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A new detector setup for γ spectroscopy and lifetime measurements at the Tandem Accelerator Laboratory of NCSR “Demokritos”

Theo J. Mertzimekis
University of Athens

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Outline

- Introduction
- The Tandem Accelerator Lab (TAL)
- A new setup
- Some measurements
- Future prospects

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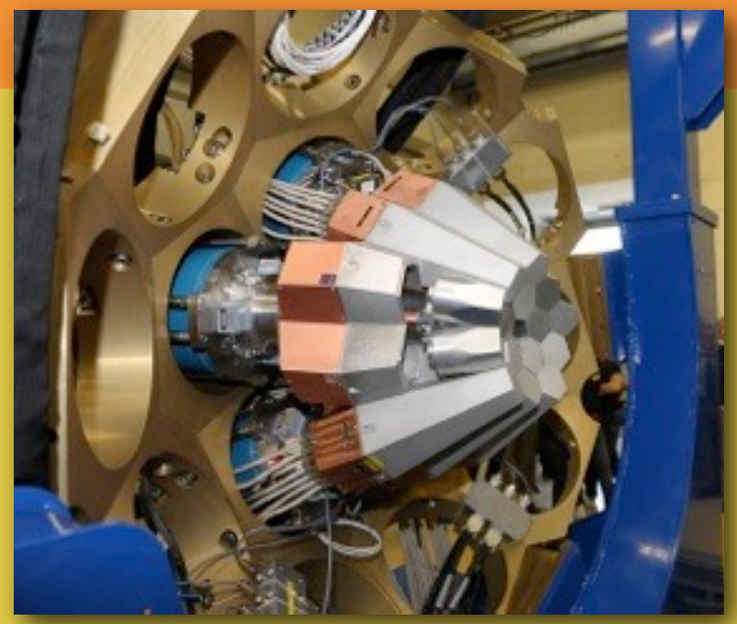
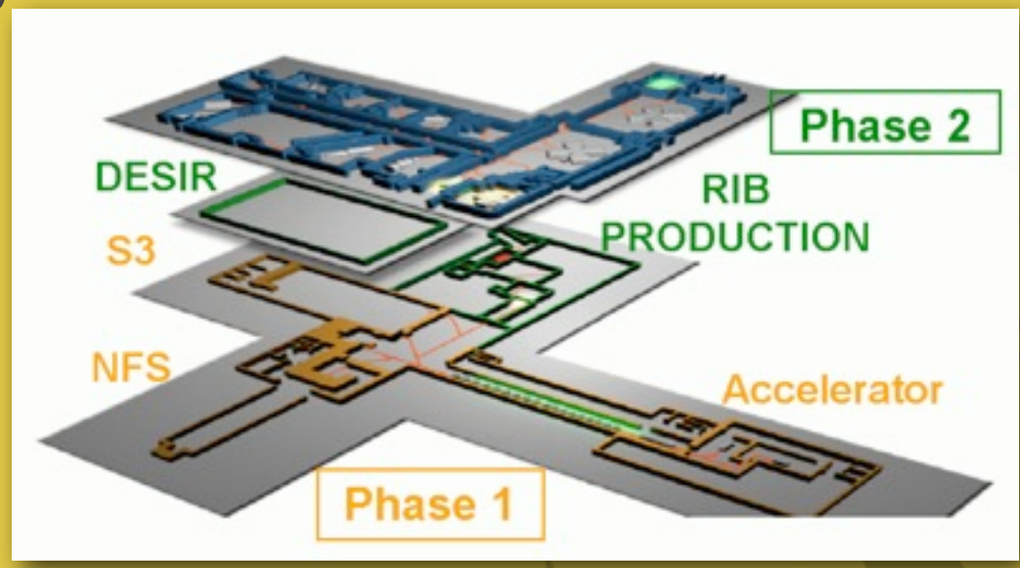
Introduction



- An exciting time for γ studies
- On the hardware side:
  - AGATA and other γ-arrays
- On the beam side:
  - RIB
- Is there a role for smaller-scale facilities?



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TAL @ Demokritos

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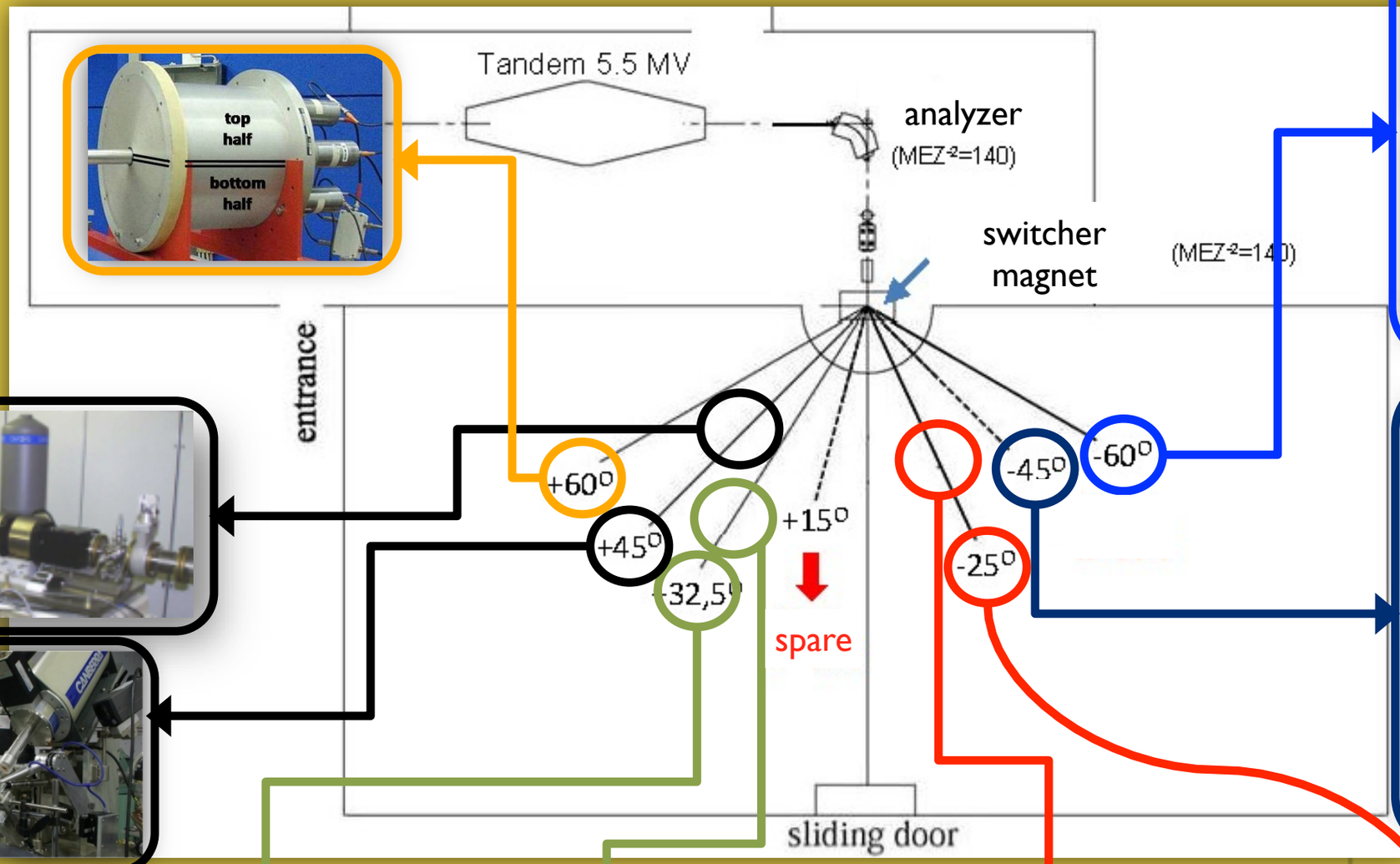

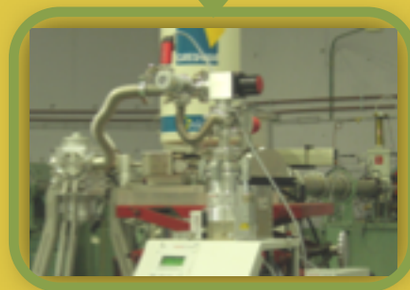

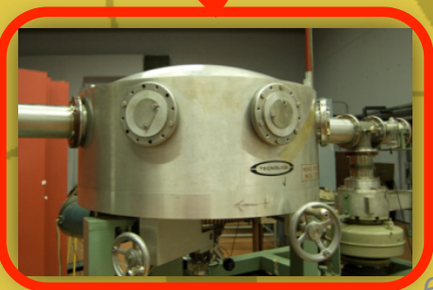

The construction phase

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Outlook

- New remotely controlled, motorized, rotating table
- **A**thens**DA**rmstadt**KO**eln**M**unich detector pool
- 4 new detector mounts/ adjust, align by laser / 3 degrees of freedom
- Enough space to accommodate additional detectors (e.g. BGO) and supporting instruments
- thin-wall Al chamber with air-cooling
- New fast-ADC, power supplies, DAQ

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The new γ setup

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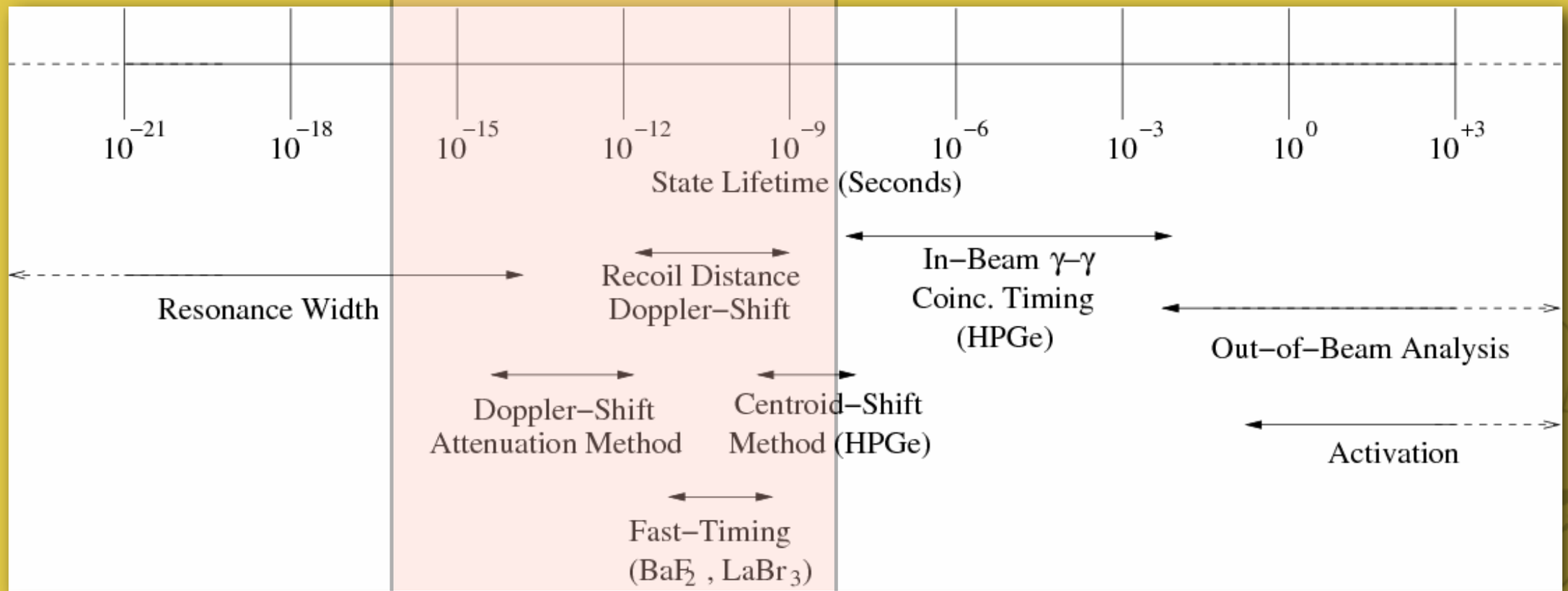
The new γ setup

Lifetimes & techniques



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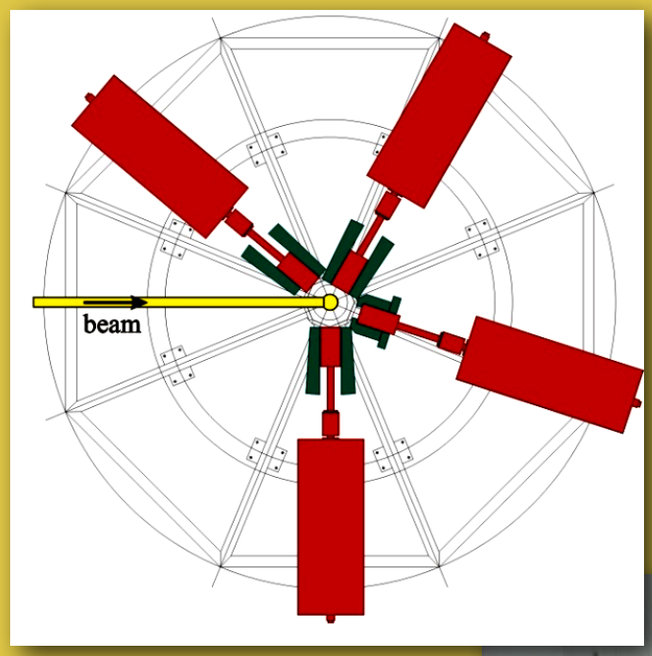
Test (p,p'γ) measurements

- **Targets:**
  - 3.5(3) mg/cm² ^{64}Zn
  - 5.0(4) mg/cm² ^{92}Mo
- **Beam:** 7 MeV, 10-20 nA protons
- **Detector angles:**
  - 0°,15°,40°,55°,90°,105°,150°,165°
- **Fast runs:** 6 hrs ^{92}Mo, ~1 hr ^{64}Zn



Centroid Shifts

- The centroid shift is given by:

$$E_\gamma(\theta) = E_\gamma(90^\circ)\,(1 + \beta F(\tau)\cos\theta)$$

- Experimentally, the energy is plotted as E_γ vs. cosϑ
- A linear fit provides $F(\tau)$
- In theory, F(τ) is given by the modified Winterbon DSA code
  - K.B. Winterbon AECL-Report 4829 (1974)
  - T. Belgya, G. Molnár and S.W. Yates, NPA 607, 43 (1996)

Typical spectra

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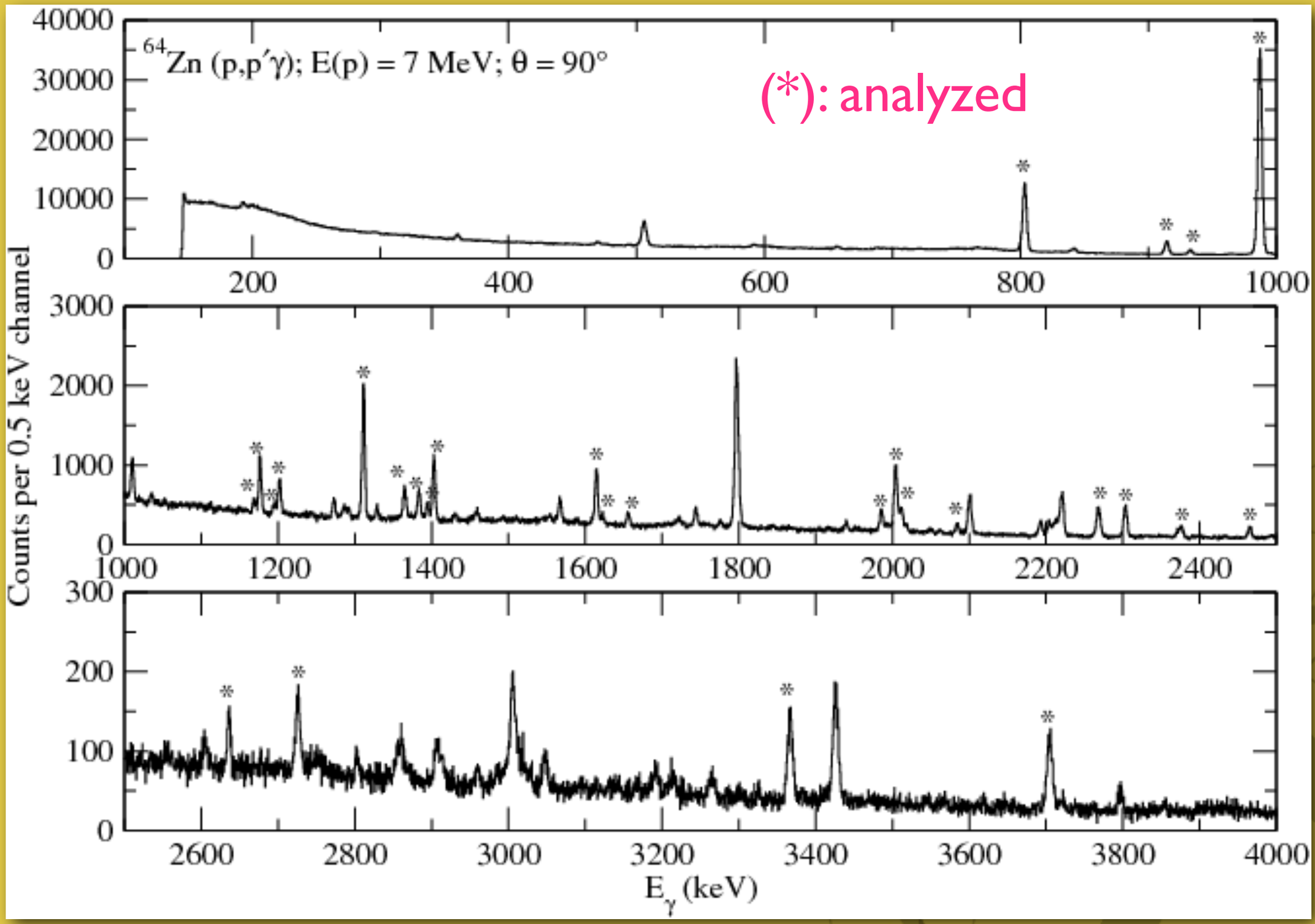

DSAM analysis

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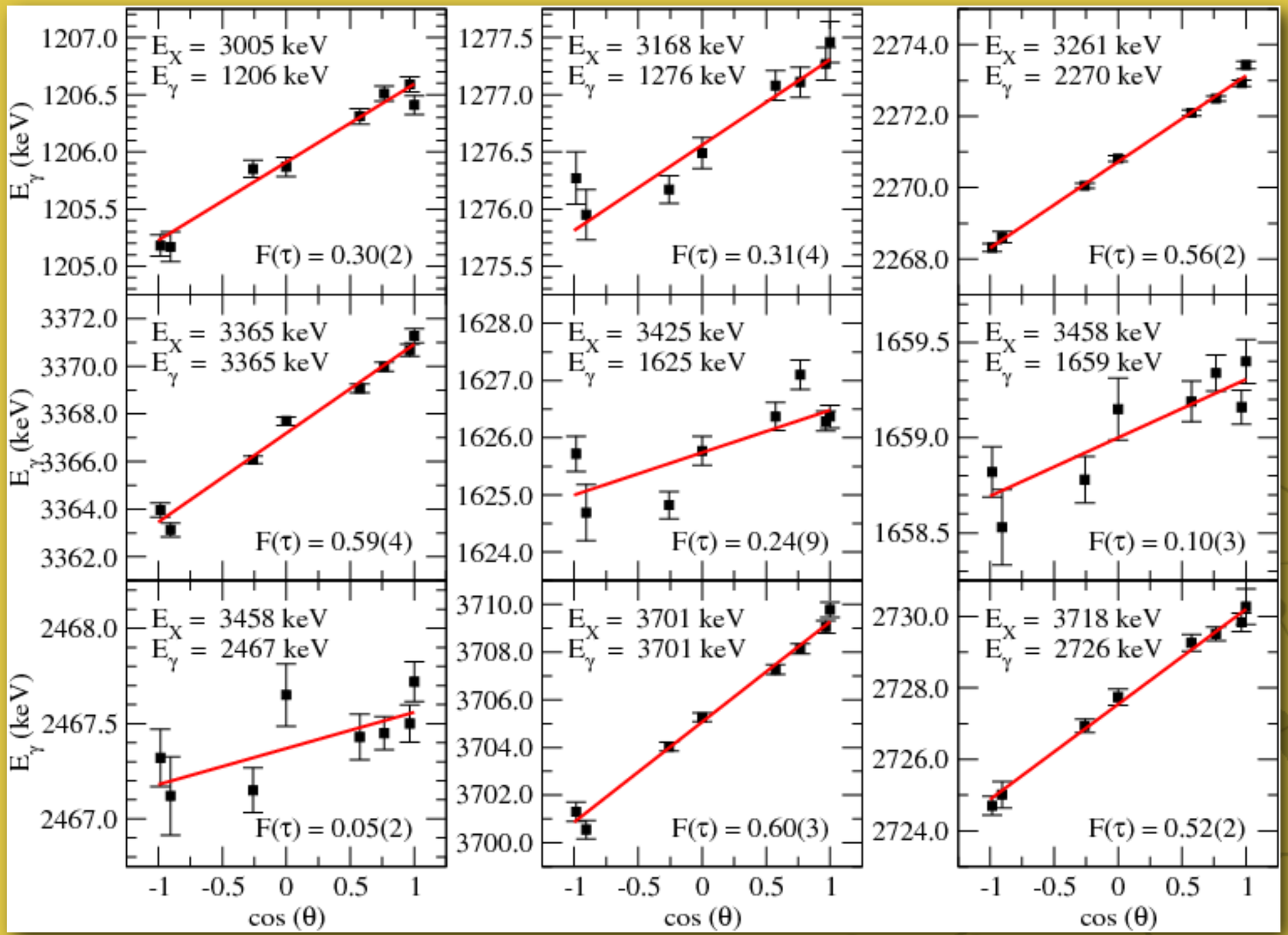

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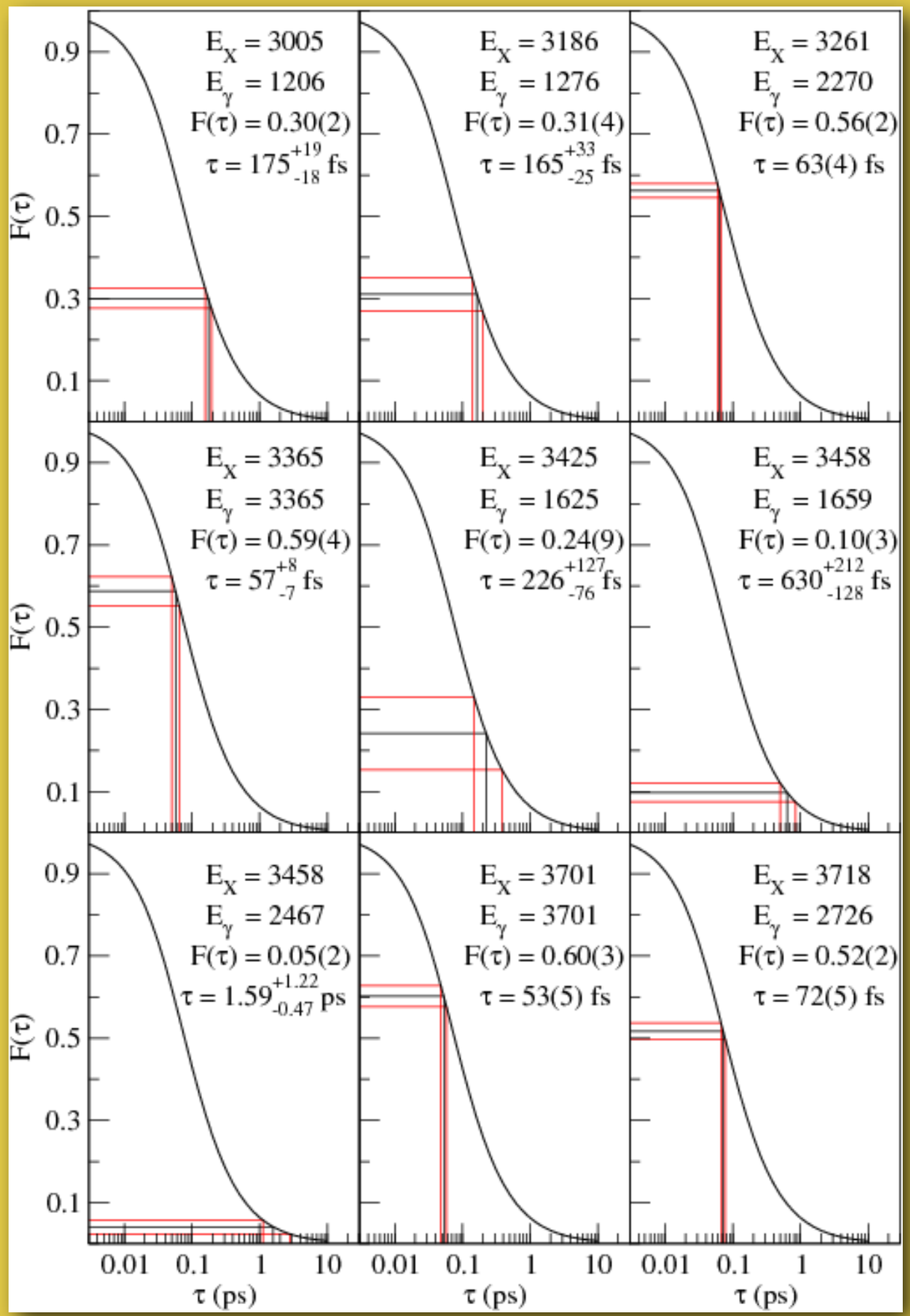
DSAM analysis



- 9 levels were measured with good statistics
- Lifetimes are in general longer compared to (α,n) and (e,e') measurements
- Analysis by S.F. Ashley

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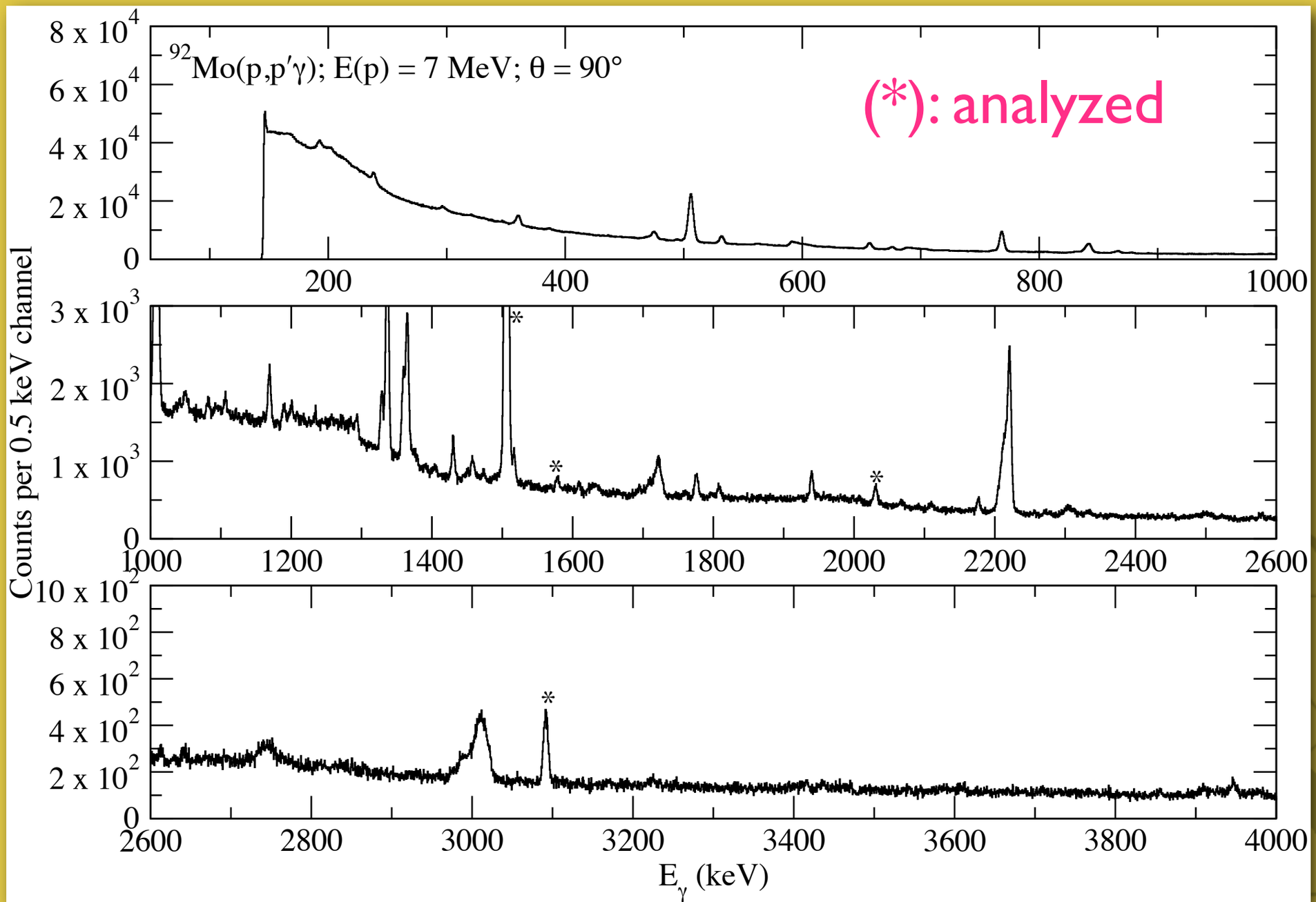
^{92}Mo data



- Levels up to ~3.5 MeV were populated
- **Good agreement** with ENSDF values

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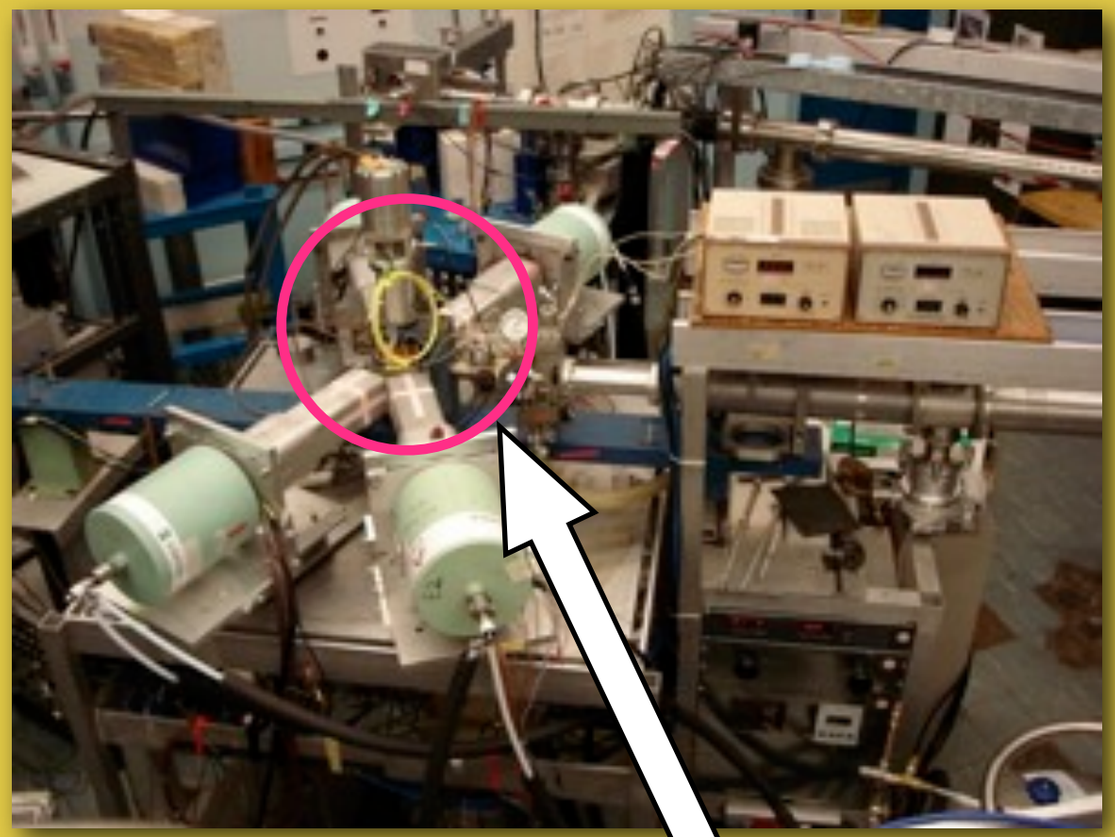
The resurrection of a magnet



Rutgers Setup at Yale

- A new magnet is arriving soon
- We need to design a new chamber
- (p,γ) coincidence is required => particle detector

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Closing...

- New γ setup at TAL, NCSR “Demokritos”
- Flexible design to accommodate several types of experiments such as (p/HI, γ) etc.
- Proof-of-principle measurements showed that we can reach the sub-picosecond range. Several new measurements are planned (test symmetries, structure systematics etc)
- A Transient-Field setup is also on the way

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The team

^{64}Zn level scheme

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