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COSMOGENIC RADIONUCLIDES IN THE CAVEZZO METEORITE: γ -RAY MEASUREMENT AND DETECTION EFFICIENCY SIMULATIONS

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The Cavezzo meteorite was recovered on January 4th, 2020, just three days after the fall, observed over Northern Italy by the all-sky cameras of the Italian PRISMA fireball network. Two specimens, weighing 3.1 g (F1) and 52.2 g (F2), were collected in the predicted strewn-field and the meteorite was classified as an L5 anomalous chondrite.

The γ -activity of F2 sample was measured at the Monte dei Cappuccini underground Research Station (Torino) with a large-volume HPGe-NaI(Tl) spectrometer. Thanks to the high efficiency, selectivity and low background of the spectrometer, we were able to measure activities below 1 decay per minute (dpm). Many cosmogenic isotopes were revealed: ⁴⁷Ca, ⁵²Mn, ⁴⁸V, ⁵¹Cr, ⁷Be, ⁵⁸Co, ⁵⁶Co, ⁴⁶Sc, ⁵⁷Co, ⁵⁴Mn, ²²Na, ⁶⁰Co, ⁴⁴Ti and ²⁶Al. The presence of nuclides with half-lives down to few days confirmed the recent fall of the sample. The very low activity of ⁴⁴Ti and ⁶⁰Co (\approx 0.1 dpm) was revealed with a particular coincidence between the HPGe and NaI(Tl) detectors.

To obtain the detection efficiency, we have simulated the response of the detector with the GEANT4 toolkit. The simulations were calibrated with standards of known activity to define the spectrometer's dead layer thickness and validated against the measurement of the Dhajala meteorite (H3-4, fall on January 28th, 1976). In this contribution, we focus on the coincidence optimization techniques and the detection efficiency computation.

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