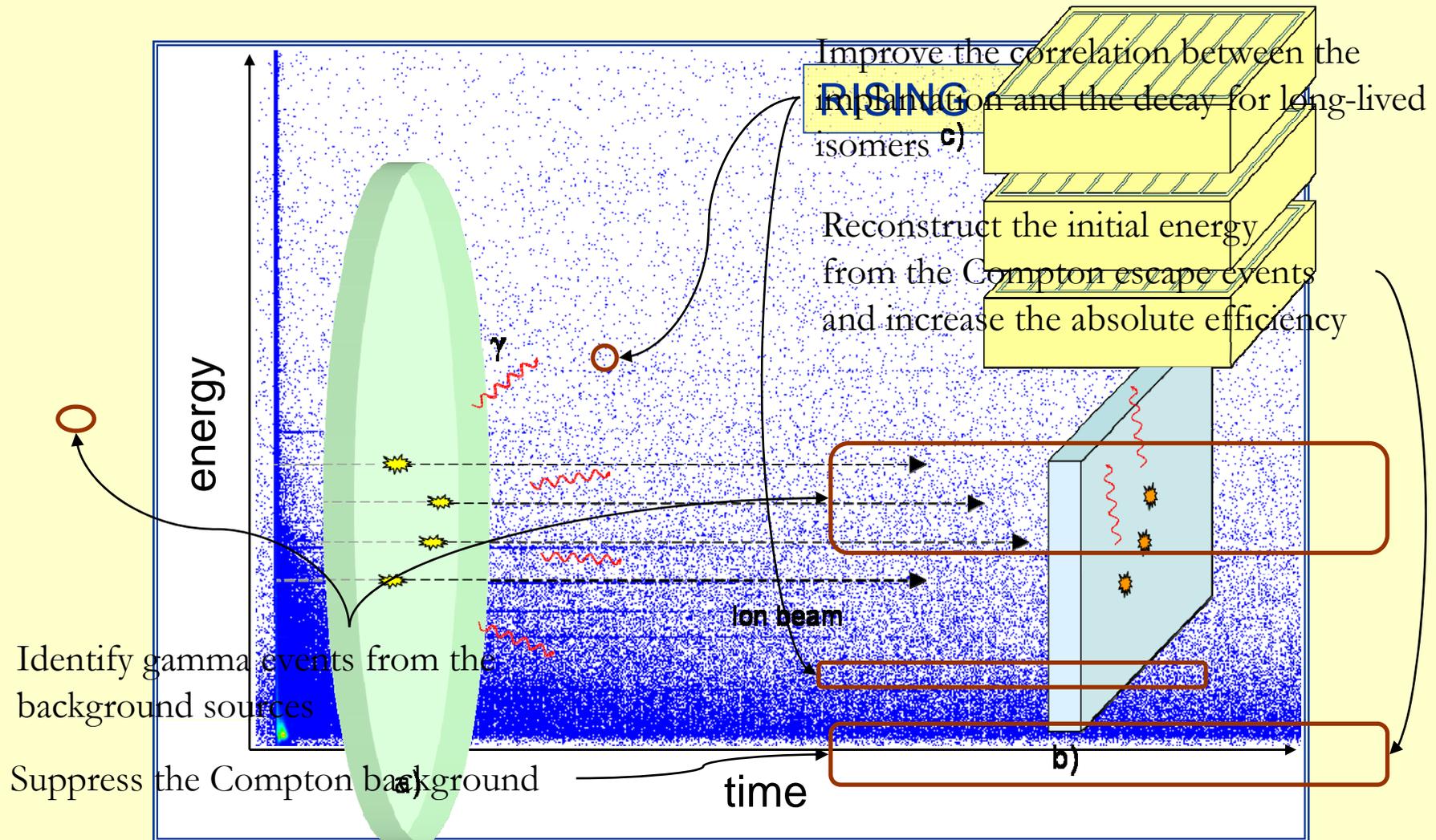
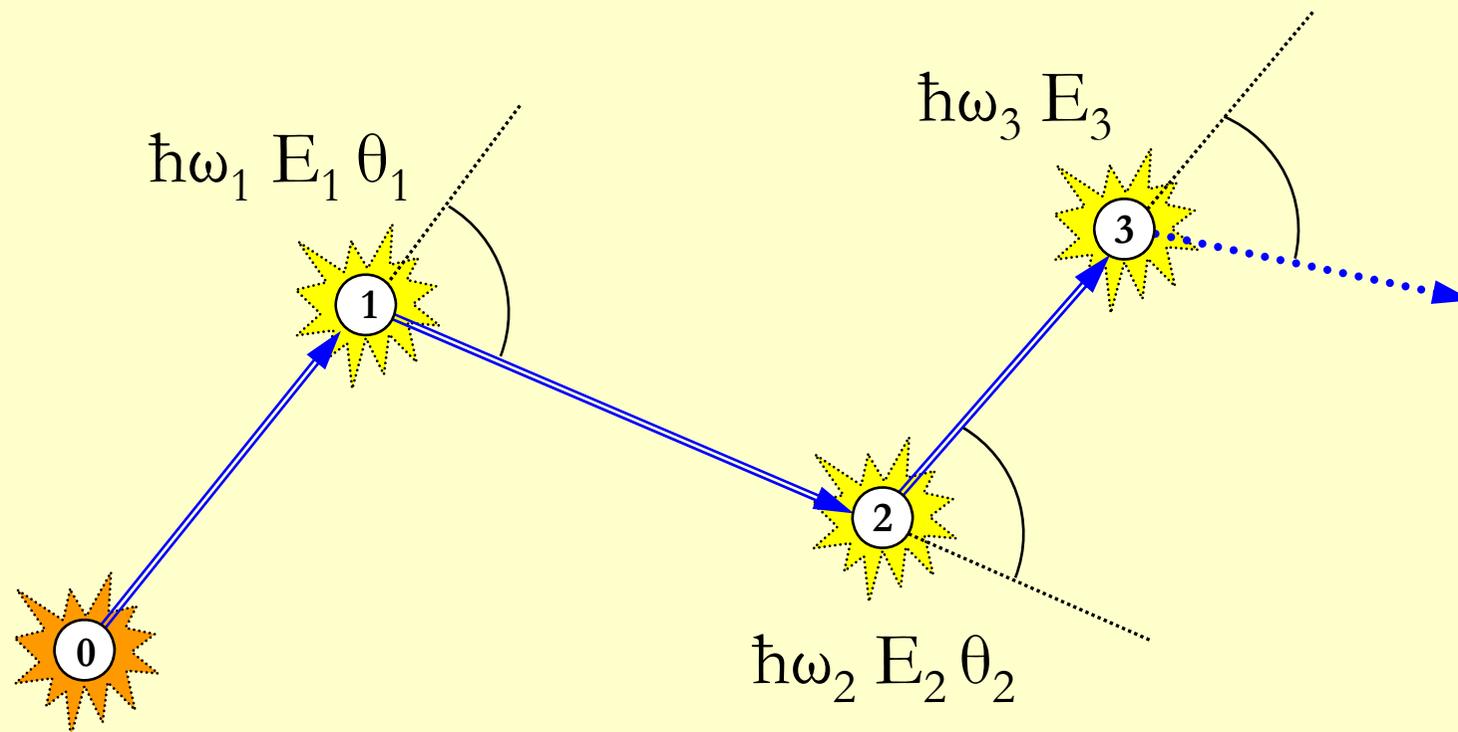


Gamma-ray tracking and background suppression in the planned germanium array of DESPEC: a comparative analysis

Stanislav Tashenov, KTH, Stockholm



New Tracking Principles



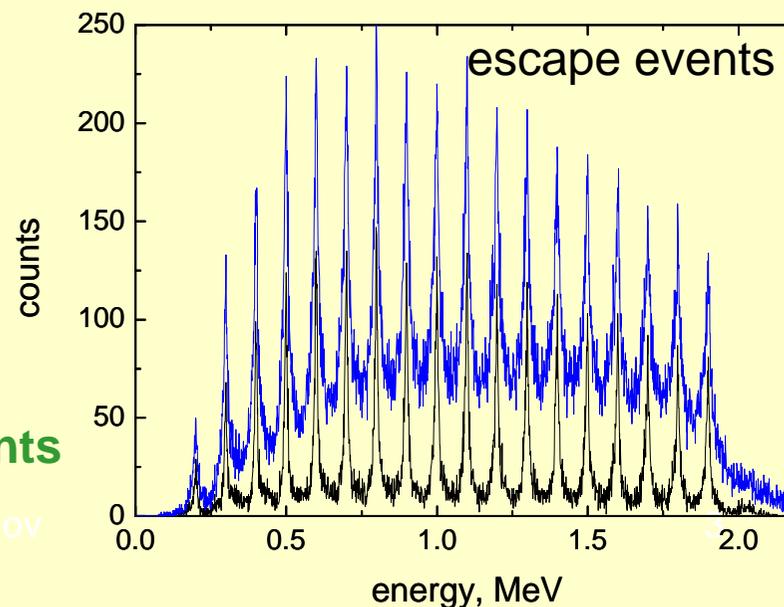
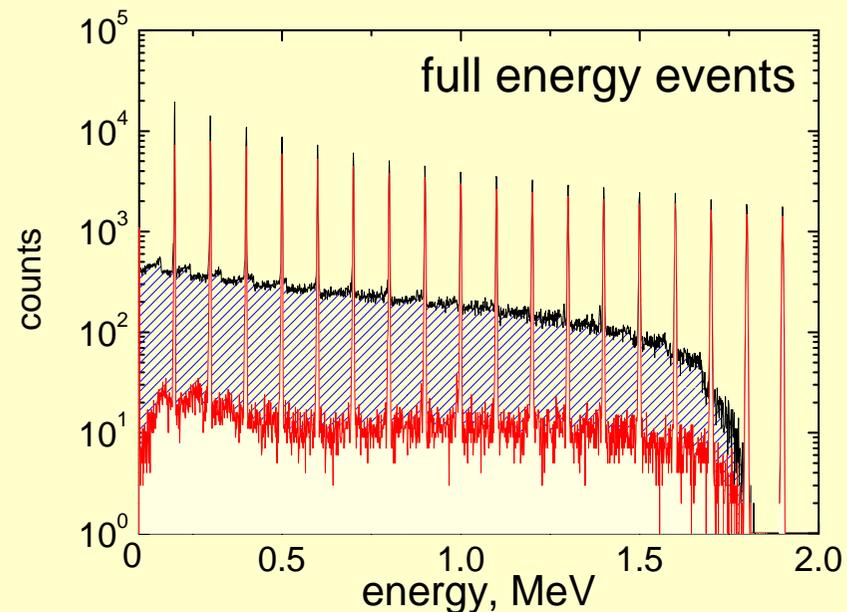
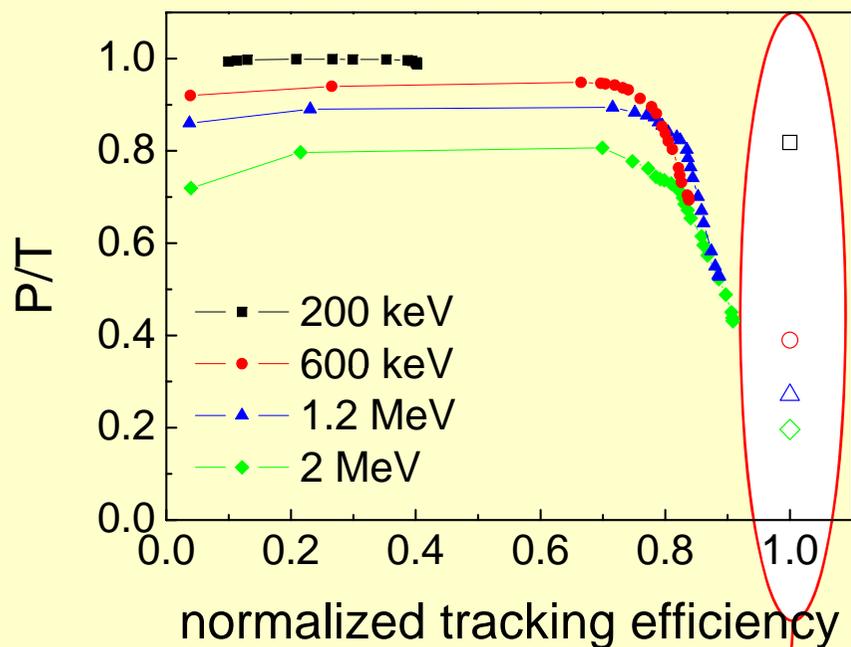
Identification of the Compton escapes:

Rather than selecting “good” events using a threshold on χ^2

Analyse the full-energy and the escape events separately

No threshold in the algorithm

Performance of tracking (1 mm position resolution)



| Energy | normalized tracking efficiency | | |
|--------|--------------------------------|---------|-------|
| MeV | full-energy | escapes | total |
| 0.6 | 0.75 | 0.35 | 1.1 |
| 1.2 | 0.8 | 0.65 | 1.45 |
| 2 | 0.8 | 0.7 | 1.5 |

Tracking can:

1) determine the sequence of the scatterings

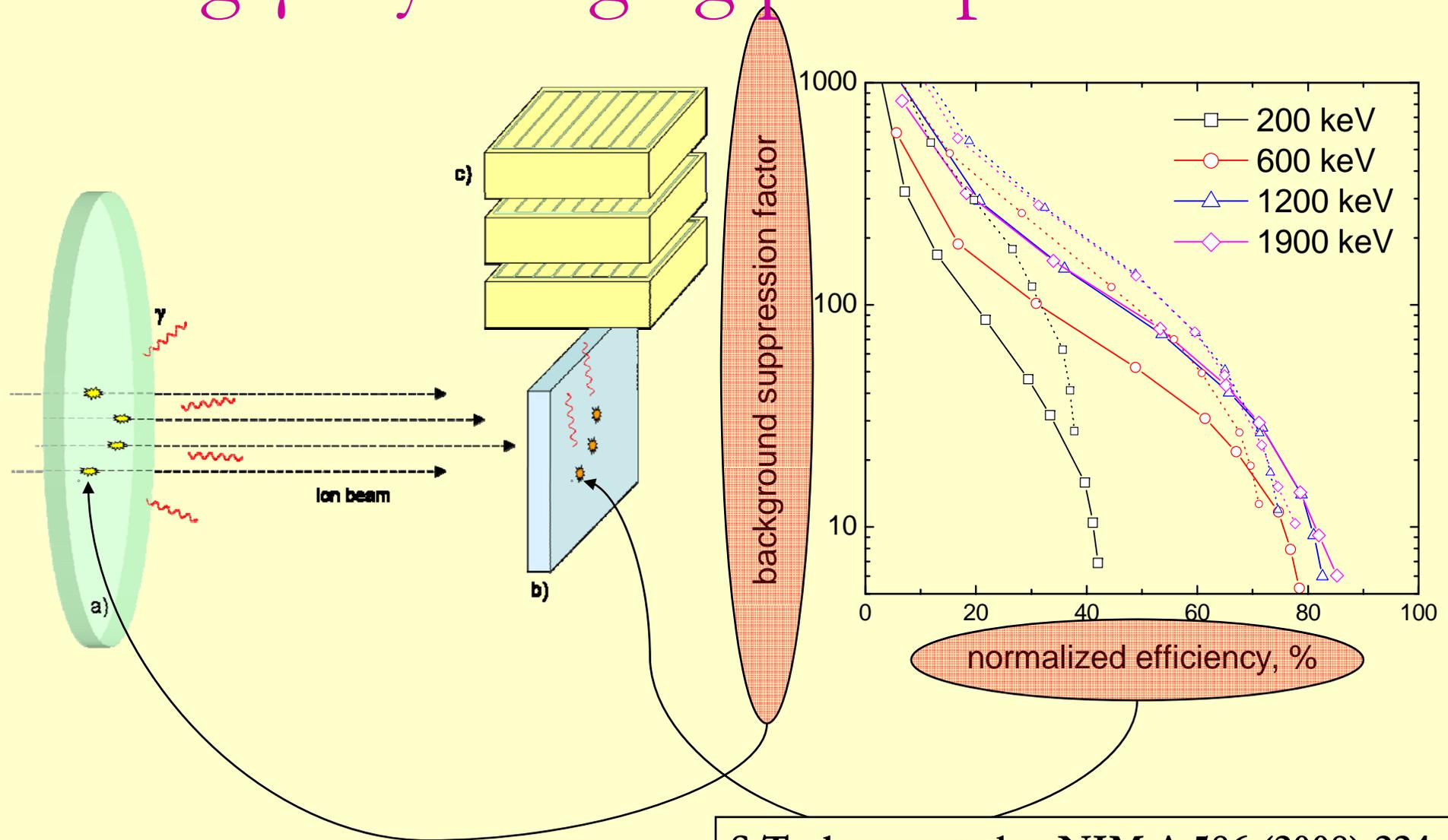
2) suppress Compton escapes

3) obtain the initial energy for the escape events !!!

© 1998

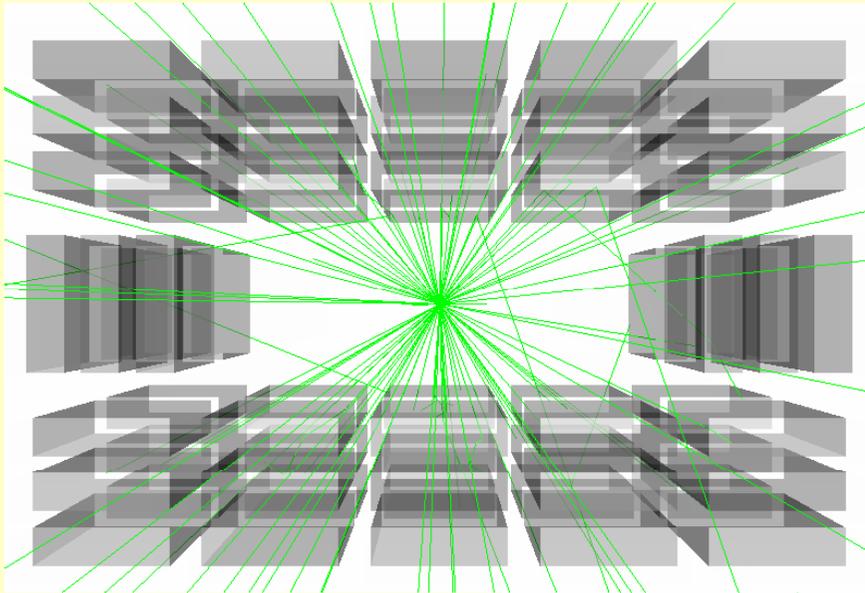
Stanislav Tishenov

Background radiation suppression using γ -ray Imaging principles

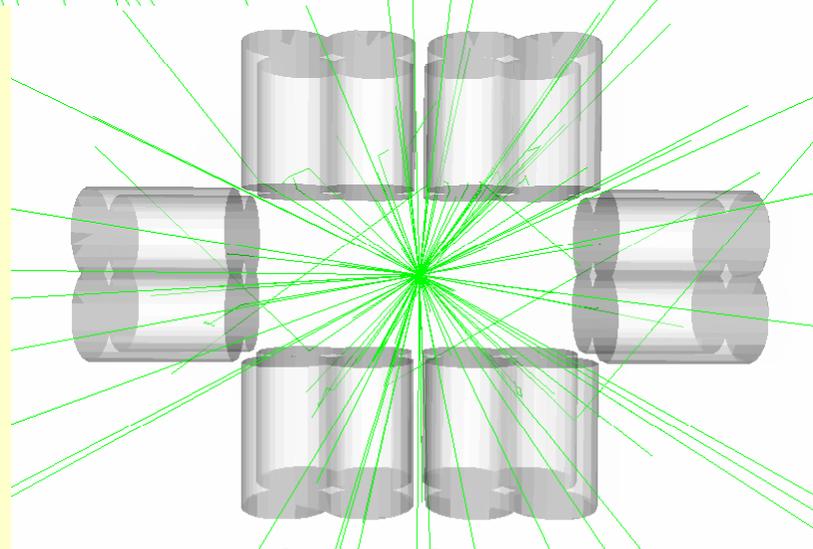
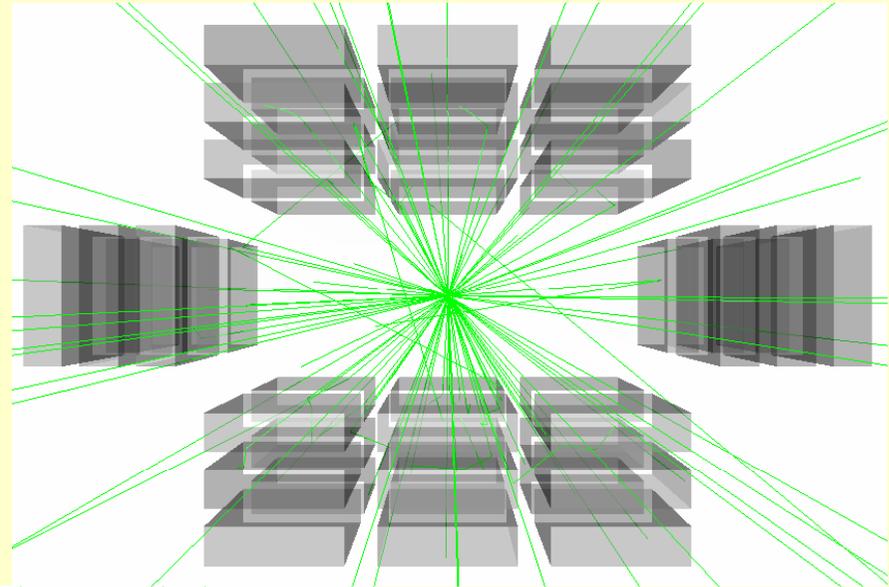


DESPEC: Considered configurations

24 planar modules



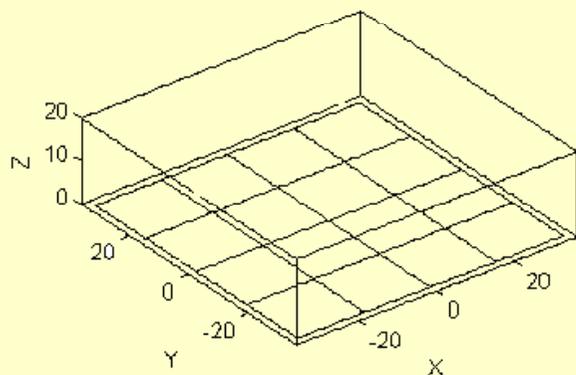
16 planar modules



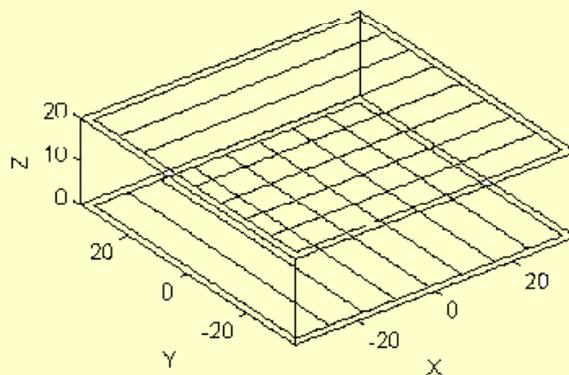
6 clover detectors

Detectors

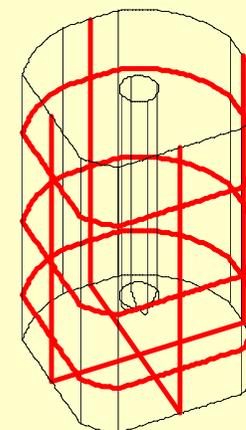
4x4 pixels + anode
(17 channels)



8+8 cross-strips
(16 channels)



16-segment clover



| | Position resolution, mm | | segmented clover |
|-----------------------|-------------------------|------|------------------|
| single interactions | 2.3 | 1.14 | 2.8 |
| multiple interactions | 3.92 | 2.2 | 6.0 |

02.09.2008

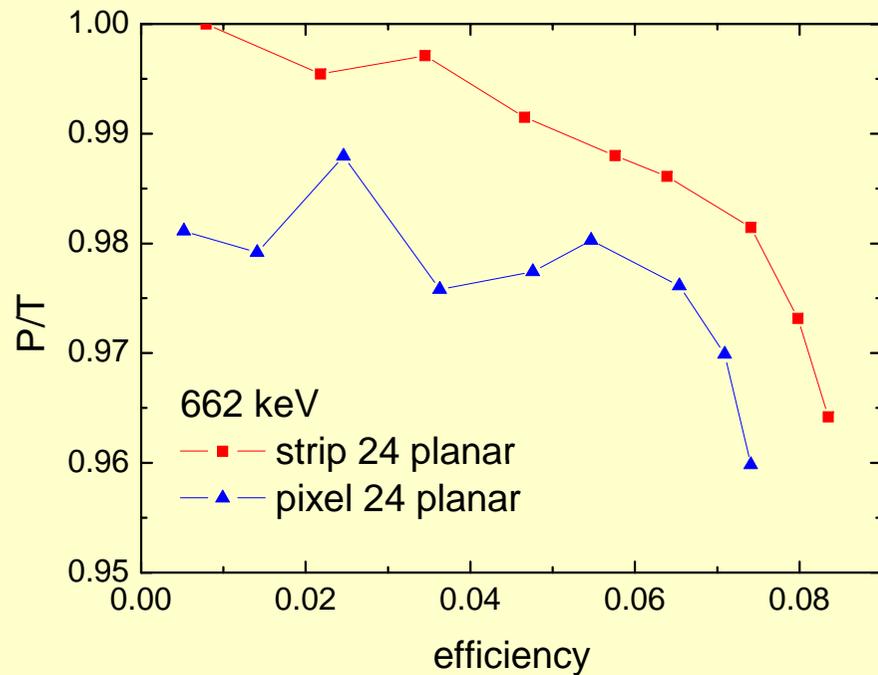
Stanislav Kashenov

10

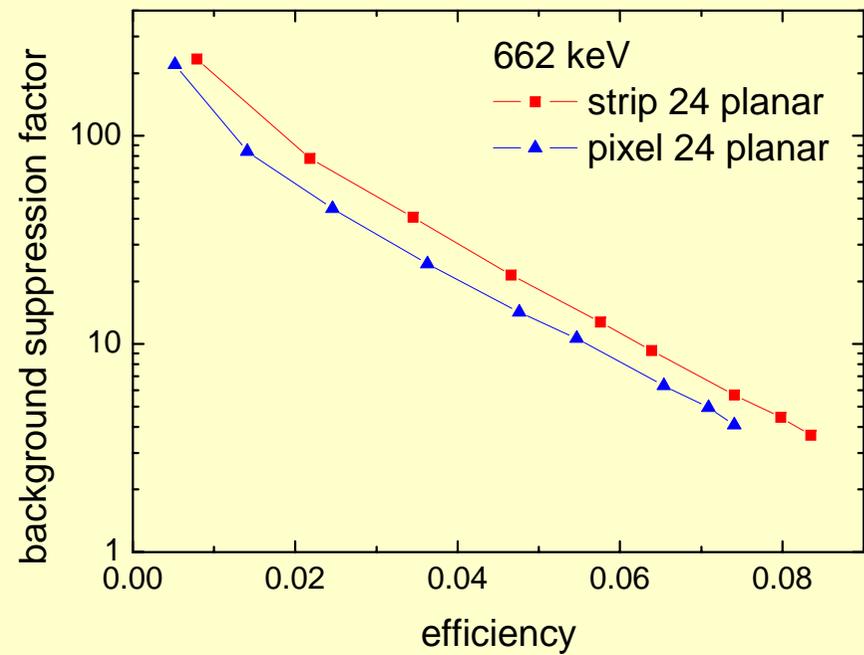
A. Khaplanov et al., NIM A 592 (2008) 325

Planar detectors

Compton suppression

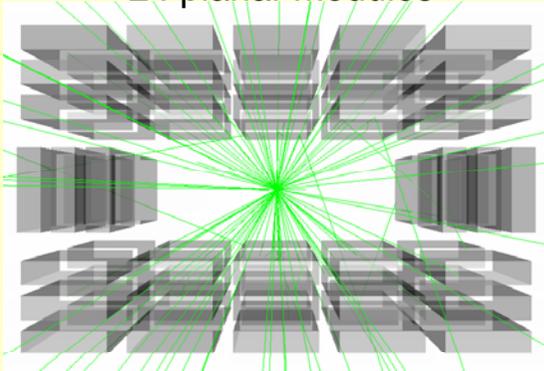


Ambient Background suppression

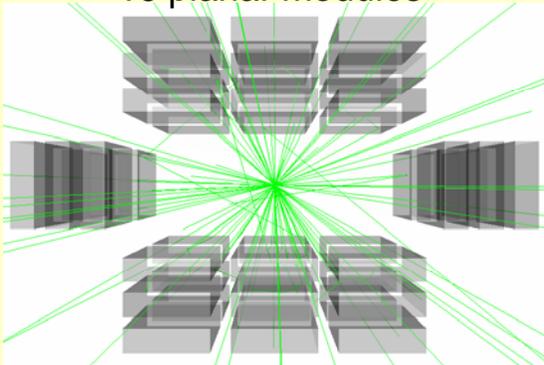


Planars vs segmented Clovers

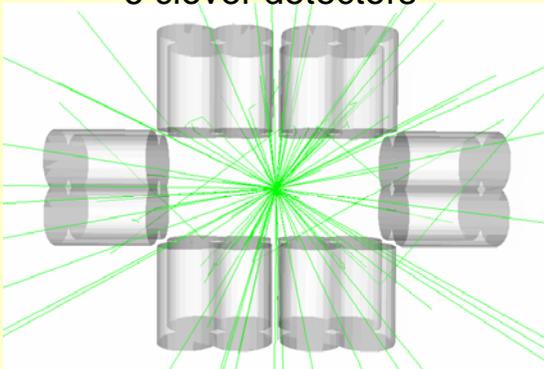
24 planar modules



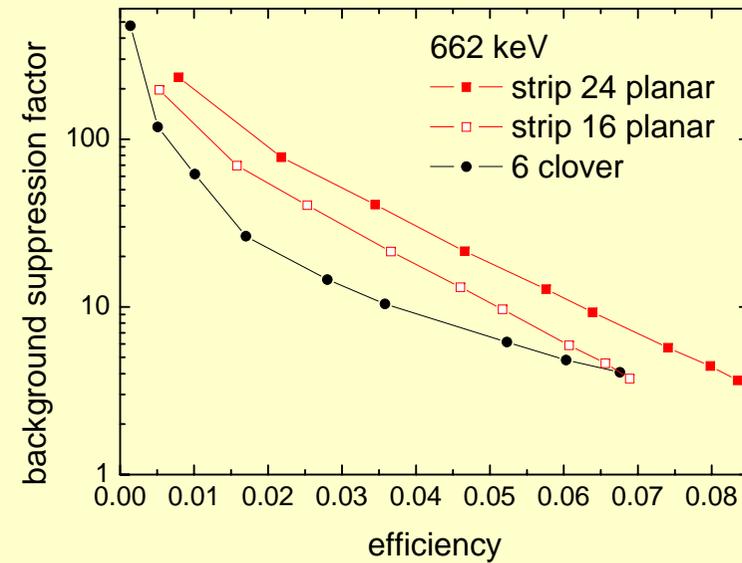
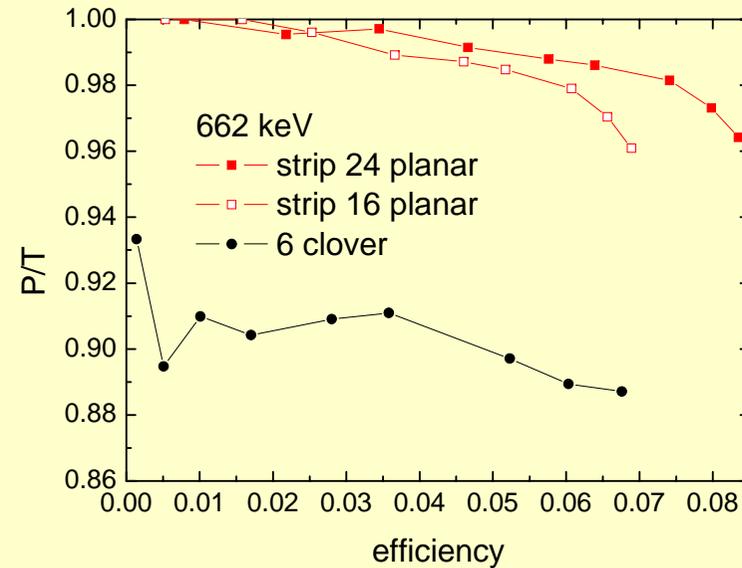
16 planar modules



6 clover detectors

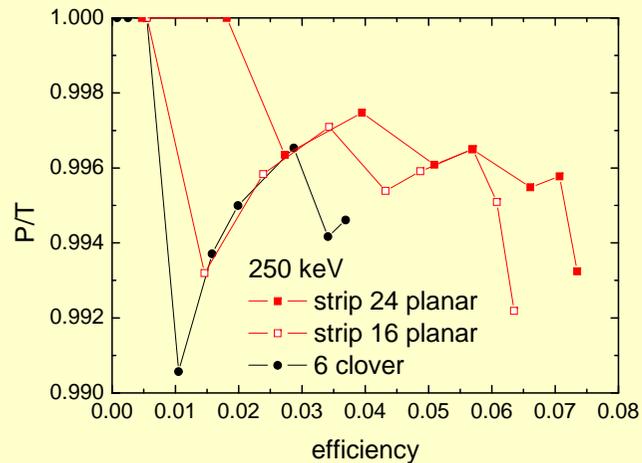


662 keV

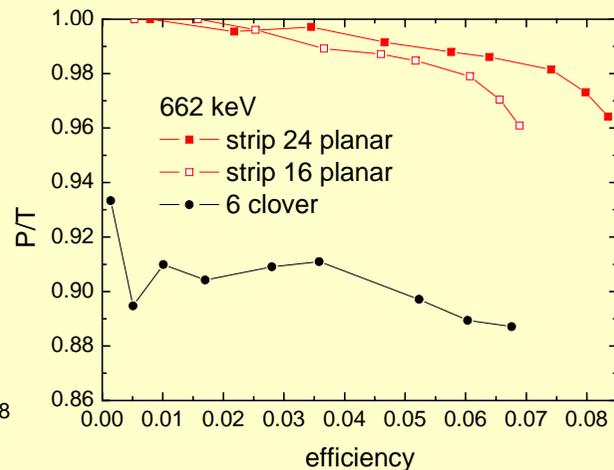


Planars vs segmented Clovers

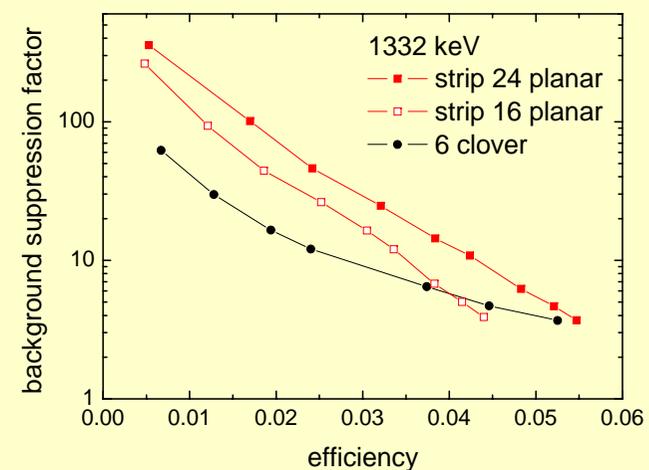
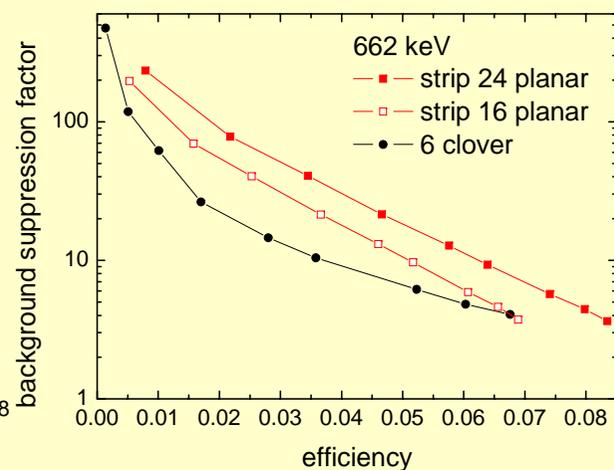
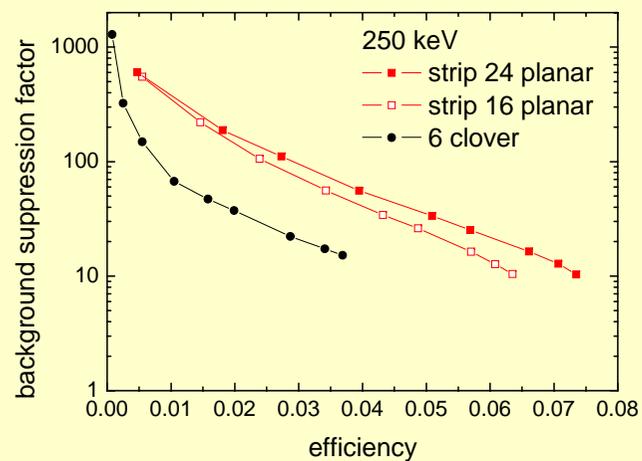
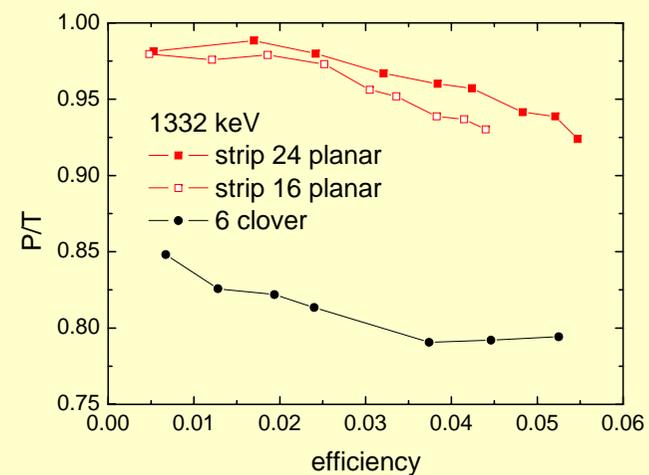
250 keV



662 keV

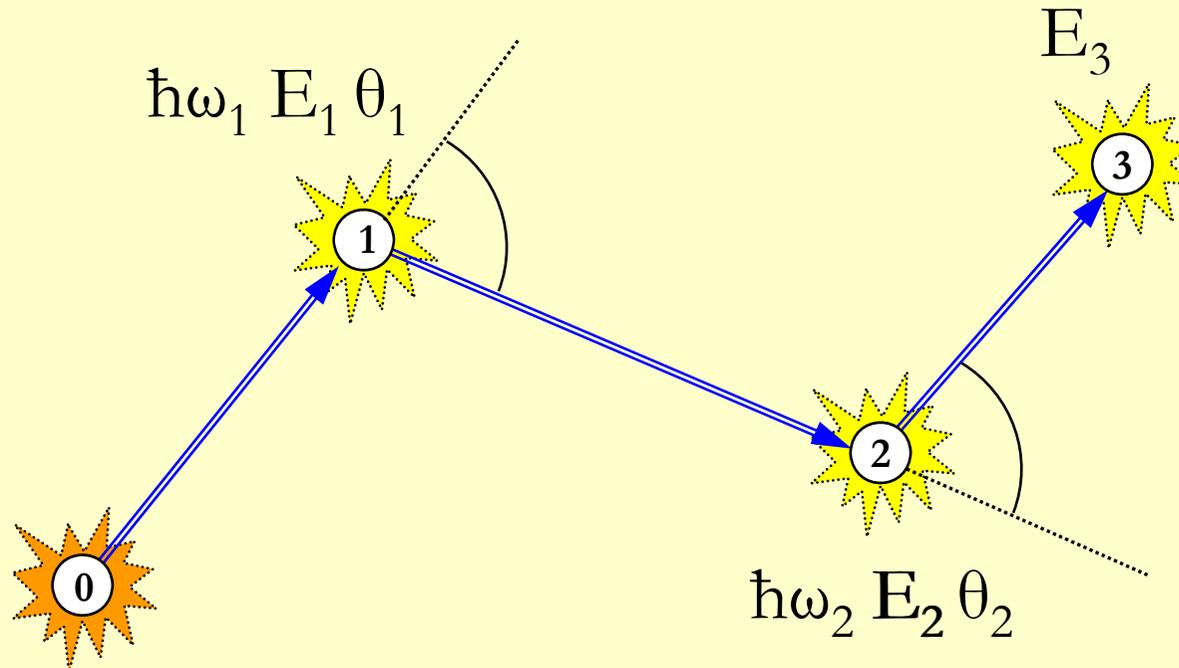


1332 keV



Thank you!

Checking for a **full-energy** event



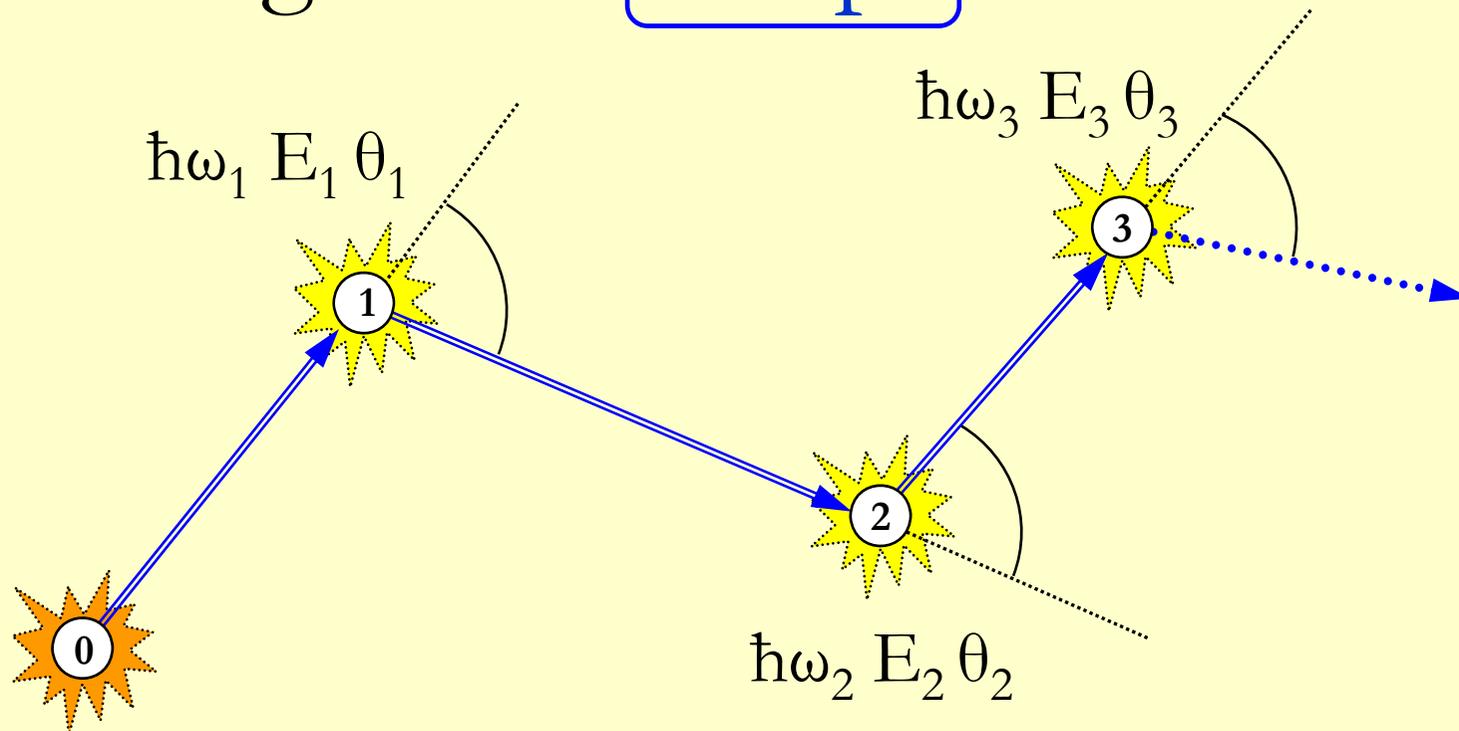
$$\hbar\omega_1 = E_1 + E_2 + E_3$$

$$\hbar\omega_2 = E_2 + E_3$$

$$\hbar\omega_1 - E_1 \stackrel{?}{=} \frac{\hbar\omega_1}{1 + \frac{\hbar\omega_1}{mc^2}(1 - \cos\theta_1)}$$

$$\hbar\omega_2 - E_2 \stackrel{?}{=} \frac{\hbar\omega_2}{1 + \frac{\hbar\omega_2}{mc^2}(1 - \cos\theta_2)}$$

Checking for an escape event



$$\hbar\omega_1^{(1)} = \frac{E_1}{2} + \sqrt{\frac{E_1^2}{4} + \frac{Emc^2}{1 - \cos\theta_1}} = F(E_1, \theta_1)$$

$$\hbar\omega_1^{(2)} = E_1 + \hbar\omega_2 = E_1 + F(E_2, \theta_2)$$

$$\hbar\omega_1^{(1)} = \hbar\omega_1^{(2)}$$

$$E_3 < \hbar\omega_3 \frac{2\hbar\omega_3}{2\hbar\omega_3 + mc^2}$$