MOPHA028

HIGH ENERGY PHOTON SOURCE CONTROL SYSTEM DESIGN*

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Abstract:

A 6-GeV high energy synchrotron radiation light source is being built near Beijing, China. The accelerator part contains a linac, a booster and a 1360-m circumference storage ring, and fourteen production beam-lines for phase one. The control systems are EPICS based with integrated application and data platforms for the accelerators and beamlines. The number of devices and the complexity level of operation for such a ma-chine is extremely high, therefore, a modern system design is vital for efficient operation of the machine. This paper reports the design, preliminary development and planned near-future work, especially the databases for quality assurance and application software platforms for high level applications.

HEPS Main Parameters:

Main Param.	Value	Unit
Top beam energy	6	GeV
Main Ring circumference	1360.4	m
Emittance	<60 (<40 with anti-bend)	pm-rad
Beam current	200	mA
Brightness	$>10^{22}$	Phs/s/mm^2/mrad/0.1%BW
Injection	Top-up	
Bunch structure	680 (high-brightness mode), 63 (timing mode)	

Introduction

HEPS Control System Design principles:

- Data centric approach
- Top-down architecture design: understanding the big picture
- Distributed control systems
- Integrated development tools (GUI code editors, repository management…) for higher software quality
- Choosing advanced yet matured technologies
- Using industrial standards, choosing commercially available products first for lowering costs
- Considering expandability at design, balancing the price and performance while satisfying physics requirements
- Collaborating with other accelerator projects
- Possible commercialization for R&D results

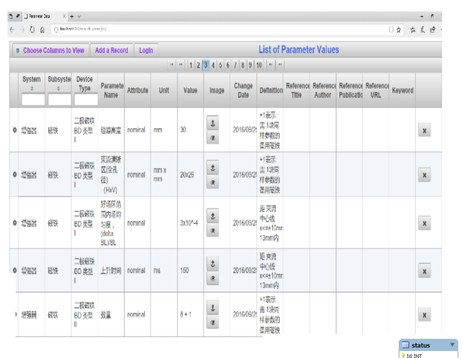
Database Work

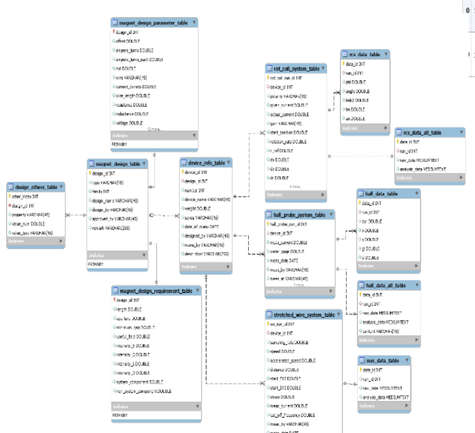
Planned Database work:

Parameter List	Logbook and Issue Tracking	Cable
Naming Convention	Maintenance/Operation	Security
Magnet	Inventory	Alarm
Accelerator Model/Lattice	Survey and Alignment	Machine Protection/Interlock
Equipment and Configuration	Work Flow Control/Traveler	MPS Postmortem
Physics Data and Machine State	Document DB	

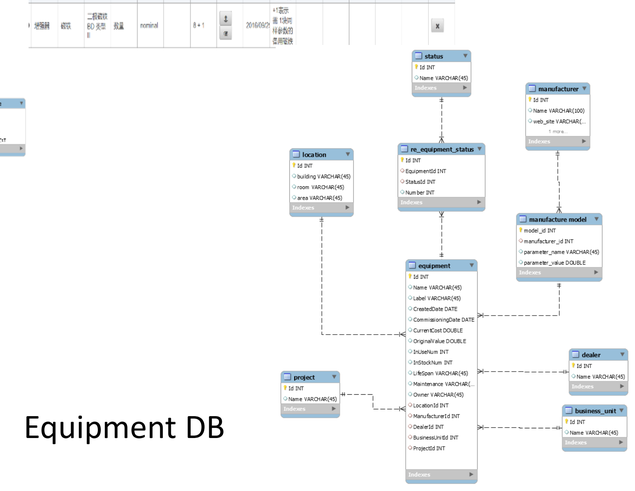
Present work:

- Design Parameter List DB
- Naming Convention DB
- Magnet DB
- Equipment DB
- Lattice & Model DB

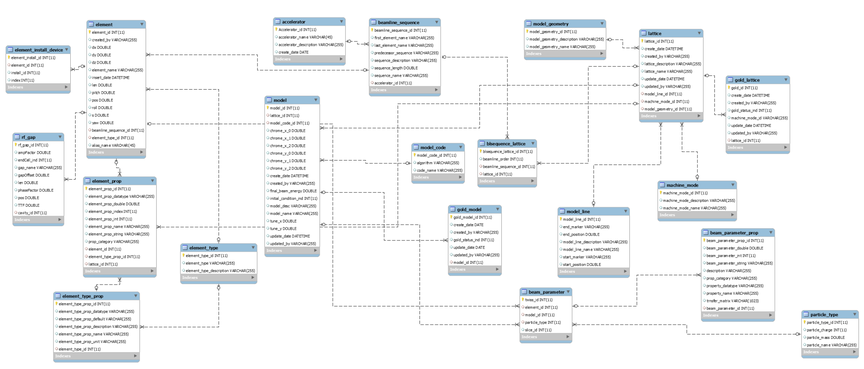




Magnet DB



Equipment DB

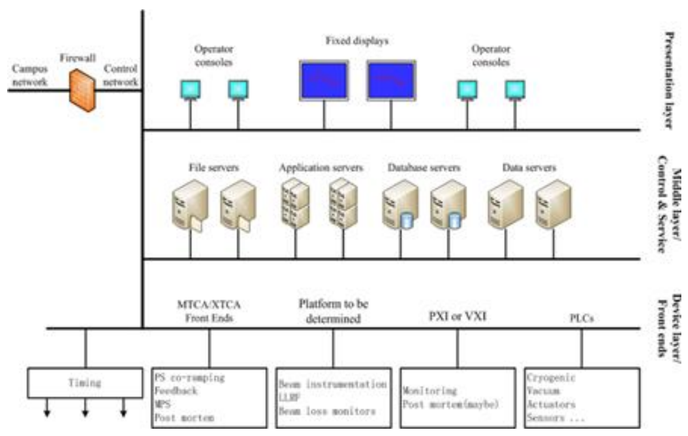


Lattice &Model DB

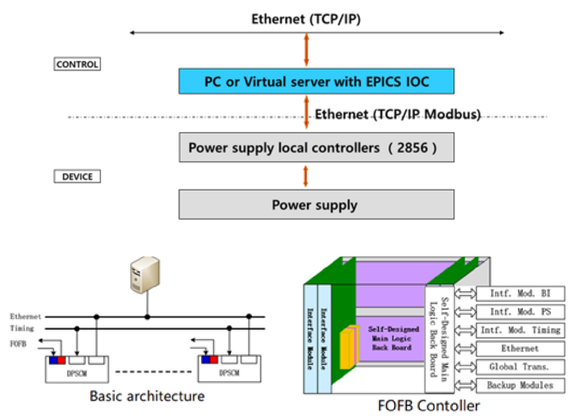
Accelerator Control

3-tier architecture:

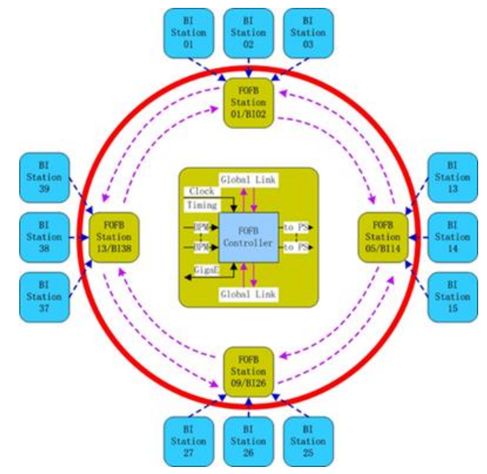
- Device layer
- Middle layer
- Presentation layer



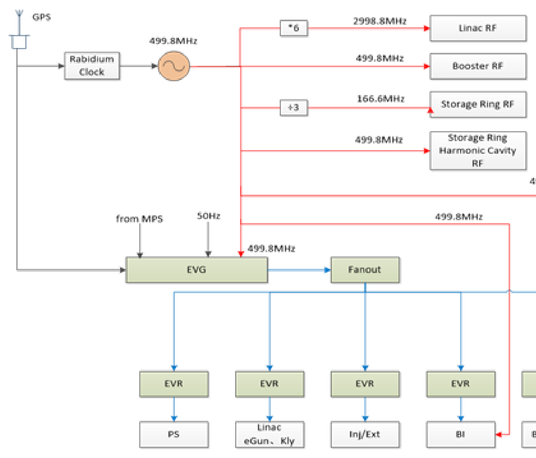
Magnet Power Supply Control:



FOFB PS Control

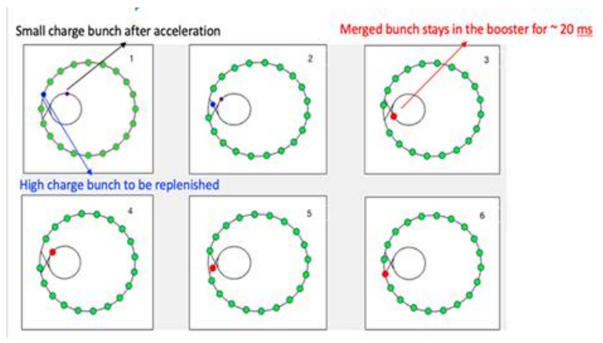


FOFB Topology



Timing System:

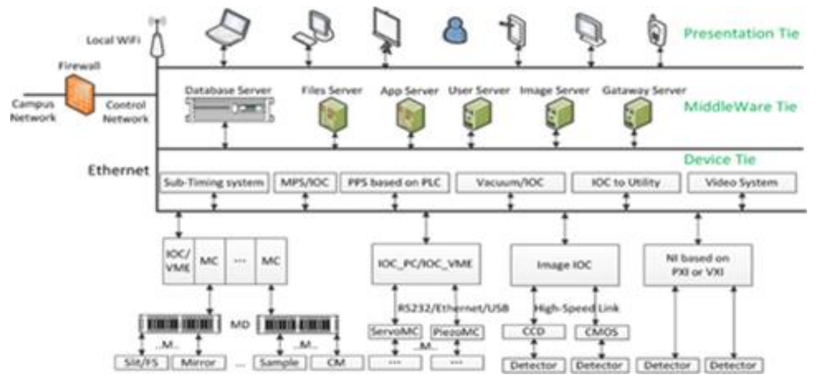
- MRF-based event trigger
- Distributed RF reference lines
- 12 ns kicker pulse width
- Swap-out top-up injection
- Considering MicroTCA EVR



Swap-out injection scheme

Beamline Control

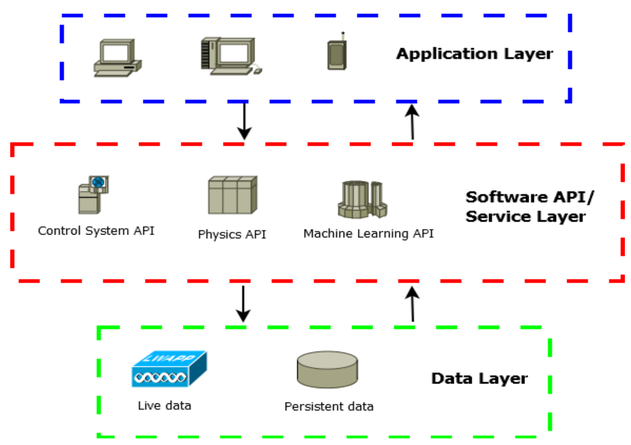
- Similar to Accelerator Control
- Considering EPICS v7
- In conjunction with DAQ, Computing



Software Platforms:

- Control system API: CS-Studio API
- Physics and general-purpose API: Open XAL
- Machine Learning: under development

Support Java and Python



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