SuperNEMO Calorimeter Commissioning

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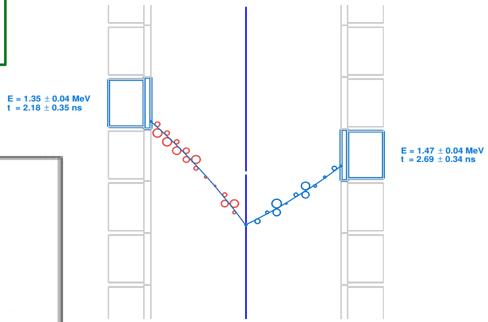
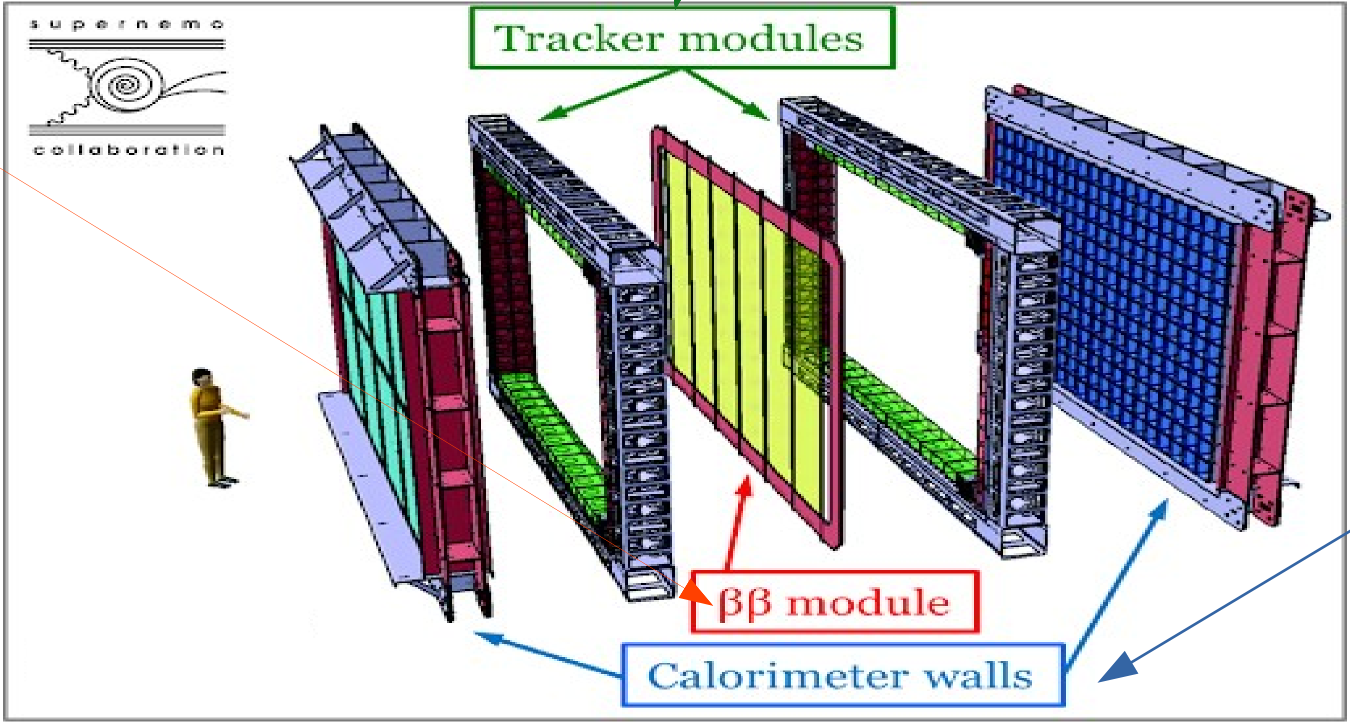
SuperNEMO and Neutrinoless Double Beta Decay ($0\nu\beta\beta$)

Full topological reconstruction → **High background rejection**
(expected $<10^{-4}$ events/keV/kg.yr)



Source separate from detector → ability to **study several isotopes**



Measure individual energies giving access To decay mechanism

Main goal to reach a sensitivity of $\mathbf{T^{0\nu}_{1/2} > 5 * 10^{26}}$ **y** with 500 kg.y exposure of ^{82}Se

The SuperNEMO Demonstrator & Calorimeter

Demonstrator module with ~ 6 kg of ^{82}Se :

Expected sensitivity **$T^{0\nu}_{1/2}$ > 6.5 * 10^{24} y, <m_ν> < (0.15 – 0.4) eV** (90% CL) for a 17.5 kg.y exposure of ^{82}Se

Reachable background sensitivity Source radio-purity A(^{208}Tl) < 2 µBq/kg & A(^{214}Bi) < 10 µBq/kg A(^{222}Rn) < 0.15 mBq/m^3

The Calorimeter of the Demonstrator :

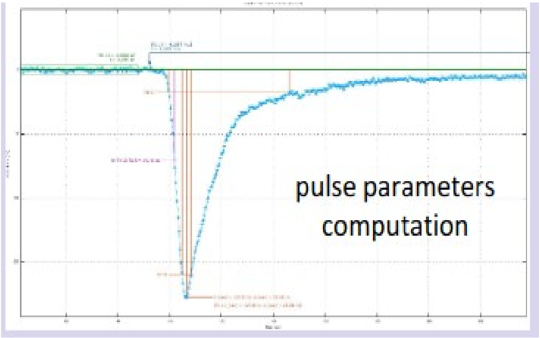
Specifications

Energy resolution
8% FWHM at 1 MeV

Time resolution σ < 400 ps
for 1 MeV electrons

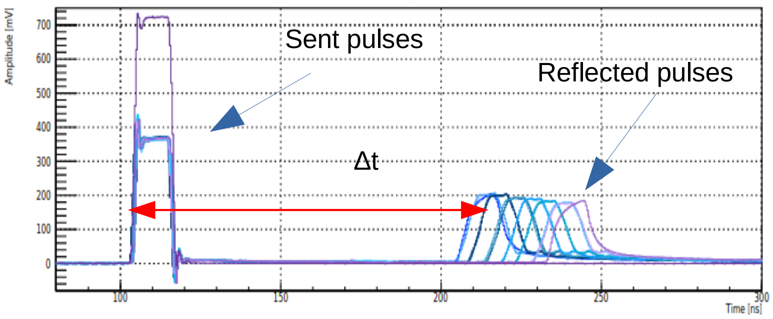
712 optical modules →

Pulse digitization:
pedestal and pulse shape tested using background runs

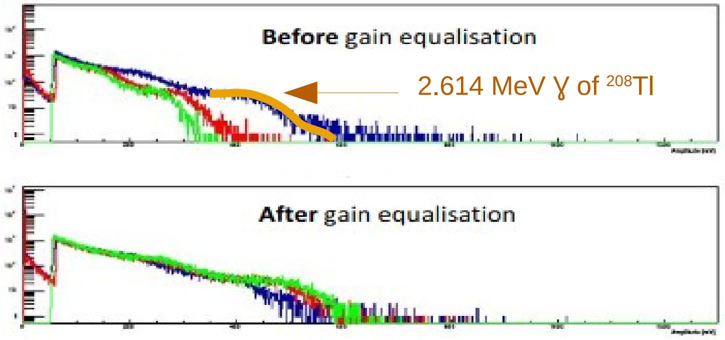


Tracker on its final steps towards commissioning, magnetic field, anti-Radon tent, gamma and neutron shielding to be installed

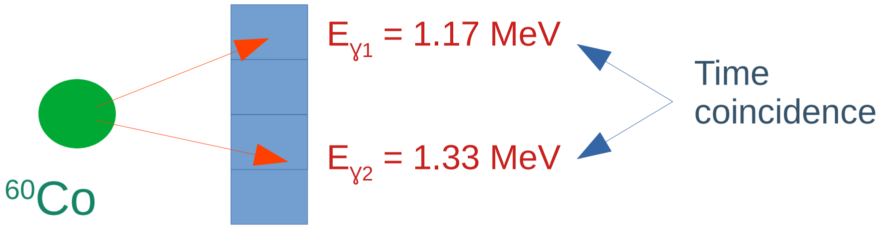
Calorimeter Commissioning analysis



Reflectometry tests to test signal attenuation and time delays between PMT channels using electronics generated pulses



PMT Gain equalization with a dedicated method using ^{208}Tl Compton edge, giving a spread in gain < 10% with gammas, better results expected with electrons



Time resolution *primarily results* using ^{60}Co give a $\boldsymbol{\sigma}$ < 600 ps for ɣs @ 1 MeV

Better results expected with an electron source and tracker commissioned

Thanks for your attention