EUROPEAN
PLASMA RESEARCH
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EXCELLENCE IN
APPLICATIONS

EuPRAXIA

Chapter 17: Control System

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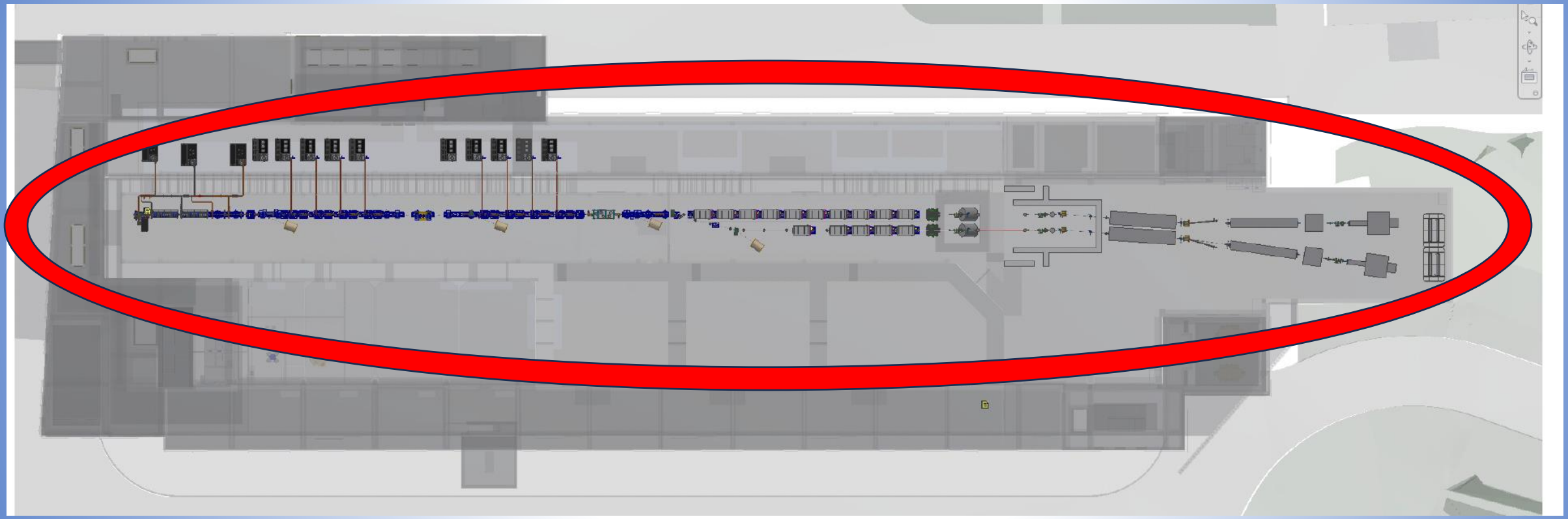
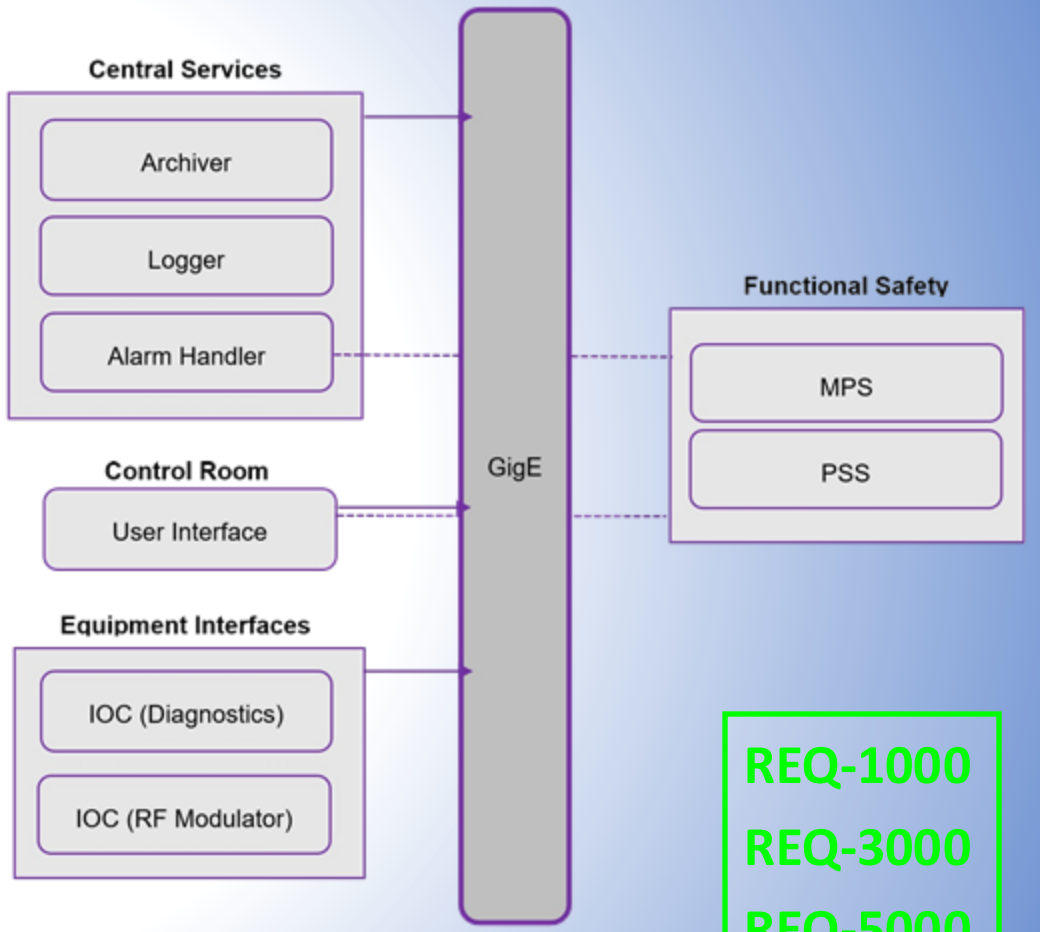
Area



Overview on EuPRAXIA Control System Chapter

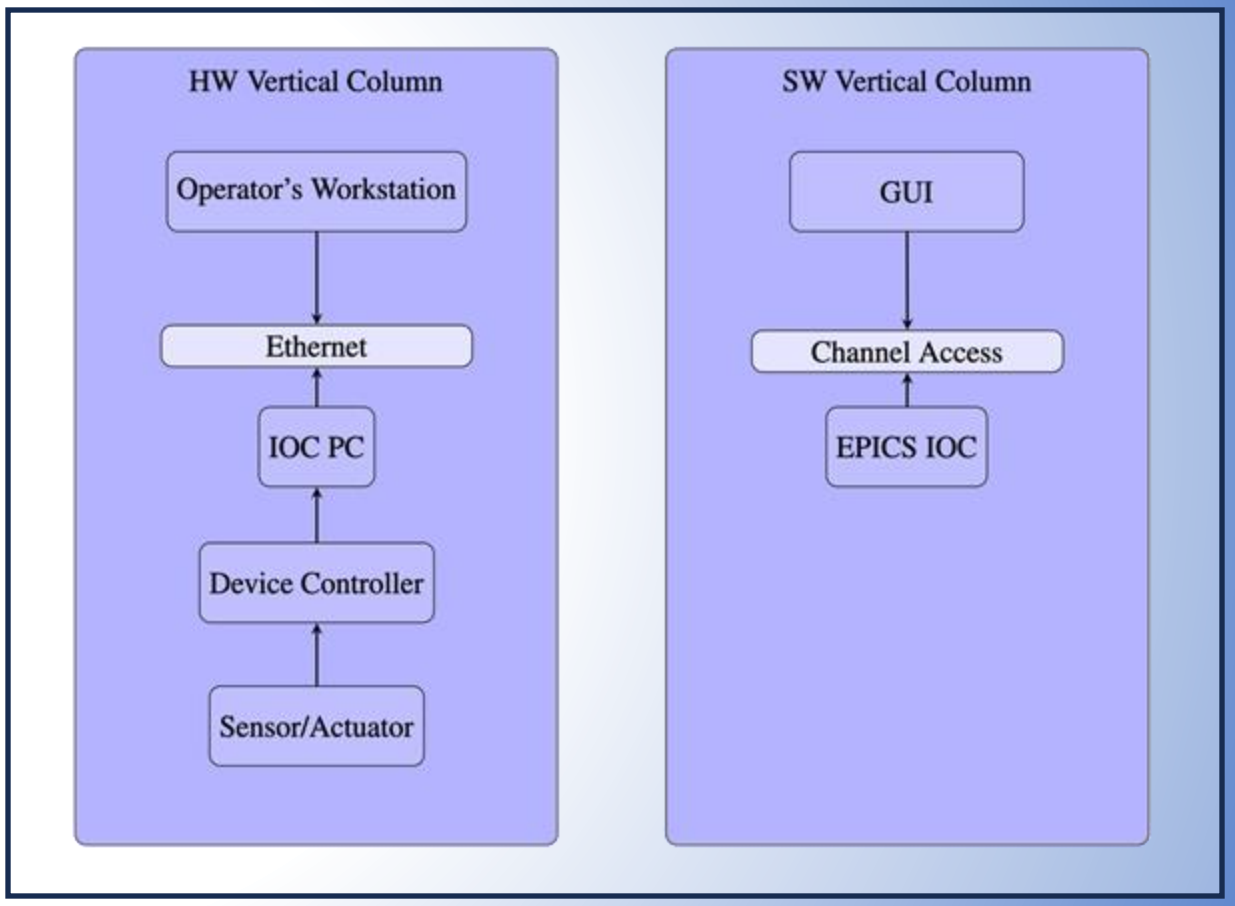
Control System Requirements and Architecture

- **REQ-1000 – Scalability:** efficient handling of large number of signals (10^5 - 10^6) without significantly impairing performance
- **REQ-2000 – Performance:** fast rate sampling capability
- **REQ-3000 – Maintainability:** new requirements and technology changes emerging over the years should be easy to be included minimally impacting other systems
- **REQ-4000 – Reliability:** low rate of failures, to meet the overall availability objectives of the facility
- **REQ-5000 – Usability:** intuitive, efficient and uniform operator interfaces (OPIs) for users, implemented to minimize the possibility of human error
- **REQ-6000 – Longevity:** EuPRAXIA is expected to be in operation for decades – need of a control system allowing for continued operation throughout the lifetime of the facility



Control System software and device integration

Vertical columns describe how the devices are integrated in the control system, by hw and sw points of view.



Control System software and device integration

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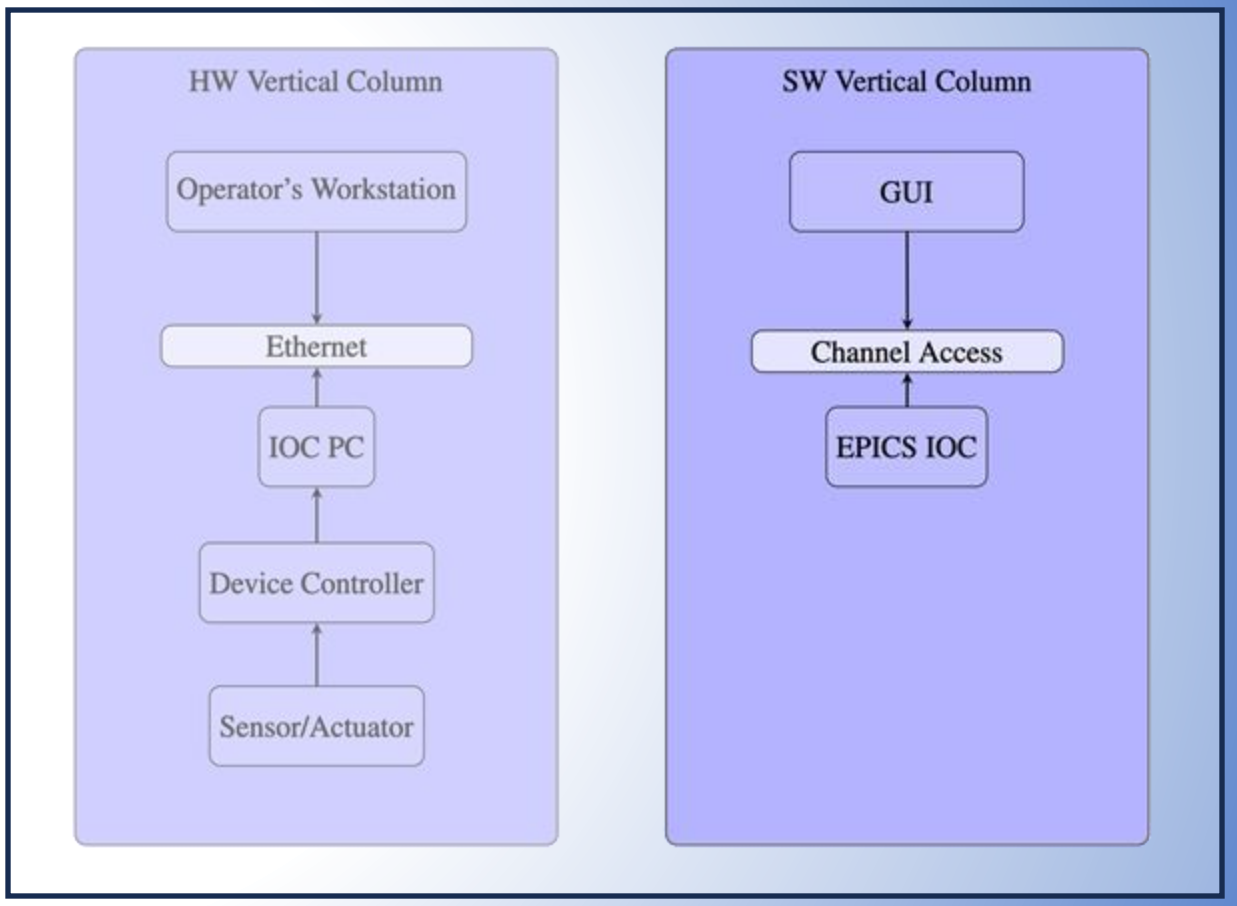
Vertical columns describe how the devices are integrated in the control system, by hw and sw points of view.

- EuPRAXIA Control System based on **EPICS – common standard for several facilities worldwide**
- Client (OPIs, central services) – Server (EPICS) architecture
- Ethernet network communication via Channel Access protocol
- OPIs and Central Services access devices parameters (PVs) in the IOC through CA

REQ-6000



Control System software and device integration

Vertical columns describe how the devices are integrated in the control system, by hw and sw points of view.

Laser
Transfer line cameras
Mirror motors
Shutters

Magnet
Power supplies

Timing
MRF distributed system

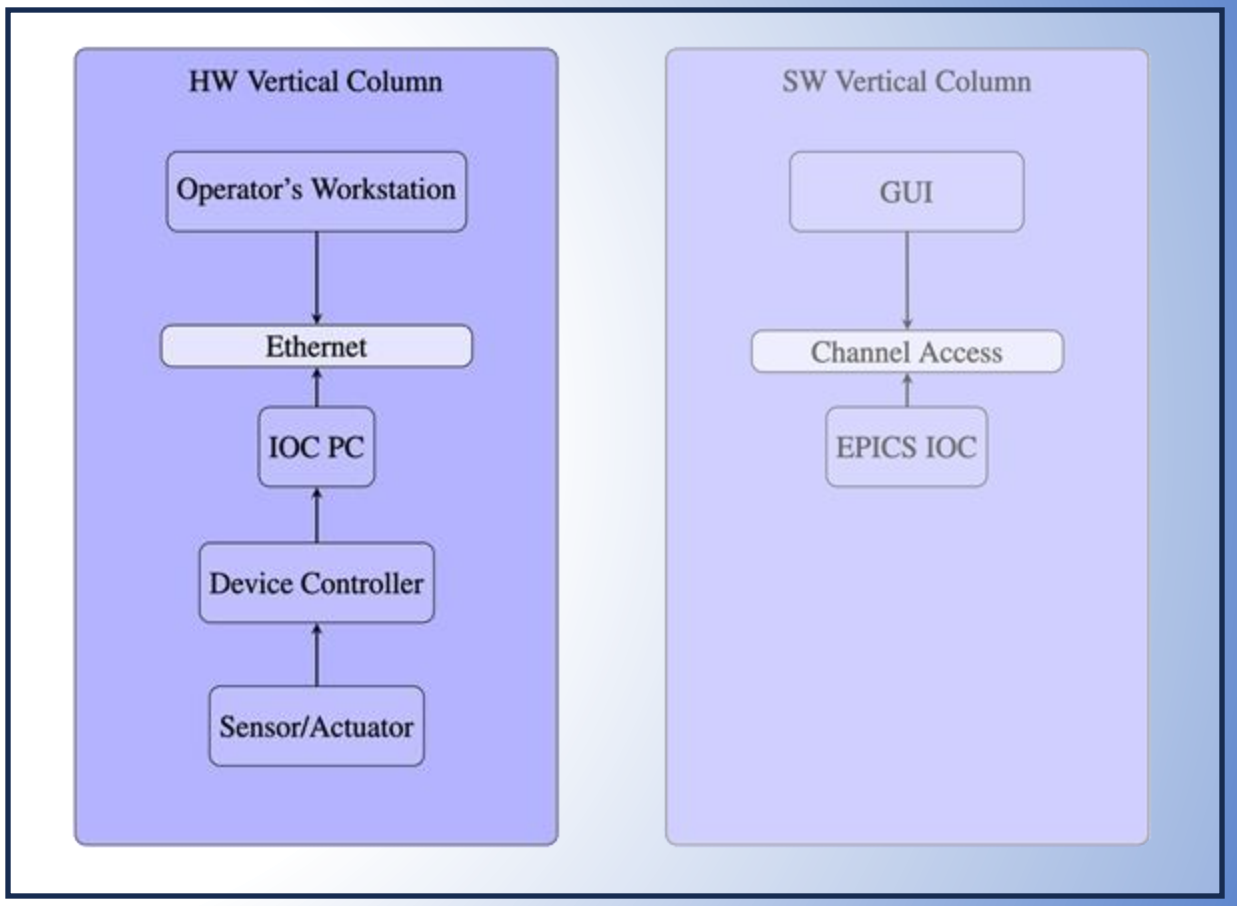
RF
ScandiNova modulators
LiberaLLRF systems
Klystron-Loop feedback
Phase Shifter

Vacuum
Ion pumps
Getter pumps
Scroll pumps
Turbo pumps
Vacuum valves

Diagnostics
Cameras
Flag Motors
Flag bulbs
Current Monitor
Faraday cups
BPMs
Cavity BPMs

Functional safety
Personnel Safety
Machine Protection
Intra-pulse interlocks
Beam Loss Monitors

Cooling
Chillers
Cooling-plant
Thermo couple



Main Central Services

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High Level Applications	Alarm Handling	Archiving	Logging
pyEpics for EPICS variables advanced pre-processing functionalities; AI automation tools for monitoring, operations and predictions	Alarms severity and thresholds can be set to EPICS variables and propagated to linked ones for immediate knowledge; Functional safety systems (MPS & PSS)	Data historization based on three-level basis for efficient disk resources management	Logging tools to for easy access to IOC error and log messages (iocLogClient, iocLogServer)
REQ-4000	REQ-4000	REQ-2000	REQ-3000

Achievements: Technological Readiness Level (Sub-Components)

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Sub - systems	TRL	Comments
EPICS IOCs development	8	EPICS-based control systems are widely used in experimental facilities. IOCs already developed for most of elements (motors, cameras, vacuum system components, RF system components), software is open source and accessible, few still in development
Archiving tool development	9	Technology proven in other facilities (TEX, SPARC_LAB, EuAPS).
Alarm handler	9	Technology proven in other facilities (TEX, SPARC_LAB, EuAPS).
AI system	7	Technology demonstrated in other facilities (TEX, Daphne LINAC, SPARC_LAB).
Graphical User Interfaces	7	Technology based on widely used platforms