INTT4 HV current

2024/7/24

Ryota Shishikura, Yui Ishigaki

Outline

- INTT4 has been suffered from large data volume in the stream readout mode.
- We checked the current values by Grafana to find out if the dark current cause this issue.

Hypothesis： the dark current in silicon sensors contributing to the large data volume is not caused by silicon sensors.

Outline

```
public | gtm_scheduler                | table    | phnxrc
public | hcal_daq_info                | table    | phnxrc
public | hcal_heartbeat               | table    | phnxrc
public | hcal_led                     | table    | phnxrc
public | hcal_nominal_vmod            | table    | phnxrc
public | hcal_pedestal                | table    | phnxrc
public | hcal_tower_mapping           | table    | phnxrc
public | hcalmpodlog                  | table    | phnxrc
public | hostinfo                     | table    | phnxrc
public | intt_mpodlog                 | table    | phnxrc
public | led_run_view                 | view     | phnxrc
public | ll1                          | table    | phnxrc
public | magnet_info                  | table    | phnxrc
public | mbd_hvlog                    | table    | phnxrc
public | mbd_hvlog_id_seq             | sequence | phnxrc
public | mbd_trigluts                 | table    | phnxrc
public | mpodlog                      | table    | phnxrc
public | mpodlog_id_seq               | sequence | phnxrc
public | mv2                          | table    | phnxrc
public | mvtx_strobe                  | table    | phnxrc
public | old_hcal_heartbeat           | table    | phnxrc
public | rc_db                        | table    | phnxrc
```

```
                    Table "public.intt_mpodlog"
   Column    |            Type             | Collation | Nullable | Default
-------------+-----------------------------+-----------+----------+---------
time         | timestamp without time zone |           | not null |
ip           | character varying(32)       |           | not null |
mpod_channel | smallint                    |           | not null |
status       | character varying(12)       |           |          |
voltage      | real                        |           |          |
current      | real                        |           |          |
Indexes:
   "pkey" PRIMARY KEY, btree ("time", ip, mpod_channel)
```

Ip - North or South

mpod_channel – Ladder and type of sensor number

North/South Roc Ladder Type A/B

$$2 \times 8 \times 7 + 1 \times 2$$

Total number of channel=256

※+1 means spare ladder

We assumed that the bias cable mapping of Run24 would be the same as Run23
so we use mpod_channel same as last year.

Resolution of current

2. Technical data

	EHS F601x-F[1]	EHS F605x-F[1]	EHS F610x-F[1]	EHS F620x-F[1]	EHS F630x-F[1]	EHS F640x-F[1]	EHS F660x-F[1]
HV channels per module	16	16	16	16	16	16	16
Output voltage $V_{O\ nom}$ [kV]	0.1	0.5	1	2	3	4	6
Output current $I_{O\ nom}$ [mA]	10	15	8	4	3	2	1
Resolution of voltage setting*) [mV]	5	20	40	80	120	160	240
current setting*) [nA]	400	600	320	160	120	80	40
voltage measurement*) [mV]	1	2	4	5	10	10	15
current measurement*) [nA]	100	150	80	40	30	20	10
Ripple and noise [mV_{P-P}]	< 5	< 10					< 30
	- at max. load and $\|V_O\| > 2\% * V_{O\ nom}$ - f > 10 Hz						
Stability(no load/load and ΔV_{IN})	0.02%* $V_{O\ nom}$						
Sample rates [samples/s]	5, 10, 25, 50, 60, 100, 500						
Digital filter averages	1, 16, 64, 256, 512, 1024						
The resolution of measurable values depends on the settings of the sampling rate and the digital filter!							
Accuracy of voltage measurement	$\pm (0.01\% * V_O + 0.02\% * V_{O\ nom})$						
Accuracy of current measurement	$\pm (0.02\% * I_O + 0.02\% * I_{O\ nom})$						
The measurement accuracy is guaranteed in the range $2\% * V_{O\ nom} < V_O \leq V_{O\ nom}$ and for 1 year							
Voltage ramp up / down [V/s]	$1*10^{-6} * V_{O\ nom}$ up to $0.2 * V_{O\ nom}$						
Floating voltage	Connector RTN to GND: $\leq \|20\ V\|$						
Temperature coefficient	$< \pm 50 * 10^{-6}/K$						
Hardware limits V_{max} / I_{max}	potentiometer per module (V_{max} / I_{max} is the same for all channels)						

*) with standard sample rate 500/s and digital filter 64

We found the manual for the HV module.

We used in INTT is

EHS F 605p-F.

It shows that the lowest measurable current is 150 nA.

→Measured currents are reliable.

Details

Hardware [edit | edit source]

Wiener's MPOD is used to apply bias to the silicon sensors. The features of our MPOD module EHS F605p-F are:

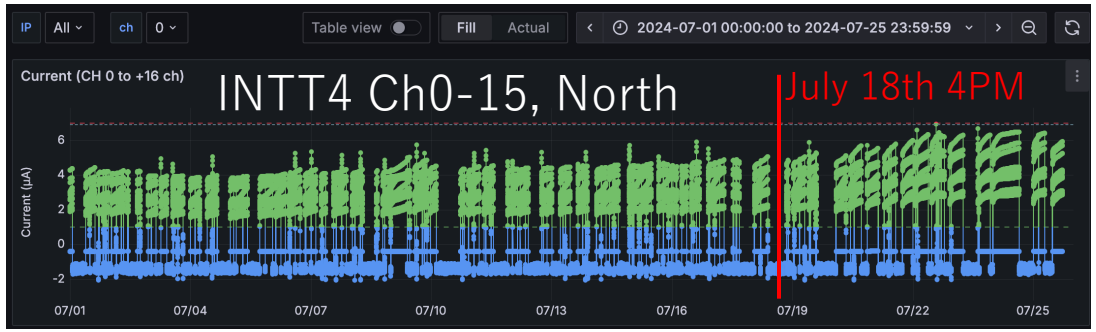
- #ch: 16
- Max Voltage: 0.5 kV
- Max Current: 15 mA
- Polarity: positive
- Rippile: < 10 mV
- Resolution of
  voltage setting: 20mV
  current setting: 600nA
  voltage measurement: 2mA
  current measurement: 150nA
- Accuracy of
  voltage measurement:± (0.01% * VO + 0.02% * VO nom)
  current measurement ±:(0.02% * IO + 0.02% * IO nom)The measurement accuracy is guaranteed in the range 2% * VO nom < VO ≤ VO nom and for 1 year

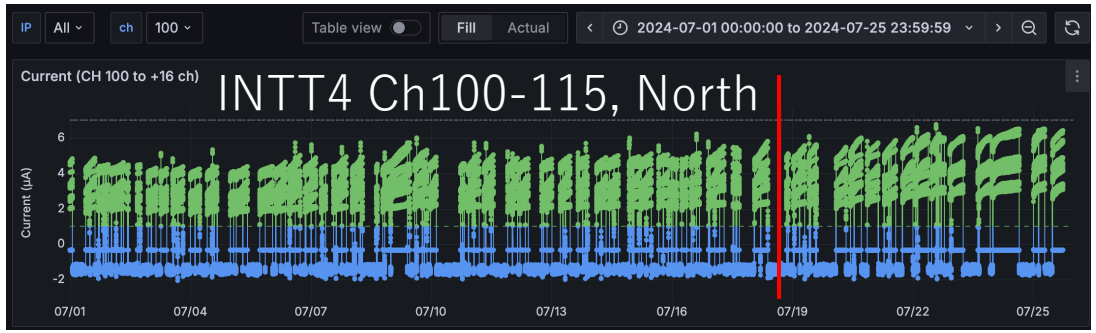
You can get manuals from the official homepage orOperator's Manual . Wiener MPod Instruction Weiner MPOD

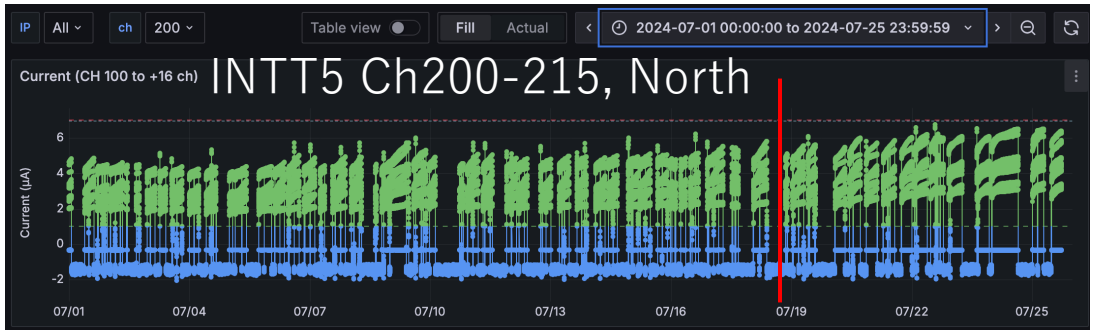
You can see details of HV module

Hardware Configuration->Bias/LV Power->Bias Power System in wiki

INTT4 current July 1 to now ①





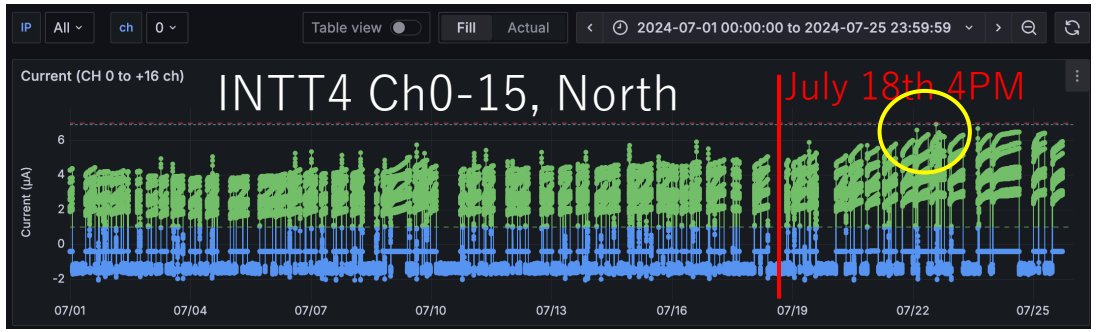


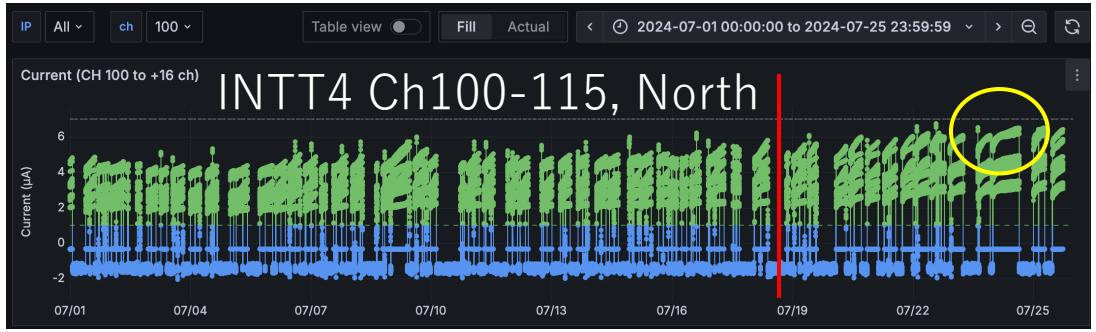
On July 18th 4PM, we switched to the stream readout mode from triggered mode.

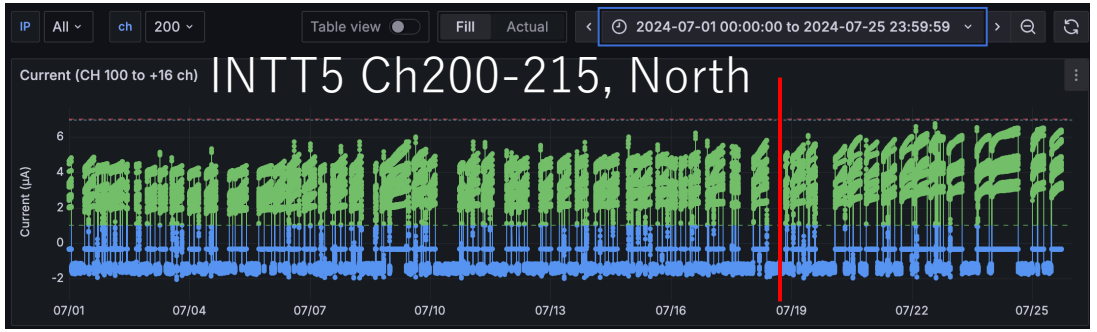
The drawing currents have been slowly increasing and the slope may get a bit steeper around July 18th.

However, the slope for INTT4 sensors are not necessarily more drastic compared to other sensors in different servers.

INTT4 current July 1 to now ②





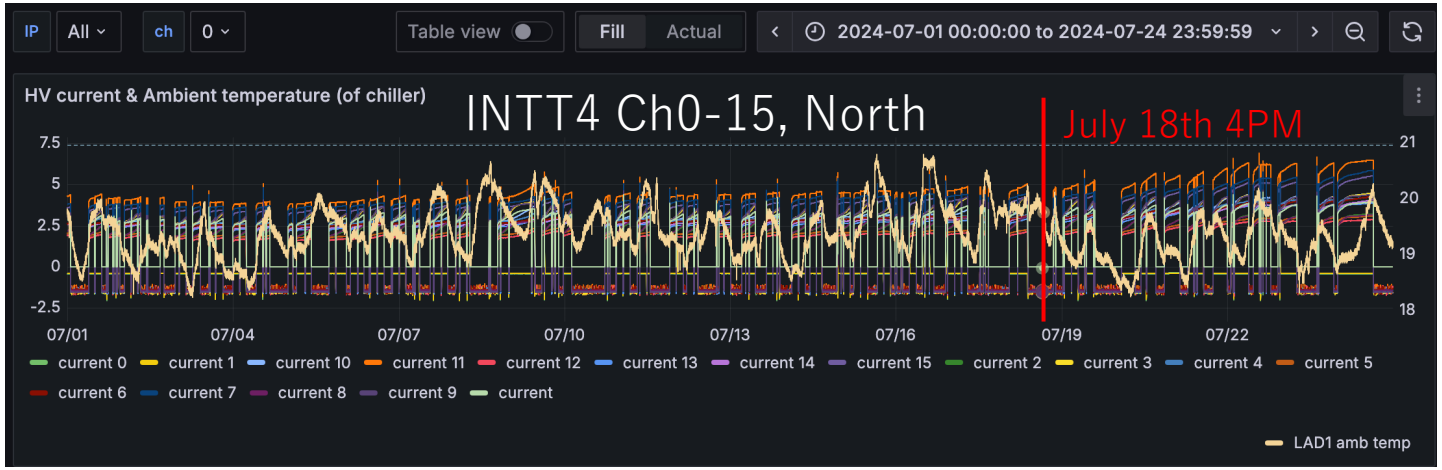


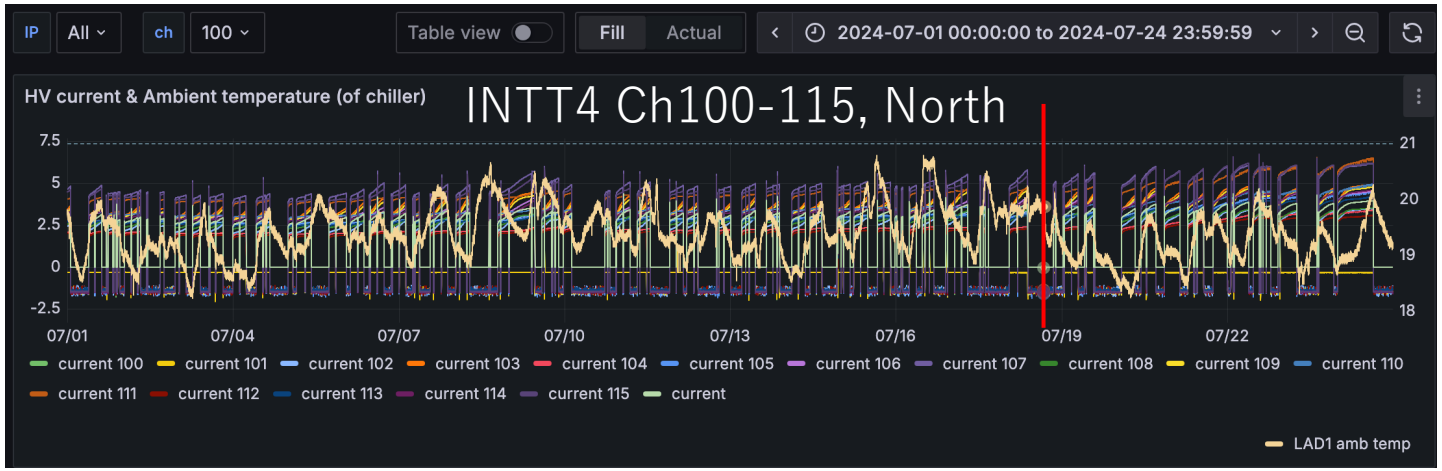
On July 18th 4PM, we switched to the stream readout mode from triggered mode.

We don't see slope change after increased dry air flow on 22nd.

→ It is not distinctive to call as the direct evidence of the larger data size in recent stream readout data from this observation.

HV current & Ambient temperature (of chiller)





Ambient temperature, it's decreasing. The current is increasing on the other hand.

This graph was made by Genki. Thank you.

On Going

- We are concerned that currents have continued to rise over the last week on all ladders.

- We will investigate if there is any hit rate increase due to increasing drawing current by monitoring normalized hit rate by the luminosity(trigger rate).

- 仮説を入れる

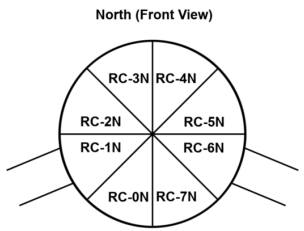
Get map of RUN23

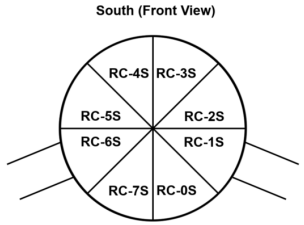
INTT DAQ servers, FELIX board and ROCs [edit | edit source]

A FELIX board has 2 ROCs. The relation is

Relation of the INTT DAQ servers, each has a FELIX board, and ROCs.

INTT DAQ server	Server IP	Packet ID (pid)	FELIX port 0	FELIX port 1
intt0	10.20.32.100	3001	RC-0S	RC-1S
intt1	10.20.32.101	3002	RC-2S	RC-3S
intt2	10.20.32.102	3003	RC-4S	RC-5S
intt3	10.20.32.103	3004	RC-6S	RC-7S
intt4	10.20.32.104	3005	RC-0N	RC-1N
intt5	10.20.32.105	3006	RC-2N	RC-3N
intt6	10.20.32.106	3007	RC-4N	RC-5N
intt7	10.20.32.107	3008	RC-6N	RC-7N






```
def GetMap():
        sip = '10.20.34.150'
        nip = '10.20.34.151'
        m = {
                'RC-0N (HV-9)':{
                        'B1L101N':{
                                'Sensor A (P3-3)':{'ip':nip, 'ch':'10'},
                                'Sensor B (P3-4)':{'ip':nip, 'ch':'11'}},
                        'B0L000N':{
                                'Sensor A (P2-5)':{'ip':nip, 'ch':'4'},
                                'Sensor B (P2-6)':{'ip':nip, 'ch':'5'}},
                        'B0L100N':{
                                'Sensor A (P2-1)':{'ip':nip, 'ch':'0'},
                                'Sensor B (P2-2)':{'ip':nip, 'ch':'1'}},
                        'B1L001N':{
                                'Sensor A (P3-5)':{'ip':nip, 'ch':'12'},
                                'Sensor B (P3-6)':{'ip':nip, 'ch':'13'}},
                        'B0L101N':{
                                'Sensor A (P3-1)':{'ip':nip, 'ch':'8'},
                                'Sensor B (P3-2)':{'ip':nip, 'ch':'9'}},
                        'B1L000N':{
                                'Sensor A (P2-7)':{'ip':nip, 'ch':'6'},
                                'Sensor B (P2-8)':{'ip':nip, 'ch':'7'}},
                        'B1L100N':{
                                'Sensor A (P2-3)':{'ip':nip, 'ch':'2'},
                                'Sensor B (P2-4)':{'ip':nip, 'ch':'3'}},
                        'FILLLER':{
                                'Sensor A (P3-7)':{'ip':nip, 'ch':'14'},
                                'Sensor B (P3-8)':{'ip':nip, 'ch':'15'}}},
                'RC-1N (HV-10)':{
                        'B0L002N':{
                                'Sensor A (P2-5)':{'ip':nip, 'ch':'104'},
                                'Sensor B (P2-6)':{'ip':nip, 'ch':'105'}},
                        'B0L102N':{
                                'Sensor A (P3-1)':{'ip':nip, 'ch':'108'},
                                'Sensor B (P3-2)':{'ip':nip, 'ch':'109'}},
                        'B0L001N':{
                                'Sensor A (P2-1)':{'ip':nip, 'ch':'100'},
                                'Sensor B (P2-2)':{'ip':nip, 'ch':'101'}},
                        'B1L003N':{
                                'Sensor A (P3-5)':{'ip':nip, 'ch':'112'},
                                'Sensor B (P3-6)':{'ip':nip, 'ch':'113'}},
                        'B1L103N':{
                                'Sensor A (P3-3)':{'ip':nip, 'ch':'110'},
                                'Sensor B (P3-4)':{'ip':nip, 'ch':'111'}},
                        'B1L002N':{
                                'Sensor A (P2-7)':{'ip':nip, 'ch':'106'},
                                'Sensor B (P2-8)':{'ip':nip, 'ch':'107'}},
                        'B1L102N':{
                                'Sensor A (P2-3)':{'ip':nip, 'ch':'102'},
                                'Sensor B (P2-4)':{'ip':nip, 'ch':'103'}},
                        'FILLLER':{
                                'Sensor A (P3-7)':{'ip':nip, 'ch':'114'},
                                'Sensor B (P3-8)':{'ip':nip, 'ch':'115'}}},
                'RC-2N (HV-11)':{
                        'B0L003N':{
                                'Sensor A (P2-1)':{'ip':nip, 'ch':'200'},
                                'Sensor B (P2-2)':{'ip':nip, 'ch':'201'}},
                        'B0L104N':{
                                'Sensor A (P2-5)':{'ip':nip, 'ch':'204'},
```