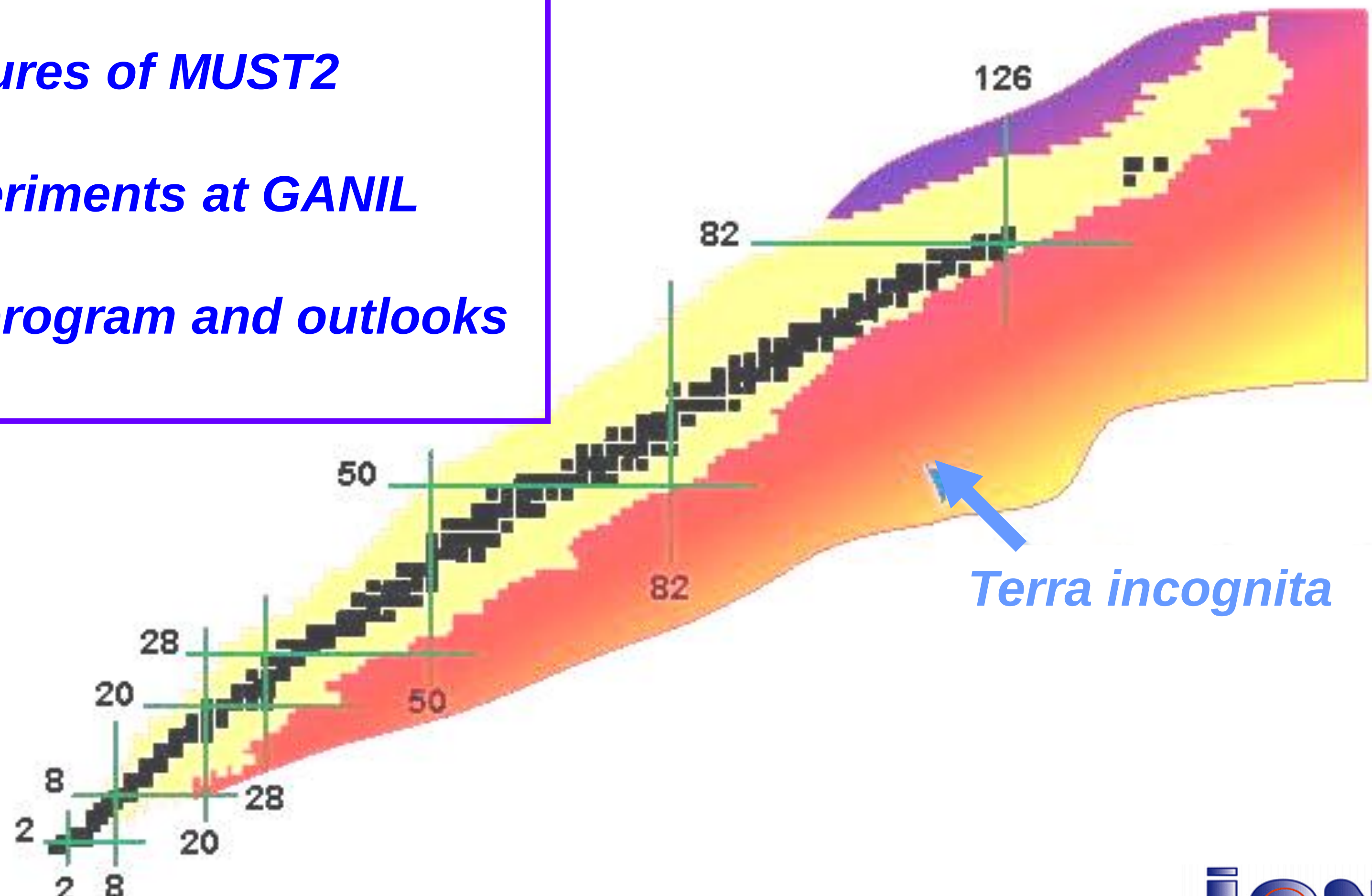
The MUST2 Array

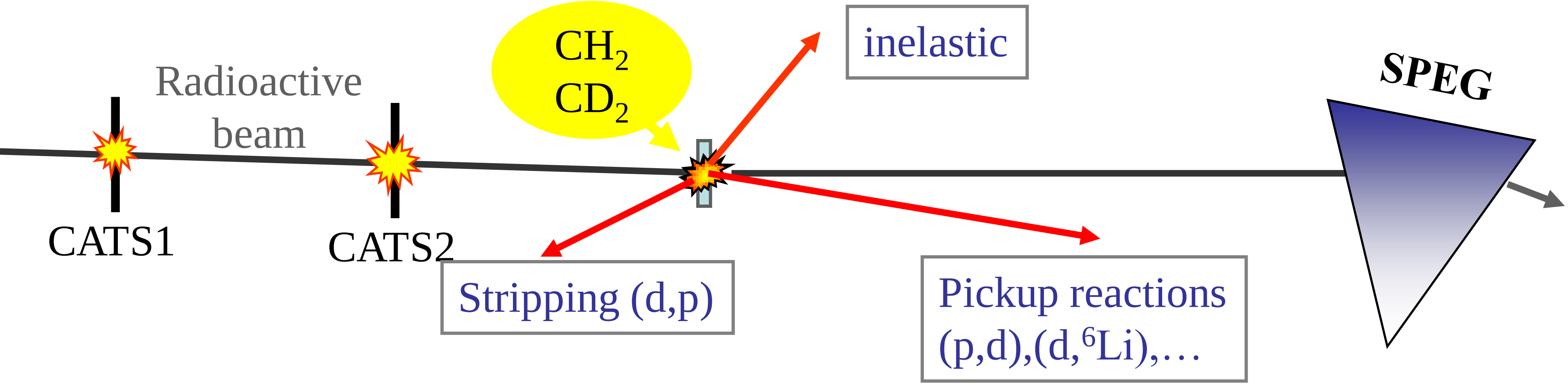
D. Beaumel, IPN Orsay

- Main features of MUST2
- First experiments at GANIL
- Physics program and outlooks



Direct reactions studies

- **MISSING MASS method**



- **INVARIANT MASS method (proton-rich nuclei)**

The MUST array

(IPNO-Saclay-Bruyères)

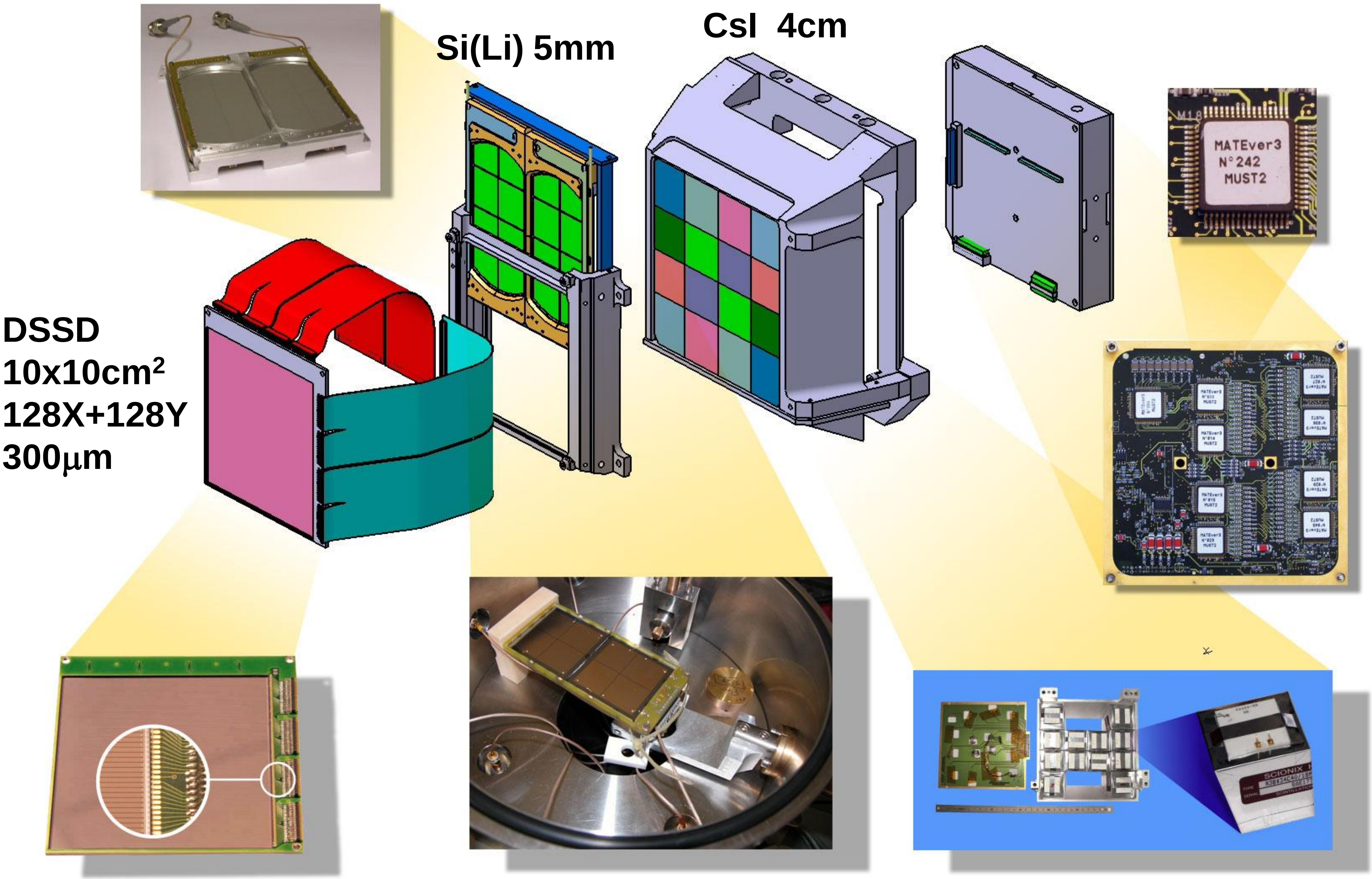
8 Telescopes **surface: 6x6cm^2**

- **DS Strip 60X+60Y (300 μm)**
- **Si(Li) 3mm**
- **CsI**

MUST2 : a major upgrade of MUST

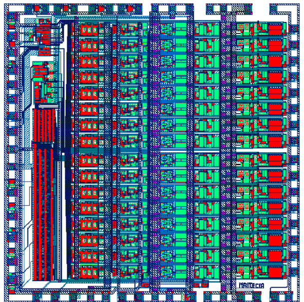
- ***Increase angular coverage***
  - ***Better efficiency***
    Several reactions in one shot
  - ***More compact***
- ***higher granularity (multiparticle)***
- ***New electronics***

Collaboration: IPNO/SPhN-Saclay/GANIL



MUST2 electronics

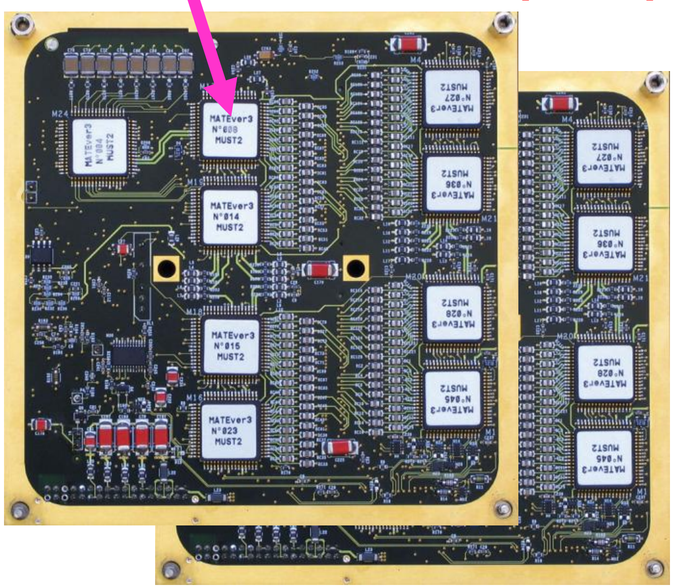
MUST2 ASIC **SACLAY (+IPNO)**



- **16 channels 28 mW/ch**
- **Energy & Time**
- **Si, Si(Li) and CsI**
- **Multiplexer**
- **I2C interface**

- **High linear. pulser**
- **T sensor**

MOTHER BOARDS (IPNO)



1 telescope

VACUUM **AIR**

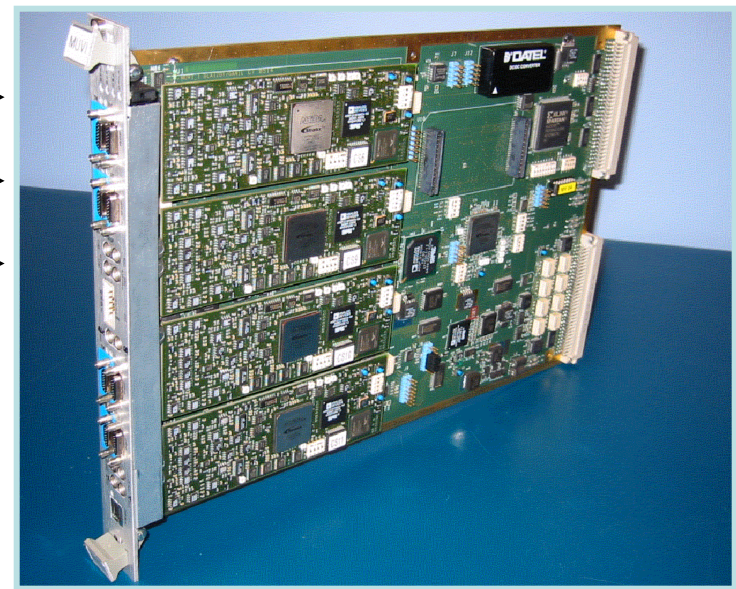
4 analog bus

Control signals

I2C bus

VXI board (GANIL)

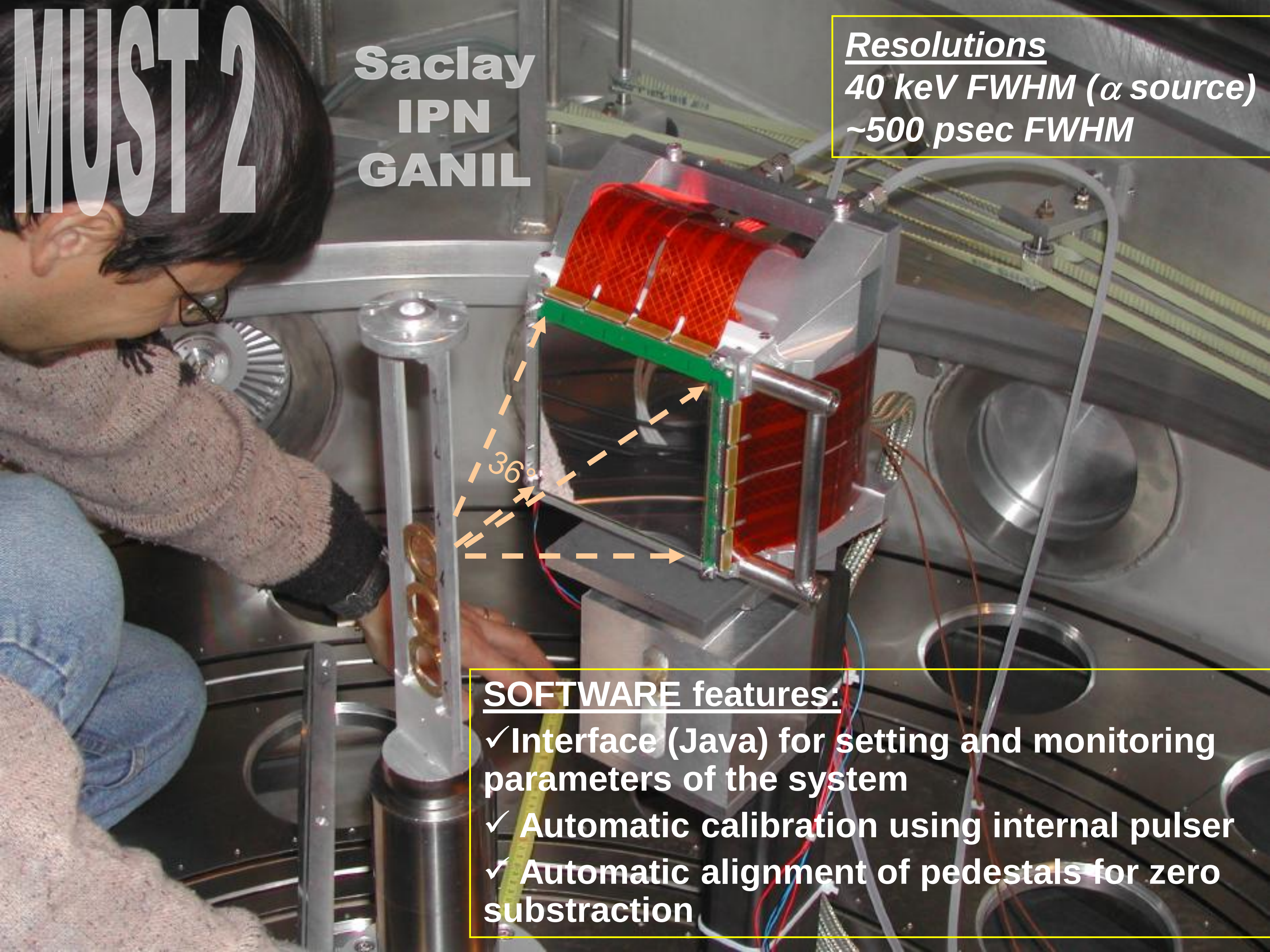
16 ADC14 bits
2.3K parameters
2MHz
Slow Control I2C
Pedestal substraction
DNL correction



4 telescopes

MUST 2

Saclay
IPN
GANIL



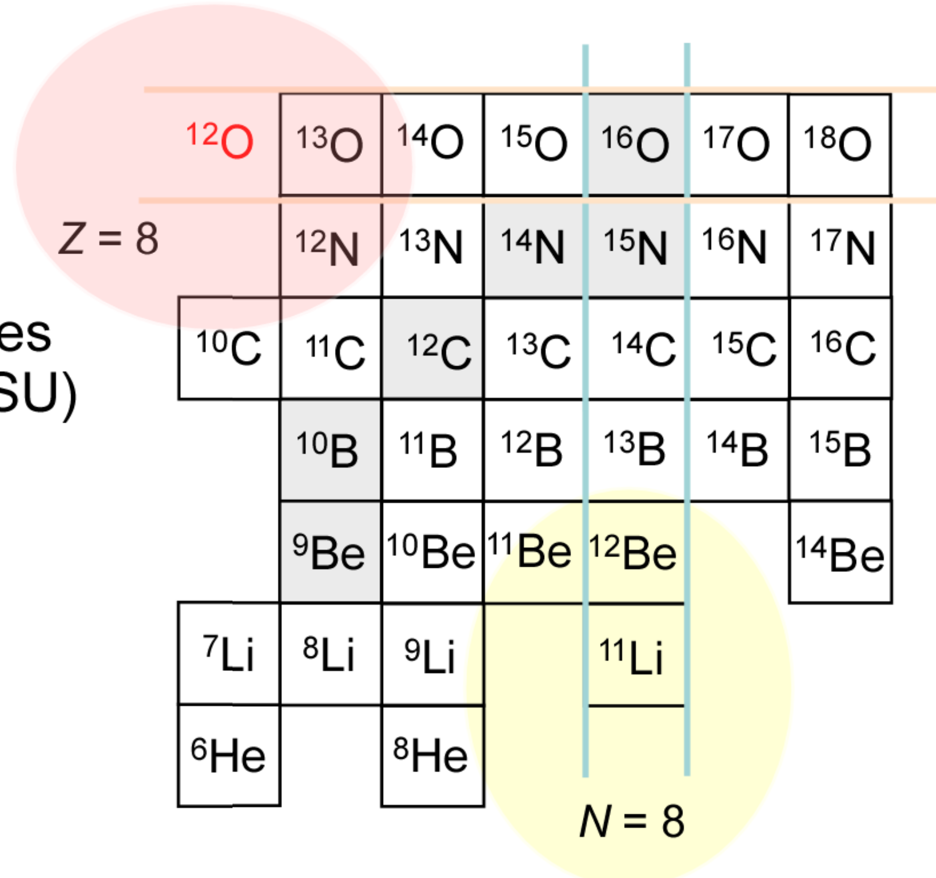
Resolutions
40 keV FWHM (α source)
~500 psec FWHM

SOFTWARE features:

- ✓**Interface (Java) for setting and monitoring parameters of the system**
- ✓ **Automatic calibration using internal pulser**
- ✓ **Automatic alignment of pedestals for zero substraction**

Magicity loss at Z=8 using the $^{14}O(p,t)$ at GANIL

Spokesperson: H.Iwasaki, IPNO
(thesis work of D. Suzuki)



magicity loss at N=8 e.g. ^{12}Be

- intruder configuration in ground states (knockout reaction at GANIL and MSU)

- low-lying intruder 1^- and 0^+ states (inelastic scattering at RIKEN
  H.Iwasaki et al. PLB481(00)7
  H.Iwasaki et al. PLB491(00)8,
  S.Shimoura et al. PLB560(03)31)

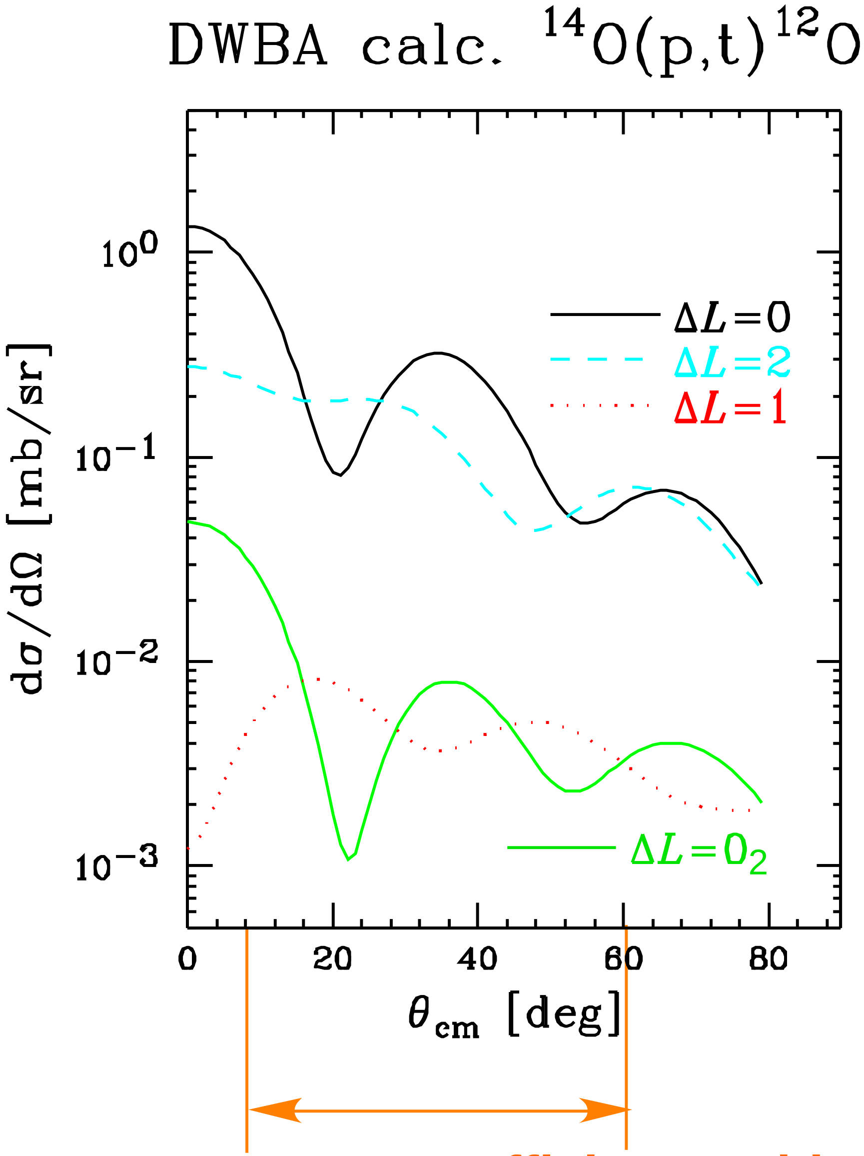
magicity loss at Z=8 ??

- low-lying $2s_{1/2}$ orbital ?

- monopole interaction ?
  ($p\ 1p_{1/2}$ - $n\ 1p_{3/2}$)

=> Spectroscopy on low-lying excited states in ^{12}O

Calculated angular distributions

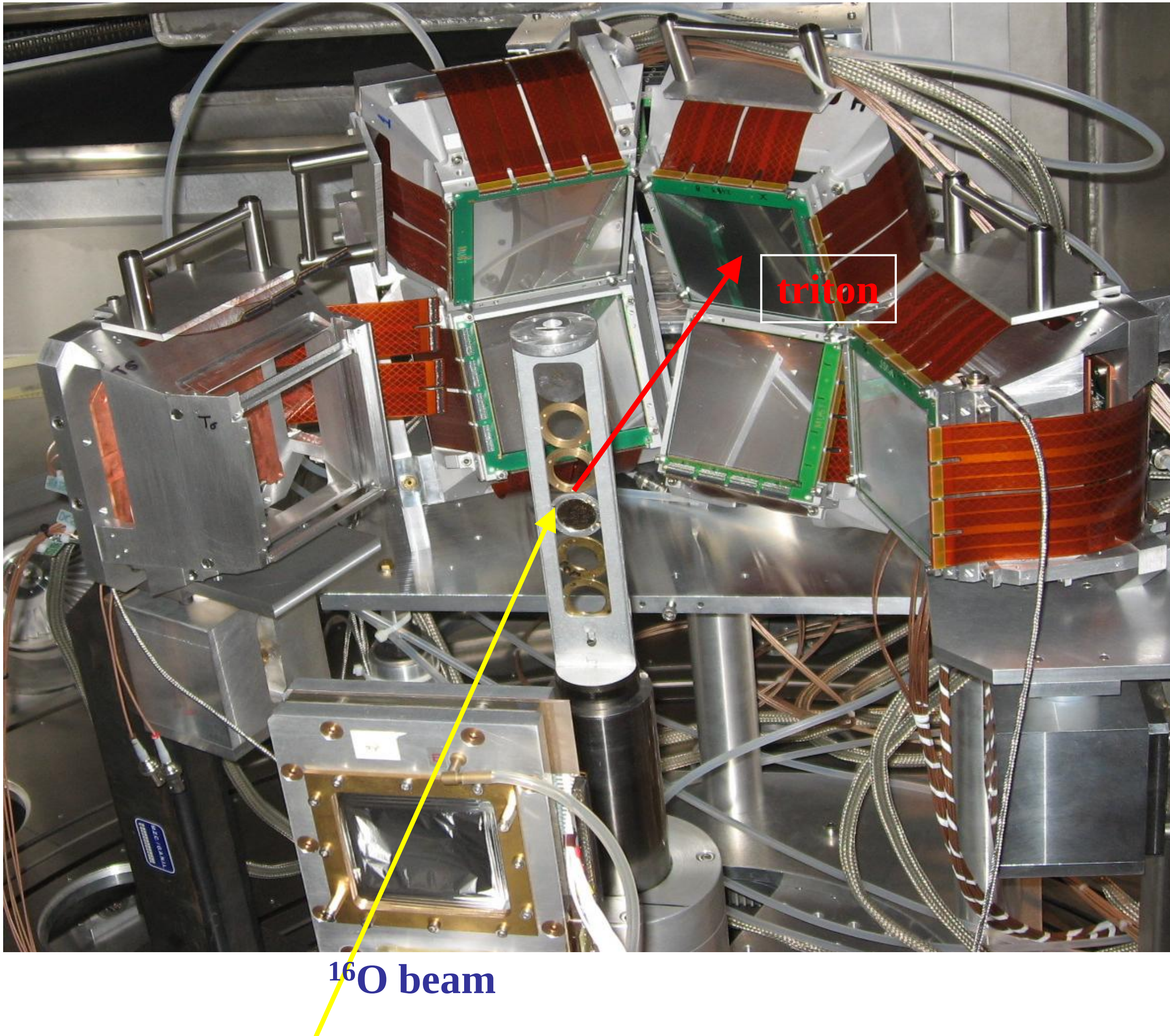


~75% efficiency with MUST2

DWUCK4 zero-range DWBA calc.

pure configurations are assumed ;
$(1p_{3/2})^2$ for 0^+, 2^+
$(1p_{3/2})(1s_{1/2})$ for 1^-, $(1p_{1/2})^2$ for 0_2^+

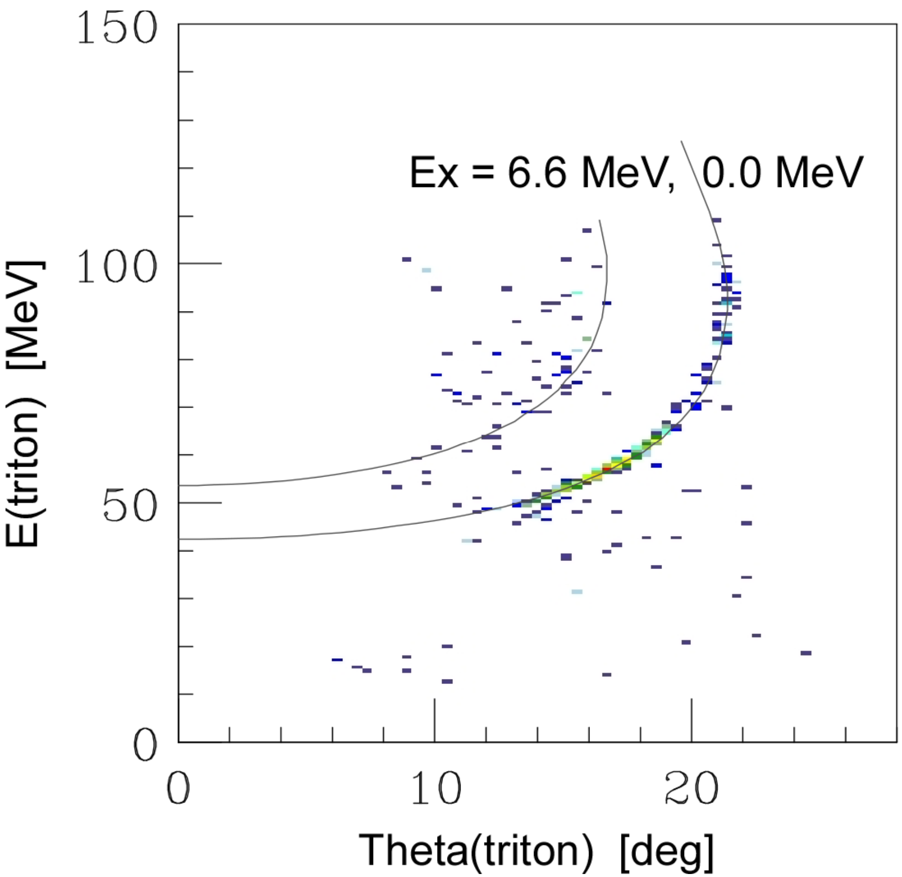
characteristic curves depending on the transfer L value
=> spin assignment

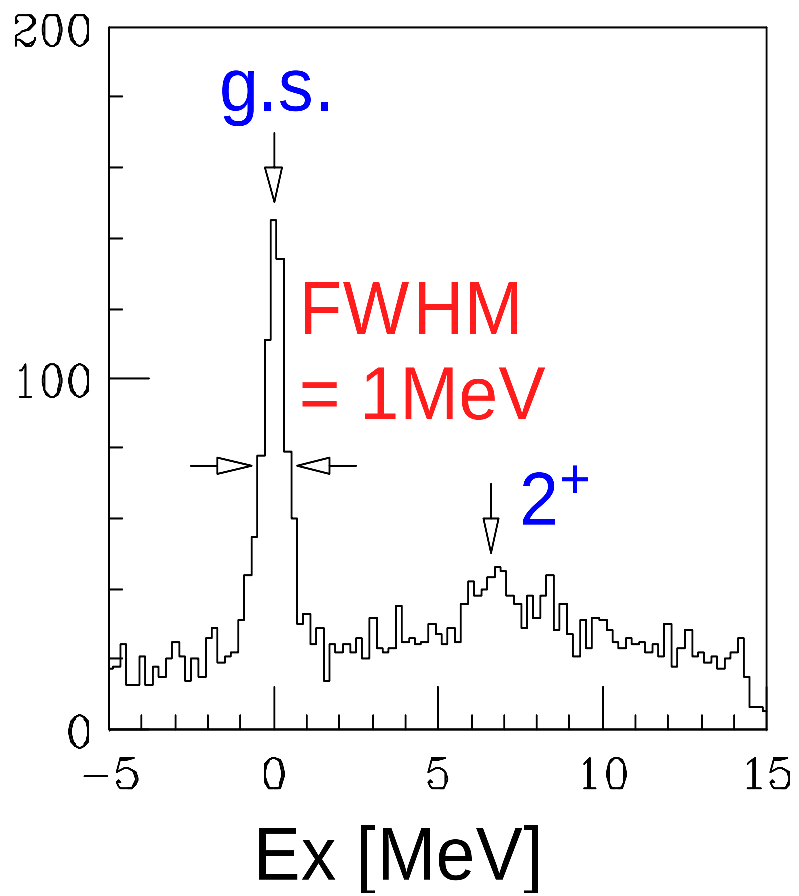

triton
^{16}O beam

Result *(preliminary)* *at GANIL April 2007*

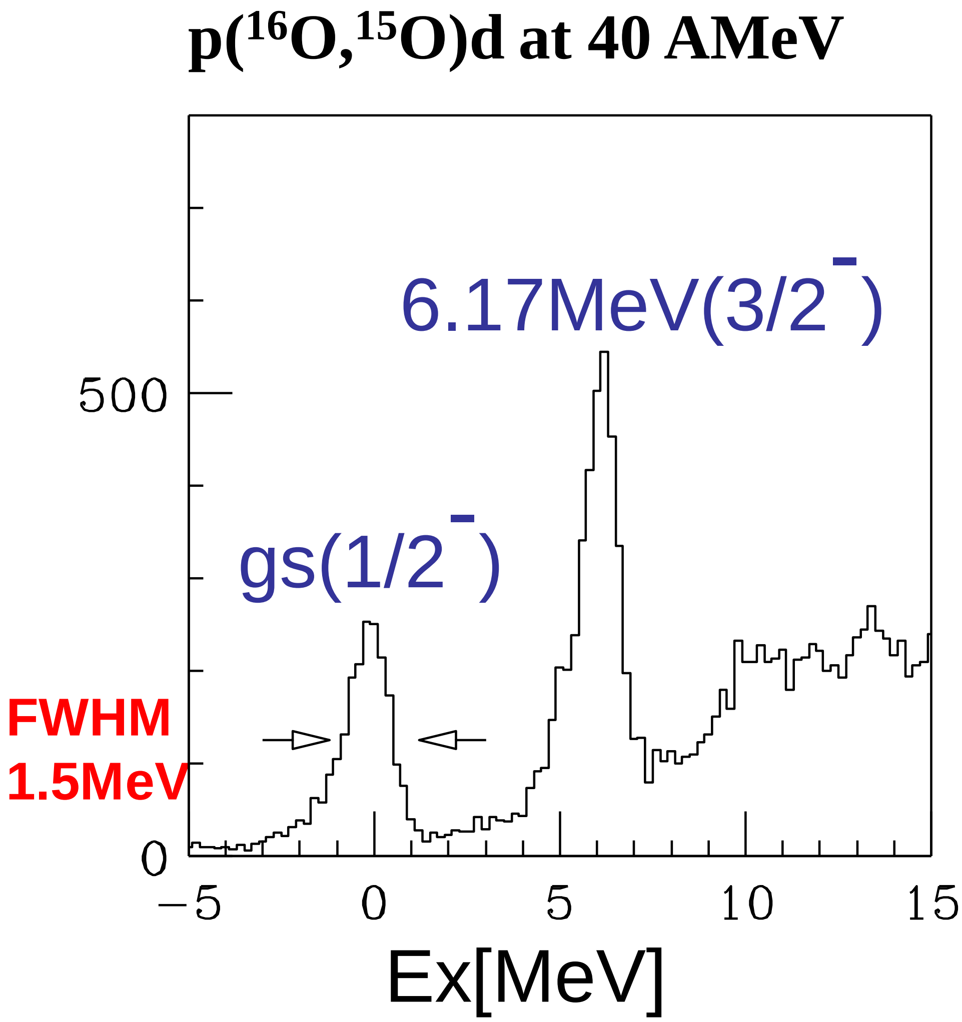
(collaboration between IPN-Orsay, Ganil, CEA-Saclay (France)
and Univ.of Tokyo, RIKEN, RCNP (Japan)

p(^{16}O,^{14}O)t at 40 AMeV

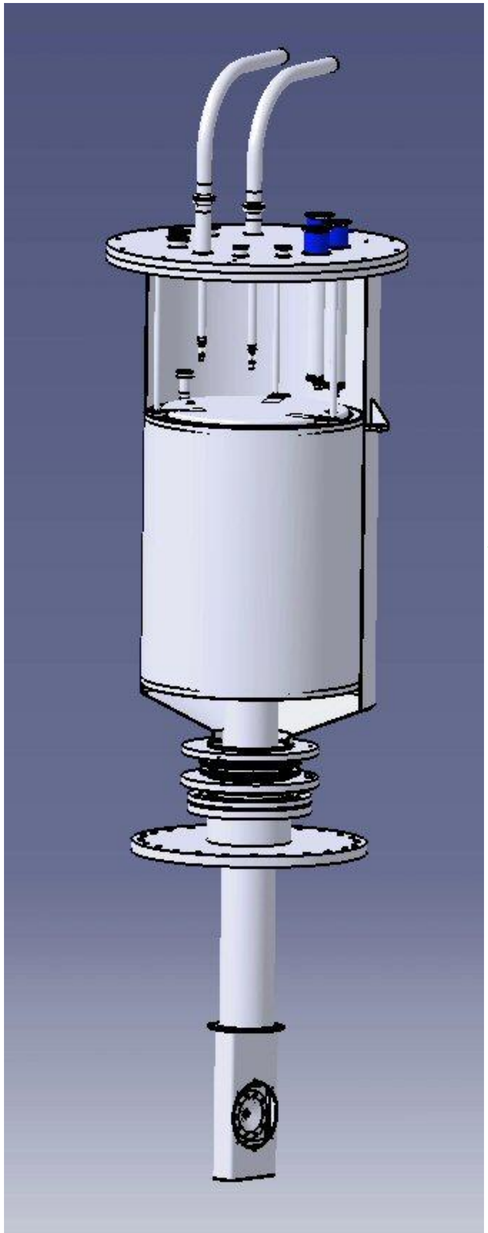




Result (preliminary)



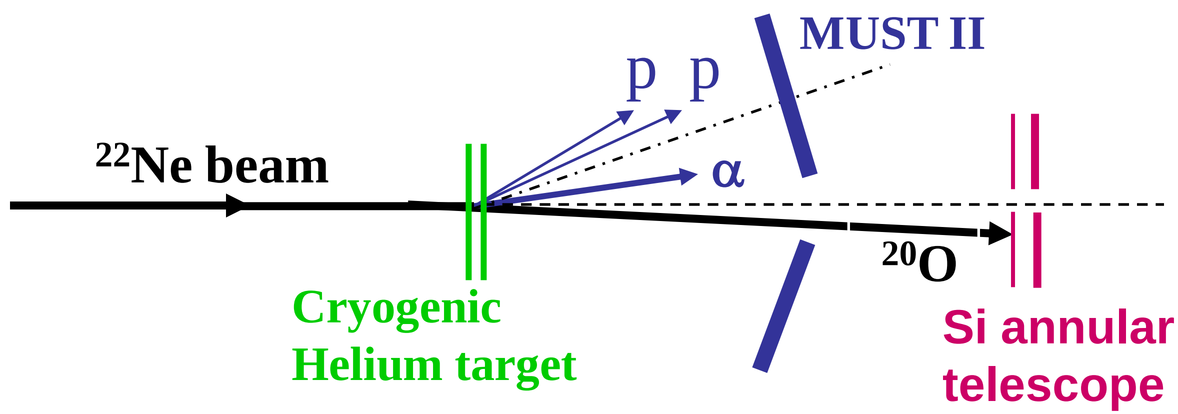
Test experiment @ GANIL: ^{22}Ne + α at 30 MeV/u



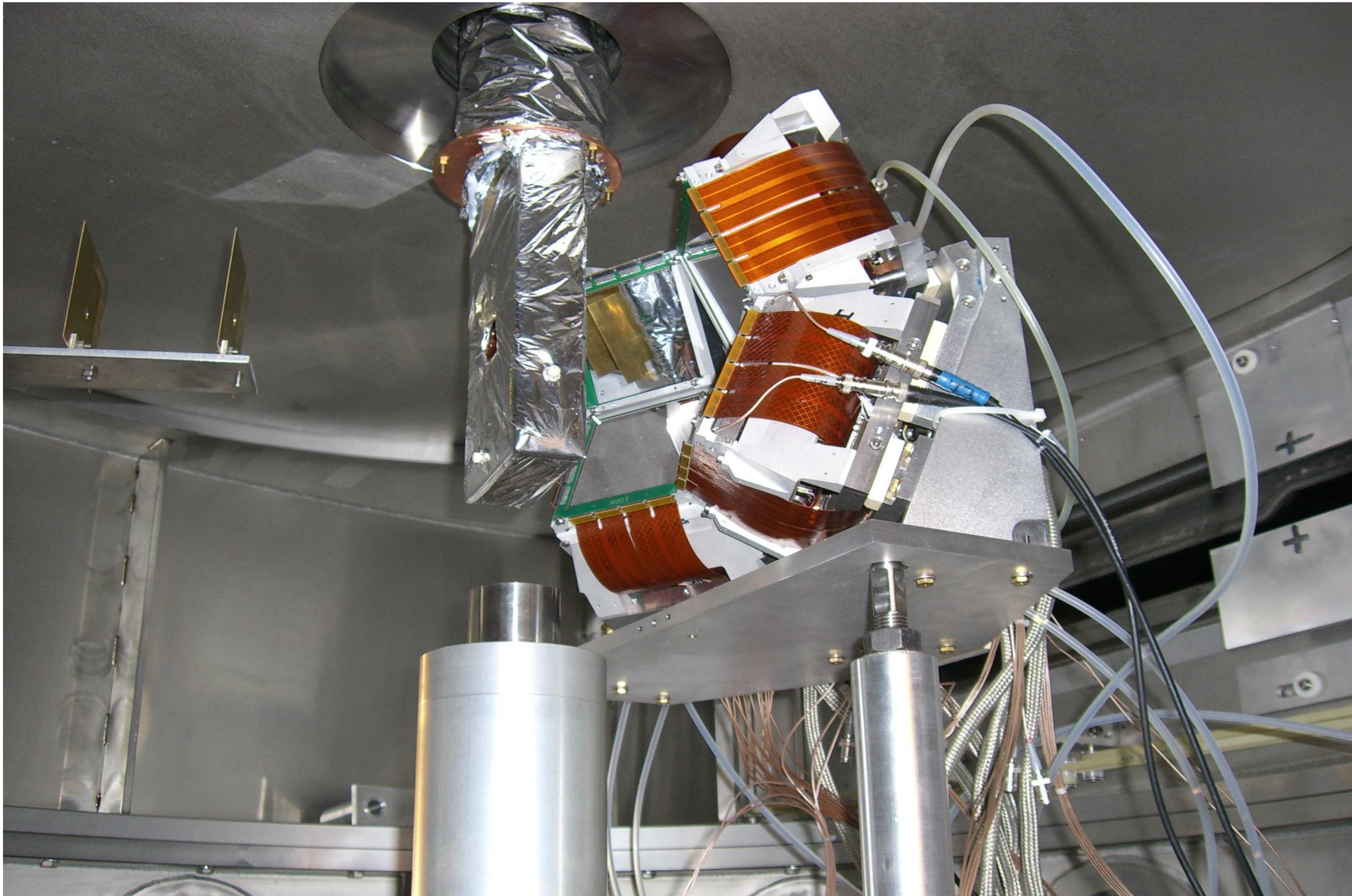
^{22}Ne(α,^{6}He)^{20}O 30 MeV/u

^{22}Ne(α,^{6}Be)^{20}O 30 MeV/u

Using cryogenic He target made for missing mass measurements

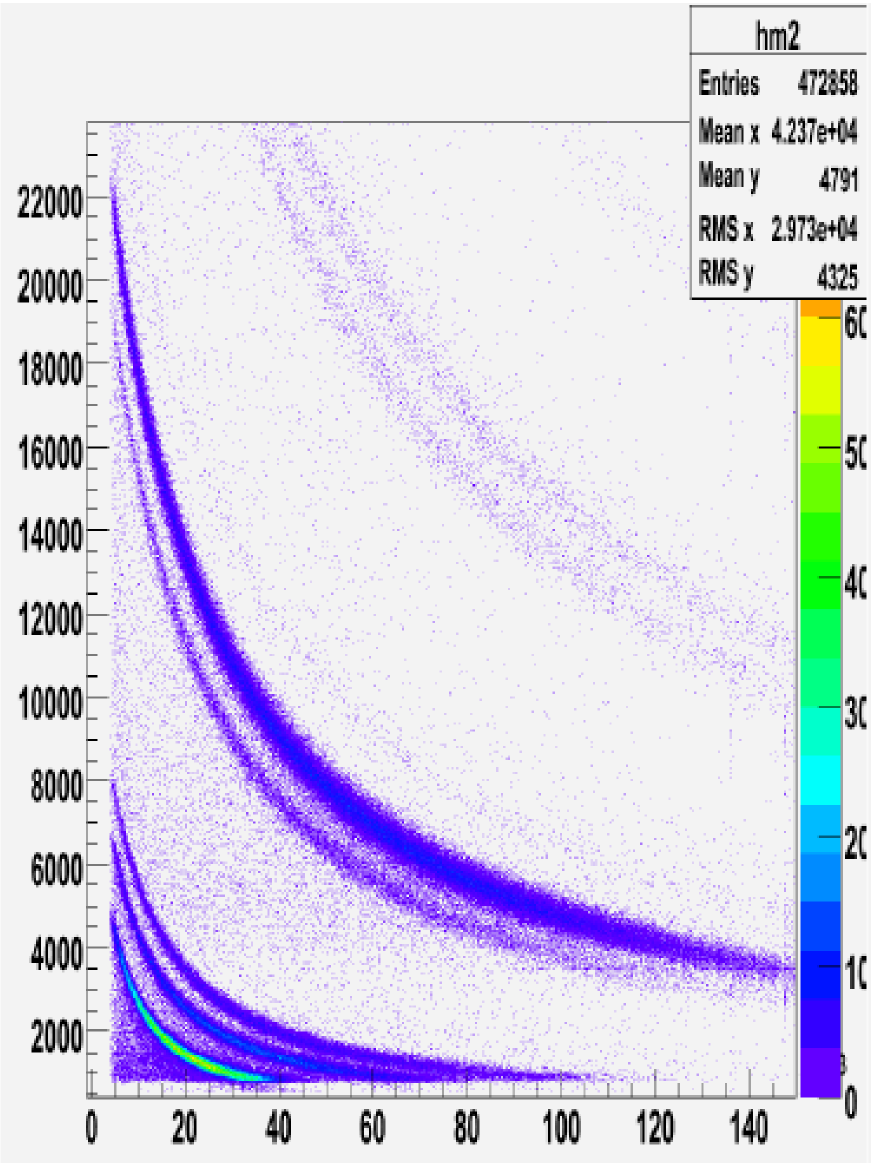


$^{22}Ne + \alpha$ at 30 MeV/u

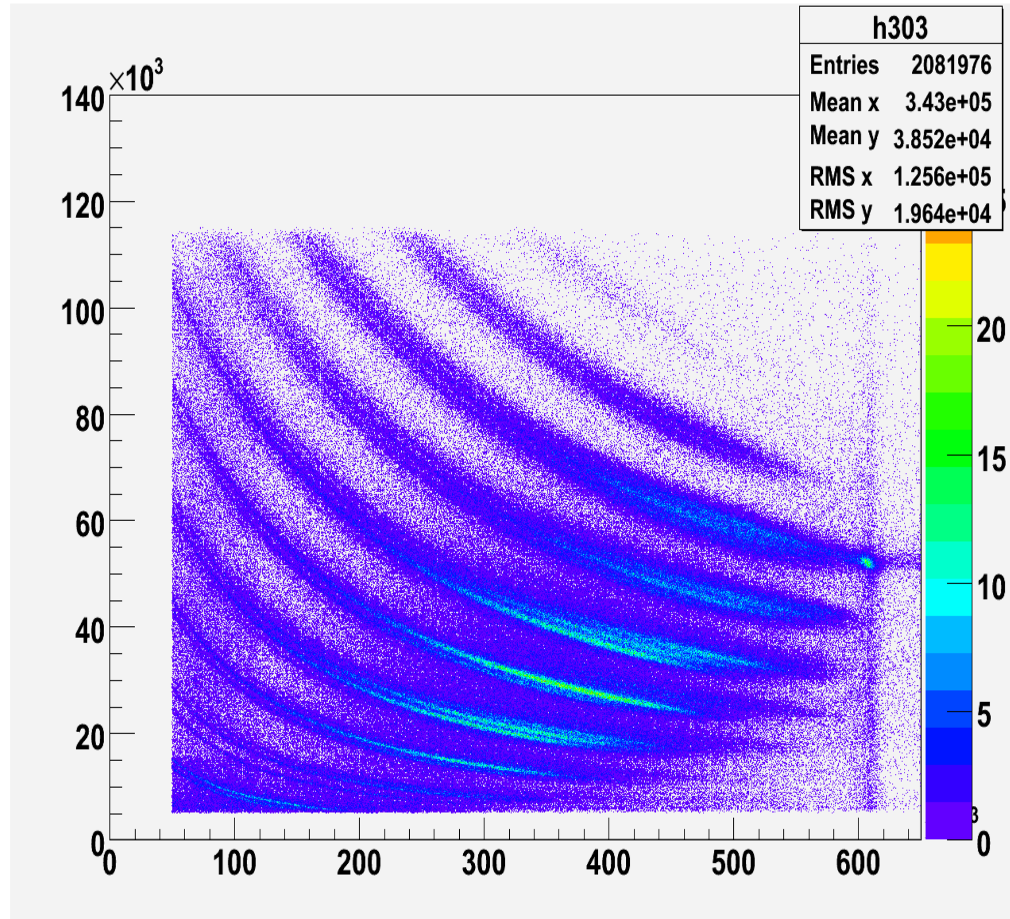


$^{22}Ne + \alpha$ at 30 MeV/u

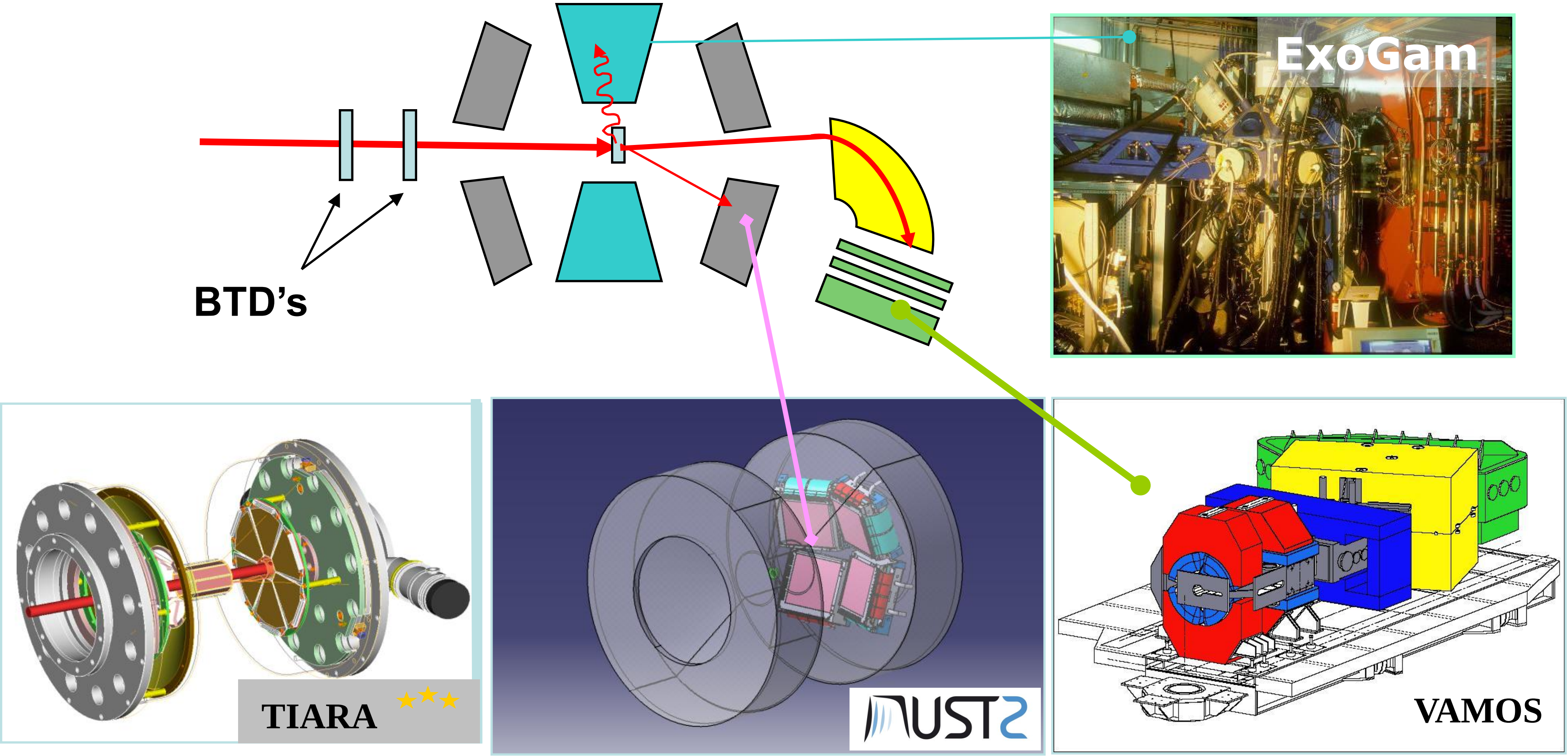
Recoil PID



Ejectile PID

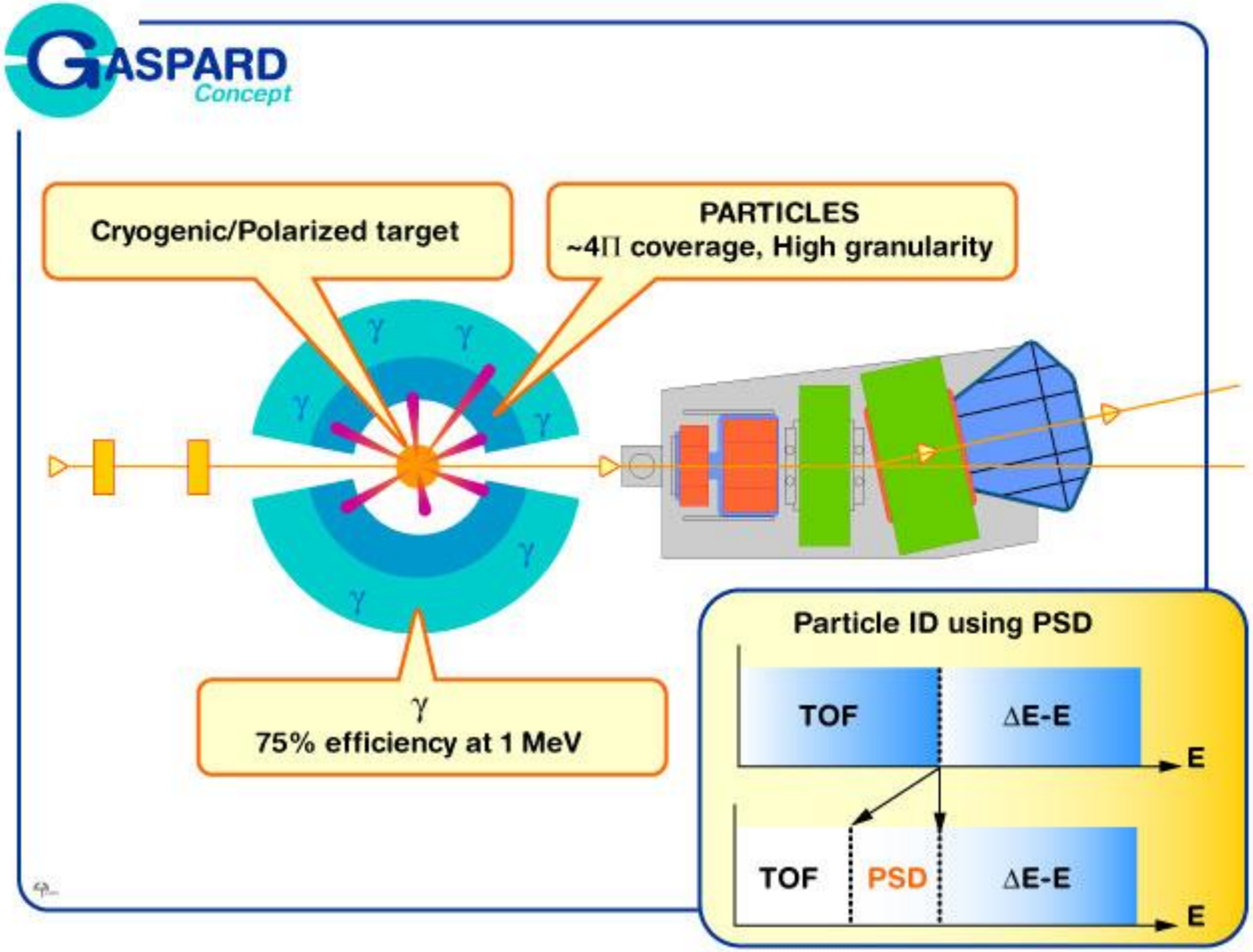


Physics program



- Shell evolution (S.O. interaction, tensor force,..)
  (d,p) : localize and identify neutron shells
  (d,^{3}He) (d,t) : SF of occupied proton (neutron) shells
- p-n isoscalar pairing
  deuteron transfer on N=Z nuclei
- Astrophysics: simulation of (n,γ) using (d,p)

In view of SPIRAL2 : the GASPARD collaboration
Gamma SPectroscopy and PARticle Detection



- Fully integrated 4π gamma (scintillators) + 4π particles high granularity
- PID for light particles using PSA in silicon