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Low-lying spectroscopy of 20O

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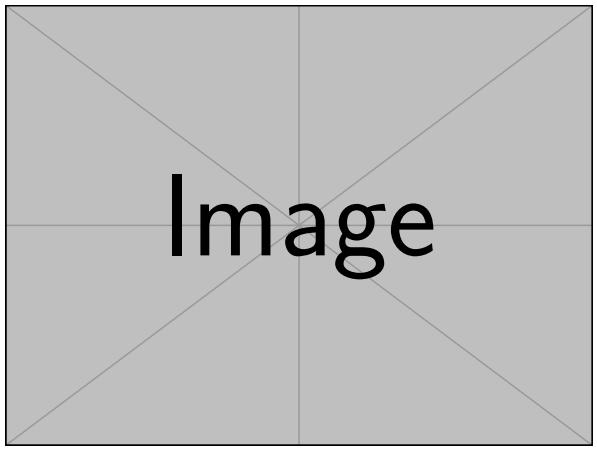
A recap on spectroscopic factors

Spectroscopic factors shed light on the occupancy of single-particle states:

$$\left.\frac{d\sigma}{d\Omega}\right|_{\text{exp}} = C^2S \cdot \left.\frac{d\sigma}{d\Omega}\right|_{\text{s.p}}, \quad \sum C^2S = (2j+1) \text{ in IPSM}$$

Experimentally:
Reduction of ~ 65 %!

- **Short-range** correlations: tensor forces,...
- **Long-range**: vibrations, giant resonances,...



L. Lapikás, Nuclear Phys. A 553 (1993)

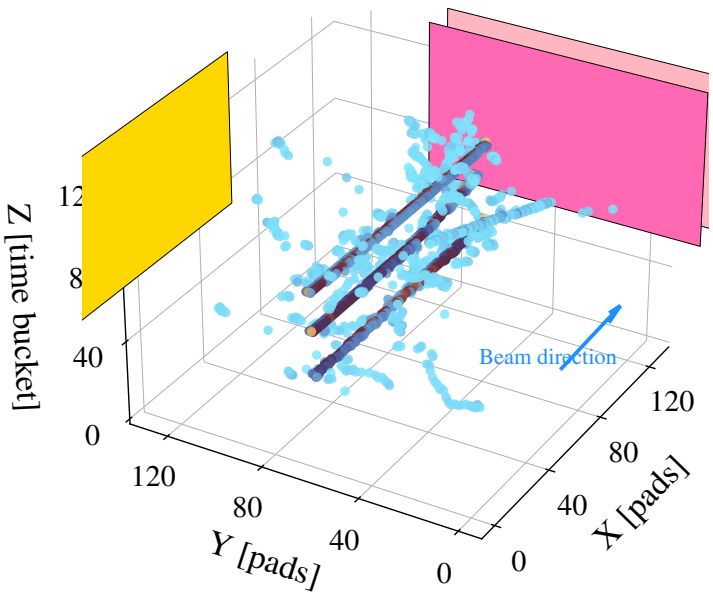
Experimental setup

E796 was performed at LISE (GANIL) back in March 2022 under these experimental conditions:

- Beam: ^{20}O @ 35 AMeV
- Gas: 90 %D_2 and 10 % iC_4H_{10}
- Silicons: two front layers and one left. 500 µm-thick

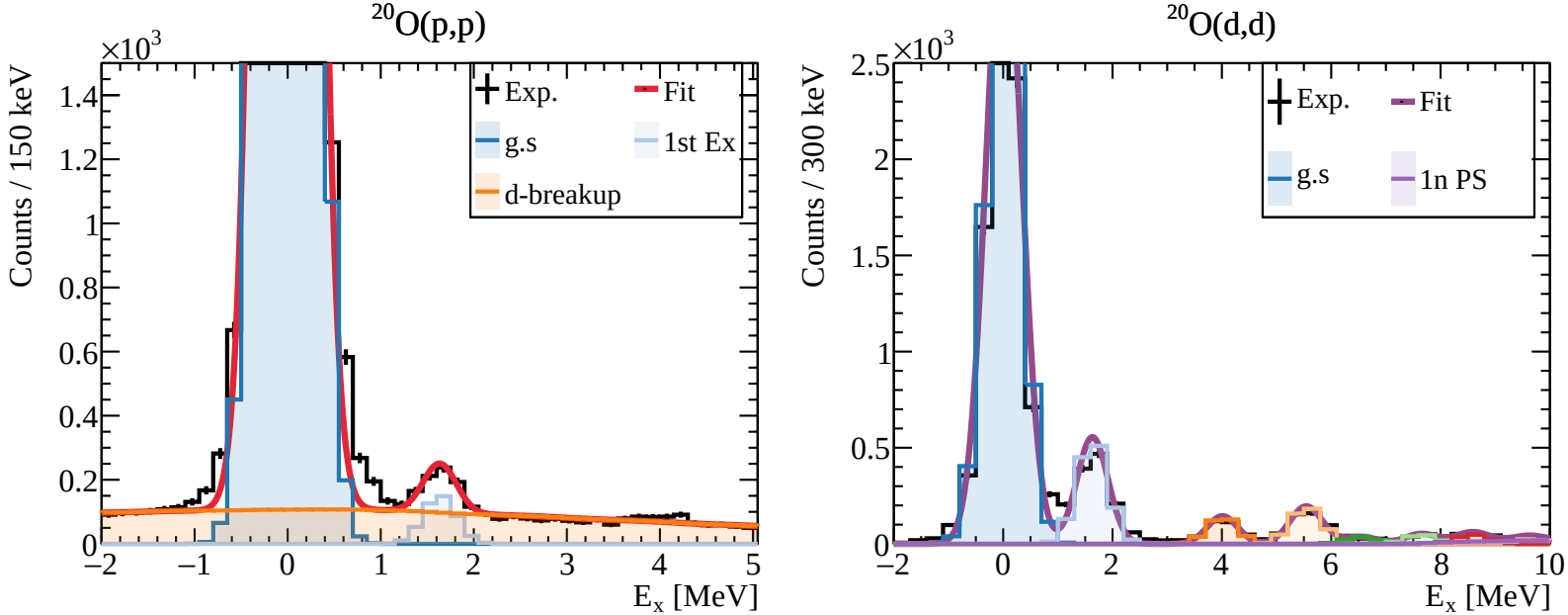
Neutron removal
^{20}O(p, d)
^{20}O(d, t)

Proton removal
^{20}O(d, ^{3}He)



Results: (in)elastic scattering

These are the excitation energy spectra for protons and deuterons.

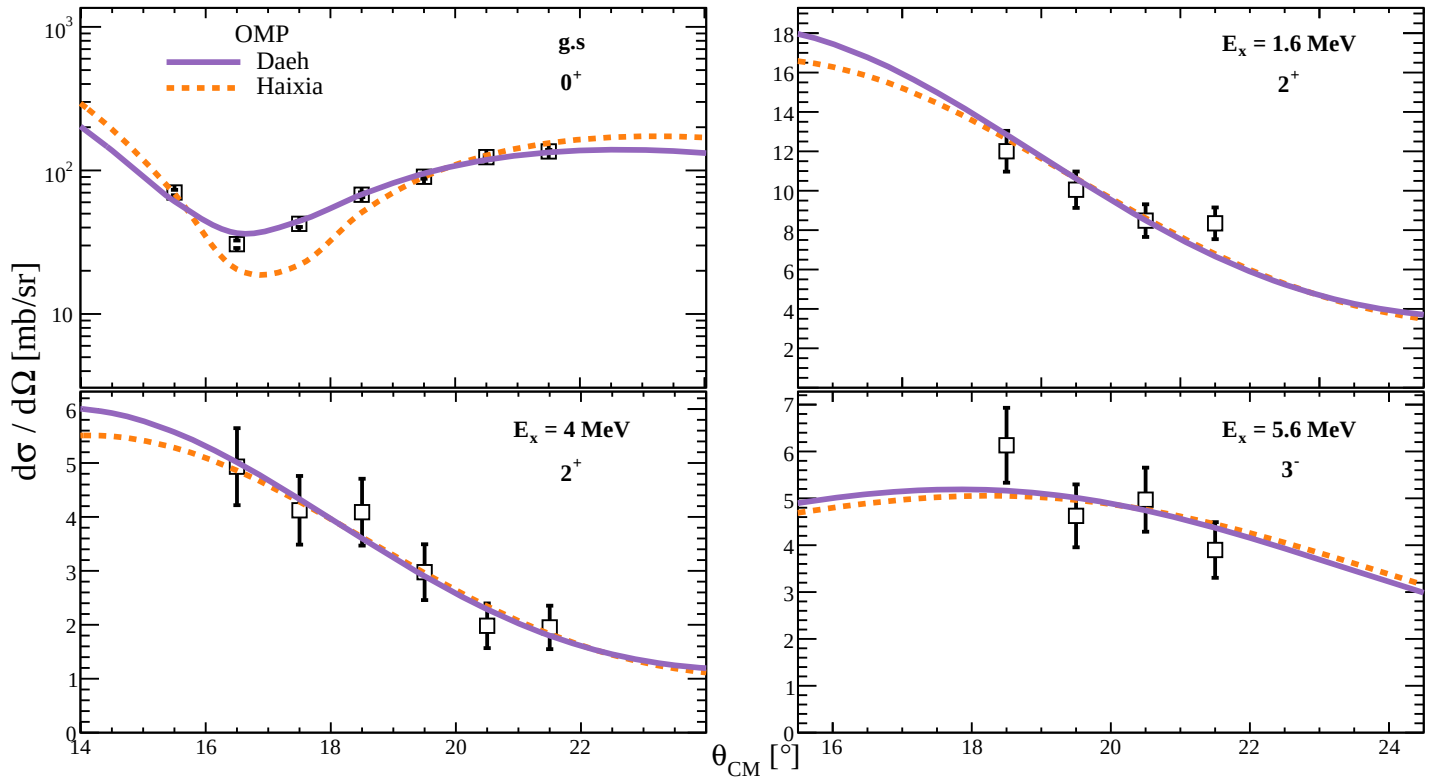


Only 1st excited state

Up to 7 $E_x > 0$ states observed!

Results: ^{20}O(d,d)

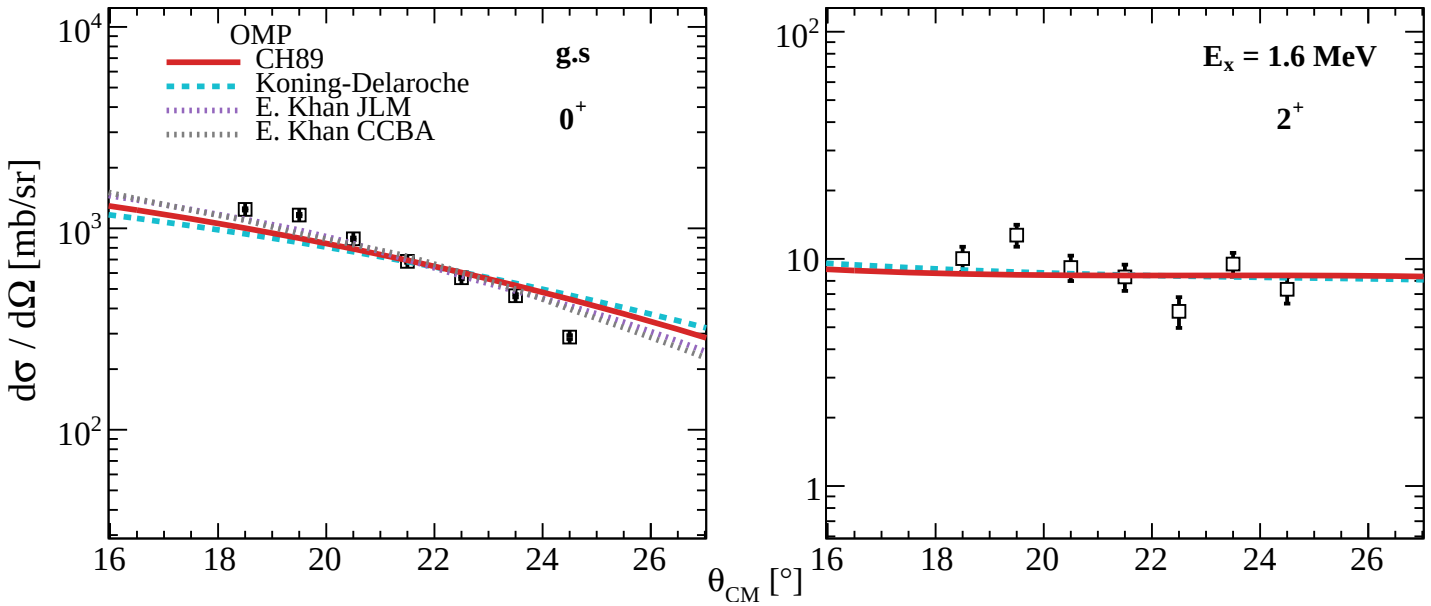
Angular distributions for the **ground-state** and first excited states:



Remaining states: low stats. Coming soon.

Results: ^{20}O(p,p)

For the proton scattering:



Issue: gs not reproduced by any OMP!

😰

1st excited as well?

About normalizations

Just to recall the xs formula:

$$\frac{d\sigma}{d\Omega} = \frac{N}{N_{\text{beam}} N_{\text{targets}} \epsilon \Delta\Omega} = \frac{N}{\alpha \epsilon \Delta\Omega}$$

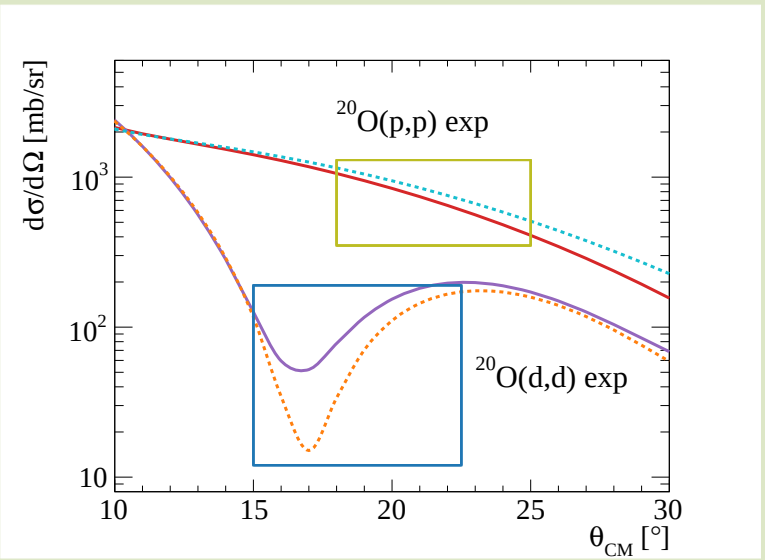
- $N_{\text{beam}} \leftarrow$ CFA counter
- $N_{\text{targets}} \leftarrow$ Gas mixture. Sensitive to p.

Theo. lines need **scaling** (α) to match experimental data

α in agreement with Juan's

$\Rightarrow$ Not likely ϵ issue

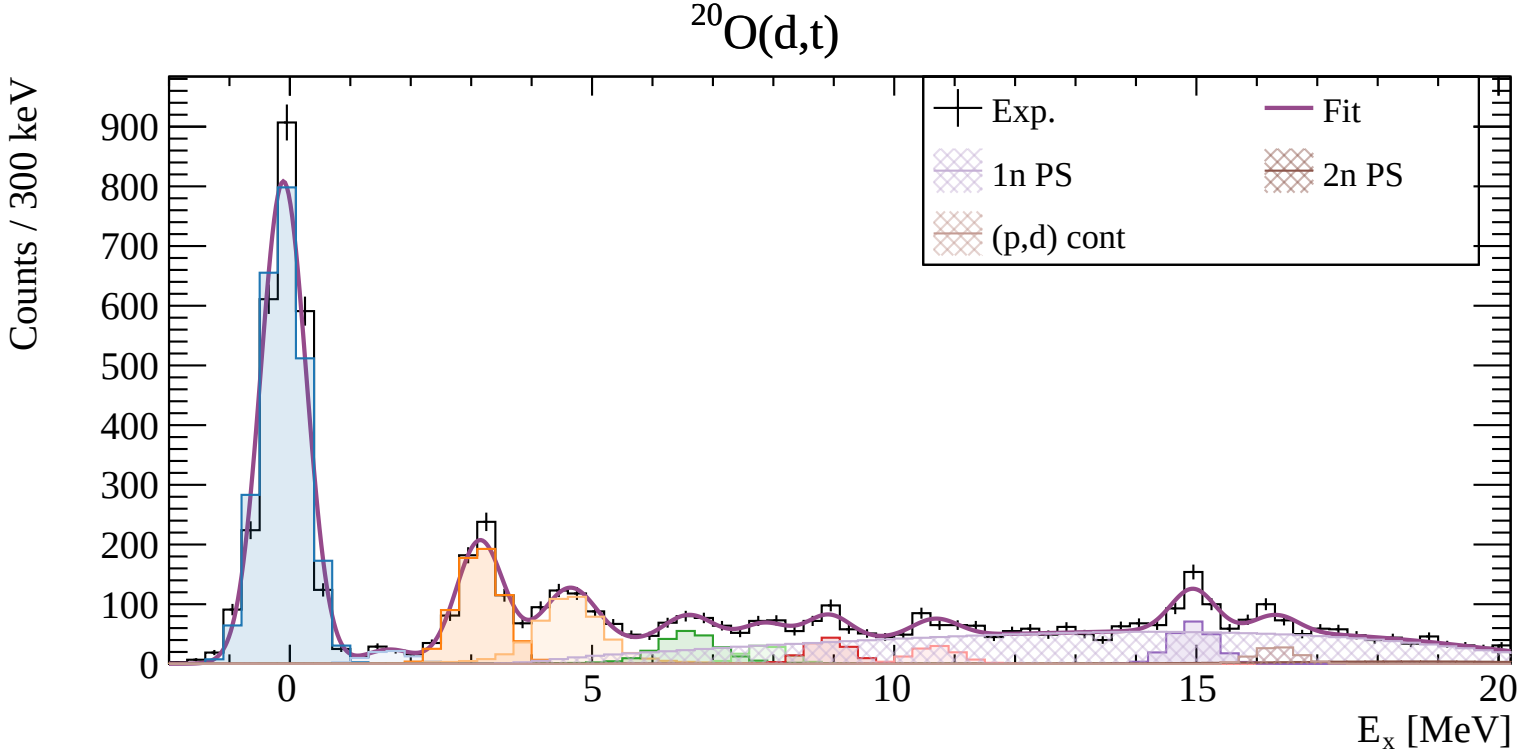
Which norm should we use?



Protons are more "reliable" 🤔

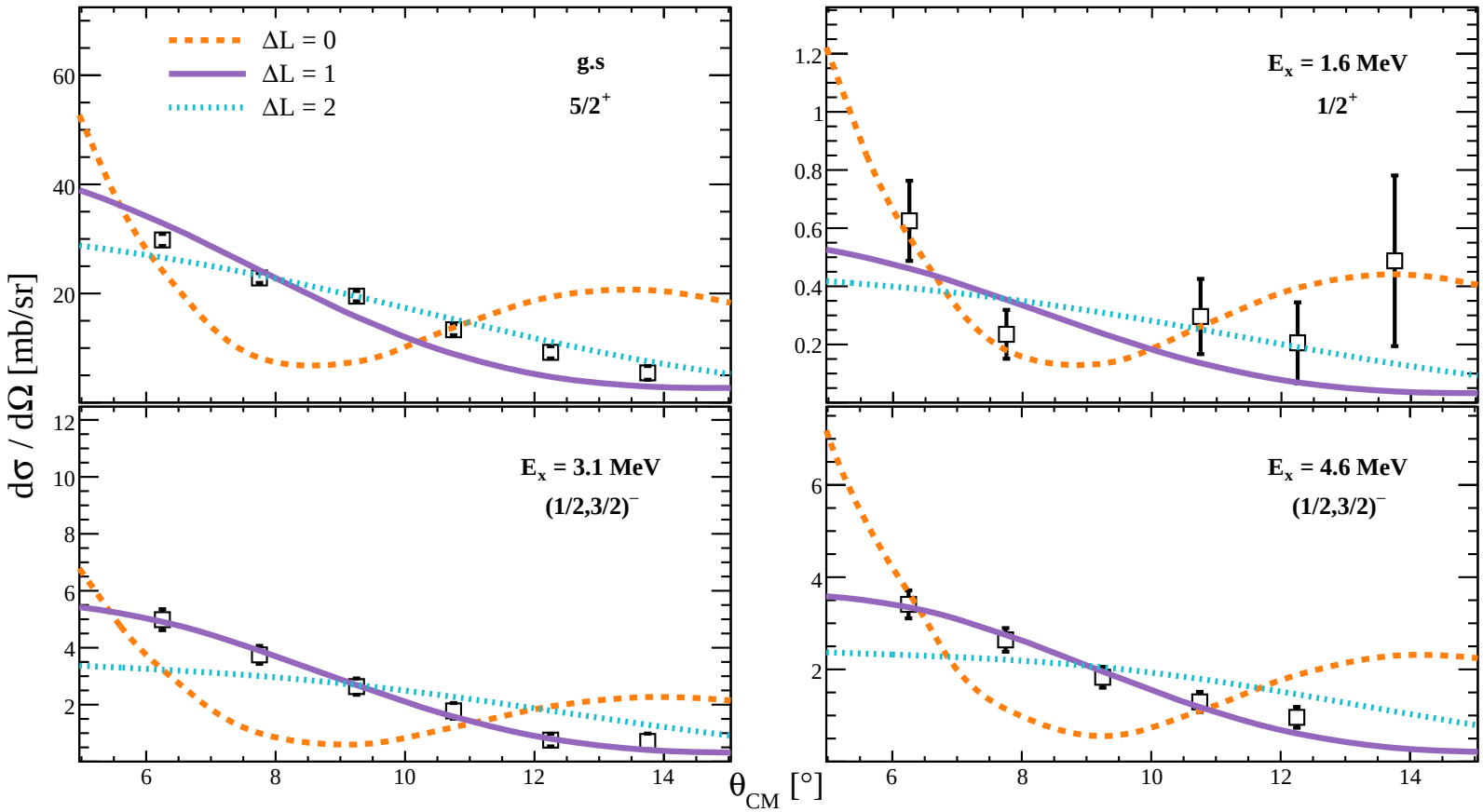
Results: ^{20}O(d,t)

Excited states are populated up to ~ 15 MeV:



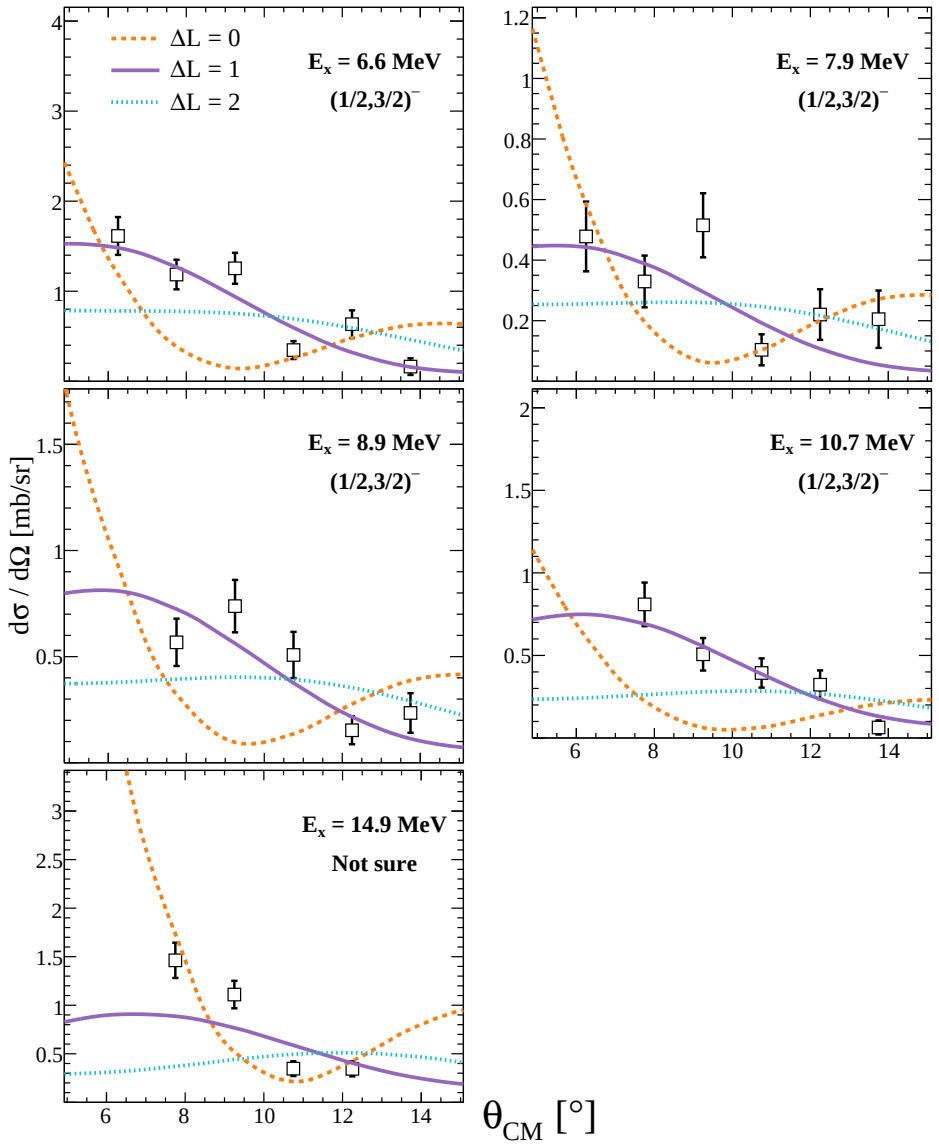
1n and 2n **phase spaces** are included in the fit. Small (p,d) contamination as ~ 16 MeV under control.

Results: ^{20}O(d,t)



g.s fits well to $\Delta L = 2$.

Results: ^{20}O(d,t)



Few stats for some. Rebinning is foreseen.

Almost all are $\Delta L = 1$!