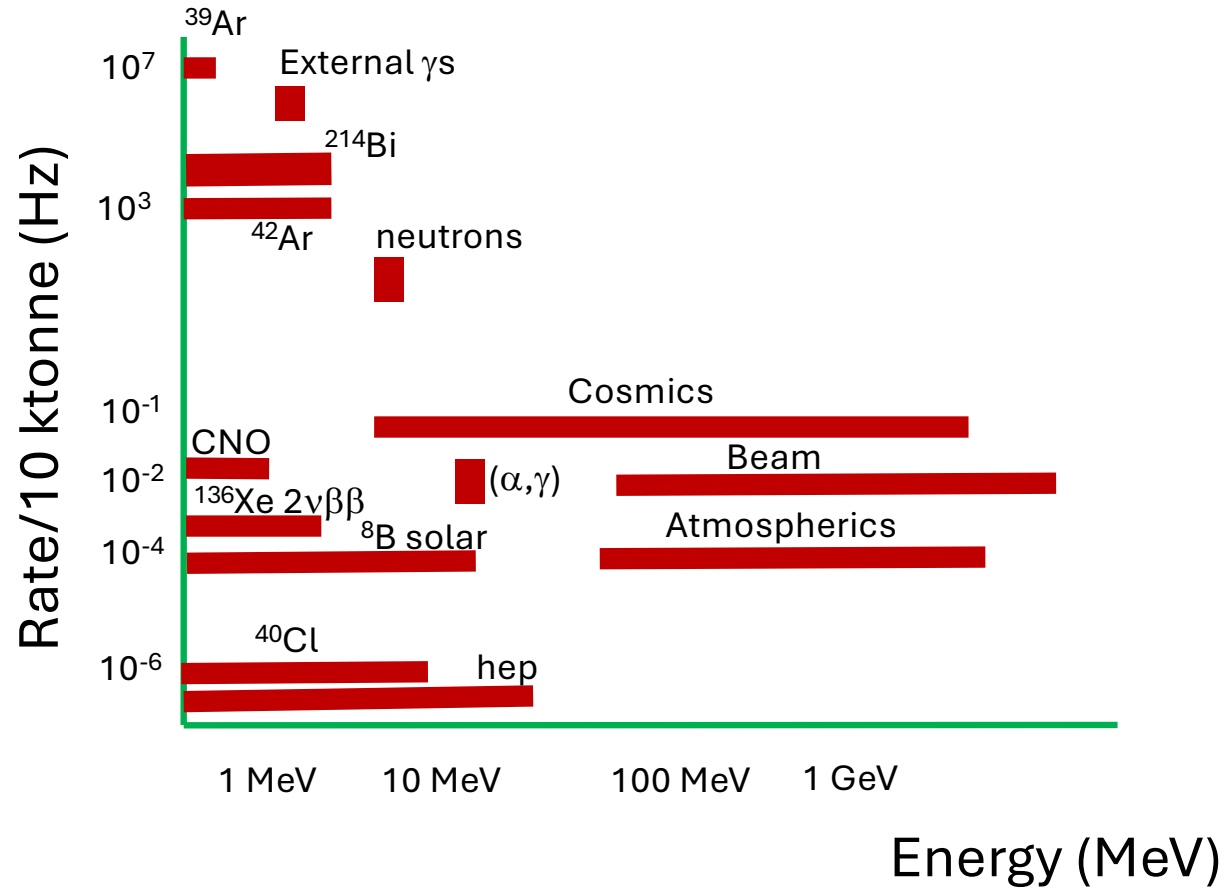


A Few Data Selection/Physics Performance Updates from DUNE CM

J. Klein, Penn
24 September 2024

Quick reminder:



Quick reminder:

Our allocation is 30 PB/year for 2 modules

- Most **conservative assumption is we read out entire detector for 2x drift time for every high-energy trigger**
- At high energies, totally dominated by cosmic rate of 4000/day/ 10 kt module
- (And we want to keep every cosmic!)

For HD:

$\sim 384,000 \text{ ch} * 14 \text{ bits/sample} * (1/512 \text{ ns}) * 5.4 \text{ ms} * 4000/\text{day} * 365 \text{ days}$

$\sim 10.35 \text{ PB/year}$

At thresholds above about 10 MeV this is our dominant data volume
(NOT including TPs!)

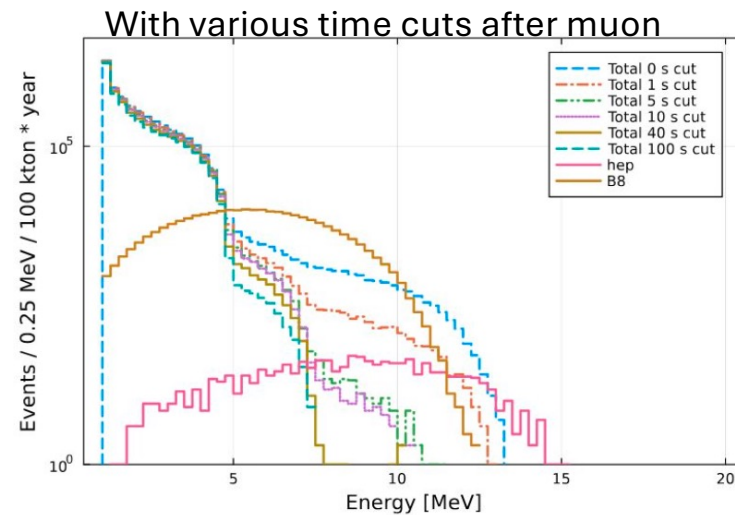
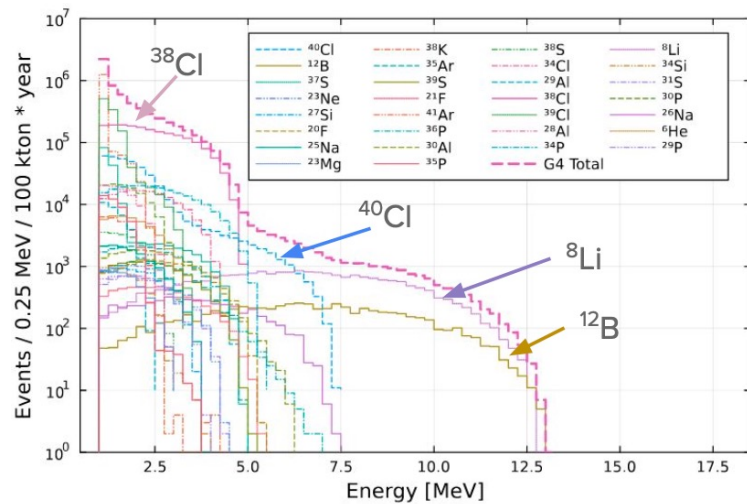
But...do we really want to read out every channel for every muon?

No, we do not. How much SHOULD we read out?

Cosmic Ray Trigger and Region-of-Interest

Ten year-old study by Phil Rodrigues suggested “typically” 6 APAs (in HD) are illuminated by cosmics (there was a tail up to 20-25).

At CM we saw study of spallation and neutrongenic backgrounds:

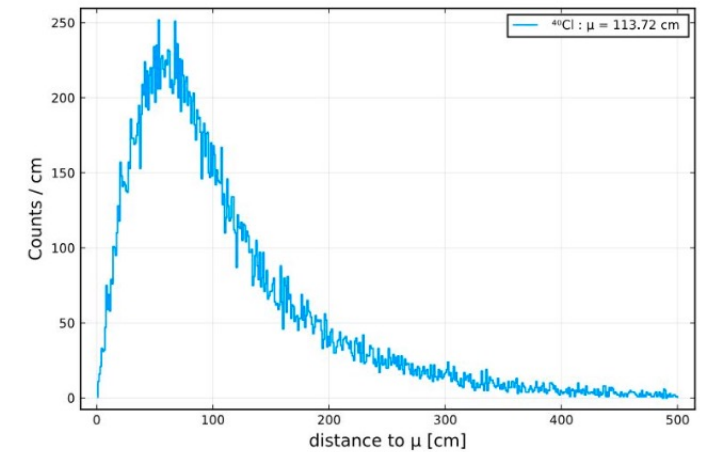
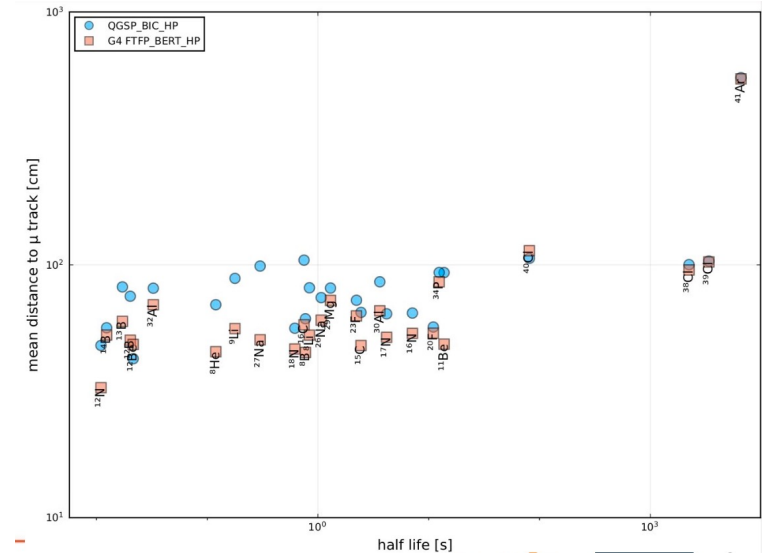
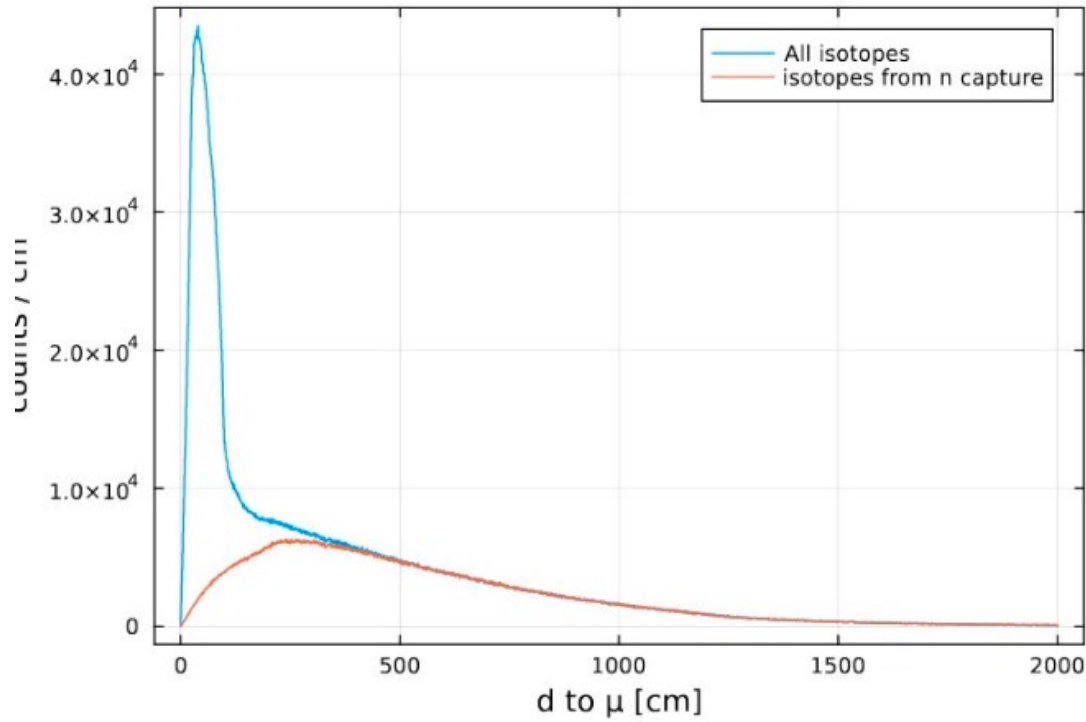


From a trigger perspective, anything more that 2x drifts after muon will be something we should trigger on

Luis Manzanillas, Mael Martin
manzanilla@lapp.in2p3.fr

DUNE collaboration meeting
 Santa Fe
 September 2024

Cosmic Ray Triggers and Region-of-Interest



Why Do We Care about Spallation?

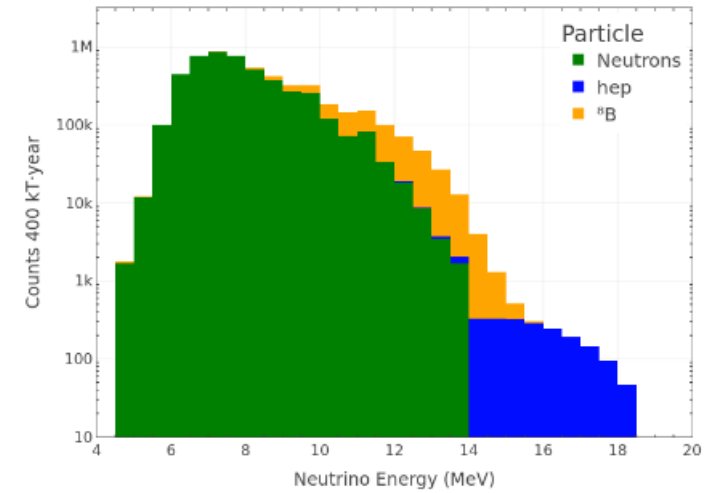
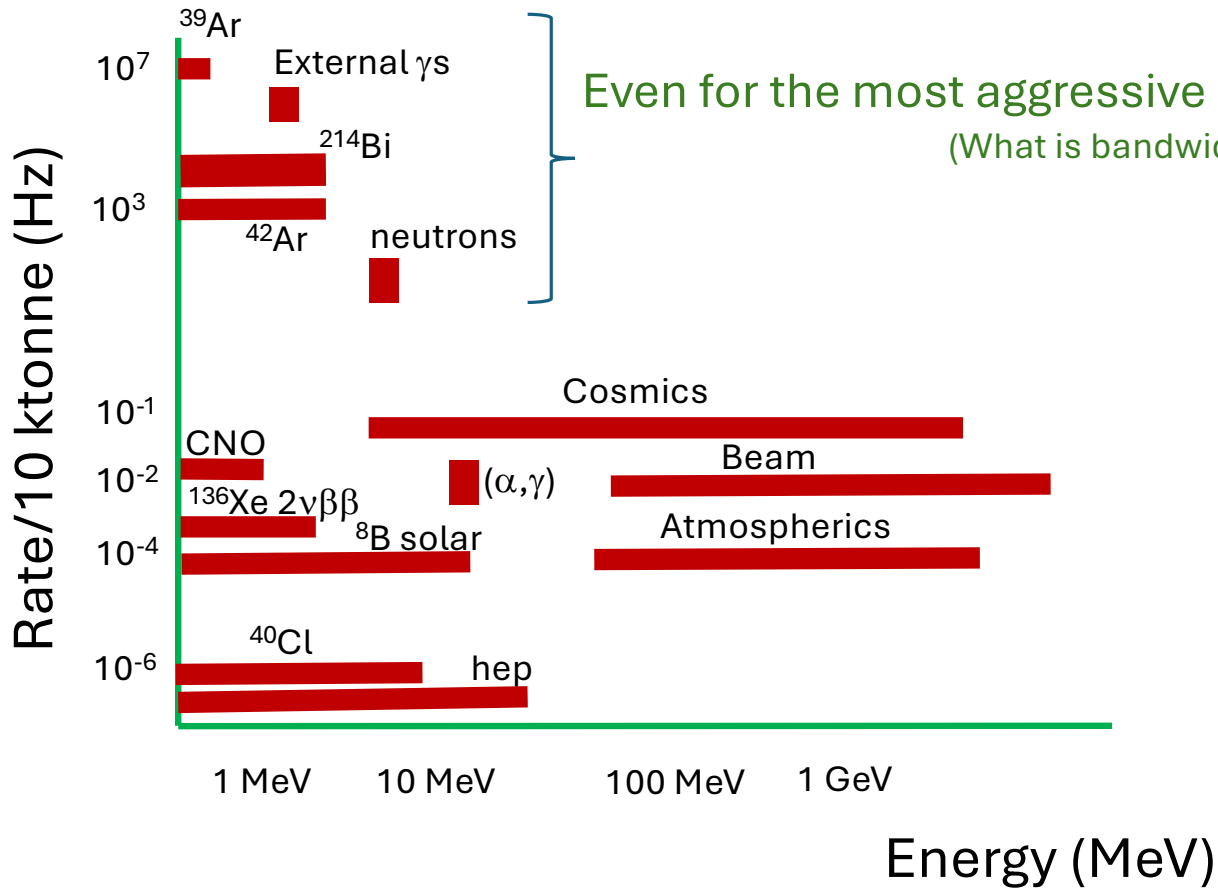
	Hit thresh	Trigger thresh	Flash match	Neutron bkg	Angular accept.	Position accept	e/γ PID	E res	Angular res
Radio	Yes					Yes		Yes	
PNS		Yes		Yes		~	Yes	Yes	
RSDS		Yes			Yes		Yes	Yes	Yes
Spall β		Yes	Yes		Yes	Yes	Yes	Yes	

Dan Pershey (FSU)
Clara Cuesta (CIEMAT)

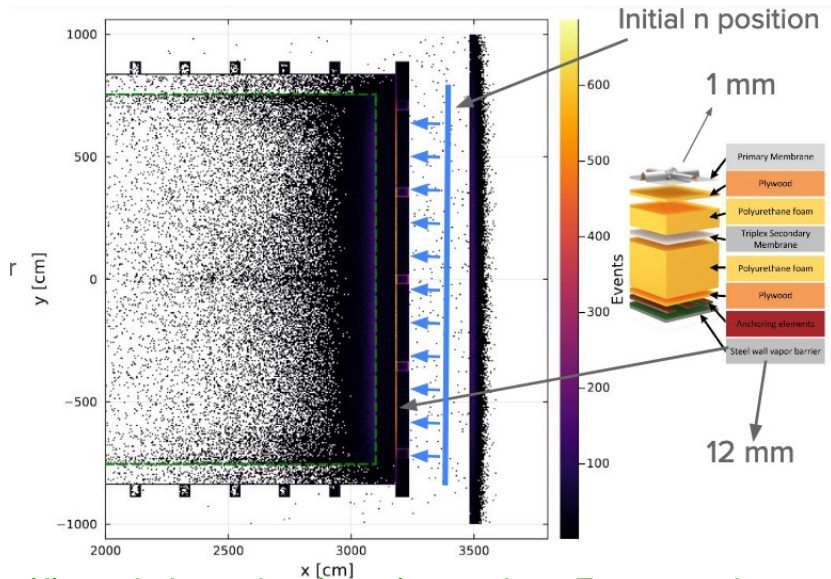
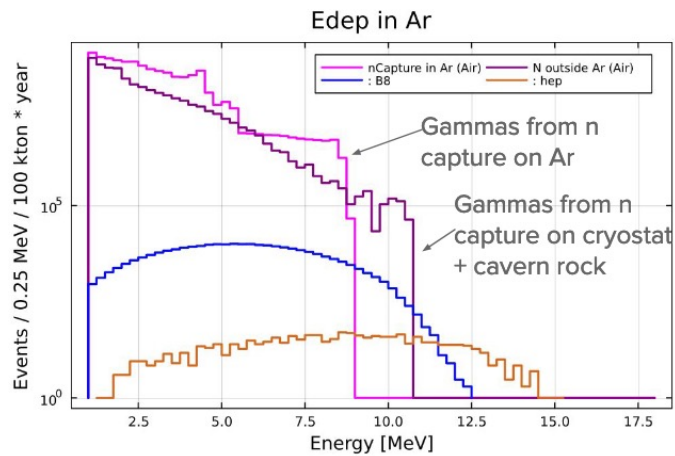
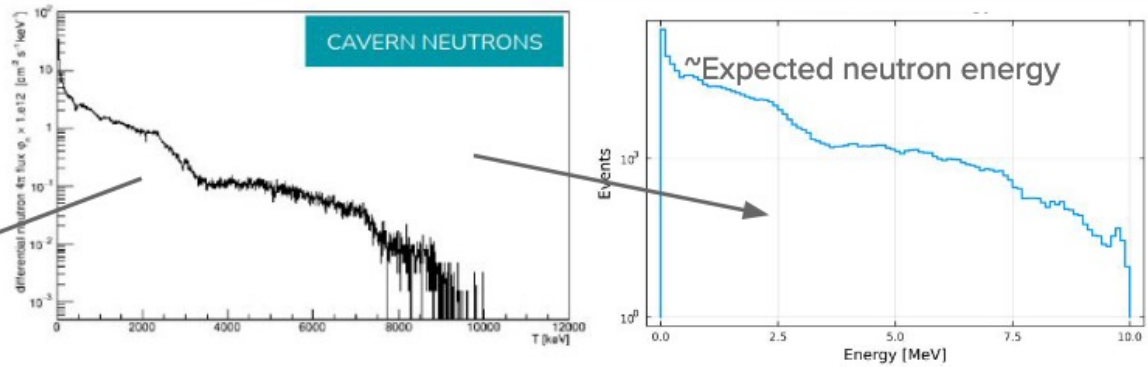
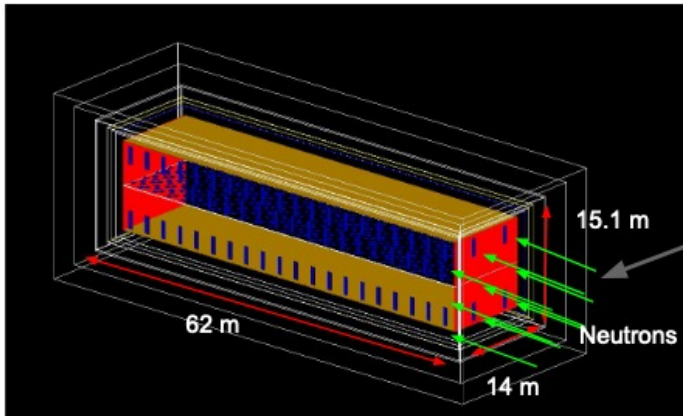
DUNE collaboration meeting
Sep 10, 2024

Low-Energy Triggers and Fiducialization

Even for the most aggressive ROI these rates are challenging
(What is bandwidth limit exactly...?)



Low-Energy Triggers and Fiducialization



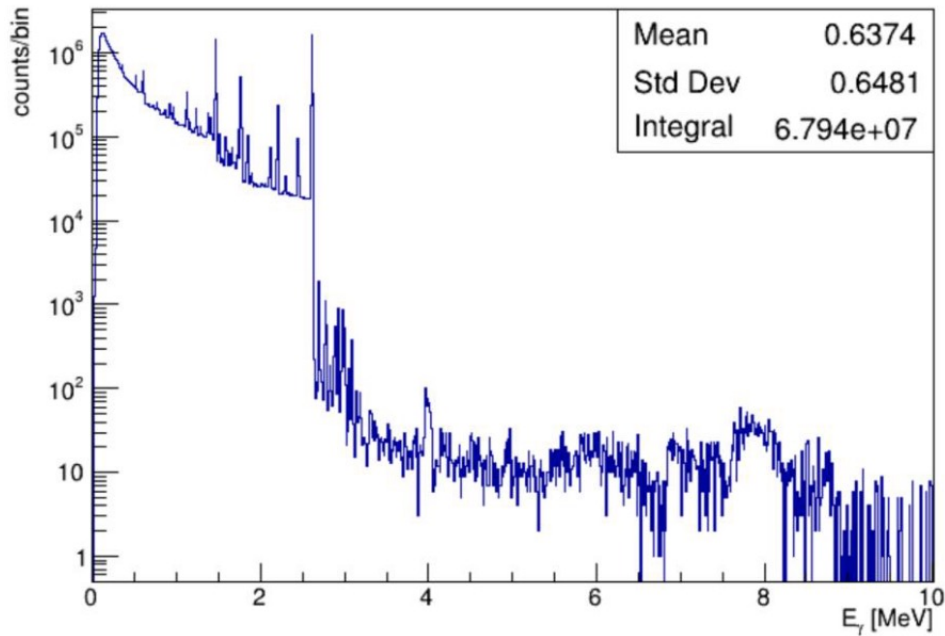
We can reduce rate significantly by only triggering on low-E events that are consistent with being > 1 m from wall

Luis Manzanillas, Mael Martin
manzanilla@lapp.in2p3.fr

DUNE collaboration meeting
 Santa Fe
 September 2024

Low-Energy Triggers and Fiducialization

Cavity gammas (U, Th, etc.) are also high rate



Wavy cavern sides means bigger surface area...



Gamma conversion length ~ 18 cm...can move 2 or 3 of these inside TPC for triggering

Low-Energy Triggers and Fiducialization

Which we will need to do given VERY high rates if we want to go below 5 MeV...

external background	4pi flux in cavern [cm ⁻² s ⁻¹]	reduction factor	attenuation factor	area factor	4pi flux at LAr [cm ⁻² s ⁻¹]	rate in full LAr (VD) [Hz]	rate in HD [Hz]	
cavern neutrons	2.94E-06	21.816	10.908	1.3687	2.70E-07	5.34E+00	4.63E+00	predicted and 4.6+/-1.1 Hz in HD from simulation of 1x2x6
n-capture gammas from cryostat	N/A	N/A	N/A	1.3687	1.68E-06	3.32E+01	1.50E+00	predicted rates [Hz] w/ approx. gamma-att. for 1.5 MeV
n-capture gammas from rock/shotcrete	3.75E-06	13.807	6.9035	1.3687	5.44E-07	1.08E+01	4.87E-01	predicted rates [Hz] w/ approx. gamma-att. for 1.5 MeV
cavern gammas from rock/shotcrete	12.60418	23.985	11.9925	1.3687	1.0510	2.08E+07	9.40E+05	predicted rates [Hz] w/ approx. gamma-att. for 1.5 MeV
foam gammas	N/A	N/A	N/A	1.0000	0.0441	8.72E+05	3.95E+04	predicted rates [Hz] w/ approx. gamma-att. for 1.5 MeV