

SMILE-II+実験のシステム概要



ref. isas17-sbs-024

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京大理, A:東北大NICHe, B:神戸大理, C:金沢大数物, D:NASA GFSC

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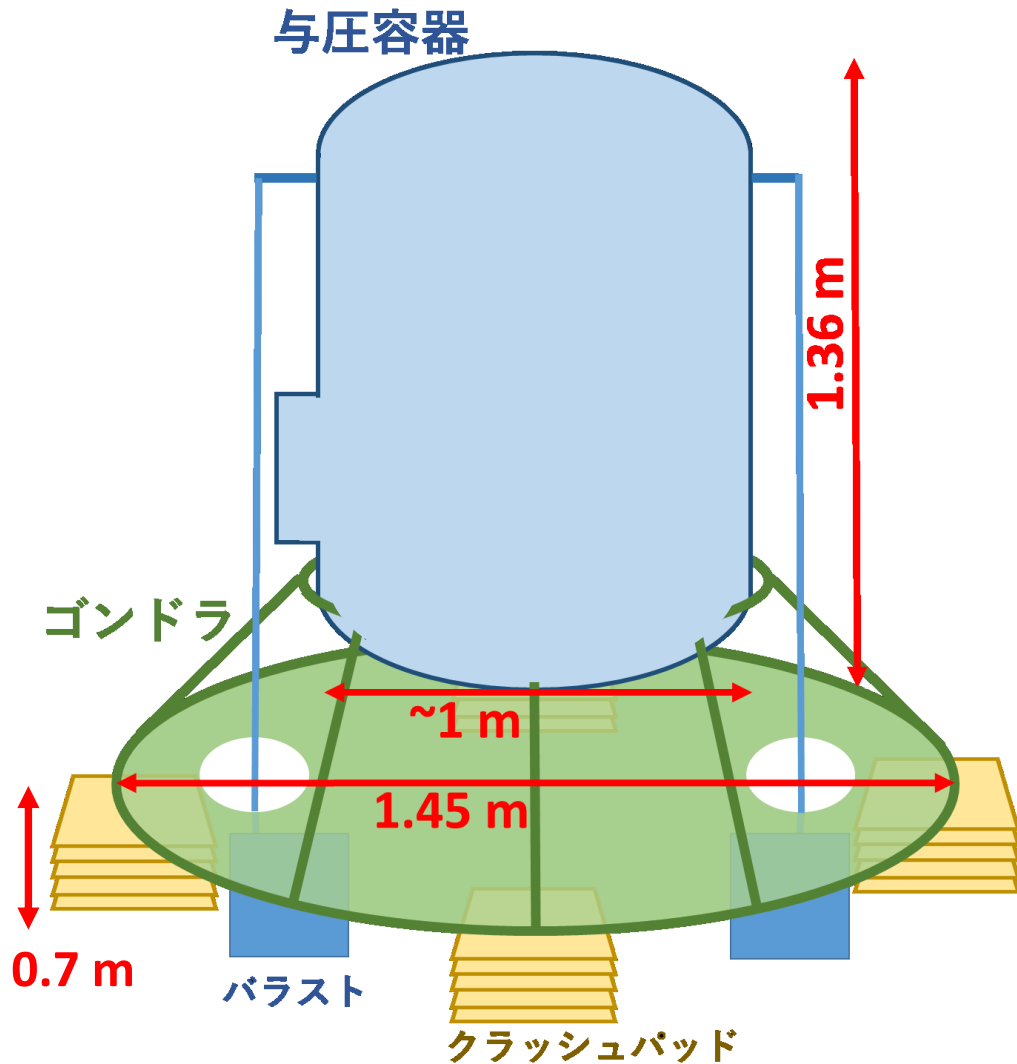
□ システム概要

全体像・通信系・電源系・熱環境

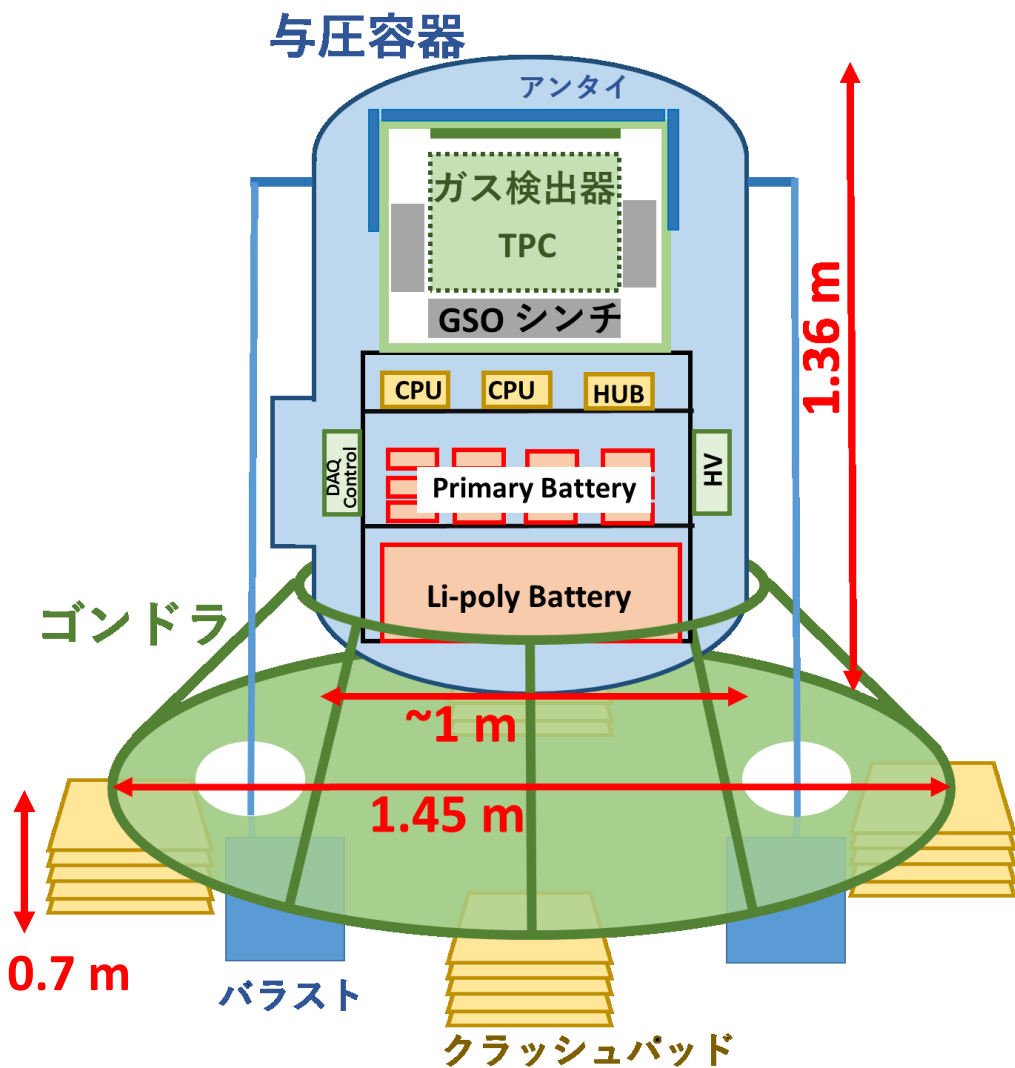
□ まとめ

気球システム全体像

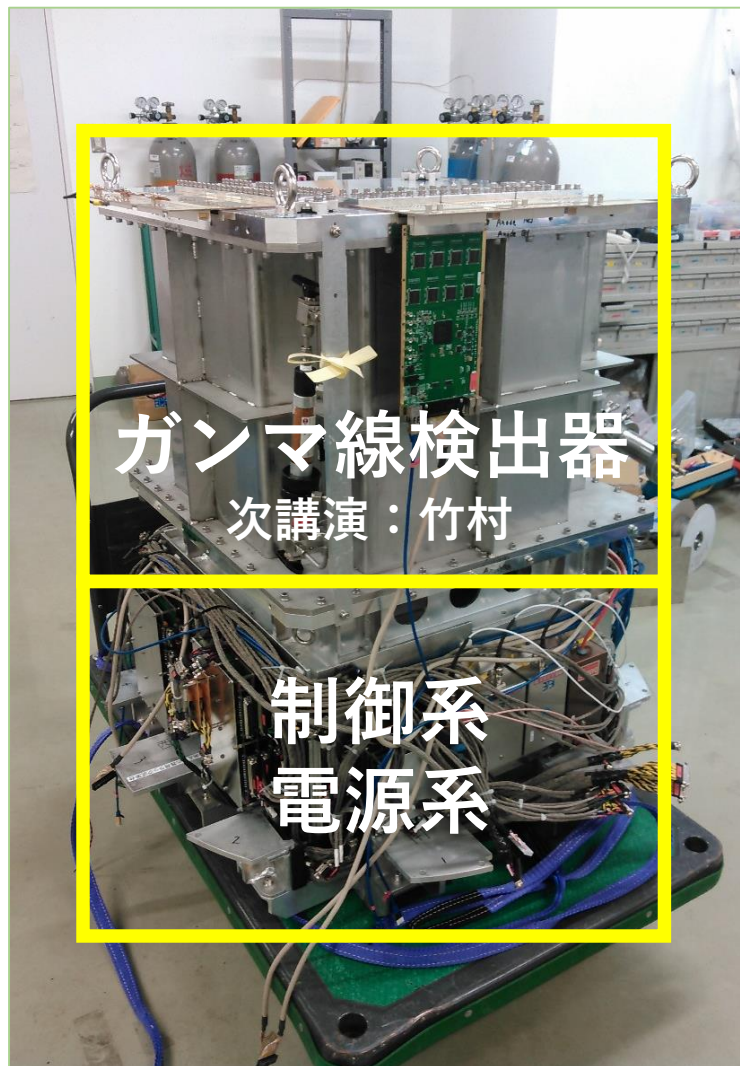
与圧容器・ゴンドラ



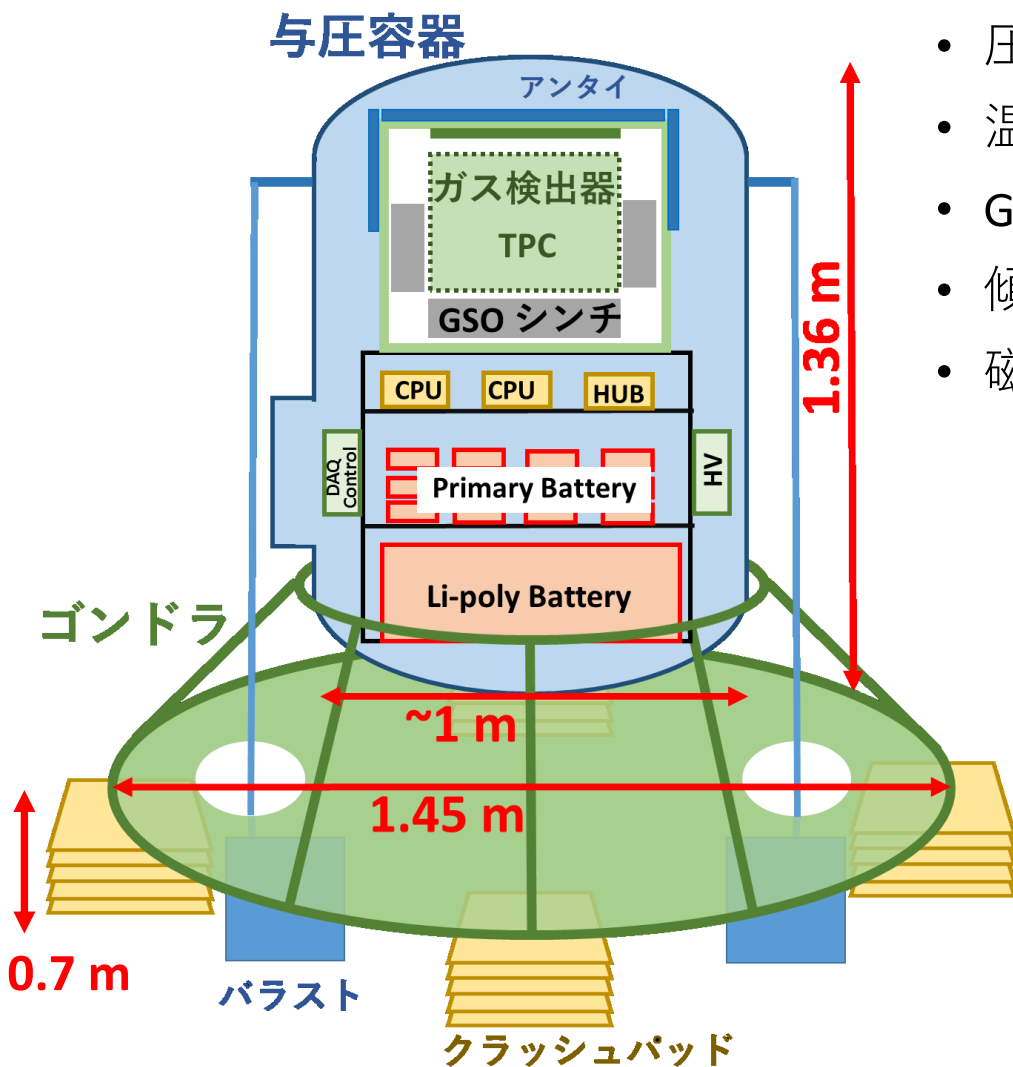
気球システム全体像



与圧容器 内部



気球システム全体像



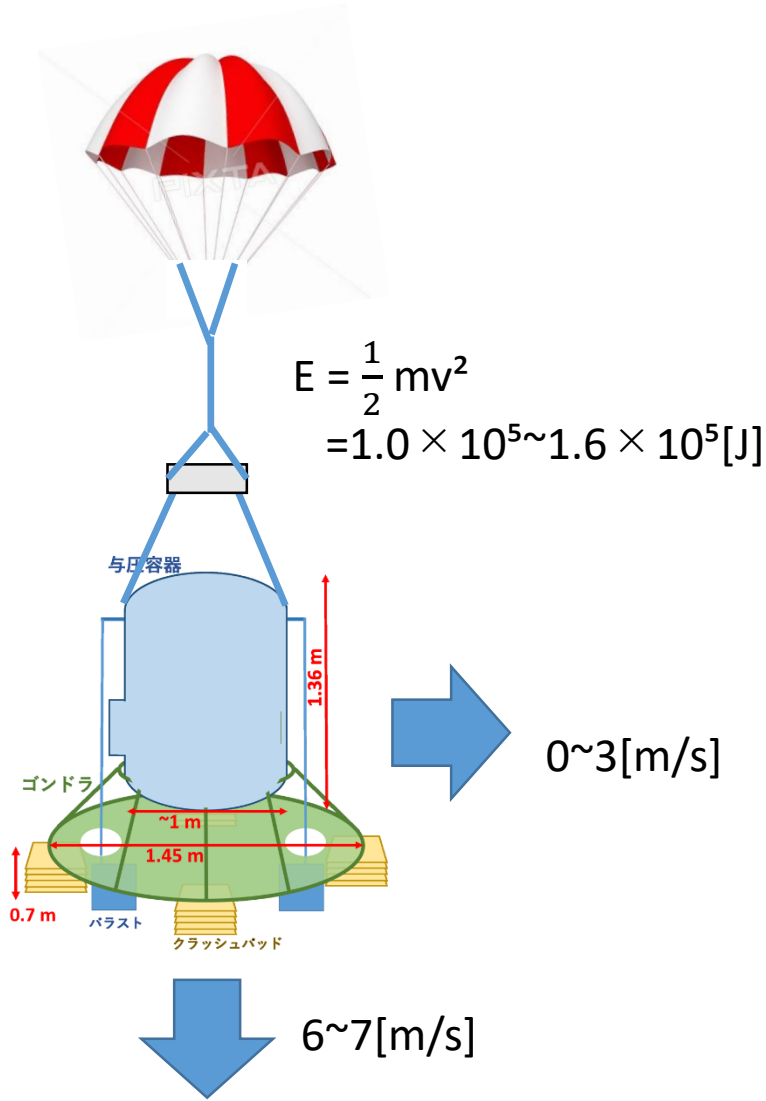
環境センサー

- 圧力計 与圧容器・外圧・ガス検出器
- 温度計 与圧容器内7か所
- GPS 時刻・位置・仰角・方位角
- 傾斜計 仰角
- 磁場計 方位角

重量[kg]

気球	900.0	} 装置 444.6
望遠鏡	500.0	
気球HK	60.0	
荷姿冗長系	75.0	
バラスト	337.0	
吊り下げ	972.0	
総計	1872.0	} パッド <10 } アンタイ <20 } 計 474.6

クラッシュパッド



- NASAの基準をもとに設計

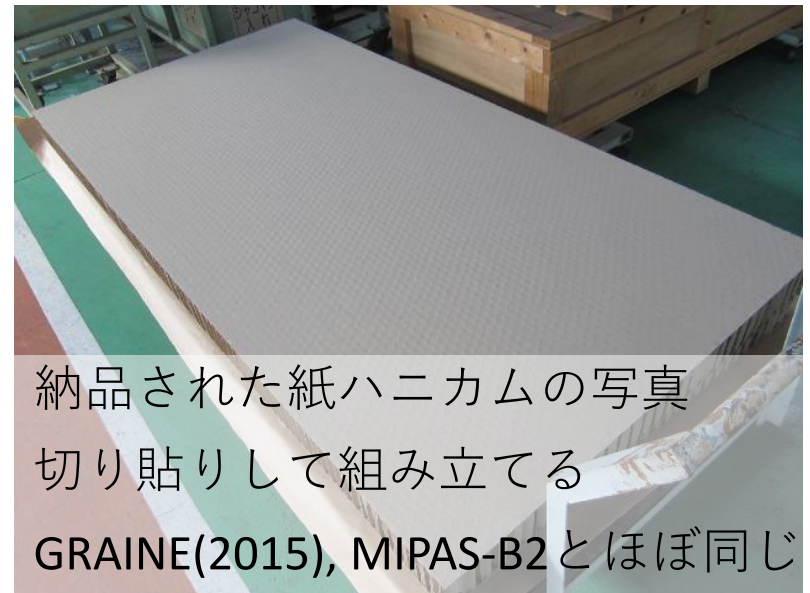
structural requirements and recommendations for balloon gondola design

クラッシュパッド4つで10Gで減速

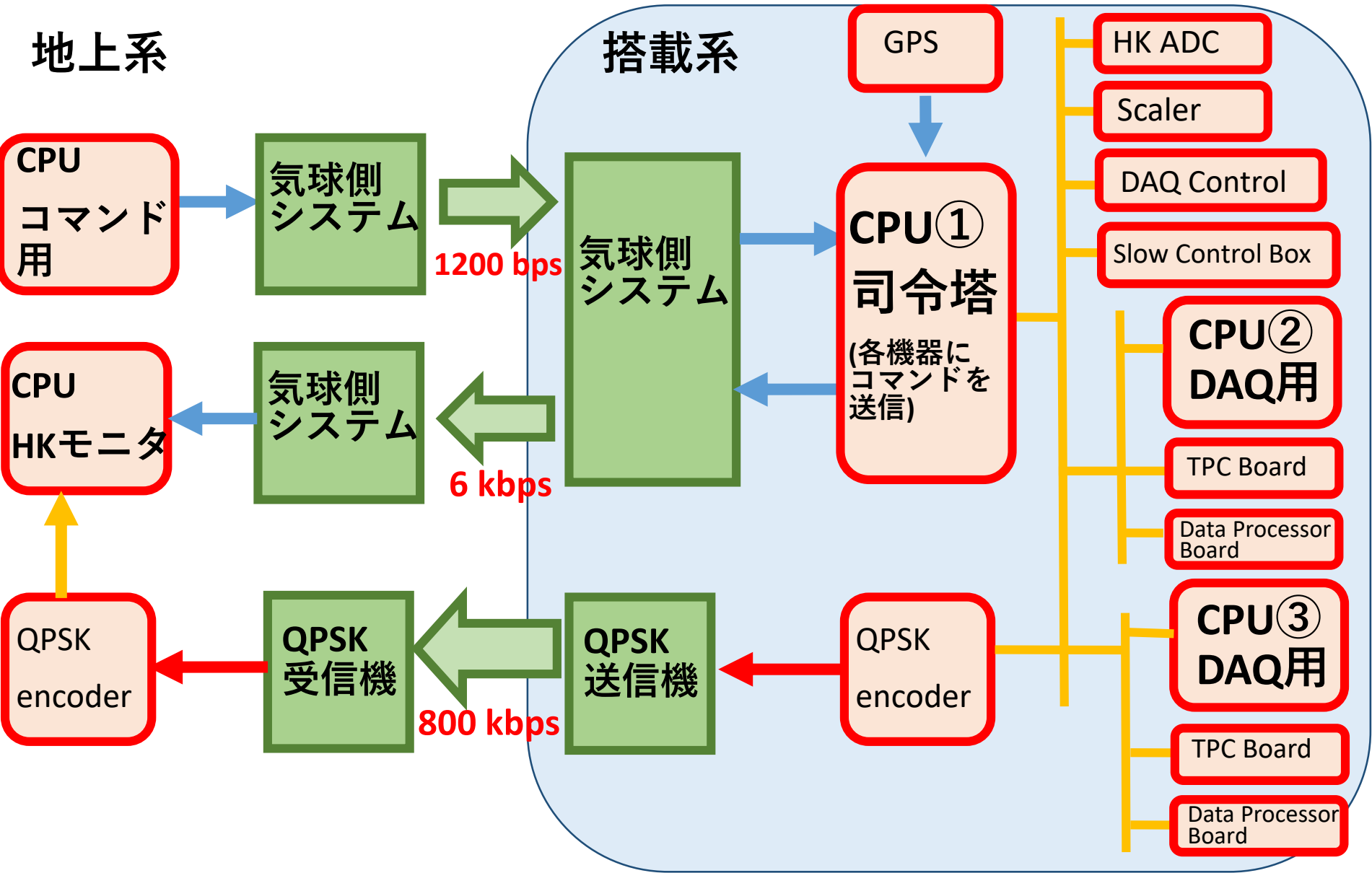
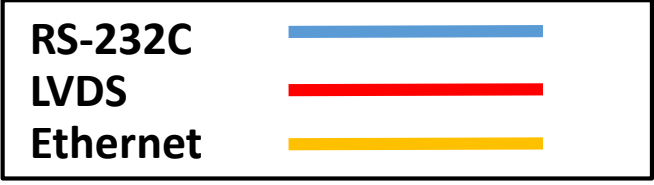
紙ハニカム(昭和飛行機25-S-0)

面積40 cm x 40 cmだと高さ50 cm以上必要




→70 cmに決定



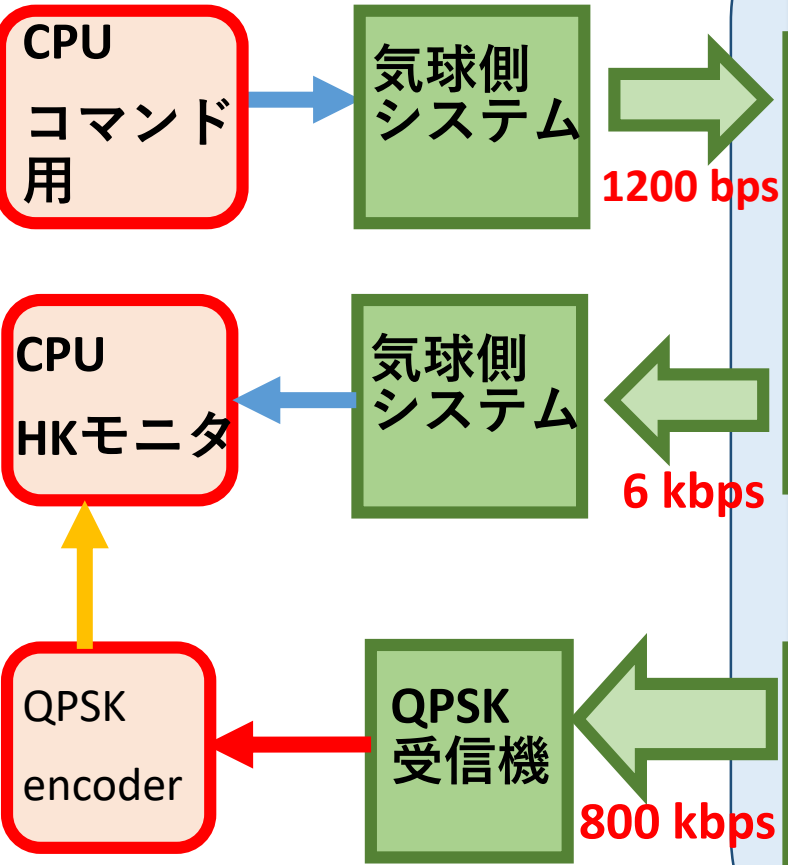
通信系



通信系

RS-232C	
LVDS	
Ethernet	

地上系



搭載品

- GPS
- HK ADC

FSK 1200 bps
地上からコマンド送信

Bi-phase 8 kbps
地上にてHKデータを1 Hzにて受信

- HK(温度・圧力など) 136 byte
- Scaler(各種カウンター) 144 byte
- 受信したコマンド内容

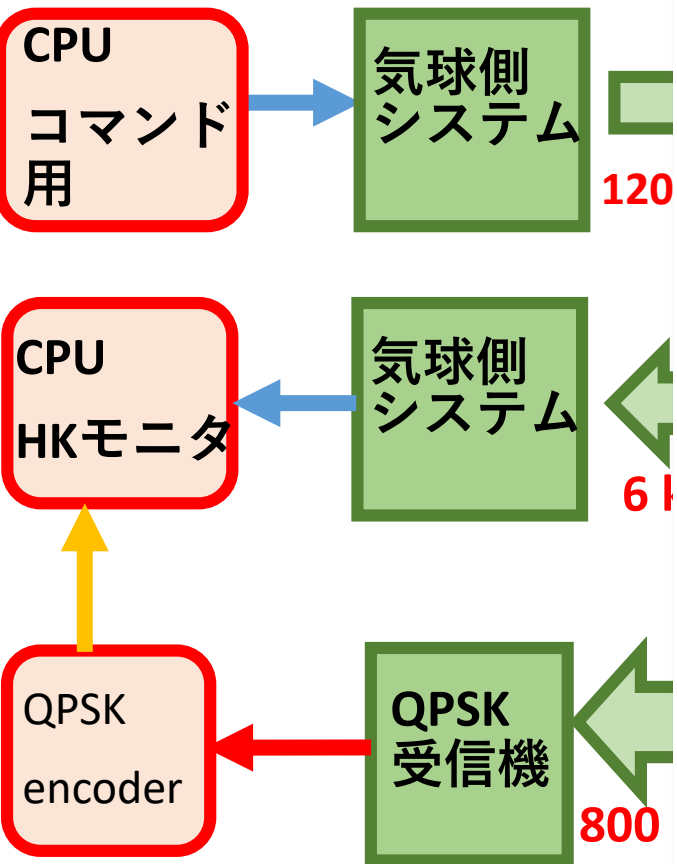
QPSK 800 kbps
地上にてイベントデータを受信
< 300 kbitを約1 Hzにて送信

通信系

RS-232C
LVDS
Ethernet



地上系

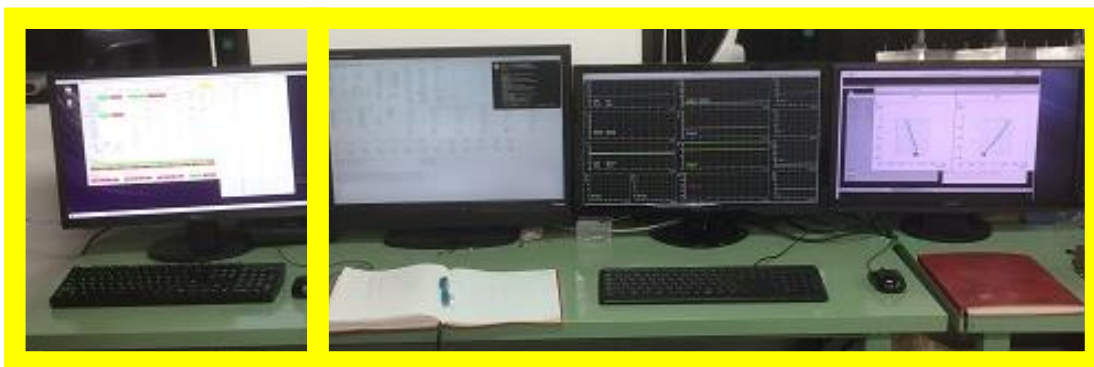


コマンドは2 byte

2段階の送信

1. 実行したいコマンドをセット
2. Executeを送信

地上PI卓 アリススプリングス・ロングリーチ
コマンド送信 QL画面



コマンド送信画面



SMILE-IIp Control Center

#Frame : 276 2017-11-06 16:53:59

Command : eb 90 10 ff 00 04 01 14 41 20 20 41 75 50 49 43 Send Command

DAQ control

Run state : Start Stop

DAQ Mode

ETCC mode

TPC cal mode

PSA cal mode

Charged particle

Auto Reset 2.5V : Start Stop

Reset

+/-2.5V

TPC HV

HA 0 HV

HA 1 HV

HA 2 HV

HA 3 HV

HA 4 HV

HA 5 HV

HA enable

HA Gr0 HA Gr1 HA Gr2

HA Gr3 HA Gr4 HA Gr5

Set Enable HA Initialize

HV control

Default All Off

Anode

Anode 1 Anode 2 Anode 3

Set 1 Set

Drift/GEM

Set 1 Set

Anti counter

Set 1 Set

PSA HV

HA Gr0 : All Set 1 Set

HA Gr1 : All Set 1 Set

HA Gr2 : All Set 1 Set

HA Gr3 : All Set 1 Set

HA Gr4 : All Set 1 Set

HA Gr5 : All Set 1 Set

threshold control

Default Th. DAC set

Anode

Anode 1 Anode 2 Anode 3

Set 1 Set

Cathode

Cathode 1 Cathode 2 Cathode 3

Set 1 Set

Anti counter

Set 1 Set

PSA Threshold

HA Gr0 : All Set 1 Set

HA Gr1 : All Set 1 Set

HA Gr2 : All Set 1 Set

HA Gr3 : All Set 1 Set

HA Gr4 : All Set 1 Set

HA Gr5 : All Set 1 Set

Power control

Power contrl enable

+/-2.5V ON

+6.6V ON

CALLTT ON

KILLUA ON

+/-12Va ON

+/-2.5V OFF

+6.6V OFF

CALLTT OFF

KILLUA OFF

+/-12Va OFF

ZENO control

ZENO control enable

Shutdown Reboot

CALLTT control

CALLTT control enable

Shutdown Reboot

KILLUA control

KILLUA control enable

Shutdown Reboot

Command control

Command control enable

Reset Execute

msgc@maya:~

ファイル(F) 編集(E) 表示(V) 検索(S) 端末(T) ヘルプ(H)

```

2017-11-06 15:02:47 Command : eb 90 10 ff 00 04 00 d6 41 20 20 41 75 50 49 43
2017-11-06 15:02:58 Command : eb 90 10 ff 00 04 00 d7 01 01 01 01 75 50 49 43
2017-11-06 15:03:03 Command : eb 90 10 ff 00 04 00 d8 41 20 20 41 75 50 49 43
2017-11-06 16:14:21 Command : eb 90 10 ff 00 04 00 d9 01 02 02 01 75 50 49 43
2017-11-06 16:14:26 Command : eb 90 10 ff 00 04 00 da 41 20 20 41 75 50 49 43
2017-11-06 16:15:11 Command : eb 90 10 ff 00 04 00 db 23 3f 3f 23 75 50 49 43
2017-11-06 16:15:16 Command : eb 90 10 ff 00 04 00 dc 41 20 20 41 75 50 49 43
2017-11-06 16:16:20 Command : eb 90 10 ff 00 04 00 dd 22 3f 3f 22 75 50 49 43
2017-11-06 16:16:24 Command : eb 90 10 ff 00 04 00 de 41 20 20 41 75 50 49 43
2017-11-06 16:16:30 Command : eb 90 10 ff 00 04 00 df 01 01 01 01 75 50 49 43
2017-11-06 16:16:52 Command : eb 90 10 ff 00 04 00 e0 41 20 20 41 75 50 49 43
2017-11-06 16:20:33 Command : eb 90 10 ff 00 04 00 e1 01 02 02 01 75 50 49 43
2017-11-06 16:20:37 Command : eb 90 10 ff 00 04 00 e2 41 20 20 41 75 50 49 43
2017-11-06 16:21:28 Command : eb 90 10 ff 00 04 00 e3 23 3f 3f 23 75 50 49 43
2017-11-06 16:21:33 Command : eb 90 10 ff 00 04 00 e4 41 20 20 41 75 50 49 43
2017-11-06 16:21:41 Command : eb 90 10 ff 00 04 00 e5 22 3f 3f 22 75 50 49 43
2017-11-06 16:22:00 Command : eb 90 10 ff 00 04 00 e6 41 20 20 41 75 50 49 43
2017-11-06 16:22:06 Command : eb 90 10 ff 00 04 00 e7 01 01 01 01 75 50 49 43
2017-11-06 16:22:09 Command : eb 90 10 ff 00 04 00 e8 41 20 20 41 75 50 49 43
2017-11-06 16:22:89 Command : eb 90 10 ff 00 04 00 e9 01 02 02 01 75 50 49 43
2017-11-06 16:25:44 Command : eb 90 10 ff 00 04 00 ea 41 20 20 41 75 50 49 43
2017-11-06 16:26:24 Command : eb 90 10 ff 00 04 00 eb 23 3f 3f 23 75 50 49 43
2017-11-06 16:26:28 Command : eb 90 10 ff 00 04 00 ec 41 20 20 41 75 50 49 43
2017-11-06 16:26:52 Command : eb 90 10 ff 00 04 00 ed 22 3f 3f 22 75 50 49 43
2017-11-06 16:26:56 Command : eb 90 10 ff 00 04 00 ee 41 20 20 41 75 50 49 43
2017-11-06 16:27:01 Command : eb 90 10 ff 00 04 00 ef 01 01 01 01 75 50 49 43
2017-11-06 16:27:09 Command : eb 90 10 ff 00 04 00 f0 41 20 20 41 75 50 49 43
2017-11-06 16:30:56 Command : eb 90 10 ff 00 04 00 f1 01 02 02 01 75 50 49 43
2017-11-06 16:30:59 Command : eb 90 10 ff 00 04 00 f2 41 20 20 41 75 50 49 43
2017-11-06 16:31:53 Command : eb 90 10 ff 00 04 00 f3 23 3f 3f 23 75 50 49 43
2017-11-06 16:31:57 Command : eb 90 10 ff 00 04 00 f4 41 20 20 41 75 50 49 43
2017-11-06 16:32:23 Command : eb 90 10 ff 00 04 00 f5 22 3f 3f 22 75 50 49 43
2017-11-06 16:32:29 Command : eb 90 10 ff 00 04 00 f6 41 20 20 41 75 50 49 43
2017-11-06 16:32:41 Command : eb 90 10 ff 00 04 00 f7 01 01 01 01 75 50 49 43
2017-11-06 16:32:44 Command : eb 90 10 ff 00 04 00 f8 41 20 20 41 75 50 49 43
2017-11-06 16:36:12 Command : eb 90 10 ff 00 04 00 f9 01 02 02 01 75 50 49 43
2017-11-06 16:36:16 Command : eb 90 10 ff 00 04 00 fa 41 20 20 41 75 50 49 43
2017-11-06 16:36:53 Command : eb 90 10 ff 00 04 00 fb 23 3f 3f 23 75 50 49 43
2017-11-06 16:36:57 Command : eb 90 10 ff 00 04 00 fc 41 20 20 41 75 50 49 43
2017-11-06 16:37:22 Command : eb 90 10 ff 00 04 00 fd 41 20 20 41 75 50 49 43
2017-11-06 16:37:55 Command : eb 90 10 ff 00 04 00 fe 22 3f 3f 22 75 50 49 43
2017-11-06 16:38:00 Command : eb 90 10 ff 00 04 00 ff 41 20 20 41 75 50 49 43
2017-11-06 16:38:04 Command : eb 90 10 ff 00 04 01 00 01 01 01 01 75 50 49 43
2017-11-06 16:38:08 Command : eb 90 10 ff 00 04 01 01 41 20 20 41 75 50 49 43
2017-11-06 16:41:20 Command : eb 90 10 ff 00 04 01 02 01 02 01 75 50 49 43
2017-11-06 16:41:28 Command : eb 90 10 ff 00 04 01 03 41 20 20 41 75 50 49 43
2017-11-06 16:42:16 Command : eb 90 10 ff 00 04 01 04 23 3f 3f 23 75 50 49 43
2017-11-06 16:42:20 Command : eb 90 10 ff 00 04 01 05 41 20 20 41 75 50 49 43
2017-11-06 16:42:27 Command : eb 90 10 ff 00 04 01 06 22 3f 3f 22 75 50 49 43
2017-11-06 16:42:47 Command : eb 90 10 ff 00 04 01 07 41 20 20 41 75 50 49 43
2017-11-06 16:42:52 Command : eb 90 10 ff 00 04 01 08 01 01 01 01 75 50 49 43
2017-11-06 16:42:55 Command : eb 90 10 ff 00 04 01 09 41 20 20 41 75 50 49 43
2017-11-06 16:46:40 Command : eb 90 10 ff 00 04 01 0a 01 02 02 01 75 50 49 43
2017-11-06 16:46:43 Command : eb 90 10 ff 00 04 01 0b 41 20 20 41 75 50 49 43
2017-11-06 16:47:32 Command : eb 90 10 ff 00 04 01 0c 23 3f 3f 23 75 50 49 43
2017-11-06 16:47:35 Command : eb 90 10 ff 00 04 01 0d 41 20 20 41 75 50 49 43
2017-11-06 16:48:12 Command : eb 90 10 ff 00 04 01 0e 22 3f 3f 22 75 50 49 43
2017-11-06 16:48:15 Command : eb 90 10 ff 00 04 01 0f 41 20 20 41 75 50 49 43
2017-11-06 16:48:18 Command : eb 90 10 ff 00 04 01 10 01 01 01 01 75 50 49 43
2017-11-06 16:48:22 Command : eb 90 10 ff 00 04 01 11 41 20 20 41 75 50 49 43
2017-11-06 16:53:56 Command : eb 90 10 ff 00 04 01 12 01 02 02 01 75 50 49 43
2017-11-06 16:53:59 Command : eb 90 10 ff 00 04 01 13 41 20 20 41 75 50 49 43
    
```

コマンド送信画面



SMILE-IIP Control Center

#Frame : 276 2017-11-06 16:53:59

Command : eb 90 10 ff 00 04 01 14 41 20 20 41 75 50 49 43

Send Command

DAQ control

Run state : Start Stop

DAQ Mode

- ETCC mode
- TPC cal mode
- PSA cal mode
- Charged particle

Auto Reset 2.5V - Start Stop

Reset

- +/-2.5V
- TPC HV
- AC HV
- HA 1 HV
- HA 2 HV
- HA 3 HV
- HA 4 HV
- HA 5 HV

HA enable

HA Gr0 HA Gr1 HA Gr2

HA Gr3 HA Gr4 HA Gr5

DAQ Enable HA Enable

HV control

Default All Off

Anode

Anode 1 Anode 2 Anode 3

Set 1

Drift/GEM

Set 1

Anti counter

Set 1

PSA HV

HA Gr0 : All

HA Gr1 : All

HA Gr2 : All

HA Gr3 : All

HA Gr4 : All

HA Gr5 : All

threshold control

Default Th.

Anode

Anode 1 Anode 2 Anode 3

Set 1

Cathode

Cathode 1 Cathode 2 Cathode 3

Set 1

Anti counter

Set 1

PSA Threshold

HA Gr0 : All

HA Gr1 : All

HA Gr2 : All

HA Gr3 : All

HA Gr4 : All

HA Gr5 : All

Power control

Power contrl enable

+/-2.5V ON

+/-2.5V OFF

+6.6V ON

+6.6V OFF

CALLTT ON

CALLTT OFF

KILLUA ON

KILLUA OFF

+/-12Va ON

+/-12Va OFF

ZENO control

ZENO control enable

Shutdown Reboot

CALLTT control

CALLTT control enable

Shutdown Reboot

KILLUA control

KILLUA control enable

Shutdown Reboot

Command control

Command control enable

Reset Execute

msg@maya:~

ファイル(F) 編集(E) 表示(V) 検索(S) 端末(T) ヘルプ(H)

```

2017-11-06 15:02:47 Command : eb 90 10 ff 00 04 00 d6 41 20 20 41 75 50 49 43
2017-11-06 15:02:58 Command : eb 90 10 ff 00 04 00 d7 01 01 01 01 75 50 49 43
2017-11-06 15:03:03 Command : eb 90 10 ff 00 04 00 d8 41 20 20 41 75 50 49 43
2017-11-06 16:14:21 Command : eb 90 10 ff 00 04 00 d9 01 02 02 01 75 50 49 43
2017-11-06 16:14:26 Command : eb 90 10 ff 00 04 00 da 41 20 20 41 75 50 49 43
2017-11-06 16:15:11 Command : eb 90 10 ff 00 04 00 db 23 3f 3f 23 75 50 49 43
2017-11-06 16:15:16 Command : eb 90 10 ff 00 04 00 dc 41 20 20 41 75 50 49 43
2017-11-06 16:16:20 Command : eb 90 10 ff 00 04 00 dd 22 3f 3f 22 75 50 49 43
2017-11-06 16:16:24 Command : eb 90 10 ff 00 04 00 de 41 20 20 41 75 50 49 43
2017-11-06 16:16:30 Command : eb 90 10 ff 00 04 00 df 01 01 01 75 50 49 43
2017-11-06 16:16:52 Command : eb 90 10 ff 00 04 00 e0 41 20 20 41 75 50 49 43
2017-11-06 16:20:33 Command : eb 90 10 ff 00 04 00 e1 01 02 02 01 75 50 49 43
2017-11-06 16:20:37 Command : eb 90 10 ff 00 04 00 e2 41 20 20 41 75 50 49 43
2017-11-06 16:21:28 Command : eb 90 10 ff 00 04 00 e3 23 3f 3f 23 75 50 49 43
2017-11-06 16:21:33 Command : eb 90 10 ff 00 04 00 e4 41 20 20 41 75 50 49 43
2017-11-06 16:21:41 Command : eb 90 10 ff 00 04 00 e5 22 3f 3f 22 75 50 49 43
2017-11-06 16:22:00 Command : eb 90 10 ff 00 04 00 e6 41 20 20 41 75 50 49 43
2017-11-06 16:22:06 Command : eb 90 10 ff 00 04 00 e7 01 01 01 75 50 49 43
2017-11-06 16:22:09 Command : eb 90 10 ff 00 04 00 e8 41 20 20 41 75 50 49 43
2017-11-06 16:22:37 Command : eb 90 10 ff 00 04 00 e9 01 02 02 01 75 50 49 43
2017-11-06 16:25:37 Command : eb 90 10 ff 00 04 00 ea 41 20 20 41 75 50 49 43
2017-11-06 16:25:74 Command : eb 90 10 ff 00 04 00 eb 23 3f 3f 23 75 50 49 43
2017-11-06 16:26:10 Command : eb 90 10 ff 00 04 00 ec 23 3f 3f 23 75 50 49 43
2017-11-06 16:26:14 Command : eb 90 10 ff 00 04 00 ed 23 3f 3f 23 75 50 49 43
2017-11-06 16:27:01 Command : eb 90 10 ff 00 04 00 ef 01 01 01 75 50 49 43
2017-11-06 16:27:09 Command : eb 90 10 ff 00 04 00 f0 41 20 20 41 75 50 49 43
2017-11-06 16:30:56 Command : eb 90 10 ff 00 04 00 f1 01 02 02 01 75 50 49 43
2017-11-06 16:30:59 Command : eb 90 10 ff 00 04 00 f2 41 20 20 41 75 50 49 43
2017-11-06 16:31:53 Command : eb 90 10 ff 00 04 00 f3 23 3f 3f 23 75 50 49 43
2017-11-06 16:31:57 Command : eb 90 10 ff 00 04 00 f4 41 20 20 41 75 50 49 43
2017-11-06 16:32:23 Command : eb 90 10 ff 00 04 00 f5 22 3f 3f 22 75 50 49 43
2017-11-06 16:32:29 Command : eb 90 10 ff 00 04 00 f6 41 20 20 41 75 50 49 43
2017-11-06 16:32:41 Command : eb 90 10 ff 00 04 00 f7 01 01 01 75 50 49 43
2017-11-06 16:32:44 Command : eb 90 10 ff 00 04 00 f8 41 20 20 41 75 50 49 43
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2017-11-06 16:37:55 Command : eb 90 10 ff 00 04 00 fe 22 3f 3f 22 75 50 49 43
2017-11-06 16:38:00 Command : eb 90 10 ff 00 04 00 ff 41 20 20 41 75 50 49 43
2017-11-06 16:38:04 Command : eb 90 10 ff 00 04 01 00 01 01 01 75 50 49 43
2017-11-06 16:38:08 Command : eb 90 10 ff 00 04 01 01 41 20 20 41 75 50 49 43
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2017-11-06 16:42:20 Command : eb 90 10 ff 00 04 01 05 41 20 20 41 75 50 49 43
2017-11-06 16:42:27 Command : eb 90 10 ff 00 04 01 06 22 3f 3f 22 75 50 49 43
2017-11-06 16:42:47 Command : eb 90 10 ff 00 04 01 07 41 20 20 41 75 50 49 43
2017-11-06 16:42:52 Command : eb 90 10 ff 00 04 01 08 01 01 01 75 50 49 43
2017-11-06 16:42:55 Command : eb 90 10 ff 00 04 01 09 41 20 20 41 75 50 49 43
2017-11-06 16:46:40 Command : eb 90 10 ff 00 04 01 0a 01 02 02 01 75 50 49 43
2017-11-06 16:46:43 Command : eb 90 10 ff 00 04 01 0b 41 20 20 41 75 50 49 43
2017-11-06 16:47:32 Command : eb 90 10 ff 00 04 01 0c 23 3f 3f 23 75 50 49 43
2017-11-06 16:47:35 Command : eb 90 10 ff 00 04 01 0d 41 20 20 41 75 50 49 43
2017-11-06 16:48:12 Command : eb 90 10 ff 00 04 01 0e 22 3f 3f 22 75 50 49 43
2017-11-06 16:48:15 Command : eb 90 10 ff 00 04 01 0f 41 20 20 41 75 50 49 43
2017-11-06 16:48:18 Command : eb 90 10 ff 00 04 01 10 01 01 01 75 50 49 43
2017-11-06 16:48:22 Command : eb 90 10 ff 00 04 01 11 41 20 20 41 75 50 49 43
2017-11-06 16:53:56 Command : eb 90 10 ff 00 04 01 12 01 02 02 01 75 50 49 43
2017-11-06 16:53:59 Command : eb 90 10 ff 00 04 01 13 41 20 20 41 75 50 49 43
    
```

データ取得

検出器電圧リセット

DAQ回路電源

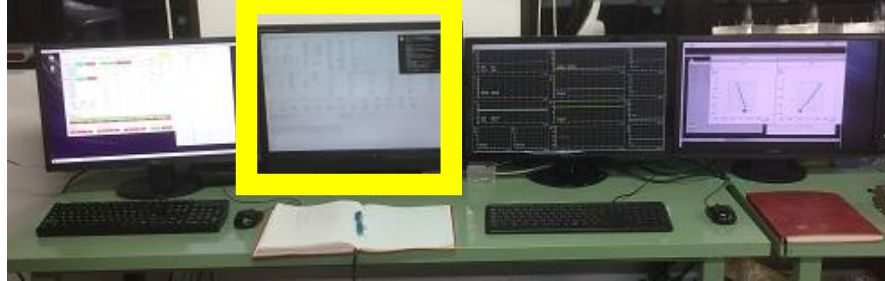
検出器電圧設定

スレッシュホールド設定

PC電源電圧

PC電源ON/OFF

QL画面① HKモニタ



```

msgc@kanpachi:~/Desktop
ファイル(F) 編集(E) 表示(V) 検索(S) 端末(T) ヘルプ(H)
--- Get HK/GPS packet ---

uPIC HV          Temperature          Scaler          DC/DC Input          zeno          calltt (Anode, Side)
Anode1: 396.64 V      6.50 nA      HK ADC 33.86 degC      HA Gr0 : 922.61 Hz      12Vd-1 : 28.71 V      0.35 A      10.17 W      DAQ Run : 1
Anode2: 398.88 V      6.39 nA      Outside 22.44 degC      HA Gr1 : 672.72 Hz      5V : 28.75 V      0.68 A      19.54 W      Work Dir: 20140404
Anode3: 394.49 V      0.50 nA      DC/DC 29.84 degC      HA Gr2 : 545.77 Hz      3.3V : 28.15 V      1.73 A      48.67 W      DAQ Mode: ETCC MeV
Drift : -7.29 kV      15.07 uA      TPC ASIC 32.12 degC      HA Gr3 : 574.76 Hz      12Vd-2 : 28.66 V      0.50 A      14.46 W      Period #: 1
Battery 28.58 degC      HA Gr4 : 598.75 Hz      12Va : 28.17 V      0.27 A      7.48 W      File #: 1
TPC Top 27.52 degC      HA Gr5 : 590.75 Hz      6.6V : 28.53 V      2.20 A      62.84 W      Disk : 811 GB
Vessel : 28.86 degC      HA trg : 3260.63 Hz      2.5V : 28.47 V      0.66 A      18.90 W
TPC Bottom : 25.89 degC      PPS trg: 1.00 Hz      Total 182.05 W
Anti. : 0.00 Hz
VETO : 3260.63 Hz
Clock : 1.000e+07 Hz
v_clock: 7.617e+05 Hz
Valid : 32.99 Hz
Clear : 3227.64 Hz
Anode : 223.91 Hz
Cathode: 204.91 Hz
Dead T.: 7.62 %

GPS data          Atitude          Pressure
Time : 114741.00      Clino1 (EW): 1.64      Outer : 171.63 hPa
HKtime: 21498sec      Clino2 (NS): -1.98      Inner : 1018.37 hPa
Lati. : 3533.46501N      GA 1 (**): 2.57      TPC : 2035.73 hPa
Long. : 13923.6346E      GA 2 (**): 2.57
Alt. : 133.8 M      GA 3 (**): 2.57
status: 1

Li-poly 0 (Lower)      Li-poly 1 (Upper)      TPC-HV DAC      HA-Gr0 HV (HA 1-3)      HA-Gr1 HV (HA 7-9)      HA-Gr2 HV (HA 31-33)      HA-Gr3 HV (HA 13-15)      HA-Gr4 HV (HA 19-21)      HA-Gr5 HV (HA 25-27)
count : 4244          count :
Charge : 95.0 %      Charge : %
Status : 0xd00      Status : 0x
Problem: 0x08        Problem: 0x
Temp 0 : 23.0 degC      Temp 0 : degC
Temp 1 : 23.0 degC      Temp 1 : degC
Temp 2 : 23.0 degC      Temp 2 : degC
Current: 0.00 A      Current: A
Voltage: 28.748 V      Voltage: V
4.108 4.108          f000          f000f0          PMT 1 : 012345          PMT 1 : 012345          PMT 1 : 012345          PMT 1 : 0123          PMT 1 : 012345          PMT 1 : 012345
4.116 4.108          f0f0f0          PMT 2 : 012345          PMT 2 : 01234          PMT 2 :          PMT 2 : 012345          PMT 2 : 012 45          PMT 2 : 012345
4.108 4.088          f0f0f0          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 0 2345          PMT 3 : 0123
4.112          f0f0f0          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 012345          PMT 3 : 0 2345          PMT 3 : 0123

Event ID          Anode 1          Anode 2          Anode 3          Cathode1          Cathode2          Cathode3          HA 1 (b)          HA 2 (b)          HA 3 (b)          HA 7 (b)          HA 8 (b)          HA 9 (b)
Event #          74717322        74717322        74717322        74735918        74735918        74735918        74735917        74735917        74735917        74735662        74735917        74735917
          915060          915061          915064          915268          915270          915266          915512          915483          915351          915536          915470          915372

Event ID          HA13 (s)        HA14 (s)        HA15 (s)        HA19 (s)        HA20 (s)        HA21 (s)        HA25 (s)        HA26 (b)        HA27 (b)        HA31 (b)        HA32 (b)        HA33 (b)
Event #          74717268        74717321        74717321        74717321        74717321        74717321        74717321        74717268        74717321        74735918        74735562        74735917
          915326        915324          915318          915306          915307          915267          915232          915210          915149          915263          915264          915167

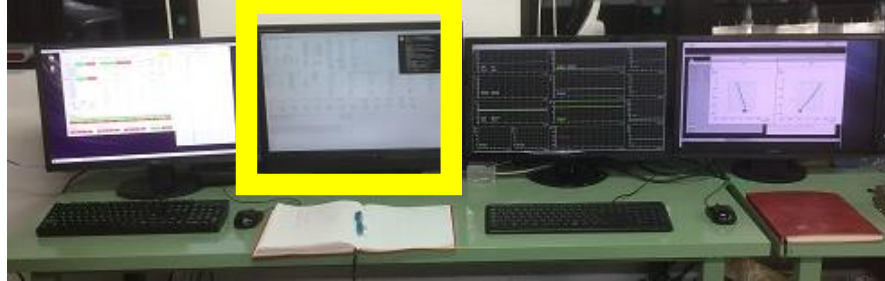
Command Ack : eb 90 10 ff 00 04 00 30 41 20 20 41 75 50 49 43
Reserved Com: DAQ ctrl Start
Com. Error : Successful

Li-Poly 0 Status: Ena-chnrg Ena-disch WakeUp
Li-Poly 0 Error :
Li-Poly 1 Status: -----
Li-Poly 1 Error : -----

Over V(W)

eb 90 81 32 54 18 01 48 0a 7a 24 47 50 47 47 41 2c 31 31 34 37 34 31 2e 30 30 2c 33 35 33 33 2e
34 36 35 30 31 2c 4e 2c 31 33 39 32 35 2e 36 33 34 36 31 2c 45 2c 31 2c 30 38 2c 31 2e 31 2c 31
33 33 2e 38 2c 4d 2c 33 38 2e 38 2c 4d 2c 2c 2a 36 34 0d 0a 00 00 00 00 00 00 00 2b e1 2a 3d
2b 4d 2b a1 2b 1f 2a f8 2b 29 2a bc 06 27 06 2e 06 20 a4 2b 01 26 01 1e 01 17 14 4e 52 76 3b 6c
1a 58 01 7f ff 3f 20 e9 20 ea 20 f0 01 01 00 01 eb 90 10 ff 00 04 00 30 41 20 20 41 75 50 49 43
    
```

QL画面① HKモニタ



msgc@kanpachi:~/Desktop

```

    ファイル(F) 編集(E) 表示(V) 検索(S) 端末(T) ヘルプ(H)
    |-- Get HK/GPS packet  ---
  
```

飛跡検出器HV

```

#HV HV
Anode1: 394.49 V
Anode2: 394.49 V
Anode3: 394.49 V
Drift : -7.29 kV 15.07 uA
          
```

温度計

```

Temperature
HK ADC 33.86 degC
OnNode 2.41 degC
TPC ADC 28.84 degC
TPC HAD 3.21 degC
Battery 28.58 degC
TPC Top 27.52 degC
Vessel : 28.86 degC
Bottom : 25.80 degC
          
```

Scaler

```

Scaler
HA Gr0 : 922.61 Hz
HA Gr1 : 672.72 Hz
HA Gr2 : 545.77 Hz
HA Gr3 : 574.76 Hz
HA Gr4 : 590.75 Hz
HA Gr5 : 590.75 Hz
HA trg : 3260.63 Hz
PPS trg: 1.00 Hz
Anti. : 0.00 Hz
VETO : 3260.63 Hz
clock : 1.000e+07 Hz
v_clock: 7.617e+05 Hz
Valid : 32.99 Hz
Clear : 3227.64 Hz
Anode : 223.91 Hz
Cathode: 204.91 Hz
Read T : 7.62 s
          
```

DC/DC入力

```

DC/DC Input
12Vd-1 : 28.71 V 0.35 A 10.17 W
5.5V : 28.75 V 1.3 A 19.54 W
12Va : 28.65 V 0.27 A 48.67 W
12Vd-2 : 28.65 V 0.25 A 14.46 W
12Va : 28.17 V 0.27 A 7.48 W
6.6V : 28.53 V 2.20 A 62.84 W
2.5V : 28.47 V 0.66 A 18.90 W
Total 182.85 W
          
```

制御用CPU

```

CPU
CPU Dir: /bin/DAQ
DAQ Mode: ETCC MeV
Period #: 1
File #: 1
Disk #: 811 GB
          
```

DAQ用CPU①

```

call: /bin/DAQ
DAQ Mode: ETCC MeV
Work Dir: 20140404
DAQ Mode: ETCC MeV
Prig #: 1
Disk : 880 GB
          
```

DAQ用CPU②

```

kill: /bin/DAQ
DAQ Mode: ETCC MeV
Work Dir: 20140404
DAQ Mode: ETCC MeV
Prig #: 1
Disk : 880 GB
          
```

GPS

```

GPS data
Time : 114741.00
HKTime: 21498sec
Latitude: 35.8501N
Longitude: 139.236346E
Alt.: 133.8 M
status: 1
          
```

姿勢

```

Attitude
Clino1 (EW): 1.64
Clino2 (NS): 1.98
GA 1 (**): 2.57
GA 2 (**): 2.57
GA 3 (**): 2.57
          
```

圧力計

```

Pressure
TPC : 7.11 hPa
Vessel : 1.18 hPa
TPC : 2035.73 hPa
          
```

DC/DC出力

```

DC/DC Output
12Vd-1 : 12.63 V
5.5V : 12.11 V
3.3V : 3.3 V
12Vd-2 : 12.45 V
12Va : 12.49 V -12.17 V
6.6V : 6.85 V
2.5V : 7.47 V -7.50 V
          
```

Li-poly 0 (Lower)	Li-poly 1 (Upper)	PC-HV DAC	HA-Gr0 HV (HA 1-3)	HA-Gr1 HV (HA 7-9)	HA-Gr2 HV (HA 31-33)	HA-Gr3 HV (HA 13-15)	HA-Gr4 HV (HA 19-21)	HA-Gr5 HV (HA 25-27)
count : 4244	count : %	Anode1: 1220	ch 1-0: 3470	ch 1-0: 2870	ch 1-0: 2950	ch 1-0: 3322	ch 1-0: 2850	ch 1-0: 3000
Charge : 95.0 %	Charge : %	Anode2: 1220	ch 1-1: 3322	ch 1-1: 3470	ch 1-1: 2830	ch 1-1: 3070	ch 1-1: 3100	ch 1-1: 2550
Status : 0xd0	Status : 0x	Anode3: 1220	ch 1-2: 3470	ch 1-2: 3000	ch 1-2: 2750	ch 1-2: 2872	ch 1-2: 2922	ch 1-2: 3150
Problem: 0x08	Problem: 0x	Drift :	ch 2-0: 3570	ch 2-0: 2850	ch 2-0: 2850	ch 2-0: 3200	ch 2-0: 3222	ch 2-0: 2722
Temp 0 : 27.0 degC	Temp 0 : degC	f000	ch 2-1: 3422	ch 2-1: 2850	ch 2-1: 2850	ch 2-1: 3150	ch 2-1: 3272	ch 2-1: 2720
Temp 1 : 27.0 degC	Temp 1 : degC	f0f0f0	ch 2-2: 3470	ch 2-2: 2800	ch 2-2: 2800	ch 2-2: 2920	ch 2-2: 2920	ch 2-2: 2670
Temp 2 : 27.0 degC	Temp 2 : degC	f0f0f0	ch 3-0: 3172	ch 3-0: 3122	ch 3-0: 3122	ch 3-0: 3170	ch 3-0: 3170	ch 3-0: 3280
Current: 0.00 A	Current: A	f0f0f0	ch 3-1: 3450	ch 3-1: 3000	ch 3-1: 3100	ch 3-1: 3072	ch 3-1: 3122	ch 3-1: 3050
Voltage: 28.748 V	Voltage: V	f0f0f0	ch 3-2: 3450	ch 3-2: 3100	ch 3-2: 2830	ch 3-2: 2970	ch 3-2: 2772	ch 3-2: 0
4.108 4.108		f000f0	PMT 1 : 0123 5	PMT 1 : 012345	PMT 1 : 012345	PMT 1 : 0123	PMT 1 : 012345	PMT 1 : 012345
4.116 4.108		f0f0f0	PMT 2 : 012345	PMT 2 : 01234	PMT 2 : 01234	PMT 2 : 012345	PMT 2 : 012 45	PMT 2 : 012345
4.108 4.088		f0f0f0	PMT 3 : 012345	PMT 3 : 012345	PMT 3 : 012345	PMT 3 : 012345	PMT 3 : 012 45	PMT 3 : 01234
4.112		f0f0f0						

Event ID	Anode 1	Anode 2	Anode 3	Cathode1	Cathode2	Cathode3	HA 1 (b)	HA 2 (b)	HA 3 (b)	HA 7 (b)	HA 8 (b)	HA 9 (b)
Event #	74717322	74717322	74717322	74735918	74735918	74735918	74735917	74735917	74735917	74735562	74735917	74735917
	915060	915061	915064	915268	915270	915266	915512	915483	915351	915536	915470	915372
Event ID	HA13 (s)	HA14 (s)	HA15 (s)	HA19 (s)	HA20 (s)	HA21 (s)	HA25 (s)	HA26 (s)	HA27 (b)	HA31 (b)	HA32 (b)	HA33 (b)
Event #	74717268	74717321	74717321	74717321	74717321	74717321	74717321	74717268	74717321	74735918	74735562	74735917
	915326	915324	915318	915306	915307	915267	915232	915210	915149	915263	915264	915167

```

Command Ack : eb 90 10 ff 00 04 00 30 41 20 20 41 75 50 49 43
Reserved :
Com. Error : Successful
          
```

Command reply

```

Li-Poly 0 Status: Emg chrg Li-Poly電池 WakeUp
Li-Poly 0 Error:
Li-Poly 1 Status:
Li-Poly 1 Error:
          
```

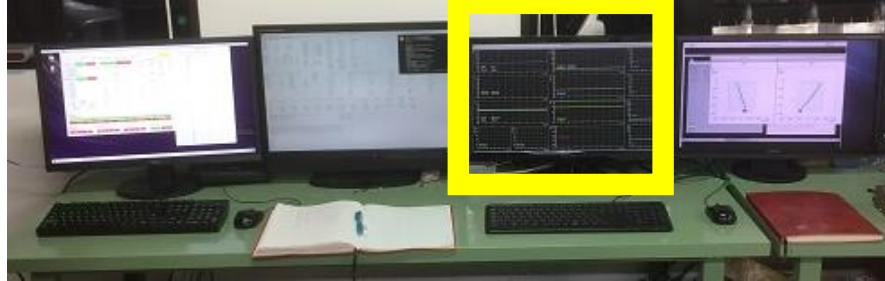
Li-Poly電池 error

受信した最新パケット

```

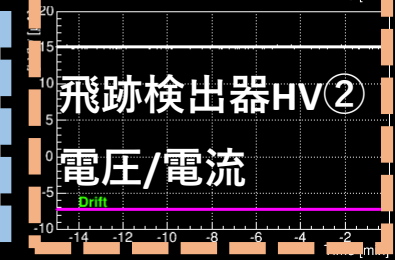
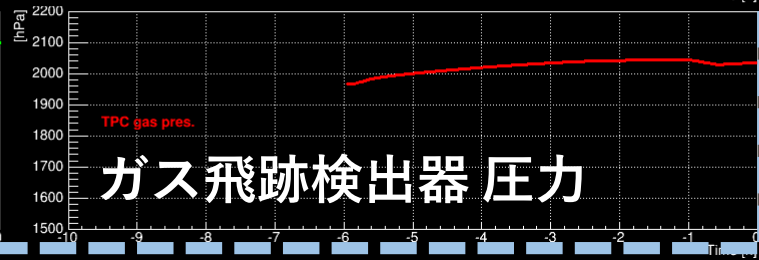
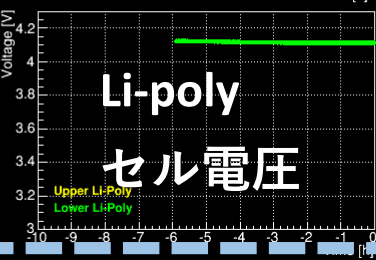
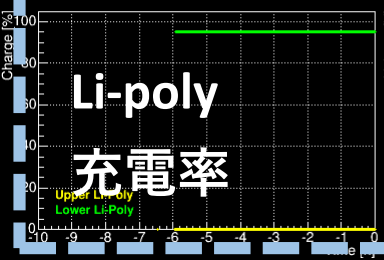
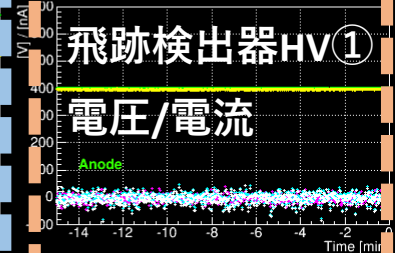
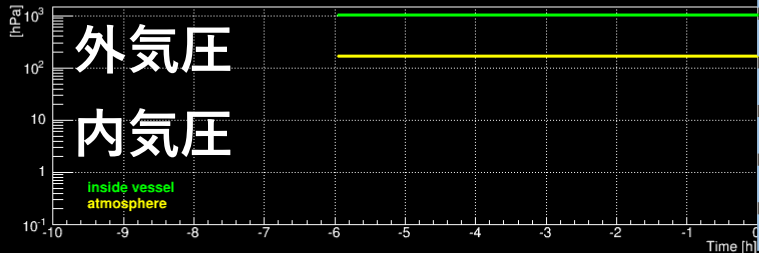
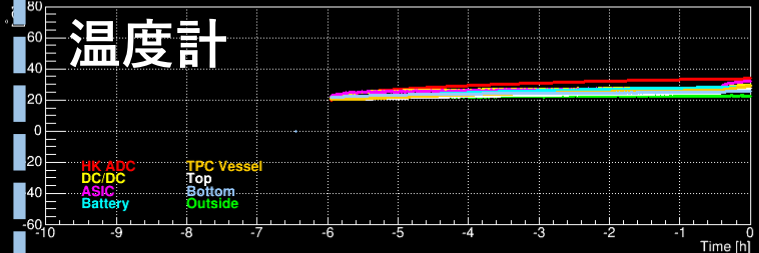
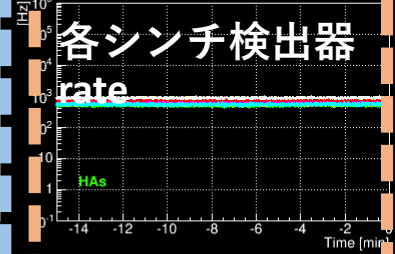
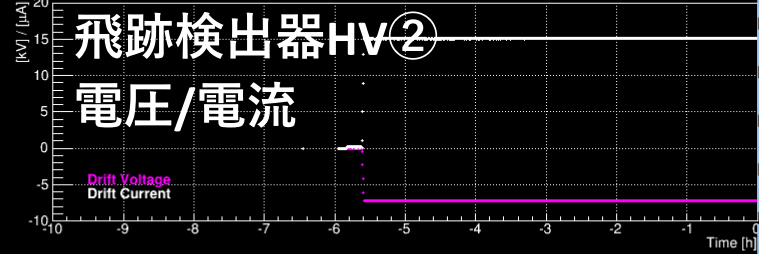
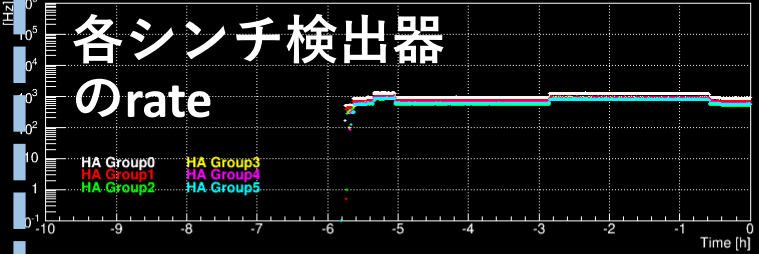
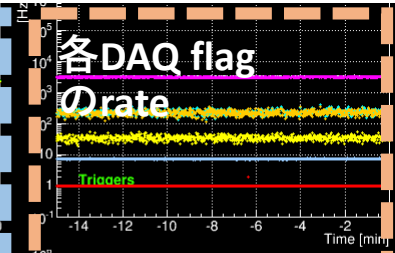
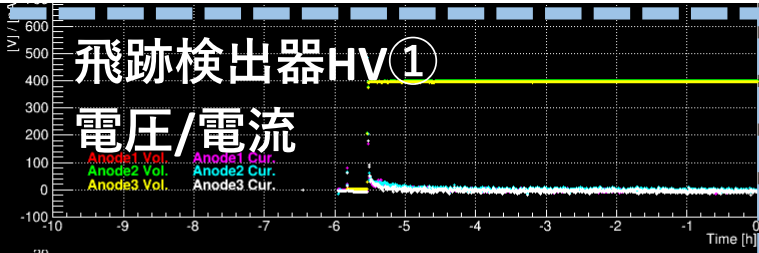
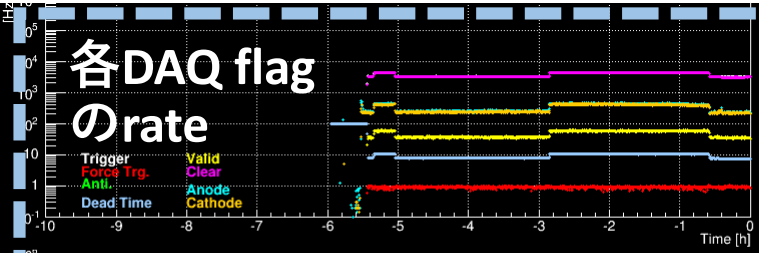
eb 90 81 23 54 18 01 48 0a 7a 24 47 50 47 47 47 2c 31 31 34 37 34 31 2e 30 30 2c 33 35 33 33 2e
34 36 3e 33 2e 20 31 33 32 33 3e 36 3e 3c 4e 31 2e 33 38 2c 31 2e 31 2c 31
33 33 2e 20 2d 0d 2c 33 38 2e 28 2c 4e 31 34 37 34 0d 00 00 00 00 00 00 2b e1 2a 3d
2b 4d 20 a2 b1 7a f8 26 29 2a 0c 00 00 2e 06 20 a4 2b 01 26 01 1e 01 17 14 4e 52 76 3b 6c
f 58 01 7f ff 3f 20 e0 20 ea 20 f0 01 01 00 01 eb 90 10 ff 00 04 00 30 41 20 20 41 75 50 49 43
          
```

QL画面② HKグラフ



過去10時間

過去15分



QL画面③ 検出事象



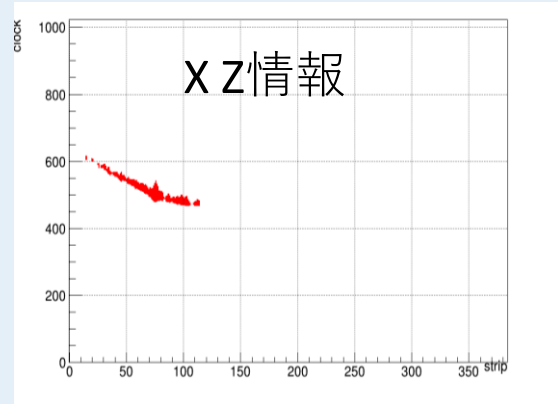
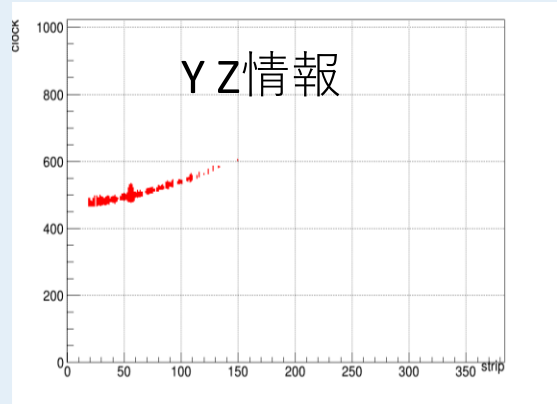
受信データ

```

msgc@kanpachi
ファイル(F) 編集(E) 表示(V) 検索(S) 端末(T) ヘルプ(H)
0f 58 0e fd 40 ca 9a f1 12 df 99 9b ae b1 29
00 01 03 1c ab 21 bd 89 d3 fe d5 a7 f3 84 38 37
6f 2a 34 84 a2 ed e3 a2 4c 97 54 fe 61 44 17 a1
7f 6e 27 70 97 9a 8a fa 06 44 3a c7 67 90 c0 c6
3e ac b9 c1 05 83 b7 2c b9 16 01 f4 c2 90 1f 6a
9e a4 1e a9 ef ed e5 1c ac 30 e5 07 4e b8 30 25
9c a0 a2 4b 4a 5e 1f 38 53 14 62 e5 82 3f 99 fa
5a 37 6a 1c 18 04 3d 05 ff de 5d 80 1b ee d6 e5
df bf 92 58 d2 e2 48 0e 80 16 d5 c7 06 64 21 de
d6 14 86 72 f2 d2 89 47 5d 06 29 8b b4 46 1e 60
5c 84 f7 7a e6 9f e3 76 23 16 b4 8b 01 dd 7e 98
c1 5c 51 a0 28 70 ef 6b 17 b9 ce 93 e4 18 80 64
55 fd 32 31 81 6b ba 88 6a 19 75 12 0f ae c1 15
ee cc ff 04 9c 35 22 32 83 c7 01 a2 45 04 bd 6d
46 0f b9 a6 4f 82 08 75 f9 07 f5 2f 29 15 77
00 01 02 03 04 05 0f 07 08 09 0a 0b 0c 0d 0e 0f
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f
30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f
40 41 42 43 44 45 46 47 48 49 4a 4b 4c 4d 4e 4f
50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f
60 61 62 63 64 65 66 67 68 69 6a 6b 6c 6d 6e 6f
70 71 72 73 74 75 76 77 78 79 7a 7b 7c 7d 7e 7f
80 81 82 83 84 85 86 87 88 89 8a 8b 8c 8d 8e 8f
90 91 92 93 94 95 96 97 98 99 9a 9b 9c 9d 9e 9f
a0 a1 a2 a3 a4 a5 a6 a7 93 a9 aa ab ac ad ae af
bb be cf 7c f3 dc 4e e4 42 f6 b1 00 5b cf b5 78
4b ea 54 65 6e 7d 8d 02 97 59 b2 1c e3 70 6c ea
df c6 26 50 4d 17 31 6d 23 4e 83 66 7e 81 c6
00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f
30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f
40 41 42 43 44 45 46 47 48 49 4a 4b 4c 4d 4e 4f
50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f
60 61 62 63 64 65 66 67 68 69 6a 6b 6c 6d 6e 6f
70 71 72 73 74 75 76 77 78 79 7a 7b 7c 7d 7e 7f
80 81 82 83 84 85 86 87 88 89 8a 8b 8c 8d 8e 8f
90 91 92 93 94 95 96 97 98 99 9a 9b 9c 9d 9e 9f
a0 a1 a2 a3 a4 a5 a6 a7 93 a9 aa ab ac ad ae af
bb be cf 7c f3 dc 4e e4 42 f6 b1 00 5b cf b5 78
4b ea 54 65 6e 7d 8d 02 97 59 b2 1c e3 70 6c ea
df c6 26 50 4d 17 31 6d 23 4e 83 66 7e 81 c6
00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f
30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f
40 41 42 43 44 45 46 47 48 49 4a 4b 4c 4d 4e 4f
50 51 52 53 54 55 56 57 58 59 5a 5b 5c 5d 5e 5f
60 61 62 63 64 65 66 67 68 69 6a 6b 6c 6d 6e 6f
70 71 72 73 74 75 76 77 78 79 7a 7b 7c 7d 7e 7f
80 81 82 83 84 85 86 87 88 89 8a 8b 8c 8d 8e 8f
90 91 92 93 94 95 96 97 98 99 9a 9b 9c 9d 9e 9f
a0 a1 a2 a3 a4 a5 a6 a7 a8 a9 aa ab ac ad ae af
b0 b1 b2 b3 b4 b5 b6 b7 b8 b9 ba bb bc bd be bf
c0 c1 c2 c3 c4 c5 c6 c7 c8 c9 ca cb cc cd ce cf
d0 d1 d0 fd 40 ca 9a f1 12 df 99 9b ae b1 29
00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f
30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d 3e 3f
40 41 42 43 44 45 46 47 48 49 4a 4b 4c 4d 4e 4f
4d 9c 9b 94 50 77 98 4a 45 30 30 5f d6 f7 a0 24
6c 0f 46 ff a5 5f ab 40 25 0d fa a5 e6 4d e6 8a
ea ca 45 de d7 1a 44 68 7f 9f 1e 45 d6 16 38 a0
b1 f5 e7 11 25 52 3a 64 2f fc 93 a9 af 7a ad b5
f4 37 a9 1b 89 91 ac 7d c2 91 12 23 8f 85 59 f9
5a 50 14 9c 75 19 48 7c 6a 4e 11 e1 d 6d 44 6b 3b
59 3c 80 61 c4 76 8c a7 58 7d fa 19 d4 53 6b ba
7d ea 23 76 25 7f 5c bc 11 db e5 80 19 c9 16 36
b3 3a c2 85 4f a8 dd 02 7d b4 3a 79 63 ef 1f 2c
22 8f 9c b2 95 a3 65 2c f6 0e 1d 52 e0 c3 dc
    
```

表示画面は作成途中だが、以下の情報を得ている。

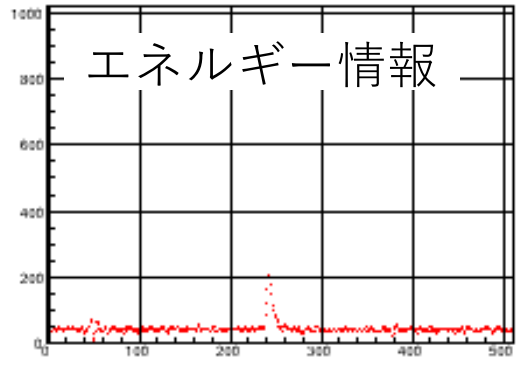
ガス検出器 粒子飛跡データ



ガス検出器検出位置の波形

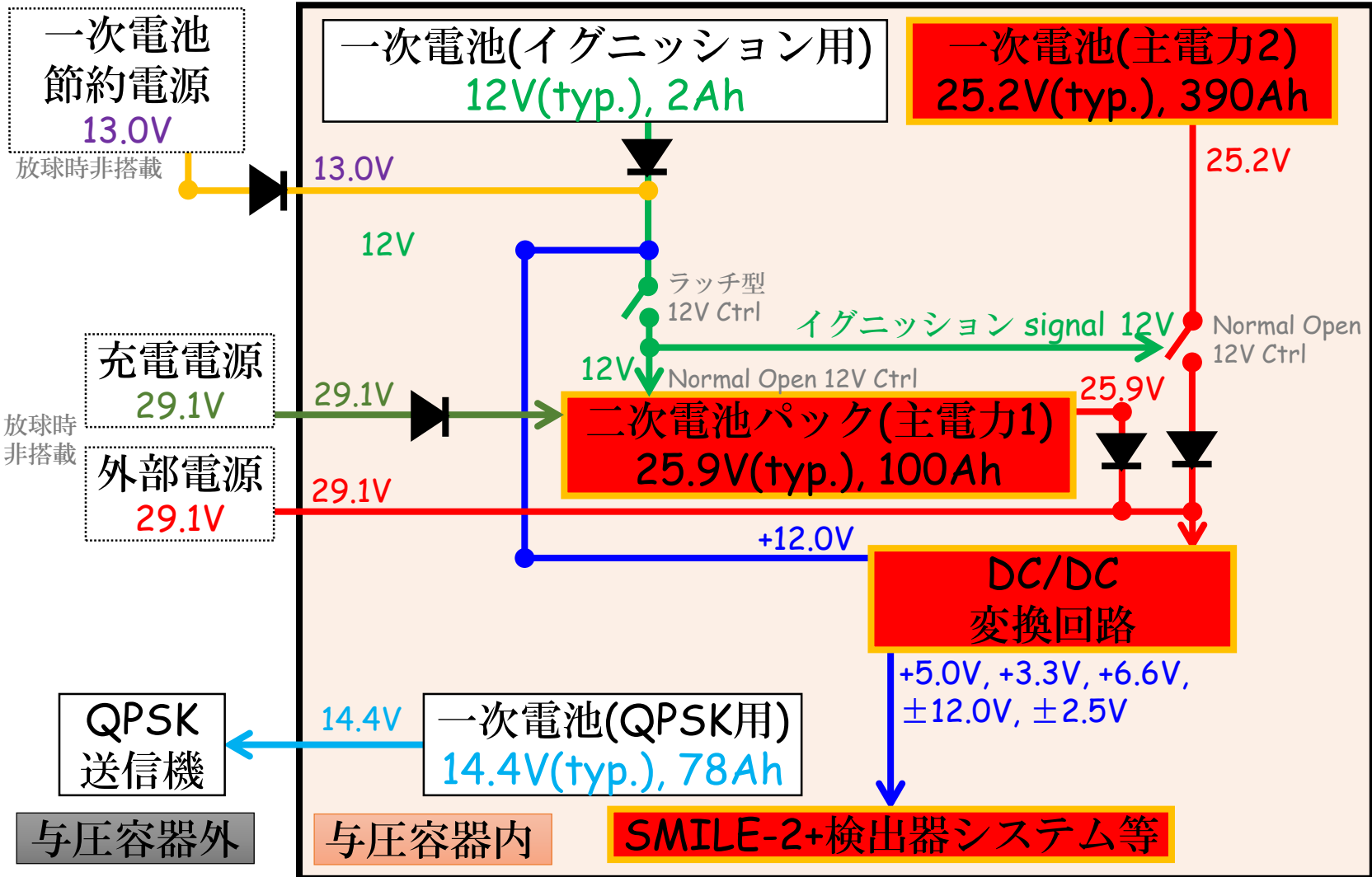
シンチレータ検出器

- エネルギー
- 検出位置

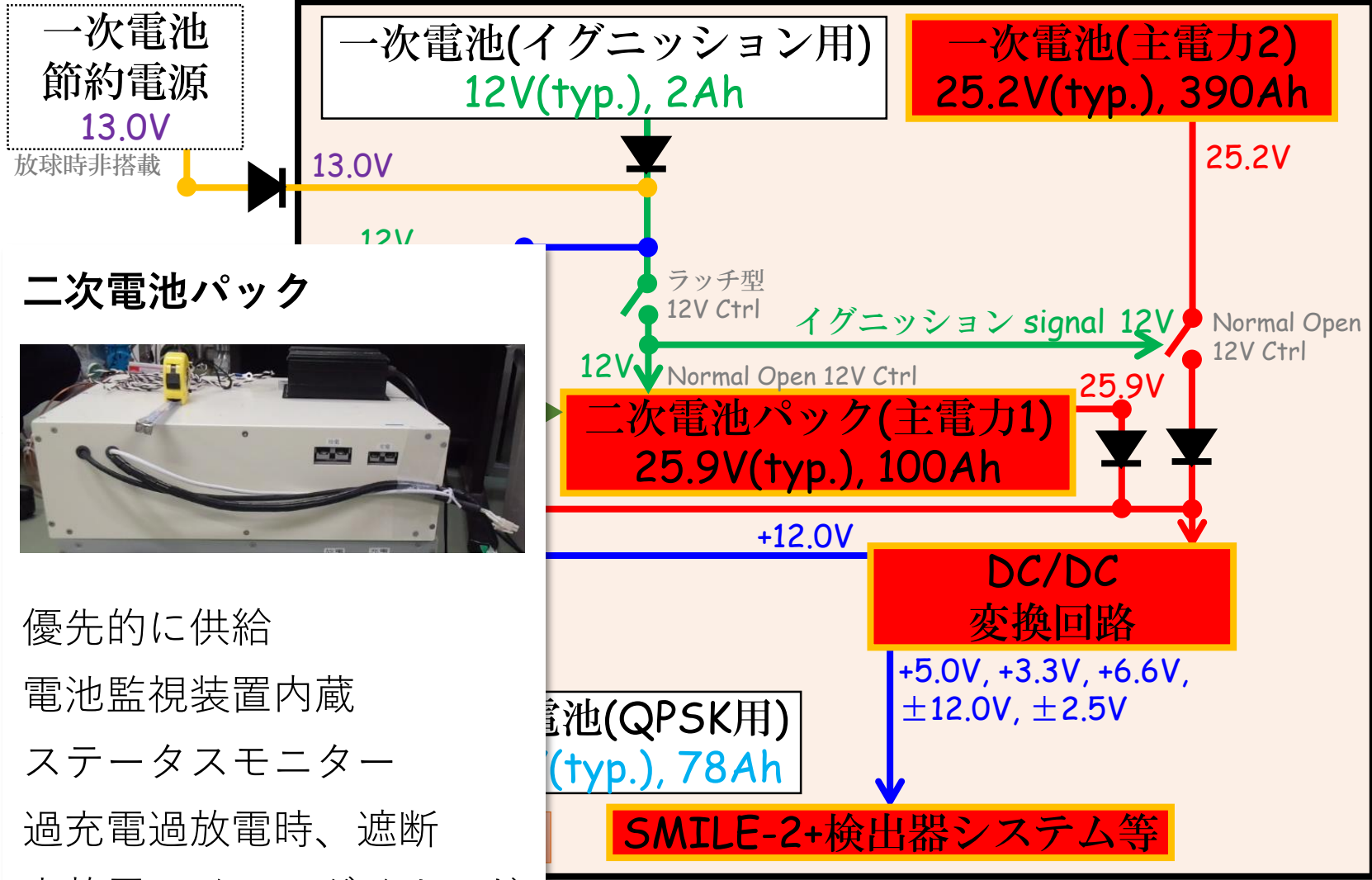


受信全事象でのエネルギースペクトルも表示予定。

電源系の結線概略図

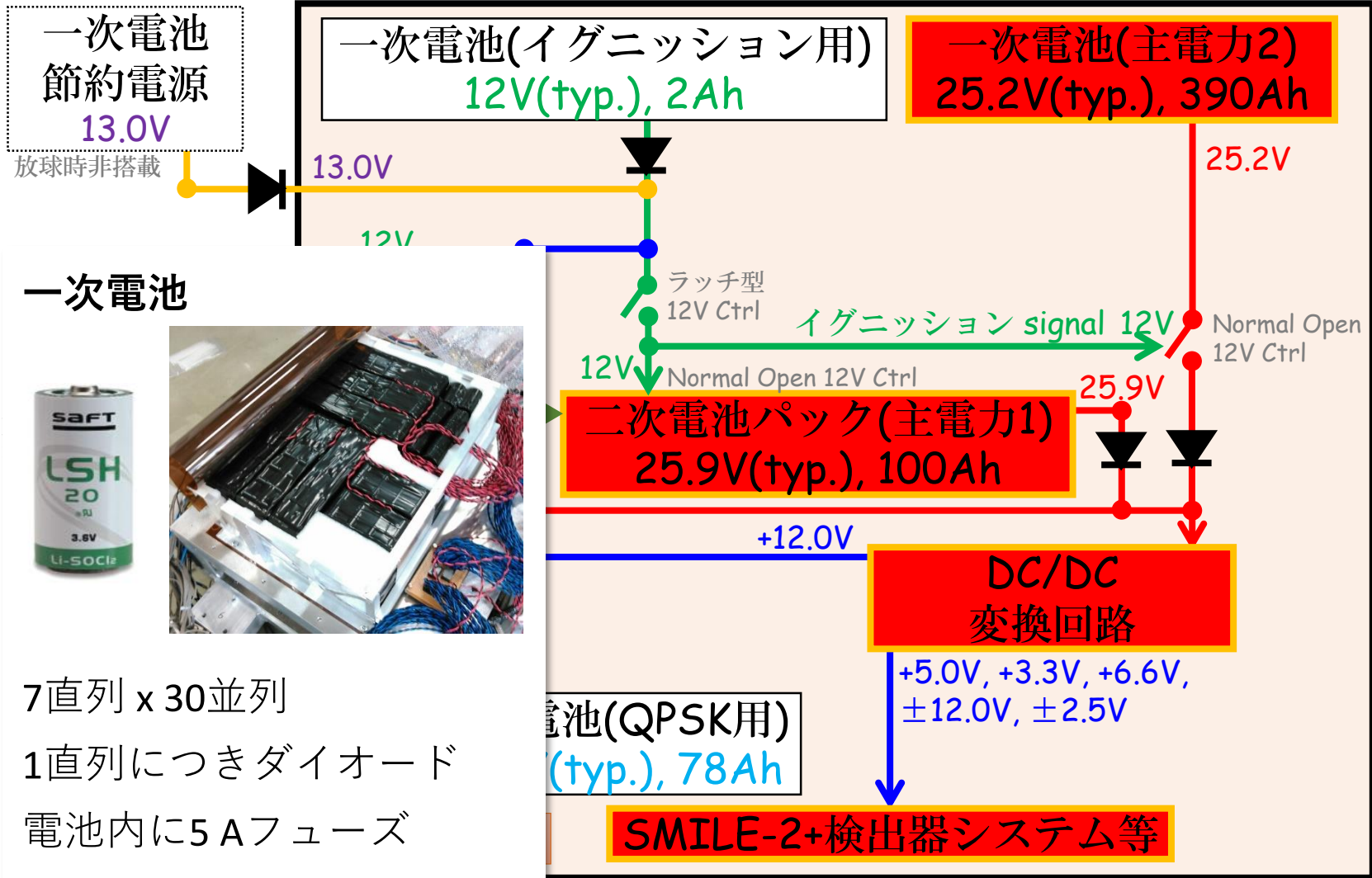


電源系の結線概略図

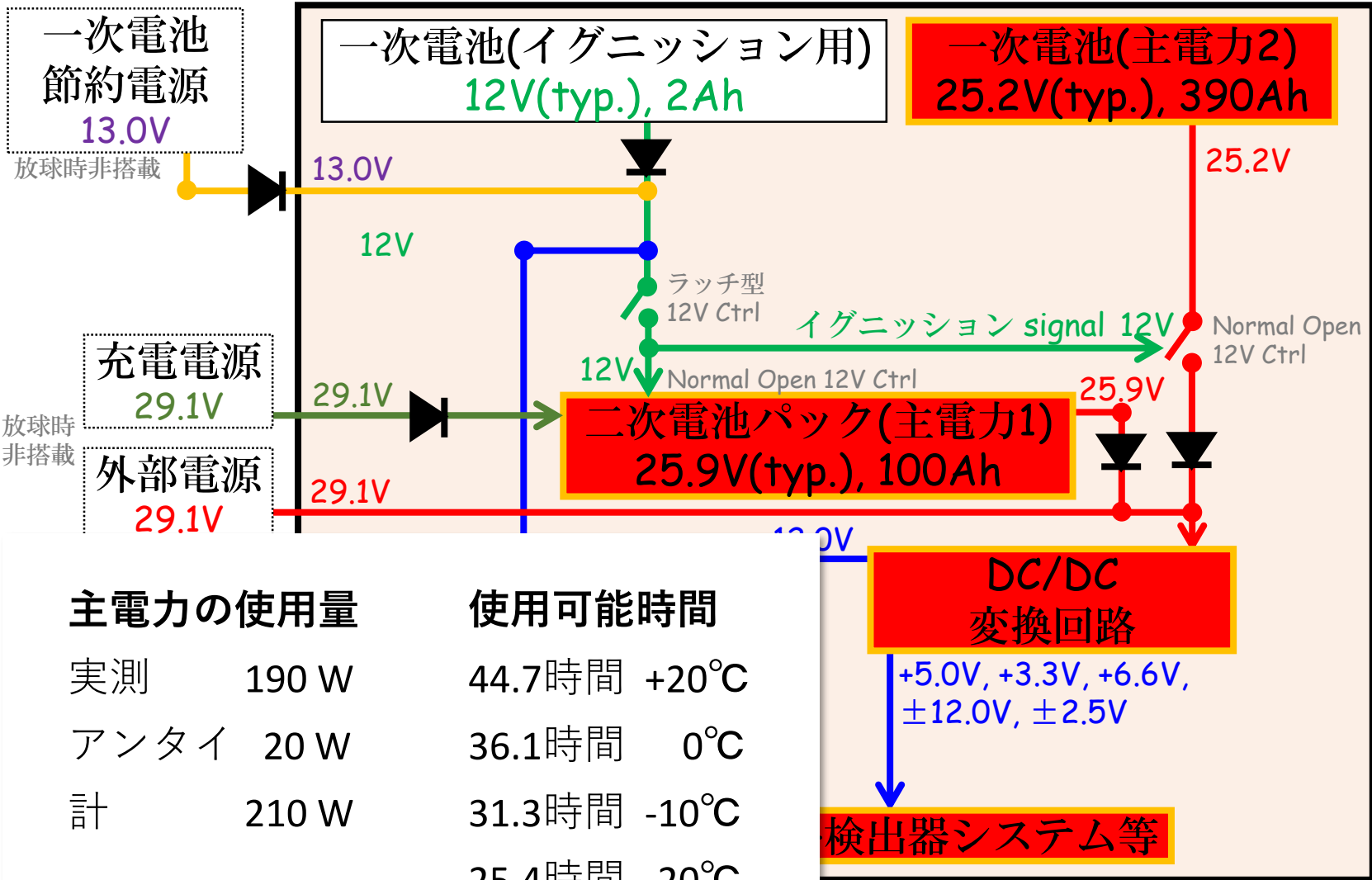


優先的に供給
電池監視装置内蔵
ステータスマニター
過充電過放電時、遮断
充放電ラインにダイオード

電源系の結線概略図

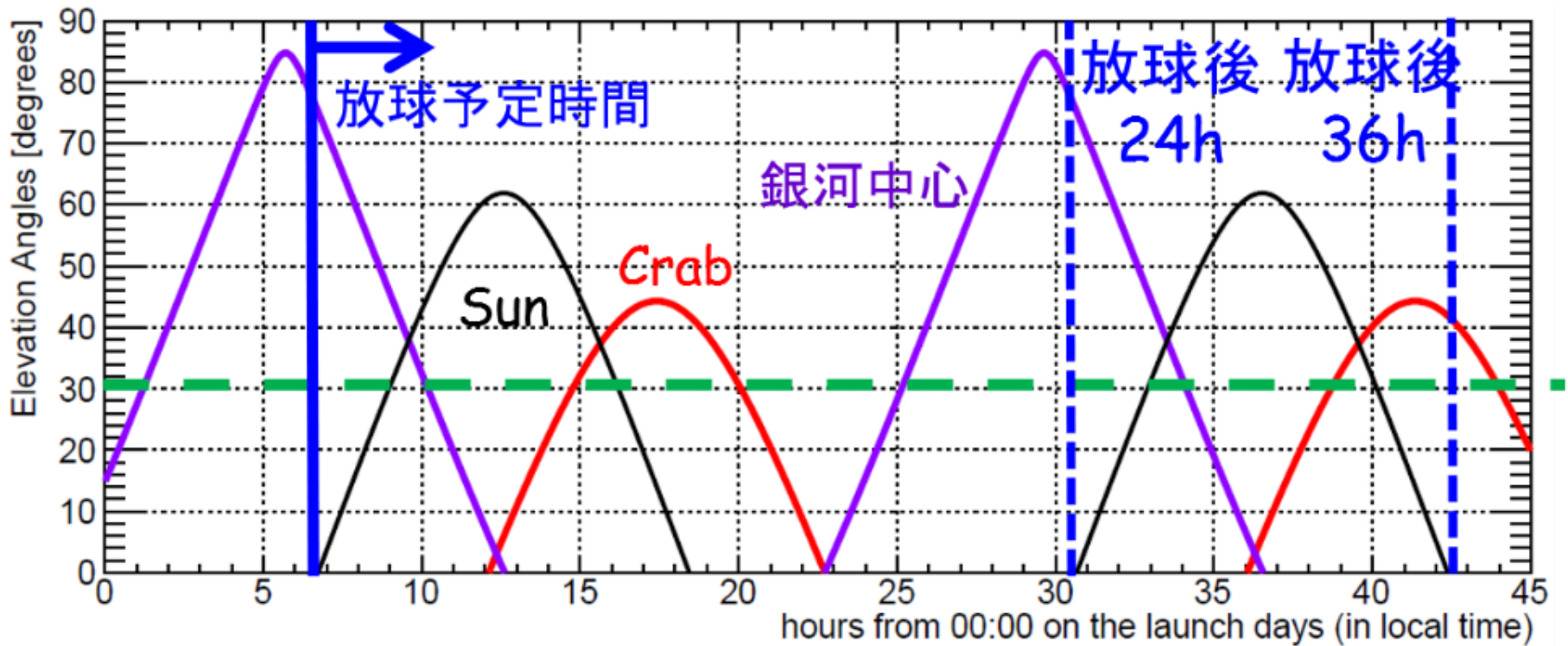


電源系の結線概略図



動作環境と要求

- 噛み合わせ 地表 昼 数時間
- リハーサル 地表 夜 数時間
- 本番 放球2-3時間前 + 観測24時間以上



動作環境と要求

- 噛み合わせ 地表 昼 数時間
- リハーサル 地表 夜 数時間
- 本番 放球2-3時間前 + 観測24時間以上

平衡状態になるまで数時間かかる。

- 噛み合わせ、リハーサル、気球上昇中の最低気温-80°Cは問題ない。
- 本番で電池がもつ、熱暴走・停止しない、ことが必要。

発熱量 + 大気輻射 + 太陽光吸収 = 系放射熱

$$210 \text{ W} + \epsilon \sigma T_a^4 S + \alpha L S = \epsilon \sigma T^4 S$$

与圧容器への断熱材の巻き方
を変えることで要求を満たす。

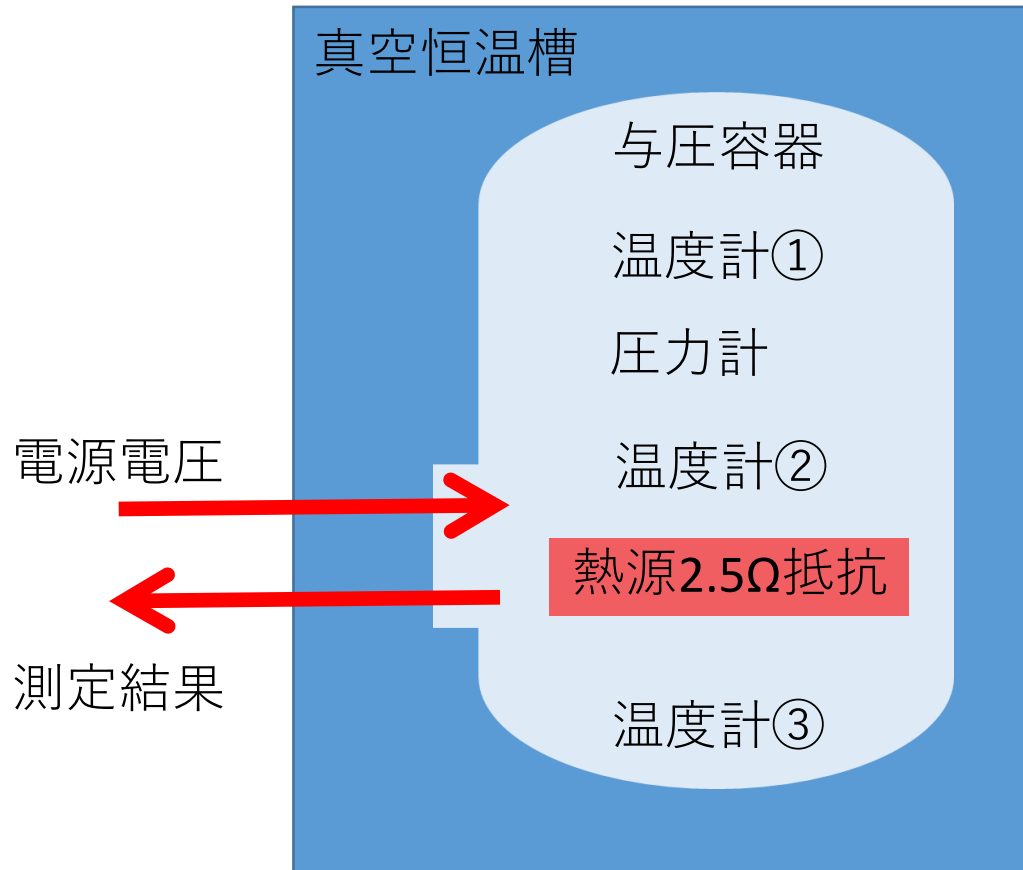
	赤外線放射率 ϵ	可視光吸収率 α
多層シートMLI	0.032	0.115
カプトン100 μm	0.755	0.544
アルミ白色塗装	0.83	~0.2

環境試験セットアップ

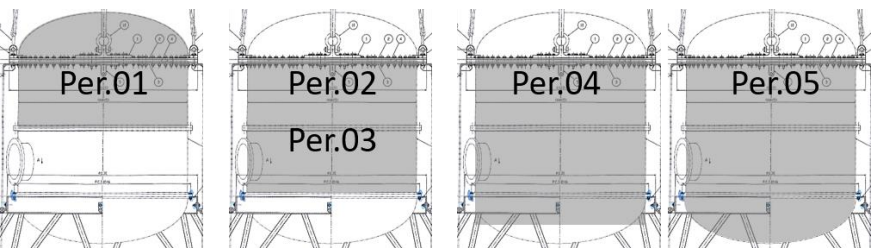
まず、模擬熱源を用いて ϵ を実測し、巻き方にあたりをつける。

日時：2017年3月

場所：宇宙科学研究所

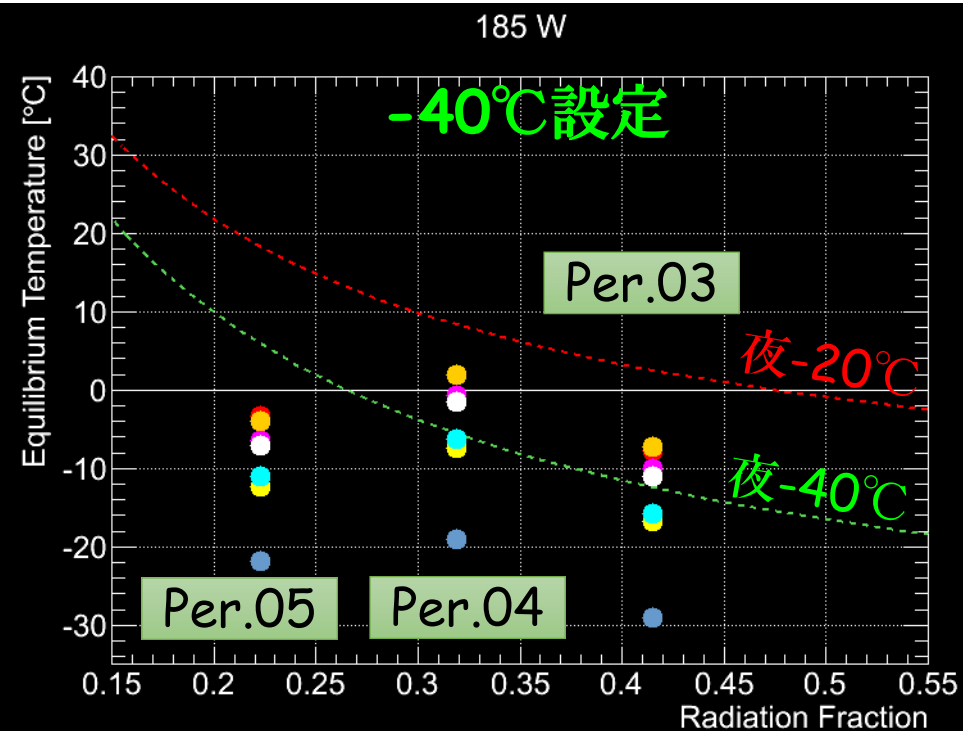
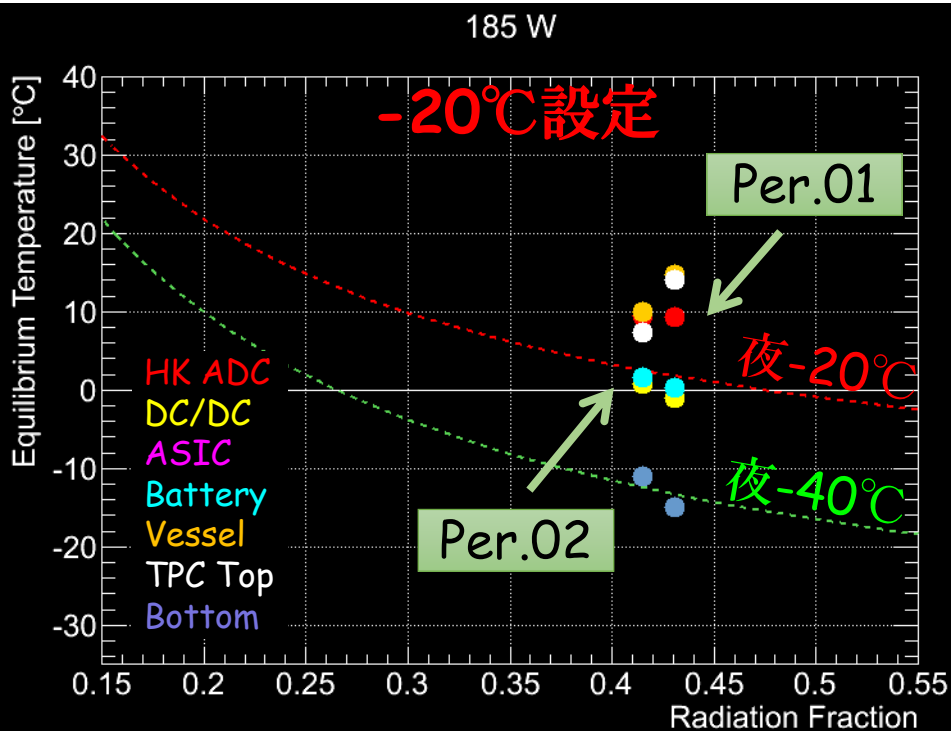


システム全体での熱試験



- 局所的に熱がたまる
- -40°C でこの実験系で動作実績。
- 電池予想温度 $>-10^{\circ}\text{C}$
- 31時間以上稼働可能。

- 1測定25時間以上
- 電源は外部電源
- 白色塗装アルミとMLI



まとめ

- SMILE-II+装置は474.6 kg < 要求500 kg
- 装置内部はイーサネット通信
- コマンドは2段階で送信
- 主電力は二次電池と一次電池
- -40°C で回路系が動作実績
- 電池予想温度 $>-10^{\circ}\text{C}$
- 31時間以上稼働できる
- 太陽の熱でさらに延びる

