

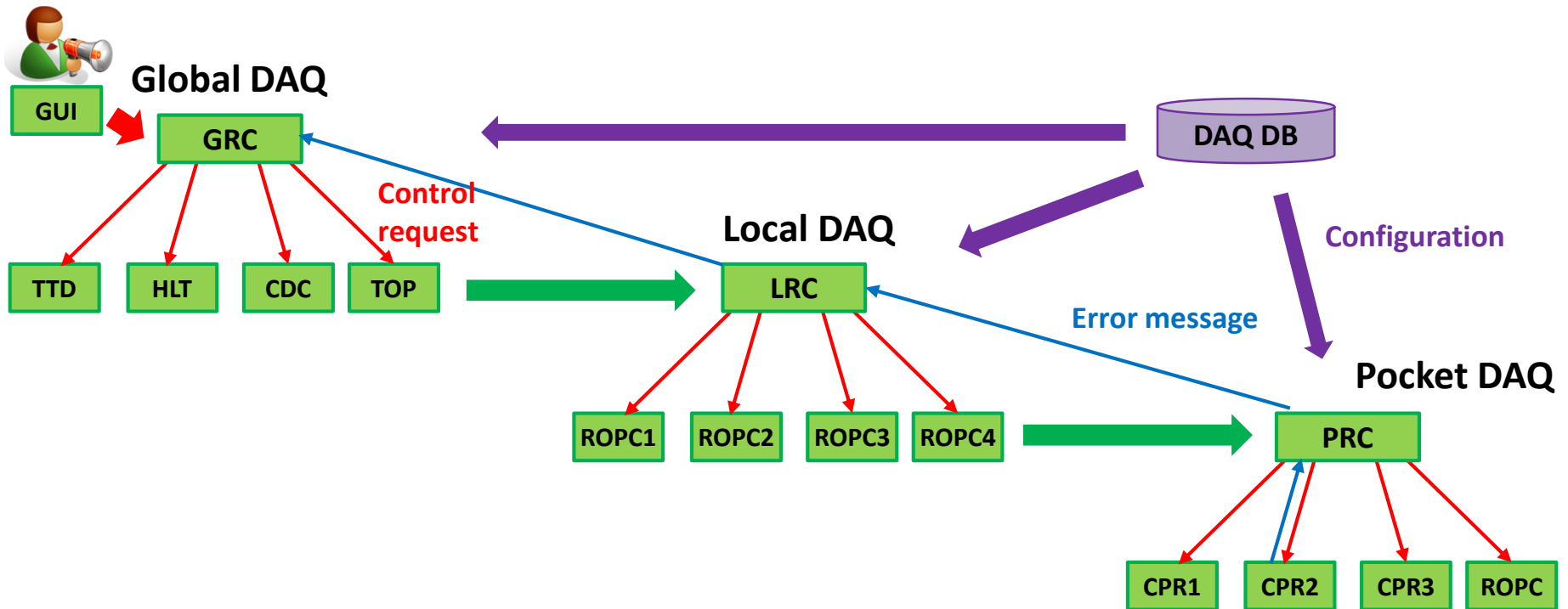
Run control

Tomoyuki Konno

TRG/DAQ workshop

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DAQ Run control



Three layers of nested run controls

- **Global DAQ** : Full system of the Belle II DAQ for physics run
- Local DAQ : Detector local DAQ setup for calibration or test
- Pocket DAQ : COPPER and RO PC for HSLB readout

=> Each layer of run control is controllable from GUI (by detector experts)

Running Run controls

Three run control systems

- **Global run control with Belle II detector**
 - Data taking shift for global cosmic ray test (GCRT)
 - Running with CDC, TOP, ECL, KLM and TRG
 - Detector local run controls for CDC, TOP, ECL
 - => Basically running stably during the GCRT
- ARICH run control at B4 => covered yesterday
 - Pocket DAQ and now extending to global DAQ
 - Good experience and debug info. to run control too
- VXD-DAQ combined run control at DESY (so-called PERSY)
 - Set up with a copy of the Belle II DAQ system for VXD

Global run control GUI

ControlMain.opi

RC Command

STOP

ABORT

Run status

Run start : 16:32:56 20/08/2017

Exp # :

Run # :

RUNNING

RUNNING

RUNNING

Trigger / Data status

	Trig. in	Trig. out	Record
#events:	20771	18124	17713
Rate [Hz]:	77.0	67.5	75.0
Flow [MB/s]:			9.29

Detector list

	RC state	Network
<input checked="" type="checkbox"/> CDC	RUNNING	RUNNING
<input checked="" type="checkbox"/> ECL	RUNNING	RUNNING
<input checked="" type="checkbox"/> TOP	RUNNING	RUNNING
<input type="checkbox"/> KLM	OFF	OFF
<input checked="" type="checkbox"/> TRG	RUNNING	RUNNING

FEE Status #184

link	mask	busy	feee	ttlost	ttltn	b2lost	b2ltn	tage	fifoe	seu

Readout PC status

Host	Network	Recieved	Rate [MB/s]	Queue [kB]	Host	Network	Recieved	Rate [MB/s]	Queue [kB]
<input checked="" type="checkbox"/> cdc01	RUNNING	40 MB	0.17	33.2	<input checked="" type="checkbox"/> ecl06	RUNNING	18 MB	0.08	0.0
<input checked="" type="checkbox"/> cdc03	RUNNING	37 MB	0.16	0.0	<input checked="" type="checkbox"/> ecl07	RUNNING	26 MB	0.12	21.8
<input checked="" type="checkbox"/> cdc04	RUNNING	42 MB	0.18	0.0	<input checked="" type="checkbox"/> ecl08	RUNNING	21 MB	0.09	0.0
<input checked="" type="checkbox"/> cdc06	RUNNING	38 MB	0.16	0.0	<input checked="" type="checkbox"/> ecl09	RUNNING	21 MB	0.09	0.0
<input checked="" type="checkbox"/> cdc07	RUNNING	40 MB	0.17	0.0	<input checked="" type="checkbox"/> ecl10	RUNNING	43 MB	0.19	32.2
<input checked="" type="checkbox"/> cdc09	RUNNING	39 MB	0.17	31.9	<input checked="" type="checkbox"/> top01	RUNNING	342 MB	1.42	0.0
<input checked="" type="checkbox"/> ecl01	RUNNING	18 MB	0.08	14.7	<input checked="" type="checkbox"/> top02	RUNNING	268 MB	1.15	170.5
<input checked="" type="checkbox"/> ecl02	RUNNING	18 MB	0.08	14.8	<input checked="" type="checkbox"/> top03	RUNNING	339 MB	1.48	0.0
<input checked="" type="checkbox"/> ecl03	RUNNING	26 MB	0.12	21.9	<input type="checkbox"/> klm01	OFF	0.0	0.00	0.0
<input checked="" type="checkbox"/> ecl04	RUNNING	26 MB	0.12	0.0	<input type="checkbox"/> klm02	OFF	0.0	0.00	0.0
<input checked="" type="checkbox"/> ecl05	RUNNING	26 MB	0.12	0.0	<input checked="" type="checkbox"/> trq01	RUNNING	384 MB	1.66	27.7

Operational with CDC, TOP, ECL, KLM and TRG

Global run control GUI

ControlMain.opi

RC Command

STOP

ABORT

Run setting

Run type : cosmic

Trig type : aux

Dummy rate : -1

resetft statft

Run status Run start : 16:21:52.200972007

Exp # : 1

Run # : 3912

Run control
RUNNING

Trigger ctl.
RUNNING

Data flow
RUNNING

Detector list

	RC state	Network
<input checked="" type="checkbox"/> CDC	RUNNING	RUNNING
<input checked="" type="checkbox"/> ECL	RUNNING	RUNNING
<input checked="" type="checkbox"/> TOP	RUNNING	RUNNING
<input type="checkbox"/> KLM	OFF	OFF
<input checked="" type="checkbox"/> TRG	RUNNING	RUNNING

FEE Status #184

link	mask	busy	feee	ttlost	ttl1dn	b2lost	b2l1dn	tage	fifoe	seu
■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■	■

Trigger / Data status

	Trig. in	Trig. out	Record
#events :	20771	18124	17713
Rate [Hz] :	77.0	67.5	75.0
Flow [MB/s] :			9.29

Readout PC status

Host	Network	Recieved	Rate [MB/s]	Queue [kB]	Host	Network	Recieved	Rate [MB/s]	Queue [kB]
<input checked="" type="checkbox"/> cdc01	RUNNING	40 MB	0.17	33.2	<input checked="" type="checkbox"/> ecl06	RUNNING	18 MB	0.08	0.0
<input checked="" type="checkbox"/> cdc03	RUNNING	37 MB	0.16	0.0	<input checked="" type="checkbox"/> ecl07	RUNNING	26 MB	0.12	21.8
<input checked="" type="checkbox"/> cdc04	RUNNING	42 MB	0.18	0.0	<input checked="" type="checkbox"/> ecl08	RUNNING	21 MB	0.09	0.0
<input checked="" type="checkbox"/> cdc06	RUNNING	38 MB	0.16	0.0	<input checked="" type="checkbox"/> ecl09	RUNNING	21 MB	0.09	0.0
<input checked="" type="checkbox"/> cdc07	RUNNING	40 MB	0.17	0.0	<input checked="" type="checkbox"/> ecl10	RUNNING	43 MB	0.19	32.2
<input checked="" type="checkbox"/> cdc09	RUNNING	39 MB	0.17	31.9	<input checked="" type="checkbox"/> top01	RUNNING	342 MB	1.42	0.0
<input checked="" type="checkbox"/> ecl01	RUNNING	18 MB	0.08	14.7	<input checked="" type="checkbox"/> top02	RUNNING	268 MB	1.15	170.5
<input checked="" type="checkbox"/> ecl02	RUNNING	18 MB	0.08	14.8	<input checked="" type="checkbox"/> top03	RUNNING	339 MB	1.48	0.0
<input checked="" type="checkbox"/> ecl03	RUNNING	26 MB	0.12	21.9	<input type="checkbox"/> klm01	OFF	0.0	0.00	0.0
<input checked="" type="checkbox"/> ecl04	RUNNING	26 MB	0.12	0.0	<input type="checkbox"/> klm02	OFF	0.0	0.00	0.0
<input checked="" type="checkbox"/> ecl05	RUNNING	26 MB	0.12	0.0	<input checked="" type="checkbox"/> trq01	RUNNING	384 MB	1.66	27.7

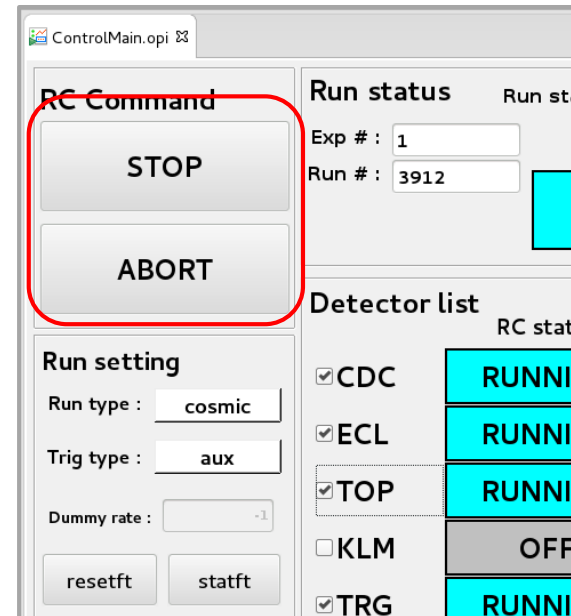
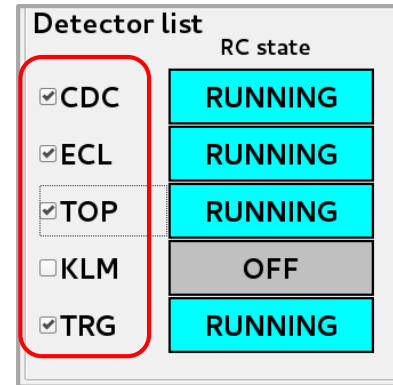
Status label is simplified

Enabling/Disabling detectors is in checkboxes

Register ramps is meaningless since FTSW firmware update

How to operate global DAQ

- Open GUI on shift PC (or VNC screen)
 1. Include/exclude detectors
 - Checkbox in the detector list
 2. Select run type:
 - cosmic : normal data taking
 - test : test data taking
 3. Push buttons to start/stop DAQ
 - LOAD : configure to be READY
 - START : start triggers to be RUNNING
 - STOP : stop trigger to be READY
 - ABORT : discards to be NOTREADY
 4. Check data flow status and logs
 - Sound or alarm is not prepared yet

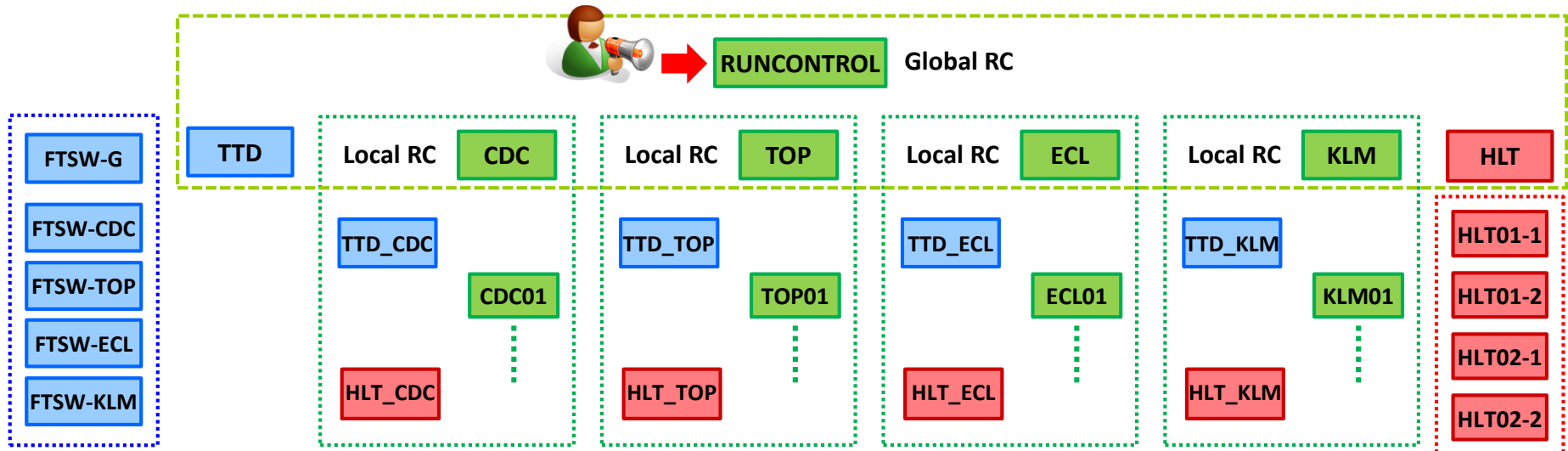


Global GUI (details)

The screenshot displays the Run control GUI with the following sections:

- RunCONTROL Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for STORAGE, RC_HLT, CDC, and ECL.
- RC_HLT Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for EB1, HLT, and TRG.
- CDC Run #: 3886 CDC@RC:cosmic.r...**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for CDC01-09.
- ECL Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for ECL01-10.
- STORAGE RUNNING**: Shows run type (cosmic), event rate (0 Hz), and file size (0 MB).
- FTSW #184 ERROR**: Shows trigger type (aux), run time (194 sec), and max time (10000 Hz).
- FEEL Status #184**: Shows a grid of status indicators for various channels.
- TOP Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for TOP01-03.
- KLM Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for KLM01-02.
- TRG Run #: 3886**: Includes buttons for RUNNING, STOP, ABORT, and BOOT, and status for TRG01.
- Hostname Status BytesRate [MB/s] HSLB-a HSLB-b HSLB-c HSLB-d**: Three tables listing the status and data rates for various channels (cdc, cpr, ecl, klm, top, cpr).

Local run controls



- Local run control contains three major parts
 - Detector R/O control common with Global Run control
 - COPPERs and readout PCs are under control of local masters
 - TTD control manages the master FTSW(#184)
 - Detector FTSWs are under control of the master FTSW
 - FTSW for TRG is not
 - Local (virtual) units of HLT /storage

Local run control GUI (in global run)

TOP-RC

Run control

RC_ECL Run #: 3906

NOTREADY TORE_ECL NOTREADY
 JHLT_ECL NOTREADY
 ECL RUNNING
 TTD_ECL NOTREADY

LOAD
 ABORT
 BOOT

FTSW #64 READY resetf stafff

Trigger type aux Run start at 2017-08-20 16:32:56
 Trigger limit -1 Run time 267[sec]
 Dummy rate -1 Trigger in 82.5 [Hz]
 Max time 351 [us] Trigger out 71.2 [Hz]
 Max trig 12 [us] Input count 22613
 Output count 19733

STORE_ECL NOTREADY

Run type ecl eb2rx input

Event rate [Hz] Event size [kB] 0
 Event counter 0
 Flow rate [MB/s] File size [MB] 0
 # of files 0

ECL Run #: 3912 ECL@RC.cosmic2...

RUNNING STOP
 RUNNING ABORT
 RUNNING BOOT

Hostname	Status	BytesRate [MB/s]
ec101	RUNNING	19818408 0.07
ec102	RUNNING	19981656 0.07
ec103	RUNNING	29527972 0.10
ec104	RUNNING	29379708 0.10
ec105	RUNNING	29425300 0.10
ec106	RUNNING	19850748 0.06
ec107	RUNNING	29424576 0.10
ec108	RUNNING	24259636 0.08
ec109	RUNNING	23887912 0.08
ec110	RUNNING	49382472 0.17

Hostname	RC state	Network	Bytes	Rate [MB/s]	HSLB-a	HSLB-b
✓ cpr5001	RUNNING	RUNNING	12459068	0.04	19737 #####	✓
✓ cpr5002	RUNNING	RUNNING	12459312	0.04	19737 #####	✓
✓ cpr5003	RUNNING	RUNNING	12523232	0.04	19737 #####	✓
✓ cpr5004	RUNNING	RUNNING	12443120	0.04	19737 #####	✓
✓ cpr5005	RUNNING	RUNNING	12458608	0.04	19737 #####	✓
✓ cpr5006	RUNNING	RUNNING	12466380	0.04	19737 #####	✓
✓ cpr5007	RUNNING	RUNNING	12439020	0.04	19737 #####	✓
✓ cpr5008	RUNNING	RUNNING	12417568	0.04	19737 #####	✓
✓ cpr5009	RUNNING	RUNNING	12399172	0.04	19737 #####	✓
✓ cpr5010	RUNNING	RUNNING	12399452	0.04	19737 #####	✓
✓ cpr5011	RUNNING	RUNNING	12440976	0.04	19737 #####	✓
✓ cpr5012	RUNNING	RUNNING	12450132	0.04	19737 #####	✓
✓ cpr5013	RUNNING	RUNNING	12454192	0.04	19737 #####	✓
✓ cpr5014	RUNNING	RUNNING	12309540	0.04	19737 #####	✓
✓ cpr5015	RUNNING	RUNNING	12312252	0.04	19737 #####	✓
✓ cpr5016	RUNNING	RUNNING	12453752	0.04	19737 #####	✓
✓ cpr5017	RUNNING	RUNNING	12454736	0.04	19737 #####	✓
✓ cpr5018	RUNNING	RUNNING	12436088	0.04	19737 #####	✓
✓ cpr6001	RUNNING	RUNNING	10785992	0.04	19737 #####	✓
✓ cpr6002	RUNNING	RUNNING	10701112	0.04	19737 #####	✓
✓ cpr6003	RUNNING	RUNNING	10620272	0.04	19737 #####	✓
✓ cpr6004	RUNNING	RUNNING	10651756	0.03	19737 #####	✓
✓ cpr6005	RUNNING	RUNNING	10611760	0.03	19737 #####	✓
✓ cpr6006	RUNNING	RUNNING	10615672	0.03	19737 #####	✓
✓ cpr6007	RUNNING	RUNNING	10696188	0.04	19737 #####	✓
✓ cpr6008	RUNNING	RUNNING	10752760	0.04	19737 #####	✓
✓ cpr1300	RUNNING	RUNNING	35429220	0.12	19450 #####	✓

CDC-RC

Run control

RC_CDC Run #: 3906 CDC@RC.cosmic...

NOTREADY TORE_CDC NOTREADY
 JHLT_CDC NOTREADY
 CDC RUNNING
 TTD_CDC NOTREADY

LOAD
 ABORT
 BOOT

FTSW #200 RUNNING resetf stafff

Trigger type aux Run start at 2017-08-20 16:32:56
 Trigger limit -1 Run time 261[sec]
 Dummy rate -1 Trigger in 1.0 [Hz]
 Max time 26 [Hz] Trigger out 72.2 [Hz]
 Max trig 5 [us] Input count 261
 Output count 19251

STORE_CDC NOTREADY

Run type cdc eb2rx input

Event rate [Hz] Event size [kB] 0
 Event counter 0
 Flow rate [MB/s] File size [MB] 0
 # of files 0

CDC Run #: 3912

RUNNING STOP
 RUNNING ABORT
 RUNNING BOOT

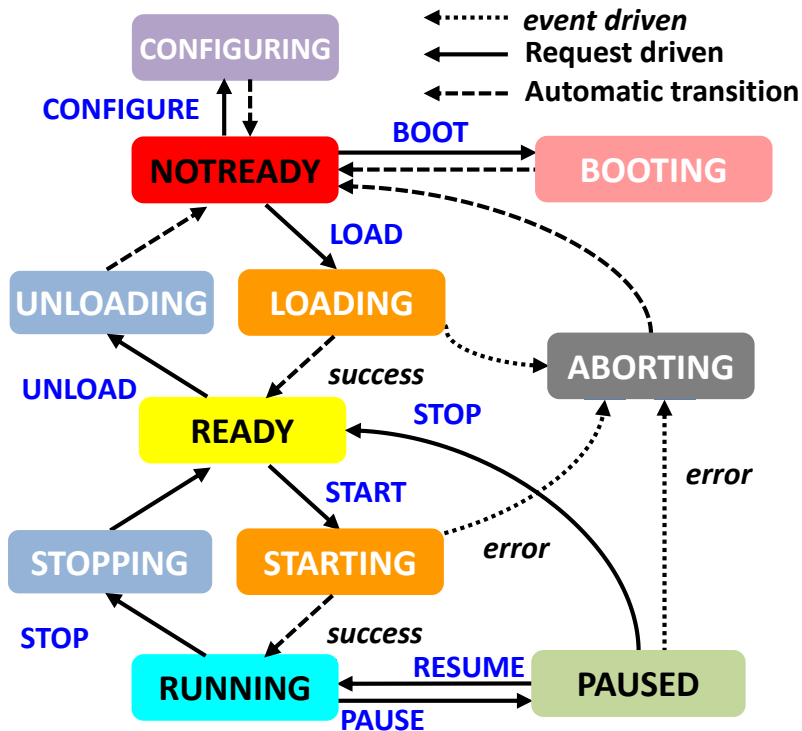
Hostname	Status	BytesRate [MB/s]
✓ cdc01	RUNNING	43194112 0.15
✓ cdc03	RUNNING	40619388 0.14
✓ cdc04	RUNNING	41038736 0.14
✓ cdc06	RUNNING	43615124 0.15
✓ cdc09	RUNNING	42920412 0.15

Hostname	RC state	Network	Bytes	Rate [MB/s]	HSLB-a	HSLB-b	HSLB-c	HSLB-d
✓ cdc01-04	RUNNING	RUNNING	6975740	0.03	18669 #####	18927 #####	19176 #####	18229 #####
✓ cpr2001	RUNNING	RUNNING	7130936	0.03	18669 #####	18927 #####	19176 #####	18229 #####
✓ cpr2002	RUNNING	RUNNING	6907484	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2003	RUNNING	RUNNING	6769736	0.02	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2004	RUNNING	RUNNING	6764972	0.02	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2005	RUNNING	RUNNING	6764972	0.02	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2006	RUNNING	RUNNING	6820724	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2007	RUNNING	RUNNING	6830996	0.02	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2008	RUNNING	RUNNING	6893612	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2009	RUNNING	RUNNING	6990748	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2010	RUNNING	RUNNING	6909868	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2011	RUNNING	RUNNING	6863700	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2012	RUNNING	RUNNING	6989916	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2013	RUNNING	RUNNING	6759952	0.03	18669 #####	18927 #####	19177 #####	18229 #####
✓ cpr2014	RUNNING	RUNNING	6077440	0.02	19255 #####	18628 #####	18892 #####	0 #####
✓ cpr2015	RUNNING	RUNNING	7401360	0.03	18962 #####	19210 #####	18270 #####	18558 #####
✓ cpr2016	RUNNING	RUNNING	7206620	0.03	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2017	RUNNING	RUNNING	6874940	0.02	18962 #####	19210 #####	18269 #####	18558 #####
✓ cpr2018	RUNNING	RUNNING	6899684	0.02	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2019	RUNNING	RUNNING	7142572	0.03	18962 #####	19210 #####	18270 #####	18558 #####
✓ cpr2020	RUNNING	RUNNING	6960216	0.03	18962 #####	19210 #####	18269 #####	18558 #####
✓ cpr2021	RUNNING	RUNNING	7215392	0.03	18962 #####	19211 #####	18270 #####	18558 #####
✓ cpr2022	RUNNING	RUNNING	7185588	0.03	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2023	RUNNING	RUNNING	6907336	0.02	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2024	RUNNING	RUNNING	6903680	0.02	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2025	RUNNING	RUNNING	7091168	0.03	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2026	RUNNING	RUNNING	7117588	0.03	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2027	RUNNING	RUNNING	7018276	0.02	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2028	RUNNING	RUNNING	7427684	0.03	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2029	RUNNING	RUNNING	7515028	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2030	RUNNING	RUNNING	7323672	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2031	RUNNING	RUNNING	7309648	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2032	RUNNING	RUNNING	7239412	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2033	RUNNING	RUNNING	7350416	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2034	RUNNING	RUNNING	7180352	0.03	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2035	RUNNING	RUNNING	7113100	0.03	19255 #####	18313 #####	18592 #####	18854 #####
✓ cpr2036	RUNNING	RUNNING	6932960	0.02	19255 #####	18313 #####	18592 #####	18853 #####
✓ cpr2037	RUNNING	RUNNING	6951812	0.02	18962 #####	19209 #####	18269 #####	18558 #####
✓ cpr2038	RUNNING	RUNNING	7035236	0.02	18962 #####	19209 #####	18269 #####	18558 #####

Run control state diagram

Run control state diagram

List of run control requests



- CONFIGURE** : Load new config. from DB
- BOOT** : (Re)initialize the system
- LOAD** : Loads parameters
- UNLOAD** : Unload parameters
- START** : Start triggers
- STOP** : Stop triggers
- ABORT** : Discards configuration

Difference between BOOT and LOAD

- BOOT : called manually when needed
- LOAD : called every time run start

Three functions : CONFIGURE/BOOT/LOAD should be implemented

- CONFIGURE : switch config to load from DB (otherwise no change from default)
- BOOT : initialization taking long time but no need before every run start
- LOAD : parameter loading called at ever run start

R/O control integration to detectors

- CDC (Nanae): Running for long term as local/global run control
 - CONFIGURE : 2 data modes for suppressed (cosmic) / raw (pedestal)
 - LOADING : loading parameters e.g. pedestals
 - Monitor : FEE temperatures
- ECL (Pavel): Collector is configured but Shaper not yet
 - CONFIGURE : different timings for global and local run
 - BOOT : first initialization of Shaper DSP => Moving into Belle2Link but not yet
 - LOAD : loading parameters such as trigger timings into Collector
- TOP (Tobias->Maeda) : nicely worked but unusable due to too long initialization time
 - BOOT : full FEE initialization, taking long time since it takes pedestals
 - FEE status including LV, current, temperatures
- KLM (Isar): Configuration scripts converted into C++ codes by T.K.
 - LOAD : loading parameters, as a copy from configuration scripts
- ARICH (Konno): Running in the test setup (outside of Belle II)
 - BOOT : programming Frontend FPGA via Merger
 - LOAD : loading parameters Frontend FPGA and ASICs such as threshold values
- TRG (Nakazawa): Interface for trigger condition control is under preparation

Issues in run control

- FTSW register readout does not work correctly
 - Status registers (b2lost,b2ldown,ttlost etc)
 - Operation mode : Local/Global
 - Masks status of FEE ports
 - => I'm now hacking Nakao-san' code and rewriting into slow control
- Synchronization of run control status takes sometime time
 - Time consumption in LOAD/ABORT is still acceptable
 - => Thanks to small number of nodes
 - => Optimization of state synchronization is ongoing...
- Disabling local run during global run and the opposite are not implemented
 - Local run control can start during global run, causing DAQ crash
- System goes down with NSM2 crashes

NSM2 troubles

NSM2 network is now unstable and nsmd2 easily goes died

- nsmd2 kills all connected process when it goes die
- Once NSM2 gets problematic, all nsmd2 must be killed

=> nsmd2 in some hosts goes died in 1-2 days

=> Full restart of slow control takes about 1 hour

Possible reasons of the instabilities

- nsmd2 master was launched at ttd1 (VME CPU) which has small memory

=> Easily move the master to other machine (rc01 for example)

- **Too many NSM2 requests are sent**

– One Set/get request can handle with only one variables

=> $O(100)$ requests might be transferred

=> **Reduction of # requests looks essential**

Summary

- Global cosmic run is in operation with run control GUI
 - Status from FTSW is difficult to monitor on the panel yet
 - Local run control is also running for each subdetector
- Run control integration into outer detectors are still on going
 - CDC is running with two data modes for cosmic and pedestal
 - ECL collector is configured via Belle2Link but shaper is still not yet
 - TOP FEE control is implemented and taken over to Maeda-san
 - KLM is also configured via Belle2Link by slow control
 - ARICH Merger and Frontend are configure by slow control
 - => Several functions to monitor FEE status are also implemented
- Missing items for run configuration
 - Trigger condition and status are unreachable
 - FTSW control on GUI is not enough and CLTs are needed
- Serious issues in NSM2 (maybe) due to too much NSM2 requests