#### 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	1360.4	m							
circumference									
Emittance	<60 (<40 with anti-bend)	pm-rad							
Beam current	200	mA							
Brightness	>10 <sup>22</sup>	Phs/s/mm <sup>2</sup> /mrad/0.1%BW							
Injection	Тор-ир								
Bunch structure	680 (high-brightness mode), 63 (timing mode)								

# **Accelerator Control** 3-tier architecture:

Device layer

**Magnet Power Supply Control:** 

Middle layer



## 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

Presentation layer  ${\bullet}$ 













FOFB Topology

#### **Timing System:**

- MRF-based event trigger
- **Distributed RF reference** lines

#### **Database Work**

#### Planned Database work:

#### Present work:

- Design Parameter List DB
- Naming Convention DB
- Magnet DB

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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							

- 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  $\bullet$
- 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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