



中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences



环形正负电子对撞机
Circular Electron Positron Collider

CEPC large scale and precision control system study in EDR

23 January, 2024

Dapeng Jin

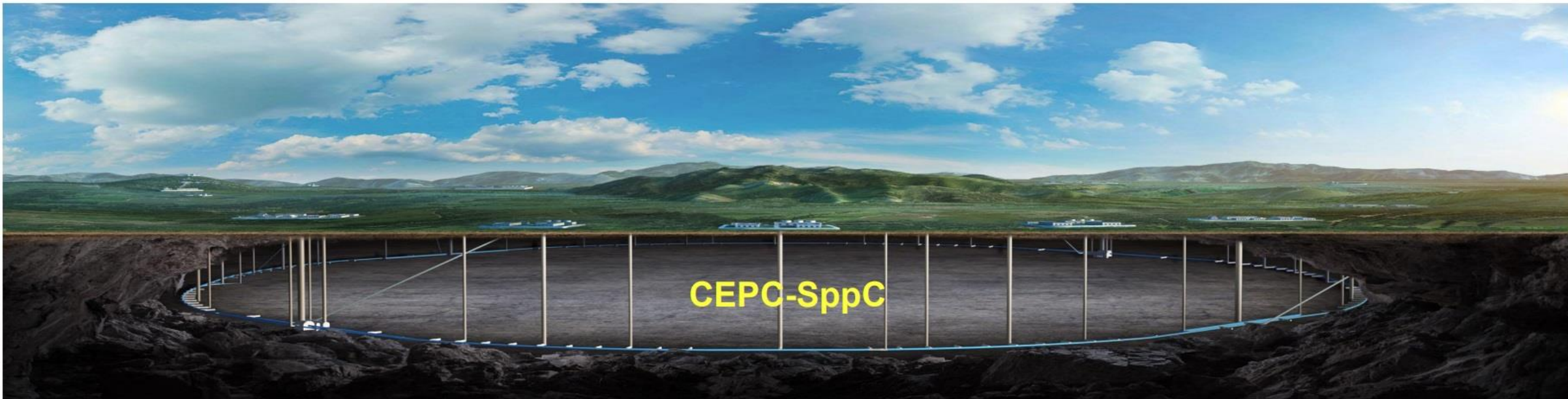
Institute of High Energy Physics, CAS, Beijing

➤ **Challenges & current status**

➤ **Further to do**

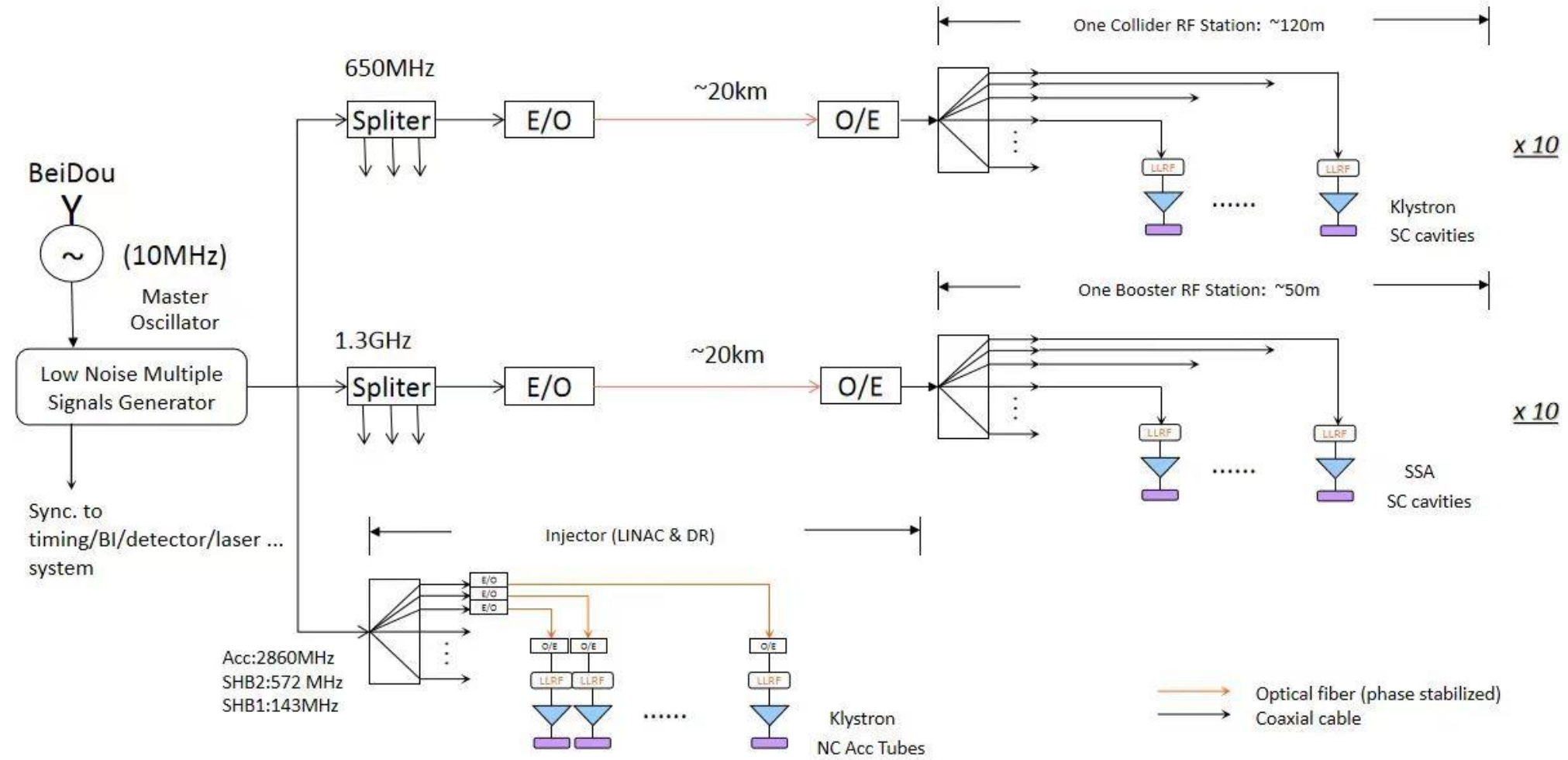
➤ **Summary**

- **Reliability & availability & low cost on large scale (First priority).**
Radiation hardness of components in tunnel.
- **Maintainability : Flexibility : Scalability (Second priority).**

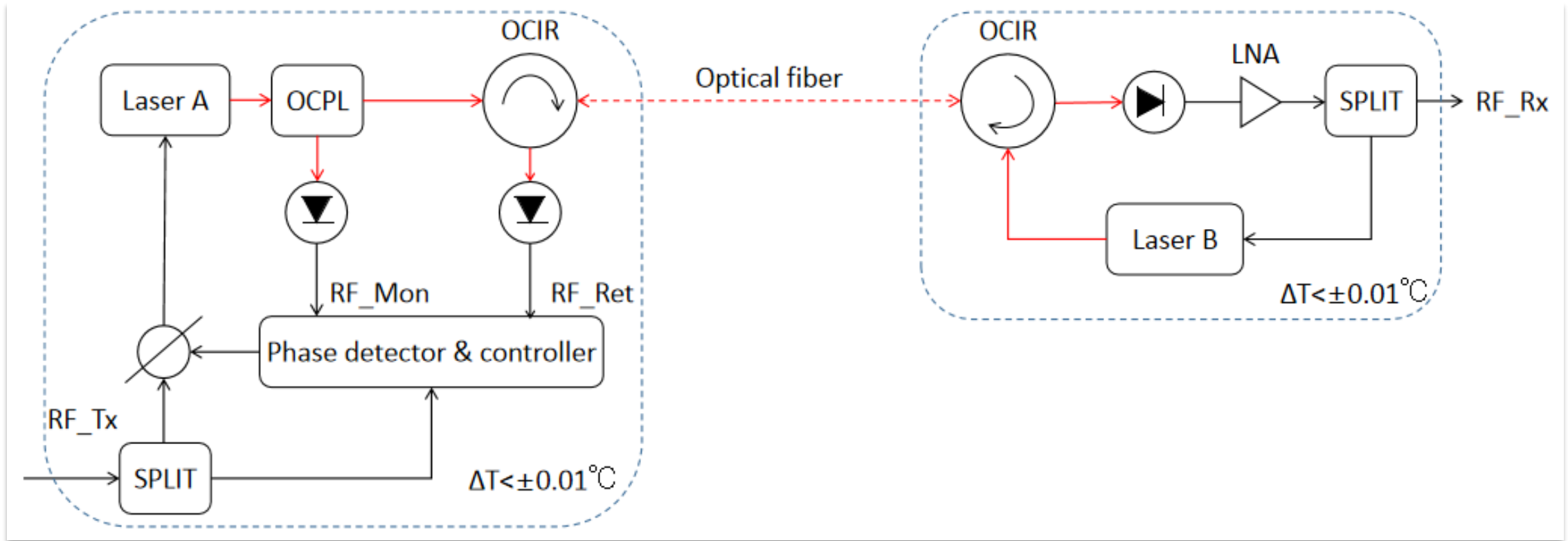


- Beam instrumentation along the **whole ring** with **high requirements** => **Performance, radiation-hardness & cost.**
- **Temperature variation induced drift** compensation. **Hundreds of ps** for **10km optical fiber** with **1 °C** change normally.
- Good **experiences** of development and application **in the BEPCII & HEPS.**

Challenges & current status Timing system & reference line



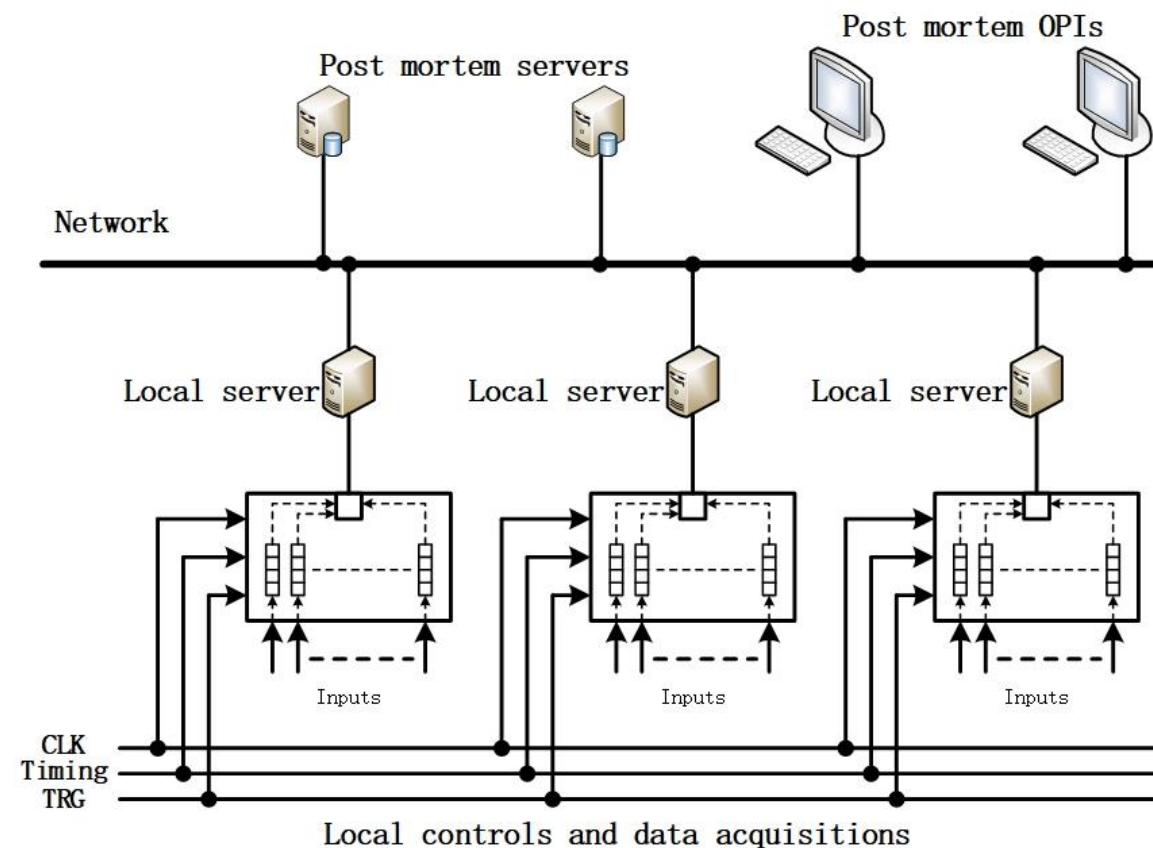
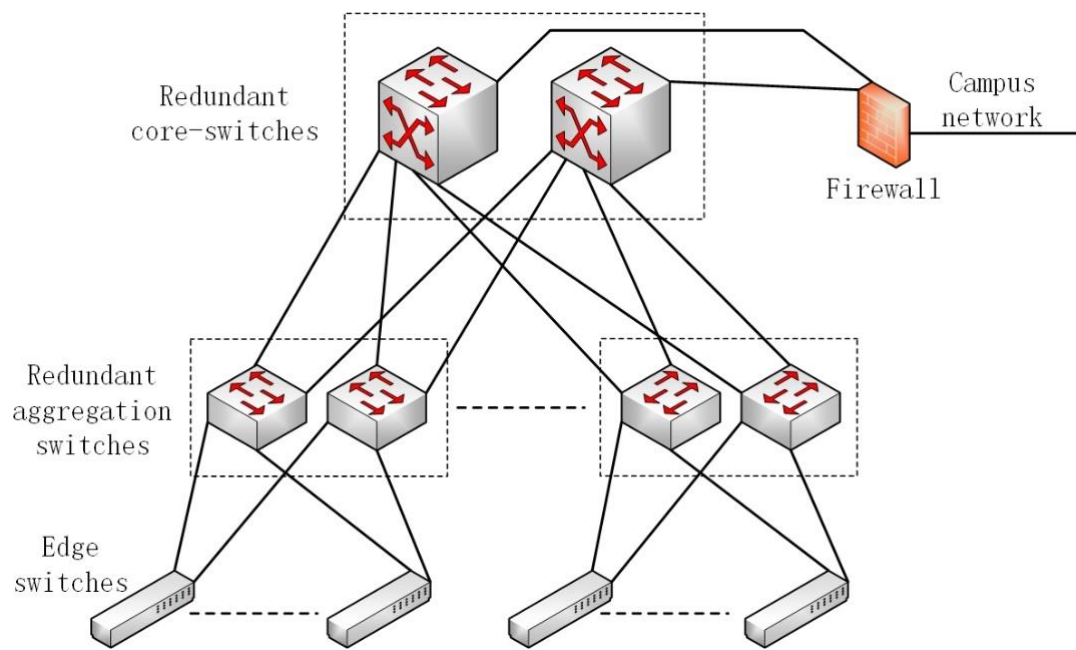
Preliminary design of the reference line (experiences in BEPCII & HEPS)



Transmission and compensation part of the reference line in detail
(Compensation for more than 1 clock cycle needs to be tested)

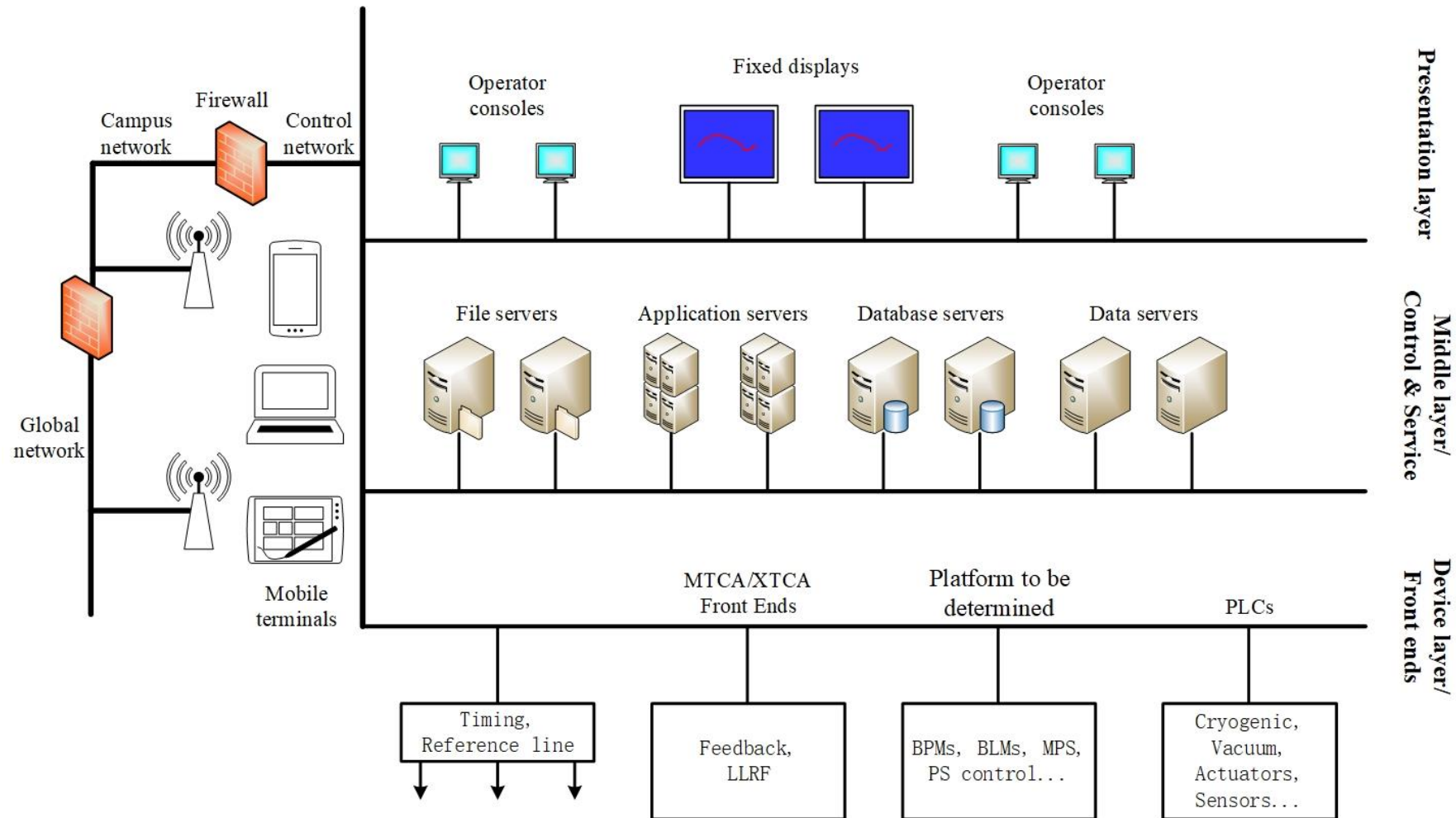
- **Integration of timing system and reference line under consideration.**

- Distributed data acquisition, **online and offline analysis.**
- **Post mortem & real-time health monitoring (Distributed Logic Analyzer)** with time correlated data. Size of front end controllers' data caches and accuracy of timestamp.



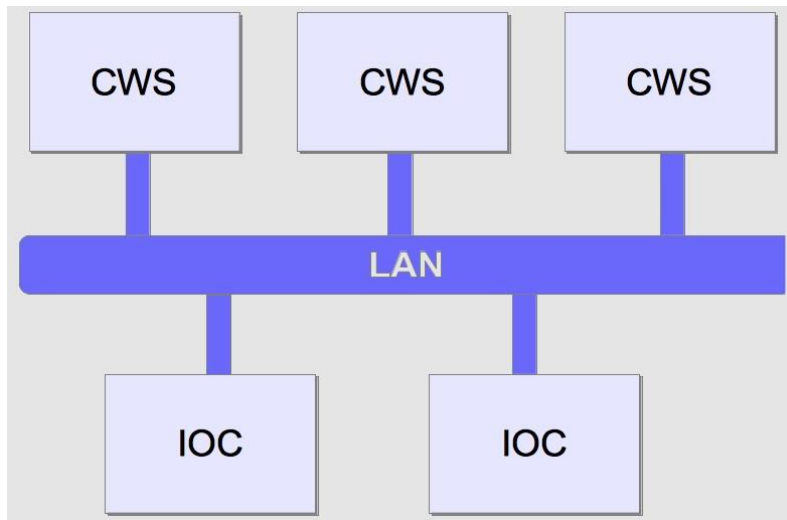
Multi-layer network : control and DAQ

- Overall control & zone allocation.
- **Automation:** development, installation, configuration, log, alarm, AI analysis, health report ...
- Joint development & management.



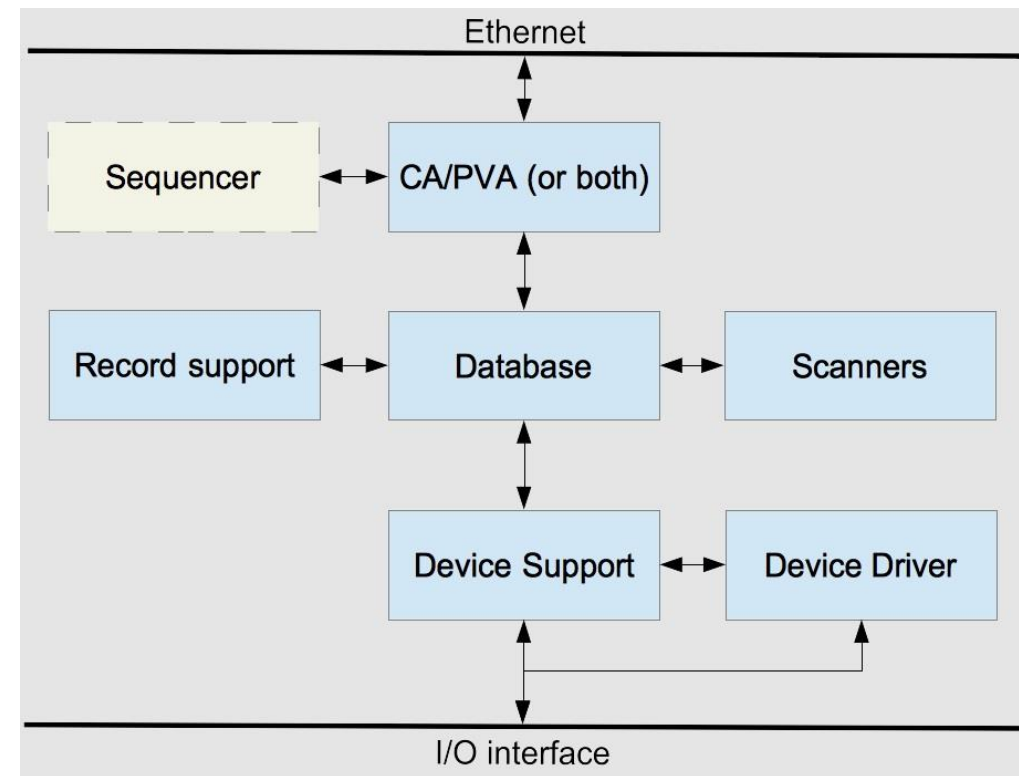
➤ EPICS is the current selection

- Good structure and performance.
- Good toolsets to use.
- Widely used, also by us.



CWS : Client WorkStation

IOC : Input/Output Controller



The EPICS collaboration includes many dozens of projects, across disciplines, sizes and continents. Here is a selection of them.



Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory

The Advanced Light Source (ALS) is a third-generation synchrotron light source at Lawrence Berkeley National...

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The Tata Institute of Fundamental Research (TIFR) is a National Centre of the Government of...

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Japan Proton Accelerator Research Complex (J-PARC)

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National Synchrotron Radiation Research Center (NSRRC)

The National Synchrotron Radiation Research Center (NSRRC) operates two synchrotron light sources, named Taiwan Light...

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Antarctic Bright Star Survey Telescope (BSST)

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Kyoto University Fixed Field Alternating Gradient Accelerator Complex (KUFFA)

The Kyoto University Fixed Field Alternating Gradient Accelerator Complex (KUFFA) was developed as a proton driver...

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UKAEA researches fusion energy and related technologies, with the aim of positioning the UK as...

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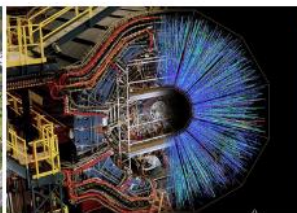
Experiments at GSI and FAIR

GSI Helmholtzzentrum für Schwerionenforschung (GSI Helmholtz Centre for Heavy Ion Research) operates a large-scale worldwide unique accelerator facility for...



China Spallation Neutron Source (CSNS)

The China Spallation Neutron Source (CSNS), operated by the Institute of High Energy Physics (IHEP),...



STAR Detector at RHIC

The STAR detector at Brookhaven National Lab specializes in tracking the thousands of particles produced by...



Beijing Electron Positron Collider (BEPC-II)

BEPC-II is the upgrade project of Beijing Electron Positron Collider (BEPC), located at the Institute...



Medical LINAC Project Pakistan (MLPP)

At the site of the Pakistan Institute of Nuclear Science & Technology (PINSTECH), we are...



KSTAR Fusion Device

KSTAR (Korean Superconducting Tokamak Advanced Research), the most recent among global tokamak facilities, is a...



W. M. Keck Observatory

From atop Maunakea on the Island of Hawaii, astronomers around the world use W. M. Keck...

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Facility for Rare Isotope Beams (FRIB)

Michigan State University (MSU) is establishing the Facility for Rare Isotope Beams (FRIB) as a...

- **Robot** considered to do the inspection
 - Easy to avoid strong radiation.
 - Easy to install more inspection equipment.
 - Low cost.
 - Ground guide method to be used.

- To integrate the **timing system and reference line together**, design and development.
- For timing system and reference line, **long distance, long time, large temperature variation compensation & test.**
- **Radiation hard optical fibers and electronics test.**
- Design of **software structure and development** for data acquisition, storage, analysis and display.
- Design and development of **control structure and automation.**

- **Key issues** have been **identified** till now, **much** work need **to be done** together with the related systems.
- **Experiences** from previous and current facilities help to the design and development, **radiation-hardness and long distance transmission** needs to be studied thoroughly.

Thanks for your attention!