# Quick fire!!

***(Poster session starts at 13:00 TODAY)***

# A Far-Infrared Light Source to Calibrate STJ detectors for the COBAND Experiment

*Fac. of Eng., Univ. of Fukui, [A]Fac. of Eng., Chubu Univ., [B]Univ. of Tsukuba, [C]FIR Univ. of Fukui, [D]Kindai Univ.*

C. Asano, M. Sakai, T. Nakamura, W. Nishimura, T. Yoshida, S. Okajima[A], K. Nakayama[A], S. Kim[B], Y. Takeuchi[B], K.Moriuchi[B], I. Ogawa[C], Y. Kato[D]

## Experimental Data

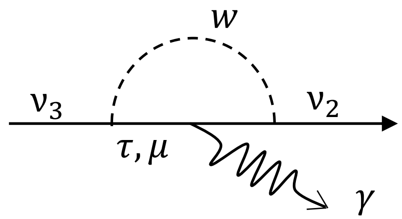
$m_3^2 - m_2^2 = 2.43 \times 10^{-3}\mathrm{eV}^2$

$m_2^2 - m_1^2 = 7.59 \times 10^{-5}\mathrm{eV}^2$

$\Sigma m_\nu < 0.59\mathrm{eV}$

Assume the neutrino mass

| $m_1$ (meV) | $m_2$ (meV) | $m_3$ (meV) | $E_\gamma$ (meV) | $\lambda$ (μm) |
|---|---|---|---|---|
| 0 | 8.7 | 50 | 24 | 52 |
| 50 | 51 | 71 | 17 | 73 |
| 194 | 194 | 200 | 6.1 | 204 |




Energy of photon

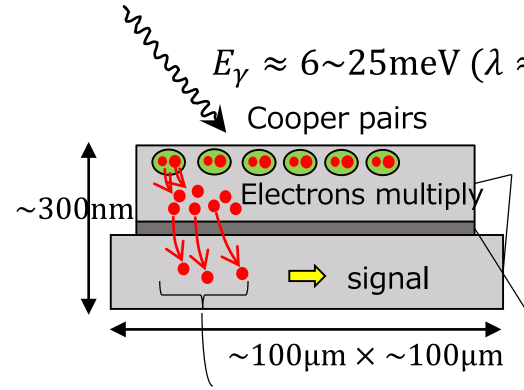
from Neutrino decay

$$E_\gamma = \frac{m_3^2 - m_2^2}{2m_3} \quad \text{(CM system)}$$

Far-Infrared region

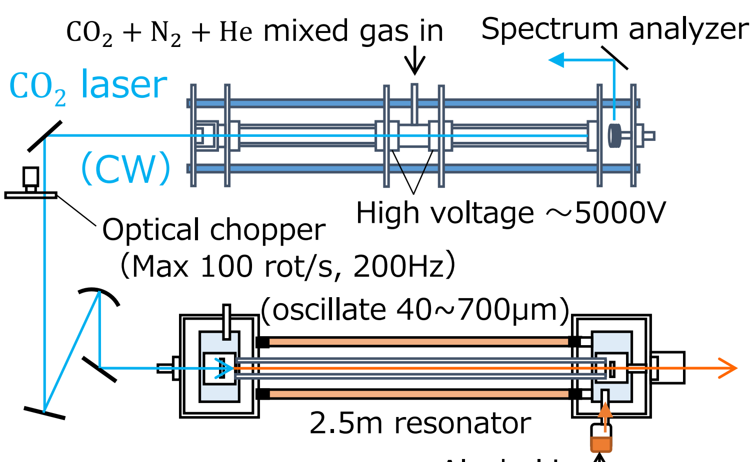
($E_\gamma \approx 6\sim24\mathrm{meV}, \lambda \approx 50\sim200\mu\mathrm{m}$)

### STJ detector

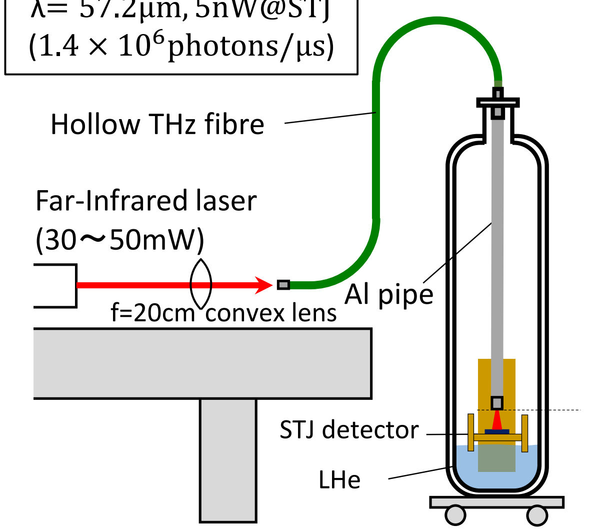



The number of the electrons pass through insulator by the tunnel effect $\propto E_\gamma$

### Light source to evaluate STJ



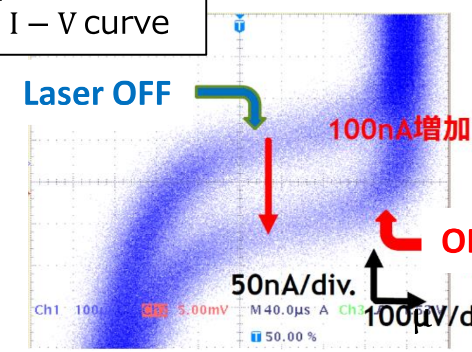

Far-Infrared molecular laser




STJ detector evaluate experiment

apply 200Hz pulsed laser I – V curve

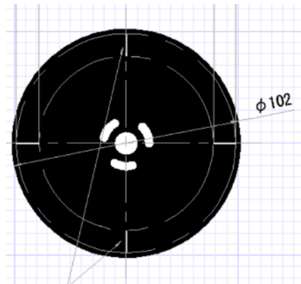
200μm square Nb/Al – STJ




Pulse width of STJ amplifier output signal ~μs

Improve optical system!

➢ *How to make pulsed laser ?*

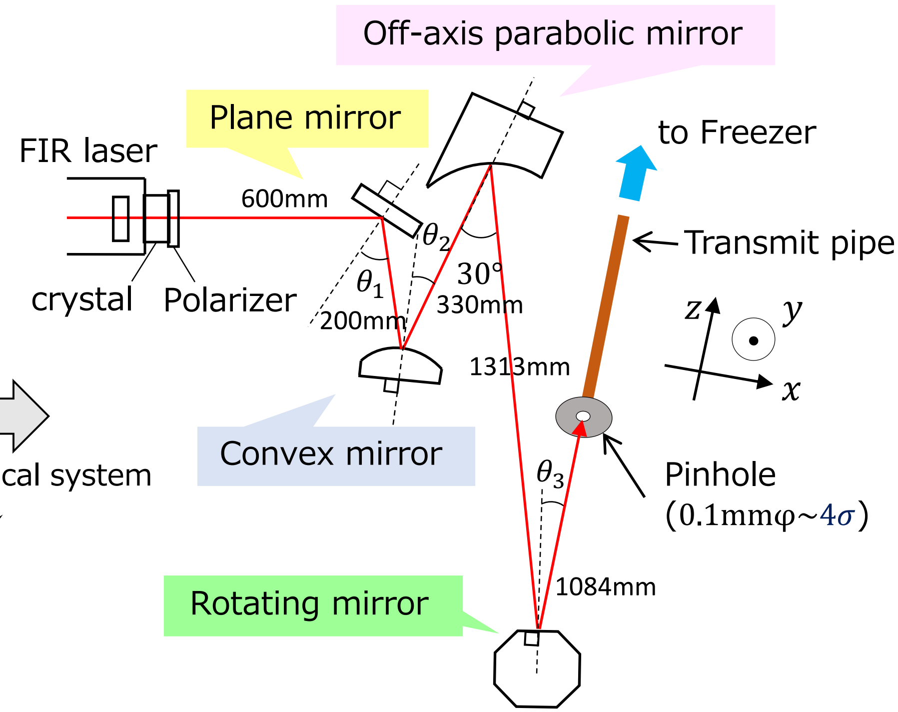



Optical chopper

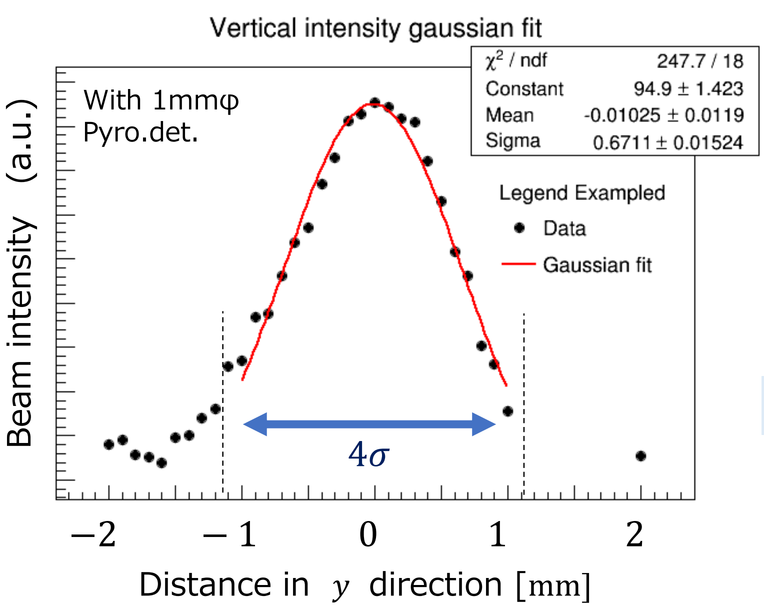
or

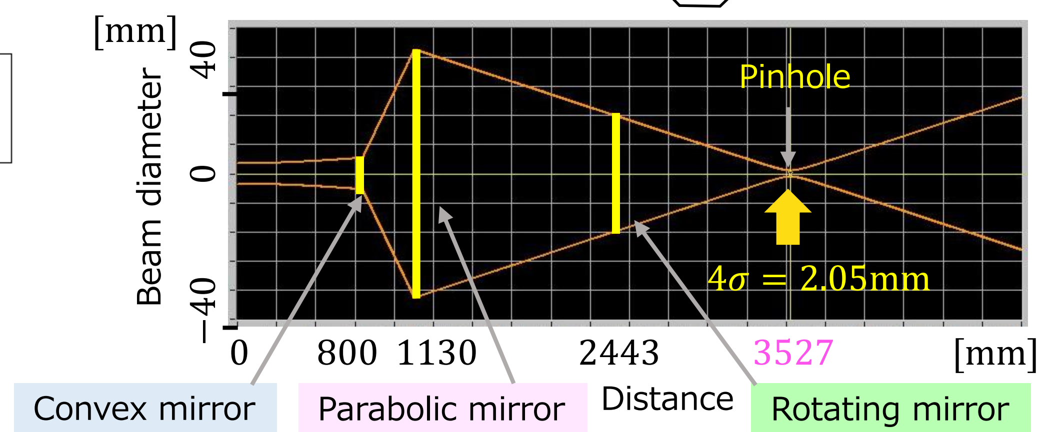

Rotating mirror

Optimized optical system




Requirements for shorter pulse width :
- Smaller beam spot size
- Longer distance from Rot. Mirror to detector




Pulse width from measured spot size $(4\sigma)$

$$\frac{2.35}{4} \times \frac{2.47\text{mm}+(0.1\sim2.47)\text{mm}}{1084\text{mm}\times\cos 7^\circ\times 2\times 377\text{rad/s}} = 1.9\sim3.6\ \mu\text{s}\ [\text{FWHM}]$$

$\Leftrightarrow$ Simulation $1.5\sim2.9\ \mu\text{s}$ $(4\sigma = 2.05\text{mm})$

# Yutaro SONODA

Univ. of Tokyo, ICRR, Kamioka obs.


Hyper-Kamiokande

## About me

- Master course student (2nd year)
- Hobby : DIY computers, Overclock

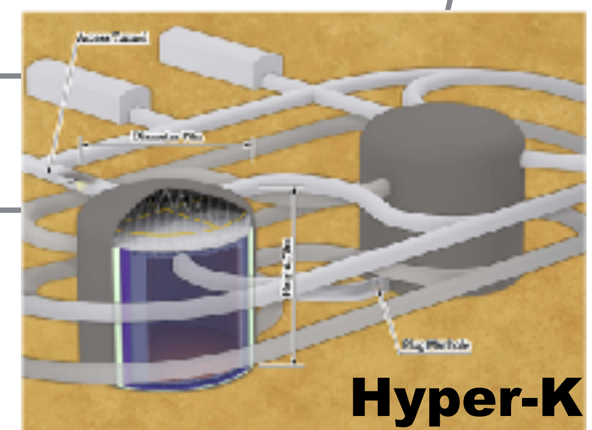
favorite parts

Pentium4
2004~

HD5870
2009~

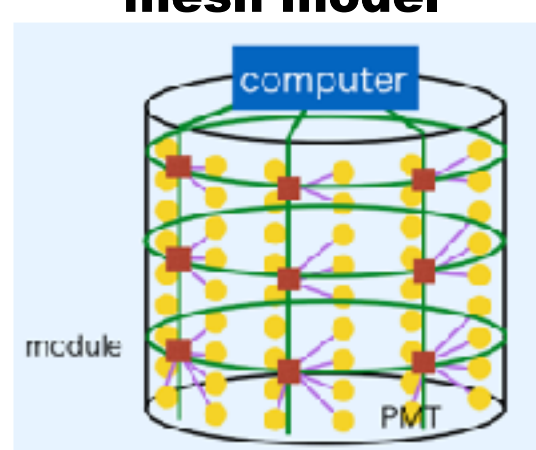
## About study

- Hyper-Kamiokande project is in progress.




- detector concept is very similar to Super-K, but it is difficult to use the data transfer system same as Super-K due to huge tank size especially from photosensor to computer.
- I suggest 3 candidate models of data transfer system.
- right figure is one of the design plan.
  - place front-end board in water and make the mesh network.
- I am developing a test board to use in this plan.

**mesh model**





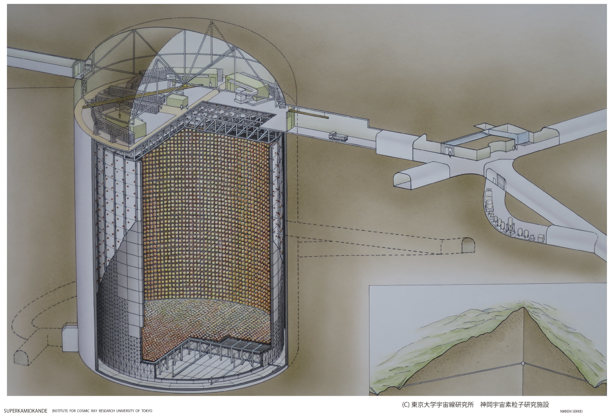
Test Board (FPGA Kintex-7)

# Stop-μ Analysis for Atmospheric $\nu_\mu$ / $\bar{\nu}_\mu$ Separation in Super-Kamiokande

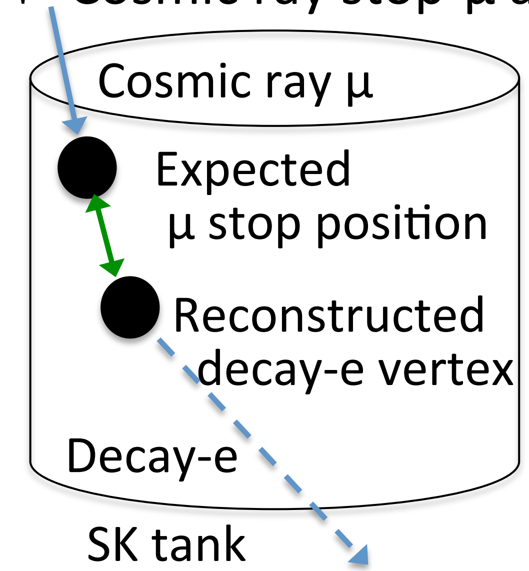
Misaki Murase
(Nagoya Univ, ISEE)

## ✧ Super-Kamiokande

Water cherenkov detector filled with 50,000 ton pure water in Kamioka



## ✧ Cosmic ray stop-μ and decay-e




Distance

Check special correlation between μ stop point and reconstructed decay-e vertex

## ✧ $\mu^+/\mu^-$ separation

$$\mu^+ \rightarrow e^+ + \nu_e + \overline{\nu_\mu}$$

$$\mu^- \rightarrow e^- + \overline{\nu_e} + \nu_\mu$$

$$\mu^- + {}^{16}\mathrm{O} \rightarrow \nu_\mu + \mathrm{n} + {}^{15}\mathrm{N}^*$$

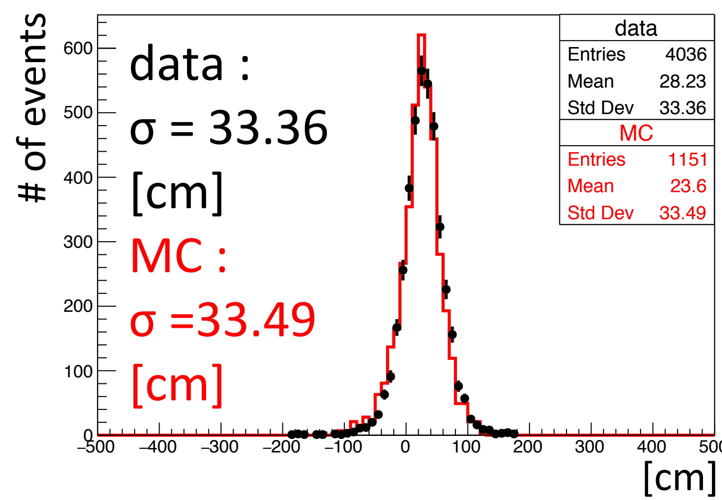
$$^{15}\mathrm{N}^* \rightarrow \gamma$$

To improve $\nu_\mu$ / $\overline{\nu}_\mu$ separation in oscillation analysis

$\mu^+/\mu^-$ separation using decay electron information (decay time, N50)

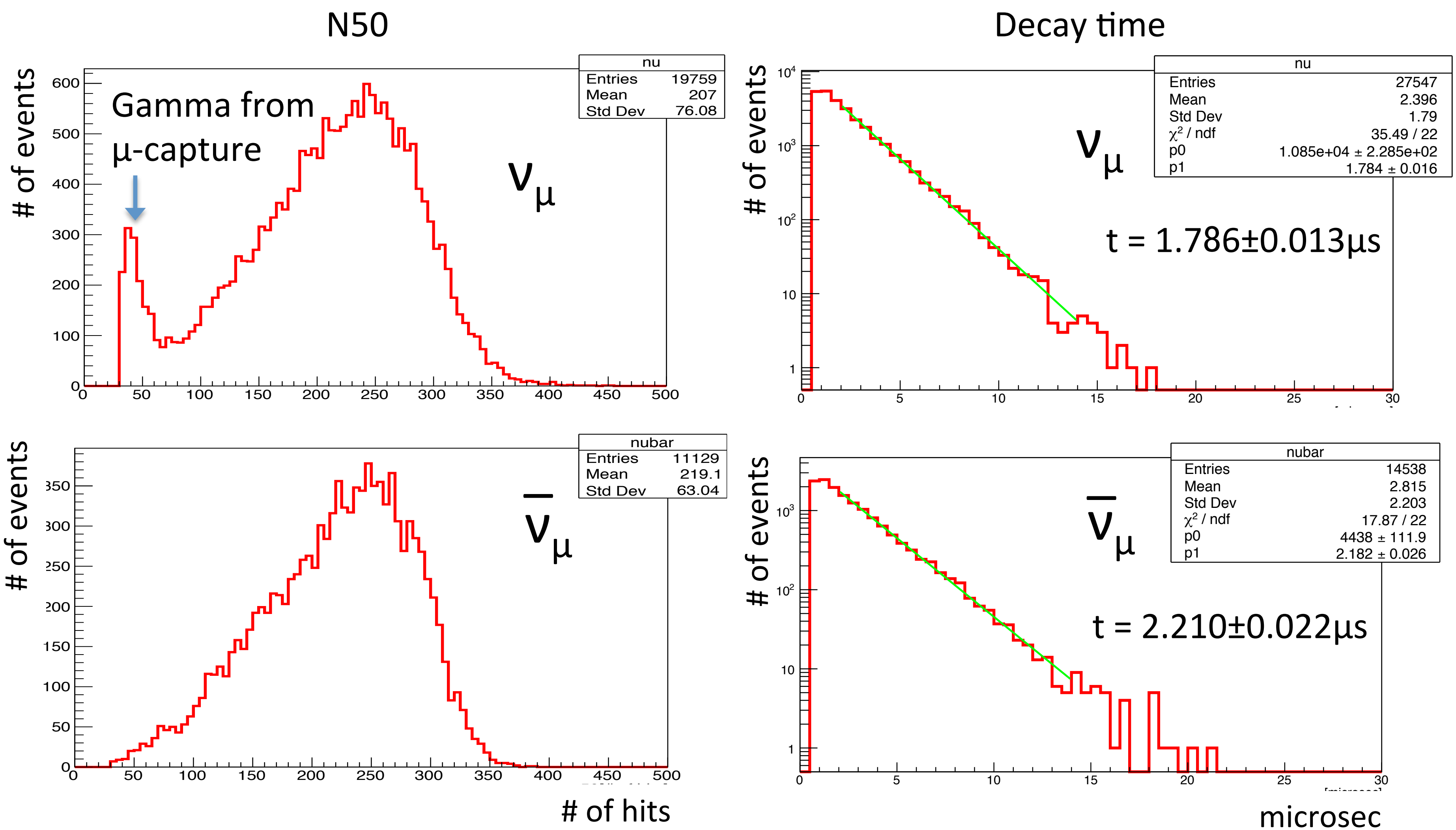
(separate using likelihood event-by-event)

Distance



# ✧ Result

Apply atmospheric ν MC and check likelihood input parameter distributions

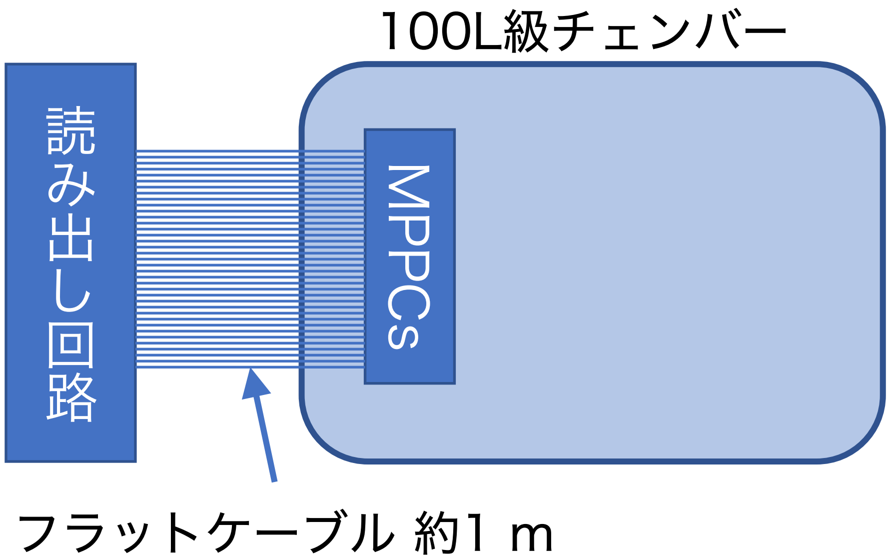


# AXEL次期試作機における信号読み出しの研究

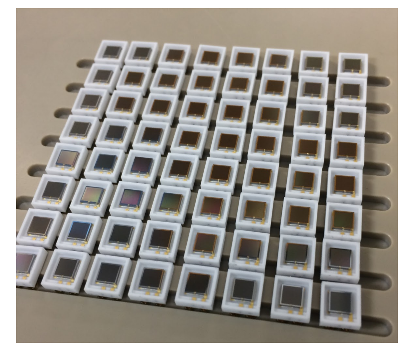
京都大学 理学研究科
高エネルギー物理学研究室
中村 和広

# AXELとは？

- ニュートリノを伴わない二重ベータ崩壊探索を目指した検出器
- 100L級次期大型試作機開発に向けて奮闘中




MPPCs



- 伝わる信号の確認を行っている
- これから開発予定のキャリブレーションシステムについても述べる

# 超新星ニュートリノ観測のためのDAQの開発

森　正光

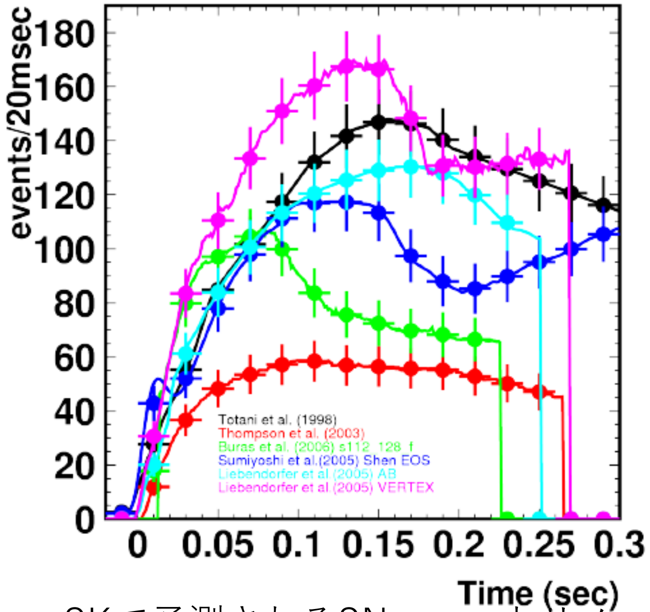
京都大学　高エネルギー物理学研究室

# DAQの概要

現在超新星爆発が数百光年以内で起こった場合スーパーカミオカンデのDAQの処理能力を大きく超えるイベントレートが予測される。

- スーパーカミオカンデの既存のDAQの処理能力：$6 \times 10^6$ event/10s
- 予測される超新星爆発時のイベント数（ベテルギウス）：$3 \times 10^7$ event/10s

イベントの取りこぼし and DAQのクラッシュが考えられる。

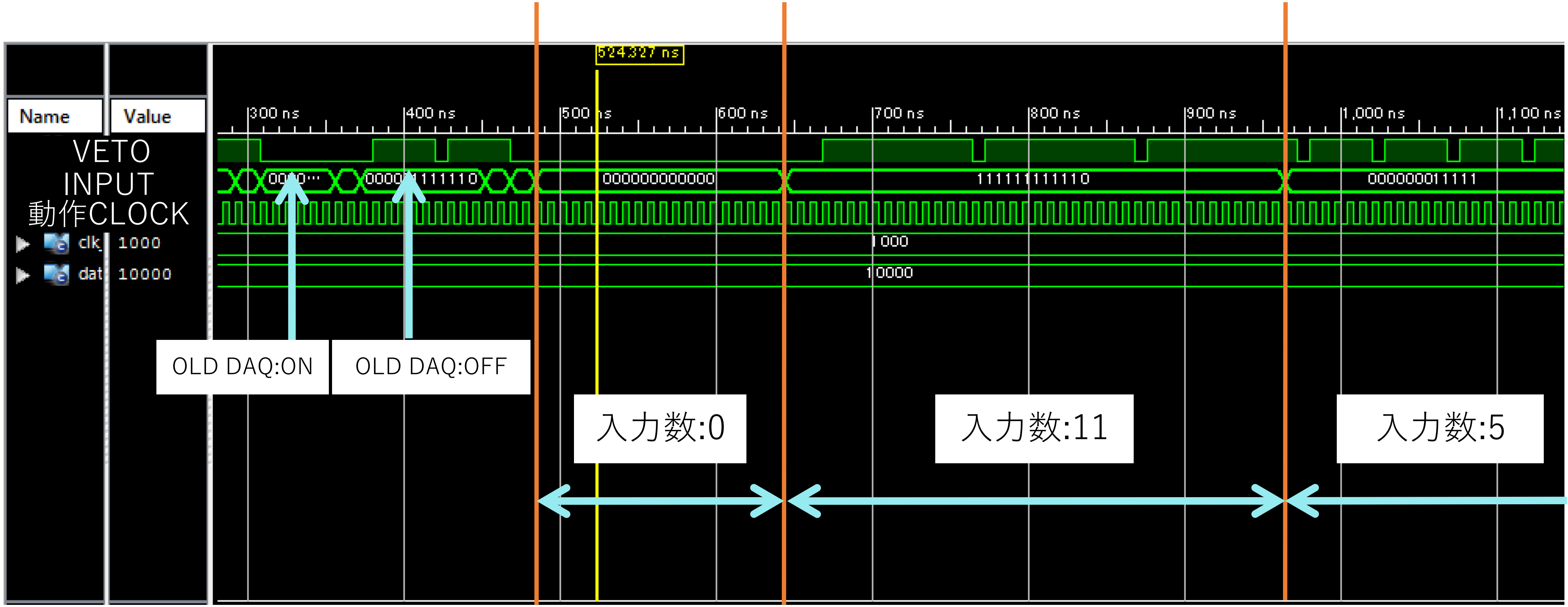



SKで予測されるSNニュートリノイベントの時間変化

新しいDAQの仕様

- FPGAで開発
- 120MHzで動作をして、60MHzのイベントレートに対応
- 12個の入力端子を持ちイベントの入力（HITSUM）に応じて動作を変える
- 高レートの時は既存のDAQにVETO信号を送りイベント間引くことでクラッシュを回避

# DAQのシミュレーション

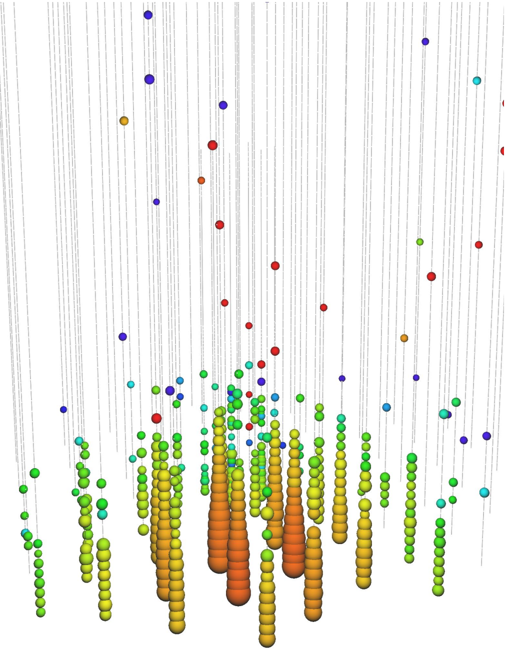



- 入力数が5以上でVETO信号を出す
- 入力が増えるとVETO信号が長くなる

# From IceCube to Gen2

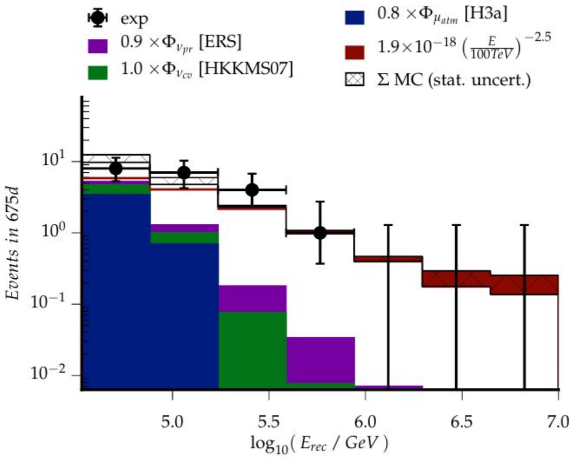
Achim Stoessl, IceHap, Chiba university
Neutrnino frontier workshop • 29/11/2016

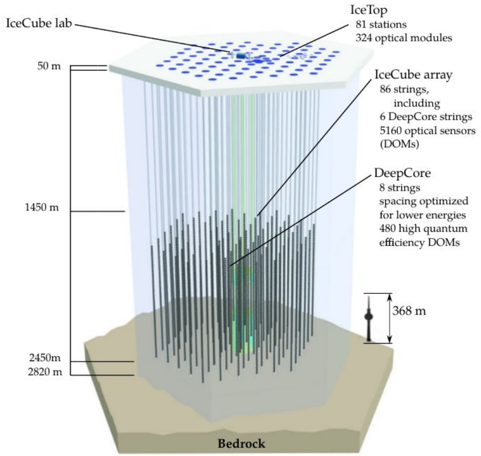
# Previous work



## “A search for particle showers at the edge of IceCube’s instrumented volume”

PhD theseis, Humboldt University Berlin, *2016*



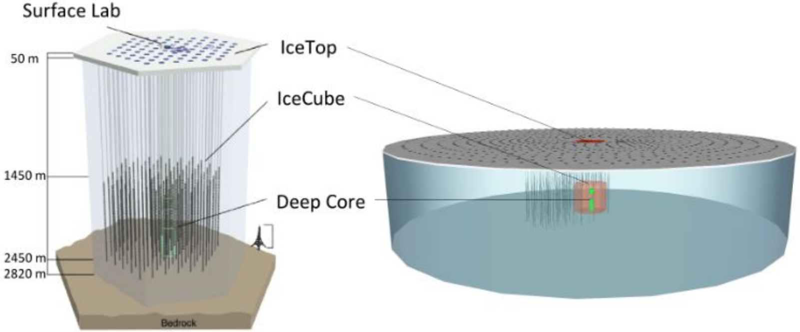



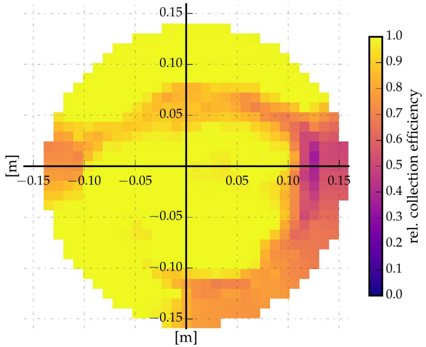
# Current work - D-Egg

CHIBA UNIVERSITY

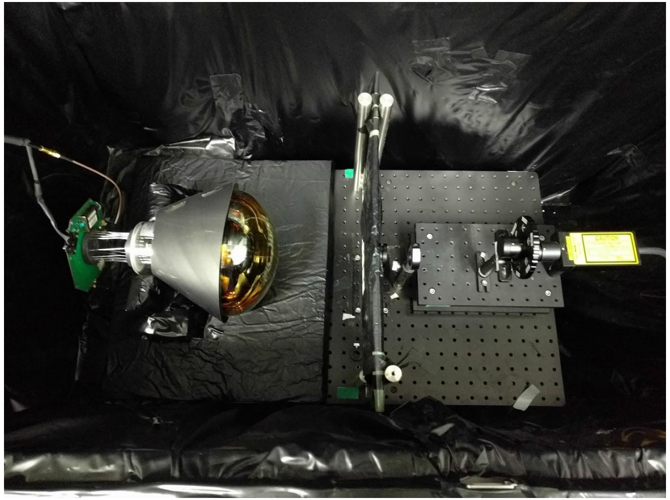
## Chiba IceCube group, helping to develop a new photosensor for IceCube Gen2

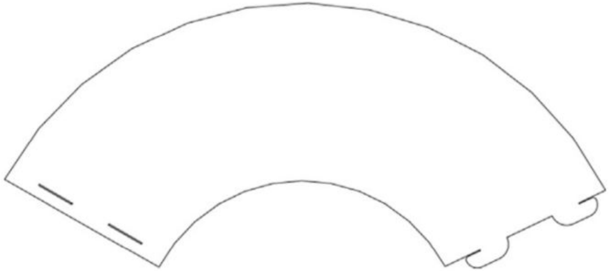
- PMT Characteristics
- Module/Readout Design
- Physics Performace



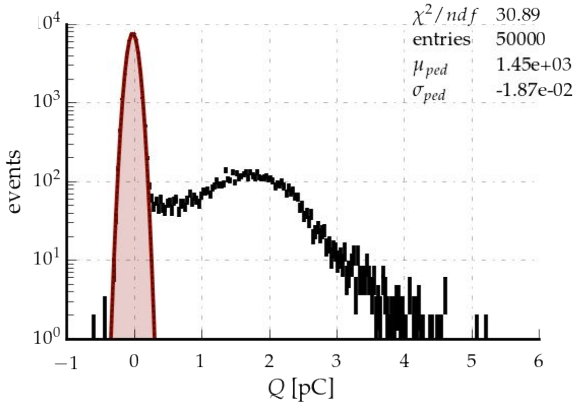



# Investigating performance of Daya Bay type magnetic shield for D-Egg





-> Poster!



# ARA Slim Detector R&D

Simon Archambault

CHIBA UNIVERSITY

Neutrino Frontier Workshop

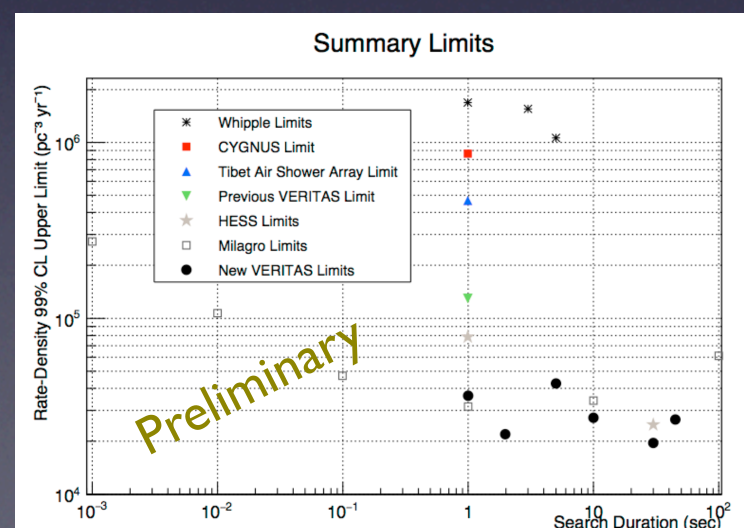
28/11/2016

# Quick Background

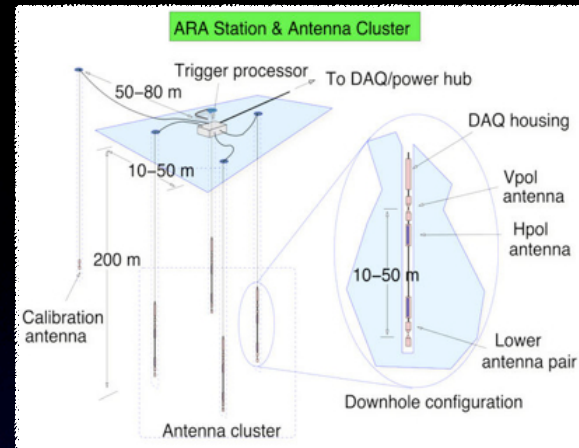
- Previously worked on the VERITAS experiment

  - Measuring whole-dish reflectivity of the telescopes

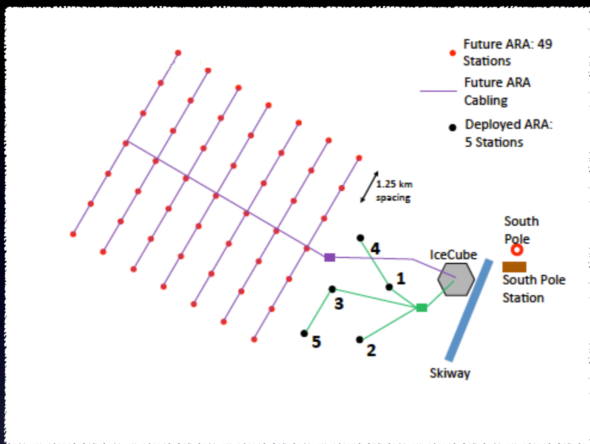

  - Looking for VHE emissions from the final evaporation of primordial black holes



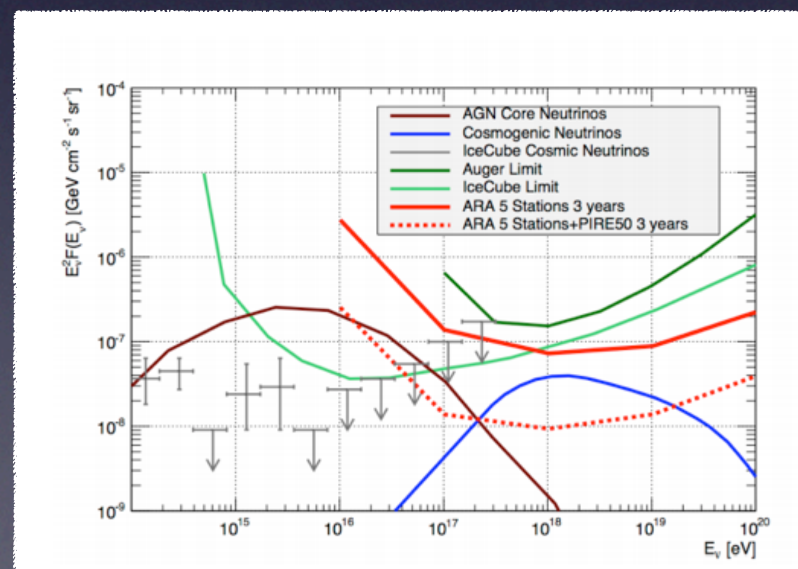
# Current Work




- Joined the ARA Experiment

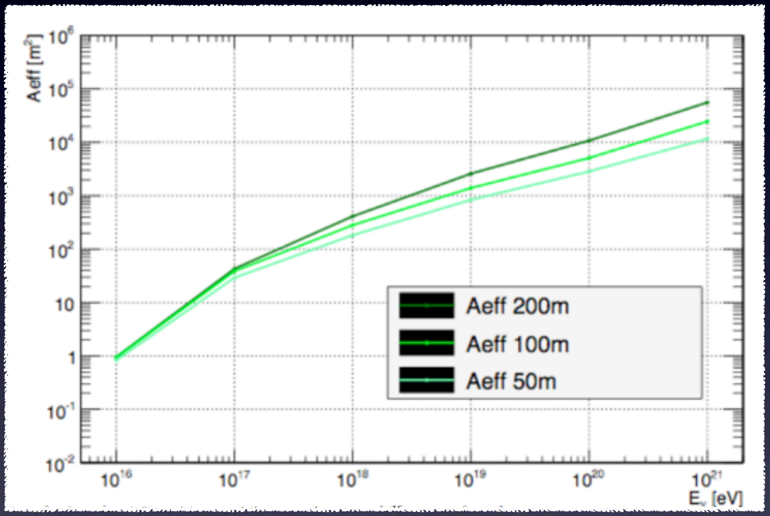



- Uses Askaryan effect to look for cosmogenic UHE neutrinos from GZK process

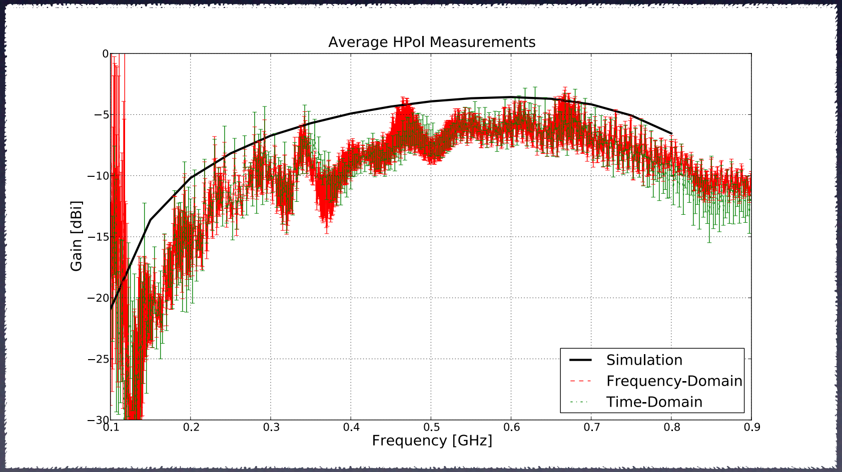



# Current Work

- Currently developing new, slim antennas
  - Loss of sensitivity
  - Saves on cost, manpower and time
    - Can drill more holes to compensate




- Gain measurement done at Chiba U




- More details in Poster Session!

# Construction of new water module for the WAGASCI experiment

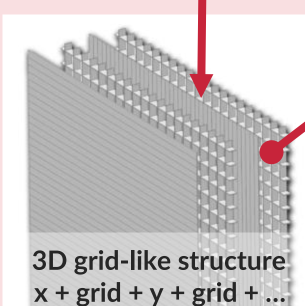
Fuminao Hosomi, *The University of Tokyo* — WAGASCI collaboration

## QUICKFIRE

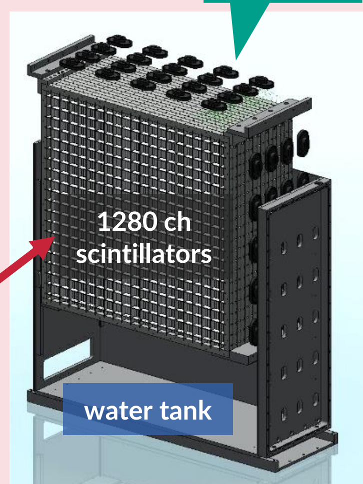
### WAGASCI experiment

Aim to measure cross section ratio between $H_2O/CH$ at J-PARC

Constructing new water module with **3D grid-like scintillators**

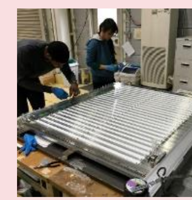

32 fibers bundled



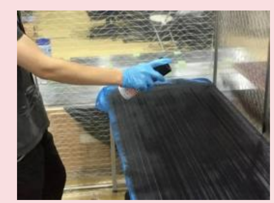

Working on T2K and J-PARC T59 (WAGASCI)


### Construction work at J-PARC

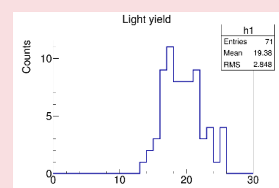
- Gluing fibers on scintillators
- Painting reflector on fiber



- Black painting on scintillator



- Light yield measurement




*Come to see my poster!*

# ニュートリノ崩壊光探索に向けた極低温増幅器の開発と現状

Rena Wakasa (Univ. of tsukuba)

# Search for Neutrino Decay

## Neutrino Decay

- Energy of photon from decay is formulated

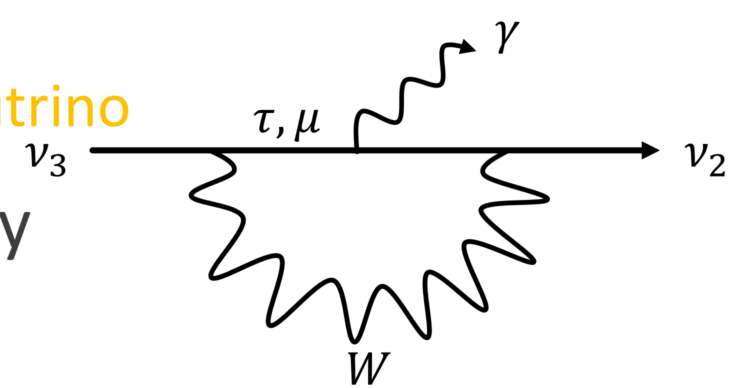
$$E_\gamma = \frac{m_3^2 - m_2^2}{2m_3}.$$

Measured by neutrino oscillation experiments

If we measure the decay photon energy, the neutrino mass is decided.

- Since neutrinos have a very long lifetime (>$10^{12}$year), we need a lot of neutrino sources.

→ Cosmic Background Neutrino




## The Expected Decay Photon Energy

- $E_\gamma$=25meV ($\lambda$=50μm)

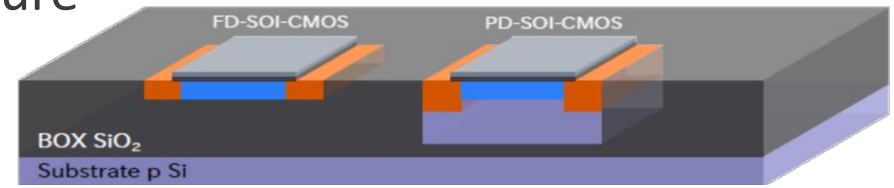
→ Superconducting Tunnel Junction Detector

# Development of cold amplifier

- We should be careful of thermal noise and load capacitance.

  ➡ Place amplifier close to STJ detector.

- Requirement for cold amplifier
  - Operation at low temperature
  - Low power consumption
  - Fast response speed




  ➡ Develop cold amplifier using FD-SOI MOSFET.

I'll present the current R&D status of cold amplifier using.

※Please see slide by Yagi, if you want to know practical amplification of signal by cold amplifier.

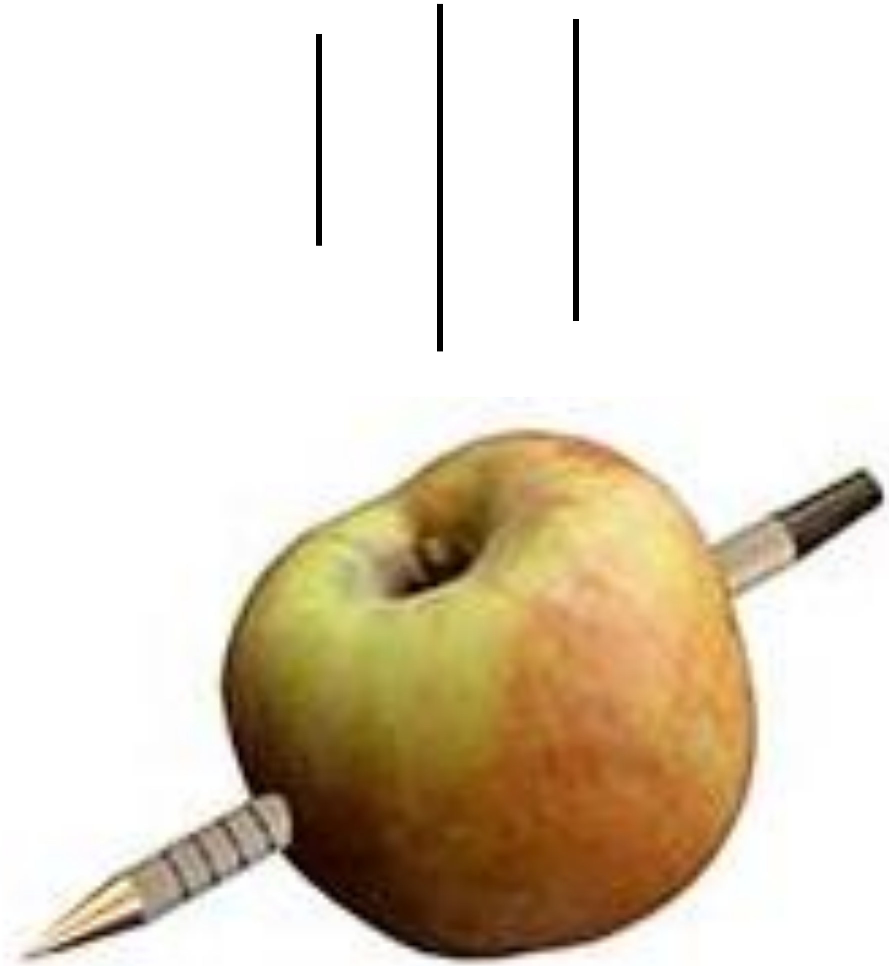
# Development of High Spatial Resolution Cold/ Ultra-cold Neutron Detector Using Fine-grained Nuclear Emulsion

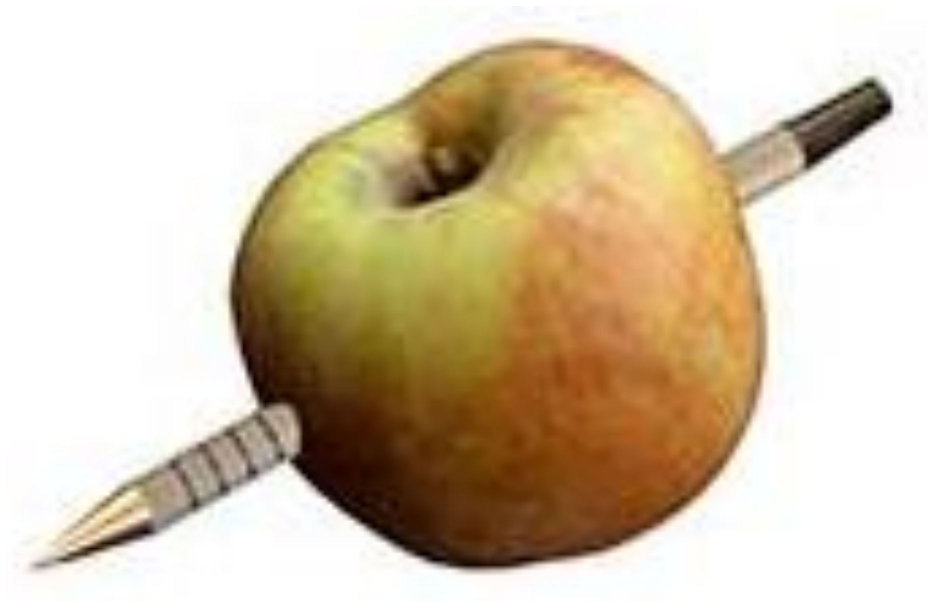
N. Naganawa (Nagoya Univ.)

Collaborators: S. Awano, M. Hino, M. Hirose, K. Hirota, H. Kawahara, M. Kitaguchi, K. Mishima, T. Nagae, H. M. Shimizu, S. Tada, S. Tasaki, A. Umemoto

# Once upon a time, . . .

(It's a legend.)





*An apple fell .*

## 350 years later,

## gravitation is still not understood.

- 1687 (1665?) I. Newton Universal law of gravitation
- 1915 E. Einstein General relativity

t

(a very much simplified timeline)

**Still one of the biggest dream.**

**With nuclear emulsion, we can add some information to accumulated knowledge of gravitation.**

# Gravitation experiment with Ultra-Cold Neutron

Previous work
2002 V. V. Nesvizhevsky et al.

Ultra-Cold Neutrons
~ 100 neV
~ 5 m/s

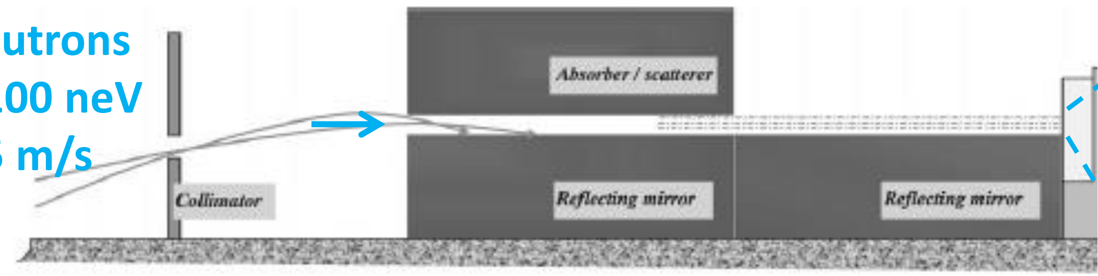



Fig. 3. General scheme of the experiment.

*V.V. Nesvizhevsky et al. / Nuclear Instruments and Methods in Physics Research A 440 (2000) 754–759*

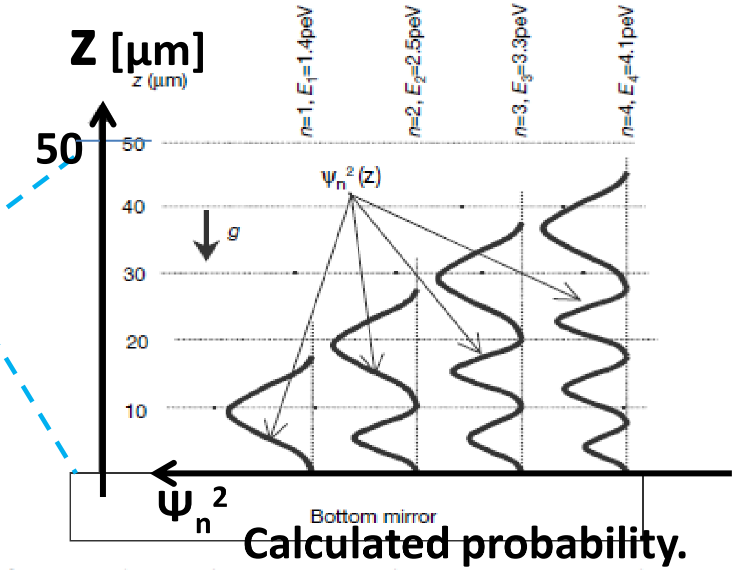



**Figure 1** Wavefunctions of the quantum states of neutrons in the potential well formed by the Earth's gravitational field and the horizontal mirror. The probability of finding neutrons at height $z$, corresponding to the $n$th quantum state, is proportional to the square of the neutron wavefunction $\psi_n^2(z)$. The vertical axis $z$ provides the length scale for this phenomenon. $E_n$ is the energy of the $n$th quantum state.

$$V(r) = G \frac{m_1 m_2}{r} \left( 1 + \alpha_G e^{-r/\lambda} \right)$$

Nesvizhevsky et al. Nature 415, 297 (2002)

**With nuclear emulsion,**
**resolution will be better by 1~2 orders → ≦ 100 nm**

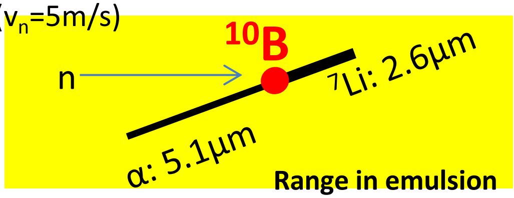
Also useful for other neutron experiment using interference pattern of neutrons.

# High resolution detection by emulsion coated $^{10}B_4C$ layer

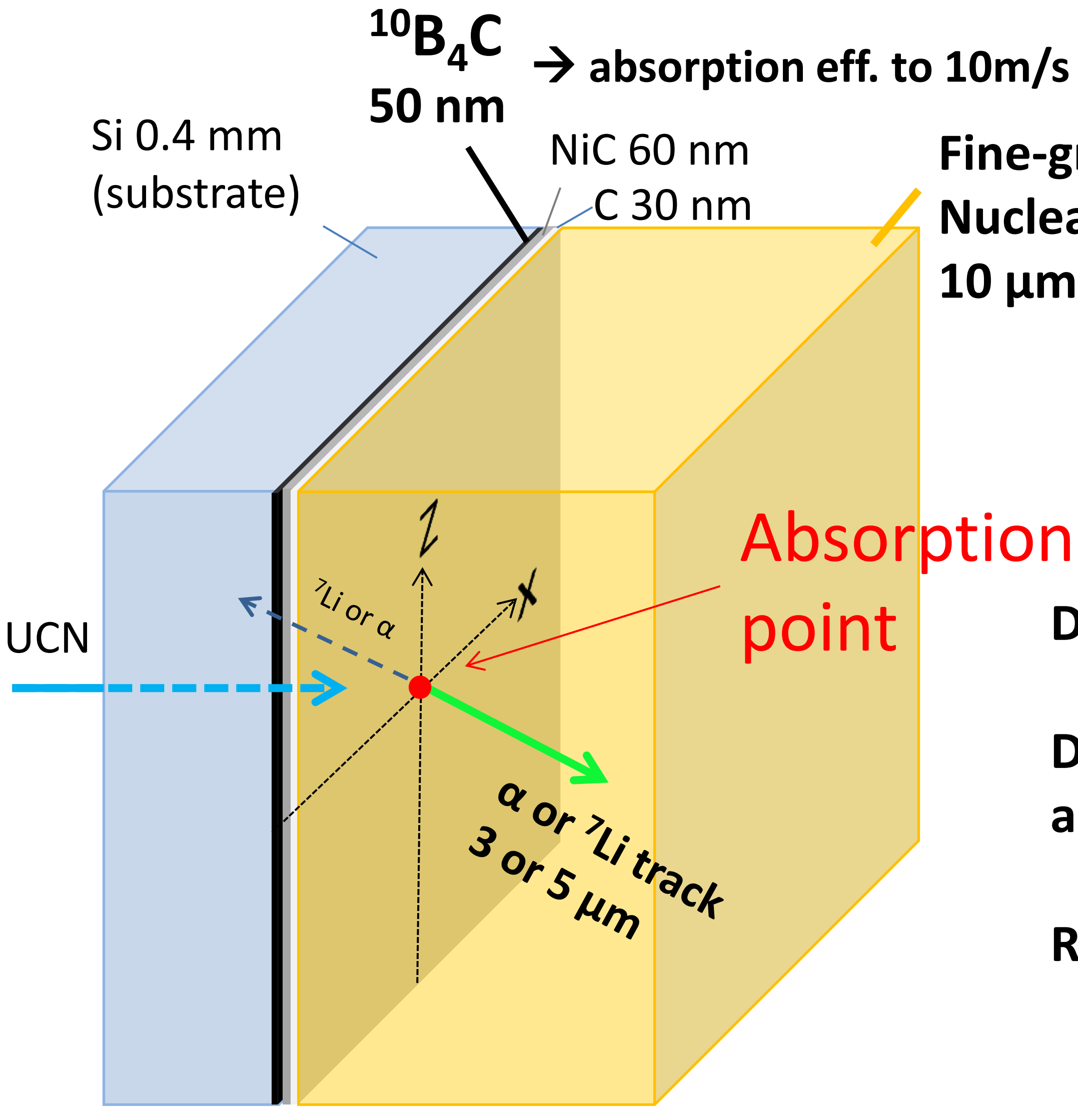
**Detection principle : neutron absorption by $^{10}B$** σ = 1.69 × 10^6 barn ($v_n$=5m/s)

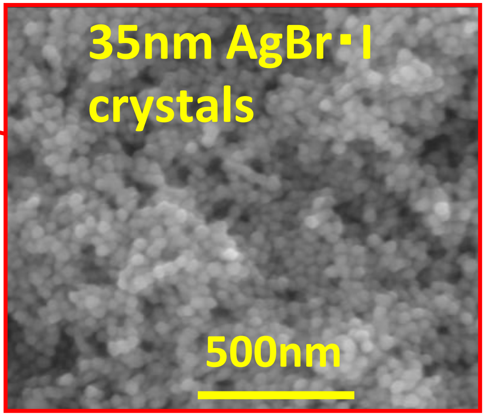
**n + $^{10}$B → α + $^{7}$Li** (ground state) + 2.79MeV (6%)

**α + $^{7}$Li** (1st excitation state) + 2.31MeV (94%)




**$^{10}B_4C$ 50 nm → absorption eff. to 10m/s UCN : 46%**



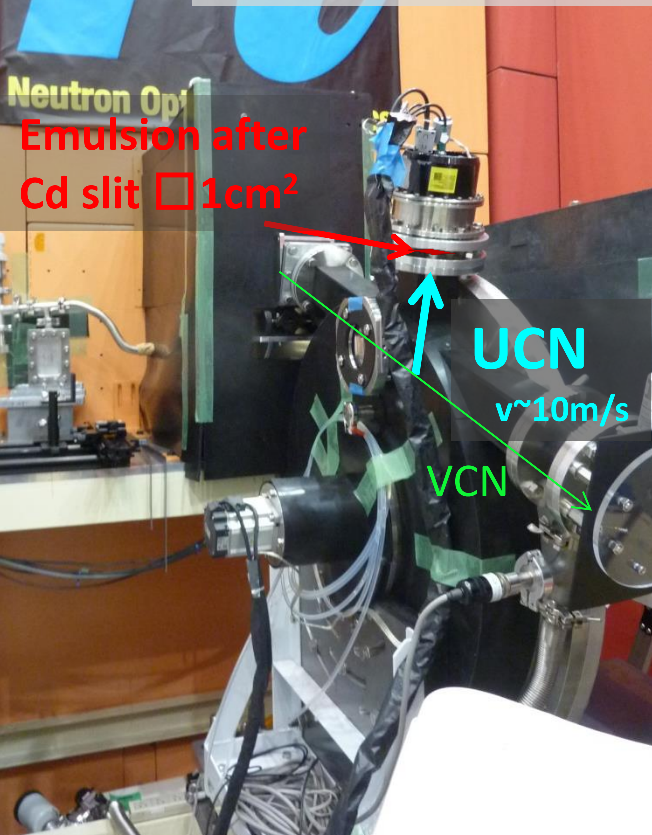

**Detect tracks of α or 7Li.**

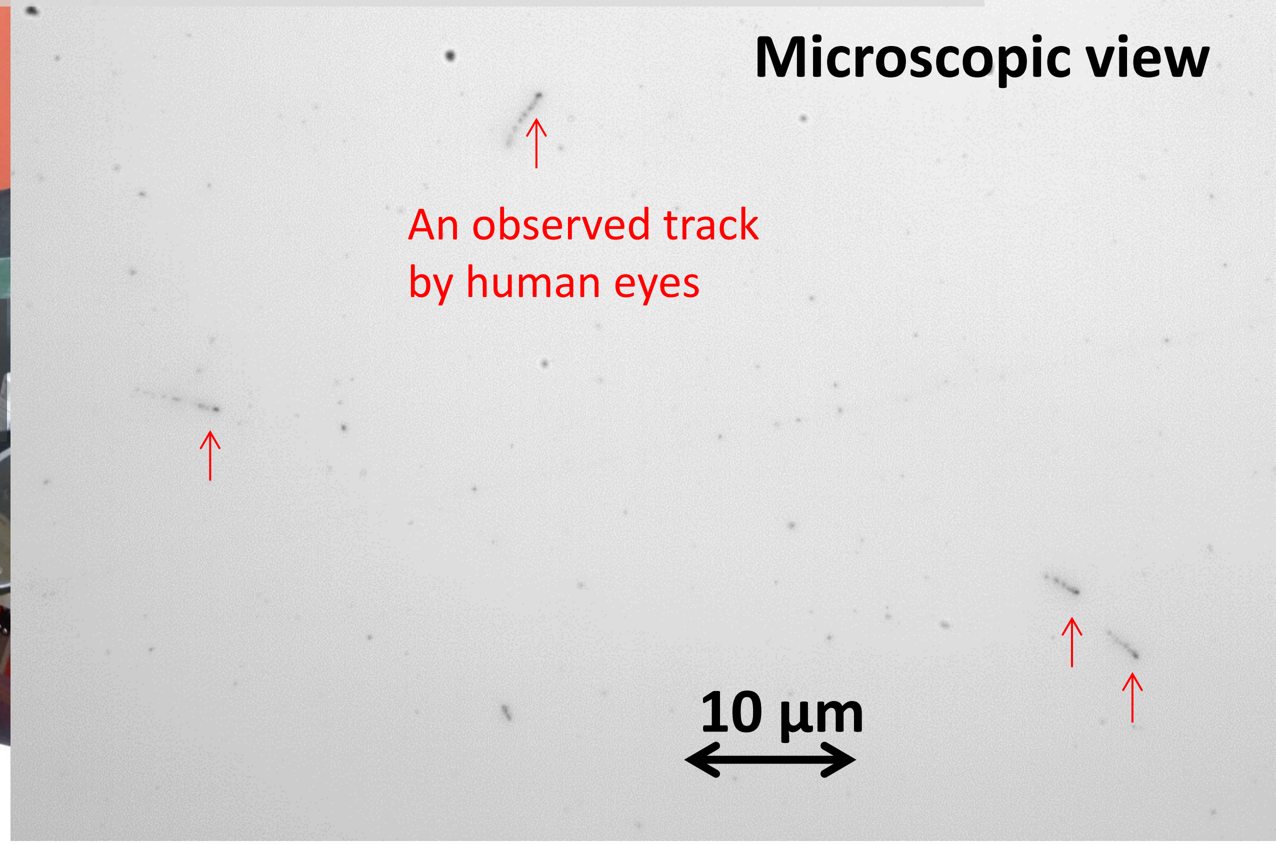
↓

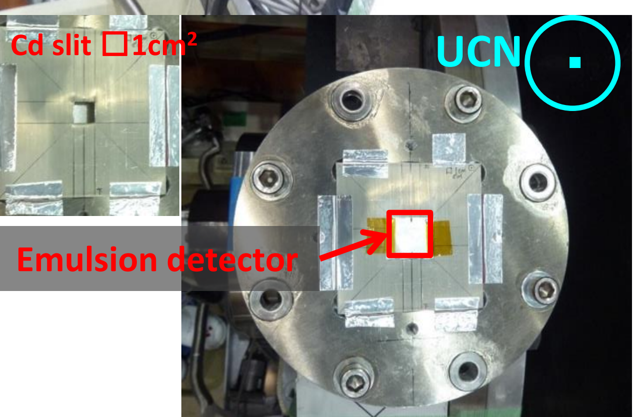
**Decide position** (X, Z) **of absorption points**

**Resolution should be ≦ 100 nm**

# UCN exposure at J-PARC MLF BL05 Nov. 2016
# Detection efficiency measurement



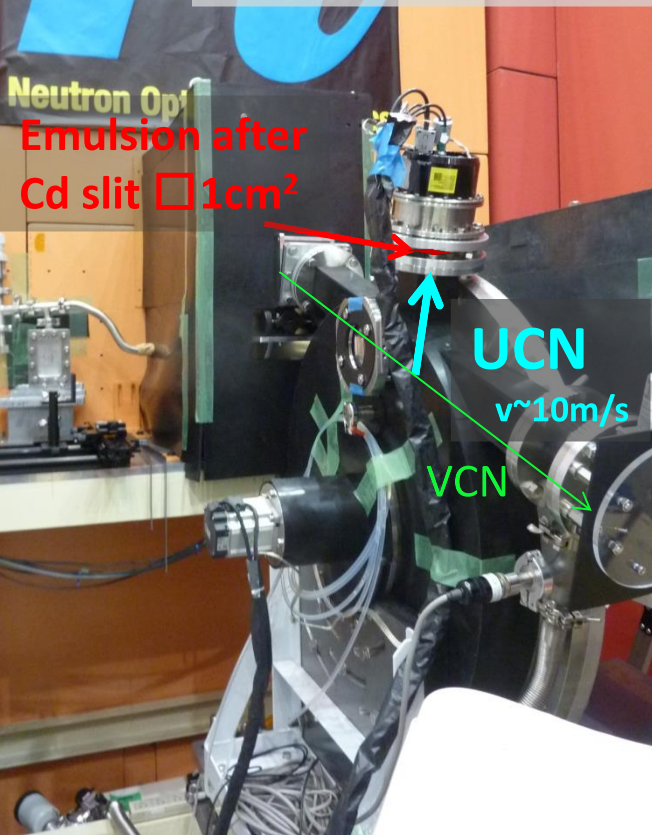

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | 1 | 3 | 2 | 0 | 1 | 0 |
| 0 | 0 | 0 | 3 | 1 | 0 | 2 | 0 | 0 |
| 0 | 0 | 1 | 1 | 3 | 2 | 3 | 0 | 0 |
| 0 | 0 | 1 | 0 | 4 | 1 | 4 | 6 | 0 |
| 0 | 0 | 2 | 1 | 3 | 1 | 0 | 2 | 0 |
| 0 | 0 | 3 | 3 | 4 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

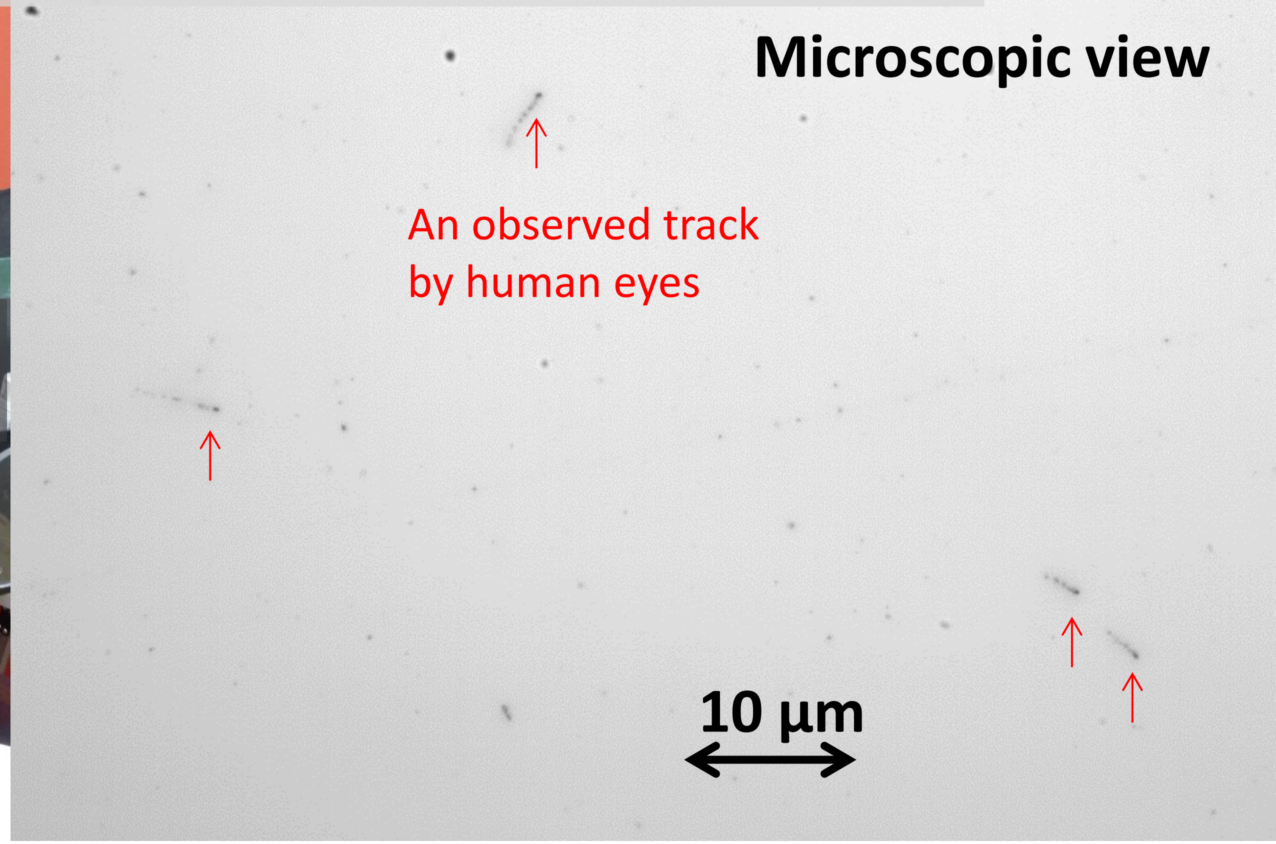
←Detected number of tracks in each view.

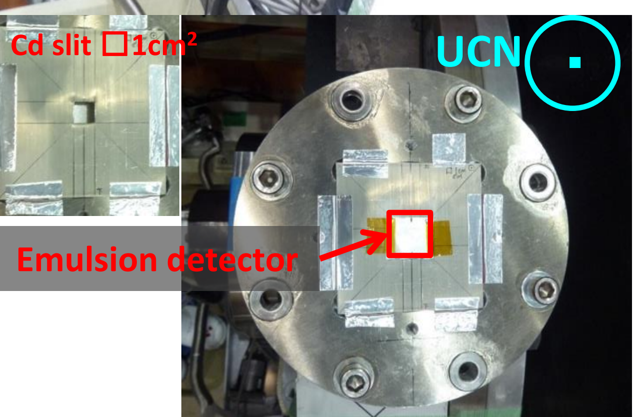
$(1cm)^2$

**Detection efficiency is …**

# UCN exposure at J-PARC MLF BL05 Nov. 2016
# Detection efficiency measurement




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 2 | 1 | 3 | 2 | 0 | 1 | 0 |
| 0 | 0 | 0 | 3 | 1 | 0 | 2 | 0 | 0 |
| 0 | 0 | 1 | 1 | 3 | 2 | 3 | 0 | 0 |
| 0 | 0 | 1 | 0 | 4 | 1 | 4 | 6 | 0 |
| 0 | 0 | 2 | 1 | 3 | 1 | 0 | 2 | 0 |
| 0 | 0 | 3 | 3 | 4 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

←Detected number of tracks in each view.

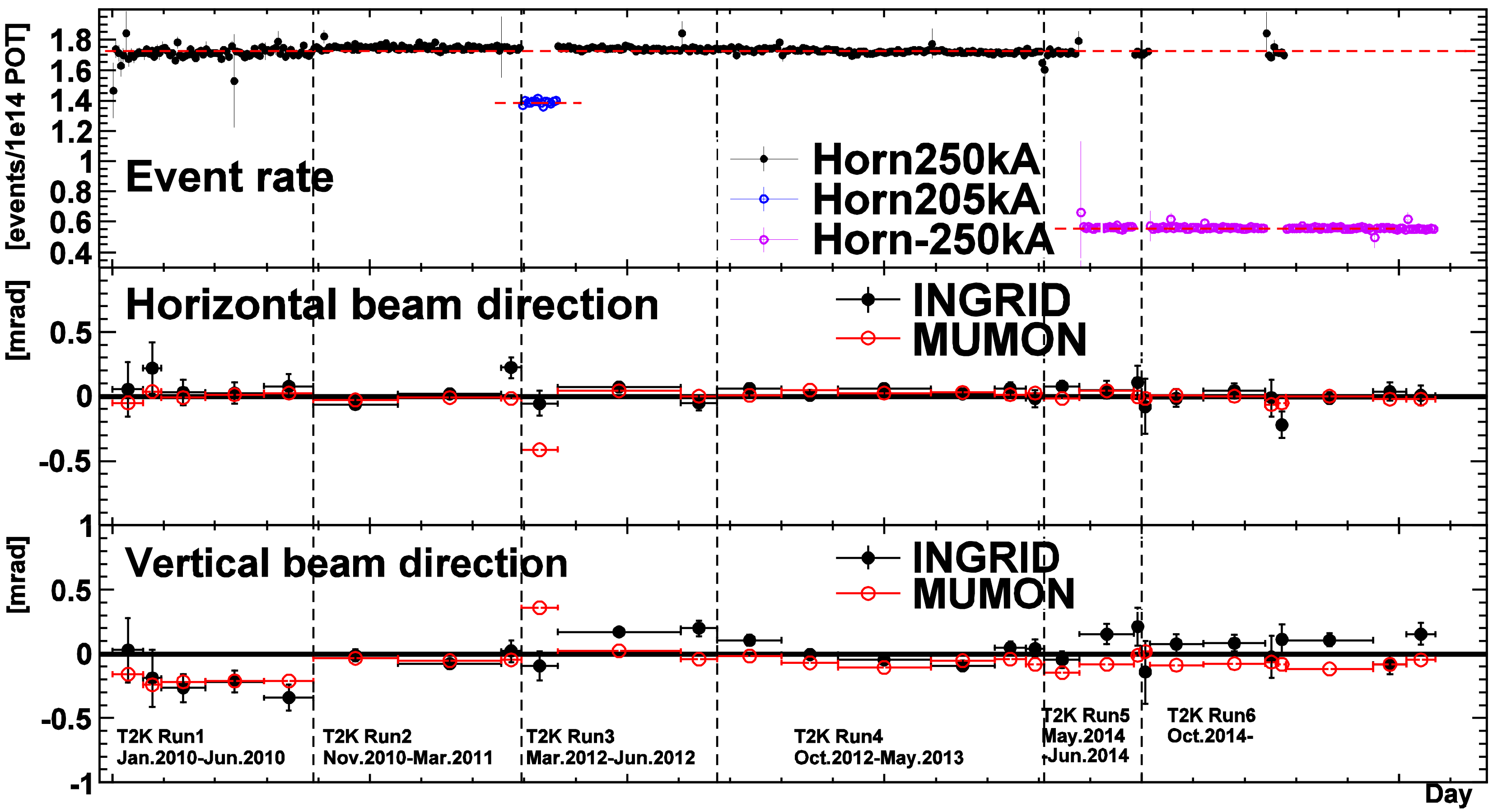
(1cm)²

## Detection efficiency is …

## in the poster !!

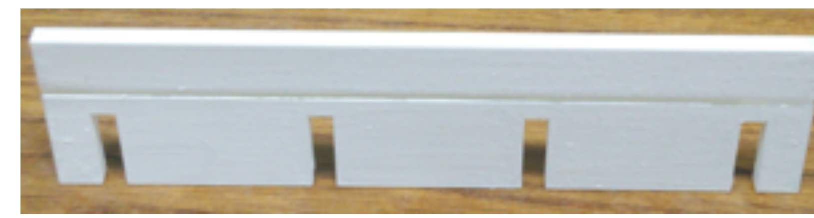
# Tatsuya Hayashino
## Kyoto University

## INGRID beam measurement



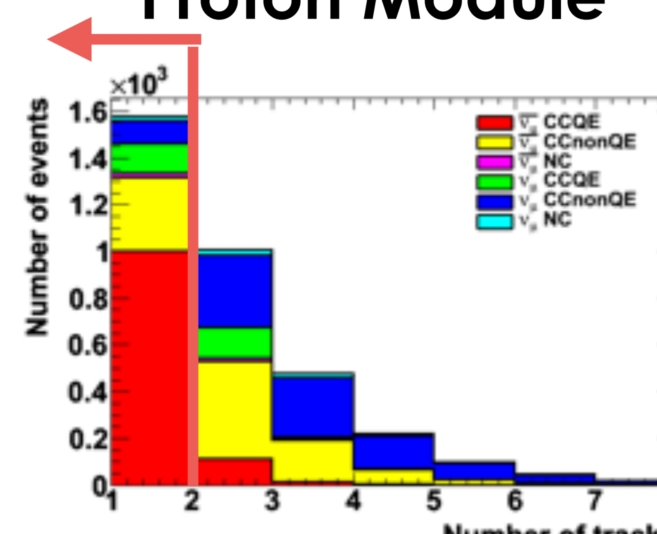

- Anti-mode beam measurement
- Plan to update analysis method to reduce systematic error
- Check the stability of event rate ← poster

## WAGASCI experiment



- Machining scintillator
- Checking scintillator quality

### $\bar{\nu}_\mu$ CC0π cross section measurement using Proton Module




- # of track = 1

# エマルションγ線望遠鏡
# GRAINE
# 宇宙線ハドロン反応解析

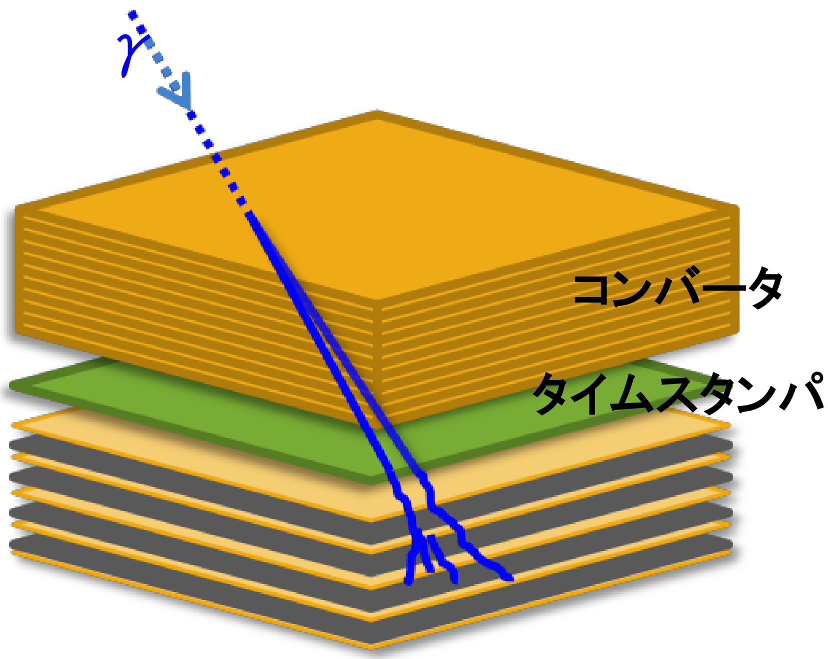

名古屋大学　河原 宏晃

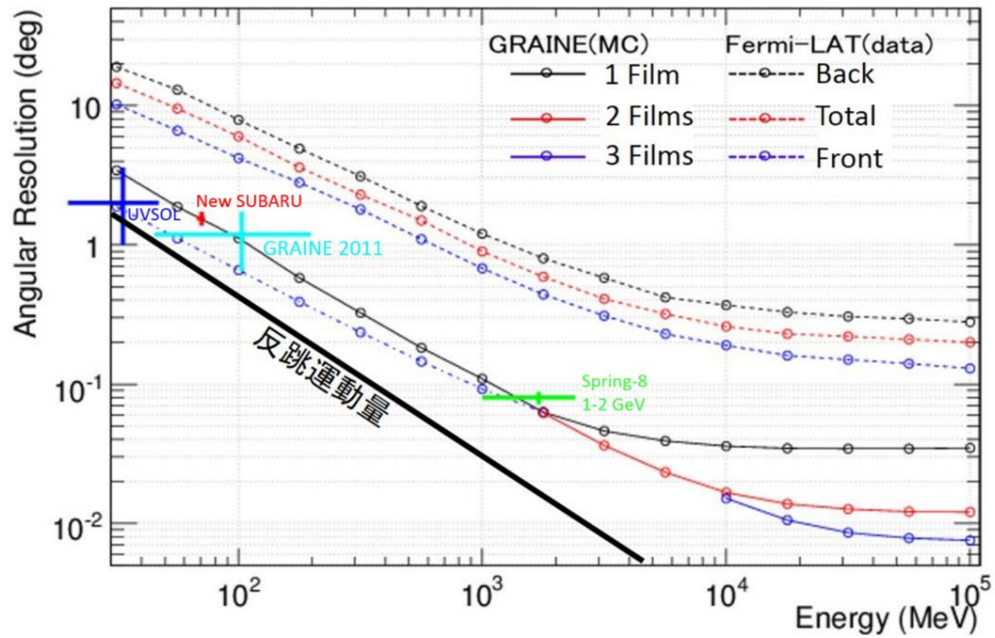
神戸大学
JAXA/ISAS
岡山理科大学
愛知教育大学
宇都宮大学

GRAINE Collaboration


ニュートリノフロンティア研究会
2016年11月29日　石川県 山代温泉 ゆのくに天祥

# エマルションγ線望遠鏡

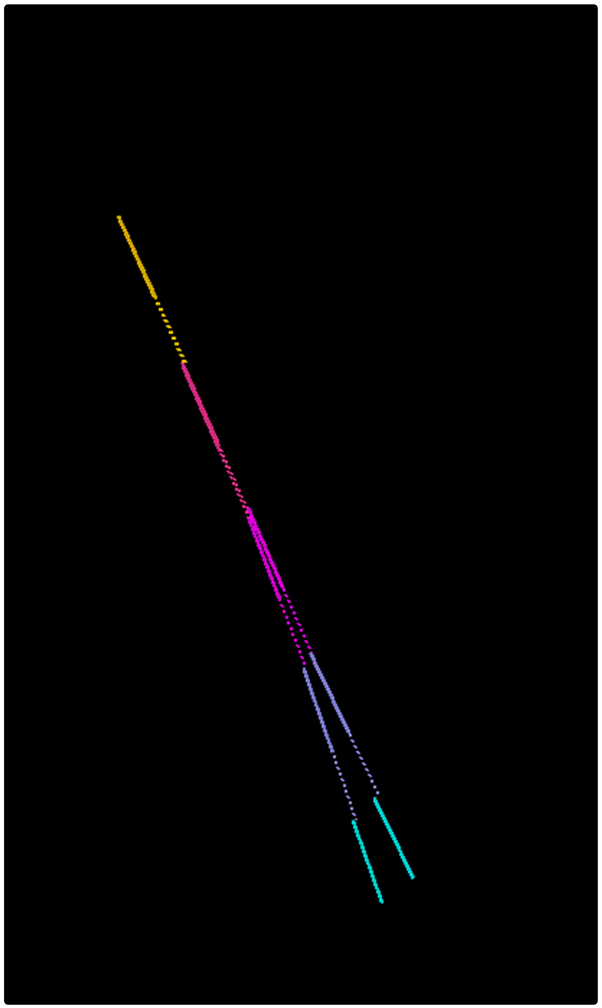



| | Fermi LAT | **GRAINE** |
|---|---|---|
| 角度分解能<br>@100MeV | 6.0deg<br>(105mrad) | **1.0deg**<br>**(17mrad)** |
| エネルギー範囲 | 20MeV～300GeV | 10MeV～100GeV |
| 偏光感度 | 無し | **有り** |
| Dead time | 26.5μsec | **free** |

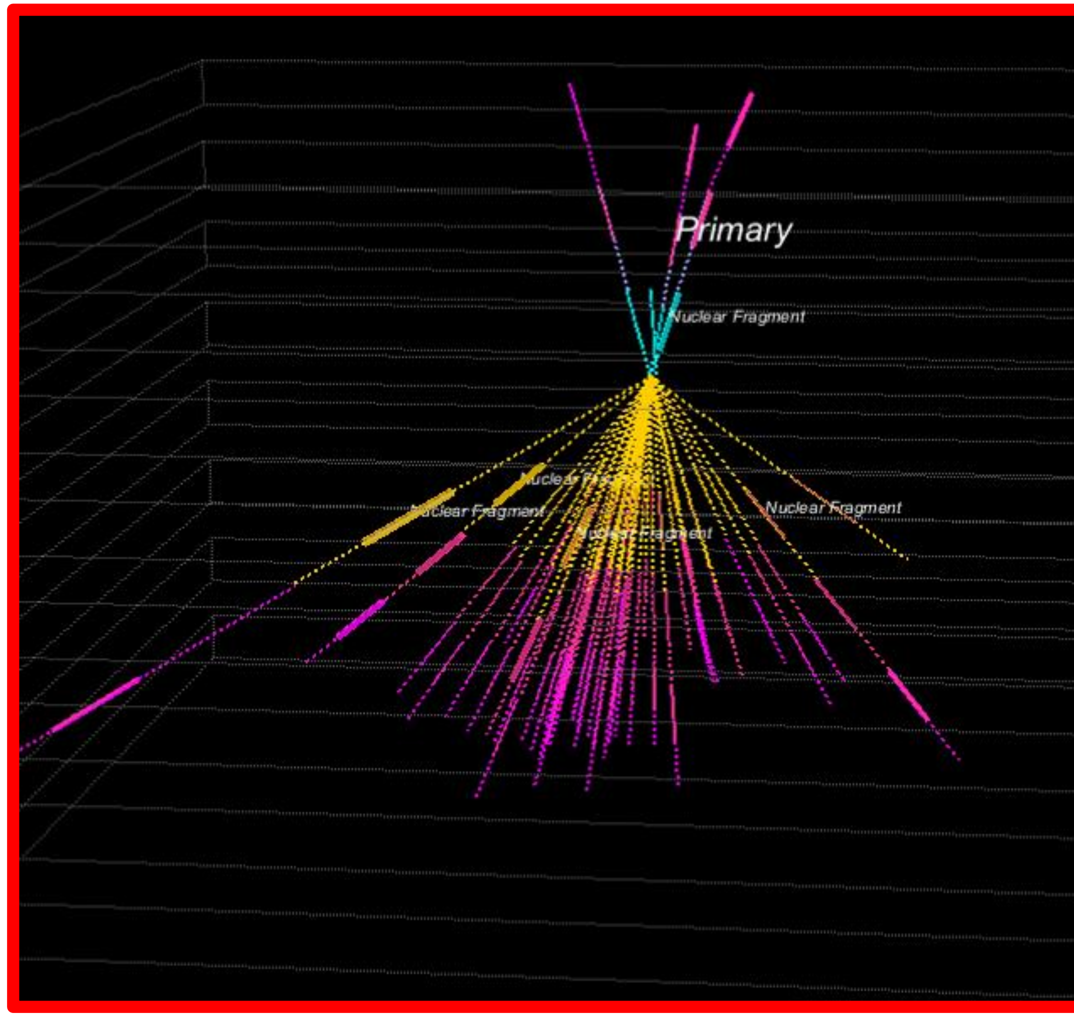
# ガンマ線

電子ー陽電子対生成



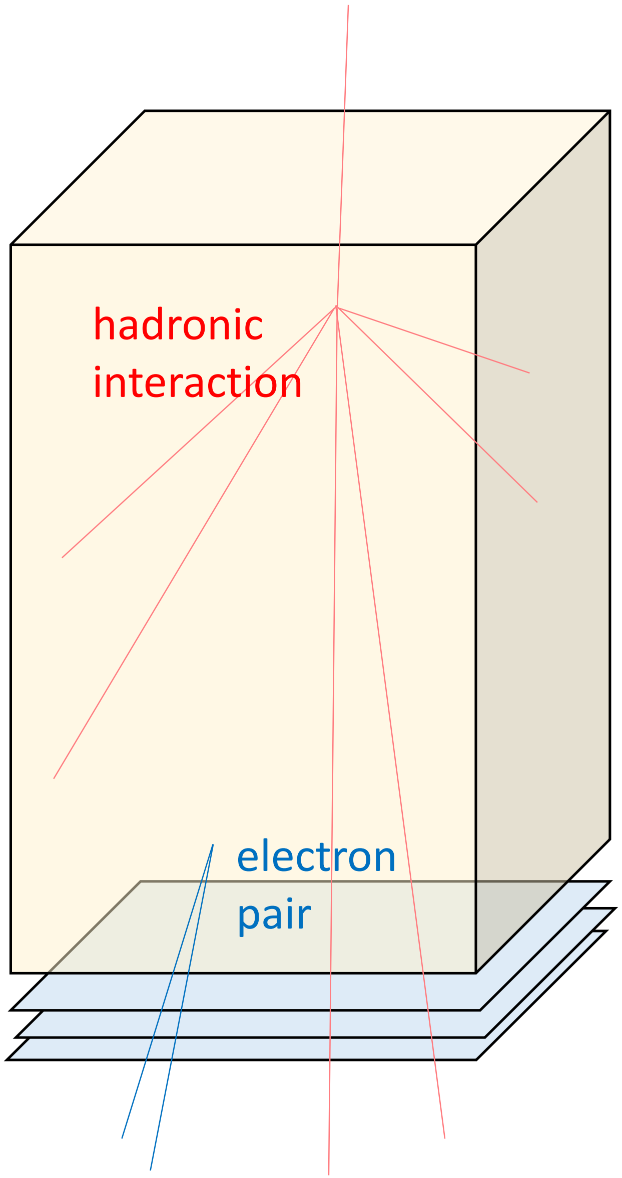
# 一次宇宙線 陽子、原子核

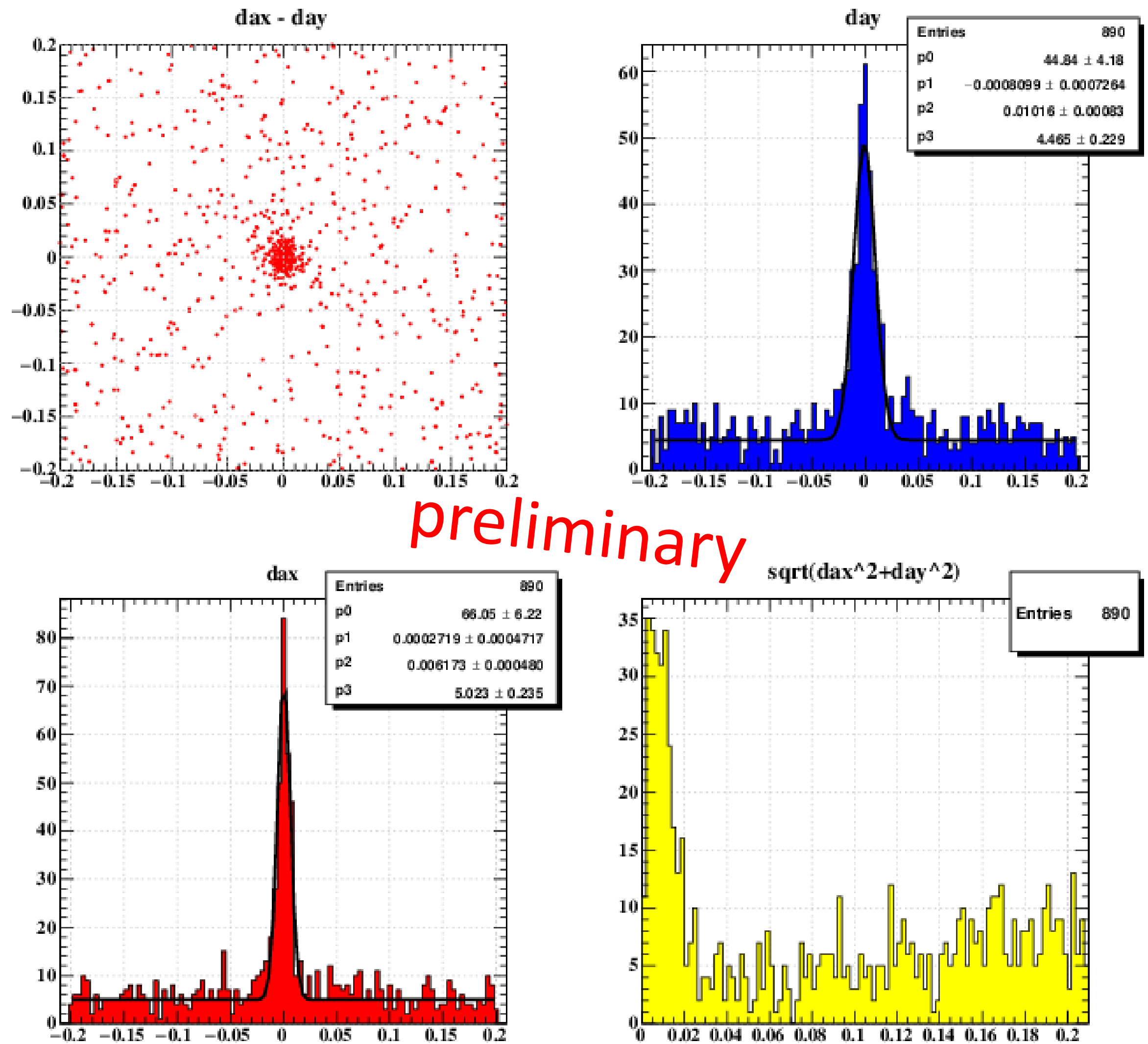
ハドロニック非弾性散乱



# $\gamma$ 線－ハドロン反応マッチング

$E_\gamma > 130$ Mev ,  $\tan\theta_\gamma < 0.5$



*Neutrino Frontier Workshop 2016, Ishikawa, Japan,*
*28- 30 Nov. 2016*

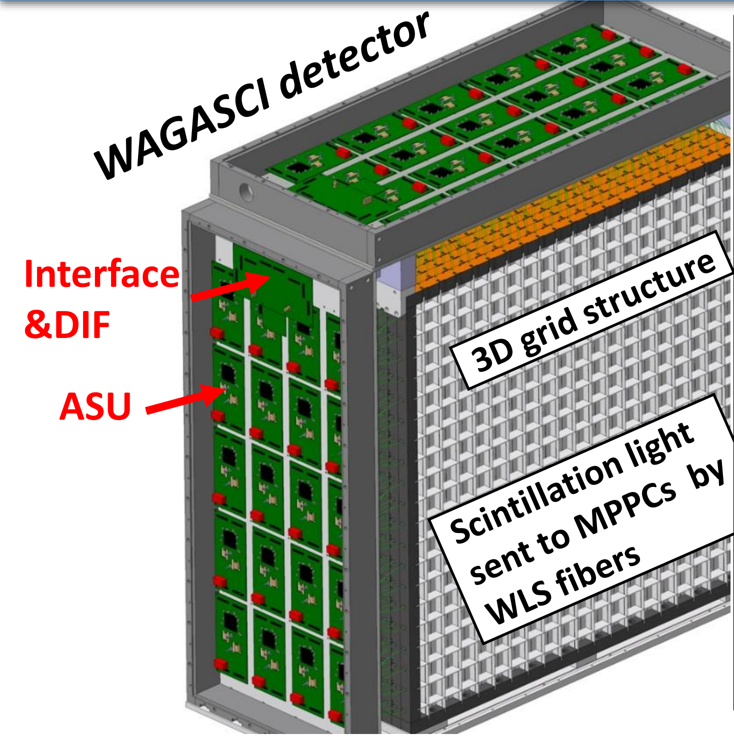
# *J-PARC T59: The WAGASCI experiment, Development of Electronics And Data Acquisition System*

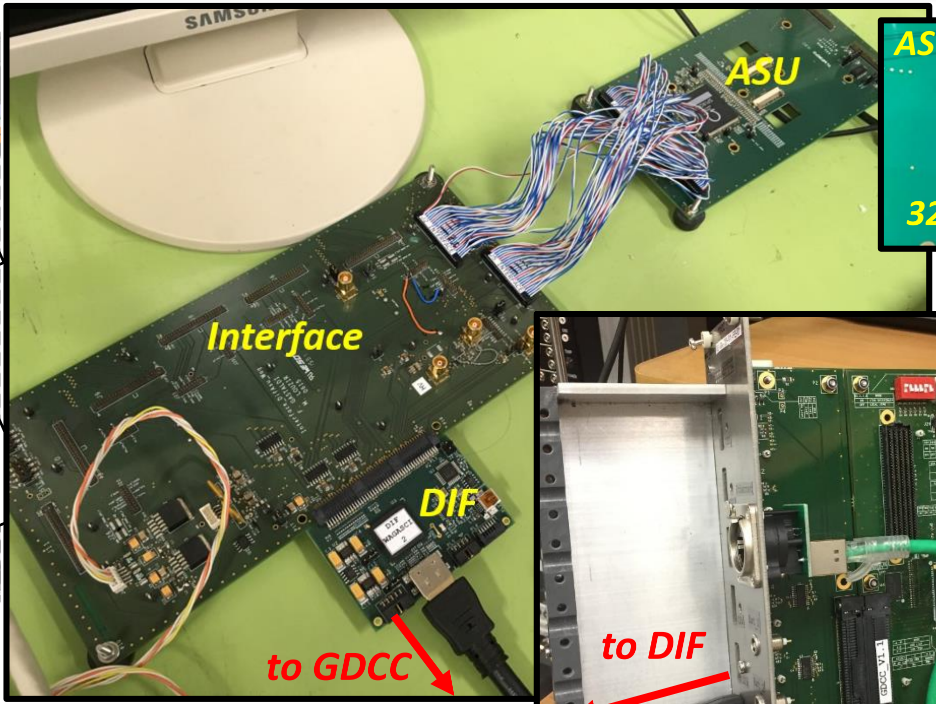
Naruhiro CHIKUMA
Department of Physics, the University of Tokyo

竹馬 匠泰
東京大学 理学系研究科 物理学専攻

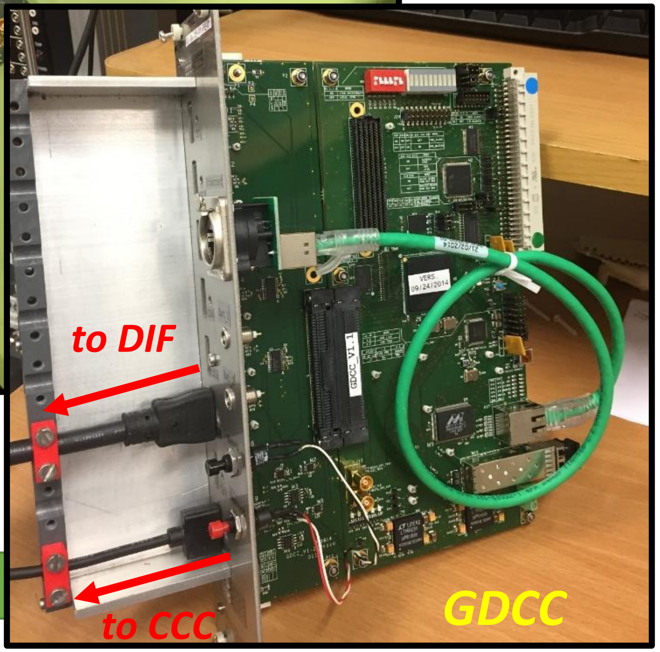
# The WAGASCI electronics

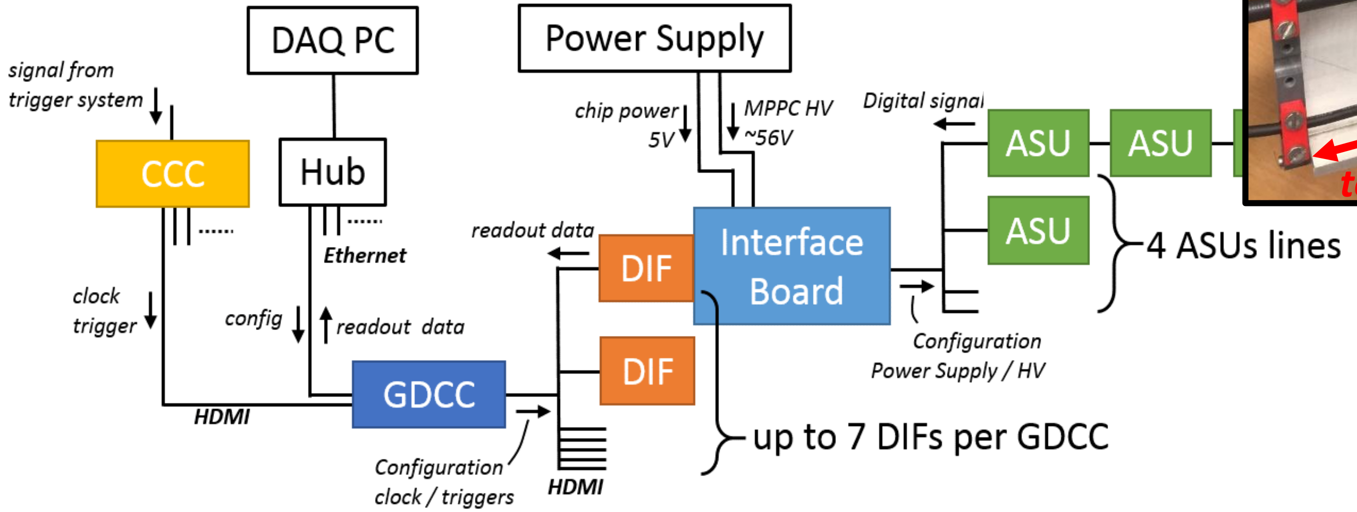




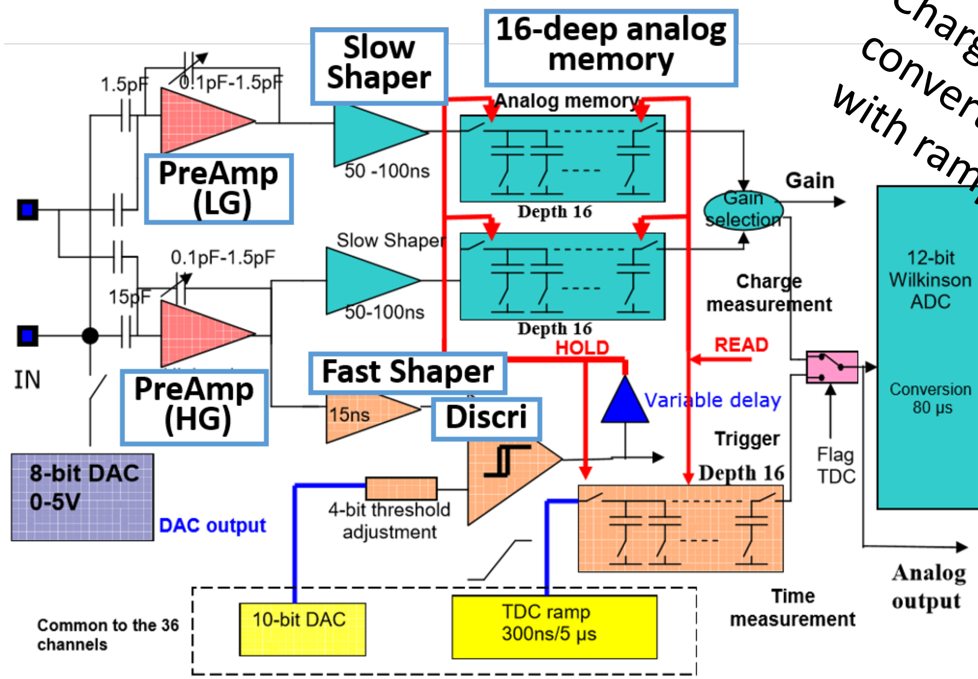




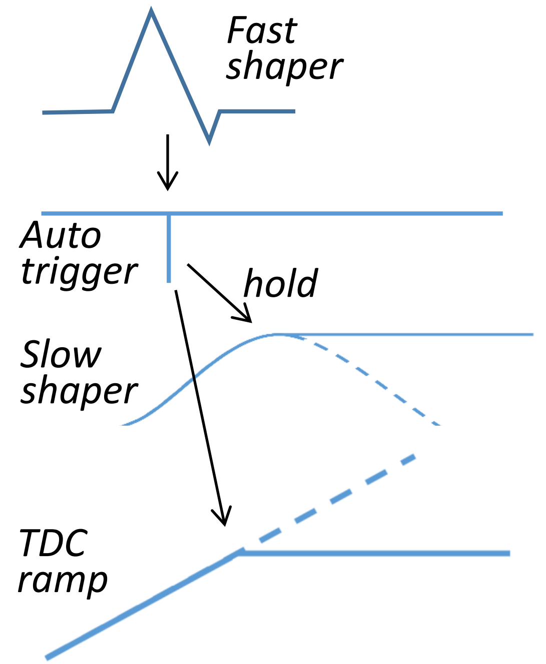




École Polytechnique, Université Paris-Saclay · CNRS IN2P3 Les deux infinis · LLR

# SPIROC2D

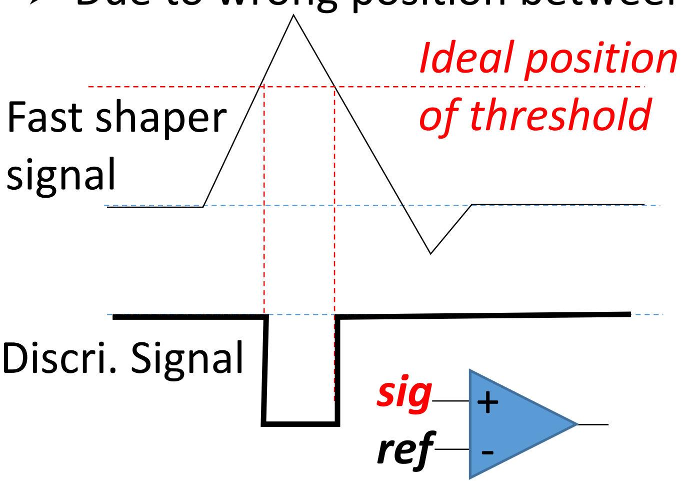



Charge & Time is converted by the ADC with ramp signals.

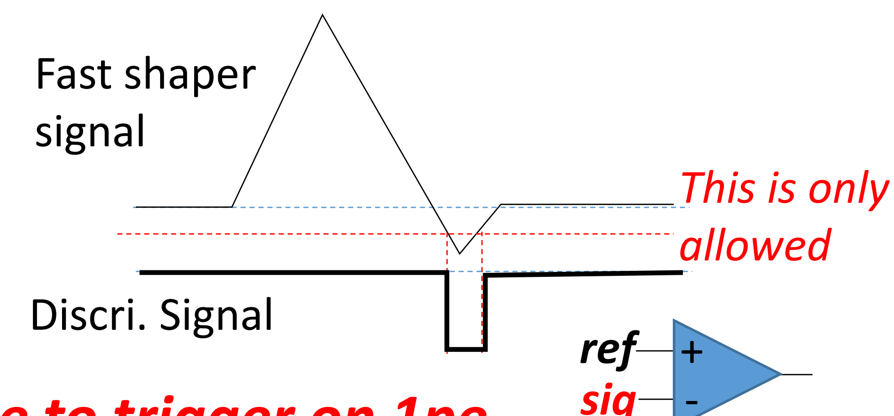



***ISSUE*** : It is only possible to set the discriminator threshold at its undershoot.

- Due to wrong position between signal and reference in the comparator.




*In real*




***But, still able to trigger on 1pe.***

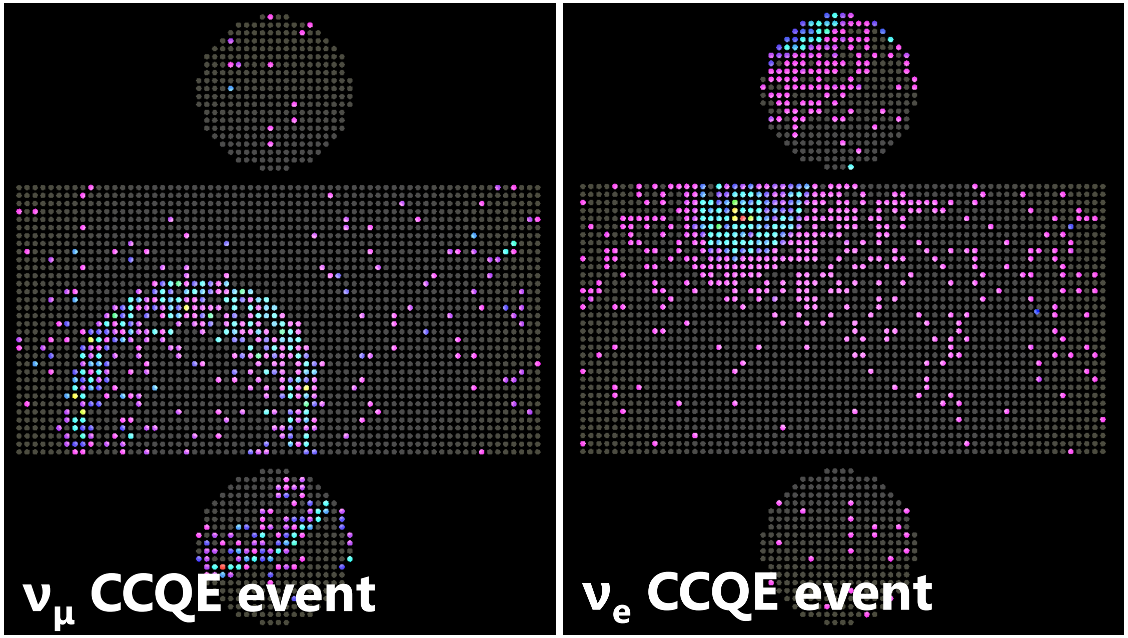
# NuPRISM detector performance study

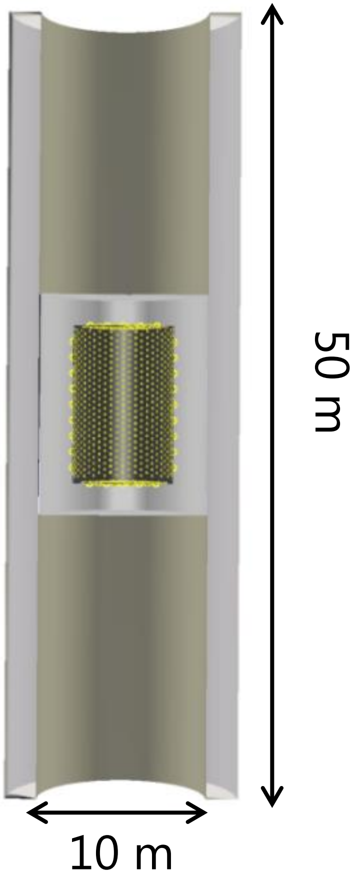
Neutrino frontier workshop 2016

Tomoyo Yoshida
Tokyo Institute of technology

# NuPRISM detector

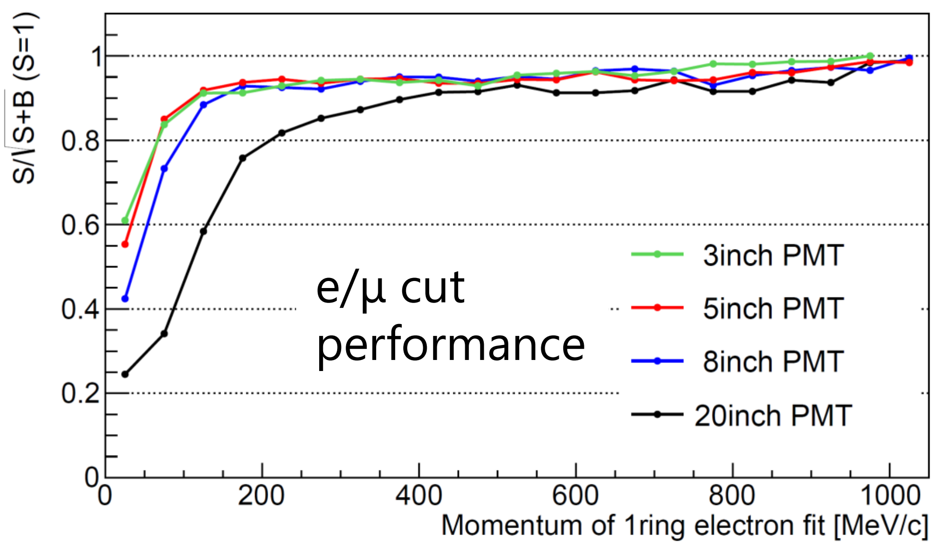
- Proposed water Cherenkov detector in the J-PARC neutrino beamline at 1~2m baseline.
- Detector optimization is ongoing using full detector simulation and reconstruction.

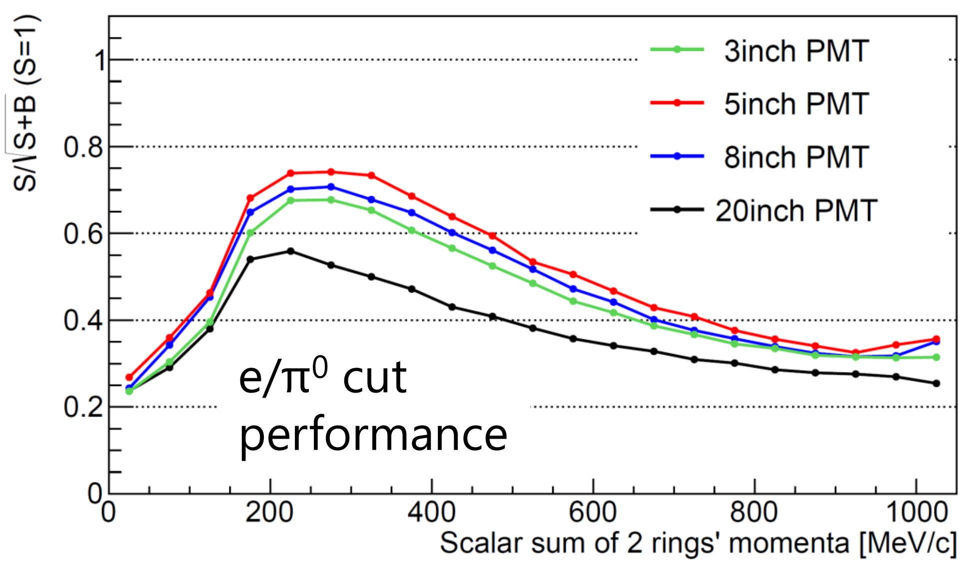


# Detector performance study

- PID performance for different PMT sizes are shown in the poster
- The performance to be validated by full-scale prototype detector on surface



# Sensitivity studies for a second Hyper-K detector in Korea

Neutrino frontier workshop 2016

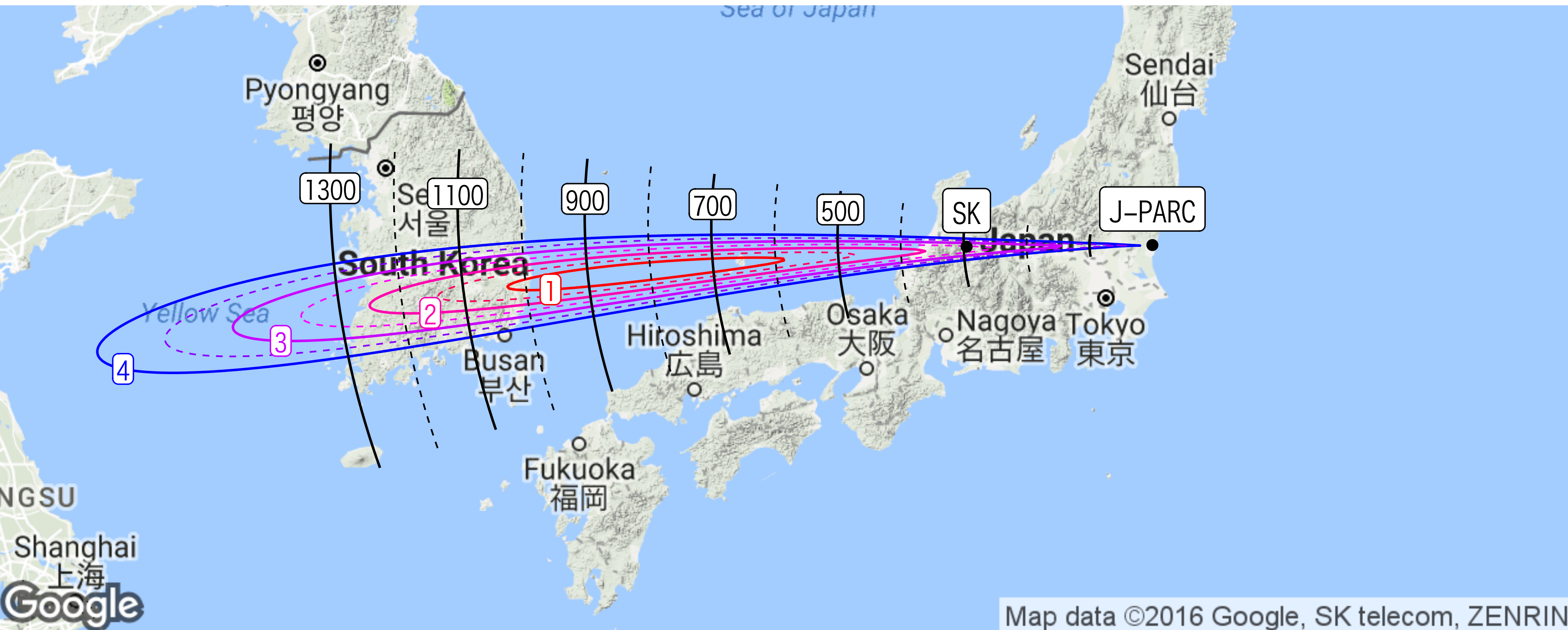
Lukas Berns
Tokyo Institute of Technology

# T2HKK experiment

- Important oscillation paramters degenerate in vacuum: mass-hierarchy, $\delta_{CP}$, $\theta_{23}$
- To resolve use matter effect
  → long baseline experiment

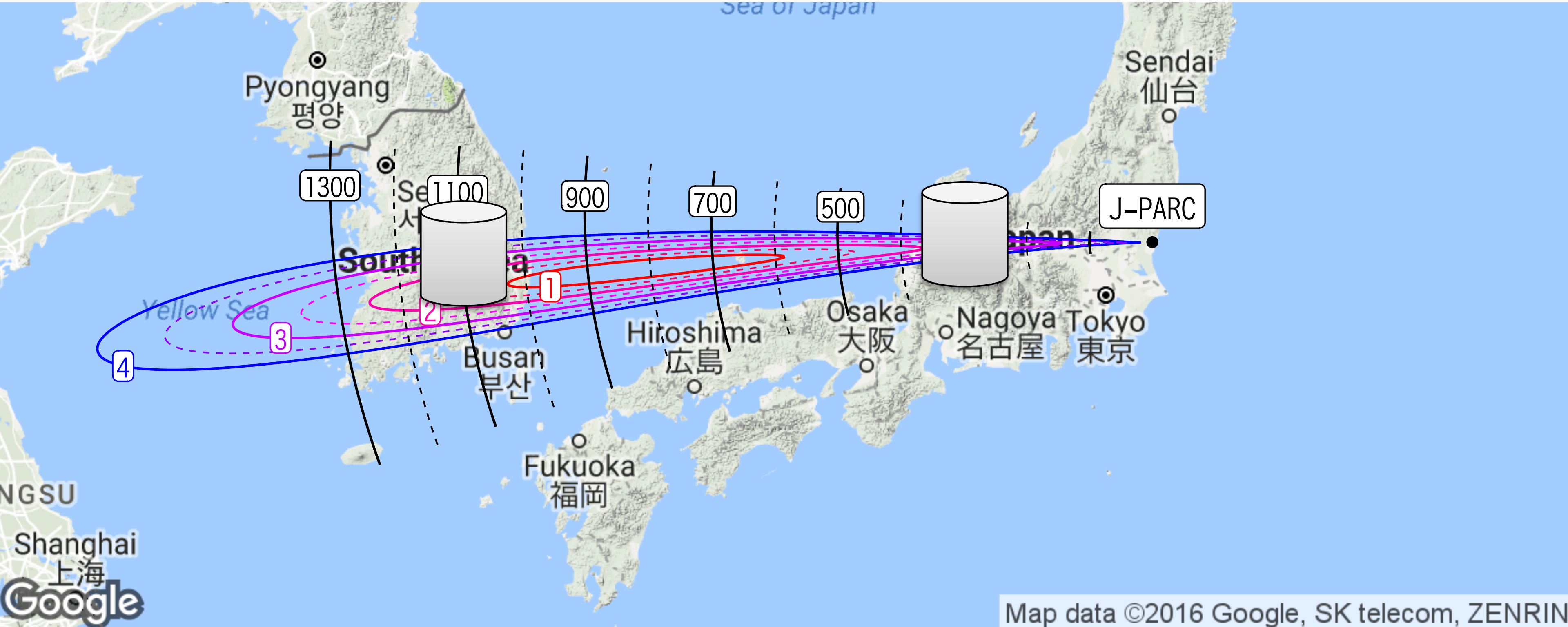
# T2HKK experiment

- T2K 2.5° off-axis beam is available in Korea

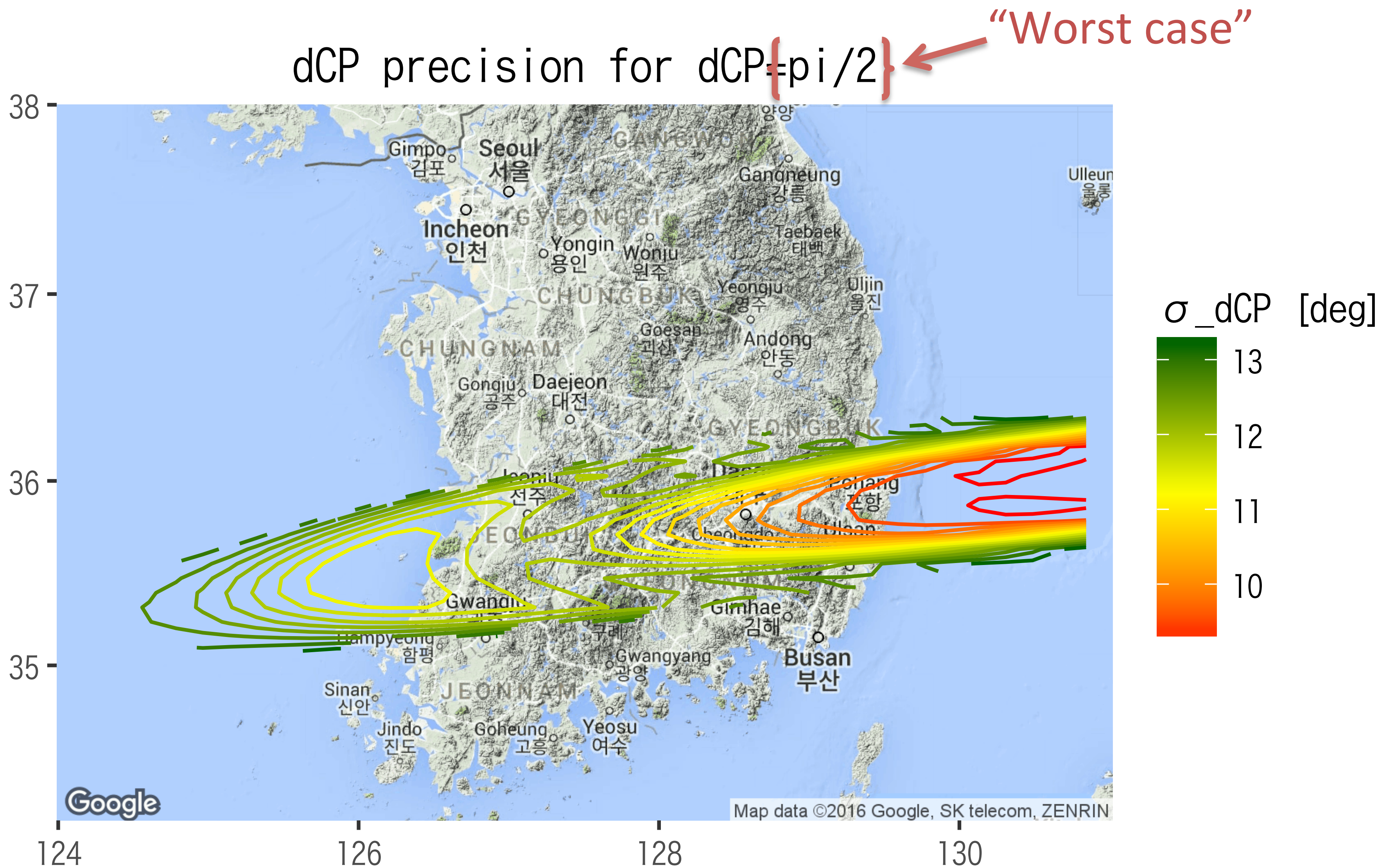


# T2HKK experiment

- T2K 2.5° off-axis beam is available in Korea
- Longer baseline + larger density + 2nd osc. max
  → resolve mass-hierarchy
  → improved $\delta_{CP}$ precision



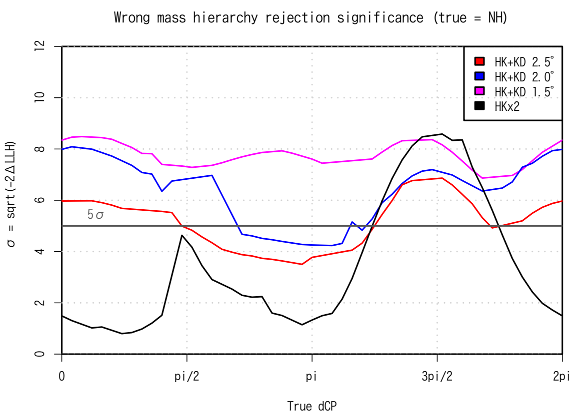
# Results

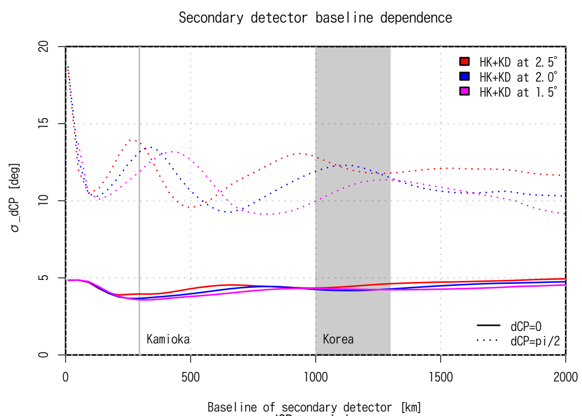


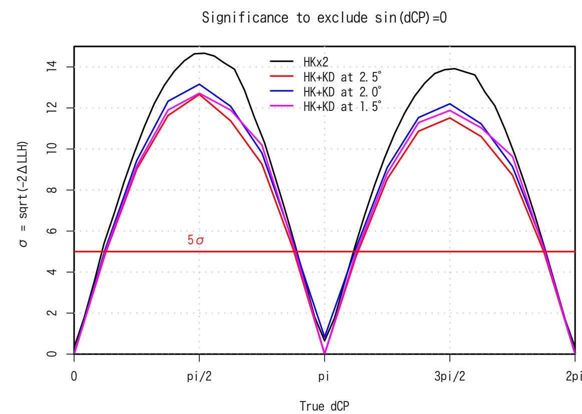
"Worst case"
dCP precision for dCP=pi/2
38
37
36
35
124
126
128
130
σ _dCP [deg]
13
12
11
10
Map data ©2016 Google, SK telecom, ZENRIN

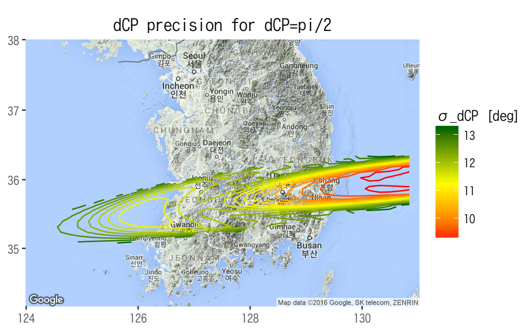
# T2HKK experiment

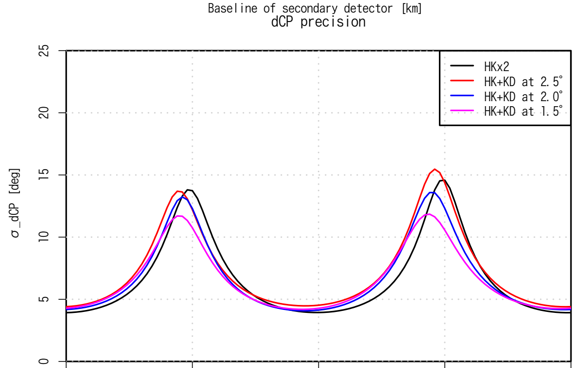
- A T2HKK sensitivity study was proposed this month: arXiv:1611.06118 [hep-ex]
- In the poster, an independent sensitivity study for mass hierarchy, $\delta_{CP}$, $\theta_{23}$ octant is presented

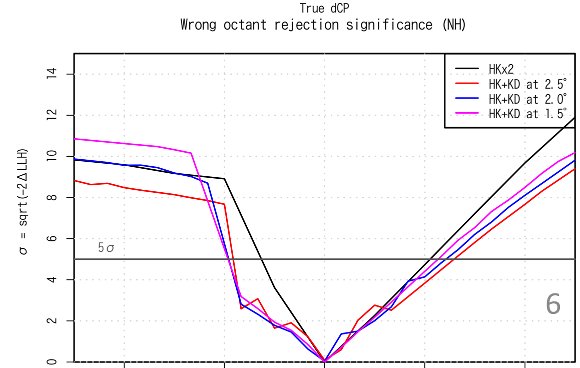


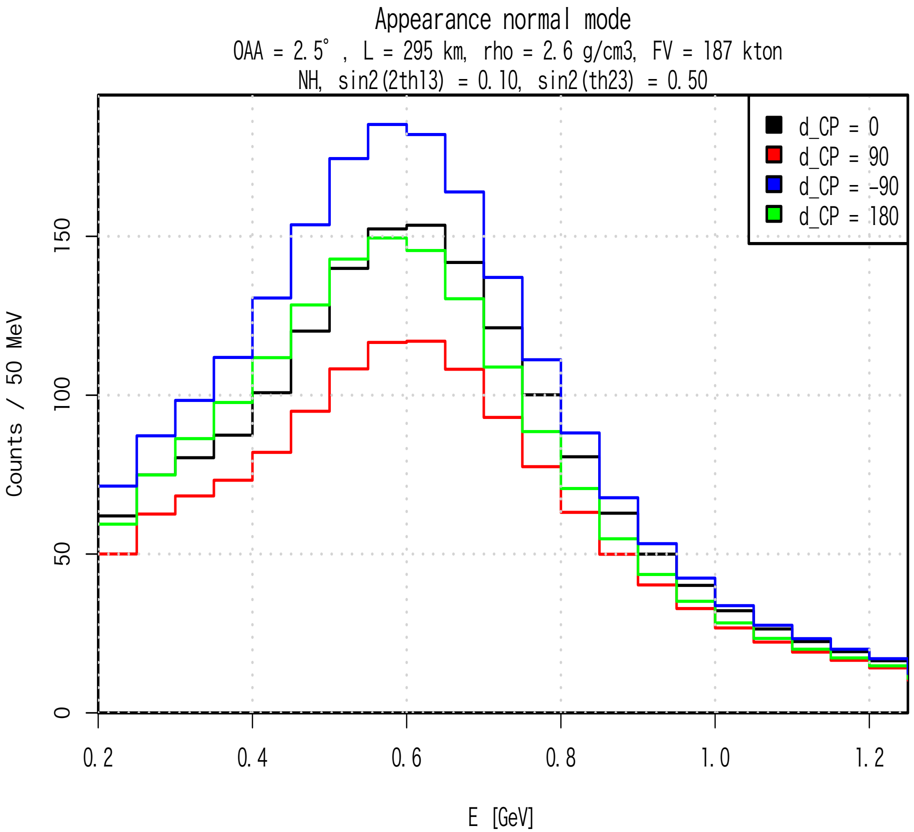



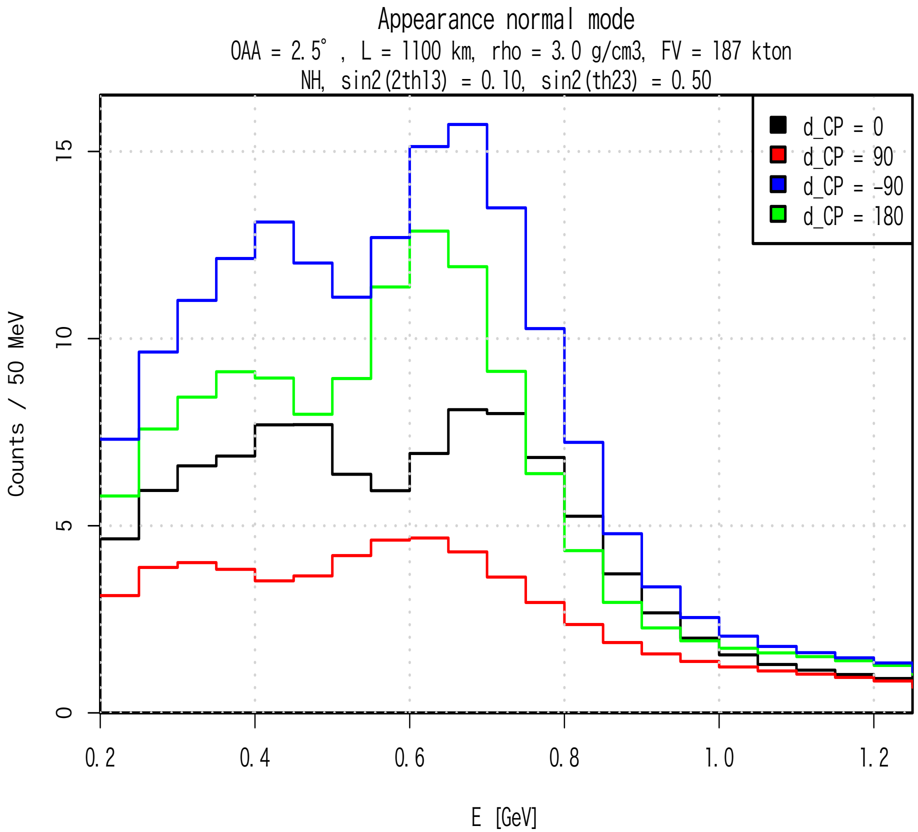



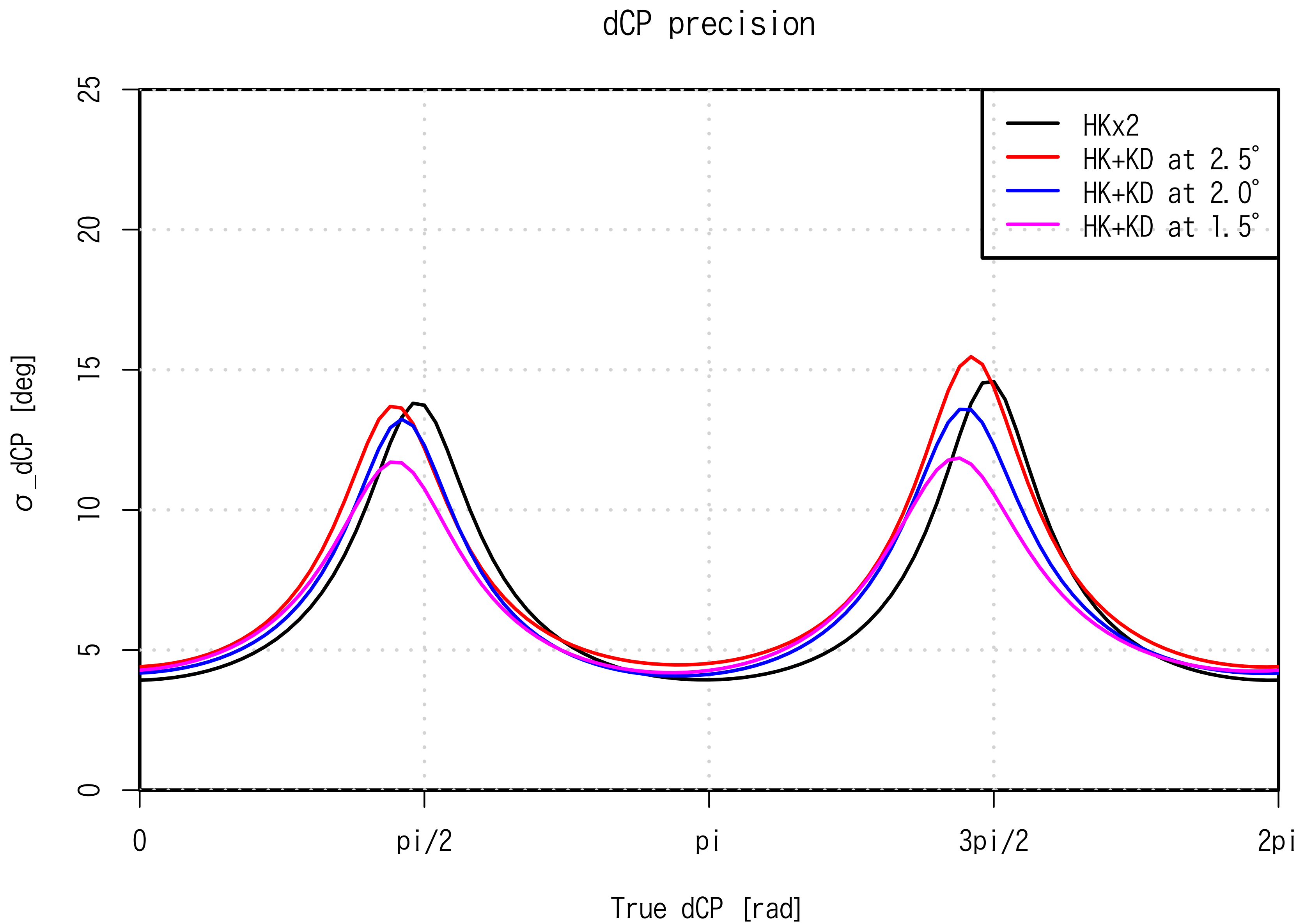
# backup




Kamioka




Korea
1100 km, 2.5°

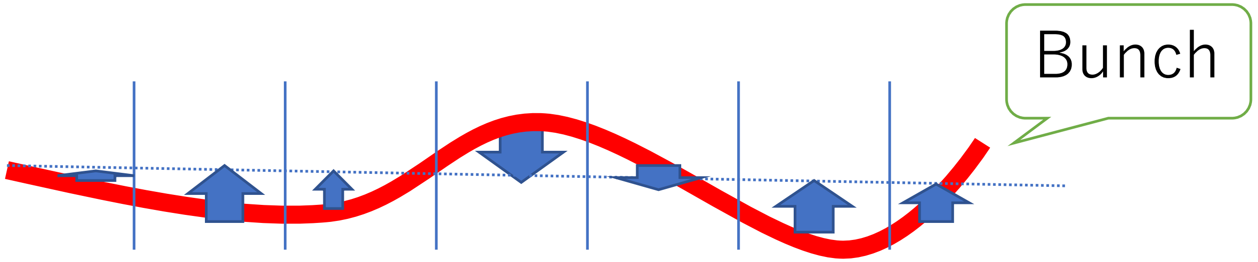


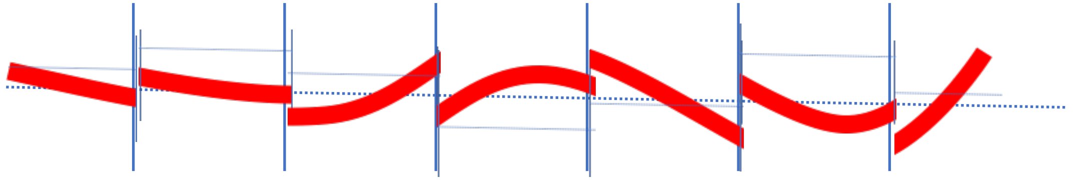
dCP precision
HKx2
HK+KD at 2.5°
HK+KD at 2.0°
HK+KD at 1.5°
σ_dCP [deg]
0
5
10
15
20
25
0
pi/2
pi
3pi/2
2pi
True dCP [rad]

# New Design of BPM for Intra-bunch feedback system @J-PARC MR

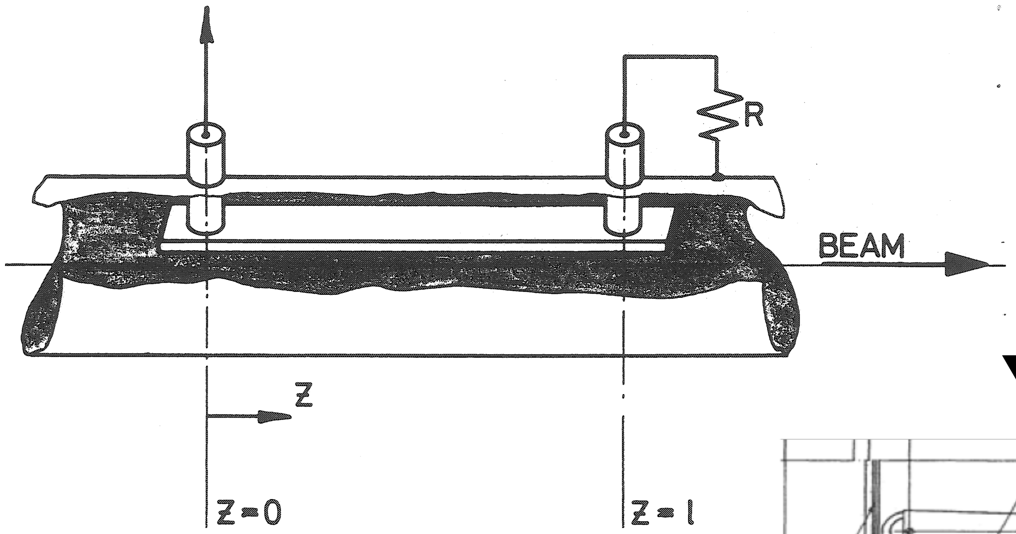
Wataru Uno (Kyoto University)

# J-PARC MR Intra-bunch feedback system



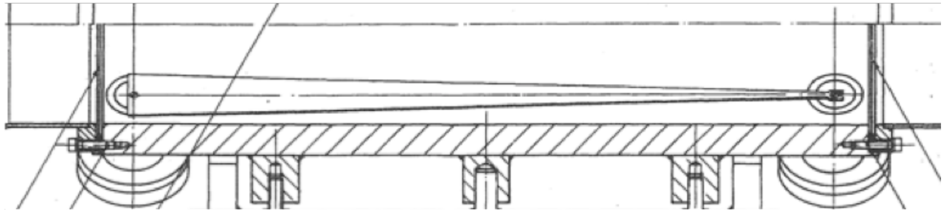



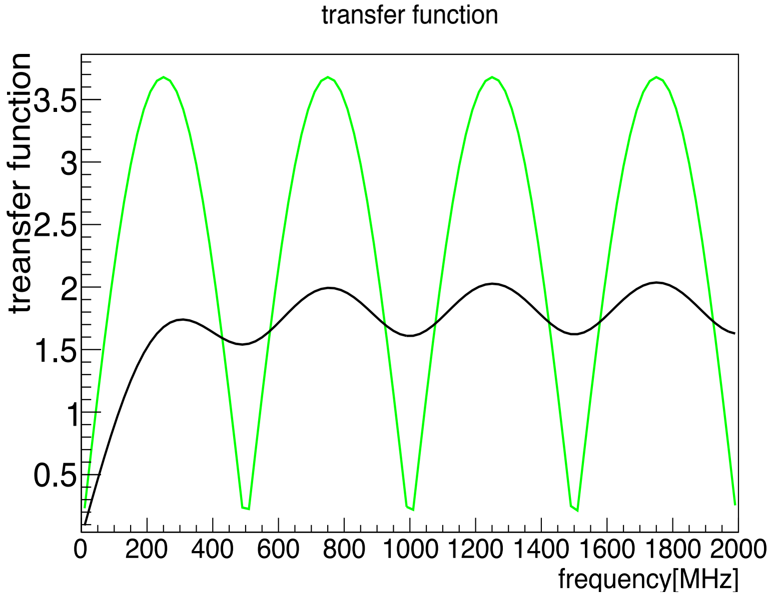
# Exponential tapered coupler BPM




▲sketch of BPM

▼sketch of pickup

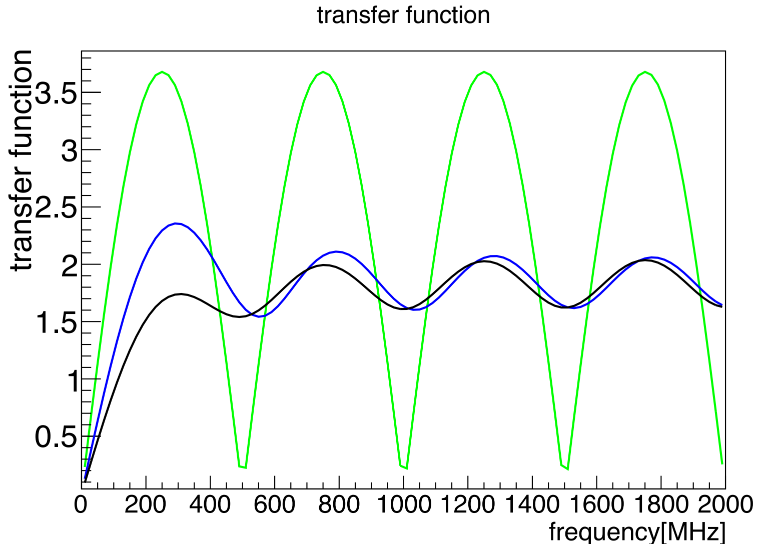


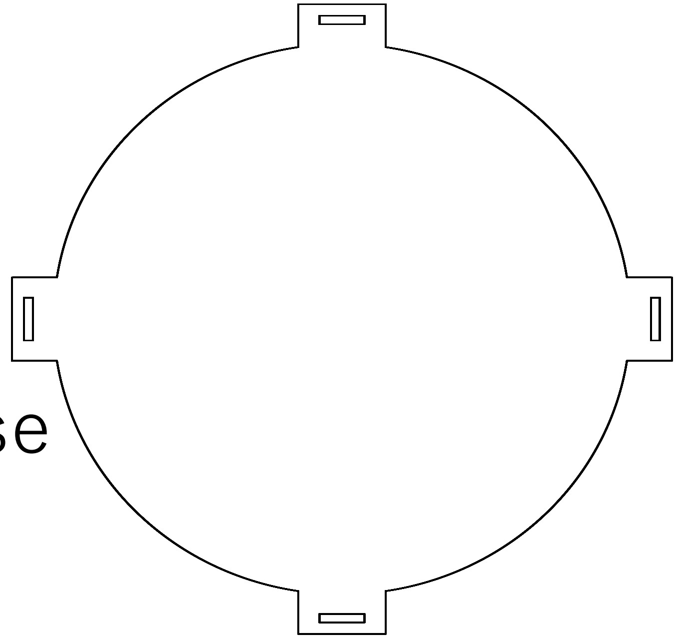


# Disadvantage of exponential tapered coupler

- Difficult to make accurately
  - ->unbalance between pickups
    - ->Background on the signal
- To solve the disadvantage
  - ->trapezoid tapered coupler
- But larger fluctuation than exponential one
- Groove on wall of pipe

  changing the depth of groove by beam direction

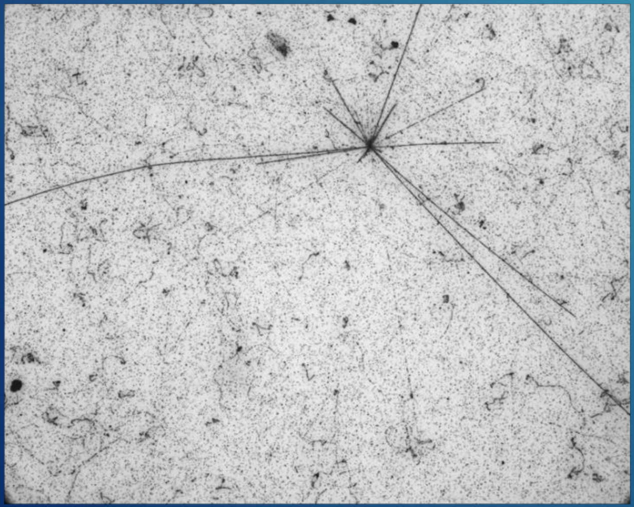


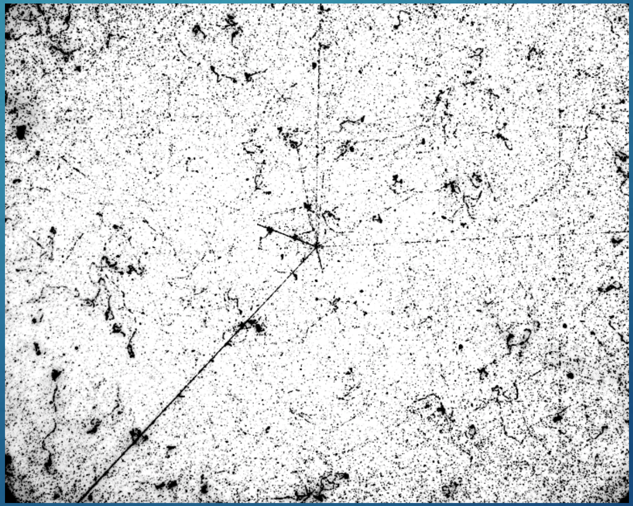



My poster is on the calculation of frequency response of new design BPM

# *J-PARC T60 Experiment study of electromagnetic component*

**Yosuke Suzuki**（Nagoya Univ. B4）





Neutrino frontier Workshop, 28th-30th Nov. 2016

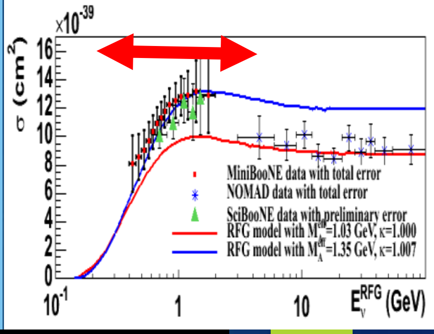
# T60 experiment

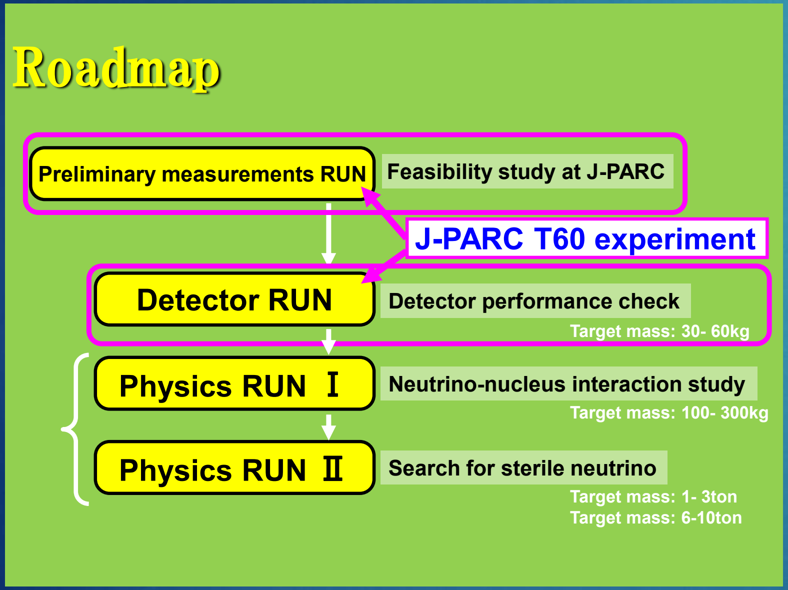


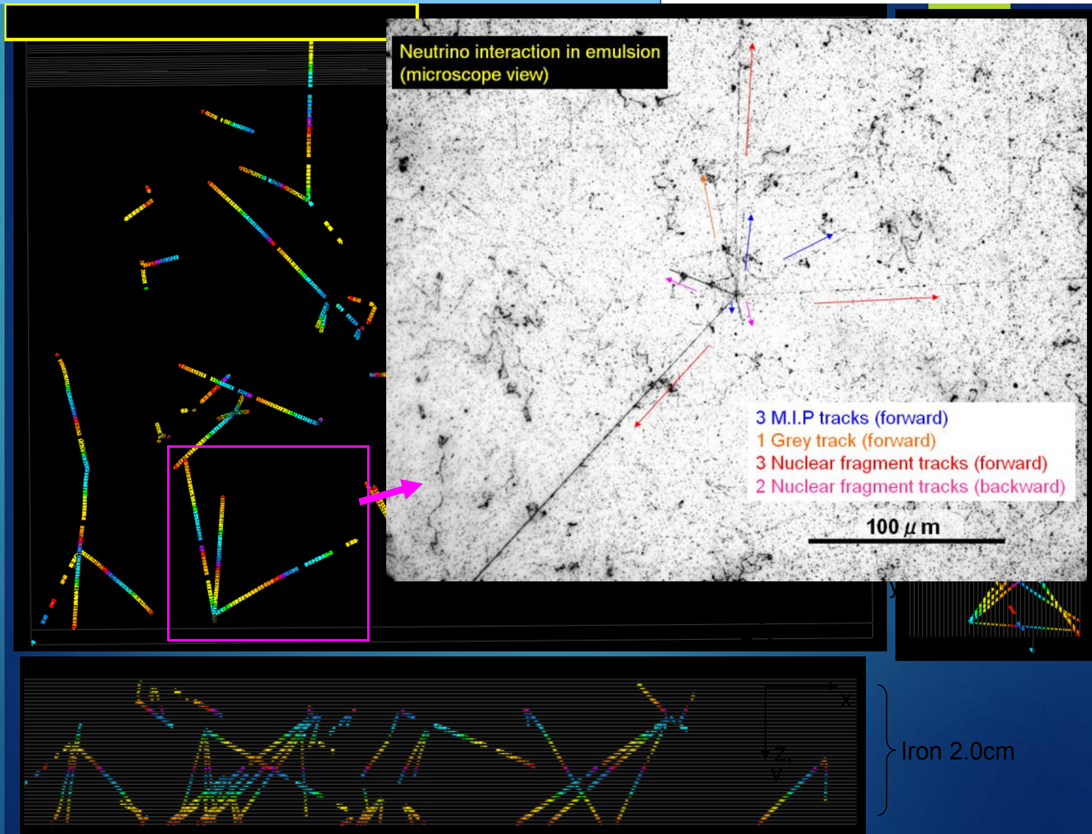
(Precise neutrino-nucleus interactions measurement with Emulsion at J-PARC)

Motivation

- Precise neutrino-nucleus interaction measurement is important to reduce the systematic uncertainty in future neutrino oscillation experiments.
- The emulsion technique can measure all the final state particles with low energy threshold for a variety of targets ($H_2O$, Fe, C,…).



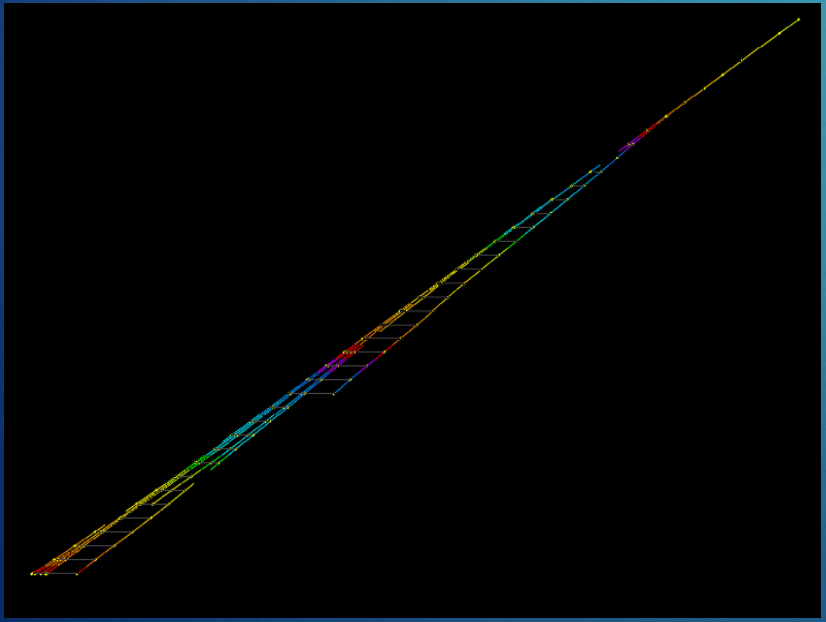



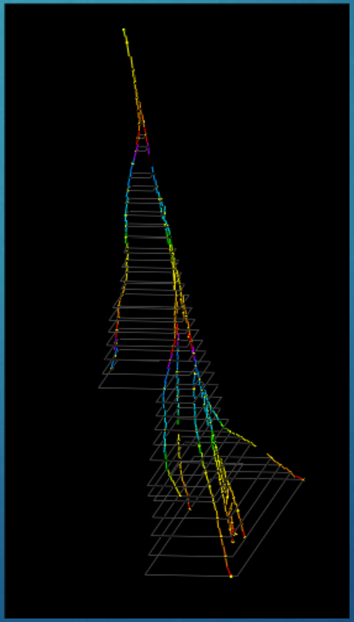

Emulsion detector
Position resolution :sub-micron
Angle resolution :2mrad~

# Shower event detection

- More than 10 shower events are detected in emulsion detector.
  - In the future, we will analyze v_e interactions so it is important to understand these detected shower events.
  - They are probably cosmic ray event because of these energy.
  - But they have a possibility to become v_e interaction background.

- I try to analyze the shower event.
  - Origin
  - Energy
  - Angle distribution
  - Position distribution
- I use many ways to analyze them.
  - Multiple Coulomb Scattering
  - Compare the simulation
  - Shower development





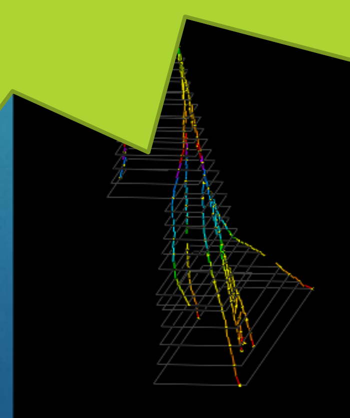
# Shower event detection



- More than 10 shower events are detected in emulsion detector.
  - In the future, we will analyze e interac so it is important to underst these detected shower events.
  - They are pro osmi of these ene
  - But they hav

Please come to my poster!

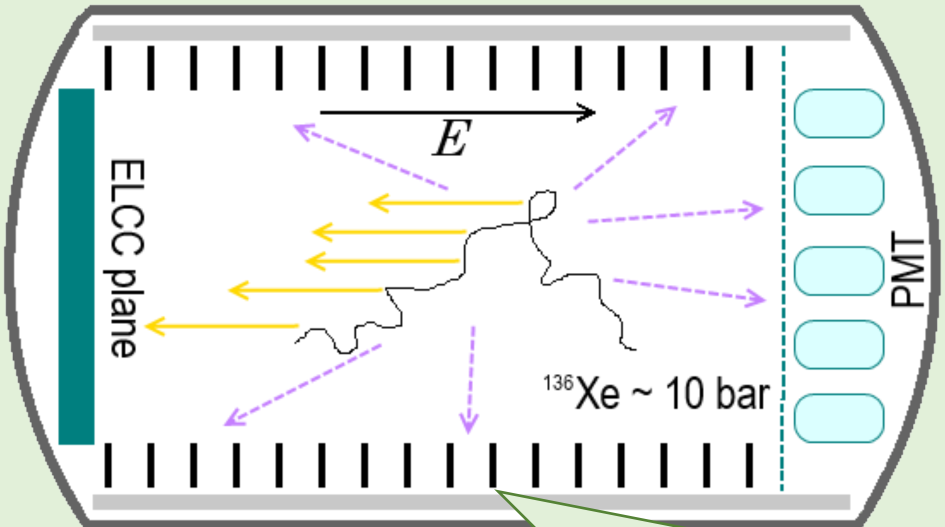
- y to analyze the shower vent
  - Energy
  - ngle distribution
  - osition distribution
- e many ways to e them.
  - Multiple Coulomb Scattering
  - Compare the simulation
  - Shower development



# 高圧XeガスTPC AXELの
# ドリフト電場形成回路の開発

京大理高エネルギー物理学研究室
吉田 将
Kyoto Univ.
M.Yoshida

AXEL検出器概念図

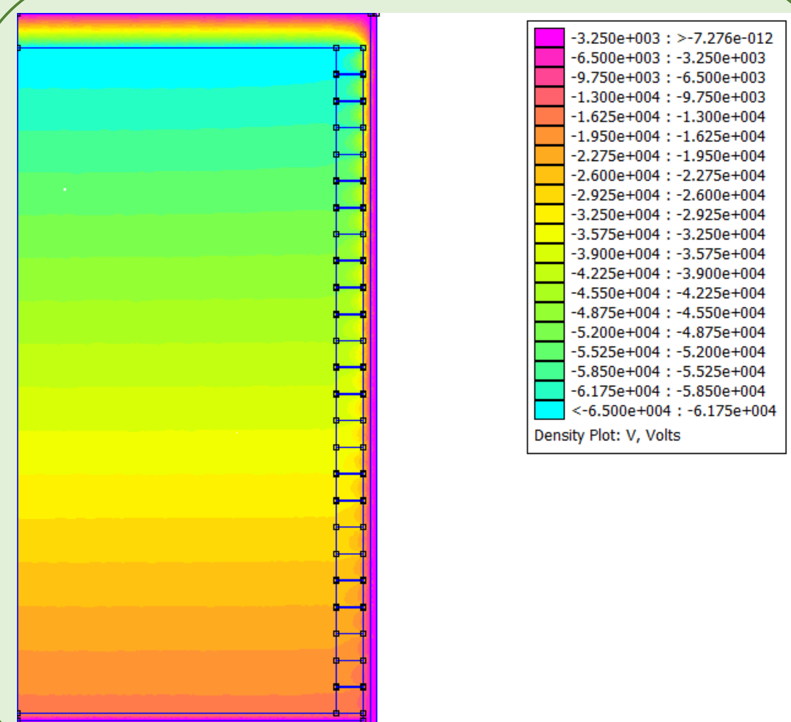



**AXEL**
…高圧XeガスTPCを用いた
$0\nu\beta\beta$崩壊探索実験

- 高いエネルギー分解能
- バックグラウンド除去

これらを達成するため
ドリフト電場には高い一様性が必要

有限要素法による
ドリフト電場シミュレーション

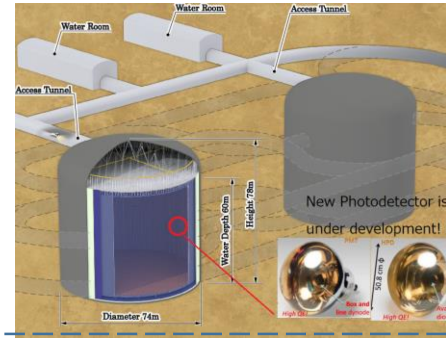



次期試作機で70kV、
将来の1t級試作機では数百kVに至る
高電圧下で一様安定なドリフト電場を
形成する技術の開発が急務

詳しくはポスター
“Formation of 70kV-class drift field
for high pressure Xe gas TPC AXEL” で

# Sensitivity of CP violation and mass order by joint analysis of neutrino oscillation on Hyper-Kamiokande

Miao Jiang (Kyoto. U)

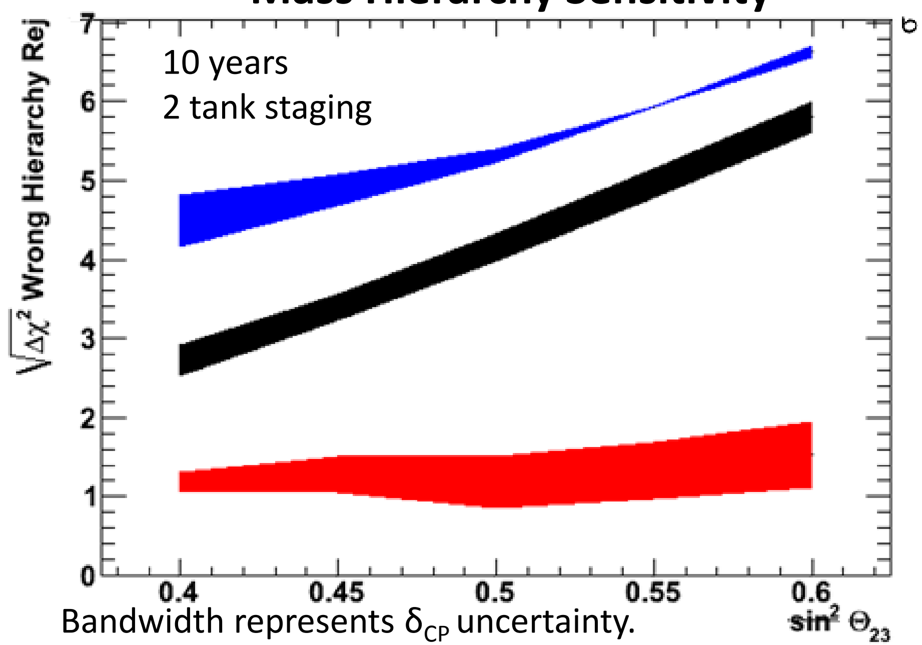



Neutrino source

- Beam neutrinos:
  - precise energy and direction
  - fixed beamline
- Atmospheric neutrinos:
  - high statistics
  - various beamline length
  - sensitive to matter effects
  - not as precise as beam ν

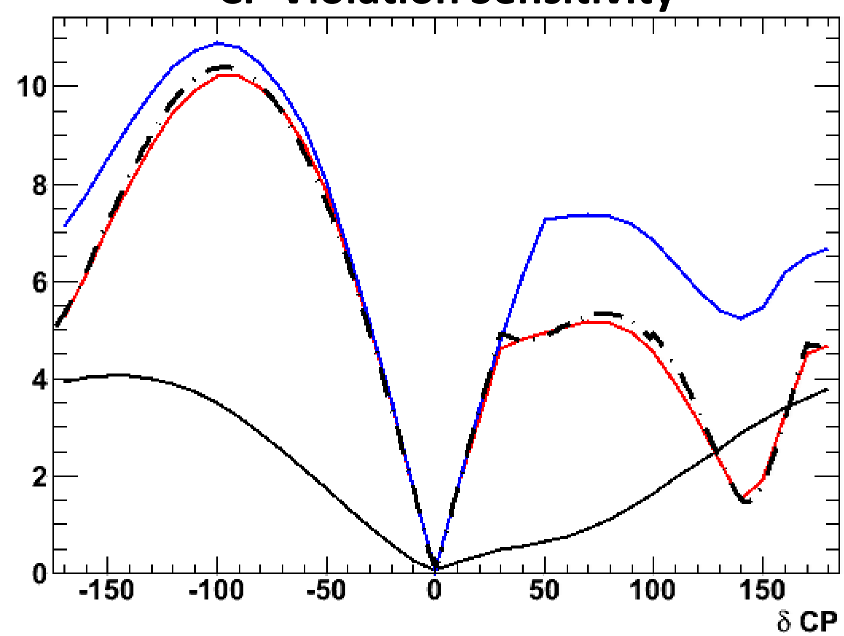
Beam ν, Atmospheric ν, Joint Analysis

**Mass Hierarchy Sensitivity**




Bandwidth represents $\delta_{CP}$ uncertainty.

**CP Violation Sensitivity**



# Study of low background bolometer for CANDLES


Konosuke Tetsuno

Osaka University/CANDLES collaboration


- CANDLES is a project to search for neutrinoless double beta decay of $^{48}Ca$ with $CaF_2$ scintillators.
- Current energy resolution is $\sigma$~2% @ Q-value (4.27MeV)
- Explore inverted hierarchy → normal hierarchy region,

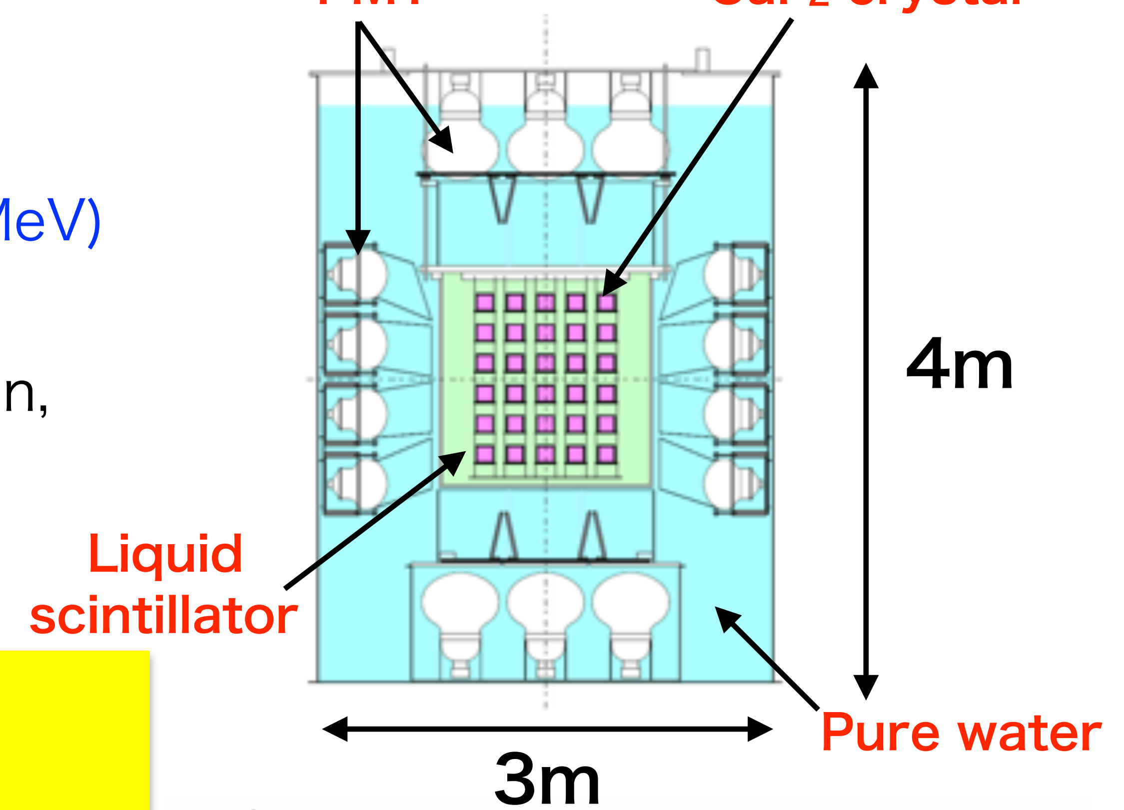
Required two improvements

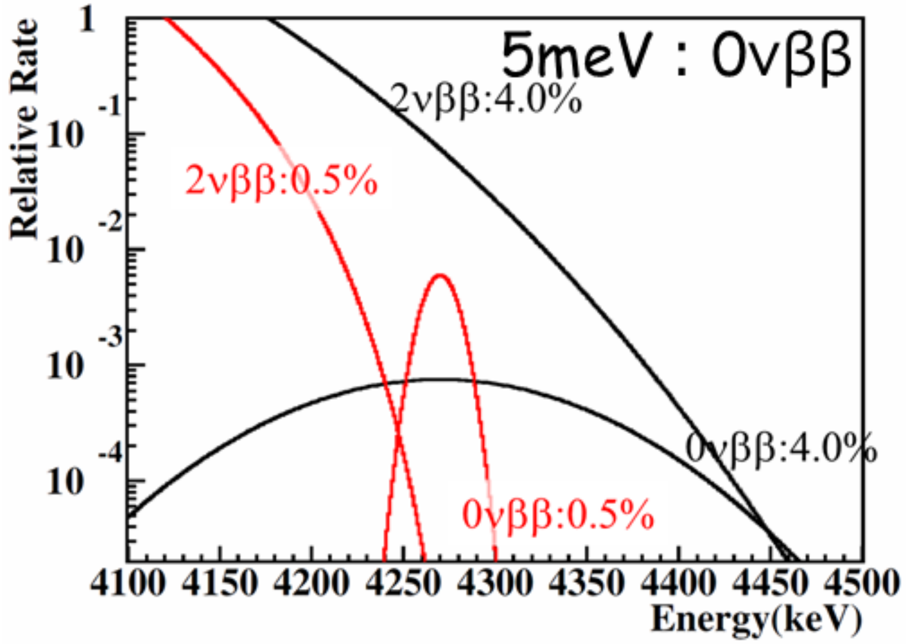
☑Much better energy resolution (to avoid $2\nu\beta\beta$ background events)
→ Developing "$CaF_2$ bolometer"

☑Realizing highly enriched $^{48}Ca$, and ton-scale detector
→ Developing "$^{48}Ca$ enrichment technique"

- We are aiming to excellent energy resolution by developing bolometer technique ($\sigma$~0.3%).

CANDLES detector

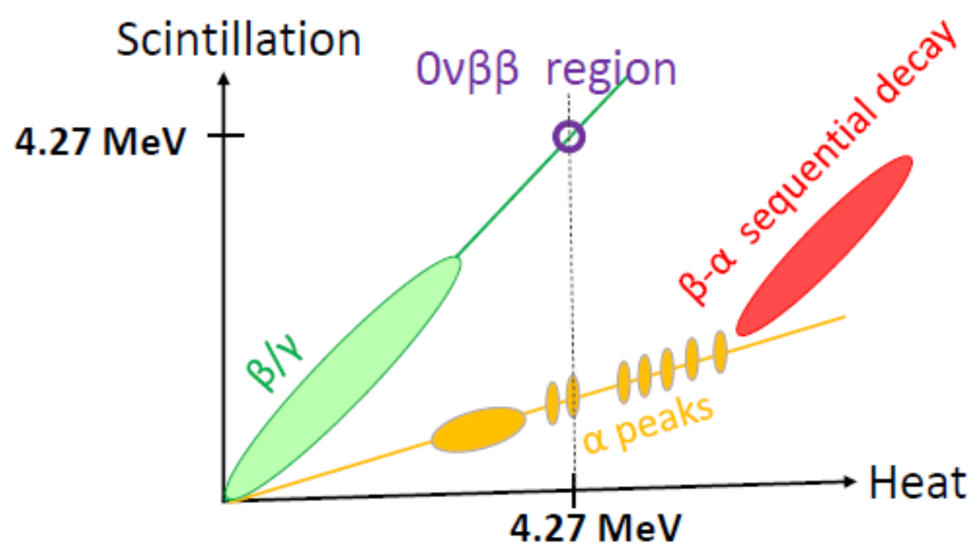


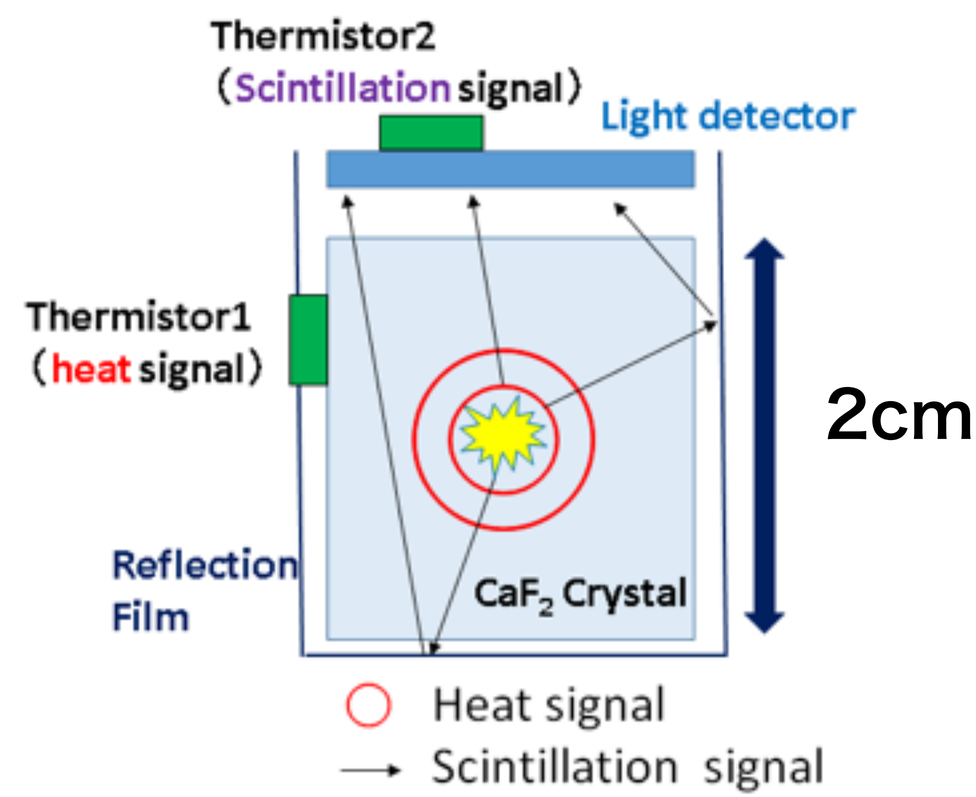



# Study of low background bolometer for CANDLES

Konosuke Tetsuno
Osaka University/CANDLES collaboration

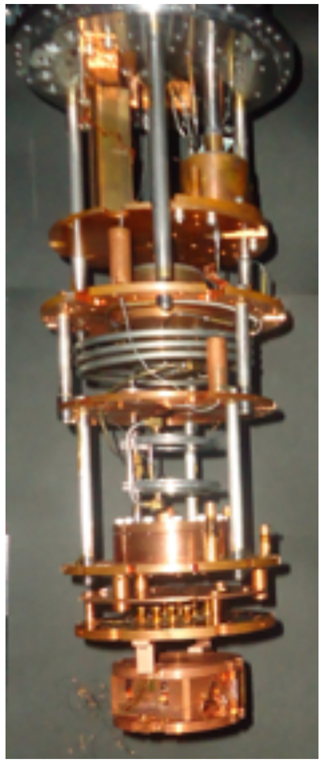
- New BG candidate in $CaF_2$ bolometer.
  $^{48}Ca$ $Q_{\beta\beta}$: 4267keV / $^{238}U$ $Q_{\alpha}$: 4270 keV
  required particle ID → Scintillating bolometer




- Simultaneous measurement of heat and scintillation enables to identify the particle types ($\alpha/\beta$ particle ID)

- Now we are developing a small bolometer with a few hundred grams of $CaF_2$ crystals in the surface laboratory.
- In my poster, the current status of development and future strategy will be reported.



# Double Chooz検出器のエネルギー応答の研究とステライルニュートリノ探索

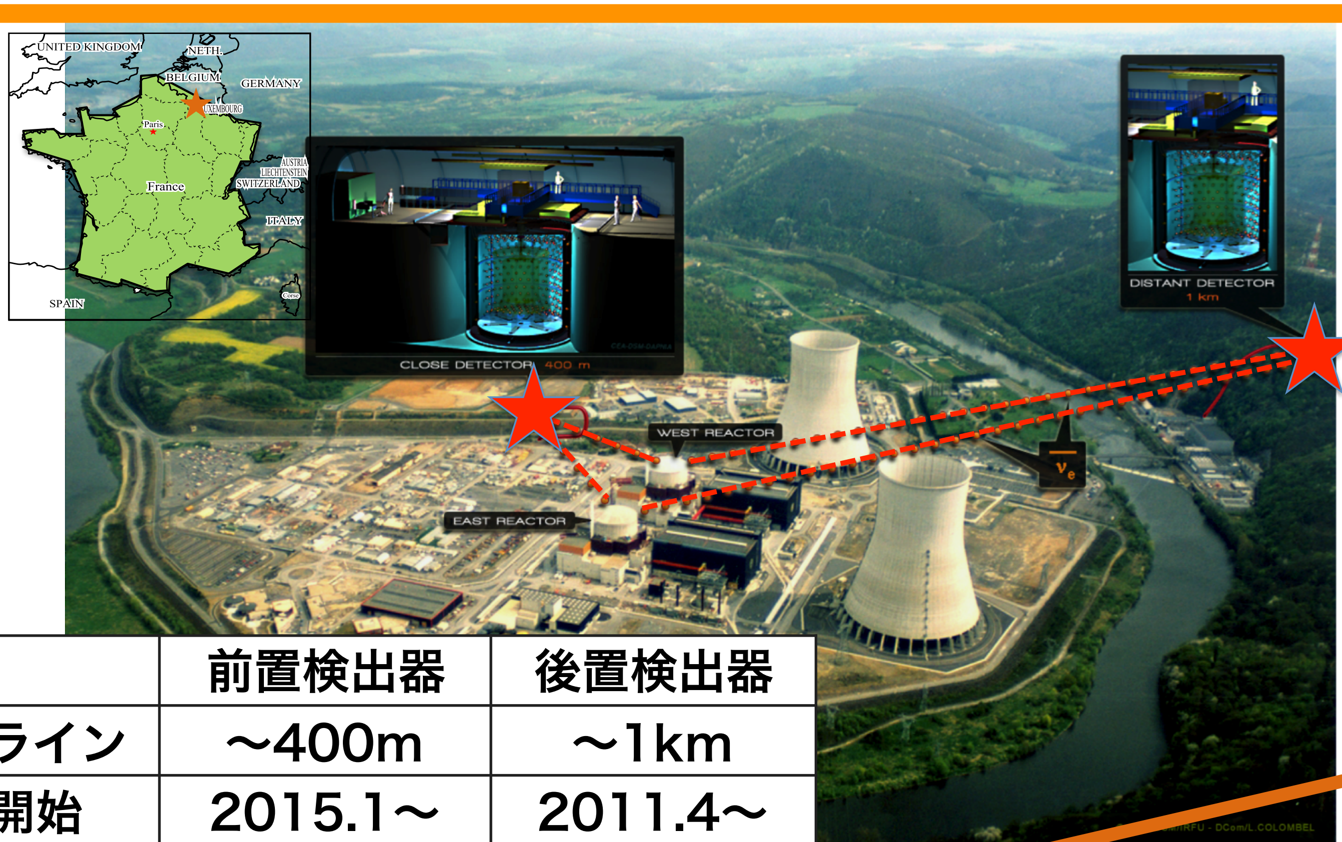
2016/11/29 ニュートリノフロンティア研究会

首都大学東京大学院 理工学研究科
町田 篤志

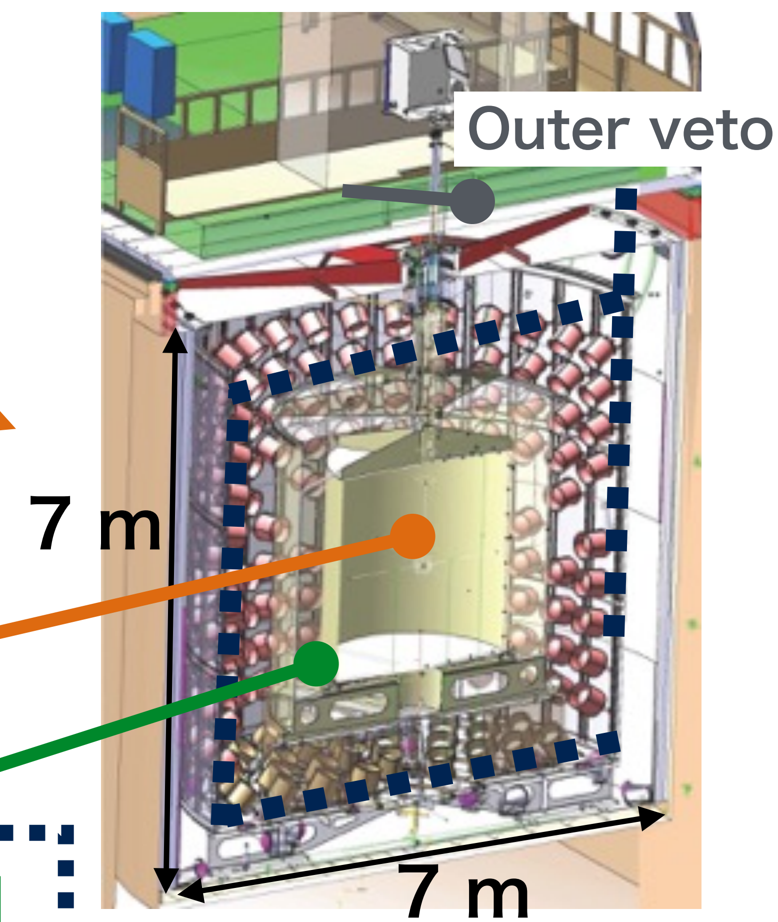
# 研究概要

**本研究の目的**

1. $\theta_{13}$精密測定にはエネルギー応答の理解が重要
   →エネルギー応答の詳細な理解にもとづいた位置依存性の補正による分解能の向上
2. 優れたエネルギー応答を用いたステライルニュートリノ探索感度の見積もり




| | 前置検出器 | 後置検出器 |
|---|---|---|
| ベースライン | ～400m | ～1km |
| 測定開始 | 2015.1～ | 2011.4～ |




**内部検出器 (ID)**

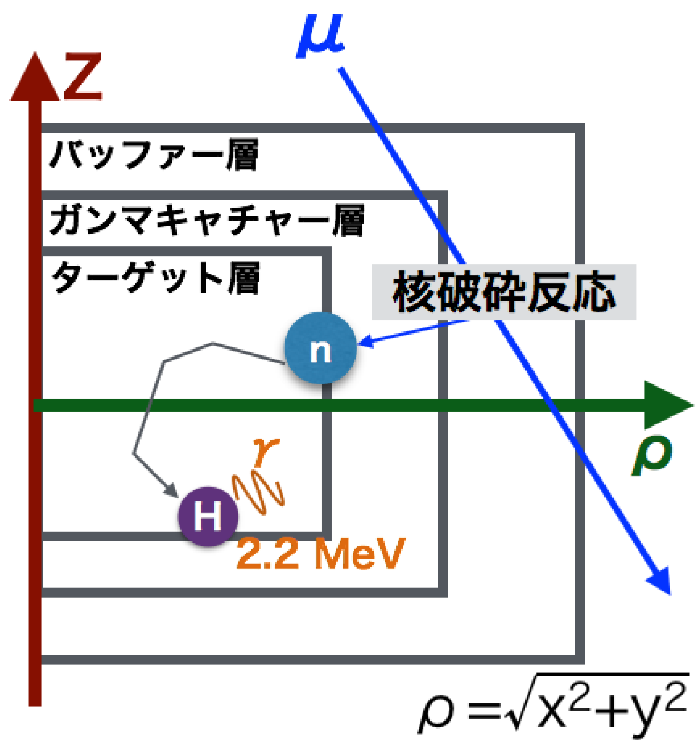
ニュートリノターゲット層(NT)：
Gdを含む液体シンチレータ($10m^3$)

ガンマキャチャー層(GC)：
液体シンチレータ($22m^3$)

バッファー層：ミネラルオイル($110m^3$)と390本のPMT(10 inch)

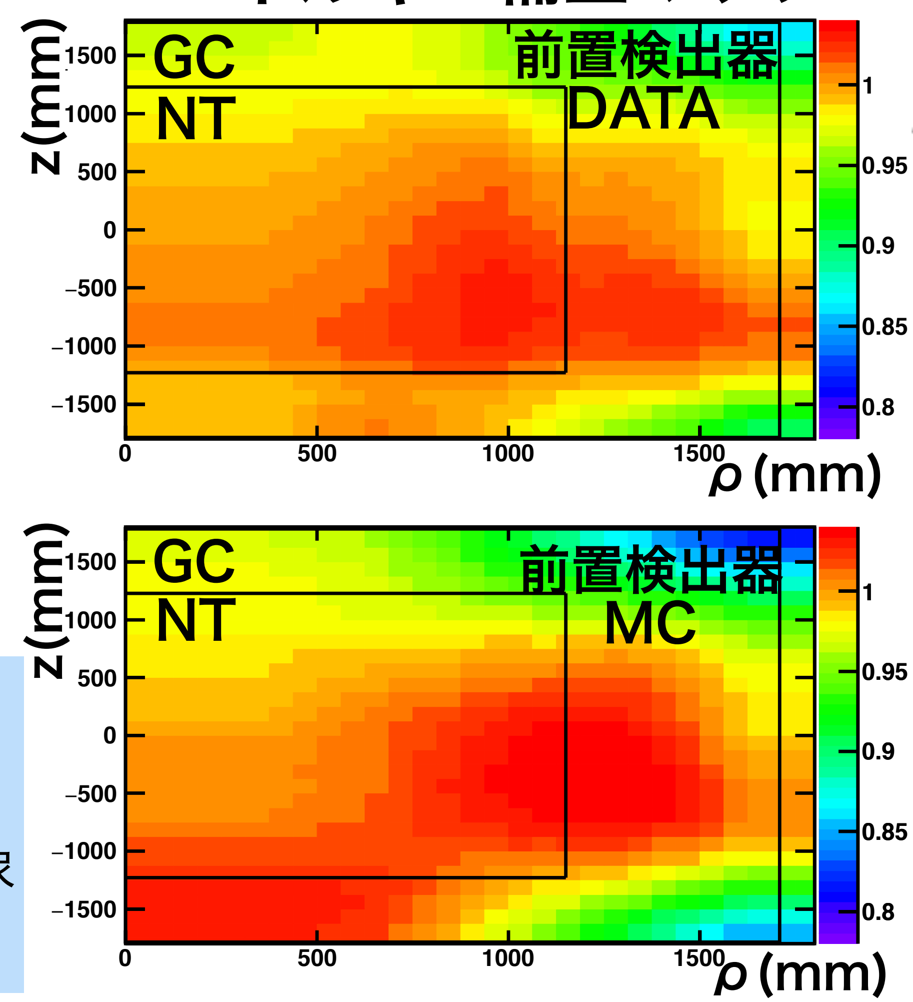
# エネルギー応答の研究

バッファー層に設置された全PMTの光量の総和からエネルギーを再構成
→ 立体角・減衰長・光子の入射角度などによって再構成**エネルギーが事象発生位置に依存**
**→ エネルギー位置依存性を見積もり補正する**

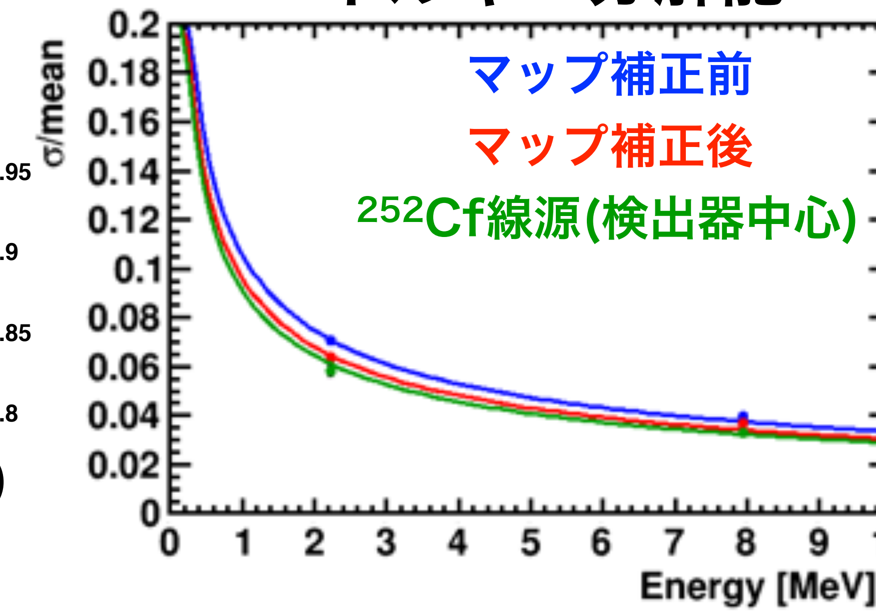



**評価・補正に使用した事象サンプル**
DATAは宇宙線による核破砕反応で生成される中性子の水素での捕獲事象 (2.2 MeV peak) を使用

**エネルギー補正マップ**




**エネルギー分解能**




**エネルギー分解能：**
**補正前10.57%/√E**
→ **補正後9.62%/√E**
**マップ補正により分解能が向上**

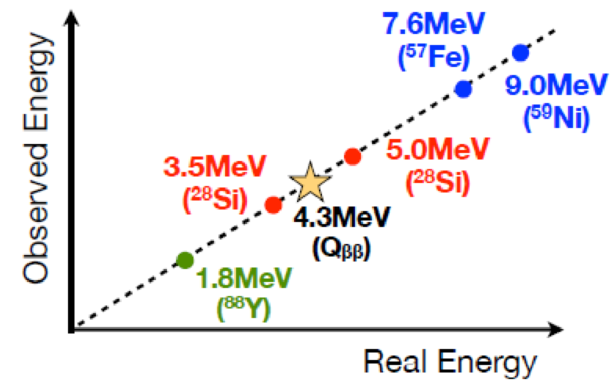
**ポスター発表ではエネルギー位置依存性の原因・線源データの検証・分解能の評価の詳細また、エネルギー分解能を向上させたスペクトル解析によるステライルニュートリノ探索の感度見積もりについて紹介する**

# Energy calibration by means of (n,γ) reaction for CANDLESⅢ+ project

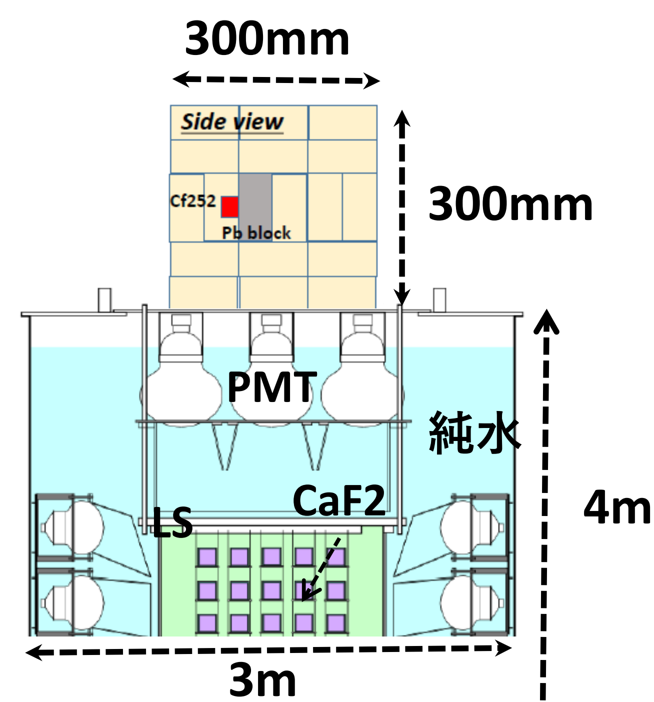
Takaki Ohata Osaka Univ.

- CANDLES実験
  - $^{48}$Caを用いた二重ベータ崩壊実験
  - 非常に稀な現象($T_{1/2}$ ： > $10^{26}$ 年)

  →高エネルギー分解能と線形性を要求



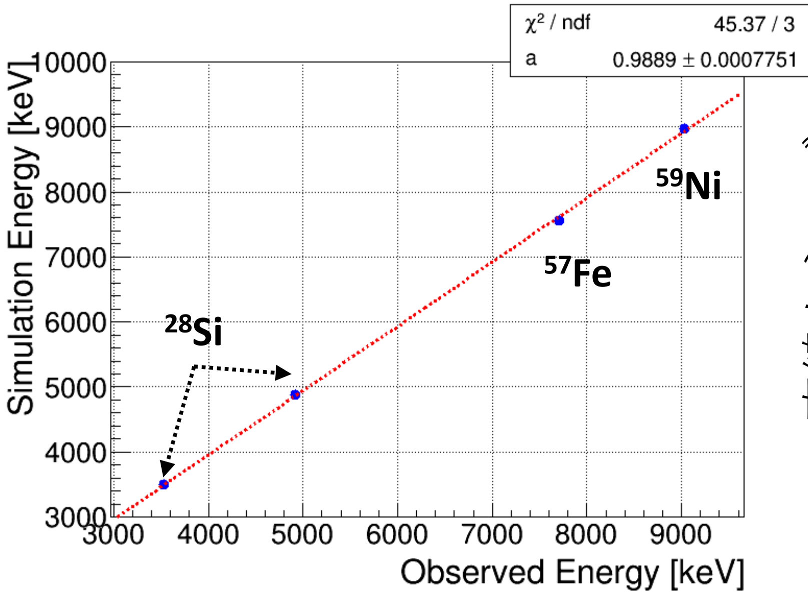

- 中性子捕獲反応を用いた線源開発
  - 人工的に(n,γ)反応を起こすキャリブレーション線源開発を行った

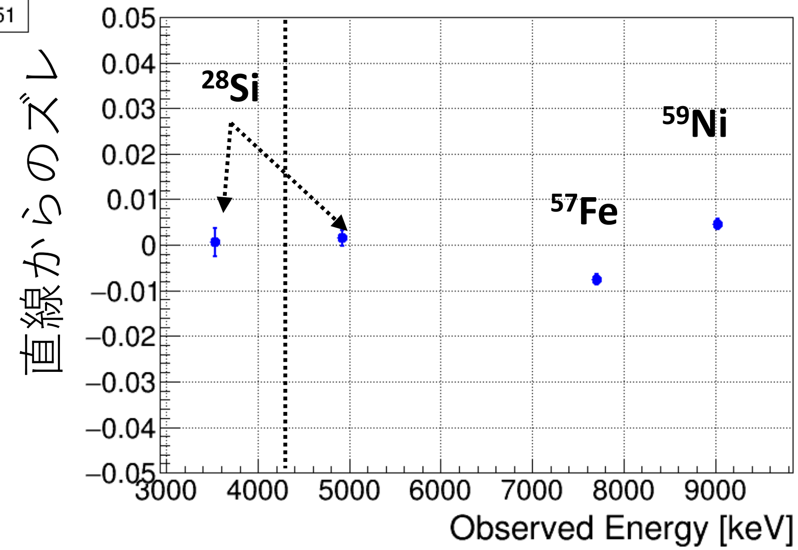


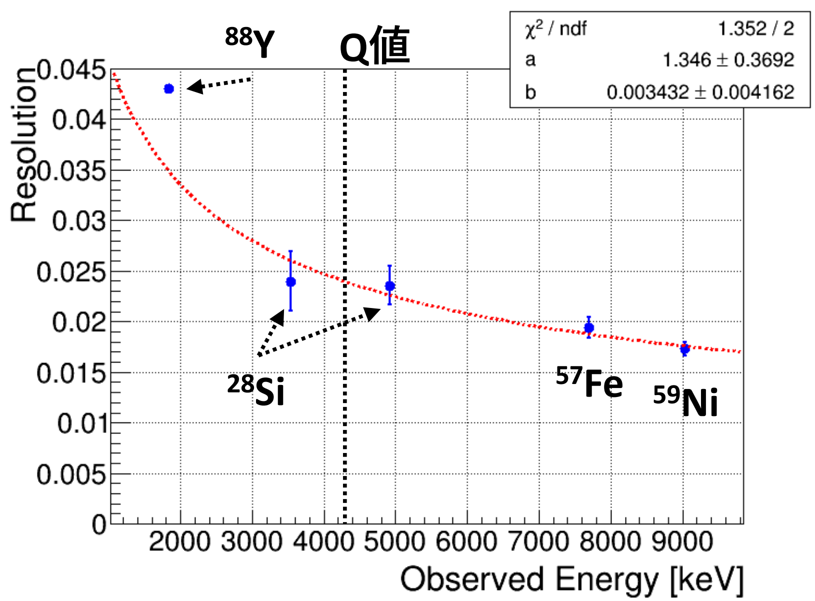

- Si : 3.5, 5.0MeV Q値前後エネルギー
- Ni : 9.0 MeV 最高エネルギー
- Fe : 7.6 MeV 検出器に含まれる

検出器上部設置しエネルギー較正を行う

# エネルギー線形性の確認




データとシミュレーションの比較を行った。

Q値での分解能は~2.3%である。また、線形性は分解能より小さい1%以下で保たれている。

新学術 ニュートリノフロンティア研究会 2016

*Neutrino Frontier Workshop 2016*

<ins>***Quickfire Session***</ins>

# ニュートリノ中性カレント反応精密測定のための核子・酸素原子核反応に関する研究

***Study on Nucleon-$^{16}$O Reaction for the Precise Estimation of Neutrino's Neutral Current Interaction Cross Section***

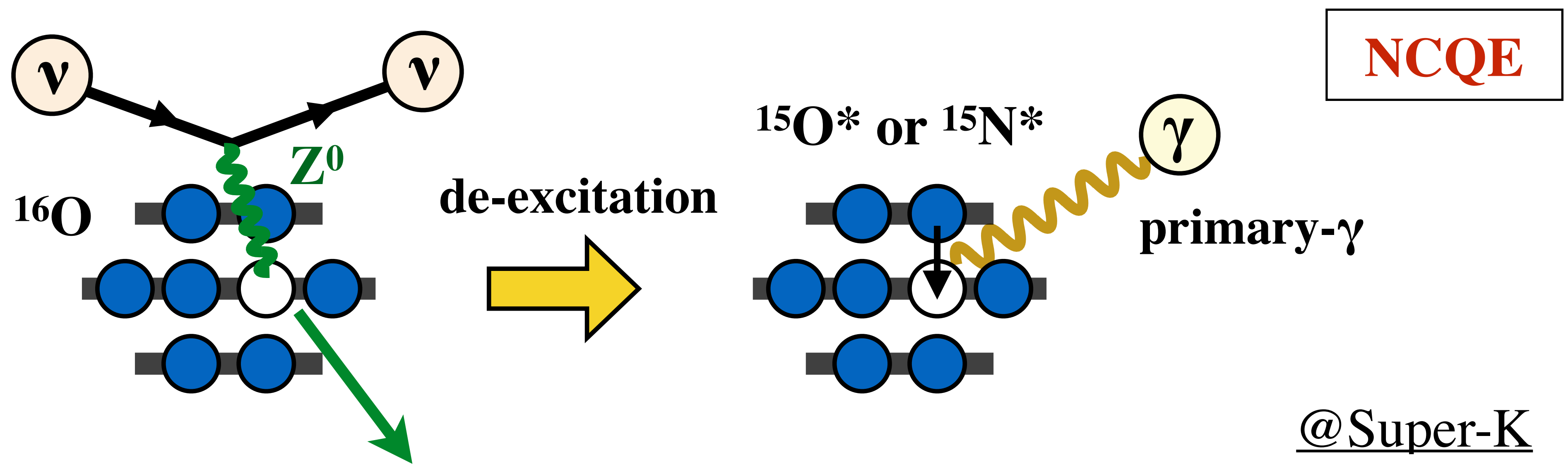

<ins>芦田 洋輔 (Yosuke ASHIDA)</ins>

**京都大学大学院理学研究科**

**高エネルギー物理学研究室**

**(Kyoto University)**


# Neutral Current Quasielastic Interaction

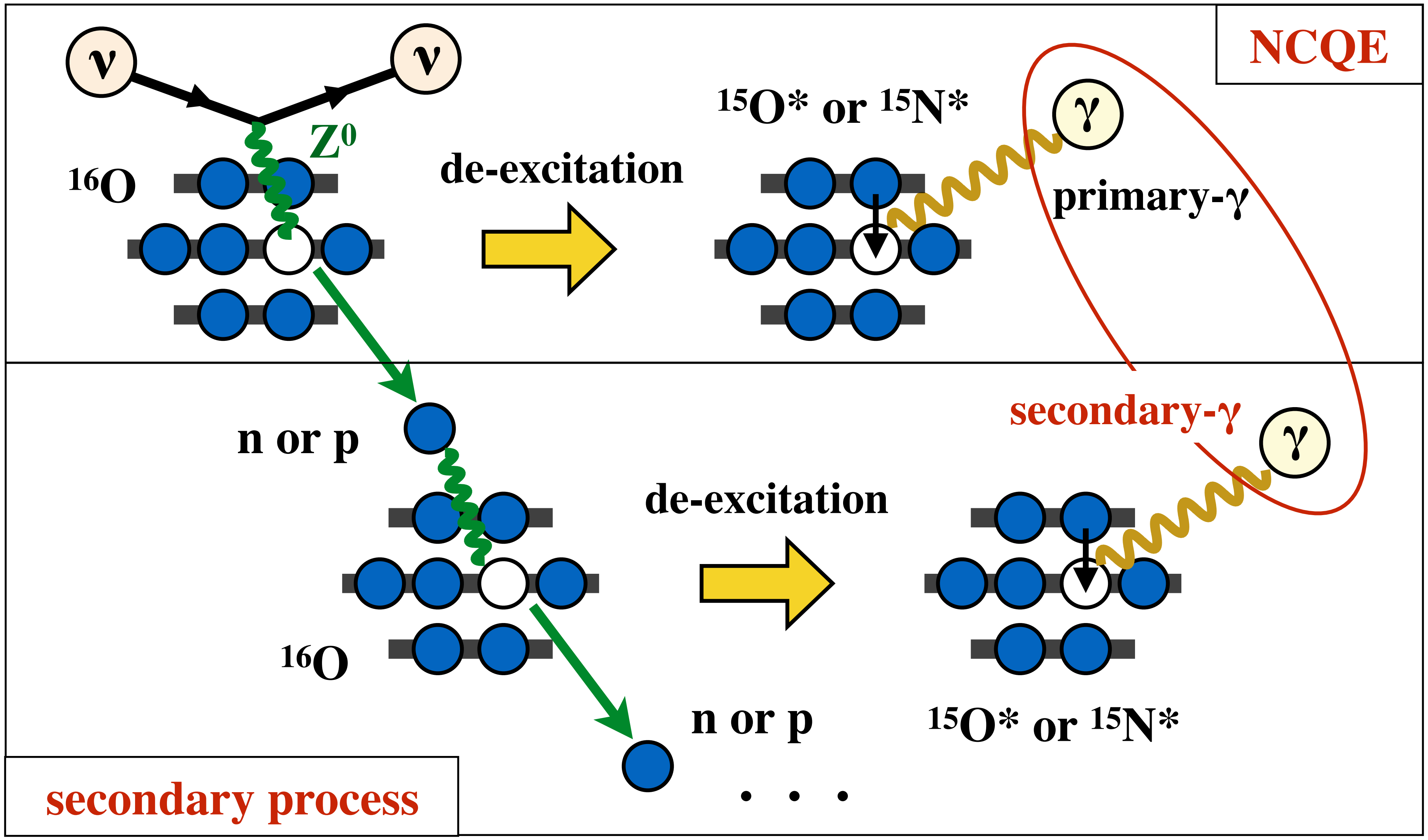



At **Super-K** (and also future **SK-Gd** and **Hyper-K**), **NCQE** events with $^{16}$O of atmospheric neutrinos are one of the main background in …

- **Supernova Relic Neutrino** search (← my largest interest)
- **Proton Decay** and **GUT Monopole** search
- Light **Dark Matter** Search
- **Sterile Neutrino** search

***Precise Measurement is Very Important!!!***

# Secondary-γ Problem




Secondary processes mainly by neutrons are the obstacle in NCQE estimation.

*To pick out and measure just secondary process is our idea!!!*

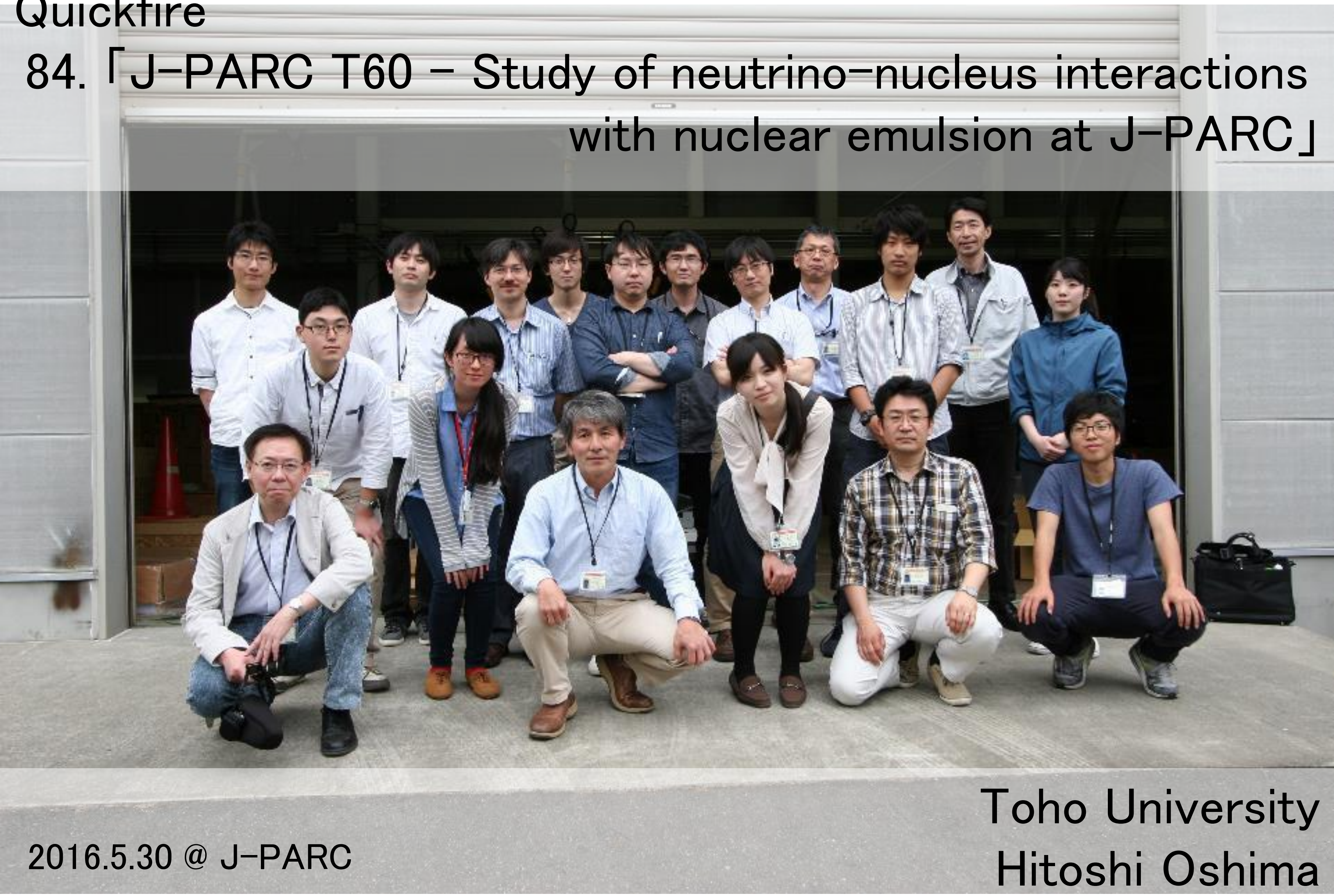
# My Poster is on …

- More detailed descriptions on NCQE interaction and secondary process
- The results from our first pilot experiment (**E465**) at RCNP
- Some plans and discussions for the future


*Please come to my site and let's have discussions!!*

Quickfire

# 84.「J-PARC T60 – Study of neutrino-nucleus interactions with nuclear emulsion at J-PARC」



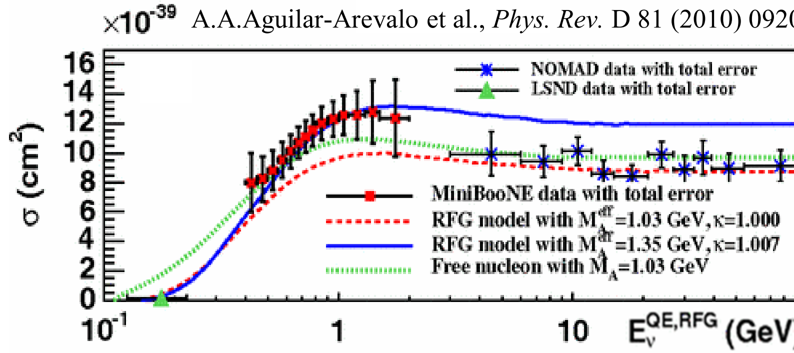

Toho University
Hitoshi Oshima


2016.5.30 @ J-PARC

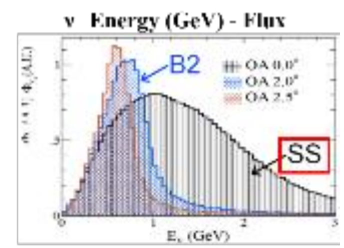
# J-PARC T60 experiment

*→ 11/28 S.Ogawa B01 talk*

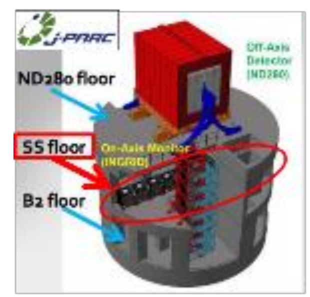
A.A.Aguilar-Arevalo et al., *Phys. Rev.* D 81 (2010) 092005.

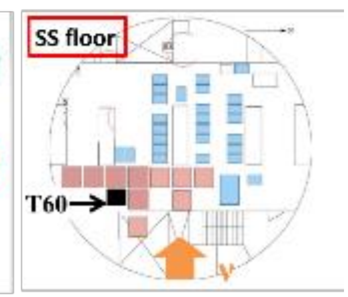


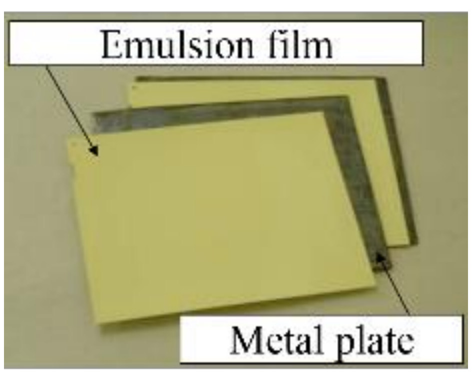

- There are large systematic error in neutrino oscillation measurements. Our understanding of neutrino interaction including nucleus effects are not sufficient at Sub-GeV to Multi-GeV energy region.

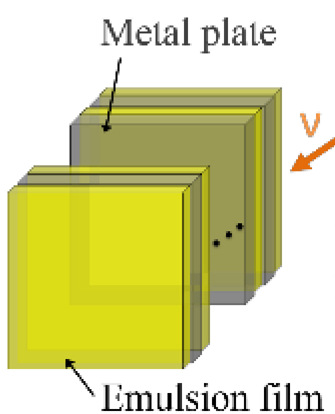


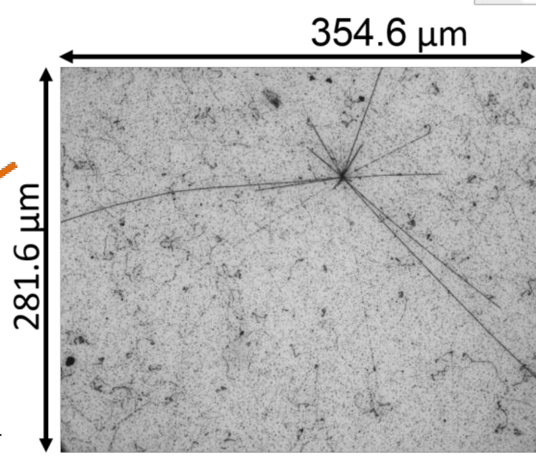

- We T60 group are studying neutrino – nucleus interactions by using nuclear emulsion @ J-PARC. One of our purpose is precise measurement of neutrino cross-section and is to get a precise data of interactions at Sub-GeV to Multi-GeV energy region to reduce the systematic error of neutrino oscillation measurement.



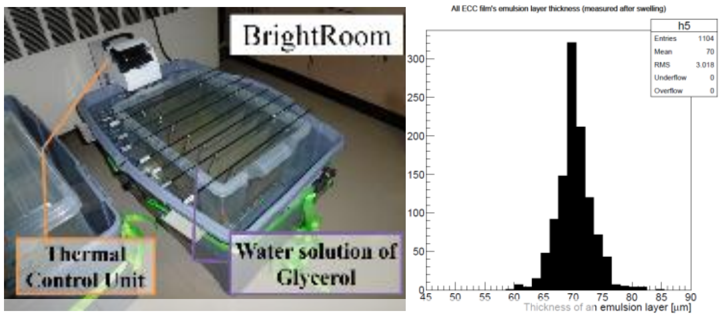




# Poster contents

*T60 Detector Run - 60kg Iron target run -*

- Hardware treatment
  - preparation of nuclear emulsion
  - development, swelling
- Data taking ( Scanning )
  - dead pixel noise rejection
  - adjustment of scanning parameter
  - status
- penetrating (muon) track analysis (very preliminary)

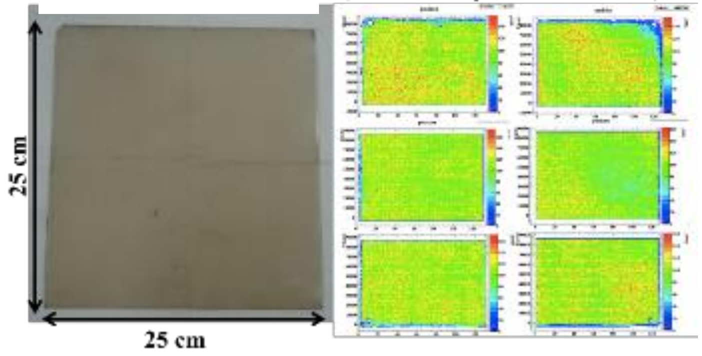
Swelling result



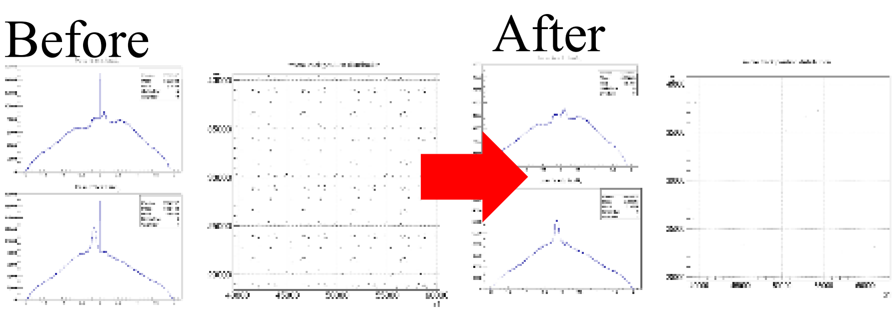

Data taking

Emulsion film

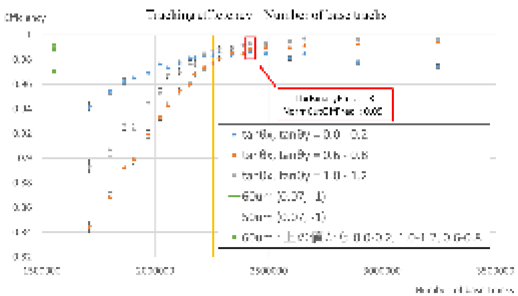
Scanning data Track position (track density ~$10^4$ tracks/cm$^2$)



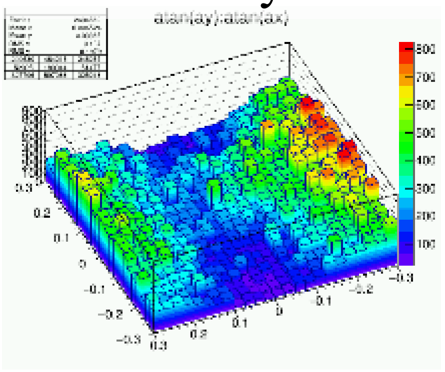

dead pixel noise rejection




Scanning parameter



Muon analysis



# Neutrinoless double beta decay search using nuclear emulsion detector

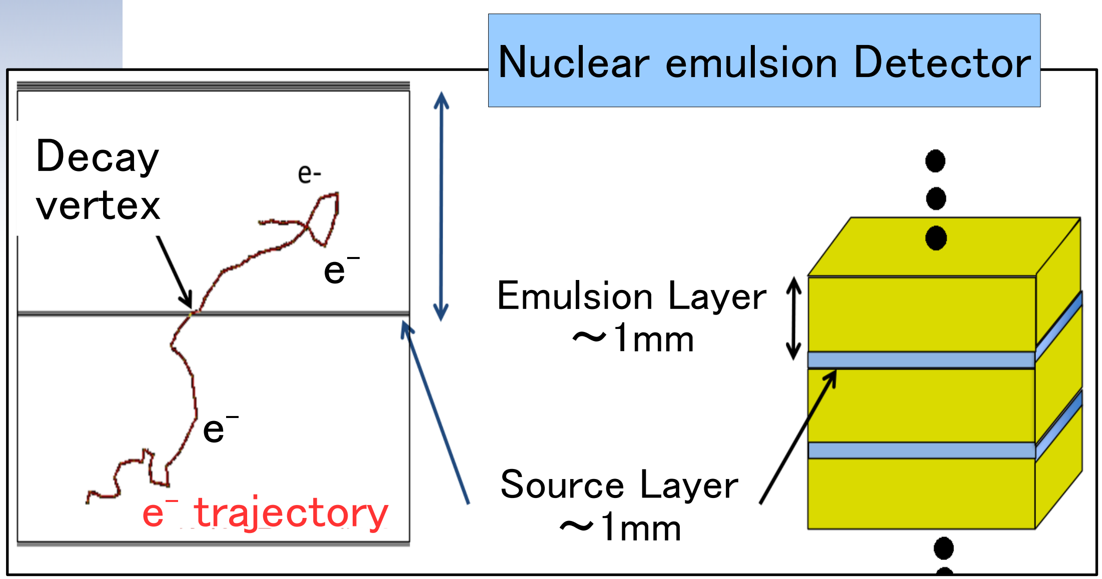
Neutrino frontier workshop 2016

Dai Hamabe
Tokyo Institute of technology

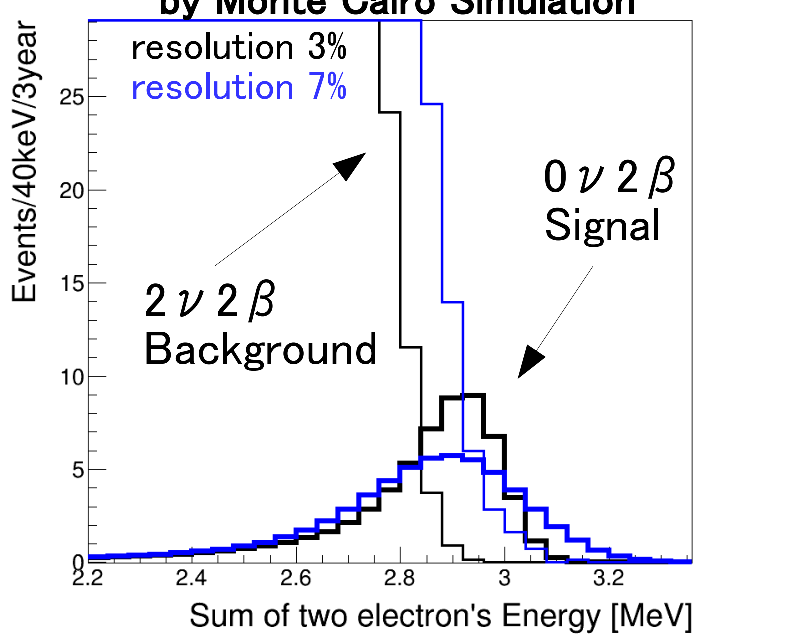
16/11/29

# Nuclear emulsion detector

- <u>Nuclear emulsion　: Photographic film to observe the trajectory of charged particles</u>
- <u>Use of emulsion technology for $0\nu 2\beta$ search</u>
  - Emulsion layer + $^{82}$Se layer
  - Search for events with two electrons emitted from same vertex
  - Distinction between Signal and background
    Use difference in total energy distribution of two electrons

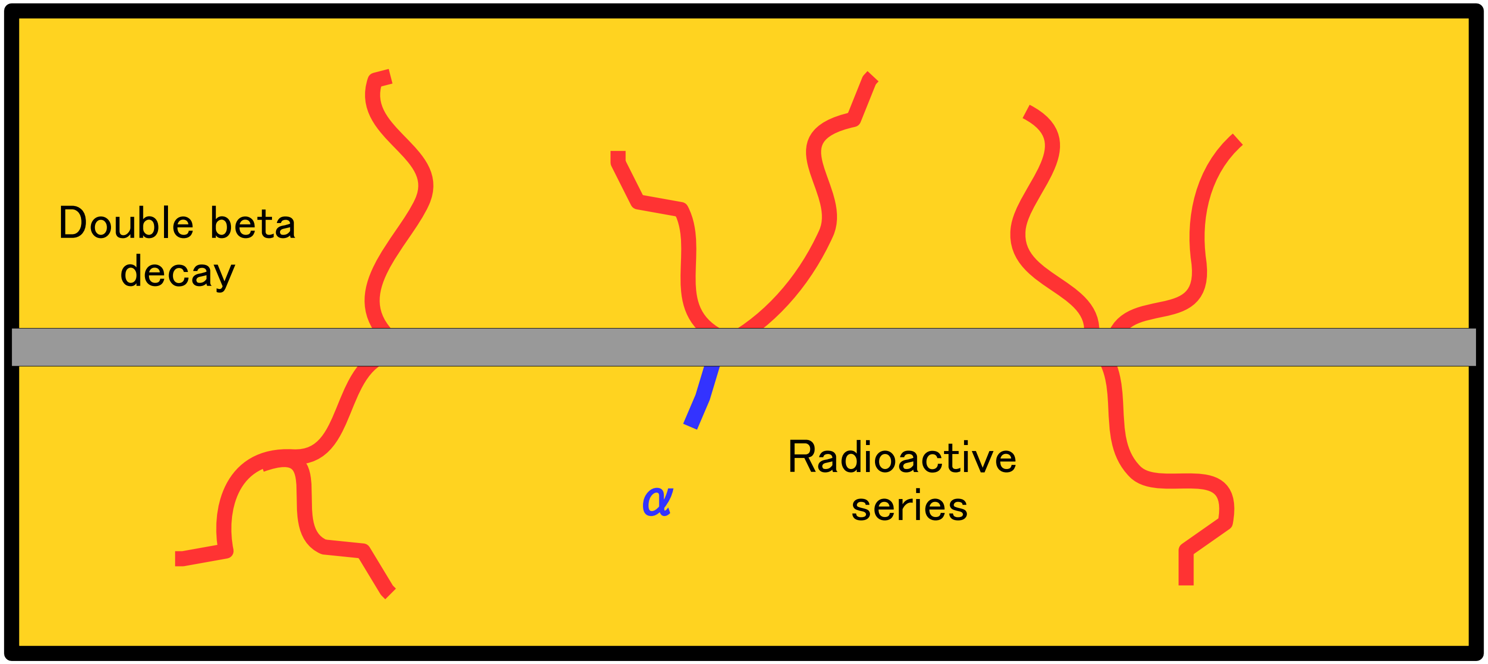



Total energy distribution of two electrons
**by Monte Calro Simulation**



# Backgrounds

- Double beta decay ($2\nu 2\beta$)
  → Energy resolution : energy reconstruction using trajctries
- Radioactive series ( $^{238}U$ , $^{235}U$ , $^{232}Th$ )
  → Tracking and e/$\alpha$ identification
- In the poster, I estimate energy resolution and evaluate the sensitivity to effective Majorana mass **by Monte Carlo simulation**



# *Web applications of the online DAQ system for the Double Chooz experiment*


**Michiru Kaneda**

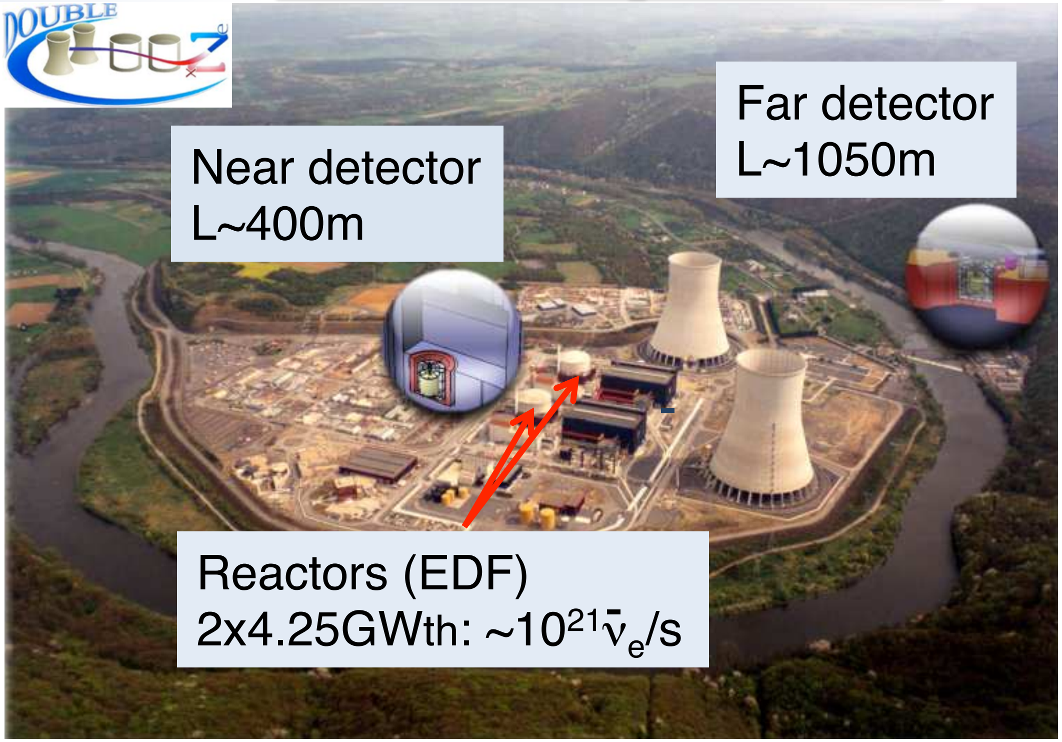
*Tokyo Institute of Technology*

**On behalf of the Double Chooz Collaboration**


29/Nov/2016

新学術領域研究「ニュートリノフロンティアの融合と進化」研究会 2016 @ 加賀

# Double Chooz

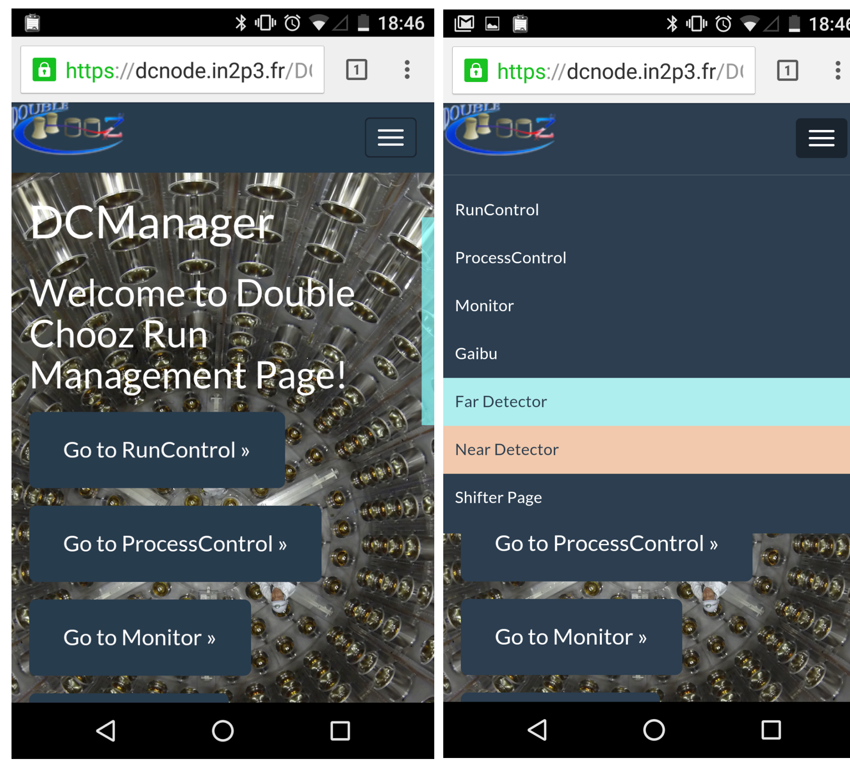



- The reactor neutrino experiment at Chooz, France.
- The main purpose is to measure mixing angle $\theta_{13}$.
- Detectors placed in the power plant, not a scientific laboratory.
  - → Normally no physicist is on site.
  - → A remote control system is important.

# Web Based Application

- No special tools are needed, only browser.
- Easy to provide applications for smart phones/tablet.
- Based on Open Source Software.


PC View




Smart Phone View

# WebSocket

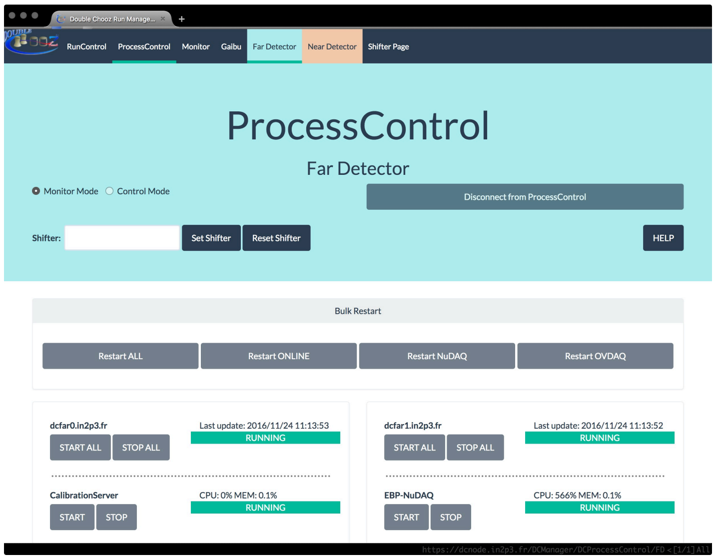
- New generation protocol of full-duplex communication, especially for web server/browser.
  →Real-time communication.
  →Small resources, faster communication.
- Most of recent browsers, including browsers for smart phones, support it.

| IE | Edge * | Firefox | Chrome | Safari | Opera | iOS Safari * | Opera Mini * | Android Browser * | Chrome for Android |
|---|---|---|---|---|---|---|---|---|---|
| | | | 49 | | | | | 4.4 | |
| 8 | 13 | 47 | 51 | | | 9.2 | | 4.4.4 | |
| 11 | 14 | 48 | 52 | 9.1 | 39 | 9.3 | all | 51 | 51 |
| | | 49 | 53 | 10 | 40 | | | | |
| | | 50 | 54 | TP | 41 | | | | |
| | | 51 | 55 | | | | | | |

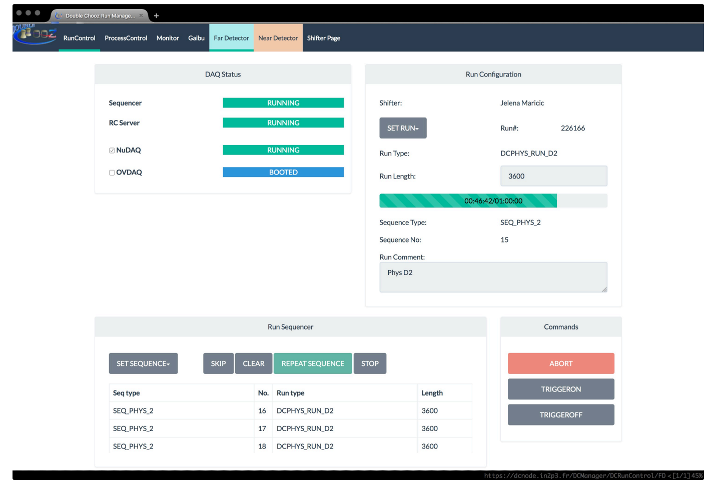
http://caniuse.com/#feat=websockets

# Double Chooz Applications

## ProcessControl

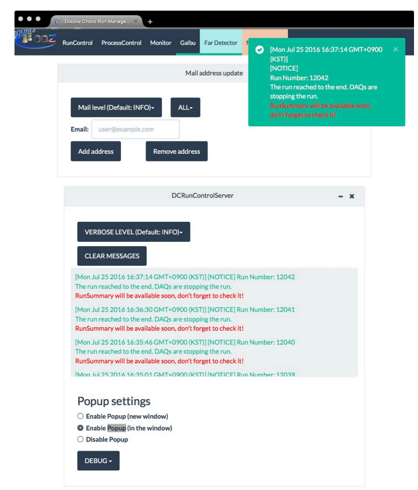



## RunControl




## Monitor


## Gaibu (Messenger)



# ニュートリノ物理のための中性子・酸素原子核反応からのガンマ線測定

岡山大学・自然科学研究科
博士課程前期２年

永田　寛貴

新学術領域研究
「ニュートリノフロンティアの融合と進化」研究会2016
@ 山代温泉

# 1 Self-introduction

PRESENTATION


- 住処：晴れの国おかやま（Okayama）

- 所属：岡山大学自然科学研究科
  博士課程前期２年

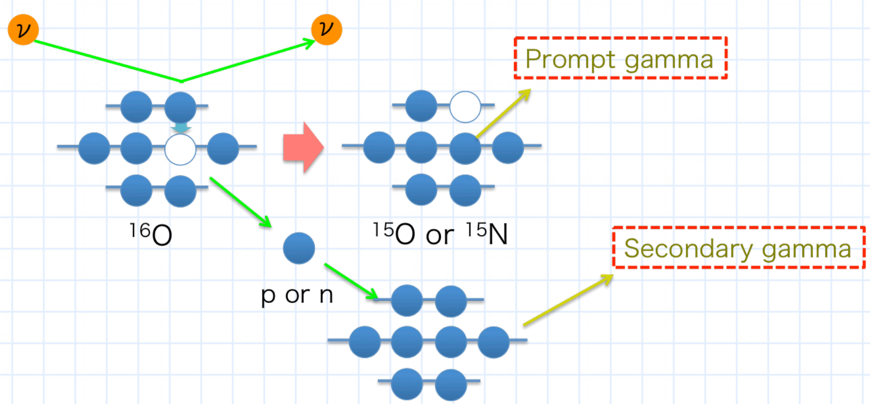
- 趣味：ツーリング・バリスタ・マジック…
  ほかにも色々と

- 研究テーマ：
  中性子・酸素原子核反応からの
  脱励起ガンマ線の測定

# 2 Research theme

PRESENTATION

✓ 研究テーマ

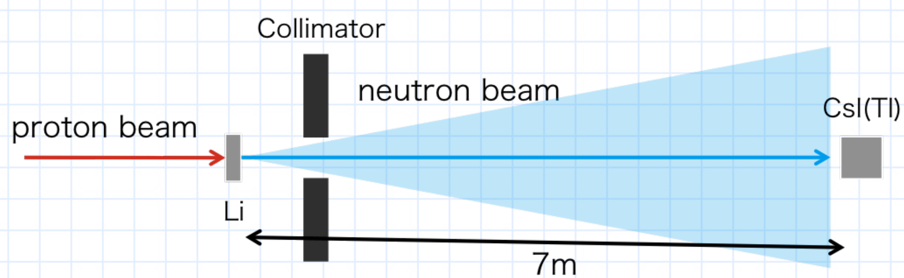


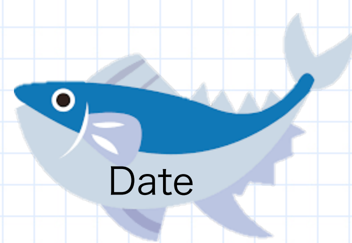

T2K実験では
ニュートリノと酸素原子核との
NCQE反応断面積が測定された
しかし、未だ不定性が大きい…

「二次ガンマ線」が不定性の大きな原因
この「二次ガンマ線」を測定することで
不定性を削減する

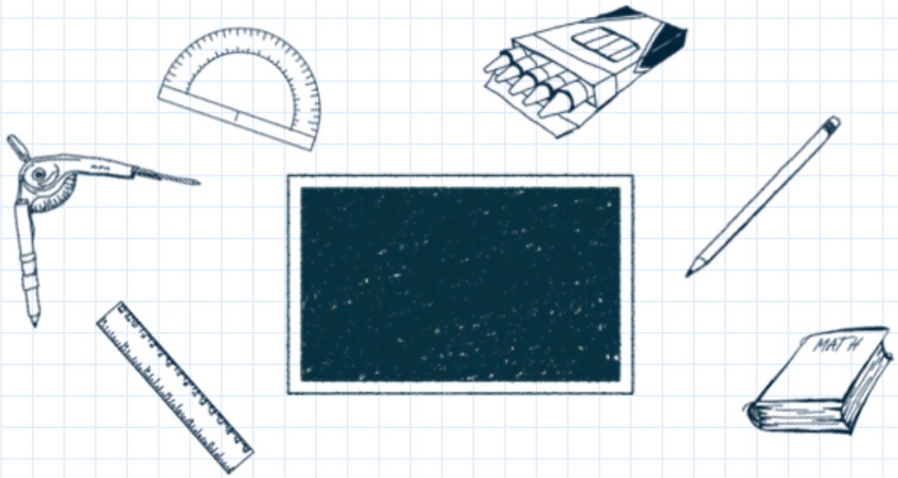
✓ 今回のポスターでは…

2016/11/17~ 東北大学 CYRICで実験




とれたてピチピチのデータを
紹介します！




# Thank you your watching !

Find more on the poster!