

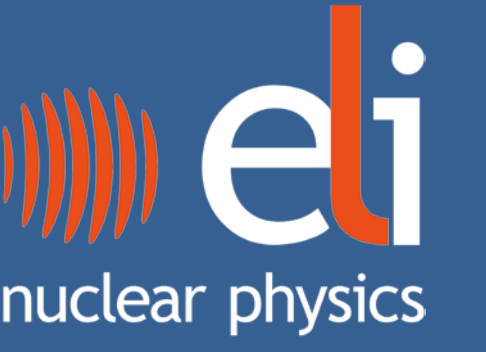
The Control System for the ELI-NP Gamma Beam Delivery and Diagnostics*



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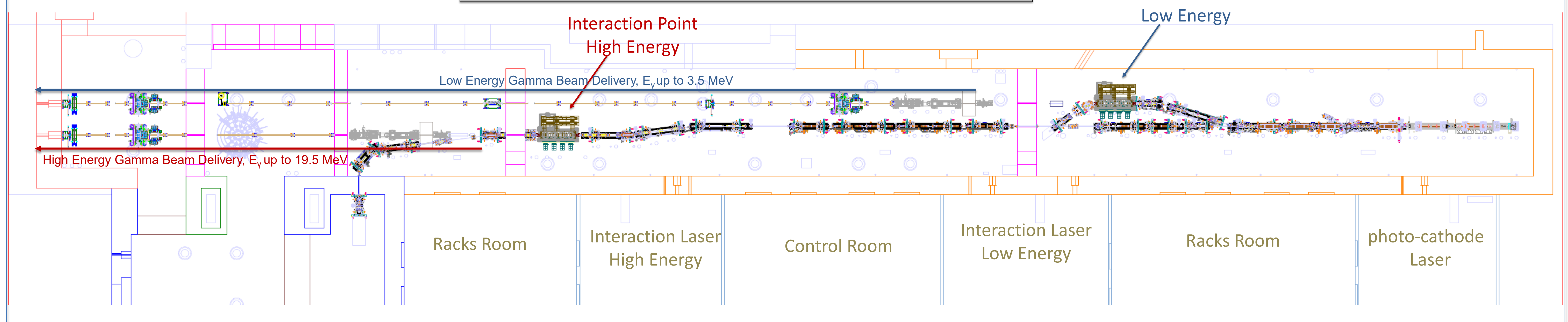
* The ELI-NP Project (<http://www.eli-np.ro/>) is supported by the European Union and co-financed by the European Regional Development Fund

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The high brilliance Gamma Beam System (GBS) of Extreme Light Infrastructure - Nuclear Physics (ELI-NP) will produce intense gamma-ray beams with spectral densities of about 10^4 g/s/eV, a narrow bandwidth (0.5%), high degree of polarization (>95%) and tuneable energy in the range from 200 keV to 19.5 MeV, based on the laser Compton backscattering technique on relativistic electrons provided by a linear accelerator. The Gamma Beam Delivery and Diagnostics (GBDD) of ELI-NP is implemented to deliver the gamma beams to the experimental setups and to monitor the characteristics of the beams. An EPICS Control System (CS) is developed for the GBDD to support two main categories of equipment: i) equipment for the delivery of the gamma beam including vacuum systems, collimators, alignment platforms, and moveable beam dumps; ii) devices to be used during the operation of the GBS for diagnostics and monitoring including digitizers, power supplies, detectors, and profile system. High-Level Software (HLS) for the Gamma Beam Diagnostics is under development to carry out the real-time measurements and monitoring including energy spread measurement, flux measurement, spatial profile monitoring, time structure monitoring, and polarization measurement.

General Layout of the Gamma Beam System

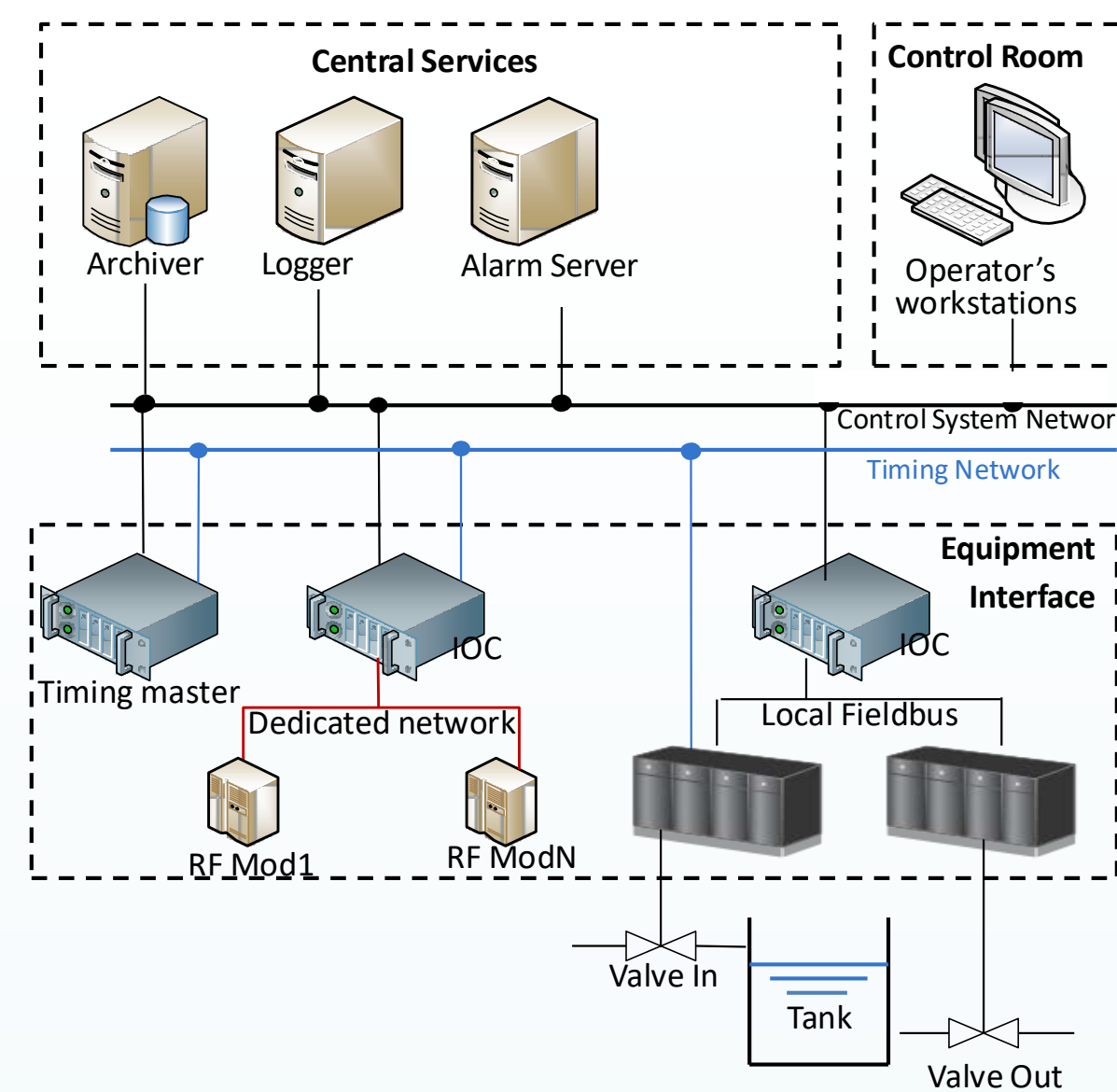


The ELI - NP - GBS Control System

The GBS system will be delivered by the EuroGammaS Association with its own EPICS based control system framework. The full ELI-NP GBS system providing the beam with the designed parameters is expected to be ready soon.

The EPICS CS for the ELI-NP GBS is a distributed control system framework based on a client-server architecture. It will provide the data collection and constantly monitoring for the devices grouped by the sub-systems:

- Diagnostic sub-system
- Laser sub-system
- Radio Frequency (RF) system
- Timing system at 100 Hz
- Vacuum sub-system
- Magnet sub-system
- Conventional facilities sub-system



General System Requirements for GBDD CS

The work package of ELI-NP Gamma Beam Delivery and Diagnostics is dealing with the equipment and techniques meant to transport and optimize the gamma beam in order to make it available for user experiments within required parameters.

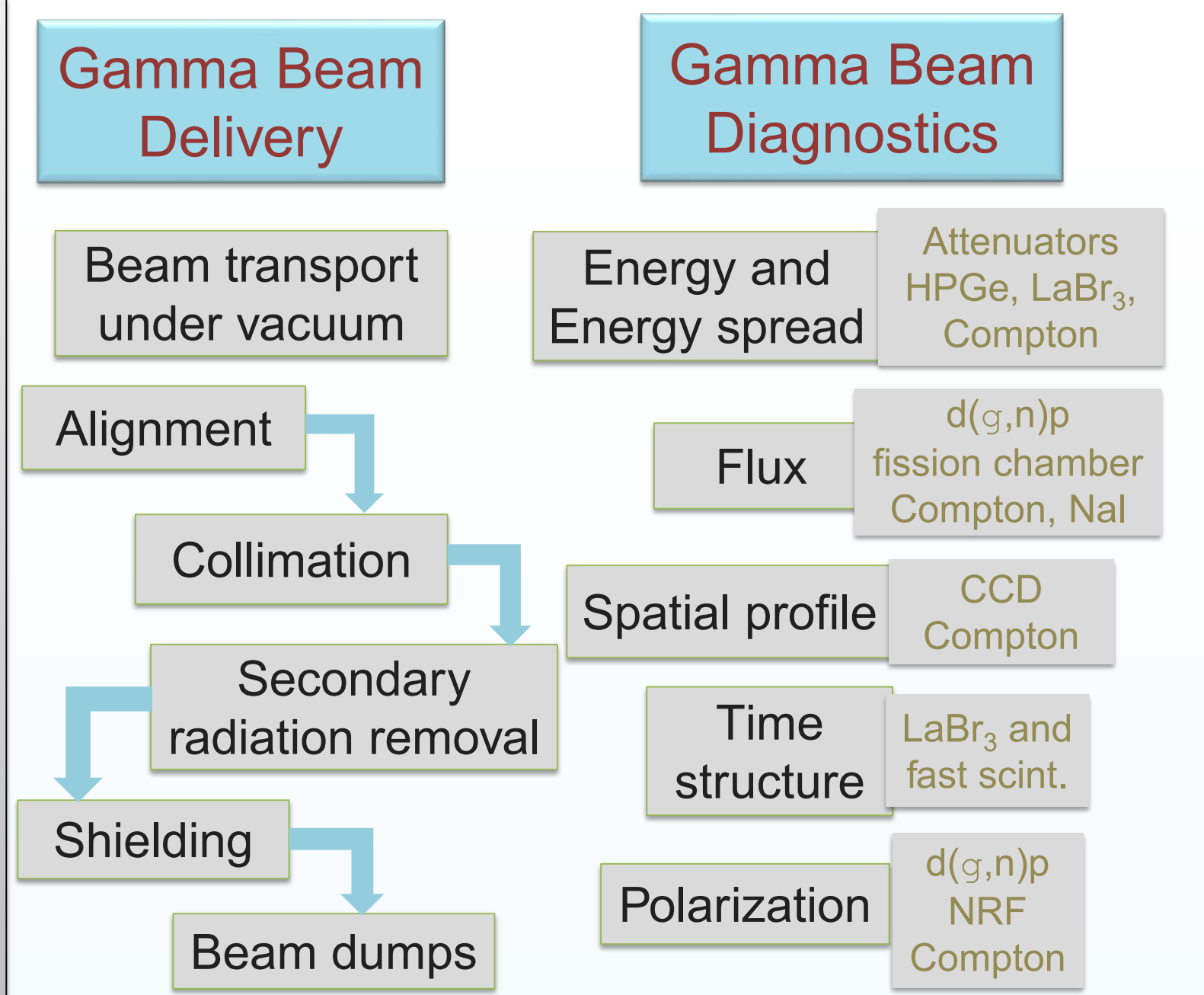
The vacuum pipe for the gamma beam transport has a modular design, allowing the removal of individual segments for the placement of experimental apparatus.

The collimator is operated under vacuum and the aperture of the individual slits.

The small beam dumps are movable. The Diagnostics will provide the real-time beam monitoring and measurement.

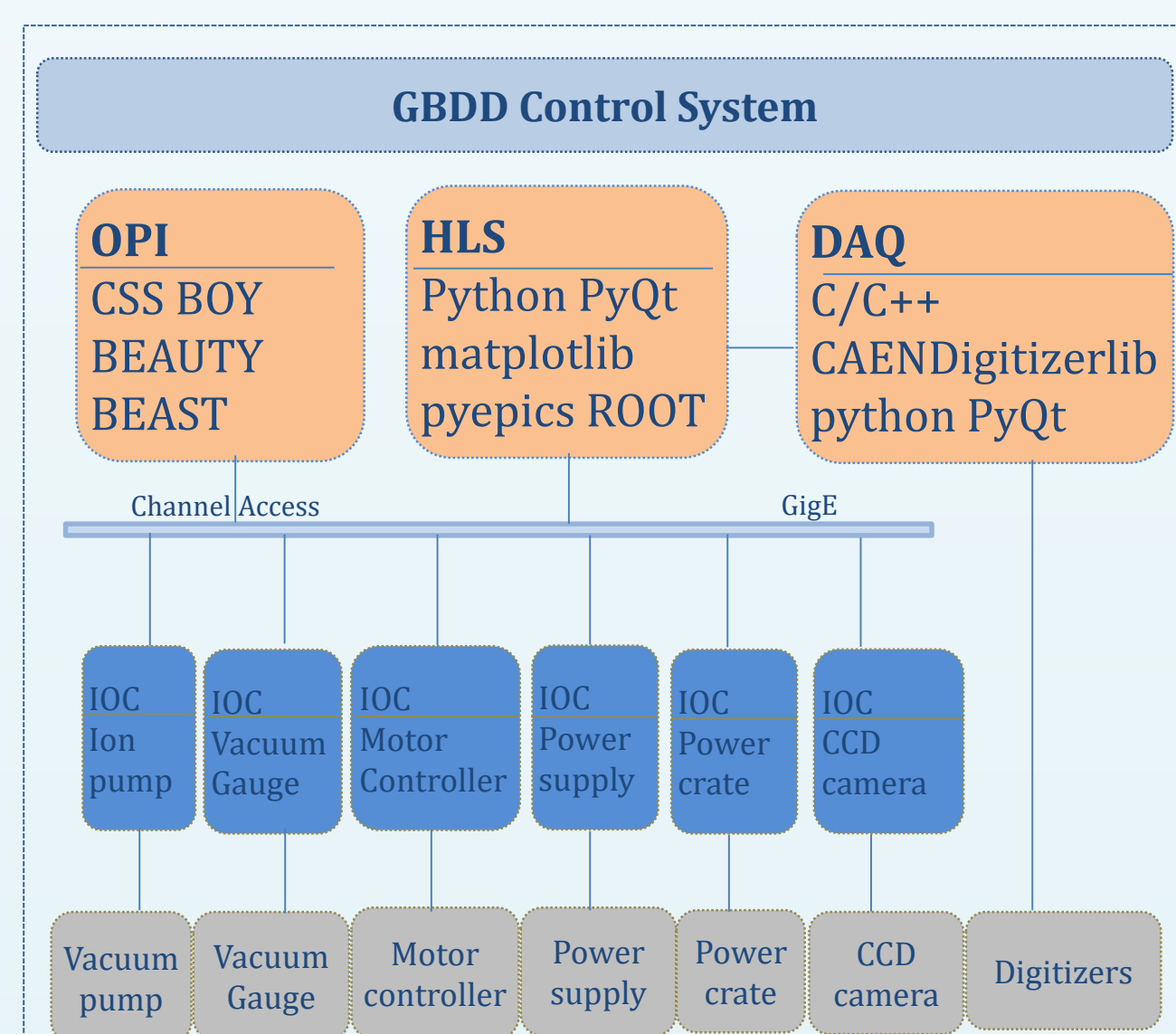
All the detectors used for Diagnostics require high voltage power.

For DAQ, 12-bit, 3.2 GS/s, and 14-bit, 500 MS/s digitizers are needed to record the waveforms.



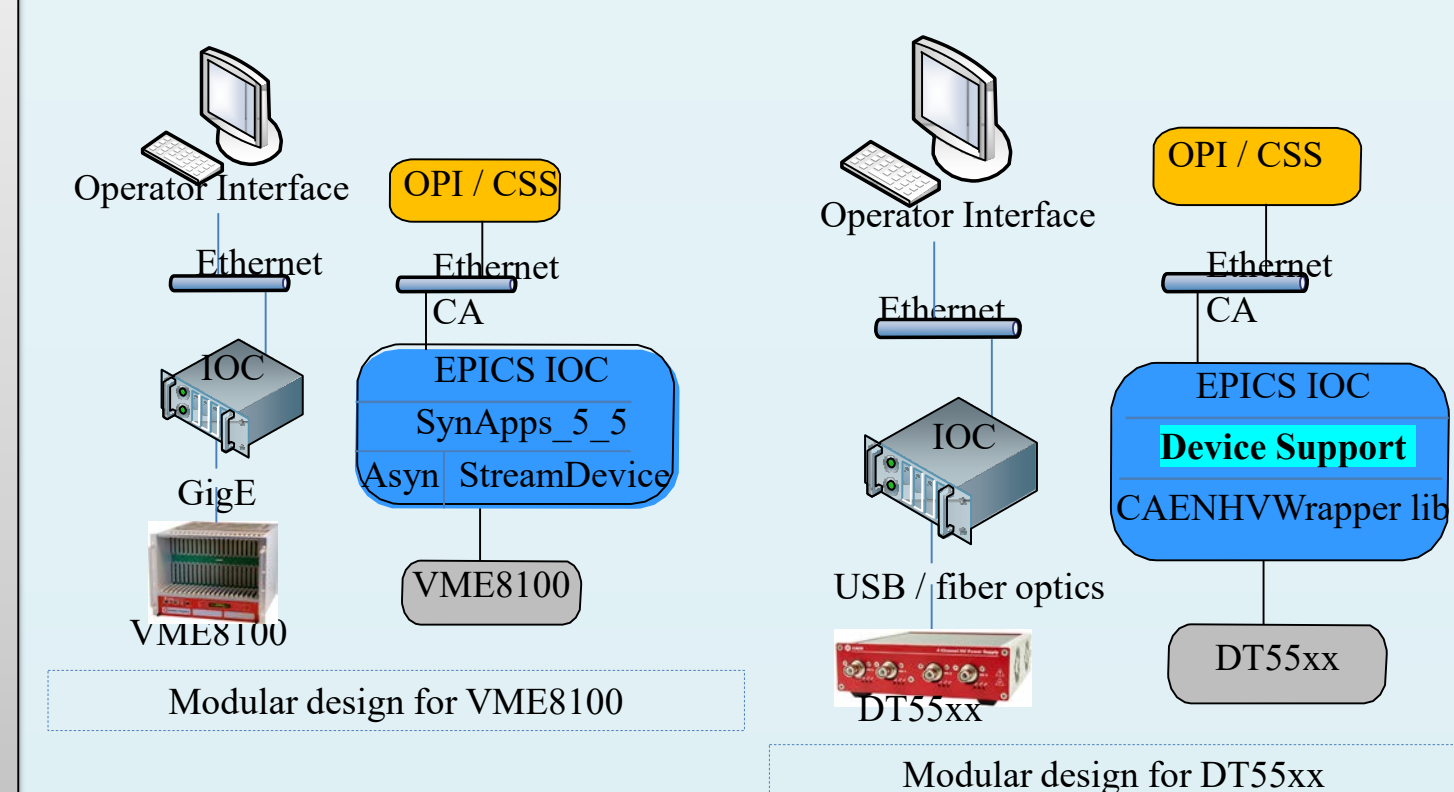
System Design for GBDD CS

The CS for GBDD based on EPICS is being designed and implemented by ELI-NP, to provide the machine information connection with the GBS CS, to collect data from GBDD devices, to monitor status of GBDD devices, and to provide the HLS for the Gamma Beam Diagnostics.



The GBDD CS is based on a modular control system design. It includes the design for the devices grouped by the following sub-modules:

- Vacuum system
- High voltage Power supply module
- Power crate module
- Data acquisition module
- Beam profile module
- Motor control module
- Interlock module



The implementation for each type of devices follows the modular design which defines the common parts:

- The required software package for Input Output Controller (IOC)
- The software framework for the design of Operator Interface (OPI)
- The communication interfaces between IOC and OPI from the hardware and software perspective

Implementation for GBDD CS

The EPICS integration has been finished for the following devices: the VME create, the high voltage power supplies, the CCD camera prototype, and the digitizers. The high-level software for Gamma Beam Diagnostics has been designed based on the physics requirement.

