Introduction of my past activity

Oct. 13 2017 (Journal Club)

Carrier

- Under Graduate Student

  -- Mainly , , , theory of elementary particles.

- Graduate Student (Master/Doctoral course)

  -- Experimental High energy Astro-Particle Physics

  -- CANGAROO-III project

- Post Doctor

  -- Experimental Nuclear-Hadron Physics

  -- J-PARC nuclear/hadron experiments. E19/E10/E07 are main experiments for me.

- Post Doctor (IHEP) -- now

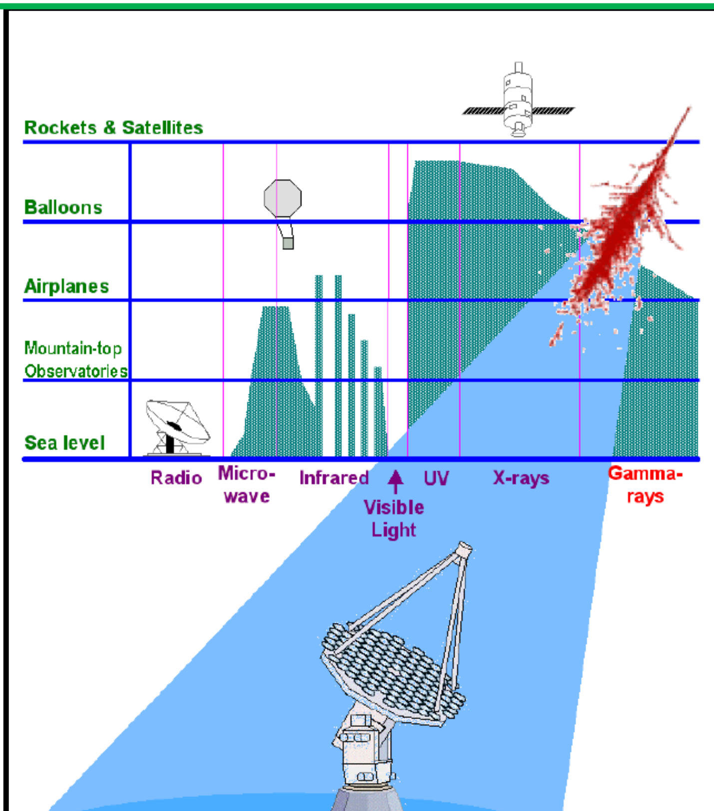
  -- Experimental Particle Physics

  -- BES-III/CEPC

CANGAROO-III

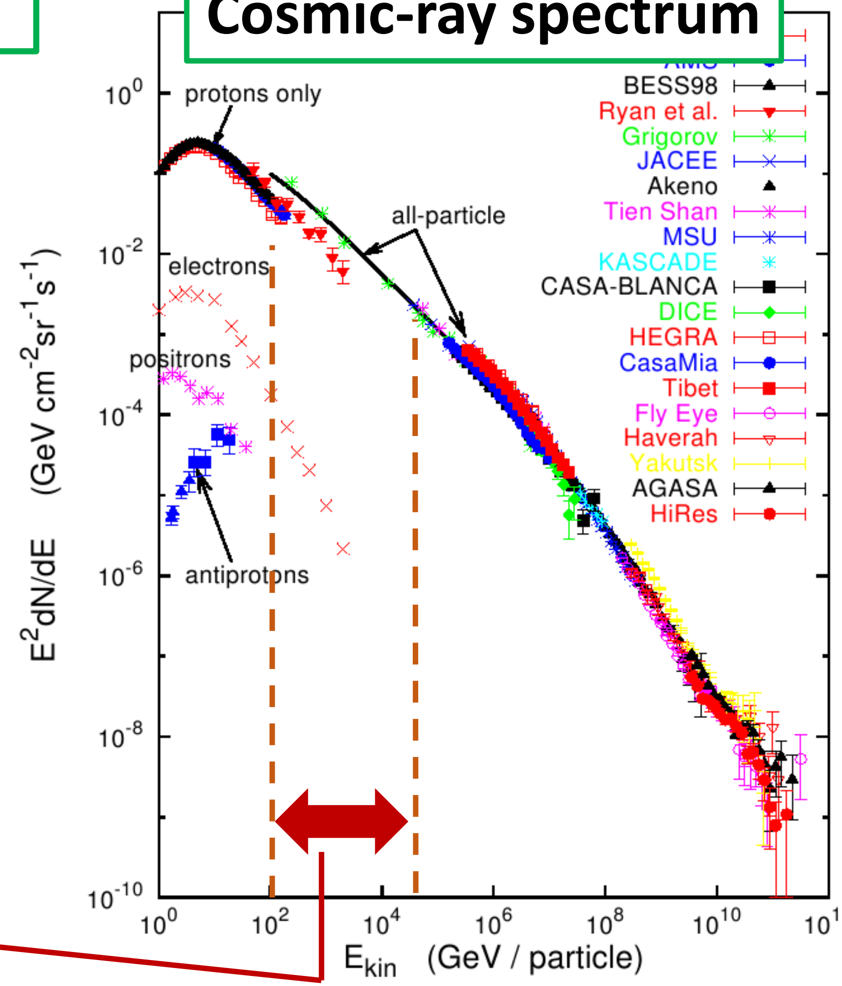
-- participated in CANGAROO-III project (Astroparticle Physics)

Imaging **A**tmospheric **C**herenkov **T**elescope



Detect sub-TeV ~ several tens of TeV γ-rays from Cherenkov light

Cosmic-ray spectrum



To search which types of celestial objects emit high-energy γ-ray

To explore what kinds of mechanism act on

Observed TeV gamma-ray emission

[天体の個数]

超新星残骸 7個

パルサー星雲 18個

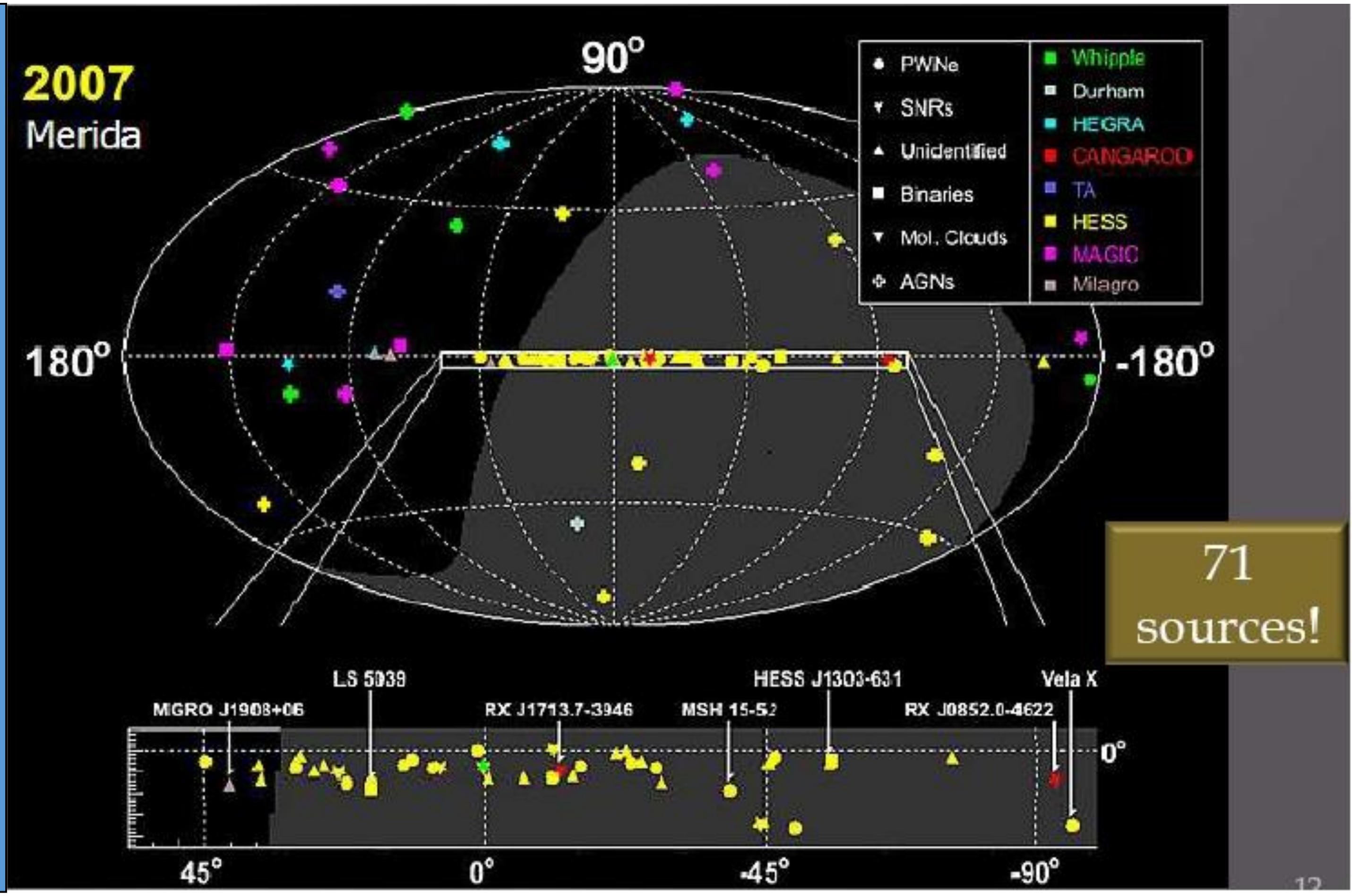
連星系 4個

Diffuse成分 2個

銀河中心 1個

活動銀河 19個

未同定天体 21個



71 sources!

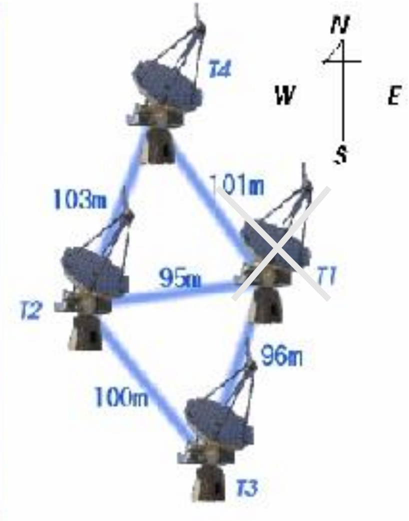
no cluster of galaxies !

J. Hinton, ICRC2007

CANGAROO-III

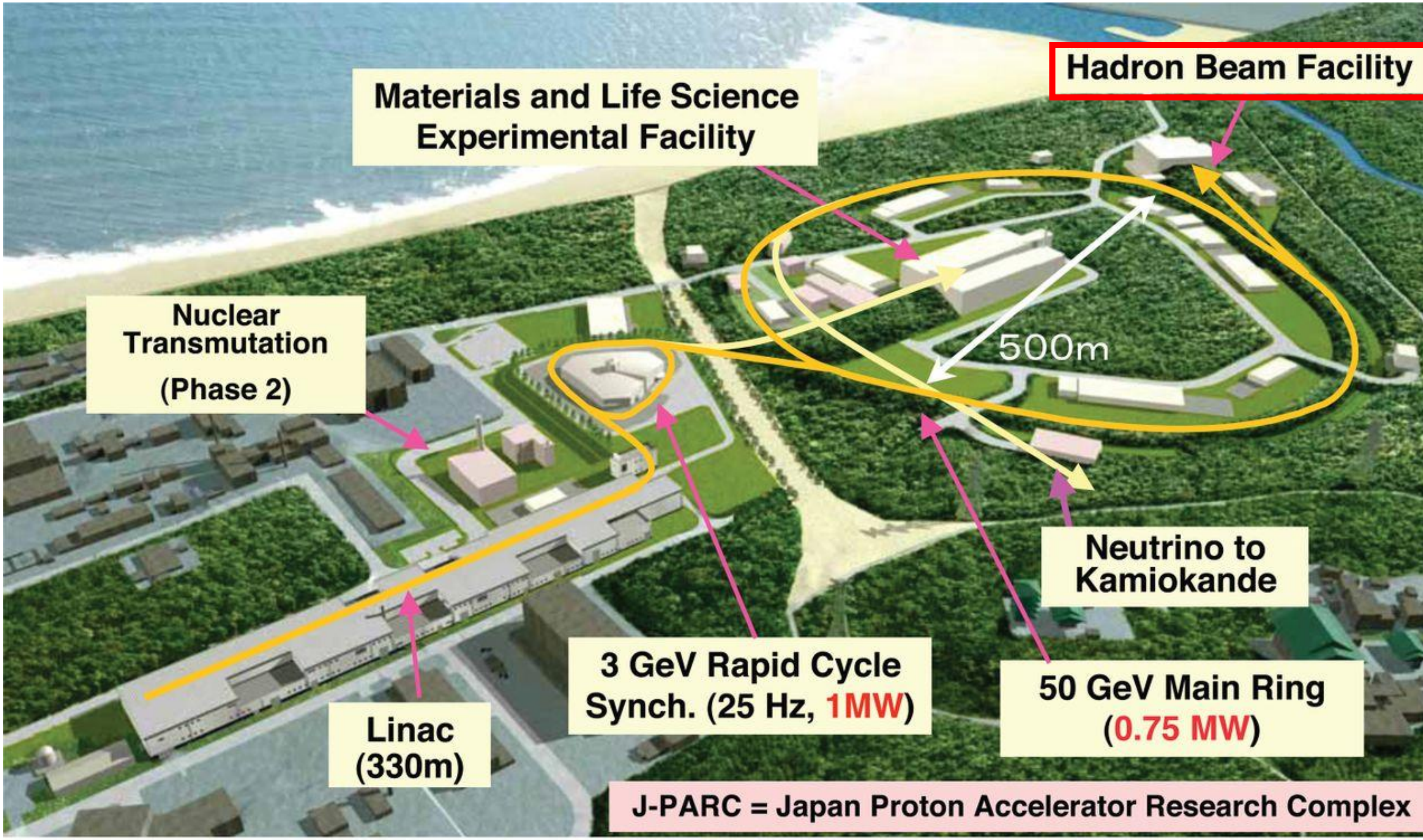
Collaboration of Australia and Nippon (Japan) for a GAmma Ray Observatory in the Outback

- Atmospheric Imaging Cherenkov
- Site is located at Australia
- I visited there (maybe) 2~3 months per year



J-PARC

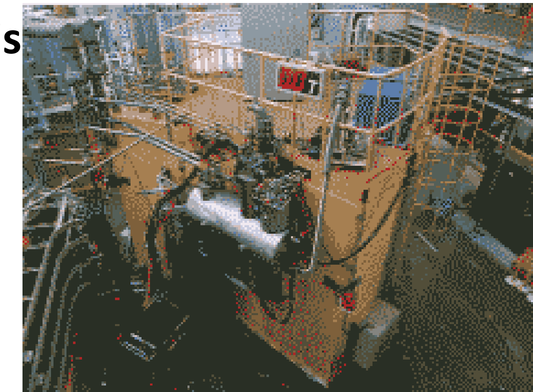
I worked at J-PARC nuclear-hadron experiments, search for new (exotic) hypernuclei, to study the Y-N interactions

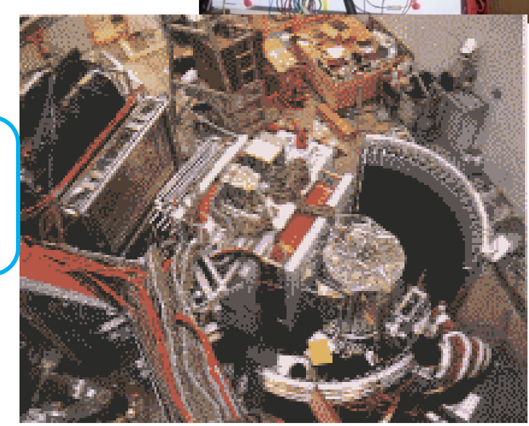


Operation of the Main Ring starts from 2008 ~


黒龙江
哈尔滨市
长春市
吉林
沈阳市
辽宁
ウラジオストク
Владивосток
北京市
天津市
大连市
北朝鮮
평양
서울
大韓民国
대구
부산
광주
제주
烟台市
济南市
青岛市
江苏
南京市
上海市
杭州市
札幌
函館
仙台
新潟
日本
東京
横浜
名古屋
京都
大阪
広島
北九州
福岡
熊本
J-PARC

Participated Experiments @ K1.8 area

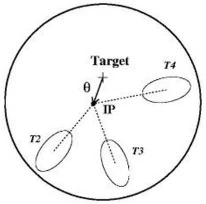




First experiment@K1.8, setup/beam tuning/(initial)physics analysis

- **E19** *High-resolution Search for Θ^+ Pentaquark in $\pi^- p \rightarrow K^- X$ Reactions* (π^-、K^-)
- **E27** *Nuclear $\bar{K}$ bound state($K^- pp$) in the $d(\pi^+, K^+)$*
- **E10** *Production of Neutron-Rich Λ-Hypernuclei with the Double Charge-Exchange Reactions* (π^-、K^+)
- **E13** *Gamma-ray spectroscopy of light hypernuclei* (K^-、π^-)
- **E05** *Spectroscopic Study of Ξ-Hypernucleus ${}_{\Xi}{}^{12}Be$, via the ${}^{12}C(K^-, K^+)$ Reaction* (K^-、K^+)
- **E07** *Systematic Study of Double Strangeness System with an Emulsion-Counter Method* (K^-、K^+)

I worked for development of SSDs

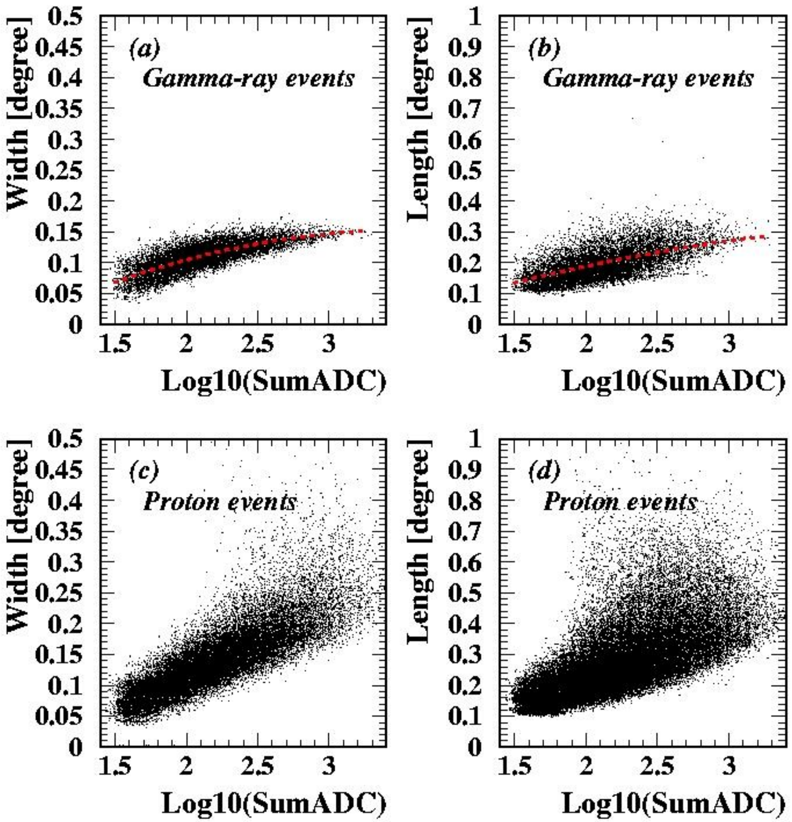


Data Analysis @ CANGAROO-III

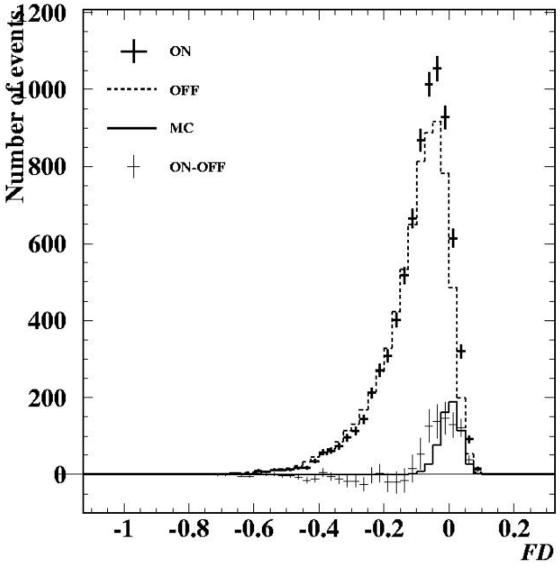
-- "Fortran/C" & "Cern Library (Paw)"

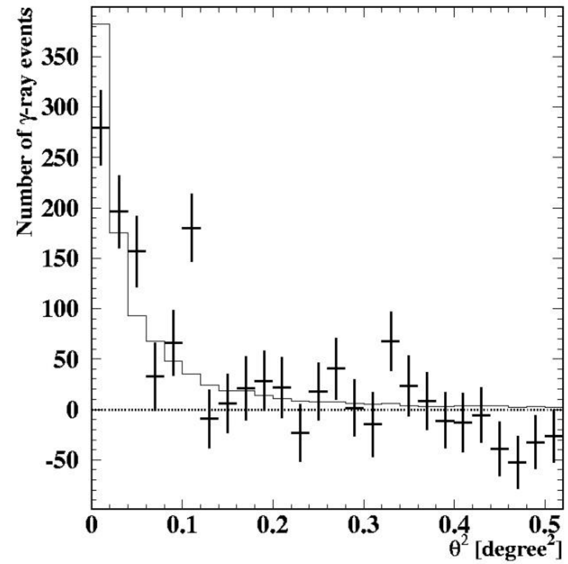
-- Involving in introducing "Fisher Discriminant method" for C-III analysis.

-- Using "Condor System" for batch job



example of "Crab pulsar"





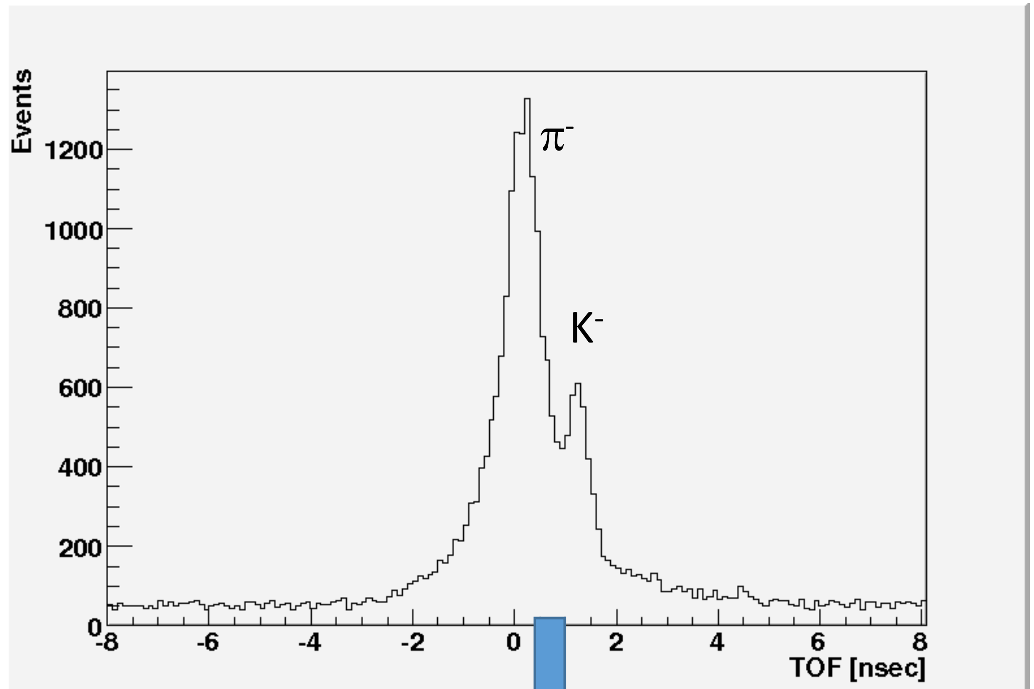
Data Analysis @ J-PARC hadron experiments

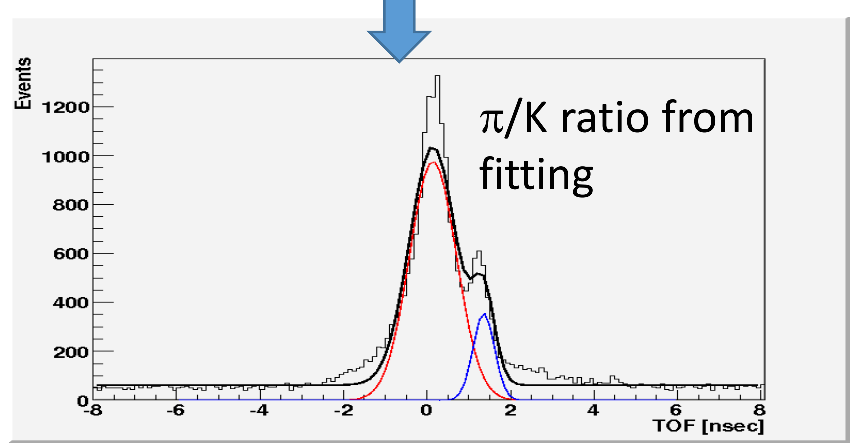
-- C++ & ROOT

-- Learn particle tracking etc.

-- Mainly evaluation of the detector performance

First K$^-$ distribution @ K1.8 beamline





<u>Condition</u>

- IFH : ±130 (Full open)
- IFV : 0 ~ 4
- Mom : ±180 (Full open)
- MS1 : ±2.35
- MS2 : ±2.5
- ESS #1,2: ±200kV

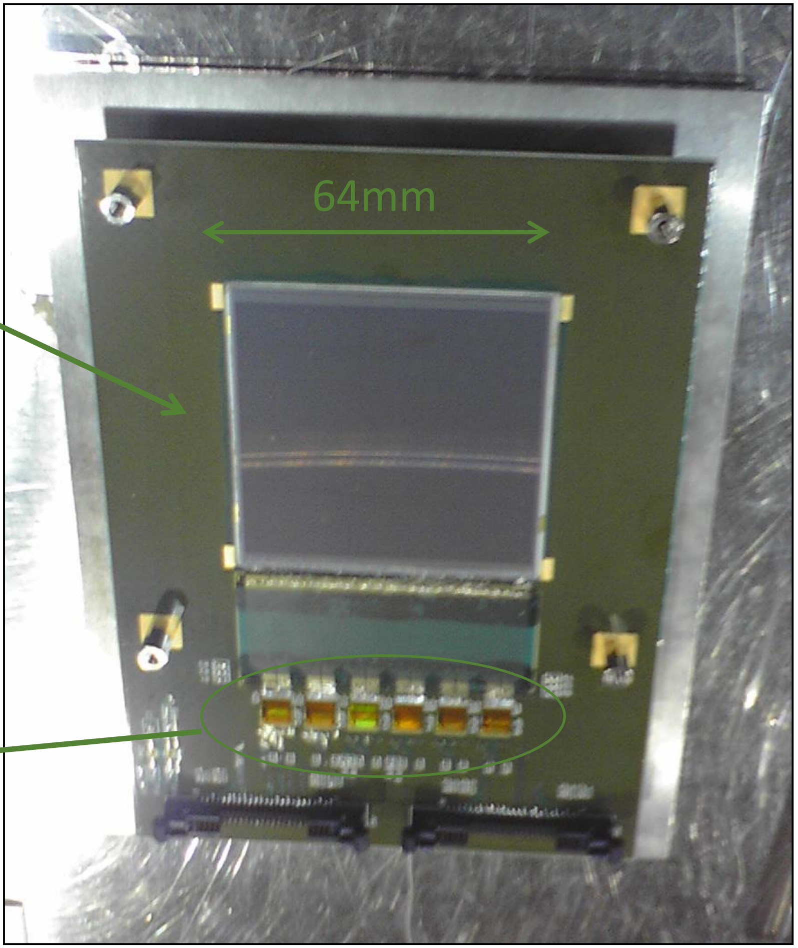
<u>MR Intensity</u>

2.5×10^{12} ppp

SSD used at E10 experiments

We have developed SSDs as a tracking detector under high intensity beam, and this detector is a first step for us!

- (Single Side) Silicon Strip Detector
  - -- developed 2009~2012
- Sensor
  - -- ATLAS sensor
  - -- Strip : 768ch , 80μm pitch
  - -- effective area 64mm
  - -- radiation tolerance >3*10^{14}
  - -- (typical operation voltage) ~ +80V

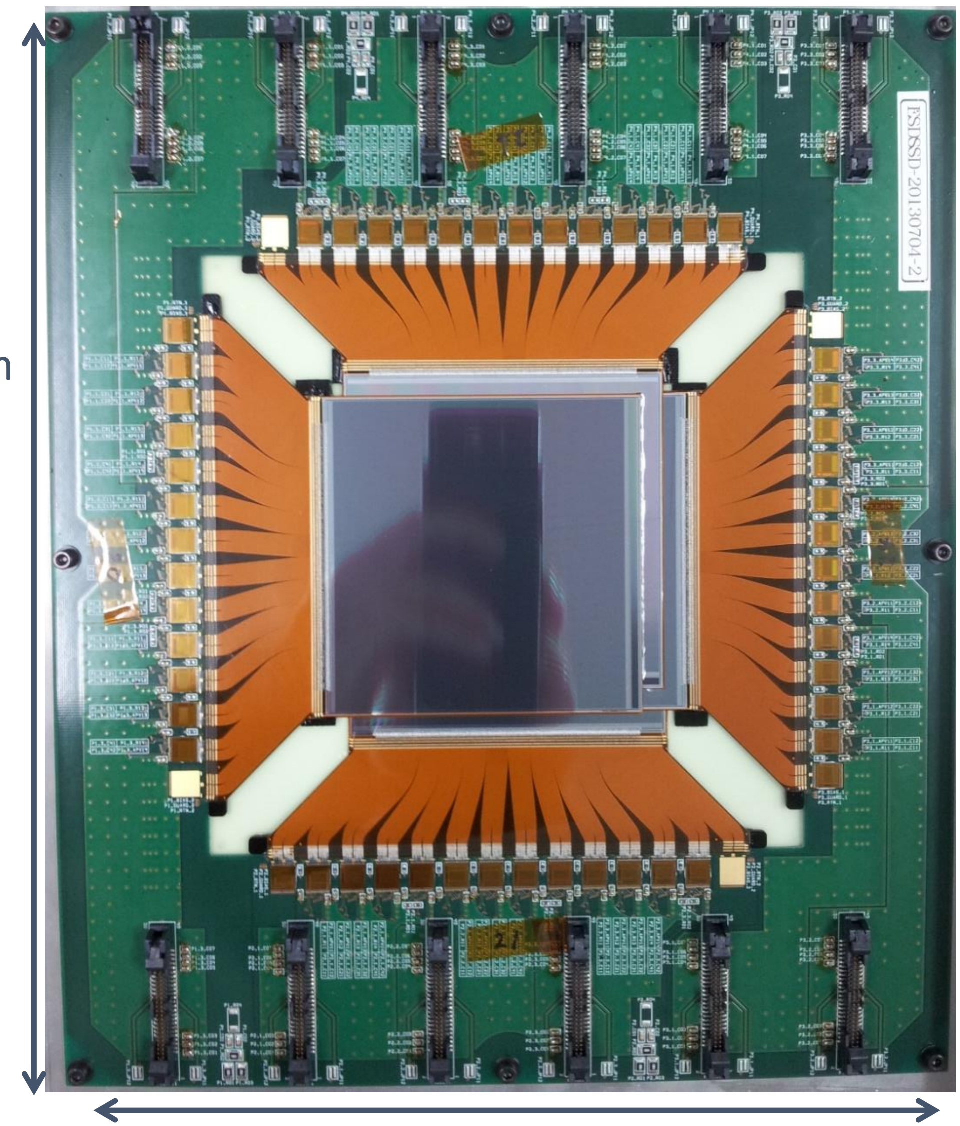


- Readout chip
  - -- APV25-s1 chip (developed by CMS)
  - -- Each chip has 128 ch of pre-amp and shaper and use serial transfer by a multiplexer

SSD Board (E07 sensor)

- Single-sided silicon strip detector
- Composition : ***X-Y-X-Y (4 layers)***
- Strip Pitch 50 μm
- Number of strips : 1536 ch
- Effective area ~ 76 x 76 mm^2
 (where all 4 layers cover)
- Operation bias voltage : ~ 80 V
- Readout chip : APV25-s1

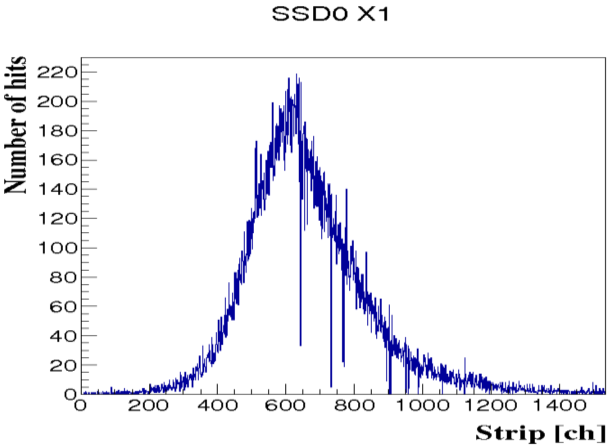
 (the same as the E10 SSD)

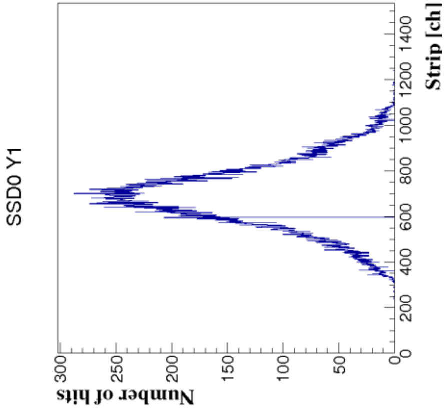


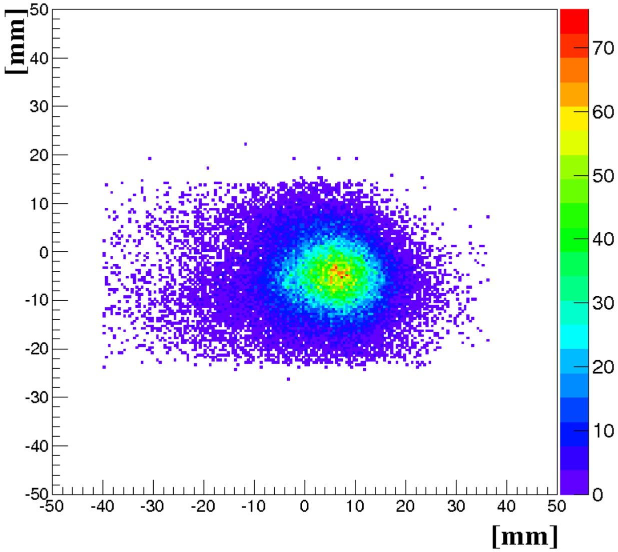
From E07 beam exposure (June 2016)

We have successfully installed & operated the silicon detectors !

2D Beam profile reconstructed from the SSD data







Test Beam exposure of the detectors

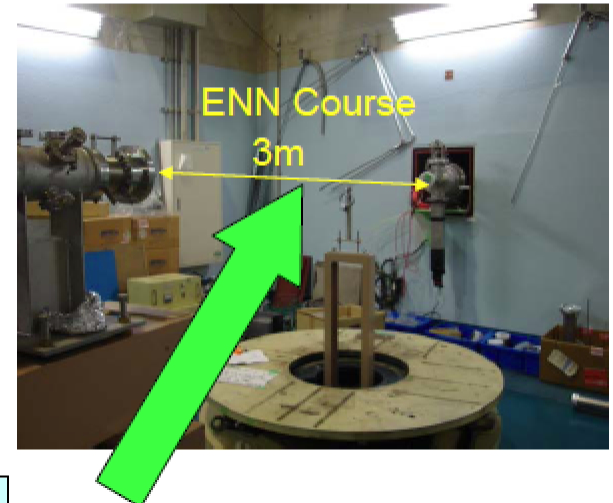
Experimental setup

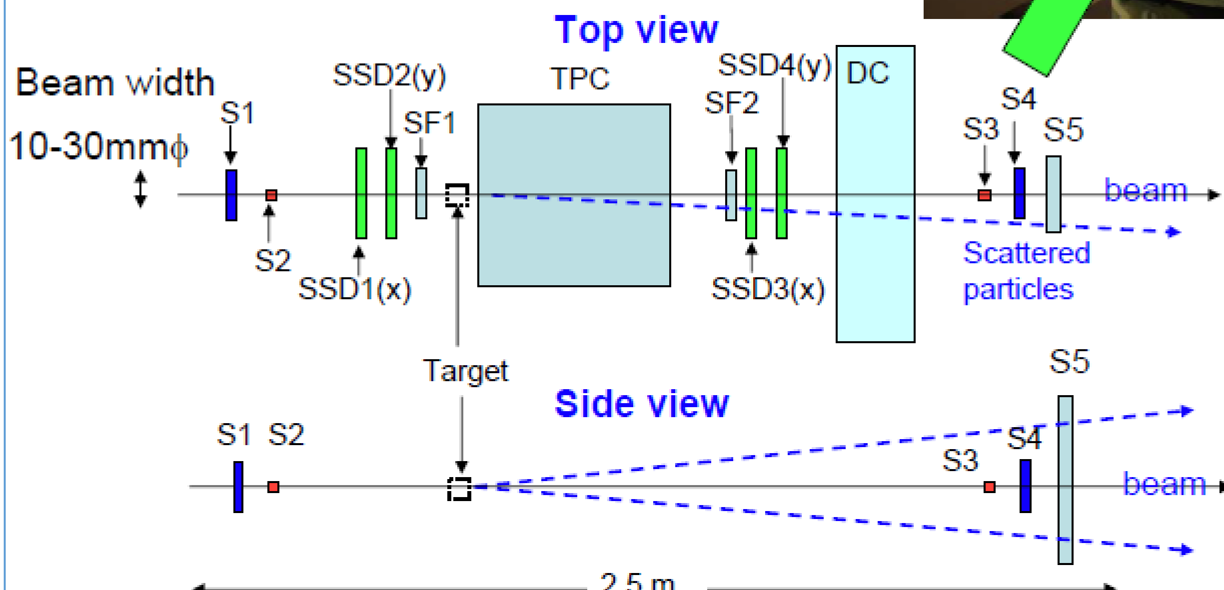
TPC in central
2 SSDs + 1 SF (upstream and downstream)
SSDs : reference trackers
Tests without the target

- Low rate ($<10^6$) beam trigger
  - S1 × S4 (S1:50 × 50 mm^2, S4:80 × 80mm^2)
- High rate (10^6-10^8) beam trigger
  - S2 × S3 (2 × 2mm^2)

Scattering experiment with a target in front of TPC
to simulate (K-,K+) reaction with high-rate beams

- Interaction trigger
  - $S1 \times \overline{S4} \times S5$ or $S2 \times \overline{S4} \times S5$





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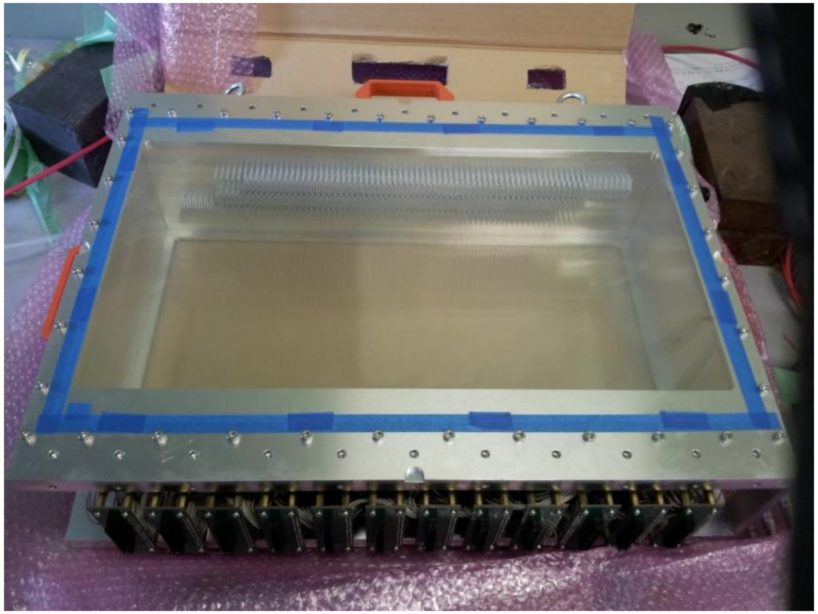
Example figure @ RCNP, OOSAKA (大阪), JAPAN

Other detectors/instruments

-- Drift Chamber



-- Scintillation counter
(w Photomultiplier)

-- TPC (not fully)

-- MPPC (short time)

-- VME/NIM

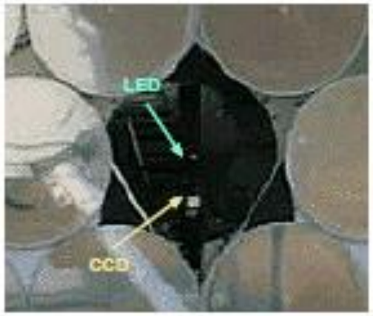
-- CAEN H.V.

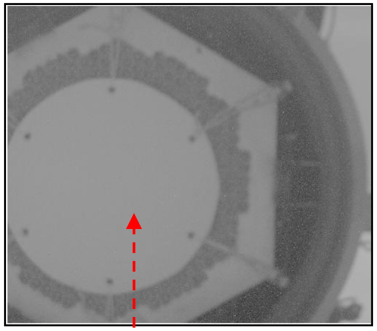
-- ....

Since there are lots of instruments/materials in KEK/JAEA, that was really good.

Tools for optical measurements

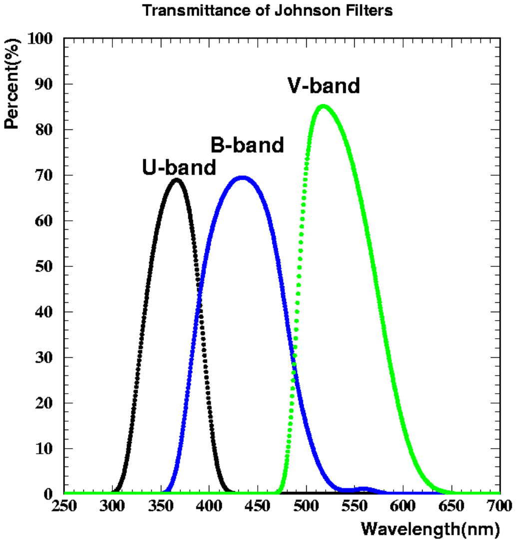
We set a cooled CCD camera at the center of the telescope.





A white screen was set in front of the PMT camera to take reflected images

We have used optical filters to limit the range of wavelength.



Performance study by using cooled CCD camera

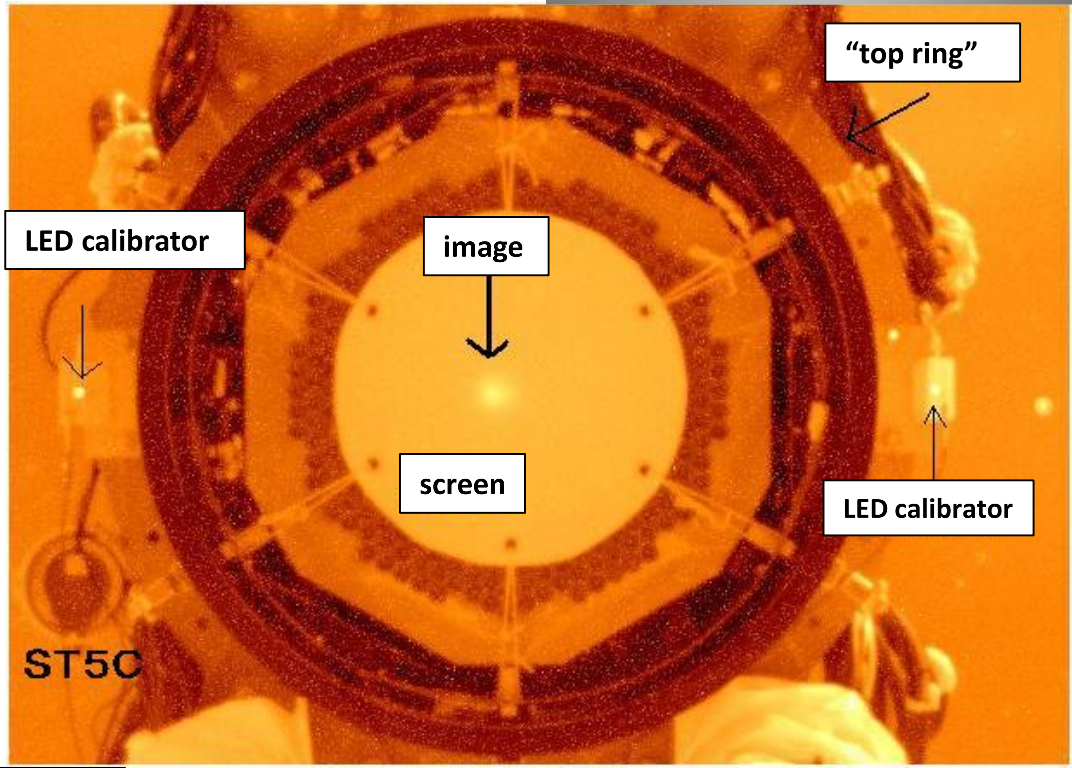
-- my master degree works --

Main contribution

- Update the cooled CCD readout system
- Calibration scheme for the CCD (dark frame/flat frame)
- Data analysis

Evaluation

- Pointing accuracy of the telescope
- Reflectivity of the mirrors
- Air transparency
- Estimation of background noise due to the night sky light

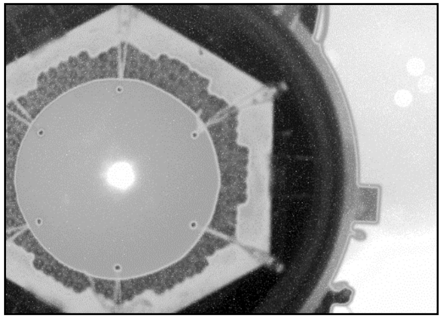


An image taken by the cooled CCD camera

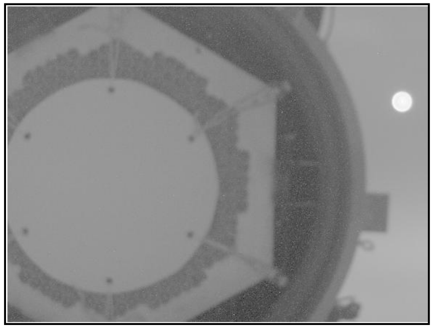
Presentation/Proc. 29th International Cosmic Ray Conference 2005

Introduction of optical measurements

- Reflectivity of telescope reflector



A reflected star image



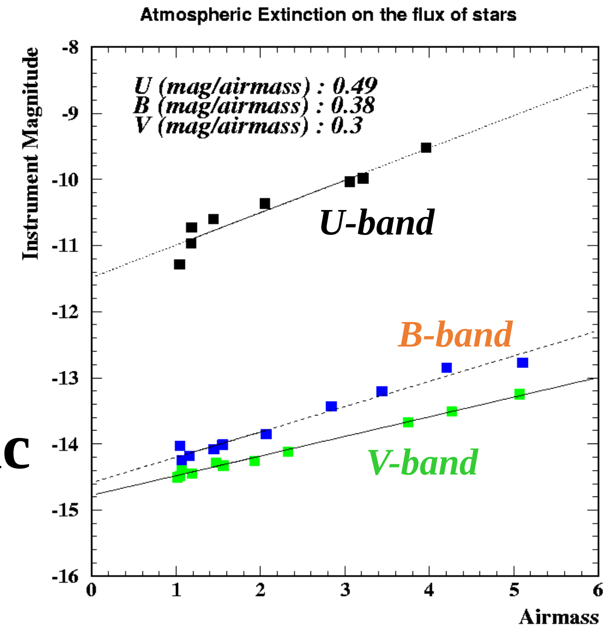
A direct star image

We compare the two images and estimate the reflectivity of whole reflector.

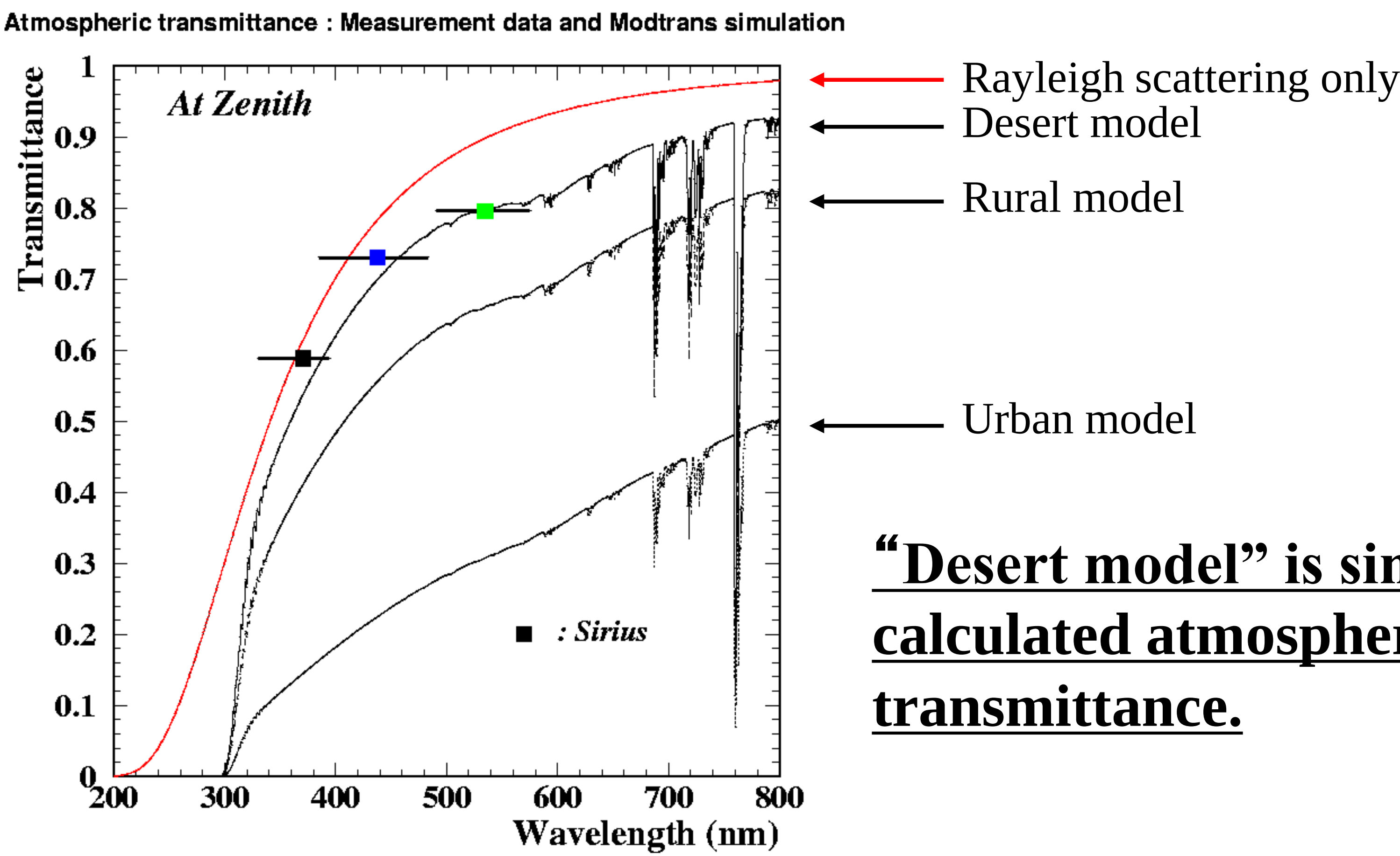
- Atmospheric transmittance

We have taken images of direct stars at various zenith angle.

We calculate the effect of the atmospheric extinction and also estimate the atmospheric transmittance



Calculated atmospheric transmittance and Modtran simulation II



<u>"Desert model" is similar to calculated atmospheric transmittance.</u>

Now studying systematical errors

2. 小型鏡の光軸調整及び結像性能

（小型鏡を動かす仕組み）

支持部

・　<u>小型鏡裏のモーター＋アクチュエーター</u>

モーターの回転に合わせてアクチュエーターの先のシャフトが上下。
二組のモーターが直交する位置にあり、小型鏡の光軸をR,TH方向に動かせる。

制御部

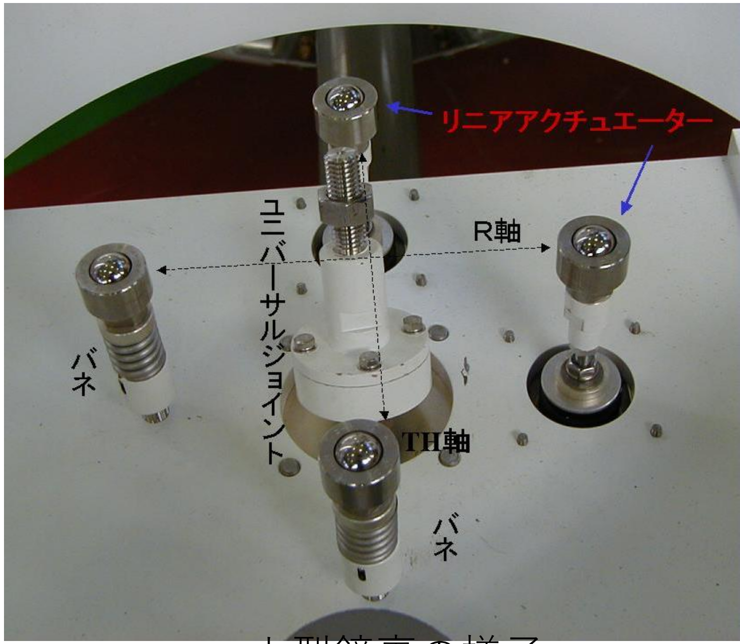
・　<u>コントローラー＋ドライバー</u>

モーターへの信号の送信

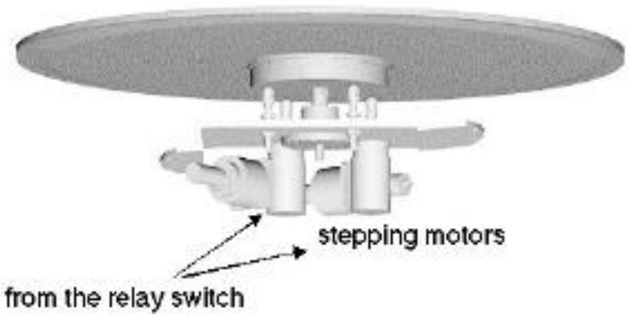
コントローラーの制御はPCで行う

・　<u>Relay回路</u>

114枚ｘ２個のモーターへの制御の切り替え



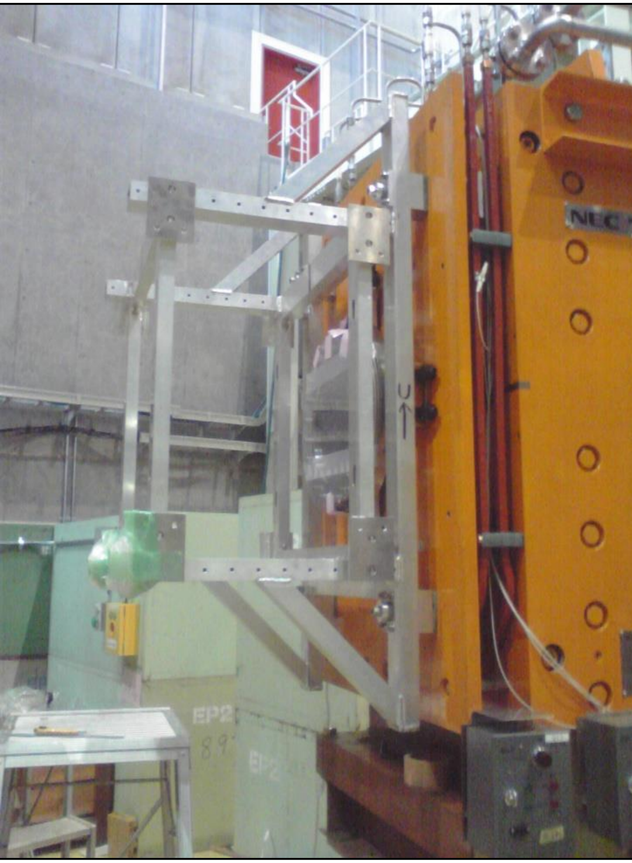
小型鏡裏の様子



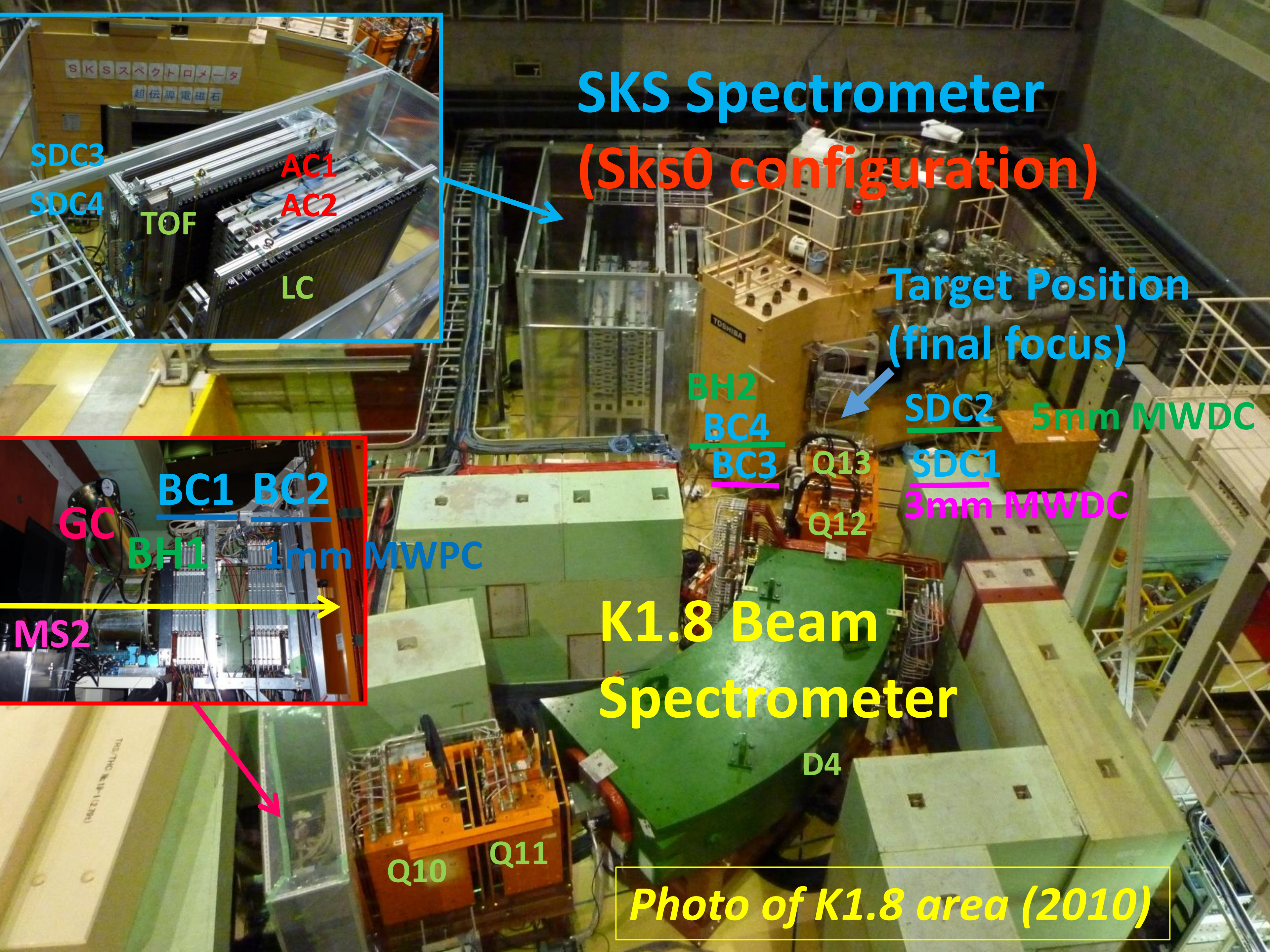
小型鏡とモーターの配置図

Detector Installation in “hadron hall”

Since the experimental area (“hadron hall”) was almost empty, user’s detector system should be installed by ourselves



detector installation, detector alignment, cabling, electronics, checking the signals , , ,



SKS Spectrometer
(Sks0 configuration)
SDC3
SDC4
AC1
AC2
TOF
LC
Target Position
(final focus)
BH2
BC4
BC3
Q13
Q12
SDC2
5mm MWDC
SDC1
3mm MWDC
BC1
BC2
GC
BH1
1mm MWPC
MS2
K1.8 Beam
Spectrometer
D4
Q10
Q11
Photo of K1.8 area (2010)

部品図⑩、⑪(SSD取付板)

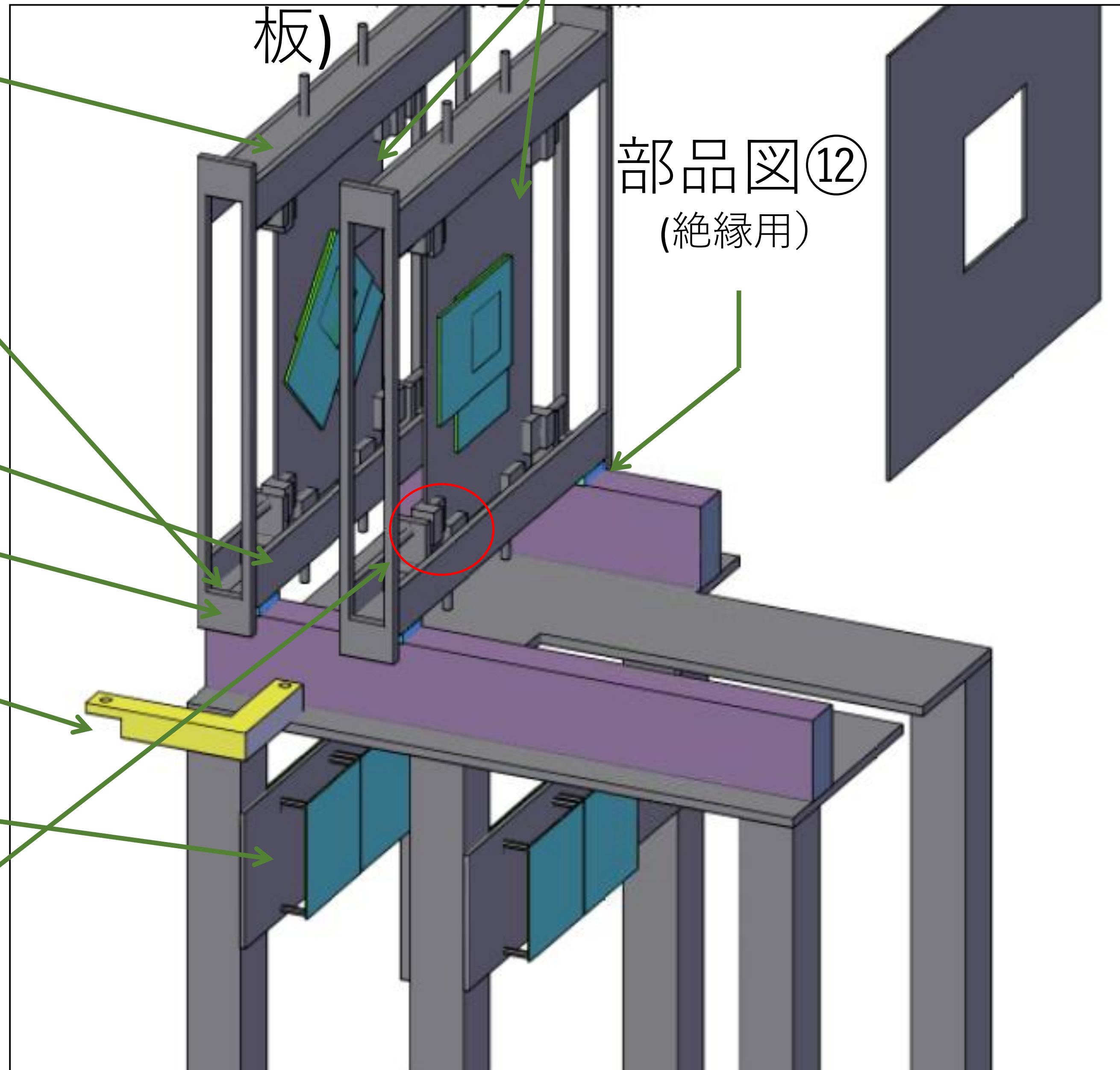
部品図③

部品図④

（③と④は描いていませんが穴が微妙に異なる）

部品図⑫

(絶縁用）



部品図⑤

部品図⑥

部品図⑧

(SFT架台連結用）

部品図⑨

（Repeator固定用板）

部品⑬、⑭、⑮

（位置調整用ジグ）

Other works

-- GUI by Tck/TK (was my first task) for mirror control

-- Slow DAQ control

-- CAD design

-- ……