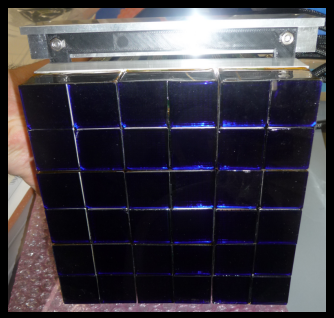
紫外線撮像望遠鏡によるTAサイトでの空気シャワー蛍光光の観測

滝澤慶之（理化学研究所）

EUSO-TA telescope



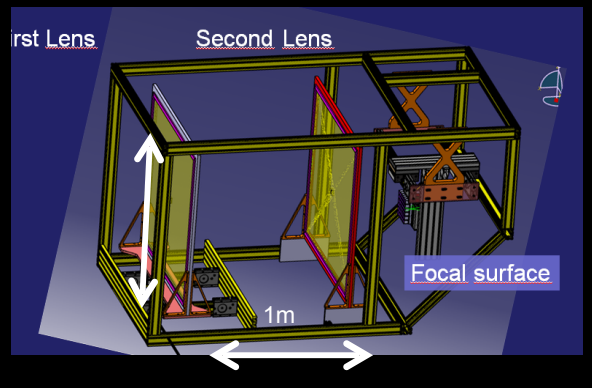
EUSO-TA optics design

Two Fresnel lenses: 1 sq. m

PDM Focal Surface: 17*17cm

Field of view: 11*11 degrees
(±5.5 * ±5.5 deg)
Pixel 0.19 deg

Sampling rate 2.5 mus



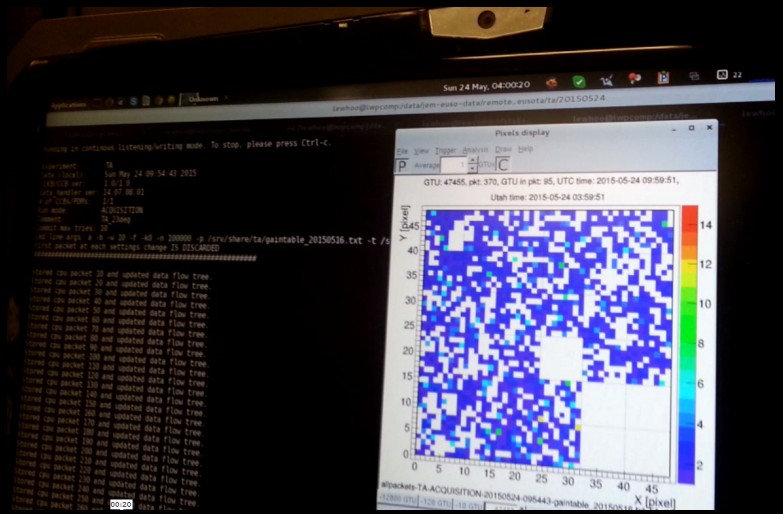
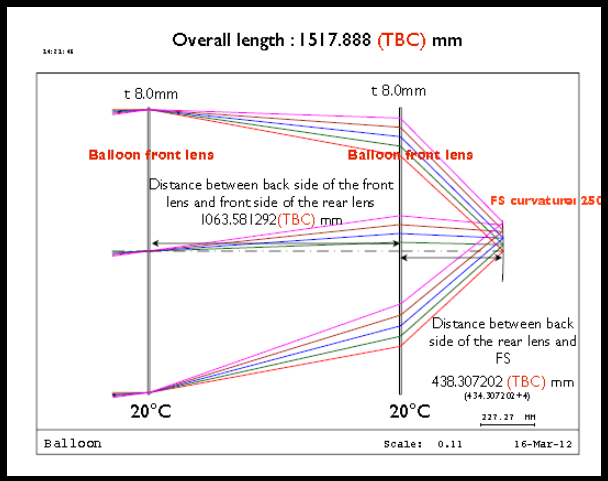


Image is inverted
(Seen from inside)



提案内容

共同研究者
Marco Casolino （理研）
Lech PIOTROWSKI （理研）
戎崎俊一（理研）
梶野文義（甲南大学）

支給額
50万 円

- EUSO-TAの焦点面検出器のバージョンアップ
- リモート観測に向けての整備

2017年までの成果

EUSO-TA campaigns

So far EUSO-TA had 6 observation campaigns:

February/March 2015	• Detector installation • Focusing, initial calibration • Initial CLF and CSOM laser observations
May 2015	• Cosmic ray observations – one UHECR detected • CLF and CSOM laser observations • Flat screen and LED calibration
September 2015	• Cosmic ray observations – analysis ongoing • CLF and CSOM laser observations
October 2015	• Cosmic ray observations – analysis ongoing • Internal trigger tests on **the balloon** PDM board – successful triggering on laser • CLF and CSOM laser observations
November 2015	• Cosmic ray observations • CLF laser observations
September 2017	• Mainly fixing + some observations

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EUSO-TA – First results from a ground-based EUSO telescope

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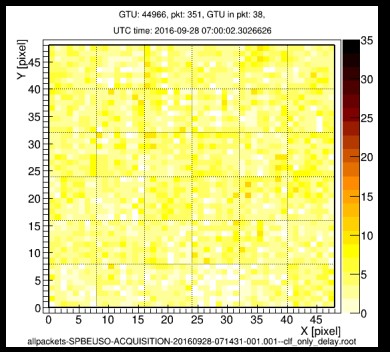
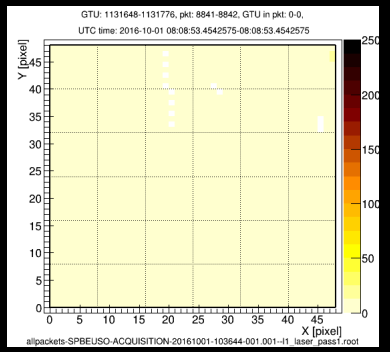
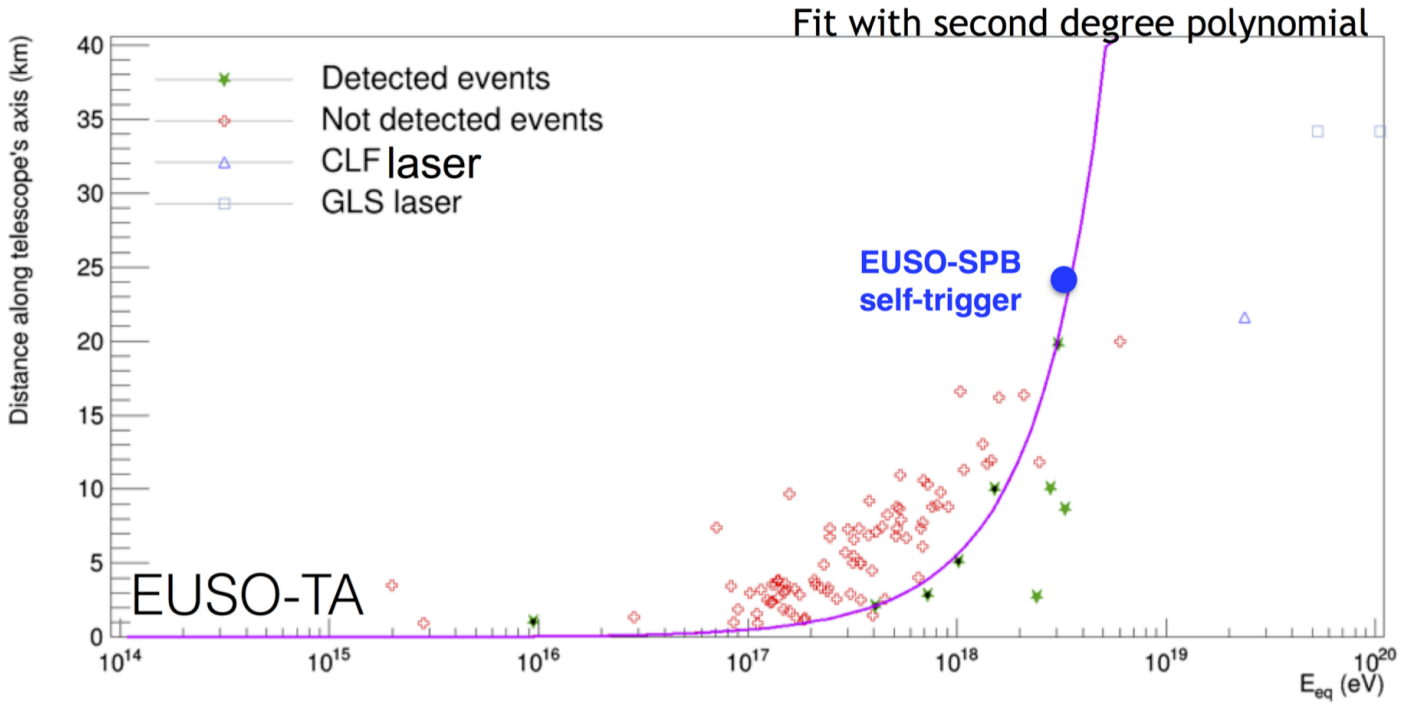
Analysis of data
(May, September, October, November 2015 and October 2016)

Days with any observation	58
TAFD external trigger (may contain UHECR)	491093 s (136.41 h)
All good data taken with TAFD trigger	469035 s (130.29 h, 95.5%)
Data taken with other external trigger	76342 s (21.21 h)
Detected UHECR	9
Meteors	5





UHECR statistics



- EUSO-TA does not look at the shower maximum
- To derive other experiments sensitivity, we have to scale to the shower maximum

EUSO-TA phase 2

2018 - 202X

1.Self trigger　　SPB2のトリガの確認も兼ねる

2.Slow Second Level Trigger　　メテオ、宇宙デブリなどの検出

3.External triggers (check event synchronization)

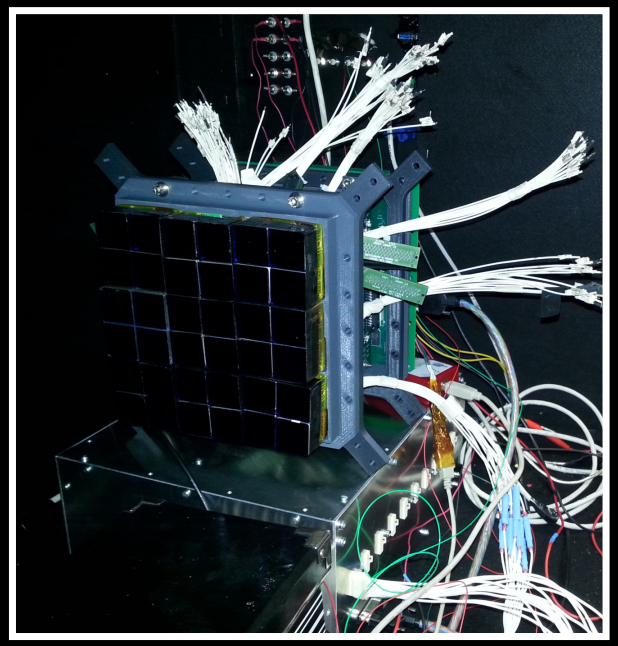
EUSO-TAの焦点面検出器のバージョンアップ

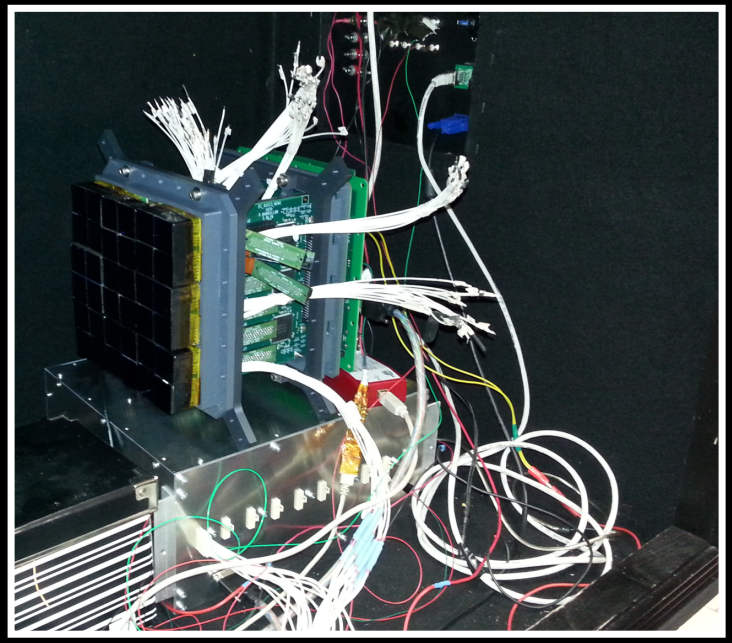
Upgrade the readout to the second generation detectors (MINI-EUSO-SPB)

New PCBs of
- Zynq (done)
- Spaciroc3 (under test)
- HVPS (under manufacturing)

- New Mechanics of PDM
- Spaciroc-1 pins → Spaciroc3
- Installation of HVPS with Zynq in Rome
- New GPS
- Replace the faulty PMTs and their frame

- Test with Mini-Euso lenses in Japan
- Use Mini-euso Lab model mechanics





2019 /February or March:
Installation in Utah

→Human resources
→Balance with Test in Japan
(Marco Casolino さんが、佐川先生と議論・調整中)

リモート観測に向けての整備

Why to automatise:

- Much higher duty cycle
- Much lower costs of operating
- Remote operation tests – shifting emulation for future missions (how to make the automatisation, help for example, SPB2?)

How to automatise:

- Remotely controlled shutter door, safety curtain
- Internet accessible power relays and power supplies
- Light sensors (outside and inside the dome), webcams, weather station?

- Tested shutter doors – they seem to work without problem
- Temporarily connected shutter door relay – opening and closing worked on the local network
- Connected Raspberry Pi in the dome – accessed webcam and shutter door relay
- Confirmed working of power (110 V) and LV relays in the dome
- Tested that all 6 bench PS turn on when AC turns on
- Many documenting photos taken
- Made a list what is in the dome

まとめ

- EUSO-TA phase2 を始めます。
  - 2018年2月 or 3月
    - 新しい焦点面検出器を設置します。
    - リモート観測に向けて整備を進めています。
  - 2019年度から、観測キャンペーンを行います。

EUSO-TA will (most likely) be the only EUSO experiment seeing UHECR for next ~3 years