



Update of MC Simulations

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SABRE Monte Carlo meeting 21 - 02 -2017

Status of the Monte Carlo simulations

Link to the spreadsheet with contaminations and background rates in DMM and KMM:

https://docs.google.com/spreadsheets/d/1j-zV_J_Qijx5RKv6jD9fb4xSRTMqARNcoqU7qkc3jXw/edit?usp=sharing

Complete simulations with the “old” geometry (no CIS, simplified vessel, old shield design):

- Crystal PMTs (kovar body + quartz window + ceramic plate)
- Enclosure copper body

Complete simulations with latest geometry for PoP:

- Enclosure copper belts and bars
- Enclosure teflon belts
- CIS Copper
- CIS Steel
- Steel Vessel
- Crystal wrapping
- Vessel PMTs

Results presented at the last MC meeting:

<https://agenda.infn.it/getFile.py/access?contribId=1&resId=0&materialId=slides&confId=1283>

<https://agenda.infn.it/getFile.py/access?contribId=0&resId=0&materialId=slides&confId=12833>

NEW !

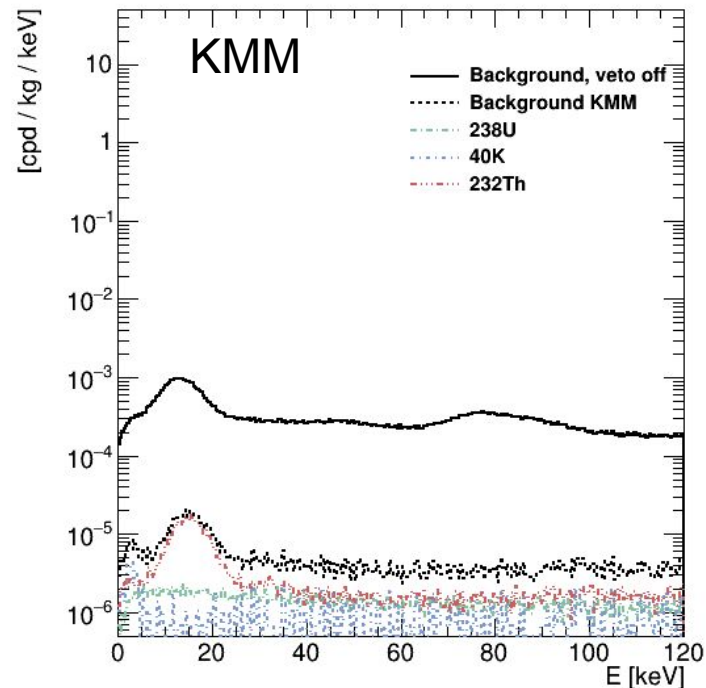
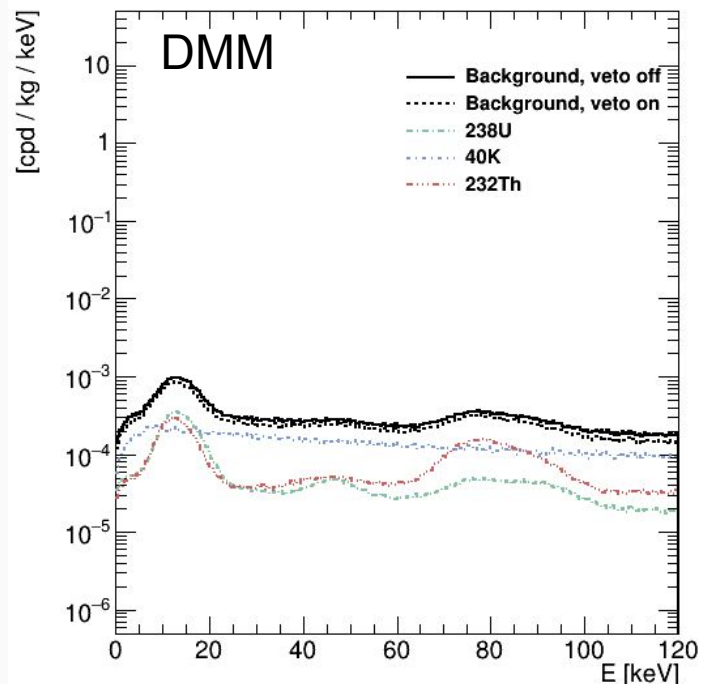
Ongoing simulations:

- Crystal (Maddalena)
- Liquid scintillator (Francis)

To do

- Decide whether old complete simulations have to be repeated
- Shielding (PE)
- External backgrounds
 - Need simulation optimization
 - to discuss if will go in another paper

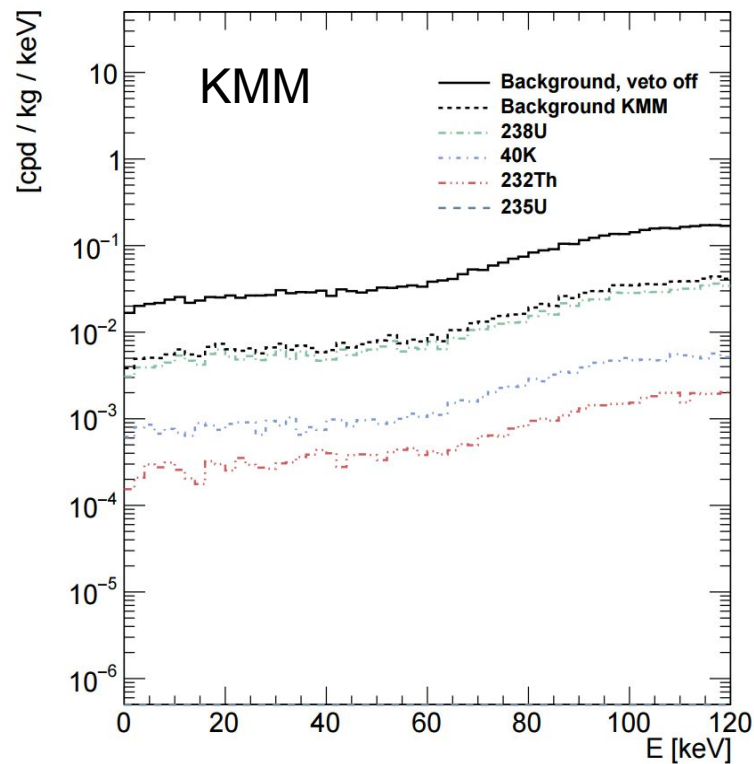
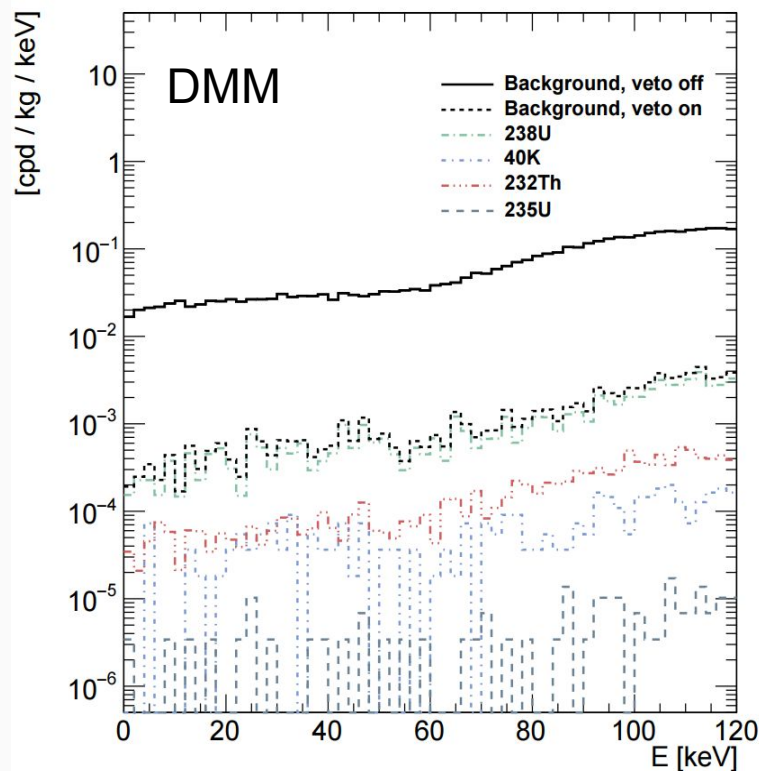
Background from crystal wrapping



Isotope #	Activity* [mBq/kg]	Bkg [cpd/kg]	BkgDMM [cpd/kg]	BkgKMM [cpd/kg]
40K	3.1	0.0007077 +/- 9.8e-06	0.0006891 +/- 9.6e-06	7.536e-06 +/- 1e-06
238U	0.25	0.0002947 +/- 1.8e-06	0.0002348 +/- 1.6e-06	3.277e-06 +/- 1.9e-07
232Th	0.5	0.0003379 +/- 2.7e-06	0.0002212 +/- 2.2e-06	5.121e-06 +/- 3.2e-07
#				
Total		0.00134 +/- 1e-05	0.001145 +/- 1e-05	1.593e-05 +/- 1.1e-06

[*] <http://www.sciencedirect.com/science/article/pii/S0927650511000971>

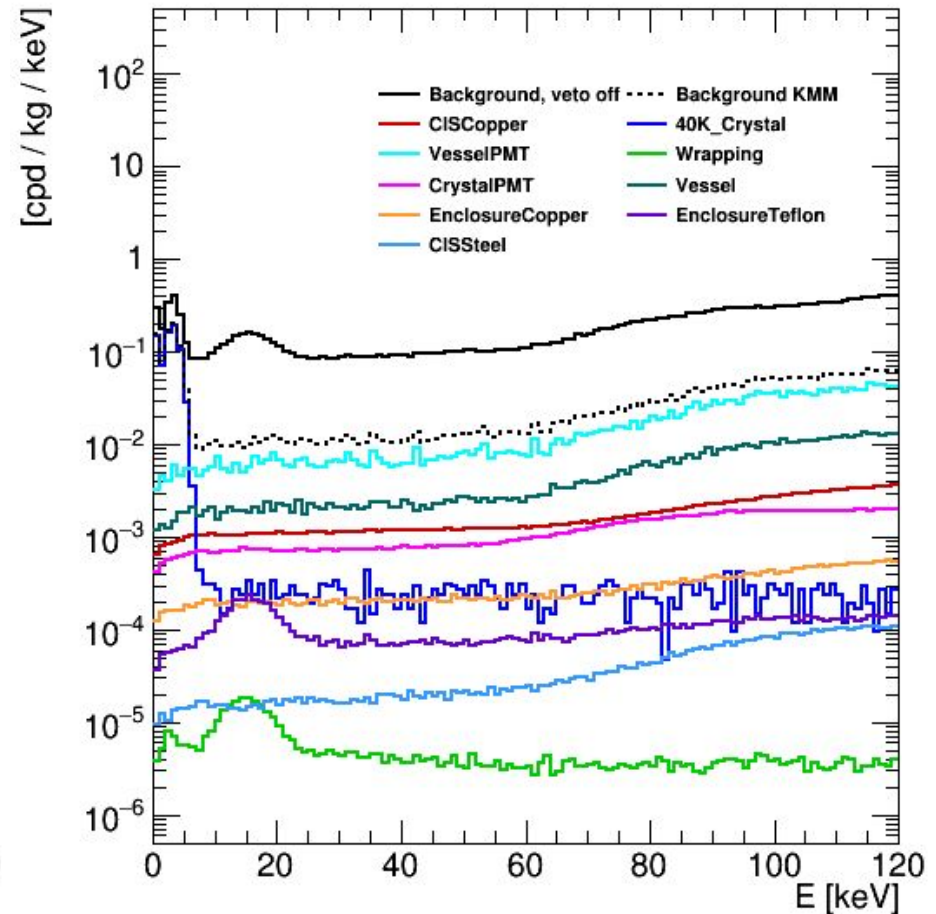
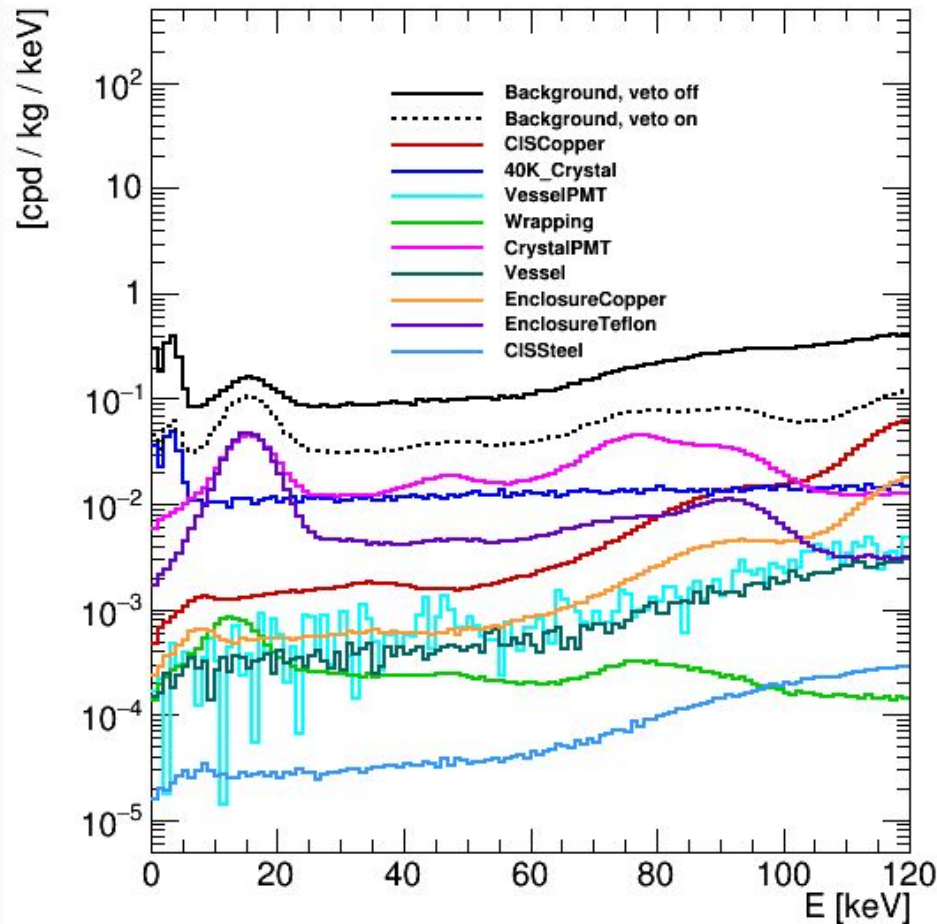
Background from Vessel PMTs



#Isotope	Activity* [mBq/kg]	Bkg [cpd/kg]	BkgDMM [cpd/kg]	BkgKMM [cpd/kg]
#-----				
40K	649 mBq/PMT	0.006 +/- 0.00047	0.0001454 +/- 7.3e-05	0.001709 +/- 0.00025
238U	883 mBq/PMT	0.06926 +/- 0.0033	0.001063 +/- 0.0004	0.0086 +/- 0.0011
232Th	110 mBq/PMT	0.01063 +/- 0.00031	0.0001326 +/- 3.7e-05	0.0004846 +/- 7.9e-05
235U	41 mBq/PMT	8.214e-05 +/- 2.4e-05	0 +/- 0	0 +/- 0
#-----				
Total		0.08598 +/- 0.0033	0.001341 +/- 0.00041	0.01079 +/- 0.0012

[*] <https://arxiv.org/pdf/1512.07896.pdf>

TOTAL Background (..so far)



Note that some contributions are **missing**:

- crystal contribution except for K40 (9 ppb)
- part of copper enclosure
- liquid scintillator
- PE + steel + Pb shielding

Thanks to Francesco and Maddalena
for sending us their results!

TOTAL Background (..so far)

Element	BKG [cpd/kg]	BKG-DMM [cpd/kg]	BKG-KMM[cpd/kg]
Crystal Wrapping	0.00134 +/- 1e-05	0.001145 +/- 1e-05	1.593e-05 +/- 1.1e-06
Crystal PMTs	0.05846 +/- 6.6e-05	0.03718 +/- 5.7e-05	0.001272 +/- 9.2e-06
Enclosure Internal Teflon	0.01654 +/- 0.00014	0.01408 +/- 0.00014	0.0001264 +/- 5.6e-06
Enclosure Internal Copper	0.007455 +/- 6.1e-05	0.00179 +/- 2.9e-05	0.0003462 +/- 1.2e-05
CIS Copper	0.0005448 +/- 7.1e-06	0.0001015 +/- 3.1e-06	2.626e-05 +/- 1.6e-06
CIS Steel	0.0005448 +/- 7.1e-06	0.0001015 +/- 3.1e-06	2.626e-05 +/- 1.6e-06
Vessel	0.03852 +/- 0.00072	0.001047 +/- 0.00012	0.002994 +/- 0.0002
Vessel PMTs	0.08598 +/- 0.0033	0.001341 +/- 0.00041	0.01079 +/- 0.0012
Total internal [NEW]	0.2391 +/- 0.0034	0.06047 +/- 0.00045	0.01079 +/- 0.0012
Crystal*	1.12 + 1.2e-1 (cosmogenic)	4.7e-1 + 5.9e-2 (cosmogenic)	3.7e-1
Enclosure copper*	2.6e-2	6.8e-3 after 6 months	2.8e-3 (2.1 after 60 days)
PE shield (40 cm box)*	1.2e-2	3.3e-4	9.1e-4
External gammas**		< 1.61 x 10 ⁻² (99% C.L.)	(2.74 ± 0.82) x 10 ⁻²



Upper limits



Measurements



Old simulations

[*] Old geometry: <https://agenda.infn.it/getFile.py/access?contribId=2&resId=0&materialId=slides&confId=12119>

[**] See Ambra's slides