XMASS experiment
Current status Ⅱ
～ Low energy study and Light guide setup～

11th ICEPP Symposium at Hakuba

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R&D by prototype detector

Demonstrations of

- Reconstruction
- Self shield
- Low Background @~100keV

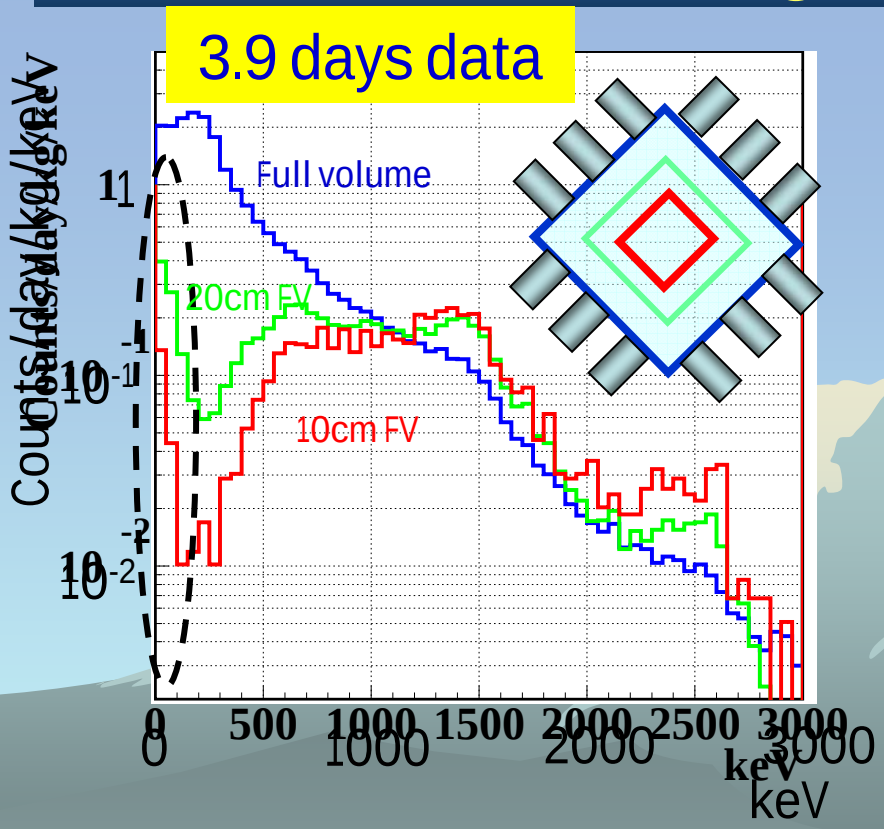
} Good results !

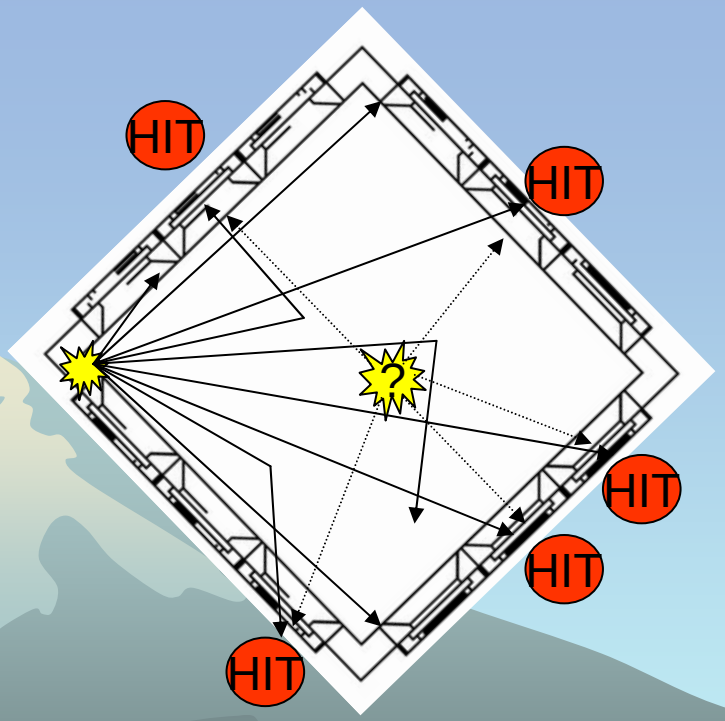
We have demonstrated these important properties for realizing the 800kg detector.

Further study BG at low energy region@~<100keV

Background Data

3.9 days data



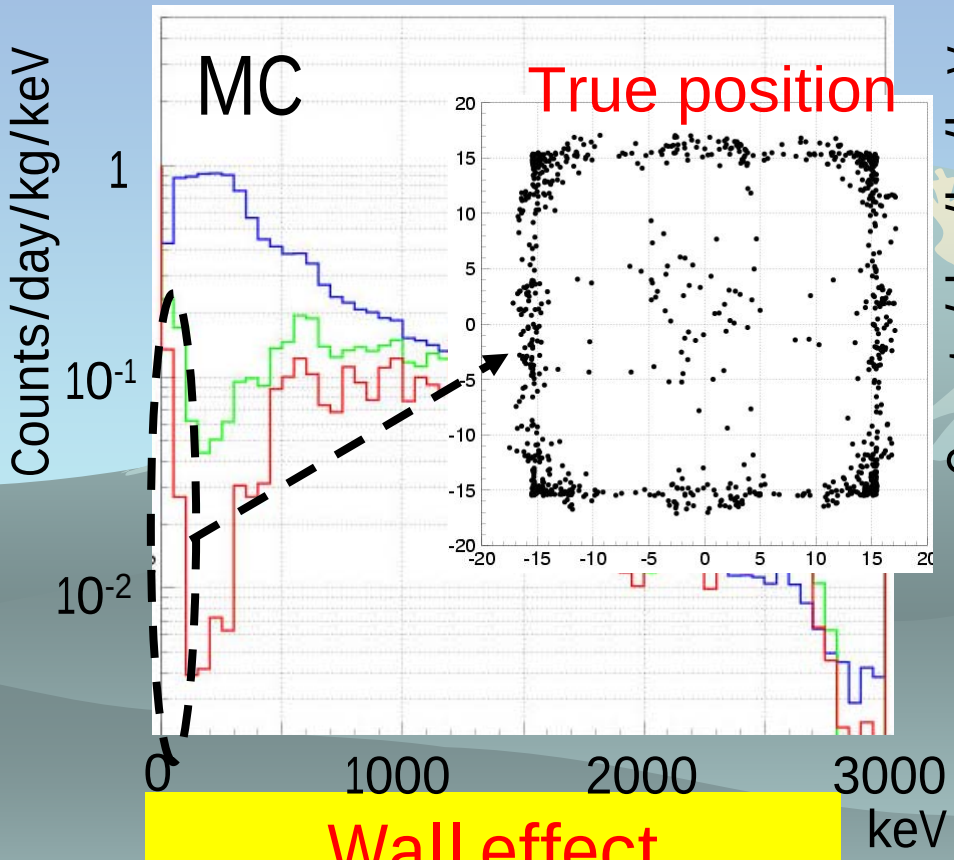


- dead angle from PMTs
- total reflection

→ “ Wall effect ”

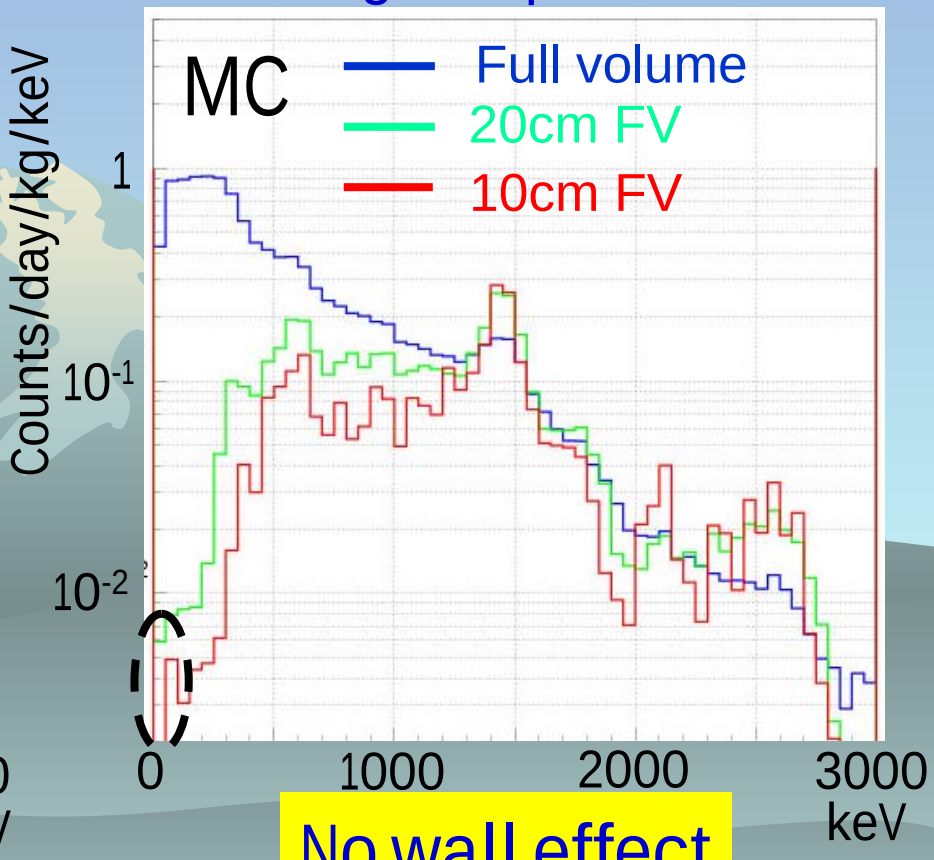
“Wall effect” study with MC

volume cut
Using reconstructed positions



Wall effect

volume cut
Using true positions



No wall effect

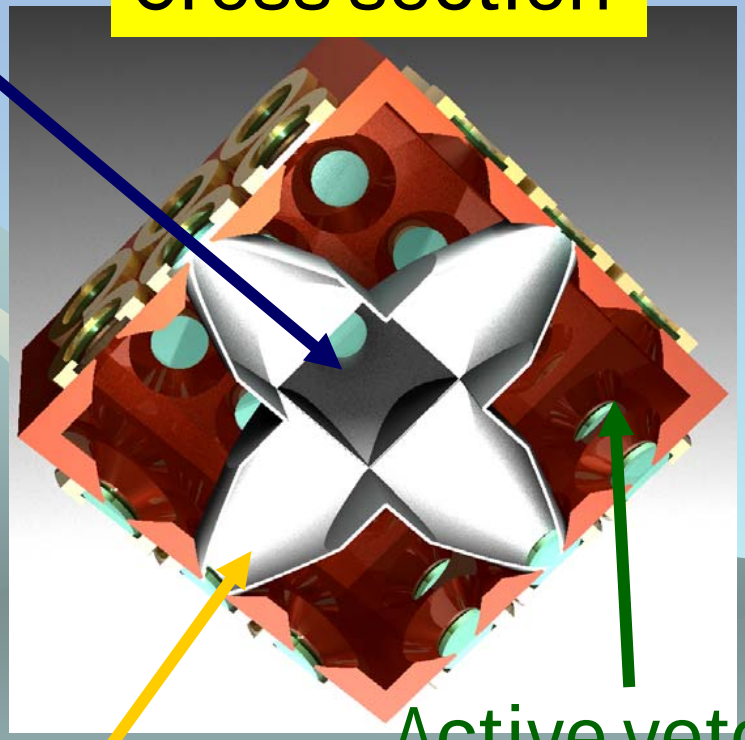
It’s difficult to show the low BG at the low energy region because of “wall effect”.

Improvement to minimize the wall effect

- if we reduce such "wall effect" by putting "PTFE light guide", we can reduce low energy mis-reconstructed events.

Fiducial Volume

Cross section



Active veto

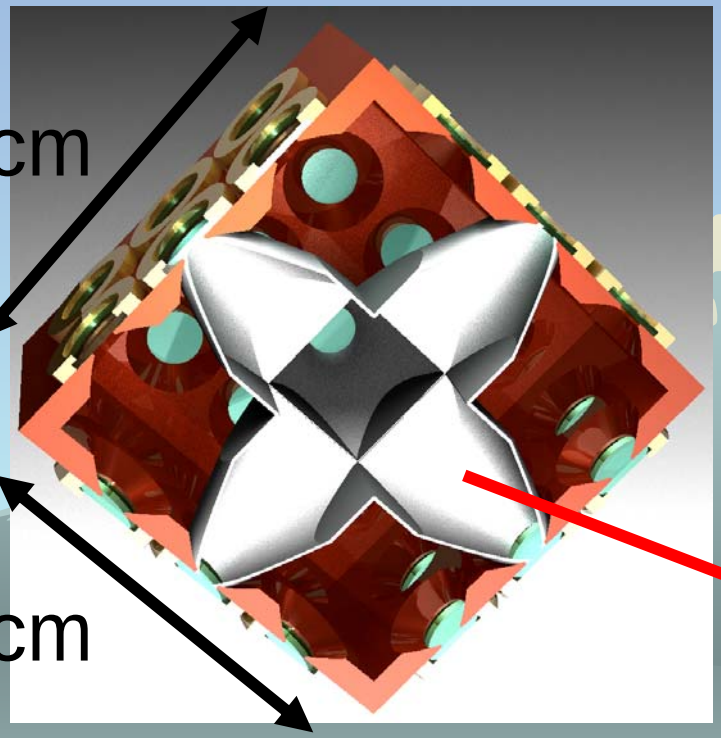
PTFE reflects scintillation light of LXe@~178nm

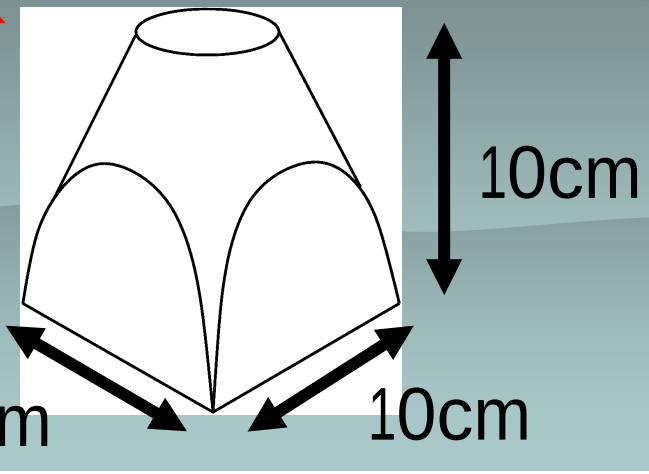
PTFE Light Guide

Reduce the dead angles from PMTs

PTFE Light guide

- Geometry

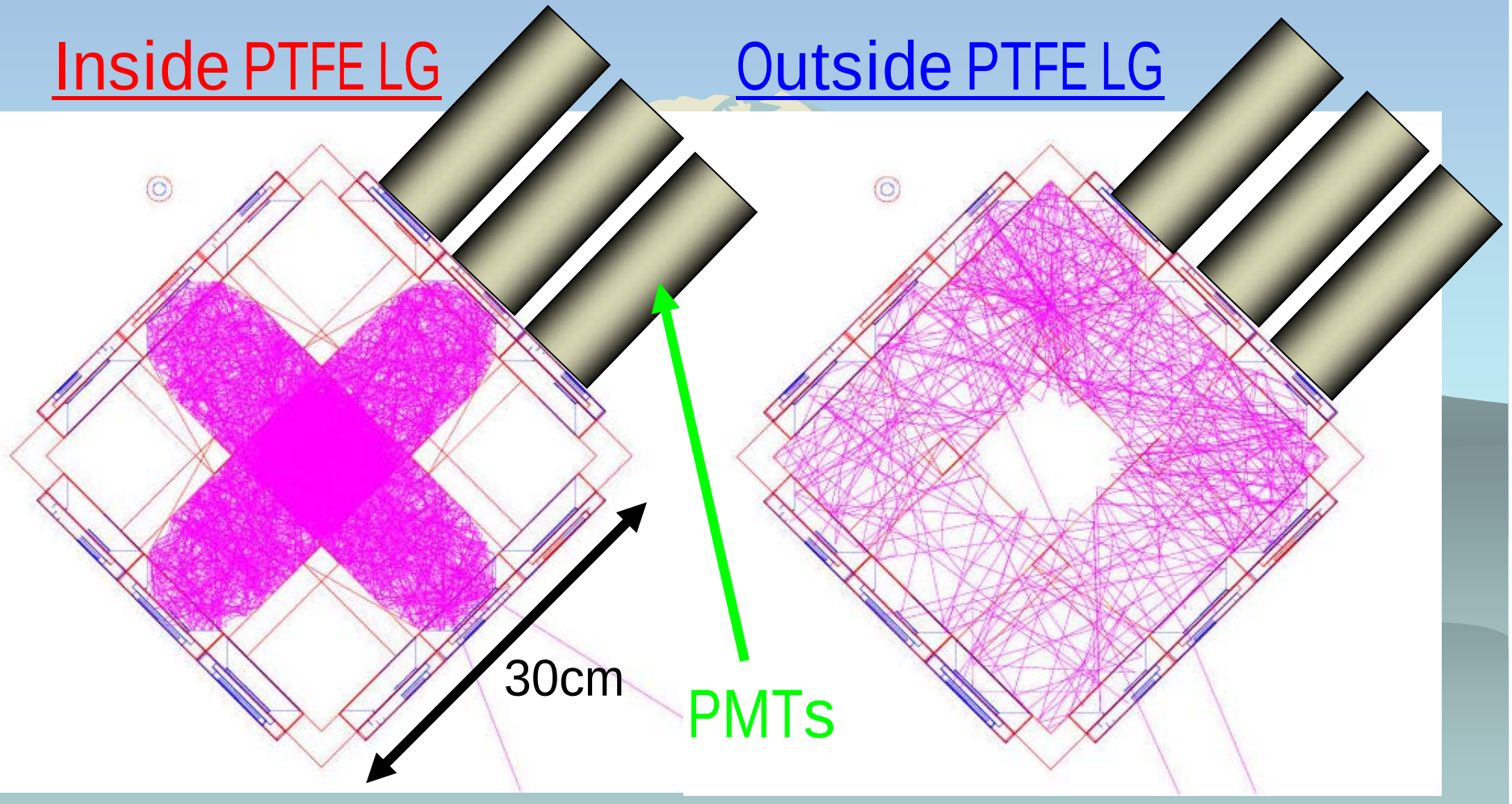




PTFE Light guide design

Photon tracking

- MC simulations with
  Lambert's law reflection



Selection criteria to extract center events

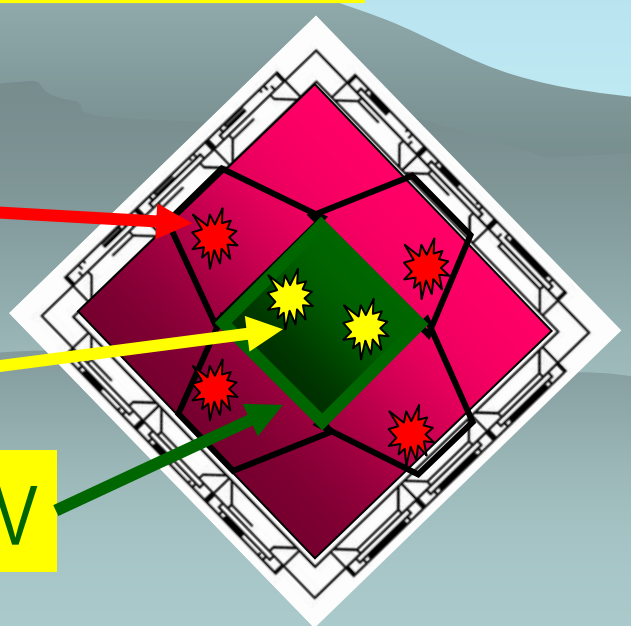
- Pare of all facing PMTs detect p.e. (Sx,Sy,Sz)
- Smin=min(Sx, Sy, Sz), Smax=max(Sx, Sy, Sz)
  - Sx>0, Sy>0, and Sz>0 (balance cut 1)
  - Smax < Smin x 2.5 (balance cut 2)
  - Except for 6 PMTs, no hits (active veto)

Smax > Smin x 2.5

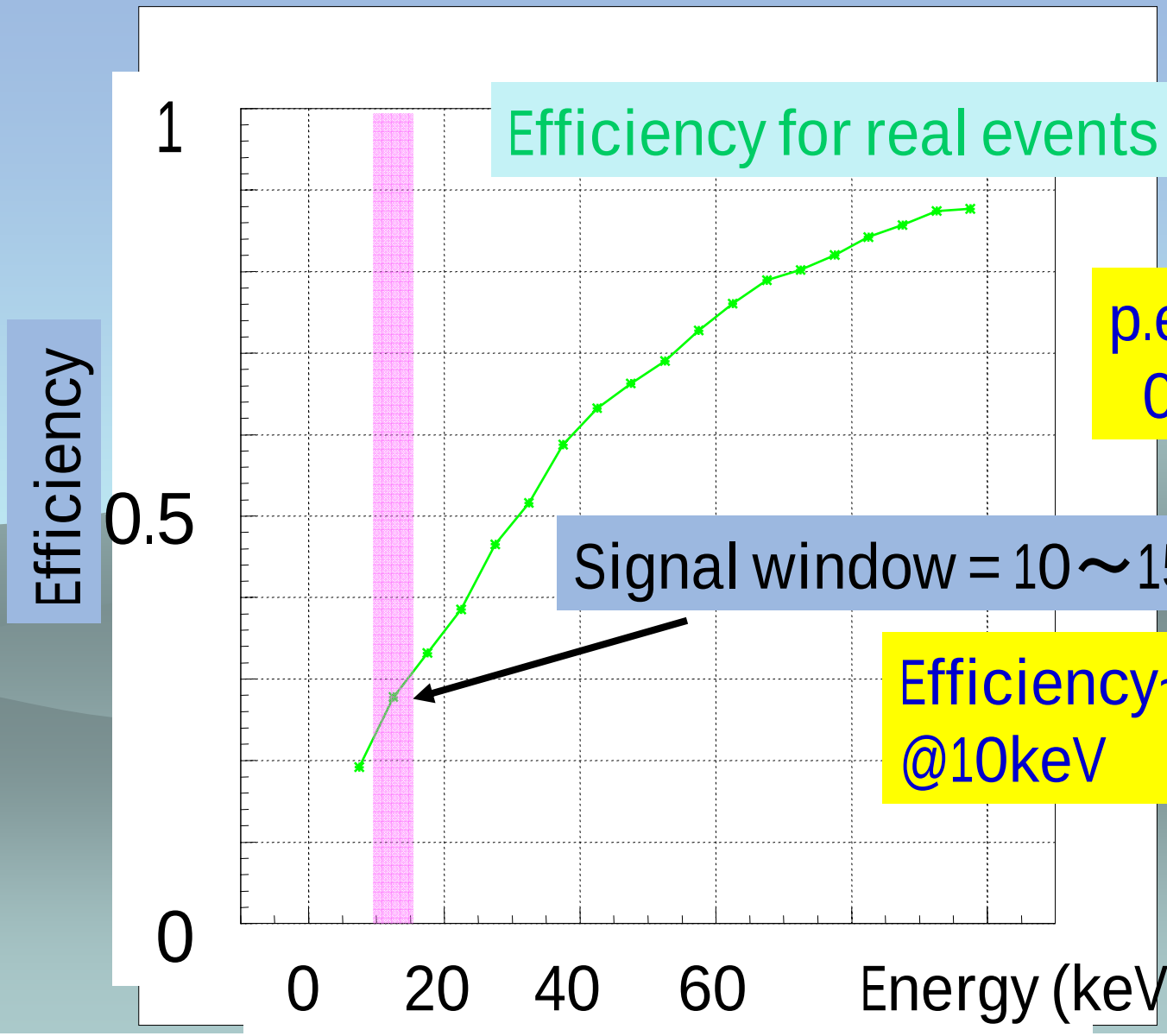
Smax < Smin x 2.5

10cm FV

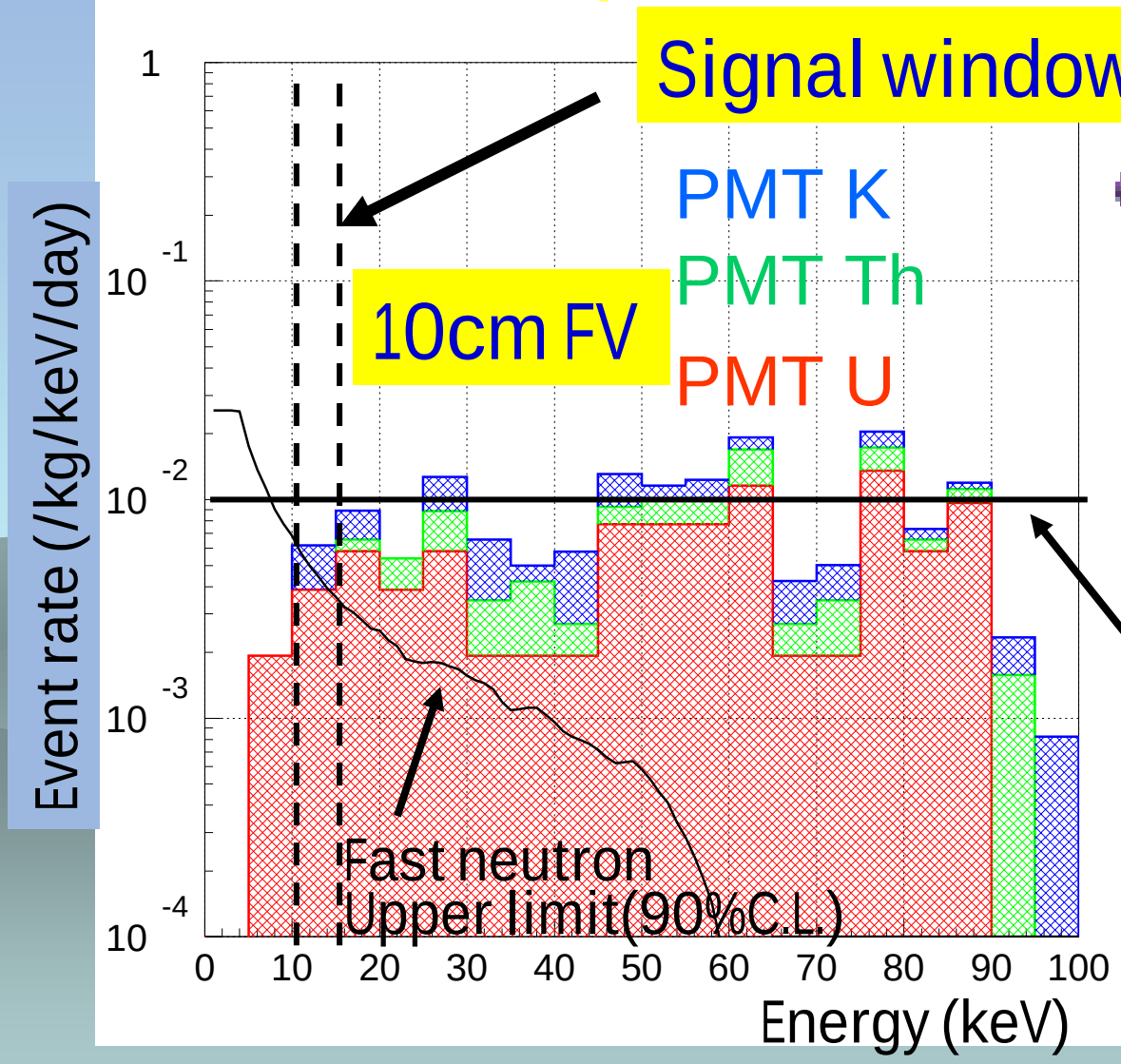
Under study



Selection efficiency (MC, under study)



Background after the selection (MC simulations)



- Detailed calibration will be needed to check the MC and efficiencies.

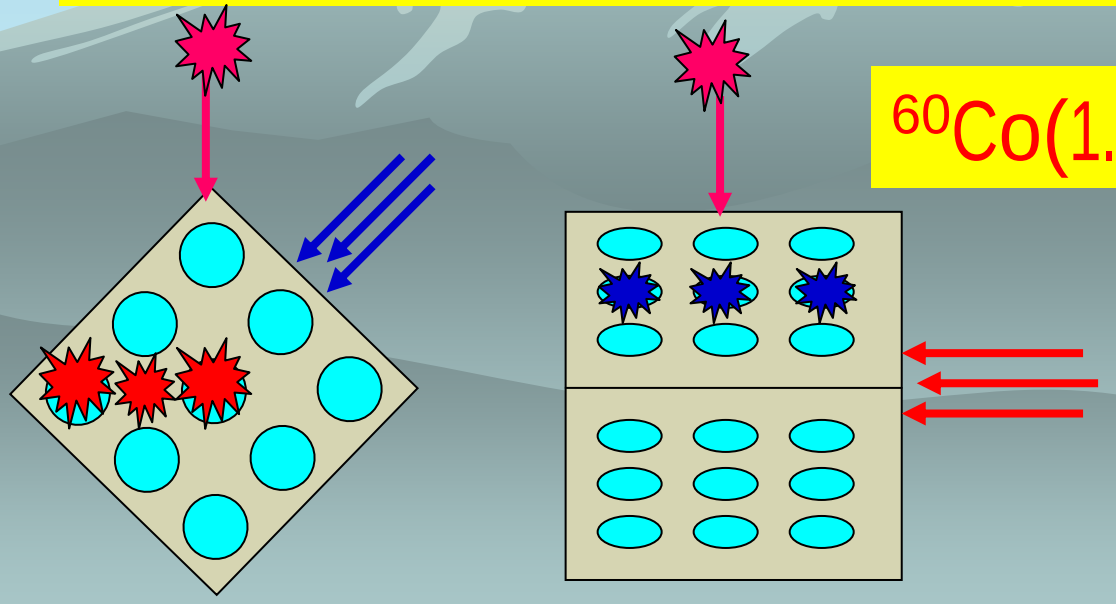
Expected BG

~10^{-2}/keV/kg/day

Calibrations

- Energy calibration for the central events
- Detector response check [depend on energy]

Gamma ray injection from various position



^{60}Co(1.173&1.333MeV)

^{137}Cs (662keV)

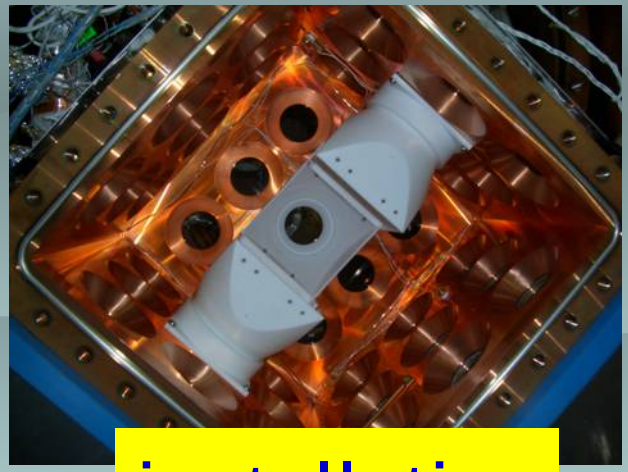
^{57}Co(122keV)

PTFE setup

shaving

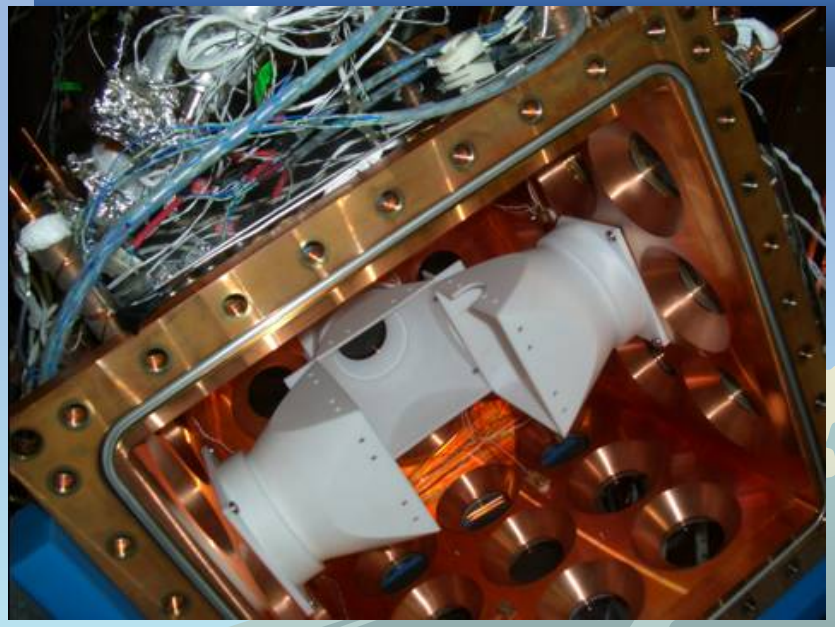
washing

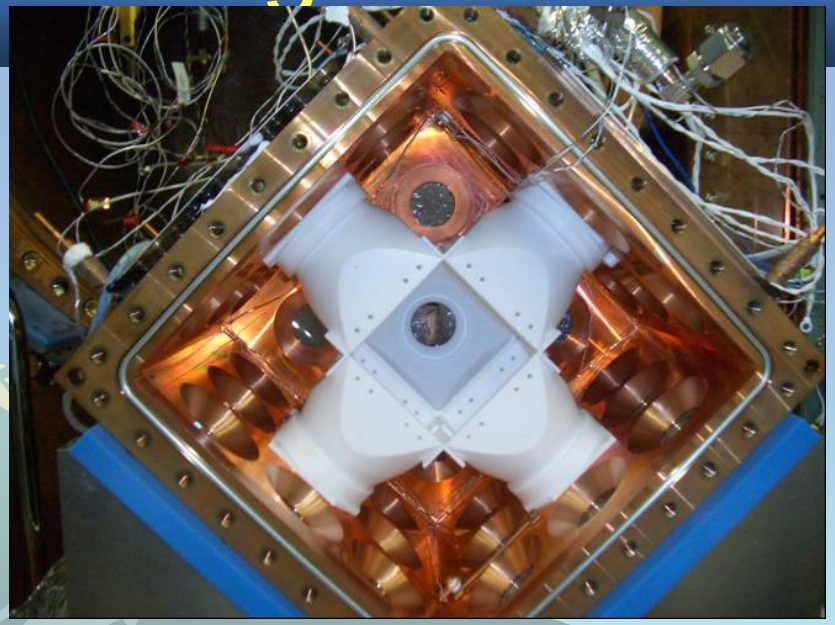
drying

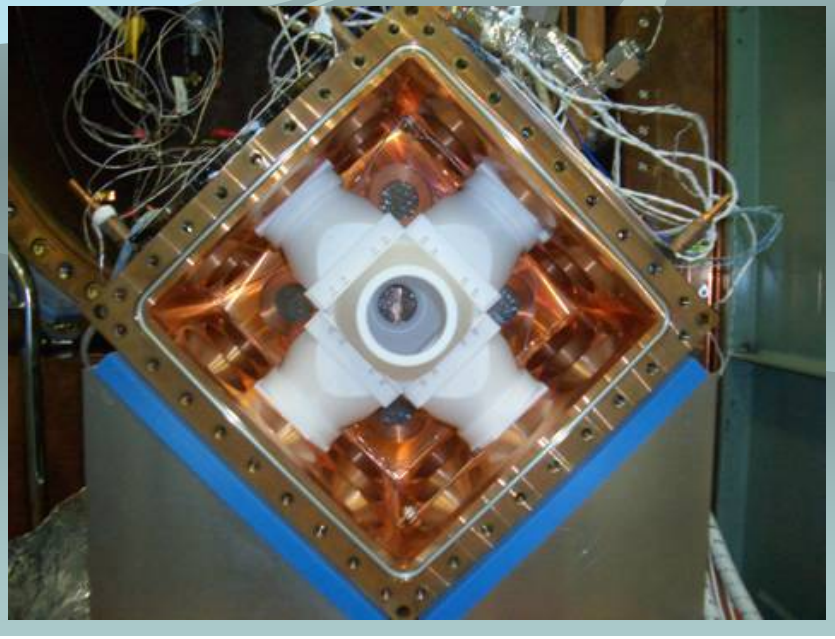


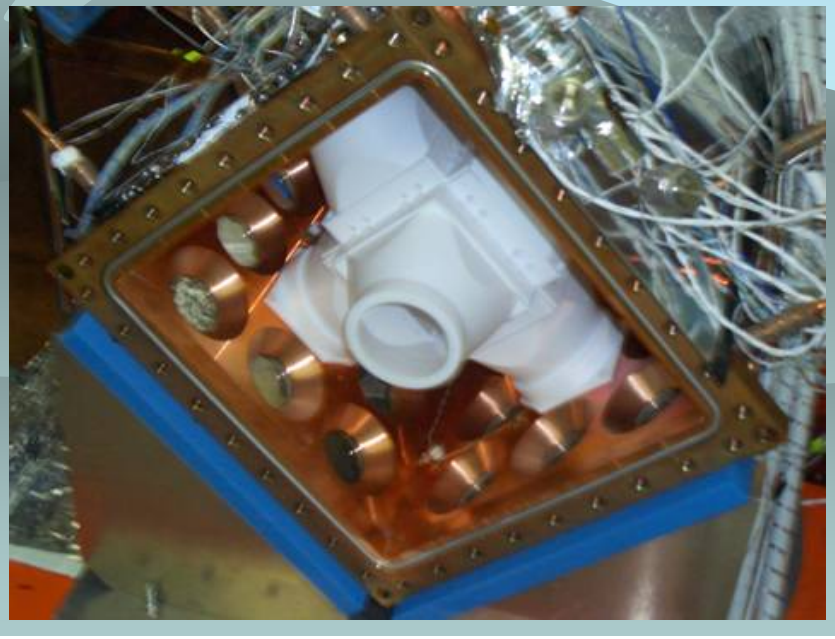
installation

The attachment of Light Guide



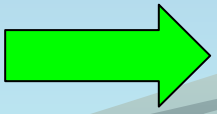






Summary

- We can reduce "wall effect" by putting "Light guide" and the dead angles from PMTs, as a result we can reduce low energy mis-reconstructed events.

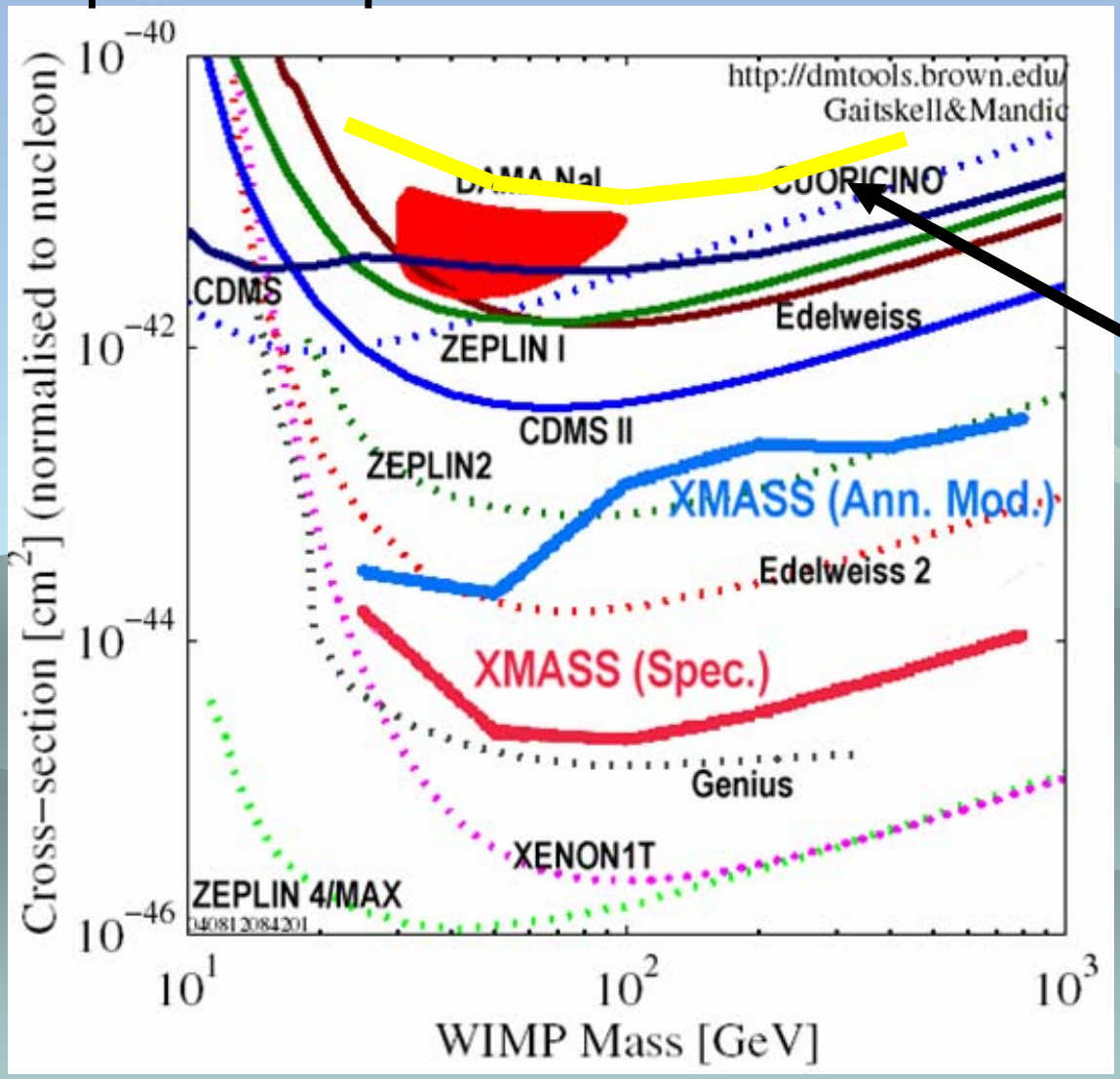


background : 10^{-2} /keV/kg/day
Efficiency : ~30%@10~15keV
@10cm FV

- Only prototype detector has "wall effect" because this detector shape is cubic and there is a total reflection by the windows in front of PMTs.
- We'll start run and data taking from this week.

Dark matter searches with light guide

Spin independent interaction



XMASS 3kg FV
1 week
E_{th} = 10 keVee
3 σ discovery