Control (Configuration) and Monitoring

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DUNE CDR: DAQ Review

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The DUNE Control (Configuration) and Monitoring System

- Ensemble of software required to control, configure and monitor the DAQ and, to some extent, elements of other systems.

- Enable the different DAQ components to be treated and managed as a coherent system.

- Naturally subdivided in 3 subsystems:
  - Control
  - Configuration
  - Monitoring

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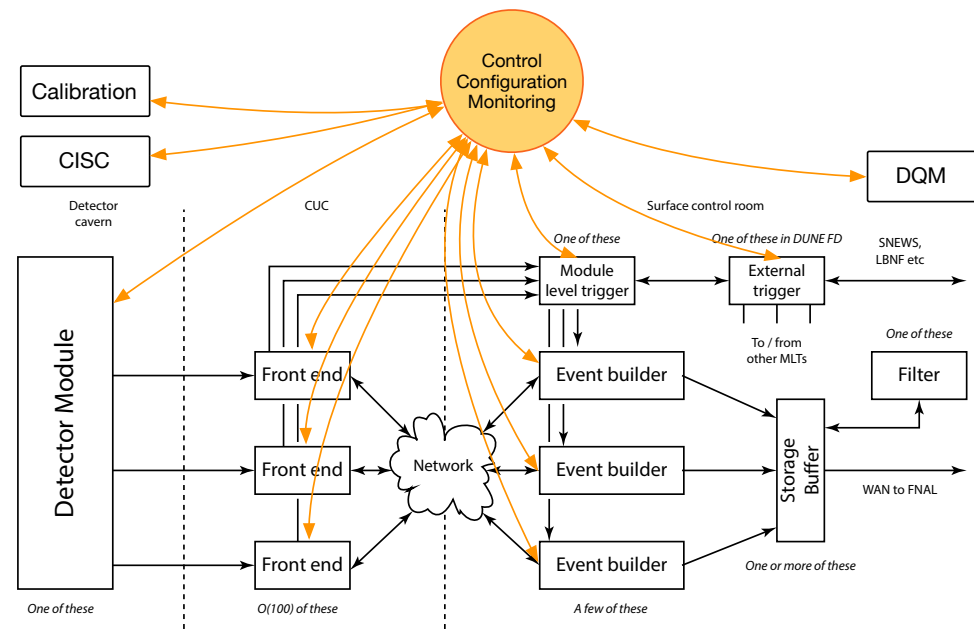
Requirements

- **Continuous data taking :** Maximum uptime

  - Flexibility
    - Elements can leave and re-join the data taking (failures, calibration, etc.)
    - Dynamic connection setup, modular configuration, loosely coupled subsystems

  - Fault tolerance and automatic error recovery

  - Good tracking of data taking conditions

- **Partitioning :** Support for "permanent commissioning" (concurrent construction/installation/commissioning/data taking)

  - One physics partition per DUNE module, in nominal conditions

  - Multiple disjunct instances of data taking when needed

  - Resource management service

  - Unique run number service

- CCM likely to be the **most complex DAQ system**, from a functionality point of view

  - It will determine the data taking efficiency and quality

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Interfaces & key challenges

- Connected to several DUNE domains

  - DAQ computers health (monitoring)

  - DAQ applications (control, configuration, monitoring)

    - Timing, Trigger, Data Selection, External Trigger Module

  - Detector applications (control, configuration, monitoring)

  - Data-quality Monitor (monitoring)

  - CISC (monitoring)

  - Calibration (monitoring, control?)

- Challenges

  - Zero-downtime operations

  - Monitoring data aggregation from non-homogeneous sources

  - Fault detection and self-healing (where applicable)

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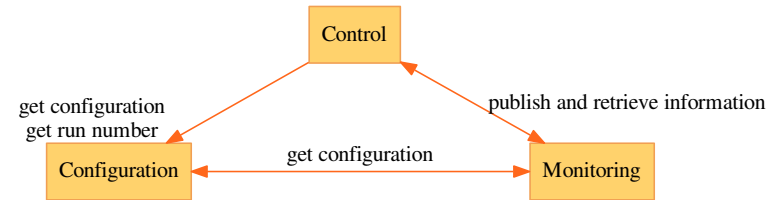Rutherford Appleton Laboratory

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Constraints & key challenges

- Support for multiple, concurrent installations
  - Labs, PD, ITF, SURF, CCU
  - Key components available early
  - Scalable, from DAQ Kits to full-size detector

- Early readiness
  - Final system development to be completed in time for ITF operations
  - Crucial in installation, for systematic validation of components later inaccessible

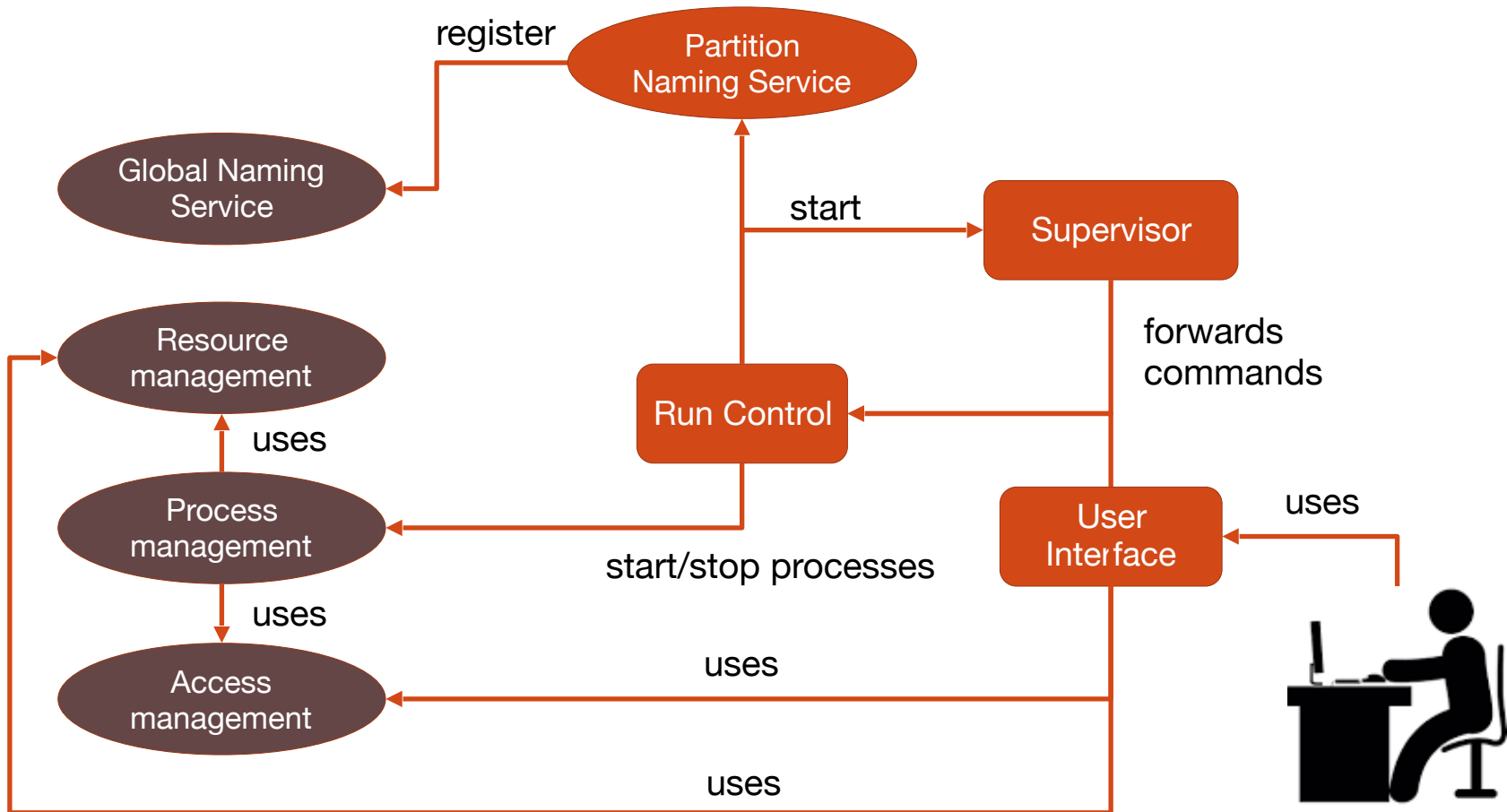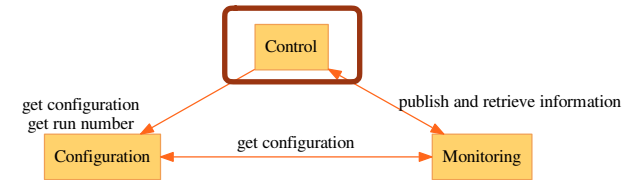Alessandro Thea | Control and monitoring
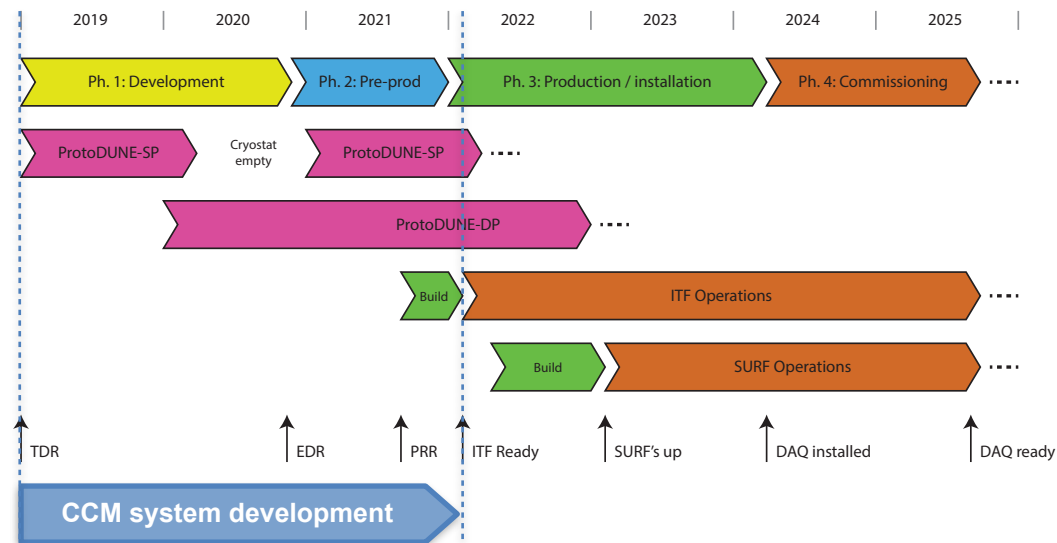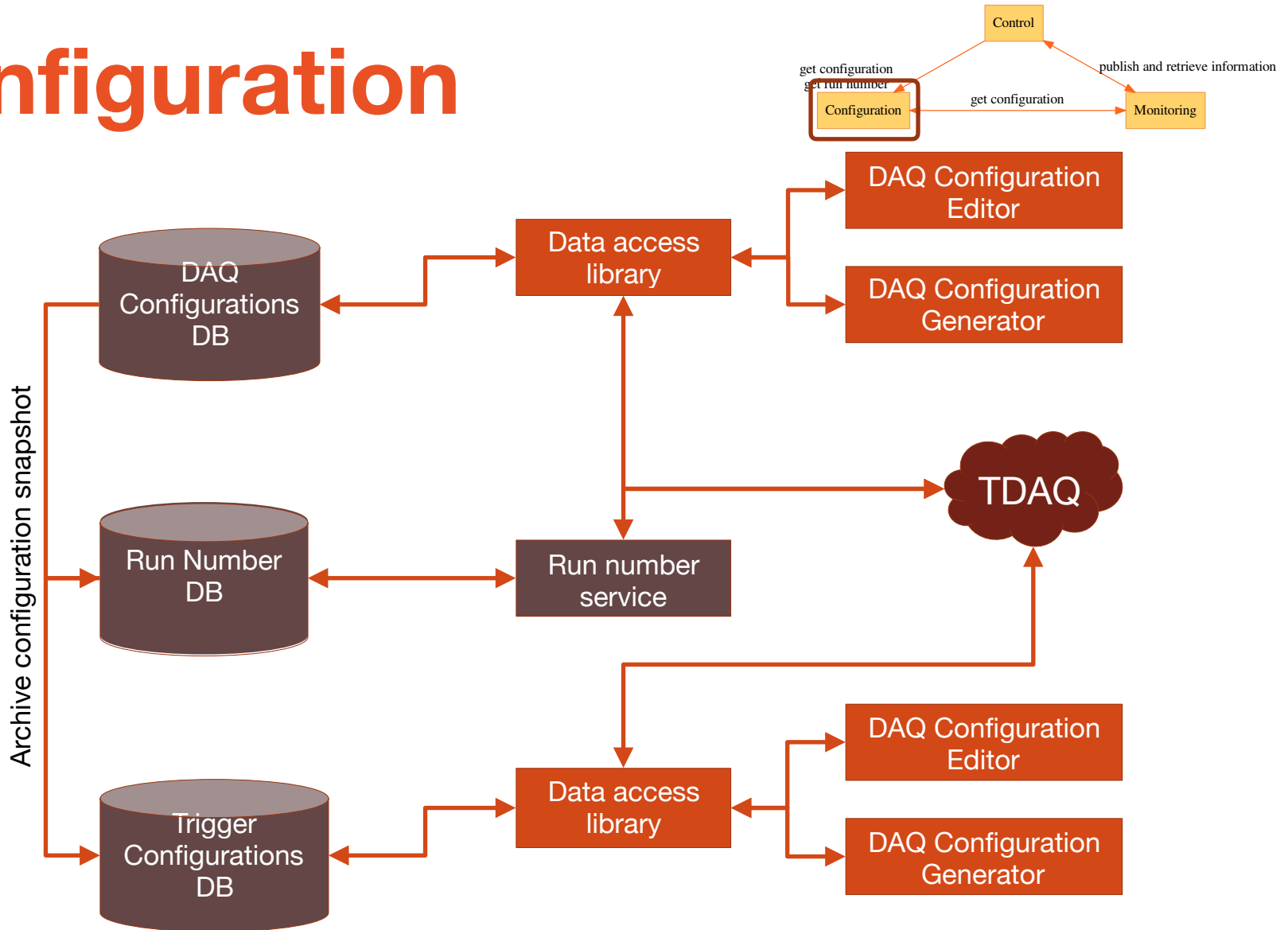
System design

- Control sub-system

  - Manages DAQ software process lifetimes,

  - Asserts access control policies,

  - Executes commands,

  - Initiates change,

  - Detects and handles exceptions and provides human interface.

- Configuration sub-system

  - Retains and provides access to information about
    - Configuration of the high-level structure of the DAQ partitions
    - Low-level configuration of each of the connected components.

- Monitoring sub-system

  - Aggregates, stores and makes available current and historical status information collected from DAQ partitions and their components.

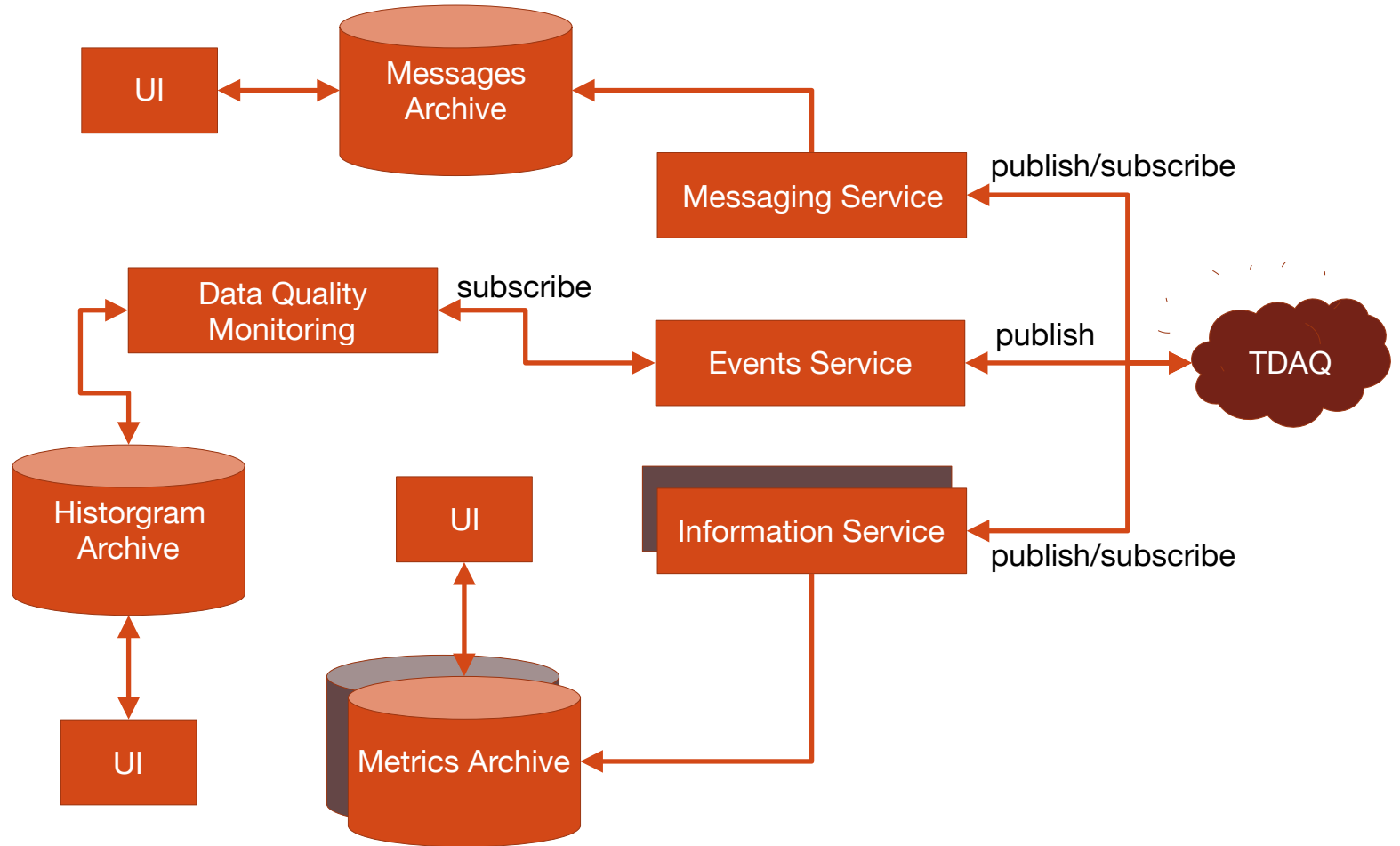Alessandro Thea | Control and monitoring

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Control

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Configuration

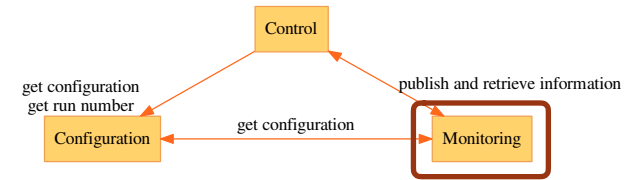Alessandro Thea | Control and monitoring

Monitoring

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Development plan up until EDR

- 2019 Q2: Conceptual design
  - ▸ Review the Lesson Learnt from ProtoDUNE beam run
  - ▸ Identify appropriate technologies for each CCM subsystems
  - ▸ Define the strategy to support different installations
  - ▸ Define adequate development and maintained practices

- 2019 Q3-Q4: Prototyping
  - ▸ Standalone demonstrators
  - ▸ DAQ Kit integration

- 2020 Q1-Q3: ProtoDUNE tests
  - ▸ Installation and operation
  - ▸ Full system demonstration

- 2020 Q4: final system specifications

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Development plan following the EDR

- 2021: Final system development

- 2022 Q1-Q2: Installation at ITF
  - ▸ Support for and feedback from ITF operations

- 2023 Q1-Q2: Installation at SURF/CUC
  - ▸ Support for and feedback from SURF/CUC operations

- 2024: Detector commissioning
  - ▸ Support for and feedback from commissioning operations

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