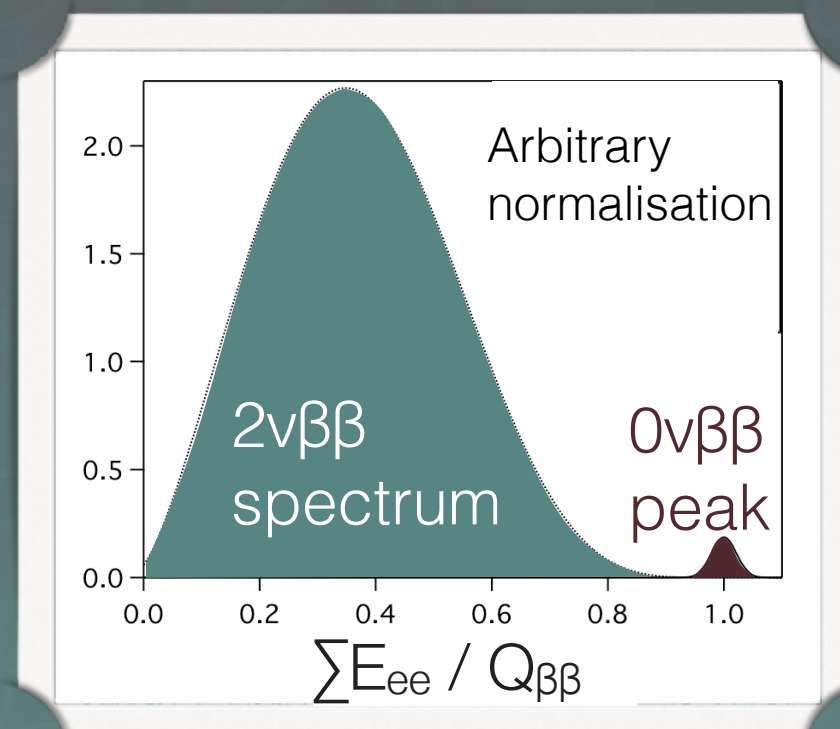
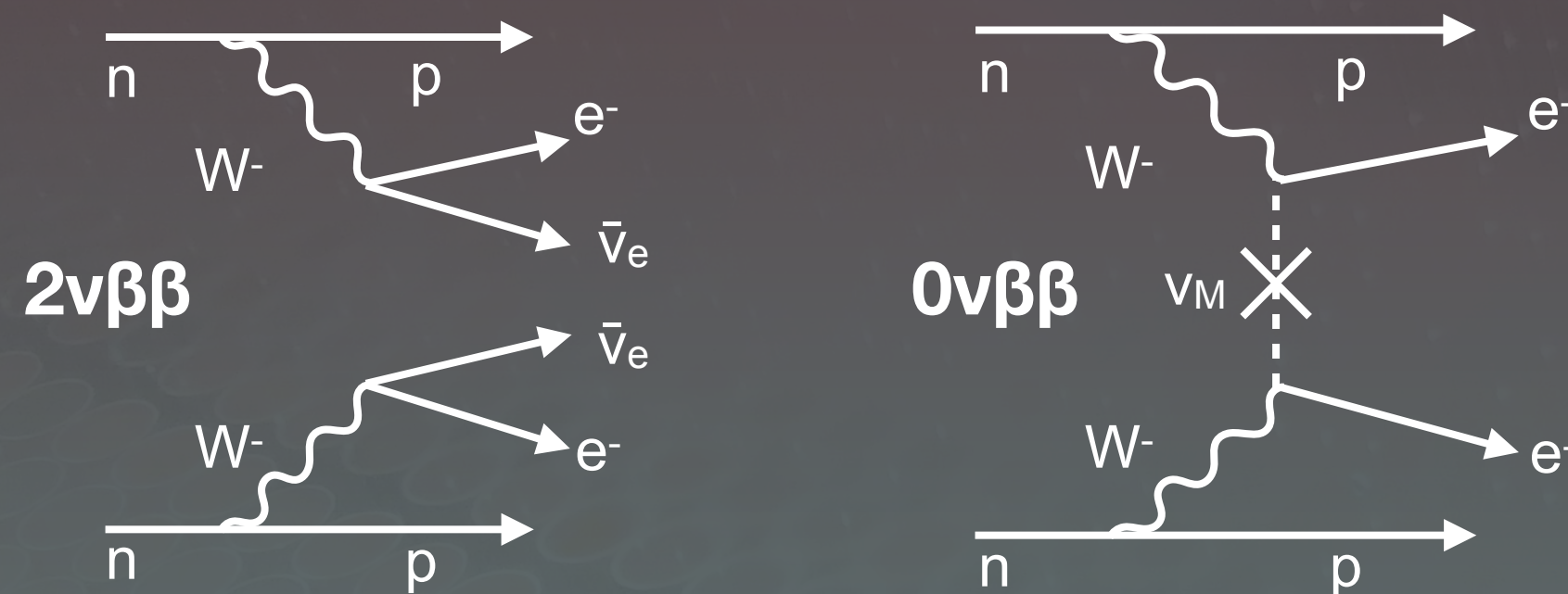


SuperNEMO $0\nu\beta\beta$ Sensitivity Studies

Neutrinoless double-beta decay ($0\nu\beta\beta$)

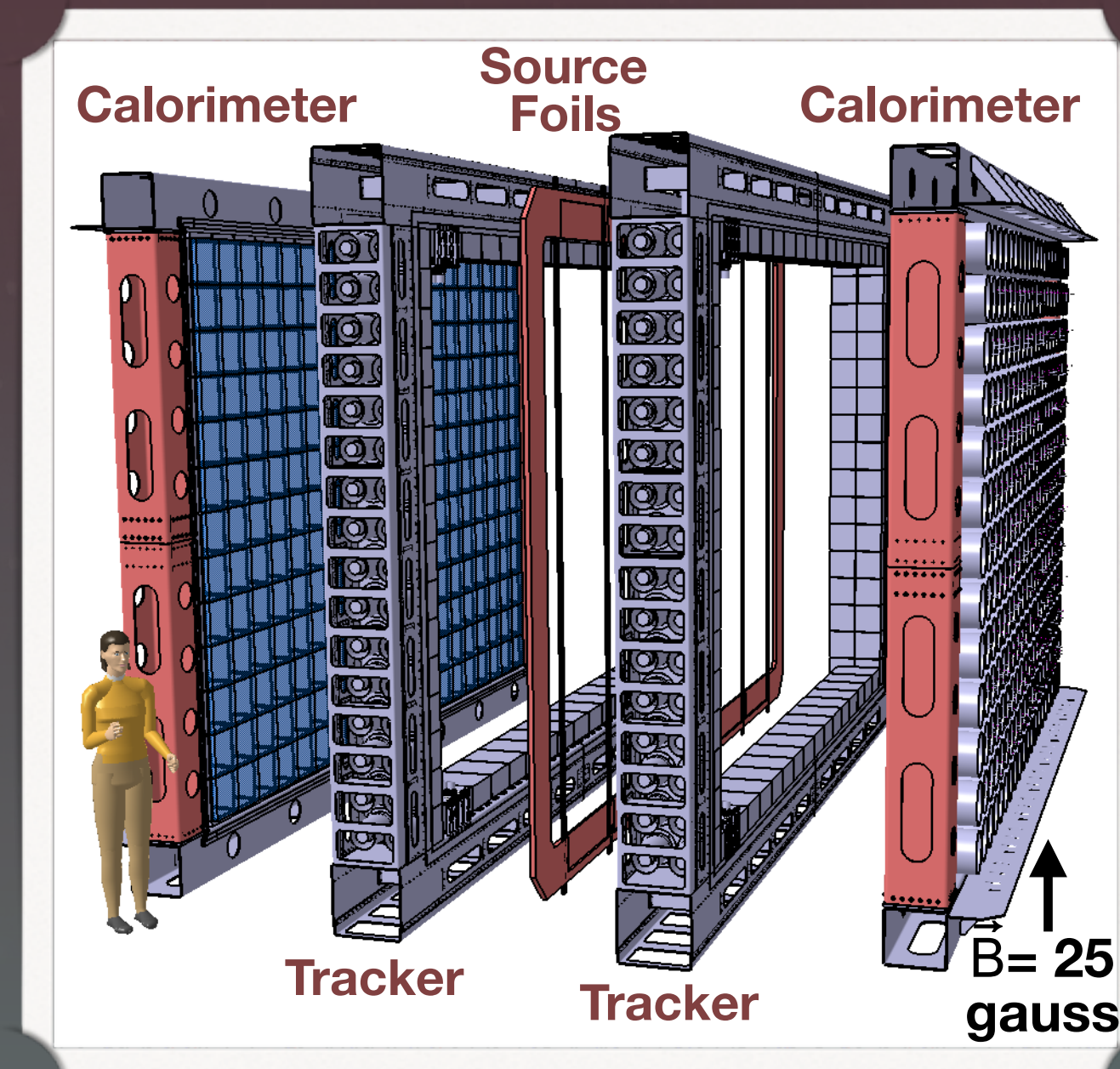
- Predicted for Standard Model double- β decaying isotopes ($2\nu\beta\beta$)
- Only if neutrinos are Majorana particles ($\nu = \bar{\nu}$).
- Violates lepton number conservation.
- $T_{1/2} > 10^{24}$ - 10^{26} years



Signature:

- 2 electrons
- No other particles
- Summed electron energy = $Q_{\beta\beta}$

The SuperNEMO Demonstrator Module



Tracker-calorimeter architecture to:

- Distinguish signal from background
- Probe underlying $\beta\beta$ decay mechanism



Demonstrator module

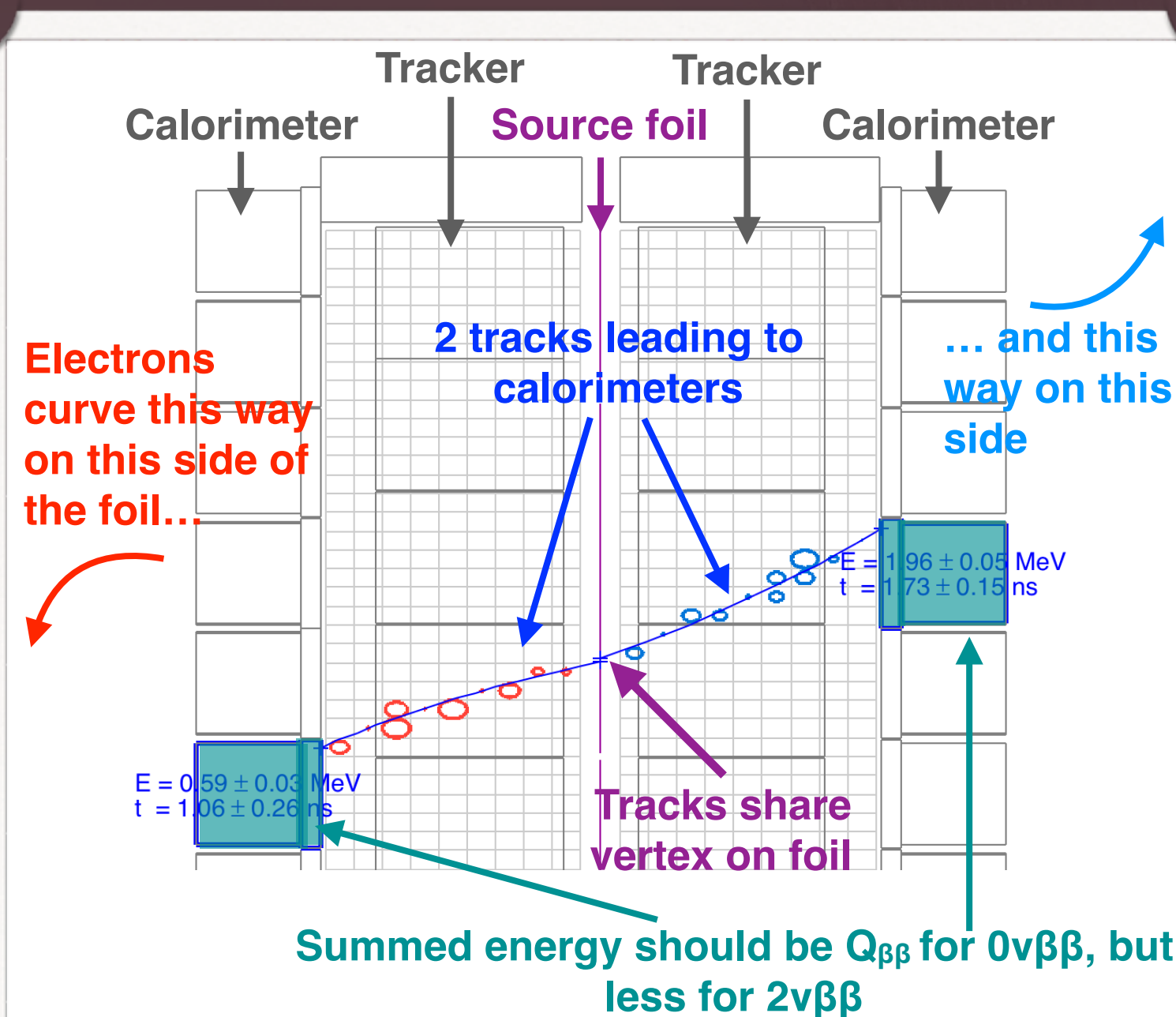
- 7kg of ^{82}Se , 2.5 years run time
- Under construction at LSM
- Closed in coming weeks

Full SuperNEMO (proposed)

- 20 modules, 500kg years with ^{82}Se
- Sensitivity 10^{26} years

SuperNEMO $0\nu\beta\beta$ Sensitivity Studies

Signal and Background



Preselect events with:

- 2 electron-like tracks associated to calorimeter hits,
- Common foil vertex
- No additional calorimeter hits (signature of γ 's in the event).

Backgrounds:

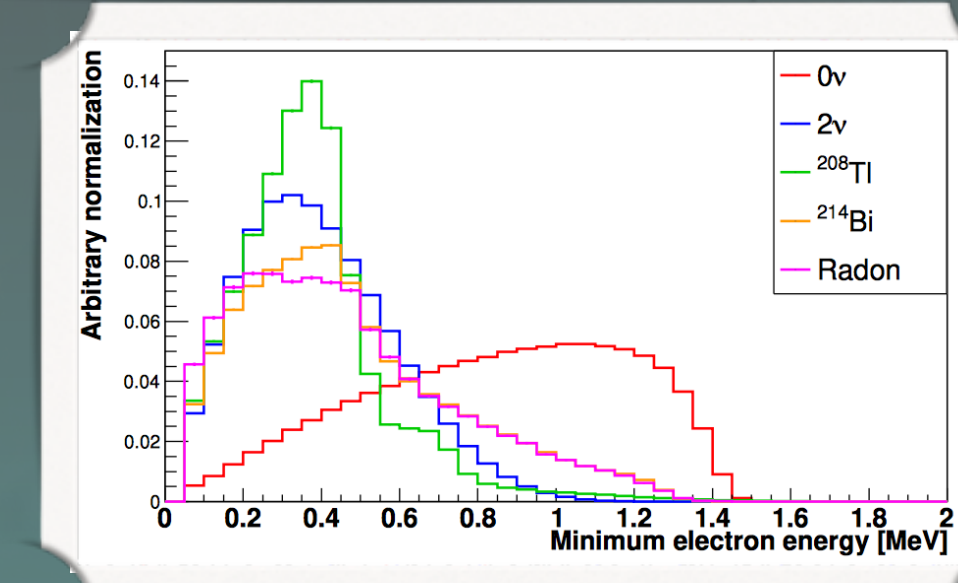
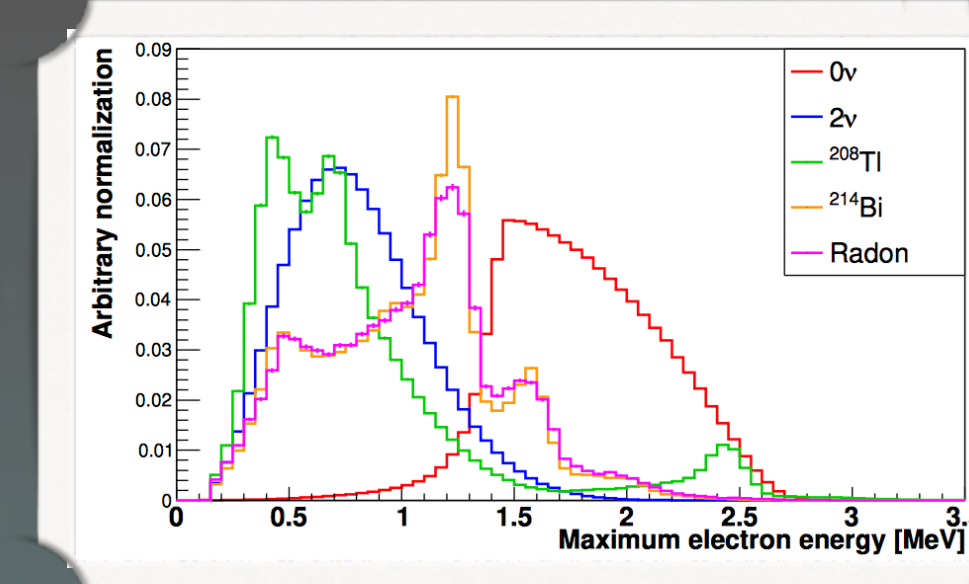
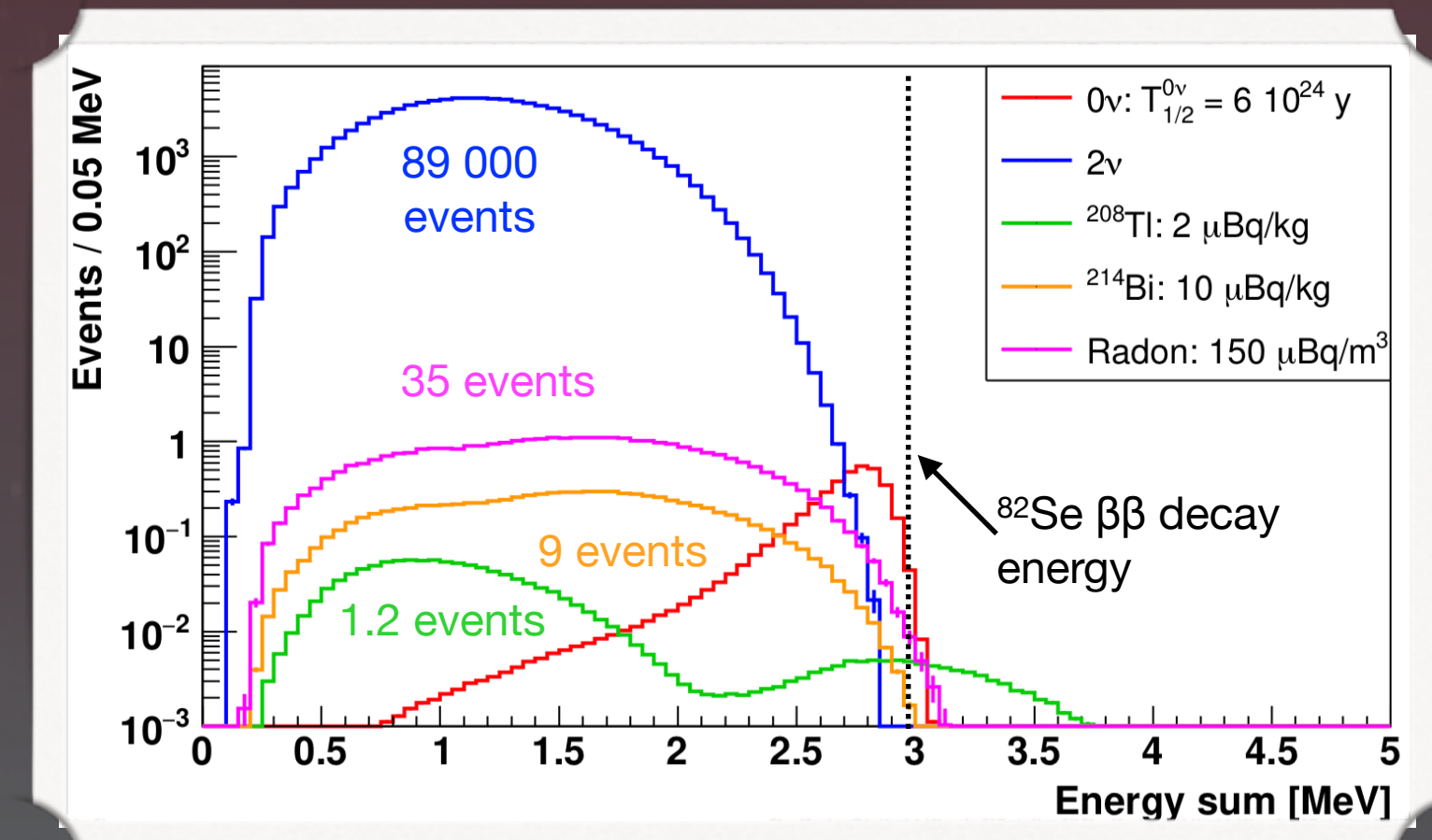
- $2\nu\beta\beta$ (at lower energies)
- β -decays above our $0\nu\beta\beta$ energy that make a 2nd electron (scattering, internal conversion)
 - ^{214}Bi and ^{208}Tl in the foil
 - Radon in the tracker

See F. Xie / C. Hugon poster for radon mitigation strategy

Sensitivity to $0\nu\beta\beta$

Background strategy:

- Radiopure components
- Preselection cut
- Measure activities using channels with pure sample



- 2-electron energy sum separates signal from background
- SuperNEMO architecture gives us more information about the topology
- Use in machine learning to improve signal / background separation

$T_{1/2}^{0\nu\beta\beta} > 5.9 \times 10^{24}$ years
(90% C. L.)