

First operation of an ACHINOS-equipped spherical proportional counter with individual anode read-out

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The spherical proportional counter is a versatile gaseous detector with applications from direct dark matter searches to neutron spectroscopy. The multi-anode sensor ACHINOS has been transformative to the capabilities of the spherical proportional counter by enabling higher pressure operation and larger detectors. Another advantage is the additional event localisation capability brought by having several —generally eleven— anodes. To date, the anodes are typically read in one or two channels due to existing read-out hardware constraints. We present the first measurements with an ACHINOS where each anode is individually read out. Previous implementations of ACHINOS will be discussed and how this lead to the development of an individual-anode read-out. Experimental results with an individually read out ACHINOS, demonstrating significant energy resolution improvement will also be presented. Extensive simulation studies were performed to understand the origin of anode-by-anode response differences, including from the design of ACHINOS and construction imperfections, and will be presented, along with mitigation and calibration methods to cover come them. This development is transformative for many applications of the spherical proportional counter, from direct dark matter searches to fast neutron spectroscopy, and the advantages brought will be discussed.

Collaboration

Role of Submitter

I am the presenter

Primary authors: KNIGHTS, Patrick (University of Birmingham); HERD, Dominic (University of Birmingham); Dr KATSIOLAS, Ioannis (University of Birmingham); MANTHOS, Ioannis (University of Birmingham (GB)); MATTHEWS, Jack (University of Birmingham); MILLINS, Lex (University of Birmingham / STFC Rutherford Appleton Laboratory); NEEP, Tom (University of Birmingham); NIKOLOPOULOS, Konstantinos (University of Birmingham); ROGERS, Giovanni (University of Birmingham)

Presenter: KNIGHTS, Patrick (University of Birmingham)

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