TABLE III: Radioactive contaminations of material used in the construction of the XENON10 detector, as obtained from screening (PMTs, bases and polyethylene shield) and by comparing the low-background data to MC simulations.

Sample	Mass or number (M)	^{238}U mBq/M	^{232}Th mBq/M	^{40}K mBq/M	^{60}Co mBq/M	^{137}Cs mBq/M	^{85}Kr mBq/M
PMTs + bases	89 pieces	0.32	0.23	8.6	1.7	1.0	
Inner cryostat	37.4 kg	130	470	310	65	8.1	
Outer cryostat	144.7 kg	80	120	39	24	8.0	
Polyethylene	1540 kg	1.2	0.3	11.6	0.01	1.0	
Teflon (TPC)	6.26 kg	1.1	4.8	48	0.01	910	
3 Feedthroughs	1.758 kg	130	28	270	30	13	
Xenon	14.5 kg						1.0

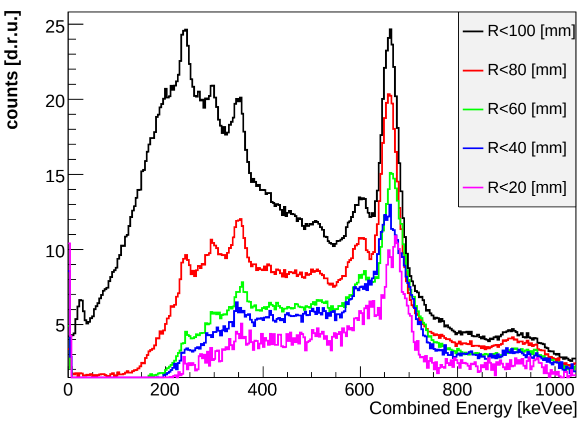

FIG. 44: (Color online) Energy spectrum of background events in XENON10 with different radial cuts, with a focus on the ^{137}Cs peak.

The main source of neutrons in XENON10 are (α,n) and spontaneous fission reactions from ^{238}U and ^{232}Th in the detector and shield material. Another source of neutrons are spallation and photo-nuclear reactions of cosmic ray muons in the rock and shield. As explained in Section III, the neutrons from outside the shield are stopped or thermalized by the polyethylene.

Using the ^{238}U and ^{232}Th activities as given in Table III, the energy spectra and number of expected neutrons from (α,n) and spontaneous fission reactions in each material has been calculated with the modified SOURCES4A code [58]. These are given in Table IV (second column).

The neutrons are then propagated into the sensitive region using the GEANT4 code and detector geometry. In figure 45 the predicted single scattering nuclear recoil energy spectrum from the neutrons from all the material considered in the simulation is shown, together with the individual contributions from all the material. The number of predicted single nuclear recoils in the WIMP search region is shown in Table IV (third column), along with the total number of single nuclear recoils (fourth column).

The total rate of single nuclear recoils in the energy region from 2 to 12 keV$_{\rm ee}$ is expected to be 1.67×10^{-3} event/kg/day, i.e. for an exposure of $5.4\,\mathrm{kg}\times58.6\,\mathrm{days}$, the total number of nuclear recoils expected from the contamination of the XENON10 detector material is less than 0.53 events [11].

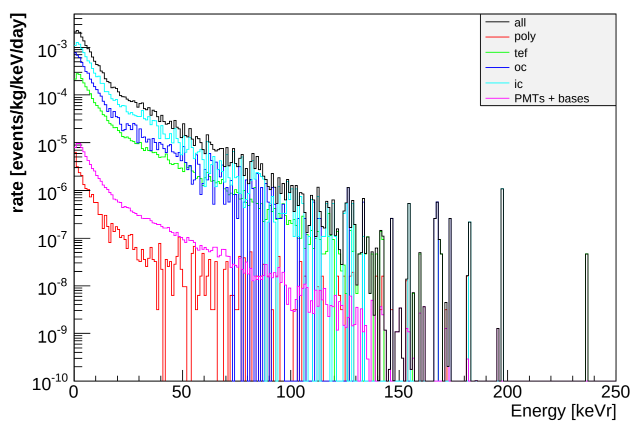

FIG. 45: (Color online) Monte Carlo simulation of total nuclear recoil spectrum expected from the neutrons produced in all the material considered (black), along with the individual contributions from each material.

2. Intrinsic backgrounds in LXe

Delayed coincidence analyses to determine the Radon, Thoron, U/Th and ^{85}Kr concentration in the LXe have been carried out by looking at the specific decay signatures. For Radon, the consecutive beta-alpha decays occurring in the decay of ^{214}Bi (shown in Eq. A2) are required to occur within the same waveform, in the same time order as in the decay scheme and with the proper energies ($E_\beta < 3000$ keV and $E_\alpha > 6500$ keV). With these cuts, the residual accidental coincidences are negligible and the events surviving the cuts are taken as real ^{214}Bi decays. The resulting Rn concentration in LXe, considering the detection efficiency and the efficiency of above cuts, is (59±2)μBq/kg. For ^{220}Rn arising from the ^{232}Th