

SMILE-II+実験のシステム概要



ref. isas17-sbs-024

吉川慶、谷森達、高田淳史、水村好貴、古村翔太郎、岸本哲朗、竹村泰斗、谷口幹幸、中村優太、小野坂健、齋藤要、黒澤俊介^A、身内賢太郎^B、澤野達哉^C、濱口健二^D、窪秀利

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

目次

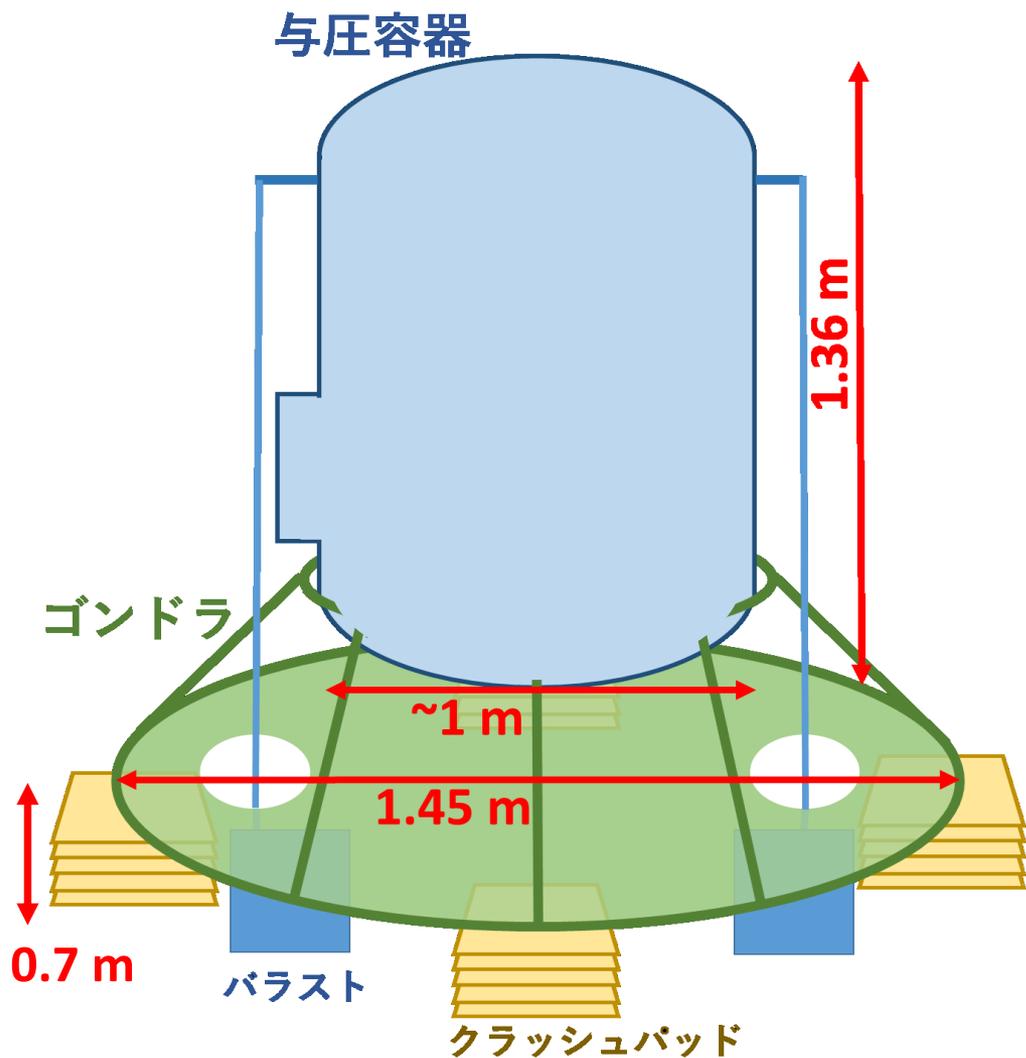
□ システム概要

全体像・通信系・電源系・熱環境

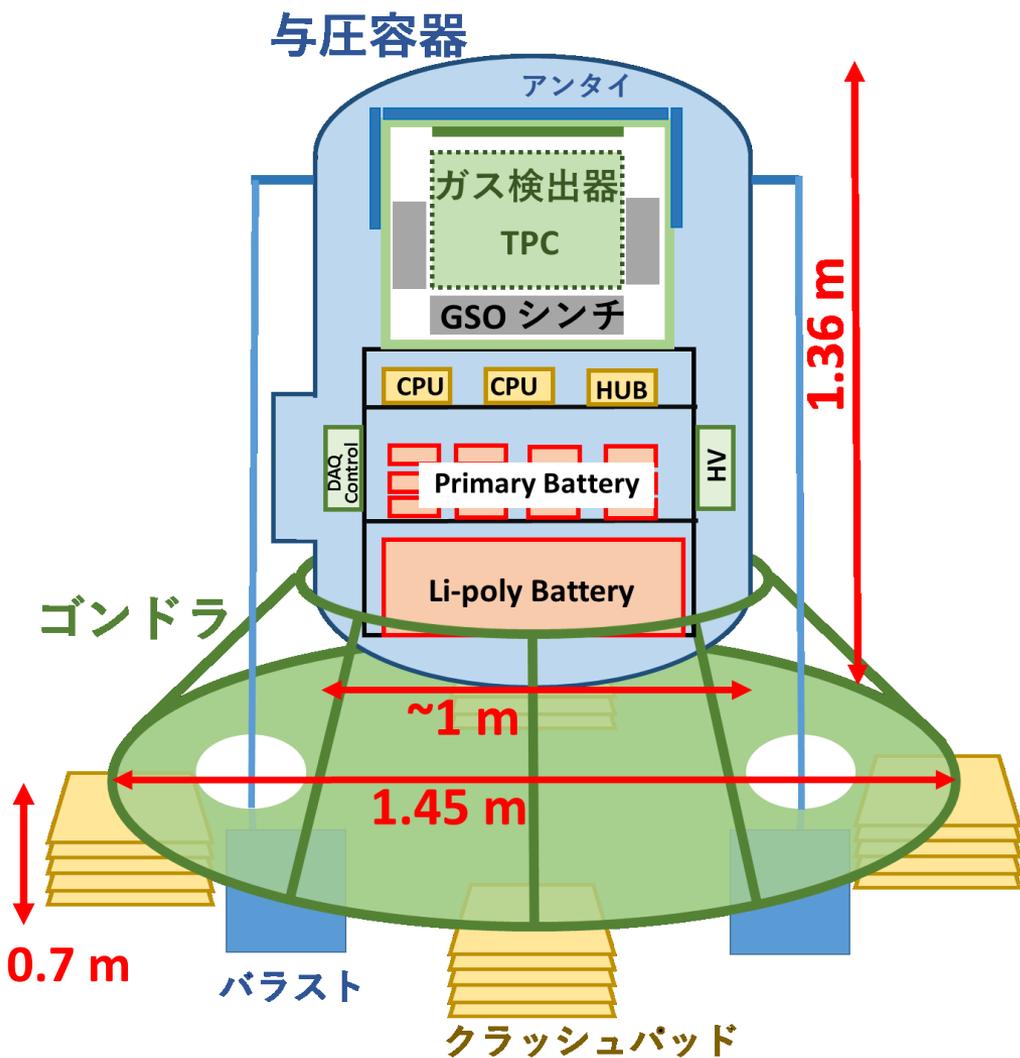
□ まとめ

気球システム全体像

与圧容器・ゴンドラ



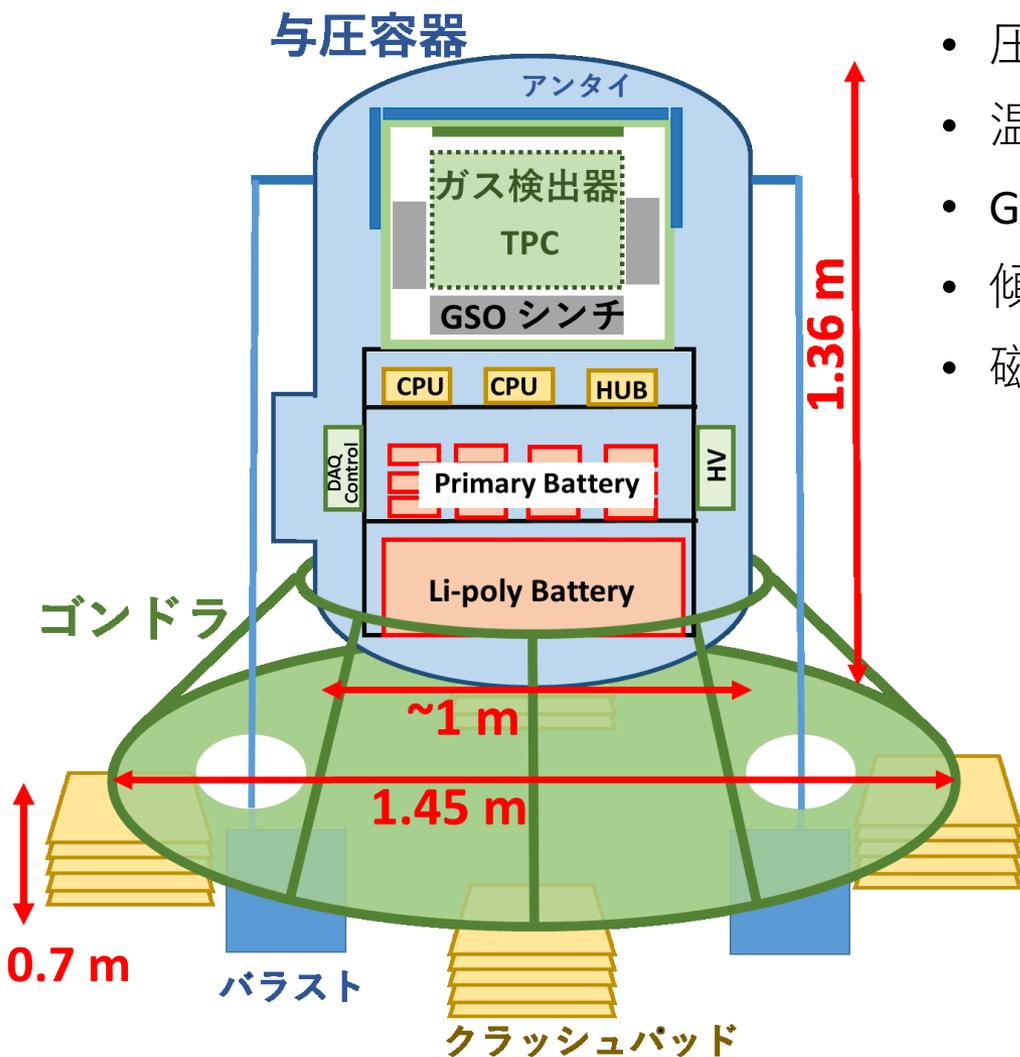
気球システム全体像



与圧容器 内部



気球システム全体像



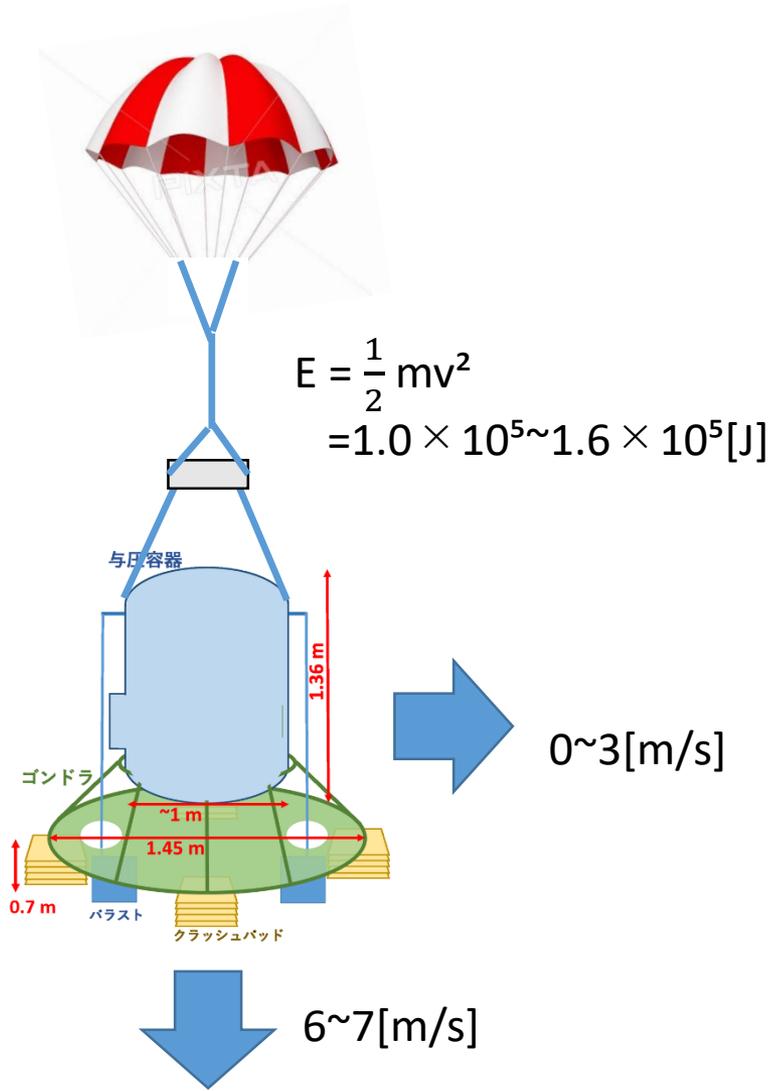
環境センサー

- 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				パッド	<10
荷姿冗長系	75.0				アンタイ	<20
バラスト	337.0				計	474.6
吊り下げ	972.0					
総計	1872.0					

クラッシュパッド



- NASAの基準をもとに設計

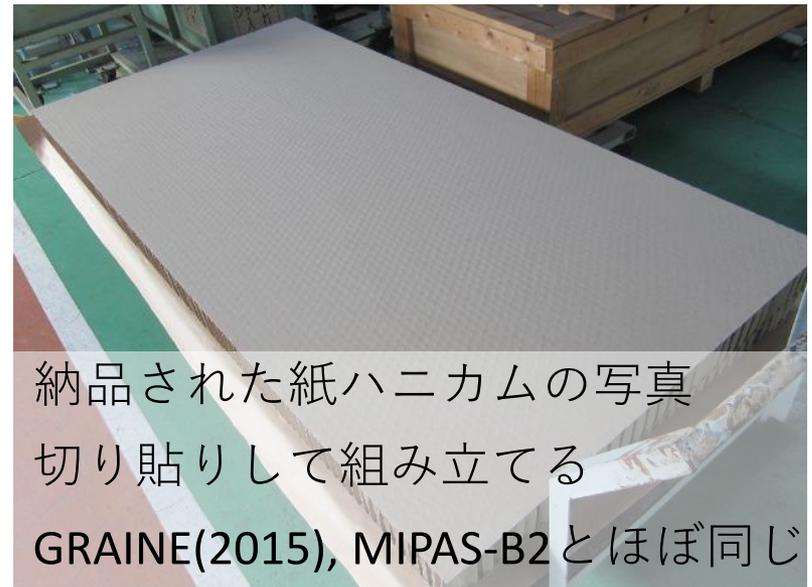
structural requirements and recommendations for balloon gondola design

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)

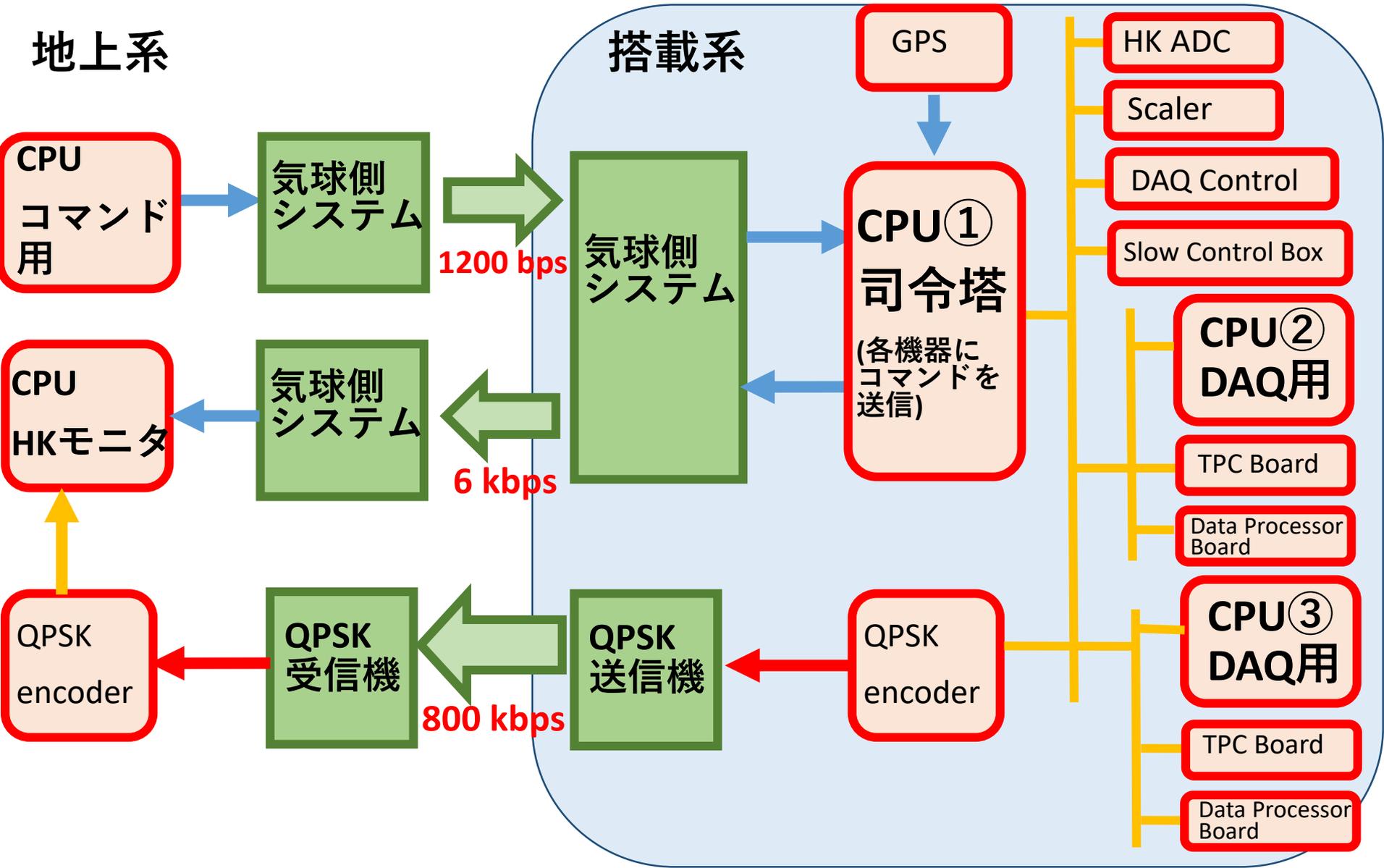
面積40 cm x 40 cmだと高さ50 cm以上必要

→70 cmに決定



通信系

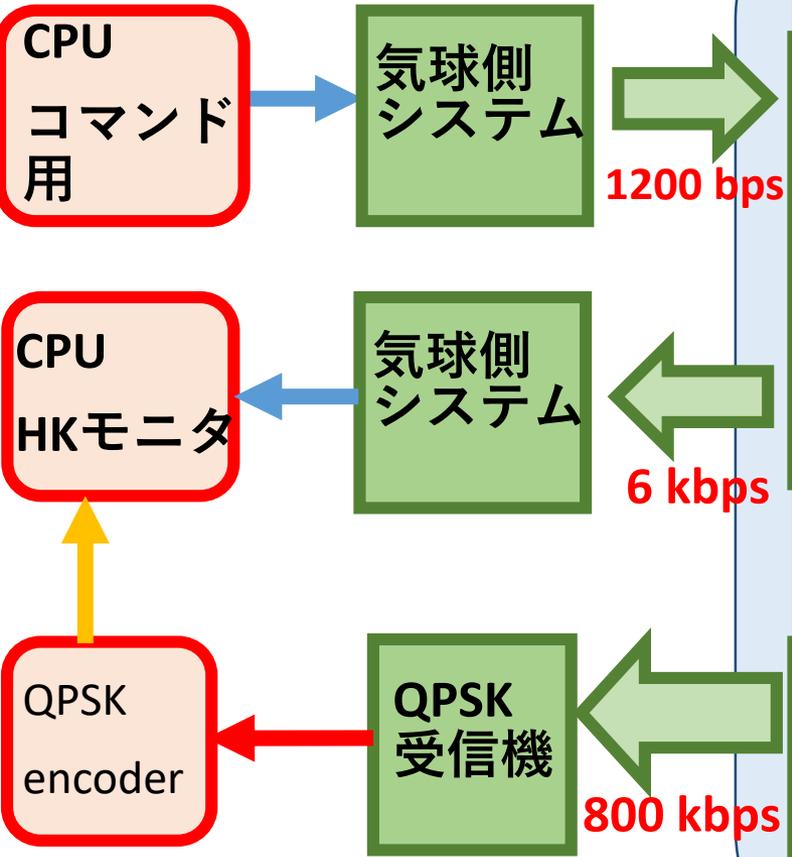
RS-232C	
LVDS	
Ethernet	



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

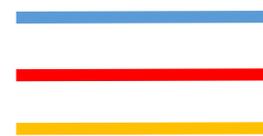
Bi-phase 8 kbps
地上にてHKデータを1 Hzにて受信

- 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

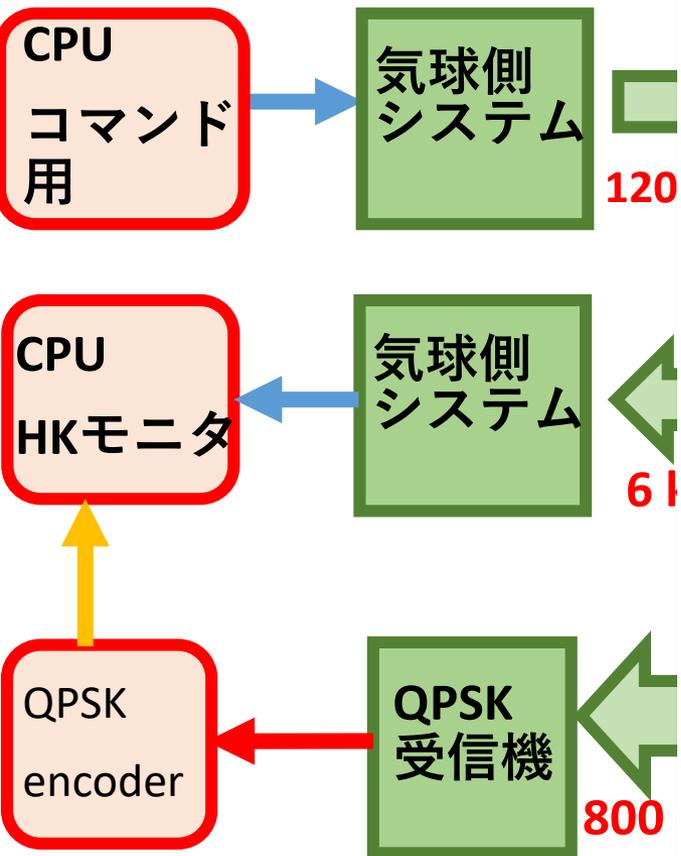
QPSK 800 kbps
地上にてイベントデータを受信
< 300 kbitを約1 Hzにて送信

通信系

RS-232C
LVDS
Ethernet



地上系

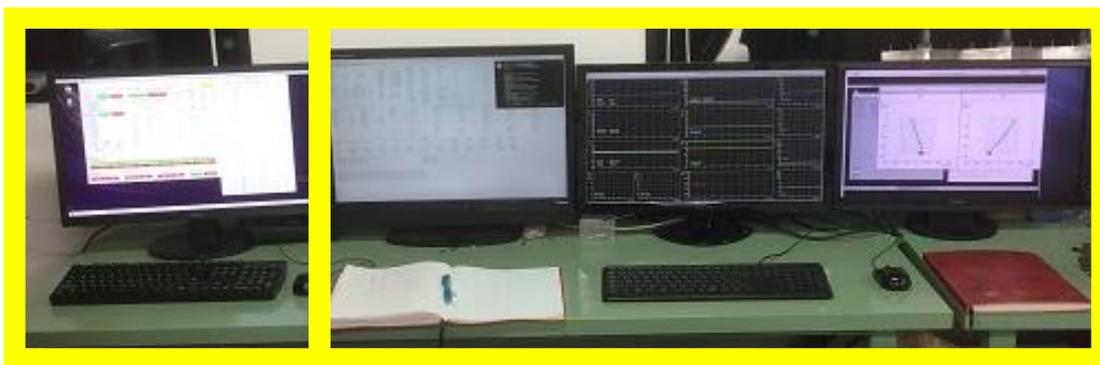


コマンドは2 byte

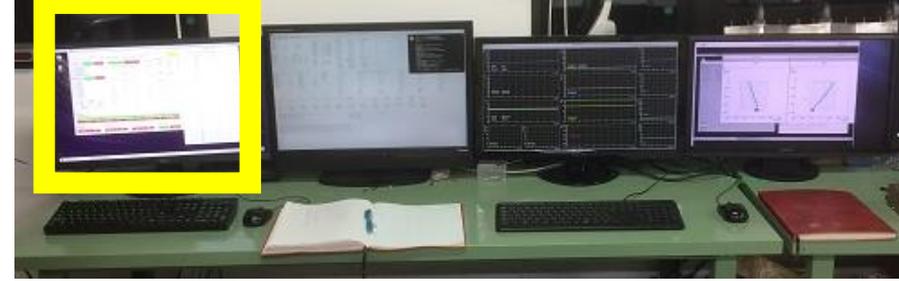
2段階の送信

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

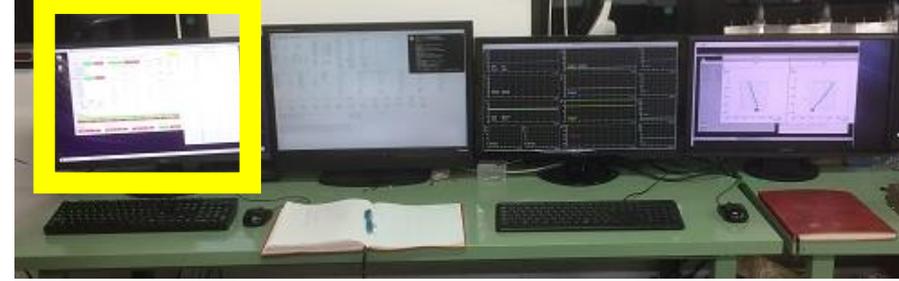
msgc@maya:~

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 16:22:09 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
- AN 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

HV control

Default All Off

Anode

- Anode 1
- Anode 2
- Anode 3

Set 1

Drift/GEM

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. DAC set

Anode

- Anode 1
- Anode 2
- Anode 3

Set 1

Cathode

- Cathode 1
- Cathode 2
- Cathode 3

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 +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

CALLTT control CALLTT control enable

KILLUA control KILLUA control enable

Command control Command control enable

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 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 16:25:34 Command : eb 90 10 ff 00 04 00 ea 41 20 20 41 75 50 49 43
2017-11-06 16:25:37 Command : eb 90 10 ff 00 04 00 eb 23 3f 3f 23 75 50 49 43
2017-11-06 16:25:40 Command : eb 90 10 ff 00 04 00 ec 3f 3f 3f 3f 75 50 49 43
2017-11-06 16:25:44 Command : eb 90 10 ff 00 04 00 ed 01 01 01 75 50 49 43
2017-11-06 16:27:01 Command : eb 90 10 ff 00 04 00 ee 01 01 01 75 50 49 43
2017-11-06 16:27:09 Command : eb 90 10 ff 00 04 00 ef 01 01 01 75 50 49 43
2017-11-06 16:30:56 Command : eb 90 10 ff 00 04 00 f0 41 20 20 41 75 50 49 43
2017-11-06 16:30:59 Command : eb 90 10 ff 00 04 00 f1 01 02 02 01 75 50 49 43
2017-11-06 16:31:53 Command : eb 90 10 ff 00 04 00 f2 41 20 20 41 75 50 49 43
2017-11-06 16:31:57 Command : eb 90 10 ff 00 04 00 f3 23 3f 3f 23 75 50 49 43
2017-11-06 16:32:23 Command : eb 90 10 ff 00 04 00 f4 20 20 41 75 50 49 43
2017-11-06 16:32:29 Command : eb 90 10 ff 00 04 00 f5 22 3f 3f 22 75 50 49 43
2017-11-06 16:32:41 Command : eb 90 10 ff 00 04 00 f6 41 20 20 41 75 50 49 43
2017-11-06 16:32:44 Command : eb 90 10 ff 00 04 00 f7 01 01 01 75 50 49 43
2017-11-06 16:36:12 Command : eb 90 10 ff 00 04 00 f8 41 20 20 41 75 50 49 43
2017-11-06 16:36:16 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 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 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 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

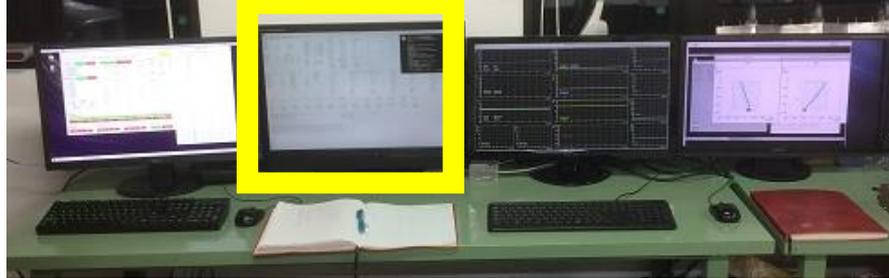
スレッショルド設定

送信済みコマンド

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
4.116 4.108      f0f0f0
4.108 4.088      f0f0f0
4.112      f0f0f0
PMT 1 : 0123 5
PMT 2 : 012345
PMT 3 : 012345

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

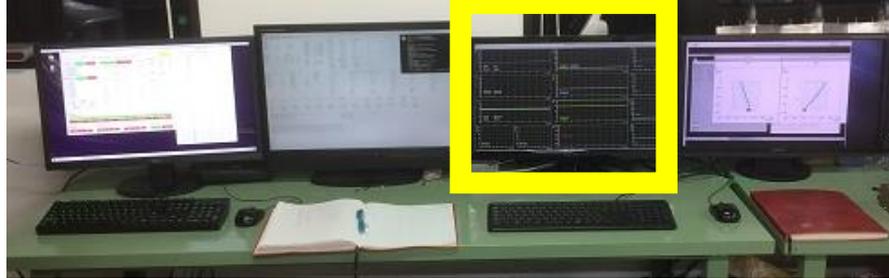
Command Ack : eb 90 10 ff 00 04 00 30 41 20 20 41 75 50 49 43
Reserved Com: DAQ ctrl Start
Com. Error : Successful

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

Over V(W)

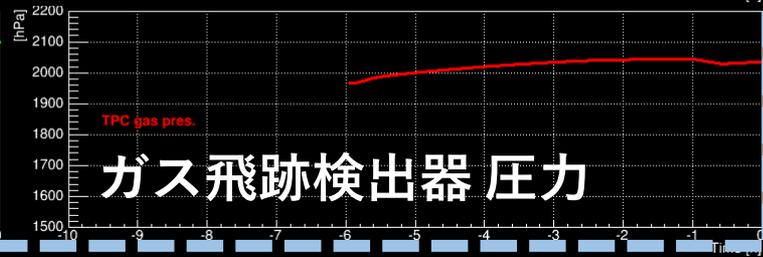
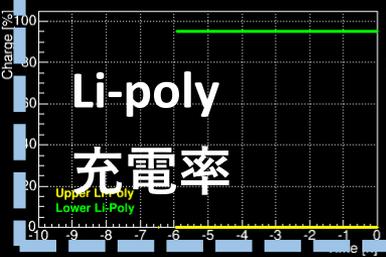
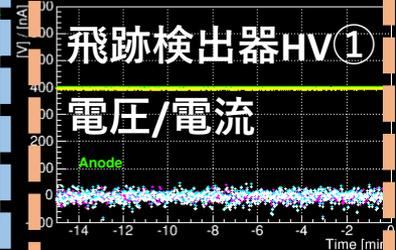
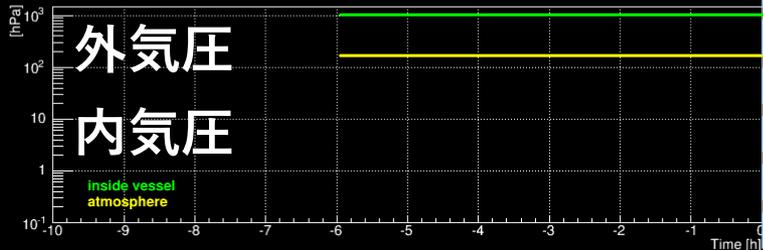
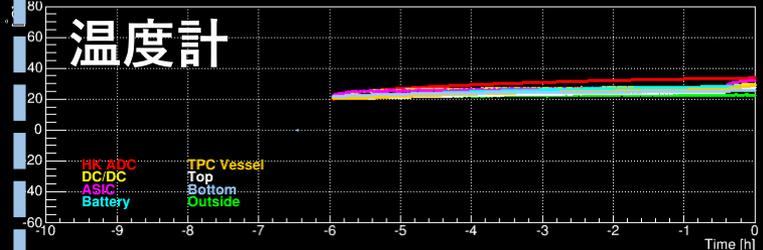
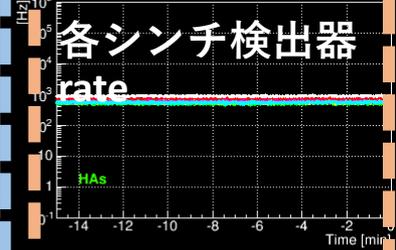
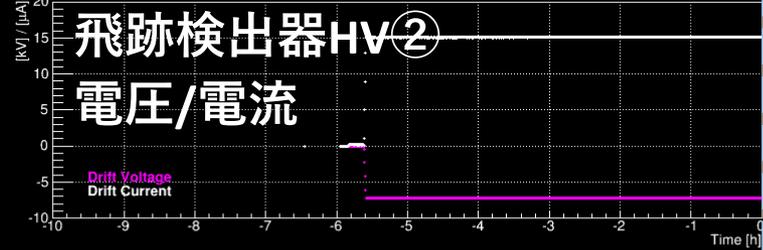
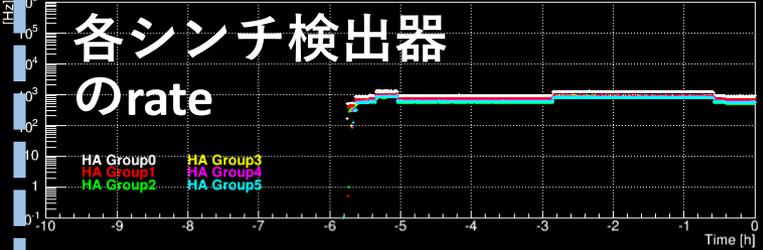
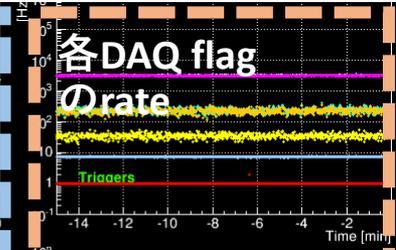
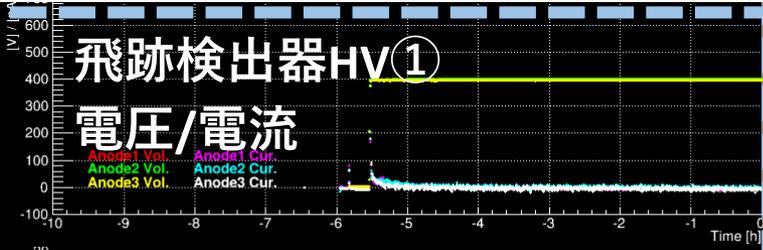
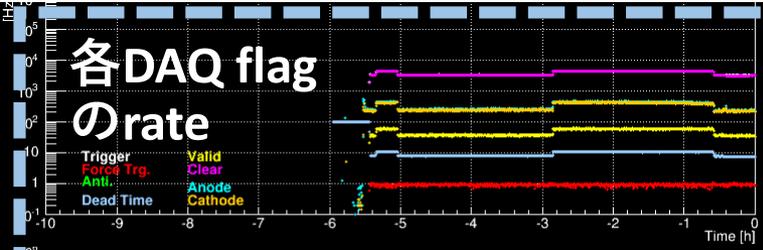
eb 90 81 32 54 18 01 48 0a 7a 24 47 50 47 47 41 2c 31 31 34 37 34 31 2e 30 30 2c 33 35 33 33 2e
34 36 35 30 31 2c 4e 2c 31 33 39 32 35 2e 36 33 34 36 31 2c 45 2c 31 2c 30 38 2c 31 2e 31 2c 31
33 33 2e 38 2c 4d 2c 33 38 2e 38 2c 4d 2c 2c 2a 36 34 0d 0a 00 00 00 00 00 00 00 2b e1 2a 3d
2b 4d 2b a1 2b 1f 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

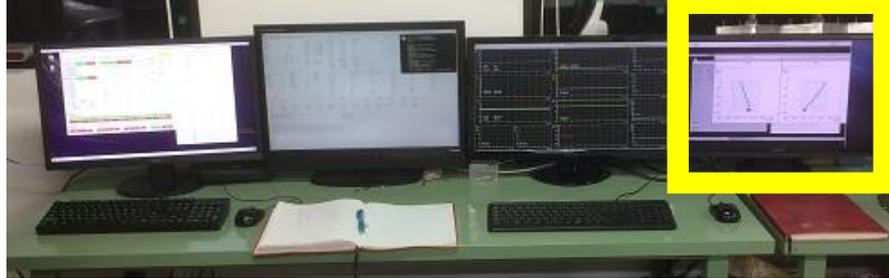


過去10時間

過去15分



QL画面③ 検出事象



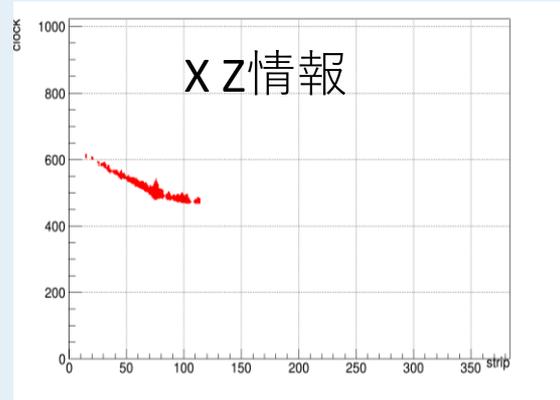
受信データ

```

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 5f 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 a4 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。

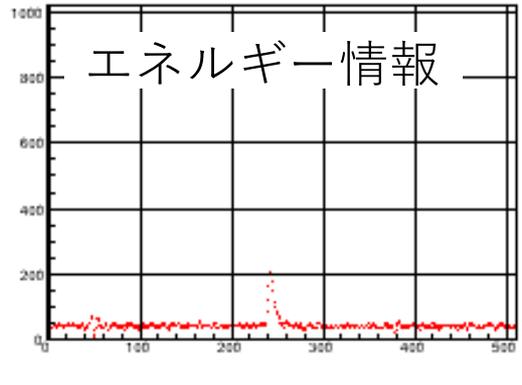
ガス検出器 粒子飛跡データ



ガス検出器検出位置の波形

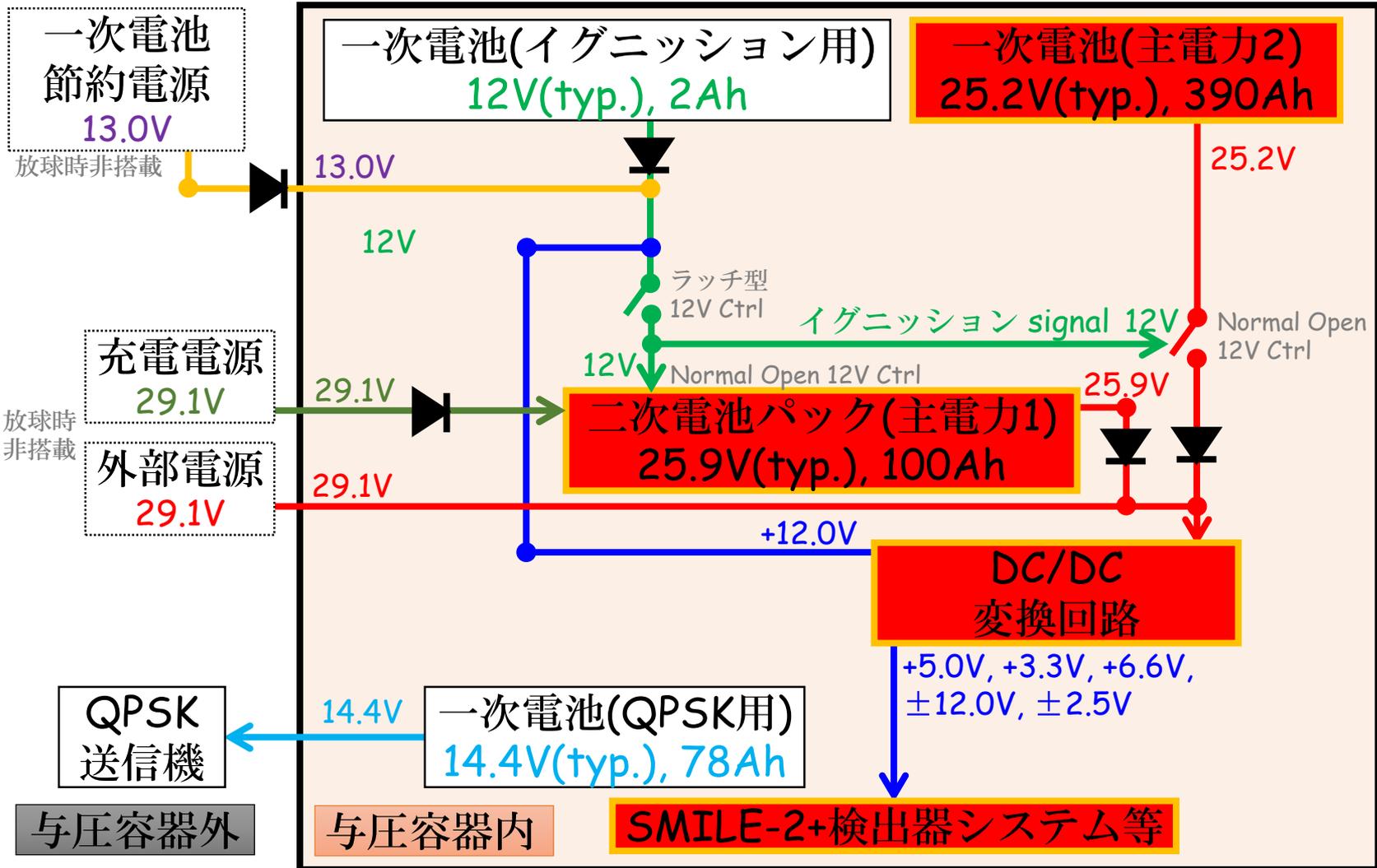
シンチレータ検出器

- エネルギー
- 検出位置

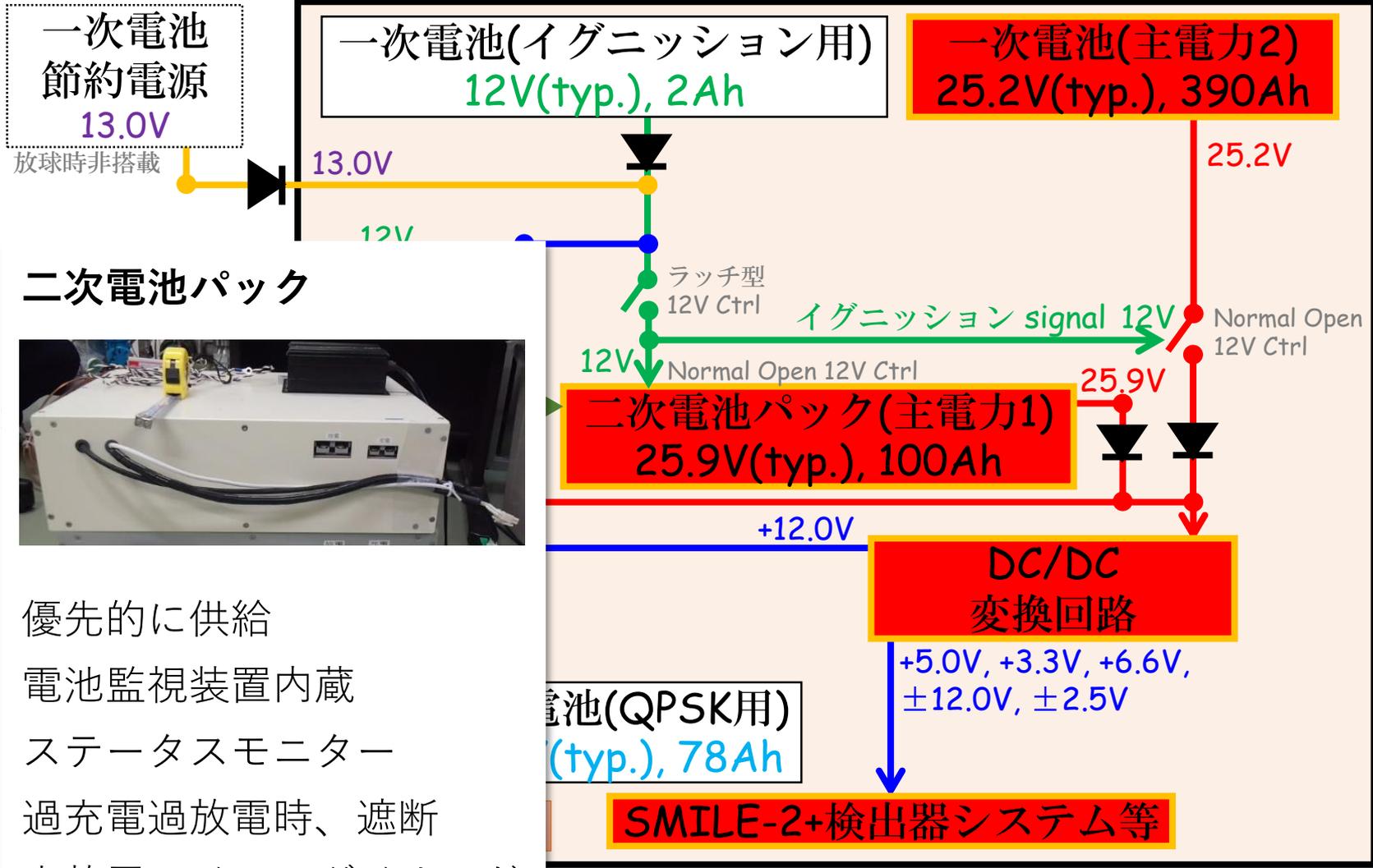


受信全事象でのエネルギースペクトルも表示予定。

電源系の結線概略図



電源系の結線概略図



一次電池
節約電源
13.0V
放球時非搭載

一次電池(イグニッション用)
12V(typ.), 2Ah

一次電池(主電力2)
25.2V(typ.), 390Ah



二次電池パック(主電力1)
25.9V(typ.), 100Ah

DC/DC
変換回路

電池(QPSK用)
(typ.), 78Ah

SMILE-2+検出器システム等

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

+5.0V, +3.3V, +6.6V,
±12.0V, ±2.5V

+12.0V

13.0V

12V

25.2V

12V

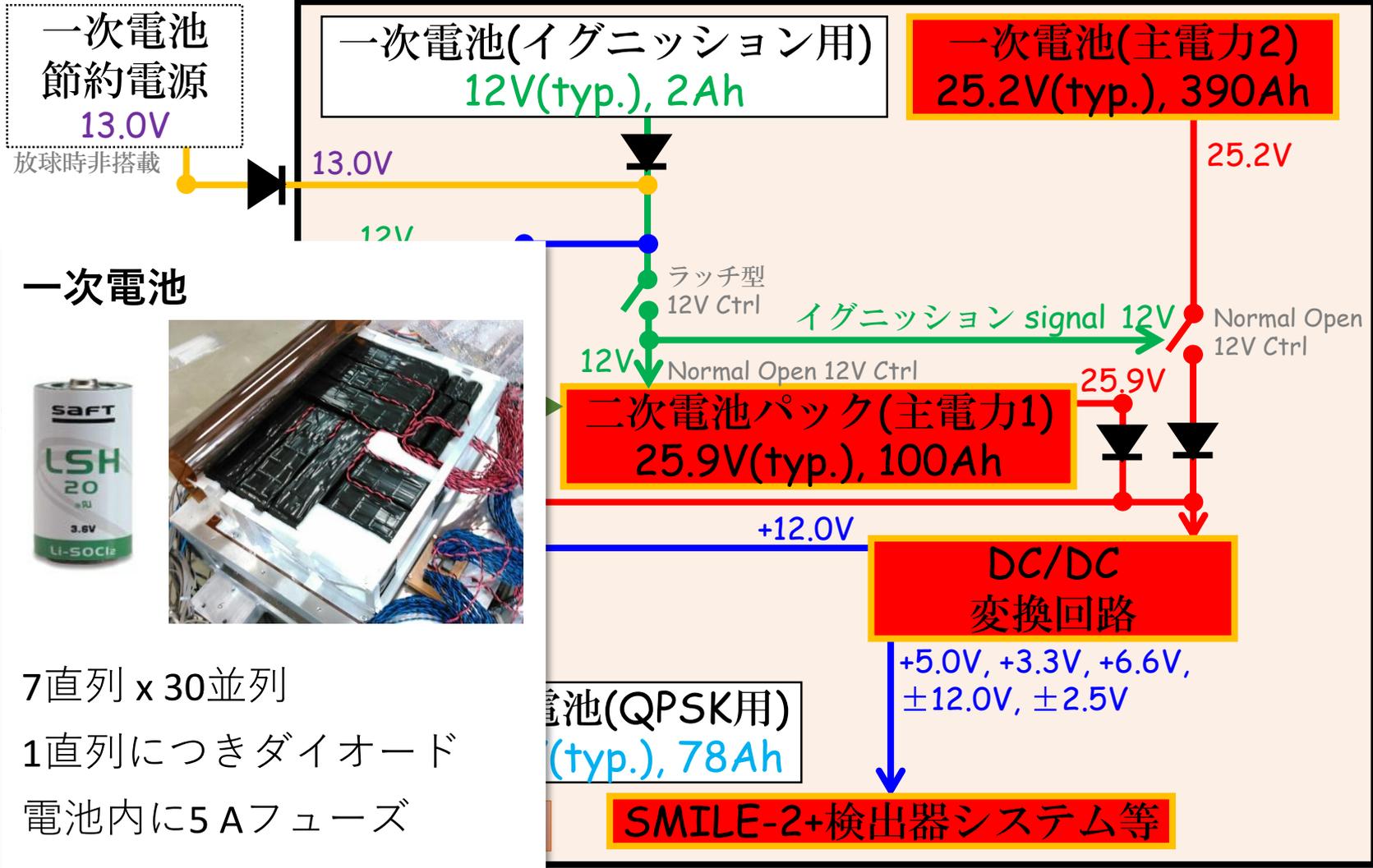
ラッチ型
12V Ctrl

イグニッション signal 12V

Normal Open
12V Ctrl

25.9V

電源系の結線概略図



一次電池

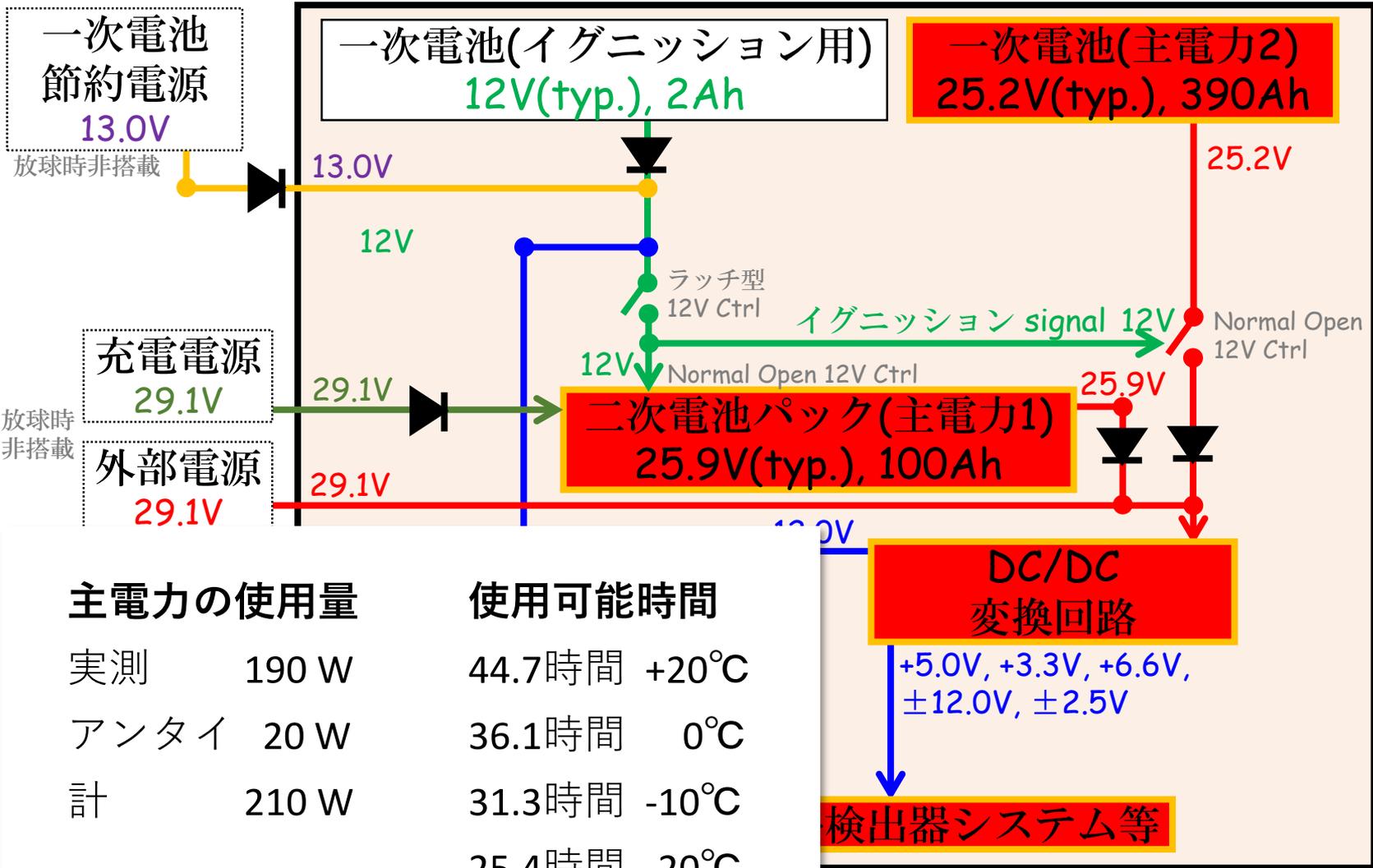


7直列 x 30並列

1直列につきダイオード

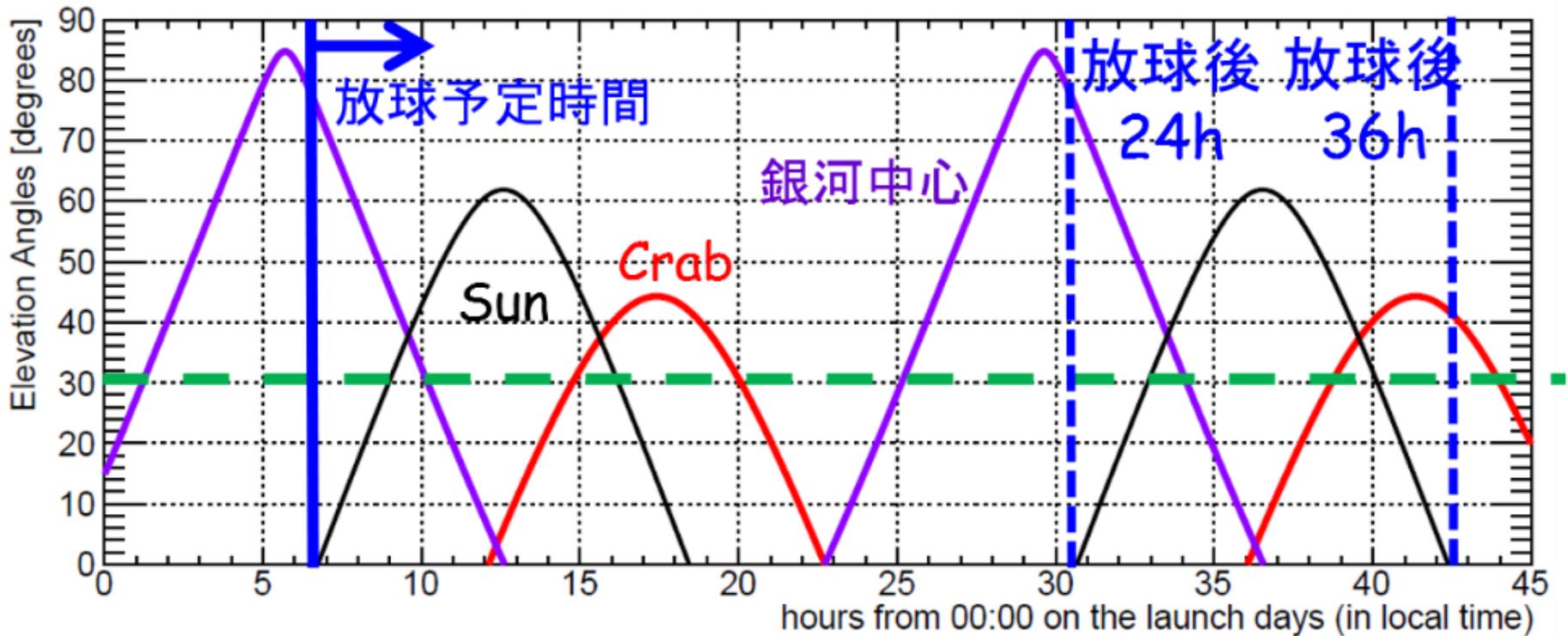
電池内に5 Aフューズ

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。

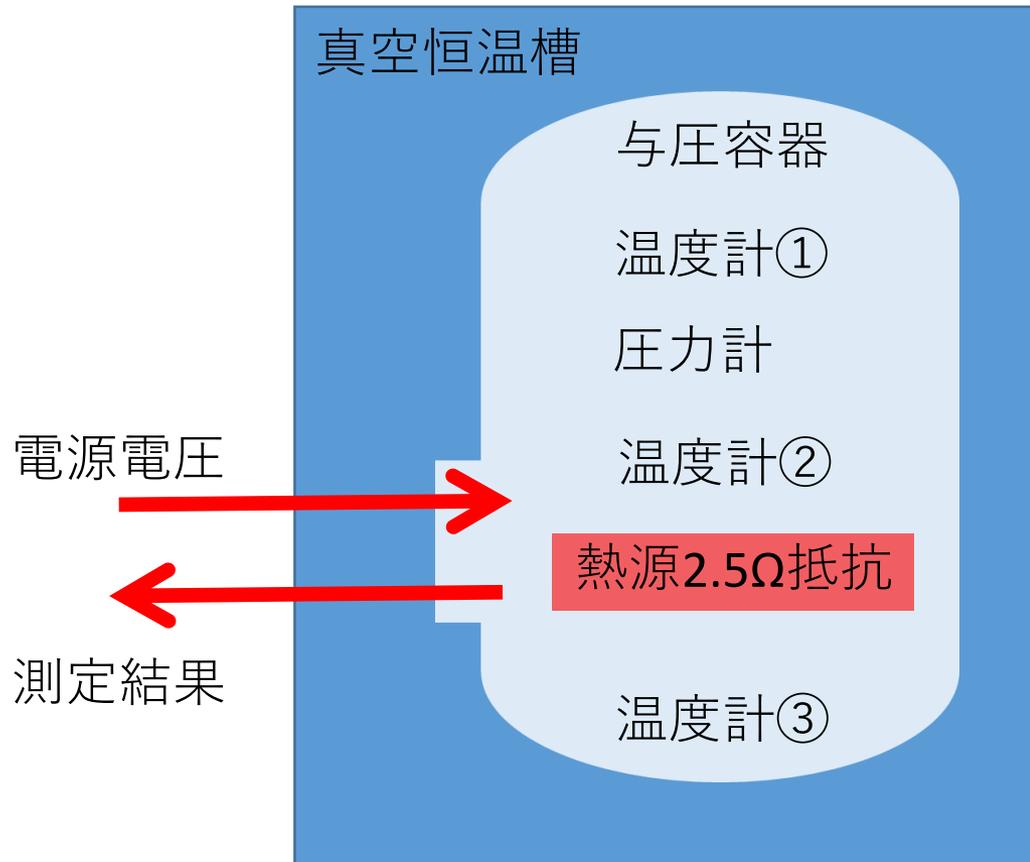
	赤外線放射率 ϵ	可視光吸収率 α
多層シートMLI	0.032	0.115
カプトン100 μm	0.755	0.544
アルミ白色塗装	0.83	~0.2

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



与圧容器のみでの熱試験

① Kapton全体+
断熱材全体



② Kapton全体
+断熱材胴部



③ Kapton全体
+ポリエチレン胴部



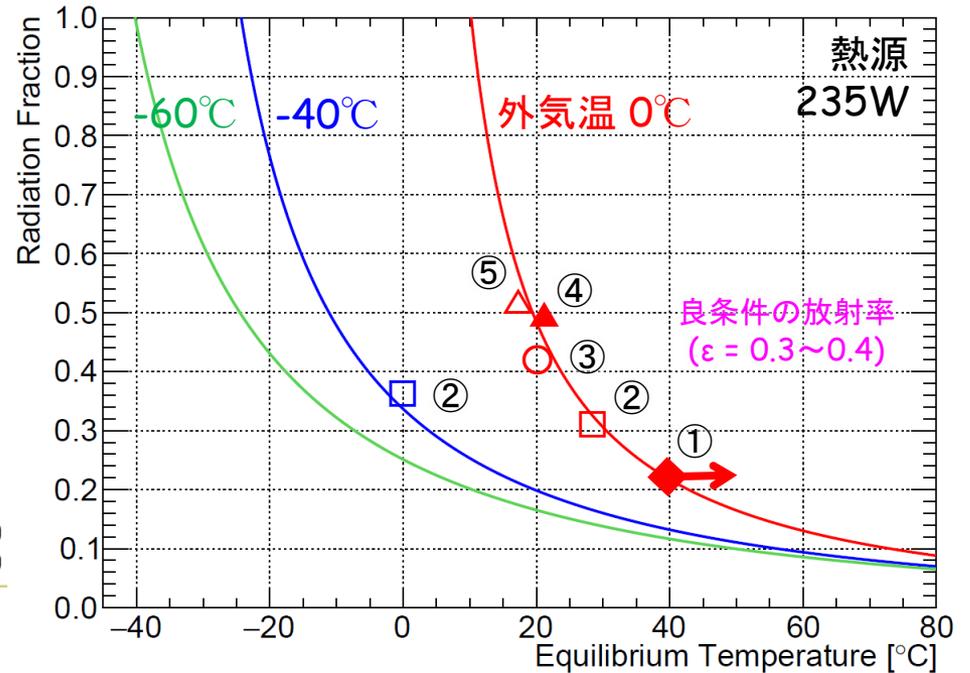
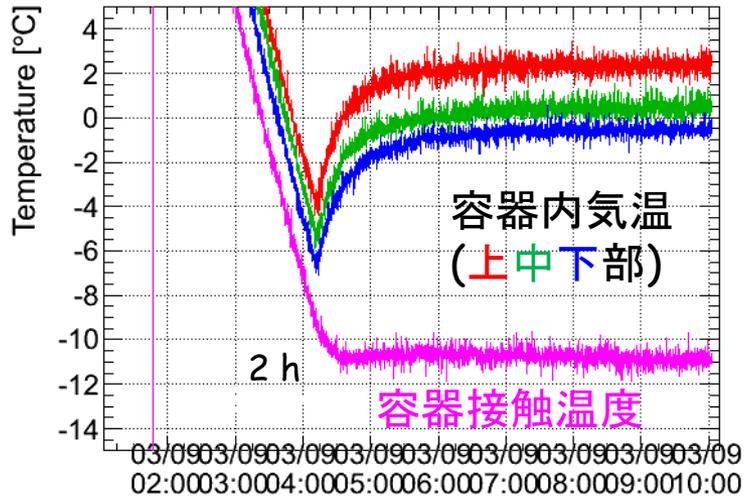
④ Kapton全体



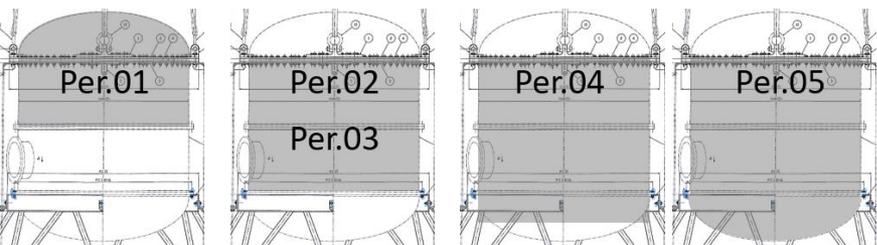
⑤ Kapton下部



熱環境試験結果 2017/3/9
(外気 -37°C, 3 hPa, 熱源 235W)

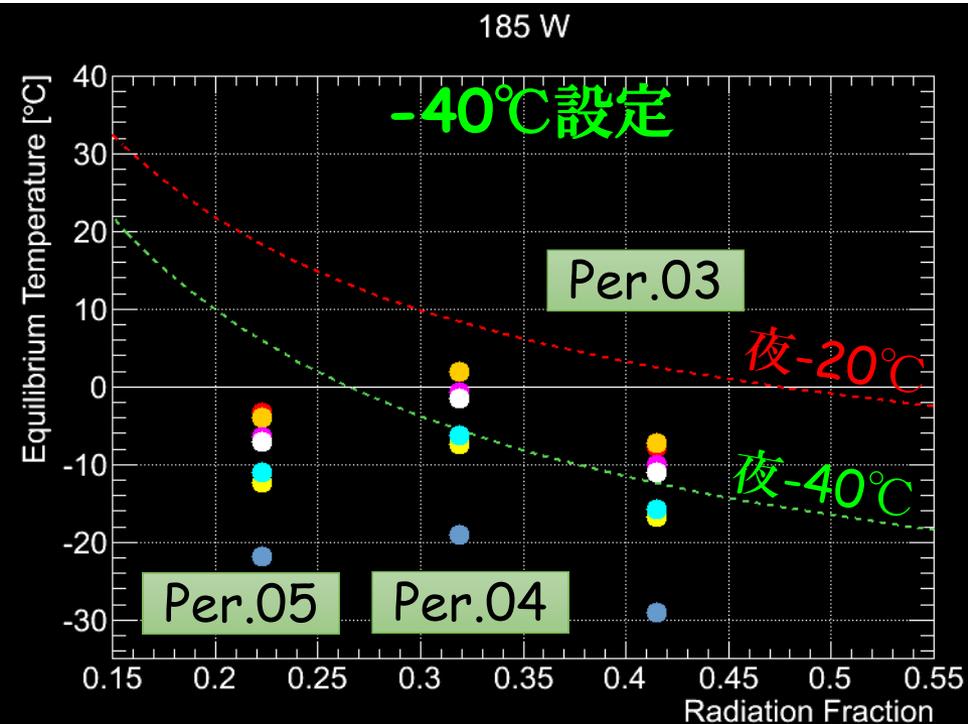
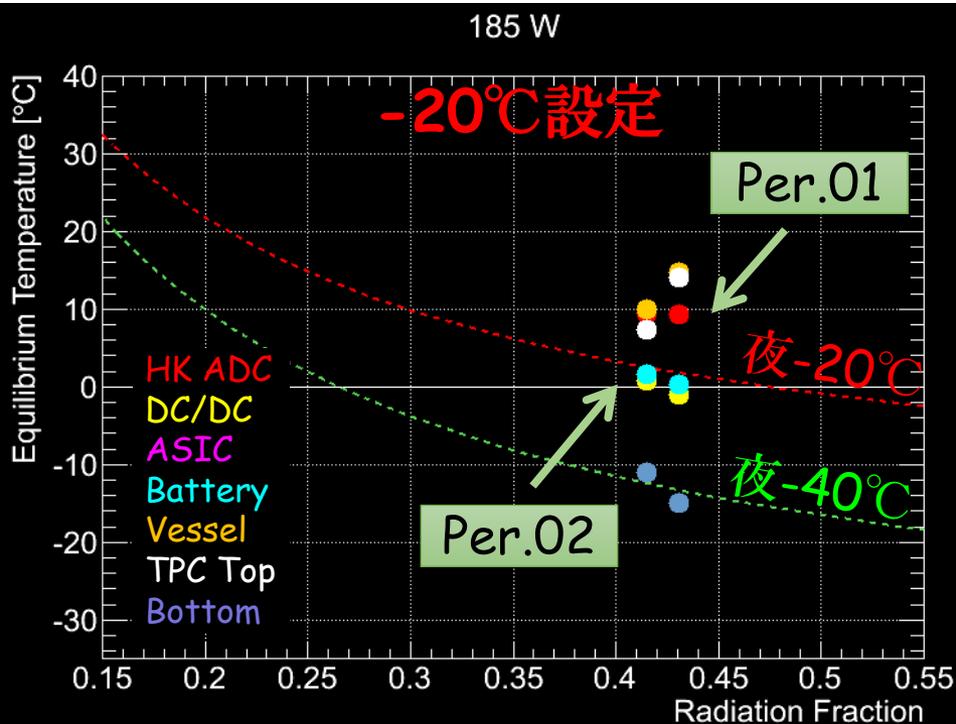


システム全体での熱試験



- 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

