

OXYGEN@200 MEV/N CROSS SECTION EVALUATION AND COMPARISON WITH LITERATURE

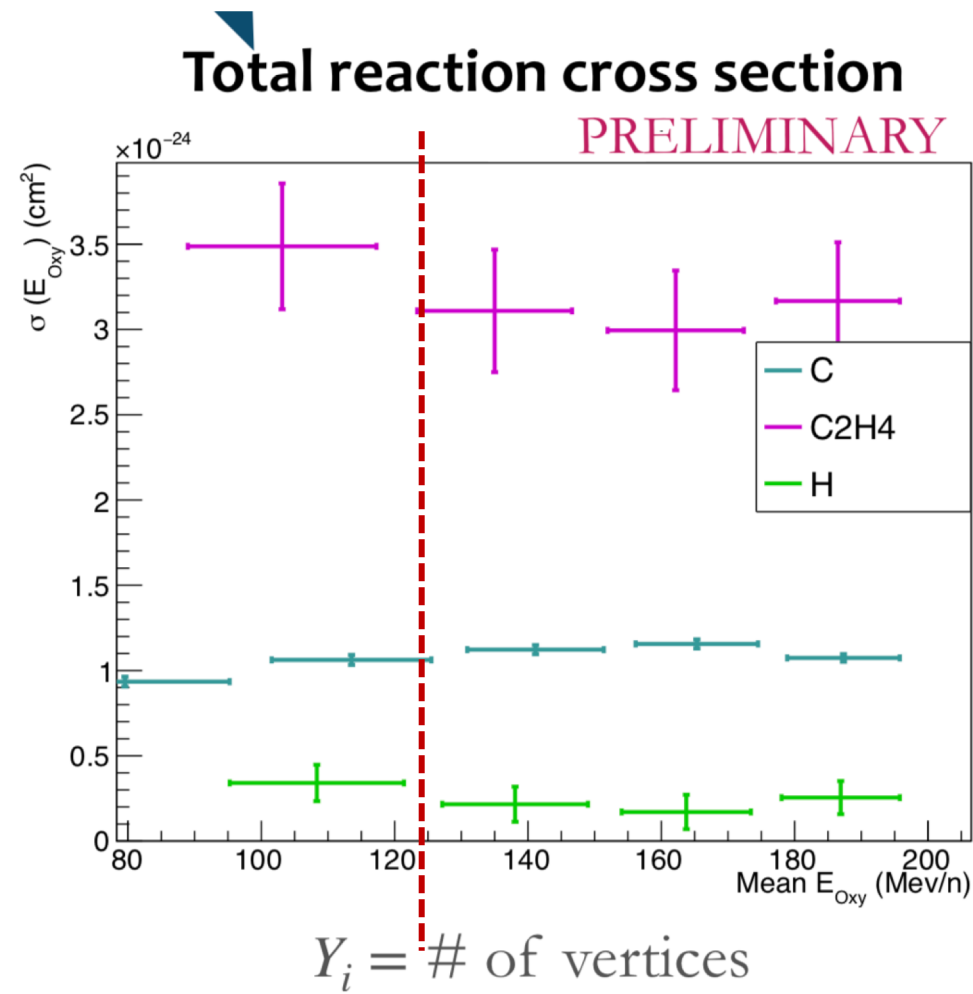


A. Alexandrov, V. Boccia, A. Di Crescenzo, G. De Lellis, G. Galati,
A. Iuliano, A. Lauria, M. C. Montesi, A. Pastore, V. Tioukov

*Università di Napoli "Federico II", INFN Napoli,
Università di Bari, INFN Bari*

FOOT: Physics meeting
Napoli, 1st February 2023

Analysis Status



❖ Reaction cross-section measurement (integrated):
¹⁶O @ 200 MeV / n on C and C₂H₄ target

Energy (MeV/n)	mBarn C ₂ H ₄	mBarn C	mBarn H
185	3,266	1,096	0,269
160	3,093	1,179	0,184
140	3,216	1,144	0,232

Analysis Status

❖ COMPARISON WITH LITERATURE DATA:

- [HTTPS://GSI.DE/FRAGMENTATION](https://gsi.de/fragmentation) (DATABASE ON LINE FROM F. LUONI ET AL., *TOTAL NUCLEAR CROSS-SECTION DATABASE FOR RADIATION PROTECTION IN SPACE AND HEAVY-ION THERAPY APPLICATION*, NEW J. PHYS., VOL 23, 101201, 2021)
- W.R. WEBBER ET AL., *TOTAL CHARGE AND MASS CHANGING CROSS SECTION OF RELATIVISTIC NUCLEI IN HYDROGEN, HELIUM AND CARBON TARGETS*, PHYSICAL REVIEW C, VOL. 41, No. 2 , PAG. 520-532, 1990
- C. ZEITLIN ET AL., *FRAGMENTATION OF ^{14}N , ^{16}O , ^{20}Ne AND ^{24}Mg NUCLEI AT 290 TO 1000 MEV/NUCLEON*, PHYSICAL REVIEW C, VOL. 83 , 034909, 2011
- YAMAGUCHI ET AL., *SCALING OF CHARGE-CHANGING INTERACTION CROSS SECTIONS AND POINT-PROTON RADII OF NEUTRON-RICH CARBON ISOTOPES*, PHYS. REV. LETT. 107, 032502, 2011

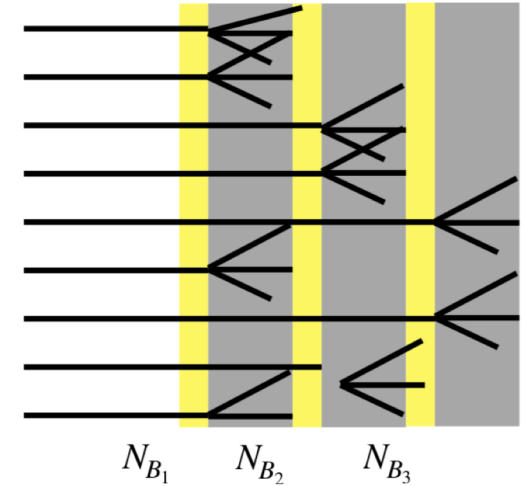
$$\checkmark \sigma(\text{H}) = 0.5 [\sigma(\text{O}^{16}\text{-}\rightarrow\text{CH}_2) - \sigma(\text{O}^{16}\text{-}\rightarrow\text{C})] = 232 \text{ mbarn (formula from Webber, @441 MeV)}$$

$$\checkmark \sigma(\text{H}) = 0.25 [\sigma(\text{O}^{16}\text{-}\rightarrow\text{C}_2\text{H}_4) - 2 \sigma(\text{O}^{16}\text{-}\rightarrow\text{C})] = 230 \pm 40 \text{ mbarn (our data, @ 160 MeV)}$$

Improvement in cross section evaluation

$$\left. \frac{d\sigma(x)}{dx} \right|_{C \text{ or } C_2H_4} = \frac{Y_i(x)}{N_B N_{TG} \Delta x \epsilon_{reco}^i(x)}$$

- $Y_i = \#$ of fragments in the interval Δx
- $N_B = \#$ of ions colliding on the target
- $N_{TG} = \#$ of particles in the target
- $\Delta x = x$ bin
- $\epsilon_{reco}^i =$ reconstruction efficiency



- Each passive material layer acts as a new target and can be considered a “new measurement”
- The number of incident beam particle on each layer has to be evaluated and is affected by its efficiency ($N_{Bi} = N_{tot} - (VX_{B1} + VX_{B2} + \dots + VX_{B(i-1)})$); VX_{Bi} number of vertex in the i layer)
- We have not already taken into account the efficiency in the VX_{Bi} determination

ON GOING

- 1) Cross section evaluation @ 400 MeV/n
- 2) PAPER ON CHARGE IDENTIFICATION: ^{16}O @ 200 MEV/N AND 400 MEV/N ON C AND C_2H_4 TARGET; **(FRONTIERS; DRAFT)**

BACK UP

The emulsion spectrometer structure

