

Björn Spruck for Mainz Group

KPH, University Mainz

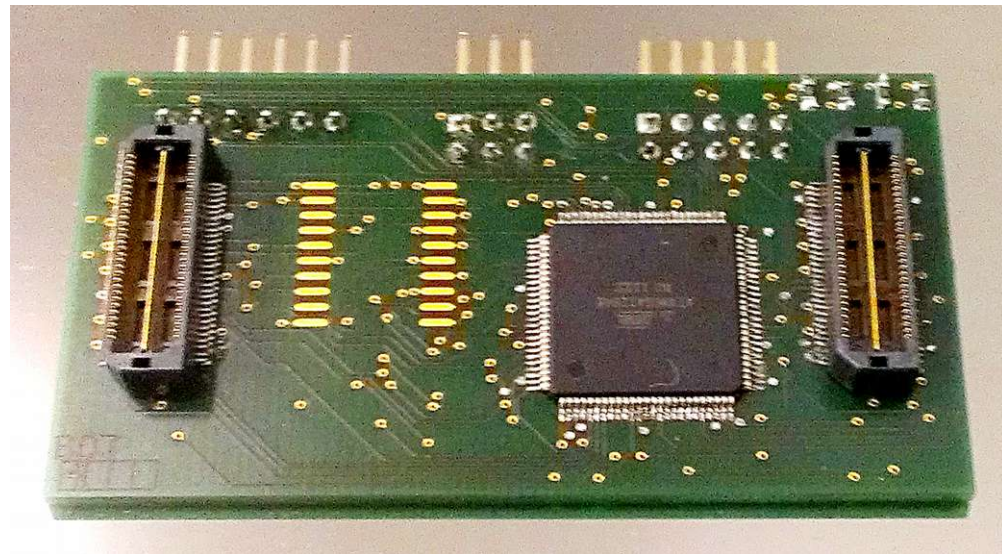
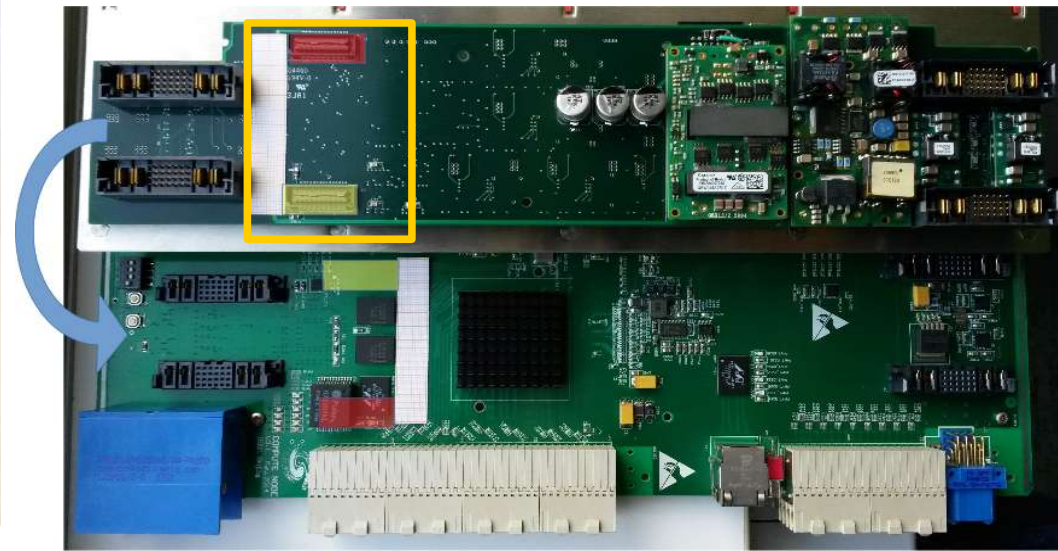
VXD Workshop, Valencia, 14.01.2016

Topics:

- IPMI Hardware, Firmware and Test Results
- Updates on CSS OPI and Run Control (Tests)

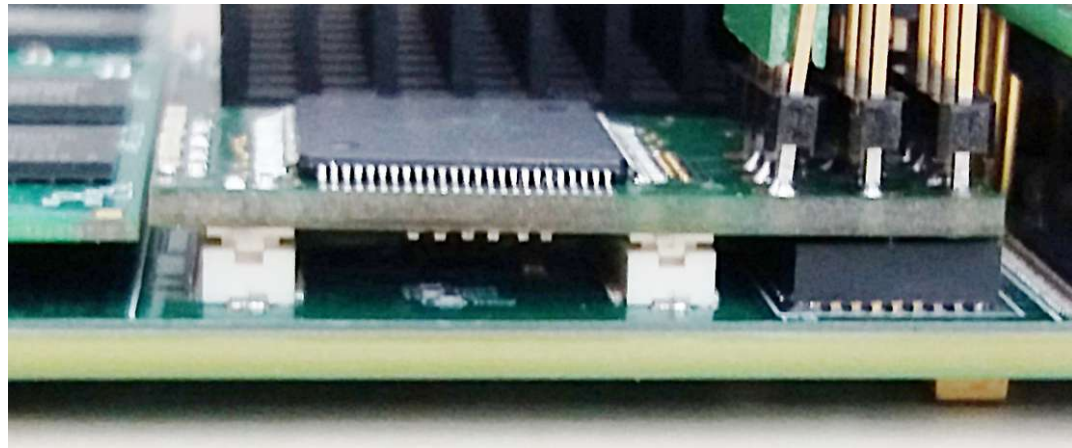
- Common tool for **monitoring** hardware in ATCA and MTCA
- The shelf controller talk with all FRUs (field replaceable units) in the shelf, shelf, power supply, fan trays, ... and all the boards.
- Hot swap, power negotiation, monitoring, **alarms**, ...
- ONSSEN requires **two** IPMI controller as add-on boards:
 - Carrier board → **IPMC**
 - AMC → **MMC**
 - Chosen MCU: atxmega 128
- IPMI → EPICS: ipmitoolIOC (M. Ritzert)
 - based on ipmitool
- Need to follow the PICMG standards more closely → monitoring and alarms will not work correctly otherwise

IPMC plugs between Carrier and PSU board.

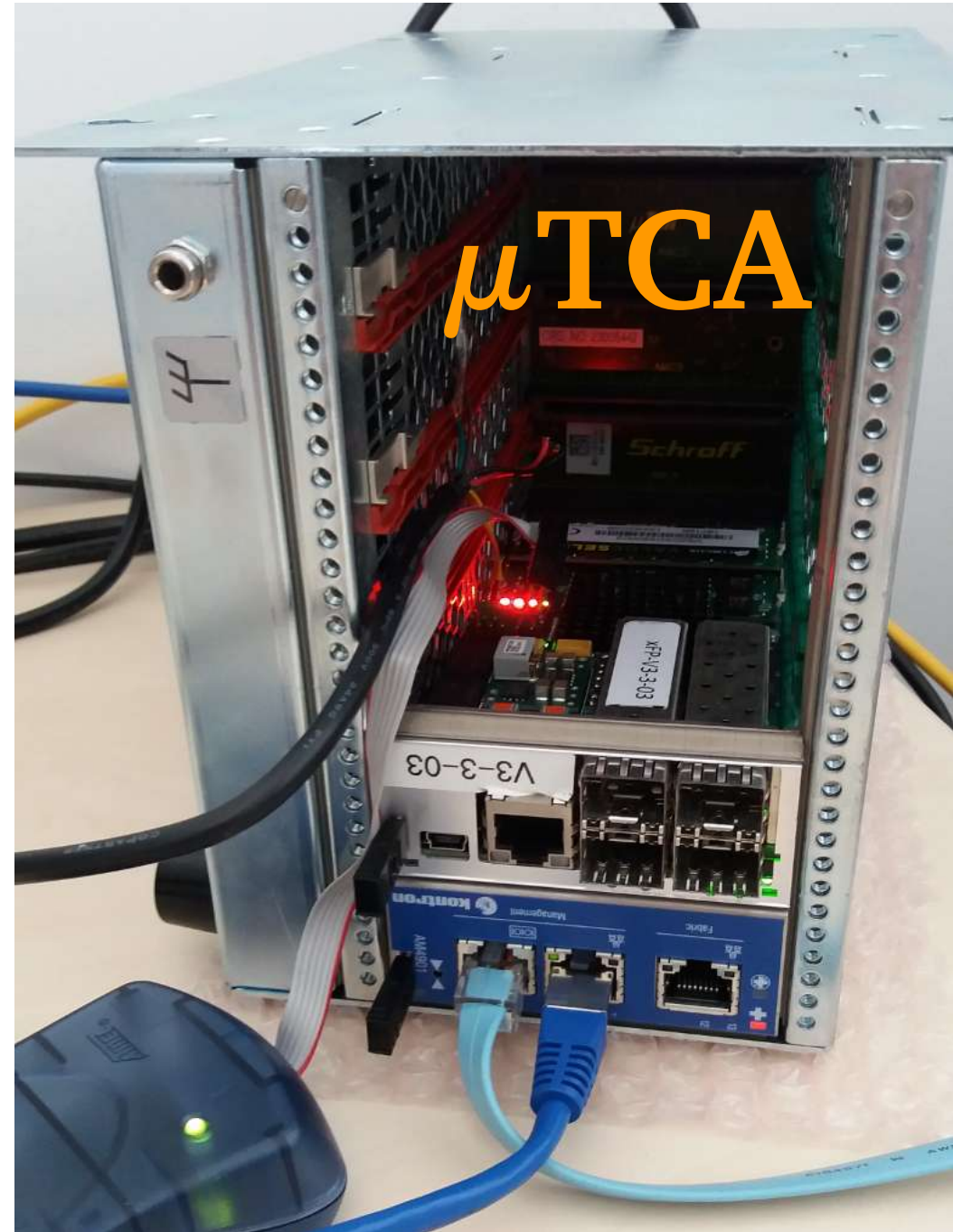


Original PCB design Th. Gessler

- Testsystem (@ Gießen):
 - Carrier V3.x (x=0,1,2,3,4)
 - PSU V1.2 & V1.3
 - ATCA Shelf (Schroff)
 - Pigeon Point Systems ShMM-500
 - AMC V3.x & V4



- μ TCA Shelf (Schroff)
- MCH: Kontron AM4901
- AMC V3.x

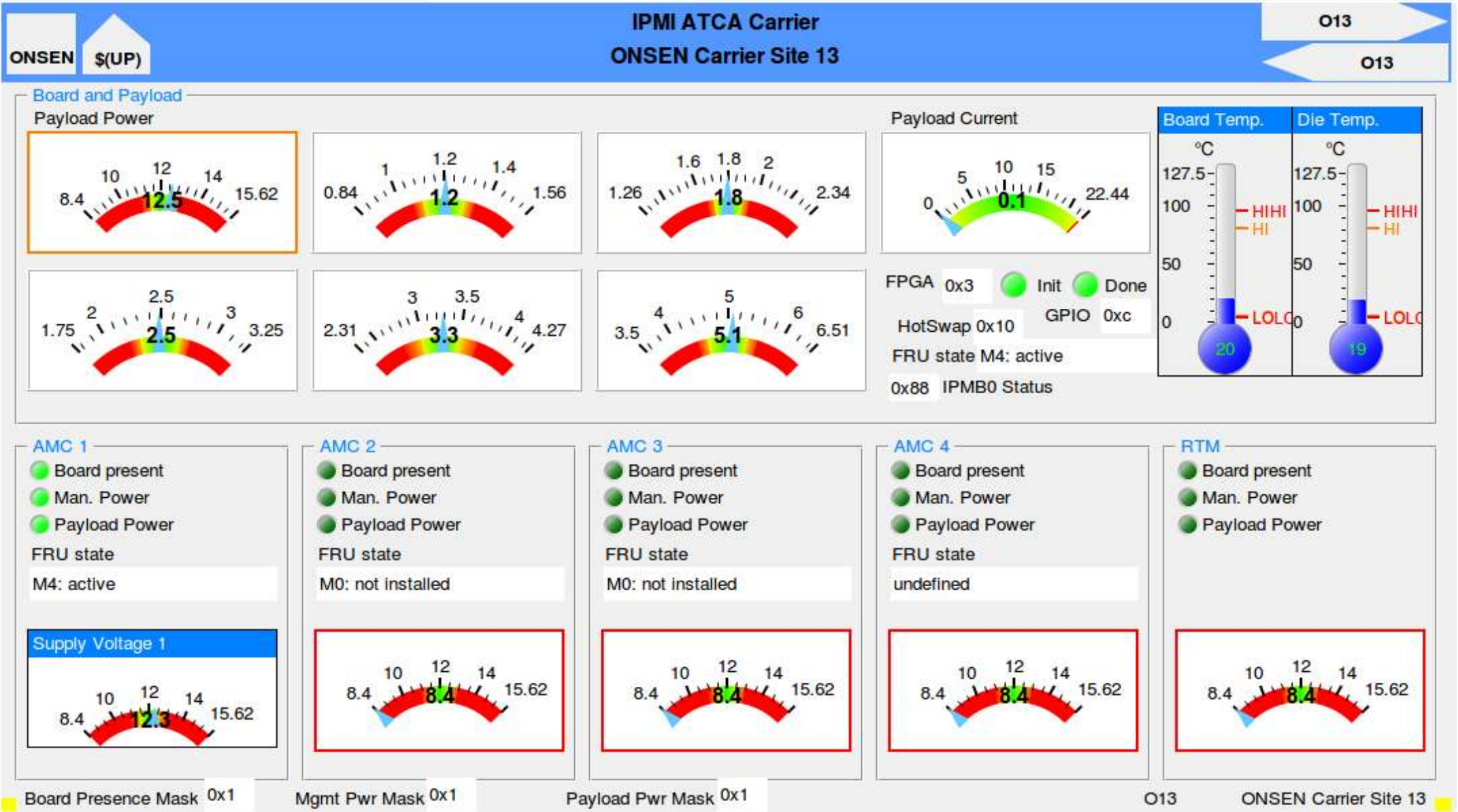


- Continued tests from Sep/Oct (reported on B2GM)
 - External RAM and EEPROM on IPMC tested
 - Communication between IPMC/MMC and FPGA/CPLD
 - Communication between IPMC and MMC
 - Debug non-working features (Presence, IPMB-L, Enable#, ...).
 - Mainly hardware debugging of Carrier, PSU and AMC (which took most of the time)
 - (List of changes in backups slides) But **no** layout change required!
 - Test with final PSU design in late December (layout change: IPMB-L and IPMB-P separation)
- A change on the final Power Supply Unit (PSU) board required changing values of a few resistors on the IPMI design to be conform to standards (as far as possible)

- IPMC and MMC hardware work on current Carrier/PSU and AMC versions
 - No change on layouts necessary
- Current status:
 - MMC PCBs in production (delivery next week)
 - Components ordered
 - IPMC PCBs ready for soldering
- All boards should be ready by March
 - For test beam we would need 2 IPMC and 5 MMC for ONSEN
 - DATCON 6 MMCs

- Firmware for IPMC differs from MMC:
 - Its an ATCA board, not AMC (or mTCA) – different standards, lots of small differences
 - It works like a shelf manager for managing the AMCs
- Firmware IPMC:
 - External memory and EEPROM (new) ✓
 - Hot swap/power cycle, sensor monitoring, temperature alarms ✓
 - Handling AMC boards e.g. hot swap/power cycle (new) ✓
 - Message bridging for sensor monitoring, temperature alarms (new) ✓
- Firmware MMC (since Sep/Oct):
 - Hot swap/power cycle, sensor monitoring, alarms ✓
 - Working in mTCA shelf (DATCON like) and in Carrier board ✓

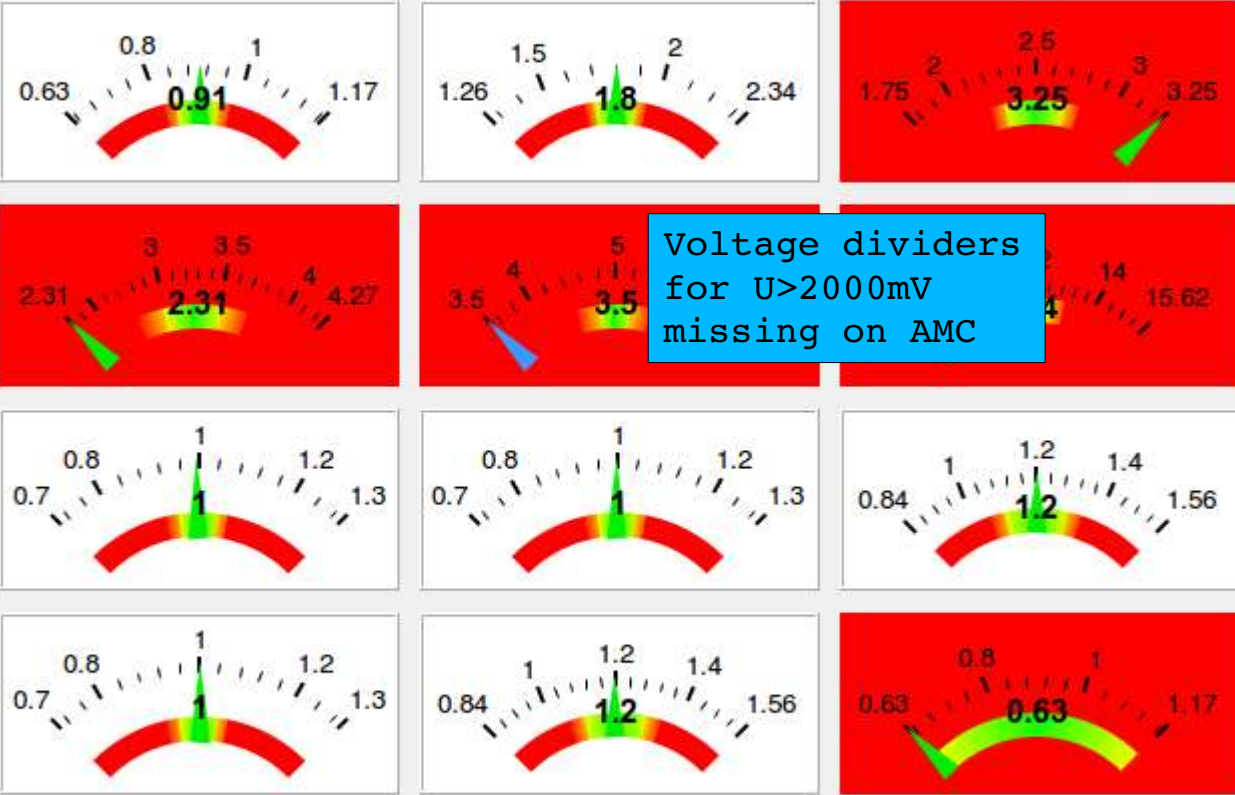
- Common Issues
 - Controller ↔ FPGA protocol not completely defined (RS232 for now)
 - Refine voltage limits
 - Status after watchdog reset
- Firmware MMC
 - No other (big) issues
- Firmware IPMC
 - Bridging of Send Message (not clear if its an issue of the IPMC, Shelf Manager or ipmitools)
 - Improve buffering of bridged messages
 - CPLD programming (sequence, automatic)
- Wishlist
 - Remote firmware updates (not directly possible with hardware)
 - Follow the standards more closely (standars have several 100 requirements)



All real states and readings, communication with MMC is now working as expected.

AMC IPMI Example
AMC Site 1

O13A1 AMC Site 1



Voltage dividers for U>2000mV missing on AMC

Die Temp. °C: 46 (LOLO), HIHI, HI

Board Temp. °C: 34 (LOLO), HIHI, HI

FPGA Status: 0x2, GPIO: 0xff, HotSwap: 0x1, Handle Closed

Force FPGA Reprogr...

AMC plugged into Carrier!

FPGA Temp higher than PCB, because bitstream is programmed and running

All real states and readings, communication with MMC is now working as expected.

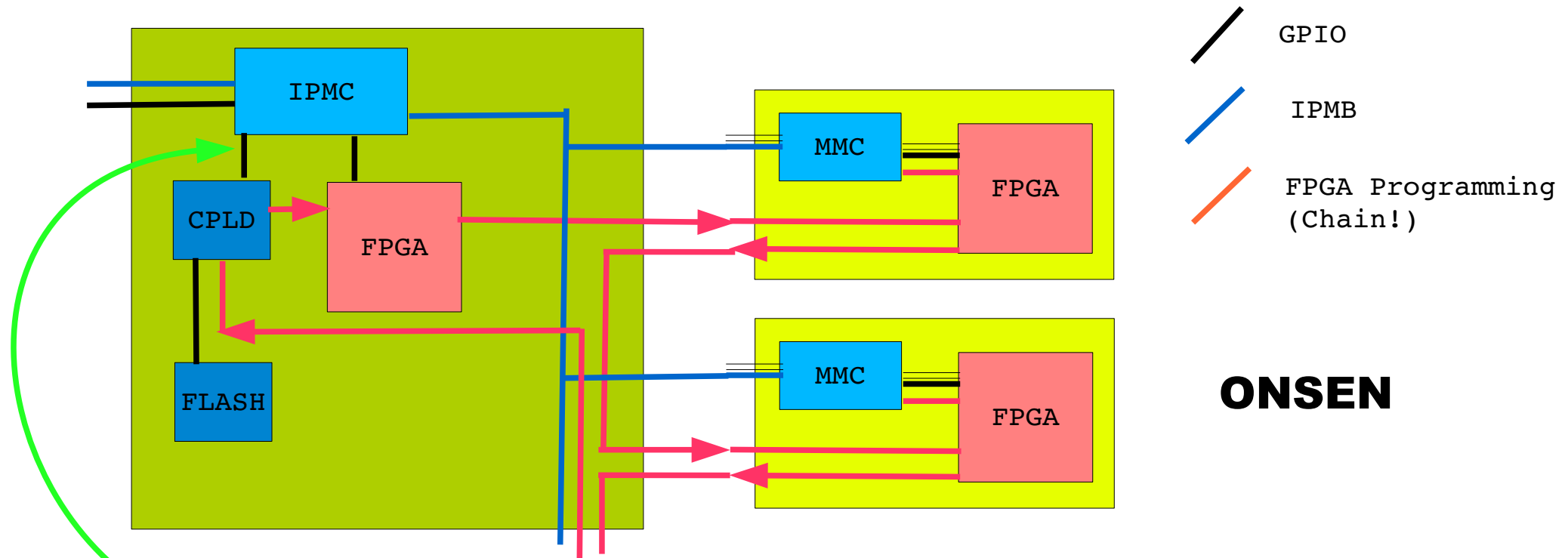
- Ipmitool IOC (M. Ritzert):
 - Doesn't like disconnected (crash) or reconnected (alarm stays) sensors
 - Requires fixed address/number for sensors, but in mTCA they can be variable.
 - Sensor types: value and status
 - TODO: Send (user) commands to FRU (reprogram, etc)
- User commands ... to what extent are they needed at all?
 - ONSEN: No way to reset/program a single FPGA; power cycle of any board will program the whole Carrier (incl AMCs)
 - → This is done on the Carrier anyway (no bridge to AMCs necessary)
 - DATCON:
 - Reprogram from PROM
 - Activate/Deactivate (→ Power cycle)
- Bugs in ipmitool?

- Using macros to create dynamic panels ($O(40)$ per view) for ONSSEN clashes with CSS ... doing it with scripts tends to be “slow”
- CSS Style Guide ask for Prev/Next buttons to navigate
 - Look-up table for relations between displays.
- Solution (M. Ritzert)
 - Precompile OPIs with scripts
 - Generate several $O(100)$ panels from “templates”
 - Works

- Repeat Run Control Test from Sep 2015 with new firmware and updated Run Control State Machines.
 - Updated SM until now only tested in “simulation”
 - Using DESY test system layout (Carrier + AMCs)
- SC Monitoring during lab tests to gain experience
 - → do we monitor the correct things?
 - → are current layouts applicable for tracking down problems?
 - Are problems visible in time graphs (resolution)?
- Optimize layout (GUI items)

Backups

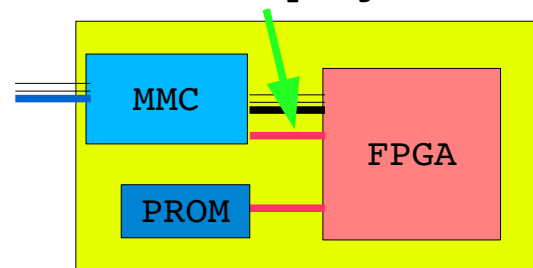
- AMC
 - IPMB isolator: Wrong component soldered (only in one production run)
- Carrier Power Supply Add-on
 - Removed 9 pull-up/down resistors
 - Added missing voltage dividers at ADCs
- Carrier
 - Invalid IPMB addresses: (removed 32 of 36 pull-up/down resistors)
 - Removed resistor with unknown function (4)
 - Removed 4 pull-up/down
- **No change in layout! Just removing or changing components**
- Remarks
 - Large numbers because its always for all 4 AMC slots (plus RTM)
 - Pull-up and pull-down were placed on some lines
 - All bugs have been confirmed and will be fixed in further (current) productions



ONSEN

IPMC can signal CPLD to program all FPGAs from FLASH

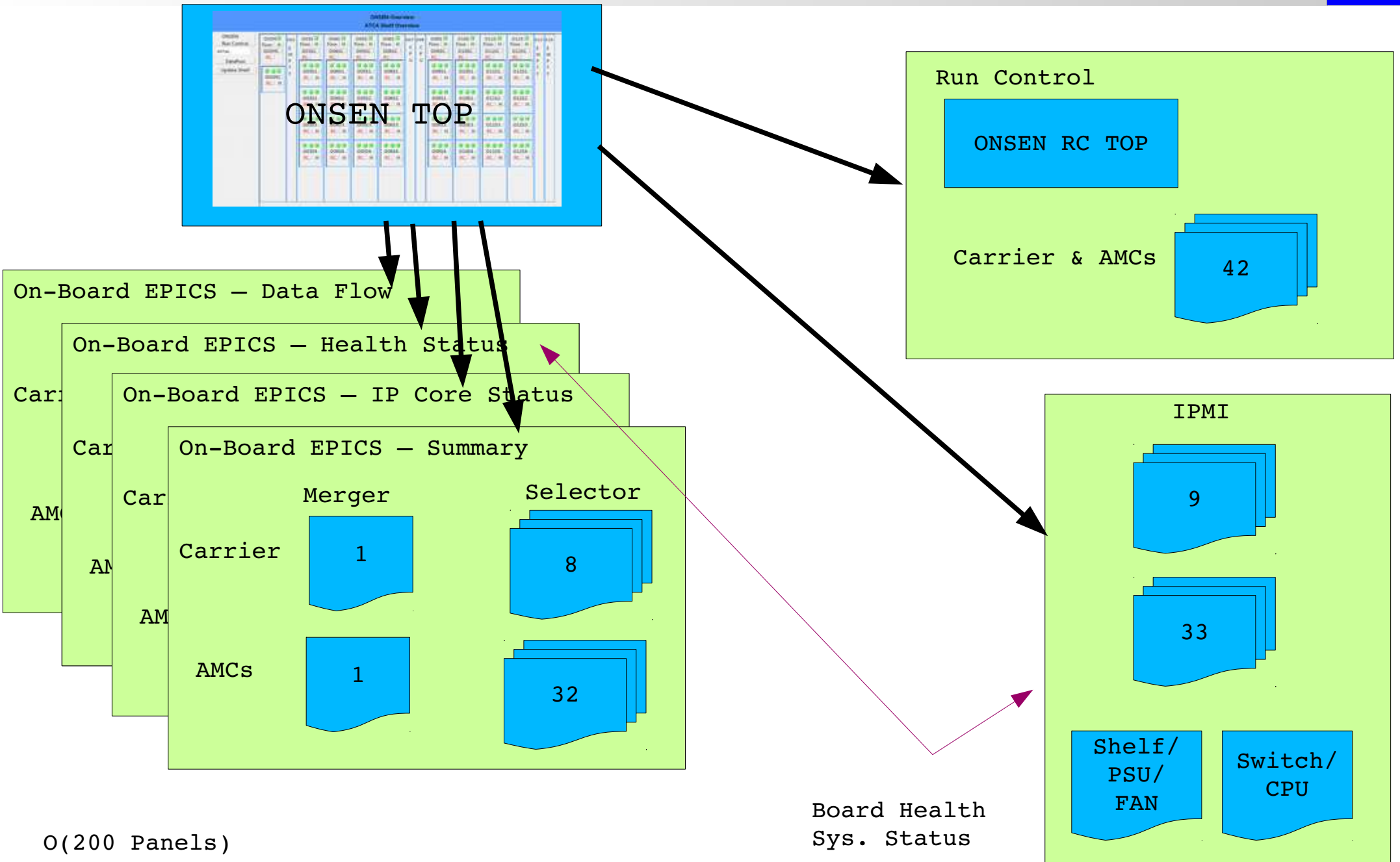
MMC can signal FPGAs to program from PROM



DATCON

- Communication IPMC/MMC ↔ FPGA: Slot addresses are connected to IPMC/MMC, not to the FPGA. FPGA need to get it from IPMC/MMC.

- Slow Control (CSS and EPICS):
 - Emphasis on monitoring, only few parameters can be set in ONSSEN
 - e.g. Flow Control Monitoring
- Same OPIs for O(32) identical boards, using “Macro” when opening
- CSS Style Guide ask for Prev/Next buttons to navigate
 - Look-up table for relations between displays.
- Use hardware layout (Shelf) as ordering scheme – not detector as there is no 1:1 connection to sensors anymore after DHC load balancing.
 - e.g. one immediately see which board need to be checked
- Done by now: CSS Scripting (“Macros”) – this works, but will be replaced by a built system ansatz, which create all OPIs statically (M. Ritzert)
- Look-up between Board and IPMI (different EPICS naming schemes)



- Goals:
- Have 1:1 mapping to actual hardware
- Open overview and most board corresponding OPIs

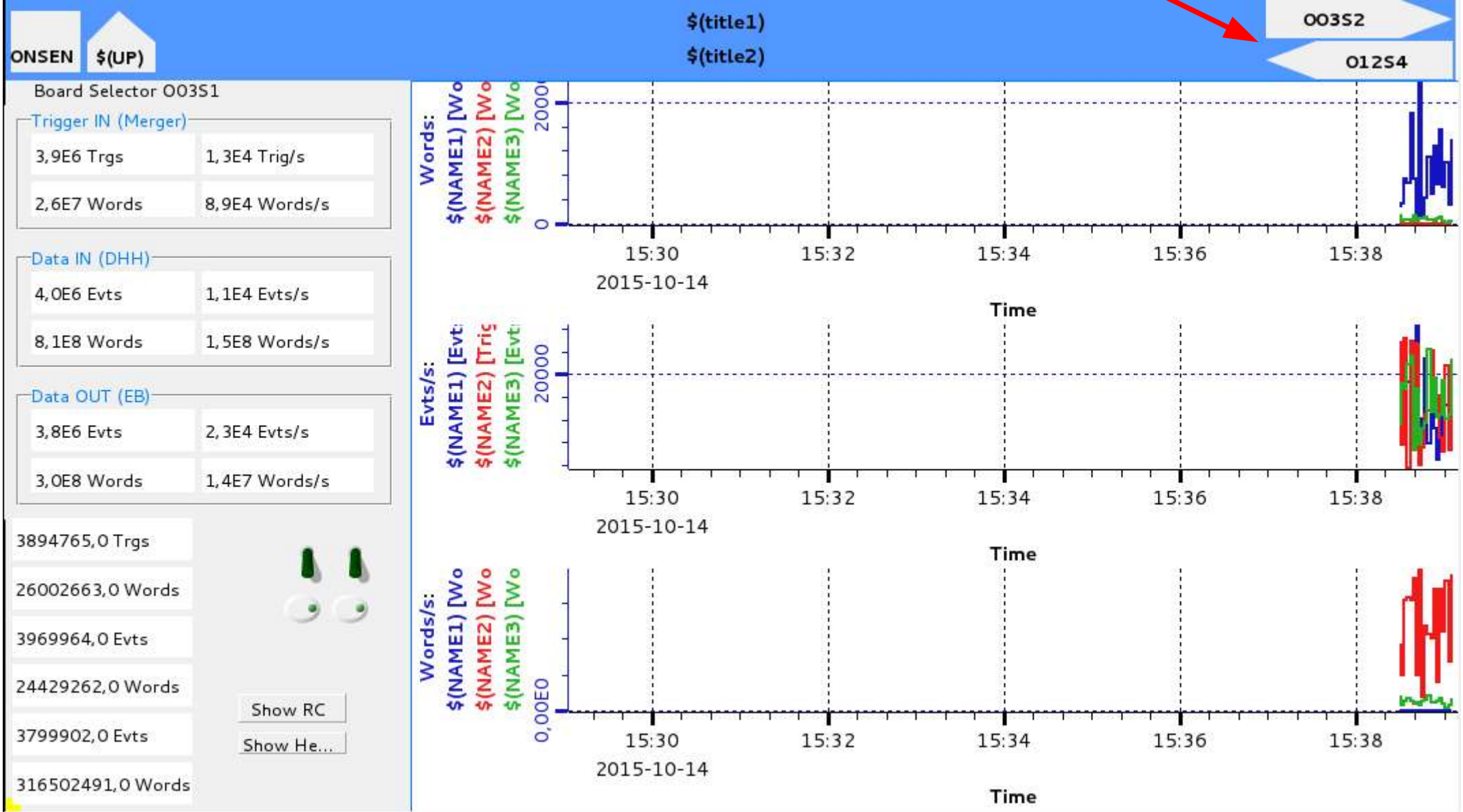
ONSEN Overview ATCA Shelf Overview

ONSEN Run Control INITIAL Dataflow Update Shelf	001M Flow H O01MC RC	002 EMPTY	003S Flow H O03SC RC	004S Flow H O04SC RC	005S Flow H O05SC RC	006S Flow H O06SC RC	007 CPU	008 CPU	009S Flow H O09SC RC	010S Flow H O10SC RC	011S Flow H O11SC RC	012S Flow H O12SC RC	013 EMPTY	014 EMPTY
	001M1 RC H	003S1 RC H	004S1 RC H	005S1 RC H	006S1 RC H	009S1 RC H	010S1 RC H	011S1 RC H	012S1 RC H					
	003S2 RC H	004S2 RC H	005S2 RC H	006S2 RC H	009S2 RC H	010S2 RC H	011S2 RC H	012S2 RC H						
	003S3 RC H	004S3 RC H	005S3 RC H	006S3 RC H	009S3 RC H	010S3 RC H	011S3 RC H	012S3 RC H						
	003S4 RC H	004S4 RC H	005S4 RC H	006S4 RC H	009S4 RC H	010S4 RC H	011S4 RC H	012S4 RC H						

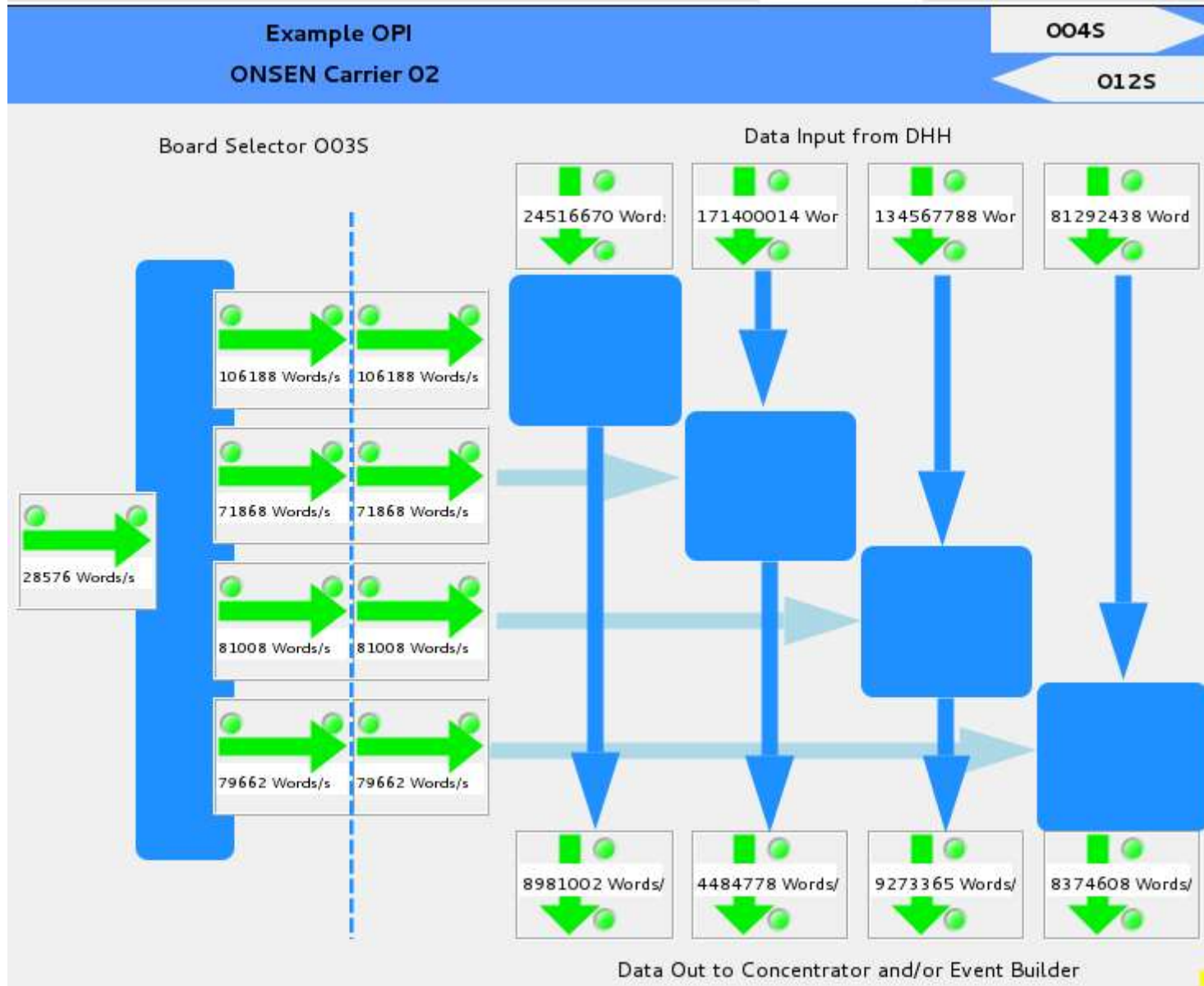
→ Slot in ATCA Shelf, ordered as in reality →
↓ AMC Slot

Simulated PVs

One Board – Detailed Data Rates

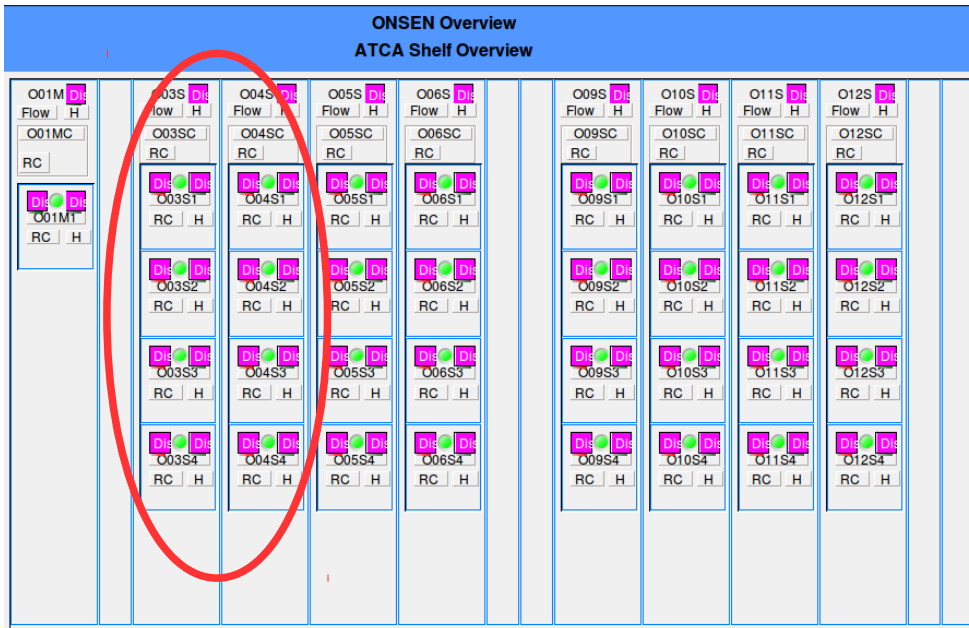
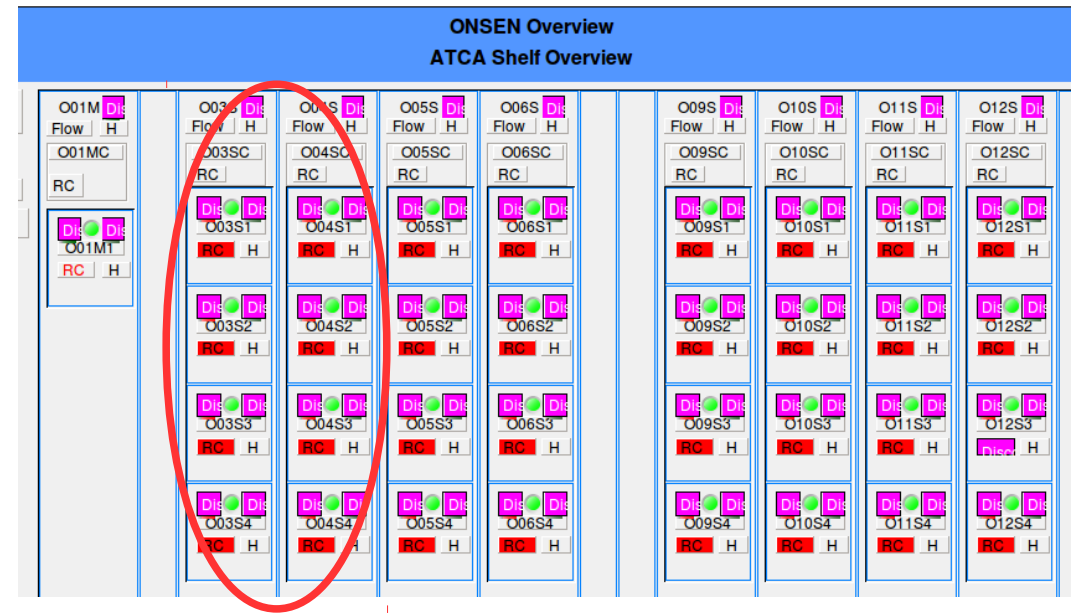
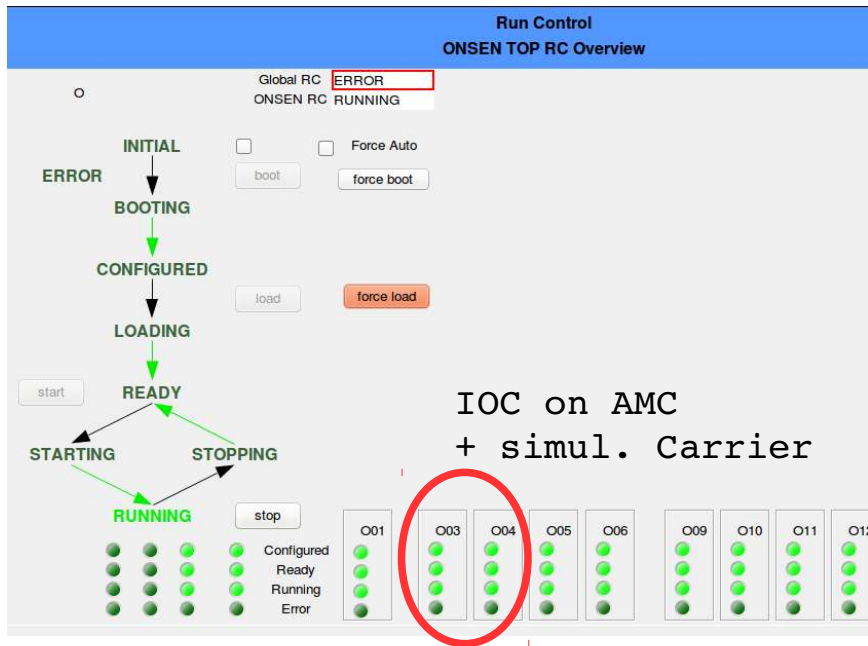


Simulated PVs

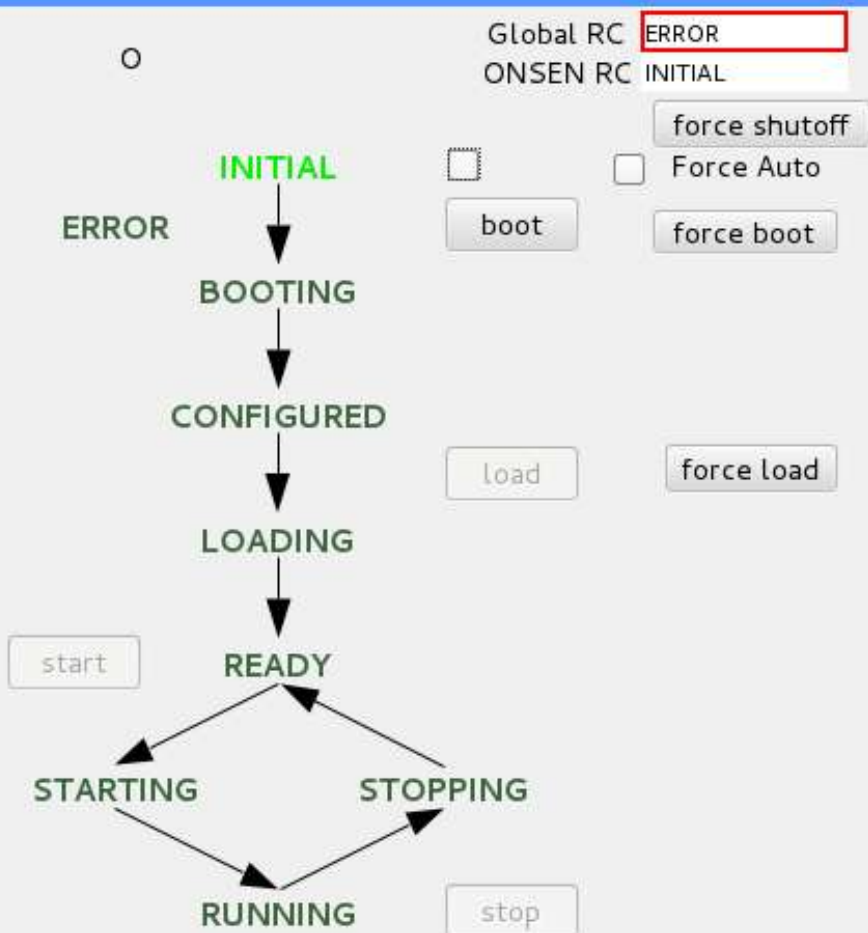


Other panel examples (RunControl IPMI) in later slides

Simulated PVs



Run Control ONSEN TOP RC Overview



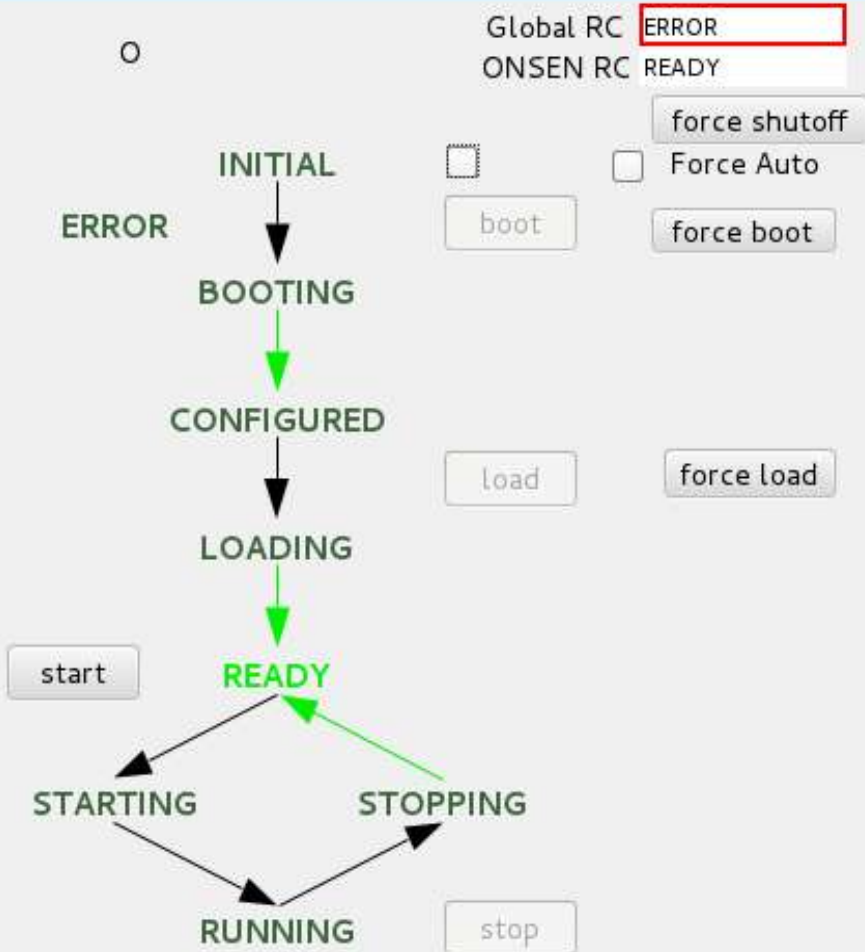
Status per Carrier

	O01	O03	O04	O05	O06	O09	O10	O11	O12
Configured	●	●	●	●	●	●	●	●	●
Ready	●	●	●	●	●	●	●	●	●
Running	●	●	●	●	●	●	●	●	●
Error	●	●	●	●	●	●	●	●	●

Disconnected IOCs

Carrier	O01	O03	O04	O05	O06	O09	O10	O11	O12
Carrier	●	●	●	●	●	●	●	●	●
AMC 1	●	●	●	●	●	●	●	●	●
AMC 2	●	●	●	●	●	●	●	●	●
AMC 3	●	●	●	●	●	●	●	●	●
AMC 4	●	●	●	●	●	●	●	●	●

Run Control ONSEN TOP RC Overview



Status per Carrier



Disconnected IOCs



- No NSM (yet), but NSM \leftrightarrow EPICS interface is out of scope
- If one board drops out unexpectedly, the main RC will not notice as the disconnected PV will have no influence on current state
 - This already fixed using timeout.
 - TODO: Test again with timeout handling
 - TODO: Test with actual data flow in the system
 - When it comes back, should/can it automatically advance to state of other boards?
 - At least one can by do it hand now w/o resetting all boards.
 - Important for (lab-) tests!

```
sensor 0x20/0x00 : compact 'FRU0 Hot Swap', event type 0x6f, type 0xf0.
sensor 0x20/0x04 : compact 'AMC4 Hot Swap', event type 0x6f, type 0xf0.
sensor 0x20/0x07 : compact 'FRU0 Reconfig', event type 0x6f, type 0x12 (System Event).
sensor 0x20/0x08 : full 'Temp Air Inlet', event type 0x01, type 0x01 (Temperature).
sensor 0x20/0x09 : compact 'Power Good', event type 0x77, type 0x08 (Power Supply).
sensor 0x20/0x0a : compact 'Power Good Event', event type 0x77, type 0x08 (Power Supply).
sensor 0x20/0x0b : full 'Vcc +12V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x0c : full 'Vcc +3.3V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x0d : full 'Vcc +3.3V MMC', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x0e : full 'Vcc +1.2V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x0f : compact 'IPMI Watchdog', event type 0x6f, type 0x23 (Watchdog2).
sensor 0x20/0x10 : compact 'IPMB0 Link State', event type 0x6f, type 0xf1.
sensor 0x20/0x11 : compact 'FRU0 IPMBL State', event type 0x6f, type 0xc3.
sensor 0x20/0x15 : compact 'AMC4 IPMBL State', event type 0x6f, type 0xc3.
sensor 0x20/0x18 : compact 'Health Error', event type 0x03, type 0x24 (Platform Alert).
sensor 0x20/0x1c : compact 'AMC4 Sensor Err', event type 0x6f, type 0x28 (Management Subsys Health).
sensor 0x20/0x1f : compact 'FRU0 Pwr Denied', event type 0x03, type 0x24 (Platform Alert).
sensor 0x20/0x23 : compact 'AMC4 Pwr Denied', event type 0x03, type 0x24 (Platform Alert).
sensor 0x20/0x26 : compact 'FRU0 Agent', event type 0x0a, type 0xc5.
sensor 0x20/0x2a : compact 'AMC4 Agent', event type 0x0a, type 0xc5.
sensor 0x20/0x2d : compact 'IPMC Storage Err', event type 0x6f, type 0x28 (Management Subsys Health).
sensor 0x20/0x2e : compact 'IPMC Reboot', event type 0x03, type 0x24 (Platform Alert).
sensor 0x20/0x2f : compact 'Ver change', event type 0x6f, type 0x2b (Version Change).
sensor 0x20/0x30 : compact 'SEL State', event type 0x6f, type 0x10 (Event Logging Disabled).
sensor 0x20/0x31 : compact 'IPMI Info-1', event type 0x70, type 0xc0.
sensor 0x20/0x32 : compact 'IPMI Info-2', event type 0x71, type 0xc0.
sensor 0x20/0x33 : compact 'ID:0276050F0804', event type 0x00, type 0x0b (Other).
sensor 0x20/0x34 : full 'HotSwap', event type 0x6f, type 0xf2.
sensor 0x20/0x35 : full '0_9V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x36 : full '1_8V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x37 : full '1_0V_int', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x38 : full '1_2V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x39 : full '2_5V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3a : full '3_3V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3b : full '5_0V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3c : full '1_0V_MGT', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3d : full '1_0V_PLL', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3e : full '1_2V_TT', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x3f : full '12V', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x40 : full 'unconnected', event type 0x01, type 0x02 (Voltage).
sensor 0x20/0x41 : compact 'FPGA_Prog', event type 0x08, type 0x0b (Other).
sensor 0x20/0x42 : compact 'FPGA_Init', event type 0x08, type 0x0b (Other).
sensor 0x20/0x43 : full 'Temp_Local', event type 0x01, type 0x01 (Temperature).
sensor 0x20/0x44 : full 'Temp_FPGA', event type 0x01, type 0x01 (Temperature).
```

I removed sensors for AMC 1-3,5-6 from list

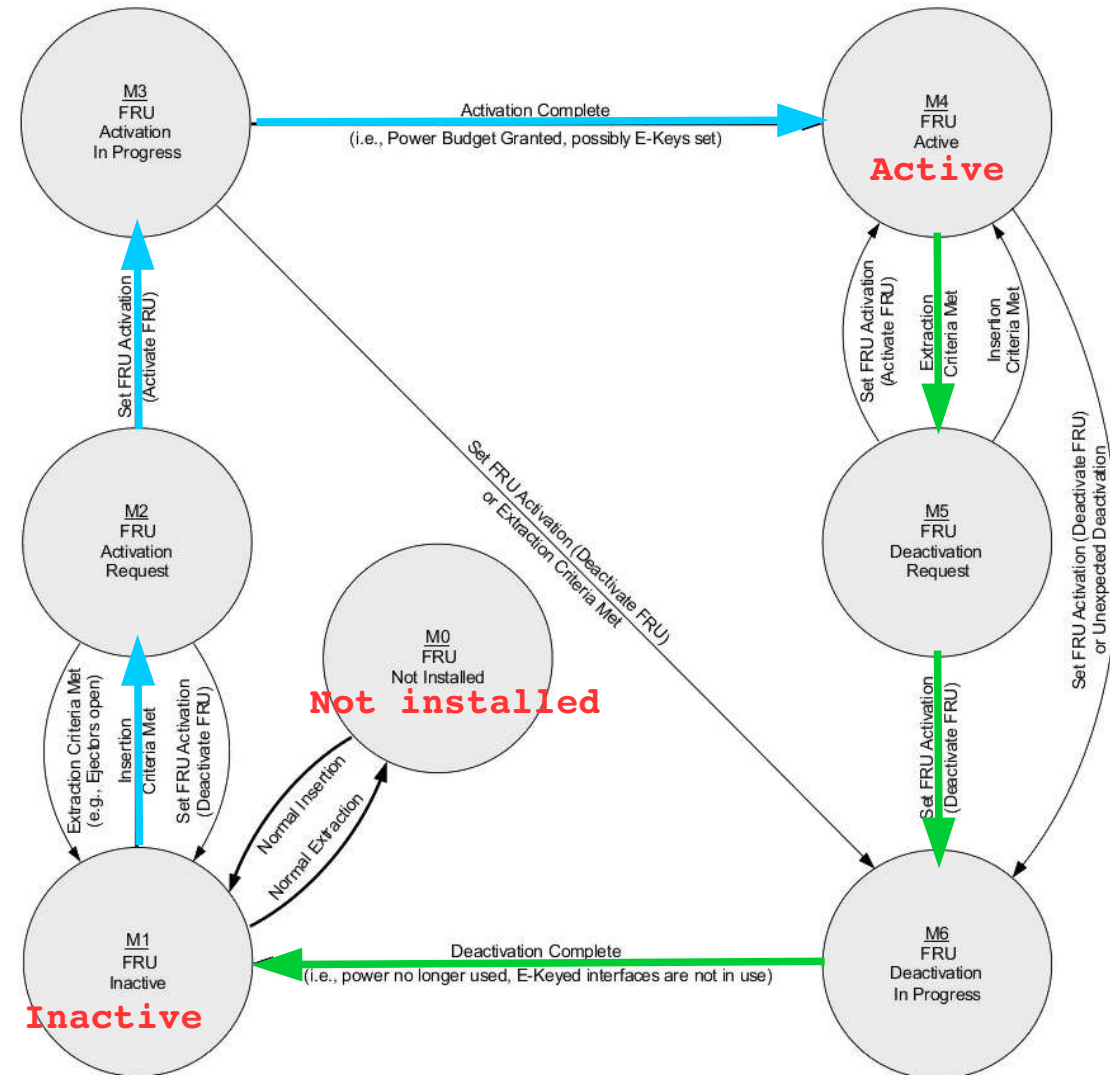
Sensors for AMC slot managed by the MCH. Numbers seem to be static.

“Copy” of AMC sensors. sensor number is NOT static, depends on the order the AMC were inserted (and other factors?)

Remark: This is MCH specific. On the Carrier IPMC we can do it in a more “defined” way

- Following PICMG Specs
 - Several steps for (de)activation
- Activation:
 - Insertion and handle closed → board talks with ShelfManager, negotiate power and finally switches power on
- Deactivation:
 - Handle opened → board asks for deactivation, turns power off, waits for extraction
- HotSwap LED shows current status
- Implemented and tested!
- Carrier handles SM for AMCs!

(simplified) FRU State diagram



- monitoring of sensors ✓
- reading limits, min/max and determine error state ✓
- sensors which are not available (yet) ✗
 - → IOC has to be started after ALL board are power-up
 - Handling of disconnects? (sensor went to major alarm and stayed there)
 - Handling of dynamic sensor changes? (AMC board unplug)
 - Change of limits?
- Anyway, only testable when we have MMC available.
- CSS → EPICS → IPMC has to be tested (power cycle etc)
- Wishlist for now:
 - Startup with unavailable sensors
 - Correct handling of de- and reconnect