Status of operations and data analysis at Waseda CALET Operations Center

DH&A Japan Yoichi Asaoka

200203 CALET-TIM @ CNR-IFAC

I. Waseda CALET Operations Center (WCOC)
II. Four Years of CALET Operations on the ISS
III. L2 PASS-04 Release
    I. Format updates
    II. Calibration updates
IV. Summary

CALET Data Flow (ISS to WCOC)

White Sands Complex, NM, USA

TDRSS

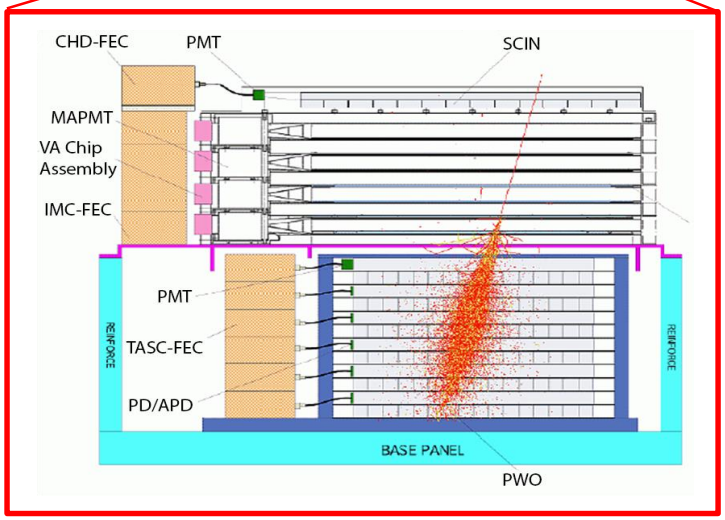
NASA Link

NASA MSFC

Data Archive

International Space Station (ISS)

CALET



JAXA Tuskuba Space Center, ISS Operation Building Japan

Waseda Univ. CALET Operations Center

WCOC

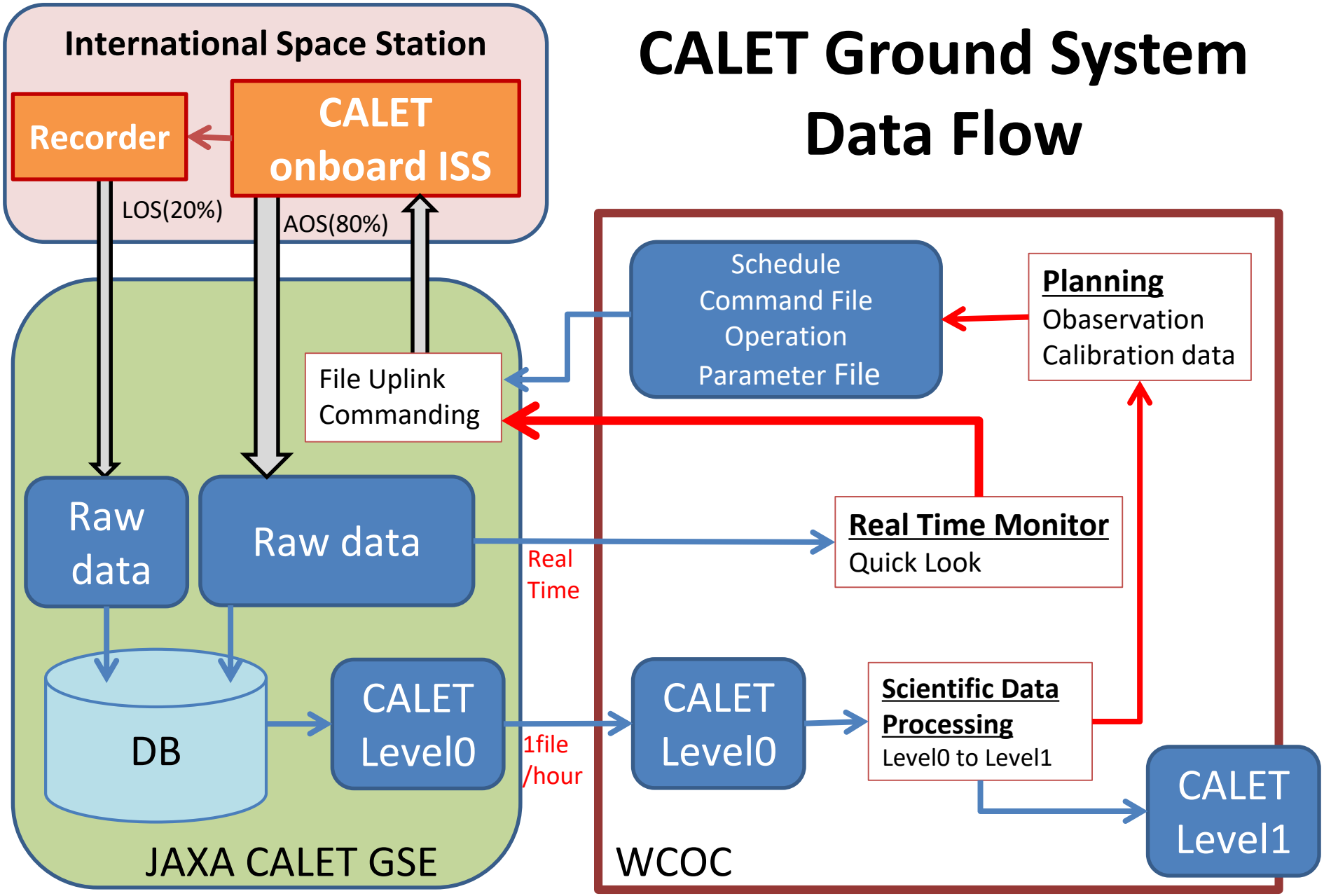
International Collaborators

JAXA-GSE was established to operate CALET on the ISS. It has direct communication with CALET to send command and receive telemetry data. JAXA-GSE is responsible for safety.

Waseda CALET Operations Center (WCOC) was established at Waseda Univ. in order to perform mission operations including monitoring and scheduling of the scientific observations and data analysis.

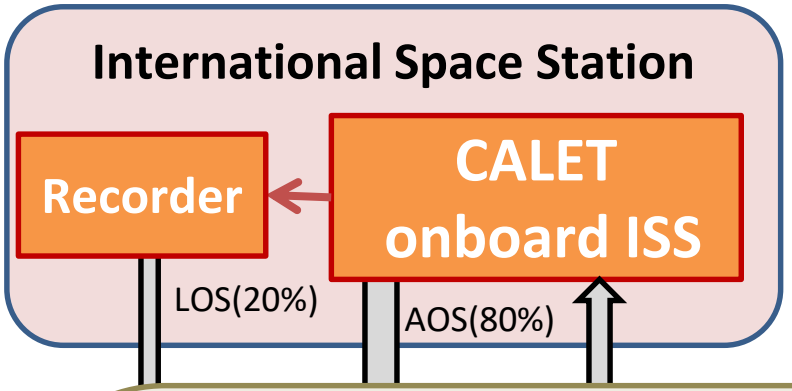
Responsible for the full CALET Operations

CALET Ground System Data Flow



GSE: Ground Support Equipment

CALET Ground System Data Flow



Schedule
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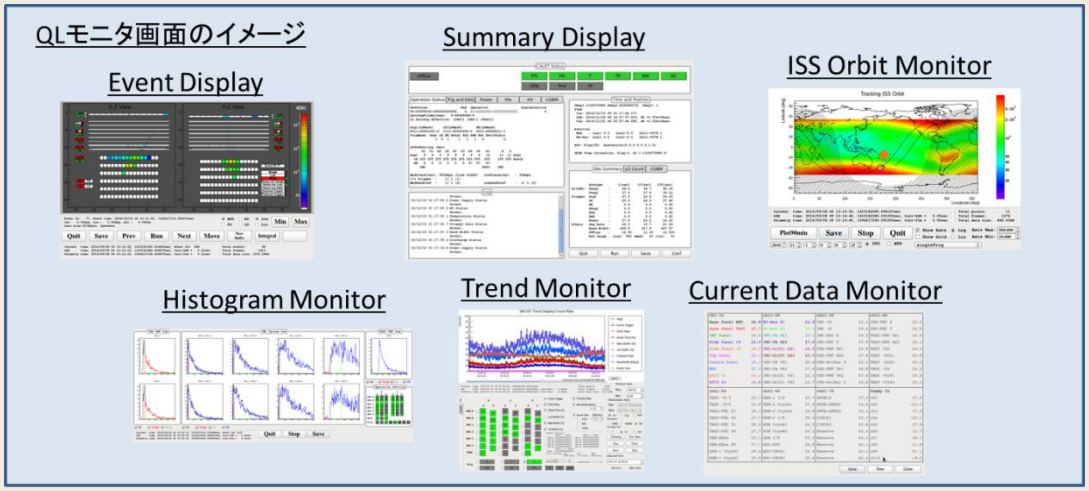
Planning
Obaservation
Calibration data



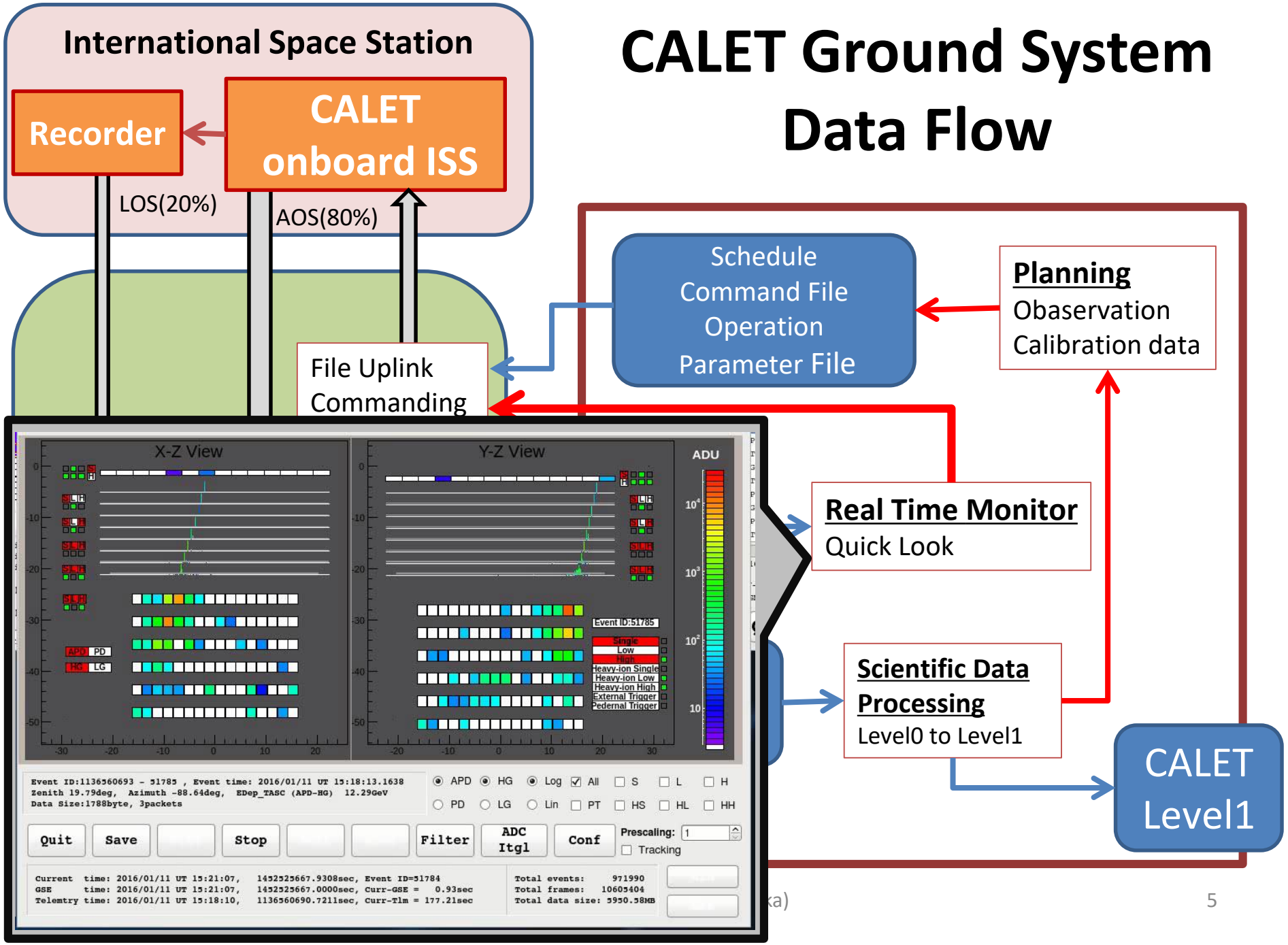
Real Time Monitor
Quick Look

Scientific Data Processing
Level0 to Level1

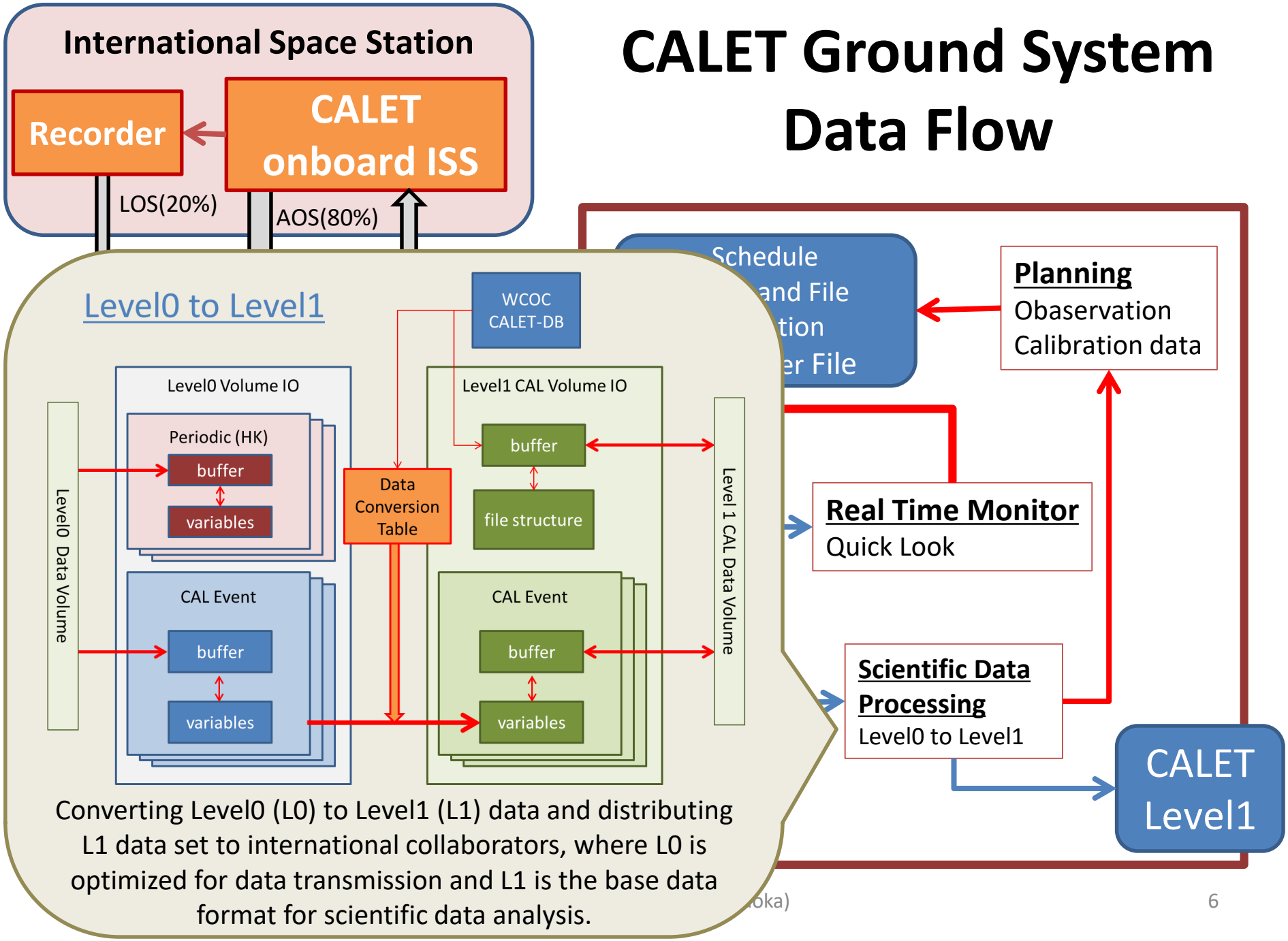
CALET Level1

- Grasps real-time observation status taking advantage of various QLs
- Commanding via JAXA operators as needed
- Researchers in Japan stays 24-7 at WCOC for first two years of operations

CALET Ground System Data Flow

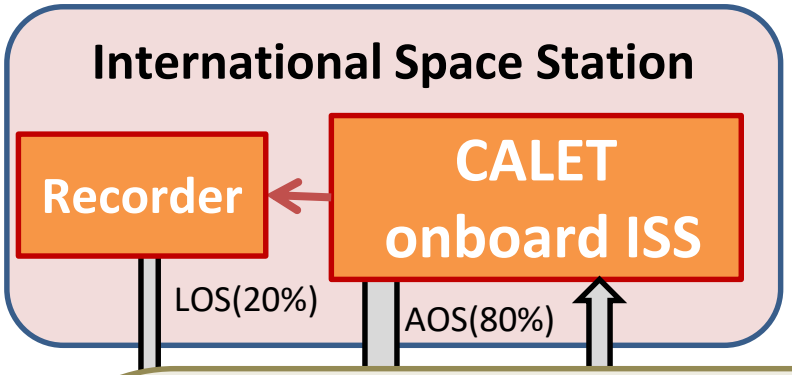


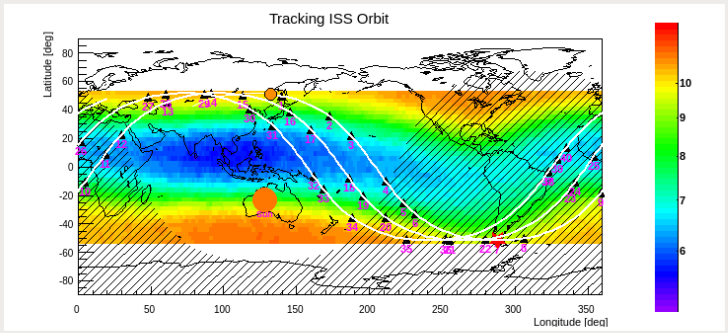
CALET Ground System Data Flow

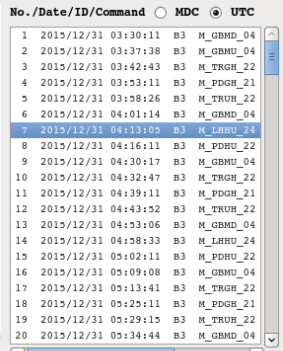


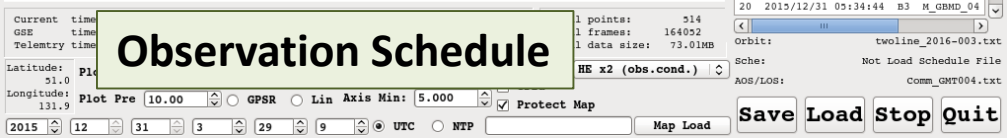
Converting Level0 (L0) to Level1 (L1) data and distributing L1 data set to international collaborators, where L0 is optimized for data transmission and L1 is the base data format for scientific data analysis.

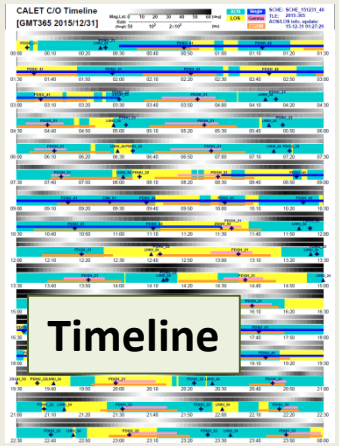
CALET Ground System Data Flow











Planning daily operation schedule based on ISS orbit.

Schedule and File tion

Planning
Obaservation
Calibration data

Real Time Monitor
Quick Look

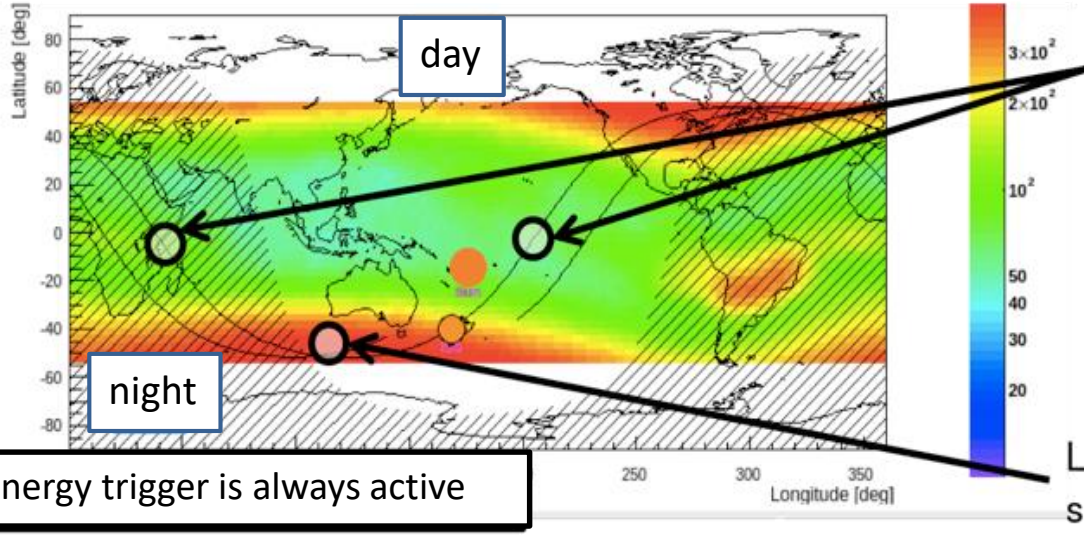
Scientific Data Processing
Level0 to Level1

CALET Level1

ISS Orbit and CALET On-orbit Operations

ISS orbit: inclination 51.6 degree, ~400 km

Concept of on-orbit operations



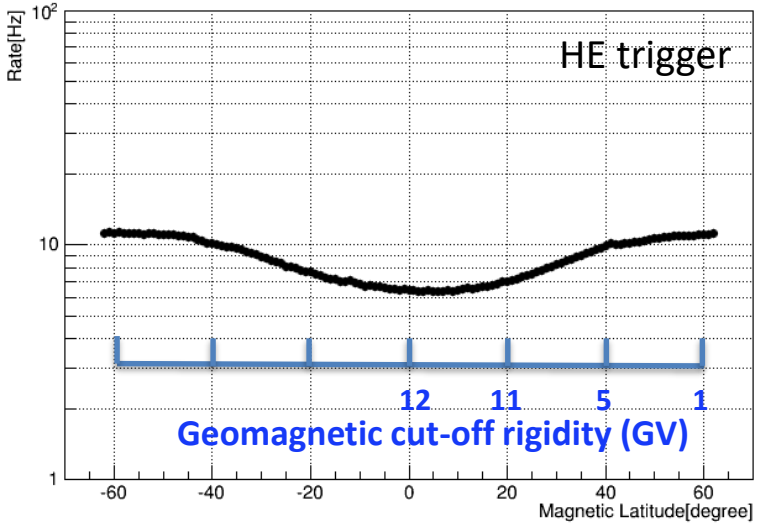
Pedestal data acquisition

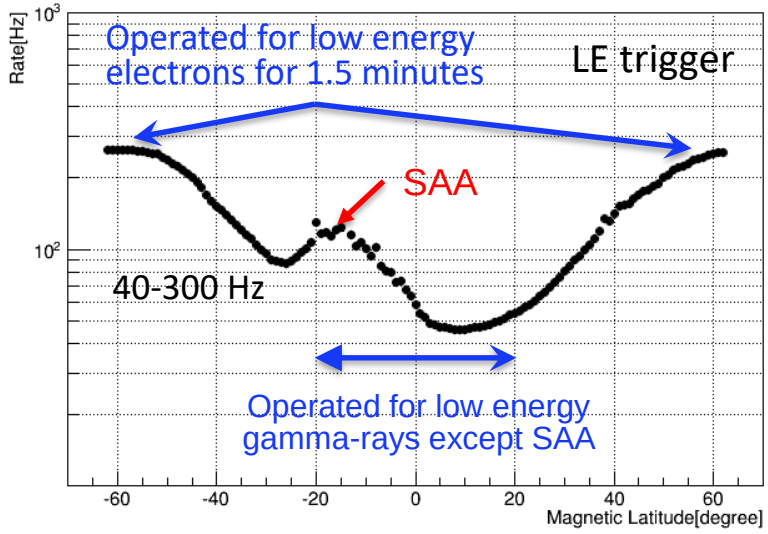
Schedule file: sequence of time and command

Low energy electron shower data acquisition

High energy trigger is always active

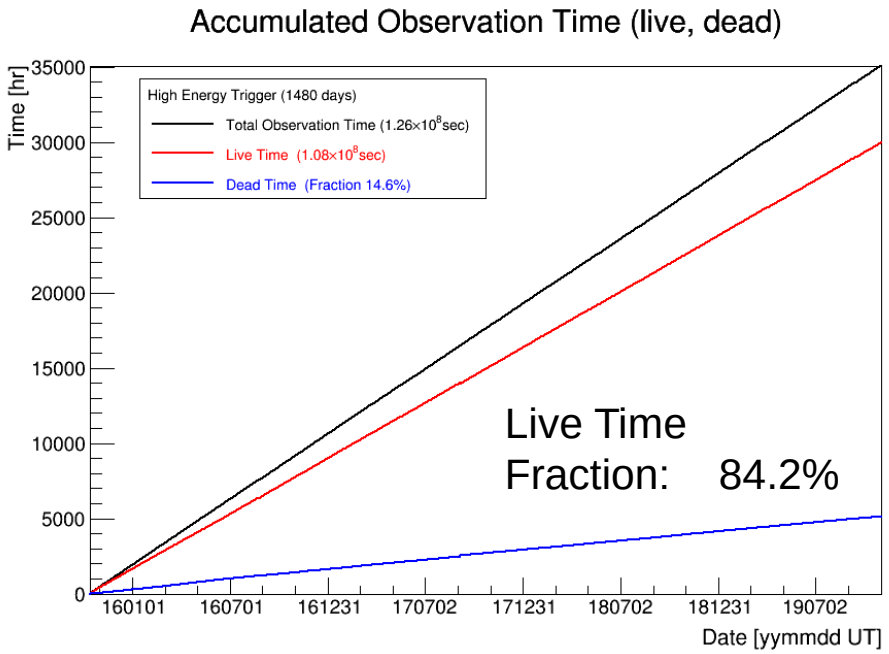
Dependence of the count rate on geomagnetic latitude

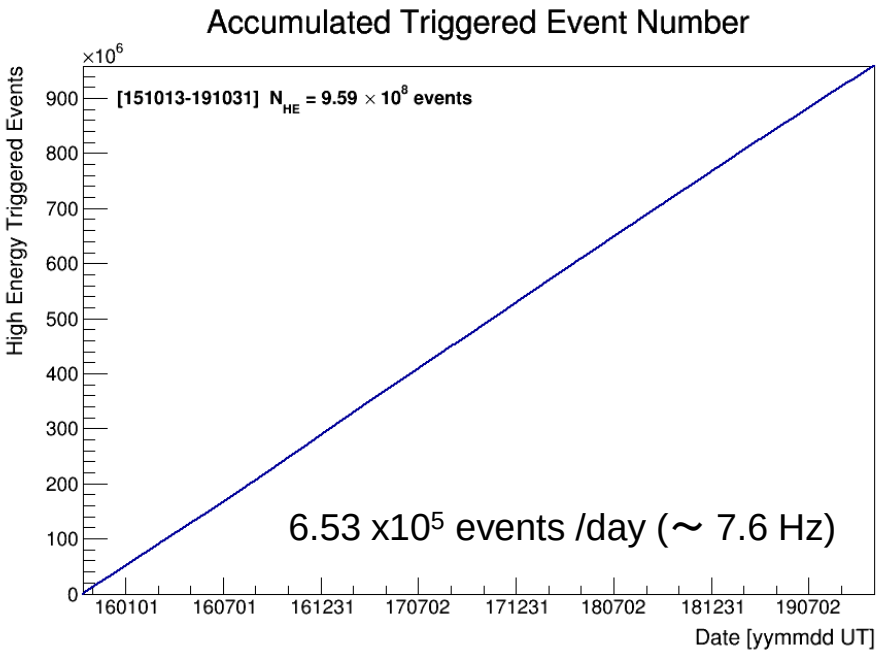




Observation with High Energy Trigger (>10GeV)

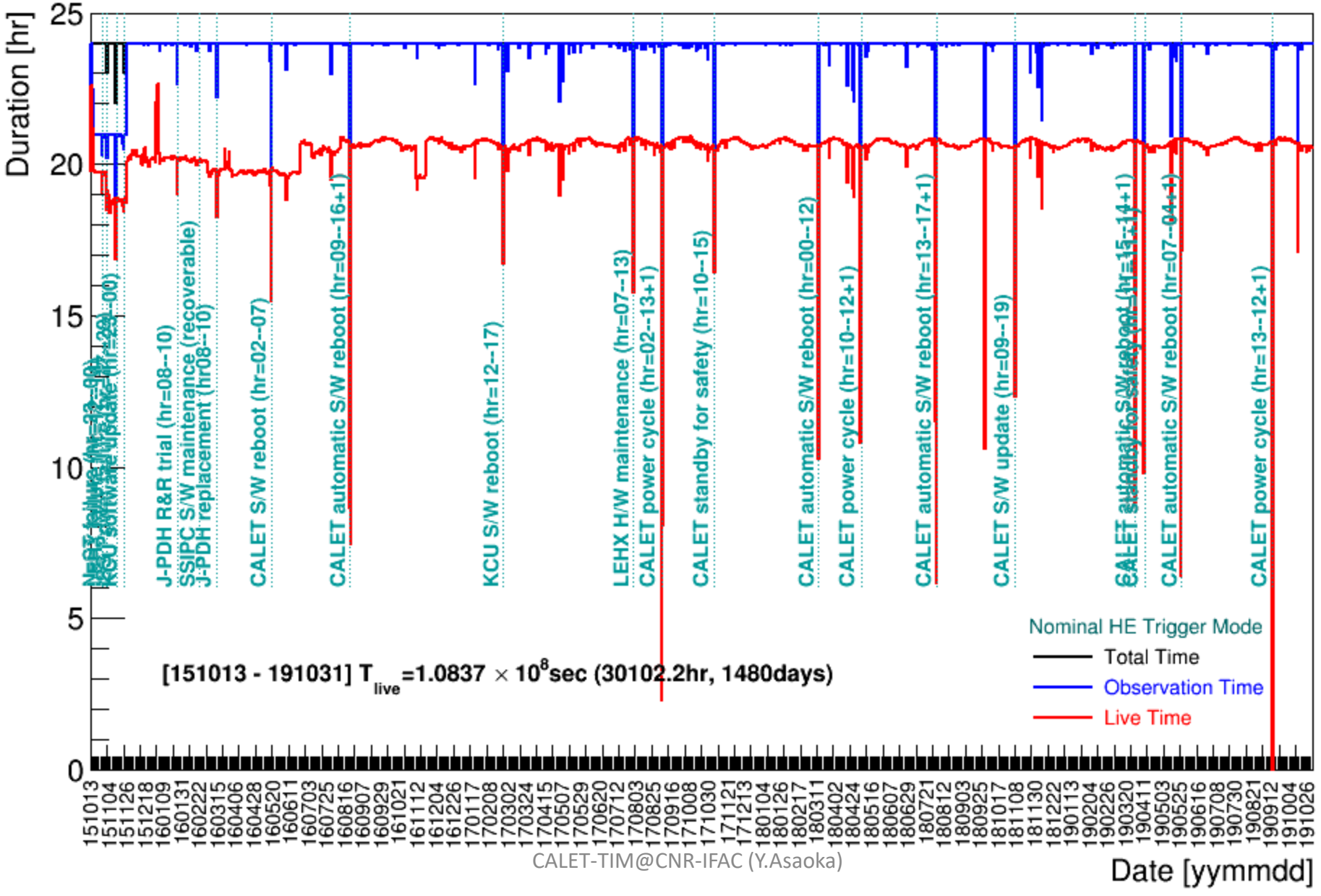
Y.Asaoka, S.Ozawa, S.Torii et al. (CALET Collaboration), Astropart. Phys. 100 (2018) 29.





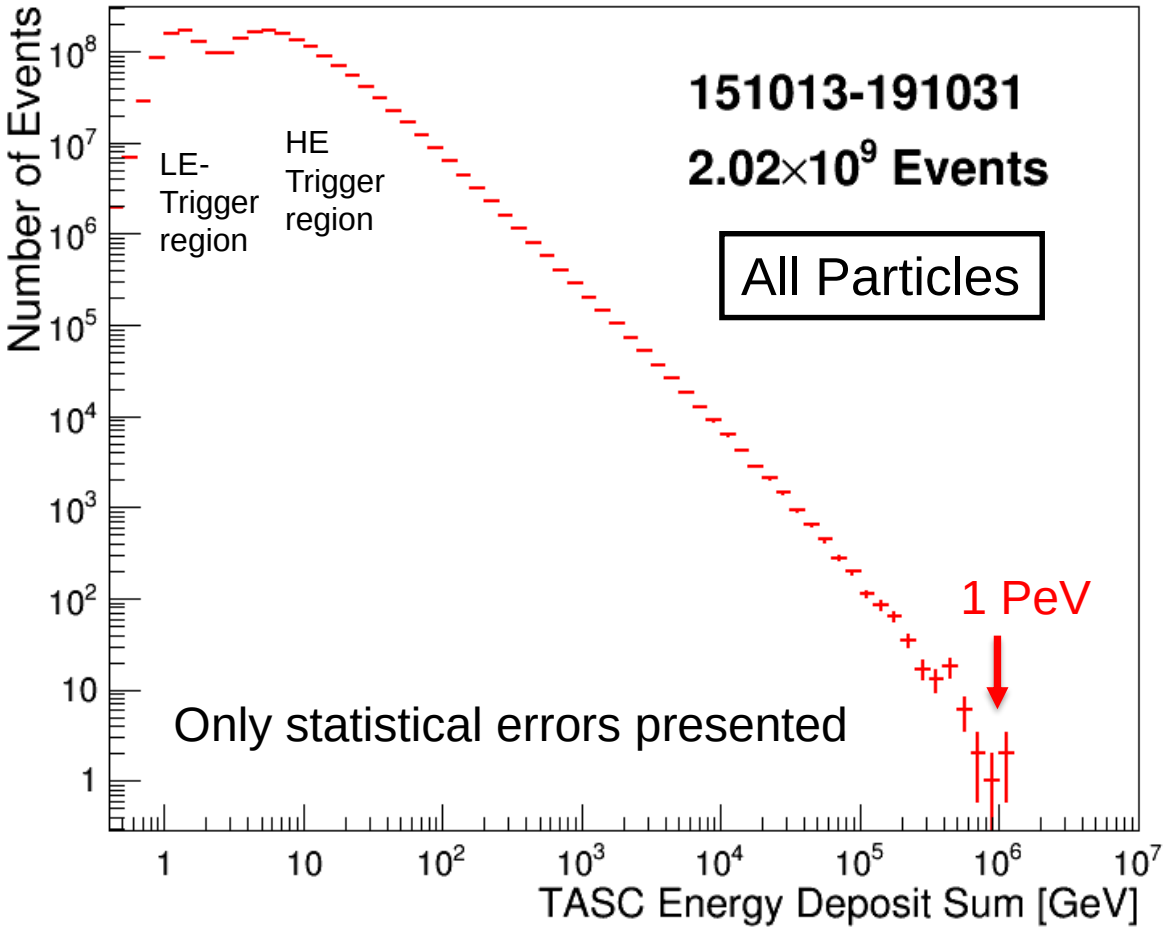
- Observation by High Energy Trigger for 1480 days : Oct.13, 2015 – Oct. 31, 2019
- The exposure, SΩT, has reached to ~150 m^2 sr day for electron observations by continuous and stable operations.
- Total number of triggered events with high-energy trigger reaches ~960 million with a live time fraction of 84.2 % (more than 2 billion events for all events triggered)

Day-by-Day Statistics (151013—191031)

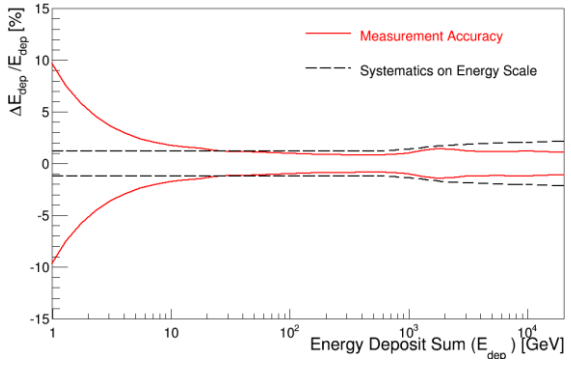


Energy Deposit Distribution of All Triggered-Events

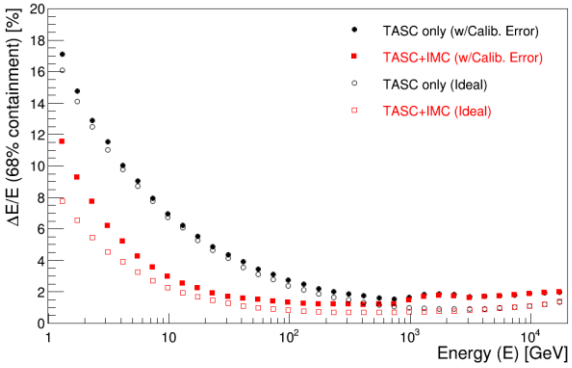
Distribution of deposit energies (ΔE) in TASC



Performance of energy measurement in 1GeV-20TeV



Energy resolution for electrons (TASC+IMC):
< 3% over 10 GeV;
<2% over 20GeV



The TASC energy measurements have successfully been carried out in the dynamic range of 1 GeV – 1 PeV.

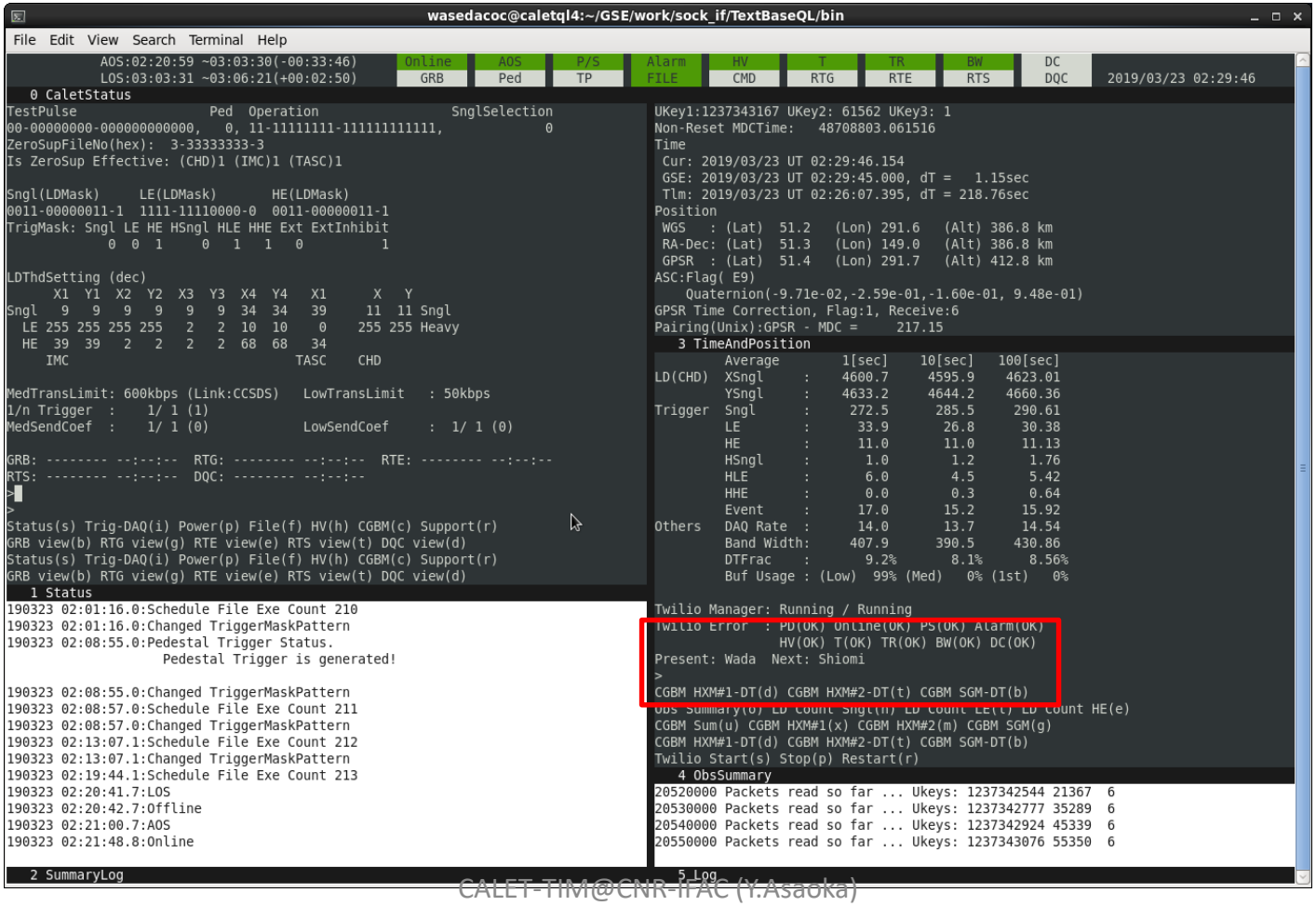
History of Monitor Shift System @WCOC

Period	Shift System
2015/10/01—2015/12/31	24hr-7 2 shifter @WCOC (2-shift system)
2016/01/01—2017/12/31	24hr-7 1 shifter @WCOC (2-shift system)
2018/01/01—2018/07/31	24hr-7, day @WCOC, night w/ phone
2018/08/01—2019/04/30	24hr-7 1 phone-shifter (2-shift system)
2019/05/01—	Daily check of DQC (Data Quality Check)

Before observation (system test, etc.)	development of QL system
FY2015—FY2016	development of DQC and Web interface **Data Quality Check**
FY2017	development of Text QL **⇒ telephone alert system**
FY2018	DQC upgrades

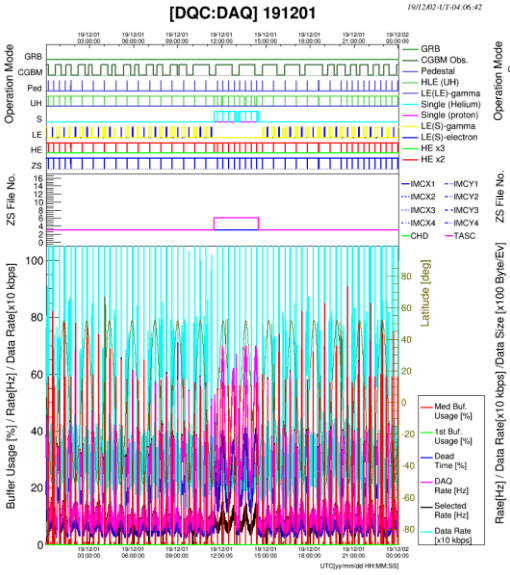
Development and Application of TextQL

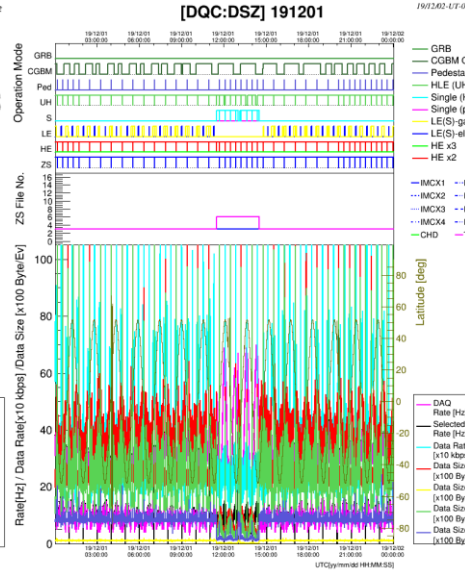
- Summary Display in QL is replaced by text based one.
- TextQL makes it possible to remotely monitor the observations using detailed information.
- Telephone alert enables to make contact with shifter when detecting malfunctions.

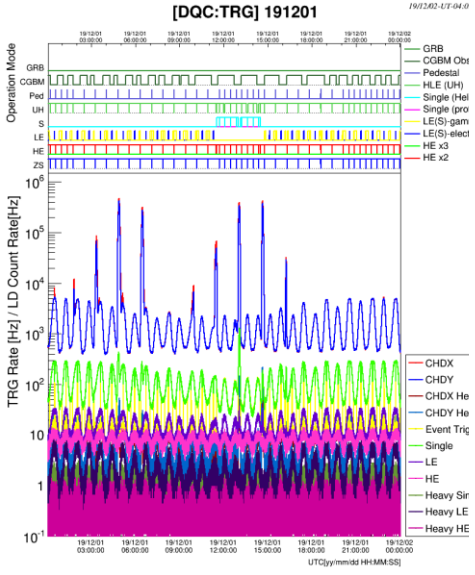


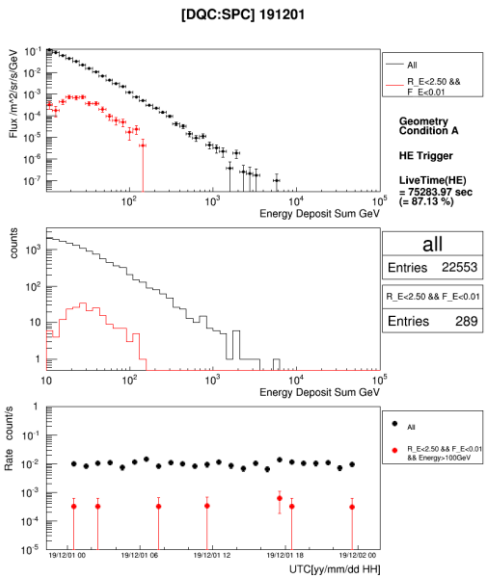
Data Quality Check [DQC]

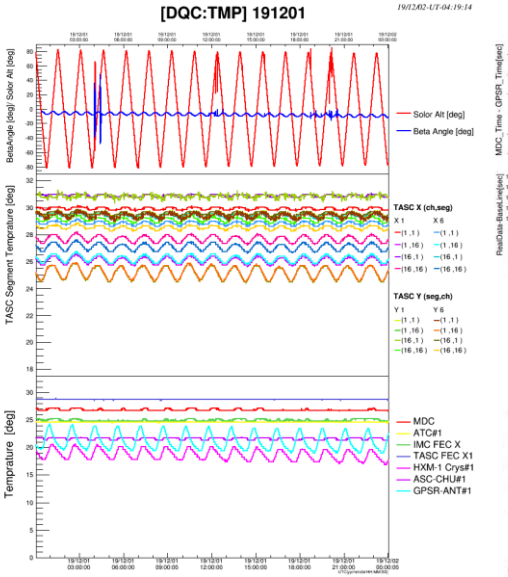
Checking the stability and quality of data ⇒ various plots are generated on daily/hourly basis

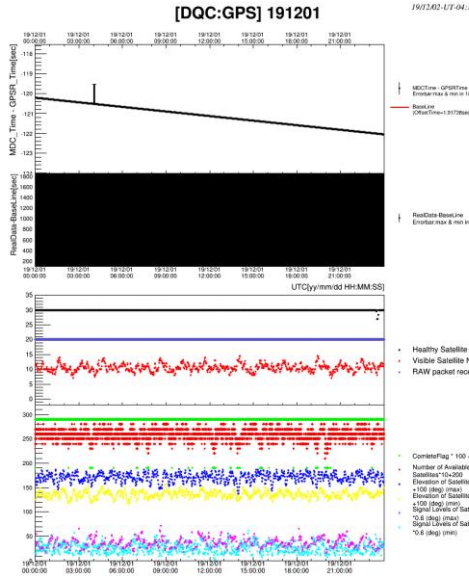


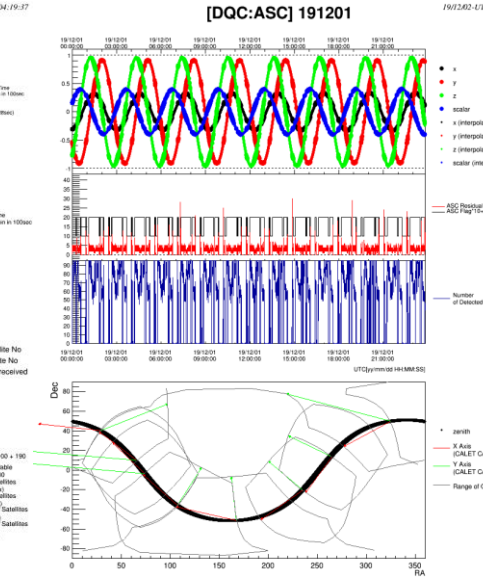


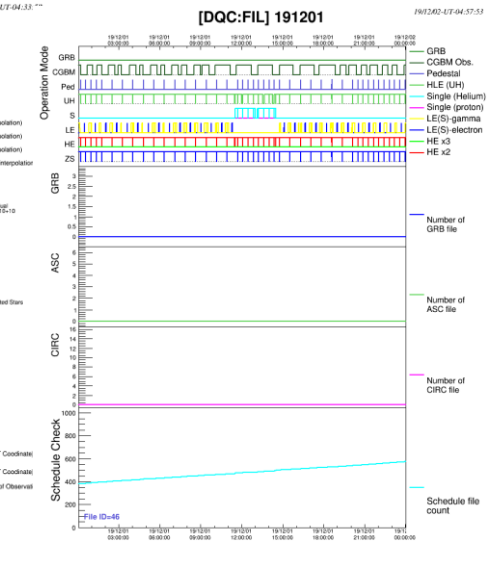












Problems during Four Years on Orbit

Although it is extremely stable,
we experienced several problems during a long observation period.

CALET on the ISS

1. TASC APD local breakdown (2015-2016) — DQC
2. Low rate sampling of periodic data(2015/12) — Trend
3. IMC VA-ASSY oscillation (2016/2, 2018/1) — Event Display
4. File descriptor full (2016/5) — ExPO
5. MDC automatic reboot (2016/8, 2018/3) — AOS/Offline, LR
6. IMC VA-ASSY fixed ADC output (2017/3) — Event Display
7. Telemetry zero-fix for every 64bit (2017/9) — Trend
8. MDC data transmission failure (2018/5) — BW, Trend
9. GPSR automatic reboot (raw data output) — DQC
10. Temperature fall below caution limit (SGM) — T, Trend
11. TASC APD fixed ADC output (2019/03) — Ped, Event Display

(*) AOS/Offline, BW (bandwidth), T (temperature) indicates warning from QL Summary Alert System

Data Transmission

12. Troubles in communication device in data transmission path — AOS/Offline
    - ISS, TDRSS, Ground line
      - Contact from ExPO
13. Troubles in JAXA-GSE — AOS/Offline, LR
    - IF/RECV servers communication error — L0
    - DB server hang-up
      - Could only be noticeable by WCOC
14. Troubles in WCOC — AOS/Offline, LR
    - Real time : socket relay failure — L0
    - L0 data : disk failure (full), network cut
15. Issues in command schedule file — Trend/Buffer Full
    - Mistake in orbit prediction (2016/1, 2016/5)

How to Identify Problems

- All problems are temporally ones and there are no problems leading a permanent failure.
- By identifying and resolving the problem as prompt as possible, highly efficient observation and operations are continued.

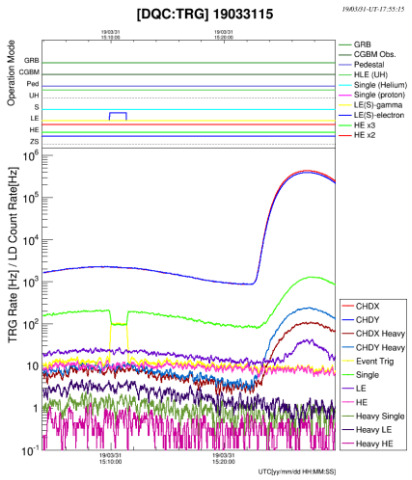
List of Single Event Upset (SEU) Related Problems Requiring MDC Reboot/Power Cycle

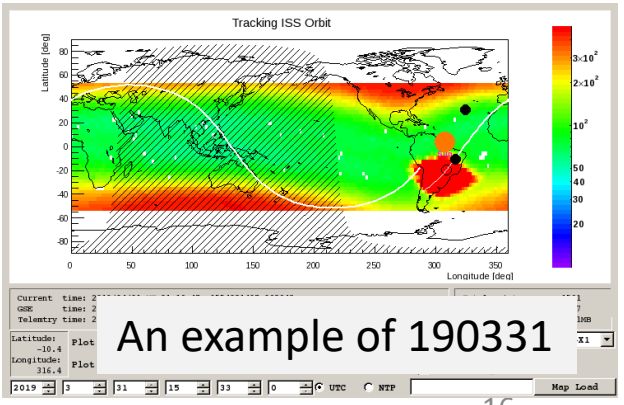
All Problems are resolved by rebooting MDC

Black : MDC Auto reboot
Blue : 1bit/64bit zero-fixed
Red : data transmission error

2015/10 Observation Started!

1.	2016/08/22	10mo	SAA
2.	2017/09/04	13mo	SAA
3.	2018/03/12	6mo	SAA
4.	2018/05/03	2mo	South Pole
5.	2018/08/12	3mo	SAA
6.	2018/10/01	2mo	North Pole
7.	2019/03/31	6mo	SAA
8.	2019/05/26	2mo	SAA
9.	2019/09/13	3mo	SAA



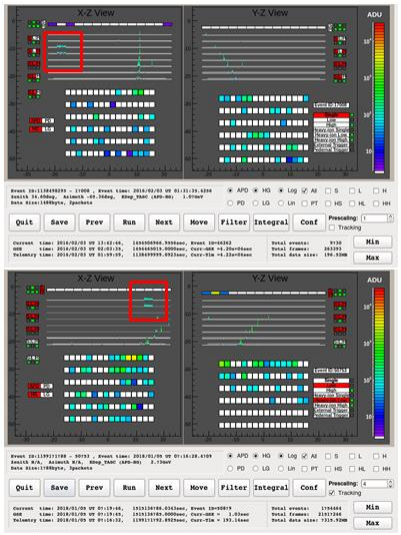


An example of 190331

Single-Event Upset on Electronics

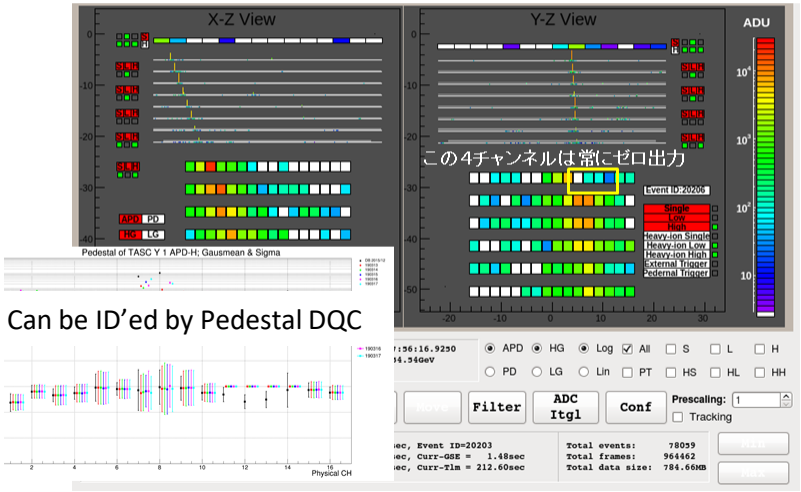
IMC VA ASSY Oscillation/Fixed Output

- Occasionally output oscillation/or fixed value occurs. in unit of MaPMT.
- It is difficult to notice because observation continues normally.
- Recovered by FEC power cycle.



TASC-Y1 APD 4ch Fixed Output

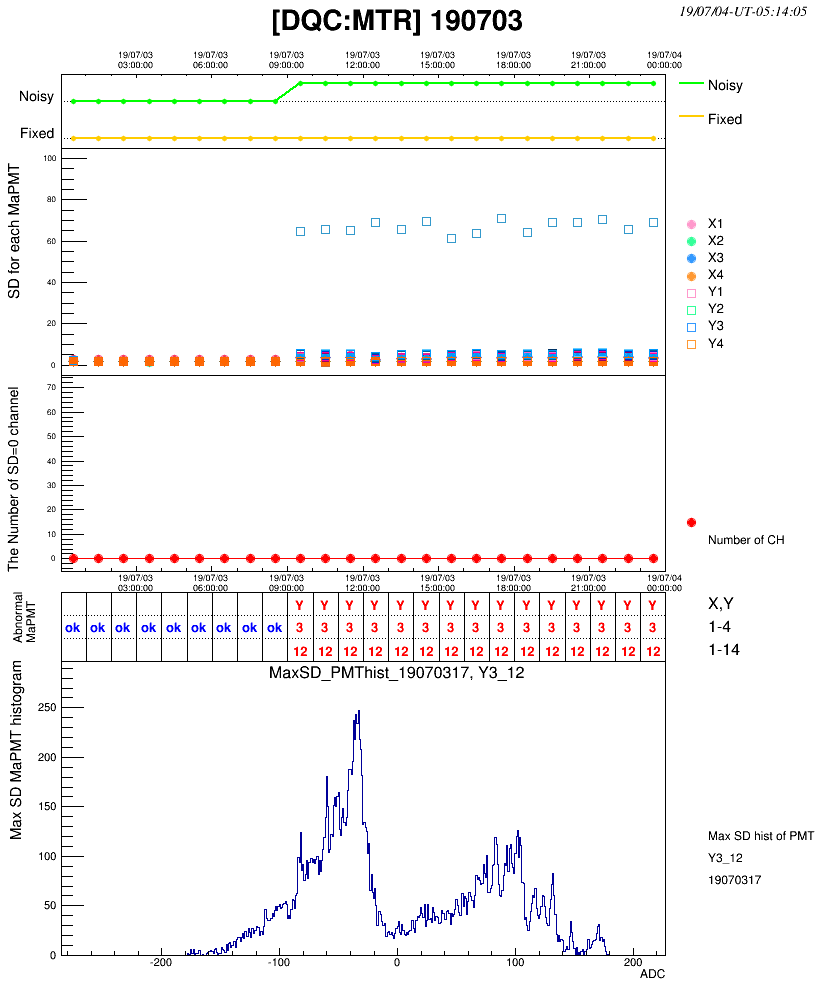
- Very rare event as only one incident over 4 years of operations.
- Recovered by FEC power cycle.

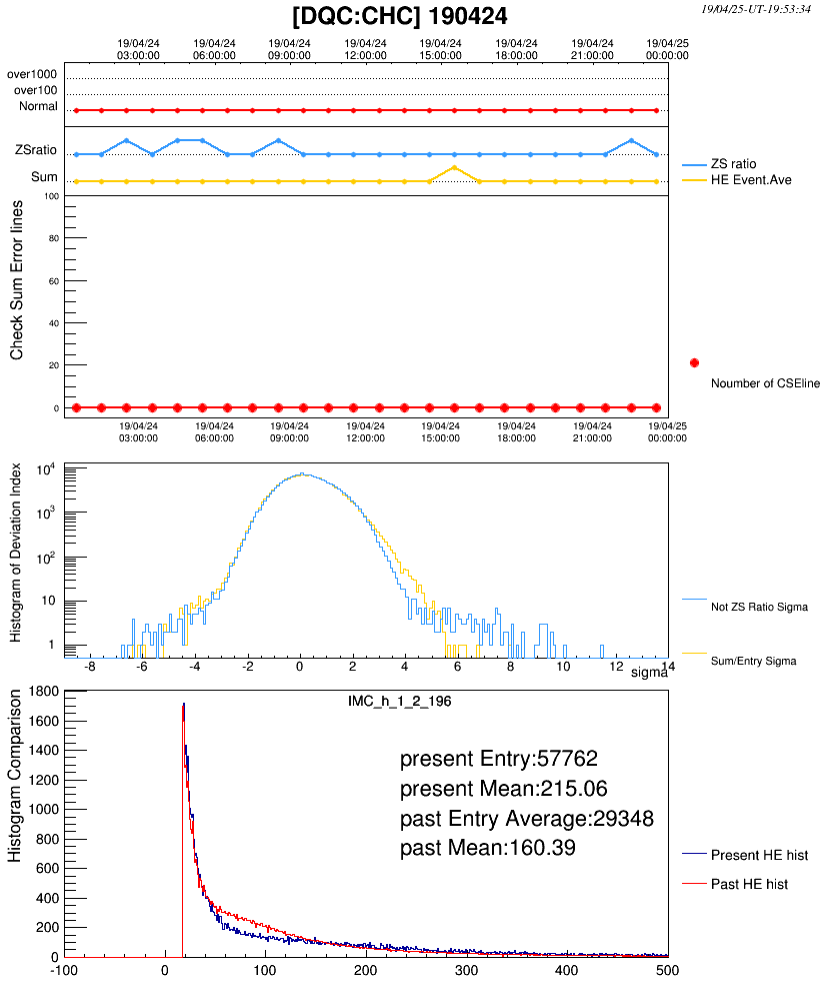


- This incident can be resolved by power cycle of corresponding FEC. However, it is difficult to notice unless you watch Event Display long enough.
- It would be very helpful if we can identify this problem automatically by DQC.
  ⇒ Developing new DQC

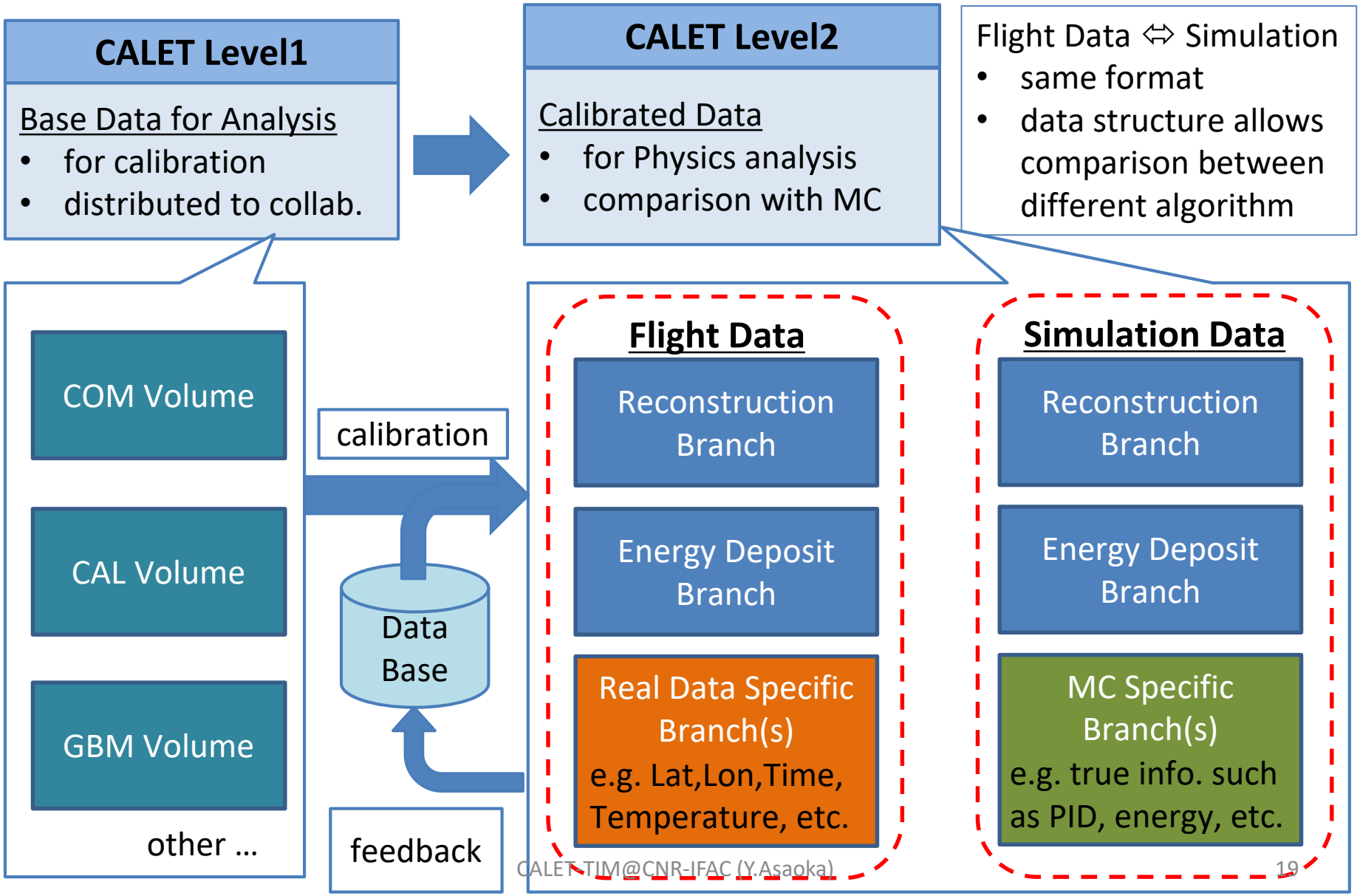
DQC Updates: Trapping Malfunctions of CALET

- Based on the previous experience, we have developed new DQCs to trap rare malfunctions which does not stop observations (therefore difficult to notice).
- It already detected IMC VA ASSY oscillation(190703)
- It checks the rate of “Check Sum Error” and whether each channel has output or not.





High-Level Data Production



L2:PASS-04 Release

1. PASS-04 production
   - Production done (151013—19731)

     + Test production: 190801-191031
     - Calibration updated
     - JC Charge updated
     - KF tracking updated (by P. Maestro)
       refer to WCOC-2019-003NC-IClib_v1.0.pdf @ DH&A document page
   - Release note circulated.
   - HDD copy done (8TB x8)
   - HDD copy sent to US and Italy and received
2. PASS-04 data check
   - 151013-190531 (same as PASS-03.1 data period)
     - Proton flux compared between KF, EM, and SW tracking
     - Electron spectrum compared

L2:PASS-04 Release Note

Release note was circulated to all CALET colleagues and related documents are uploaded to indico DH&A team page.

```
                                                                    WCOC-2019-006NC
================================================================================
Release Note ... L2:PASS-04 (release_v191126)          191126 DH&A Japan & Y.Asaoka
================================================================================
1. This version is CALET Level2 PASS-04
       - production period is October 13, 2015 to July 31, 2019 (151013--190731)
         while July 1, 2019 to October 31, 2019 is also included as a test producition.
         In the test produciton, IMC gain jump calibration is not updated, at least,
         and there might be other issues in this extended period.
       - If there's any problems, we will fix them and update the git repositories
         including the tag: release_v191126.
       - In any case, we will keep the tag: release_v191126 to point to the latest
         PASS-04 production.

2. Prerequisites
       - No change since PASS03

3. All repositories are tagged as 'release_v191126' and you can retrieve each
   of those repositories by:
       $ git fetch
       $ git checkout refs/tags/release_v191126

4. Building L2 Production Envronments
       - Step by step method to build L2 production environment is summarized at:
             WCOC-2016-009C-L2ProdcutionEnvironment.pdf at:
             https://indico.calet.jp/event/4/contribution/13/material/slides/
       - Newly installed BuildEnvL2.git can be used to automatically install all
         the software library prepared by CALET collaboration.
             tag: release_v191126 can be used to build the L2 environment
             for PASS04 (PASS04 branch can also be used to retrieve this).
       - Prerequisites and their installation instruction can be found at
             dbtool.git

5. Calibration Updates
       (1) TASC Time dependence
           - channels which deviates more than 5%: X2-16,X3-6,X3-13,
             X4-16, Y1-3, Y4-7.
           - time dependence curves for all channels are redefined.
       (2) CHD Time dependence
           - considering the recent deviations from unity after applying
             the previous calibration, the calibration contstants are
             updated for all channels.
           - some channels seem to start decreasing after the initial
             increase and saturating behavior, which requires new
             correction functions (furture work).
       (3) IMC gain jump
           - gain jump calibration uses Z=8.
           - calibration updated until July 31, 2019.
       (4) Channel Status
           - carefully examined the periods with problems, including
             the HV off and FEC off periods during recovery operations.
       (5) Observation Status
           - extracted the all periods when the observations
             are not normal.
           - new calibration table (calibration_observation_status) is
             defined to store this information.
           - the parameter value will be retrieved in TL2CALSummary::ObsStat
             => if ObsStatus is not zero, the events should not be used
                in physics analysis.
       (6) monthly FOV cut
           - daily FOV cut added when background level is high,
             ... 3-sigma and 5-sigma high background dates are
                 identified by Nick and daily FOV cuts are defined
                 for those dates.
           - calibration updated until July. 31, 2019.
           - default FOV cut is updated with class=default based on
             Nick's study.
           - FOV cuts from Aug. to Oct. 2019 will be defined
             by Y.Kawakubo soon

    => WCOC-2019-004NC-191126CalibUpdates-PASS04.pdf @ DH&A document page

6. PID class for JC Charge (only for Z=1,2)
       - Calculation of TL2CALPID_ChargeJC instance is updated in ProcL2.
       - You can retrieve the correct (updated) JC charge
         by selecting Algorithm == 2 (NOTE: Algorithm == 1 is not good).
         ### THE ALGORITHM WAS RIVSED SINCE PASS03.1

    => WCOC-2019-005NC-191126JCChargeCheck.pdf @ DH&A document page

7. IClib update (P.Maestro)
       - In this production, IClib v1.0 was used.
       - Main improvements:
             - Re-tracking for heavy nuclei implemented
             - IC charges: separate CHD/IMC charge reconstruction
               for p/He and heavy nuclei analysis
             - Development of an internal architecture to be used to
               handle multiple tracks (and related reconstructed variables
               like charges, acceptance types, etc.) in a future s/w update
             - New branch (named "recev") in L2tree, containing an object
               of TRecEvent class
             - TRecEvent object is filled with objects and variables related
               to reconstruction (charges, tracks, dEdx's, e/p variables,
               total energy deposits, KF and refitted track, reconstructed
               charges computed with different methods).

    => WCOC-2019-003NC-IClib_v1.0.pdf @ DH&A document page

(Note1) DH&A document page is located at:
        https://indico.calet.jp/event/4/
(Note2) DH&A team teleconference page is located at:
        https://indico.calet.jp/category/34/
```

L2:PASS-04 –Calibration Updates-

5. Calibration Updates
   (1) TASC Time dependence
   - channels which deviates more than 5%: X2-16,X3-6,X3-13, X4-16, Y1-3, Y4-7.
   - time dependence curves for all channels are redefined.

   (2) CHD Time dependence
   - considering the recent deviations from unity after applying the previous calibration, the calibration contstants are updated for all channels.
   - some channels seem to start decreasing after the initial increase and saturating behavior, which requires new correction functions (furture work).

   (3) IMC gain jump
   - gain jump calibration uses Z=8.
   - calibration updated until July 31, 2019.

   (4) Channel Status
   - carefully examined the periods with problems, including the HV off and FEC off periods during recovery operations.

   (5) Observation Status
   - extracted the all periods when the observations are not normal.
   - new calibration table (calibration_observation_status) is defined to store this information.
   - the parameter value will be retrieved in TL2CALSummary::ObsStat
     => if ObsStatus is not zero, the events should not be used in physics analysis.

   (6) monthly FOV cut
   - daily FOV cut added when background level is high,
     ... 3-sigma and 5-sigma high background dates are identified by Nick and daily FOV cuts are defined for those dates.
   - calibration updated until July. 31, 2019.
   - default FOV cut is updated with class=default based on Nick's study.
   - FOV cuts from Aug. to Oct. 2019 will be defined by Y.Kawakubo soon

=> WCOC-2019-004NC-191126CalibUpdates-PASS04.pdf @ DH&A document page

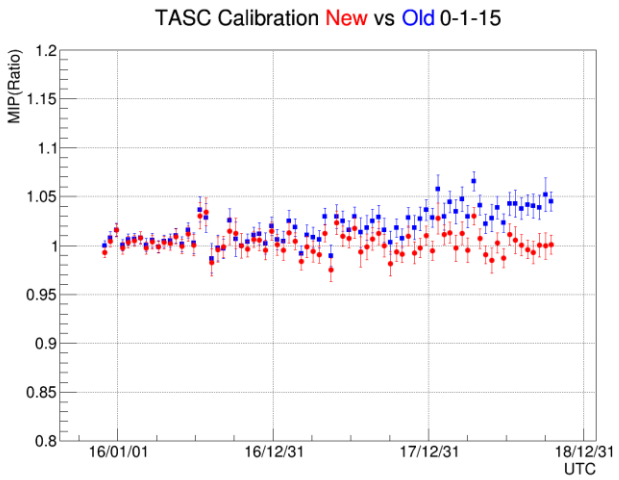
Calibration Updates for PASS-04

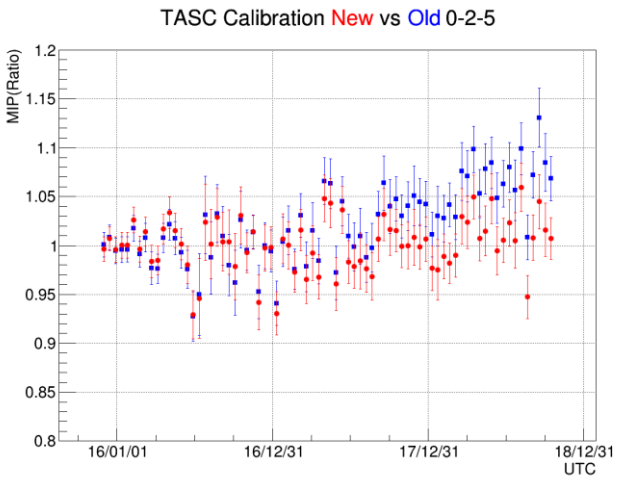
Prepared for PASS-04 Release

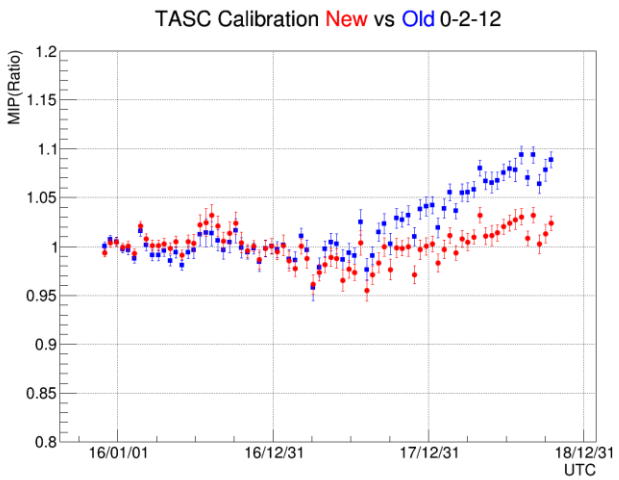
1. TASC Time Dependence … revision applied for all channels
2. CHD Time Dependence … revision applied for all channels
3. Gain Jump calibration updated
   - All suspicious channels were checked and corrections were defined including all channels in Paolo's list.
4. Channel Status calibration updated
   - TASC-Y1 fixed output period (4ch) was defined.
   - Wrongly assigned IMC-X2 channel status (160201-160219) was fixed.
   - Interface routine (wcocdb_if) was refactored (+minor bug fix)
5. New calibration table "Observation Status" added and registered
   - In order to mask the period which should not be used in the physics analysis
   - Period of recovery operations from MDC reboot, intentional standby etc.
   - wcocdb_if, level2_if (now use ObsStatus in TL2CALSummary), ProcL2 has been updated.
6. FOV cut map

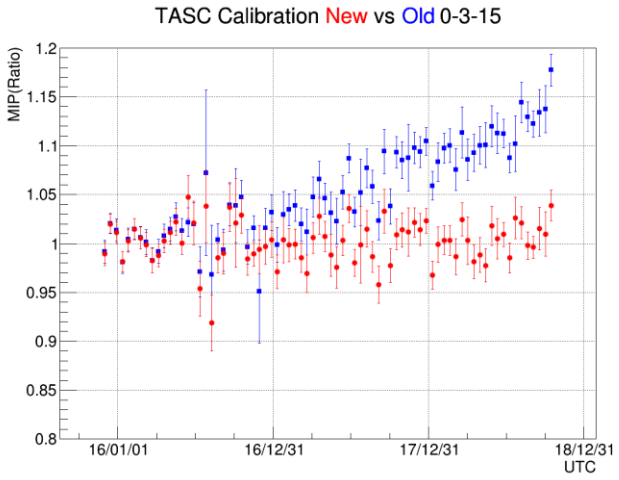
Correction of TASC-MIP Time Dependence

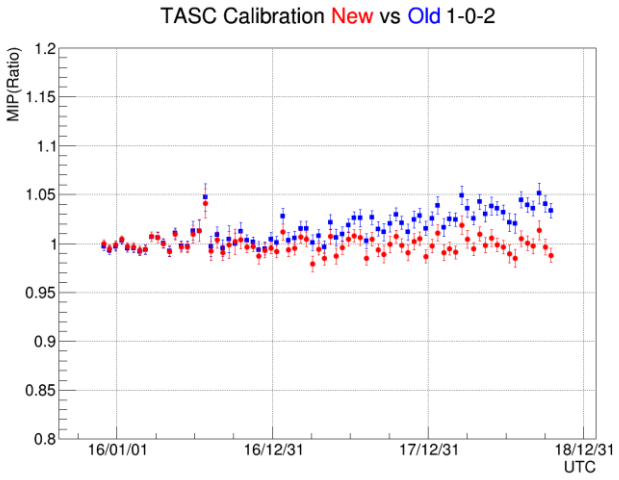
- Channels which deviates more than 5%: X2-16,X3-6,X3-13, X4-16, Y1-3, Y4-7
- Time dependence curves for all channels are redefined for future reproduction.

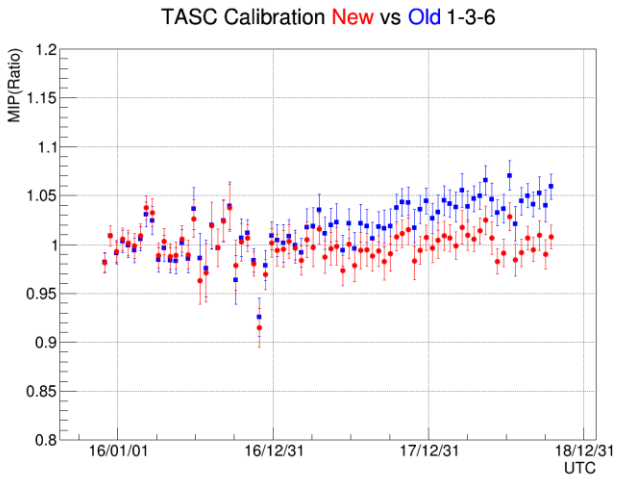




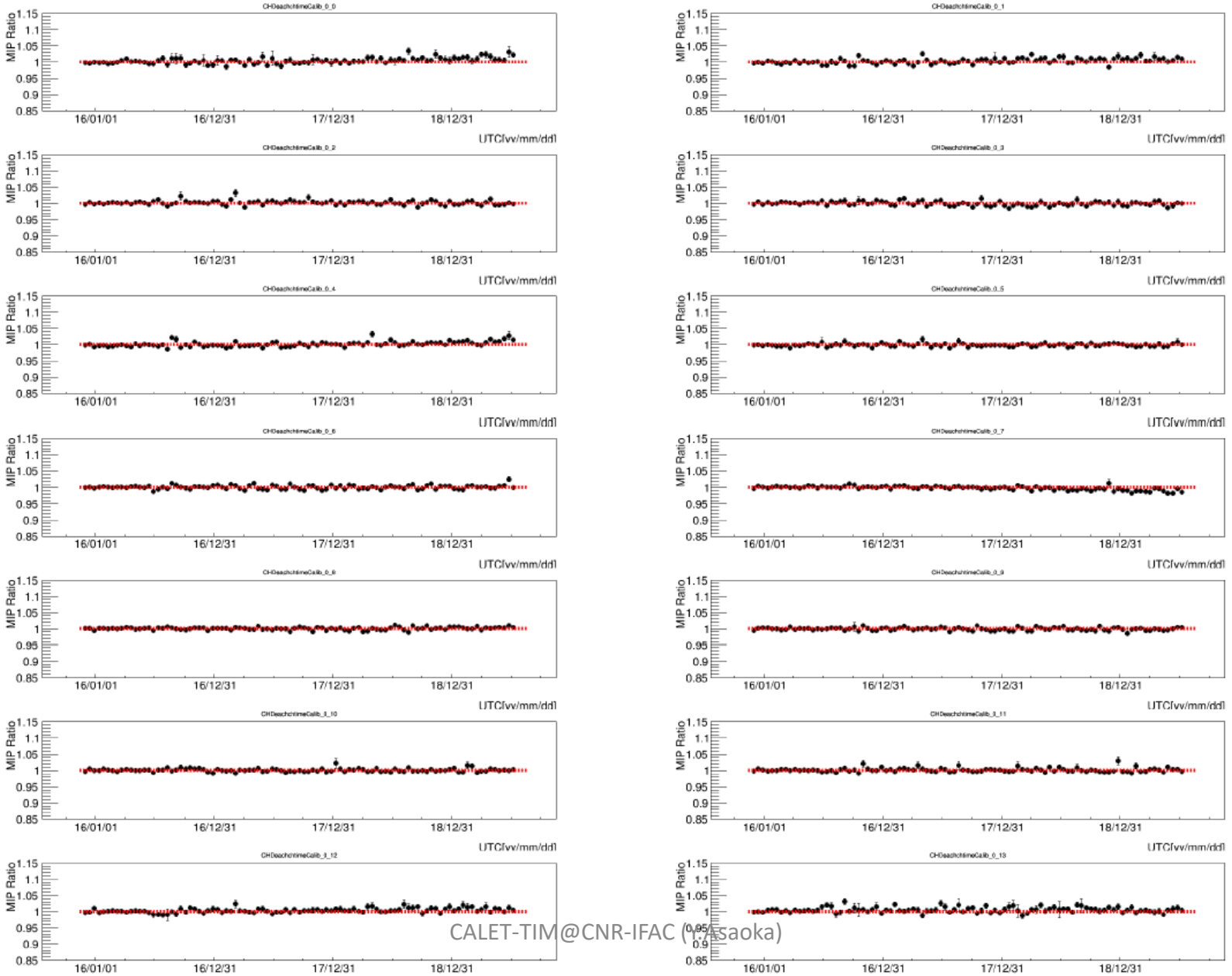




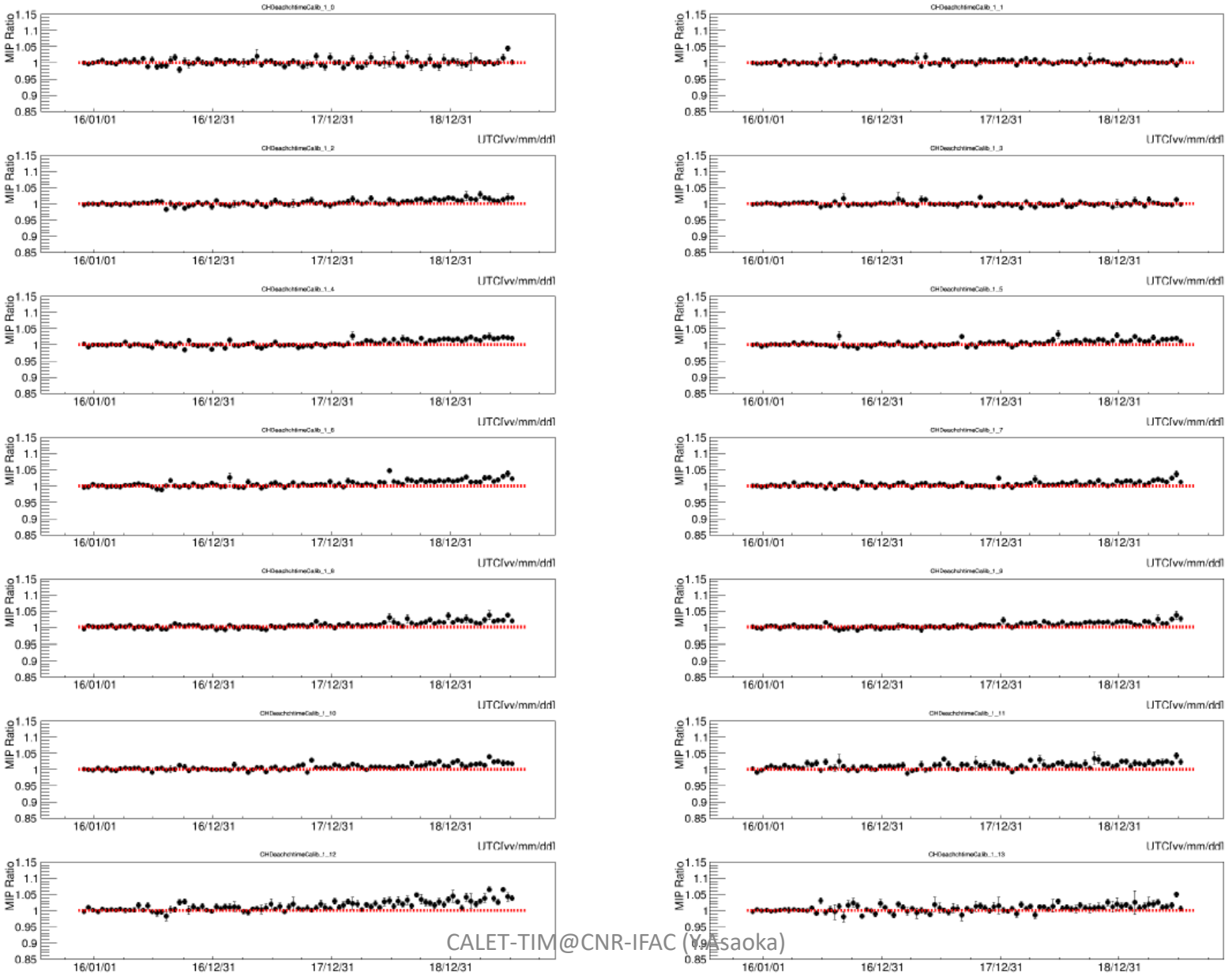




CHD-X Time Dependence Calibration @ PASS-03.1

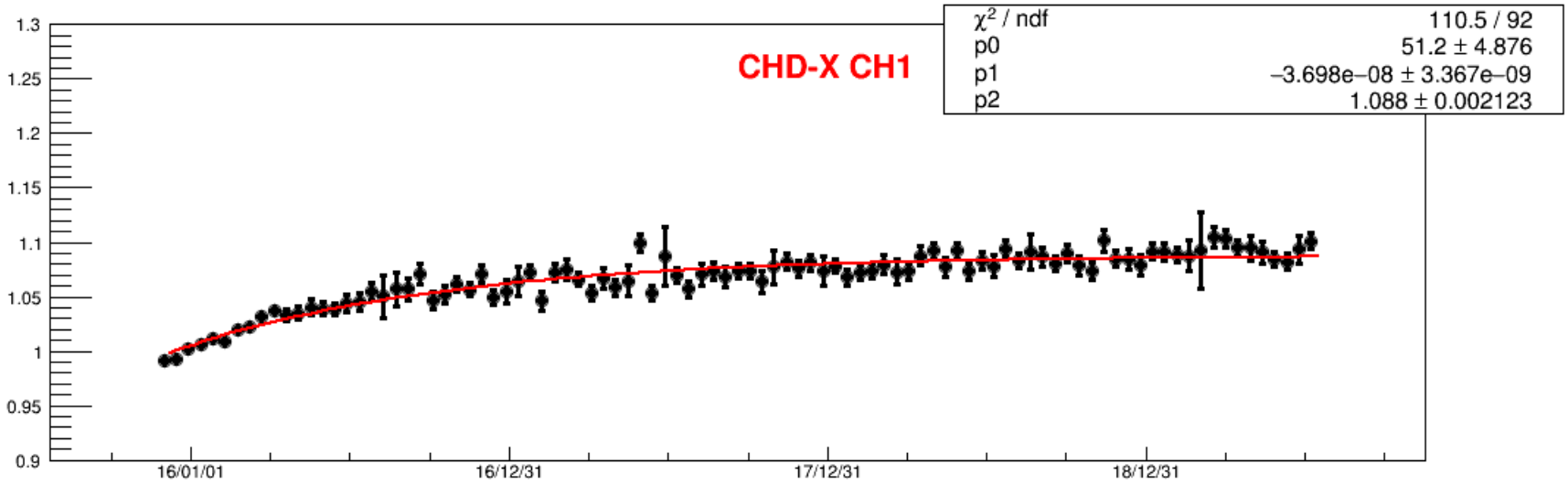


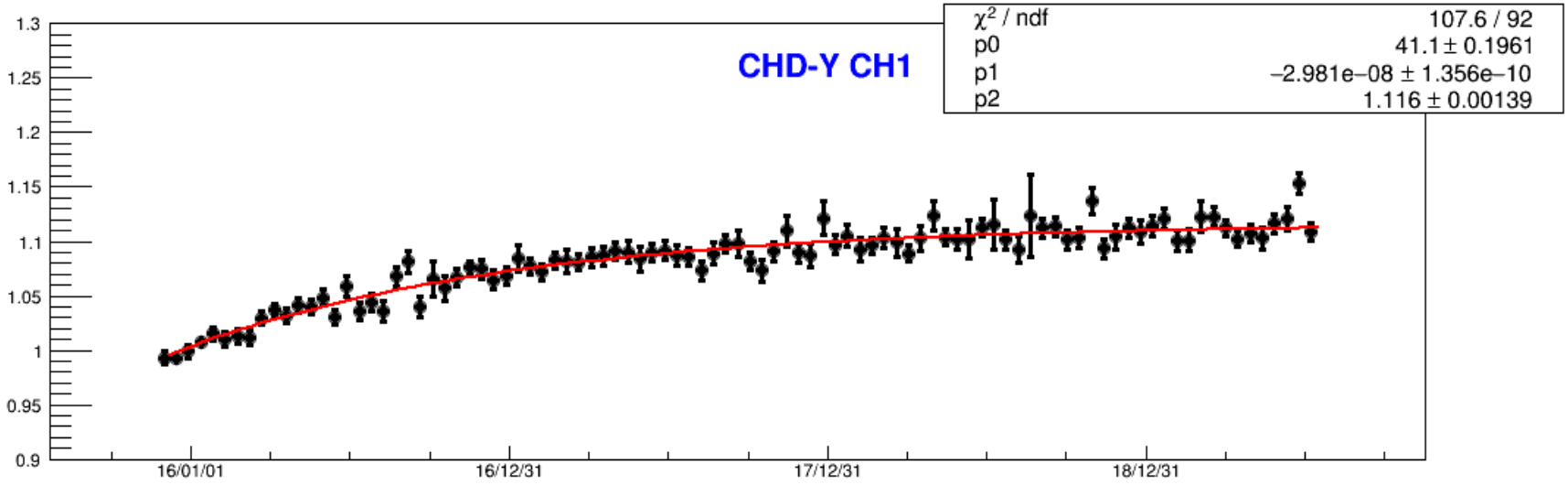
CHD-Y Time Dependence Calibration @ PASS-03.1



CHD Time Dep Calibration Update for PASS-04 (1)

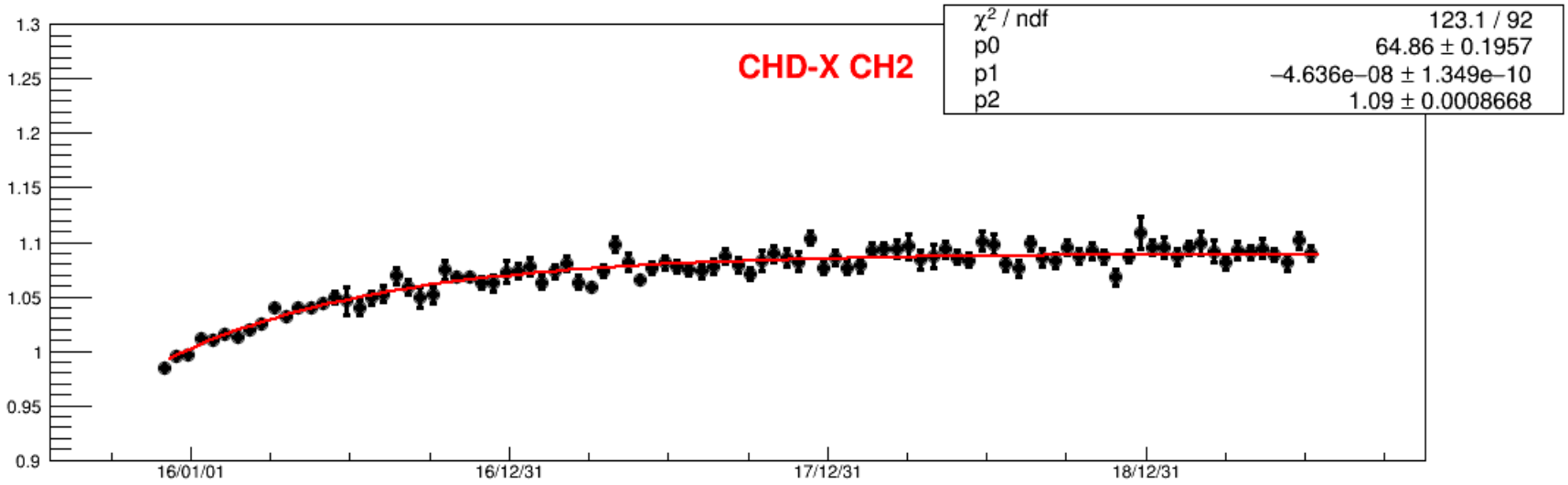
Up to 190731

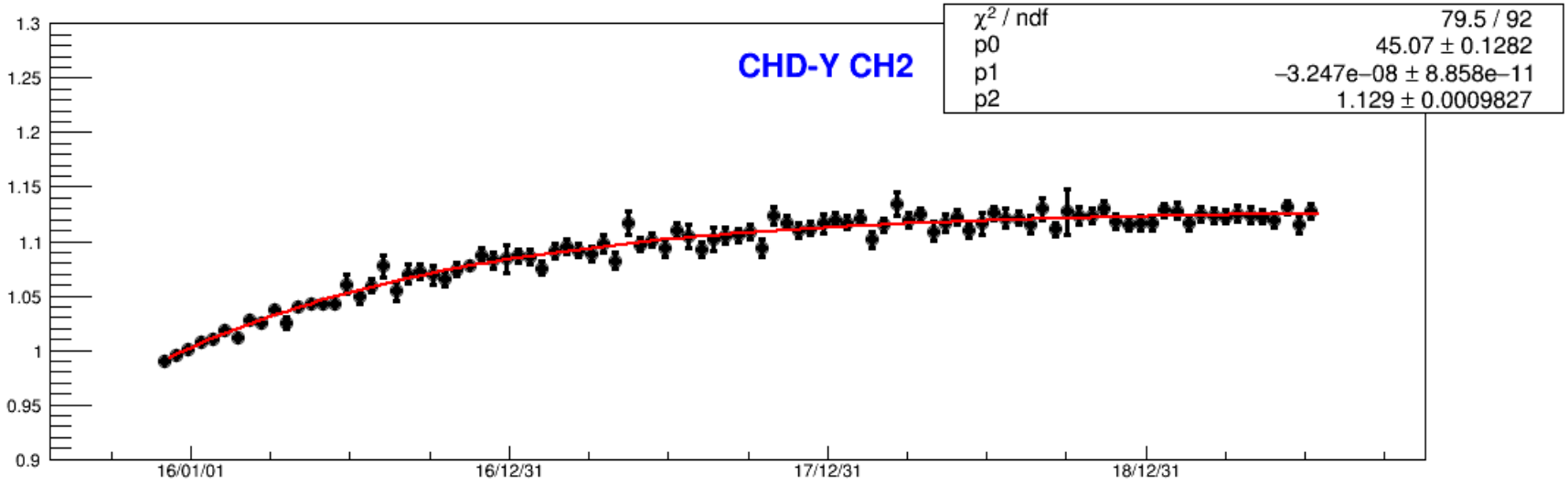




CHD Time Dep Calibration Update for PASS-04 (2)

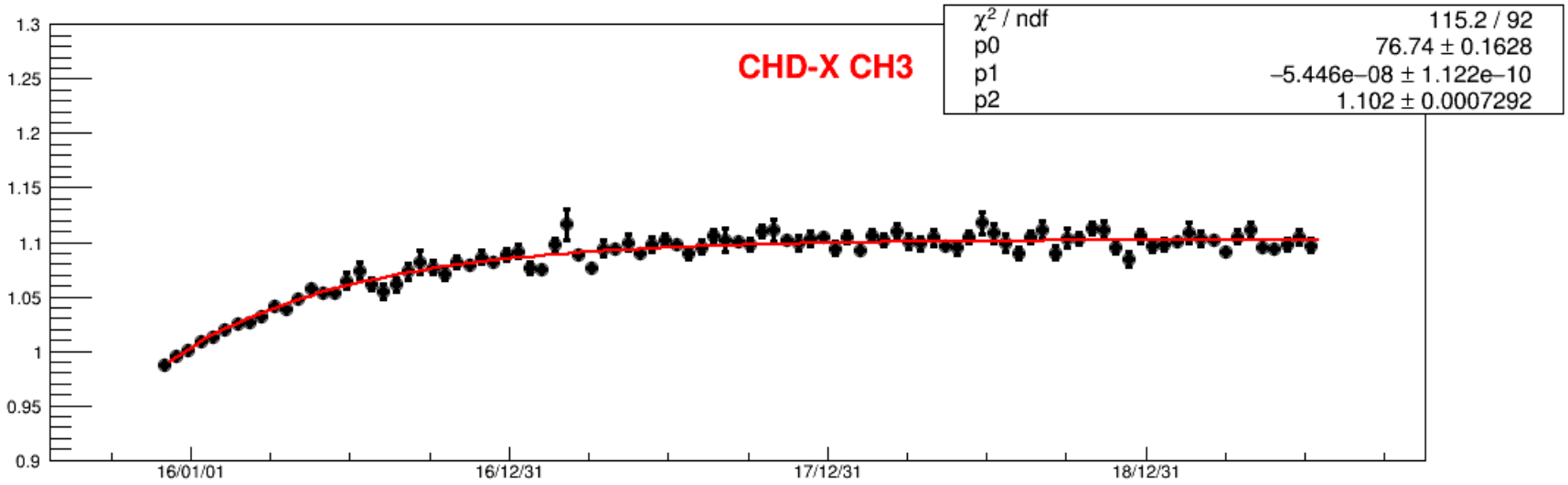
Up to 190731

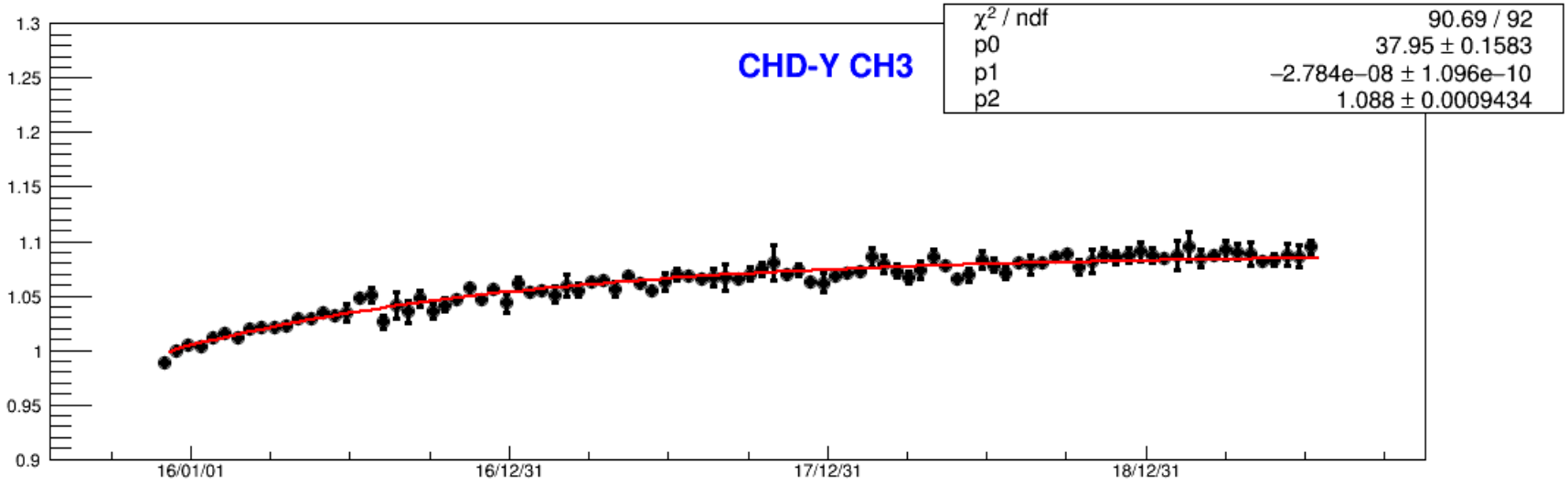




CHD Time Dep Calibration Update for PASS-04 (3)

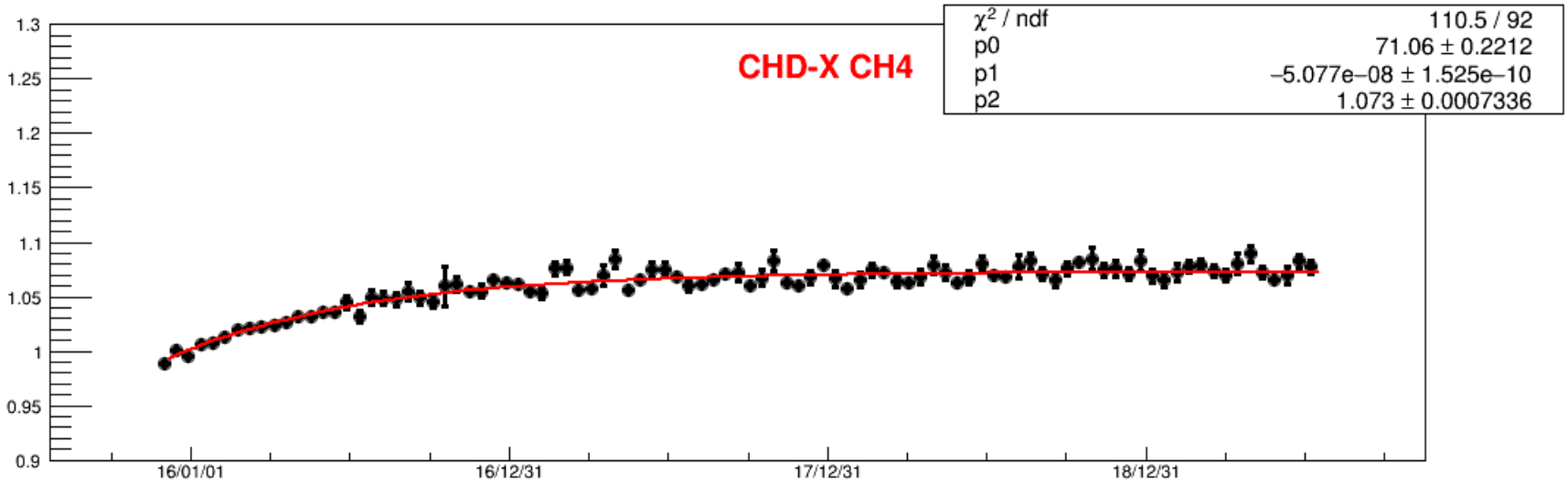
Up to 190731

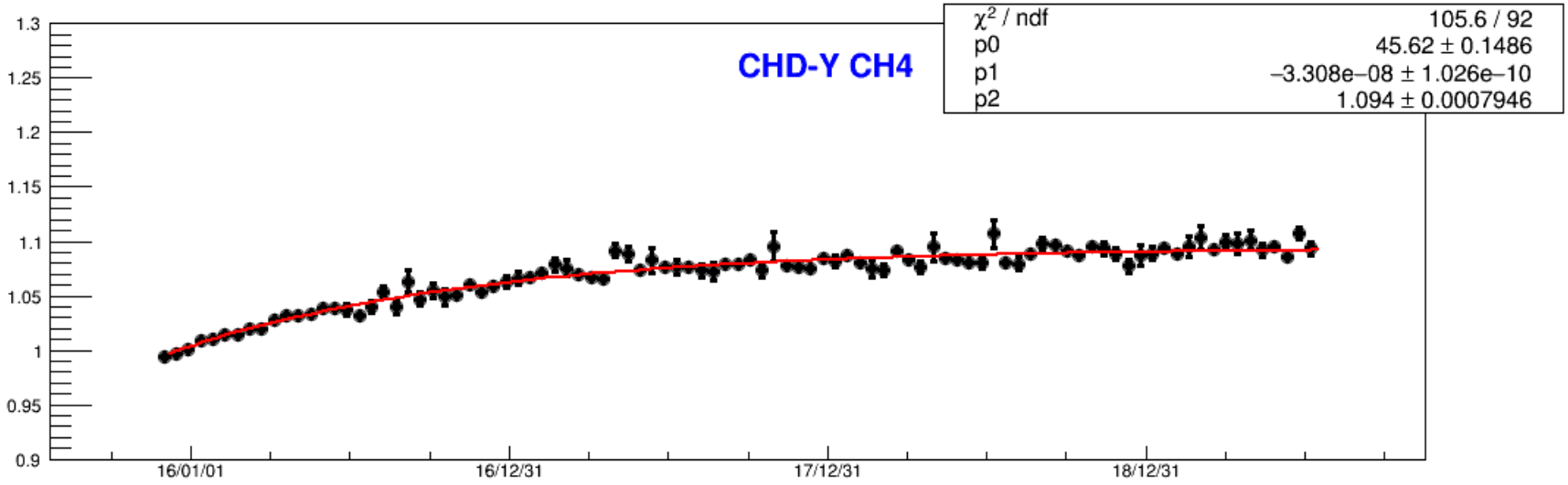




CHD Time Dep Calibration Update for PASS-04 (4)

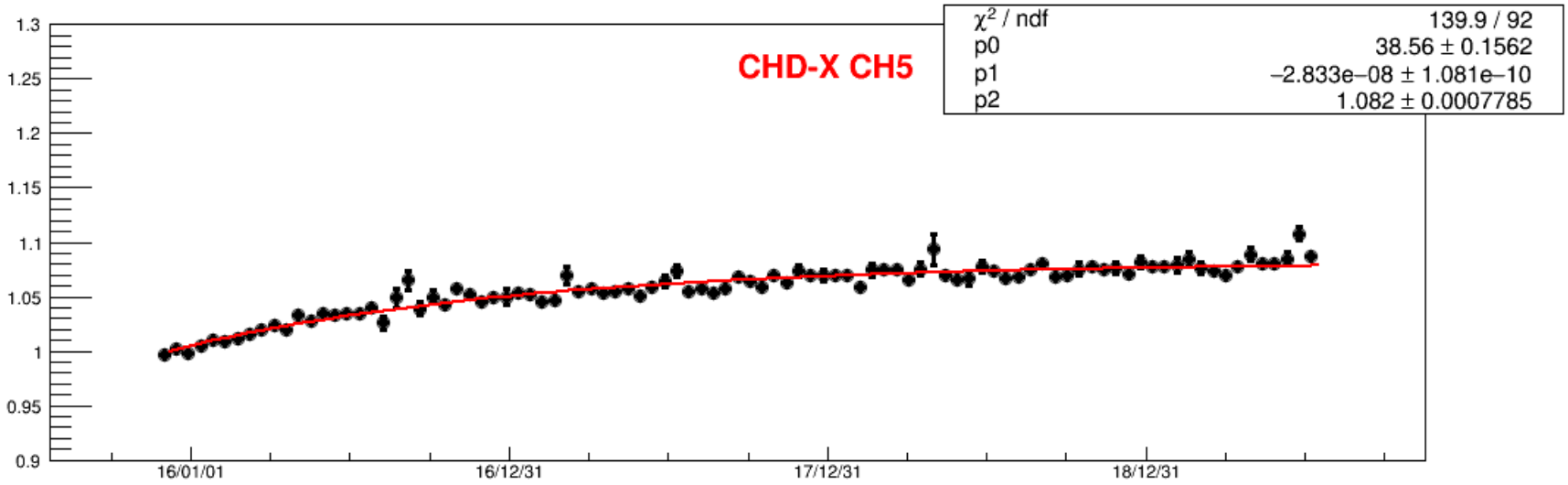
Up to 190731

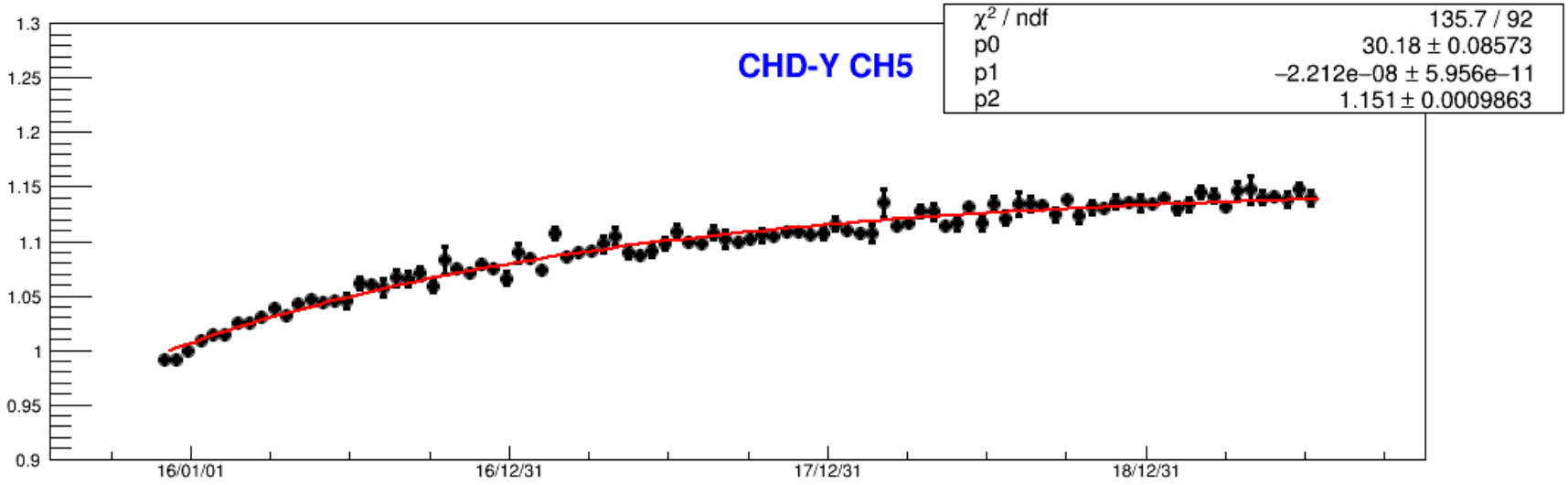




CHD Time Dep Calibration Update for PASS-04 (5)

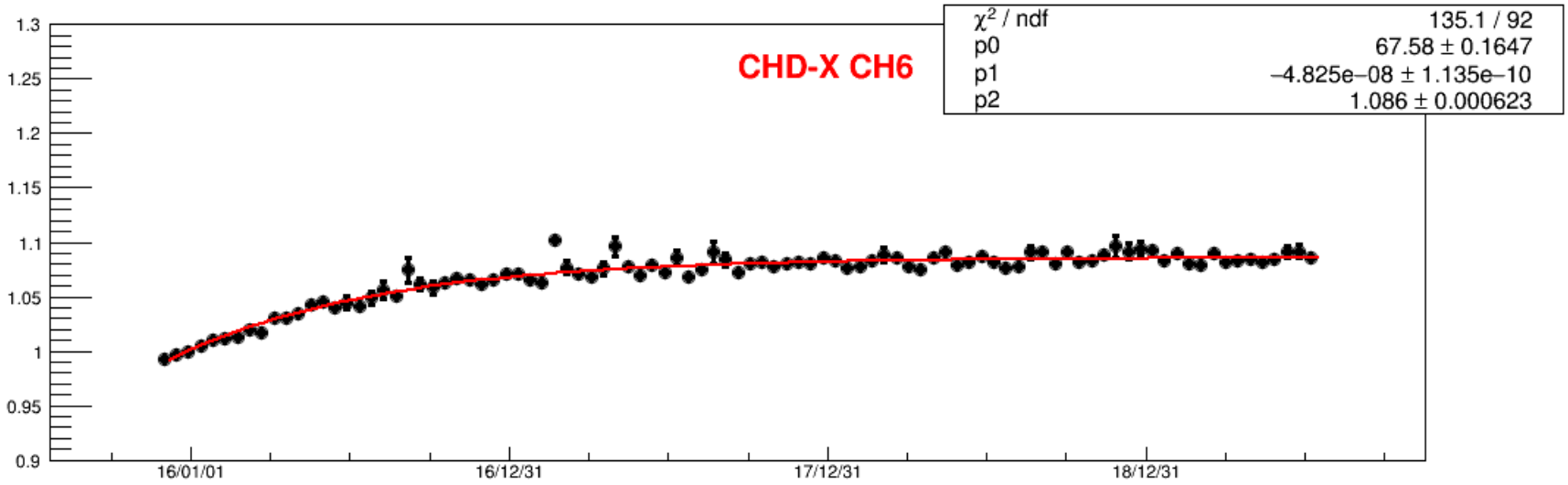
Up to 190731

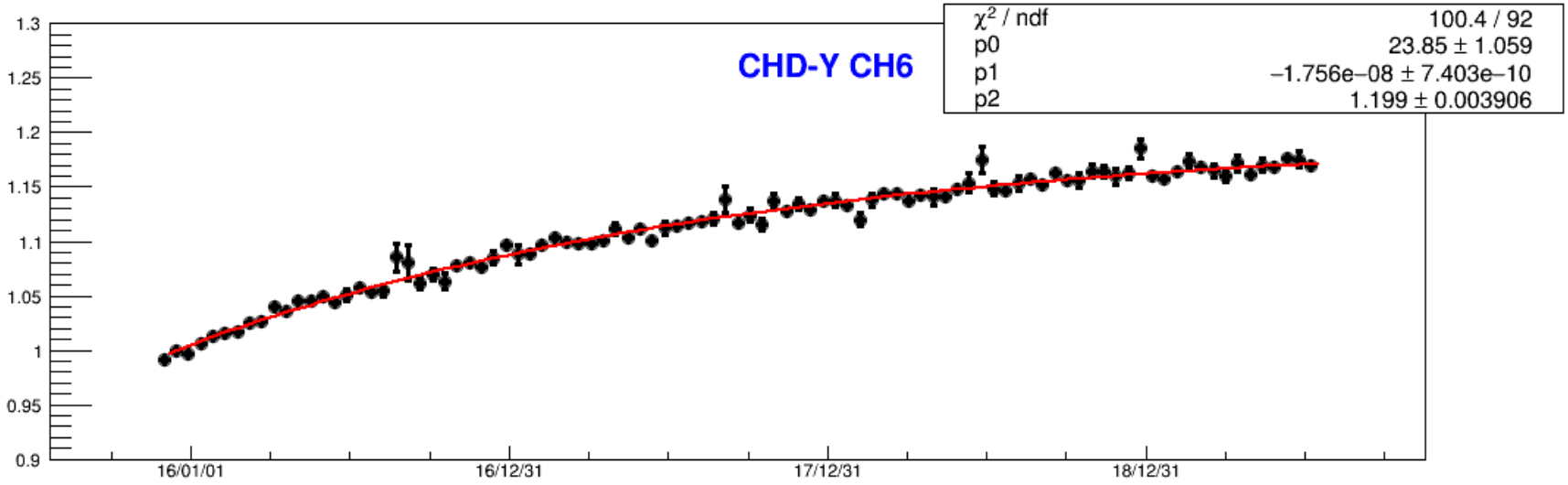




CHD Time Dep Calibration Update for PASS-04 (6)

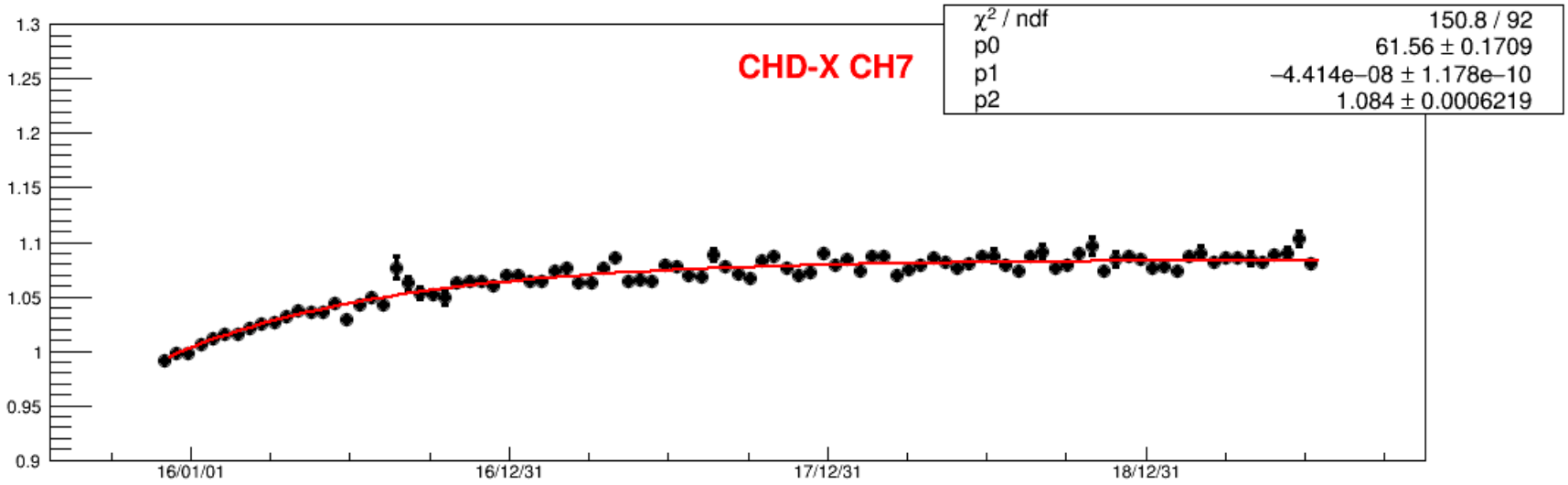
Up to 190731

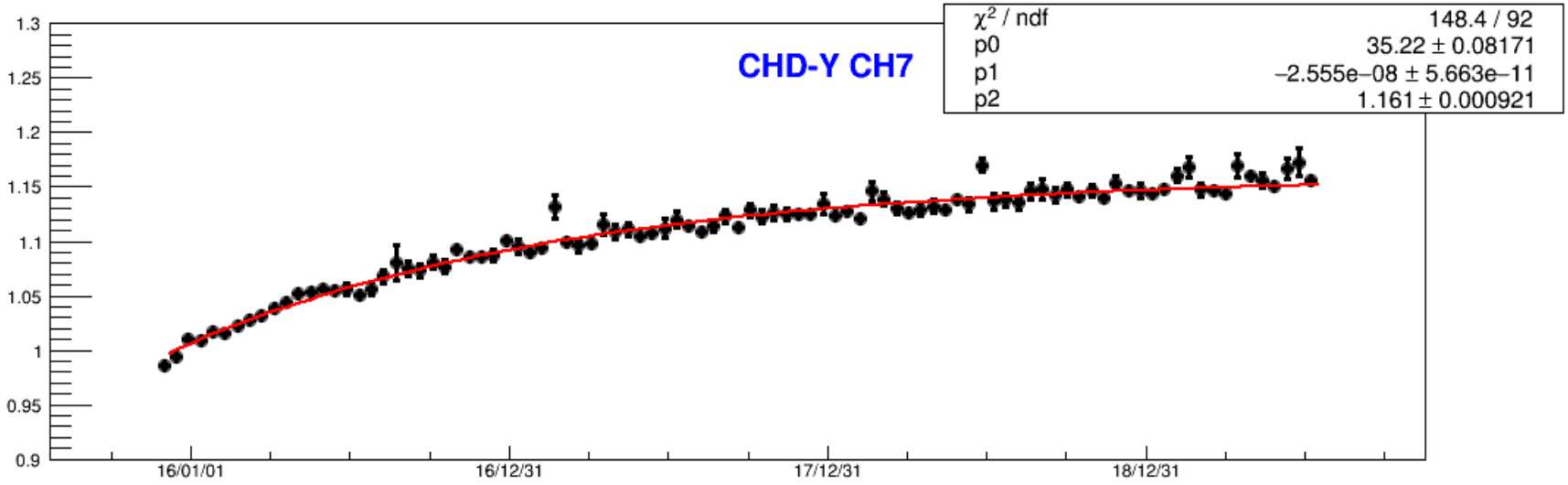




CHD Time Dep Calibration Update for PASS-04 (7)

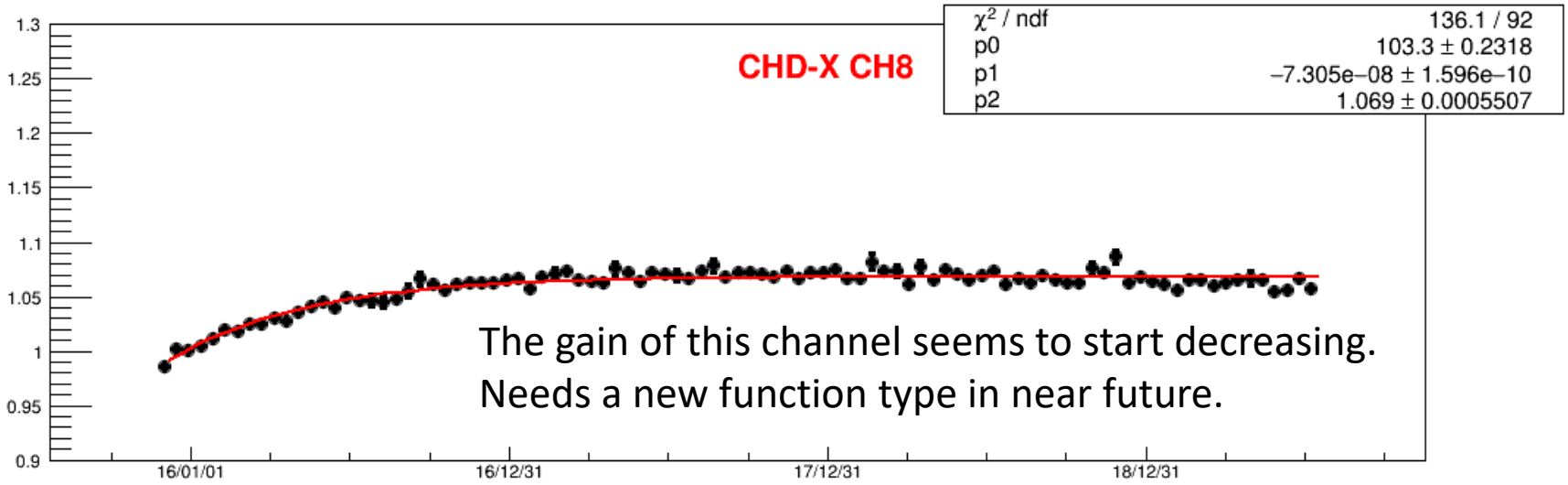
Up to 190731



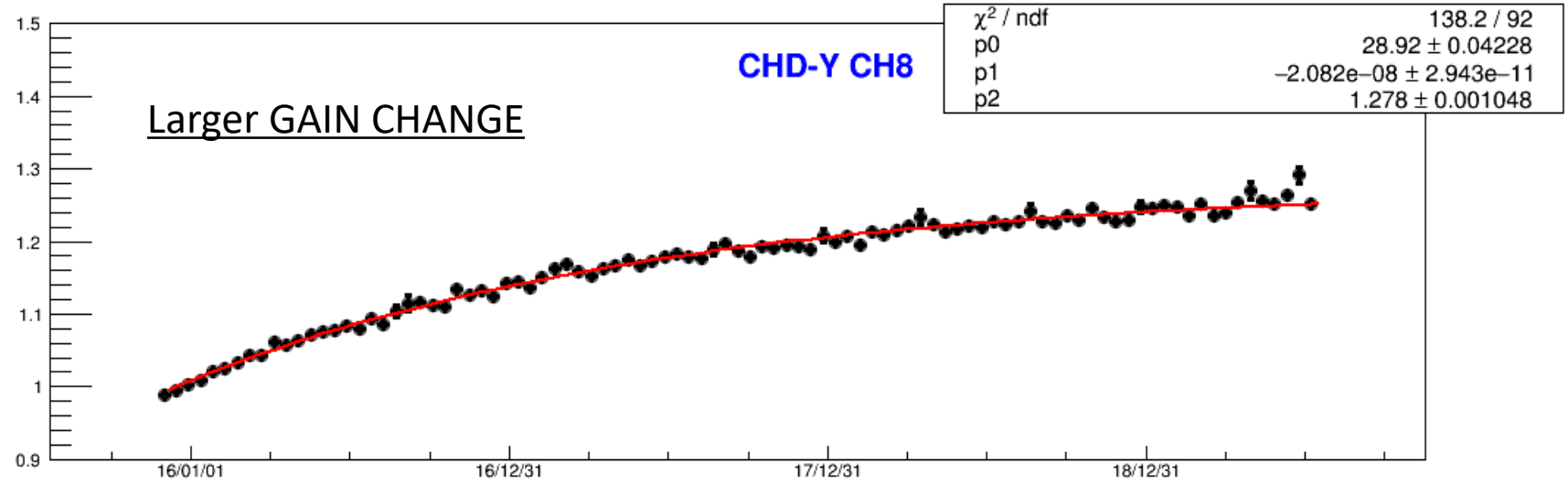


CHD Time Dep Calibration Update for PASS-04 (8)

Up to 190731



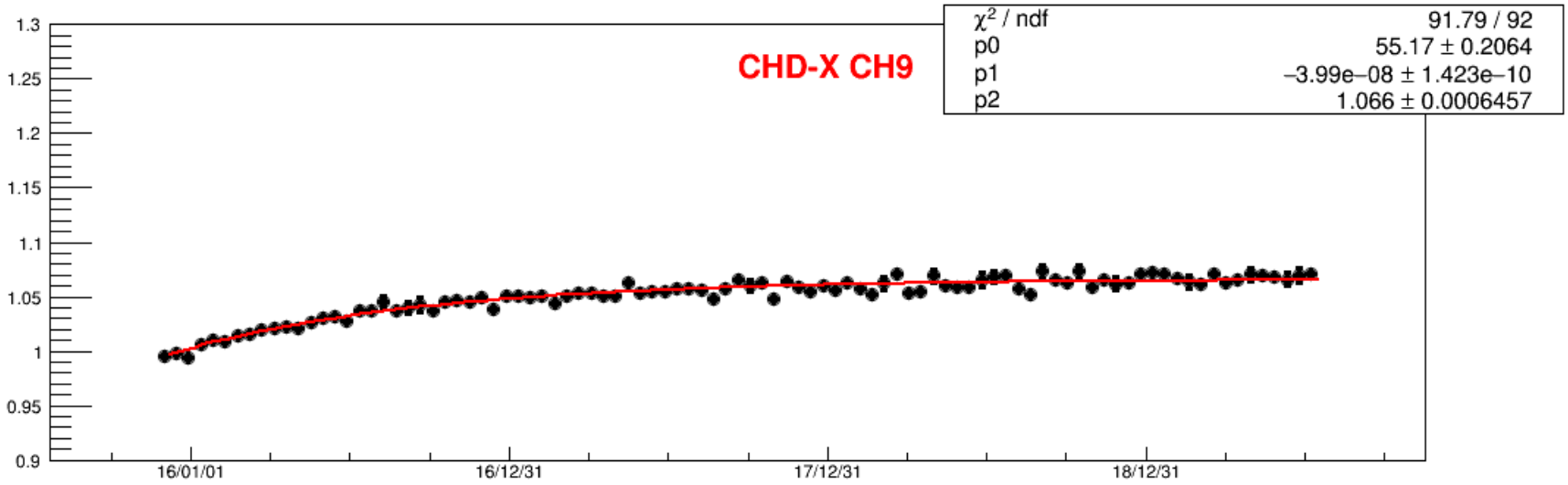
The gain of this channel seems to start decreasing.
Needs a new function type in near future.

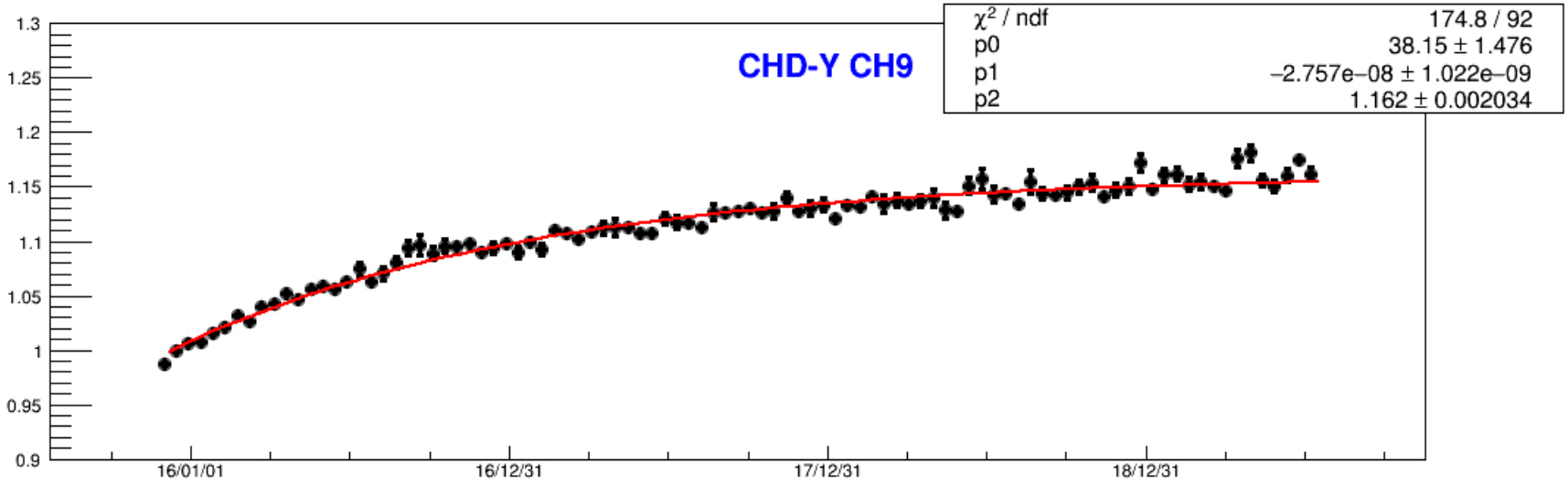


Larger GAIN CHANGE

CHD Time Dep Calibration Update for PASS-04 (9)

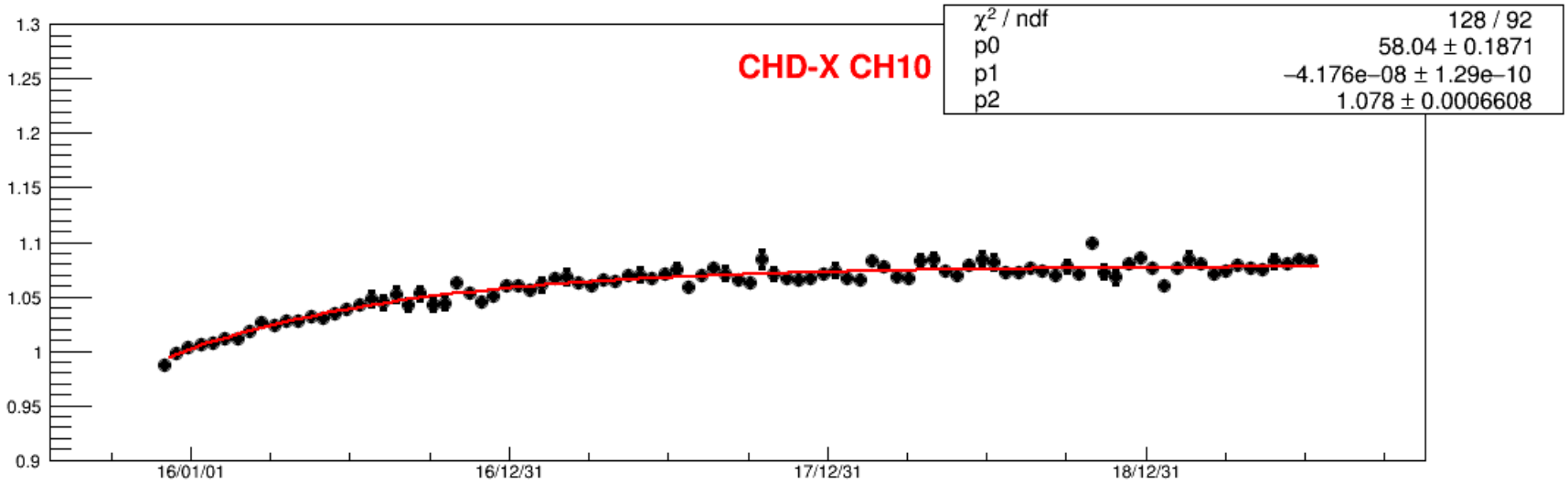
Up to 190731

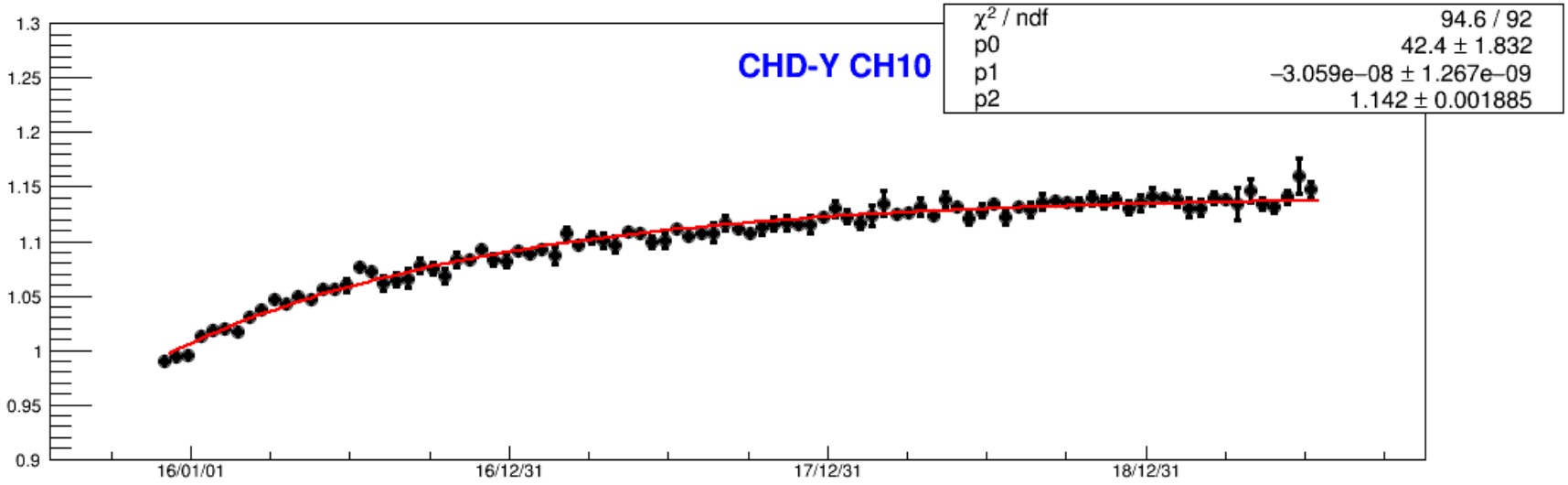




CHD Time Dep Calibration Update for PASS-04 (10)

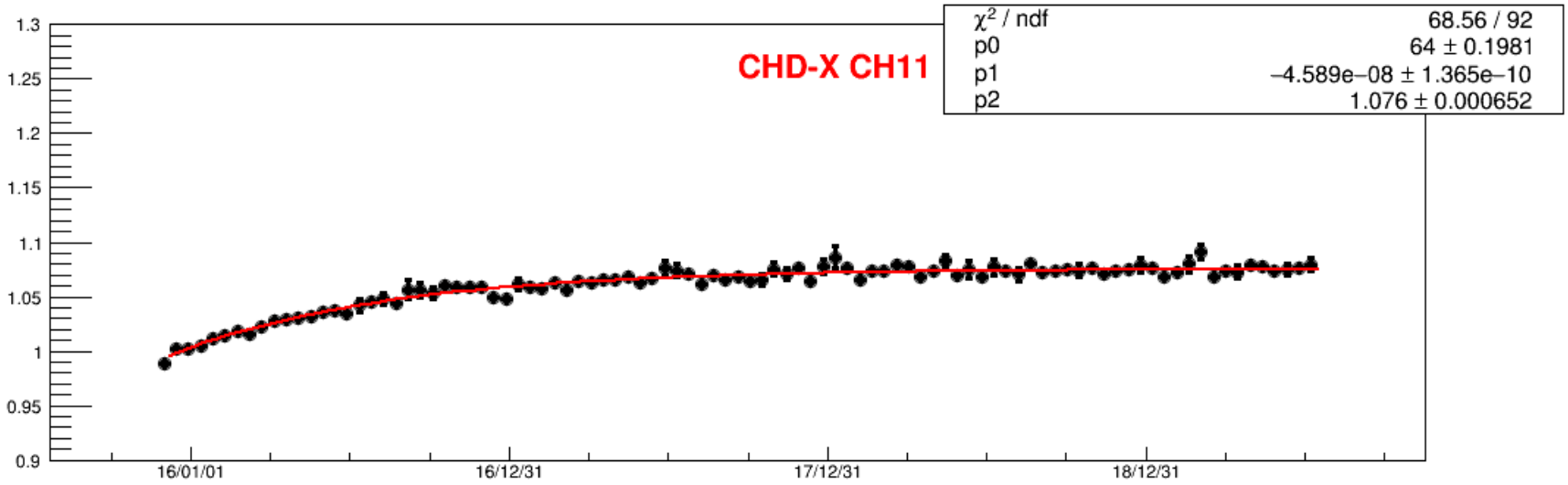
Up to 190731

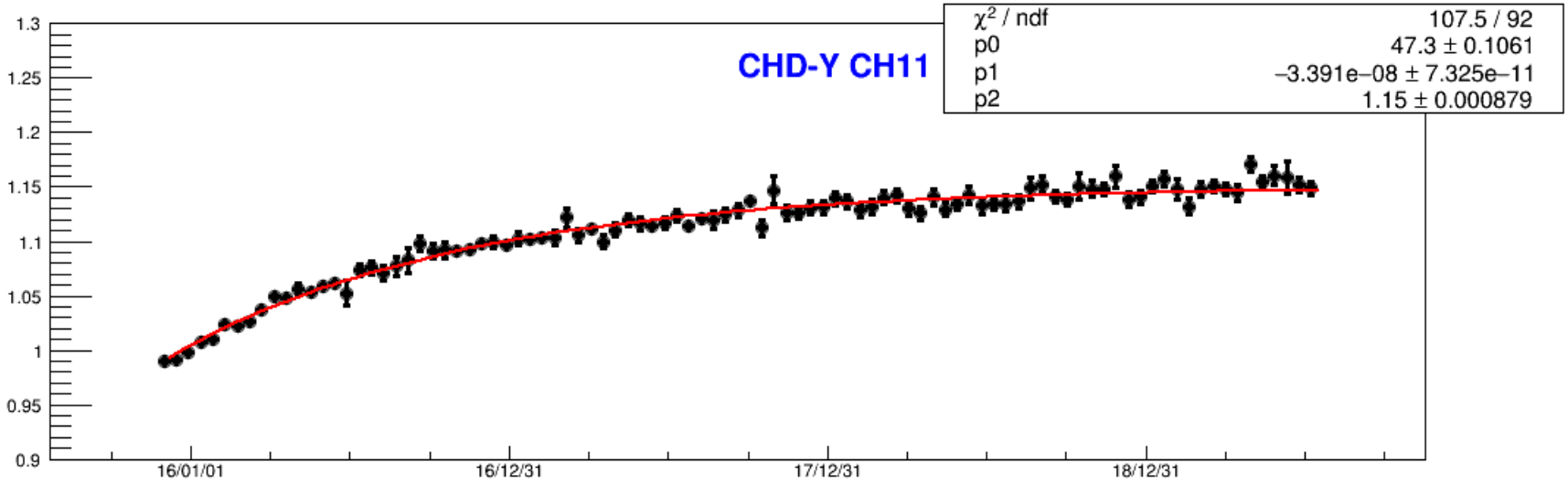




CHD Time Dep Calibration Update for PASS-04 (11)

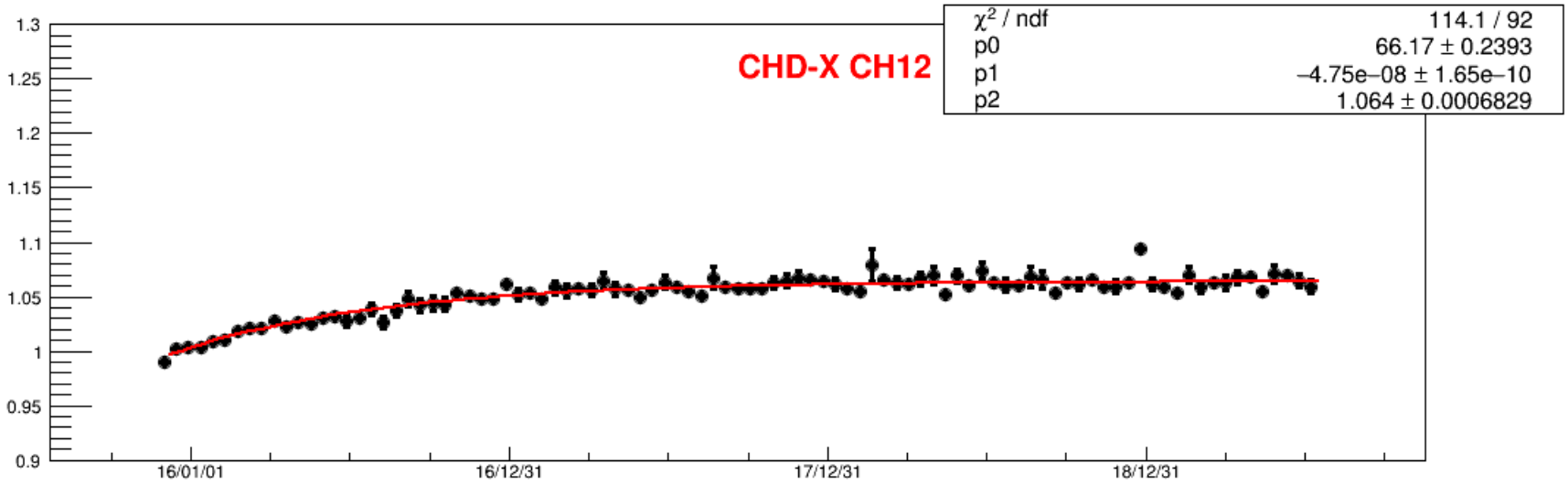
Up to 190731

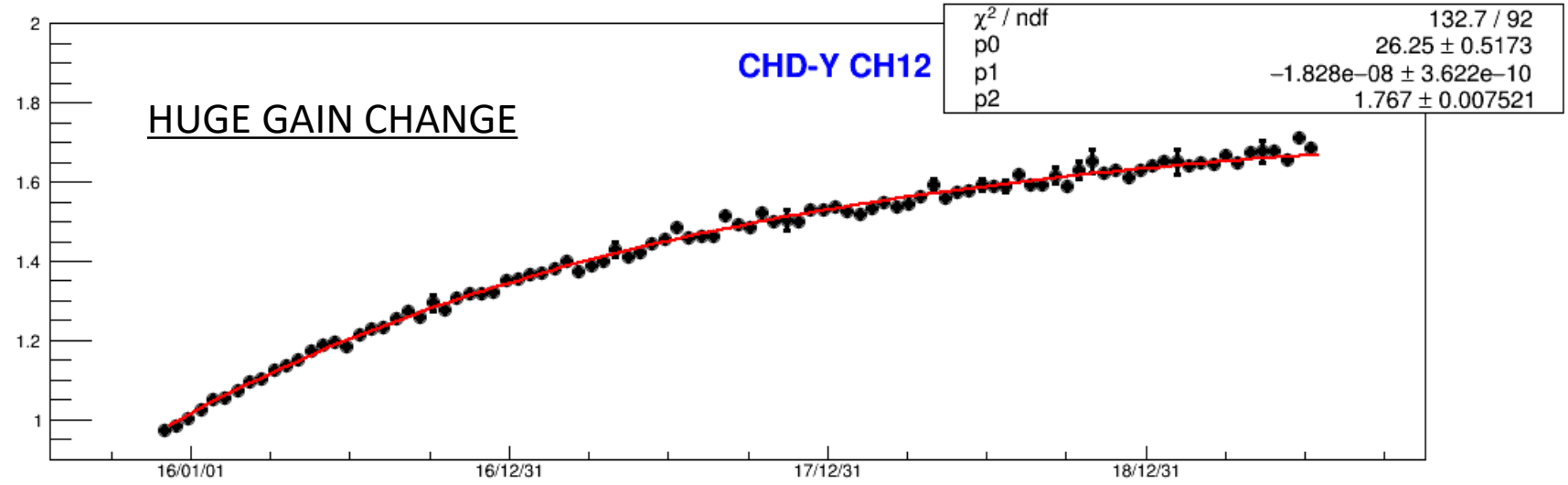




CHD Time Dep Calibration Update for PASS-04 (12)

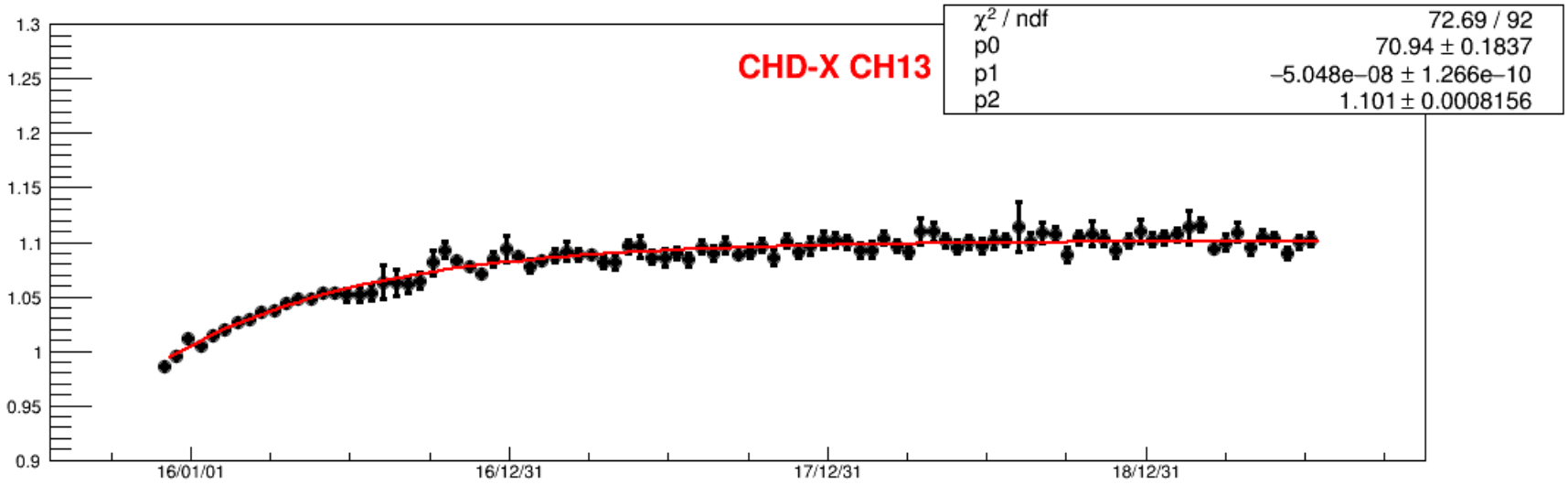
Up to 190731

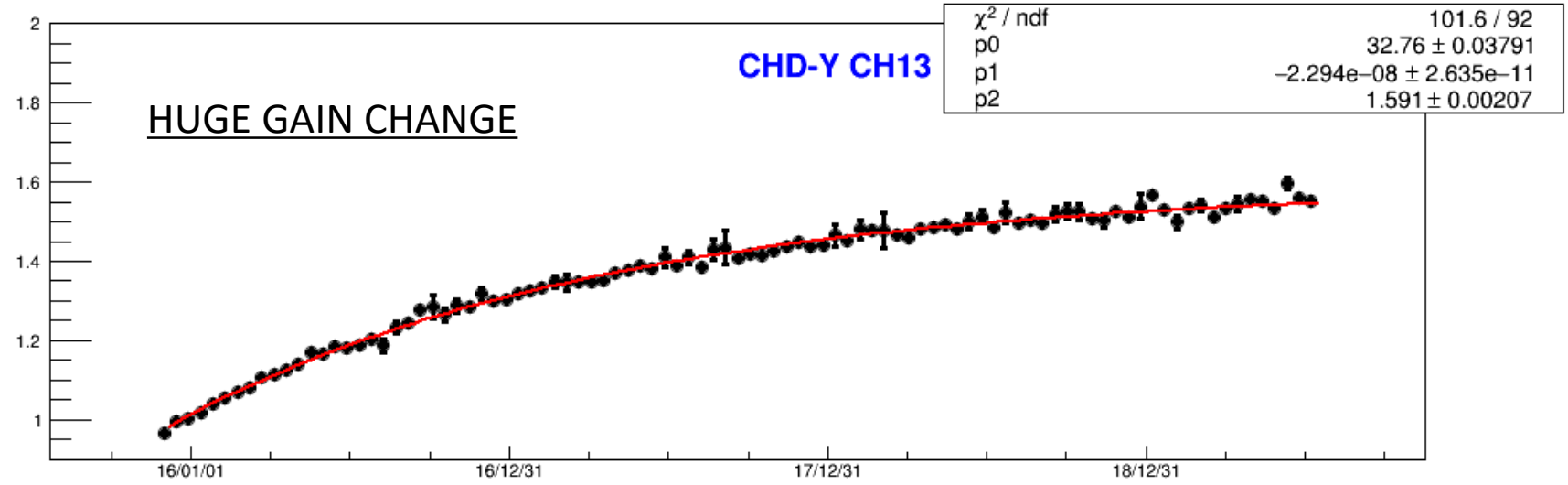




CHD Time Dep Calibration Update for PASS-04 (13)

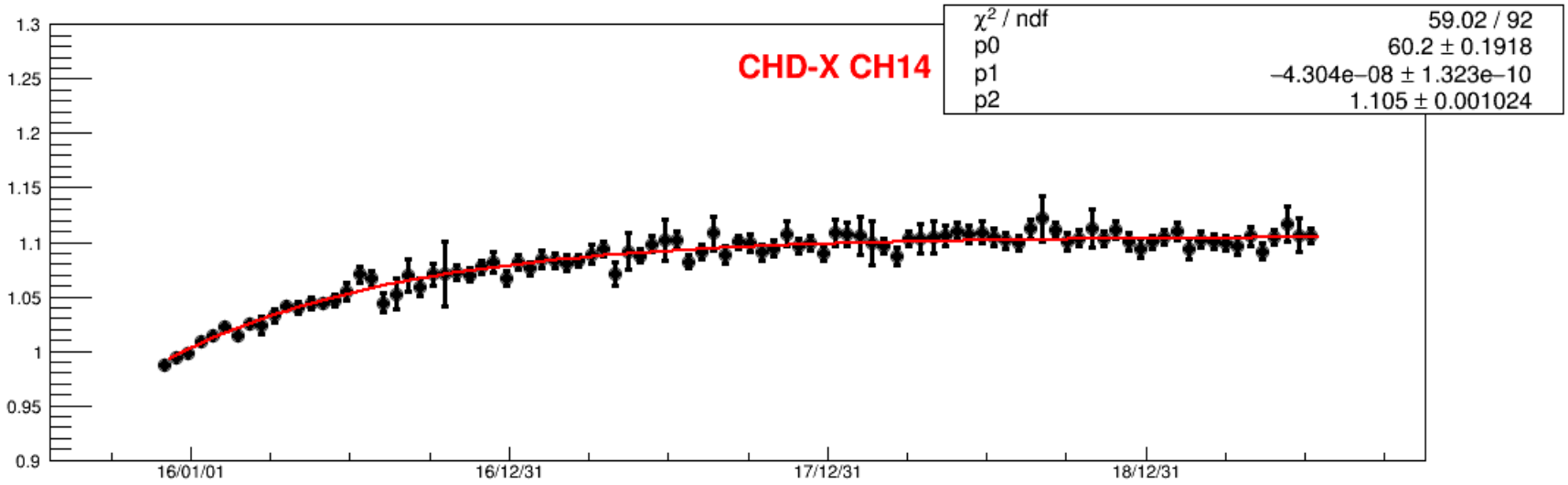
Up to 190731

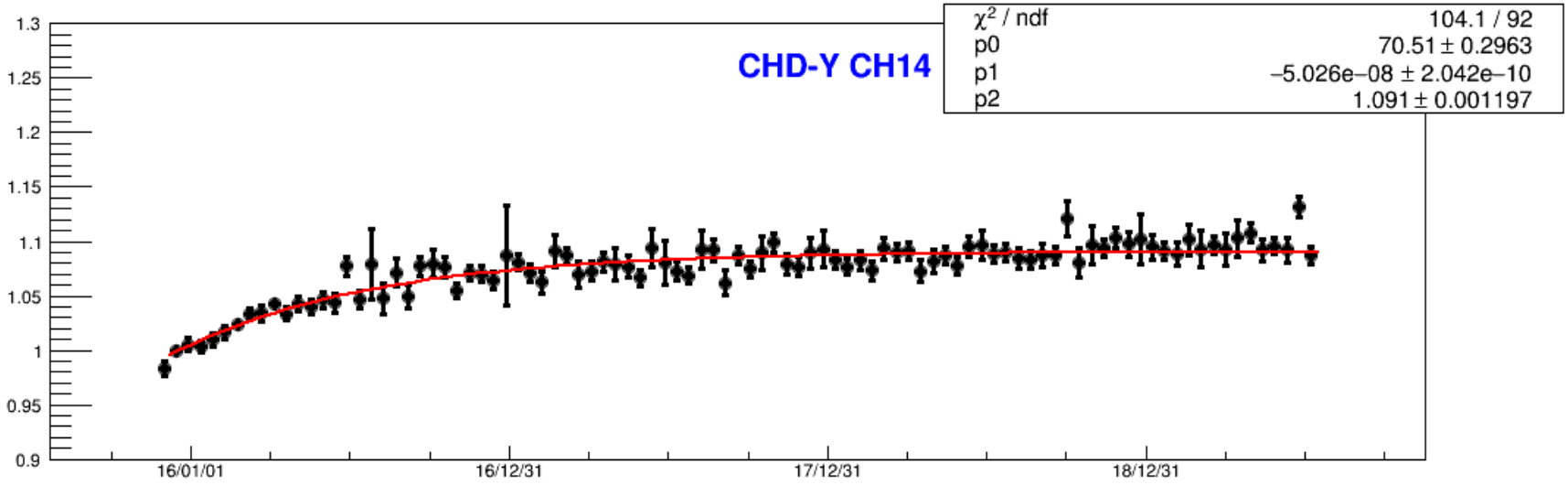




CHD Time Dep Calibration Update for PASS-04 (14)

Up to 190731





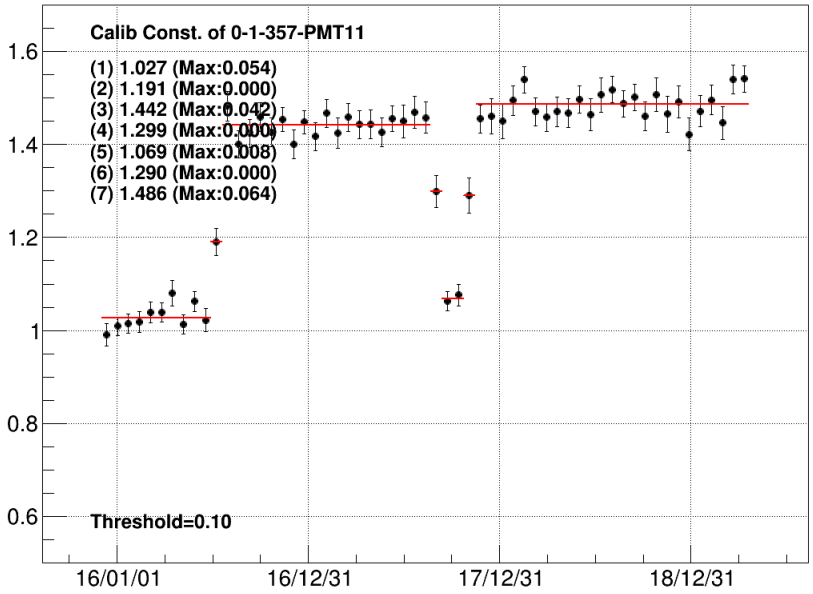
IMC Gain Jump Calibration Updated Channels

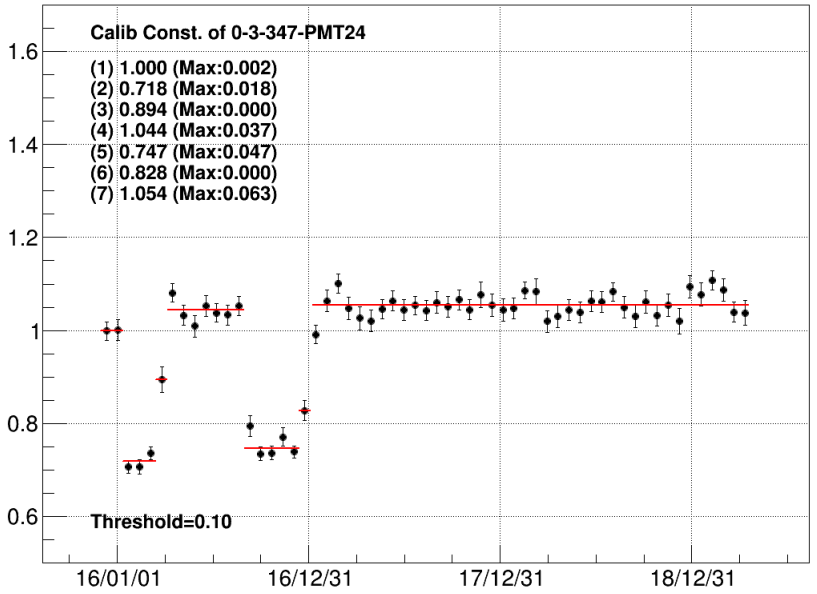
X0-10 X0-45 X0-46 X0-47 X0-48 X0-53 X0-54 X0-56 X0-57 X0-58 X0-125 X0-244 X0-248 X0-280
X0-308 X0-359 X0-395 X0-419 X0-422 X0-434 X1-17 X1-29 X1-46 X1-50 X1-58 X1-91 X1-126
X1-141 X1-186 X1-228 X1-237 X1-239 X1-242 X1-244 X1-251 X1-254 X1-255 X1-264 X1-268
X1-272 X1-275 X1-283 X1-286 X1-303 X1-334 X1-337 X1-346 X1-357 X1-396 X1-400 X1-406
X1-408 X1-415 X1-428 X2-24 X2-25 X2-27 X2-98 X2-99 X2-103 X2-106 X2-110 X2-111 X2-129
X2-144 X2-152 X2-327 X2-331 X2-332 X2-334 X2-343 X2-423 X3-30 X3-31 X3-33 X3-38 X3-57
X3-101 X3-102 X3-104 X3-109 X3-114 X3-115 X3-118 X3-133 X3-140 X3-328 X3-339 X3-346
X3-347 X3-350 X3-415 X3-417 X4-37 X4-193 X4-411 X5-42 X5-71 X5-92 X5-405 X6-47 X6-55
X6-167 X6-184 X6-248 X6-250 X6-251 X6-267 X6-272 X6-273 X6-314 X6-318 X6-368 X6-377
X7-187 X7-189 X7-253 X7-255 X7-268 X7-281 X7-299 X7-301 X7-313 X7-316 X7-365 Y0-14
Y0-21 Y0-52 Y0-88 Y0-105 Y0-112 Y0-149 Y0-152 Y0-193 Y0-194 Y0-201 Y0-202 Y0-209 Y0-229 Y0-261 Y0-292
Y0-297 Y0-299 Y0-303 Y0-322 Y0-334 Y0-335 Y0-371 Y0-433 Y1-19 Y1-77 Y1-83 Y1-86 Y1-154 Y1-160 Y1-168
Y1-171 Y1-173 Y1-178 Y1-182 Y1-194 Y1-198 Y1-199 Y1-201 Y1-205 Y1-218 Y1-224 Y1-234 Y1-237 Y1-255 Y1-258 Y1-292 Y1-324 Y1-325 Y1-326 Y1-327 Y1-328
Y1-332 Y1-379 Y1-387 Y1-402 Y1-425 Y1-426 Y2-24 Y2-31 Y2-75 Y2-133 Y2-200 Y2-201 Y2-202 Y2-266 Y2-289
Y2-359 Y2-361 Y2-369 Y2-375 Y2-378 Y2-379 Y2-384 Y2-419 Y3-109 Y3-349
Y3-358 Y3-366 Y3-367 Y3-383 Y3-384 Y3-401 Y3-409 Y3-411 Y3-412 Y3-413 Y3-414 Y4-35 Y4-64 Y4-68 Y4-101
Y4-108 Y4-195 Y4-320 Y4-329 Y4-403 Y4-405 Y4-406 Y4-407 Y5-40 Y5-41 Y5-64
Y5-68 Y5-70 Y5-71 Y5-96 Y5-129 Y5-133 Y5-134 Y5-135 Y5-198 Y5-355 Y5-358 Y5-393 Y5-397
Y5-398 Y5-399 Y5-400 Y5-401 Y6-260 Y6-363 Y6-390 Y6-393 Y6-394 Y6-395 Y7-50 Y7-162 Y7-272 Y7-364 Y7-370 Y7-388 Y7-389

The channels identified by Paolo were separately checked in page 5 and 6.

(NOTE: This list corresponds to the calibration up to the end of May, 2019)

Examples of Some Usual Channels

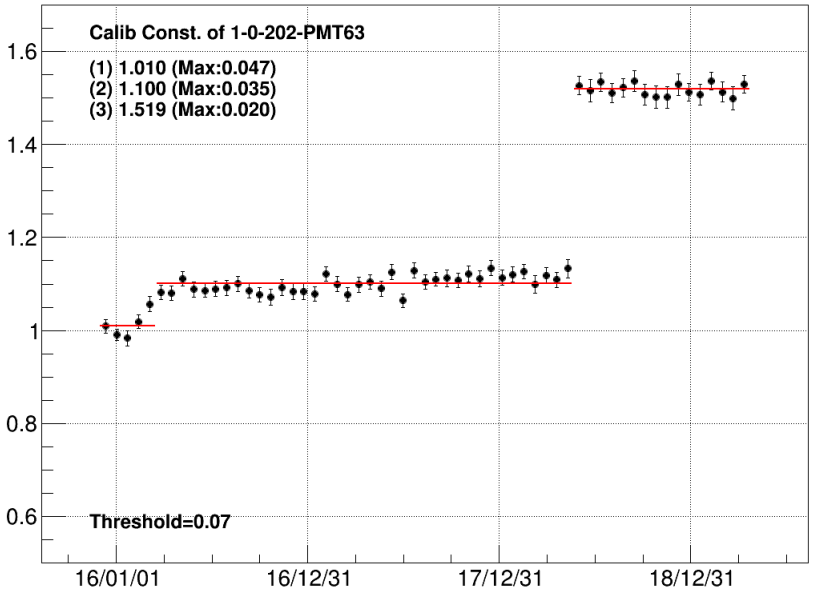




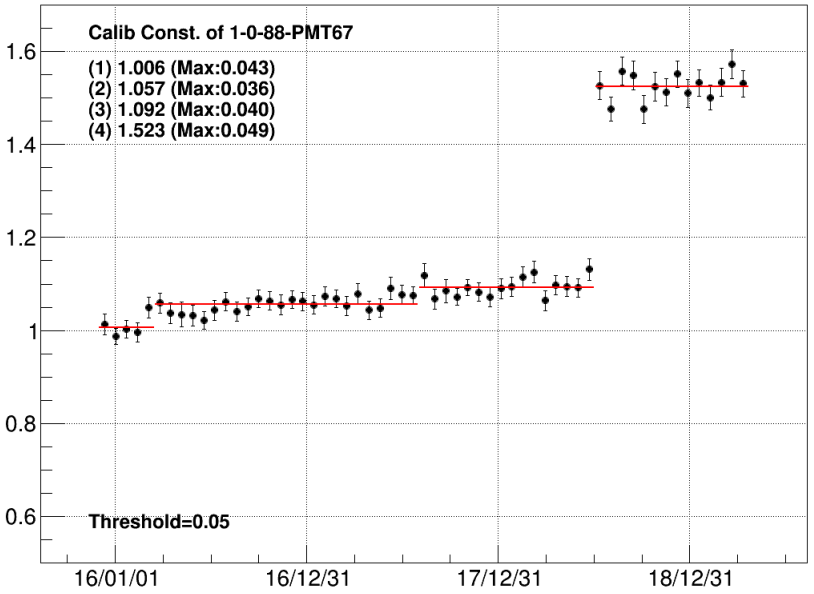
Data points are calculated without applying any gain jump calibrations. Gain jump calibrations for channels listed in the previous page will be replaced by new calibrations.

Examples of Some Strange Channels

Gradual gain change in a relatively short time period

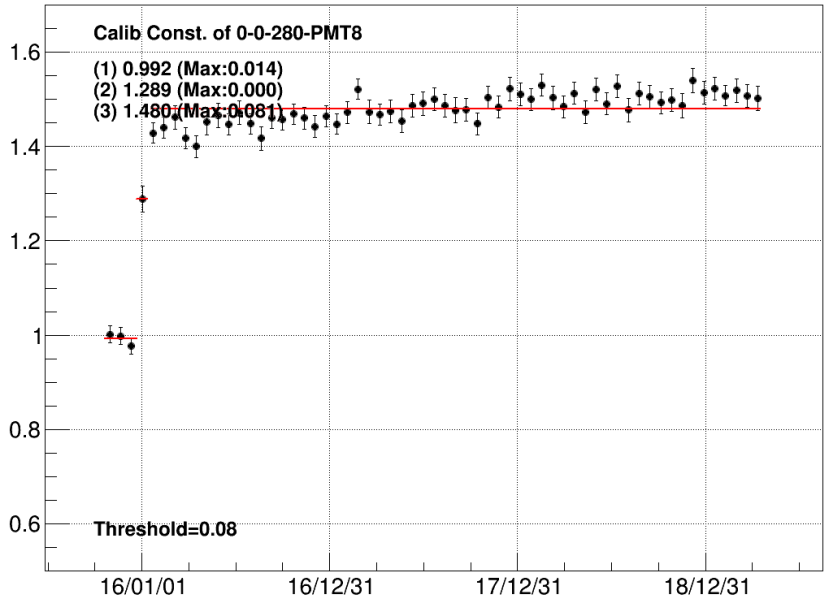


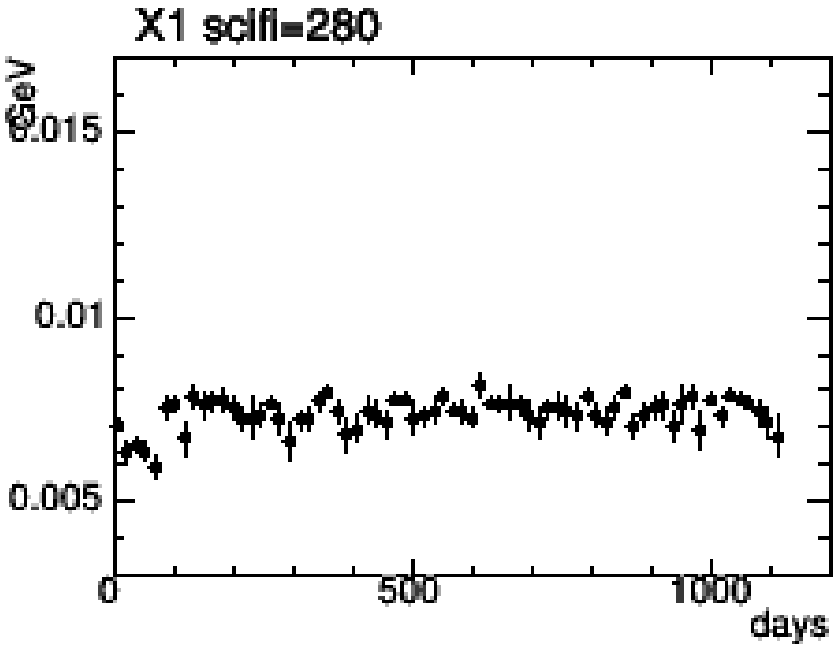
Gradual gain change over the long time period.



All the calibration results are archived as png file in Z8.zip.

An example of channels which have gain jump in the beginning: 0-0-280 (X1-280 in Paolo's identifier)





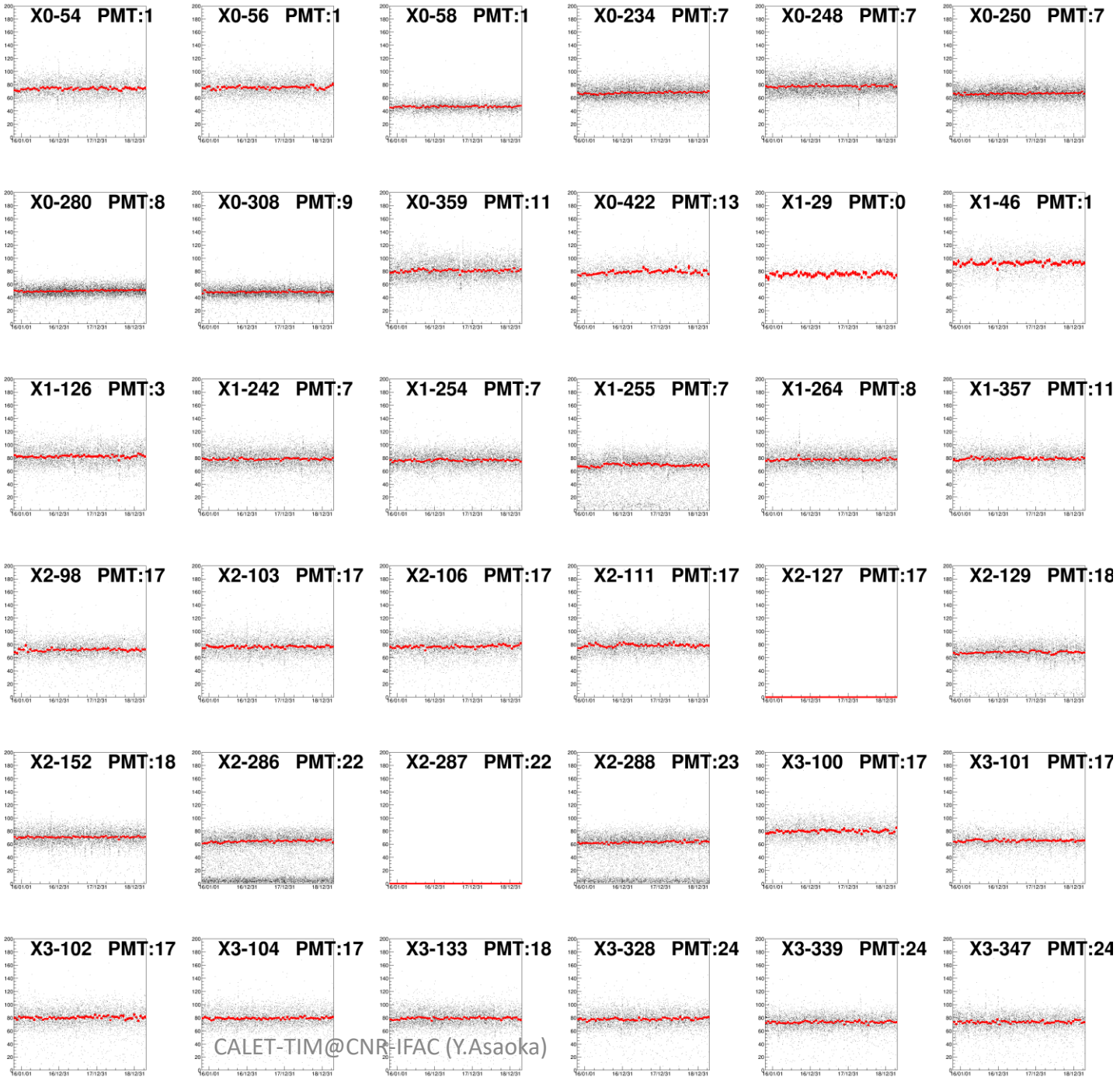
Channels Identified by Paolo (1)

The trends are shown after applying newly defined calibration. Except for the no-signal channels listed below, gain jump calibration parameters are obtained as expected.

No signal at all:
X2-127
X2-287
Y1-99

Already identified as bad channels

Dead during flight:
Y2-360



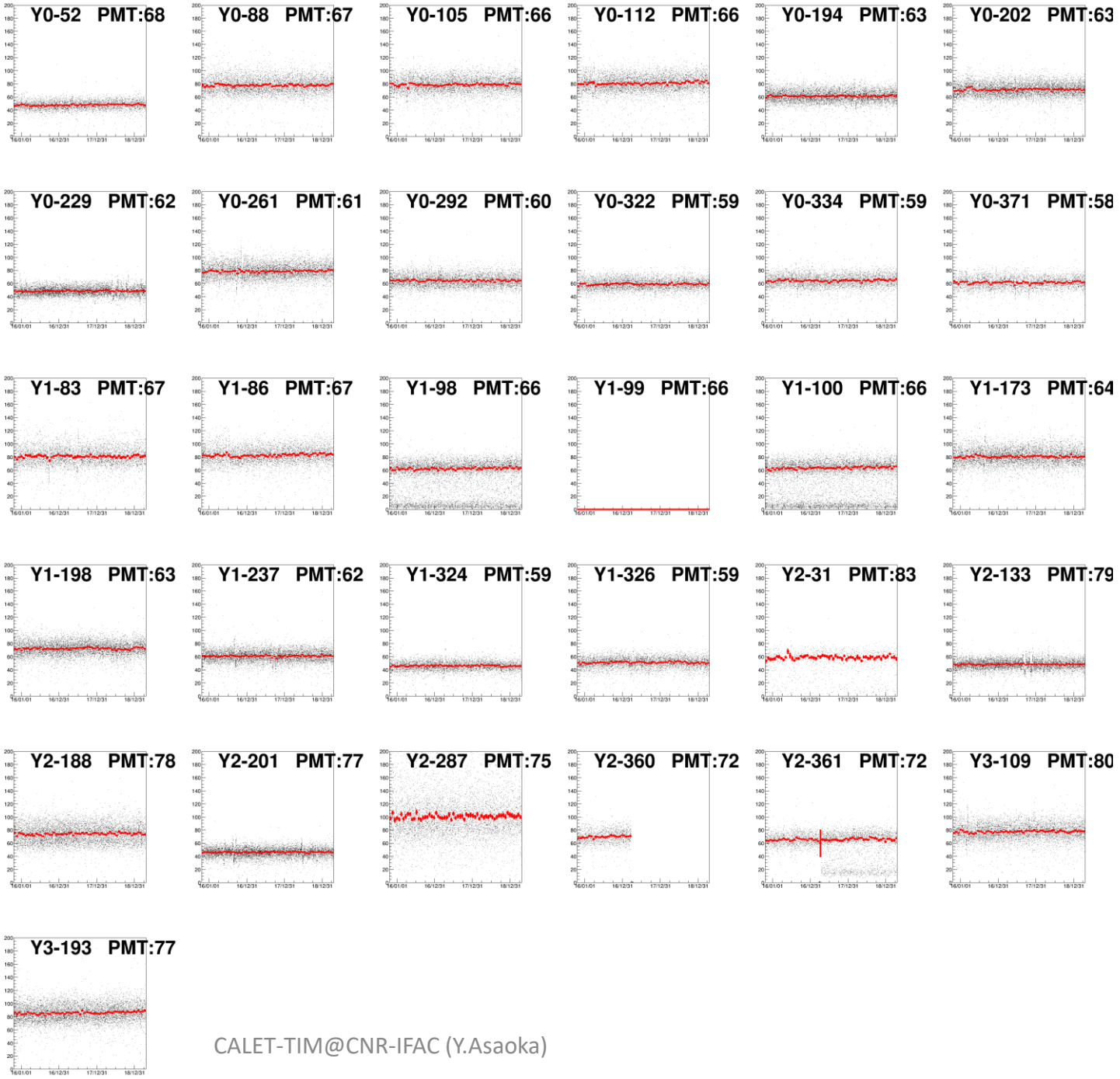
Channels Identified by Paolo (2)

The trends are shown after applying newly defined calibration. Except for the no-signal channels listed below, gain jump calibration parameters are obtained as expected.

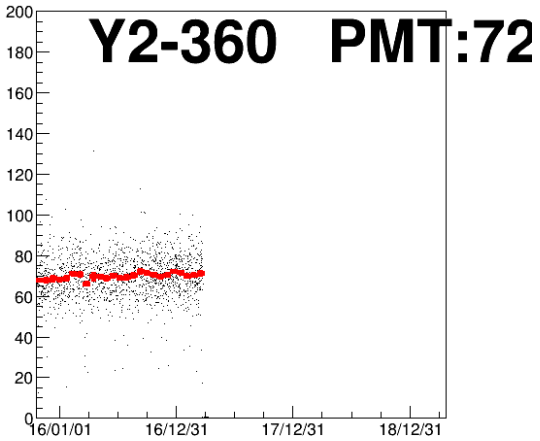
No signal at all:
X2-127
X2-287
Y1-99

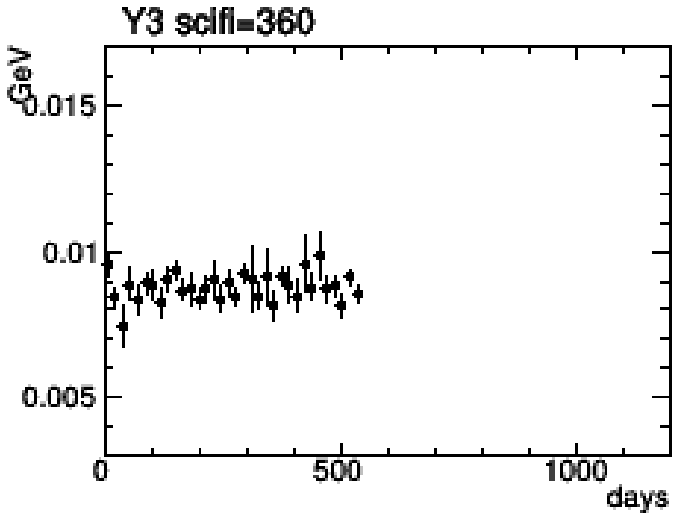
Already identified as bad channels

Dead during flight:
Y2-360



The channel stop working:
1-2-360 (Y3-360 in Paolo's identifier)





Confirmed …. The channel was added to the ChannelStatus

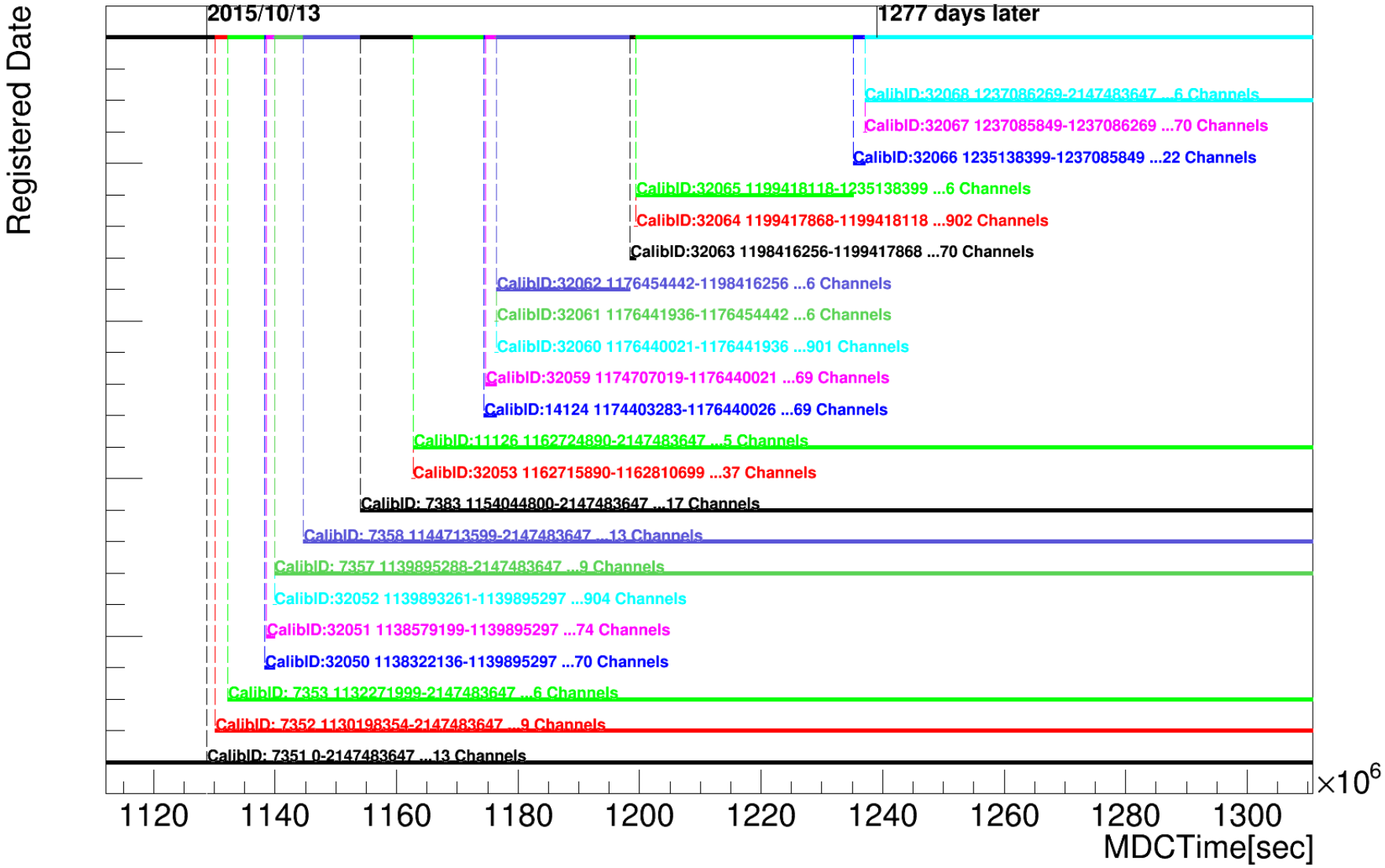
NO SIGNAL from 1490671819 sec (UT)

1174707019 sec (MDC Time)

This occurs at the same time of the fixed MaPMT signal.

… This is the only permanent malfunction occurred so far.

Channel Status Calibration Table



Channel Status (What's registered)

CalibID	#bad	MDC Time [from, to]		(yymmddHH [from,to])	Description of bad channels
7351	13	0	1130198354	(Start--15103000)	IMC-LG 5ch, TASC-Y3-3,Y4-16
7352	9	1130198354	1132271999	(15103000--15112300)	IMC-LG 5ch, TASC-Y4-16
7353	6	1132271999	1138322136	(15112300--16020100)	IMC-LG 5ch (+1 dummy ch, same for below)
32050	70	1138322136	1138579199	(16020100--16020400)	IMC-LG 5ch, IMCFEC-X2 1MaPMT
32051	74	1138579199	1139893261	(16020400--16021905)	IMC-LG 5ch, IMCFEC-X2 1MaPMT, TASC-Y5-12
32052	904	1139893261	1139895297	(16021905--16021905)	IMC-LG 5ch, IMCFEC-X2 all, TASC-Y5-12
7357	9	1139895297	1144713599	(16021905--16041500)	IMC-LG 5ch, TASC-Y5-12
7358	13	1144713599	1154044800	(16041500--16080100)	IMC-LG 5ch, TASC-Y5-12, Y5-14
7383	17	1154044800	1162715890	(16080100--16110908)	IMC-LG 5ch, TASC-Y5-12, Y5-13, Y5-14
32053	37	1162715890	1162810699	(16110908--16111011)	IMC-LG 5ch, TASC-Y5-9-16
11126	5	1162810699	1174403283	(16111011--17032415)	IMC-LG 5ch
14124	69	1174403283	1174707019	(17032415--17032803)	IMC-LG 5ch, IMC-Y2 1MaMPT
32059	69	1174707019	1176440021	(17032803--17041704)	IMC-LG 5ch, IMC-Y2 1MaPMT
32060	901	1176440021	1176441936	(17041704--17041705)	IMC-LG 5ch, IMC-FEC-Y2 all
32061	6	1176441936	1176454442	(17041705--17041708)	IMC-LG 6ch (added 1-2-360 = IMC-Y3-361)
32062	6	1176454442	1198416256	(17041708--17122713)	IMC-LG 6ch
32063	70	1198416256	1199417868	(17122713--18010803)	IMC-LG 6ch, IMCFEC-X1 1MaPMT
32064	902	1199417868	1199418118	(18010803--18010803)	IMC-LG 6ch, IMCFEC-X1 all
32065	6	1199418118	1235138399	(18010803--19022514)	IMC-LG 6ch
32066	22	1235138399	1237085849	(19022514--19032002)	IMC-LG 6ch, TASC-Y1-11-14
32067	70	1237085849	1237086269	(19032002--19032003)	IMC-LG 6ch, TASC-FEC-Y1 all
32068	6	1237086269	2147483647	(19032003--End)	IMC-LG 6ch

Calib ID=7351 TASC Y3,Y4 total 2ch

```
###          0 -- 2147483647 [in MDC time] (   13 bad channels)
###   15101300 -- xxxxxxxx   [in yymmddHH  (approx.)]

IMC  0 2 127          == IMC-X3-128
IMC  0 2 287          == IMC-X3-288
IMC  0 7   3          == IMC-X8-004
IMC  0 6 223          == IMC-Y7-224
IMC  1 1  99          == IMC-Y2-100

TASC 1 2  2  0        == TASC-Y3-03
TASC 1 2  2  1
TASC 1 2  2  2
TASC 1 2  2  3
TASC 1 3 15  0        == TASC-Y4-16
TASC 1 3 15  1
TASC 1 3 15  2
TASC 1 3 15  3
```

Calib ID=7383 TASC-Y5 total 3ch

```
### 1154044800 -- 2147483647 [in MDC time] (   17 bad channels)
###   16080100 -- xxxxxxxx   [in yymmddHH  (approx.)]

IMC  0 2 127
IMC  0 2 287
IMC  0 7   3
IMC  0 6 223
IMC  1 1  99

TASC 1 4 11  0         == TASC-Y5-12
TASC 1 4 12  0         == TASC-Y5-13
TASC 1 4 13  0         == TASC-Y5-14
TASC 1 4 11  1
TASC 1 4 12  1
TASC 1 4 13  1
TASC 1 4 11  2
TASC 1 4 12  2
TASC 1 4 13  2
TASC 1 4 11  3
TASC 1 4 12  3
TASC 1 4 13  3
```

Calib ID=32050 IMCFEC-X2 1MaPMT

```
### 1138322136 -- 1139895297 [in MDC time] (   70 bad channels)
###   16020100 -- 16021905   [in yymmddHH   (approx.)]
Unknown    32

IMC  0 2 127
IMC  0 2 287
IMC  0 7   3
IMC  0 6 223
IMC  1 1  99
```

IMC 0 2 63	IMC 0 3 35	IMC 0 3 40
IMC 0 2 59	IMC 0 3 33	IMC 0 3 44
IMC 0 2 58	IMC 0 3 38	IMC 0 3 50
IMC 0 2 54	IMC 0 3 42	IMC 0 3 54
IMC 0 2 50	IMC 0 3 46	IMC 0 3 58
IMC 0 2 44	IMC 0 3 48	IMC 0 3 59
IMC 0 2 40	IMC 0 3 52	IMC 0 3 63
IMC 0 2 36	IMC 0 3 56	IMC 0 3 60
IMC 0 2 32	IMC 0 2 55	IMC 0 3 34
IMC 0 2 62	IMC 0 2 51	IMC 0 3 39
IMC 0 2 57	IMC 0 2 45	IMC 0 3 43
IMC 0 2 49	IMC 0 2 41	IMC 0 3 47
IMC 0 2 47	IMC 0 2 42	IMC 0 3 49
IMC 0 2 43	IMC 0 2 37	IMC 0 3 53
IMC 0 2 39	IMC 0 2 38	IMC 0 3 57
IMC 0 2 35	IMC 0 2 33	IMC 0 3 62
IMC 0 3 41	IMC 0 2 34	
IMC 0 3 45	IMC 0 2 61	
IMC 0 3 51	IMC 0 2 53	
IMC 0 3 55	IMC 0 2 48	
IMC 0 2 52	IMC 0 2 46	
IMC 0 2 56	IMC 0 3 32	
IMC 0 2 60	IMC 0 3 37	
IMC 0 3 61	IMC 0 3 36	

Calib ID=14124 IMCFEC-Y2 1MaPMT

```
### 1174403283 -- 1176440026 [in MDC time] (   69 bad channels)
###   17032415 -- 17041704   [in yymmddHH  (approx.)]
IMC  0 2 127
IMC  0 2 287
IMC  0 7   3
IMC  0 6 223
IMC  1 1  99
```

IMC 1 2 352	IMC 1 3 380	IMC 1 3 375
IMC 1 2 356	IMC 1 3 382	IMC 1 3 371
IMC 1 2 357	IMC 1 3 377	IMC 1 3 365
IMC 1 2 361	IMC 1 3 373	IMC 1 3 361
IMC 1 2 365	IMC 1 3 369	IMC 1 3 357
IMC 1 2 371	IMC 1 3 367	IMC 1 3 356
IMC 1 2 375	IMC 1 3 363	IMC 1 3 352
IMC 1 2 379	IMC 1 3 359	IMC 1 3 355
IMC 1 2 383	IMC 1 2 360	IMC 1 3 381
IMC 1 2 353	IMC 1 2 364	IMC 1 3 376
IMC 1 2 358	IMC 1 2 370	IMC 1 3 372
IMC 1 2 366	IMC 1 2 374	IMC 1 3 368
IMC 1 2 368	IMC 1 2 373	IMC 1 3 366
IMC 1 2 372	IMC 1 2 378	IMC 1 3 362
IMC 1 2 376	IMC 1 2 377	IMC 1 3 358
IMC 1 2 380	IMC 1 2 382	IMC 1 3 353
IMC 1 3 374	IMC 1 2 381	
IMC 1 3 370	IMC 1 2 354	
IMC 1 3 364	IMC 1 2 362	
IMC 1 3 360	IMC 1 2 367	
IMC 1 2 363	IMC 1 2 369	
IMC 1 2 359	IMC 1 3 383	
IMC 1 2 355	IMC 1 3 378	
IMC 1 3 354	IMC 1 3 379	

Calib ID=32063 IMCFEC-X1 1MaPMT

```
### 1198416256 -- 1199417868 [in MDC time] (   70 bad channels)
###   17122713 -- 18010803   [in yymmddHH  (approx.)]
IMC  0 2 127
IMC  0 2 287
IMC  0 7   3
IMC  0 6 223
IMC  1 1  99
IMC  1 2 360
```

IMC 0 0 383	IMC 0 1 355	IMC 0 1 360
IMC 0 0 379	IMC 0 1 353	IMC 0 1 364
IMC 0 0 378	IMC 0 1 358	IMC 0 1 370
IMC 0 0 374	IMC 0 1 362	IMC 0 1 374
IMC 0 0 371	IMC 0 1 366	IMC 0 1 378
IMC 0 0 364	IMC 0 1 368	IMC 0 1 379
IMC 0 0 360	IMC 0 1 372	IMC 0 1 383
IMC 0 0 356	IMC 0 1 376	IMC 0 1 380
IMC 0 0 352	IMC 0 0 375	IMC 0 1 354
IMC 0 0 382	IMC 0 0 370	IMC 0 1 359
IMC 0 0 377	IMC 0 0 365	IMC 0 1 363
IMC 0 0 369	IMC 0 0 361	IMC 0 1 367
IMC 0 0 367	IMC 0 0 362	IMC 0 1 369
IMC 0 0 363	IMC 0 0 357	IMC 0 1 373
IMC 0 0 359	IMC 0 0 358	IMC 0 1 377
IMC 0 0 355	IMC 0 0 353	IMC 0 1 382
IMC 0 1 361	IMC 0 0 354	
IMC 0 1 365	IMC 0 0 381	
IMC 0 1 371	IMC 0 0 373	
IMC 0 1 375	IMC 0 0 368	
IMC 0 0 372	IMC 0 0 366	
IMC 0 0 376	IMC 0 1 352	
IMC 0 0 380	IMC 0 1 357	
IMC 0 1 381	IMC 0 1 356	

Calib ID=32066 TASC-Y1 4ch

```
### 1235138399 -- 1237085849 [in MDC time] (   22 bad channels)
###   19022514 -- 19032002   [in yymmddHH  (approx.)]

IMC  0 2 127
IMC  0 2 287
IMC  0 7   3
IMC  0 6 223
IMC  1 1  99
IMC  1 2 360
```

```
TASC 1 0 10  0 == TASC-Y1-11
TASC 1 0 11  0 == TASC-Y1-12
TASC 1 0 12  0 == TASC-Y1-13
TASC 1 0 13  0 == TASC-Y1-14
TASC 1 0 10  1
TASC 1 0 11  1
TASC 1 0 12  1
TASC 1 0 13  1
TASC 1 0 10  2
TASC 1 0 11  2
TASC 1 0 12  2
TASC 1 0 13  2
TASC 1 0 10  3
TASC 1 0 11  3
TASC 1 0 12  3
TASC 1 0 13  3
```

Observation Status

- Extracted the all periods when the observations are not normal.
- New calibration table (calibration_observation_status) is defined to store this information
- The parameter value will be retrieved in TL2CALSummary::ObsStatus
  … if ObsStatus is not zero, the events should not be used in physics analysis.

intended reboot
16051823 (23:30UT) 1147649164 (dqcShutDown -10sec)
16051908 (08:04UT) 1147680250 (from CommandLog)

automatic reboot
16082209 (09:30UT) 1155893246 (getMDCTimeEnd.sh)
16082316 (16:54UT) 1156006319 (from CommandLog)

fixed bit per 64bit
17090402 (02:32:26UT) 1188527554 (dqcShutDown -10sec)
17090515 (15:29:14UT) 1188660553 (from CommandLog)

standby
17110709 (09:53:??UT) 1194083566 (dqcShutDown -10sec)
17110716 (15:48:00UT) 1194104772 (from CommandLog)

automatic reboot
18031223 (00:01:33UT) 1204934192 (getMDCTimeEnd.sh)
18031312 (12:35:19UT) 1204979719 (from CommandLog)

transmission failure
18050310 (10:14:48UT) 1209377623 (from report)
18050412 (12:07:00UT) 1209470839 (from CommandLog)

automatic reboot
18080213 (13:22:35UT) 1217251235 (getMDCTimeEnd.sh)
18080317 (17:45:00UT) 1217353500 (from CommandLog)

automatic reboot
18100101 (01:41UT) 1222393281 (getMDCTimeEnd.sh)
18100113 (13:57UT) 1222437239 (from CommandLog)

MDC S/W update
18110609 (09:38UT) 1225532094 (dqcShutDown -10sec)
18110619 (19:46UT) 1225568642 (dqcFullObs)

automatic reboot
19033115 (15:??UT) 1238081159 (getMDCTimeEnd.sh)
19040114 (14:??UT) 1238163452 (dqcFullObs)

standby ###190604YAs added
19041111 (11:10UT) 1239016162 (dqcShutDown -10sec)
19041211 (11:15UT) 1239103800 (dqcFullObs)

automatic reboot
19052607 (07:14UT) 1242889957 (getMDCTimeEnd.sh)
19052704 (04:15UT) 1242965597 (dqcFullObs)

Observation Status (What's registered)

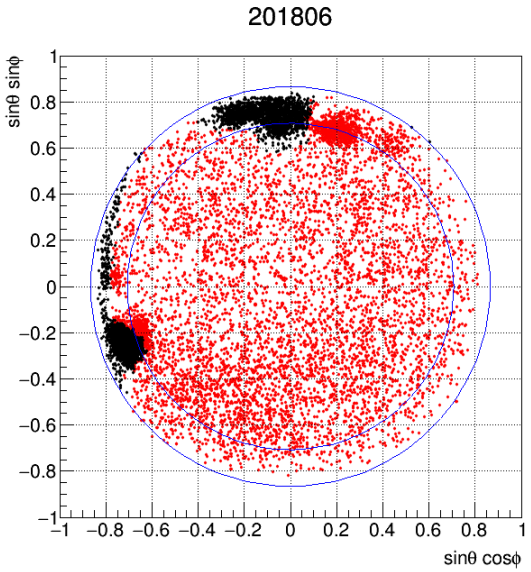
CalibID	Status	MDC Time [from, to]	(yymmddHH [from,to])	Description of Observation Status
32069	0	1128729599 1147649164	(Start--16051823)	Nominal
32070	11	1147649164 1147680250	(16051823--16051908)	Intended MDC reboot & recovery
32069	0	1147680250 1155893246	(16051908--16082209)	Nominal
32071	101	1155893246 1156006319	(16082209--16082316)	MDC auto reboot & recovery
32069	0	1156006319 1188527554	(16082316--17090402)	Nominal
32072	1001	1188527554 1188660553	(17090402--17090515)	zero-fixed bit/64bit & recovery
32069	0	1188660553 1194083566	(17090515--17110709)	Nominal
32073	11	1194083566 1194104772	(17110709--17110715)	standby for safety & recovery
32069	0	1194104772 1204934192	(17110715--18031223)	Nominal
32074	101	1204934192 1204979719	(18031223--18031312)	MDC auto reboot & recovery
32069	0	1204979719 1209377623	(18031312--18050310)	Nominal
32075	10001	1209377623 1209470839	(18050310--18050412)	transmission failure & recovery
32069	0	1209470839 1217251235	(18050412--18080213)	Nominal
32076	101	1217251235 1217353500	(18080213--18080317)	MDC auto reboot & recovery
32069	0	1217353500 1222393281	(18080317--18100101)	Nominal
32077	101	1222393281 1222437239	(18100101--18100113)	MDC auto reboot & recovery
32069	0	1222437239 1225532094	(18100113--18110609)	Nominal
32078	100001	1225532094 1225568642	(18110609--18110619)	MDC S/W update & recovery
32069	0	1225568642 1238081159	(18110619--19033115)	Nominal
32079	101	1238081159 1238163452	(19033115--19040114)	MDC auto reboot & recovery
32069	0	1238163452 1239016162	(19040114--19041111)	Nominal
33087	11	1239016162 1239103800	(19041111--19041211)	standby for safety & recovery
32069	0	1239103800 1242889957	(19041211--19052607)	Nominal
32080	101	1242889957 1242965597	(19052607--19052704)	MDC auto reboot & recovery
32069	0	1242965597 2147483647	(19052704--End)	Nominal

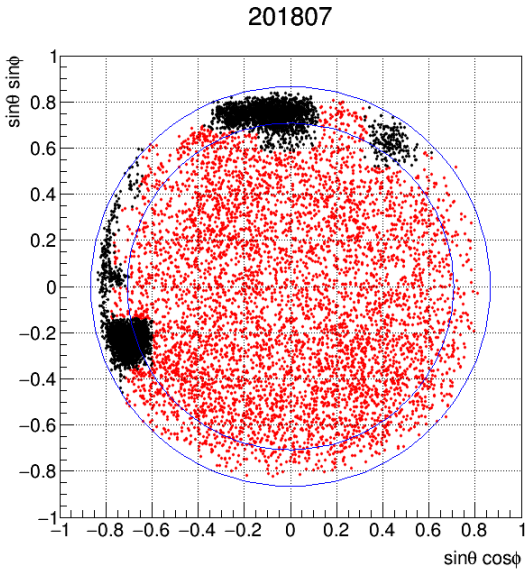
FOV Cut Map Updates

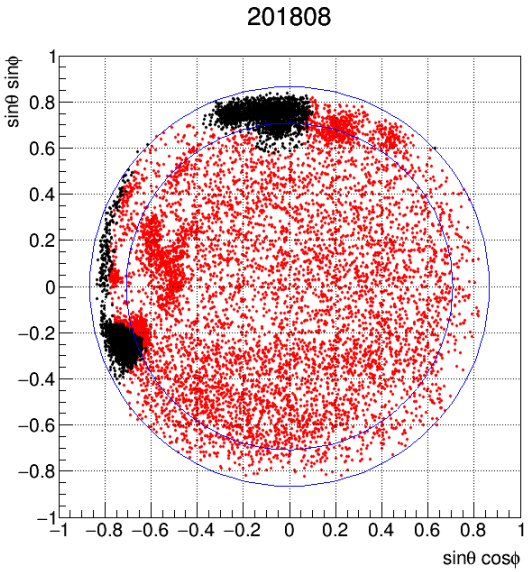
1. Monthly FOV cut map was updated.
2. Daily FOV cut map was defined.
3. Default FOV cut map was defined and updated.

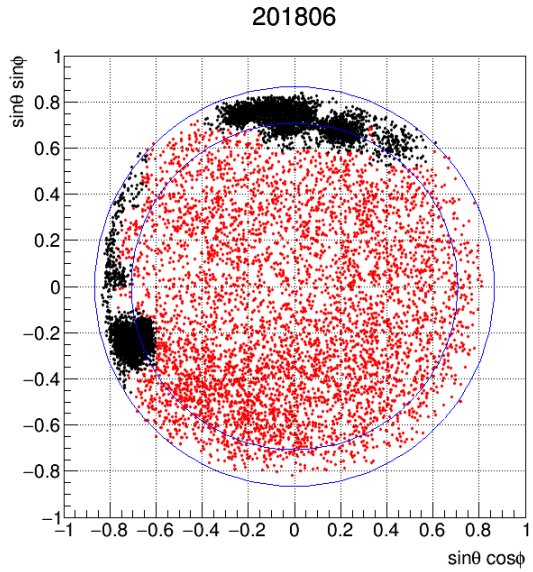
4. This part is still extensively updated by Nick. We might hear more updated information from him.

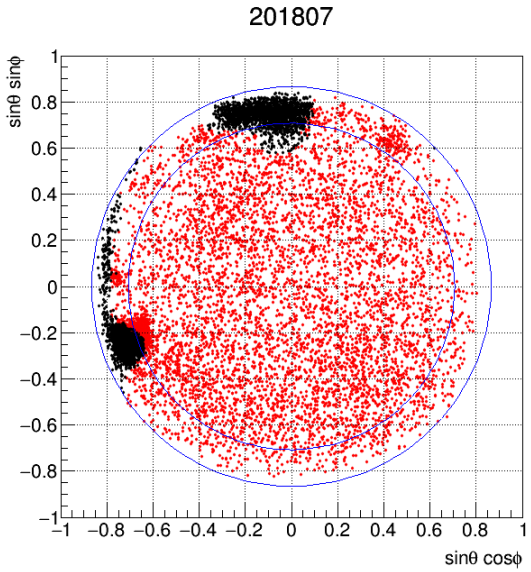
Monthly FOV cut defined from 1806 to 1904
1806, 1807, 1808

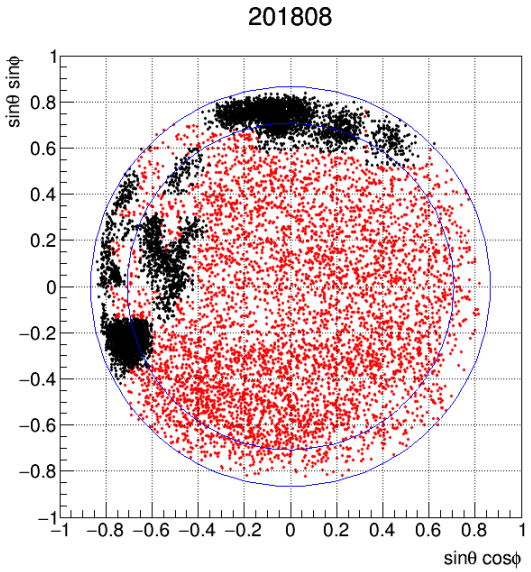




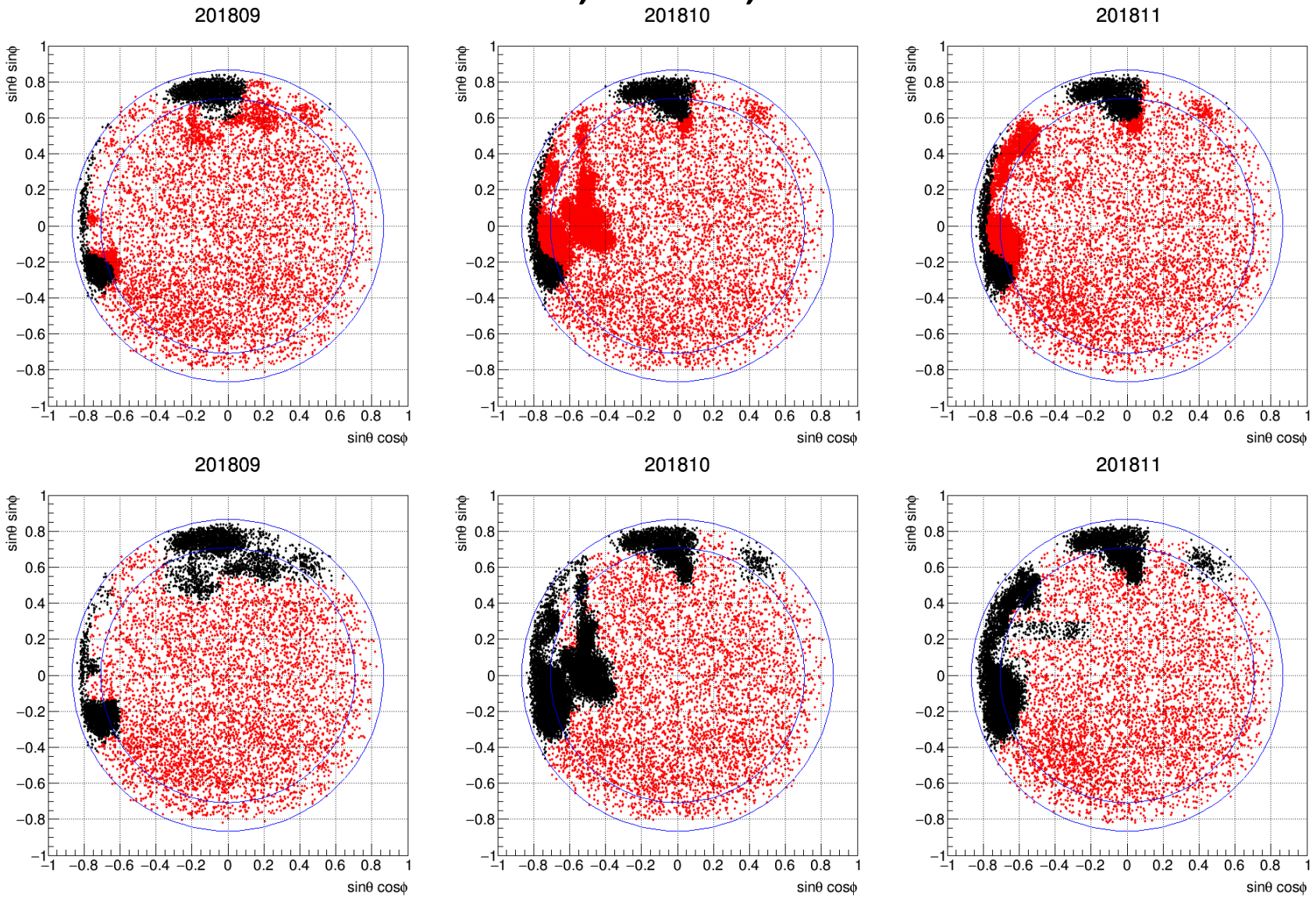






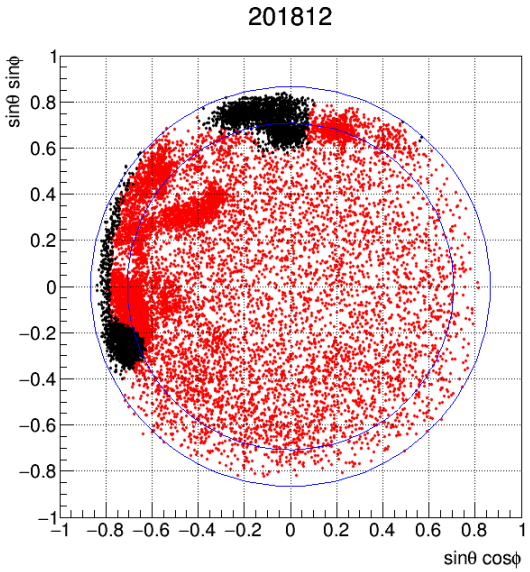


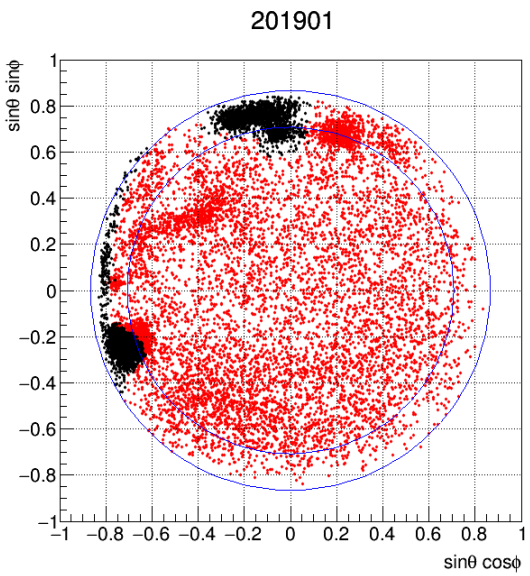
Monthly FOV cut defined from 1806 to 1904
1809, 1810, 1811

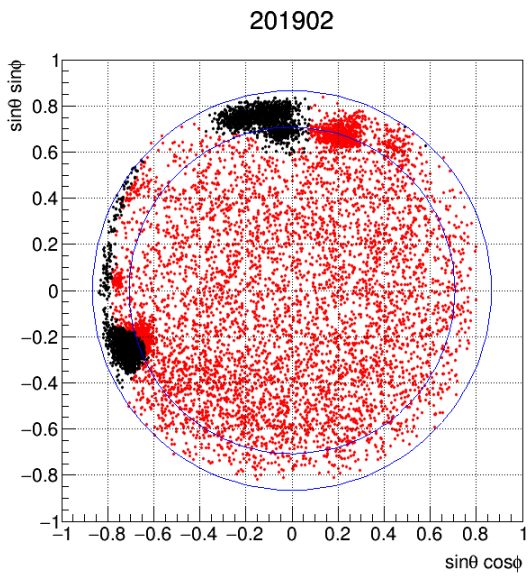


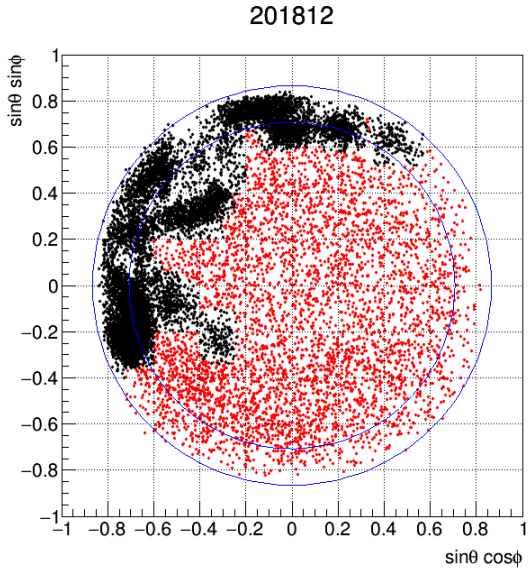
Monthly FOV cut defined from 1806 to 1904

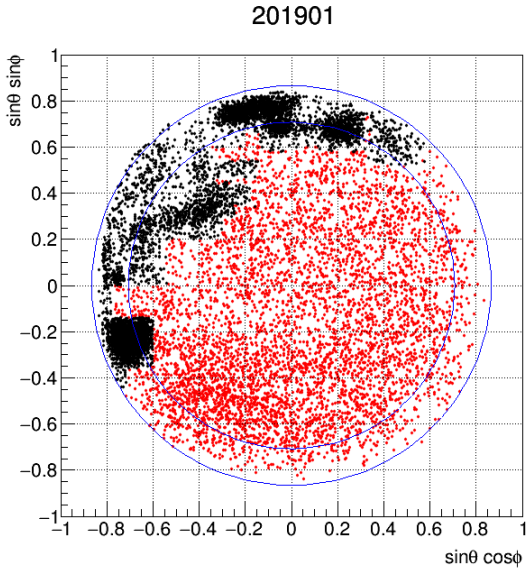
1812,1901,1902

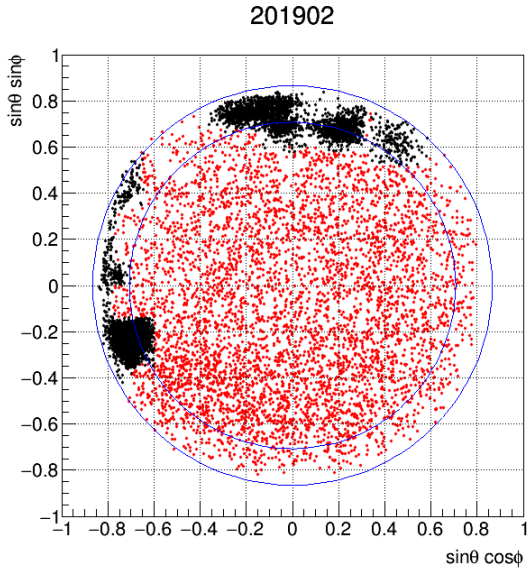




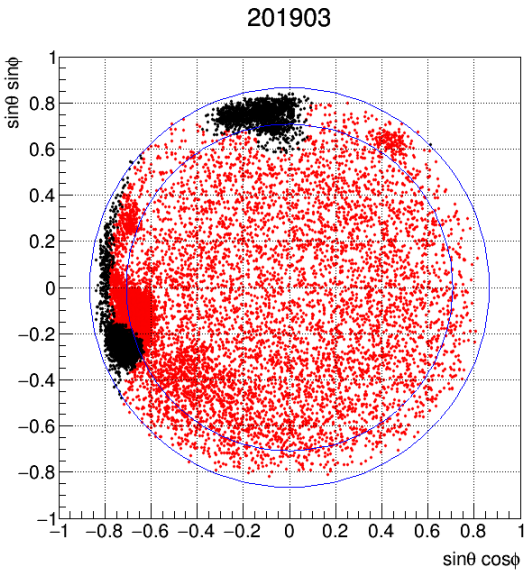


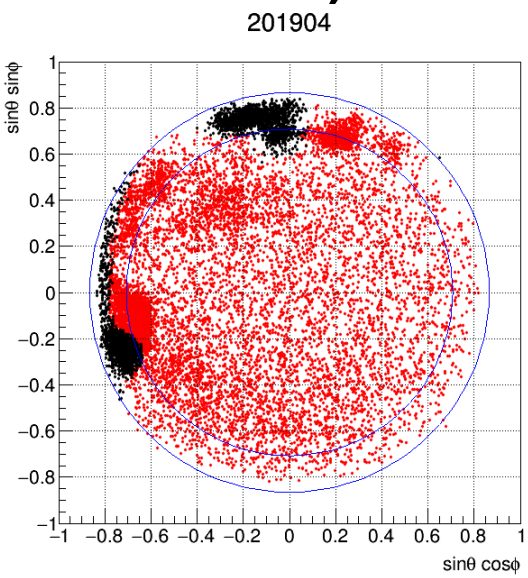


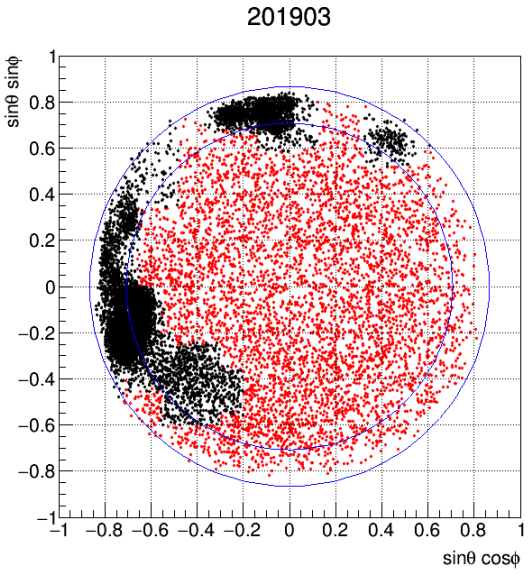


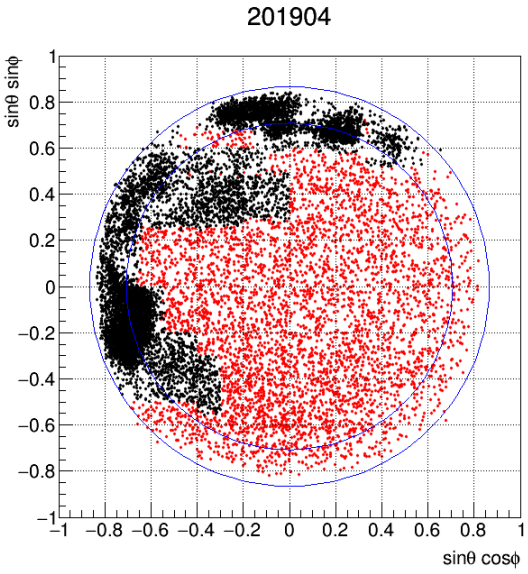


Monthly FOV cut defined from 1806 to 1904
1903,1904





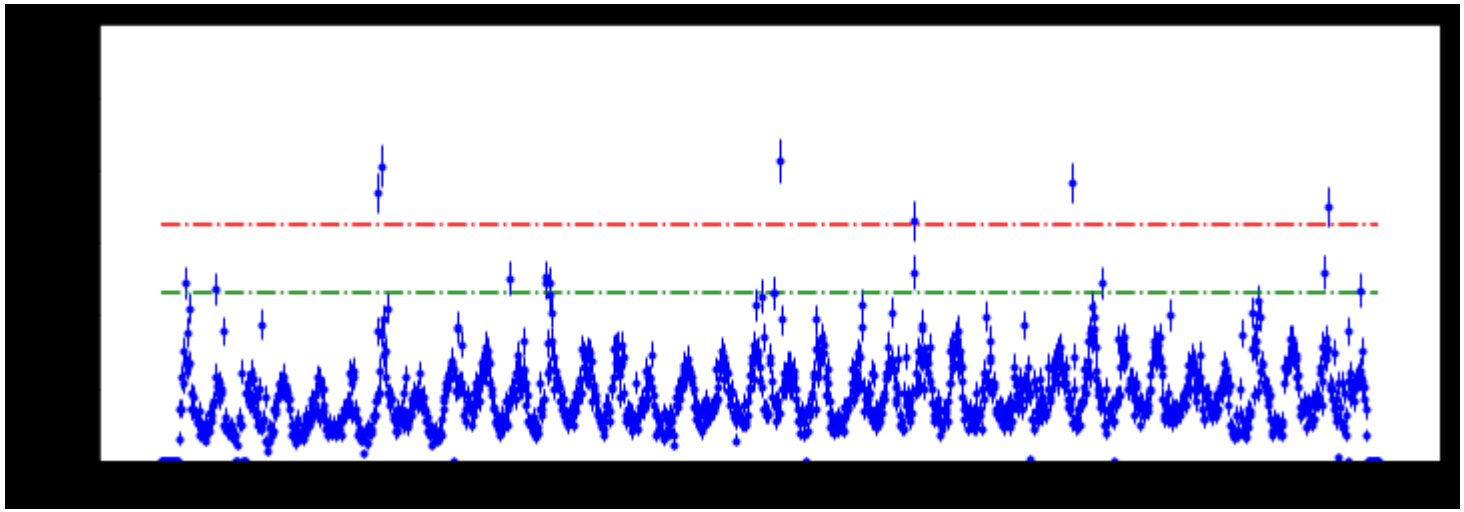




Updated exposure file and GAM event files are uploaded in:
/mnt/CALET_PUB/CoWorking/wasedacoc/SPC/rootExpo and
/mnt/CALET_PUB/CoWorking/wasedacoc/DST/GAM.daily

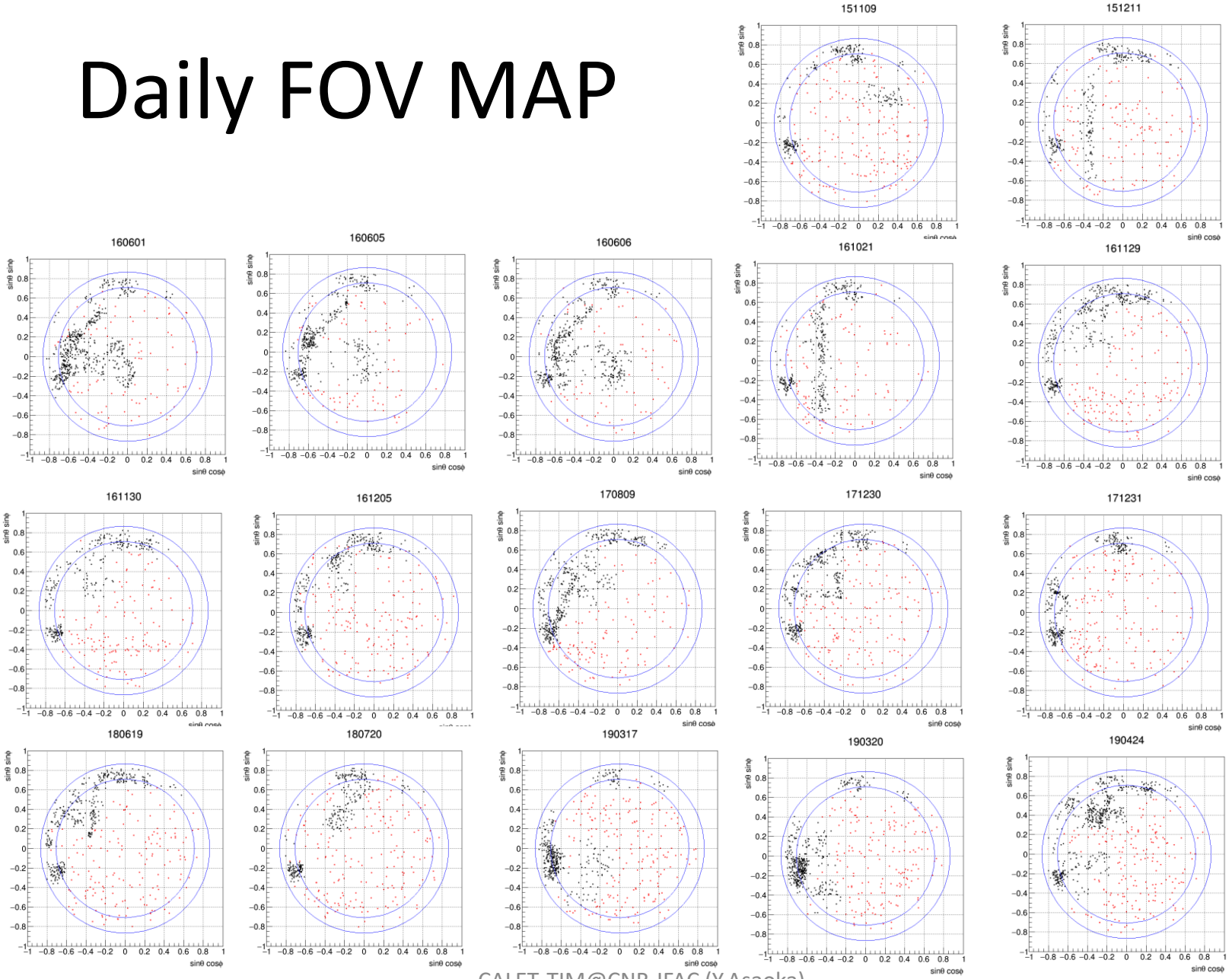
FOV Cut Map Updates

- Daily FOV MAP
  - Daily FOV cuts are defined for each day when the number of gamma-rays are significantly more than normally expected by Nick (+3,5σ).

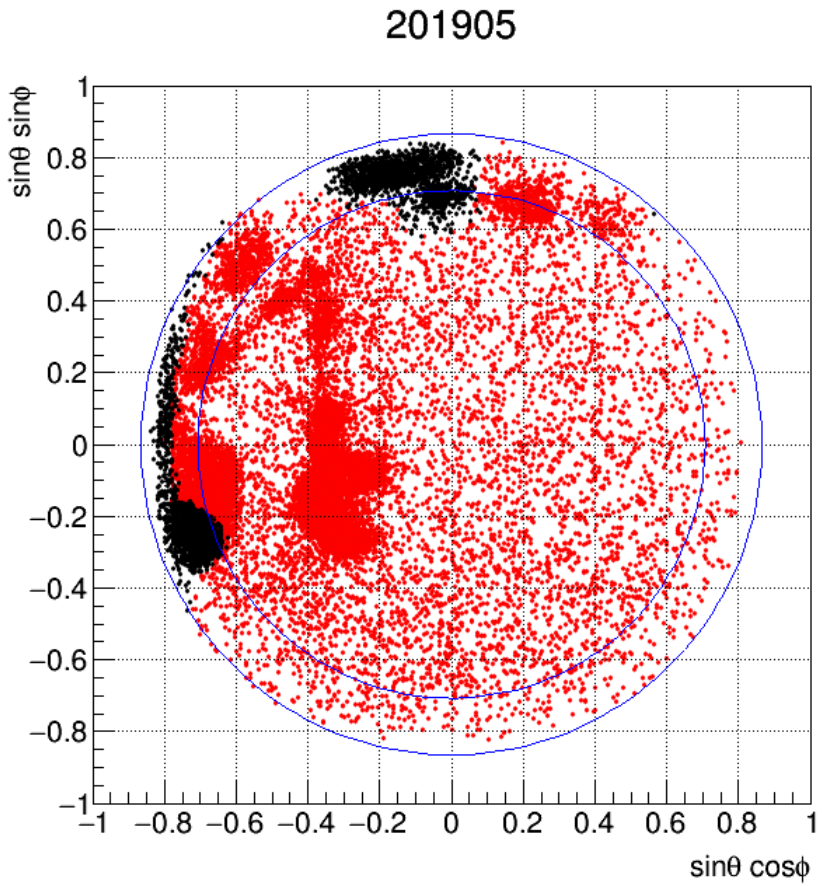


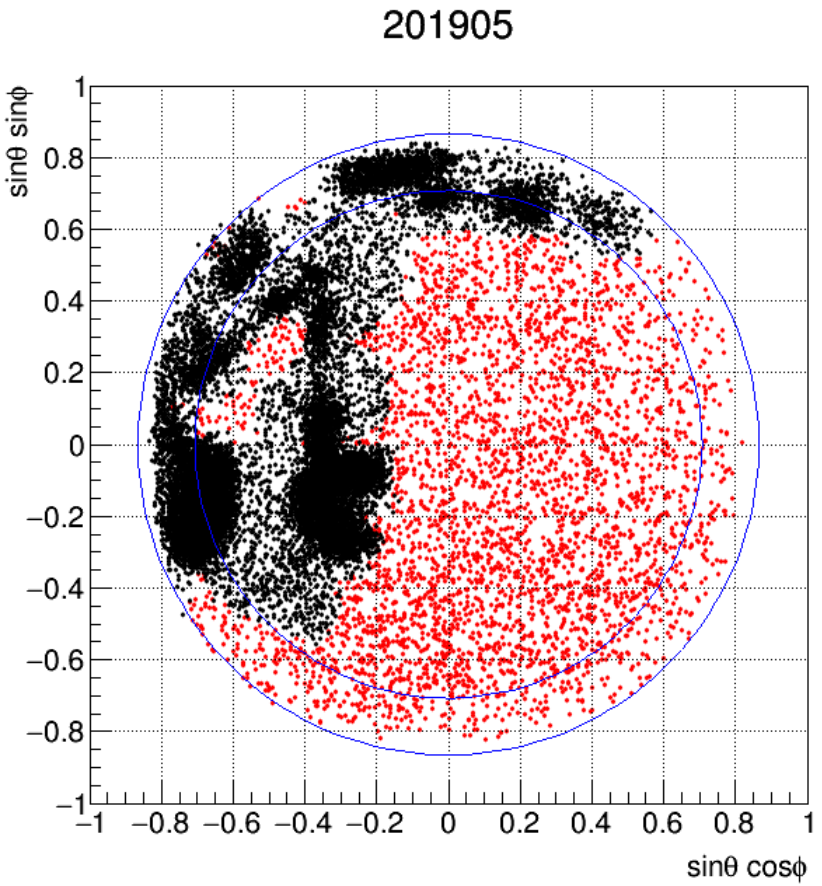
- Monthly MAP
  - Added 201905 monthly map

Daily FOV MAP

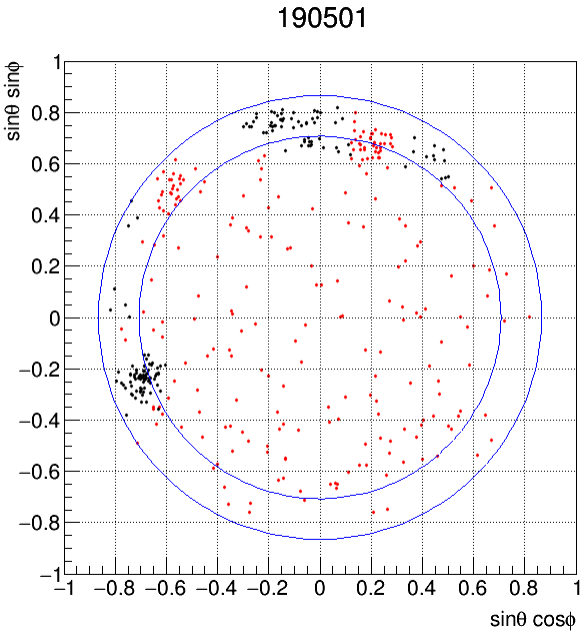


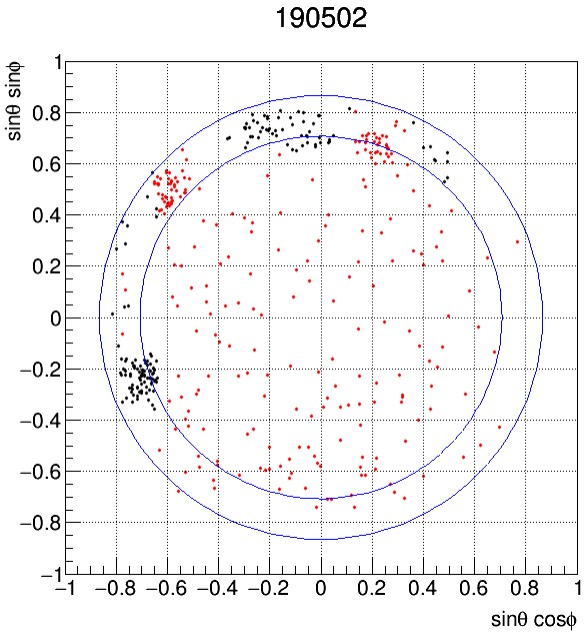
Monthly FOV cut for 201905

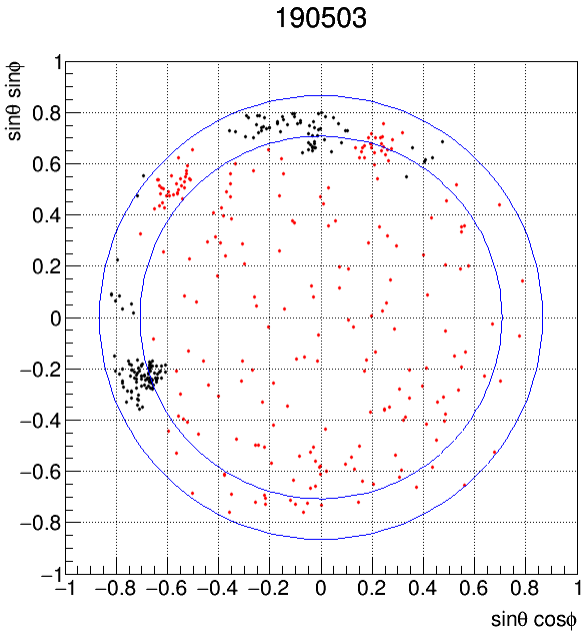


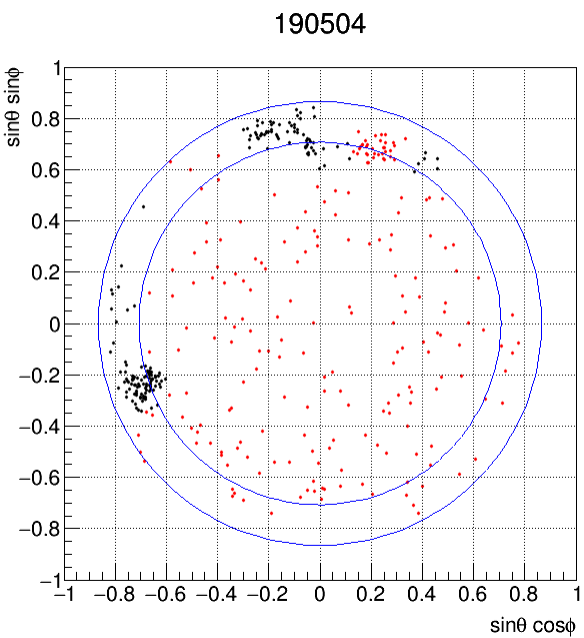


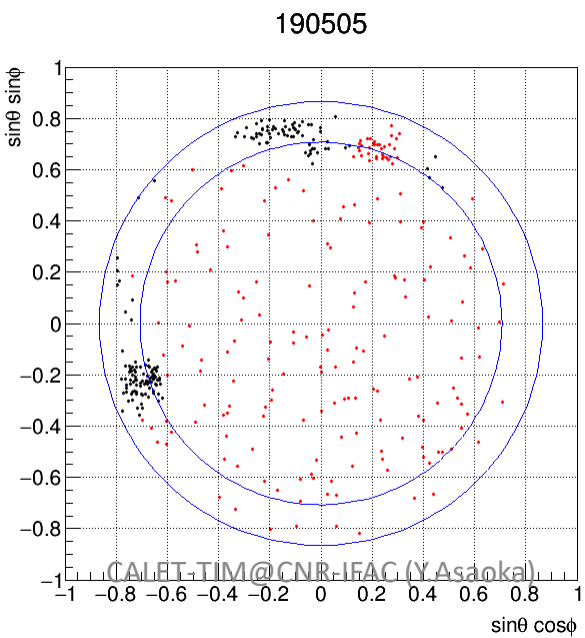
Daily Gamma-Ray Map in CALET FOV (1)

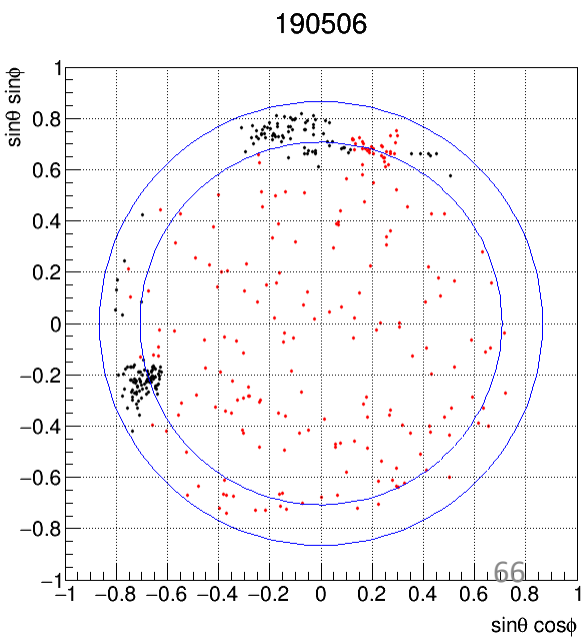




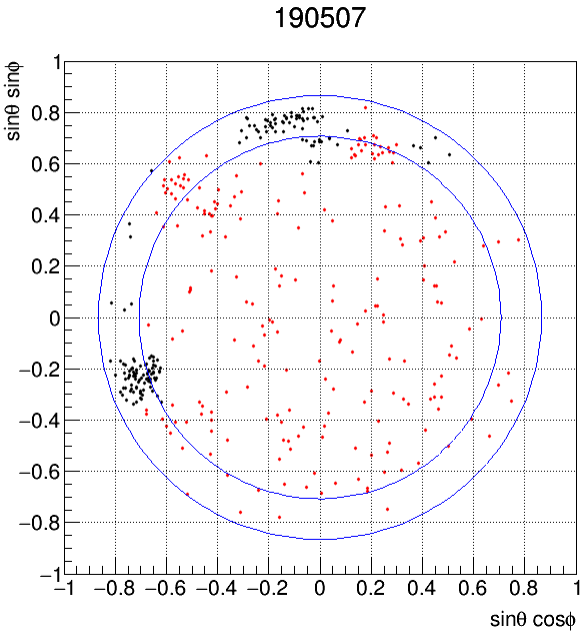


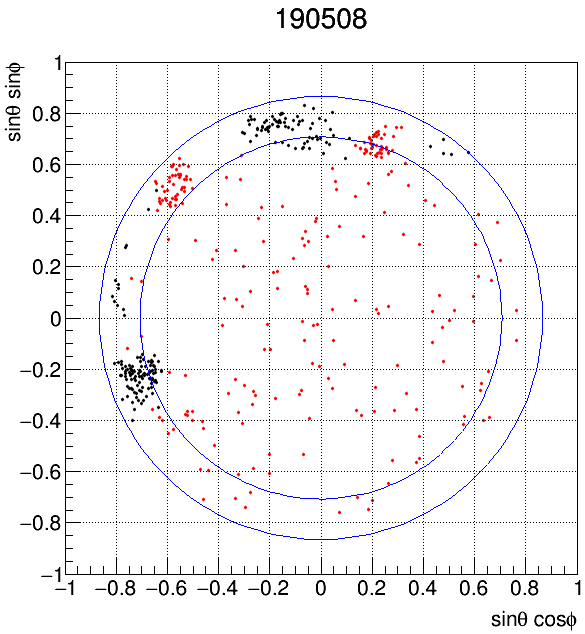


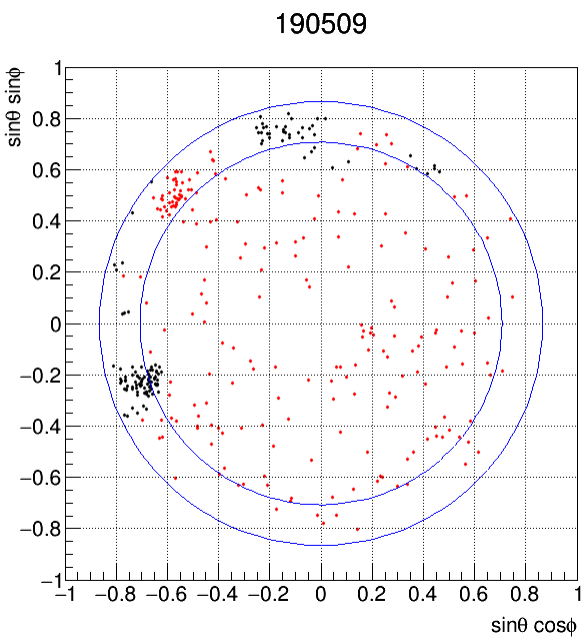


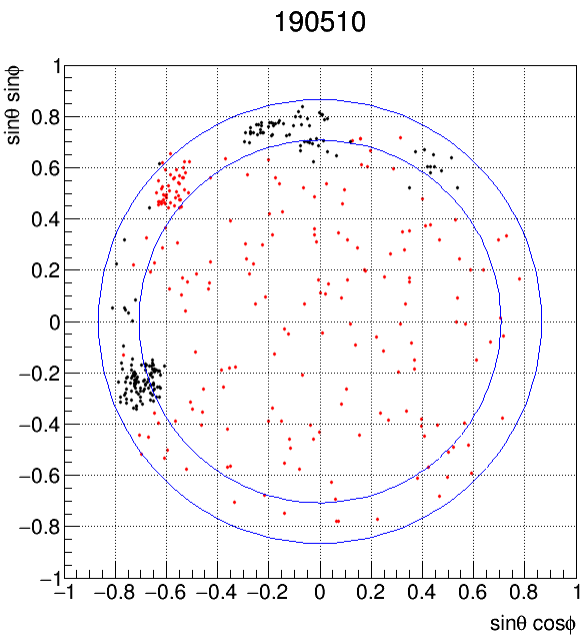


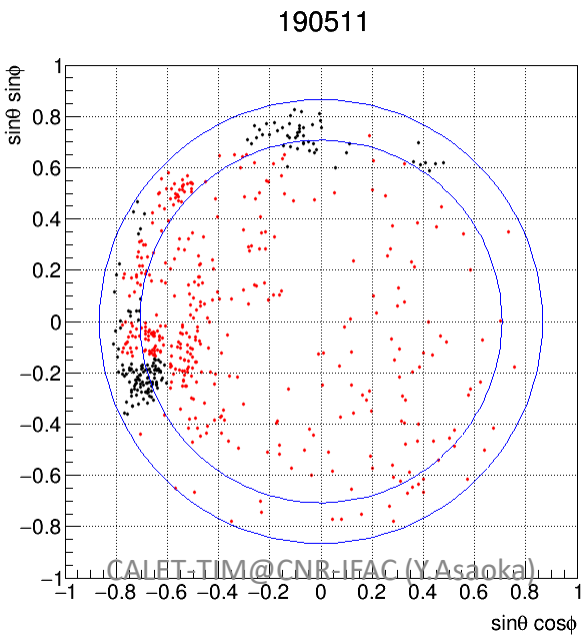
Daily Gamma-Ray Map in CALET FOV (2)

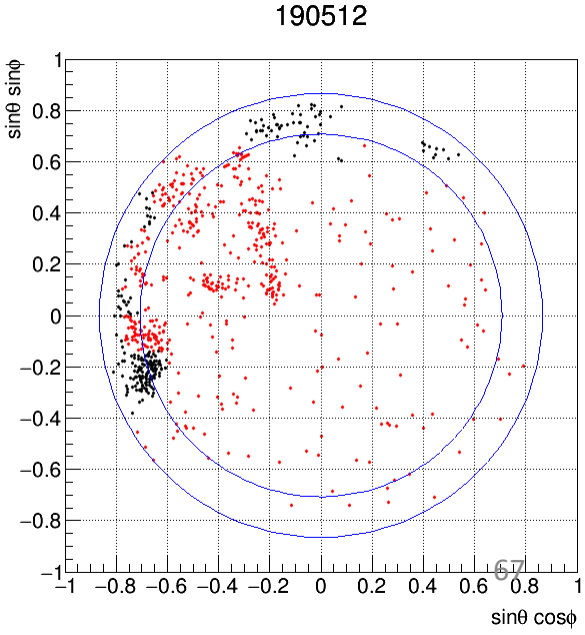






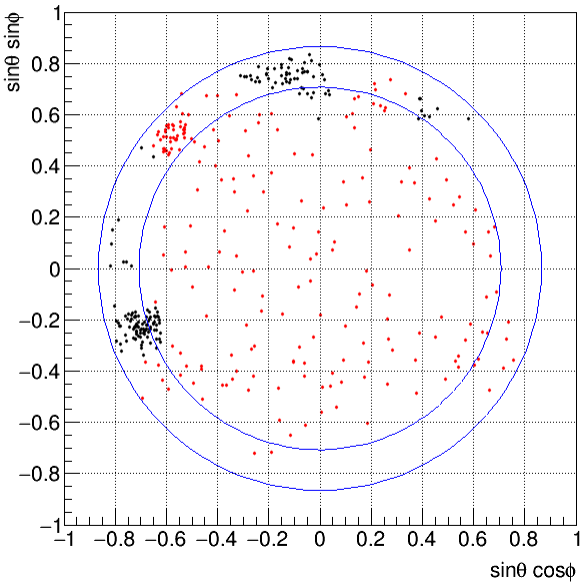




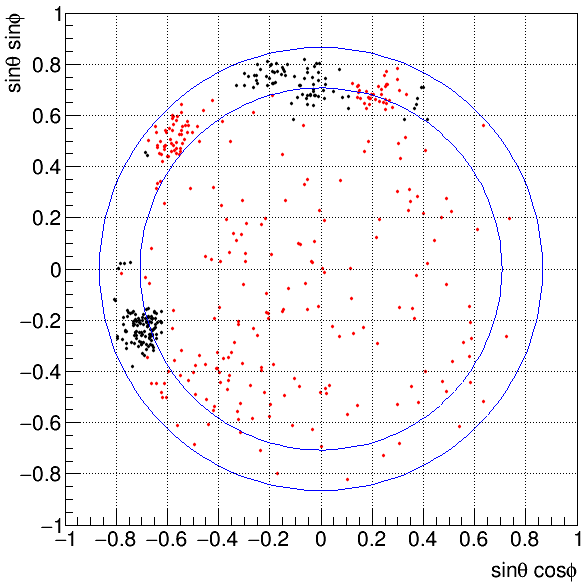


Daily Gamma-Ray Map in CALET FOV (3)

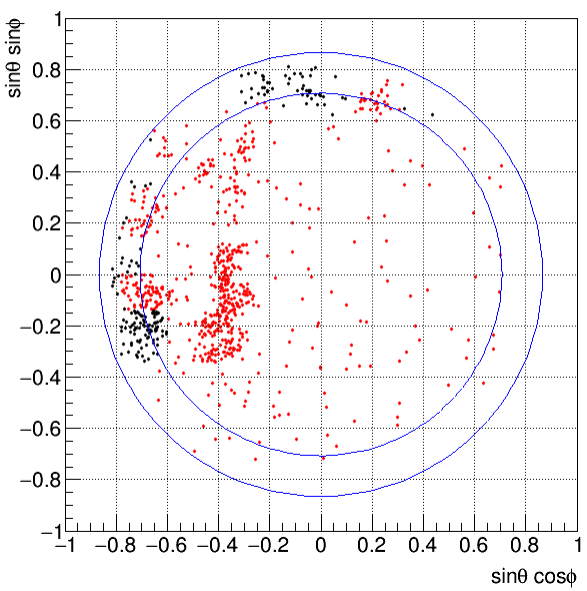
190513



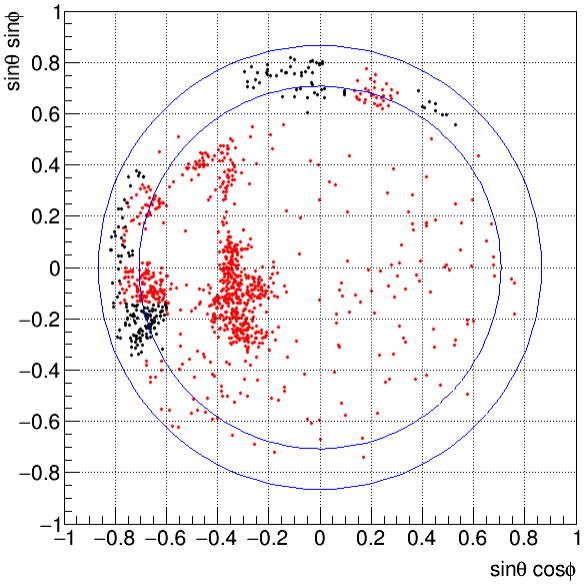
190514



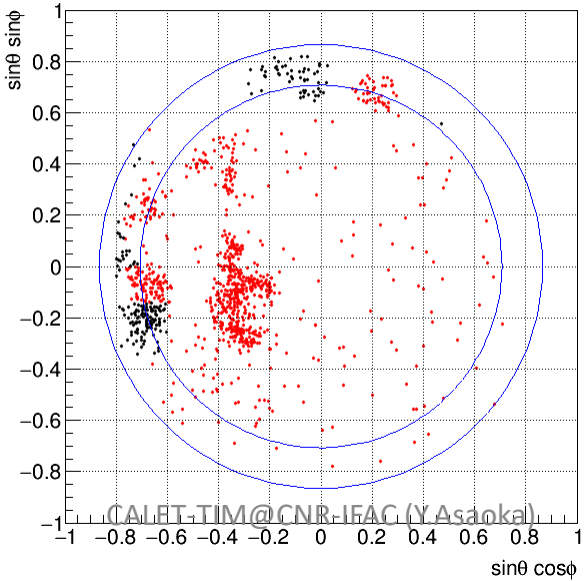
190515



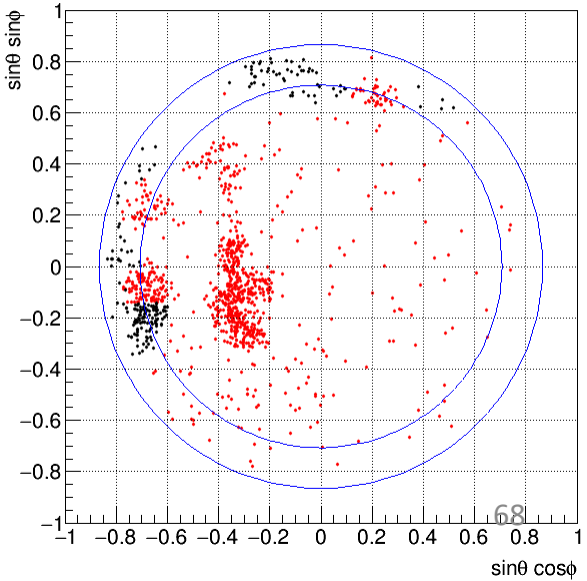
190516



190517

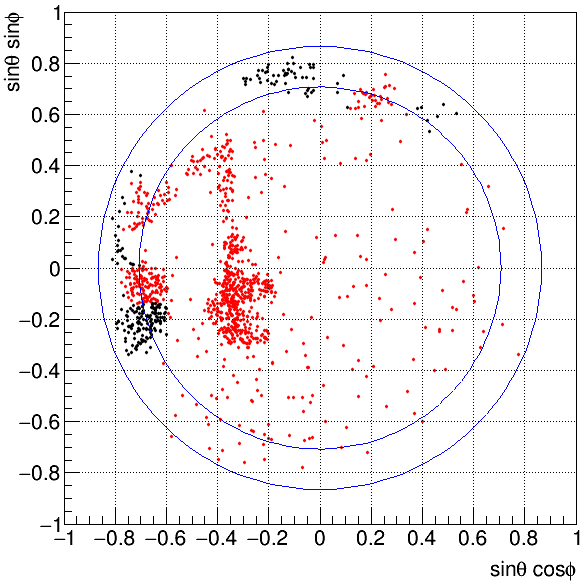


190518

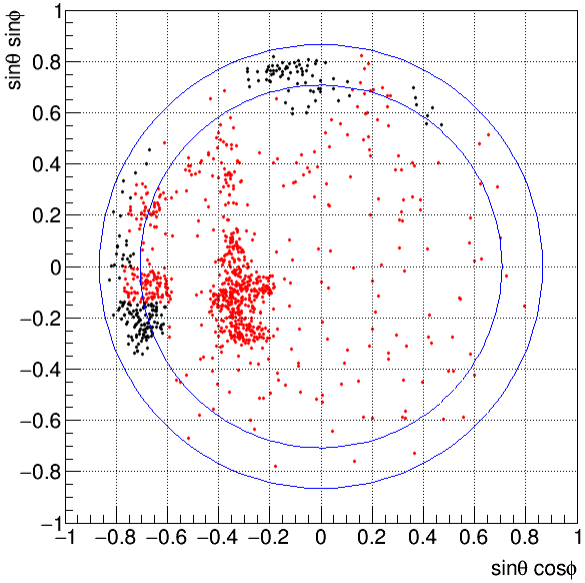


Daily Gamma-Ray Map in CALET FOV (4)

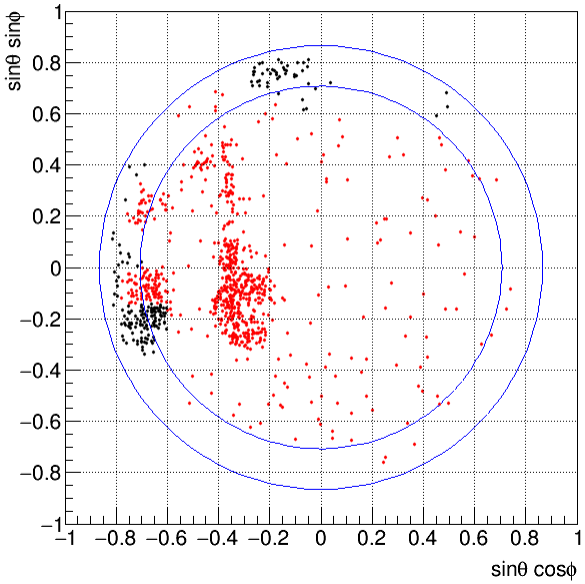
190519



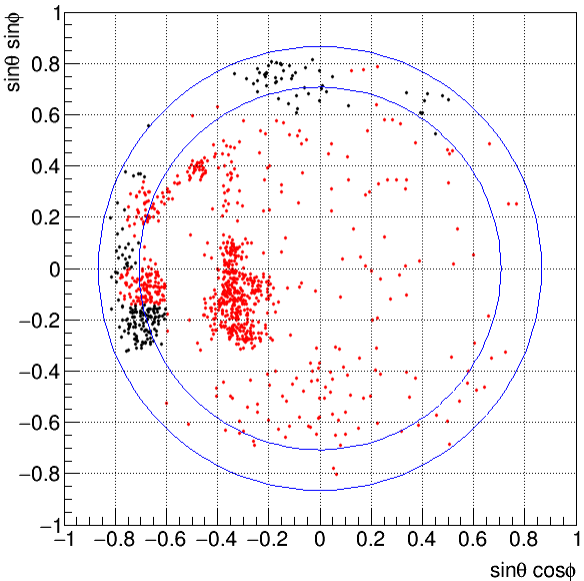
190520



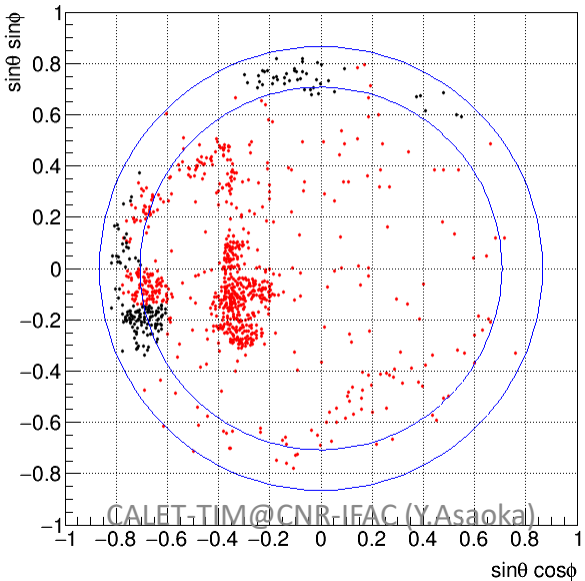
190521



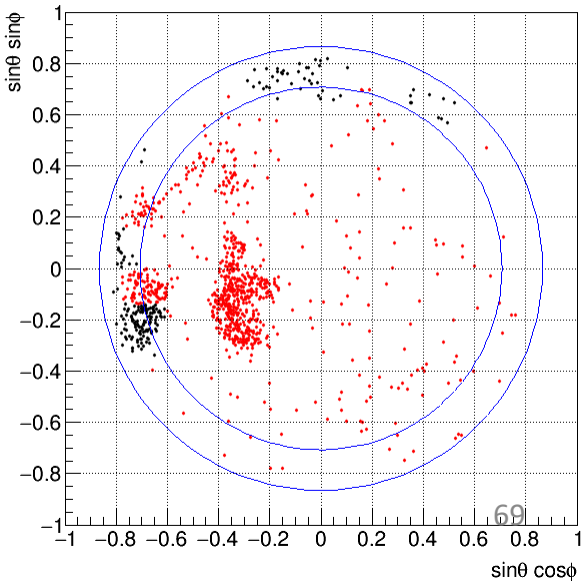
190522



190523

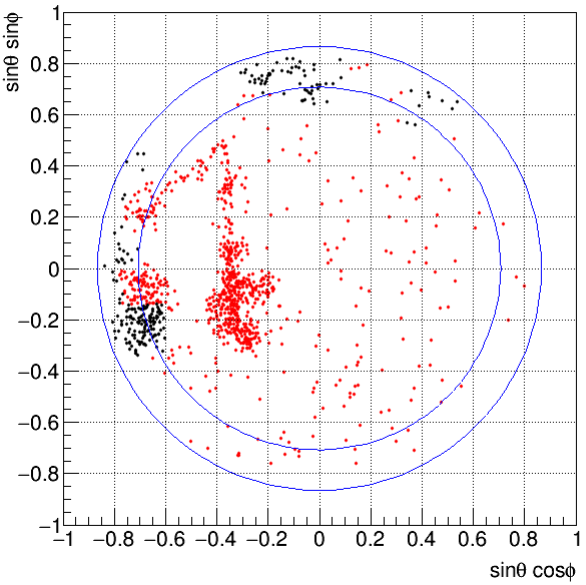


190524

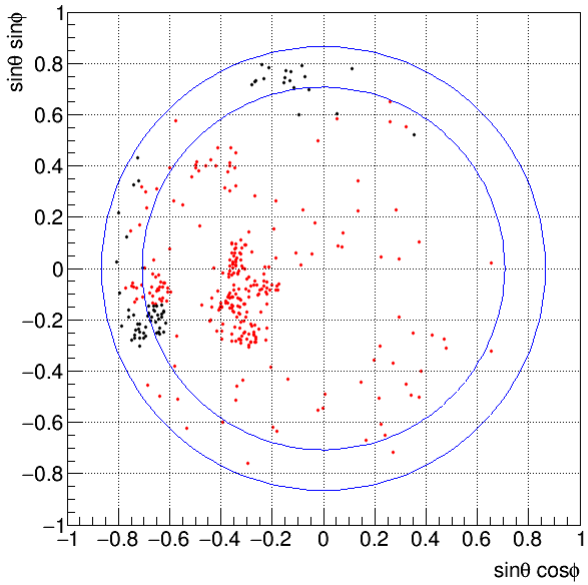


Daily Gamma-Ray Map in CALET FOV (5)

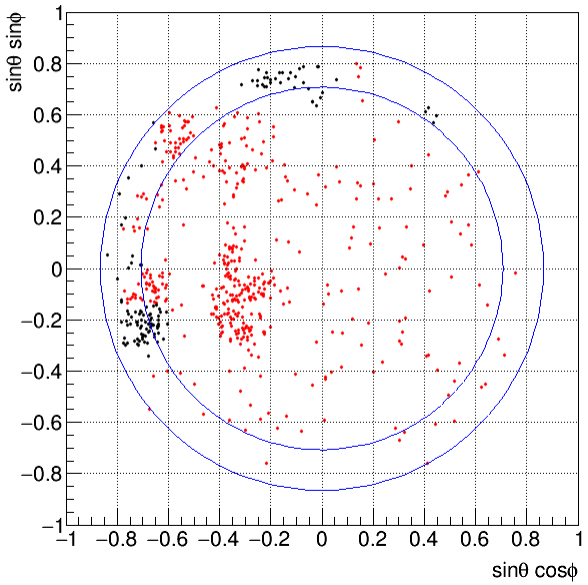
190525



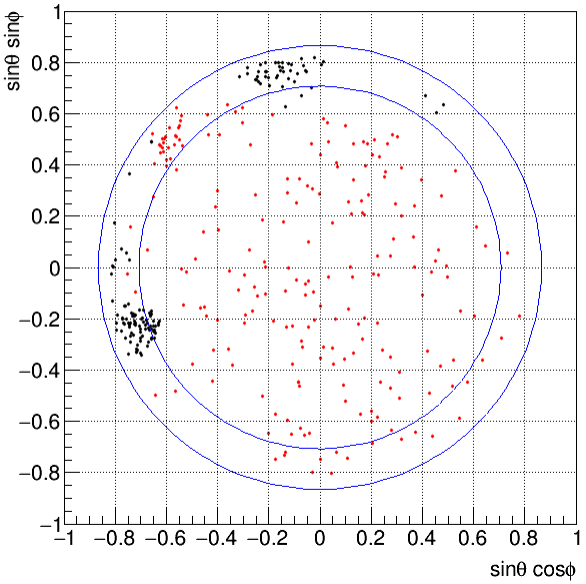
190526



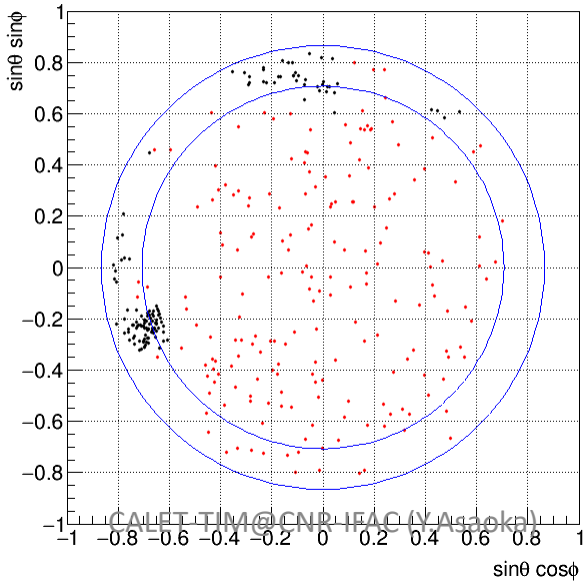
190527



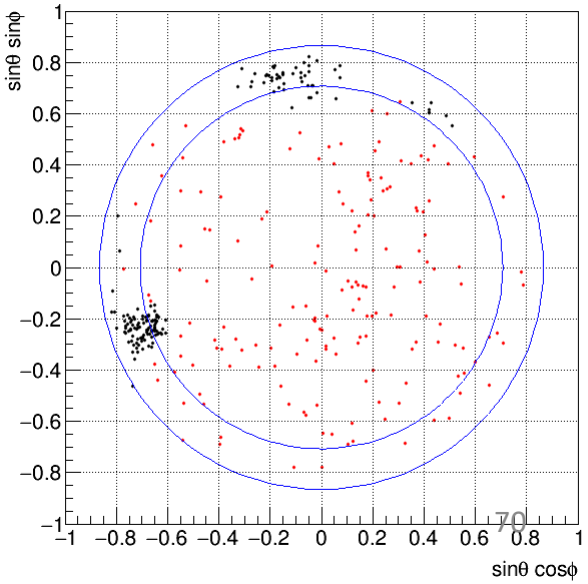
190528



190529

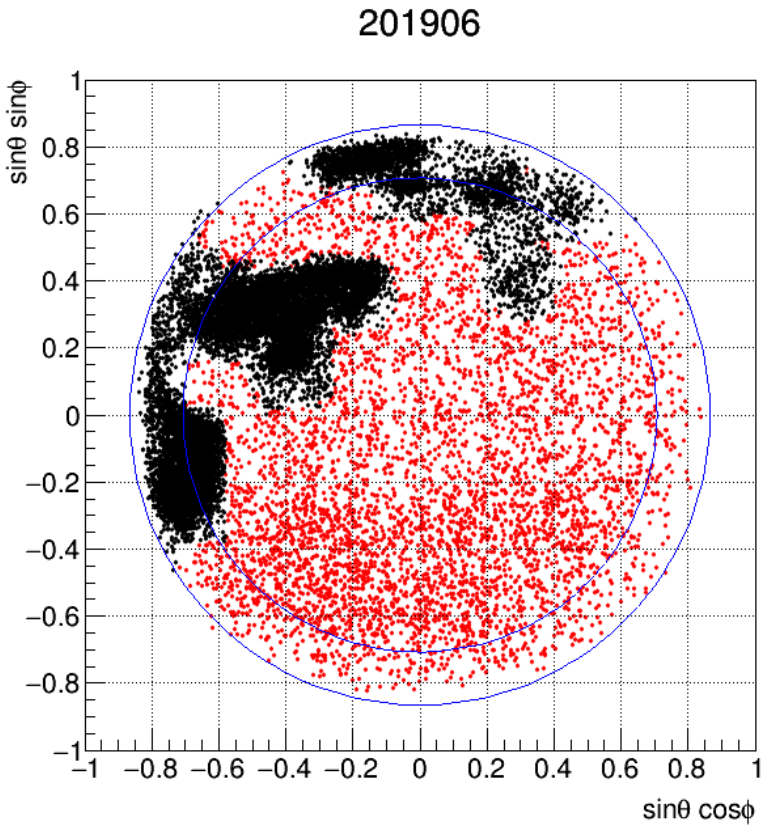


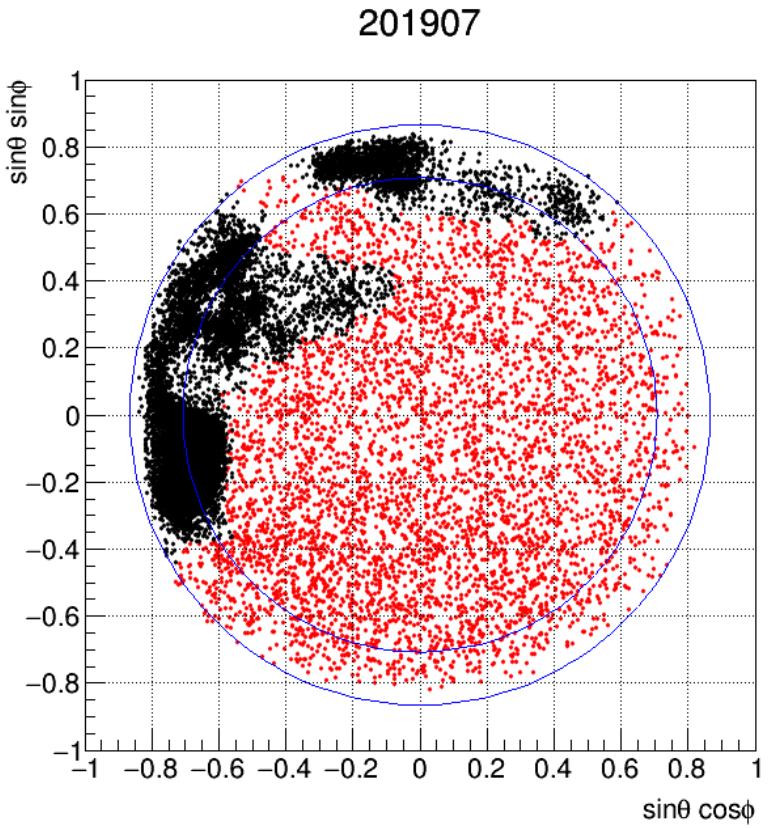
190530



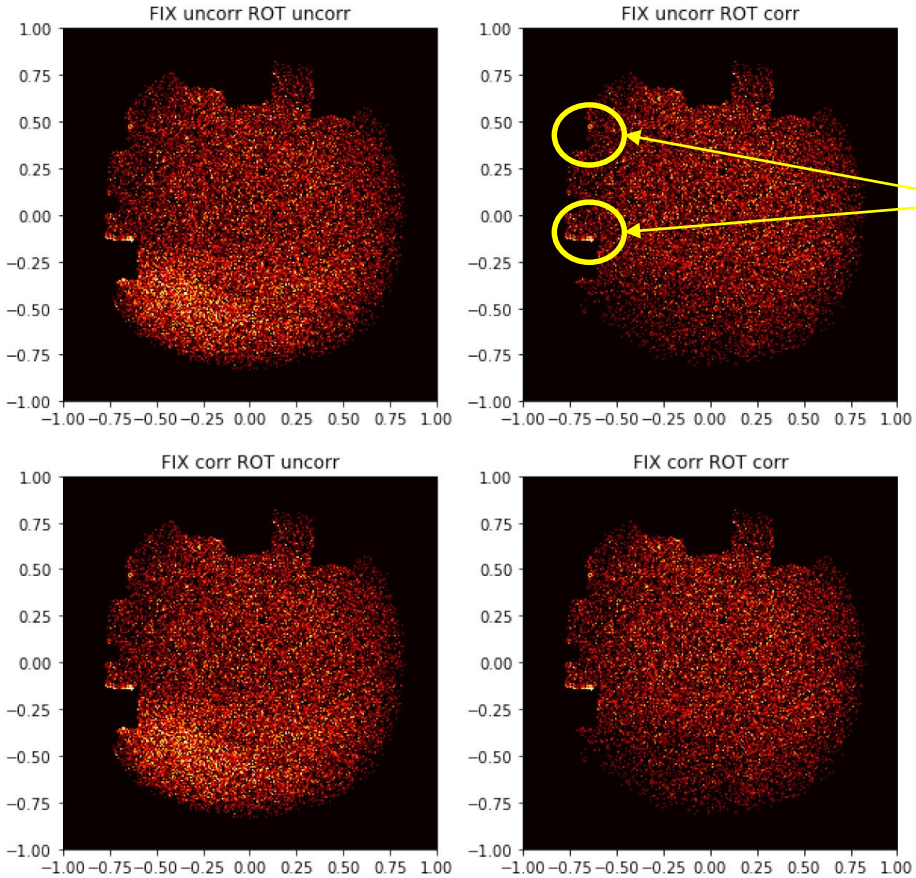
Further updates:

- In addition, monthly FOV cuts for 1906,1907 are defined.
- Recently, robot arm activity is much more frequent. As a result, more FOV





Nick's report (190914) about insufficient default FOV cut:



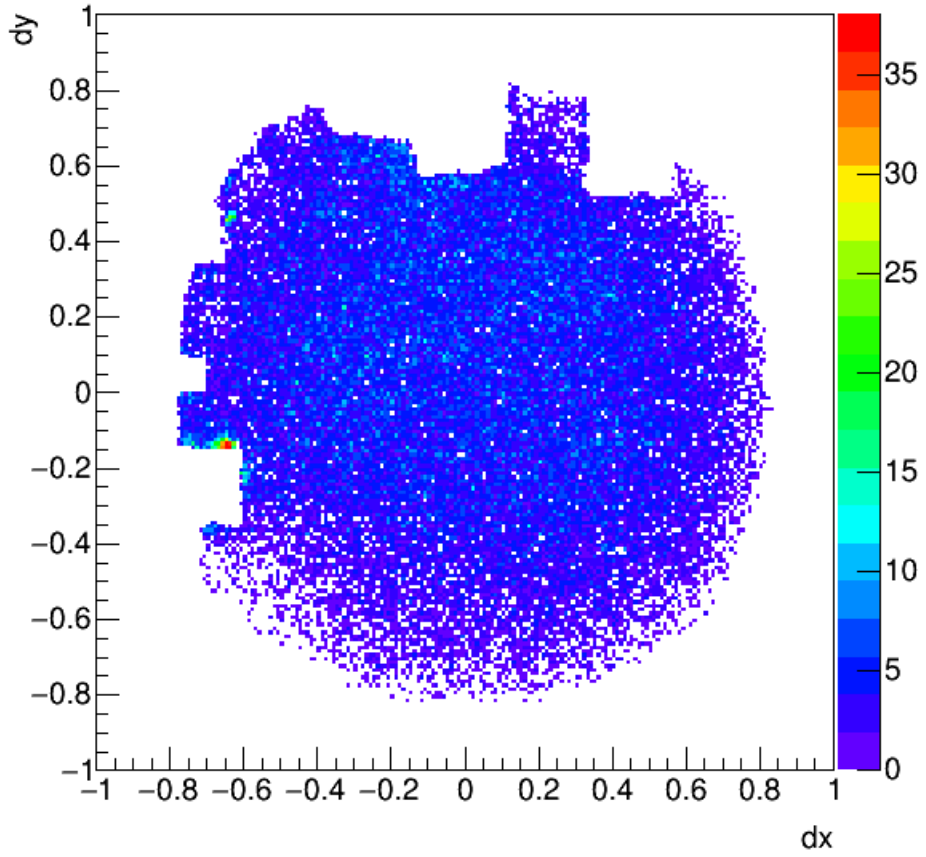
Independent of several conditions, there are two gamma-ray hot spots near the default FOV cut region.

=> This indicates that the default FOV cut is not sufficient.

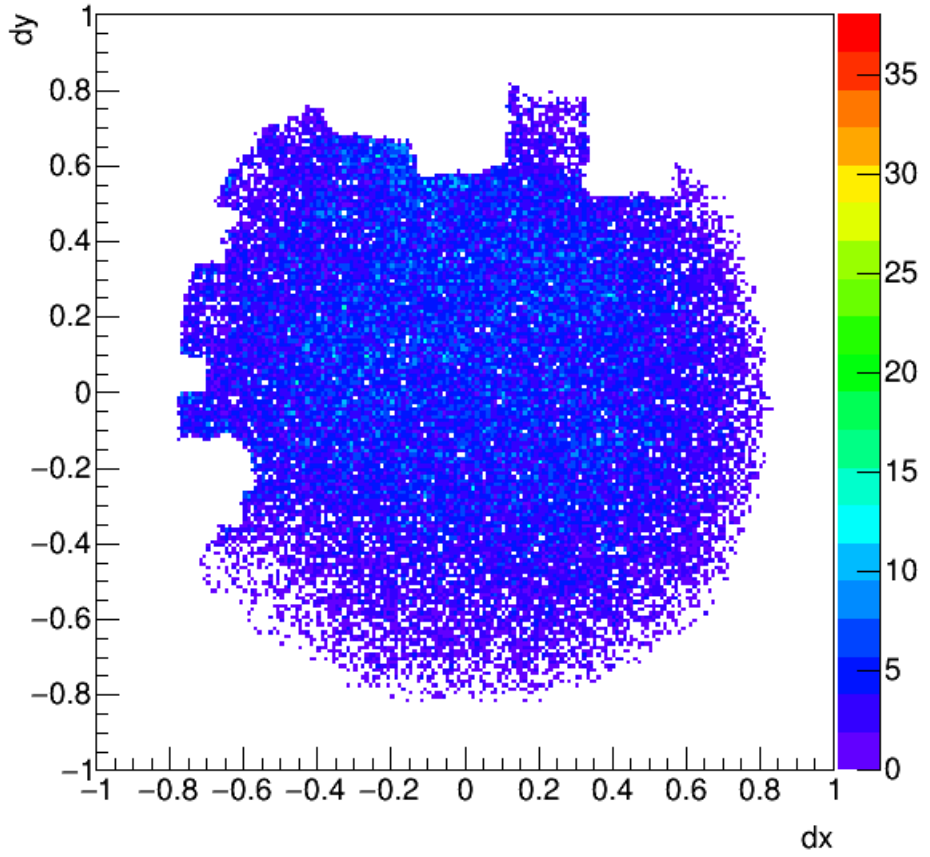
Default FOV Cut Update

- Based on Nick's report, I have refined the default FOV cut as follows:
- I will register those FOV cut into database.

CALET FOV cut (previous version)



CALET FOV cut (updated version)



L2:PASS-04 –JC Charge Implemented—

```
6. PID class for JC Charge (only for Z=1,2)
        - Calculation of TL2CALPID_ChargeJC instance is updated in ProcL2.
        - You can retrieve the correct (updated) JC charge
          by selecting Algorithm == 2 (NOTE: Algorithm == 1 is not good).
          ### THE ALGORITHM WAS RIVSED SINCE PASS03.1

    => WCOC-2019-005NC-191126JCChargeCheck.pdf @ DH&A document page
```

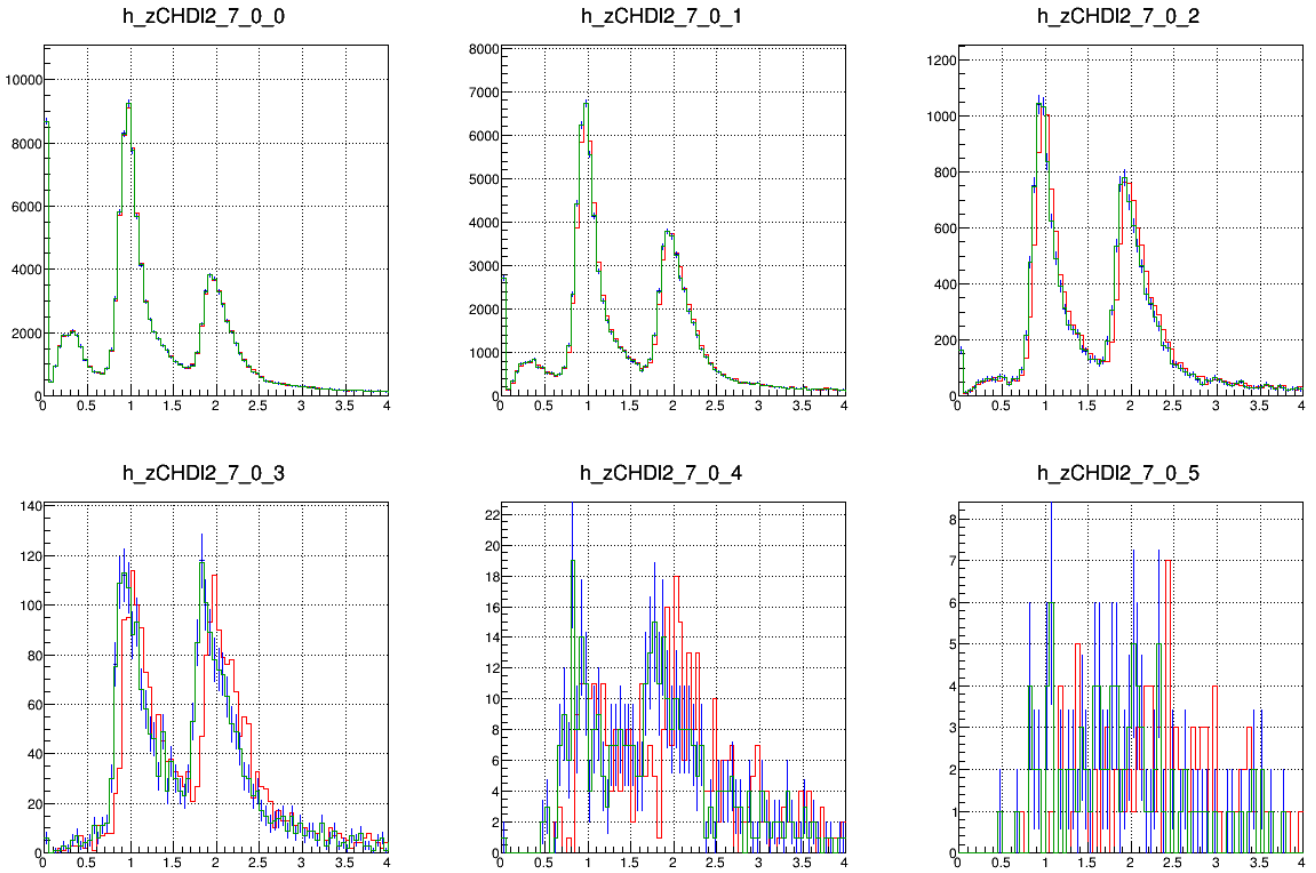
JC Charge Checks for L2:PASS-04

The how and why of 'JC Charge Check'

1. Previous version (Algorithm No. = 1) did not match JC charge calculated in DST.
2. I have investigated it, but it was not easy (it was implemented by Takahashi-san). So I reimplemented it.
3. Now Algorithm = 2 gives another JC charge and I confirmed that this matches exactly with the DST calculated charge in flight data (as of 190705).
4. Same checks are done for EPICS protons and helium, and confirmed that algorithm = 2 coincides with DST charge (updated on 190712).

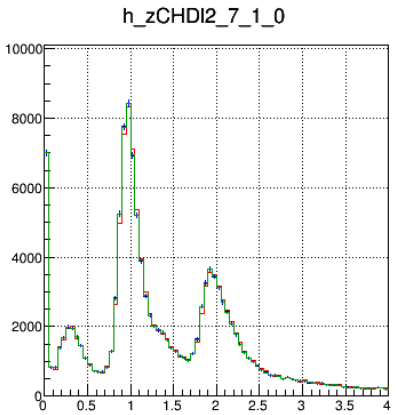
FD
Z (CHD-X)

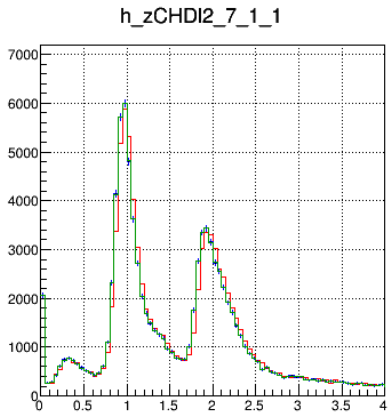
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

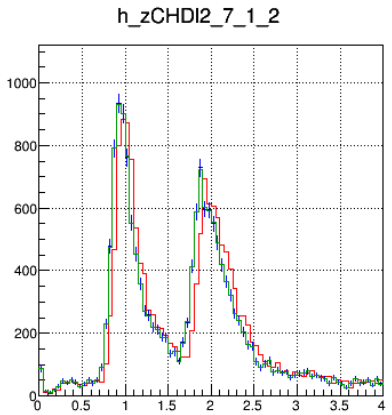


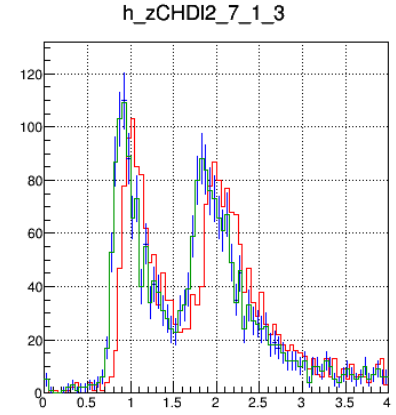
FD
Z (CHD-Y)

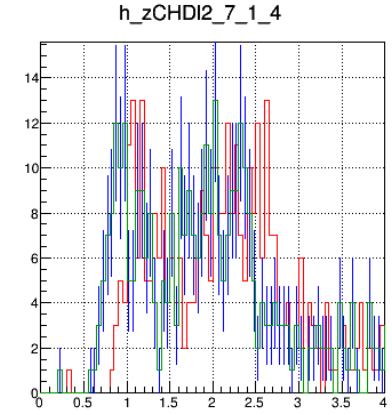
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

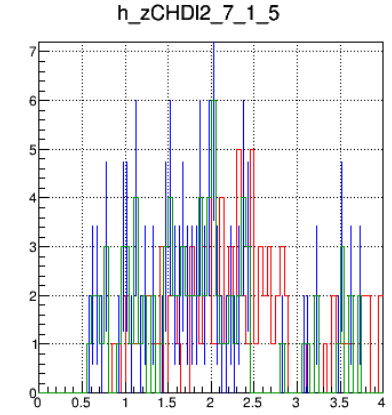






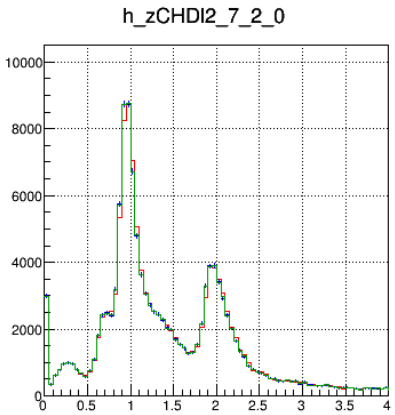


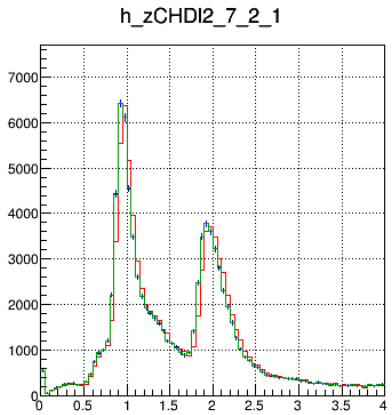


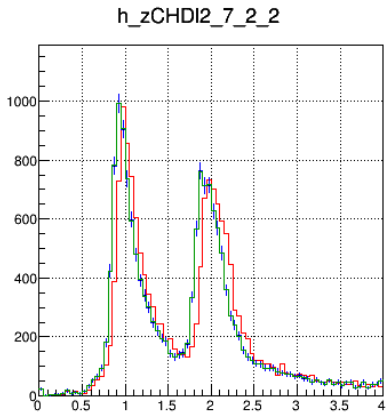


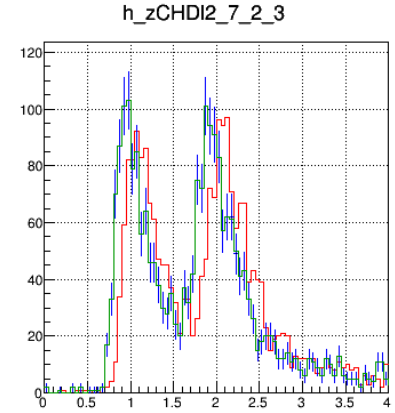
FD
Z (CHD)

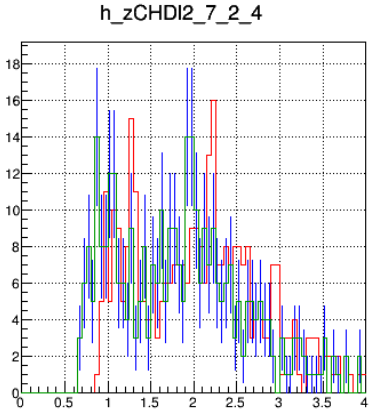
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

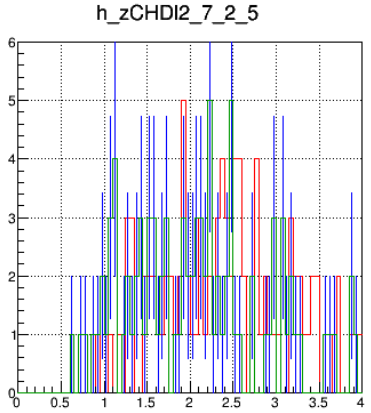






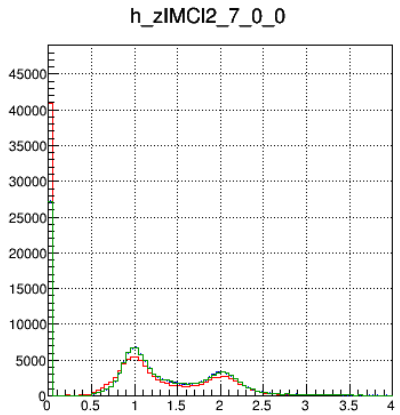


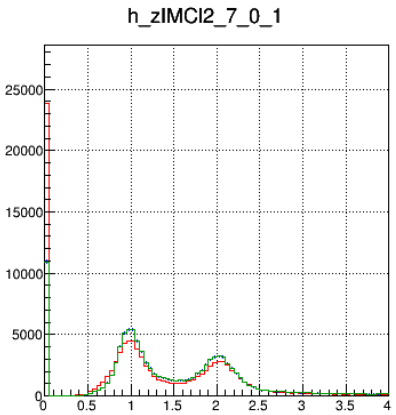


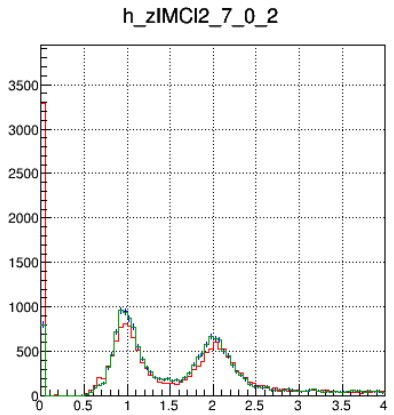


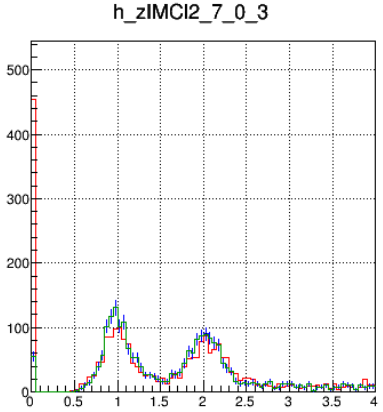
FD
Z (IMC-X)

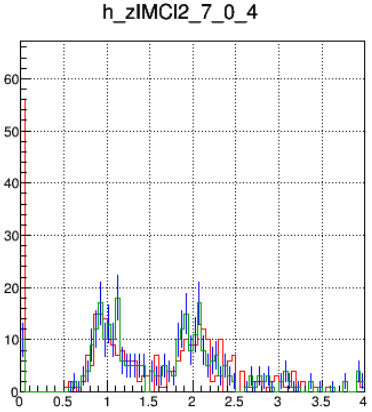
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

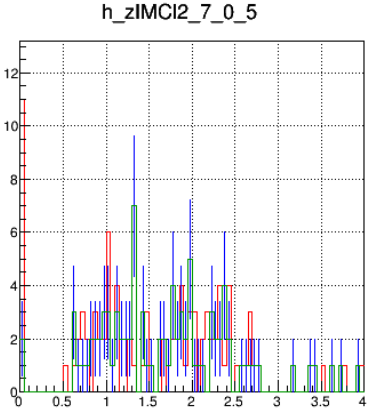






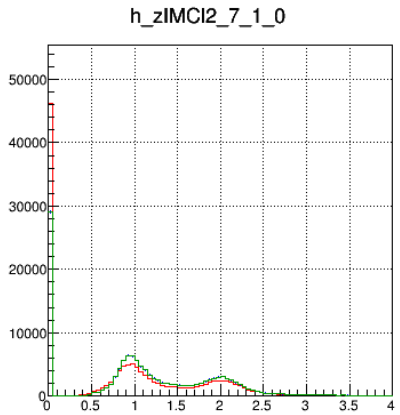


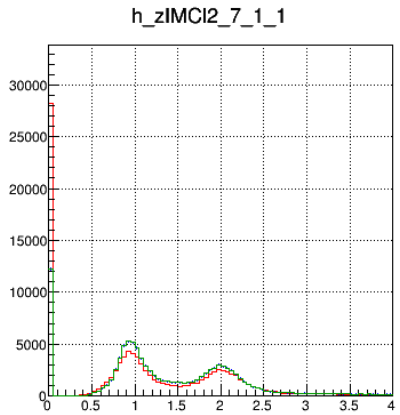


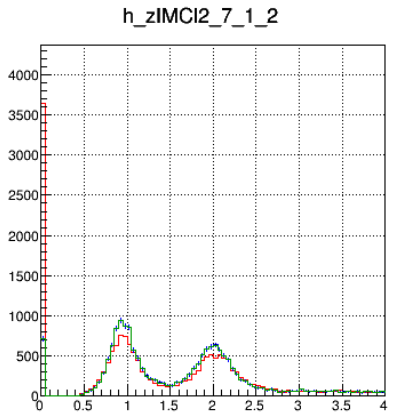


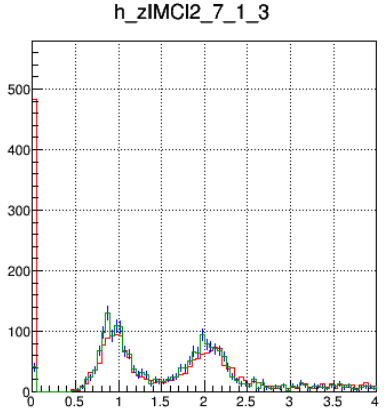
FD
Z (IMC-Y)

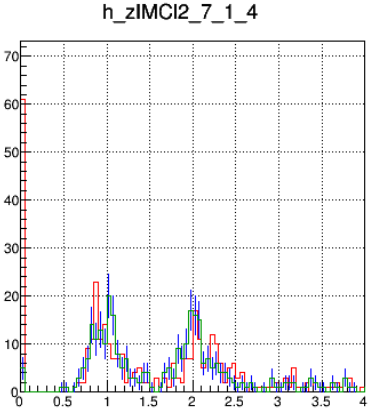
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

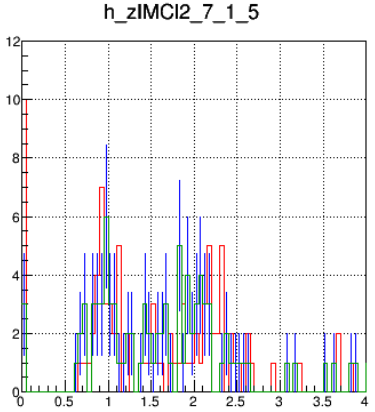






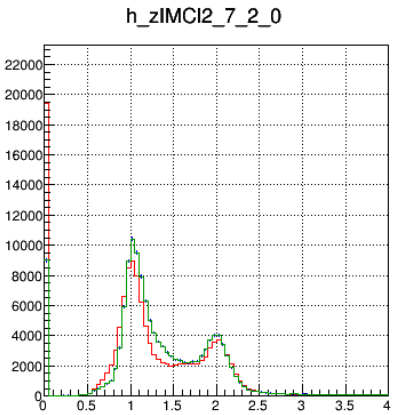


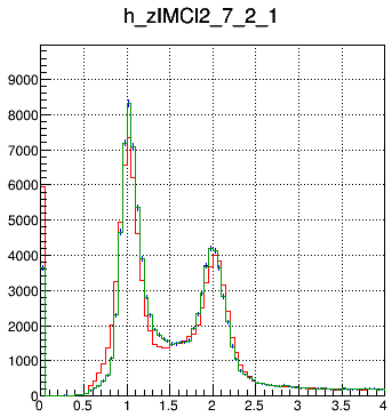


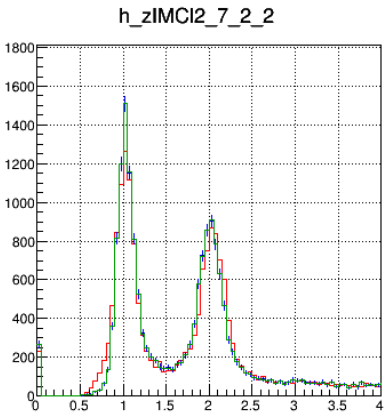


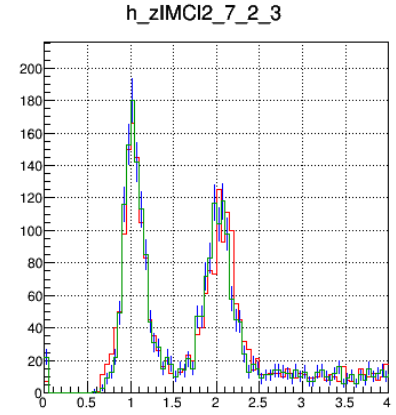
FD
Z (IMC)

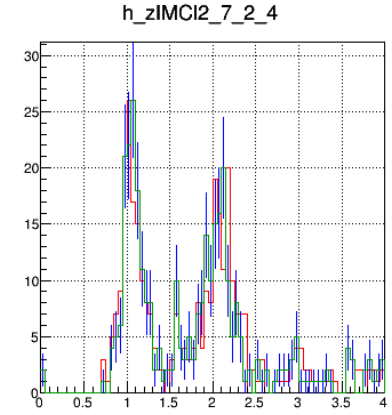
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

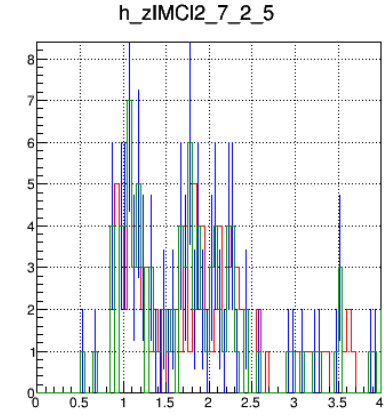






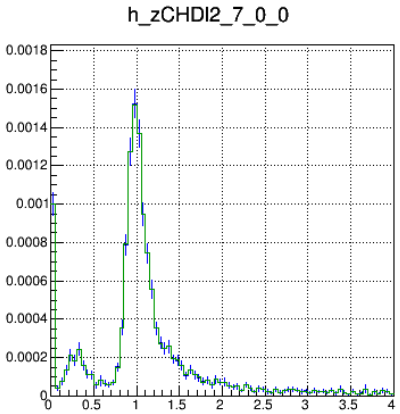


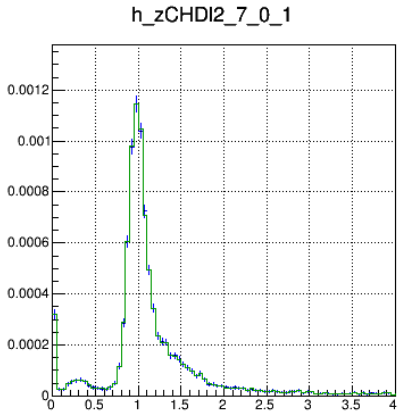


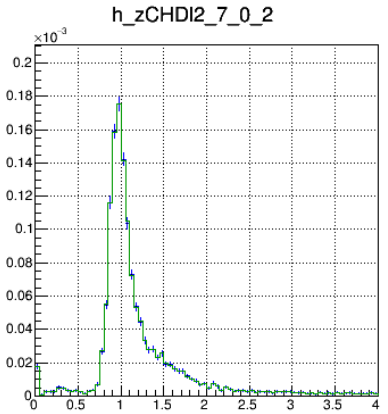


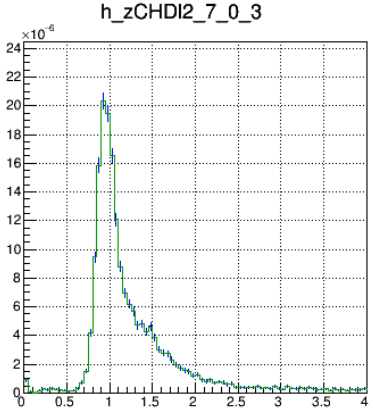
MC EPICS-p Z (CHD-X)

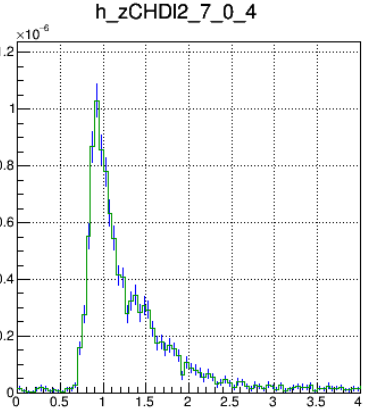
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

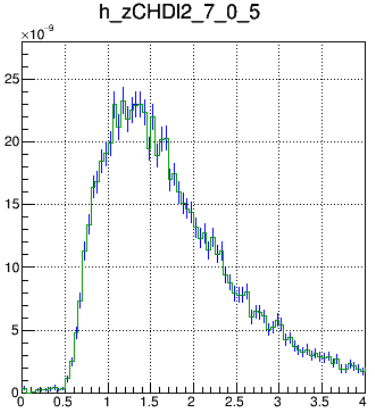






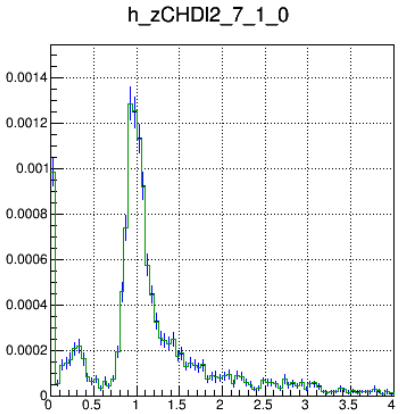


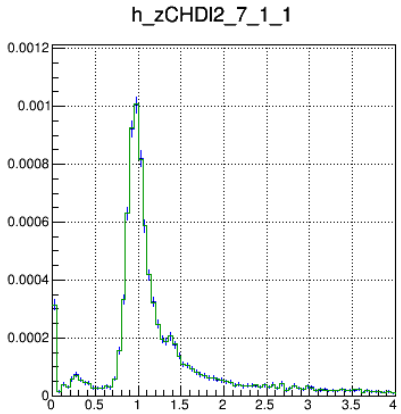


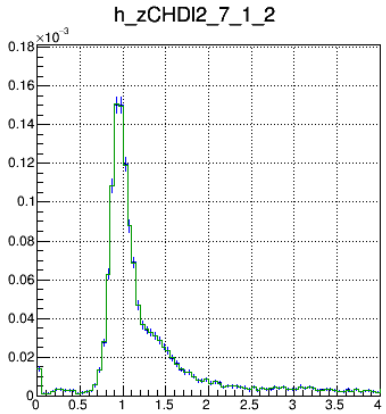


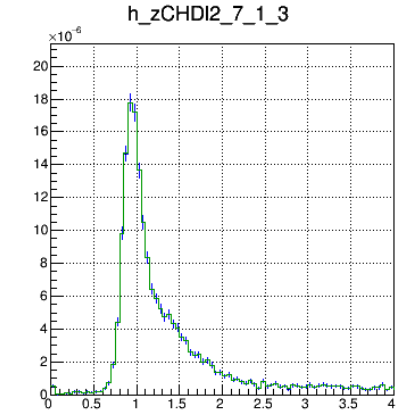
MC EPICS-p Z (CHD-Y)

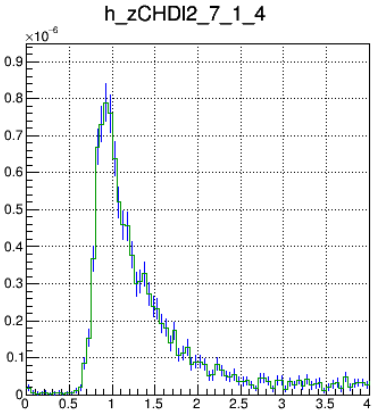
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

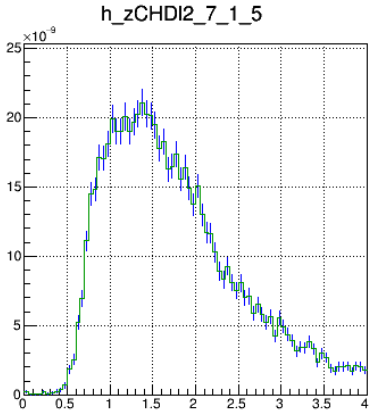






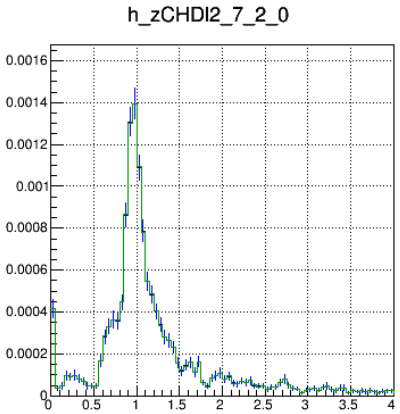


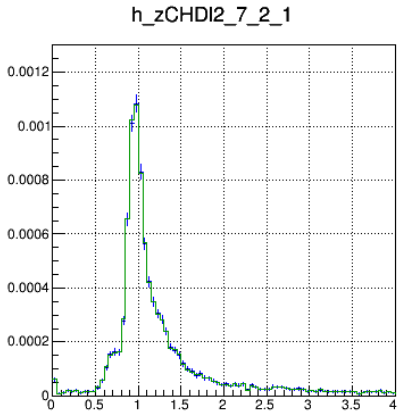


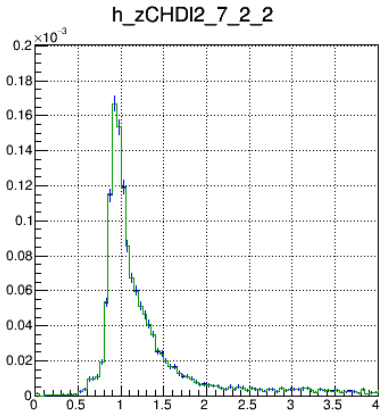


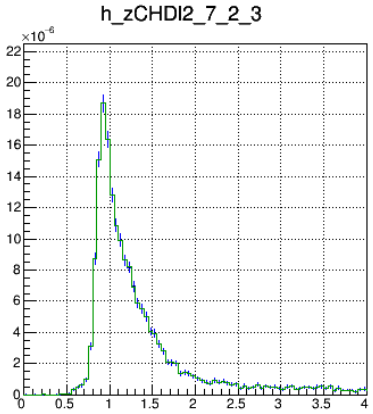
MC EPICS-p Z (CHD)

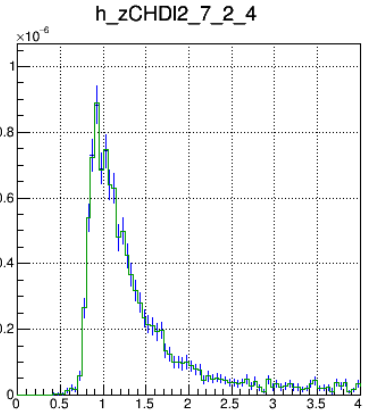
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

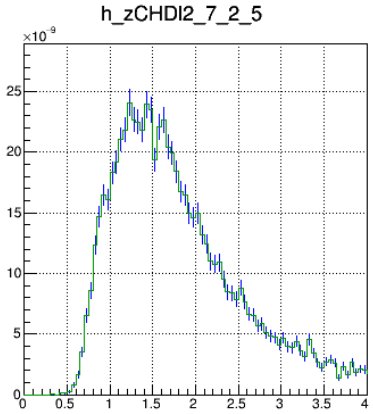






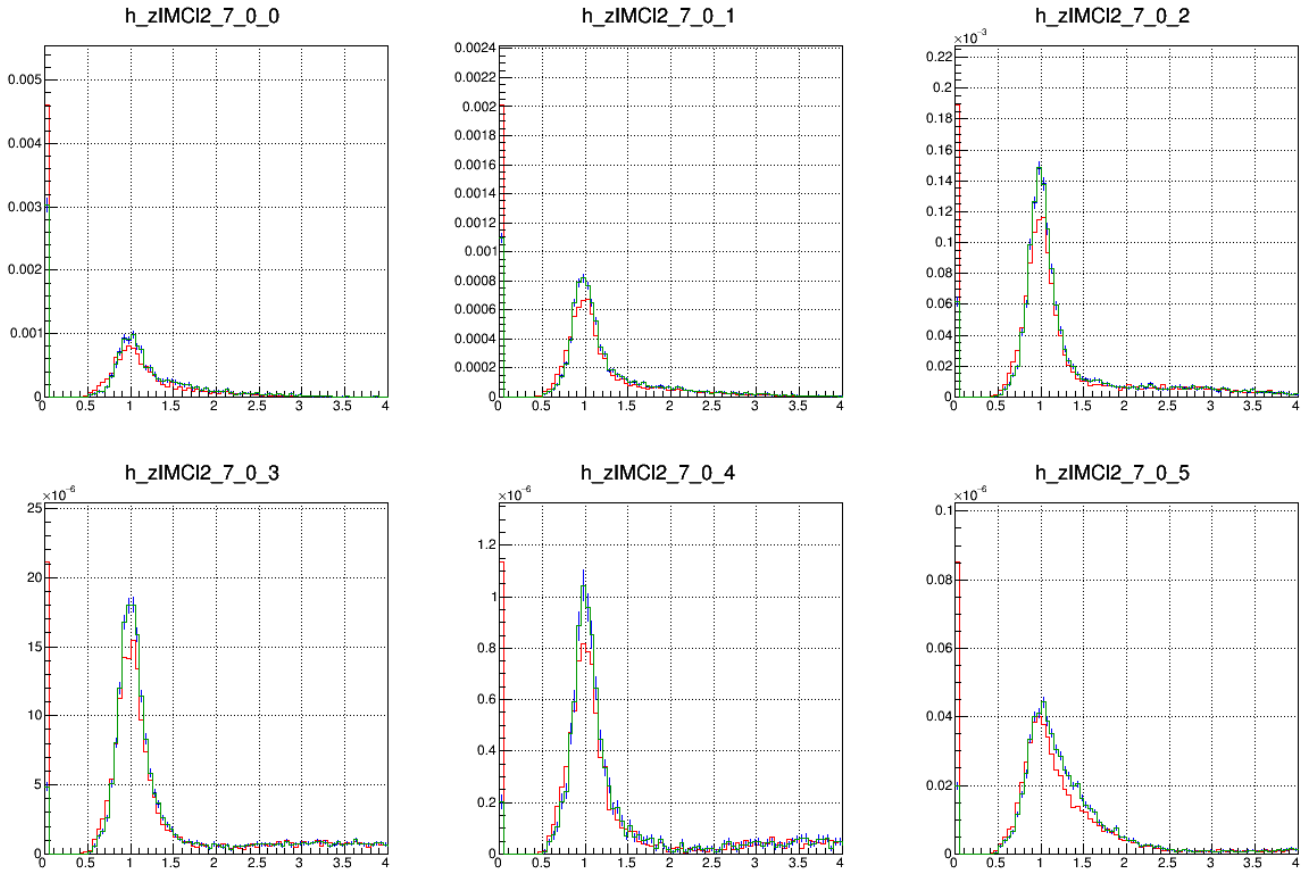






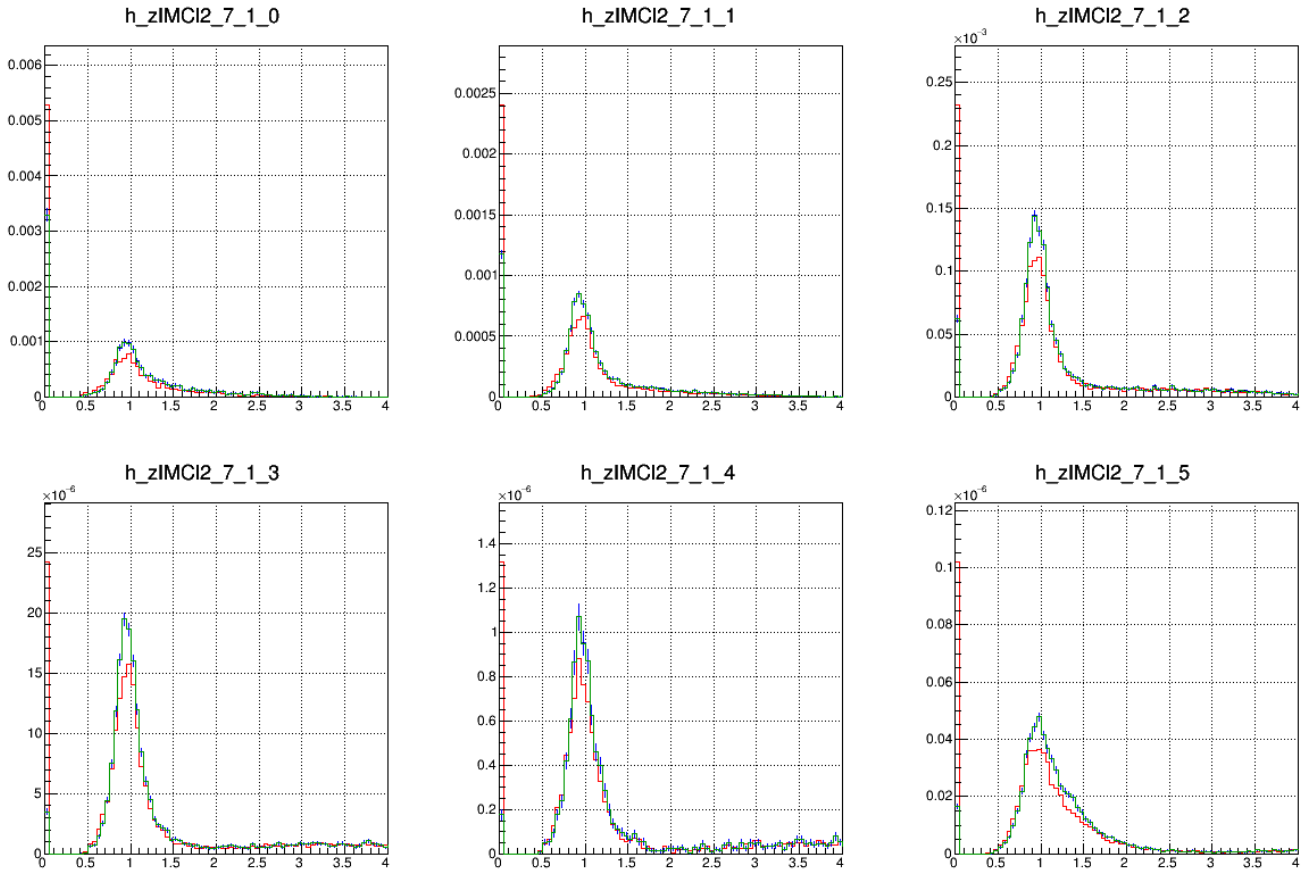
MC EPICS-p Z (IMC-X)

Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC



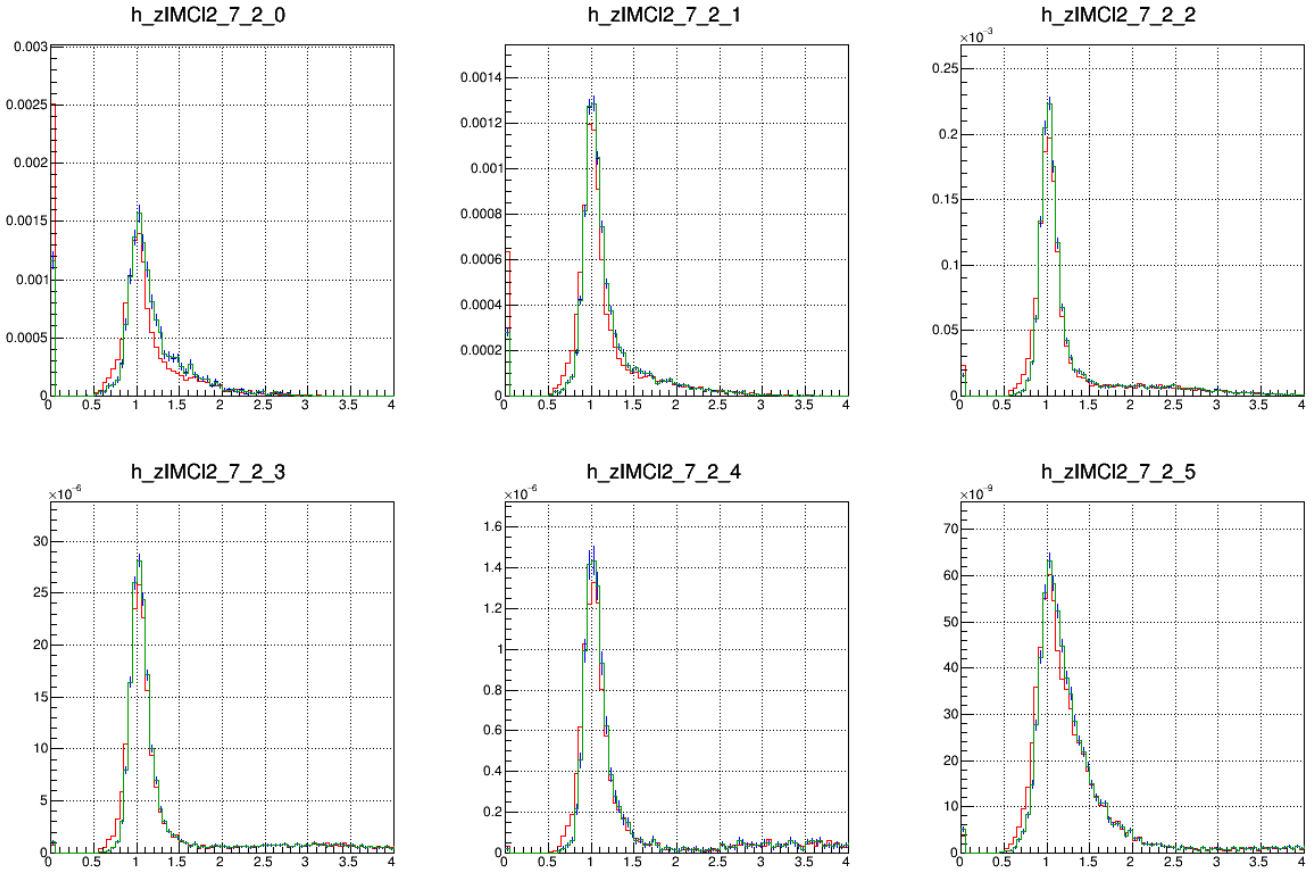
MC EPICS-p Z (IMC-Y)

Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC



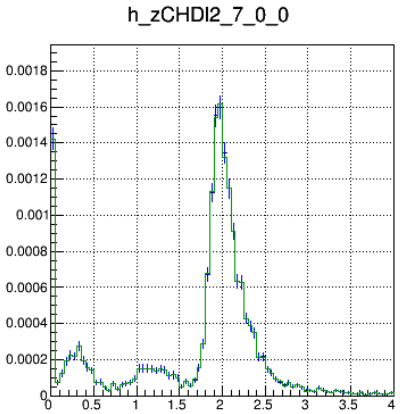
MC EPICS-p Z (IMC)

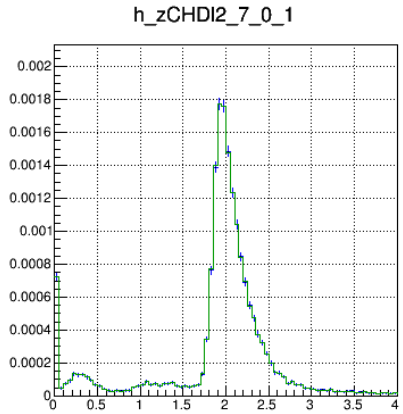
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

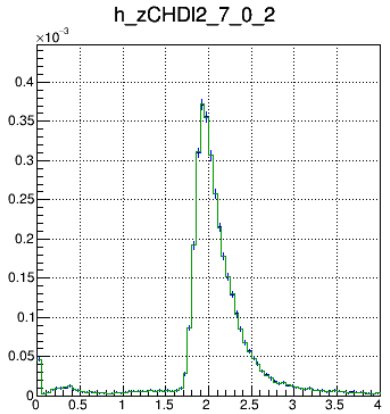


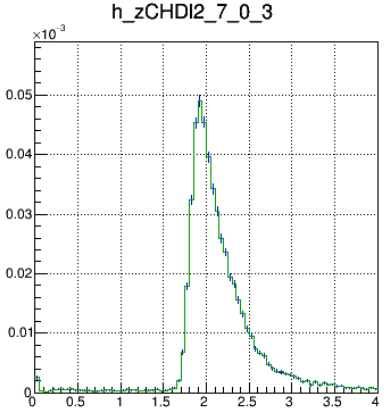
MC EPICS-He Z (CHD-X)

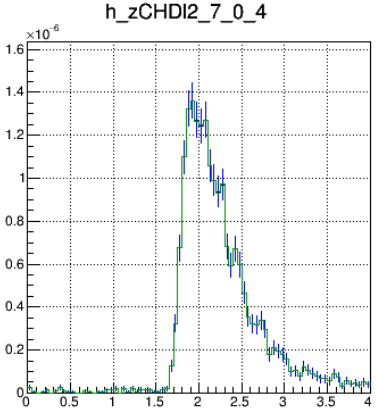
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

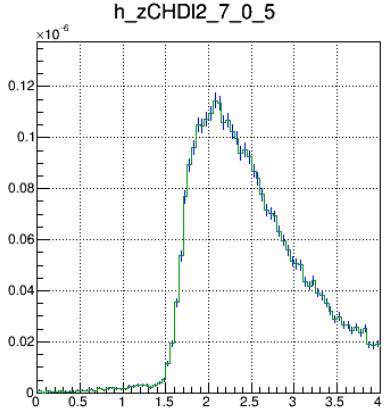






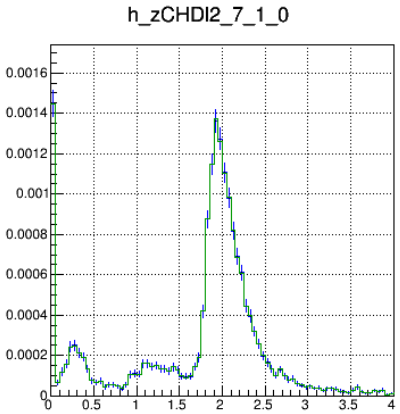


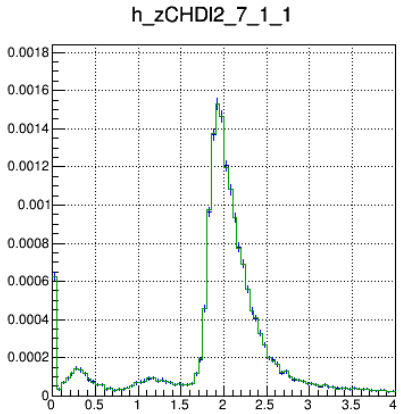


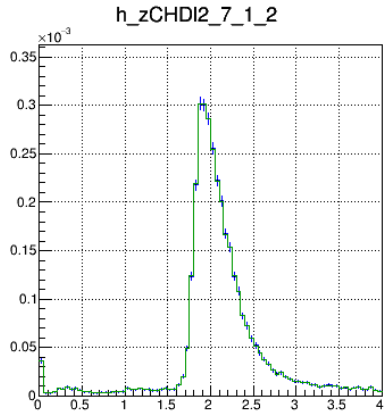


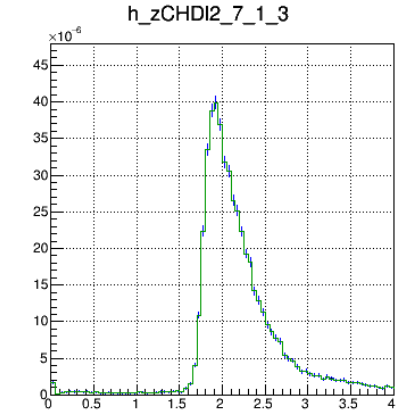
MC EPICS-He Z (CHD-Y)

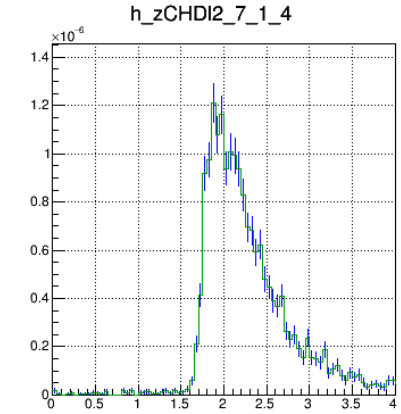
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

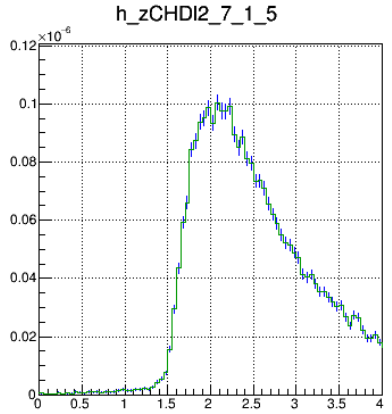






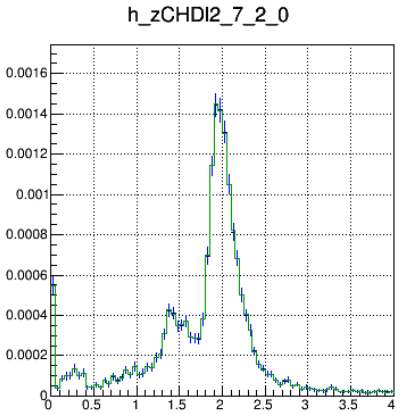


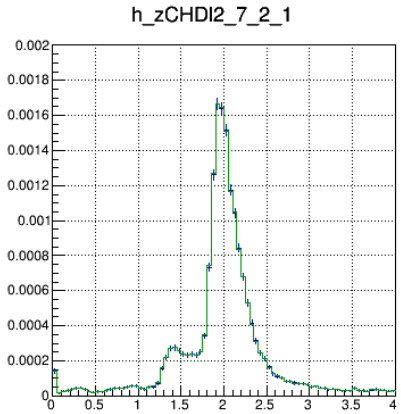


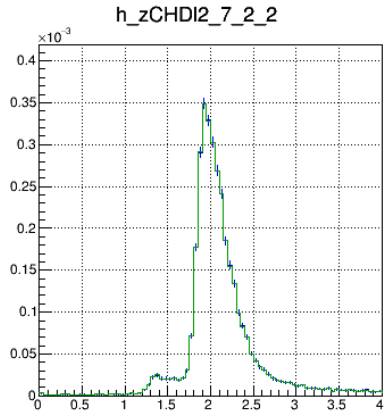


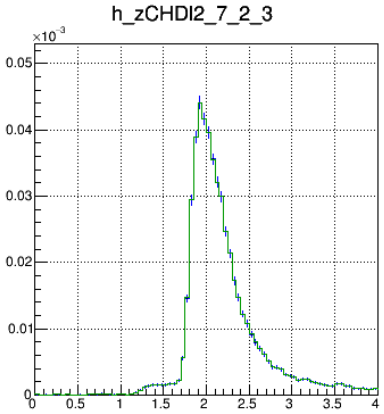
MC EPICS-He Z (CHD)

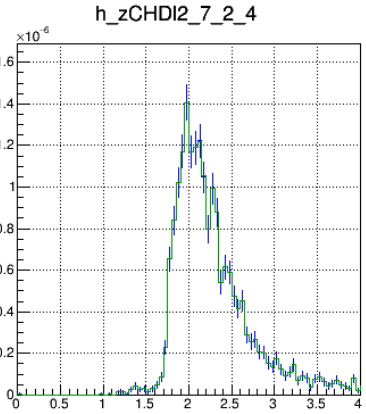
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

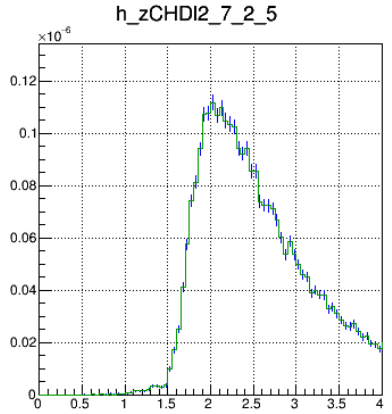






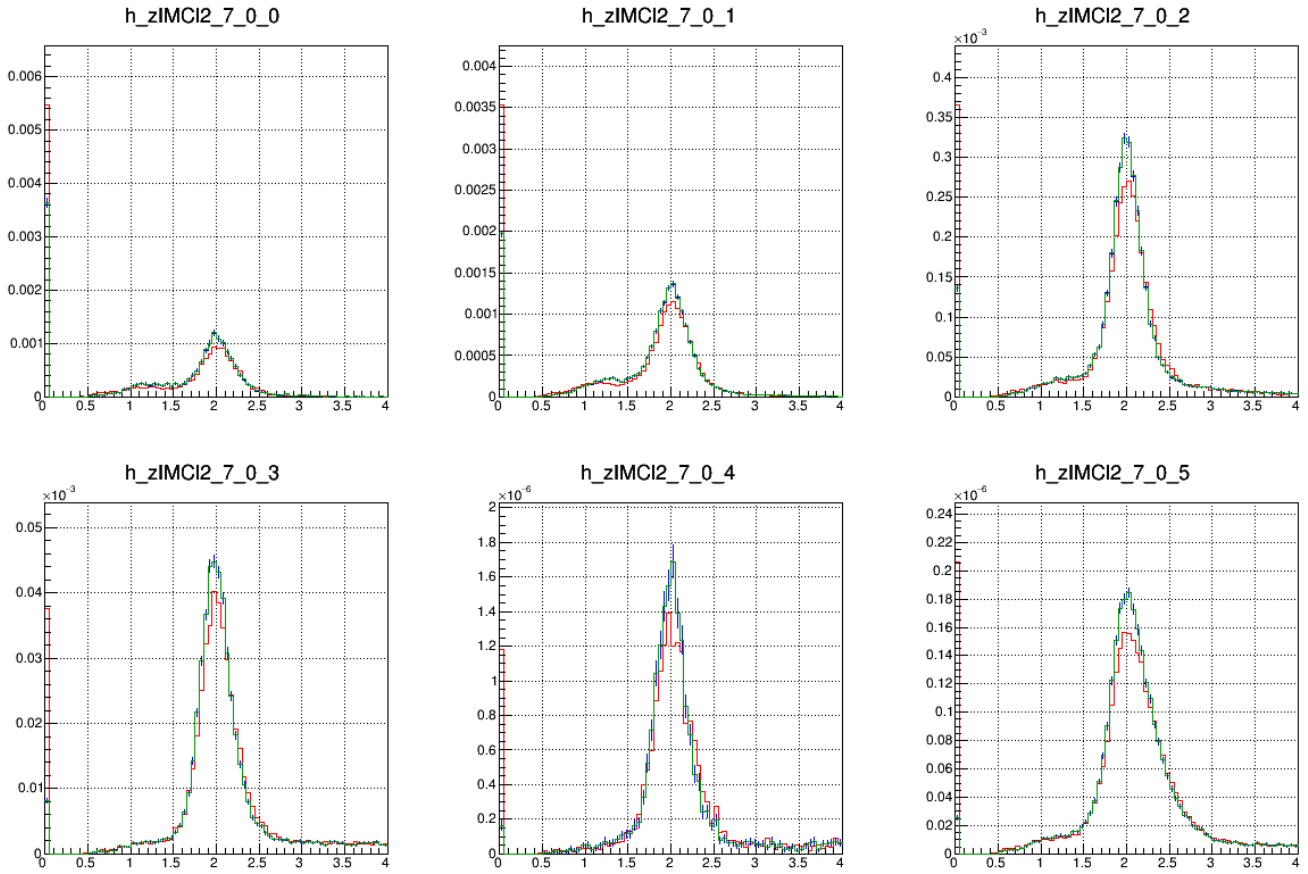






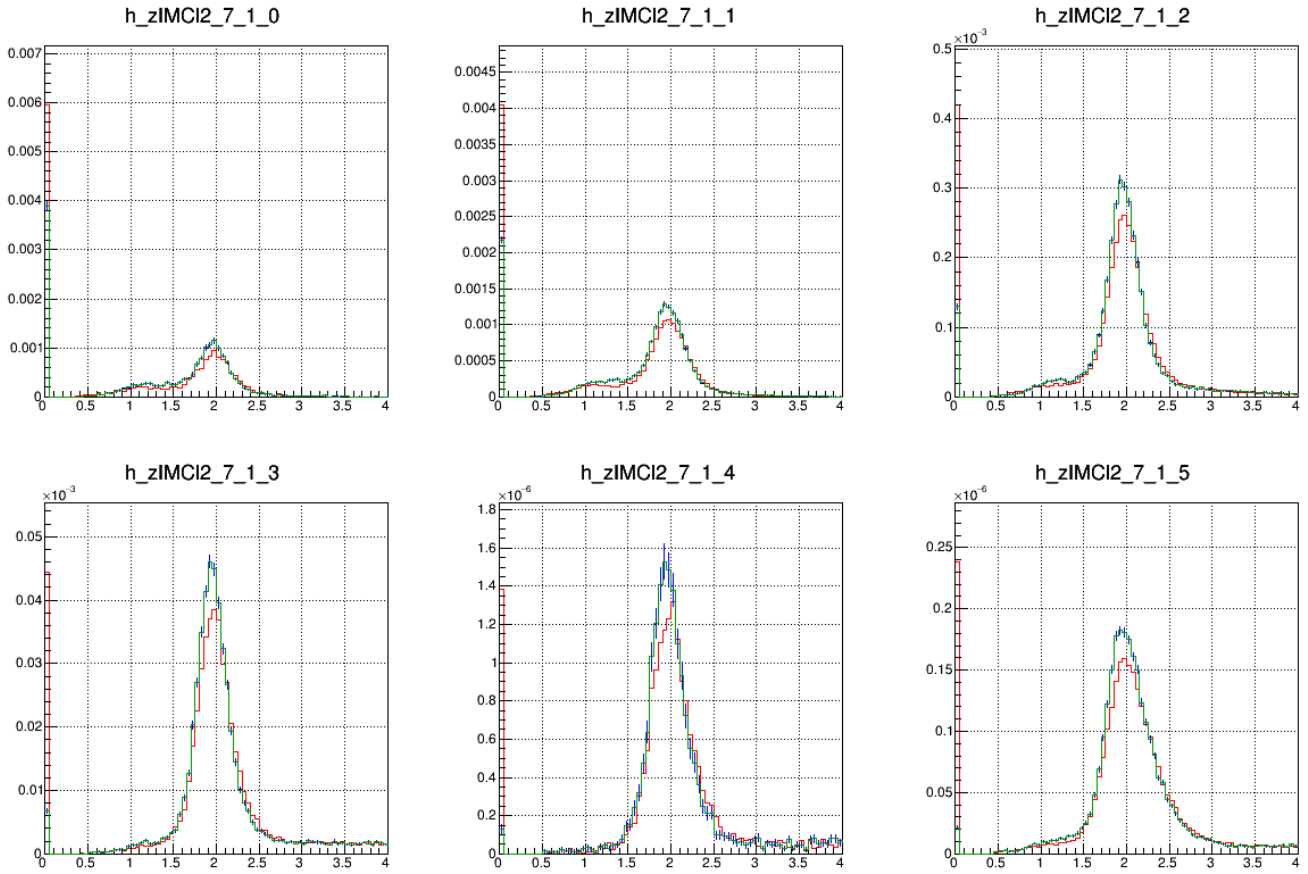
MC EPICS-He Z (IMC-X)

Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC



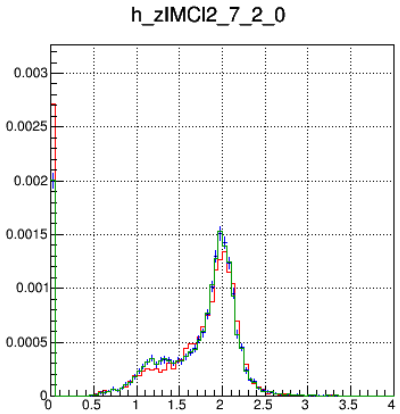
MC EPICS-He Z (IMC-Y)

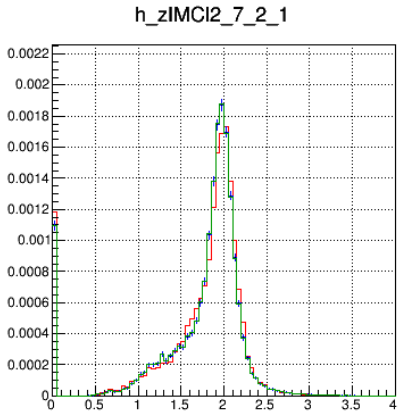
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

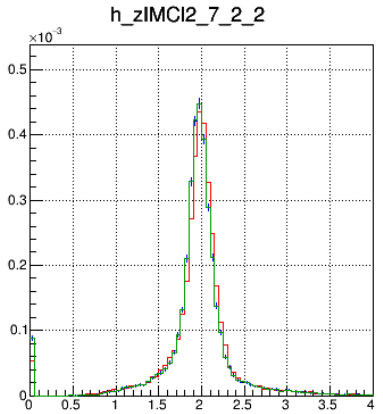


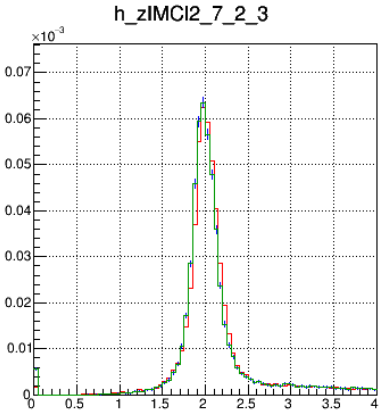
MC EPICS-He Z (IMC)

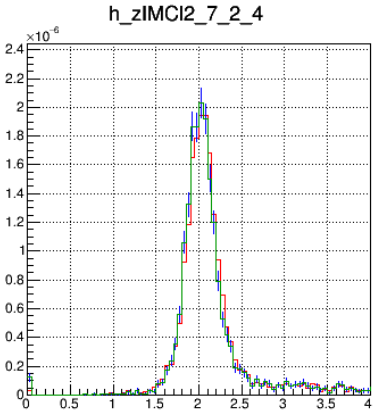
Red: L2 Z_JC (old version) algorithm = 1
Green: L2 Z_JC (new version) algorithm = 2
Blue: DST Z_JC

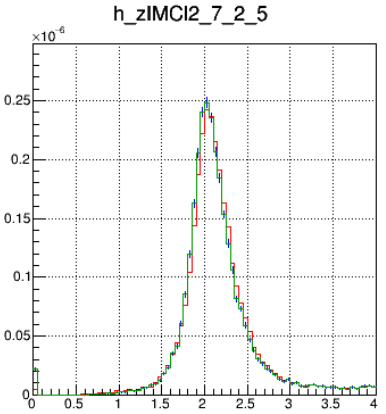






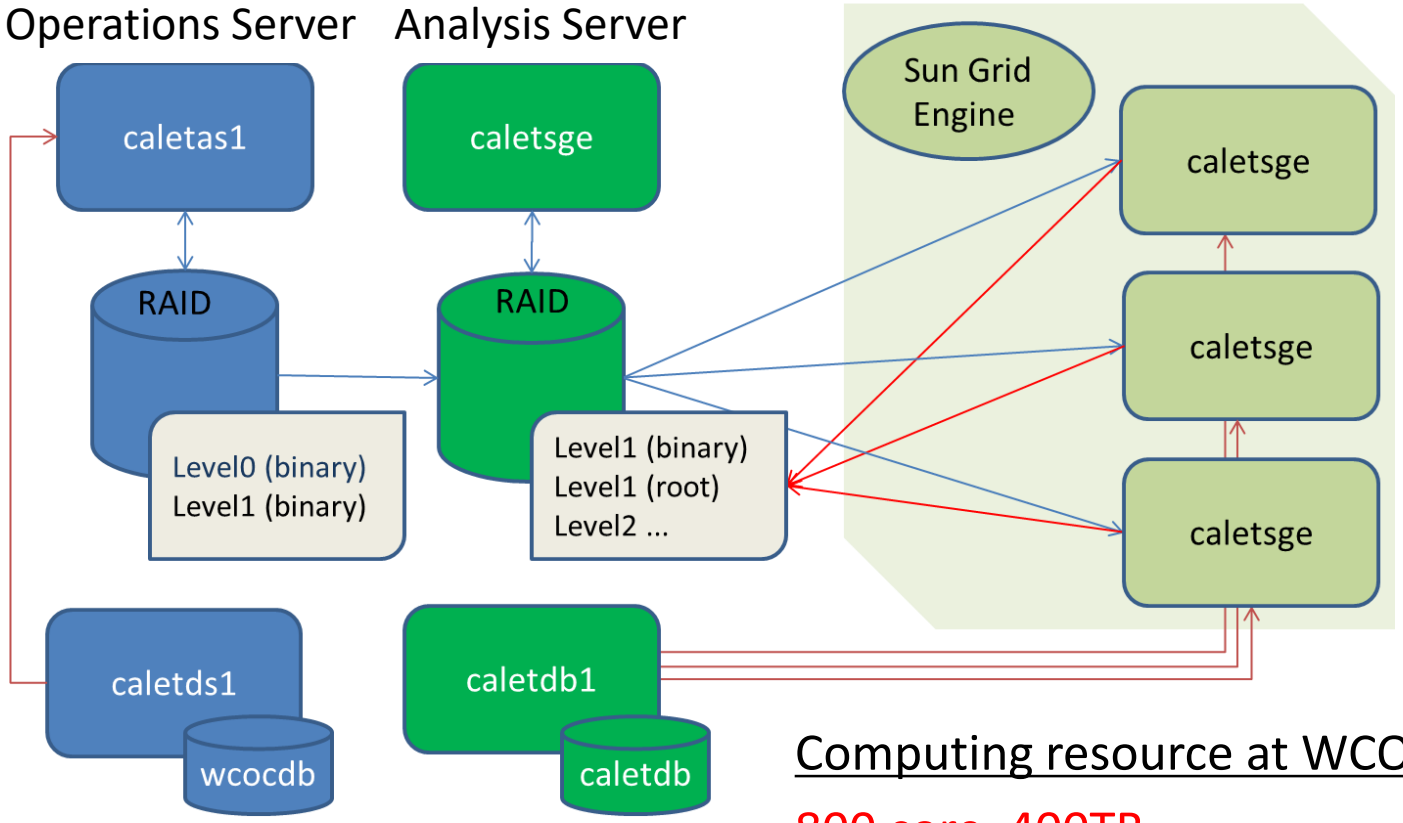






CALET Level2 Data Mass Production

WCOC consists of Operation and Analysis Servers



To process one hour of L2 data, it takes cpu resource of 10-20 hour・core and about 1.5GB storage.

⇒ 5×10^5 core・hr, 52TB (4yr=35,000hr)

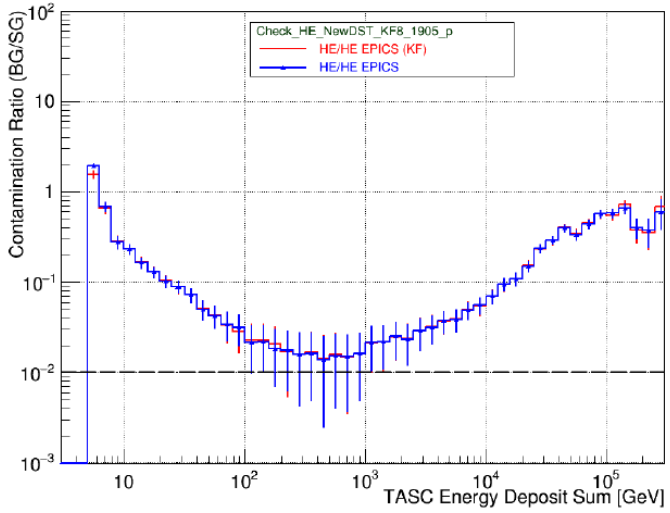
Needs one full month to process 4yr data

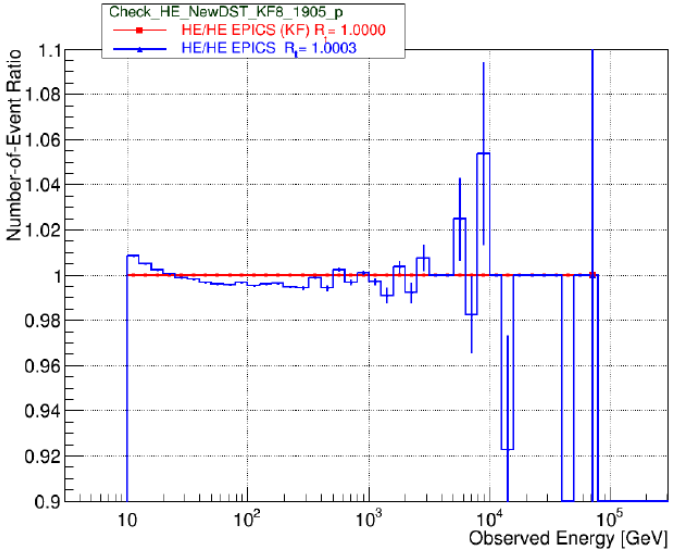
<u>Computing resource at WCOC</u>

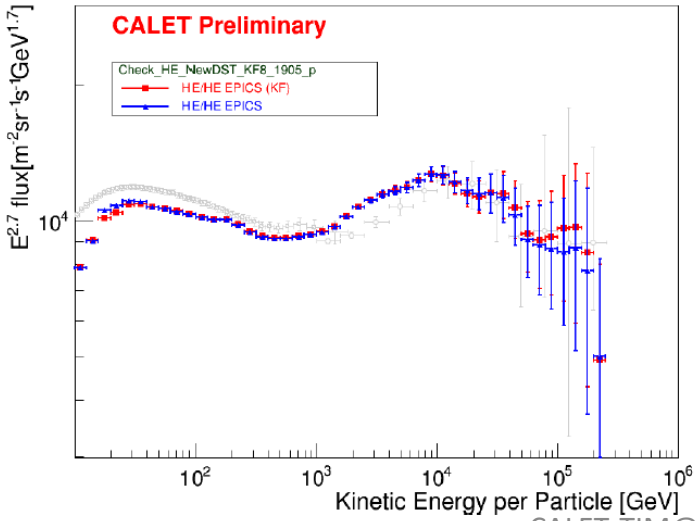
800 core, 400TB

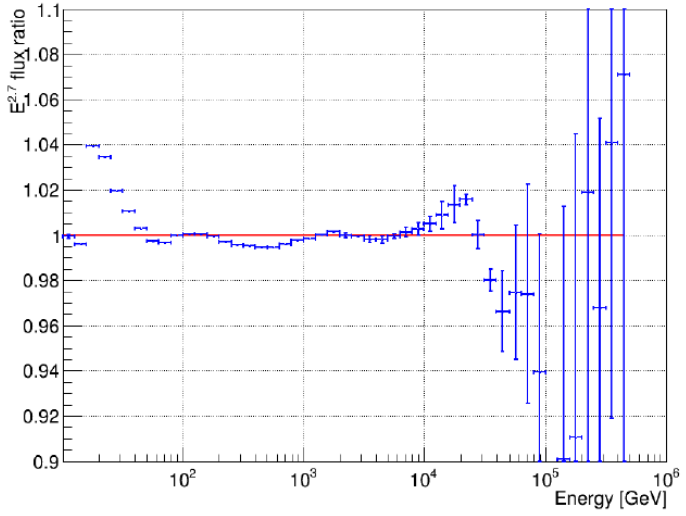
Fully occupied by calibration, high level data production, etc.

PASS-04 vs PASS-03.1 KF

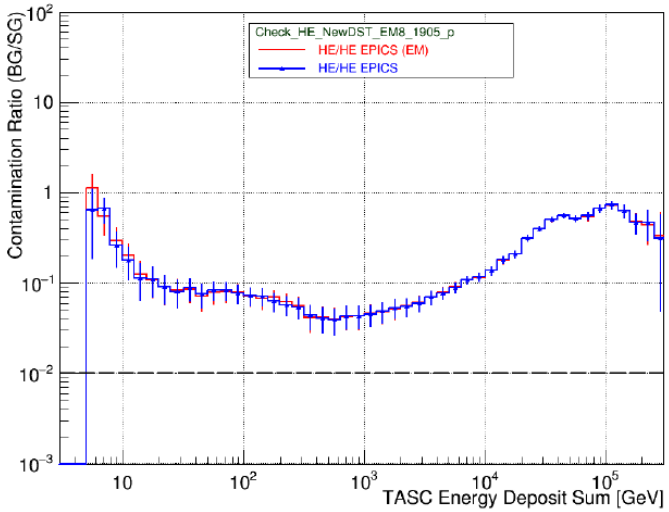


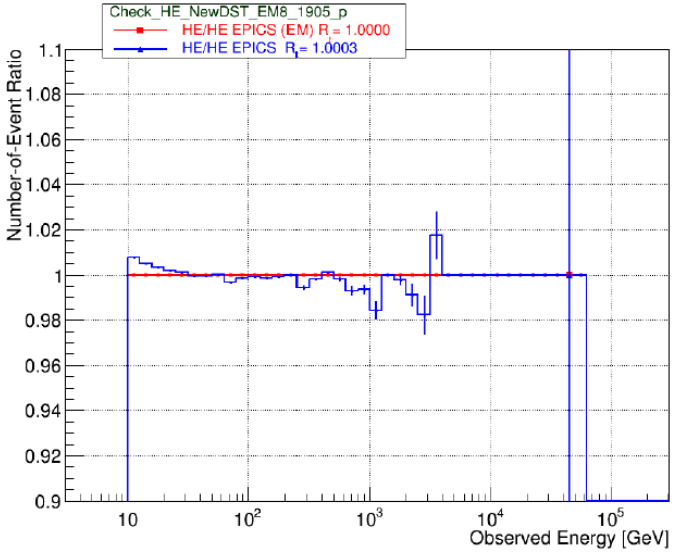


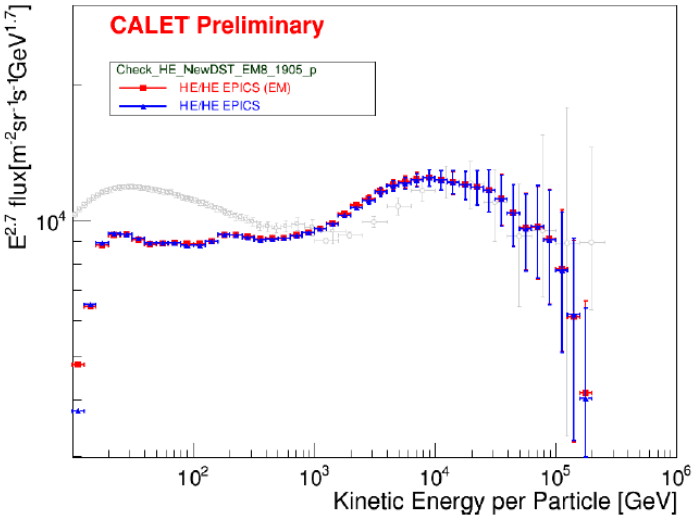


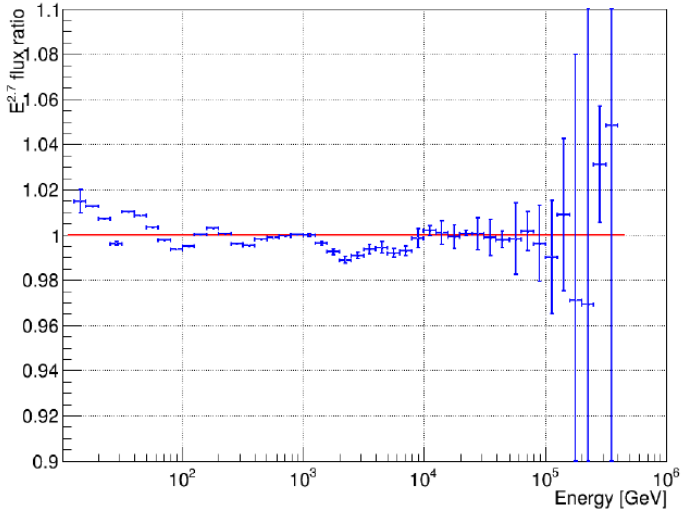


PASS-04 vs PASS-03.1 EM

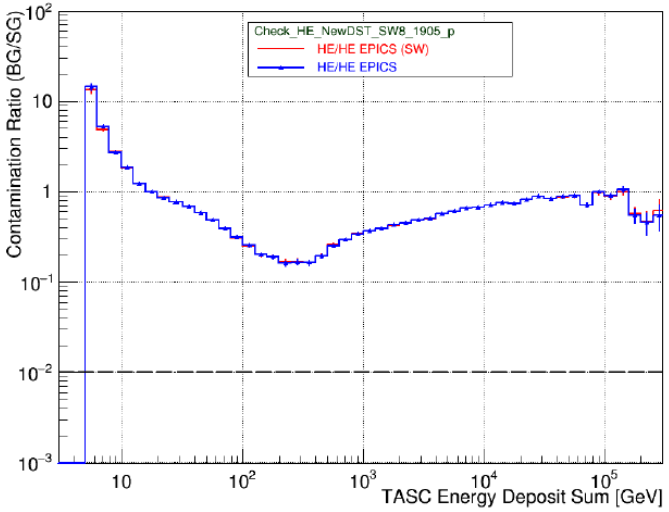


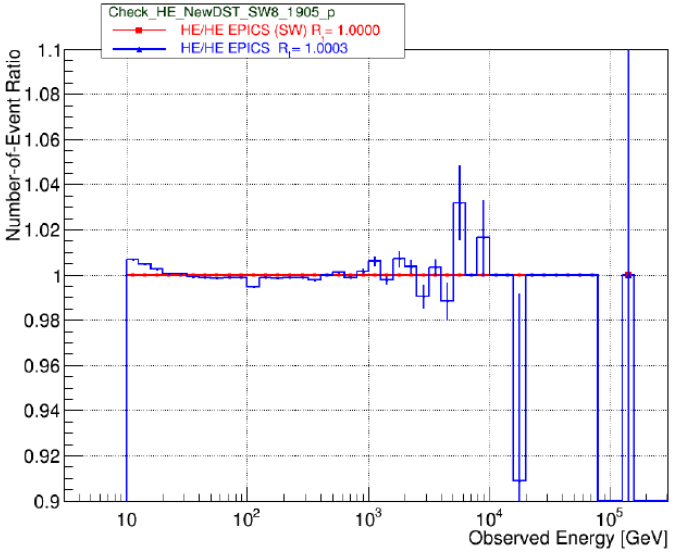


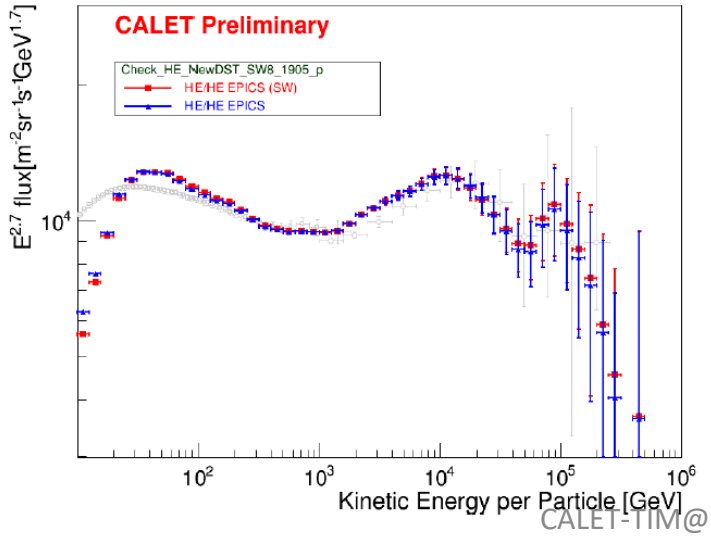


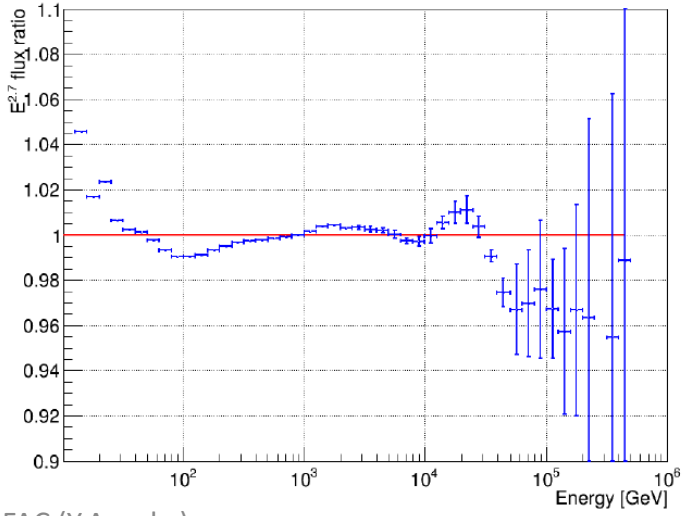


PASS-04 vs PASS-03.1 SW

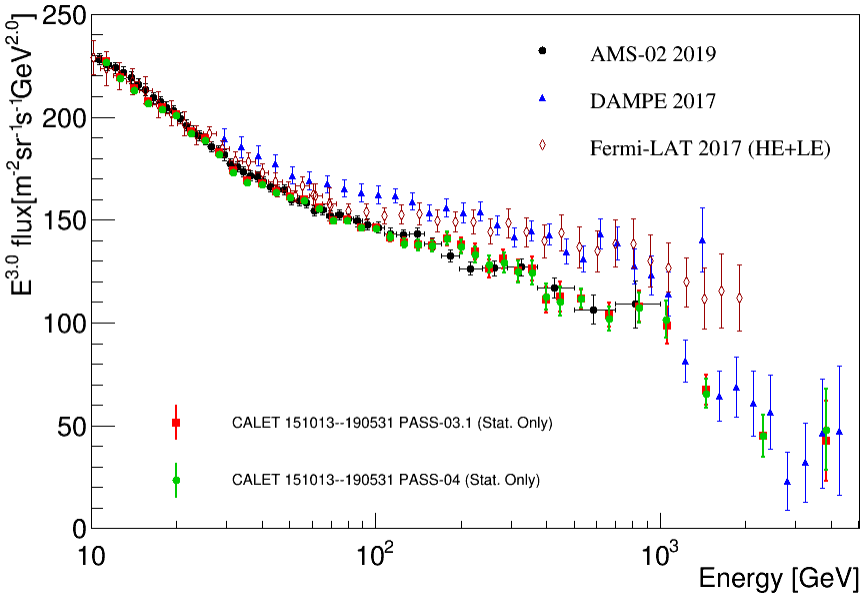


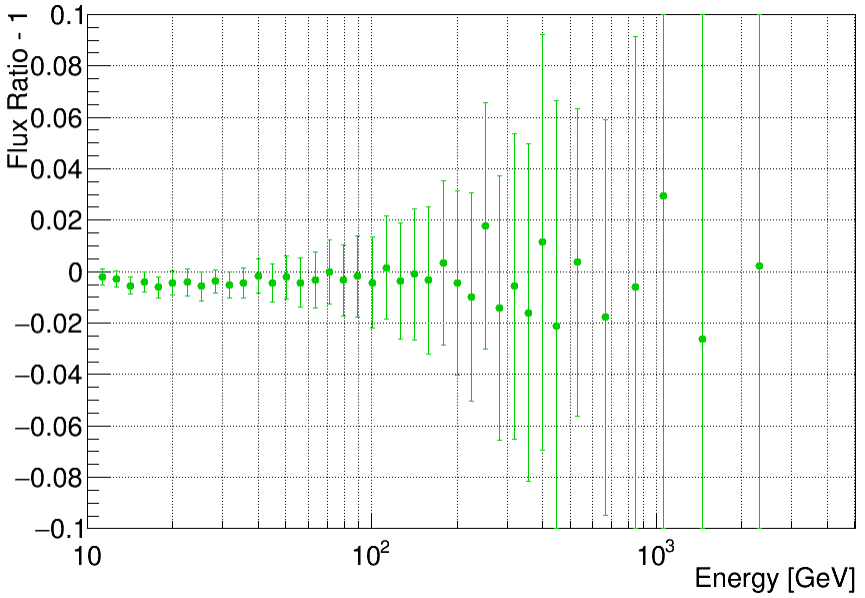






PASS-04 vs PASS-03.1
Electron Analysis Comparison





In the electron analysis, the difference between PASS03.1 and PASS04 was found to be 0.5% level.

Reason for the Difference

- There are differences between PASS04 and PASS03.1 at the level of 0.5—1%.
  - Protons
  - Electrons
- The energy region where the discrepancy is visible depends on the tracking algorithms.
- The updated points (which may affect proton flux):
  - TASC time dependence (4 channels)
  - CHD time dependence (all channels)
  - Gain jump
  - KF tracking (not main cause)
- It would be very helpful if someone would study this in detail.

CALET L2:PASS-04 HDDs

Ready to ship 8TB x 8 HDDs (3 sets; in total 24 HDDs)

Dr. Paolo Maestro
c/o Istituto Nazionale di Fisica Nucleare
Edificio C - Polo Fibonacci,
Largo B. Pontecorvo 3
56127 Pisa (Italy)
Telephone: +39 0502214349

Mr. Doug Granger
202 Nicholson Hall
Dept. Physics and Astronomy
Louisiana State University
Baton Rouge, LA 70803
Telephone: +1 225-578-2261

All disks are checked after copy to ensure completeness of the data

- Production done (151013—19731)
- Test production: 190801-191031

L2:PASS-04 HDD Packed

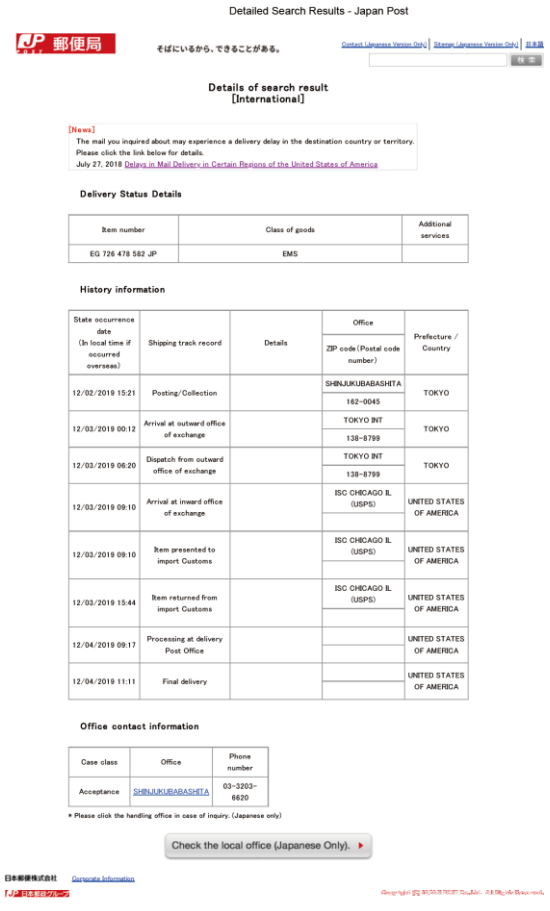
- The HDDs are packed and shipped to LSU and Pisa Univ. on Dec. 3, 2019.
- EMS (Express Mail Service) was used as usual.
- The post-office guy told me that there might be a delivery delay in Italy.

L2:PASS-04 HDD Shipped & Received!

Tracking the Packages…

US: Final delivery completed within two days

Italy: Final delivery completed after some struggles in Italy



2019/12/6 Detailed Search Results - Japan Post

郵便局 そばにいるから、できることがある。

Details of search result [International]

[News]
The mail you inquired about may experience a delivery delay in the destination country or territory.
Please click the link below for details.
July 27, 2018 Delays in Mail Delivery in Certain Regions of the United States of America

Delivery Status Details

Item number	Class of goods	Additional services
EG 726 478 582 JP	EMS	

History information

State occurrence date (In local time if occurred overseas)	Shipping track record	Details	Office / ZIP code (Postal code number)	Prefecture / Country
12/02/2019 15:21	Posting/Collection		SHINJUKUBABASHITA 162-0045	TOKYO
12/03/2019 00:12	Arrival at outward office of exchange		TOKYO INT 138-8799	TOKYO
12/03/2019 06:20	Dispatch from outward office of exchange		TOKYO INT 138-8799	TOKYO
12/03/2019 09:10	Arrival at inward office of exchange		ISC CHICAGO IL (USPS)	UNITED STATES OF AMERICA
12/03/2019 09:10	Item presented to import Customs		ISC CHICAGO IL (USPS)	UNITED STATES OF AMERICA
12/03/2019 15:44	Item returned from import Customs		ISC CHICAGO IL (USPS)	UNITED STATES OF AMERICA
12/04/2019 09:17	Processing at delivery Post Office			UNITED STATES OF AMERICA
12/04/2019 11:11	Final delivery			UNITED STATES OF AMERICA

Office contact information

Case class	Office	Phone number
Acceptance	SHINJUKUBABASHITA	03-3203-6620

* Please click the handling office in case of inquiry. (Japanese only)

Check the local office (Japanese Only).

日本郵便株式会社 Corporate Information

2019/12/6 Detailed Search Results - Japan Post

郵便局 そばにいるから、できることがある。

Details of search result [International]

[News]
The mail you inquired about may experience a delivery delay in the destination country or territory.
Please click the link below for details.
Countries/territories with possible delayed delivery of international mail

Delivery Status Details

Item number	Class of goods	Additional services
EG 726 478 596 JP	EMS	

History information

State occurrence date (In local time if occurred overseas)	Shipping track record	Details	Office / ZIP code (Postal code number)	Prefecture / Country
12/02/2019 15:21	Posting/Collection		SHINJUKUBABASHITA 162-0045	TOKYO
12/03/2019 00:12	Arrival at outward office of exchange		TOKYO INT 138-8799	TOKYO
12/03/2019 06:20	Dispatch from outward office of exchange		TOKYO INT 138-8799	TOKYO
12/05/2019 11:22	Arrival at inward office of exchange		MALPENSA LONATE POZZOLO	ITALY
12/05/2019 11:23	Item presented to import Customs		MALPENSA LONATE POZZOLO	ITALY
12/05/2019 19:58	Item returned from import Customs		MALPENSA LONATE POZZOLO	ITALY
12/05/2019 20:00	Departure from inward office of exchange		MALPENSA LONATE POZZOLO	ITALY

Office contact information

Case class	Office	Phone number
Acceptance	SHINJUKUBABASHITA	03-3203-6620

* Please click the handling office in case of inquiry. (Japanese only)

E-mail notification of completed delivery

Check the local office (Japanese Only).

日本郵便株式会社 Corporate Information

MUST state explicitly **“NOT for commercial”**

Summary

- The on-orbit operations for four years were exceptionally smooth and we have accumulated valuable observation data.
- Monitoring works in Japan improves as we better understand the possible malfunctions and what to be closely checked to identify them.
- Scientific data processing at WCOC functions very well and provides massive high-level data to international collaboration.