A NEW calorimeter telescope for heavy ion detection

RISING

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HOW TO IDENTIFY HEAVY IONS AT RELATIVISTIC ENERGIES ?

1. The RISING set-up

Synchrotron accelerated HI-beam

GSI-Fragment Separator

CATE

2.

Si-ΔE
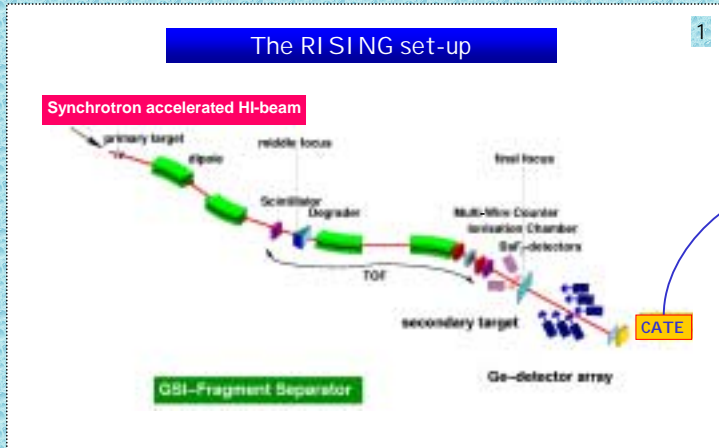
CsI(Tl)-E

- A NEW Calorimeter Telescope array (CATE) is being developed for the RISING (Rare Isotope Investigations at GSI) γ-campaign [1].

- It is meant to identify charge and mass of exotic heavy ions after secondary reactions at relativistic energies of 100 – 200 MeV/n.

- CATE will consist of nine Si and CsI(Tl) detector telescopes for ΔE-E measurement [2].
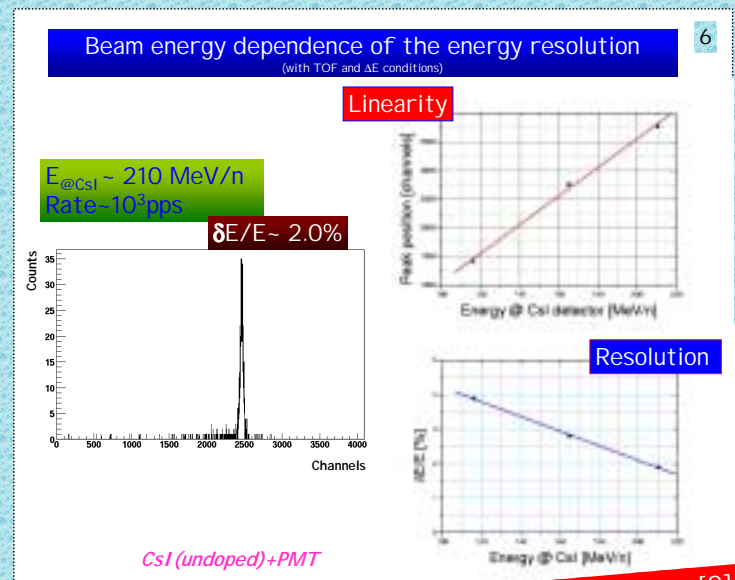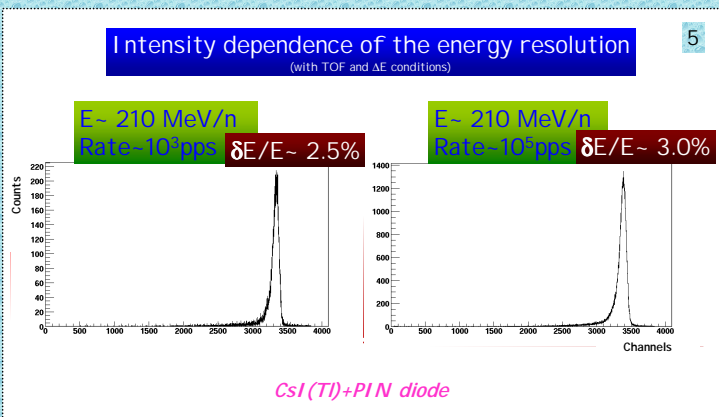
3. The experimental test set-up

First prototype tests have been performed and are presented here [HK 12.29] and in [HK 12.8]. For the E-detector test the following set-up was used:

Beam energy : 116 MeV/n, 210 MeV/n, 165 MeV/n
Beam type : ^{48}Ca
Beam intensity : $10^2 - 10^5$ pps

4. The prototypes

PIN diode

PMT

The CsI scintillator was tested with either PMT or PIN diode read-out.

5. Intensity dependence of the energy resolution
(with TOF and ΔE conditions)

E~ 210 MeV/n Rate~10^3pps δE/E~ 2.5%

E~ 210 MeV/n Rate~10^5pps δE/E~ 3.0%

CsI(Tl)+PIN diode

6. Beam energy dependence of the energy resolution
(with TOF and ΔE conditions)

Linearity

$E_{@CsI}$~ 210 MeV/n Rate~10^3pps

δE/E~ 2.0%

Resolution

CsI(undoped)+PMT

The test of CATE-prototype E-detectors revealed an energy resolution of about 2% with PMT read-out at low beam intensity. At higher beam intensity the resolution strongly deteriorated due to overloading of the used PMT. With PIN diode read-out almost no rate dependence was observed. The achieved resolution increased with increasing the particle energy. Further development is going on to achieve optimal resolution at 100 MeV/n as well as at higher rates.

The resolution δE/E of 2.0% to 3.0% achieved in this and in the previous tests [2] is sufficient for mass (A~100-200) identification of an incident particle produced by reactions at the RISING secondary target. Therefore those type detectors will be employed for the Fast-beam RISING campaign.

References:

[1] http://www-aix.gsi.de/~wolle/EB_at_GSI/main.html
[2] http://www-linux.gsi.de/~lozeva/cate.html

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