

The SLS 2.0 Beamline Control System Upgrade Strategy

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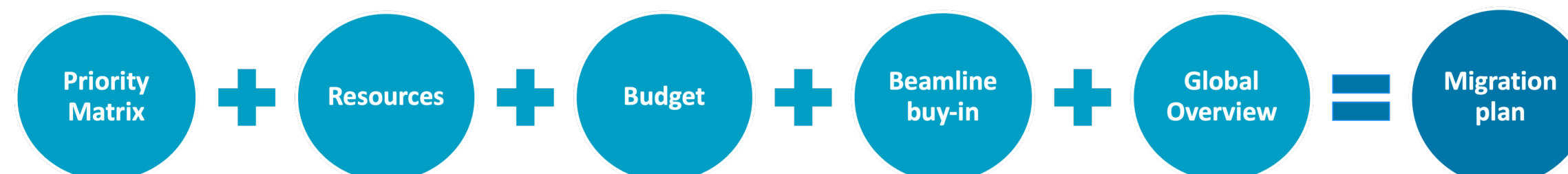
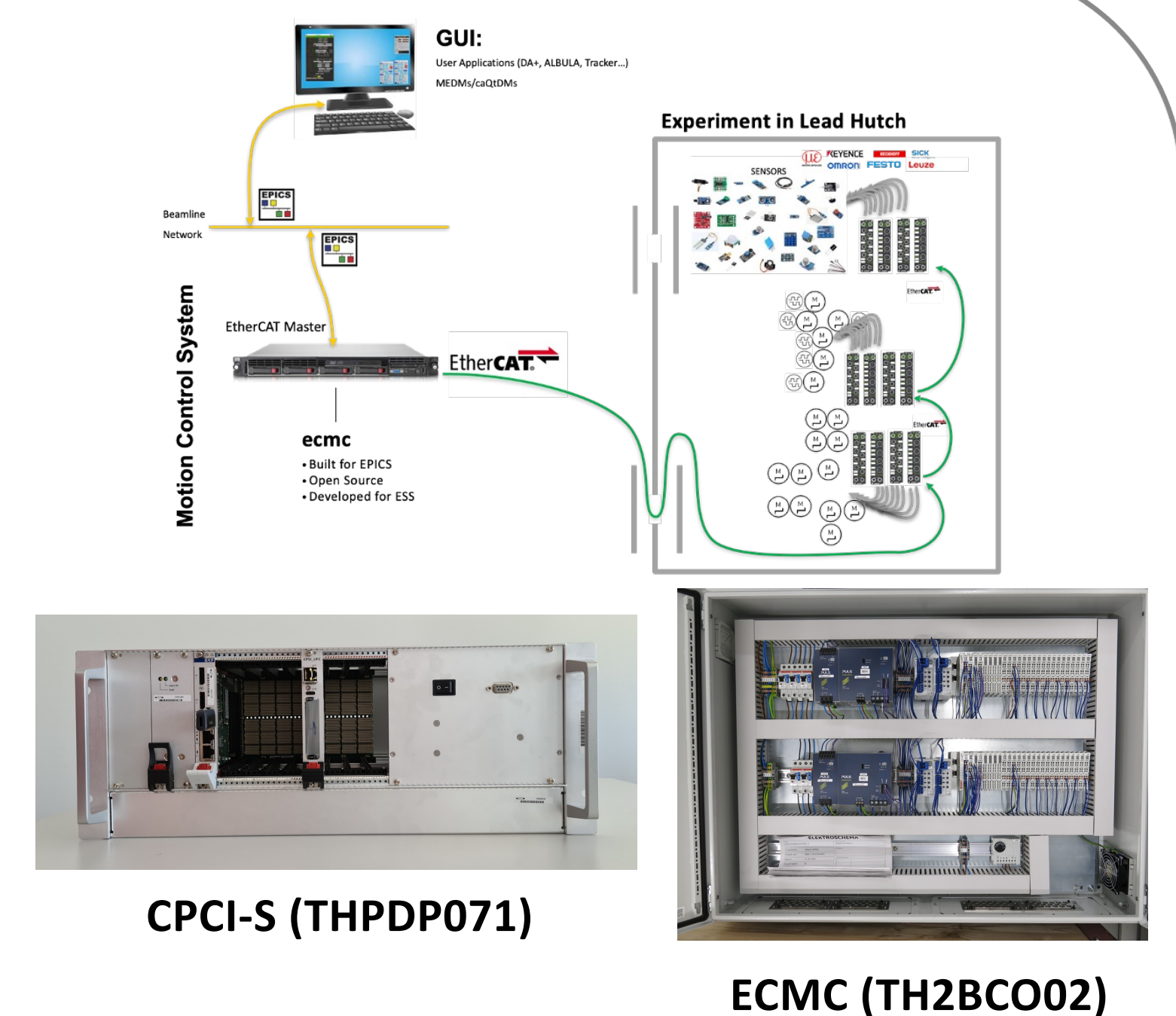
Abstract

With over two decades of successful operation, the SLS facility will now undergo a major upgrade that includes the complete replacement of the storage ring, yielding substantial improvements in beam emittance and brilliance and setting the stage for a new era of scientific exploration. As a critical component of the SLS 2.0 project, beamline upgrades are integral to harnessing the full potential of these enhanced beam characteristics. To ensure that our users enjoy an optimal beamtime experience and maximize the scientific output, it is imperative to elevate the capabilities of our beamline control and data acquisition tools. Therefore, a thorough modernization and upgrade of our current control system stack is not just desirable but essential.

Diversify Controls HW Portfolio

subsystem	SLS	SLS 2.0
Timing / EVR	VME	cPCI-S
Fast I/O	VME (Hytec), other special ADCs	cPCI-S (can be customized for user applications – FPGA on Zync-UltraScale chip)
Slow I/O	VME (Hytec), Wago	ECMC, Wago
High voltage power supplies	VME (ISEG)	ISEG – network device (SNMP)
Motion	VME motors (OMS), encoders (ECM) Variety of supported motor and encoder types	ECMC (EtherCAT, Beckhoff) (guideline: 2-phase bipolar stepper or servo + absolute encoders) MCS2 controller for SmarAct
Scalers	VME (Struck, Jörger, Hytec)	cPCI-S (in development - TBD)

- HW lifecycle management
 - aging VME HW, low market availability
 - difficult to support new EPICS versions on vxWorks
- Meet modern user requirements
 - Performance (motion, ADCs, customization)
 - Experiment orchestration capabilities
- Use widespread technologies



Project Mgmt.

- Communication, workflow definitions - minimize delays before commissioning starts
- Staged migration plan with coexistence of new and legacy systems - **global**
- Beamline upgrade coordinator role is critical (BL staff) - **local**

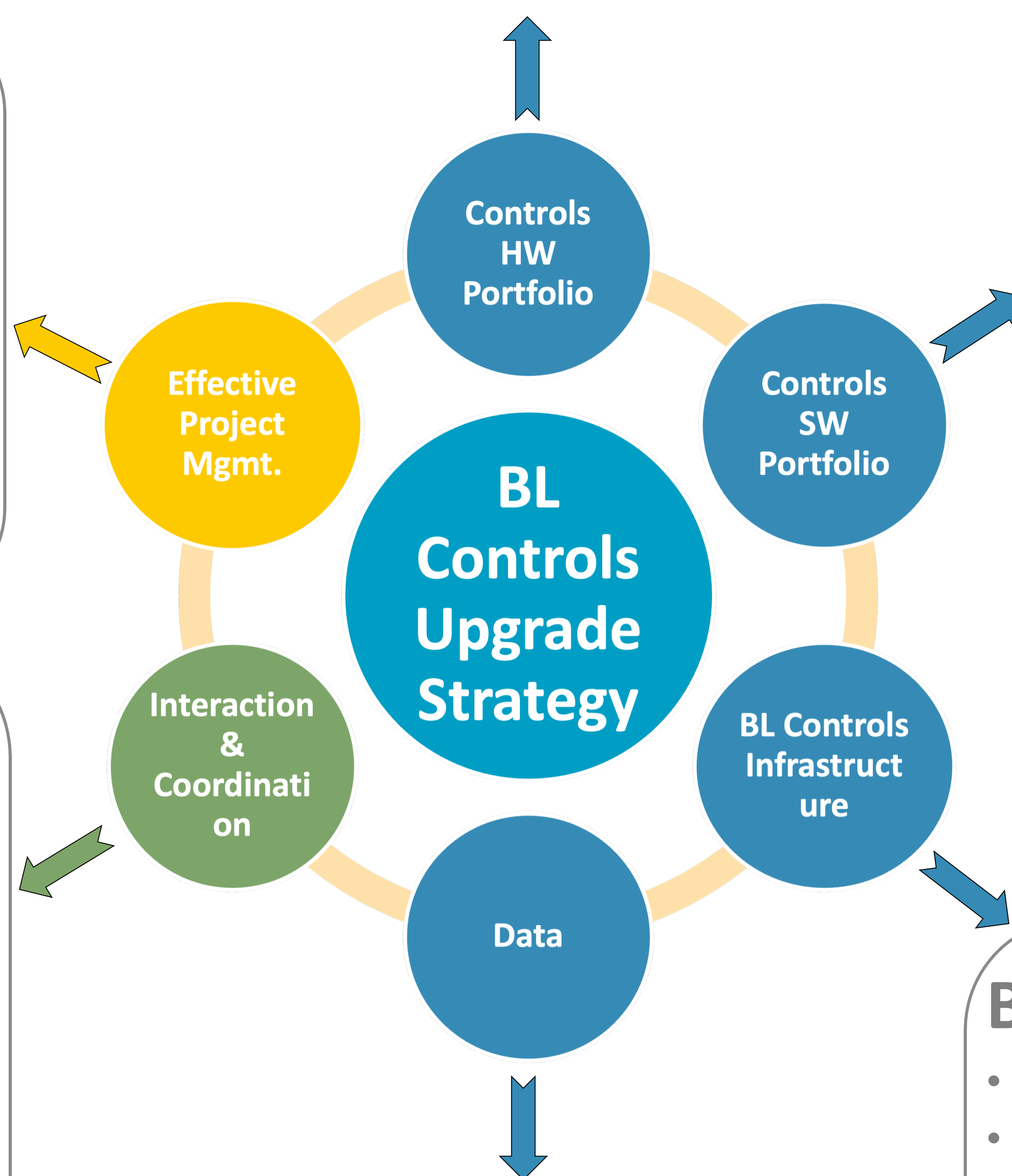
Coordination features

Fly Scanning

- Increase scan efficiency by cont. motion and detector triggering
- Use-cases: 3 tiers of complexity
 - SW-based (BEC level)
 - Standard HW portfolio-based (ECMC)
 - High-end, customized

Beamline Experiment Control (BEC)

- Central point of experiment orchestration
- Use Bluesky toolbox, adapted for PSI
- Abstraction layer - Bluesky's Ophyd
- **MO2A002**



Controls SW Portfolio

- EPICS 7 (no pvAccess on day 1)
- OPC-UA (replace Siemens s7plc)
- Continuation of caQtDM
- Migration to RHEL8 (and later RHEL9) for softioc hosts
- Build, Deployment and Provisioning system (THPDP070)

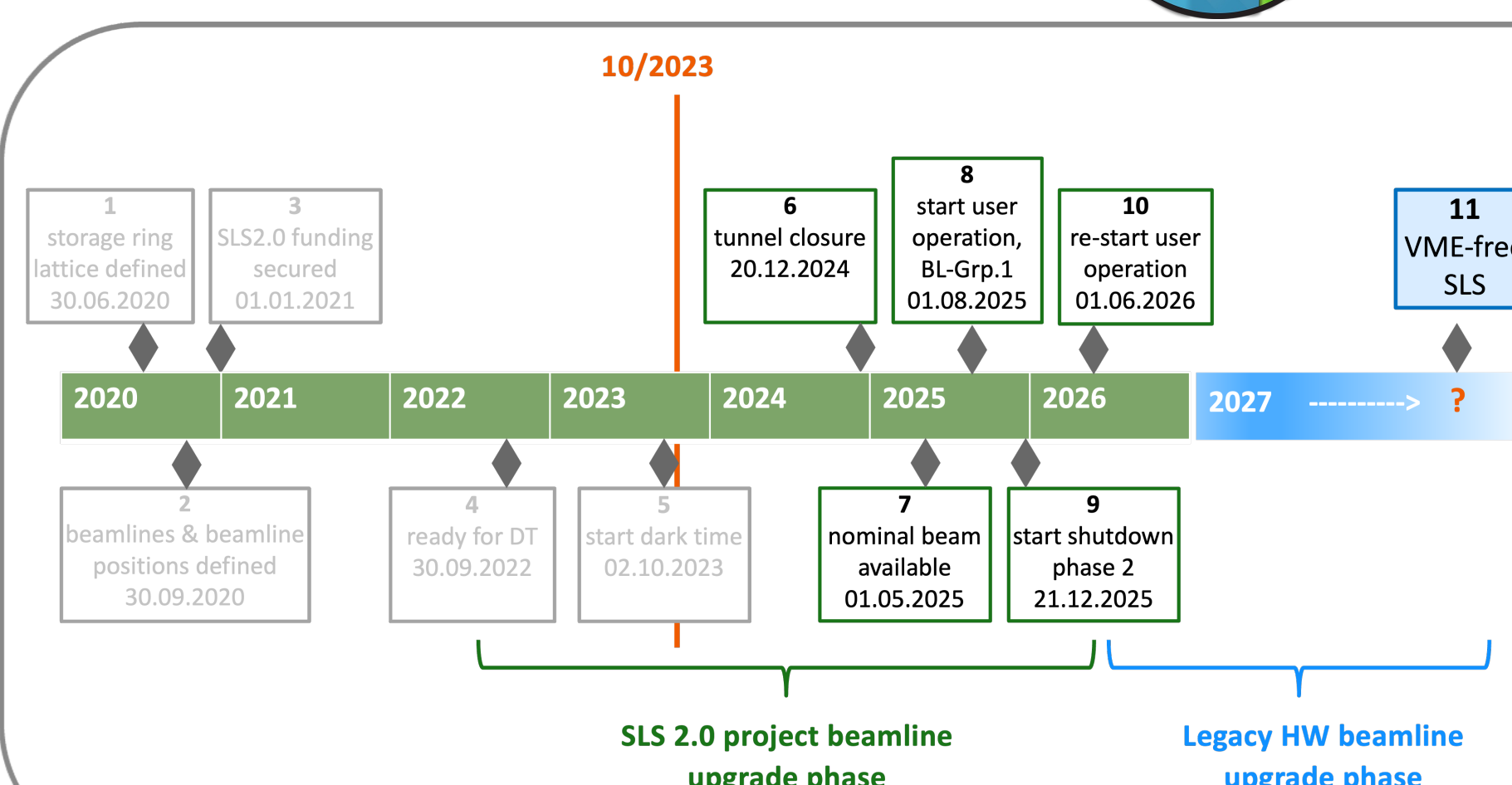


BL Ctrl. Infrastructure

- EPICS ioc hosts (virtual/physical)
- Triggering infrastructure
- Timing system distribution
- PTP (Precision Time Protocol) server
- BEC server
- Local Data processing servers (if needed)
- EtherCAT link ID <-> Monochromator

Data acq., processing, IT

- Unified data ingest, processing and storage
- Standard DAQ backend layer (large detectors mostly)
- Archiving system (**WE3BC001**)
- Stream processing service (**THSDSC04**)



SLS 2.0 Project

- Storage ring upgrade (DT Oct 23' - Dec 24')
- 19 User beamlines after the upgrade (3 upgrade Phases)
- Controls and Science IT (CaSIT) one of four SLS 2.0 sub-projects

