# FAZIA days

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 $\rightarrow$ Hoyle state radius should be **remeasured** 

- A resonant state of <sup>12</sup>C that lies at an energy approximately 7.65 MeV above the ground state
- According to all theoretical frameworks, the Hoyle State is larger than the Ground State by at least 20%
- No consensus on the Hoyle State Radius
- Experimentally, Hoyle State 0.5 fm larger than the Ground state radius

Main purpose of the experiment :

Measuring the single- and doubleexcitation of the Hoyle State cross section at low scattering angles.

• Experiment e881 :

A <sup>12</sup>C target was irradiated with a <sup>12</sup>C beam at an energy of 8.75 MeV/u. The emitted <sup>12</sup>C or three  $\alpha$  particles resulting from the decay of the projectile-like detected in FAZIA.

• FAZIA Multidetector : :

12 Blocks: Cover angles from  $2^{\circ}$  to  $13^{\circ}$ . 192 Telescopes: Composed of Si-Si-CsI



## Direct missing mass

#### Invariant & Indirect missing mass

When the projectile-like (excited or not) is scattered without decaying into other particles Direct <sup>12</sup>C detection Using 2-body kinematics, we extract the excitation energy of the projectile-like Probe excited states below the threshold emission, decaying via radiative transitions When the excited projectile-like decays into 3  $\alpha$ Using the conservation laws applied to the decay product ( $3-\alpha$ ) kinematical properties, we reconstruct the  $^{12}$ C. We extract the excitation energy of the projectile-like. Probe the angular distribution at angles

where no detection system is placed.



 $d\sigma \,/\, d\Omega$  (no corr, no norm)

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## Experiment E881

- <sup>12</sup>C at 8.75 MeV/A run in GANIL in April
- 8/14 UTs of 12C beam at 8.75 MeV/A on a target (Au, C, CH<sub>2</sub>)
- <sup>12</sup>C at 13.7 MeV/A in order to calibrate the second stage Si2
- 4.5UTs of 12C beam at 13.7 MeV/A delivered last week.

## List of tasks - FAZIA





- Possible energy values to be used for the Si1 calibration
  - Ground + First Excited states of <sup>12</sup>C ( <sup>12</sup>C & <sup>197</sup>Au )
  - Ground + Excited states using the transfer channels (<sup>11</sup>C & <sup>13</sup>C &
    - $^{11}\mathsf{B} \text{ and } ^{13}\mathsf{N}$  )
  - Tri-Alpha source

- Simulates the scattering of particles
- *E*<sub>lab</sub>(θ) from relativistic two-body kinematics
- Randomizes interaction
  depth
- Apply energy loss in target  $\Delta E_{\text{target}}$
- Scattering angles weighted by the Rutherford cross section
- Calculates energy loss in each detector alonng the particles path



## Calibration - Si2

 Possible energy values to be used for the Si1 calibration

— <sup>12</sup>C at 13.7 MeV/A
 — Elastic & Inelastic

(4.44 MeV, 9.65 MeV, ...)

 $\rightarrow$  Calibrate the second stage Si2



QL1 (adc units)

## Completed Tasks

- PSA- Si1 was completed for 137 detectors
- Si1-Si2 Identification was completed for 173 identification telescopes
- Si1-Csl Identification was completed for 162 identification telescopes
- Si1 Calibration was completed for 135 detectors



• Some Si1 show some issues to be fixed :

- Subtraction of the baseline
- Shapers parameters, etc ..



QL1 (adc units)

 $\rightarrow$  Signal Processing should be performed on these Si1 detectors !!

## Thank you for your attention