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## Nuclear Astrophysics with TPCs and Gamma-Beams

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Measurements of cross section and their extrapolation to stellar conditions are now routinely performed with accuracy of 5% or better. But the formation of  $^{16}\text{O}$  in the fusion of helium with  $^{12}\text{C}$ , in the  $^{12}\text{C}(\text{a,g})^{16}\text{O}$  reaction, is still not known with sufficient accuracy, in spite of the central role that this reaction plays in stellar evolution theory.

We developed [1] a new method to measure this cross section by measuring with (mono-energetic) gamma-beams the inverse process of the photo-dissociation of  $^{16}\text{O}$  to  $^{12}\text{C}$  and an alpha-particle. The measurements are performed at the HIGS facility using TPC detectors [1] operating with  $\text{CO}_2$  gas, hence also serving as an active target TPC (AT-TPC).

We will discuss initial measurements with the UConn-TUNL optical readout TPC (O-TPC) [2] that demonstrated the viability of our method [3] and recent results obtained in 2022 [4], with the Warsaw electronic readout TPC detector (eTPC).

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