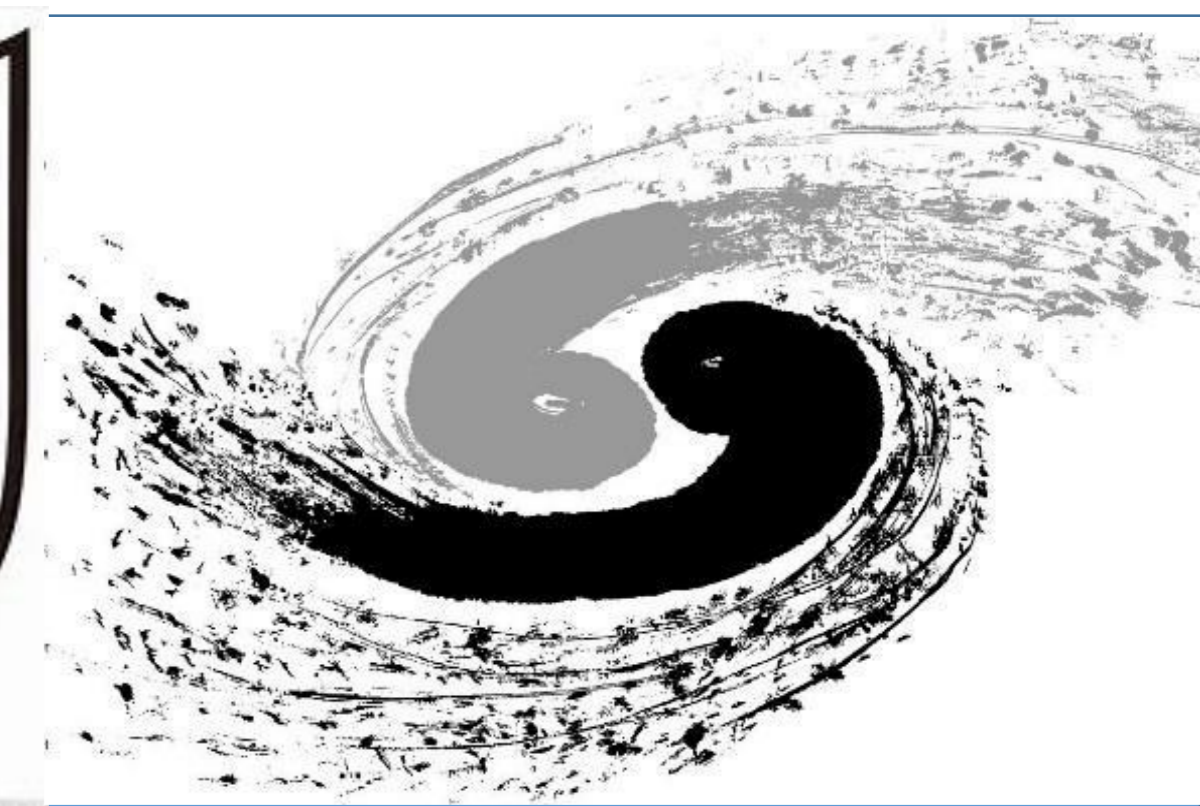




Taishan Antineutrino Observatory

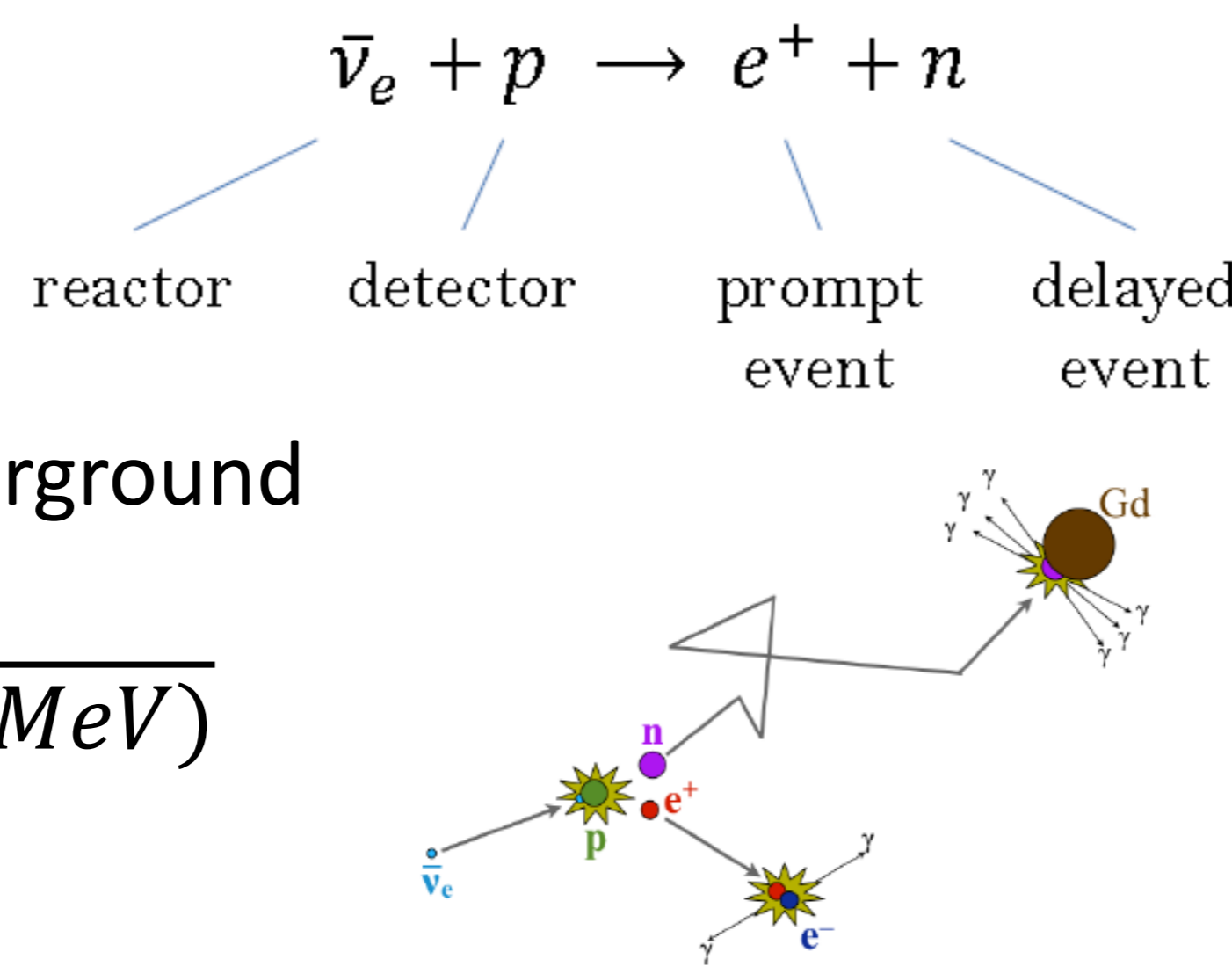
Wei Wang on behalf of the JUNO Collaboration
 NJU, IHEP, CAS, Beijing wangwei@ihep.ac.cn



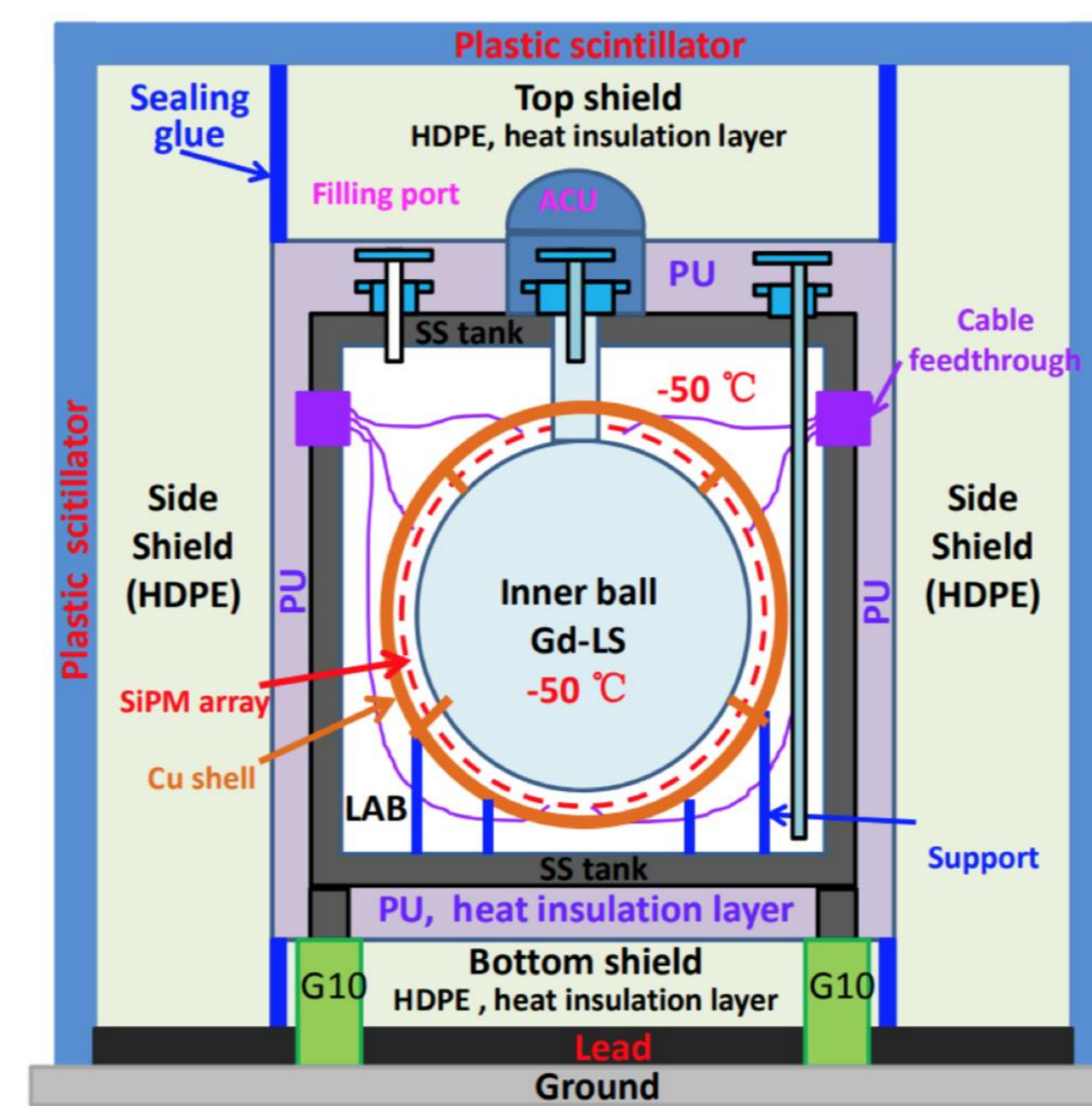
TAO Experiment

Physics Goals:

1. Reactor neutrino spectrum fine structure measurement
2. Reference Spectrum for Jiangmen Underground Neutrino Observatory (JUNO) energy resolution better than $3\%/\sqrt{E(\text{MeV})}$
3. Sterile Neutrino
4. Reactor Monitoring and Safeguard



Detector overview



JUNO-TAO

Detector Geometry

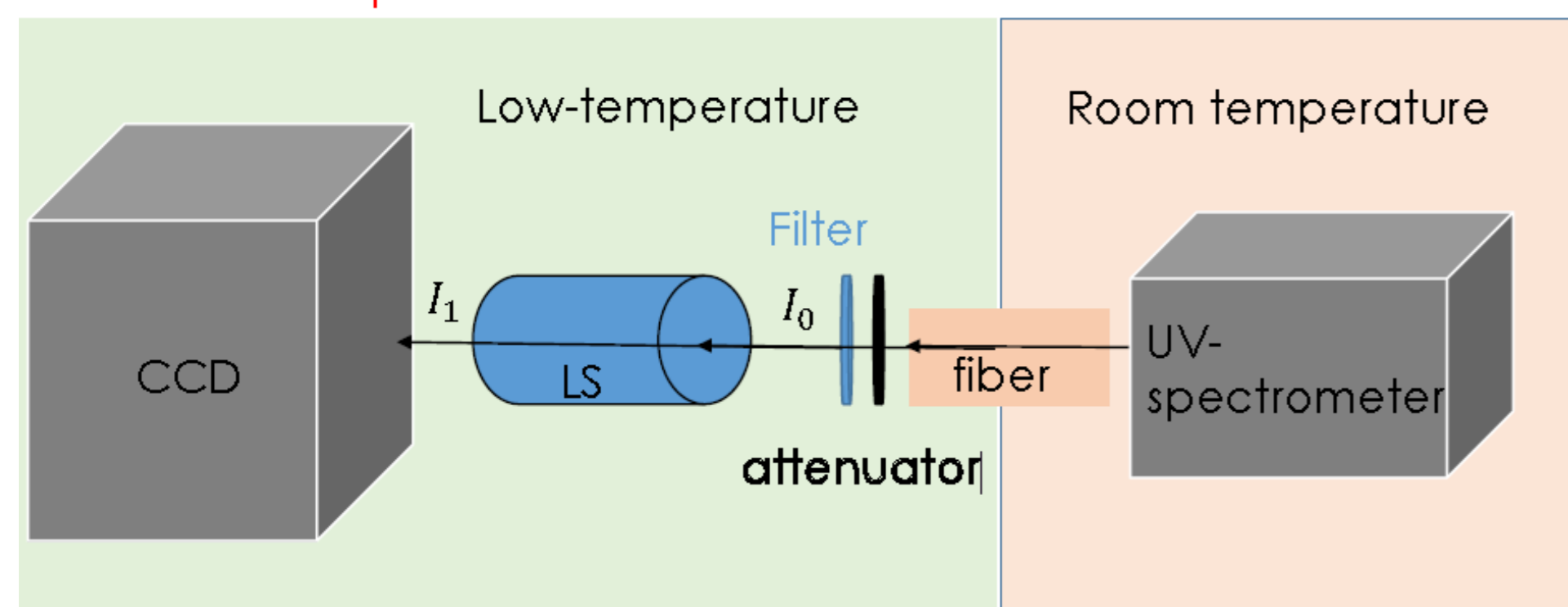
Layout: Gd-LS -> balloon -> acrylic -> LAB -> SiPM
 Shape: sphere
 Size: diameter = 1.8 m
 Photo-sensor: SiPMs
 Operation temperature: -50°C
 Gd-LS mass = 2.6 ton

Low-Temperature Liquid Scintillator (LS) Experiment For TAO

Recipe: LAB+PPO(fluorescence)+bis-MSB(wave-shifter)

Test scheme for the Low Temperature LS transparency measurement

Sketch map:



Filter: 430nm
 Attenuator: 0.1
 LS: different recipe
 Cuvette: quartz(10cm)

$$A_{t_1} = \lg\left(\frac{I_0}{I_{t_1}}\right)$$

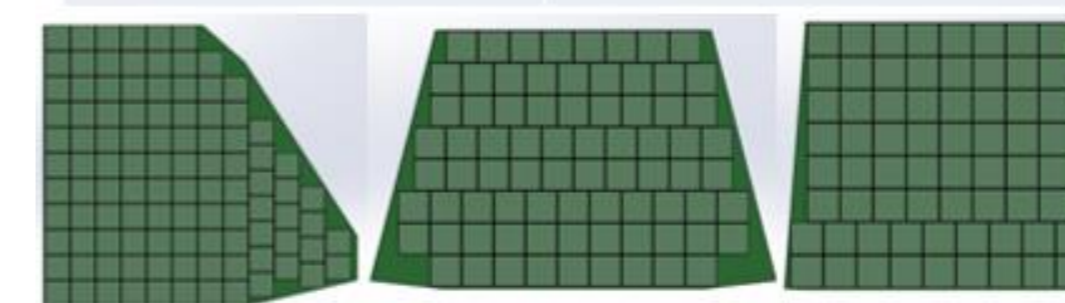
$$\Delta A = A_{t_2} - A_{t_1} = \lg\left(\frac{I_0}{I_{t_2}}\right) - \lg\left(\frac{I_0}{I_{t_1}}\right)$$

$$= \lg\left(\frac{I_{t_1}}{I_{t_2}}\right)$$

Transparency: $\frac{I_{t_1}}{I_0}$ Absorption value: A_{t_1}
 Change of absorption value: ΔA

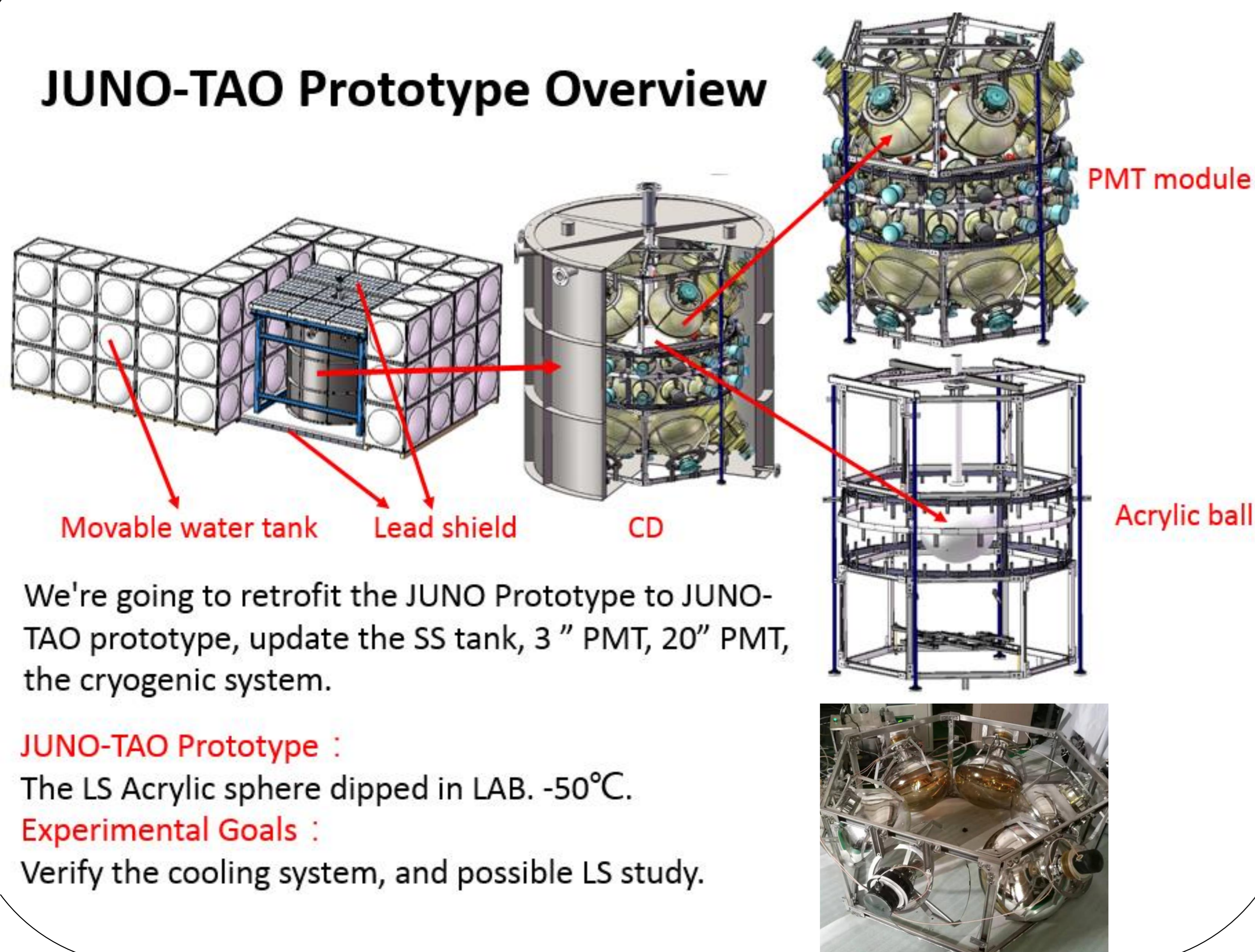
SiPM Arrangement

Coverage of PCB	Option A	Option B	Option C
Division of shell	3 parts	2 parts	2 parts, special-shaped PCB to fill gaps
qty of PCB	4086	4150	4185
Coverage	Low, 94%	Middle, 95.5%	High, 96.3%
Cost	L	M	H
Transport and installation	Easy	Difficult	Difficult



Three kinds of special-shaped PCB for Option C. Options are not decided yet. The pros and cons of each option need further comparison.

JUNO-TAO Prototype Overview



We're going to retrofit the JUNO Prototype to JUNO-TAO prototype, update the SS tank, 3" PMT, 20" PMT, the cryogenic system.

JUNO-TAO Prototype :

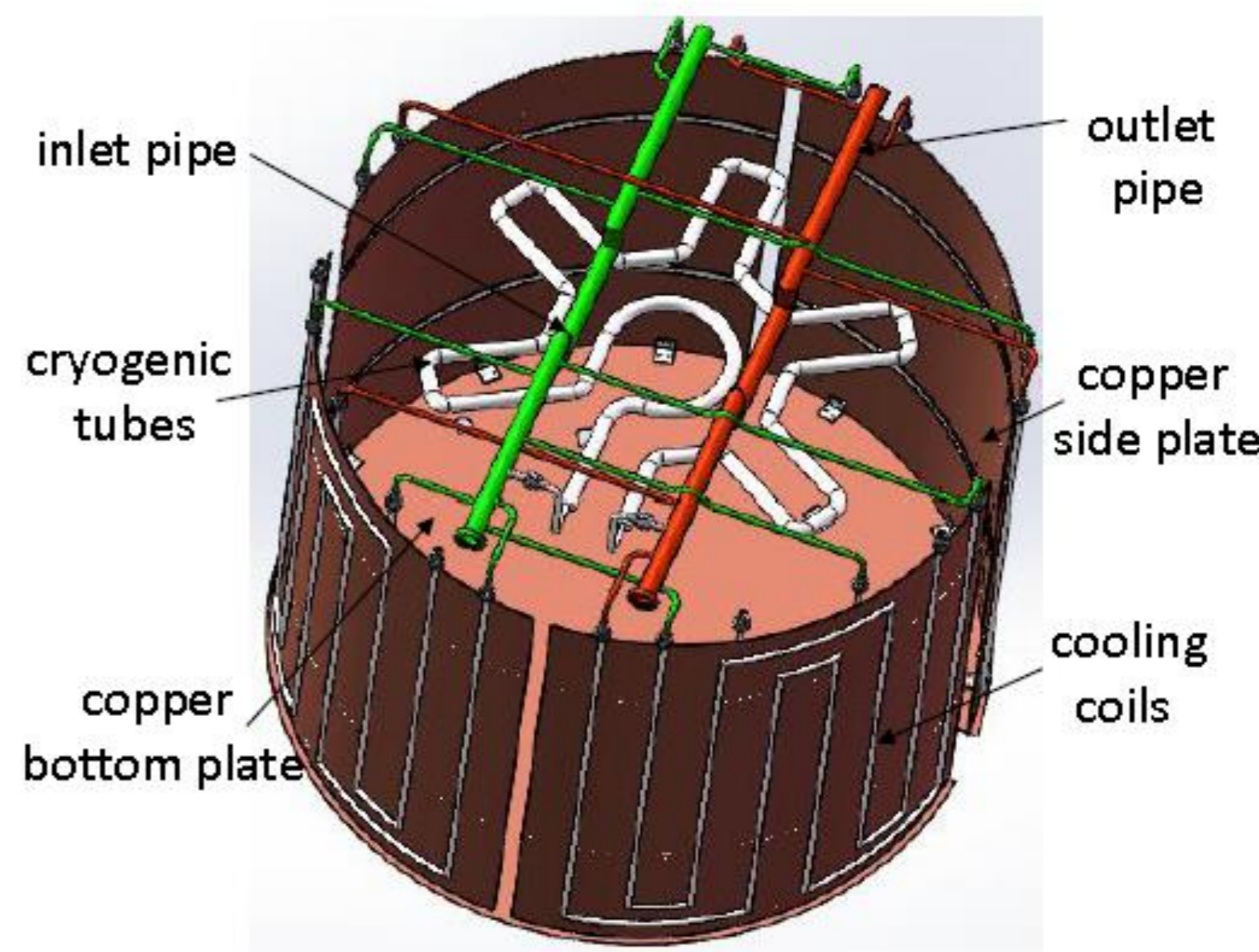
The LS Acrylic sphere dipped in LAB. -50°C.

Experimental Goals :

Verify the cooling system, and possible LS study.

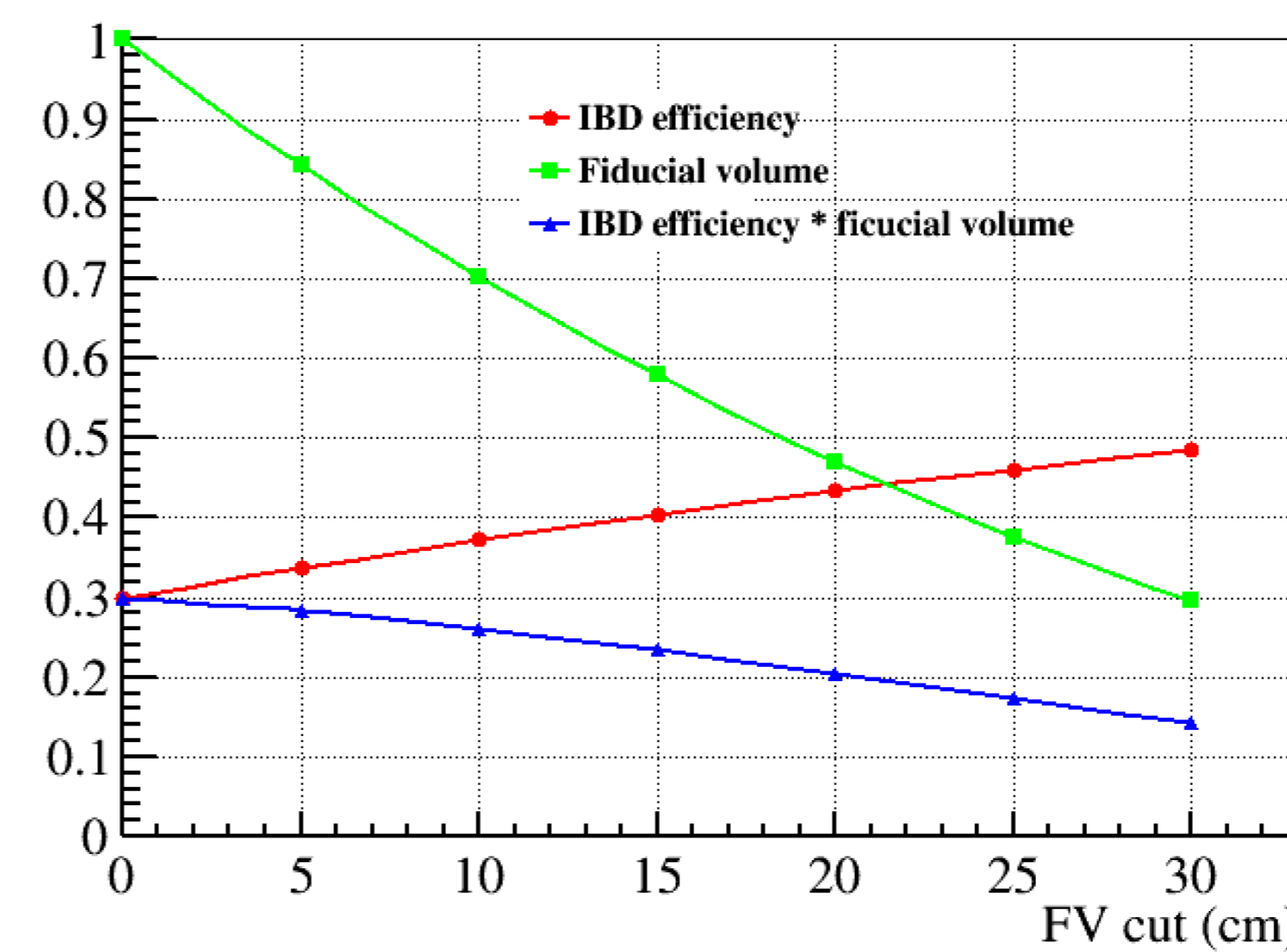
Cooling Coils Design

Considering the possibility of adding a hot load in the future, or operating at a lower temperature, we will decide whether to add a copper screen cooling.



- The side copper is divided into 4 pieces
- Each piece is equipped with a separate coil
- The bottom also has a copper with coils, the top has cryogenic tubes

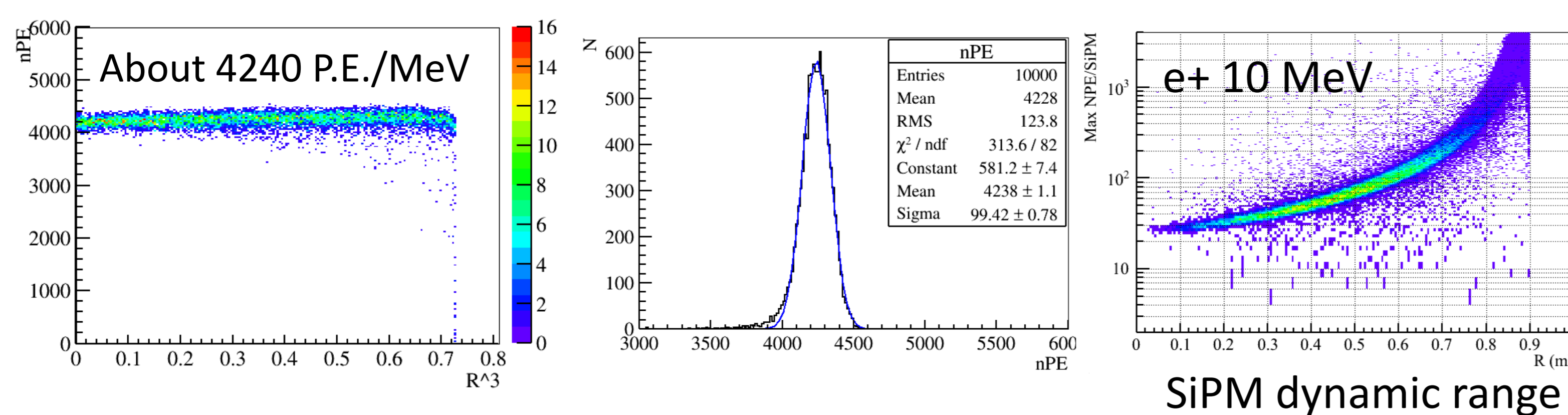
Event Rate



Fiducial mass: 1 ton
 (Radius= .65 m, cut= 25 cm)
 Baseline: ~30 m from the reactor
 Thermal power(Taishan power plants): 4.6 GW_{th}
 Statistics: ~ 2 million IBD for 3 years.

Simulation of TAO

Efficiency of SiPM is about 50%. Coverage of SiPM is 94%.



Prompt energy deposition(MeV) Delayed energy deposition(MeV)

