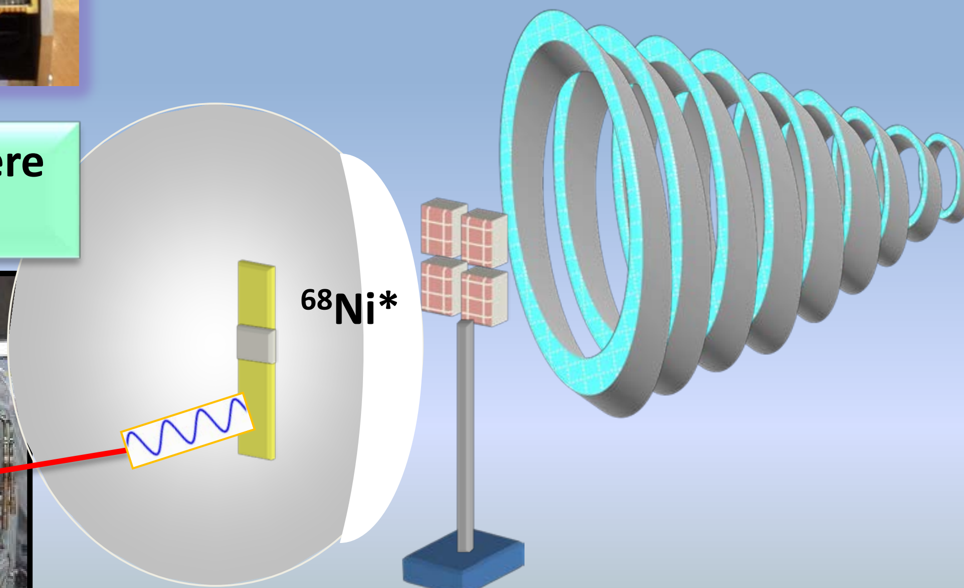
FRIBS beam + Chimera&Farcos in Pygmy experiment



Search of the isoscalar excitation of the PYGMY resonance in **^{68}Ni** using the LNS FRIB facility from a 40 A.MeV ^{70}Zn primary beam



The CsI(Tl) in the Sphere provide γ detection



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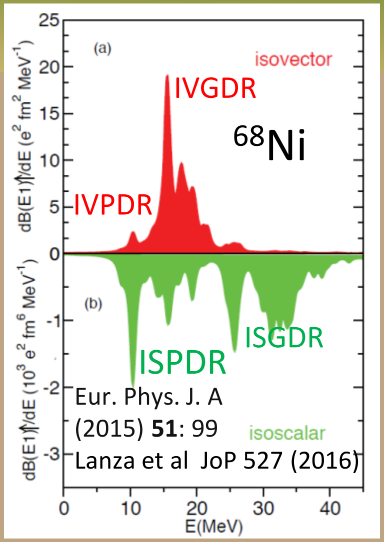
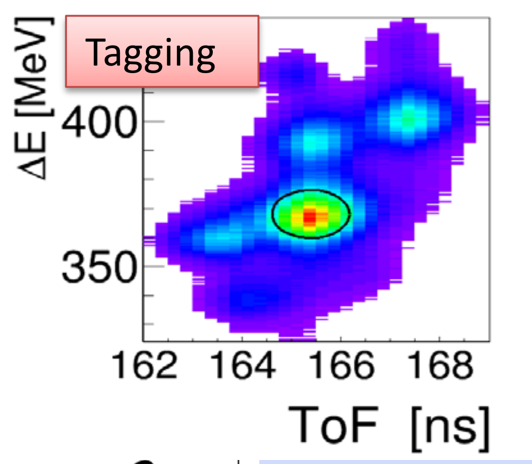
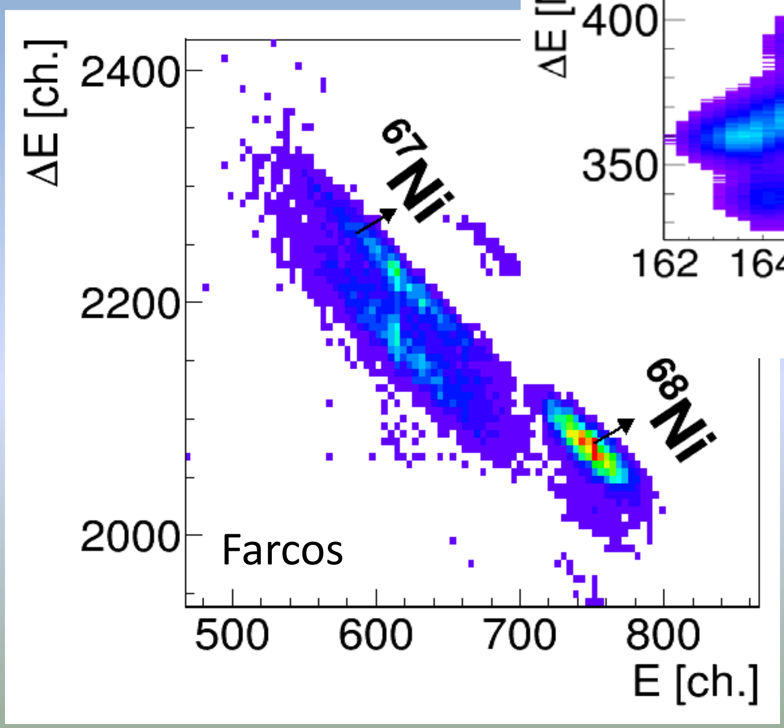


^{68}Ni + ^{12}C reactions mostly produce:

- quasi-elastic reactions → ^{68}Ni
- Emission of neutrons → ^{66,67}Ni

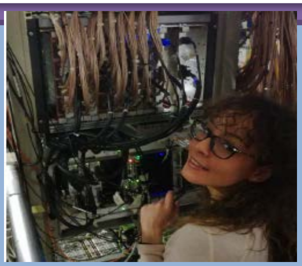




The CsI(Tl) in the Sphere provide γ detection

The Pygmy experiment

See N. Martorana poster



First measurement of the isoscalar excitation above the neutron emission threshold of the Pygmy Dipole Resonance in ^{68}Ni

N.S. Martorana[a,b,*], G. Cardella[c], E.G. Lanza[c], L. Acosta[d,c], M.V. Andrés[e], L. Auditore[f,c], F. Catara[c], E. De Filippo[c], S. De Luca[f,c], D. Dell' Aquila[g], B. Gnoffo[b,c], G. Lanzalone[h,a], I. Lombardo[c], C. Maiolino[c], S. Norella[f,c], A. Pagano[c], E.V. Pagano[a], M. Papa[c], S. Pirrone[c], G. Politi[b,c], L. Quattrocchi[c], F. Rizzo[a,b], P. Russotto[a], D. Santonocito[c], A. Trifirò[f,c], M. Trimarchi[f,c], M. Vigilante[g], A. Vitturi[i]

[a]*INFN-LNS, Catania, Italy*
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[c]*INFN-Sezione di Catania, Catania, Italy*
[d]*Instituto de Fisica, Universidad Nacional Autonoma de Mexico, Mexico City, Mexico*
[e]*Departamento de FAMN, Universidad de Sevilla, Sevilla, Spain*
[f]*Dipartimento MIFT, Messina, Italy*
[g]*INFN-Sezione di Napoli and Dipartimento di Fisica, Università di Napoli Federico II, Napoli, Italy*
[h]*Facoltà di Ingegneria e Architettura, Università Kore, Enna, Italy*
[i]*Dipartimento di Fisica e Astronomia, Università G. Galilei and INFN-Sezione di Padova, Padova, Italy*

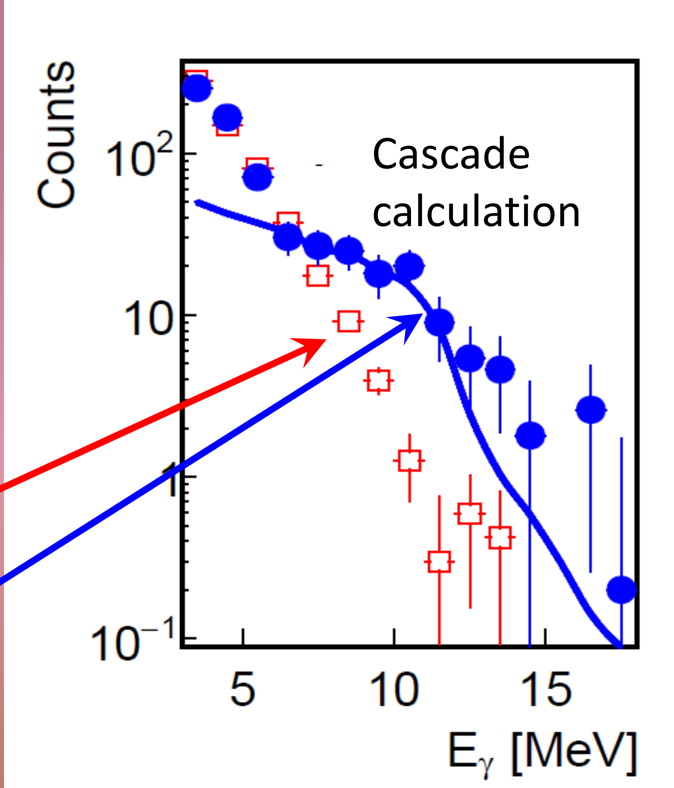
Abstract

The excitation of the Pygmy Dipole Resonance (PDR) in the ^{68}Ni nucleus, above the neutron emission threshold, via an isoscalar probe has been observed for the first time. The excitation has been produced in reactions where a ^{68}Ni beam, obtained by the fragmentation of a ^{70}Zn primary beam at INFN-LNS, impinged on a ^{12}C target. The γ-ray decay was detected using the CsI(Tl) detectors of the CHIMERA multidetector sphere. The ^{68}Ni isotope as well as other heavy ion fragments were detected using the FARCOS array. The population of the PDR was evidenced by comparing the detected γ-ray energy spectra with statistical code calculations. The isotopic resolution of the detection system allows also to directly compare neutron decay channels with the ^{68}Ni channel, better evidencing the PDR decay response function. This comparison allows also the extraction of the PDR cross section and the relative γ-ray angular distribution. The measured γ-ray angular distribution confirms the E1 character of the transition. The γ decay cross section for the excitation of the PDR was measured to be 0.32 mb with a 18 % of statistical error.

Phys. Lett. B (2018) :
doi.org/10.1016/j.physletb.2018.05.019

Evidences of the PDR:

- γ-rays energy spectrum in coincidence with ^{66,67}Ni channels
- γ-rays energy spectrum in coincidence with ^{68}Ni channel



The Pygmy experiment

See N. Martorana poster

First measurement of the isoscalar excitation above the neutron emission threshold of the Pygmy Dipole Resonance in ^{68}Ni

N.S. Martorana[a,b,*], G. Cardella[c], E.G. Lanza[c], L. Acosta[d,c], M.V. Andrés[e], L. Auditore[f,c], F. Catara[c], E. De Filippo[c], S. De Luca[f,c], D. Dell' Aquila[g], B. Gnoffo[b,c], G. Lanzalone[h,a], I. Lombardo[c], C. Maiolino[c], S. Norella[f,c], A. Pagano[c], E.V. Pagano[a], M. Papa[c], S. Pirrone[c], G. Politi[b,c], L. Quattrocchi[c], F. Rizzo[a,b], P. Russotto[a], D. Santonocito[c], A. Trifirò[f,c], M. Trimarchi[f,c], M. Vigilante[g], A. Vitturi[i]

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Phys. Lett. B (2018) :
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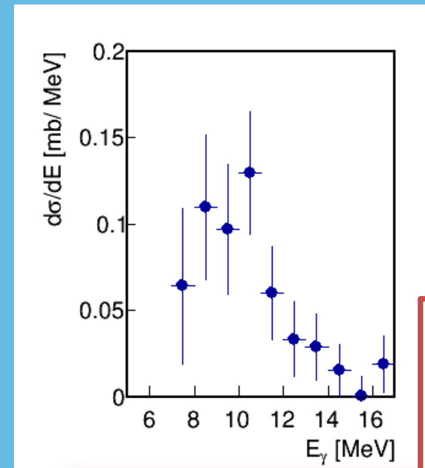
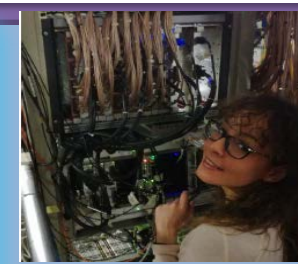
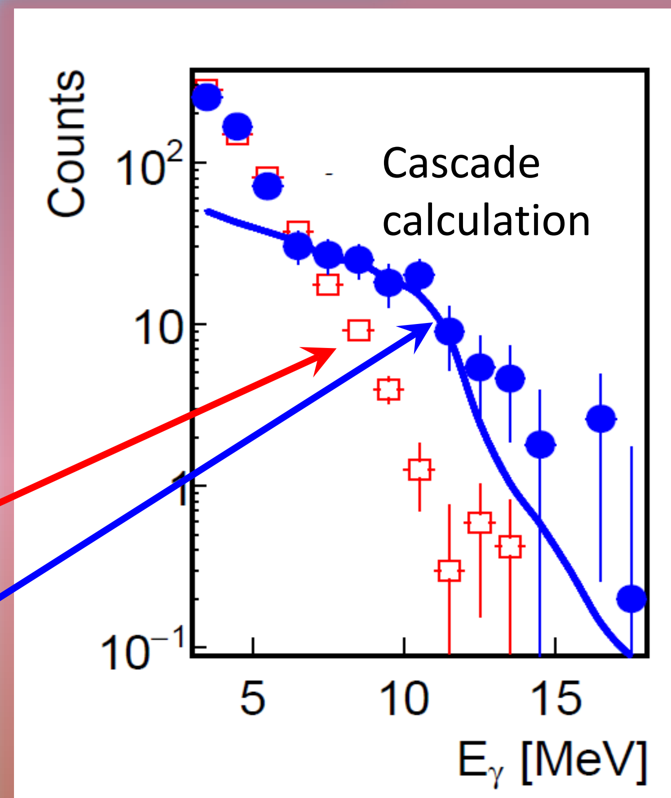




Cross section for the PDR γ-decay, σ_γ = 0.32 mb (±18%)

Evidences of the PDR:

- γ-rays energy spectrum in coincidence with $^{66,67}Ni$ channels
- γ-rays energy spectrum in coincidence with ^{68}Ni channel



Why a new front-end electronic ?

CHIMERA CsI(Tl) front-end (1192 detectors) is now obsolete, in particular the amplifiers and the **VME** QDCs for CsI fast-slow component integration (more than 15 years old technology). The final FARCOS array constituted by 5 modules (20 telescopes, in the final project) needs the readout of about **4k** channels.

Our choice was to develop a first stage front-end circuit for FARCOS (including new ASIC pre-amplifiers) and new dual-gain modules coupled to a compact hardware architecture covering digitalization and signal readout, syncronization and trigger functions . All these last aspects are covered by the GET project.

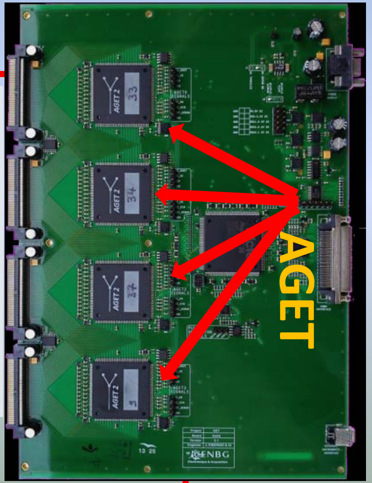
Consequences → digital DAQ for Farcos and CHIMERA (CsI) + Analog DAQ (Silicons)
Upgrade of the CHIMERA front-end for CsI(Tl) (in progress…)

R&D Financed 75% (France)
25% (USA)

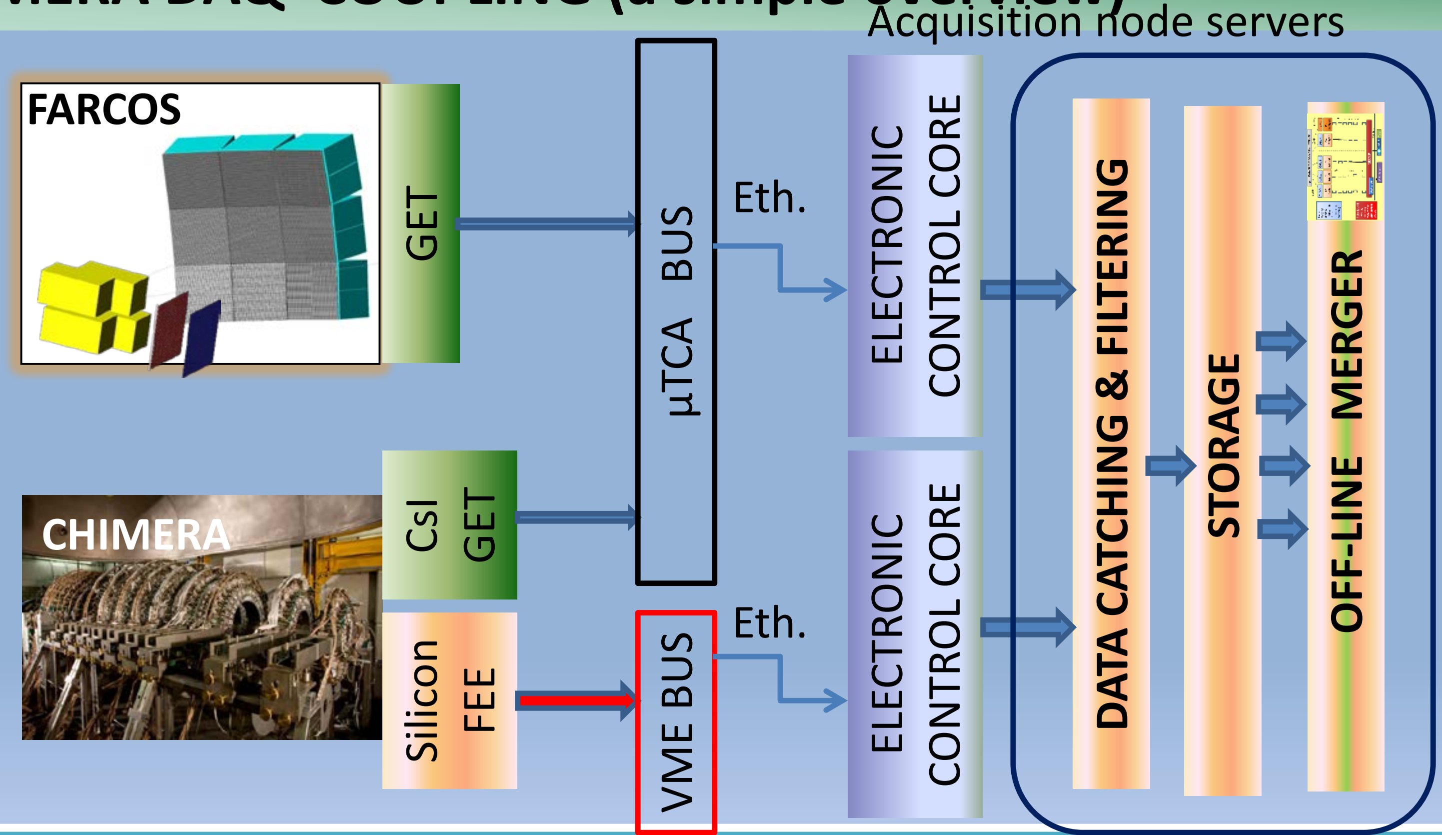
Project supervisor: E. Pollacco

GET Project

256 + (16 FPN)
input channels



GET + CHIMERA DAQ COUPLING (a simple overview)

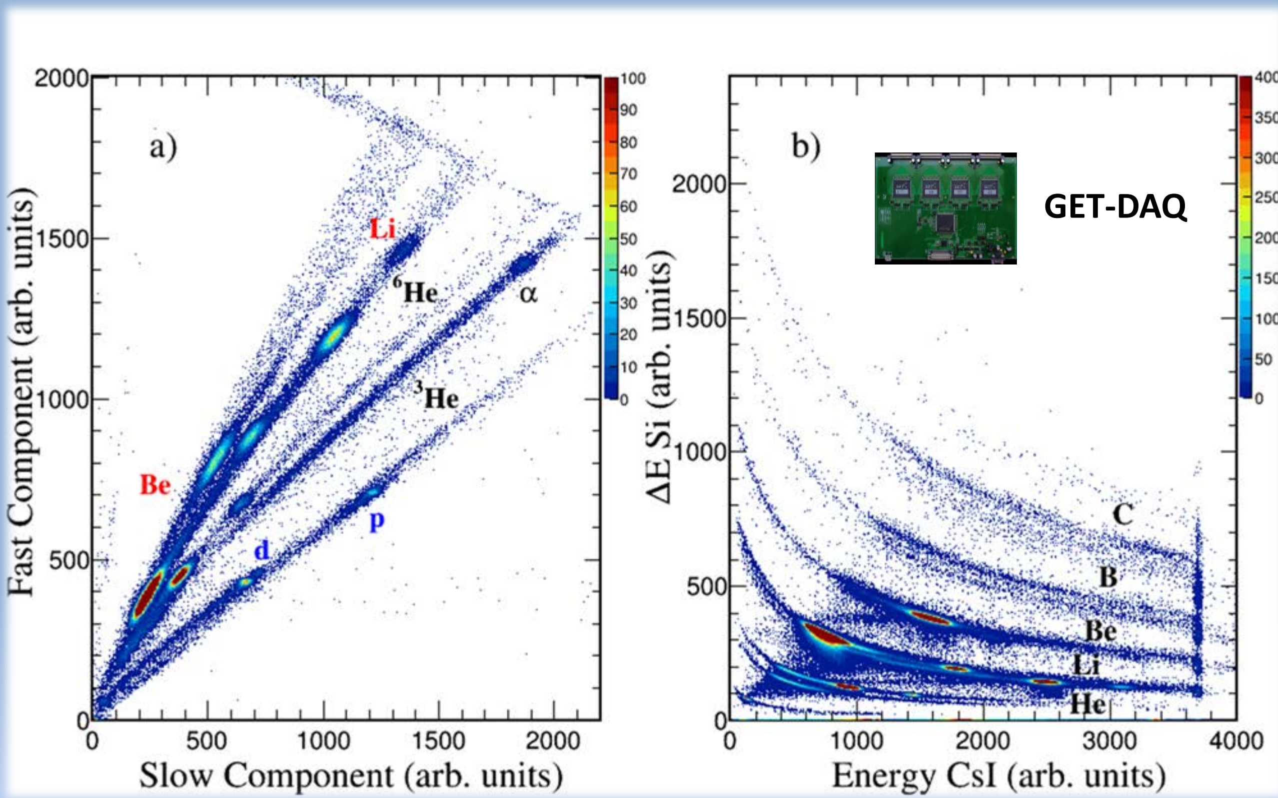


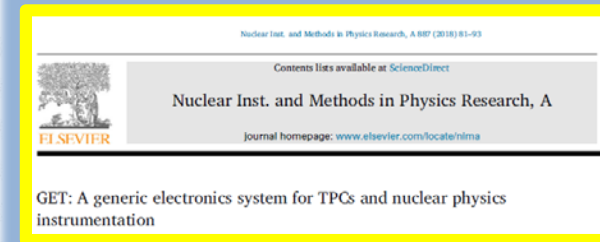
Hybrid DAQ based on «NARVAL» supervisor for both CHIMERA and GET data acquisitions

- Narval developed at IPN-Orsay by X. Grave
- based on the concept of generic Actors
- written in OO language ADA with C++ interface
- Data flow: TCP/IP
- Run Control Core and GUI interface based on Java (GANIL)

VME DAQ, VME-GET Coupling, Data Analysis software for CoBo(s) and VME and general off-line MERGER, Dual Gain Modules developed at INFN Catania

GET tests: fragmentation beams (primary 55 A.MeV ^{18}O) on plastic target




Nuclear Inst. and Methods in Physics Research, A 887 (2018) 81–93

Contents lists available at ScienceDirect

Nuclear Inst. and Methods in Physics Research, A

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

ELSEVIER

GET: A generic electronics system for TPCs and nuclear physics instrumentation

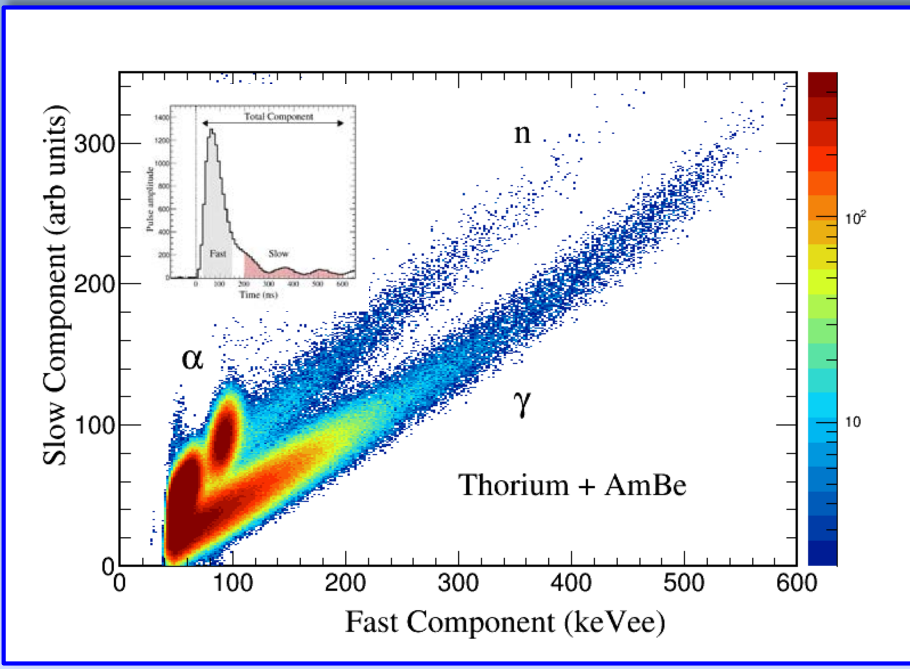
See: E.C. Pollacco et al., NIM A 887, 81-93 (2018)

E.d.F. et al. Journal Of Phys: Conf. Series 104, 012003 (2018)

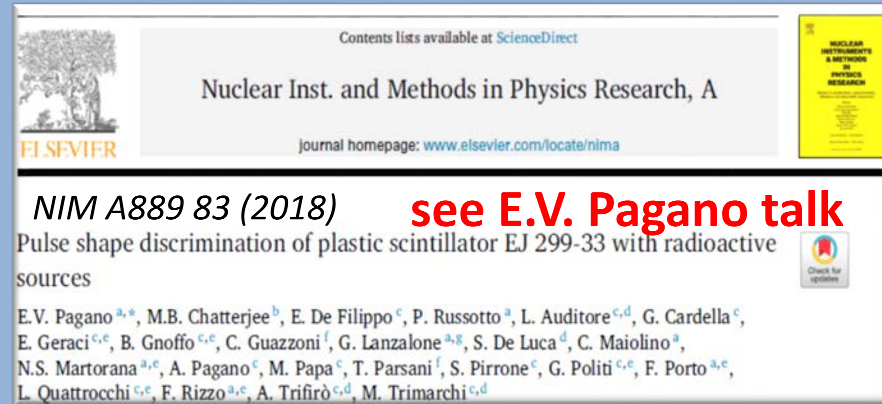
- ❑ Standard CHIMERA preamplifier used in the silicon stage (2 mV/MeV) [Chimera, ring 2E]
- ❑ The signals are digitized at a frequency of 50MHz
- ❑ Both signals Si/CsI are shaped with a 1μs shaping time in the SKF filter stage of AGET chips.
- ❑ Better isotopic resolution obtained with GET respect to analog DAQ.
- ❑ Note the CHIMERA CsI fast component signal saturation → dual gain (DG) module needed (as well for FARCOS silicon strips)

Neutron signals: tests with the EJ299-33 and GET electronics

A 3x3x3 cm **EJ299-33** plastic scintillator was tested with radiactives sources and Tandem beams for its capability to detect neutrons along with light charged particles



Output signal is digitized by GET electronics after and sampled at 100 MS/s after filter shaping . Fast and Slow gates are obtained by software integration of the digital pulse.



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Nuclear Inst. and Methods in Physics Research, A

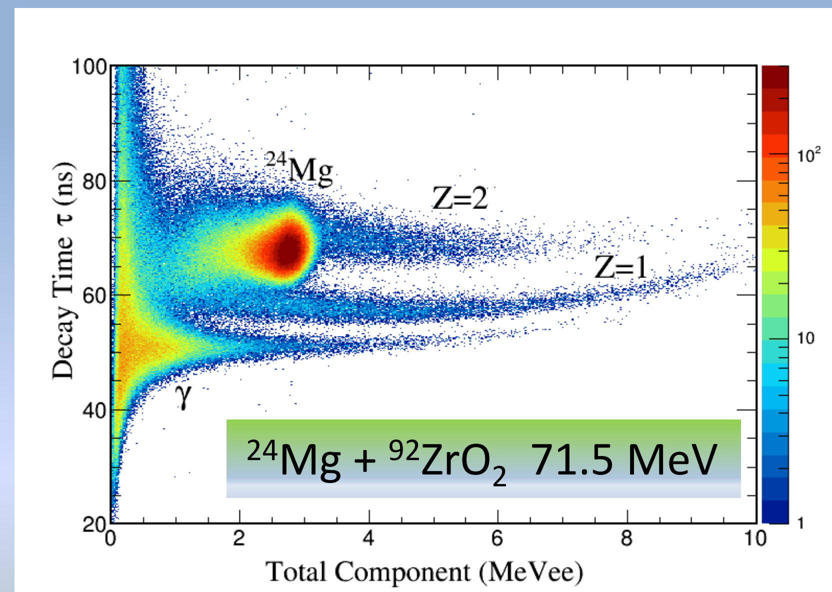
journal homepage: www.elsevier.com/locate/nima

ELSEVIER

NIM A889 83 (2018) **see E.V. Pagano talk**

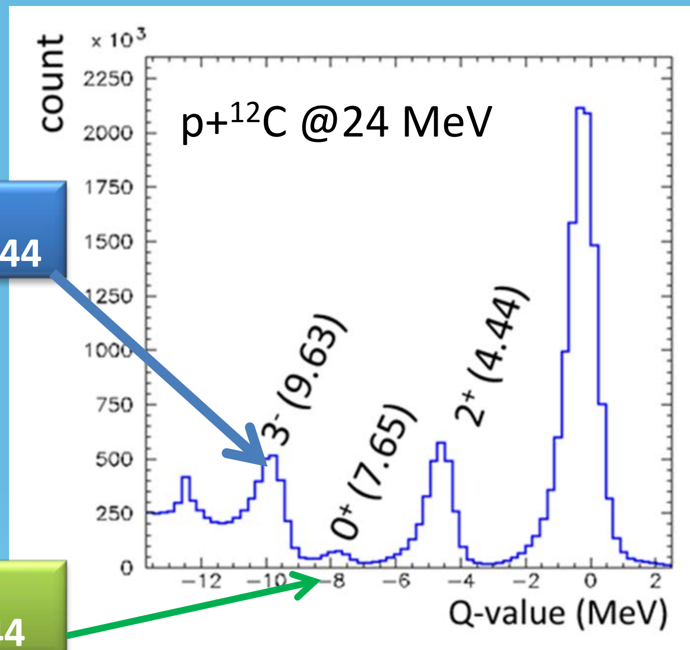
Pulse shape discrimination of plastic scintillator EJ 299-33 with radioactive sources

E.V. Pagano[a,*], M.B. Chatterjee[b], E. De Filippo[c], P. Russotto[a], L. Auditore[c,d], G. Cardella[c], E. Geraci[c,e], B. Gnoffo[c,e], C. Guazzoni[f], G. Lanzalone[a,g], S. De Luca[d], C. Maiolino[a], N.S. Martorana[a,e], A. Pagano[c], M. Papa[c], T. Parsani[f], S. Pirrone[c], G. Politi[c,e], F. Porto[a,e], L. Quattrocchi[c,e], F. Rizzo[a,e], A. Trifirò[c,d], M. Trimarchi[c,d]



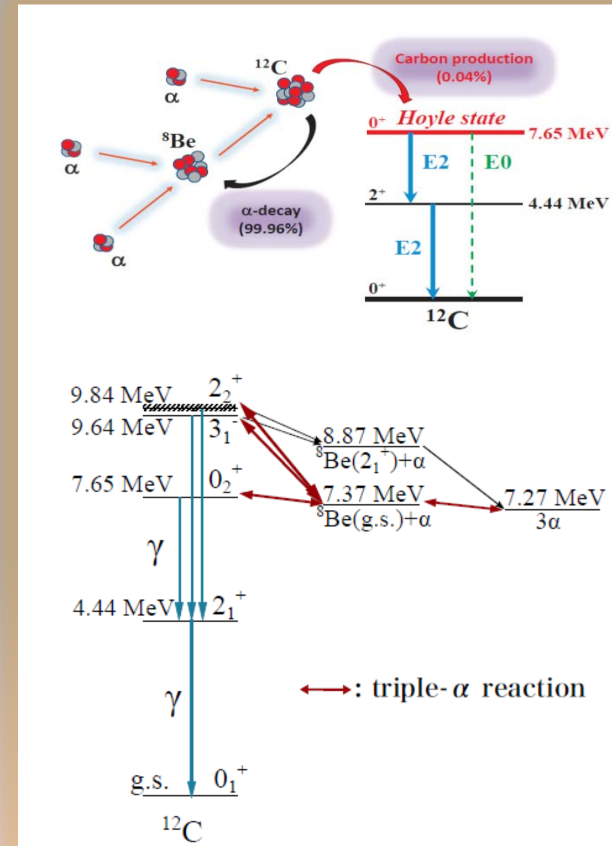
Decay time of the digitized signals as a function of the total component, ***accepted in NIM A (2018)***

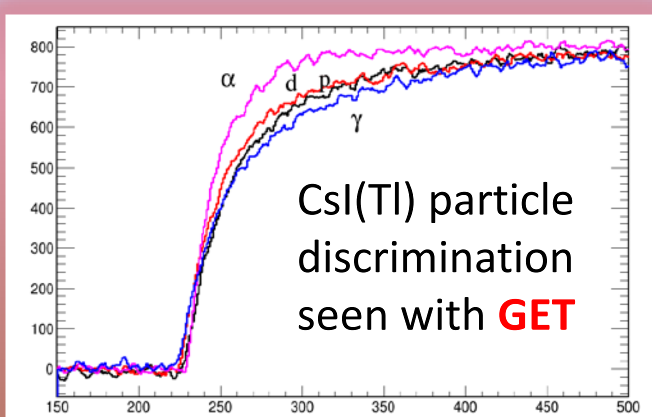
The Hoyle-GAMMA experiment: search of the γ-decay branching ratio of the Hoyle state and first excited 3^- level of ^{12}C by α (60 MeV) + ^{12}C reaction (2017)



$^{12}C + \alpha + \gamma_{5.2} + \gamma_{4.44}$

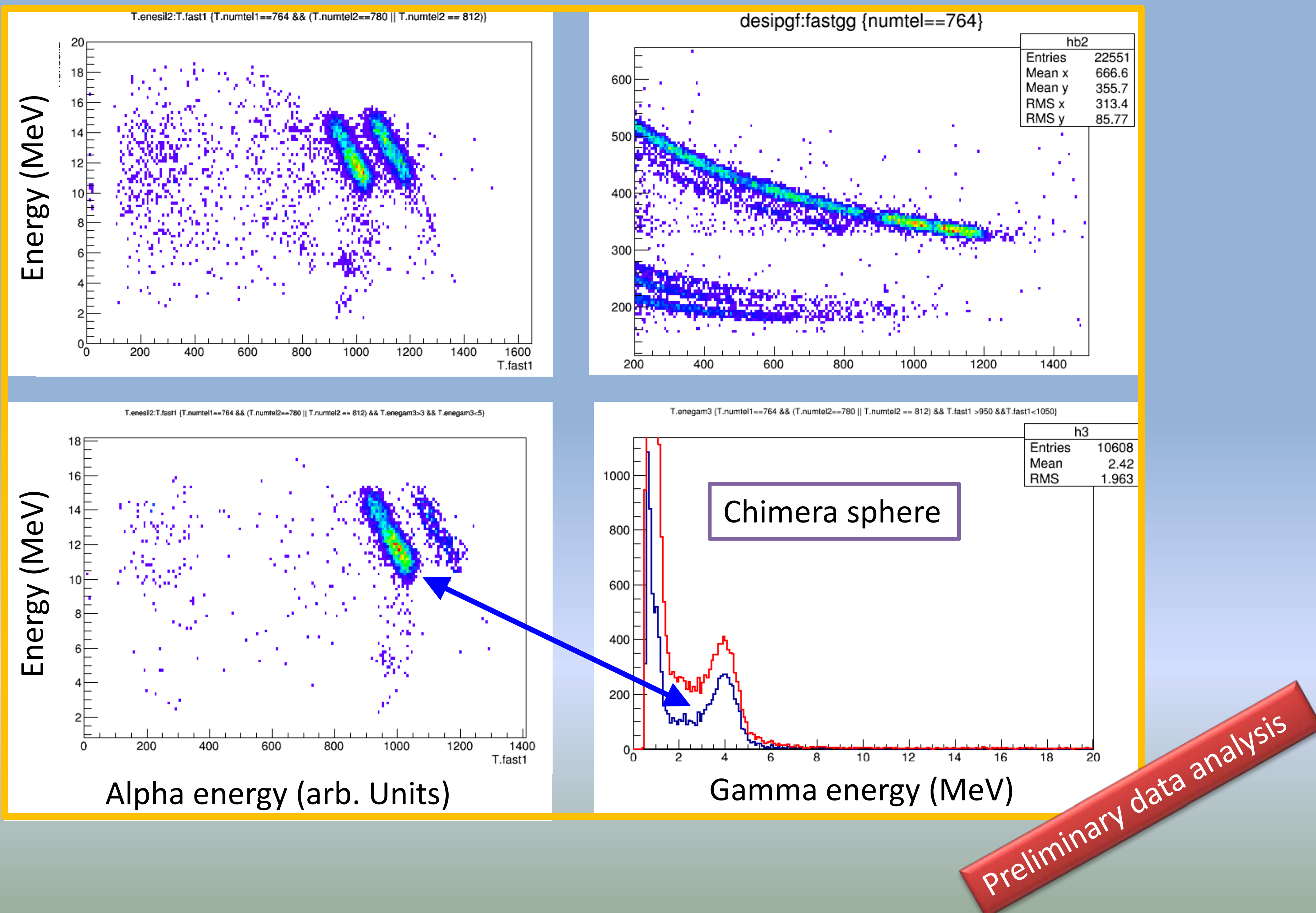
$^{12}C + \alpha + \gamma_{3.21} + \gamma_{4.44}$





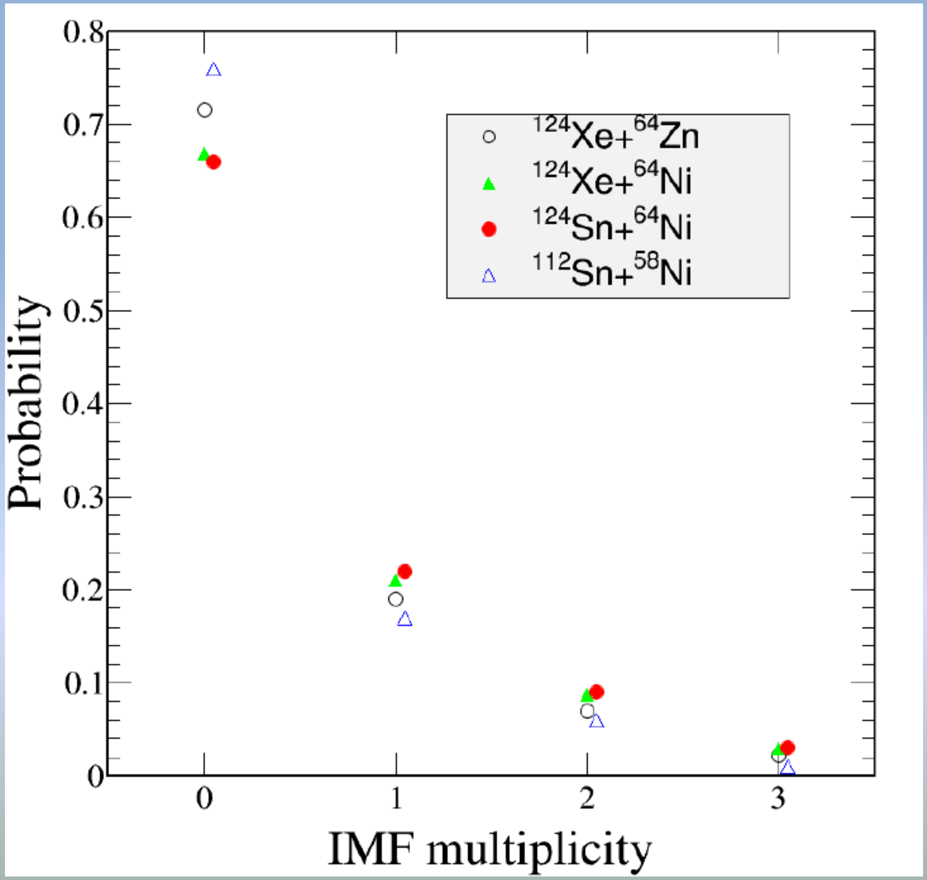
The proposed method: CHIMERA is able to see the 4-fold coincidence (scattered alpha + recoiling carbon + γ-γ coincidence with good efficiency

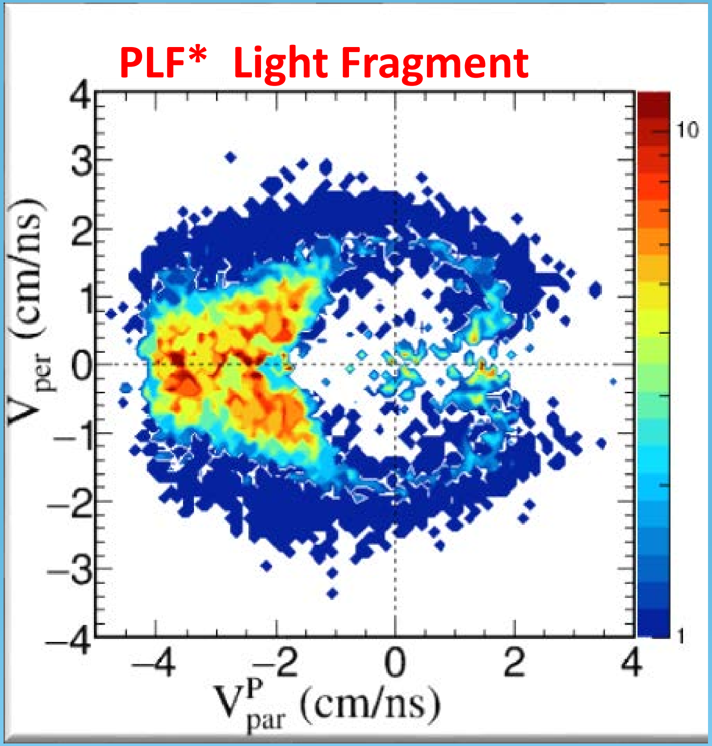
The Hoyle-GAMMA experiment: first results, alpha-Carbon-γ correlations



Isospin influence on dynamical production of IMFs in the InKiIsSy (Inverse Kinematics Isobaric Systems) experiment: ^{124}Xe + ^{64}Zn,^{64}Ni@35 A.MeV

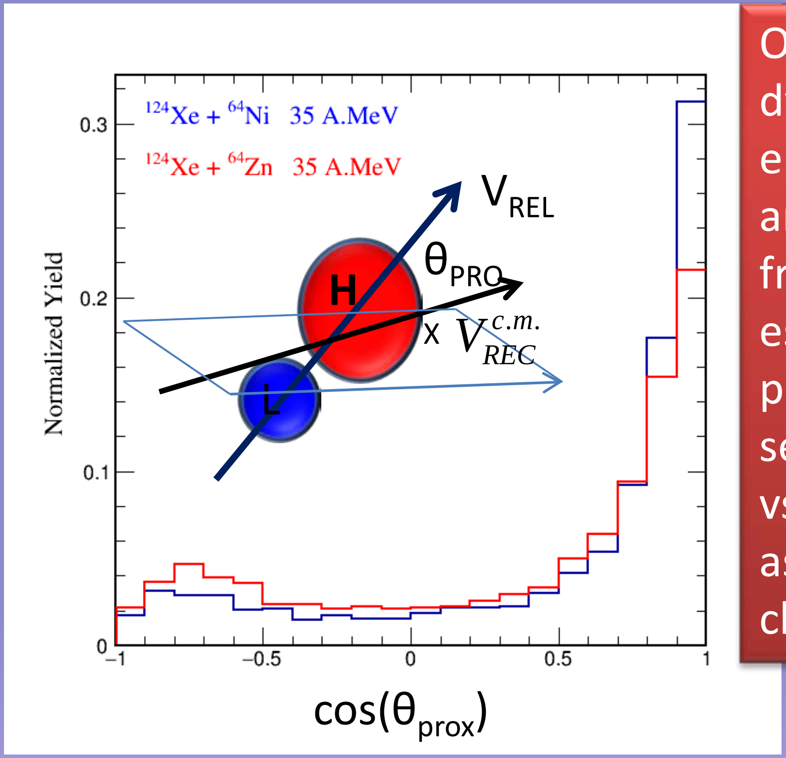
Physical case: competition between dynamical and statistica IMF emission.
Influence of the N/Z ratio of the entrance channel in the dynamical fission of the quasi-projectile





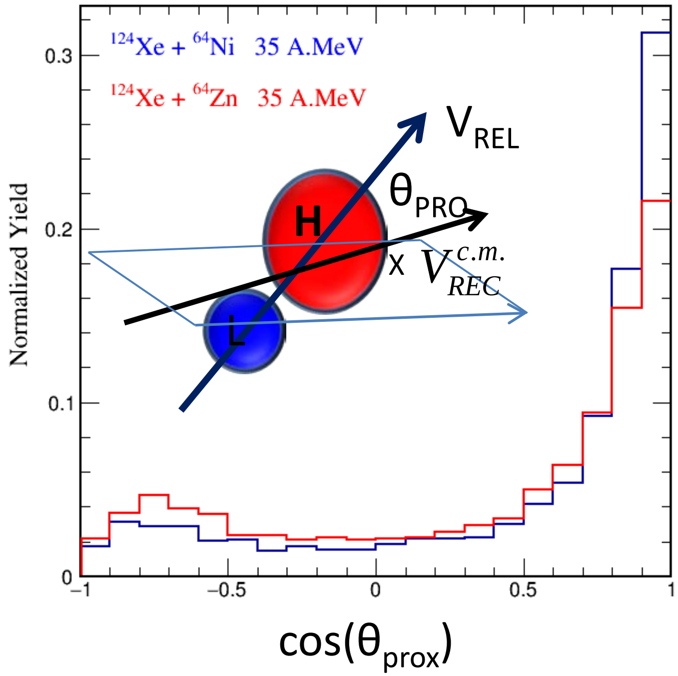
System	N/Z Projectile	N/Z target	N/Z compound
^{124}Sn+^{64}Ni	1.48	1.29	1.41
^{124}Xe+^{64}Ni	1.30	1.29	1.29
^{124}Xe+^{64}Zn	1.30	1.13	1.24
^{112}Sn+^{58}Ni	1.24	1.07	1.18

PLF BREAK-UP ANGULAR DISTRIBUTIONS



Our approach to dynamical IMF emission is to use angular distribution of fragments in order to estimate the probabilities or cross-sections of dynamical vs. statistical emission as a function of IMFs charge

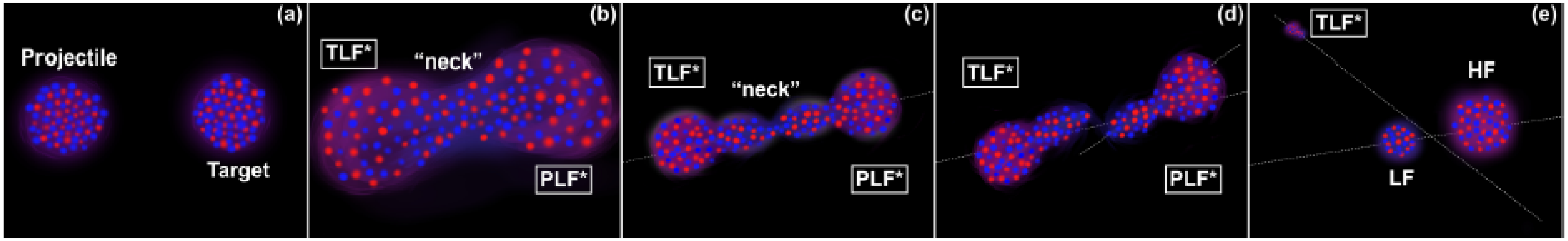
PLF BREAK-UP ANGULAR DISTRIBUTIONS



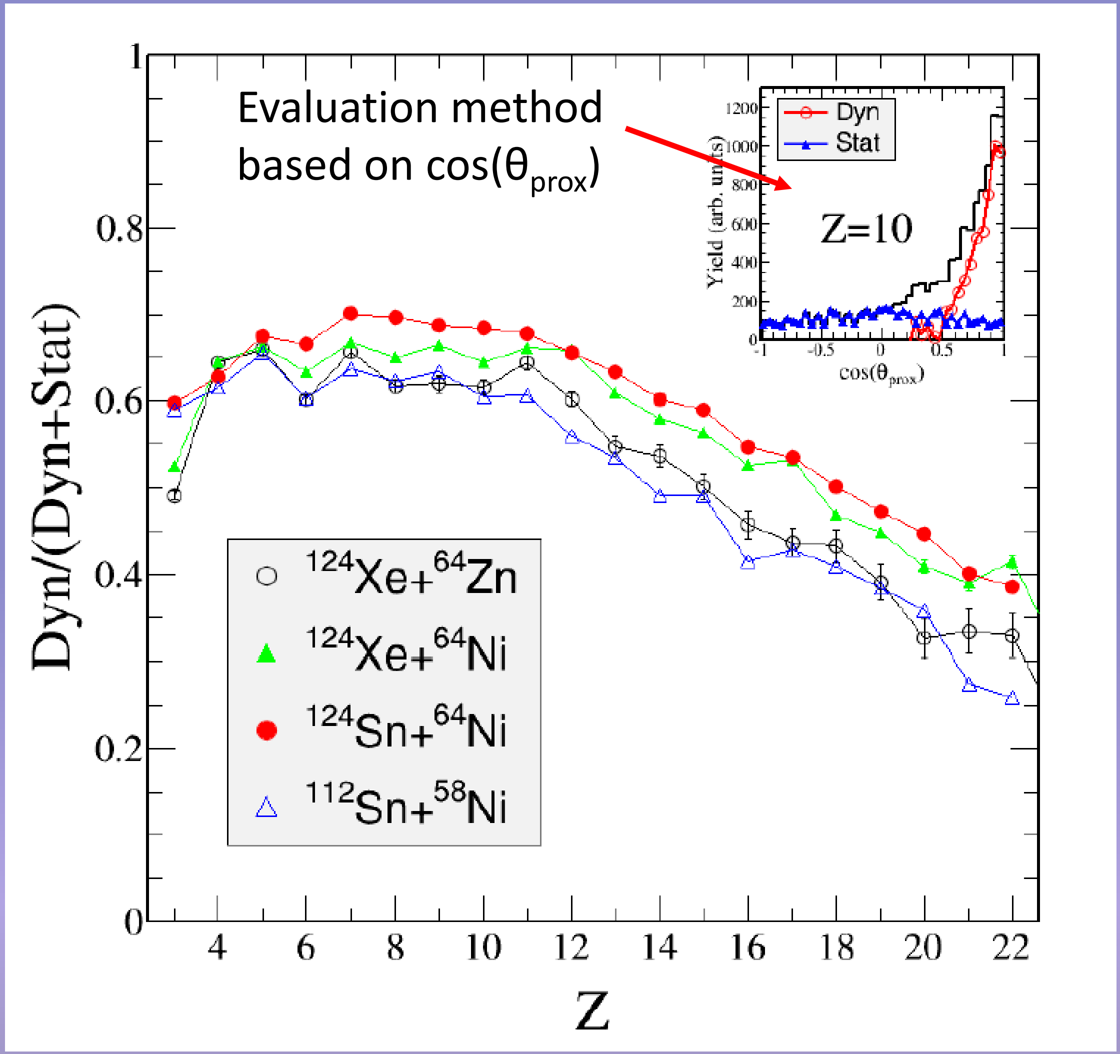
Our approach to dynamical IMF emission is to use angular distribution of fragments in order to estimate the probabilities or cross-sections of dynamical vs. statistical emission as a function of IMFs charge

This is a different and complementary study respect the case where the relation between the N/Z of fragments is observed as a function of the break-up angular distributions, finally related to the time-scale of the process.

A. RODRIGUEZ MANSO *et al.* PHYSICAL REVIEW C **95**, 044604 (2017)

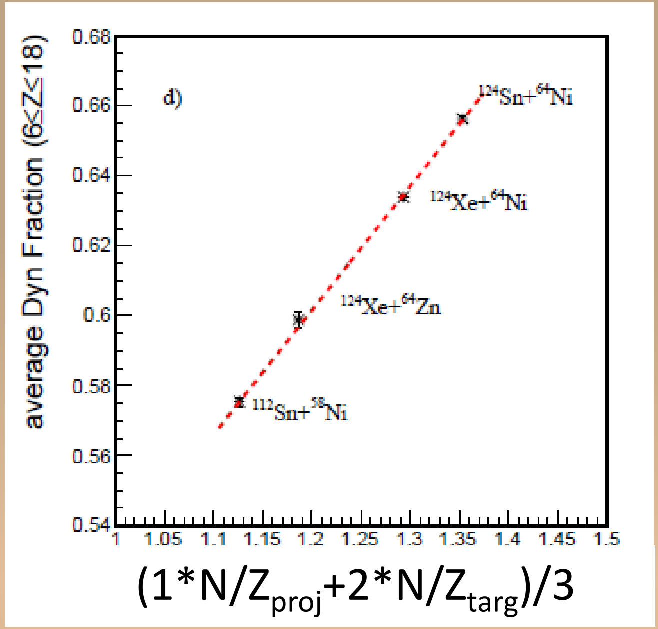


Main experimental Result: dynamical emission is favored by an increase of projectile and target Isospin and is independent by the system size



P. Russotto et al. arXiv:1803.03046v1 (2018)

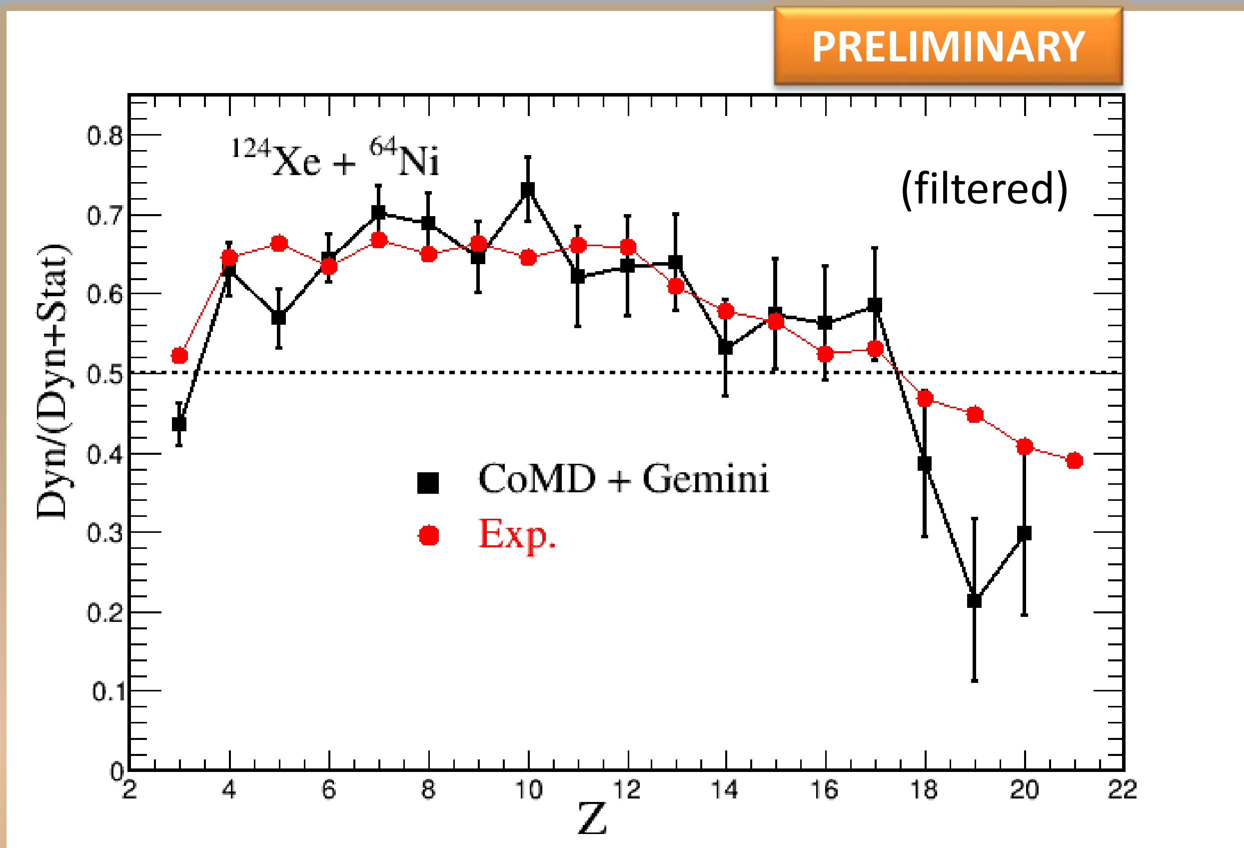
Linear Scaling with a weighted N/Z content of projectile and target



Dynamical emission is mainly ruled by The N/Z content of both projectile and target

Constrained Molecular Dynamics simulation (CoMD-3)

Model → see M. Papa, Phys. Rev. ***C87****, 014001 (2013) and refs therein*

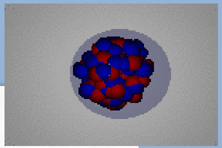


650 fm/c and stiffness parameter on $E_{sym}(\rho)$, γ=1 (stiff). Data analysis as for the experimental data.

(work in progress…)

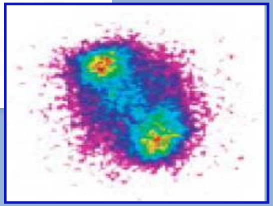
DENSITY AND ISOSPIN DEPENDENCE OF EOS: ASYEOS and ASYEOS-II

see for example: Neutron skins and Neutron Stars in the «**Multimessengers**» era: Fattoiev et al., Phys. Rev. Lett. **120**, 172702 (2018)



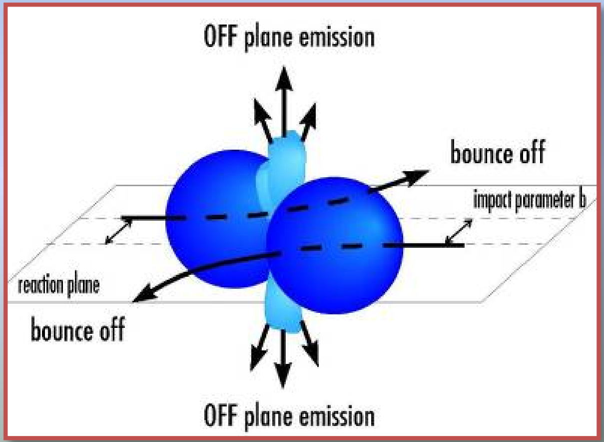
Sources:

finite nuclei	$\rho/\rho_0 \le 1$
heavy − ions	$\rho/\rho_0 \le 3$
neutron stars	$\rho/\rho_0 \le 10$



see: J. Lukasik talk on Thursday

ASYEOS METHOD USED: COLLECTIVE ELLIPTIC FLOW



$$\frac{dN}{d(\phi-\phi_R)}(y,p_t)=\frac{N_0}{2\pi}\left(1+2\sum_{n\ge 1} v_n \cos n(\phi-\phi_R)\right)$$

Transverse flow

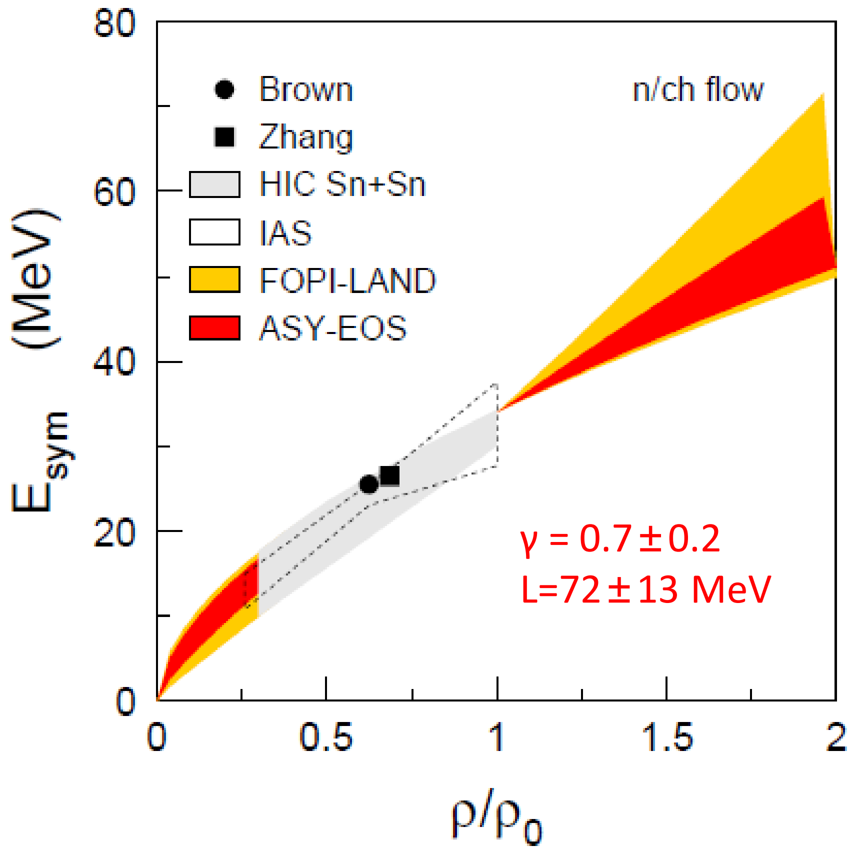
$$V_1(y,p_t)=\left\langle \frac{p_x}{p_t} \right\rangle$$

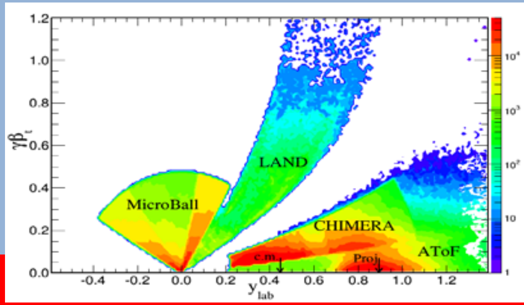
Elliptic flow

$$V_2(y,p_t)=\left\langle \frac{p_x^2-p_y^2}{p_t^2} \right\rangle$$

Elliptic flow: competition between in plane ($V_2>0$) and out-of-plane ejection ($V_2<0$)

FLOW ratios of neutrons/Charged particles in comparison with UrQMD predictions



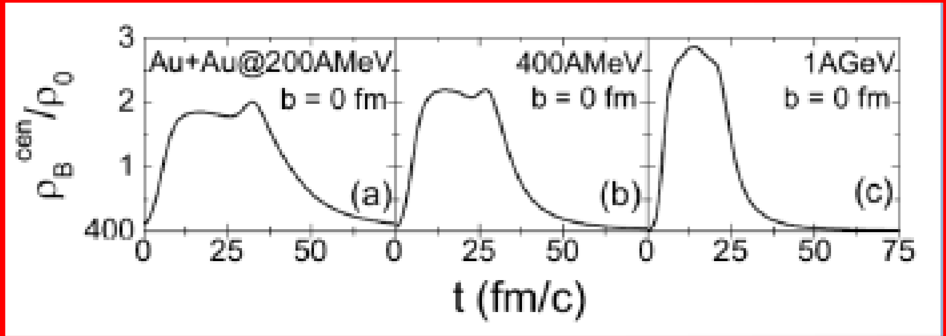


ASYEOS data,
P. Russotto et al., Phys. Rev. C94, 034608 (2016)

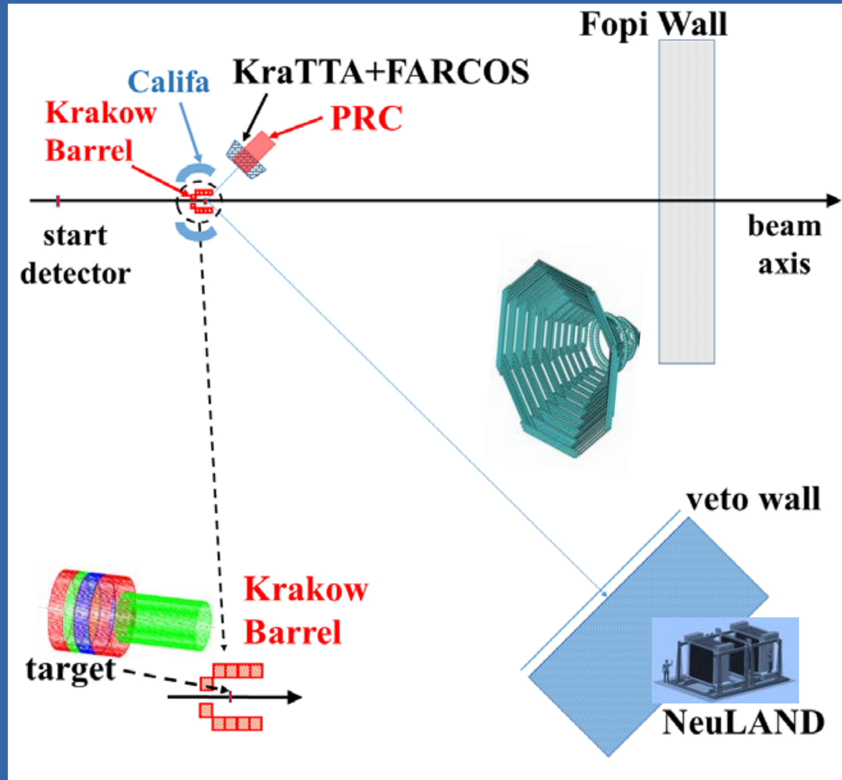
HIC: (mainly Sn+Sn . . .)
M.B. Tsang et al., PRC 86, 015803 (2012)
Neutron skin thickness, binding energies,….: *B.A. Brown, PRL 111, 232502 (2013); Zhang and Chen, Phys. Lett. B 726 (2013).*
FOPI DATA : P.Russotto et al., Phys. Lett. B 697 (2011) : **$\gamma = 0.9 \pm 0.4$; L=83±26**
ASYEOS DATA
$\gamma = 0.72 \pm 0.19$; L=72±13

ASYEOS-II@GSI : towards higher incident energies and higher explored densities

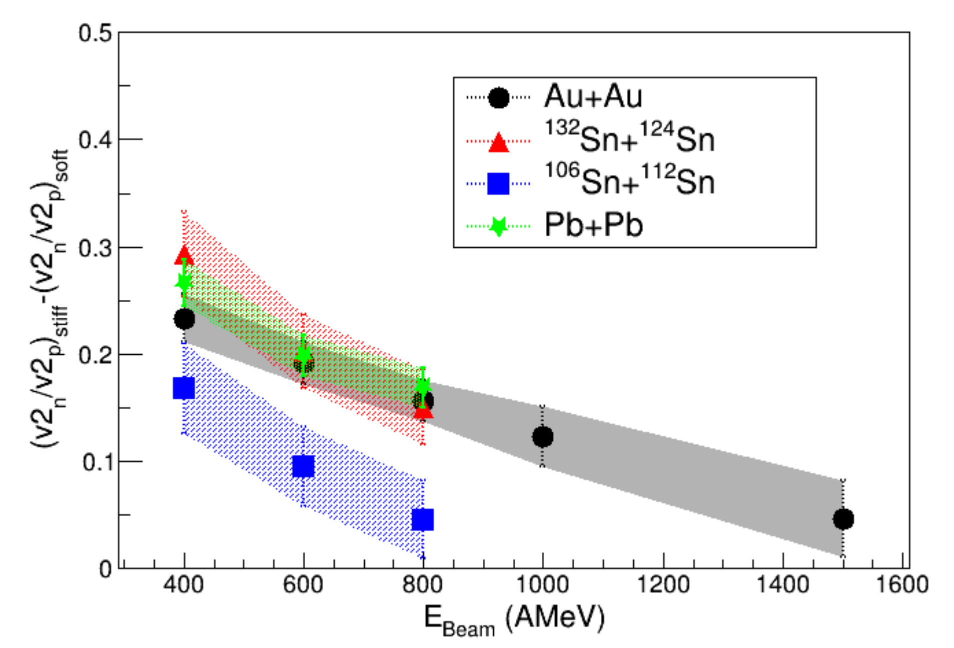
J. Xu et al. PRC 87, 067601 (2013)



Constrain the symmetry term of EOS: New data occur at suprasaturation densities



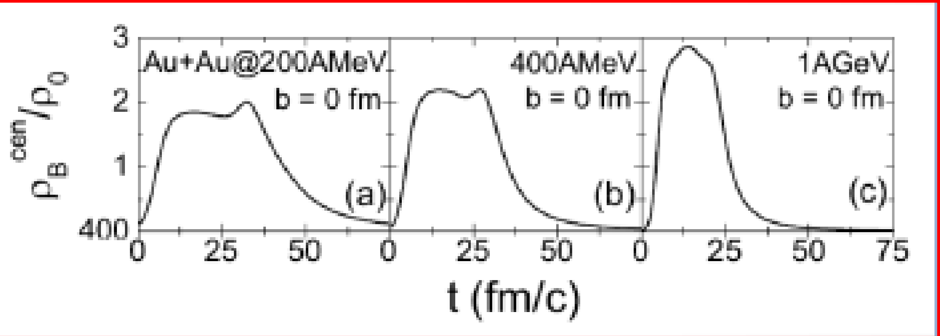
New possible setup: G-PAC LoI S464



UrQMD predictions (AsyEos meeting, LNS 2017)

ASYEOS-II@GSI : towards higher incident energies and higher explored densities

J. Xu et al. PRC 87, 067601 (2013)



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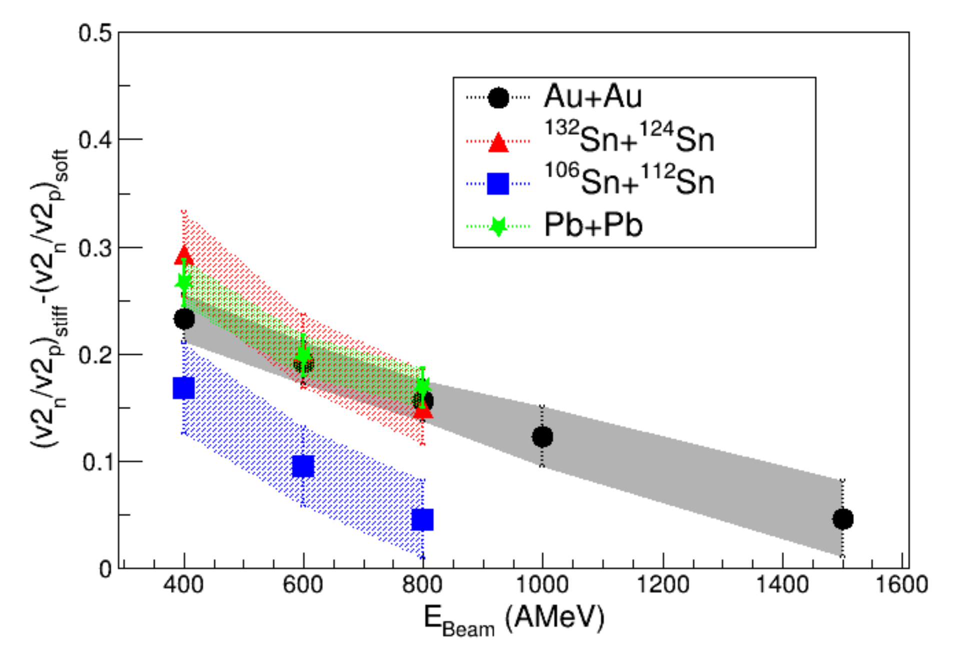
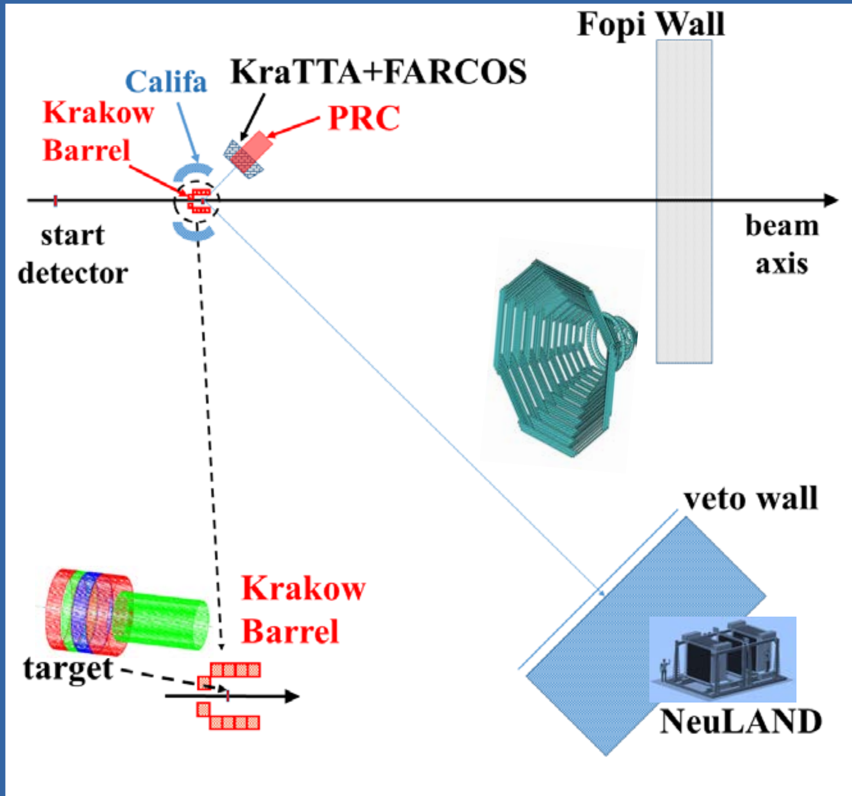




New possible setup: G-PAC LoI S464

UrQMD predictions (AsyEos meeting, LNS 2017)

Krakow Barrel (rings of scintillating fibers): hit distributions at backward angles for triggering, reaction plane and centrality determination

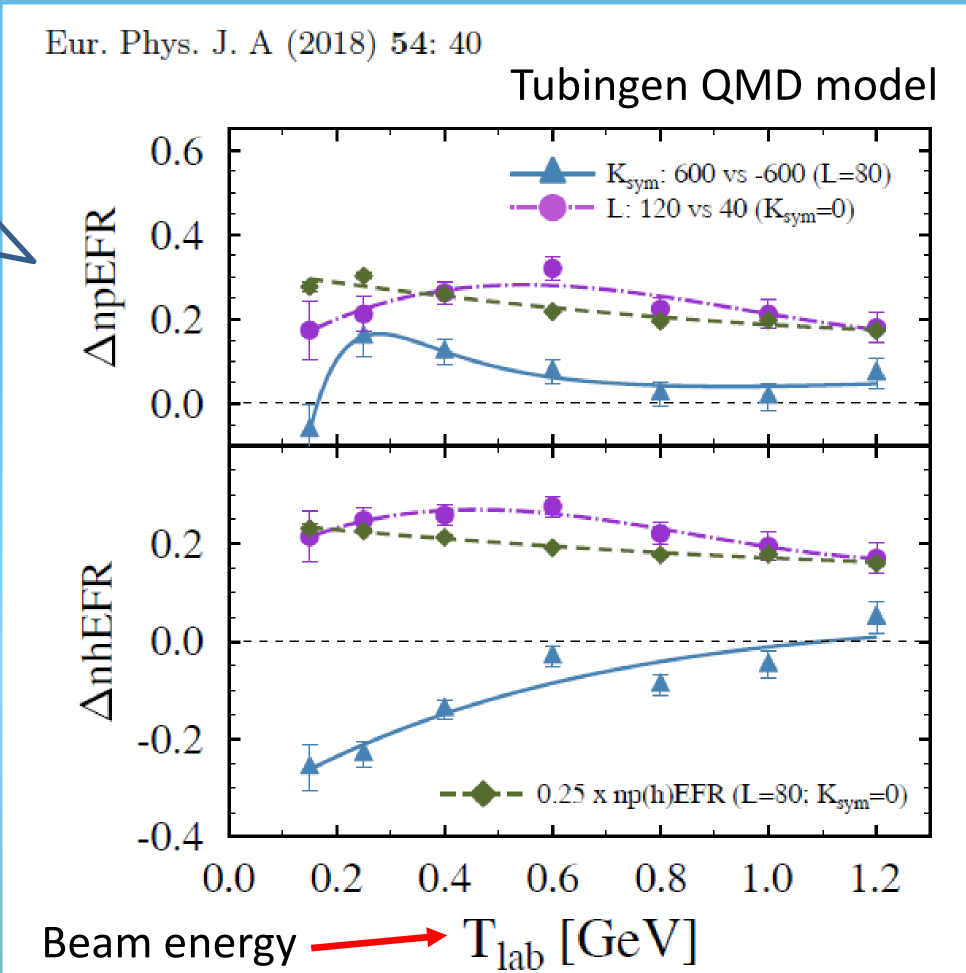
ASYEOS-II@GSI : new perspectives ?

$$S(\rho) = S_0 + \frac{L}{3}\left(\frac{\rho-\rho_0}{\rho_0}\right) + \frac{K_{sym}}{18}\left(\frac{\rho-\rho_0}{\rho_0}\right)^2 + ...$$

A suggestion for the future presented by **M.D. Cozma** at AsyEos 2017 meeting at LNS:

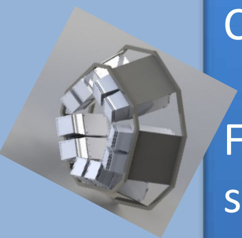
Look simultaneously at slope (L) and curvature (K_{sym}) of the symmetry energy by using the experimental elliptic flow data

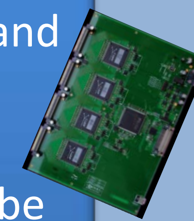
Stiff – Soft neutron-proton EFR sensitivity



Summary

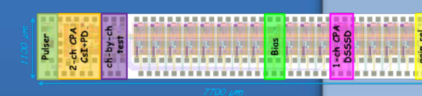
Advances and news in «Chimera» Instrumentation

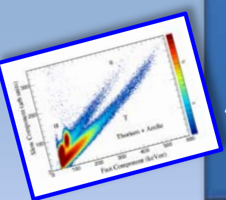




Due to the construction of 20 Farcos telescopes we have adopted a compact electronic front end based on the design of new ASIC preamplifiers for silicon strips and the GET electronics for digitalization and data readout in FARCOS and CHIMERA CsI.

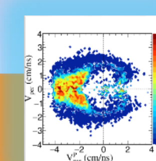
FARCOS, with its high and angular resolution, enhances the physics that can be studied with the CHIMERA array (including two and multi-particles correlations) It can be coupled with other devices in laboratories (LNS, SPES,GANIL,GSI…) following the physics cases

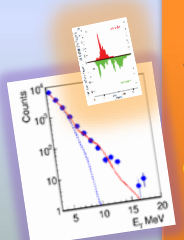




A reserch to develop a multi-detector plastic prototype based on EJ299-33 devoted to neutron detection has been started

Results and news in «Physics»





I have shown a summary of activities performed by CHIMERA collaboration spanning from nuclear dynamics to nuclear structure by using both stable and radiactive beams **to the ASYEOS collaboration plannings for new experiments at GSI related to the symmetry energy parametrization at high density.**

The project of LNS Cyclotron upgrade and new Fragment Separator «FraISe» match perfectly with our planning and perspectives for the next future

Collaboration for Farcos project and Chimera upgrade

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