Our experience in environmental monitoring

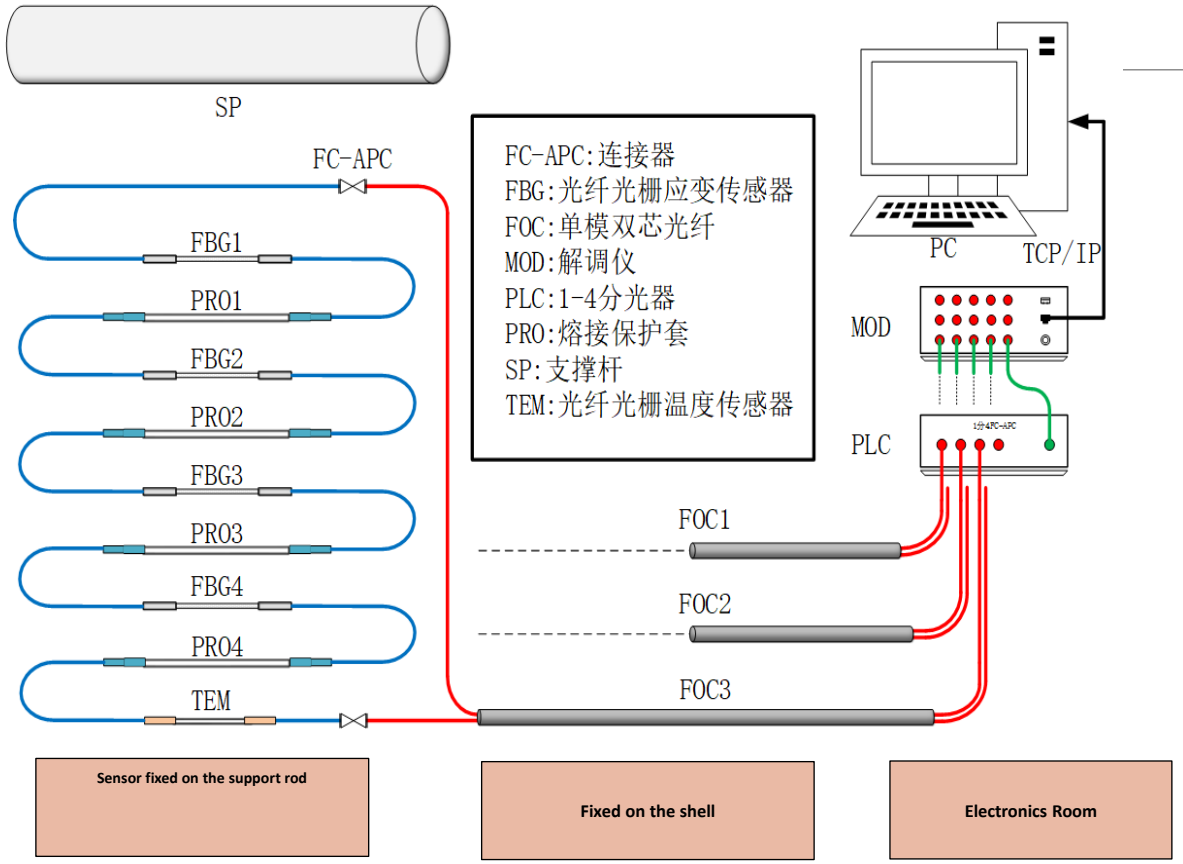
CEPC REF-TDR

2025.3.13

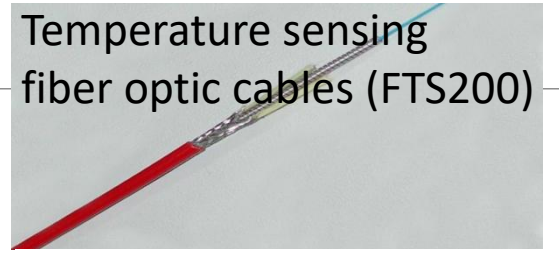
Outline

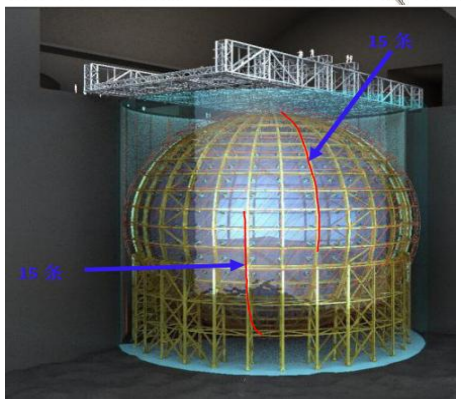
1. JUNO-CD environmental monitoring with fiber
2. JUNO environmental monitoring in experimental hall
3. BESIII environmental monitoring
4. On going technology with LoRa for temperature and radiation monitoring

Strain and temperature monitoring with Fiber



Structure of Connection bar strain monitoring system

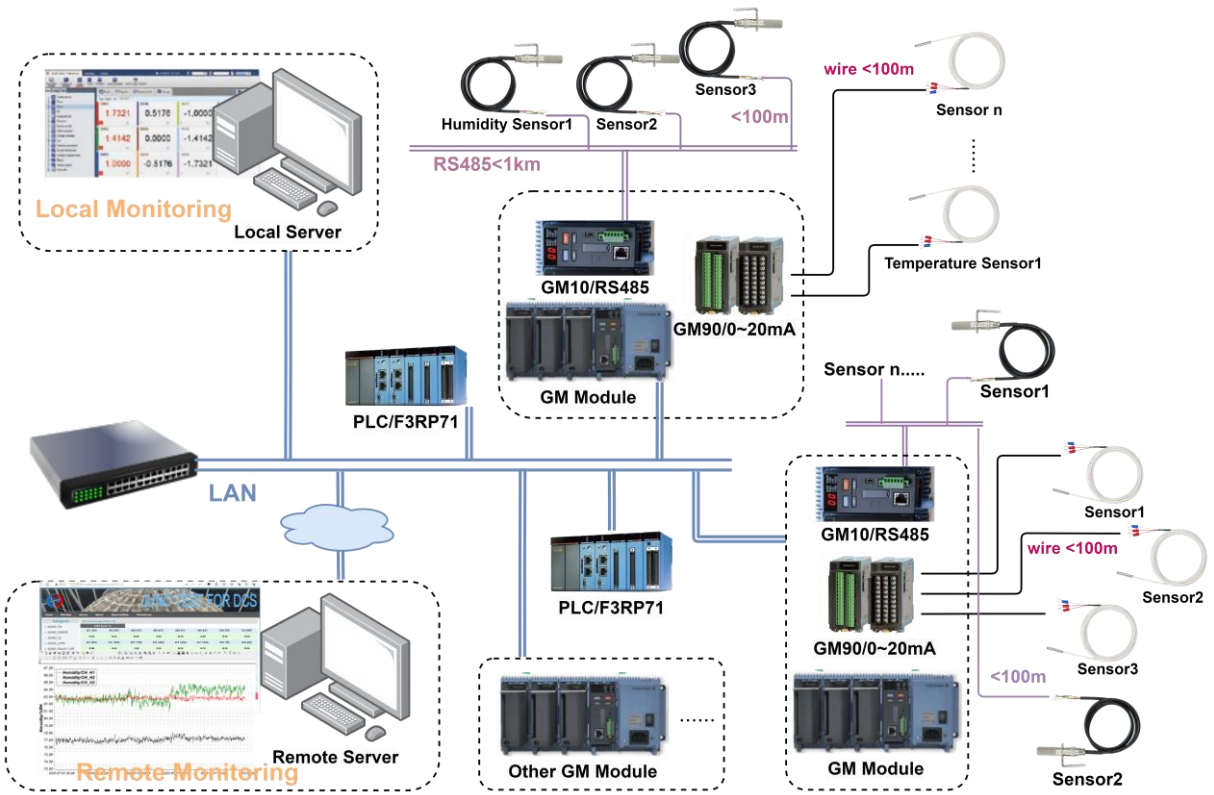


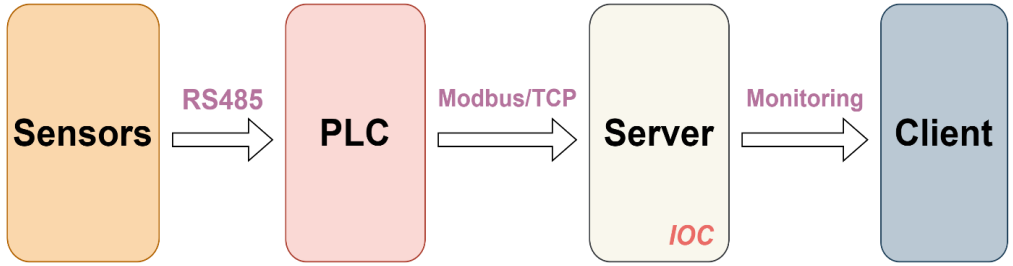


Temperature Monitoring During Filling and Operation

* From Lei Yang,Zhijian Zhang,Siming Feng on behalf of DGUT group

Temperature and humidity monitoring with PT100





☐ Sensors

- **Temperature sensor:** PT100 RTD type
- **Humidity sensor:** RS485 type

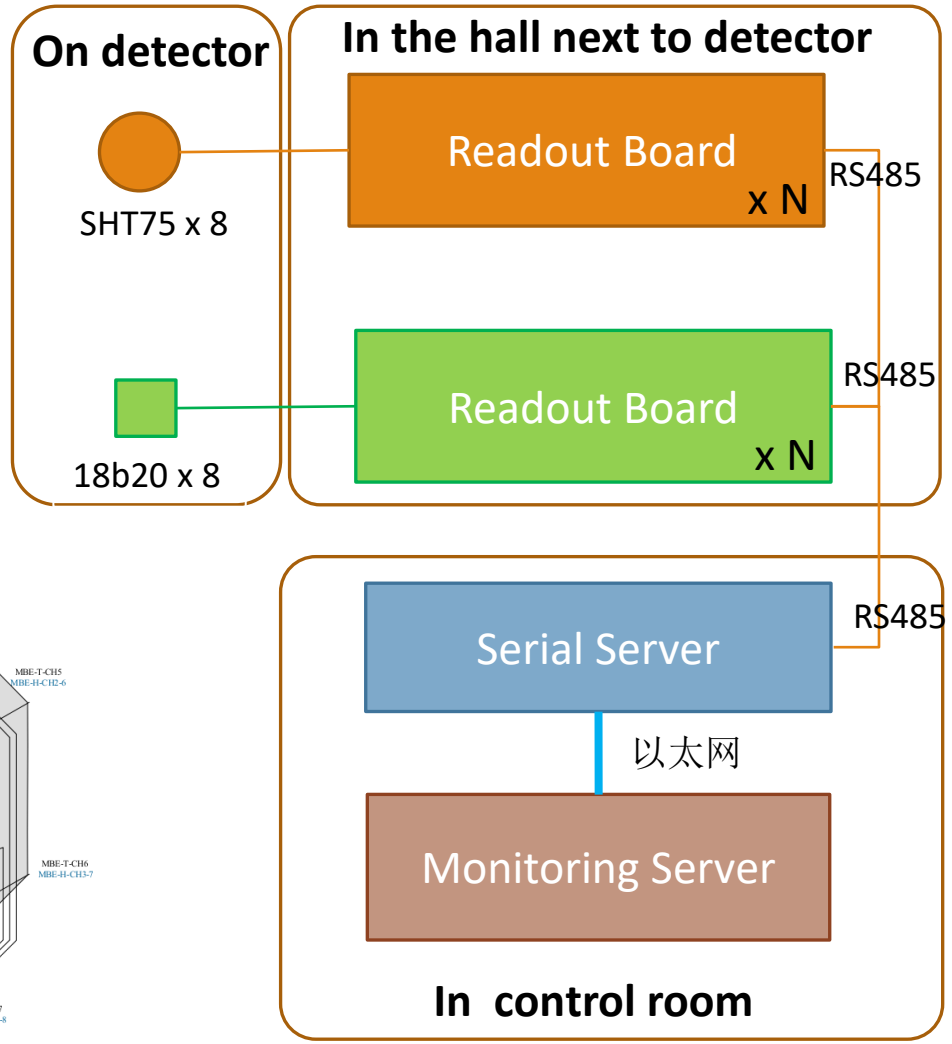
☐ Acquisition: EPICS (Modbus)

- Development of temperature and humidity IOC based on modbus protocol.

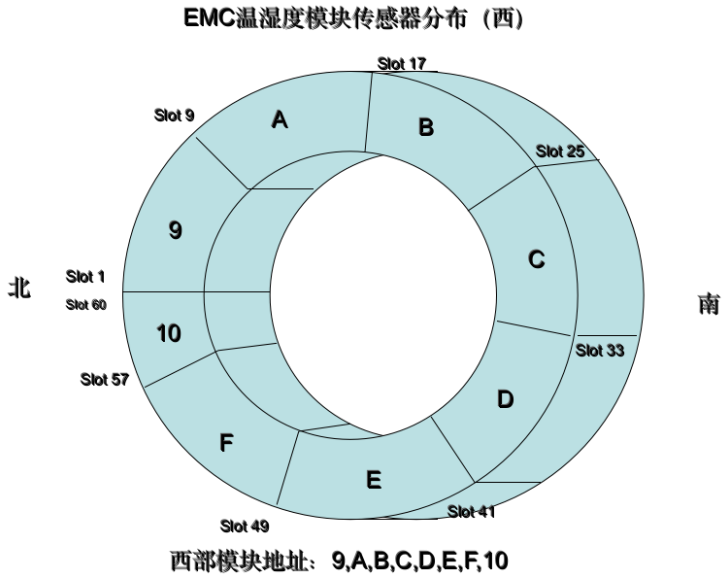
* From Shenghui Liu of JUNO slow control group

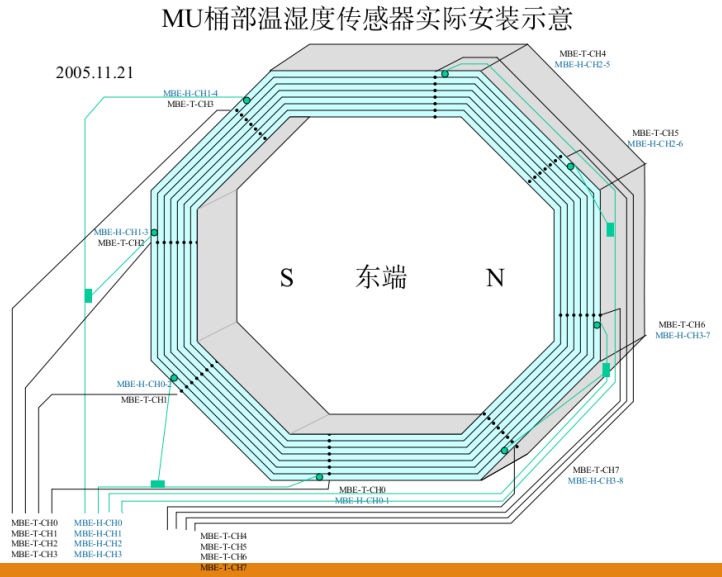
BESIII environmental monitoring

- **EMC**:
  - T&H monitoring, digital SHT75 sensor.
  - T monitoring, digital 18b20 sensor.
- **Muon**:
  - H monitoring, digital LTM-8901.
  - T monitoring, digital 18b20 sensor.



BESIII 温湿度数据采集方案



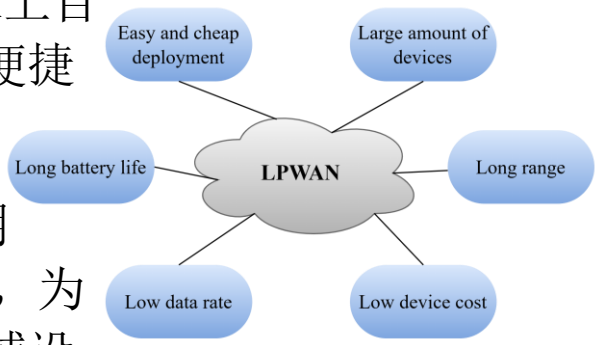


* From Jian Min of BESIII slow control group

On going technology with LoRa monitoring

LoRa技术在CEPC中的可能应用场景：

- **温湿度监测方案：**LoRa 无线传输方案优势显著。仅需部署 1 - 2 个网关，即可轻松接入上百个温湿度节点。节点可按需灵活移动，能随时根据实验需求重新布局，可提升监测的便捷性与适应性。



- **CEPC 对撞区域辐射本底测量：**CEPC 对撞区域包含多种探测器及复杂电子学系统。利用 LoRa 无线测量技术，能够评估不同区域辐射本底水平，进而确认探测器未来工况环境，为探测器安装奠定基础，也为对撞取数提供科研依据。同时，该技术大量减少数据线缆铺设成本，安装灵活且低功耗运行，极大增加了应用的便捷性。

- **已实现基于MCU的LoRa传感器节点采集卡的开发：**
  - 集成了DHT22温度传感器
  - 同时能提供I2C、SPI、RS232、模拟量输入和GPIO等多种接口，方便其他传感器的接入。
  - 开发了LoRaWAN的协议栈，通过商用网关已能将传感器数据传输到网路服务并显示。
  - 目前在超低功耗优化中。

* From Yinhong Zhang of CEPC Ref-TDR TDAQ group