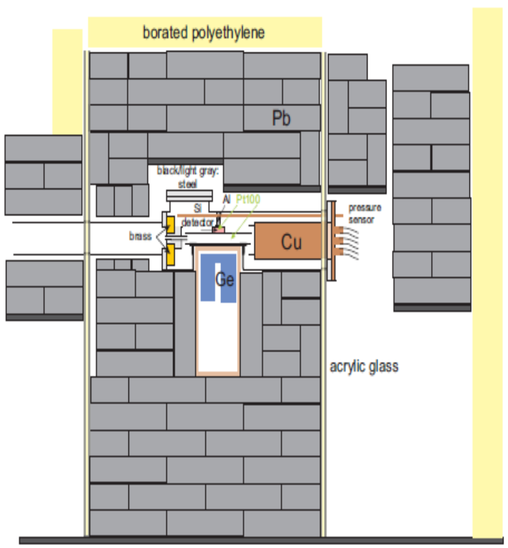
Ultra-Sensitive -Ray Spectroscopy Set-Up for Investigating Primordial Lithium Problem

G. Gervino for LUNA Collaboration
Dipartimento di Fisica, Università di Torino and INFN Torino

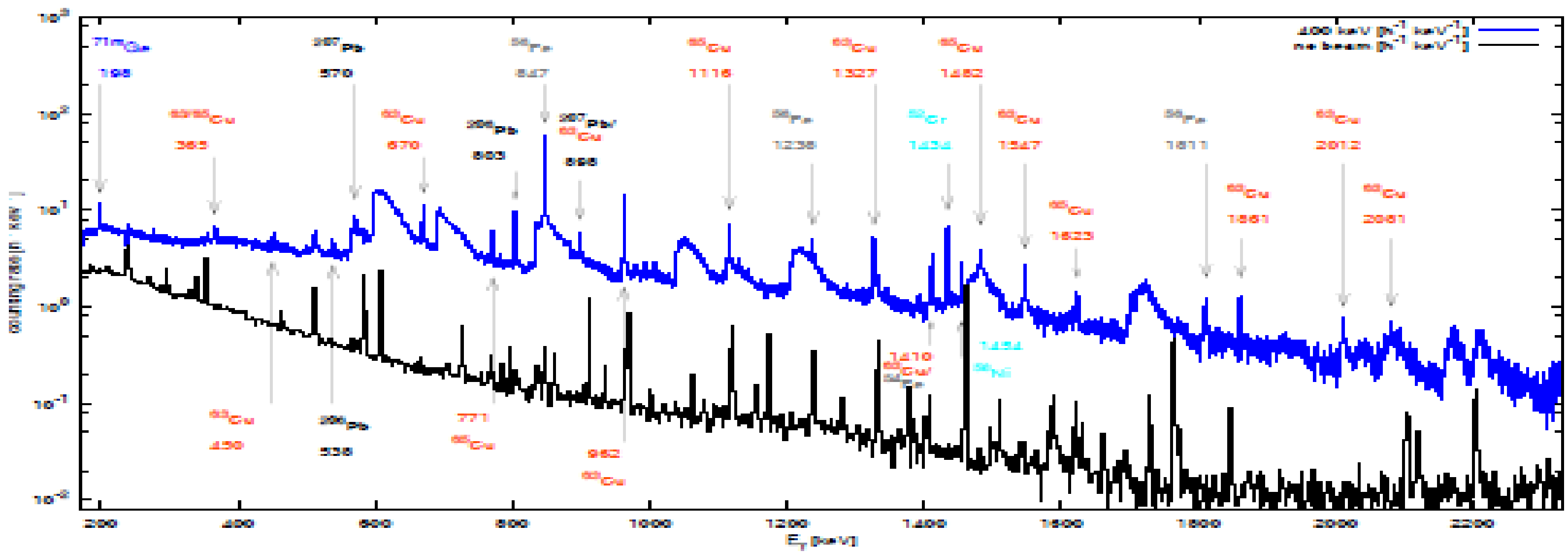
To precisely determine BBN ^{6}Li production, the cross section of the nuclear reaction $^{2}H(\alpha,\gamma)^{6}Li$ must be directly measured within the astrophysical energy range of 30 - 400 keV. This measurement requires an ultra-low -ray background. We have realized these conditions at LUNA, in the INFN Gran Sasso National Laboratory (LNGS), Italy.



Experimental setup, as seen from the side. The central chamber of the windowless gas target is seen near the center of the plot

LUNA2 400 kV accelerator

Mostly of the remaining γ-ray background seen in the spectra are coming from the energetic deuterons scattered in the gas target by the beam. Thanks to the low neutron environmental background at LUNA, the effect of this weak flux of 2-3 MeV neutrons on HpGe detectors has been studied in details and the results are presented and discussed.



Spectra taken with the HpGe (130% efficency). Blue line: in-beam spectrum at E = 400 keV, pTarget= 0.3 mbar, laboratory background subtracted. The quantity plotted is the counting rate. Black line: Laboratory background. The most important in-beam lines due to (n,n') and (n,γ) processes on structural and shielding materials are marked with arrows, and the relevant target nuclide is given, as well as the gamma-ray energy in keV.