Fazia Status

- Experiments
- Scientific Output
- Detectors and Electronics
- Scientific programs
- Funding
- International links and collaborations

Fazia Status

- Experiments of the FAZIA-INDRA phase

E789 58,64Ni+58,64Ni 32,52MeV/u
E818 58Ni,36Ar+58Ni 74MeV/u
84Kr+124Sn 68MeV/u (meant to INDRA performance study)
calibration runs O+Au two energies

PAC DeadLine:24102022; meeting dec 2022; if won in 2023

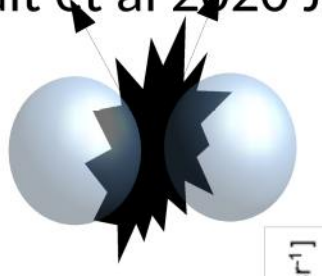
NOTE: from 2024 no cyclotron beam at Ganil

Fazia Status

E818

produzione e **studio di gas di adroni e cluster (h-c) a bassa densita'**

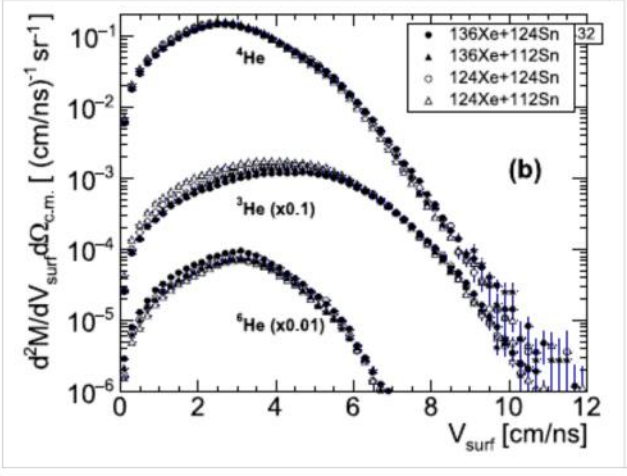
R Bougault et al 2020 J. Phys. G: Nucl. Part. Phys. 47 025103

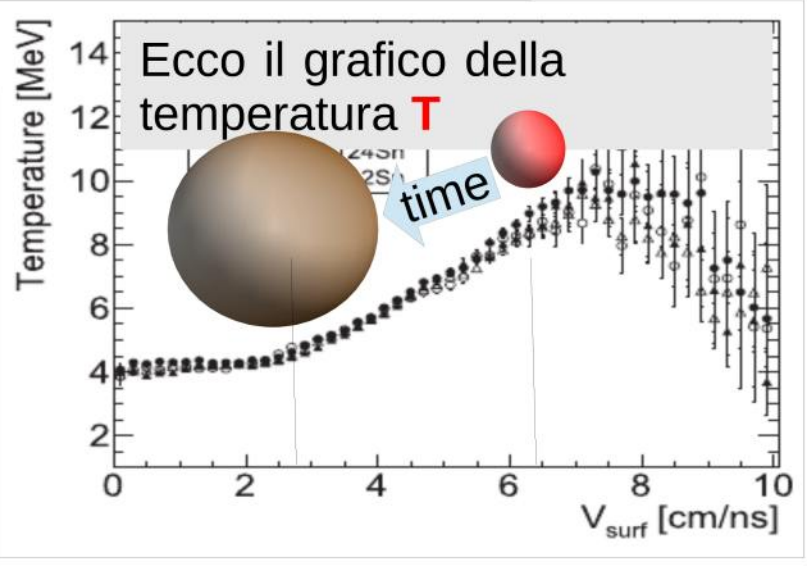


Equilibrium constants of hydrogen and helium isotopes at low nuclear densities

B_{red}=0-0.15

circa 2% reac.Xsection





Perche’ E818?

- Confermare l’analisi e l’approccio proposto da H.Pais cioe’ che esistono modificazioni dell’energia di legame dei cluster in materia diluita. (scaling xs)
- Verificare che xs=0.92 anche per sistemi piu’ leggeri (Indra ha studiato Xe+Sn c.c.)
- Inserire tra i cluster anche quelli maggiori di 6He (INDRA) arrivando possibilmente fino a Carbonio (FAZIA)

Vaporizzazione gia’ studiata da Indra in Ar+Ni a 50-90MeV/u
All’epoca l’analisi era molto meno accurata, si assumeva un volume 3V0 andante senza ulteriore controllo (modelli di multiframmentazione statistica)

PASSATO
-midvelocity
-zona con popolazione di IMF poco variata

E818
-vaporizzazione del QP in centrali
-zona con popolazione di IMF piu’ ampia sistema di adroni e cluster piu’ esteso (fino a Z=10)

Fazia Status

- Experiments of the FAZIA-INDRA: on going calibrations (Alex, Lucia, Caterina, Nicolas, Diego ...)

E818 **FAZIA**
O+Au at 8.7 and 13 MeV/u: E-cal of Si1 (8.7) and Si2(13) done
Cross check on Si1 thickness from PT points
This time: si1E+Si2E vs Cs for better PiD having high energies
CsI PiD fast/slow_vs_slow matrices clicked Ar-Ni,Ni-Ni done; small adjustements needed sometimes to better follow ridges
Si1PSA: ArNi done up to lithium + vetoed regions (few ions are there!)

E818 **INDRA**
CsI PiD f-slow under clicking; pointed out the wave behaviour of ridges in LCP HE-regions; known fact but larger than in the past; unknown origin; impact on physics?
Needed some adjustments to better follow ridges from run batch to batch.

With Remi, organizing a meeting on E818 calib-pid beginning july
To speed up the scientific output

Fazia Status

Scientific Output 1

LNS Legacy

FaziaCOR (a part from PhD theses)

C.Frosin et al internal review, to be submitted PRC (clusterization in light systems)

A.Rebillar et al: 3Alpha channel (12C* studies)

FaziaPRE (a part from PhD theses)

S.Piantelli et al. Final draft ready, internal revisions (BU of hot nuclei after incomplete fusion in Ca+C reactions)

S.Upadhiahia et al. a prossible draft Ca+Al

E789 58,64Ni+58,64Ni 32,52MeV/u:

2 PHD Theses

C.Ciampi et al submitted to PRC 2022 (isospin diffusion via QP and LCP)

Material ready for a 2nd C.Ciampi et al (isospin details in the QP BU channel)

E818 58Ni,36Ar+58Ni 74MeV/u

E818+ 84Kr+124Sn 68MeV/u (meant to INDRA performance study)

E818++ calibration runs O+Au two energies

PAC DeadLine:24102022; meeting dec 2022; if won in 2023

Fazia Status

Scientific Output 2

Conferences 2022, Sent Abstracts

INPC2022 in South Africa

(Caterina Ciampi from INFN/University Florence)
First results from the E789 INDRA/FAZIA experiment in GANIL

EMIS2022 in Korea

Large-acceptance isotope identification array FAZIA: Status and R&D activities for upgrade
(MinJung Kweon for the FAZIA collaboration)

Joint Workshop of the COLL-AGAIN - COPIGAL – POLITA, Orsay

(Alex Rebillar-Soulié, LPC Caen)
The E818 GANIL experiment (INDRA/FAZIA)
(Caterina Ciampi from INFN/University Florence)
First results from the E789 INDRA/FAZIA experiment in GANIL

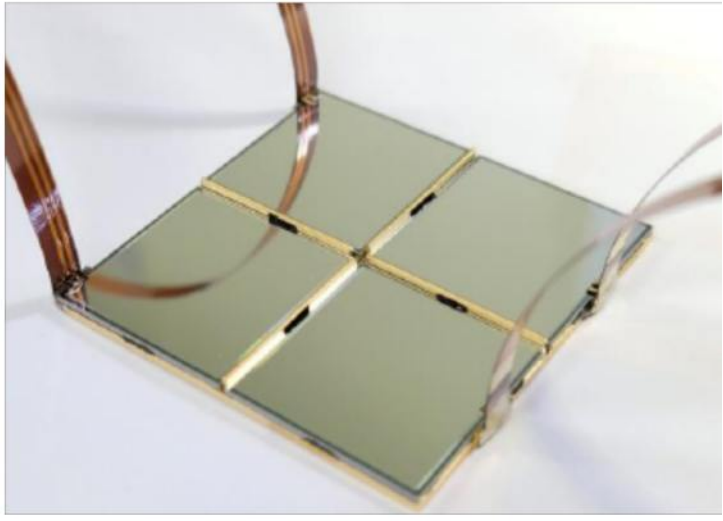
Paper: Nupecc Nuclear physics News

FAZIA and INDRA – performances and first results (GC and Nicolas Le Neindre) a paper requested for 10 sept 2022 in preparation

Fazia Status

- Detectors

Note: HEAD=detector head; BLK=complete block DET+ELEC
HEAD made of 16Si1 (4 quartetti) + 16Si2 (4 quartetti) + 16 CsI



Status: 12 BLOCKS at GANIL mounted + 1 spare HEAD

Si1 300
Florence LAB and Clean Room
6 quartetto Si1 ready
4 quartetto Si1 spare II choice
5 quartetto Si1 to be re-checked
249 new pads (2019 UHPS CIS) available
Achievable total number of quartetto Si1-300 (estimated): 60-65 means >15 DETS

Si2 500
Florence LAB and Clean Room
15 quartetto Si1 ready
1 quartetto Si1 spare II choice
1 quartetto Si1 to be re-checked
30 new pads (2019 UHPS CIS) available
Achievable total number of quartetto Si2-500 (estimated): 23-25 means ≈6 DETS

Fazia Status

Detectors

Note: HEAD=detector head; BLK=complete block DET+ELEC
HEAD made of 16Si1 (4 quartetti) + 16Si2 (4 quartetti) + 16 CsI

Si2 750
Florence LAB and Clean Room
50 new pads (2020 CIS) available
Achievable total number of quartetto Si2-750 (estimated): 12 means ≈3 DETS

CsI
Florence LAB and Clean Room
31 crystals ready
15 crystals to be entirely wrapped
3 crystals front mylar missing
>50 crystals new
70 Hamamatsu 10x10mm2
Achievable total number of CsI (estimated): 100 means >6 DETS

E818 detect. summary report

Si1 18 missing+some strange
Si2 21 or so missing, bad
S1&Si2 8 missing, problems

Conclusion
no problem to prepare 6 new complete DET HEADS (3 with 750micron Si2)

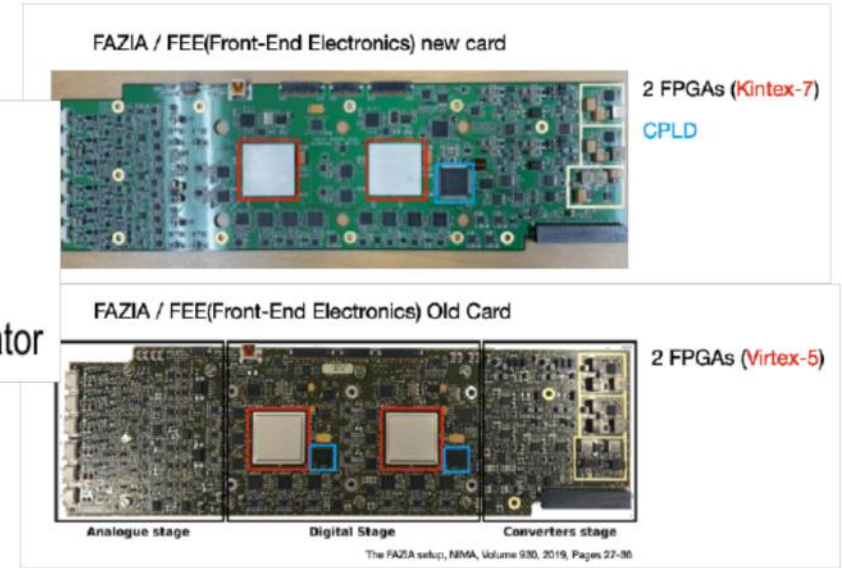
Fazia Status

- Electronics

Successful korean FEE production (2022)

New FEE card was contructed by NOTICE Korea.

- Usage of Kintex-7 for two FPGAs
- Usage of one CPLD
- Absence of 250 MHz clock generator makes us use 500 MHz clock generator



Two boards are in Florence for further tests (Simone)
Validation by mid july?

Big effort to repair many FEE cards (Simone and a bit GC)
AGE company, Viareggio
Many Cards (>21) repaired (mainly preamp issues but not only)
Operation will be completed end june 2022

A break occured perhaps in the Hbridge of BLK6, GANIL: to be repaired

Fazia Status

- Scientific Programs

NOTE: Beam scarcity in our reference labs!

LNS

Fraise upgrading

No cyclotron beams up to

Ciclope dimsantled and experimental site under complete change to host the second RIB channel

GANIL

Last PAC 12/2022 for some ‘small’ UT assignement 2023 (we will try)

From 2024 stop machines, uncertain schedule

RAON

Mid-long term programs must include experiments there

First ISOL beams (also for FAZIA tests) at 18-20MeV/u will be available

in 2024, stable beams probably also mid 2023 (Citation Byungsik, nov2021)

LNL

Less appealing as beam-energy combination (remind: Kr-Sn ISOL beam at E/A<10MeV)

ALPI beams in 2025 or so, even stable?

GSI

Not used with this lab

Interesting E-range but difficult

Lab dynamics and scenarios uncertain (Russian invasion effects)

OTHER CHANCES for selected physics?: Bronowice (p beams), TIFPA, Pavia?, NFS_GANIL ...

Fazia Status

- Scientific Programs

LNSFraise upgrading

From Slides 2022 L.Celona

^{12}C q=4+	60
^{18}O q=6+	20
^{18}O q=6+	29
^{18}O q=6+	45
^{18}O q=6+	60
^{18}O q=7+	70
^{20}Ne q=7+	28
^{20}Ne q=7+	70
^{40}Ar q=14+	60

In the following:
-Al 100 μm homogenous degrader on symmetry plane

-100 μm SiC tagging detector at the exit

Primary currents $O(10^{13})$

^{22}Ne (50 AMeV) @ 2 kW on ^{9}Be target

^{19}Ne	^{20}Ne	^{21}Ne	^{22}Ne	^{23}Ne	^{24}Ne
^{18}F 9.8E7 36	^{19}F	^{20}F 4.2E8 37	^{21}F 1.6E8 42	^{22}F	^{23}F
^{17}O	^{18}O	^{19}O 3.2E7 40	^{20}O 9.2E6 43	^{21}O 8.9E4 40	^{22}O 3.0E2 43
^{16}N	^{17}N	^{18}N 1.5E6 40	^{19}N 3.2E5 43	^{20}N 2.7E3 42	^{21}N

Esempio 1: figli di 22Ne

^{40}Ar^{18+} @ 70 AMeV 2 kW on 500 um ^{9}Be target

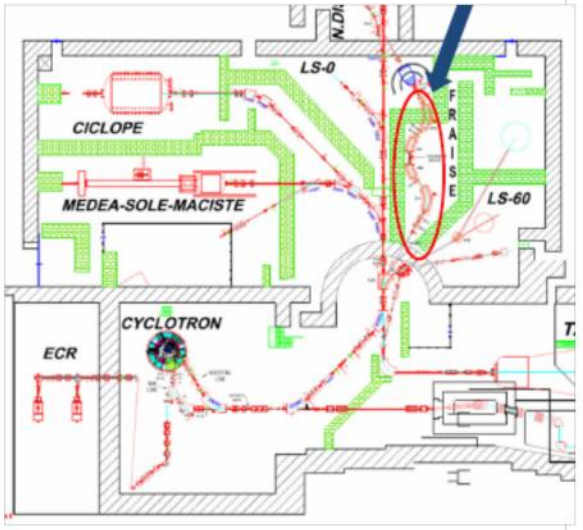
^{35}K	^{36}K 6.6E3 48	^{37}K 8.2E4 48	^{38}K 6.3E5 49	^{39}K	^{40}K	^{41}K	^{42}K 8.2E5 32
^{34}Ar	^{35}Ar 8.9E5 45	^{36}Ar	^{37}Ar 5.2E7 39	^{38}Ar	^{39}Ar 7.0E8 39	^{40}Ar	^{41}Ar 7.9E6 34
^{33}Cl 7.1E5 33	^{34}Cl 8.1E6 34	^{35}Cl	^{36}Cl	^{37}Cl	^{38}Cl 4.5E8 35	^{39}Cl 2.0E8 35	^{40}Cl 3.6E6 30
^{32}S	^{33}S	^{34}S	^{35}S 1.1E8 35	^{36}S	^{37}S 3.9E7 36	^{38}S 1.2E7 40	^{39}S 1.1E5 40
^{31}P	^{32}P 5.2E7 40	^{33}P 6.7E7 48	^{34}P 3.9E7 44	^{35}P 1.5E7 46	^{36}P	^{37}P 8.2E5 50	^{38}P 7.9E3 48
^{30}S	^{31}Si 3.5E7 45	^{32}Si 1.3E7 48	^{33}Si 3.5E6 52	^{34}Si 1.0E6 52	^{35}Si 1.9E5 49	^{36}Si 2.5E4 49	^{37}Si

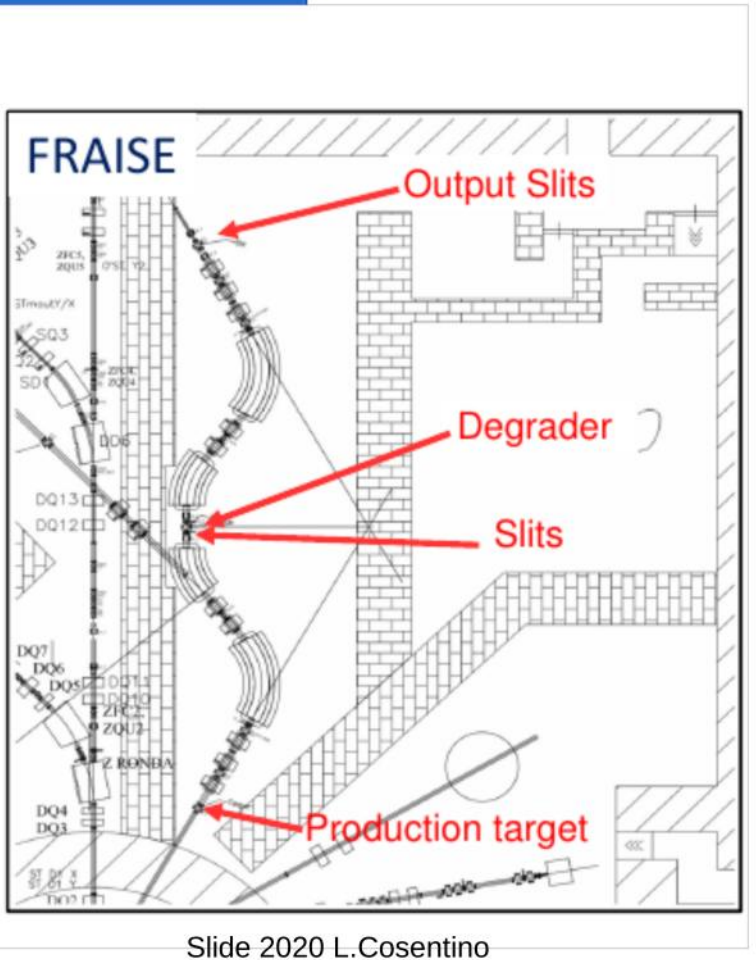
Esempio 2: figli di 40Ar

Fazia Status

- Scientific Programs

LNSFraise upgrading





now

Slide 2020 L.Cosentino
2022 L.Celona

Fazia Status

Scientific Programs

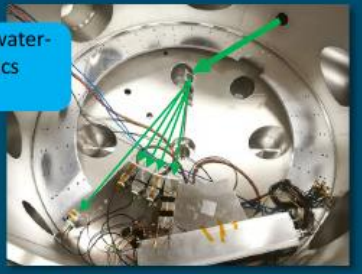
Protons,protons,protons!

- energy 70 MeV – 230 MeV
- rapid energy change
- DE/E < 0.7%,
- 20 nA for 230 MeV - 30 pA at 70 MeV
- Spot size 3 – 7 mm (1σ);
- Field size 30cm x 40cm;
- Field homogeneity ≤ 2%;

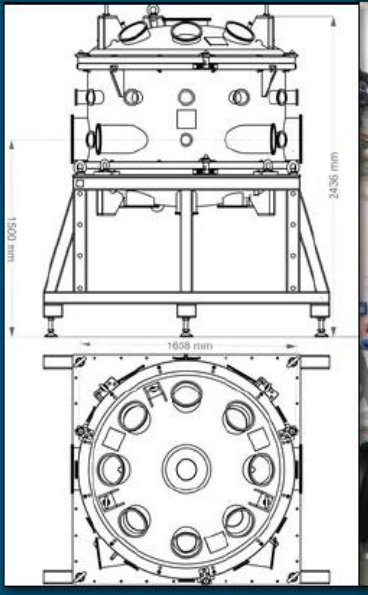
- **Large vacuum chamber (diameter 1.5 m)**

Used for FAZIA, CALIFA, and other detector tests in the past years (2013 up to now).

FAZIA telescopes - water-cooled FEE electronics placed in vacuum



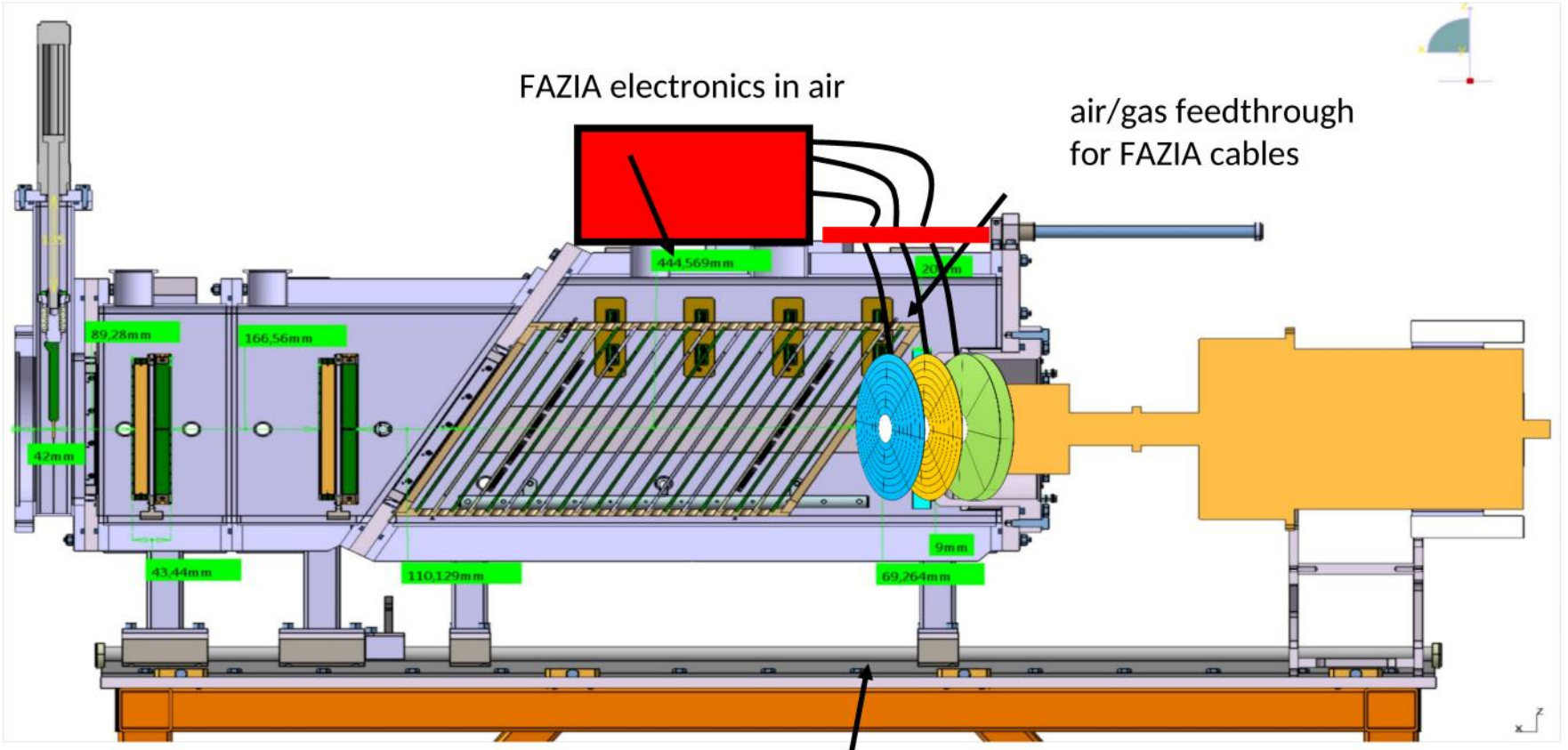
X,Y detector scanner (β-plast detector for DESPEC/NUSTAR/FAIR)



E. Nacher et al., NIM A 769 (2015) 105,
B. Pietras et al., NIM A 814 (2016) 56
C. Frosin et al. , NIM A 951, (2020) 163018.

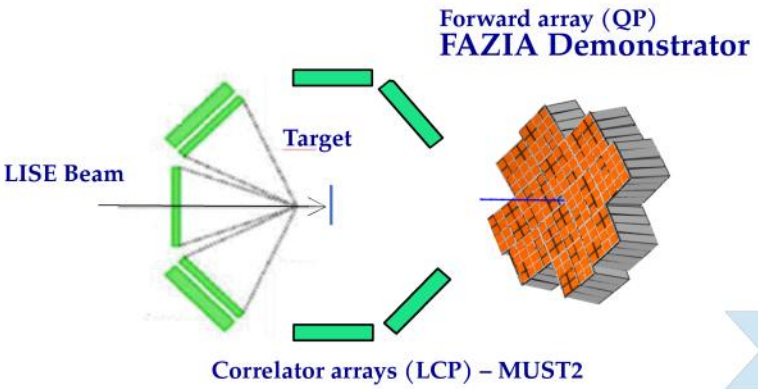
LISE zero degree, PHASE 2, with FAZIA zero degree array

Presented may2021 at GANIL meeting

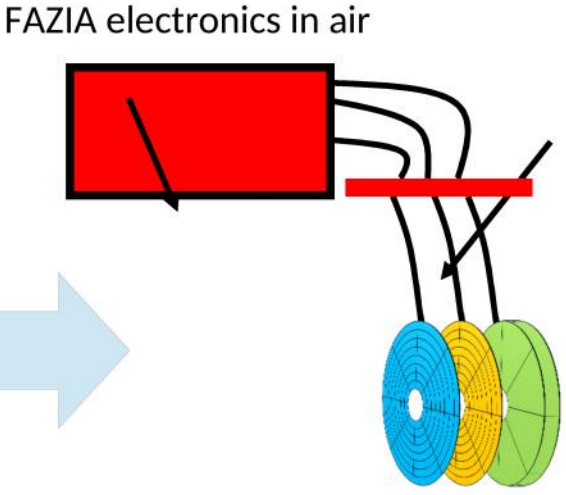


LISE zero degree, PHASE 2, with FAZIA zero degree array

Presented may2021 at GANIL meeting



2019



air/gas feedthrough
for FAZIA cables

2021

Fazia Status

- New directions on Detectors and Physics (boiling ideas)

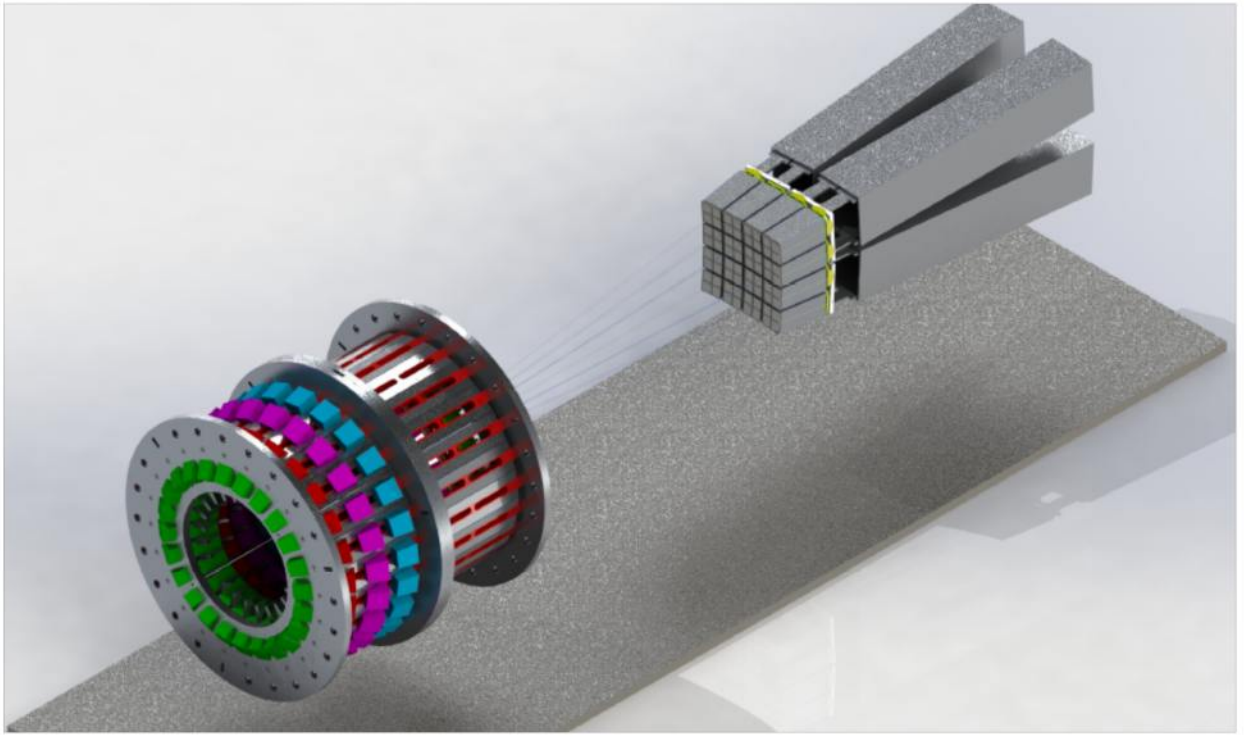
- LNS mid-term plan: FaziaForw + MEDEA for GDR+FRAGMENT studies
- GANIL plan: FaziaZERO + Arlecchino (IC,ATS,HPGe) at the LISE channel
- LNL plan: try to some Fazia-Like solution for Hresidue detection (new Rco, basically)
- NFS: recover the idea of neutron studies with FAZIA Telescopes
- CCB studies (e.g. p+11B,12C at 70-200MeV for 12C states?)
- CNAO,TIFPA: ideas?
- RAON: is a real future experimental site? what would exactly be useful there?

- Silicon side: go thicker: efforts in Korea (1000micron, at reach)
- Silicon side: go thinner: further still uncertain efforts in Korea (150micron)
- Silicon side: go very thin: Micron Ltd at 20micron? Costs! Physics!
- CsI: no tensions yet

Fazia Status

- New directions on Detectors and Physics (boiling ideas)

  Remind: LNS mid-term plan process with many contributions.
  Silvia and GC contributed to the presentation of slides (G.Cardella) and to the text of a paper to be published.
- Working group: GR and FRAGMENTS



By Carlo Cialdai

Fazia Status

- Funding overview

France
Well supported by IN2P3 last years: financed the INDRA electronics upgrading in toto (≈300ke)
Uncertain budget next years, what future?

Italy
Operation funds in recent years; no major problems. What future?

Korea
financed 2018 750micron 25 wafers (3ke)
Cofunding 750mic pad production (CIS, Germany) 10ke (about 10ke also Italy,France)
Financed 2022 2 new FEE from Notice in Korea
Financed 2022 R&D on 1000micron sensors (Fazia type)
Unknown future spending profile

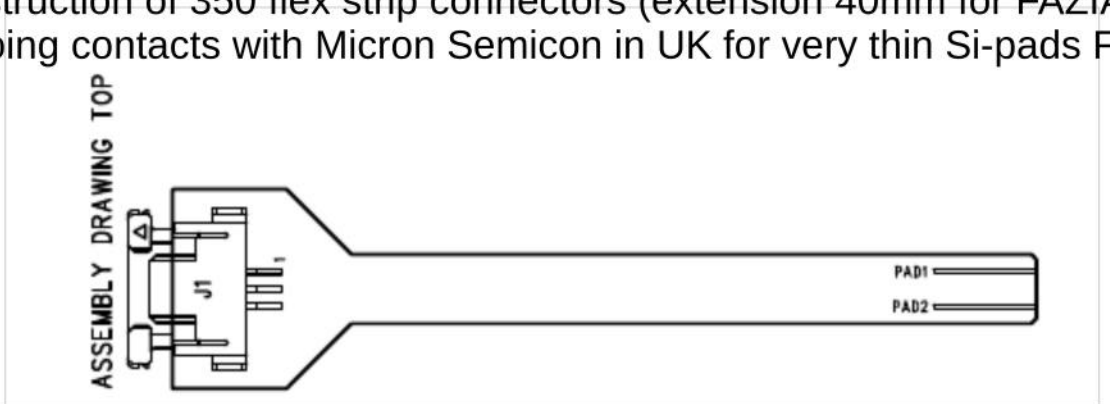
Poland-Spain
Powder...

Fazia Status

- Funding CSN3 2022

Italy
Fi FAZIA: spese per alloggiamento di silici di spessore diverso **11ke**
Fi FAZIA: co-finanziamento in collaborazione con il gruppo coreano di silici compatibili con la meccanica FAZIA di 150um di spessor **10ke s.j.**
Na FAZIA; **2ke** componentistica ricambio per schede blocco

Use of funds 2022
-repair of FEE cards (250e/cad) initiated in 2021
-construction of 350 flex strip connectors (extension 40mm for FAZIA)
-ongoing contacts with Micron Semicon in UK for very thin Si-pads Fazia type (invest in this? See s.j.)



Delivery next week
Will be used next BLK changes

Fazia Status

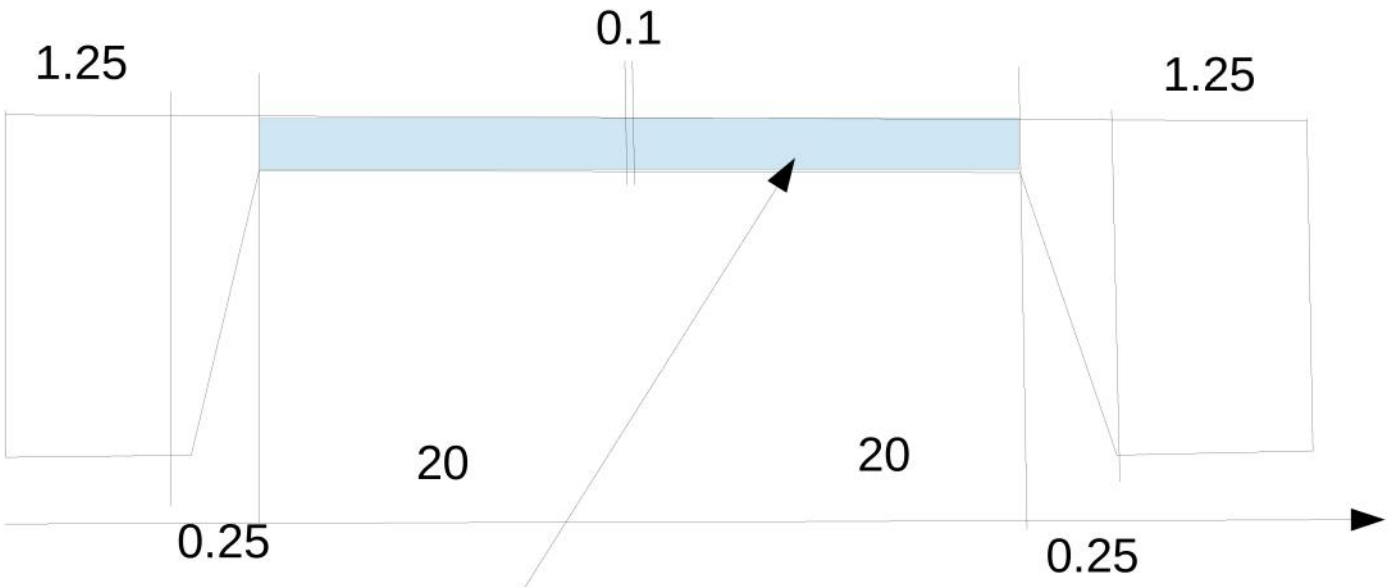
- Funding CSN3 2022: invest or not on this? Insufficient funding CSN3.
- Goal? Lower DE-E thresholds for SPES oriented experiments
- (capacitance will be from 300micron 135pF to 20micron 2nF)

DETECTOR ACTIVE AREA 40 200 x 40 200 um^2 ELEMENT 2 x 2 ARRAY CHIP DIMENSIONS 43 200 x 43 200 um^2 SILICON THICKNESS 16 – 24 um/200 um SILICON VARIATION ACROSS ACTIVE AREA +/- 2 um	4.00	5,000.00	Zero Rated	20,000.00

Please note that the Unit price for 2T/2M window is Euro 4000 if the thick/ thin metal is not required on the rear of the detector				
NRE mask set	1.00	6,000.00	Zero Rated	6,000.00
NRE shipping cases	4.00	100.00	Zero Rated	400.00
Prices FOB INFN				
			Subtotal	26,400.00

Fazia Status

- Proposal from MICRON: a unique quartetto with edges
- Goal? Lower DE-E thresholds for SPES oriented experiments
- (capacitance will be from 300micron 135pF to 20micron 2nF)



Fazia Status

- International links and collaborations

MoU
Actual is expiring 2022
New one in preparation 2023-2027
Keypoints: physics, where, Korea role, joung collaborators and manpower profile on 5y scenario
ACTAR-LISE groups
Appealing and discussion at GANIL
Brainstorming on a modified version FAZIARING (close to zero annular detector for exotic LISE beams)
Viable? In the Mou? Starting a real construction path (funding and csn3)?
China
Not easy contacts since 2019
Emails on FaziaZERO, last paper submission
Not clear future

A FPMB session fixed 21 june 2022 will deal with these subjects and perspectives