

GANIL presentation D-Day

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GANIL
spirat2
laboratoire commun CEA/DRF CNRS/IN2P3

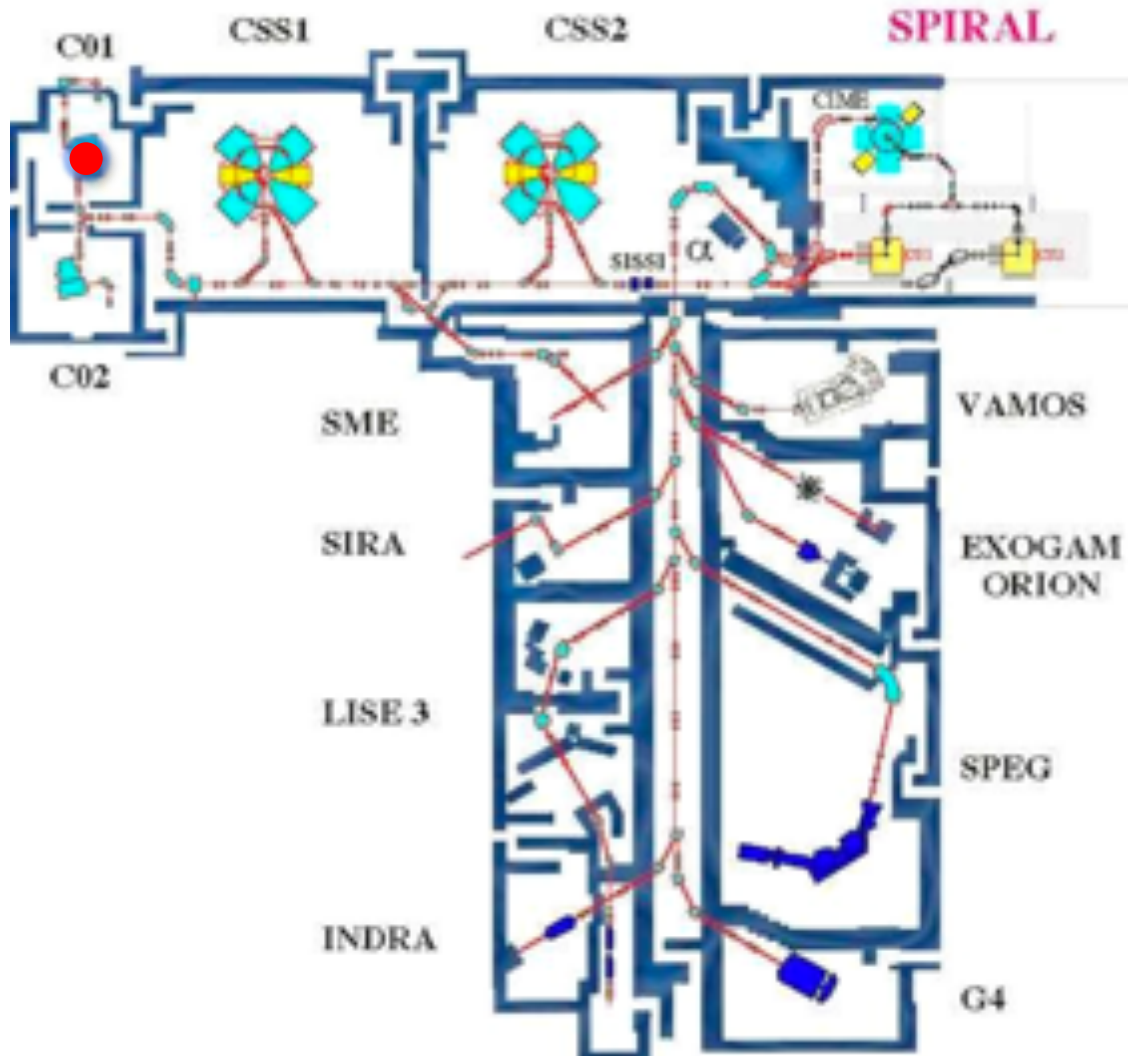
GANIL in numbers



- 288 permanent (researchers, engineer, administratives)
- 700 researchers from 30 different countries welcomed every years
- 2000 visitors each years
- More than a 100 discovered nucleus

GANIL = Grand accélérateur national d'ions lourds

- In GANIL we accelerate beams from ^{12}C to ^{235}U

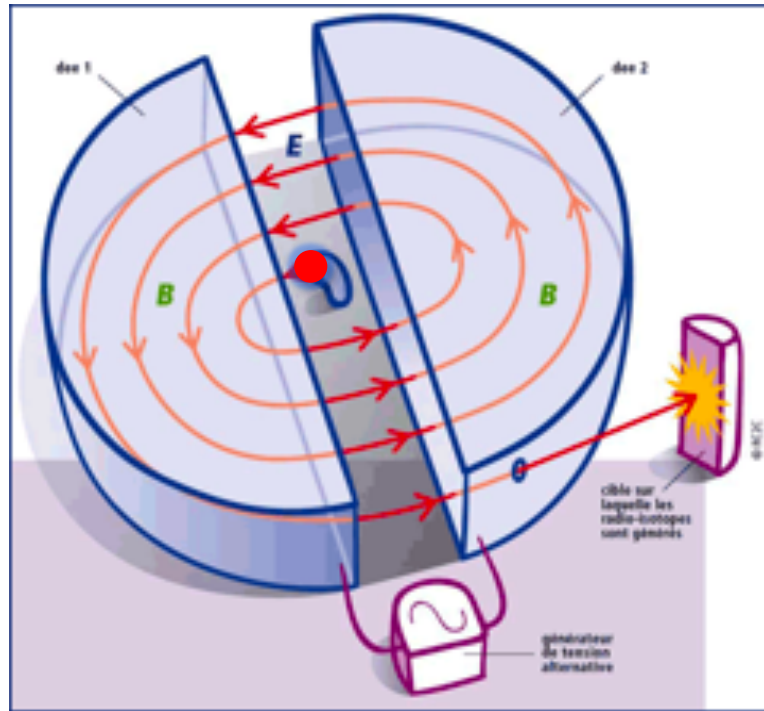


Light ions in GANIL travel at around 1/3 of the speed of light.

With a maximum intensity of $2 \cdot 10^{13}$ pps for stable beams

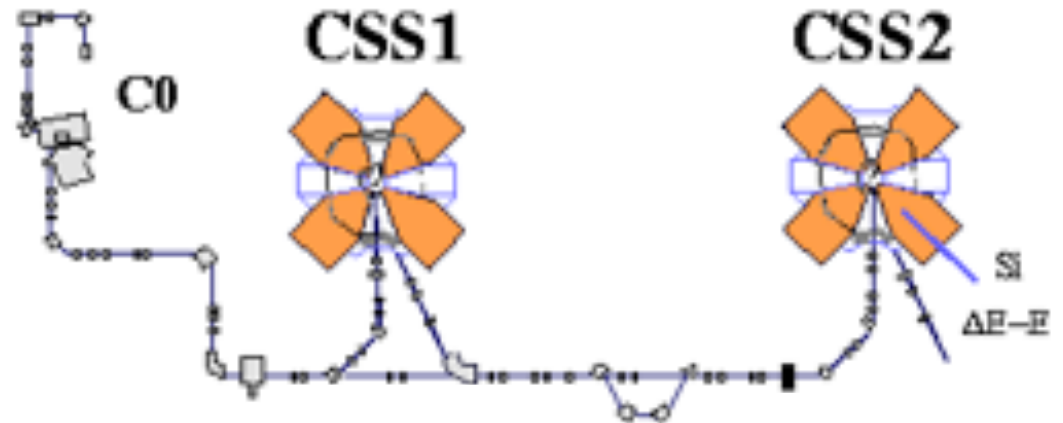
Accelerators

Working principle of a cyclotron :



$$B \rho = m V / Q$$

GANIL cyclotrons :



In GANIL, depending on the energy needed, one can use either one or two cyclotron for stable beam acceleration

Radioactive beams

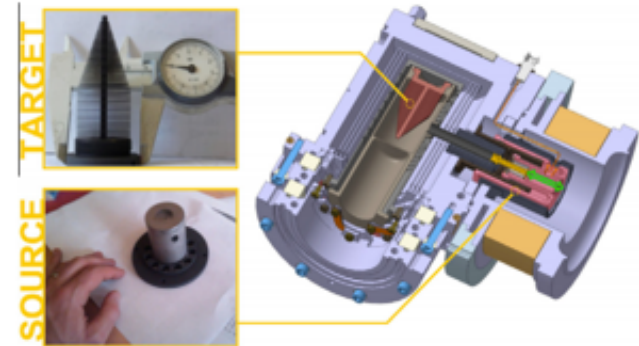
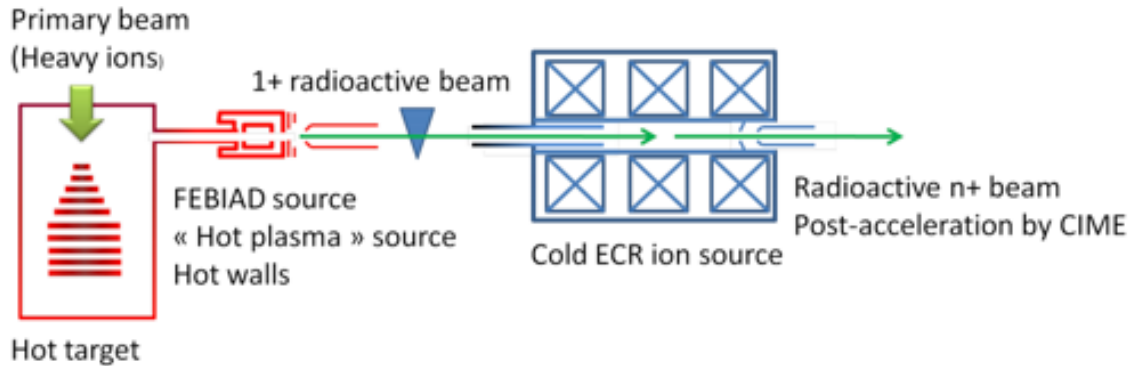
SPIRAL : Système de production d'Ions Radioactifs Accélérés en Ligne



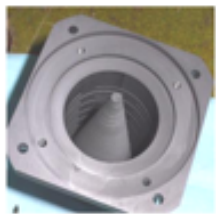
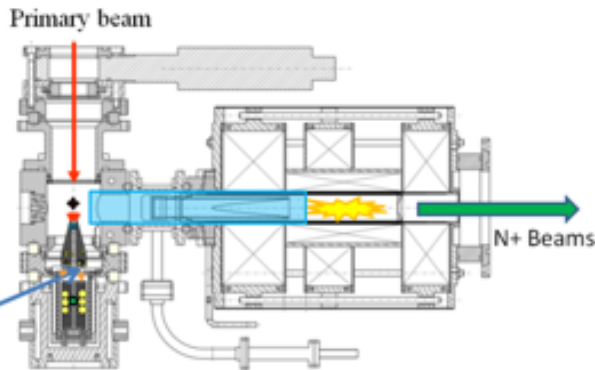
Radioactive beams

Target Ions Sources System

1+/ n + ionisation scheme



Current Target Ions Source
ECR $N+$: Nanogan3 + C

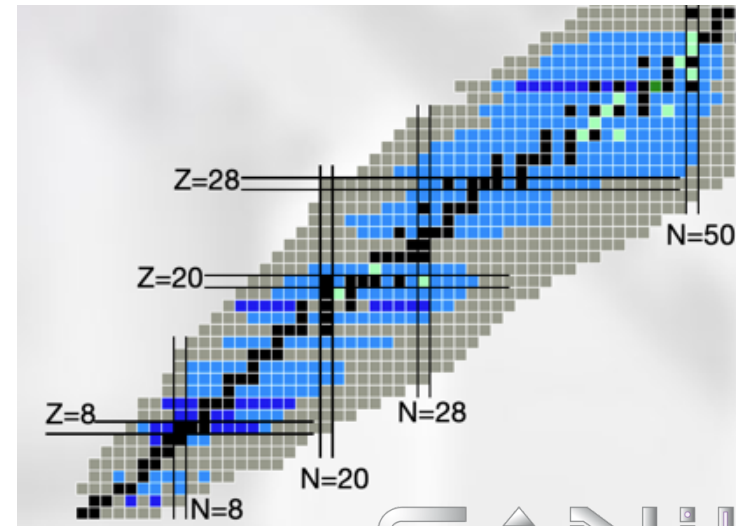


4 kW



3 kW ^{12}C beam

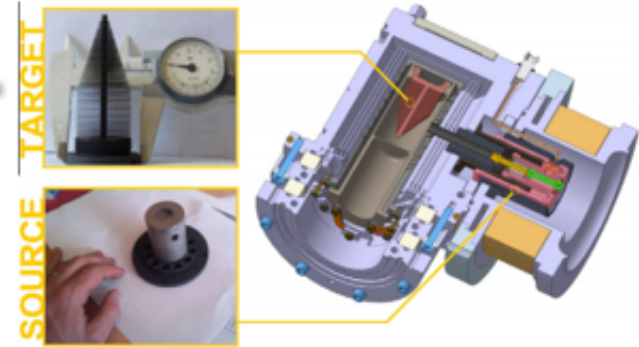
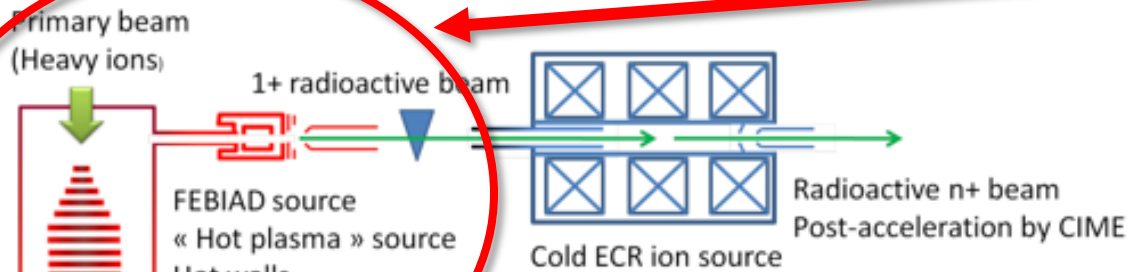
Spiral 1 beams :



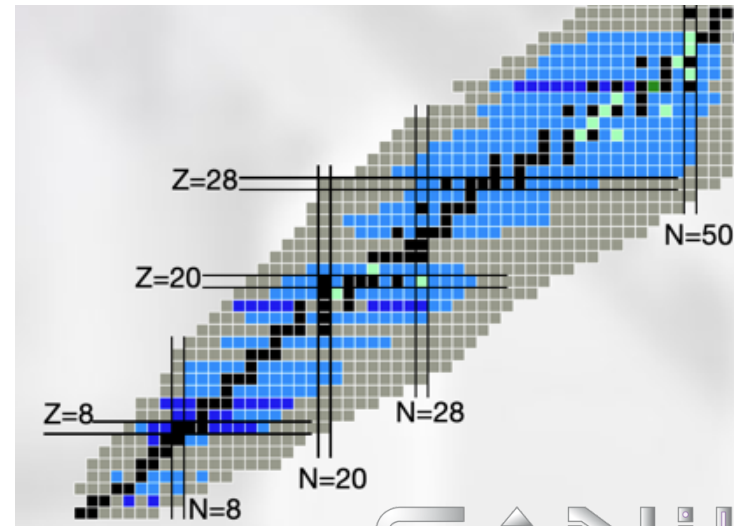
Radioactive beams

Target Ions Sources System

1+/n+ ionisation scheme

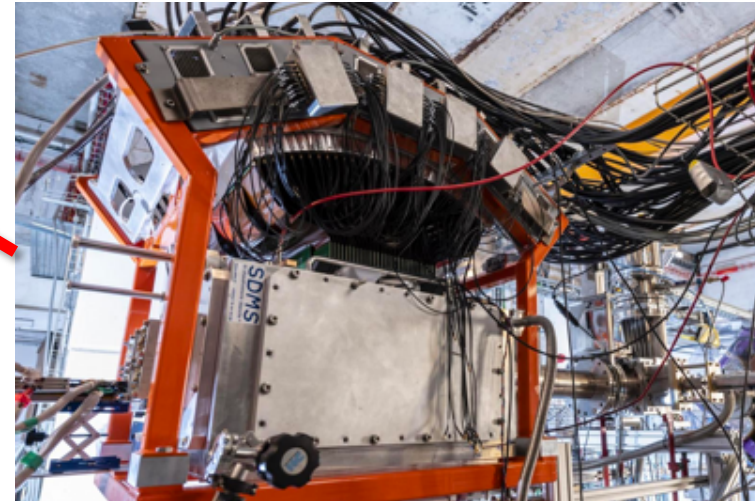
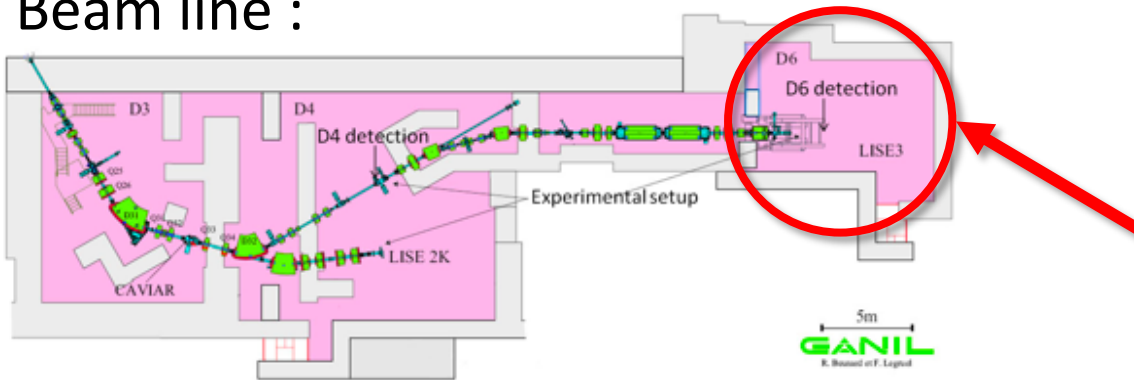


Spiral 1 beams :



Experimental area (D)

Beam line :

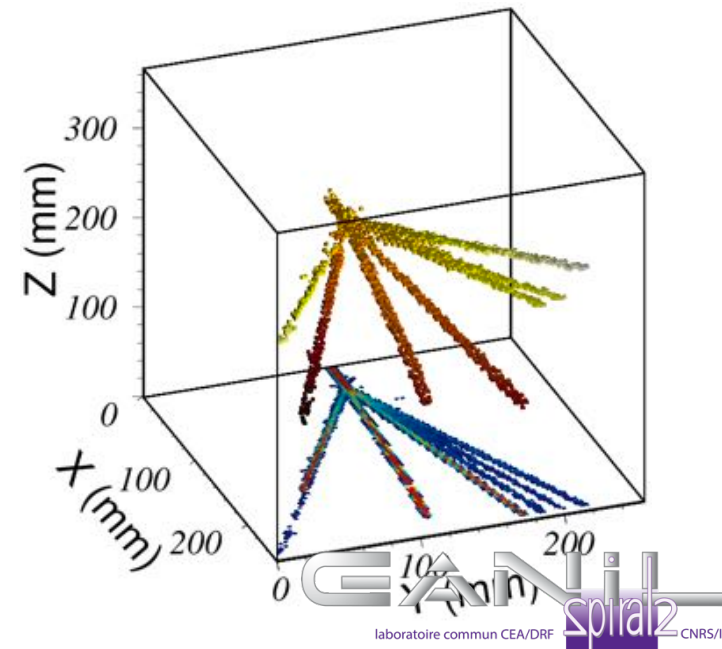
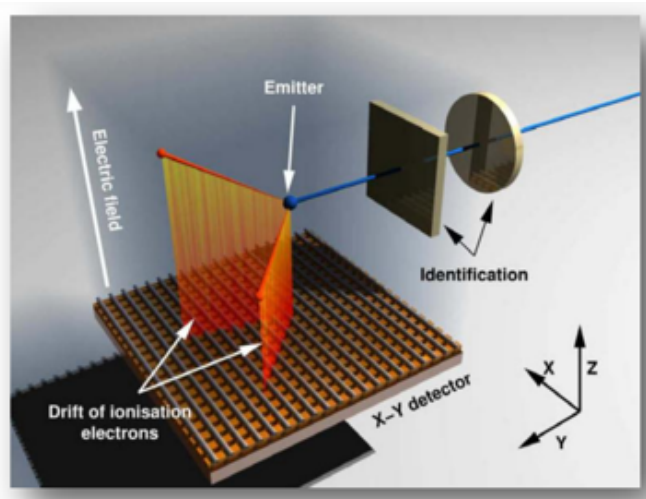


Beam produced by fragmentation and selected using the spectrometer.

Example of a detector currently located in D6 :

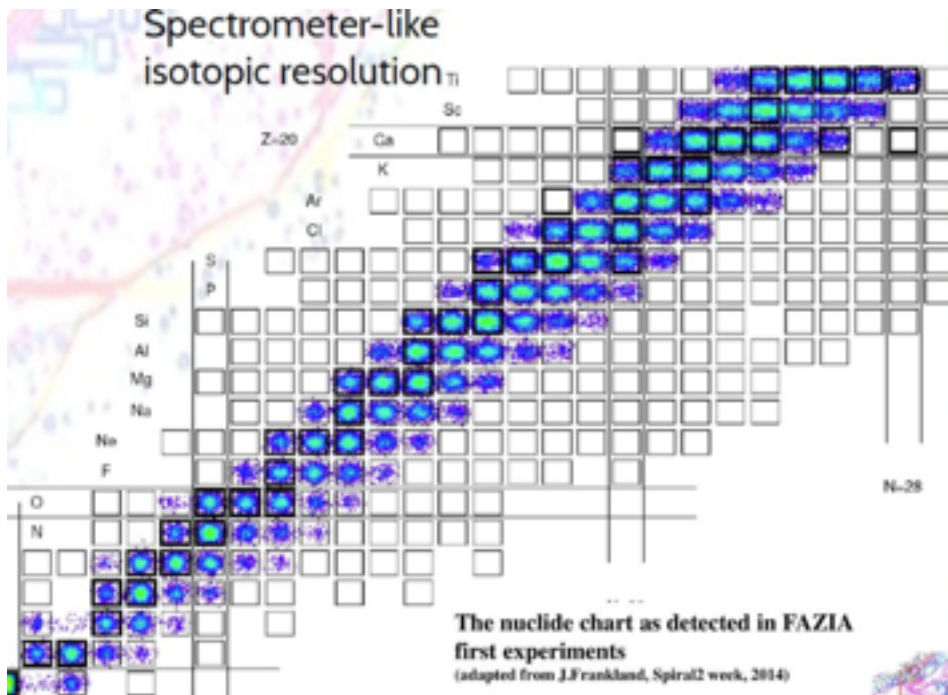
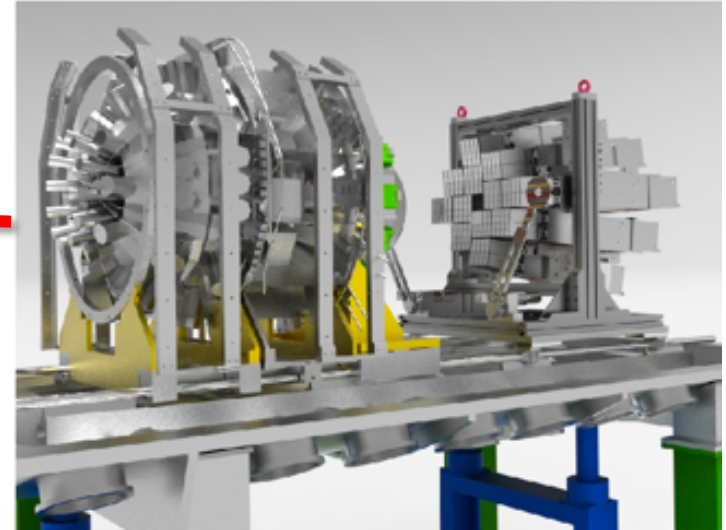
ACTAR TPC :

Time
Projection
Chamber



Experimental area (D)

Beam line :

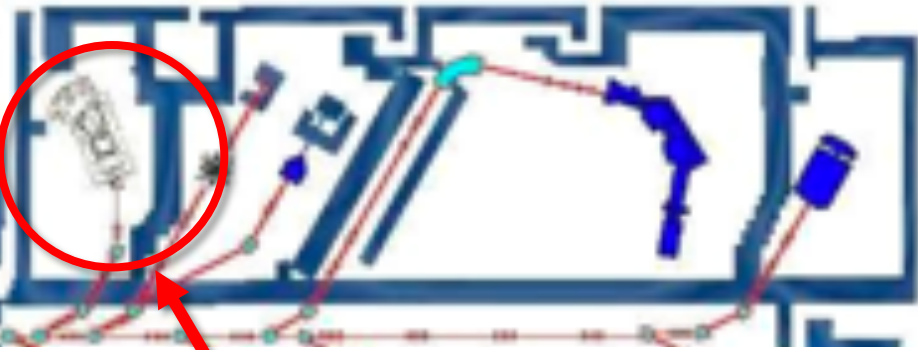


Measurement to constrain the equation of state of nuclear matter.

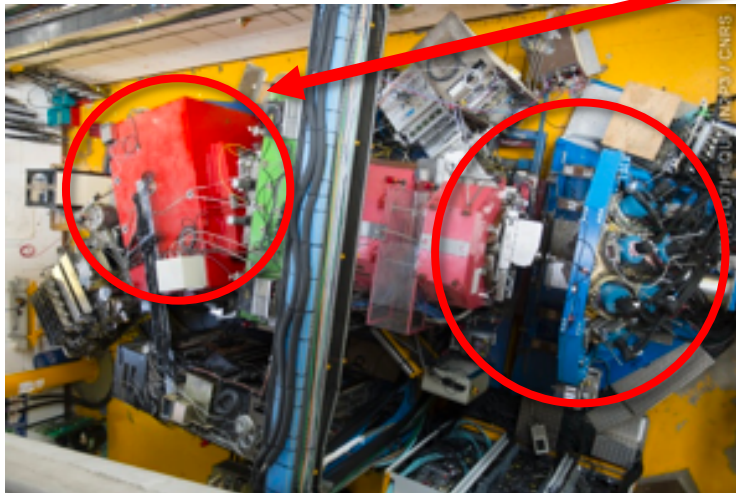
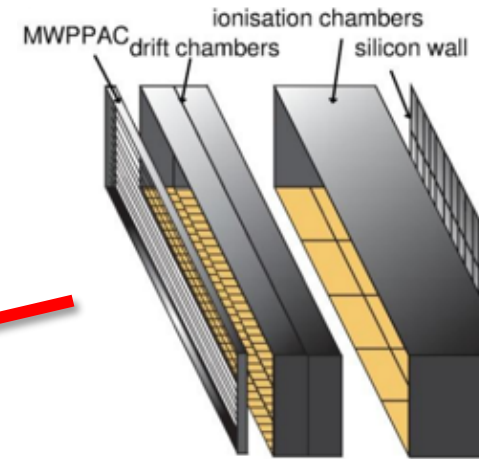
Interesting for both nuclear physics and understanding astrophysical objects such as neutron star, supernovae...

Experimental area (G)

Beam line :

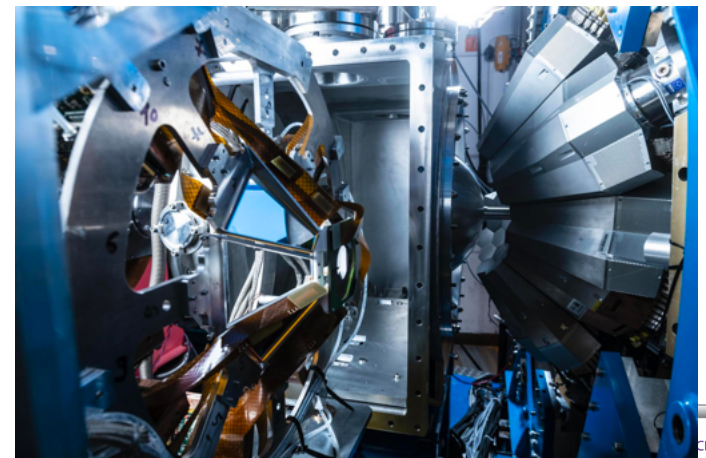


VAMOS : Heavy Ions

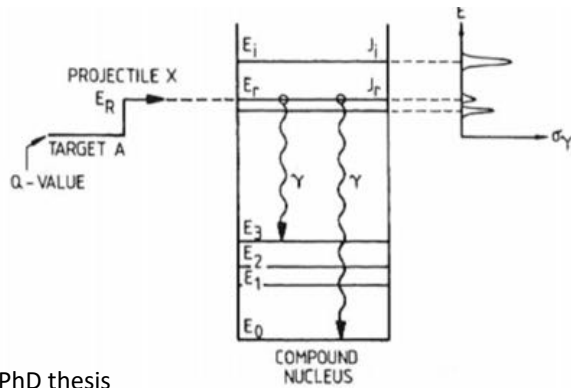
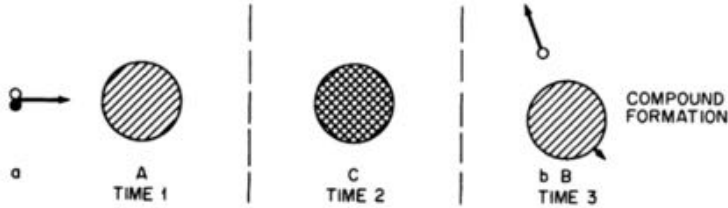


Mugast :
light particles

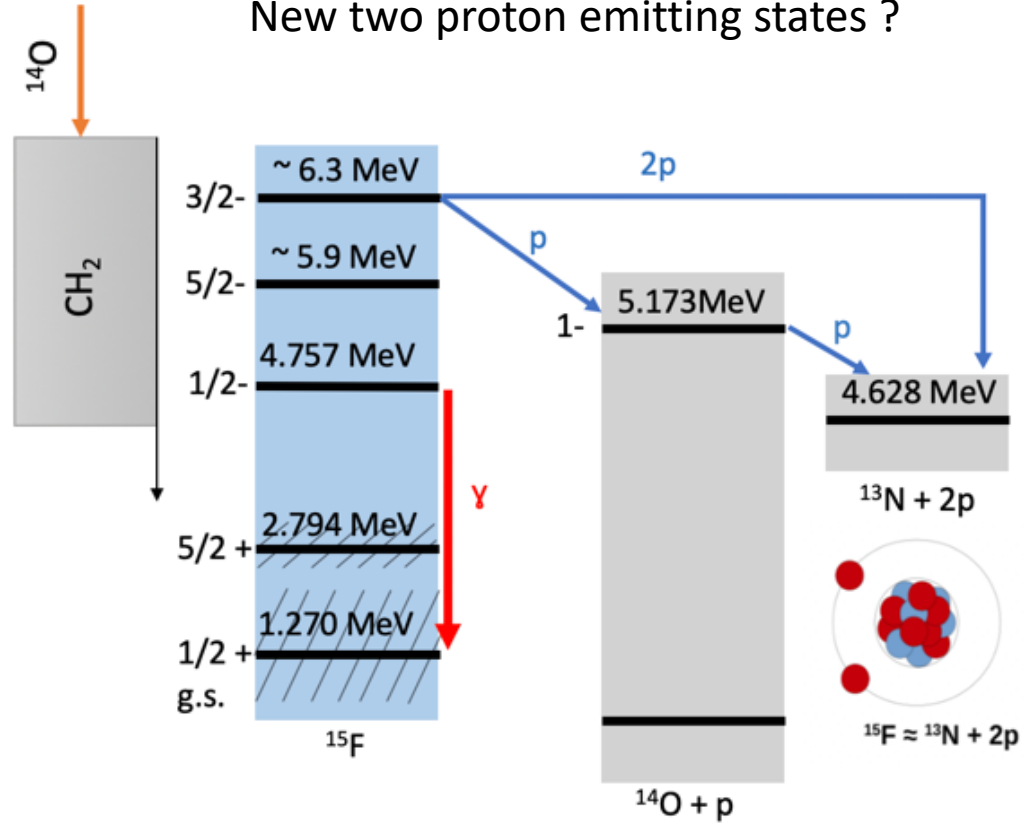
AGATA :
gamma particles



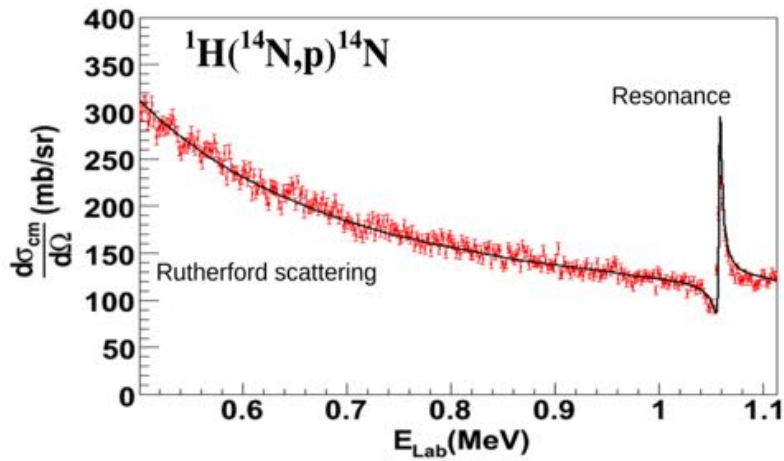
Motivations



New two proton emitting states ?



I. Stefan PhD thesis



PhD experimental setup

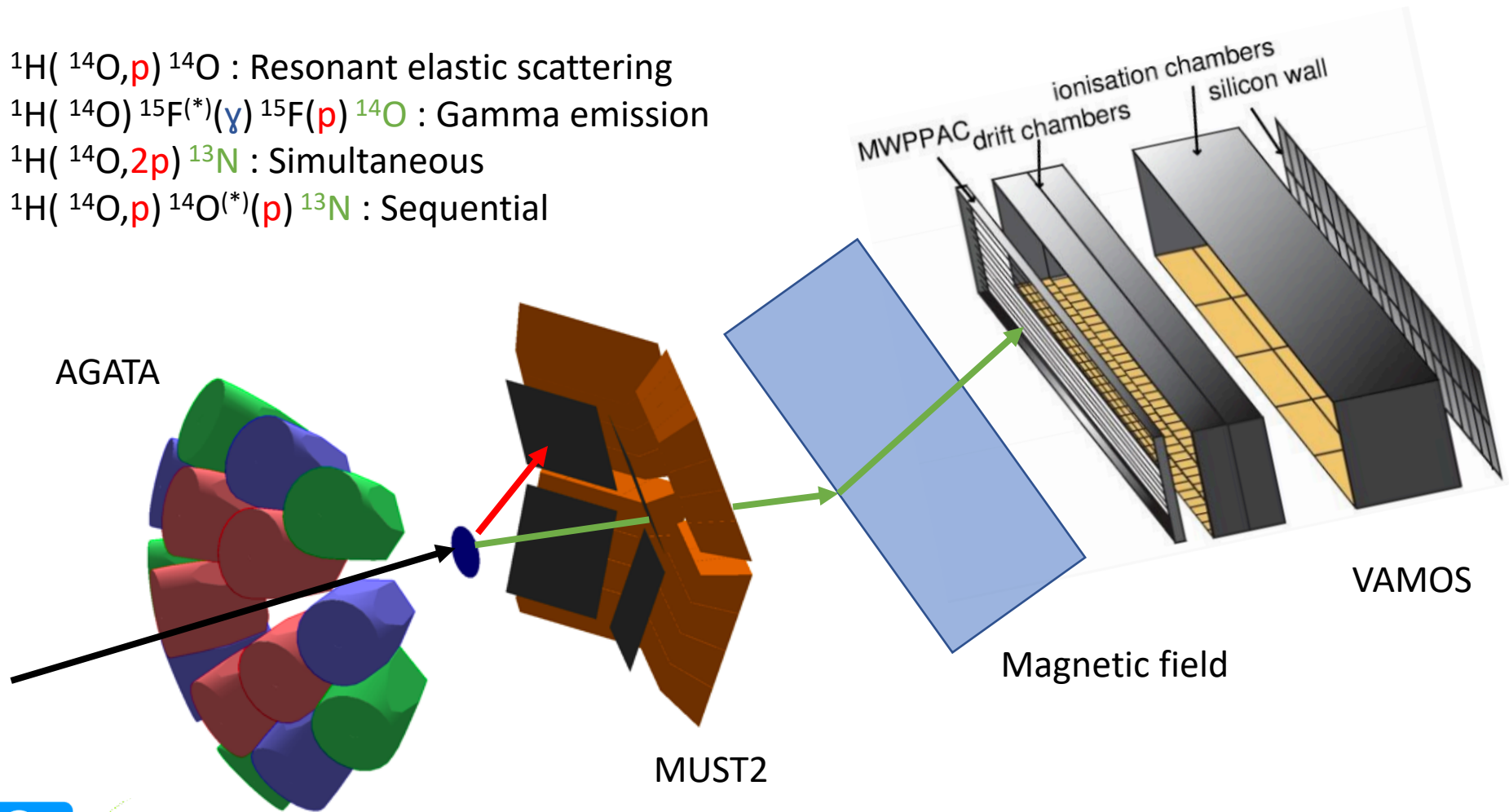
Nuclear reactions studied :

$^1\text{H}(^{14}\text{O},\text{p})^{14}\text{O}$: Resonant elastic scattering

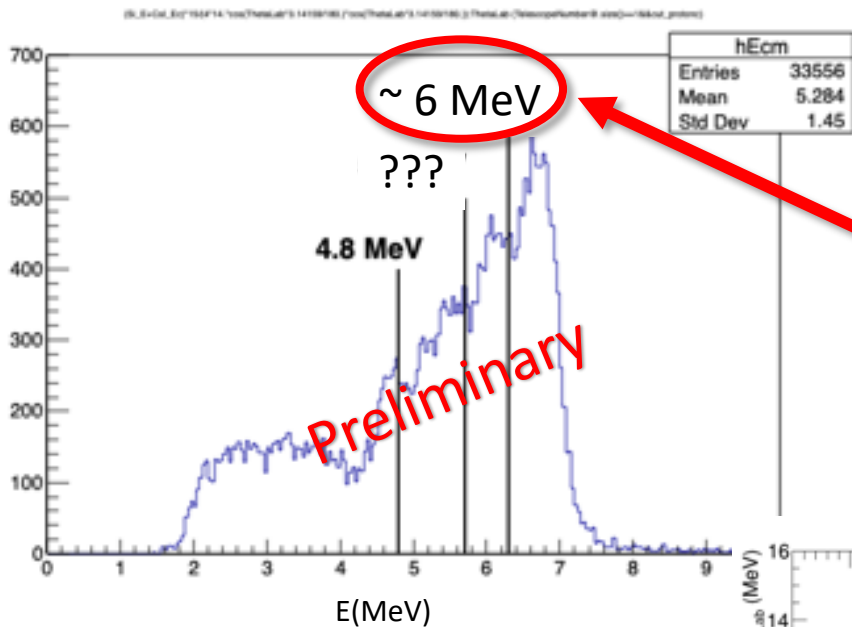
$^1\text{H}(^{14}\text{O})^{15}\text{F}^*(\gamma)^{15}\text{F}(\text{p})^{14}\text{O}$: Gamma emission

$^1\text{H}(^{14}\text{O},2\text{p})^{13}\text{N}$: Simultaneous

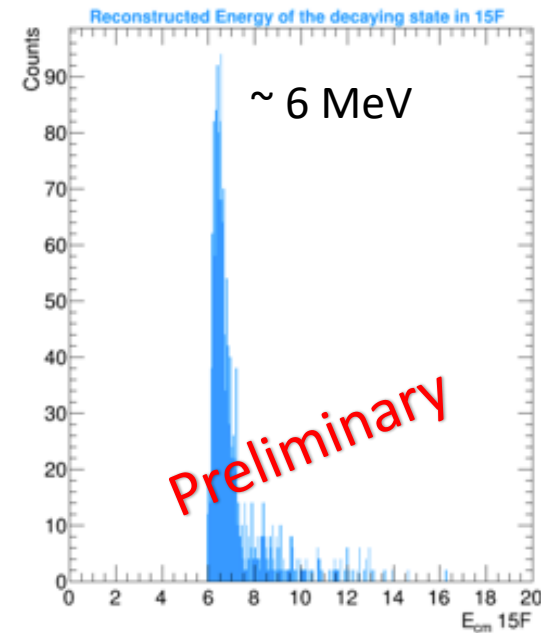
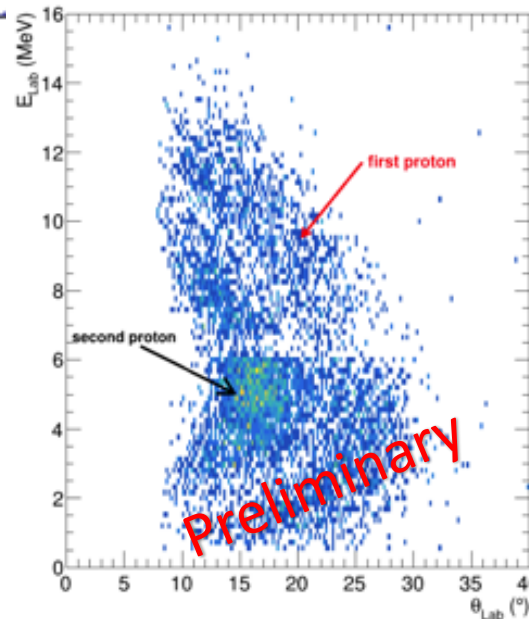
$^1\text{H}(^{14}\text{O},\text{p})^{14}\text{O}^*(\text{p})^{13}\text{N}$: Sequential



Preliminary results

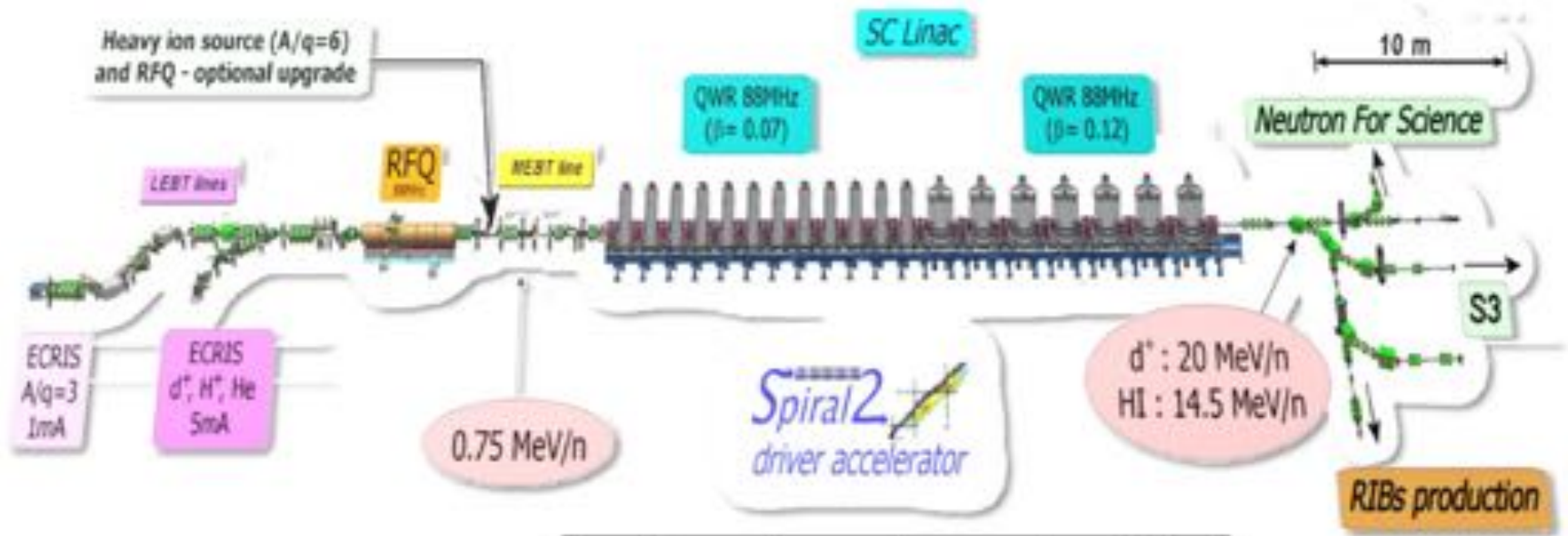


J	E (MeV)	Γ (keV)	Ex (MeV)
1/2-	4.8	35.1	3.5
3/2-	~ 6	29.2	5.0
3/2+	6.9	106.8	5.6



There seem to be a state that decrease by emitting two proton sequentially at the expected energy of ~ 6 MeV

SPIRAL 2



L'ASN autorise la mise en service de la phase 1 de l'extension SPIRAL2 [...]
 Publié le 08/07/2019x à 09:52

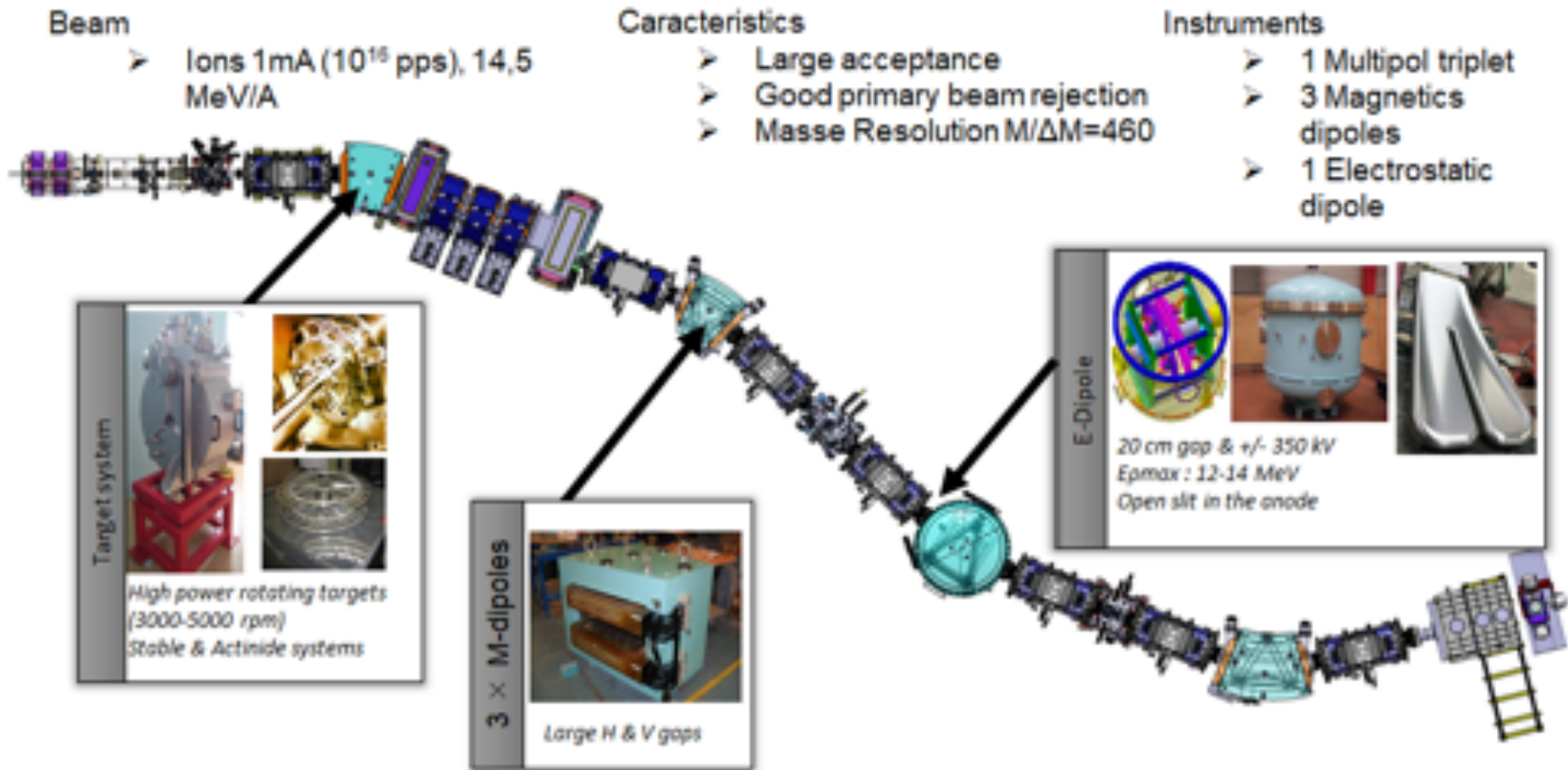
<https://www.asn.fr/Informer/Actualites/GANIL-mise-en-service-de-SPIRAL2>

	Q/A	I max (mA)	Energy (MeV/n)	CW max beam power (kW)
P	1/1	5	2 - 33	165
D	1/2	5	2 - 20	200
Ions	1/3	1	2 - 14.5	45
	1/7	1	2 - 8	48

SOURCE : Vide en milieu ionisants GANIL 22-24/11/2017 - P. Dolegievievz



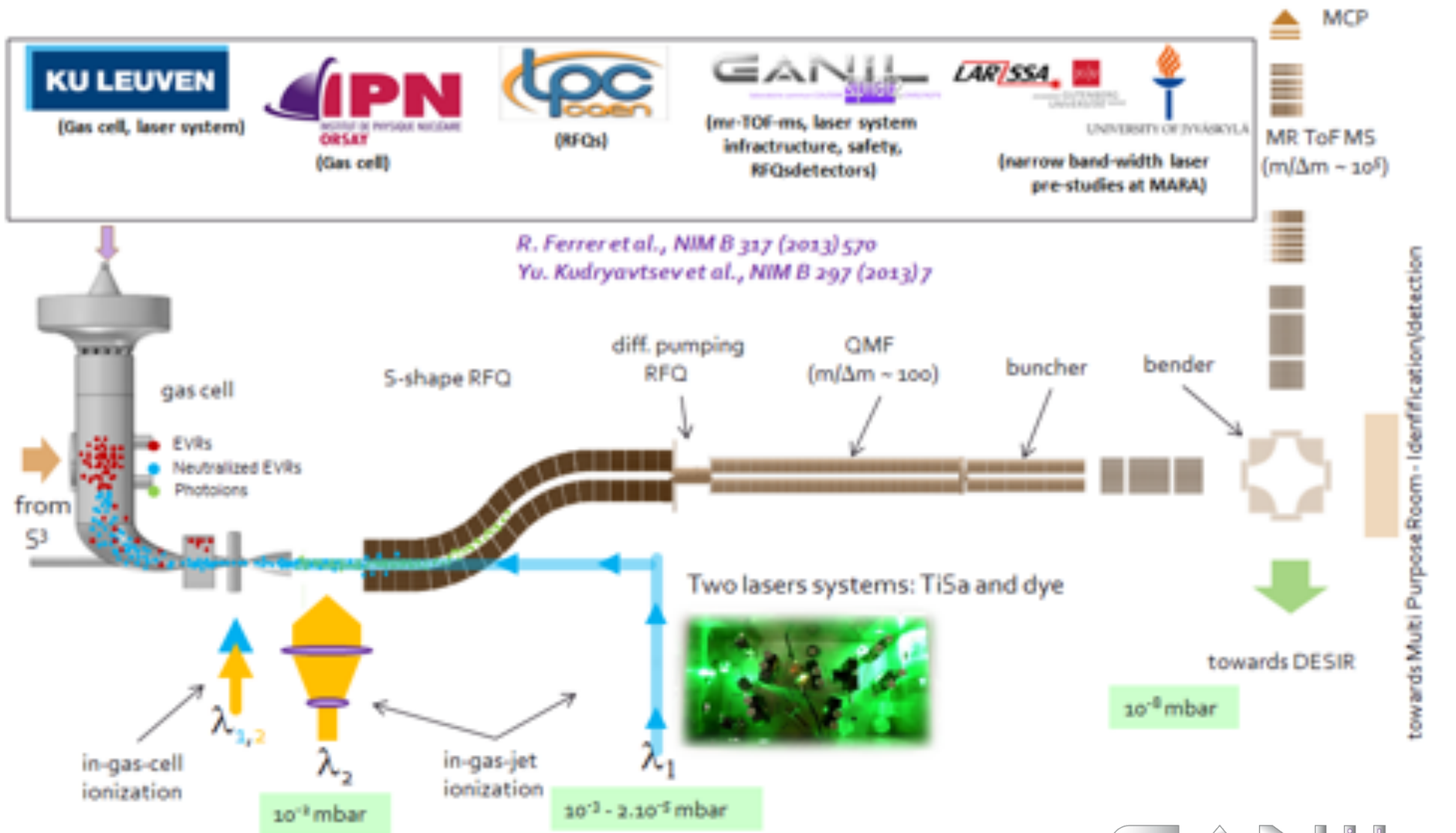
Super Separator Spectrometer



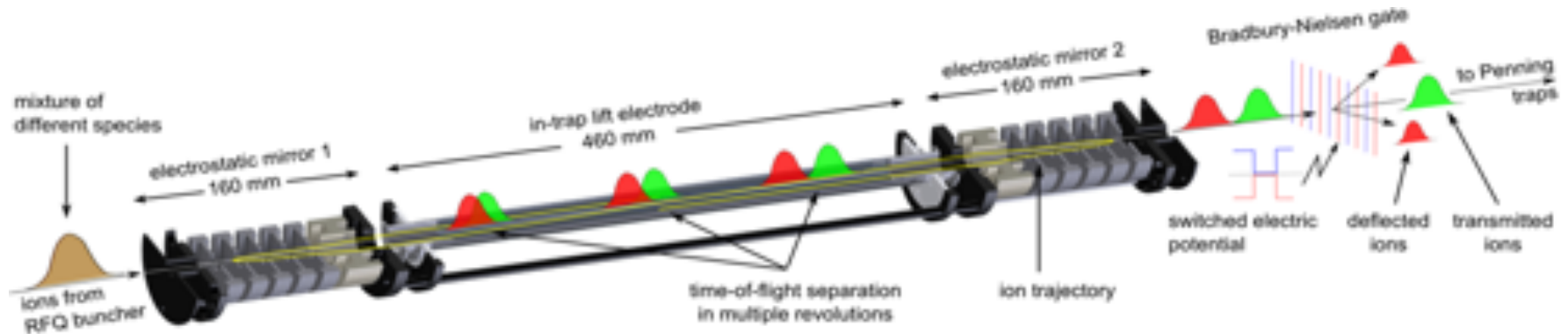
F. Déchery et al. NIMB376 (2016) 125.
F. Déchery et al., Eur. Phys. J. A (2015) 51: 66



REGLIS3



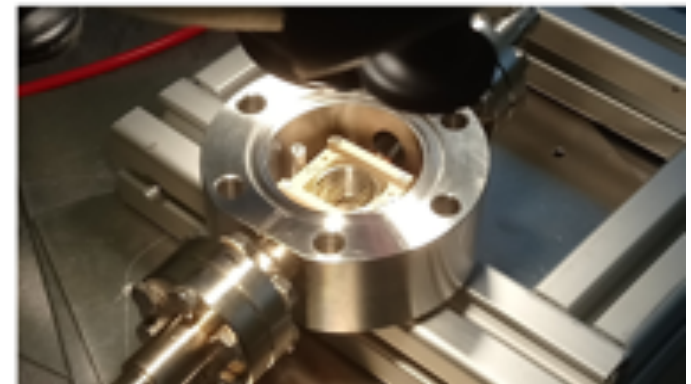
PILGRIM



Photograph Courtesy : R. N. Wolf (University of Greifswald)

PILGRIM

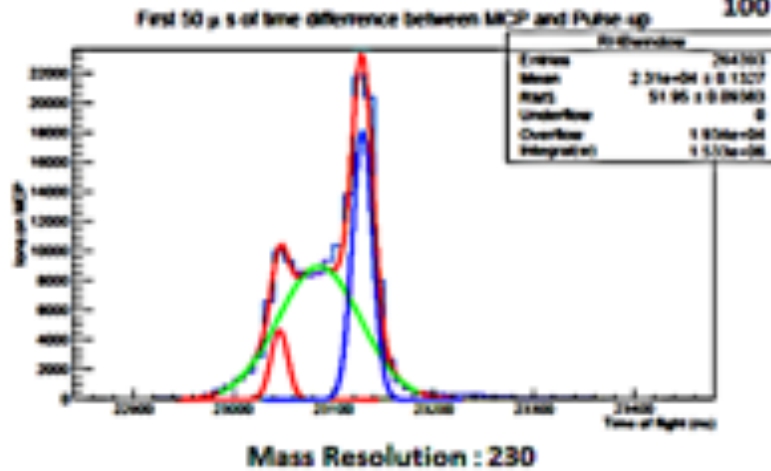
- Max resolution expected $M/\Delta M = 200000$
- Test with K ion source using B-N Gate
 - Determination of the resolution



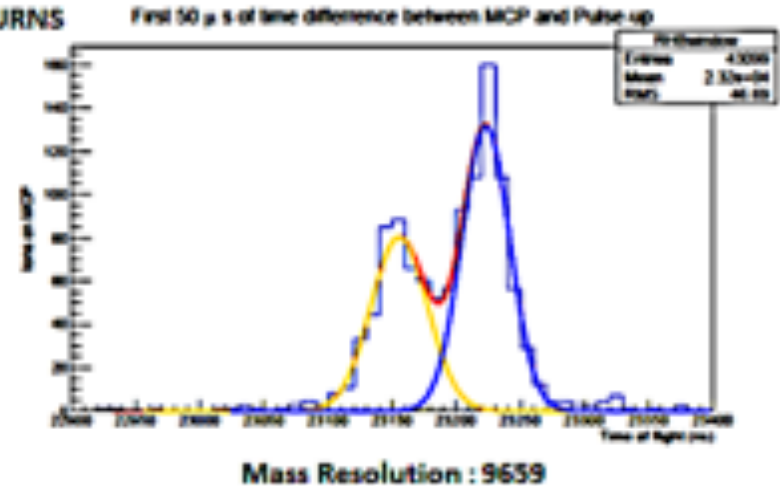
Time focusing and mass resolution

Tests with bunches of K

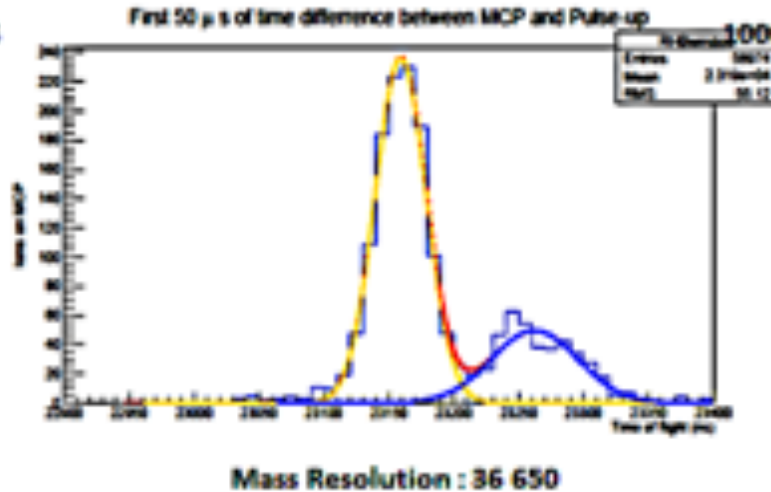
0 TURNS



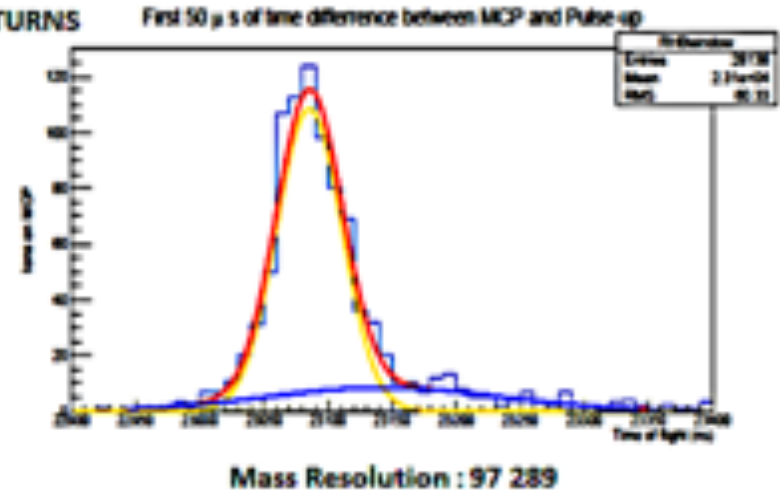
100 TURNS



500 TURNS



1000 TURNS



Thank you for your attention !