Electron conversion spectroscopy at Heavy Ion Laboratory in Warsaw

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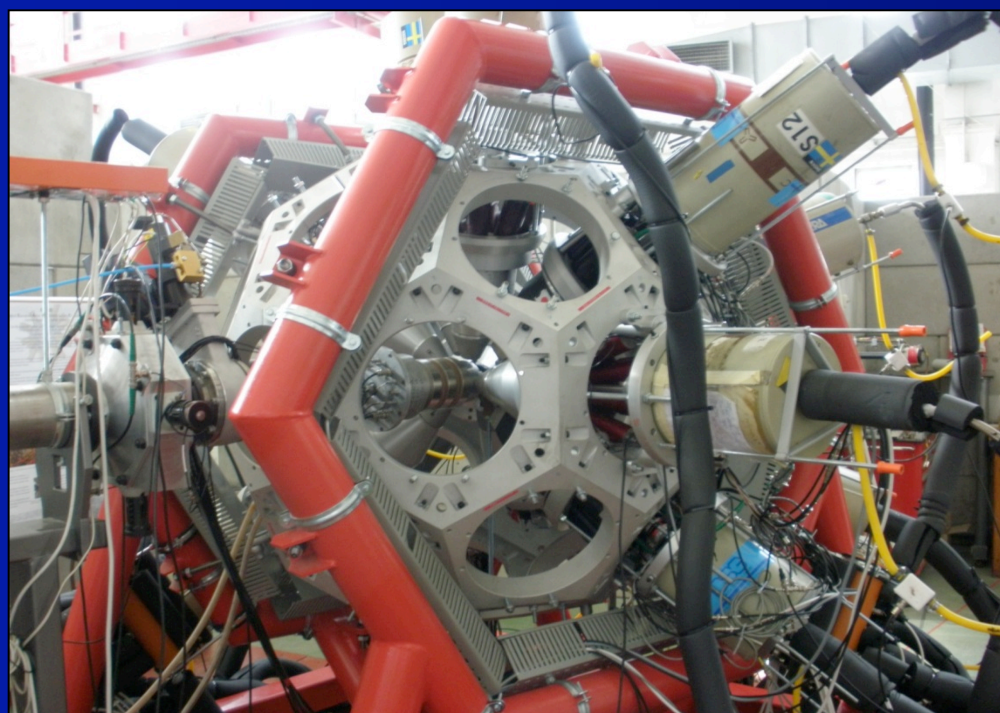


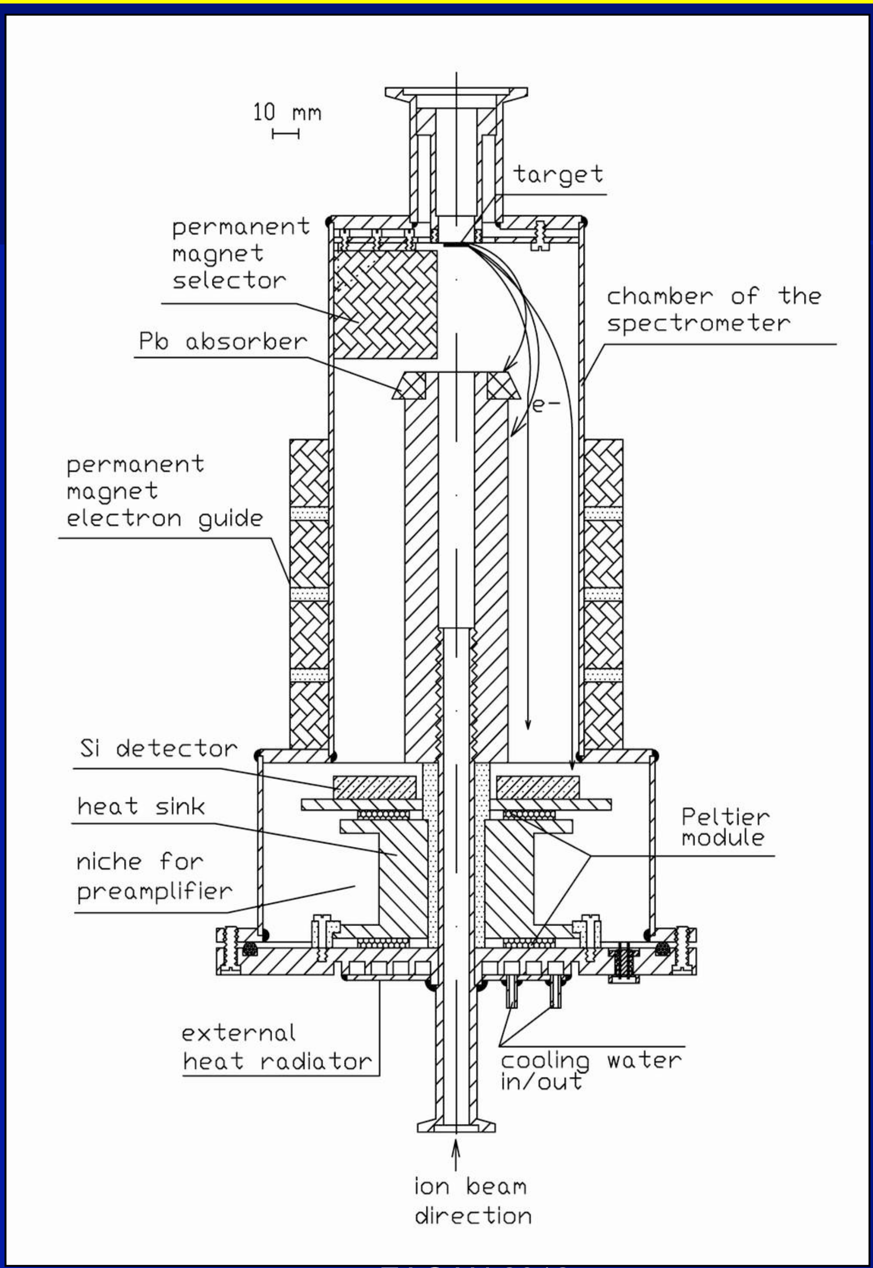
Plan of the talk

I. The internal-conversion spectrometer.

II. Study of $I^{\pi}=K^{\pi}=8^{-}$ isomeric state for N=74.

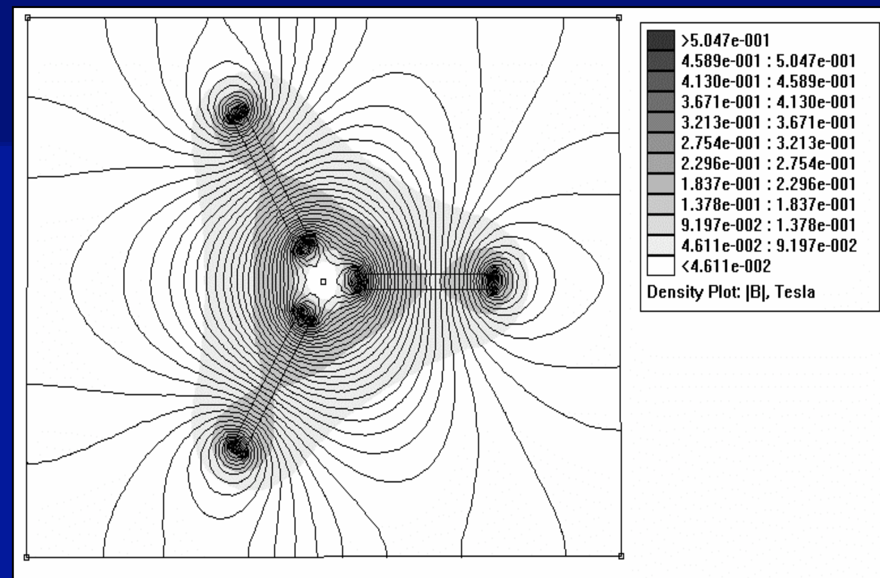
I. The internal-conversion spectrometer

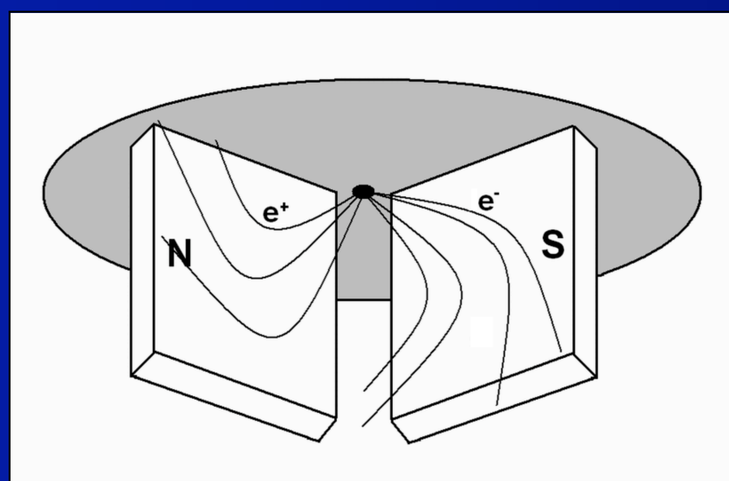
Design of the electron spectrometer



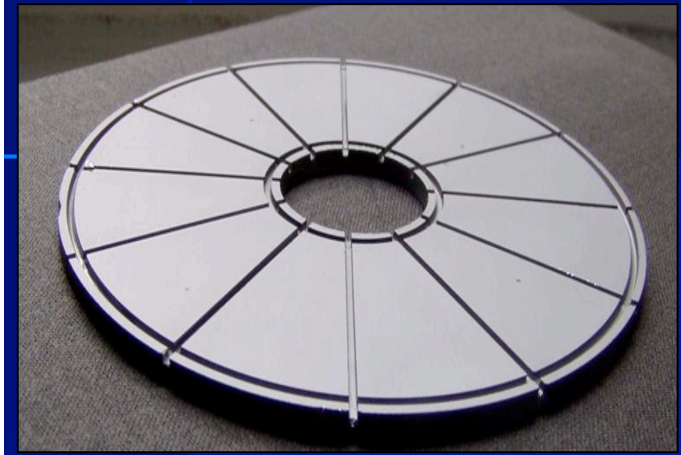
The magnets

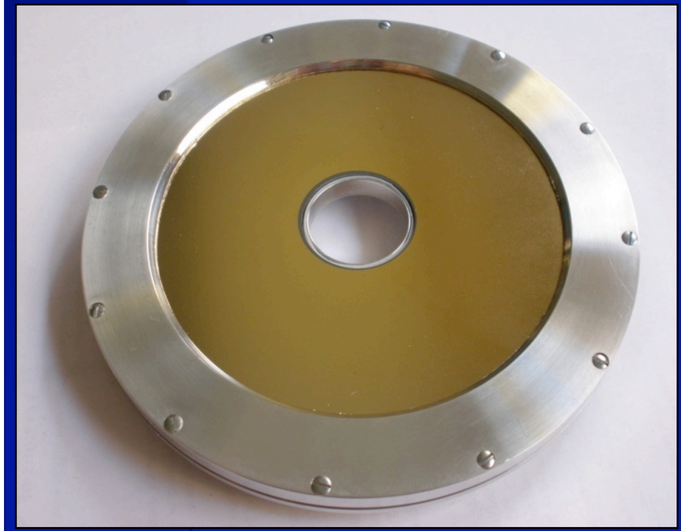

9

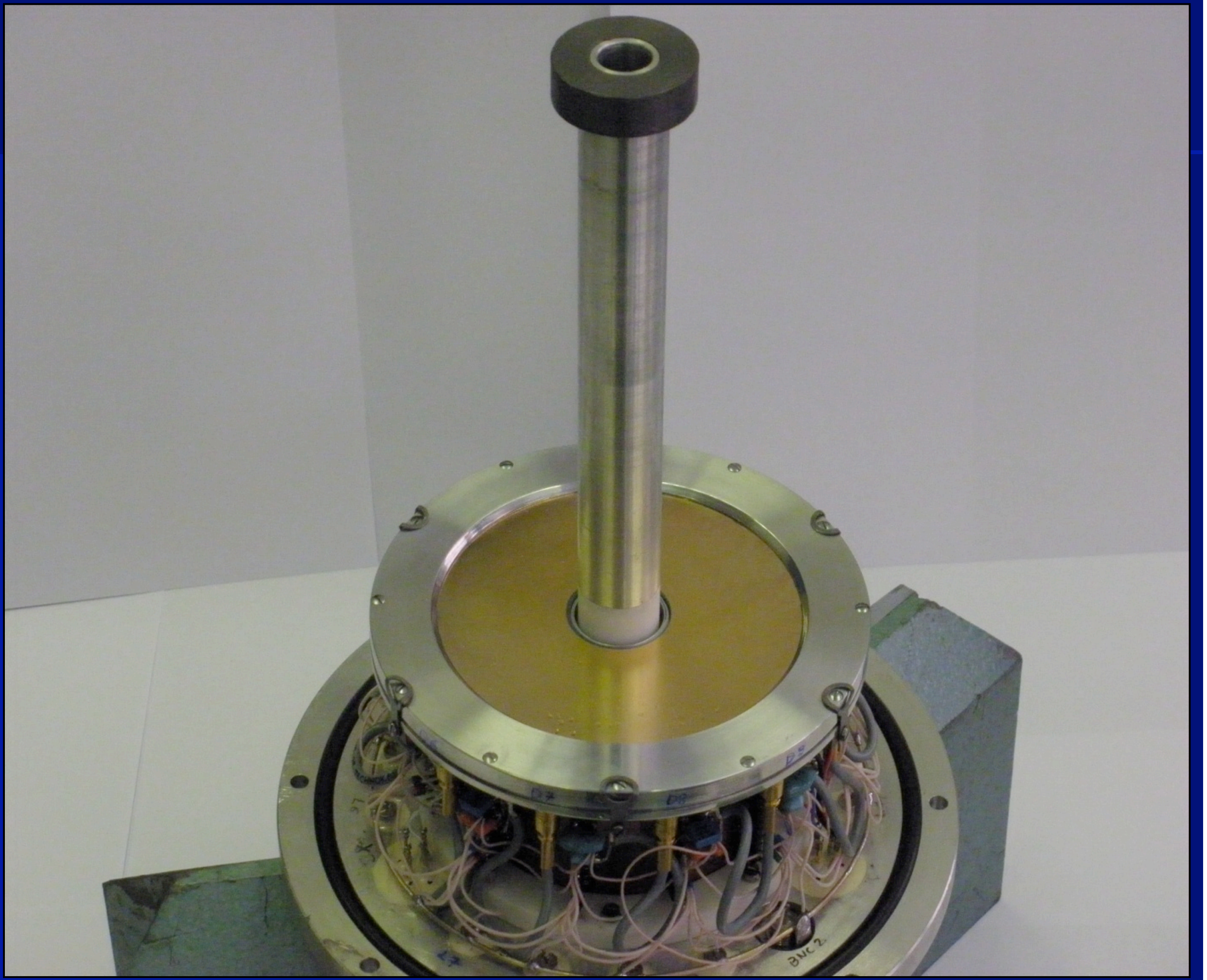

>5.047e-001
4.589e-001 : 5.047e-001
4.130e-001 : 4.589e-001
3.671e-001 : 4.130e-001
3.213e-001 : 3.671e-001
2.754e-001 : 3.213e-001
2.296e-001 : 2.754e-001
1.837e-001 : 2.296e-001
1.378e-001 : 1.837e-001
9.197e-002 : 1.378e-001
4.611e-002 : 9.197e-002
<4.611e-002
Density Plot: |B|, Tesla


e+
e-
N
S

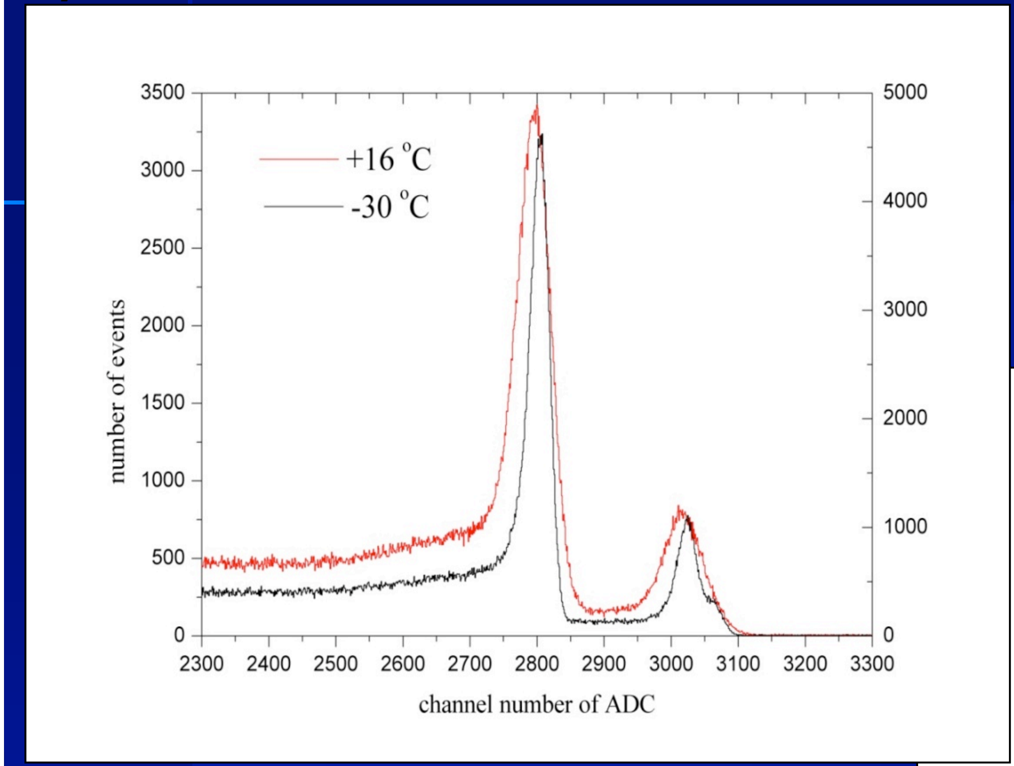
The detection set-up

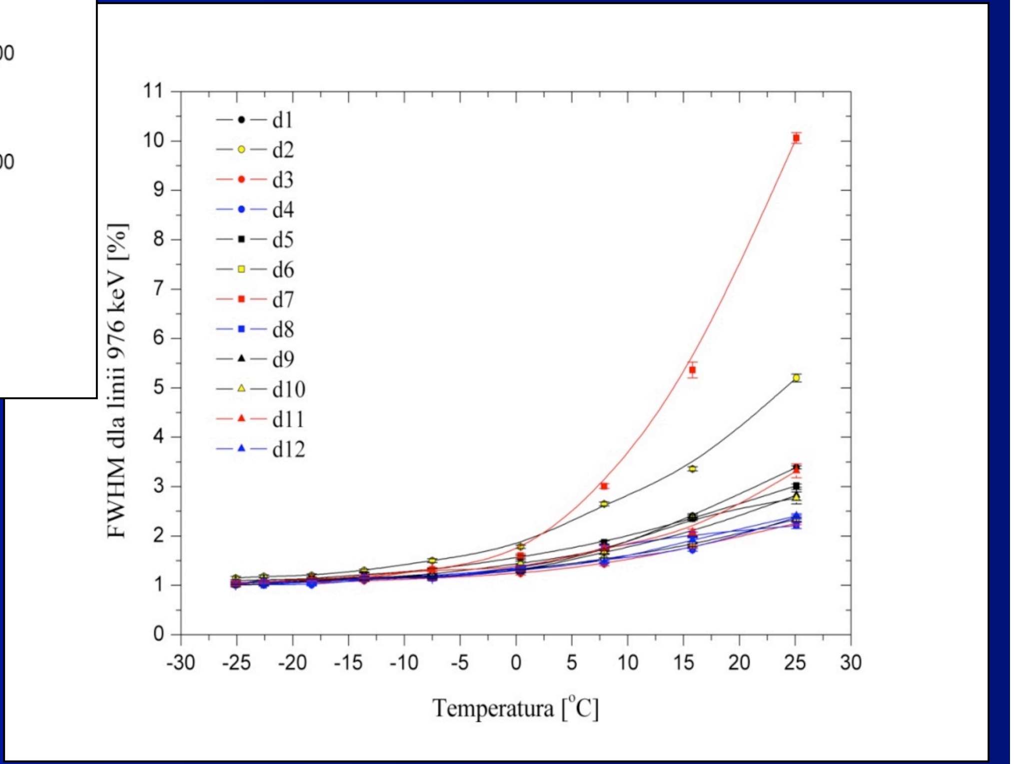






Cooling system

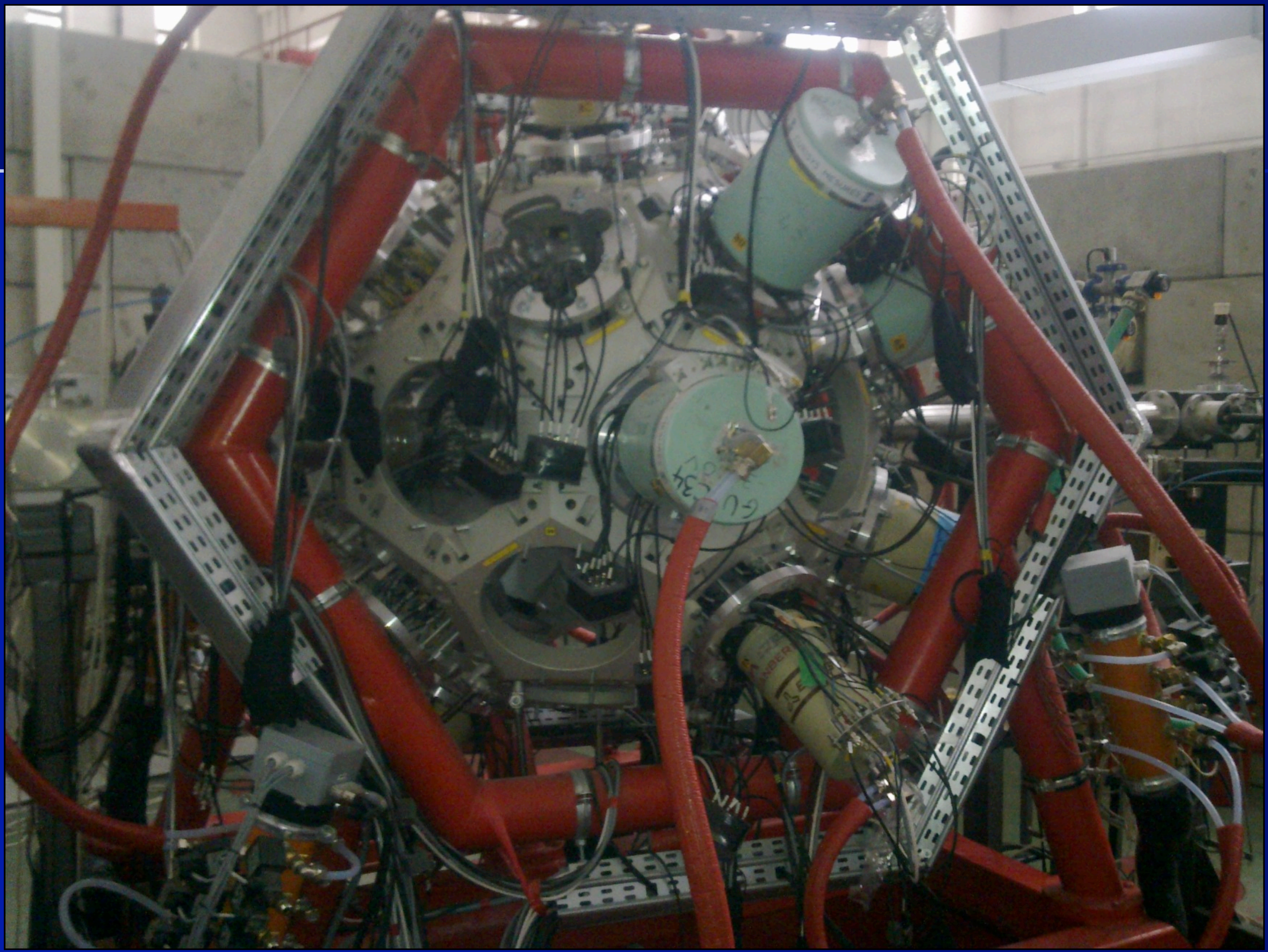




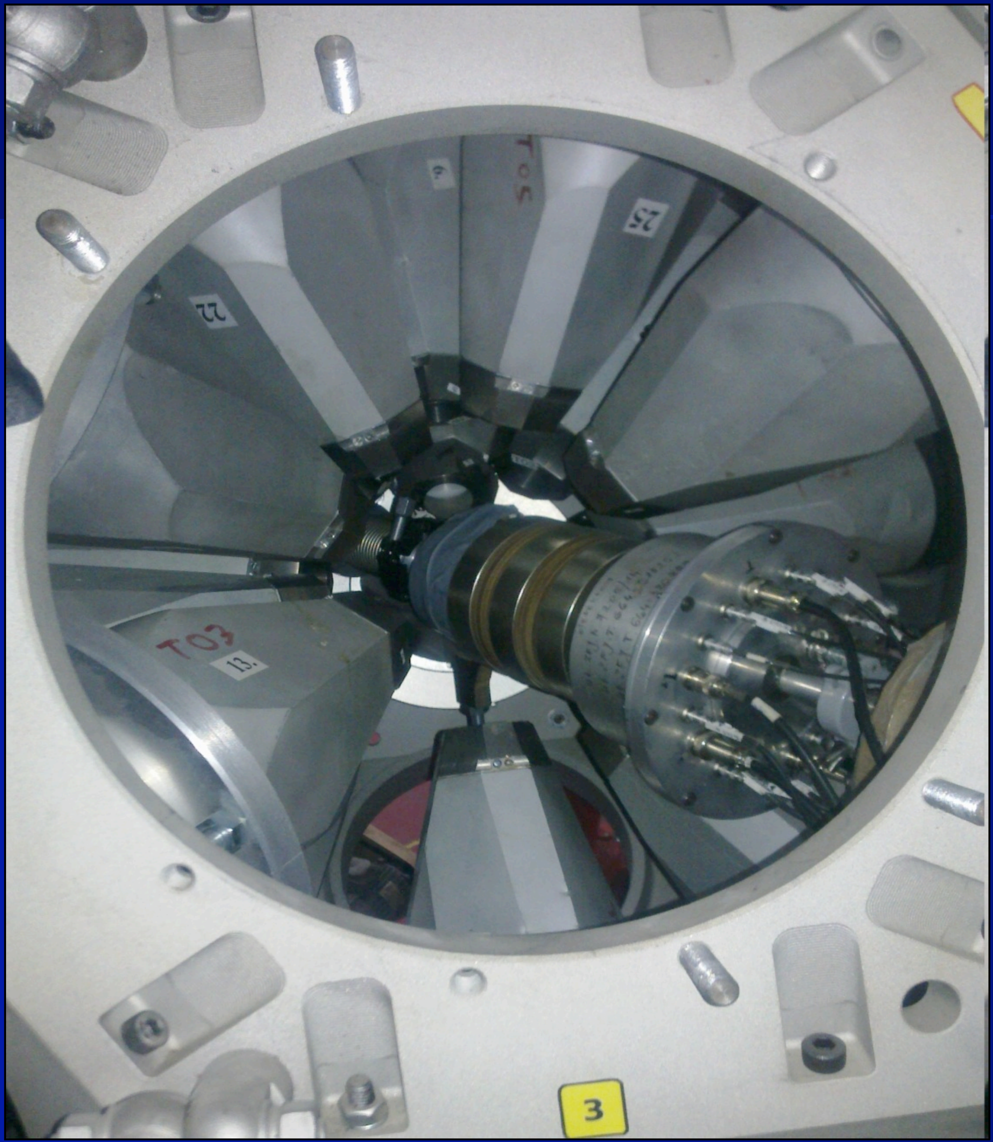
Characteristics of the electrons spectrometer

- Elimination of positrons,
- Back geometry + magnetic selector allow to minimize number of delta electrons which could reach the detector,
- Thanks to cooling of detector and preamplifiers to temperature -30˚C energetic resolution for electrons spectra is improved significantly,
- Decreasing of photon background originated in the target and registered by detectors was obtained by using the absorber on the light path (very important for „in-beam" measurements),
- The segmented Si(Li) detector at active area ~60 cm^2.

The EAGLE + the electrons spectrometer

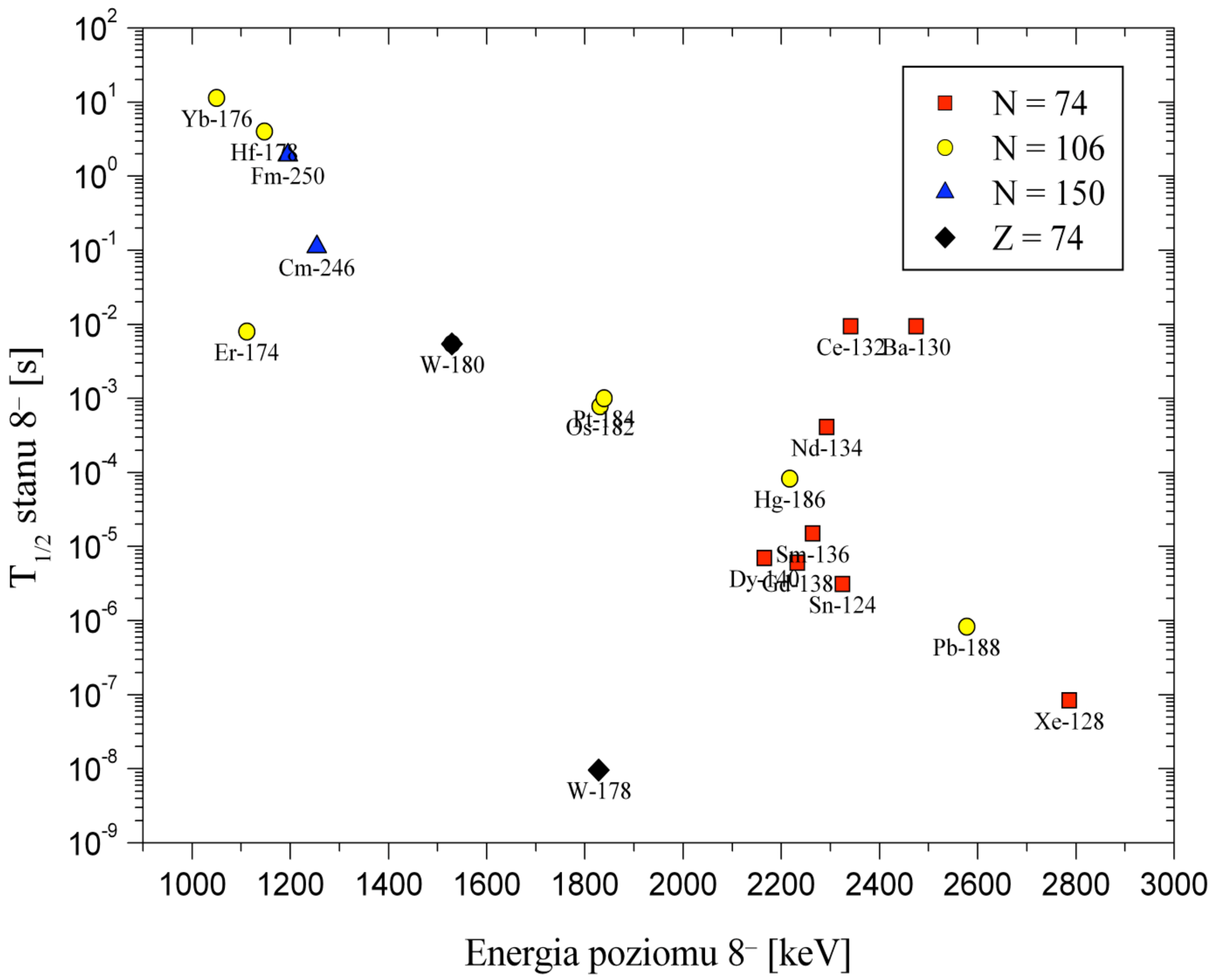


The EAGLE + the electrons spectrometer



II. Study of $K^{\pi}=8^{-}$ isomers for N=74.

Motivation



N = 74
N = 106
N = 150
Z = 74
Yb-176
Hf-178
Fm-250
Cm-246
Er-174
W-180
Pt-184
Os-182
Ce-132
Ba-130
Nd-134
Hg-186
Sm-136
Dy-140
Gd-138
Sn-124
Pb-188
Xe-128
W-178
$T_{1/2}$ stanu 8^- [s]
Energia poziomu 8^- [keV]

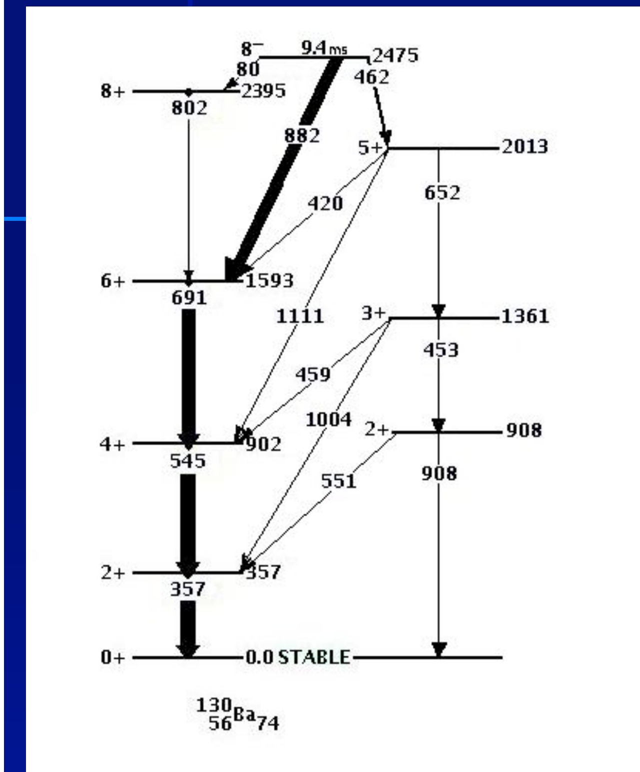
Motivation

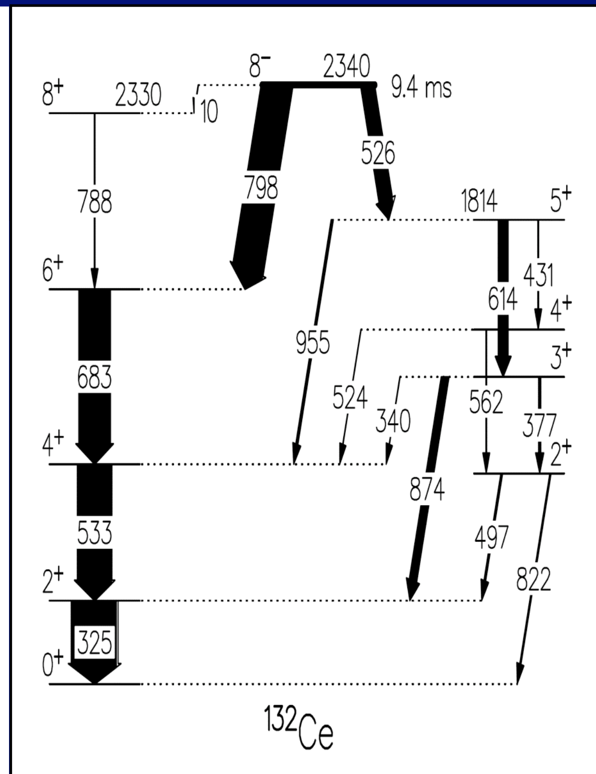
The problem of the K selection rule violation for electromagnetic transitions in nuclei is still actual problem.

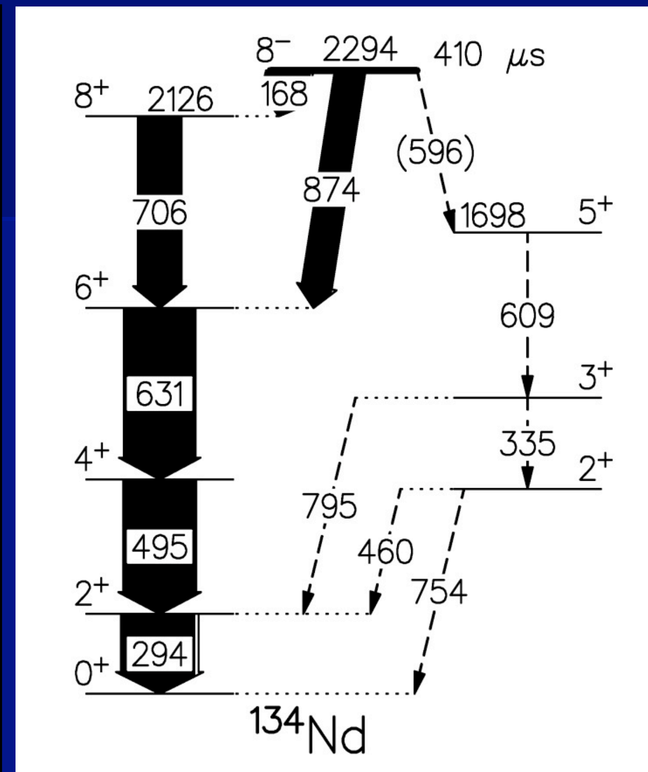
Possible explanations of this phenomenon are:

- The Coriolis force cause mixing of states with different K values,
- The orientation of the angular momentum represents a new degree of freedom,
- The tunneling effect in the γ-deformation.

Motivation

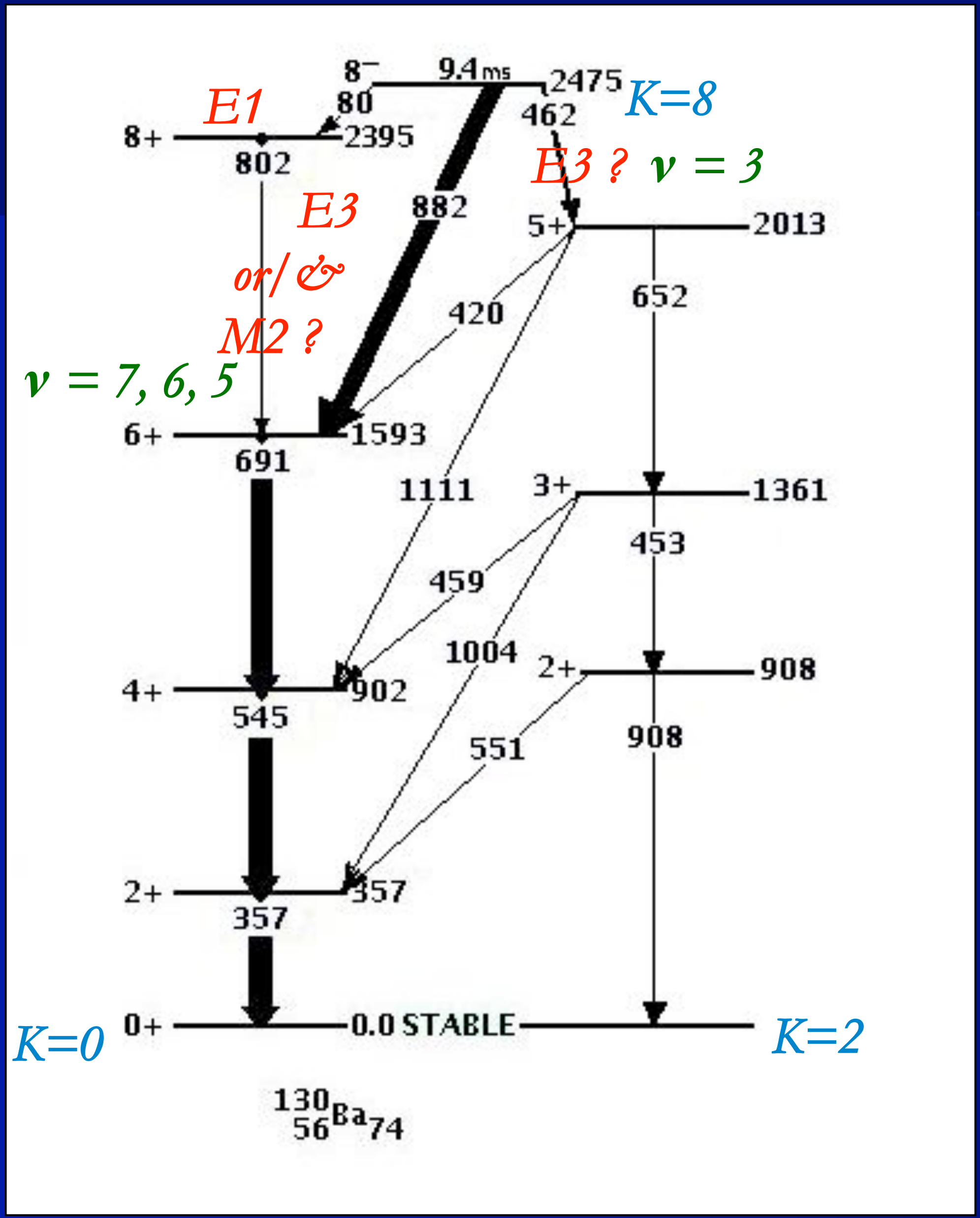






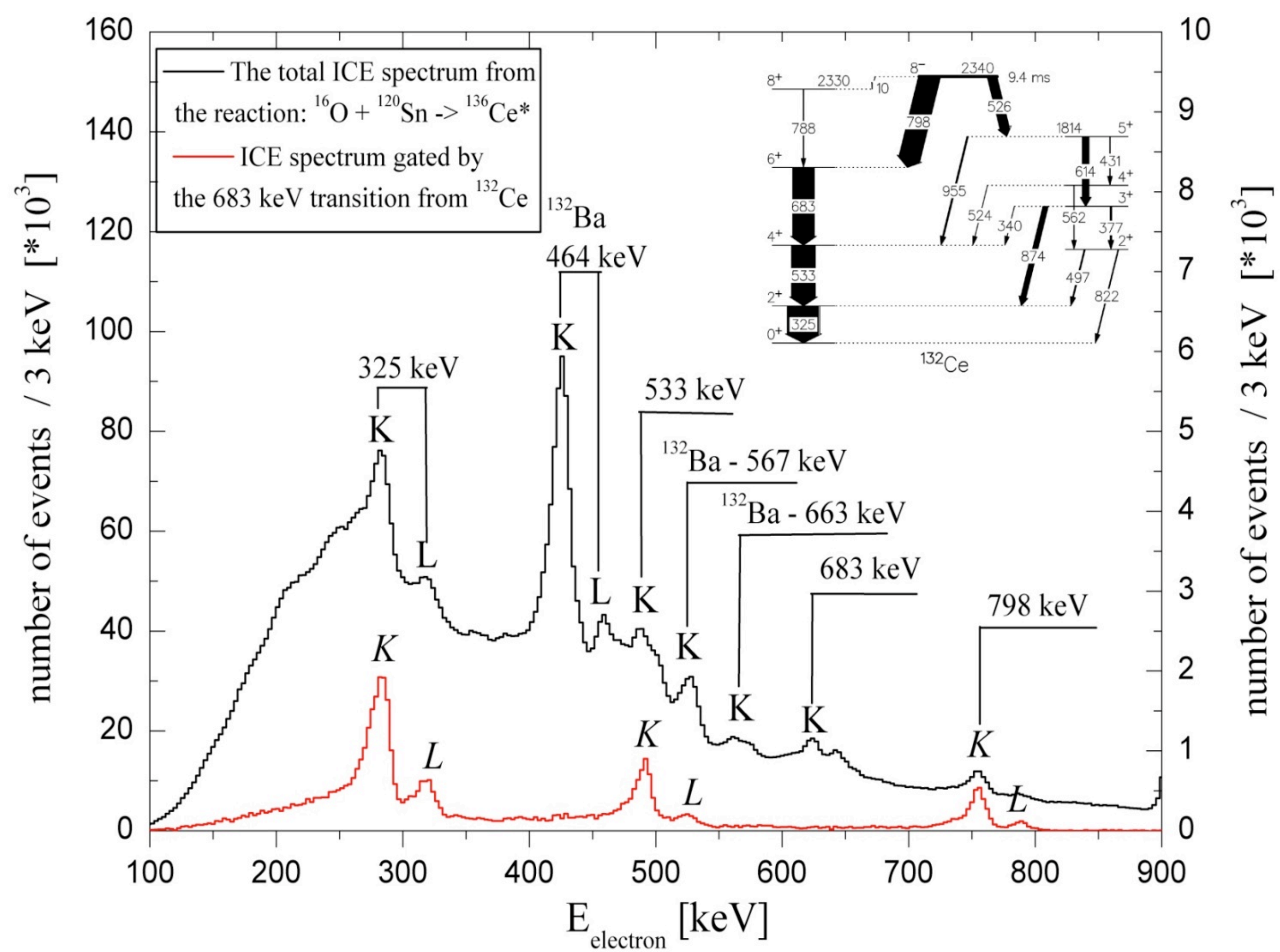
The $K^{\pi}=8^{-}$ isomeric state is interpreted as: **ν7/2-[404] ⊗ ν9/2-[514].**

Motivation

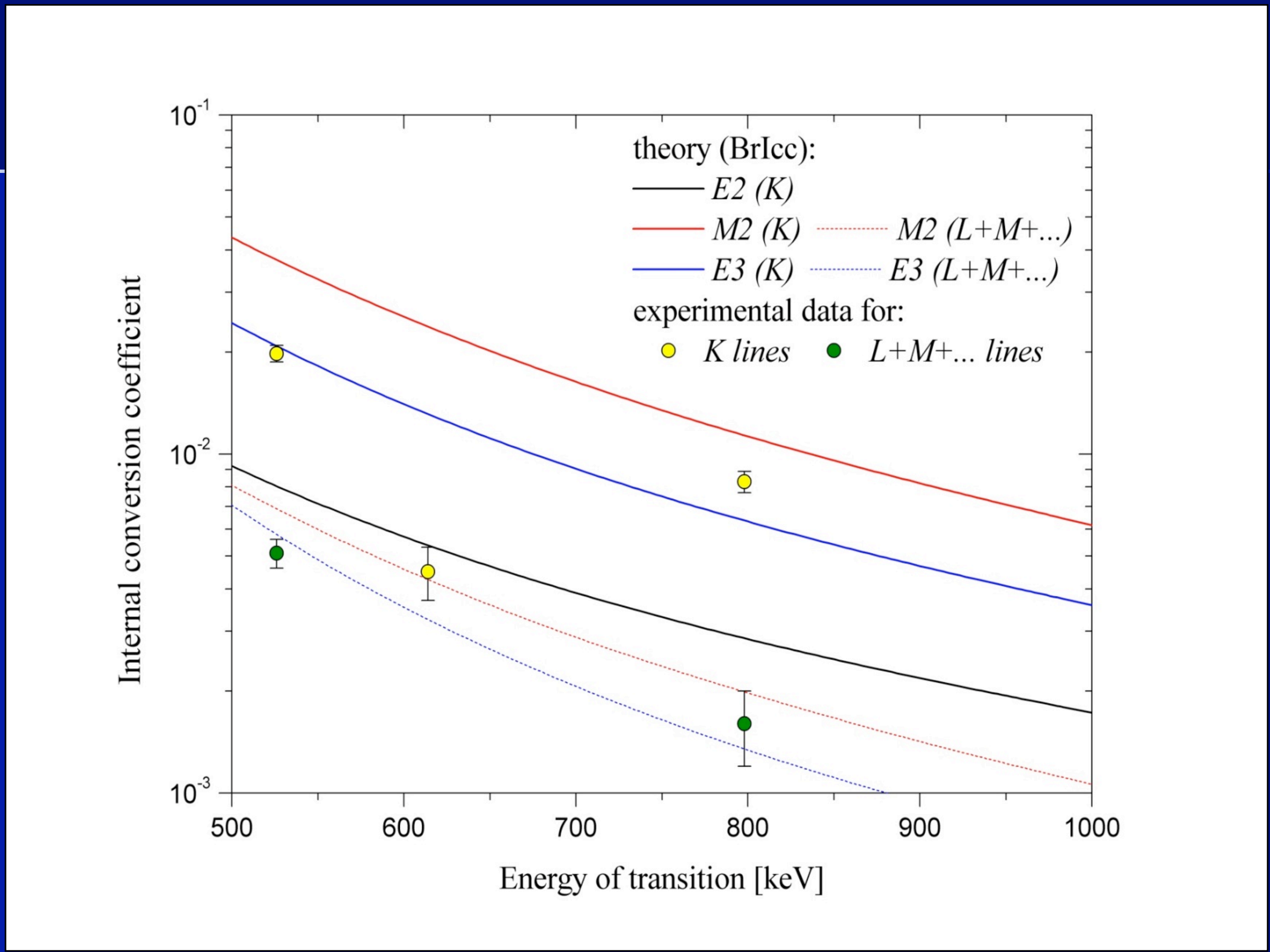


8−
9.4ms
2475
K=8
E1
80
462
8+
2395
802
E3 ? ν = 3
E3
882
5+
2013
or/ &
652
420
M2 ?
ν = 7, 6, 5
6+
1593
691
1111
3+
1361
453
459
1004
2+
908
4+
902
545
551
908
2+
357
357
K=0
0+
0.0 STABLE
K=2
$^{130}_{56}Ba_{74}$

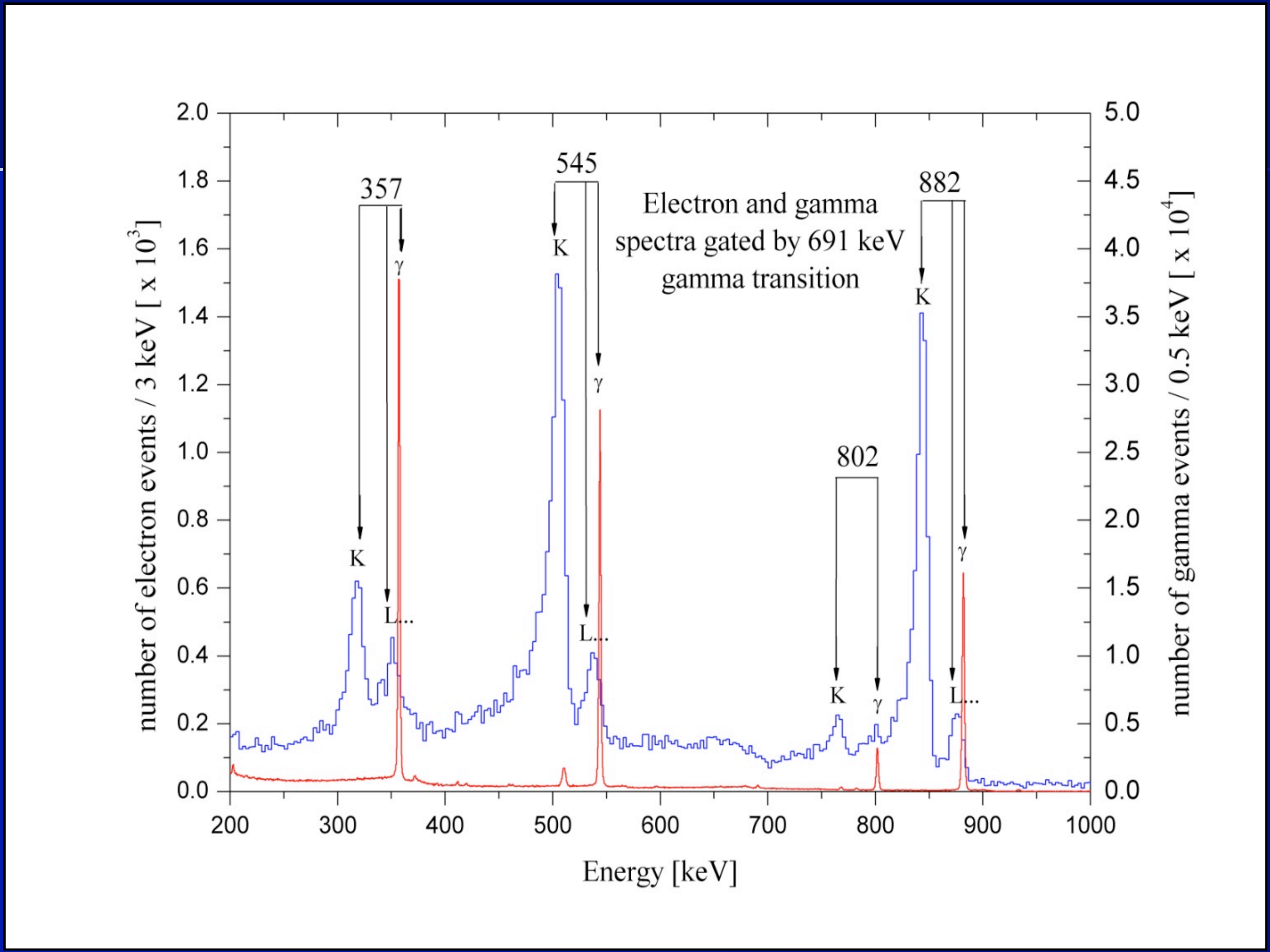
Results for ^{132}Ce



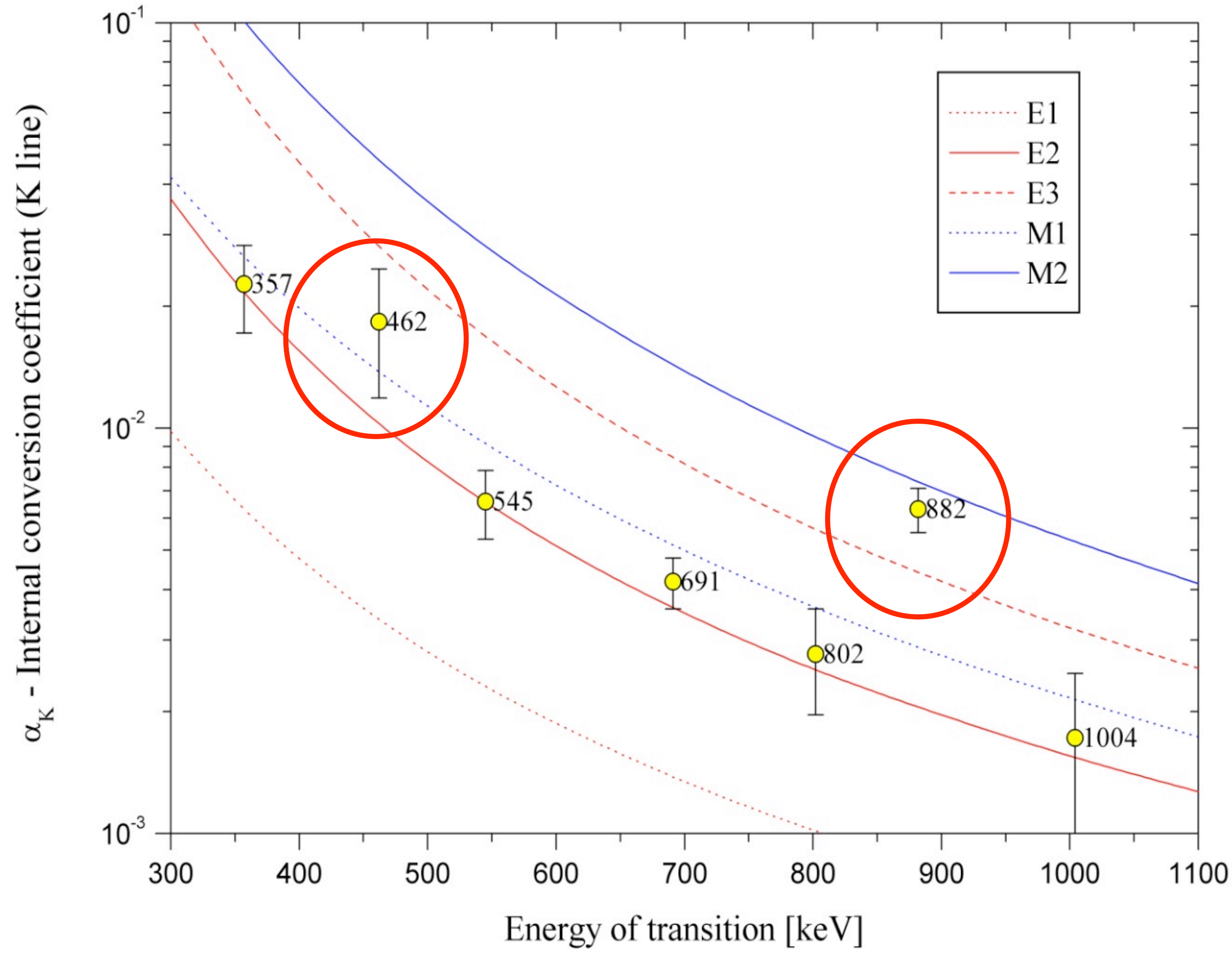
Results for ^{132}Ce



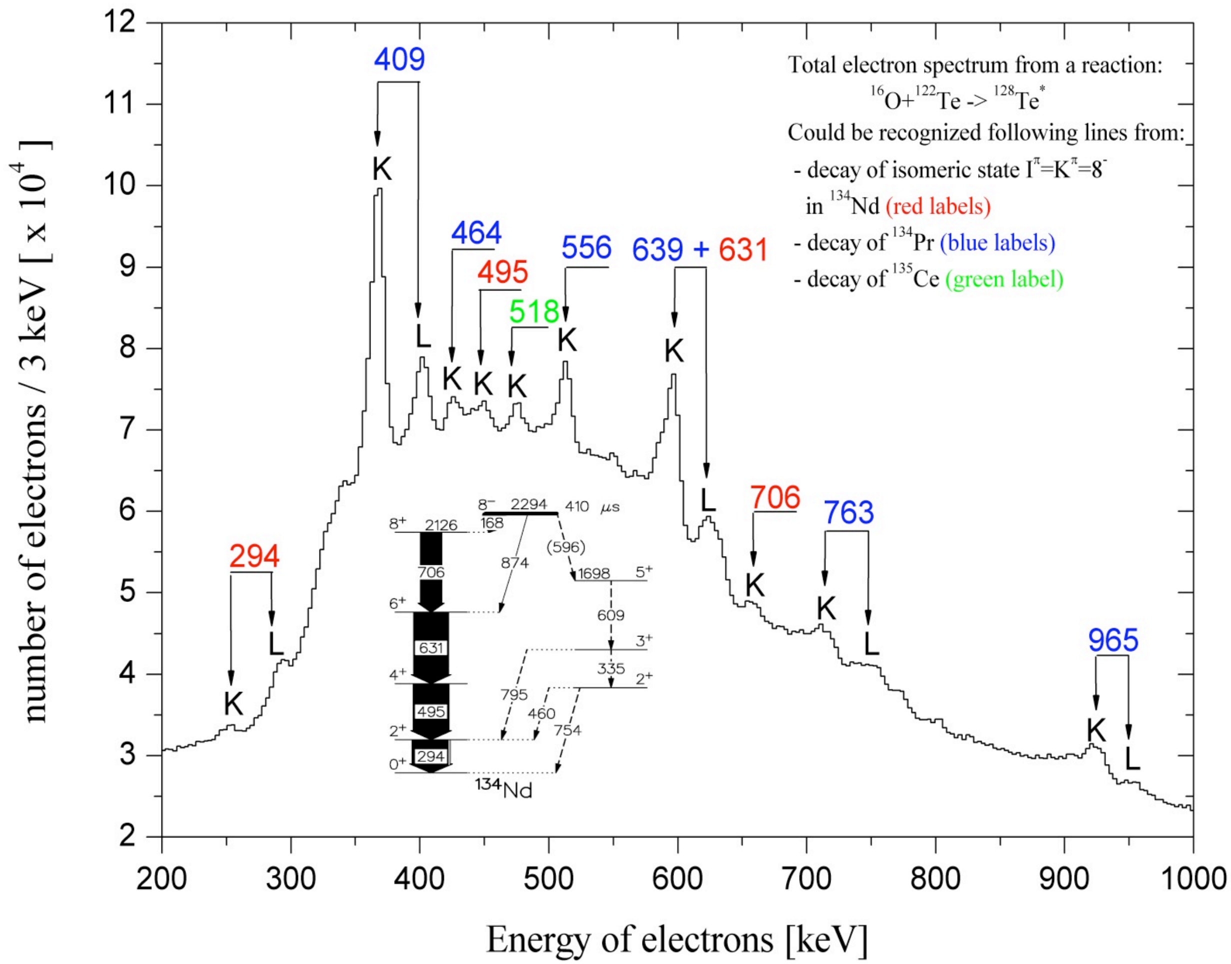
Measurement for ^{130}Ba



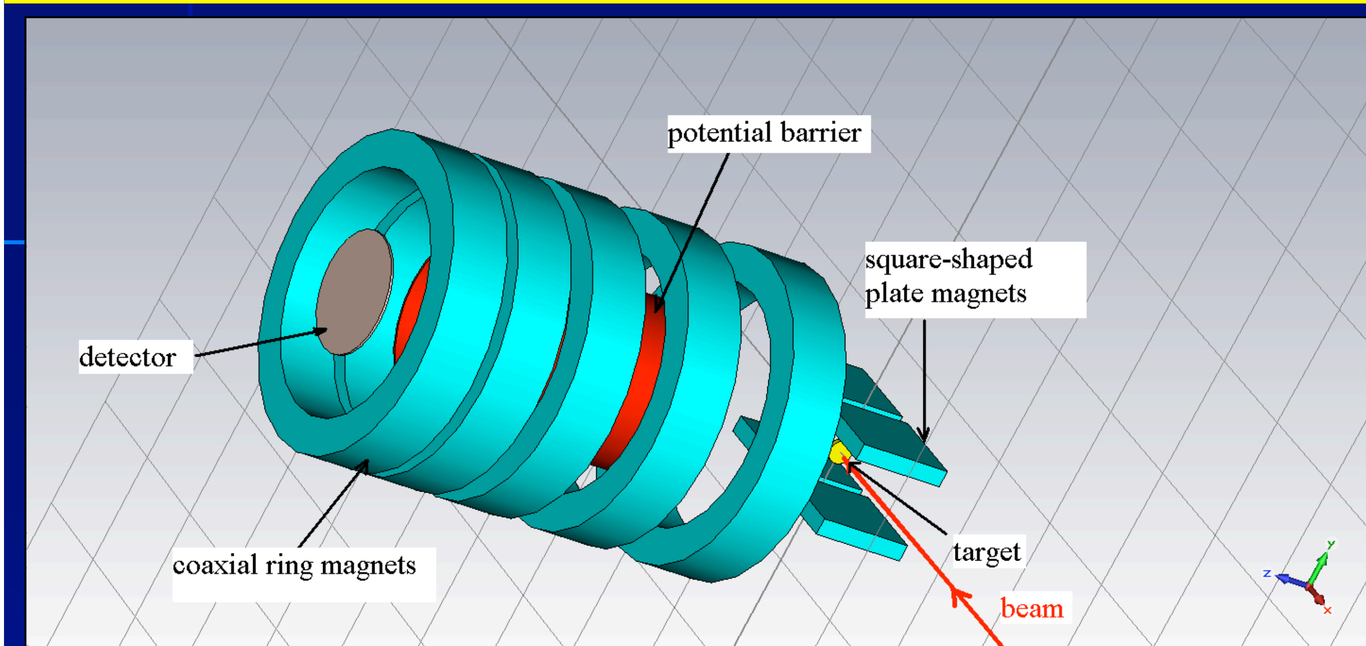
Measurement for ^{130}Ba

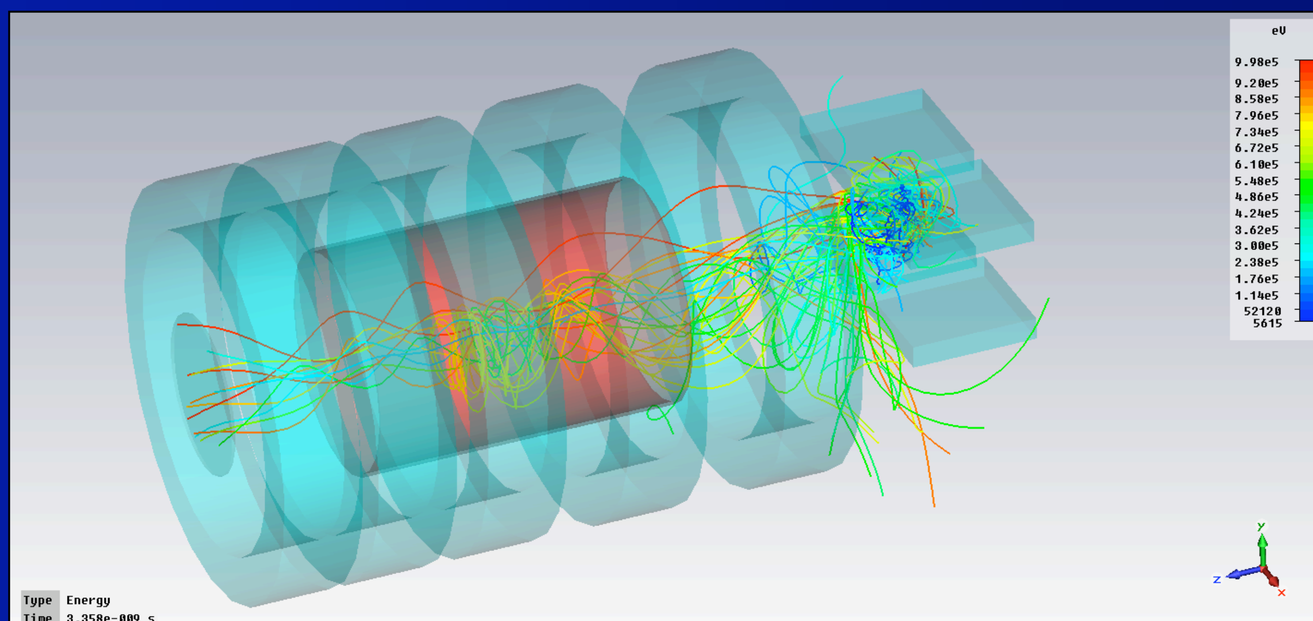


Measurement for ^{134}Nd



Idea of the new conversion-electron spectrometer





Summary

1. The set of magnetic field used in the spectrometer allows to reduce the number of „delta" electrons significantly, that enables the internal conversion electron spectrometry during „in-beam" time intervals,
2. The design of spectrometer eliminates positrons from stream of the particles reaching the silicon detector,
3. The cooling system warrants stabilization of temperature of detectors ~ -30°C,
4. We studied of the K selection rule violation for electromagnetic transitions in decay of the $I^{\pi} = K^{\pi} = 8^{-}$ isomeric state in nuclei: ^{130}Ba, ^{132}Ce and ^{134}Nd by using the conversion-electron spectrometer.

Thank You for your attention!