

BLMSPS Software

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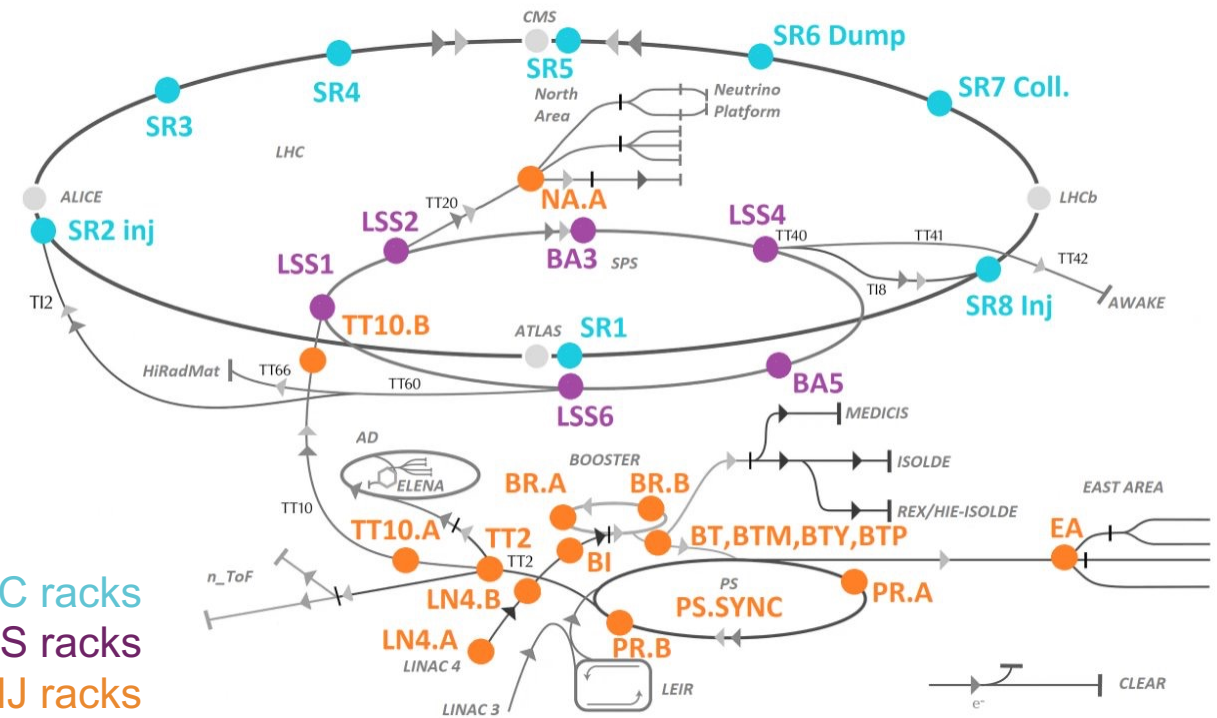
BLM: Critical Machine Protection System



Measure number of particles escaping the beam pipe

Beam Loss Monitoring systems :

- Protect against machine damage
 - Real-time dump request, interlocked
- Beam diagnostics & optimisation
- Present in all accelerators at CERN
- 4500+ ionisation chambers across CERN
- BLM SPS to be renovated during LS3



Thanks to M. Sacconi

Timeline of BLMSPS software

Development phases:

- **Phase 1:** Read the Running Sums and log them on NXCALS (**for this Technical Stop**)
- **Phase 2:** Add Diagnostic data fields (~250 registers)
- **Phase 3:** Implement raw data storage
- **Phase 4:** Making the system operational (for LS3)
 - According to OP needs

A GUI will be developed in parallel using the Python Ecosystem of S.B. Pedersen & S. Jensen

Main goal of Phase 1, 2 and 3 are to **facilitate hardware validation.**

All Phases will follow (evolving) standards.

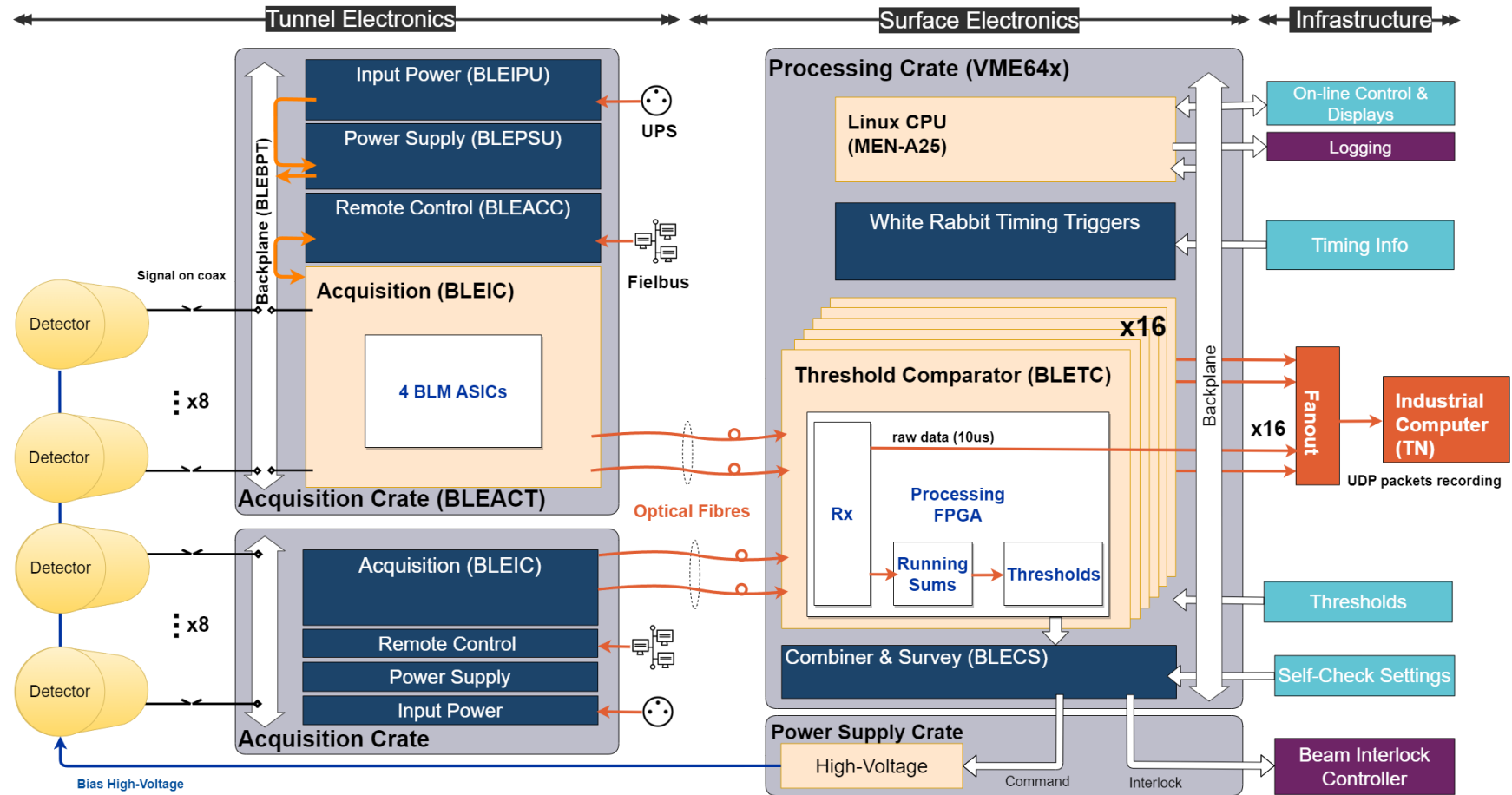
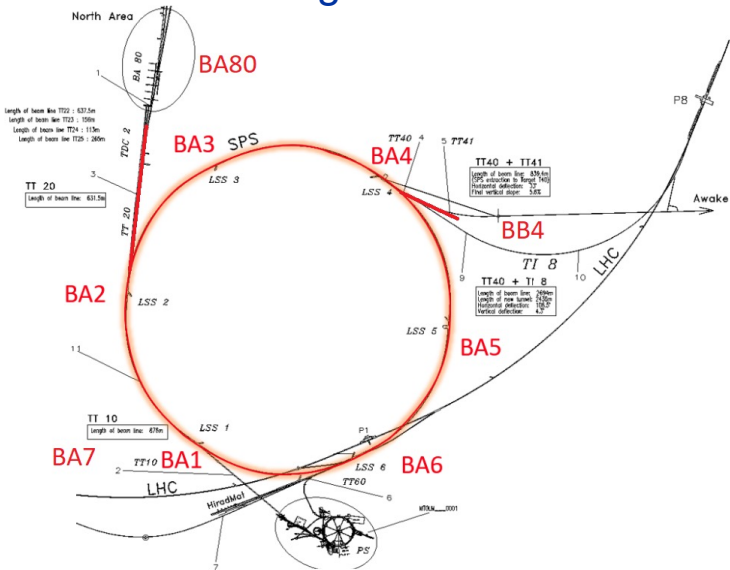
BLMSPS Phase 1 - Read Running Sums (RS)

BLM SPS installation:

- 426 detectors
- 14 racks (VME crates)
- 41 tunnel crates

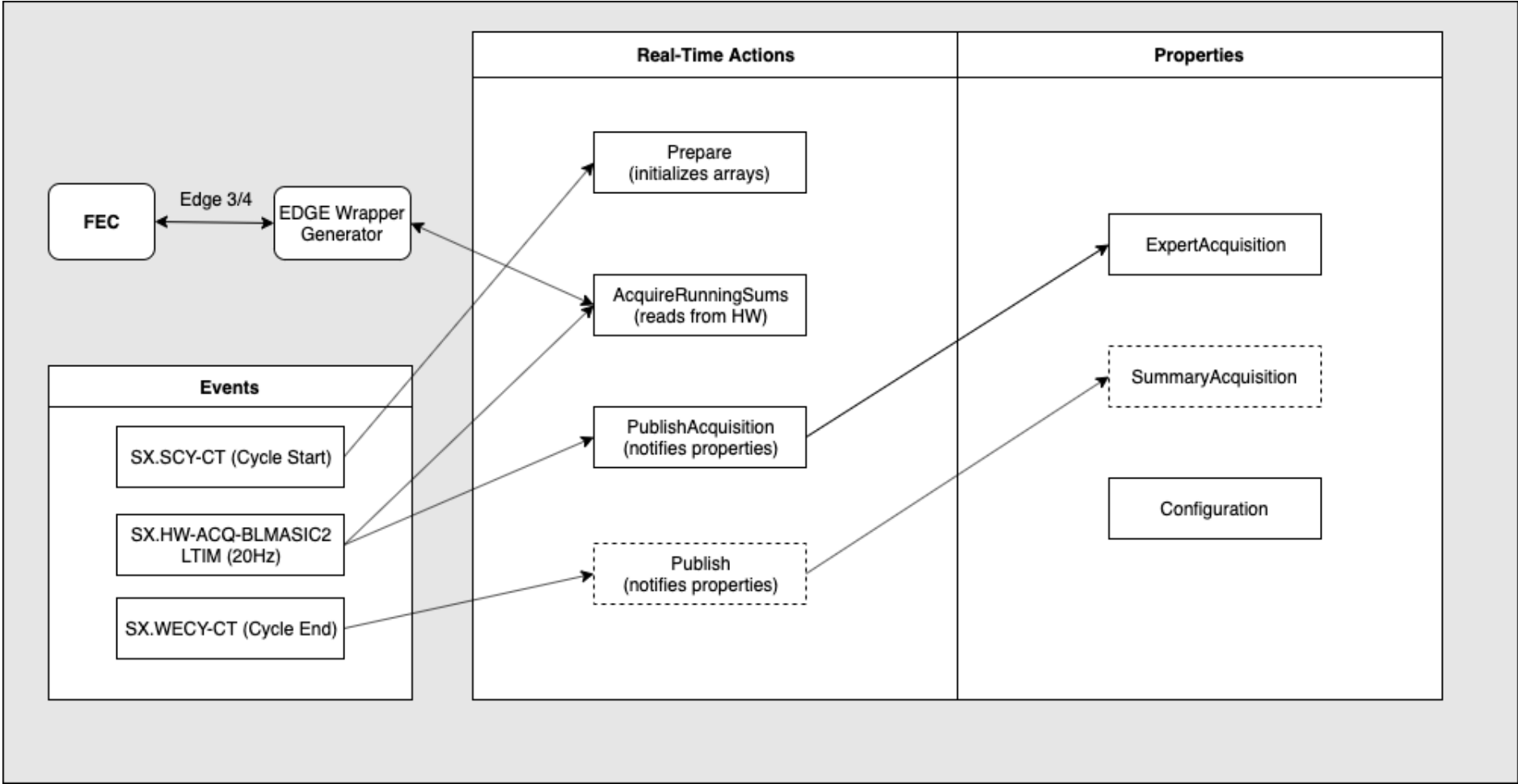
BLETC (Threshold Comparator) :

- Up to 16 Cards,
- 16 Channels/Card,
- Up to 16 RS/Channel,
- 64 bits register for each RS.



Thanks to M. Saccani and C. Zamantzas

Phase 1 - FESA Class Structure

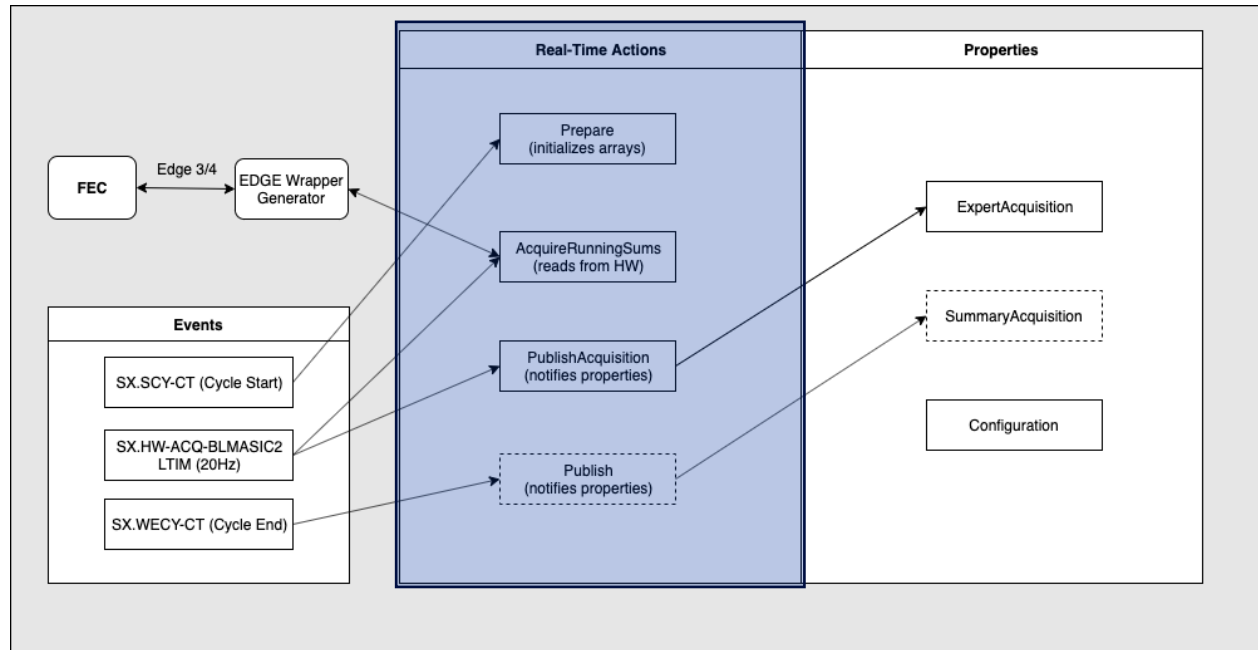


RS read @ 20Hz, for hardware validation, will be changed to 1Hz on a later stage. An LTIM is used due to its adjustability.

Phase 1 - FESA Class Specifics

RTDeviceClass.h: Contains definitions to variables that are available to all the Real Time Actions, eg:

- **lunList:** a list of all the LUNs to connect to (configuration field),
- **handlersList:** a list given by EDGE, one for each LUN.



SpecificInit:

- Fills the **handlersList** with the EDGE handlers for each LUN.

If a connection to a card fails the FESA class exits!

Prepare RTA:

- Clears the device data fields.

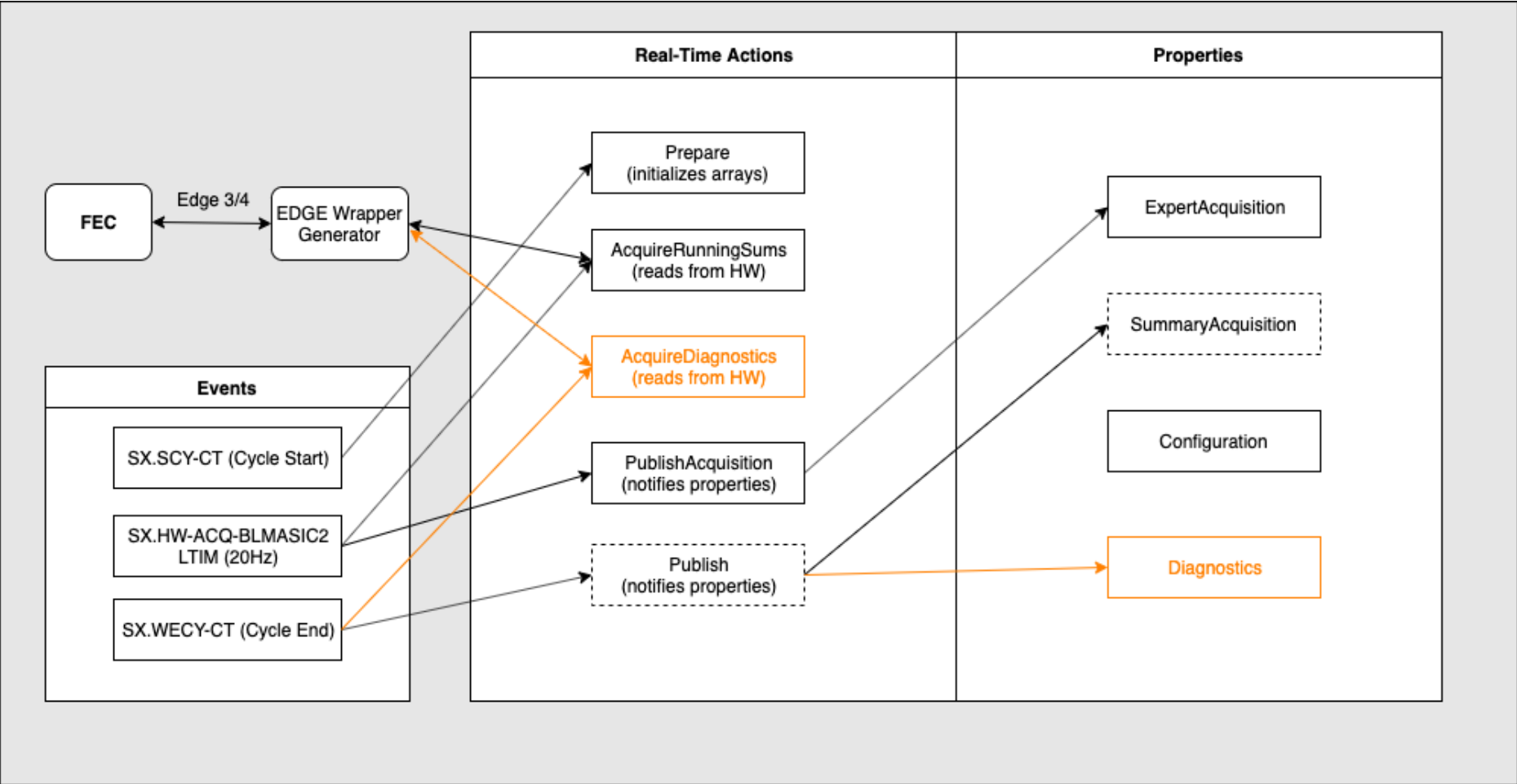
Acquire RTA:

- Fills the device data fields with the Running Sum data from the hardware.

Publish RTA:

- Notifies the properties.

BLMSPS Phase 2 - Add diagnostic fields



Read ~250 status registers and expose them on a FESA property

BLMSPS Phase 3 - Raw data storage

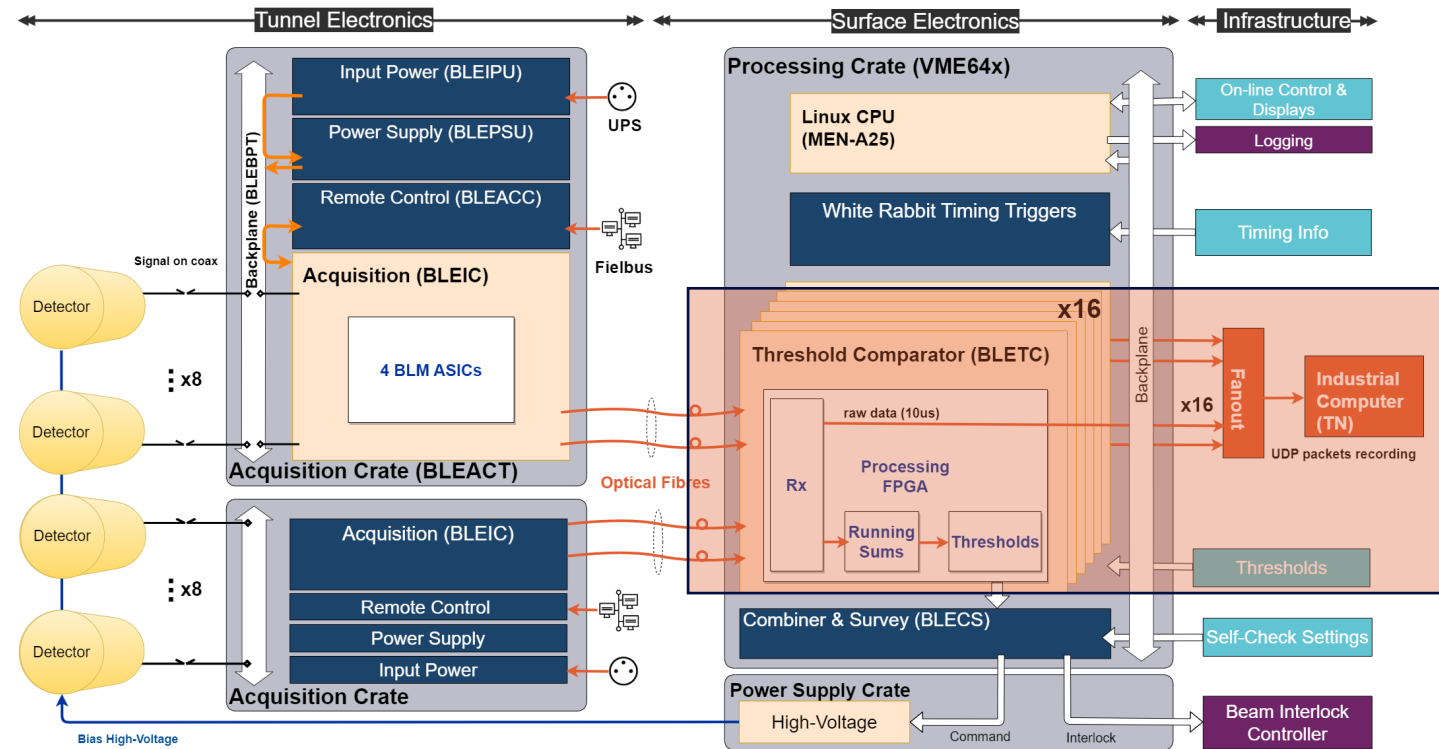
Raw data: 10 μ s integral measurement

Phase 3 Goal: Capture raw data for offline analysis as needed.

Proposed solution: Raw data sent to a separate Industrial PC (IPC) and stored on an SSD using the HDF5 file format.

Reasons:

- Current VME FECs are insufficient.
 - Not enough CPU power,
 - No 2nd network interface available,
- Avoid compromising the operational system.



Thanks M. Saccani and C. Zamantzas

BLMSPS Phase 4 - Making system operational

Devices:

1 FESA device per FEC with up to 256 Channels

The operators will be in charge of creating a UCAP node to access Channels as separate devices (similar to BLMLHC system).

Losses:

FESA publishes electronic bits, not losses.

The UCAP node will apply conversion factors to convert to Gy/s (like BLMLHC).

In general, extensive communication with the operators will be necessary to adjust the FESA class according to their needs.

Useful Documentation

- **BLMASIC Hardware TB presentations (7/3/2024):** <https://indico.cern.ch/event/1388673/>
- **BLMSPS wiki page:**
<https://confluence.cern.ch/pages/viewpage.action?spaceKey=BEBI&title=System+portal+%3A+BLMSPS+-+future+SPS+BLM+system+based+on+rad-hard+ASIC>
- **EDGE library generation wiki:** <https://confluence.cern.ch/display/BEBI/Software+-+Driver+-+Edge+-+EDGE+library+generation>
- **BLMASIC Prototype Manual:**
<https://confluence.cern.ch/pages/viewpage.action?spaceKey=BEBI&title=Prototype+User+Manual>
- **BLMSPS LS3 Installation:** <https://confluence.cern.ch/pages/viewpage.action?pageId=481493237>

Thank you!

Any questions?



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