

# **PCle40 upgrade for SVD**

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# Commissioning of PCIe40 based SVD readout

- Slow control, TTD, dataflow for PCIe40 SVD was tested
- Local run could running with 30 kHz poisson trigger for several hours
  - SVD also joined global run with 30 kHz poisson trigger
  - Global run with COPPER system, local run with PCIe40 system to take data in parallel. the data was recorded for both global/local run
- Masking and program PCIe40 firmware based on GUI has been tested
- Issues still remained
  - Masking (SVDRC control by “SVD”) changing to CONFIGURING
    - Takes time and need a ABORT to fix the state
  - Update GUI for setup the run mode

| Items          | status | comment    |
|----------------|--------|------------|
| daq_slc        | ✓      |            |
| restart script | ✓      |            |
| GUI            | ✓      |            |
| HLT/Storage    | ✓      |            |
| RC config db   | ✓      |            |
| ttd db         | ✓      |            |
| Unpacker       | ✓      |            |
| Data flow      | ✓      |            |
| Data quality   | ✓      | Cosmic run |

# Operation panel for SVD

Mask/unmask scheme

- Check / uncheck
- Save & Apply Mask to active

TTD link status

DMA FIFO

DMA transmit data size

TTD clock status

- Program PCIe40 firmware
- Resume for operation automatically

The screenshot displays the SVD operation panel with several control panels and data tables. The SVD panel (Run # 20) shows 'RUNNING' status for SVDRC, RSVD1-5, and RSVD5. The FTSW panel (Run # 66) is also 'RUNNING'. The RC\_HLT\_RSVD panel (Run # 11) is 'NOTREADY'. Below these are 'Load & Apply Mask' and 'Save & Apply Mask' buttons. On the right, three tables show Belle2link channel status for rsvd1, rsvd2, and rsvd3. Each table includes columns for Hostname, TTD, DMA, DMA [kBytes], Size [Bytes], Rate [MB/s], and Program PCIe40. The tables show channel numbers 0-11 with checkboxes for TTD and DMA, and progress bars for DMA [kBytes] and Program PCIe40.

Belle2link mask status

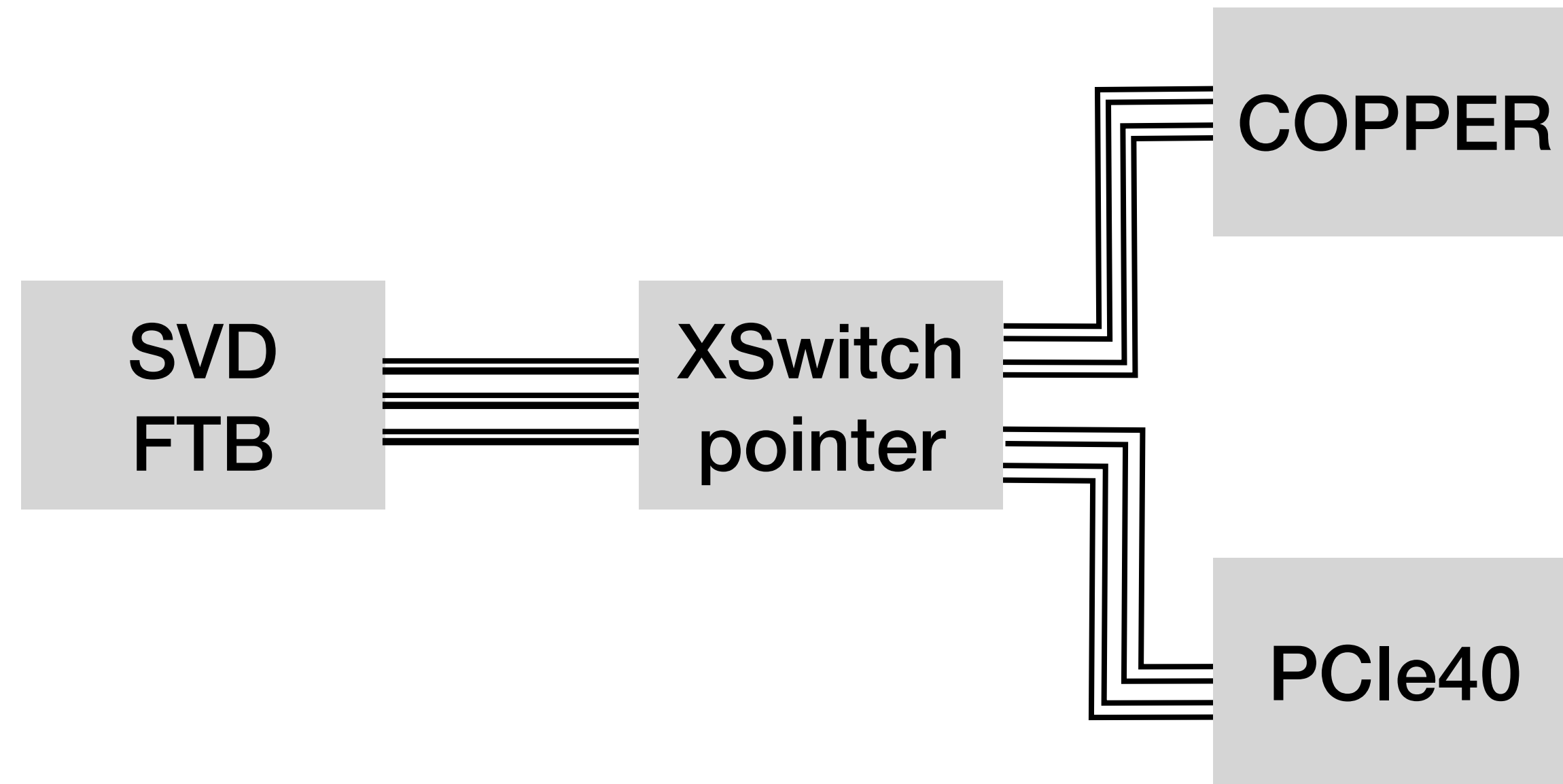
Belle2link up/down status FIFO usage on PCIe40

length FIFO usage

No. of events

# Preparation for PCIe40 based SVD readout

- Manual to switch readout system for SVD



- SVD FTB used for PCIe40 readout test
  - FTB connected to a XSwitch pointer, the splitter of fibers connect to COPPER and PCIe40 system
  - The use of the system could be switched by the software
- The database for TTD system (maskdb, namedb, ttodb) were created for both system
  - Need to change the database entry to switching the system
  - Use one of the slow control system to avoid conflict (runcontrold of “SVD”)

# Global run and local SVD run in parallel

The screenshot displays the Belle II control interface with several key sections:

- RC\_SVD (Run # 669):** Shows STORE\_RSVD, RC\_HLT\_RSVD, and TTD\_SVD all in a 'RUNNING' state.
- SVD (Run # 668):** Shows SVDRC, SVD01-SVD09, and SVD05-SVD06 all in a 'RUNNING' state.
- RC\_HLT\_RSVD (Run # 669):** Shows HLTIN\_RSVD, HLTOUT\_RSVD, EB1\_RSVD, HLTWK14\_RSVD, HLTWK15\_RSVD, HLTWK16\_RSVD, and DQM\_RSVD all in a 'RUNNING' state.
- STORE\_RSVD (Run # 669):** Shows event rate at 3.79 kHz, event counter at 546794, and flow rate at 34.46 MB/s.
- Detector Status Monitors:** Multiple panels show the status of various detectors (PXD, CDC, TOP, ARICH, ECL, KLM, TRG) and their data flow rates.
- Trigger / Data status:** A table showing event rates and flow rates for HLT01 through HLT10.

- Wait for a break of global run
- Download the firmware of PCIe40
  - A special firmware for PCIe40 for the b2l establishment
- Start slc on rsvd1, but kill “runcontrold svd -d” to avoid the conflict with global run (COPPER system)
- Exclude “SVD” and “TTD\_SVD” from local “RC\_SVD”
- Control the local HLT and storage to be RUNNING
- Use “rcrequest” to manually start “RSVD1” on rsvd1 ROPC
- Wait for global run start, then the data will flowing both on global and local run system

# Update of local run GUI

The screenshot shows a GUI with several control buttons on the left: 'LOAD', 'ABORT', 'BOOT', 'Load M', and 'Save & Apply Mask'. A text box lists 'Run mode: fadc, test1, test2, rand1, rand2, ...'. A 'Set run mode' button is also present. The main area displays two data tables for 'rsvd2' and 'rsvd3'. The 'rsvd3' table has a red box around its header and a blue box around a specific row (index 1). A red arrow points from the 'Set run mode' button to the 'rsvd3' table, and a blue arrow points from the blue box to the 'Adding FTB variables' text.

```
$ nsmvlistget -c pcie40link PCIE40LINK00
svd[0].busy : int get set
svd[0].busy[0] : int get
svd[0].busy[1] : int get
svd[0].busy[2] : int get
svd[0].busy[3] : int get
svd[0].busy[4] : int get
svd[0].busy[5] : int get
svd[0].busy[6] : int get
svd[0].busy[7] : int get
svd[0].cfr : int get set
svd[0].error : int get set
svd[0].error[0] : int get
svd[0].error[1] : int get
svd[0].error[2] : int get
svd[0].error[3] : int get
svd[0].error[4] : int get
svd[0].error[5] : int get
svd[0].error[6] : int get
svd[0].error[7] : int get
svd[0].fadc.id : int get set
svd[0].mask.datconerr : int get set
svd[0].mask.fadcerr : int get set
svd[0].mbmr : int get set
svd[0].mt32.nword : int get set
svd[0].runmode : int get set
svd[0].runmode_s : text get set
svd[0].status : int get set
svd[0].status[0] : int get
svd[0].status[1] : int get
svd[0].status[2] : int get
svd[0].status[3] : int get
svd[0].status[4] : int get
svd[0].status[5] : int get
svd[0].status[6] : int get
svd[0].status[7] : int get
svd[0].testreg : int get set
svd[0].trgcnt : int get
version : text get
```

- A dedicated meeting with SVD expert was hold
  - K. Hara -san will adding the FTB variables
  - Katsuro-san will update the script to change the run mode, then implement it to the GUI

b2svd@rsvd1: ~/svd\_daq\_pcie40/ftb\_mode\_nsm.py

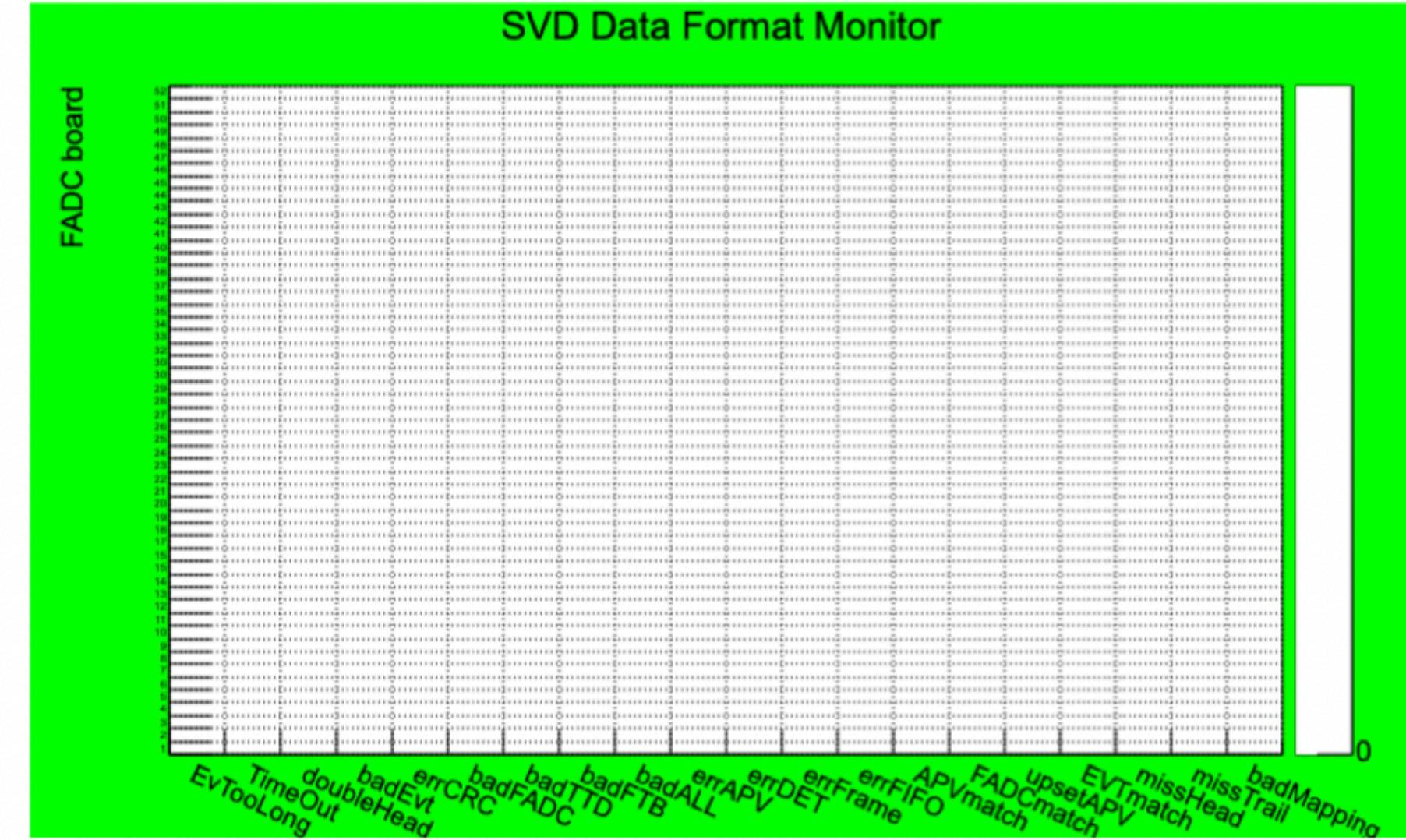
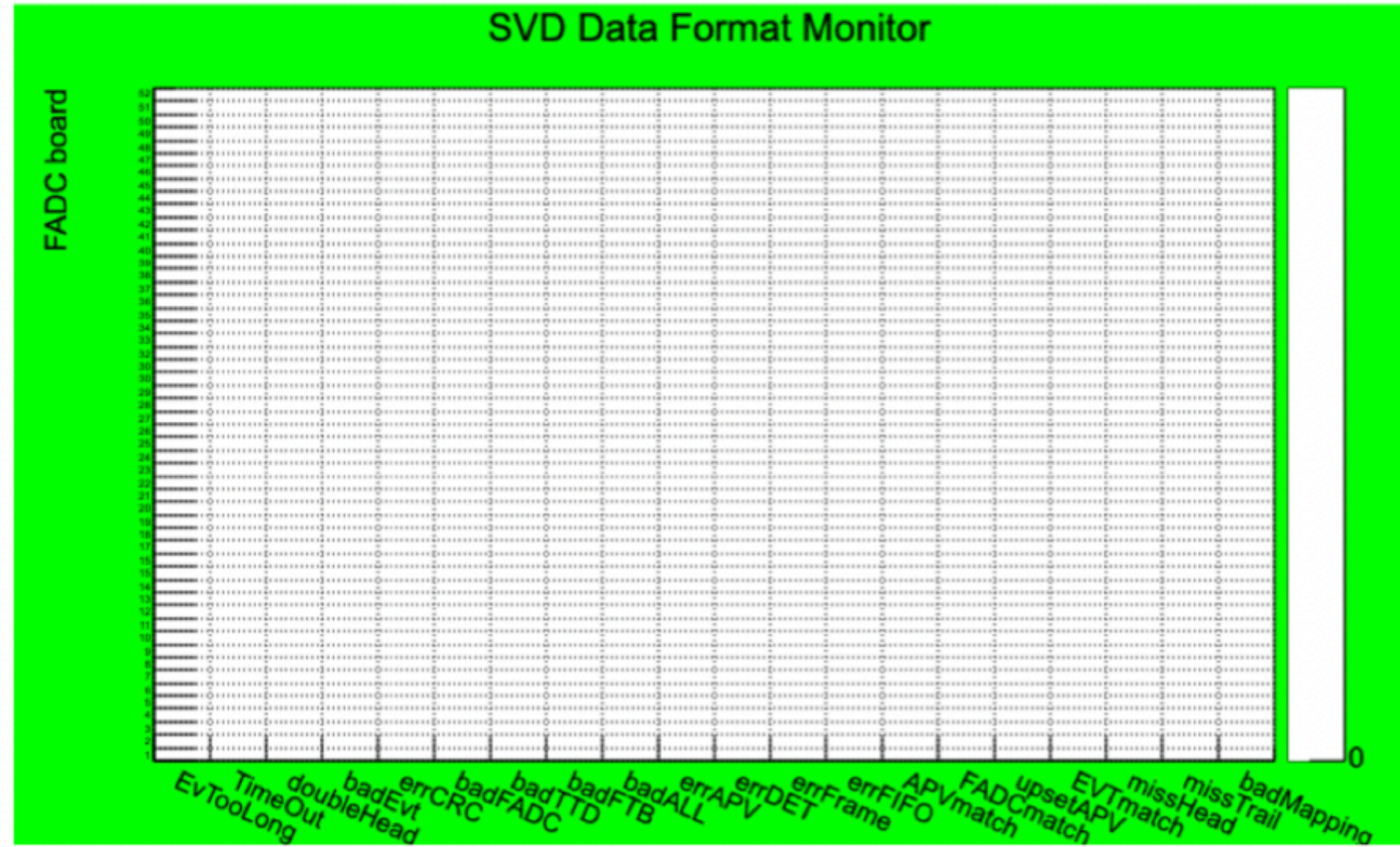
# Data quality check for PCIe40 based SVD readout

- **Cosmic run with PCIe40 based SVD readout**
  - **Date: Jun 29 (solenoid OFF)**
  - **Exp No.: 27, Run No.: 74**
  - **Sub-systems: SVD, CDC, ECL, TRG**
  - **Duration: 5 hours 47 mins. (~3.8 M events)**
  
- **Cosmic run with COPPER based SVD readout (reference)**
  - **Date: Jun 23 (end of 2022b, solenoid OFF)**
  - **Exp No.: 26, Run No.: 2091**
  - **Sub-systems: all included**
  - **Duration: 7 hours 47 mins. (~15 M events)**

# Data quality check for PCIe40 based SVD readout

Unpacker error: PCIe40 readout

Unpacker error: COPPER readout

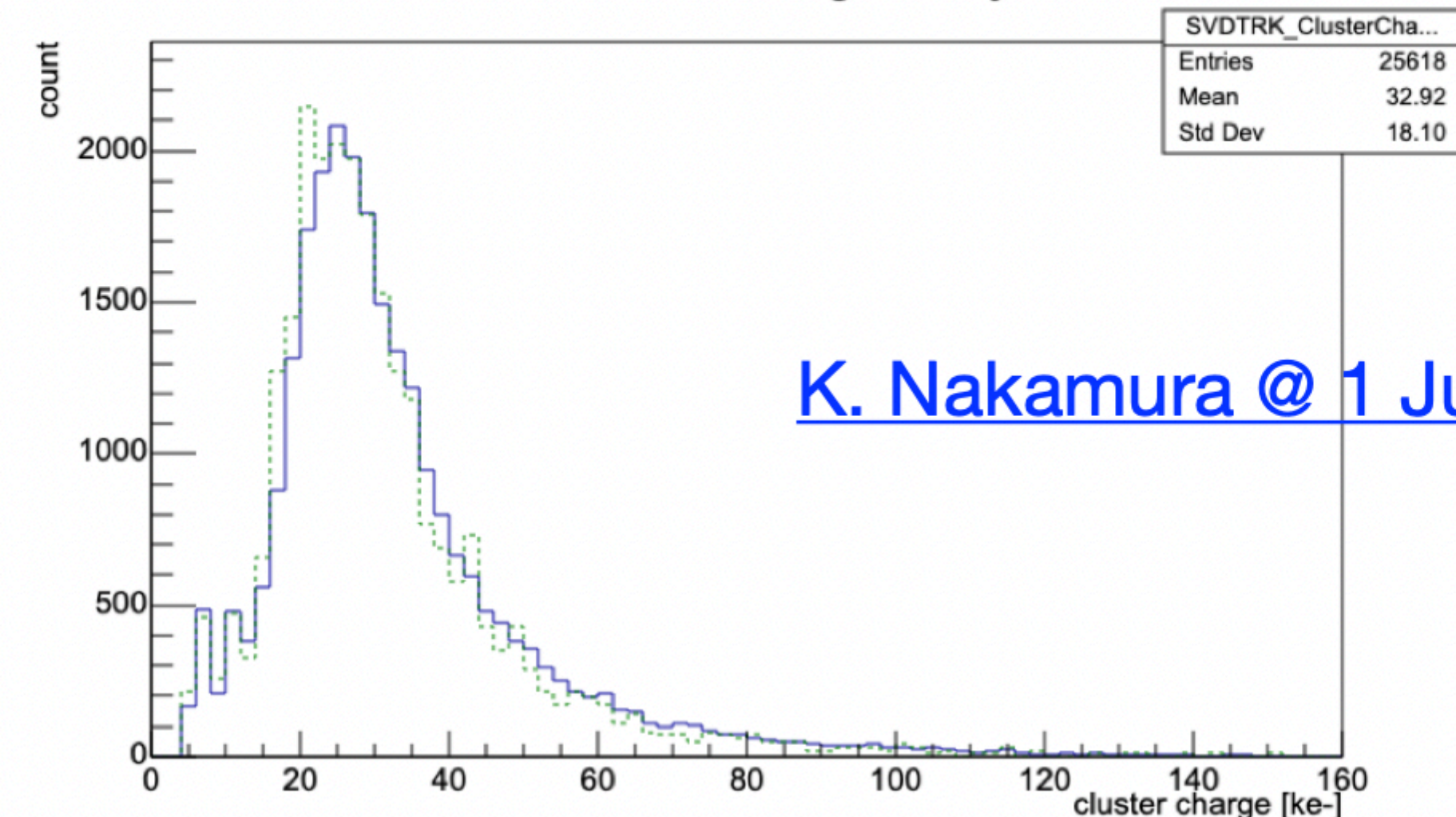
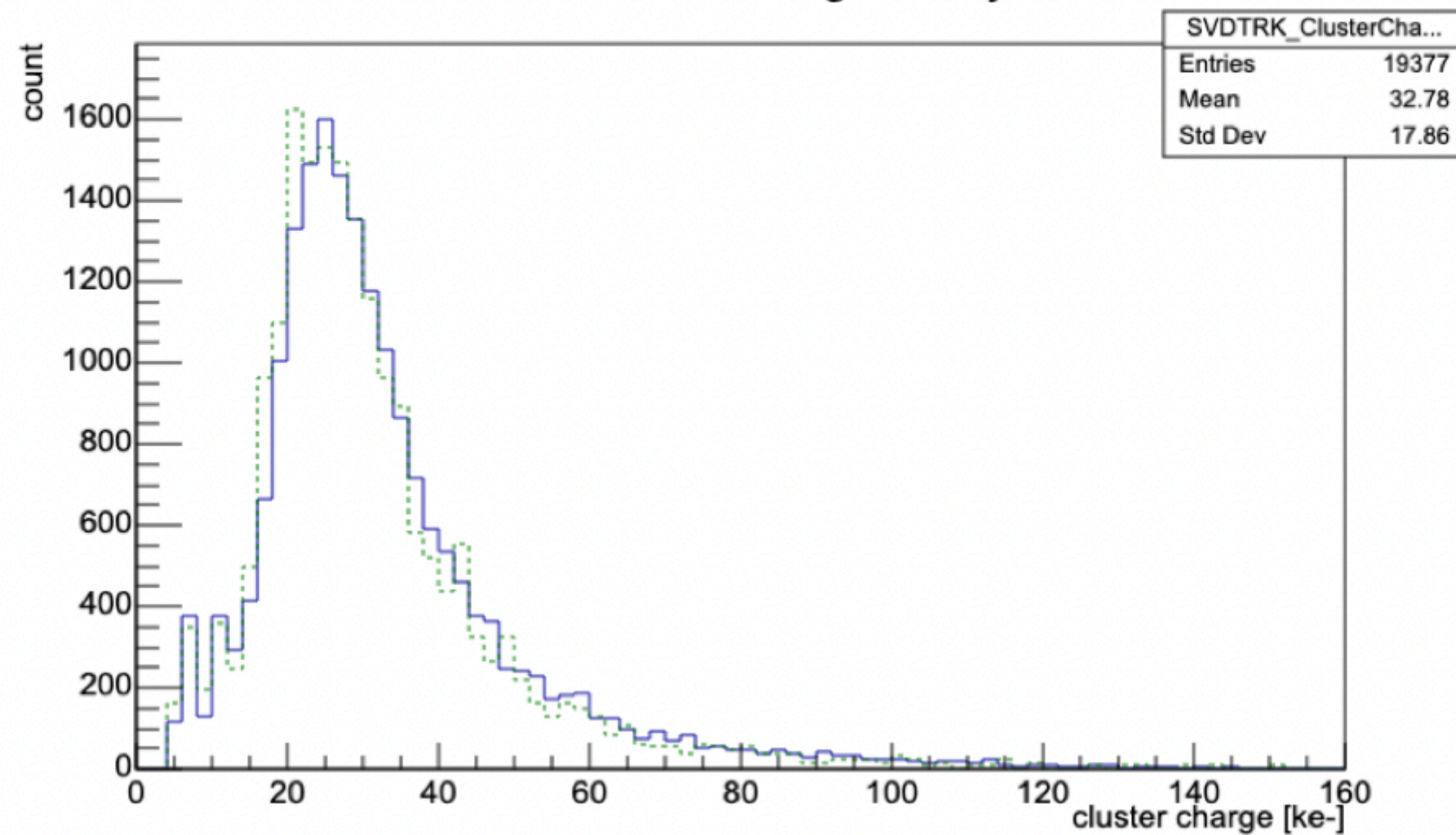


Cluster charge (layer 3): PCIe40 readout

Cluster charge (layer 3): COPPER readout

SVD U-Cluster-on-Track Charge for layer 3 sensors

SVD U-Cluster-on-Track Charge for layer 3 sensors



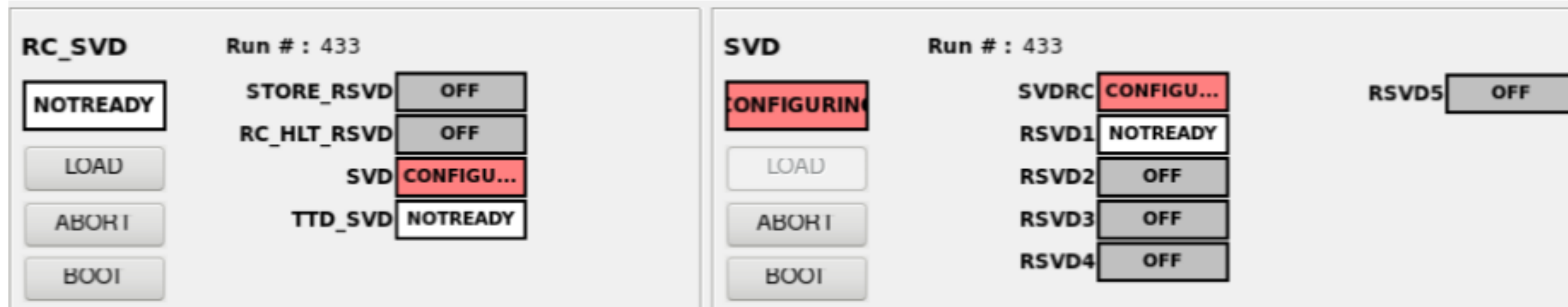
[K. Nakamura @ 1 Jul. 2022](#)



# Prepare high rate test for SVD

- nsmd2 9210 was not running on b2db2
  - restart it by restart script
- nsmd2 9210 running on rc01 (not necessary)
  - stopped by killing it
- pocket ttd\_svd and ttctrld for svd was not running on ttd11
- local HLT for SVD on HLT06 was not running, started by restart script
- store\_svd was not running, started by nsmd2 9210, then storeaged
- nsmd2 on rsvd4 could not be started, lan cable connection issue (reconnected the lan cable by Yamada-san, fixed it)
- SVDRC need to be excluded, when SVD electrics was turned off due to no cooling system
- In order to join global run, SVD need to change their runmode to “rand2”
  - pcie40\_regconfig or  
`[b2svd@rsvd1 daq_slc]$ nsmvset -c pcie40link PCIE40LINK00 svd[0].runmode_s text rand2`

# SVDRC change to CONFIGURING during masking



## svdrc callback.cpp

```
73 void eventCallback(struct event_handler_args eha)
74 {
75     chid chid = eha.chid;
76     if(eha.status != ECA_NORMAL) {
77         printChidInfo(chid, "eventCallback");
78     } else {
79         const std::string pvdata = StringUtil::toupper((const char *)eha.dbr);
80         const char* pvname_c = ca_name(eha.chid);
81         if (pvname_c != NULL) {
82             std::string pvname = StringUtil::replace(pvname_c, ":", ".");
83             //int ival = atoi(pvdata.c_str());
84             LogFile::info("Event Callback: %s = %s", pvname.c_str(), pvdata.c_str());
85             if (pvname == "SVD.CTRL.State") {
86                 if (pvdata == "IDLE") {
87                     g_callback->setState(RCState::NOTREADY_S);
88                     g_callback->set(pvname, "IDLE");
89                 } else if (pvdata == "DOWN") {
90                     g_callback->setState(RCState::NOTREADY_S);
91                     g_callback->set(pvname, "DOWN");
92                 } else if (pvdata == "CONFIGURING") {
93                     g_callback->setState(RCState::LOADING_TS);
94                     g_callback->set(pvname, "CONFIGURING");
```

## RCCommand.cc

```
104 108 RCState RCCommand::nextTState() const
105 109 {
106 110     const RCCommand& cmd(*this);
107 -   if (cmd == CONFIGURE) return RCState::CONFIGURING_TS;
111 +   if (cmd == CONFIGURE || cmd == SETMASK) return RCState::CONFIGURING_TS;
108 112     else if (cmd == LOAD) return RCState::LOADING_TS;
109 113     else if (cmd == START) return RCState::STARTING_TS;
110 114     else if (cmd == STOP) return RCState::STOPPING_TS;
111 115     else if (cmd == RESUME) return RCState::RUNNING_S;
112 116     else if (cmd == PAUSE) return RCState::PAUSED_S;
113 117     else if (cmd == RECOVER) return RCState::RECOVERING_RS;
114 118     else if (cmd == ABORT) return RCState::ABORTING_RS;
115 119     else if (cmd == BOOT) return RCState::BOOTING_RS;
116 120     else return Enum::UNKNOWN;
117 121 }
```

Need a change of "SETMASK" to not used  
"CONFIGURING\_TS"

# Summary and plan

- SVD could running with 30 kHz with PCIe40 based readout in global and local run
  - A stability test with on-side detector
- A cross-point switch gained the flexibility for the commissioning during operation
  - Global run and local run (including data-recording) realized
- Data quality was checked with cosmic run, compared with COPPER readout system
  - No significant difference was found
- To-do:
  - Test the updated RC state slow software to avoid “CONFIGURING” when do masking
  - Implement a functionality botton to change the run-mode for FTB

# Backup

# A local run with GUI

The screenshot displays a GUI for a local run with GUI, organized into several panels:

- RC\_SVD (Run # : 412):** Shows a **RUNNING** status with buttons for STOP, ABOHI, and BOOI. It includes sub-sections for STORE\_RSVD (RUNNING), RC\_HLT\_RSVD (RUNNING), SVD (RUNNING), and TTD\_SVD (RUNNING).
- SVD (Run # : 412):** Shows a **RUNNING** status with buttons for STOP, ABOHI, and BOOI. It includes sub-sections for SVDRC (RUNNING), RSVD1 (RUNNING), RSVD2 (OFF), RSVD3 (OFF), RSVD4 (OFF), and RSVD5 (OFF).
- FTSW #66 (RUNNING):** Shows a **RUNNING** status with buttons for resettt and statft. It includes fields for Trigger type (poisson), Trigger limit (-1), Dummy rate (30000 [Hz]), Max time (35143 [us]), Max trig (12), Run start at (2022-05-19 16:09:30), Run time (112[sec]), Trigger in (30403.1 [Hz]), Trigger out (23276.3 [Hz]), Input count (3413048), and Output count (2670940).
- RC\_HLT\_RSVD (Run # : 412):** Shows a **RUNNING** status with buttons for STOP, ABOHI, and BOOI. It includes sub-sections for HLTIN\_RSVD (RUNNING), HLTOUT\_RSVD (RUNNING), EB1\_RSVD (RUNNING), HLTWK14\_RSVD (RUNNING), HLTWK15\_RSVD (RUNNING), HLTWK16\_RSVD (RUNNING), and DQM\_RSVD (RUNNING).
- STORE\_RSVD (RUNNING):** Shows a **RUNNING** status with buttons for Load & Apply Mask and Save & Apply Mask. It includes fields for Run type (svd), Event rate [kHz] (0), Event size [kB] (0), Event counter (0), Flow rate [MB/s] (0), File size [MB] (0), and # of files (0).
- Terminal Window:** Displays system logs for statft-20210921 FTSW #066 / ft2o093a 2022.02.24-11:04:52 -> 05.19 16:19:05. The logs show the system is **RUNNING** (about 27436.7Hz since 2022.05.19 16:18:25 for 40s) and provide details on trigger parameters, mask settings, and system status.

- Current limitation 10 trigger pre 130 us from SVD FEE fifo
- 30 kHz input -> 27 kHz output same performance with COPPER system

# File name contains same runno for global and local run

- Data was recorded for both global run (physics...) and local run (svd...) on storage 06
  - Both global run and local run created with the runno 661, caused the issue for offline transfer
  - We are using the same SVD FTB data, the expno, runno, from database distributed by TTD system
  - TTD system is basically controlled by global run (COPPER)
  - Even the local run (660) is assigned to “RC\_SVD” and “RSVD1”, the file name is defined by expno, runno.
  - Yamagata-san has made a filedb need to be tested for this issue

```
-rw-r--r-- 1 stordaq daq 7.9G May 25 15:43 svd.0026.00661.HLT6.f00000.sroot
-rw-r--r-- 1 stordaq daq 7.9G May 25 15:48 svd.0026.00661.HLT6.f00001.sroot
-rw-r--r-- 1 stordaq daq 7.9G May 25 15:52 physics.0026.00661.HLT6.f00000.sroot
-rw-r--r-- 1 stordaq daq 7.9G May 25 15:53 svd.0026.00661.HLT6.f00002.sroot
```

# fadc ctrl rerr issue

- “ttaddr -66 -p” shows rerr from fctrl, which is a module of SVD for distributing the clock and trigger

```
6=14700 reg=18100001 18100001 anyerr rerr=0  
0=14701 38100000 rerr=none [fctrl]
```

- Comment from Nakao-san

START request should be sent to TTD\_SVD only after the START request to SVD is completed, but in the current setting, START request is sent to SVD and TTD\_SVD with no delay. This is the incorrect configuration of "sequental" flag in rc\_svd.conf.

```
node[2].name      : SVD  
node[2].used      : bool(true)  
node[2].sequential : bool(false)  
node[2].rcconfig  : RC:test:cosmic  
node[3].name      : TTD_SVD  
node[3].used      : bool(true)  
node[3].sequential : bool(false)  
node[3].rcconfig  : RC:test:cosmic
```



```
node[2].name      : SVD  
node[2].used      : bool(true)  
node[2].sequential : bool(false)  
node[2].rcconfig  : RC:test:cosmic  
node[3].name      : TTD_SVD  
node[3].used      : bool(true)  
node[3].sequential : bool(true)  
node[3].rcconfig  : RC:test:cosmic
```

- After fixing this configuration for “RC\_SVD”, to start TTD\_SVD sequentially, rerr issue of fctrl has be fixed

# Unpacker error for FADC51

- SVDUnpacker for FADC=51 has been found during the global run test
  - This issue need to be fixed by SVD expert
  - The data recorded by global run and local run may also be used for data quality check, need SVD expert to analysis the data

```
Event number = 401333
FADC = 51 { module: SVDUnpacker }
[2022-05-20 12:29:52] [ERROR] basf2 : (7076) Missing FTB Header is detected. SVD data might be
corrupted!
Event number = 401445
FADC = 51 { module: SVDUnpacker }
[2022-05-20 12:29:52] [ERROR] basf2 : (7076) Missing FTB Trailer is detected. SVD data might be
corrupted!
Event number = 401445
FADC = 51 { module: SVDUnpacker }
[2022-05-20 12:29:52] [ERROR] basf2 : (7040) Missing FTB Header is detected. SVD data might be
corrupted!
Event number = 401417
FADC = 51 { module: SVDUnpacker }
[2022-05-20 12:29:52] [ERROR] basf2 : (7040) Missing FTB Trailer is detected. SVD data might be
corrupted!
Event number = 401417
FADC = 51 { module: SVDUnpacker }
```