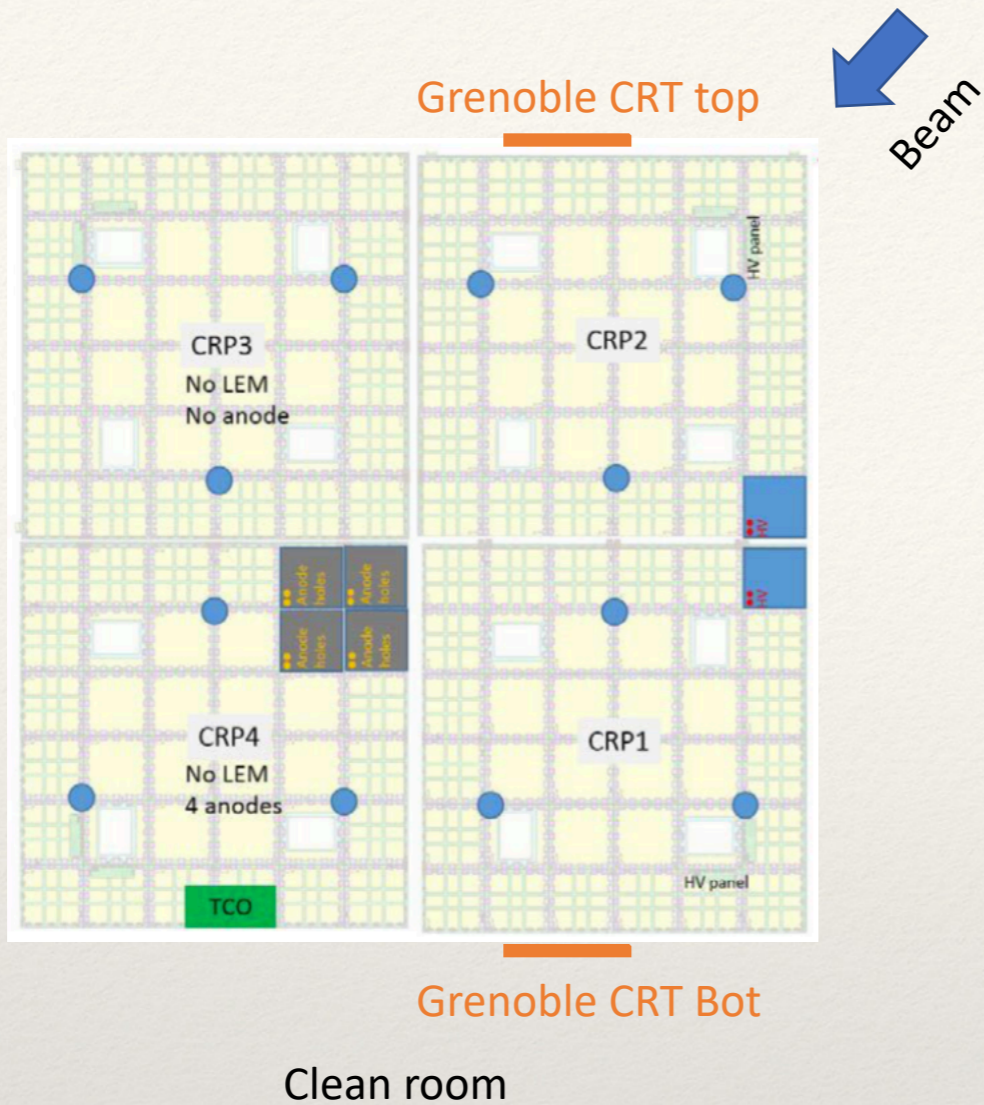


Js Real, Js Ricol, A Robert. LPSC Feb. 26 2020

CRT for NP02

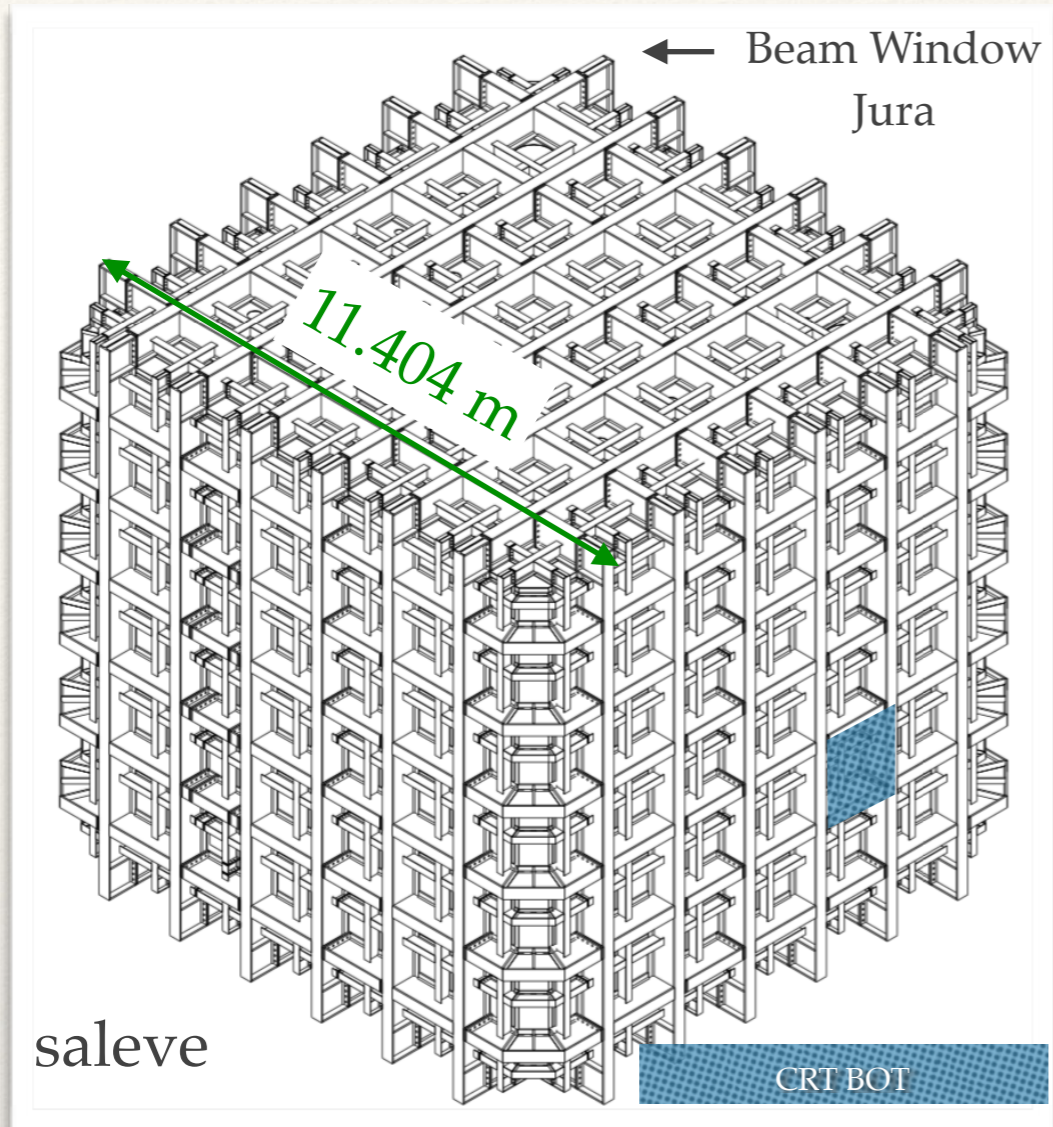


- ❖ Muon track triggered by the CRT (top-bot coincidence) pass in CRP1 and CRP2 regions

- ❖

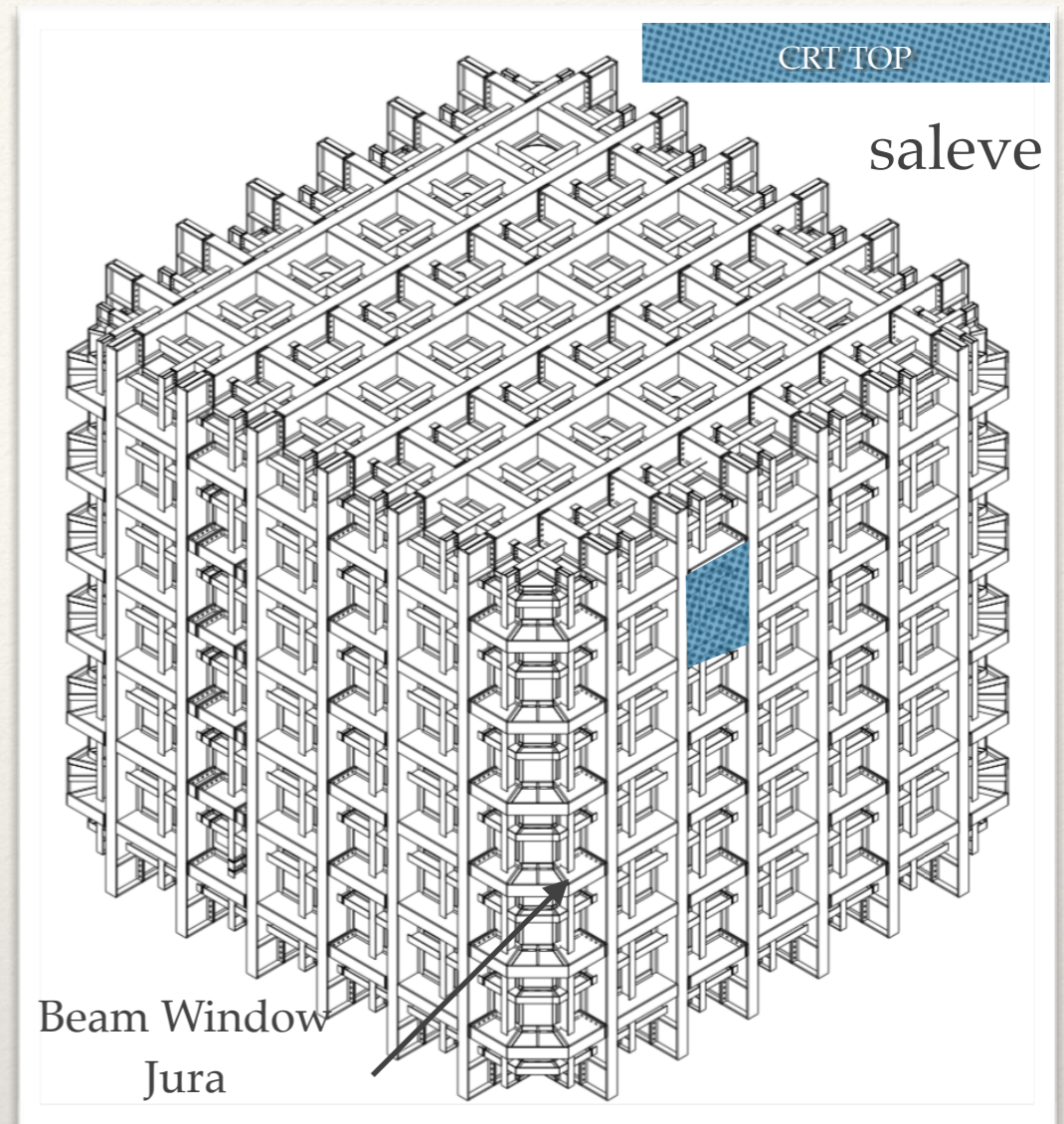
Top view

Geometry

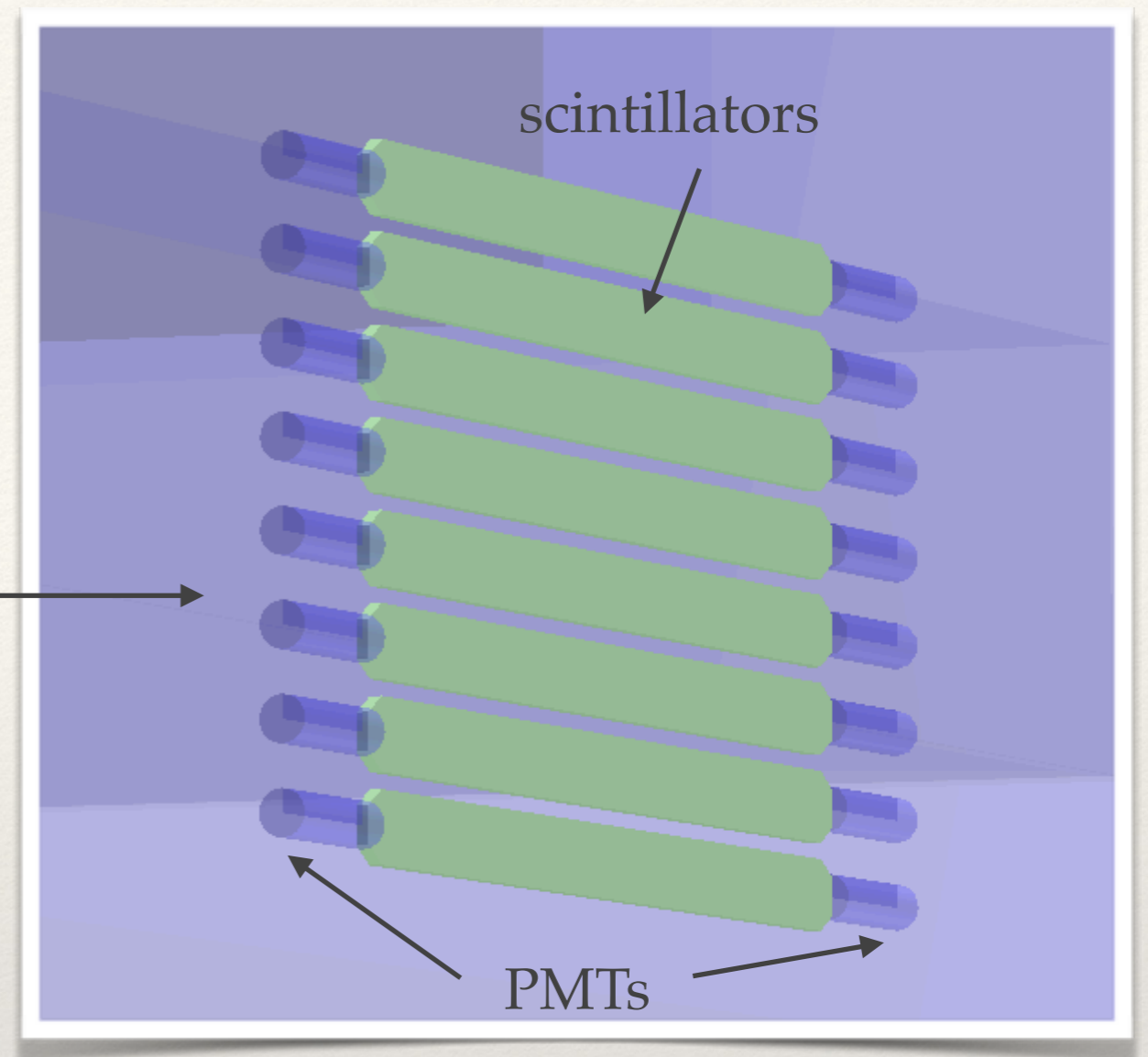
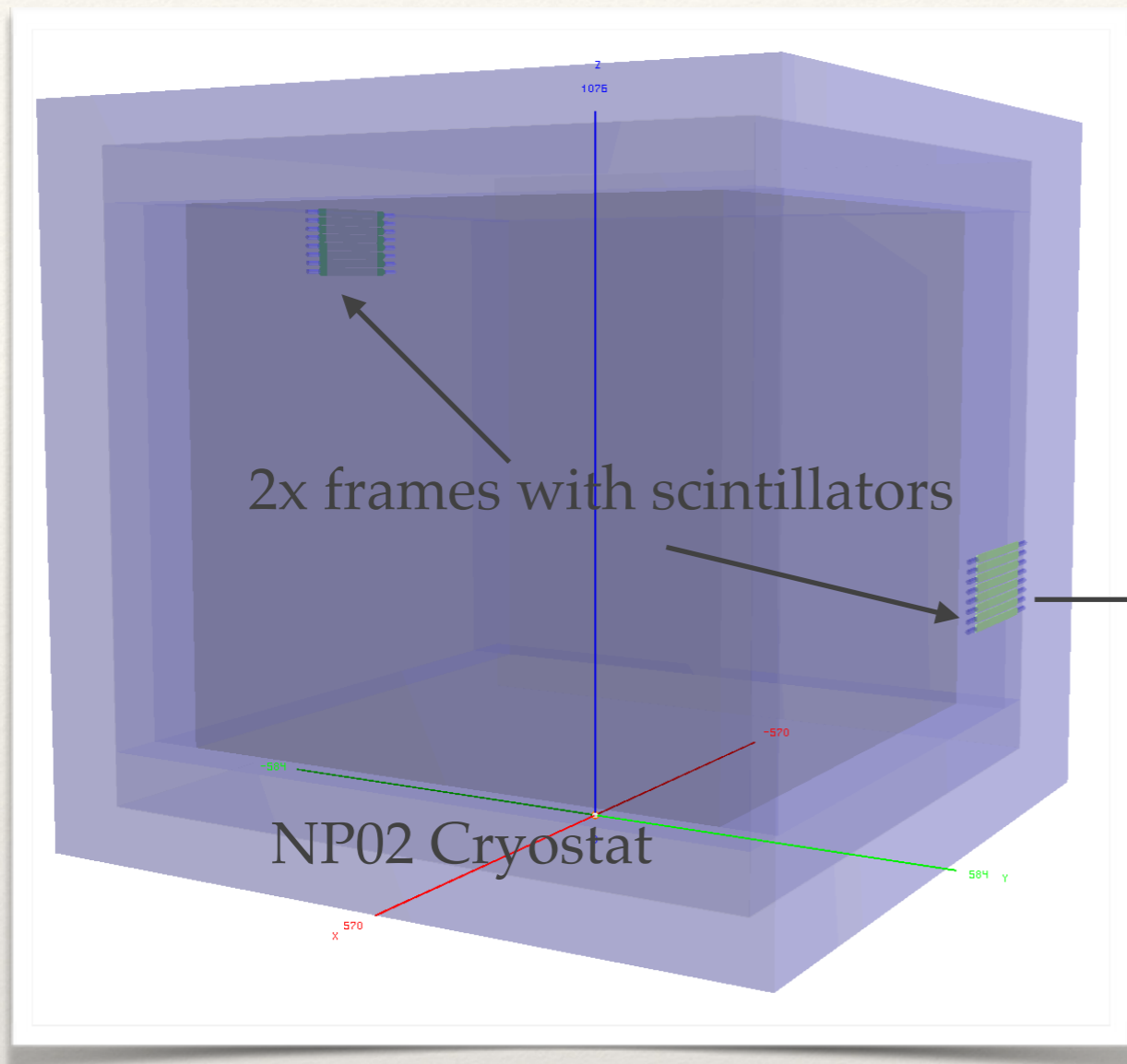


Lorem Ipsum Dolor

Side views



Geometry



- ❖ 2X 8 scintillator paddles ($1.44 \times 0.12 \sim 1\text{m}^2$), read on both end by PMTs (32 PMTs signals)
- ❖ Custom compact uTCA boards (4 boards needed for 32 channels).
- ❖ Trigger logic is build inside the uTCA crate (Charge trigger on analog sum of both PMTs for each paddle, coincidence between the 2 planes).
- ❖ Trigger: keep CRT data on file, Output TTL signal for DP external trigger (foreseen to have 2 TTL signal)

CRT operation/data

- ❖ CRT electronic and DAQ are located in room 887
- ❖ DAQ is continuously running
- ❖ Runs are automatically stop / start each 24h
- ❖ Raw data are automatically preprocessed to write a simple Tree in a root file (1 file per 24h)
- ❖ Raw data are copied within 1 hours in `/eos/experiment/neutplatform/protodune/rawdata/np02/CRT/`
- ❖ Preprocessed files are copied within 1 hours in `/eos/experiment/neutplatform/protodune/rawdata/np02/CRT/rootfiles/`
- ❖ Run name `CRT_yyyymmdd_hhmmss.root` (ex:`CRT_20191120_110741.root`). the time in the run name correspond to the beginning of the run



CRT data

- ❖ preprocessed files in `/eos/experiment/neutplatform/protodune/rawdata/np02/CRT/rootfiles/` contains run information and a simple root Tree: (all coordinate units are in meter)
 - ❖ KEY: TParameter<long> RunDuration;1 duration of the run in second
 - ❖ KEY: TVectorT<float> ytop;1 float[8] with Y position of the top scintillators (+- 2 cm)
 - ❖ KEY: TVectorT<float> ztop;1 float[8] with Z position of the top scintillators (+- 6 cm)
 - ❖ KEY: TVectorT<float> ybot;1 float[8] with Y position of the bottom scintillators (+- 2 cm)
 - ❖ KEY: TVectorT<float> zbot;1 float[8] with Z position of the bottom scintillators (+- 6 cm)
 - ❖ KEY: TTree CRTtree;1 CRTtree :
 - ❖ **tstamp**: time stamp of event with 1 sec precision. Corrected to match the WR timestamp.
 - ❖ **deltatime**: difference of time between 2 events in sec with $1\sim\mu\text{s}$ precision.
 - ❖ **mult_top**: number of top scintillateurs fired
 - ❖ **mult_bot**: number of bottom scintillateurs fired
 - ❖ **Qtop[8]**: ADC charge of the top scintillateurs
 - ❖ **Xtop[8]**: X position in the top scintillators calculated from difference of time information in both PMTS with a precision of +-11cm
 - ❖ **CFDtop[8]**: CFD time of the top scintillator with 1 ns precision to be used for delta time with CFDbot
 - ❖ **Qbot[8]**: ADC charge of the bottom scintillateurs
 - ❖ **Xbot[8]**: X position in the bottom scintillators calculated from difference of time information in both PMTS with a precision of +-10cm
 - ❖ **CFDbot[8]**: CFD time of the top scintillator with 1 ns precision to be used for delta time with CFDtop
 - ❖ **muon_flag**: -1 if no muon candidate, $(i_Scint_top) * 10 + i_Scint_bot$ if muon candidate (i_Scint_top and i_Scint_bot between 0-8) muon candidate flag is valid if one can find a top and bot fired paddle with a difference of time between 40 and 45 ns.
 - ❖ **ft**: difference fo time between top and bot.

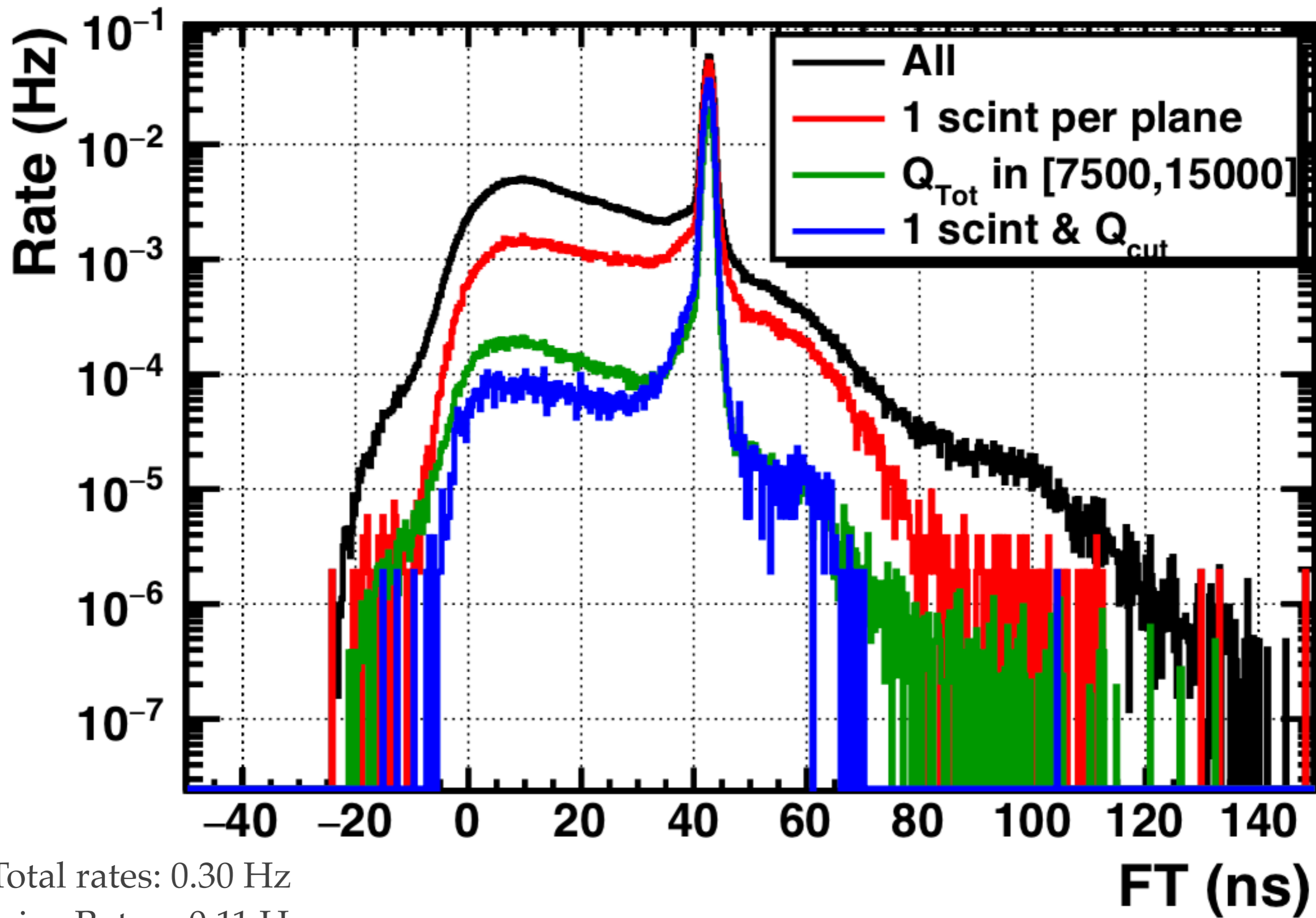


Figure 11: Event rate as function of $t_{Bot} - t_{Top}$ flight time.

coordinates

- ❖ Coordinates frame follow the standard survey one (<https://edms.cern.ch/document/2090769>). z positive upward.
- ❖ The origin is the center of the cryostat.
- ❖ Differs from LarSoft which seems to be in cm.
 - ❖ y vertical centered on the active liquid volume ($y_{\text{larsoft}} = z_{\text{CRT}} - 45.2$ cm)
 - ❖ x_{larsoft} and z_{larsoft} have to be checked

