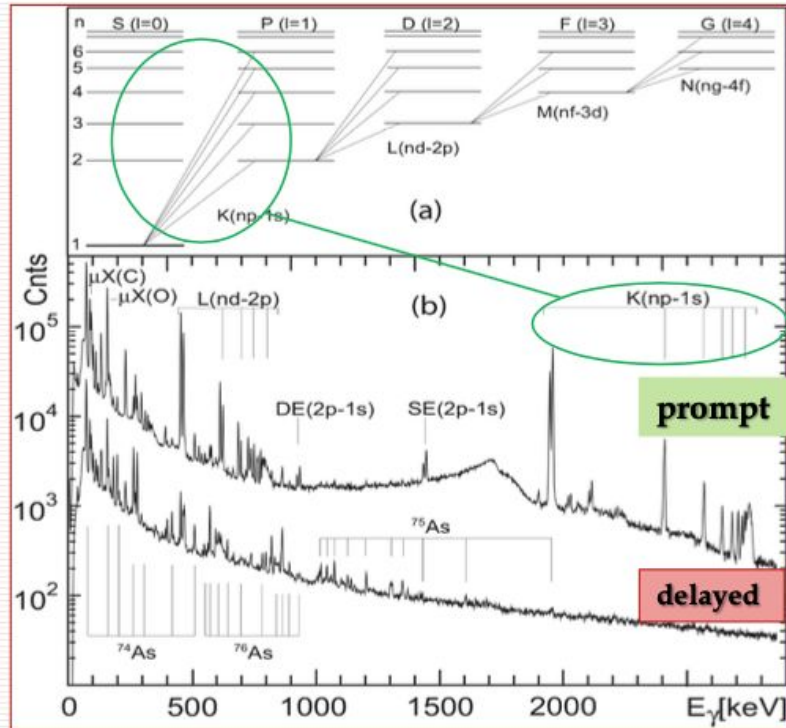# Discussion: Do we really need the K-series μX-rays?

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Analysis meeting 20.06.2023
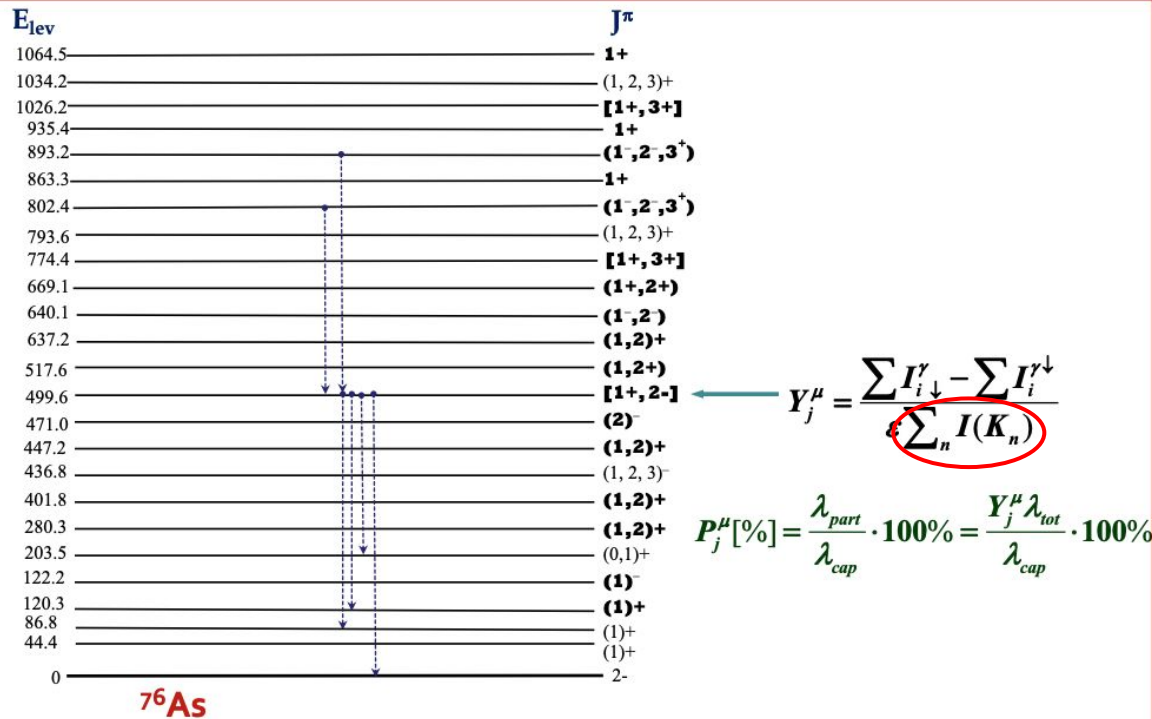
The K-series μX-rays

From Daniya's talk at CM

All muons finally reach the np states, **producing a μX-ray in the K(np-1s) series***

The integral of the K-series μX-rays is a good estimation of the number of muons reaching the target

Combining it with the **total capture rate**, we can extract the number of muon captured

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Why do we need IT?

Partial μ-capture probabilities to ^{76}As

$$Y_j^\mu = \frac{\sum I_{i\downarrow}^\gamma - \sum I_i^{\gamma\downarrow}}{\sum_n I(K_n)}$$

$$P_j^\mu[\%] = \frac{\lambda_{part}}{\lambda_{cap}} \cdot 100\% = \frac{Y_j^\mu \lambda_{tot}}{\lambda_{cap}} \cdot 100\%$$

Any uncertainty on this number directly translate into an uncertainty on the partial capture rate!

From Daniya's talk at CM

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Uncertainties on the integral of K-series

- **Theoretical uncertainty:** probability of muon captured at higher shells than K shell -> how well do we know it?

- **Experimental uncertainties:**
  - Integral -> large uncertainty?
  - Efficiency -> large uncertainty?
  - Total capture rate -> ~1%, negligible?)
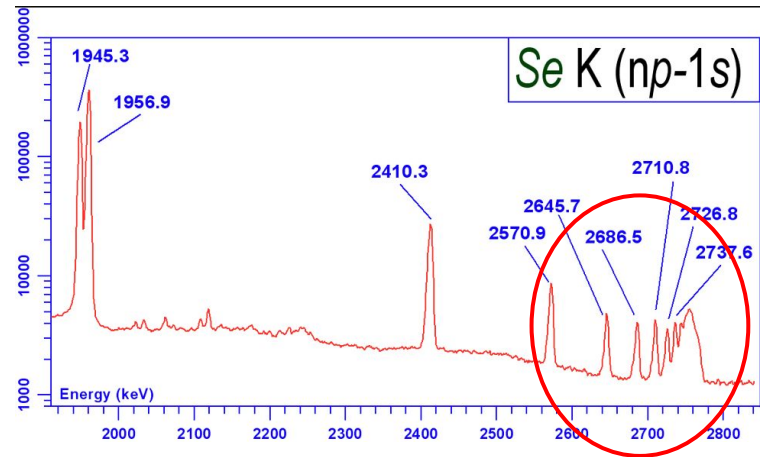
Do we really need IT?

What if we provide experimental ratios between partial capture rate (= ratios between yields)?

$$P_j^\mu / P_k^\mu = Y_j^\mu / Y_k^\mu = \left(\frac{\sum I_{j,out}^\gamma - \sum I_{j,in}^\gamma}{\sum I(K_n)} \right) \left(\frac{\sum I(K_n)}{\sum I_{k,out}^\gamma - \sum I_{k,in}^\gamma} \right)$$

- **We can provide quite accurate and robust experimental measurements:**
  - All correlated systematic uncertainties cancel out
  - We don't need the K-series
- Comparison with theory should not be a problem (if they can calculate P, they can also calculate ratios of P)
- *Am I missing something?*

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