

Workshop on Active Targets and Time Projection Chambers for High-intensity and Heavy-ion beams in Nuclear Physics

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The ACTAR TPC and its Physics program

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The Active TARget and Time Projection Chamber (ACTAR TPC), is a new state-of-the-art gaseous detector founded by the European Research Council (ERC), composed of 16384 channels handled through the GET electronics. It has been recently commissioned at GANIL and is now fully operational to use for physics cases.

After introducing the ACTAR TPC, which is suitable for low rate reactions with exotic beams, I will present the wide physics program that will be done with the detector starting next Spring.

Two approved experiments will use the cubic geometry. The first one will measure the branching ratio for the $2p$ emission from the 6.15 MeV resonance in ^{18}Ne using the the $^{17}\text{F} + p$ proton resonant elastic and inelastic scattering. The decay products will be tracked with the TPC, which will be essential for identifying the $2p$ decay channel from the majority $1p$ -decay events. The tracking capability will allow us to make angular correlation in order to identify the nature of the decay (sequential or simultaneous). The second one will study the spectroscopy of the unbound and unobserved proton-unbound ^{33}K through the proton resonant scattering $^{32}\text{Ar} + p$ reaction, giving insights on the $Z = 20$ and $Z = 16$ shell gap at $N = 14$.

The ACTAR TPC is also planned to be used in a different geometry (cuboid with a rectangular pad plane), mainly to study the $2p$ -decay of proton-rich isotopes. In particular to measure the proton-proton correlations in the decay of ^{54}Zn and ^{48}Ni that is planned at GANIL and to establish the two-proton radioactivity nature of ^{67}Kr in RIKEN.

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