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# The (NA)2STARS: Neutrinos, Applications and Nuclear Astrophysics with a Segmented Total Absorption with higher Resolution Spectrometer, a combination of calorimetric and spectroscopic tools for beta decay and in-beam measurements

The international collaboration constituted based on the Total Absorption Gamma-ray Spectroscopy technique (TAGS) in Europe is aiming to build a Total Absorption Spectrometer (TAS) of the next generation. TAGS is a calorimetric technique using large monolithic or segmented scintillators that cover more than 80% of 4, but with limited energy resolution. It complements high-resolution spectroscopy using Germanium crystals. It is particularly well suited to physics themes requiring the detection of high-energy or multiple gamma photons, as in the case of beta decay of short-lived nuclei, or the measurement of reaction cross sections useful in certain nucleosynthesis processes. Indeed, in the case of beta decay of nuclei with large Q-values, the excitation energy states of the daughter nucleus are located at high energy and de-excited by multiple gamma lines or very energetic gamma-rays. A systematic error known as the Pandemonium effect [1] can affect data due to the low intrinsic or geometric efficiency of devices based on HPGe-type detectors. This effect results in poor determination of beta intensity distributions, and has far-reaching consequences for topics involving good knowledge of these intensity distributions.
The new instrument, called STARS (Segmented Total Absorption with higher Resolution Spectrometer), will ally efficiency with a higher segmentation and energy resolution than the existing spectrometers thanks to the addition of 16 LaBr3 crystals. The two segmented TAS that exist in Europe that will benefit from this upgrade are DTAS detector (18 NaI crystals [2]) and the Rocinante detector (12 BaF2 crystals [3]). The scientific advances that will be made possible will concern nuclear structure, nuclear astrophysics, neutrino and reactor physics, topics to which the TAGS technique has proven to bring significant advances [4]. The research objectives span a wide physics program that will bring together a wide international community of users around the proposed advanced TAS.

[1] J. C. Hardy et al., Phys. Lett. 71 B, 307 (1977).
[2] V. Guadilla et al., Nucl. Instr. Meth. A910, 79-89 (2018).
[3] E. Valencia et al., Phys. Rev. C 95, 024320 (2017).
[4] A. Algora, B. Rubio, J.-L. Tain, M. Fallot, W. Gelletly, Eur. Phys. J. A 57, 85 (2021) and references therein.

**Author:** FALLOT, Muriel (Subatech)

**Presenter:** FALLOT, Muriel (Subatech)

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