# Addendum to IS521 proposal

## Simultaneous spectroscopy of γ rays and conversion electrons: Systematic study of E0 transitions and intruder states in close vicinity of mid-shell point in odd-Au isotopes


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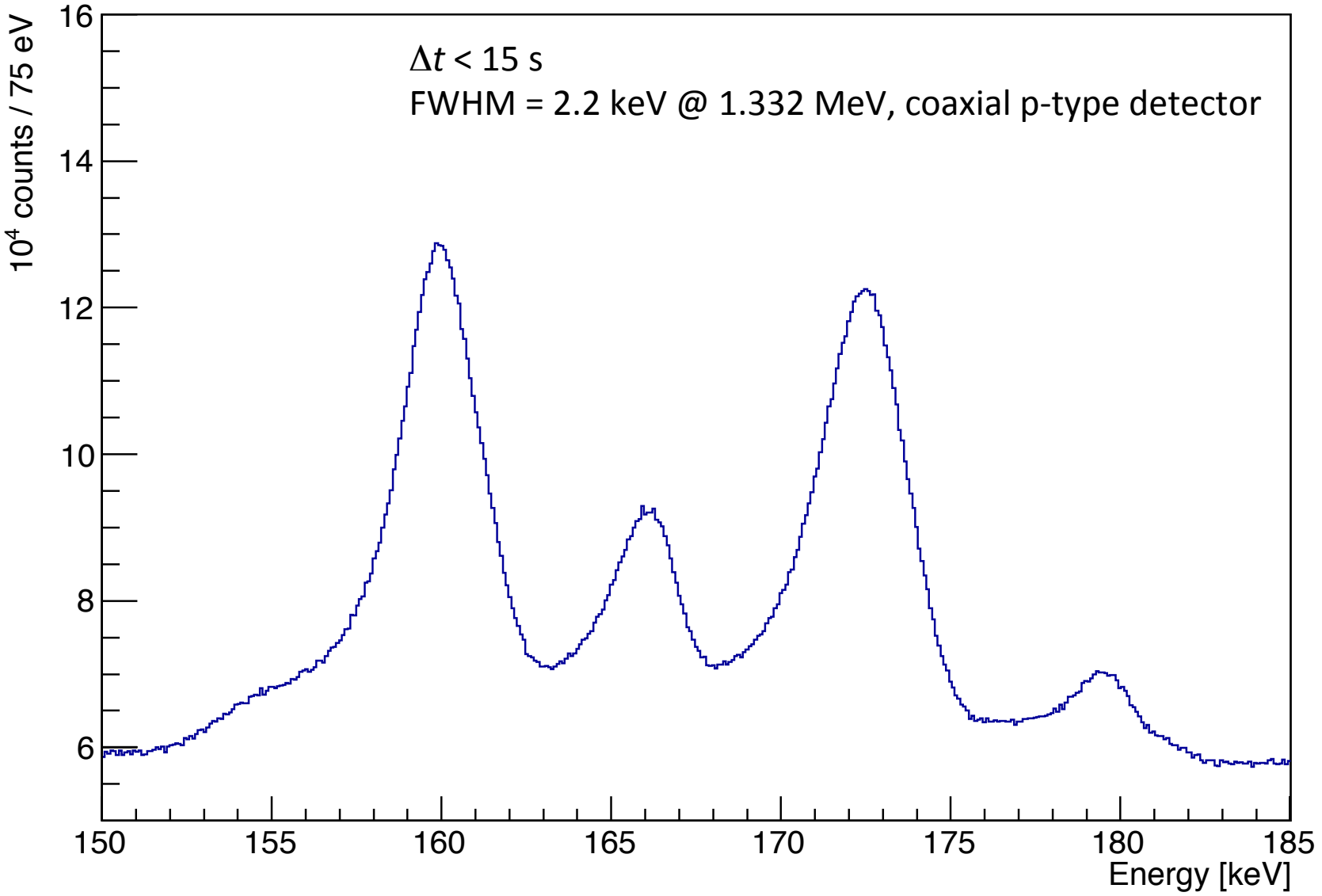
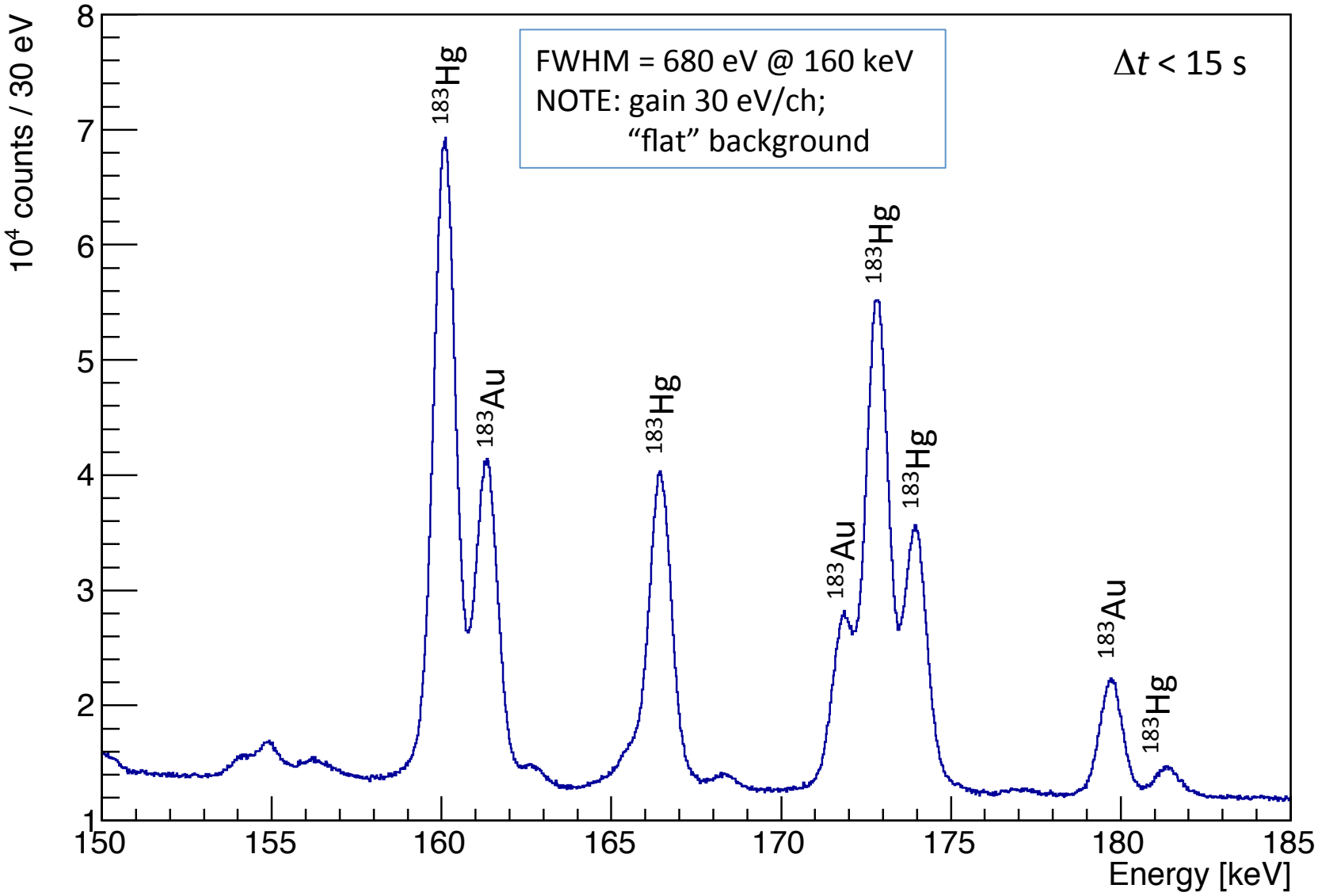
# IS521 first run in August 2014

- TATRA tape transportation system developed at Institute of Physics, Slovak Academy
- Metallic tape (acts as Faraday cup—excellent for beam tuning onto tape)
- Very good vacuum properties, strong material…
- Simple, precise, versatile and transportable
- BEGe detector BE2020 (smallest BEGe available at the time)
- 2 coaxial p type detectors
- No conversion electrons – delay of delivery of $LN_2$ cooled Si(Li) detector by Canberra
- Detector arrived 5 days before transport – no chance for testing…

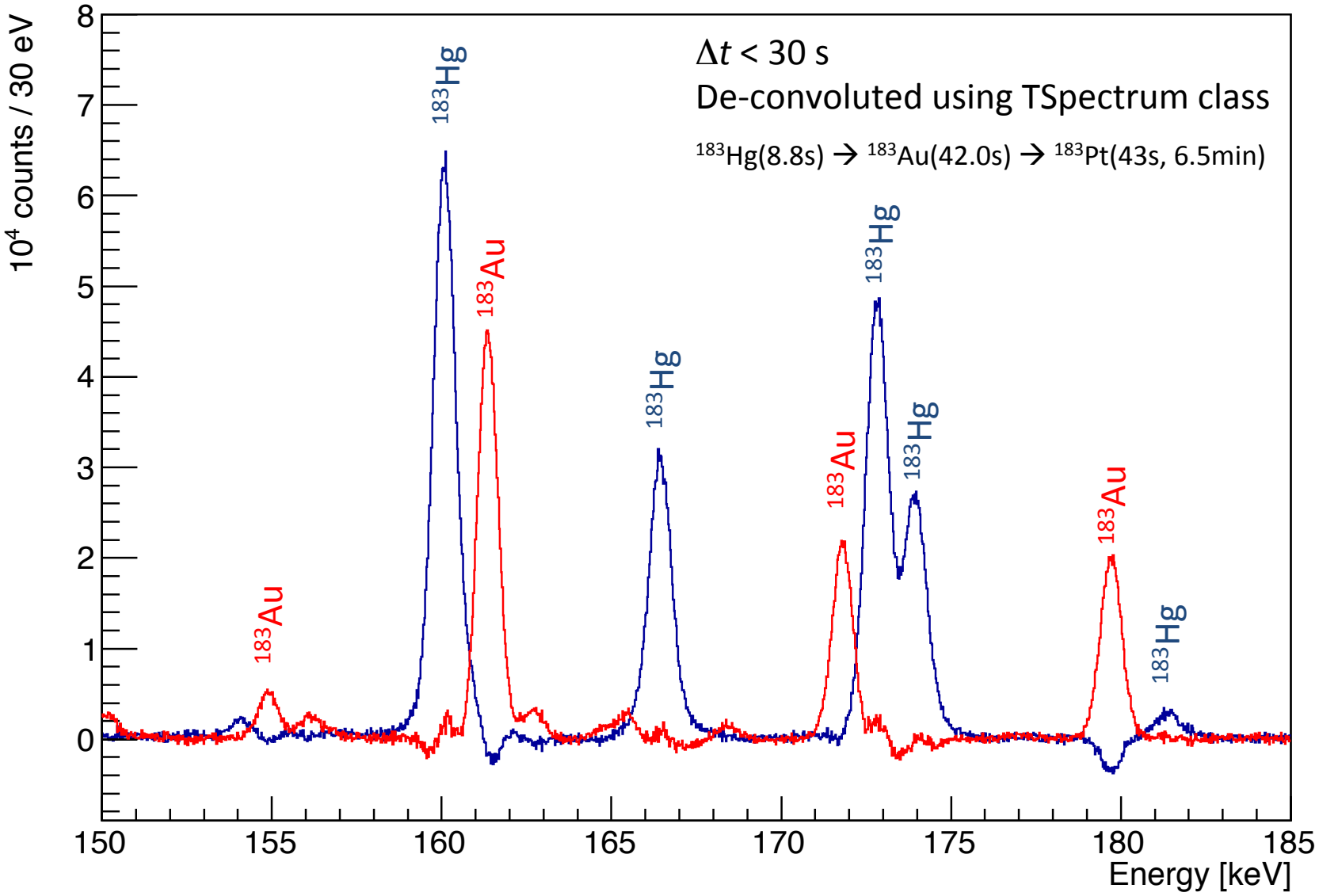
# $^{183}$Hg -> $^{183}$Au -> $^{183}$Pt decay: coaxial Ge detector



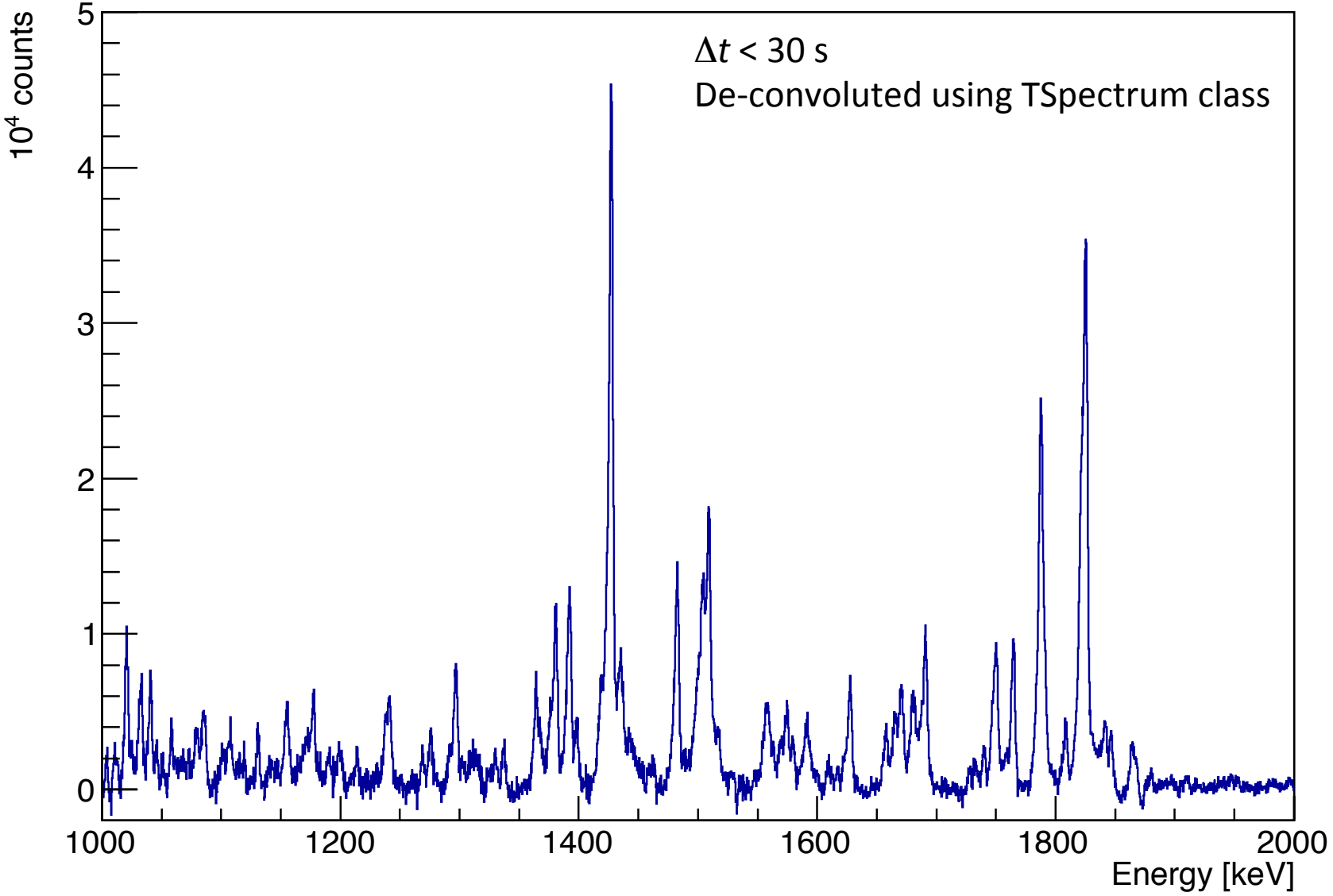
# $^{183}$Hg -> $^{183}$Au -> $^{183}$Pt decay: Example of BE2020 spectrum



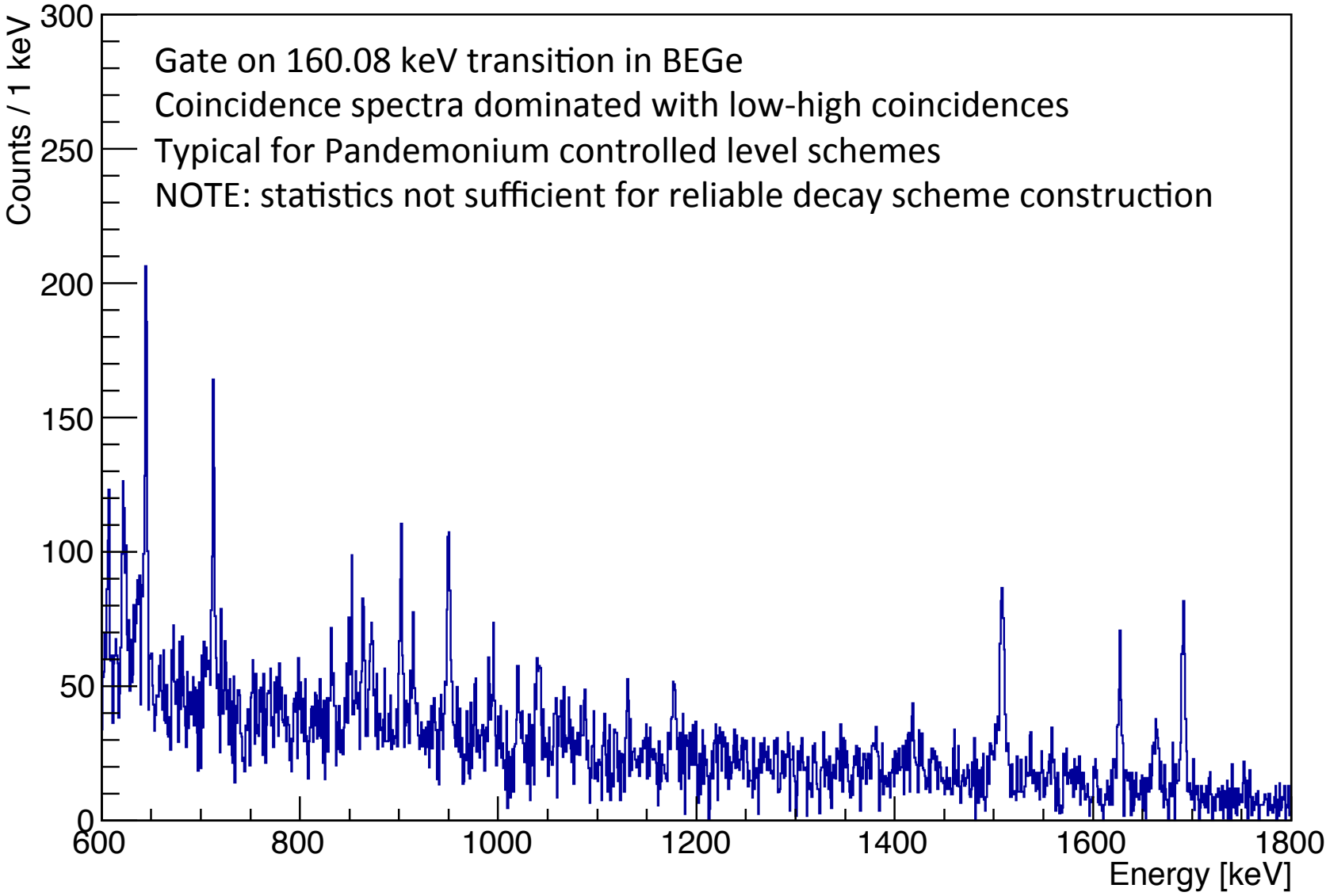
# $^{183}$Hg -> $^{183}$Au -> $^{183}$Pt decay: Identification of peaks using timing



# Coaxial detector spectrum: decay strength at higher energies



# Example of low-high coincidence spectrum

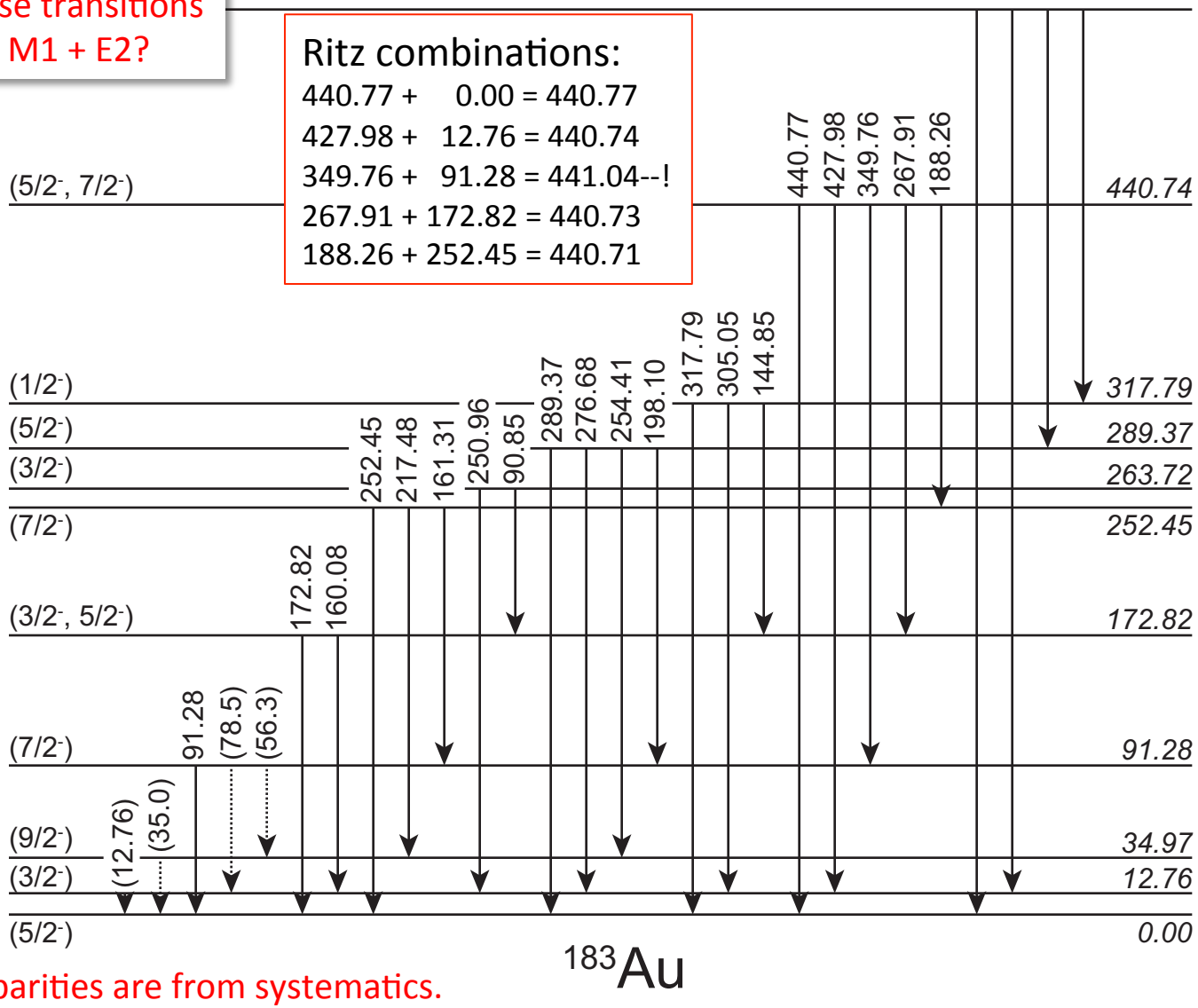


# $^{183}$Hg -> $^{183}$Au decay: part of constructed level scheme

Which of these transitions involves E0 + M1 + E2?

Ritz combinations:

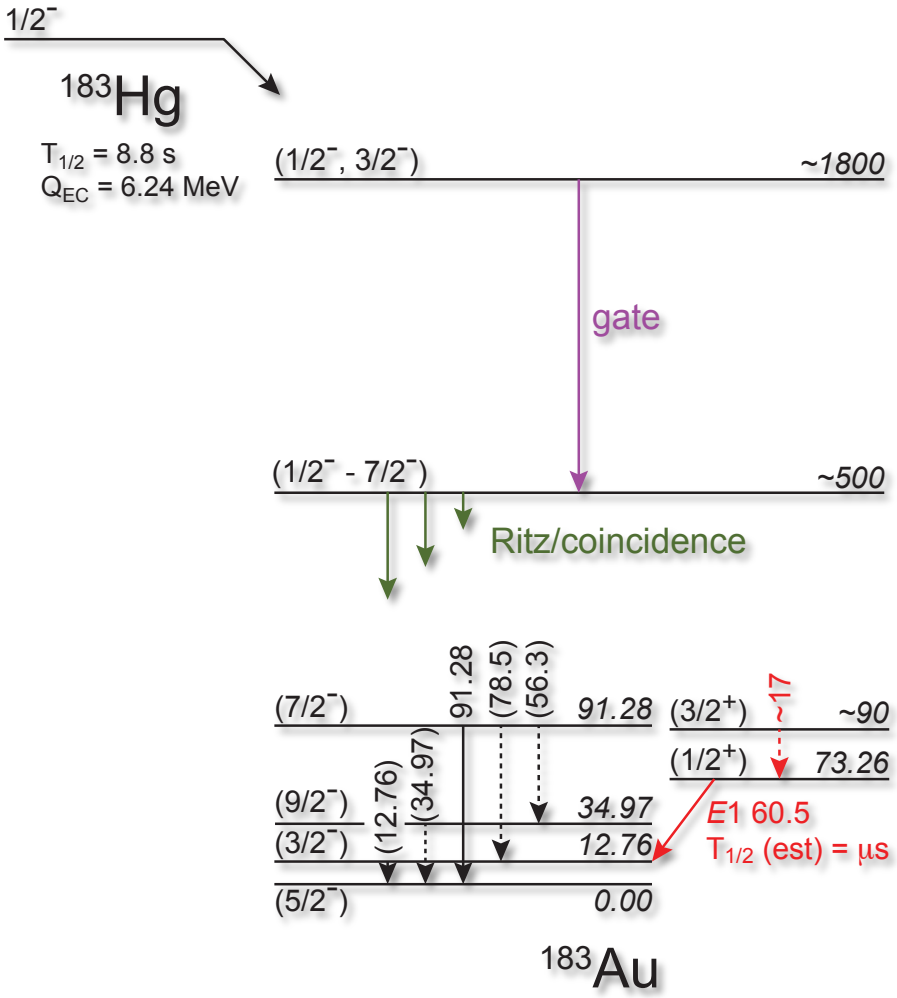
440.77 + 0.00 = 440.77
427.98 + 12.76 = 440.74
349.76 + 91.28 = 441.04--!
267.91 + 172.82 = 440.73
188.26 + 252.45 = 440.71

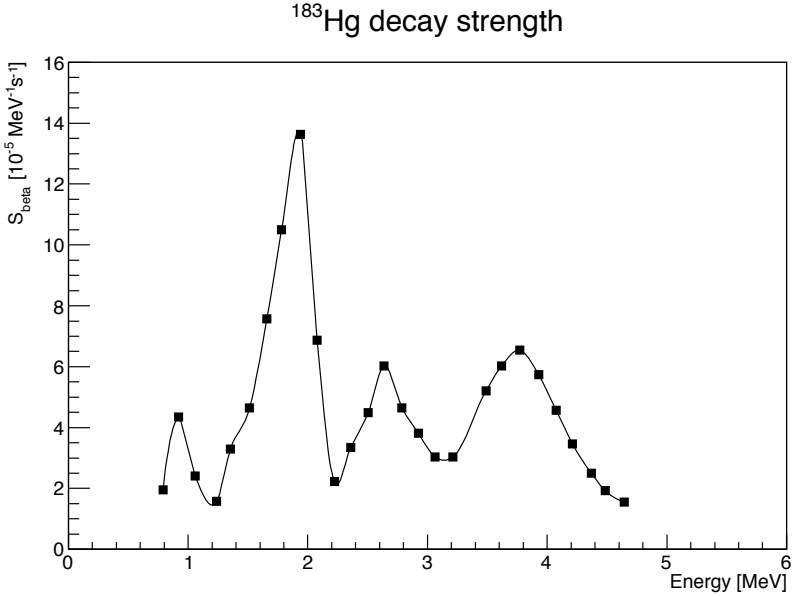



NOTE: spin-parities are from systematics.

# $^{183}$Hg -> $^{183}$Au decay: Coinc./ Pandemonium / BEGe strategy

Using Pandemonium / Coax-BEGe, high-low coincidences: needs a long RUN time



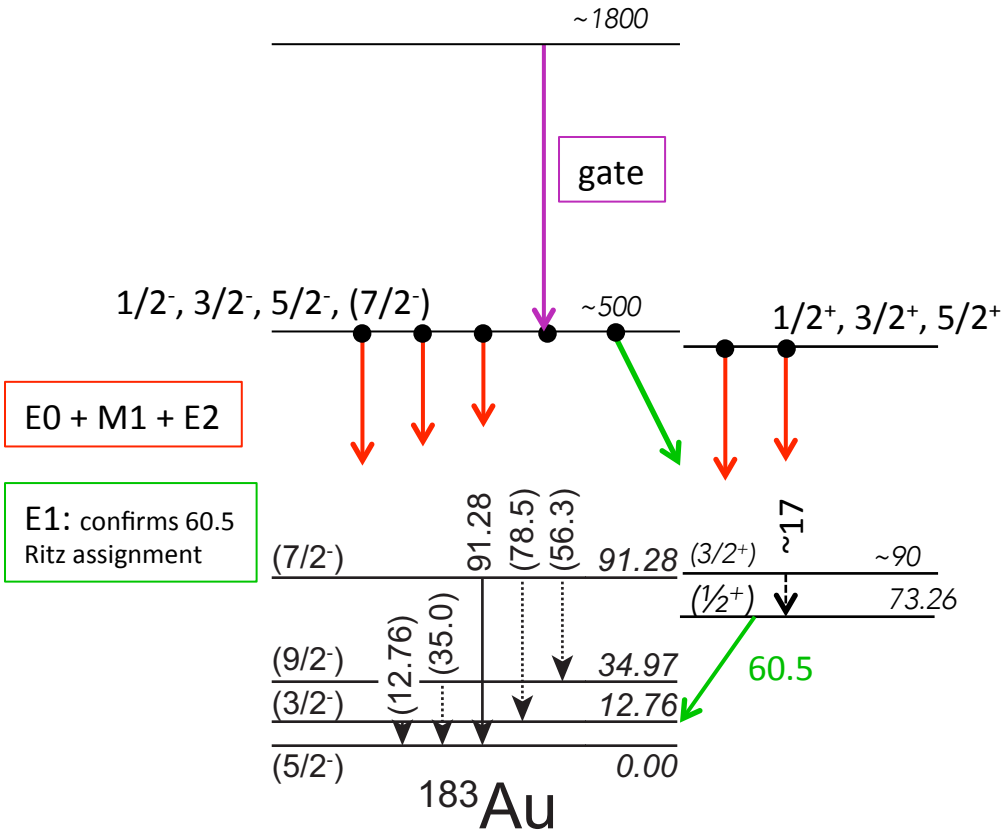

P. Hornshøj *et al.*, Nucl. Phys. **A239**, 15 (1979).

- NO COINCS. with 12.76, ~17 keV trans.
- NO COINCS. with 60.5 keV trans. (isomeric)
- NEED e-γ coincs. for best statistics on E < 100 keV trans.

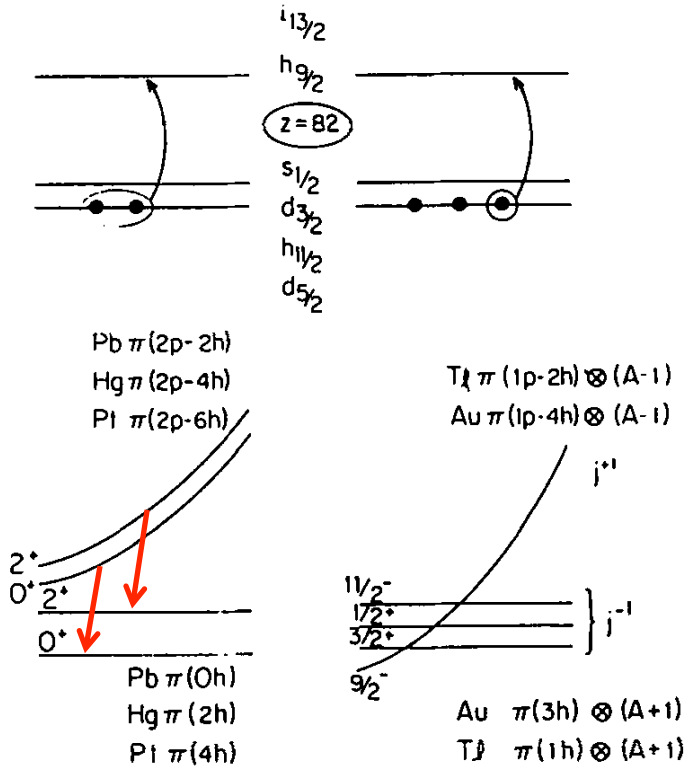
# $^{183}$Hg -> $^{183}$Au decay: γ-e coinc. to locate E0 strength

*E*0 transitions will be highly converted

Also, *E*1 transitions will be weakly converted—this identifies *parity changing* transitions and positive / negative parity sub-schemes




E0's from core intruder structures



# Experimental upgrades for Addendum

- New vacuum system: vacuum now < 1E-7 mbar
- Si(Li) detector was repaired by Canberra
- 2 BEGe detectors will be used (BE2020 and BE6530)
- 2 coaxial detectors for high energies
- Aluminum detector chamber with ConFlat® standard with copper gaskets
- Detector chamber has 50 microns thick titanium windows
- BEGe efficiency will be increased by a factor of 7

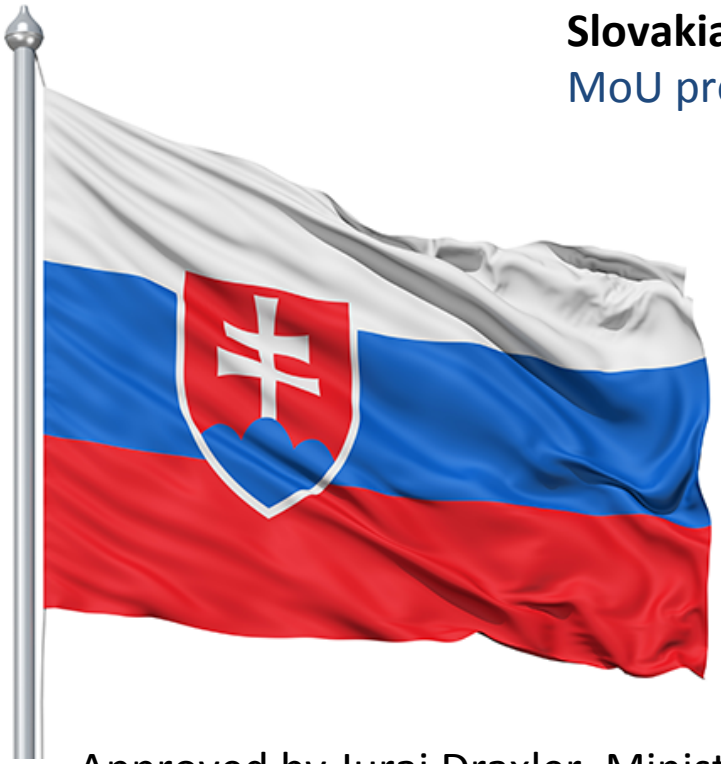
# Why 10 days?

- Level scheme is controlled by Pandemonium effect
- Mostly high-low energy coincidences
- Present data is insufficient for detailed gamma-gamma analysis
- This will allow us to assign important weak low-energy decay branches
- Needed for high statistics conversion electron-gamma coincidences
- Previous measurement of $^{183}$Hg: 4 shifts
- With improved BEGe efficiency and 30 shifts: approximately 50 – 100 increase of statistics
- This will increase statistics in strongest gamma line to 1E+8 counts
- With this we will be able to place transitions with intensity 1E-5 of the strongest line
- Efficiency to detect conversion electrons ~15 %

# Why $^{183}$Hg?

- Our collaboration (Bratislava + Liverpool + John Wood) conducts studies of odd-Au nuclei
- High-statistics in-beam experiments: $^{173,175,177,179,187}$Au (Jurogam2, Afrodite)
- Systematic understanding ends at $^{185}$Au
- Goal is to close the gap between proton-unbound nuclei and $^{185}$Au
- Natural step: $^{183}$Hg decay
- Extensive level scheme for $^{183}$Hg decay will allow us to interpret unpublished data for $^{185}$Hg
- Later we will continue with dedicated $^{185g,m}$Hg (including lasers) and $^{181,179}$Hg studies

# Political aspect…



**Slovakia: new member of the ISOLDE collaboration since 2016**

MoU preparation is in progress, funding is secured

Approved by Juraj Draxler, Minister of Education, Science, Research and Sport