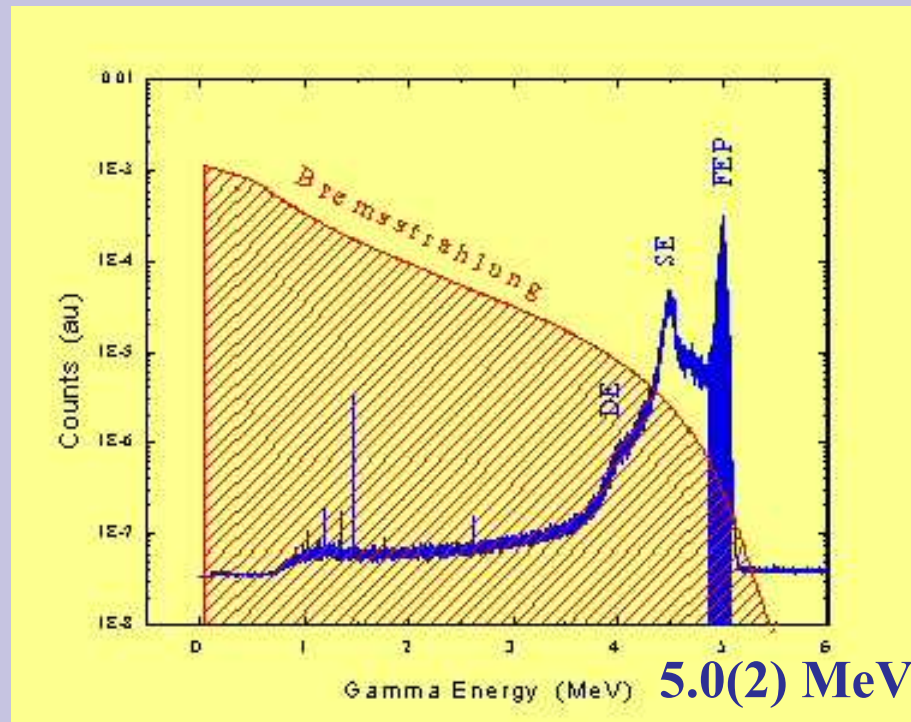


Nuclear Resonance Fluorescence: HIGS vs. Bremsstrahlung



Bremsstrahlung:

- continuous energy spectrum
- max. 10-30% polarization

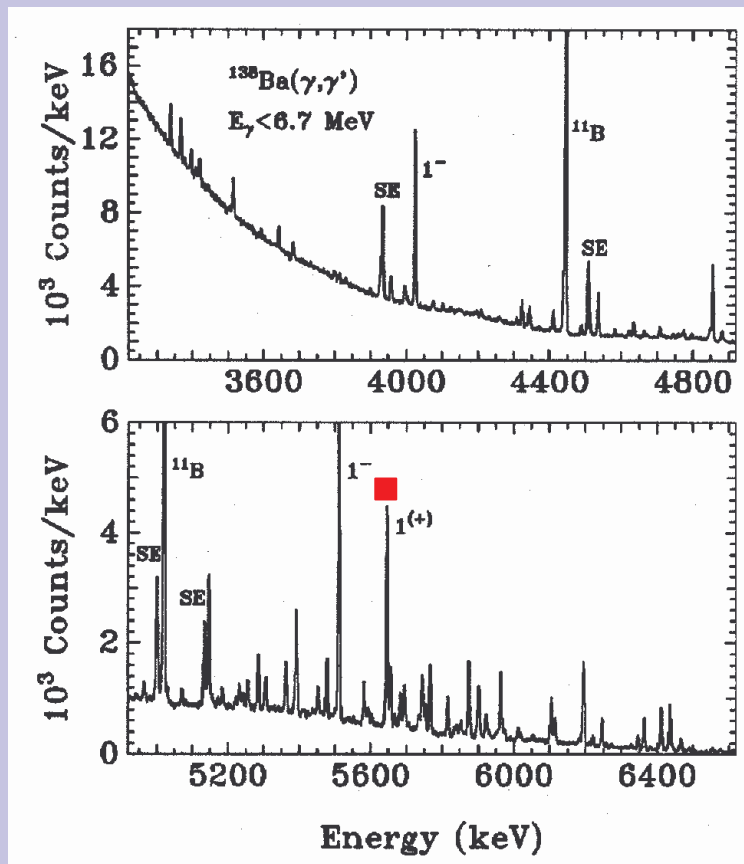
S-DALINAC (Darmstadt)	10 MeV
Dynamitron (Stuttgart)	4.3 MeV
ELBE (FZ Rossendorf)	20 MeV

HIGS:

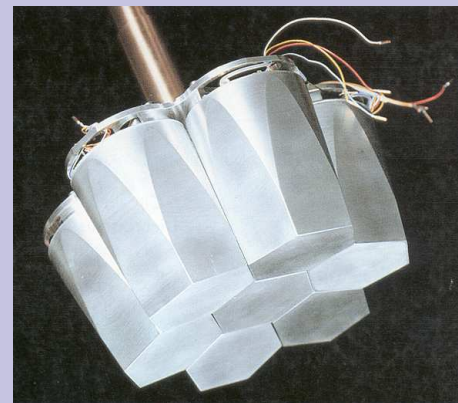
- “monochromatic” γ -energy
- 100% linear polarization

“Old-fashioned” NRF experiment using 2 Cluster detectors at S-DALINAC

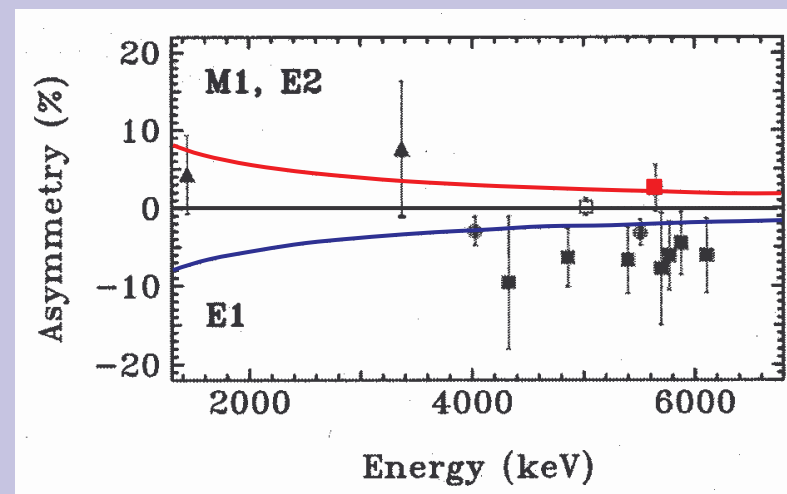
end-point energy: 6.7 MeV



R.-D. Herzberg et al., PRC 60 (1999) 051307

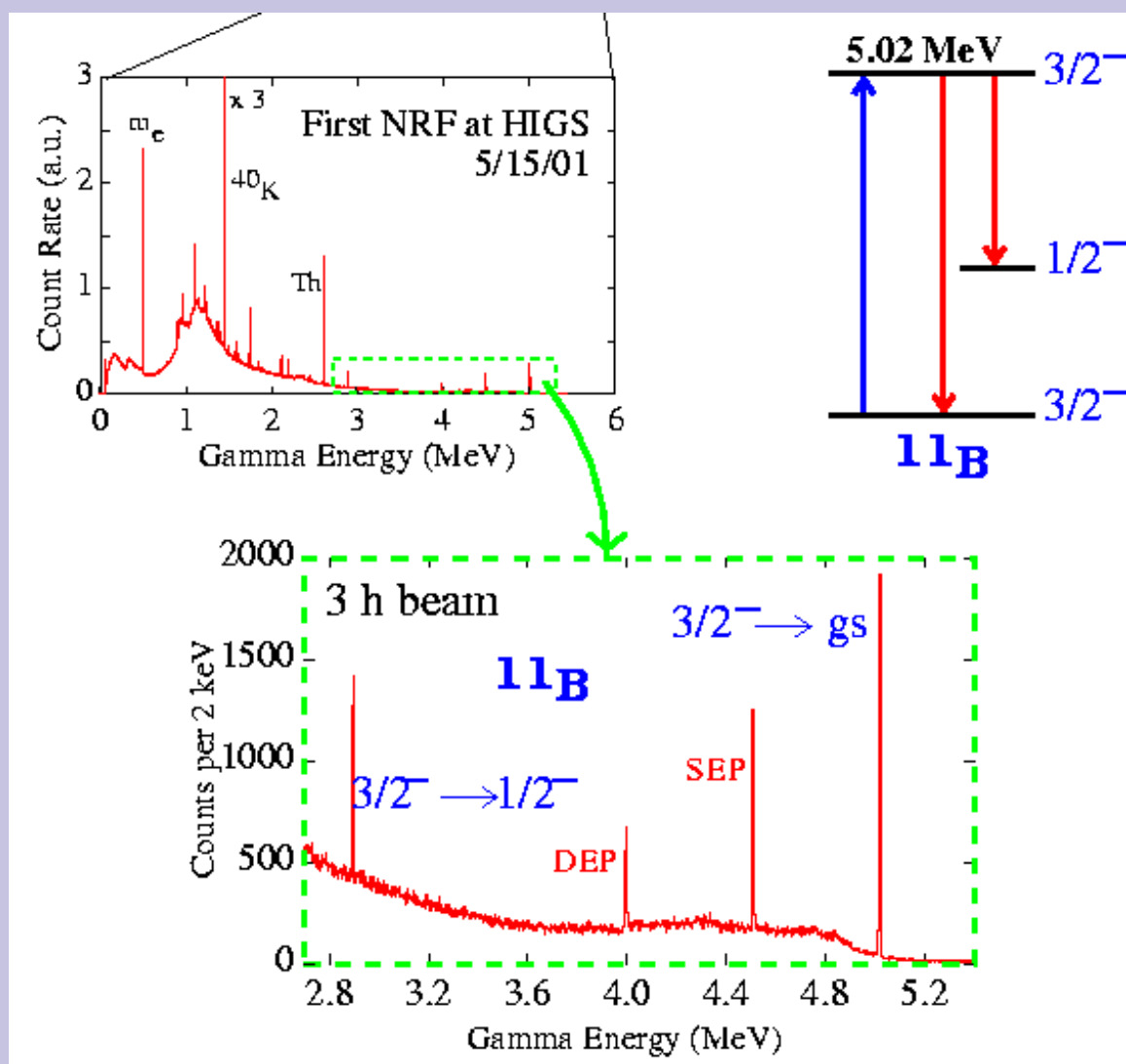


use of Cluster detector
as Compton polarimeter

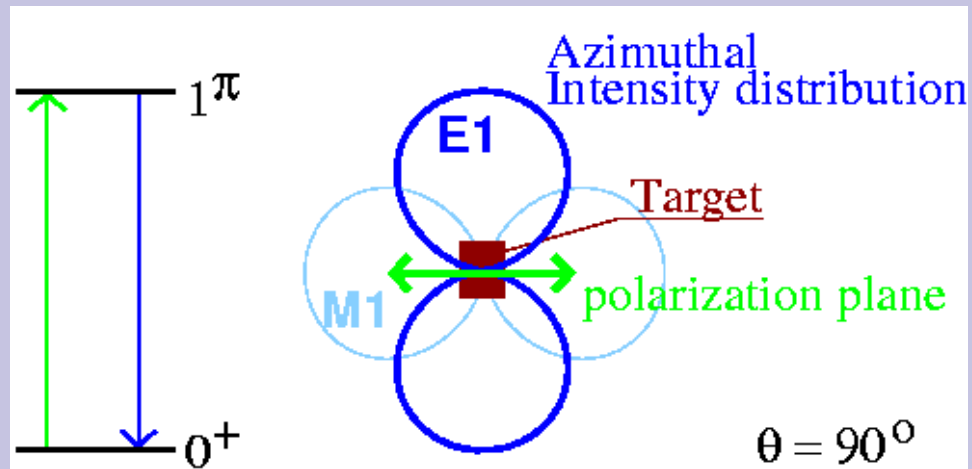


Analyzing power of Compton scattering
process decreases with energy !

The first NRF experiment at HIGS: ^{11}B in May 2001



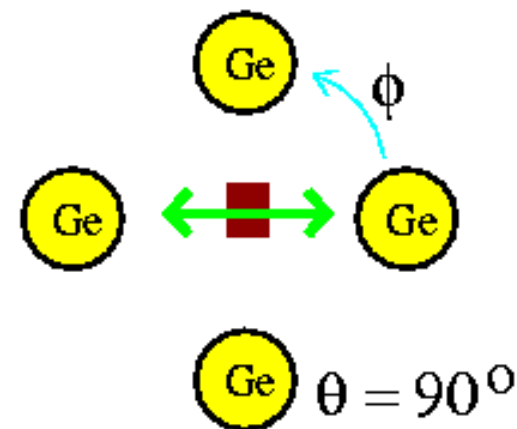
Parity determination with a polarized beam



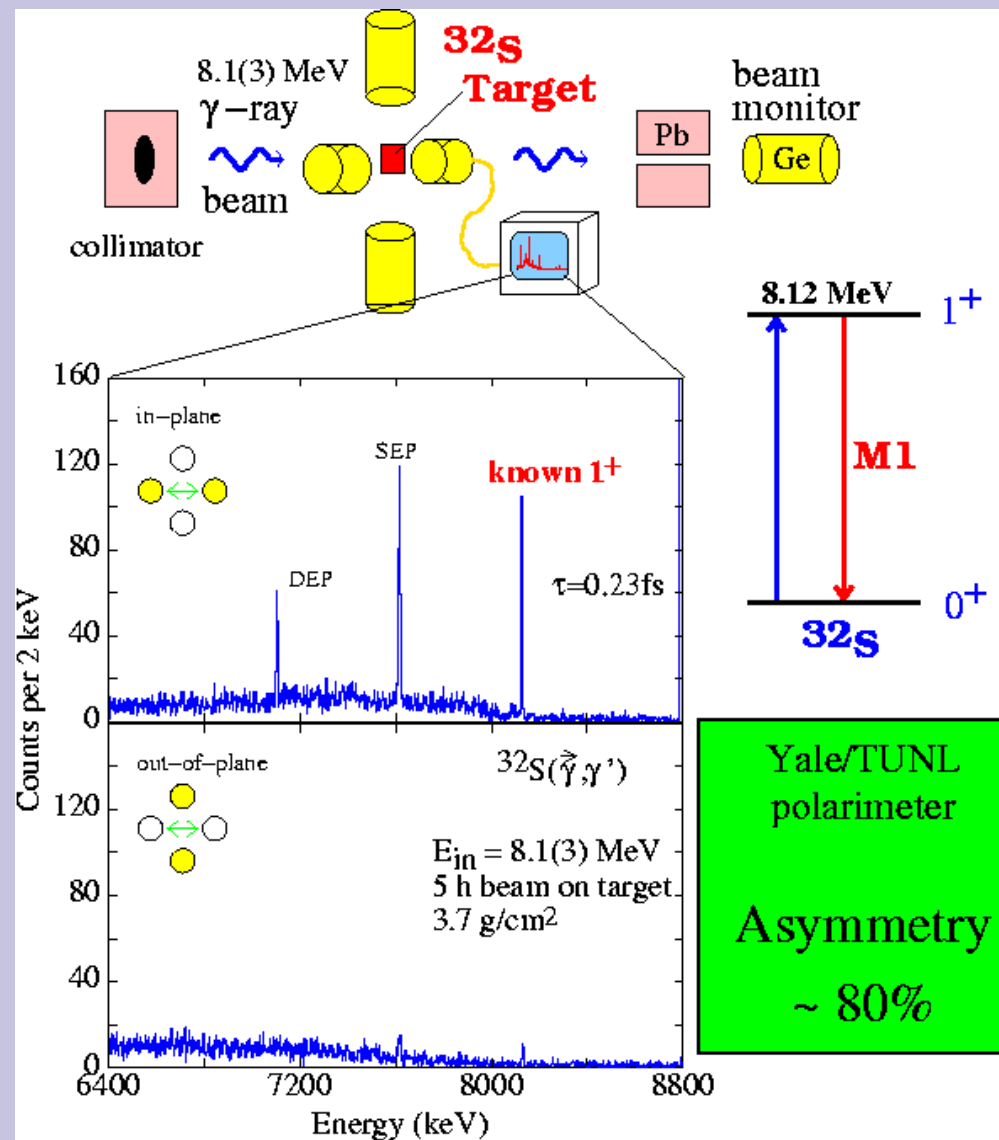
$$\Sigma = \frac{I(\parallel) - I(\perp)}{I(\parallel) + I(\perp)} = \begin{cases} +1 \\ -1 \end{cases} \text{ for } \begin{matrix} 1^+ \\ 1^- \end{matrix}$$

simple set-up consisting of four 60% Ge detectors

TUNL/HIGS polarimeter:

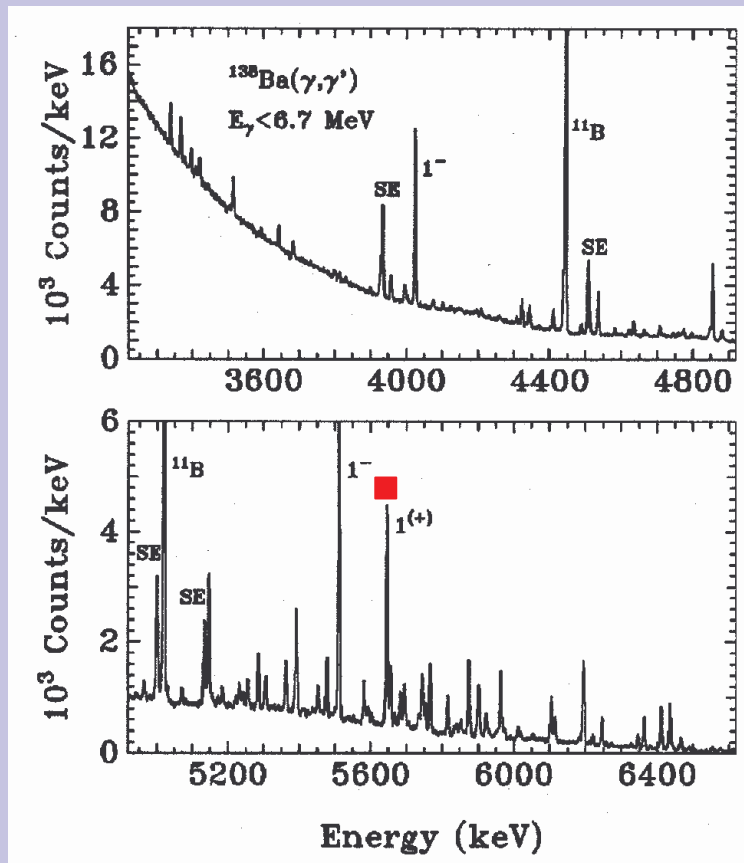


The proof of principle

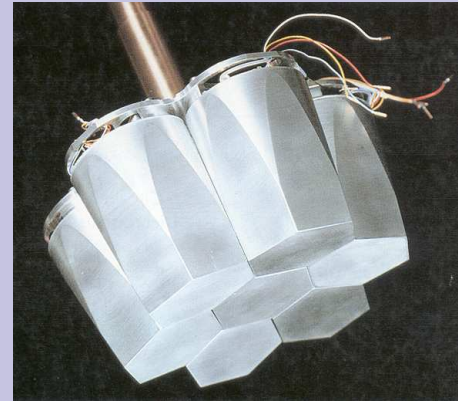


“Old-fashioned” NRF experiment using 2 Cluster detectors at S-DALINAC

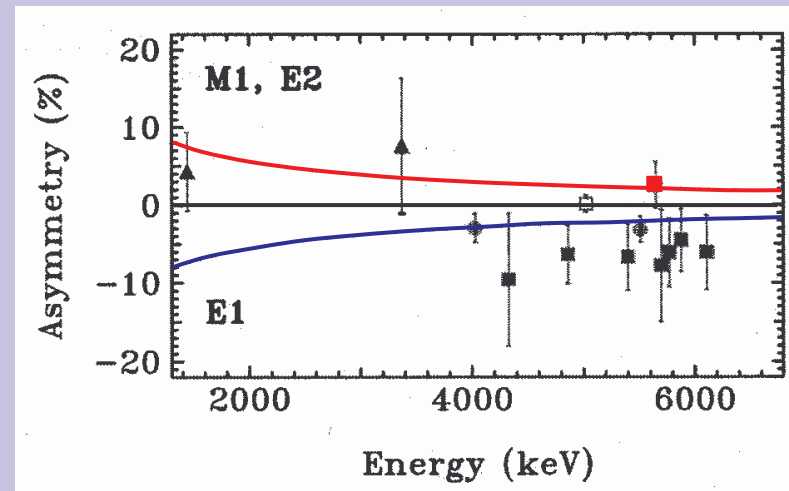
end-point energy: 6.7 MeV



R.-D. Herzberg et al., PRC 60 (1999) 051307

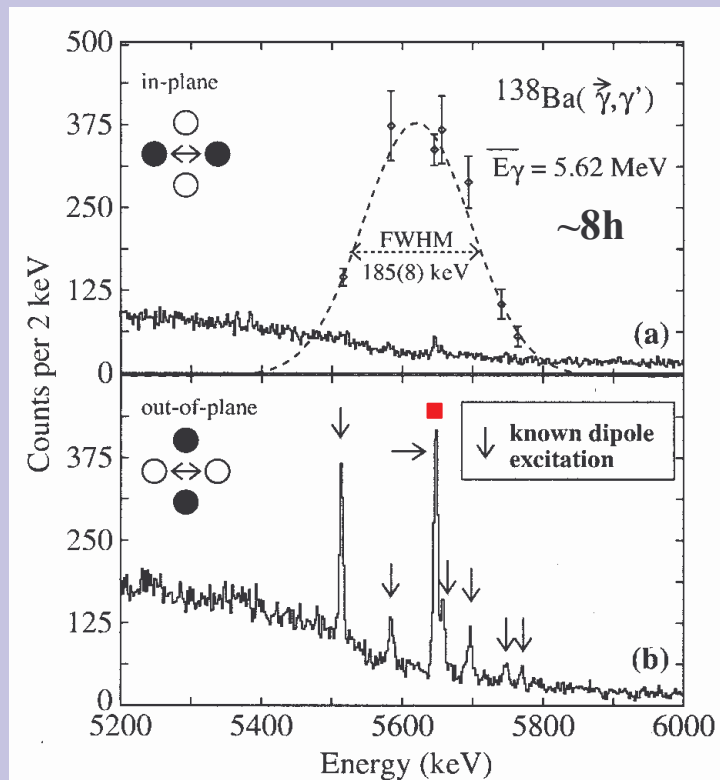


use of Cluster detector
as Compton polarimeter

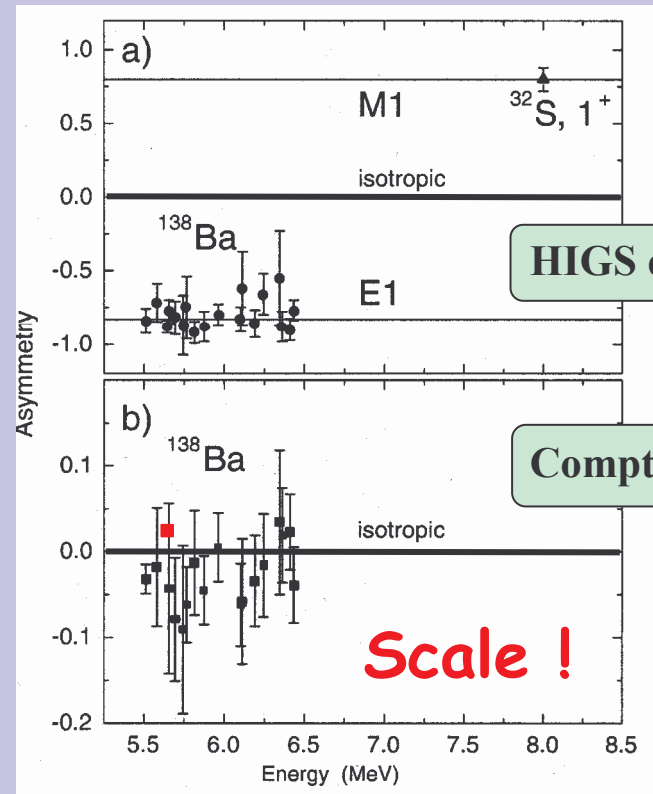


Analyzing power of Compton scattering
process decreases with energy !

HIGS NRF experiment on ^{138}Ba



- $1.6 \times 10^8 \gamma/\text{sec}$ total
- $0.9 \times 10^7 \gamma/\text{sec}$ on target behind coll. ($\Delta E_\gamma / E_\gamma \sim 3.2\%$)
- $0.4 \times 10^5 \gamma/(\text{sec keV})$ at maximum



"Strong transition with likely M1 character" is just one more E1 !

N. Pietralla et al., PRL 88 (2002) 012502, PRC 65 (2002) 047305, NIM A483 (2002) 556

NRF measurements already performed at HIGS:

^{138}Ba

PRL 88 (2002) 012502

^{88}Sr

PRC 65 (2002) 047305

^{92}Zr

^{96}Mo

$^{172,174,176}\text{Yb}$

$^{162,164}\text{Dy}$



summer 2003

NRF experiments at Laser Compton backscattering facilities are very interesting !

But will they still be in a couple of years ?