

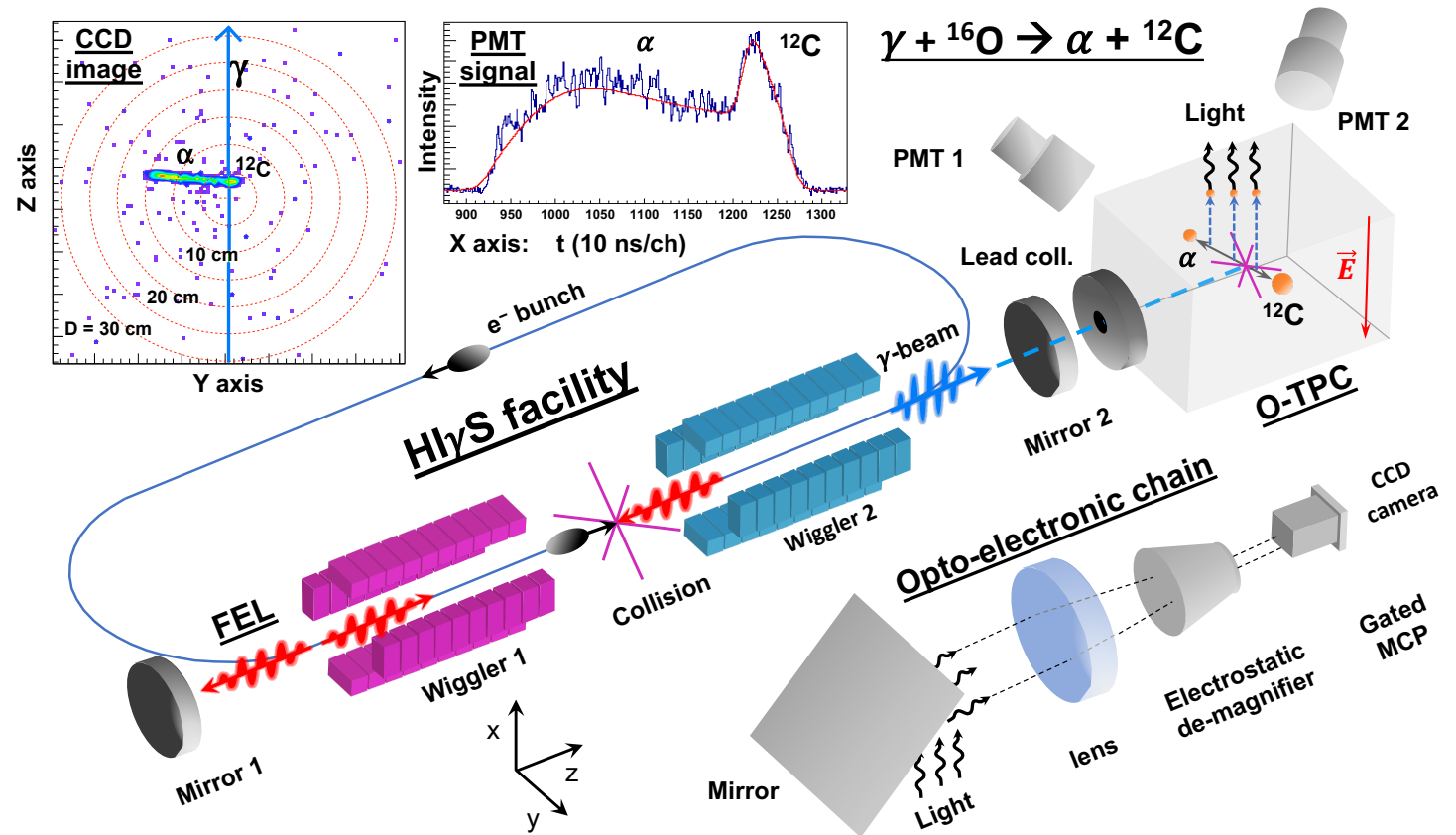
# AT-TPCs at the High Intensity Frontiers (With Fast Timing)

## Improved eTPC with good Timing

(R&D Developments for Readout of Prompt Light)

1. At the **HIGS** for  $^{12}\text{C}(\alpha,\gamma)$  C/O Ratio at low energies (n -  $\gamma$  discrimination)
2. At the **FRIB** an  $(\alpha,p)$  Factory for X-Ray Bursts (Fast Beam Trigger)
3. At the **SARAF** the  $p(n,\gamma)$  for BBN (Neutron TOF)

## The **HIGS** O-TPC Measurement of the $^{12}\text{C}(\alpha,\gamma)$ Reaction



R. Smith, M. Gai, D.K. Schweitzer, S.R. Stern and M.W. Ahmed, **Nature Communications**, 12, 5920 (2021).

<https://www.nature.com/articles/s41467-021-26179-x>

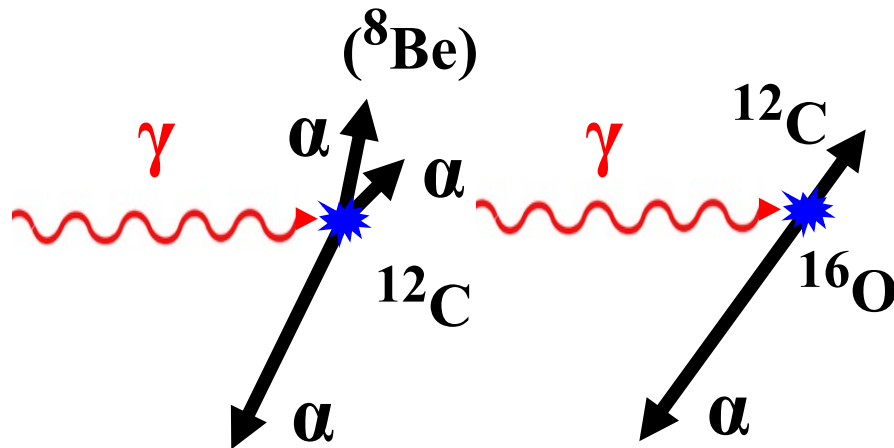
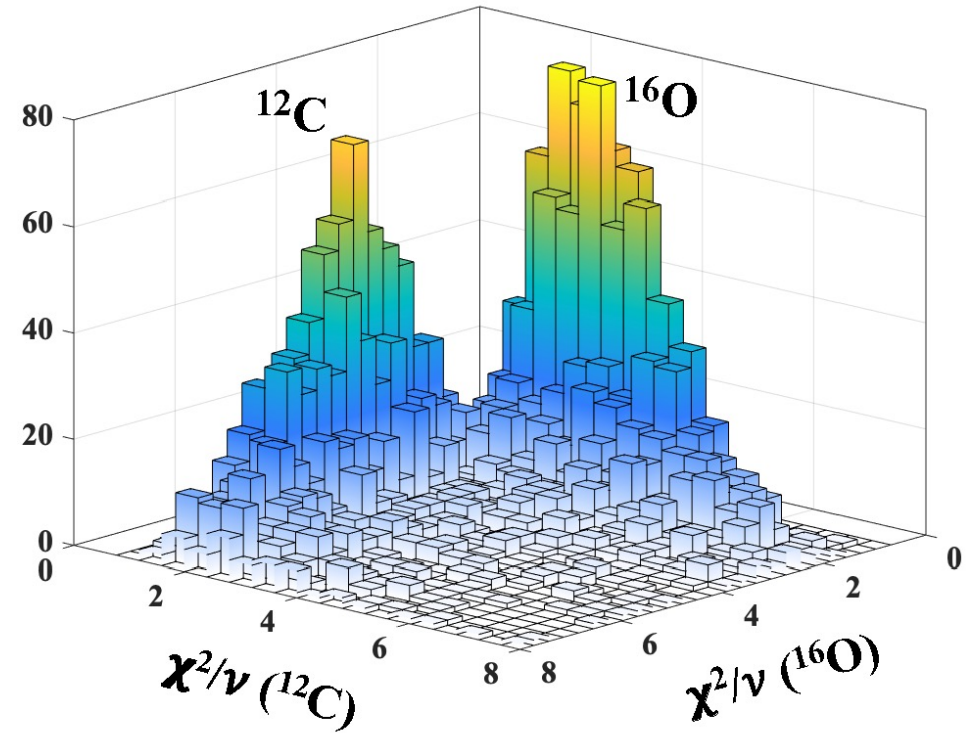
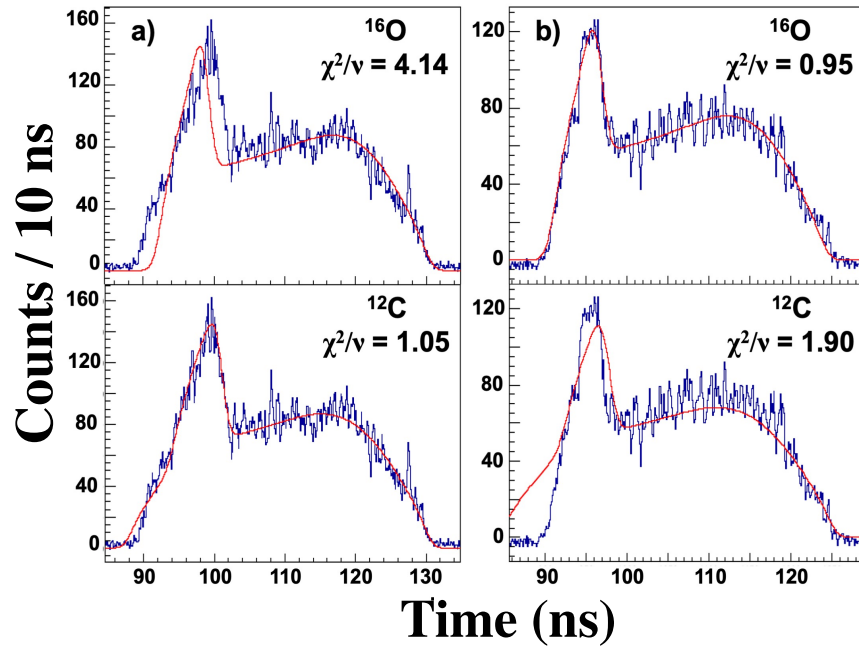
**UConn-TUNL O-TPC@HIγS (2009)**



**U Warsaw eTPC@HIγS (2022)**



# Line Shape Analysis (Machine Learning)



$^{12}\text{C}$ : Nuclear Structure, Hoyle State

$^{16}\text{O}$ : Nuclear Astrophysics,  $^{12}\text{C}(\alpha, \gamma)$