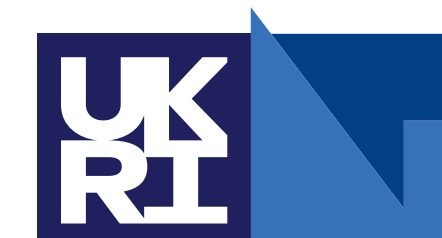


DAQ strategy and location

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Far-site Installation/Integration Planning Workshop

2 February 2020



Science and
Technology
Facilities Council

Overview

- DAQ Location
- Installation and Commissioning Strategy
 - ▶ Surface
 - ▶ Underground
 - ▶ Validation
 - ▶ Detector support



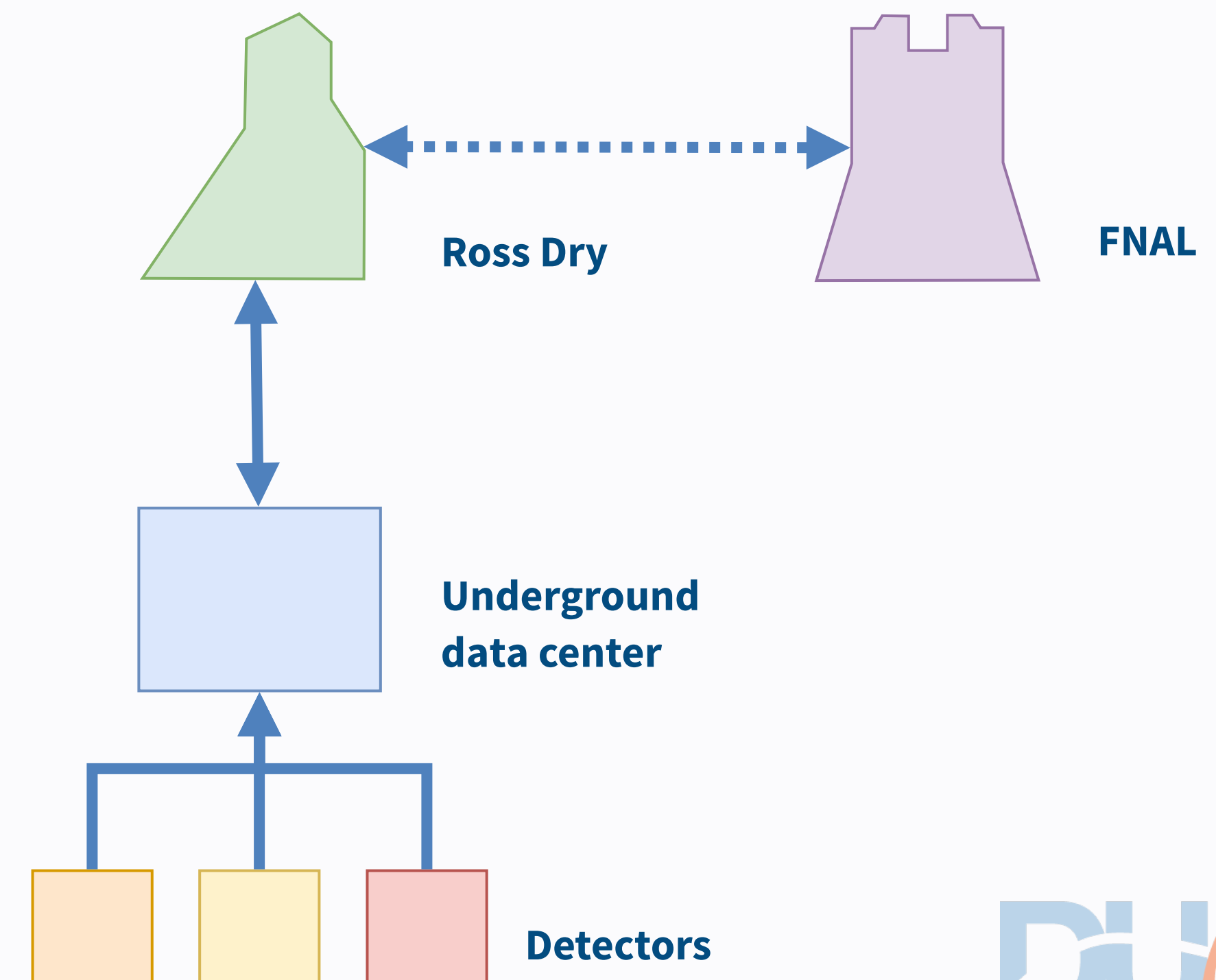
DUNE DAQ distributed system

DAQ designed as a distributed system between underground and surface

- ▶ Underground data centre
 - Timing master, readout units, data-selection servers, control servers
- ▶ Surface data room (Ross-dry)
 - GPS receiver, event builder, storage, high level filter
 - DAQ network and management services
 - Link to FNAL

In addition

- ▶ Surface office space and work area



DAQ location

In the previous I&I Workshop at SURF, the TDR baseline scenario of the underground data center was assumed

- ▶ CUC data centre serving 4 modules (~60 racks, 400 kW)

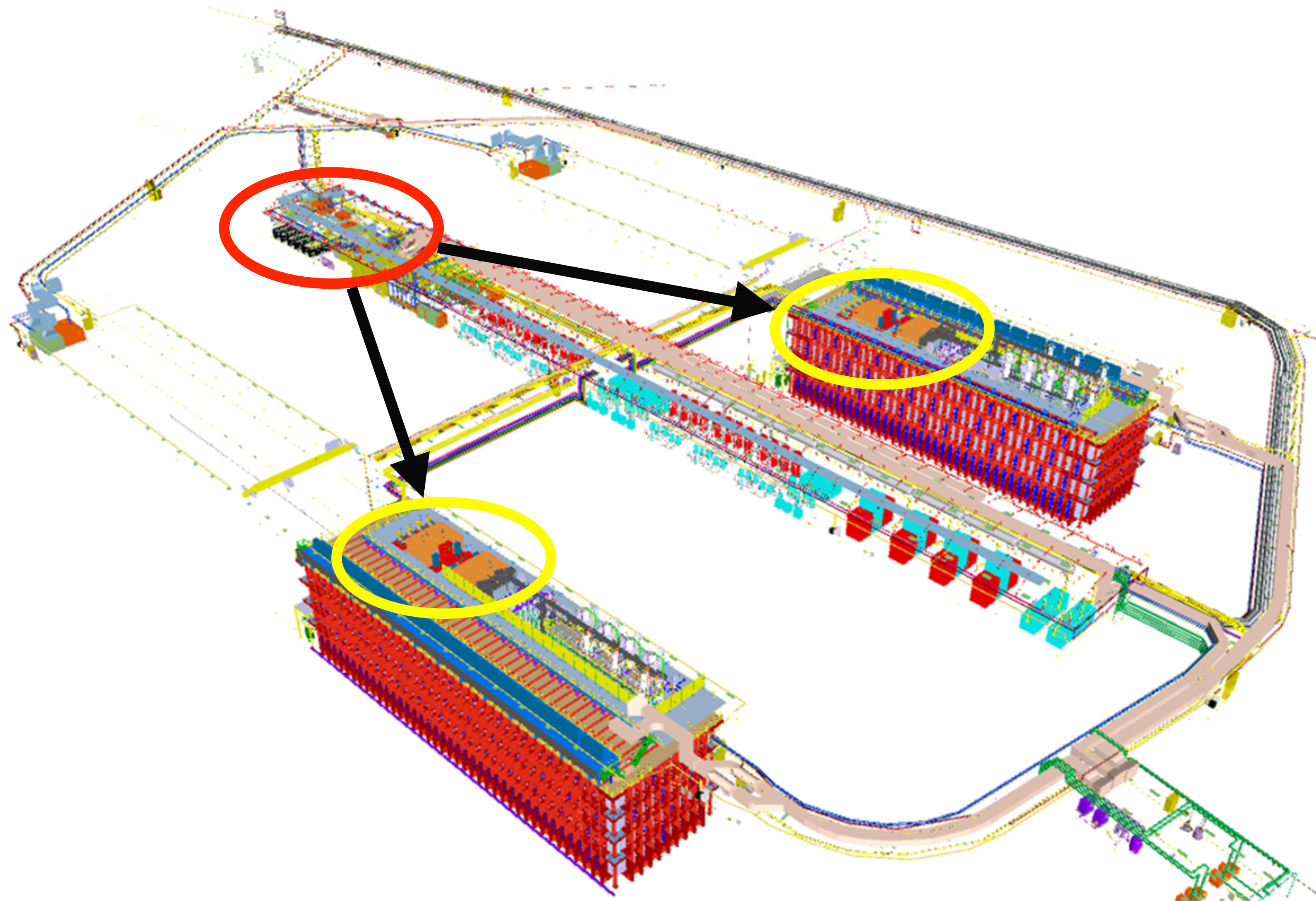
Comparative study on alternative locations carried out in autumn 2019

- ▶ Result presented at DUNE's Technical Board in December
- ▶ **Move of the DAQ to the cryo-mezzanine** endorsed by the Executive Board last week to allow validating all installation and integration aspects during the this workshop

For this workshop we will consider the underground DAQ installation to be distributed over the 4 cryogenic mezzanines in 4 independent data centres

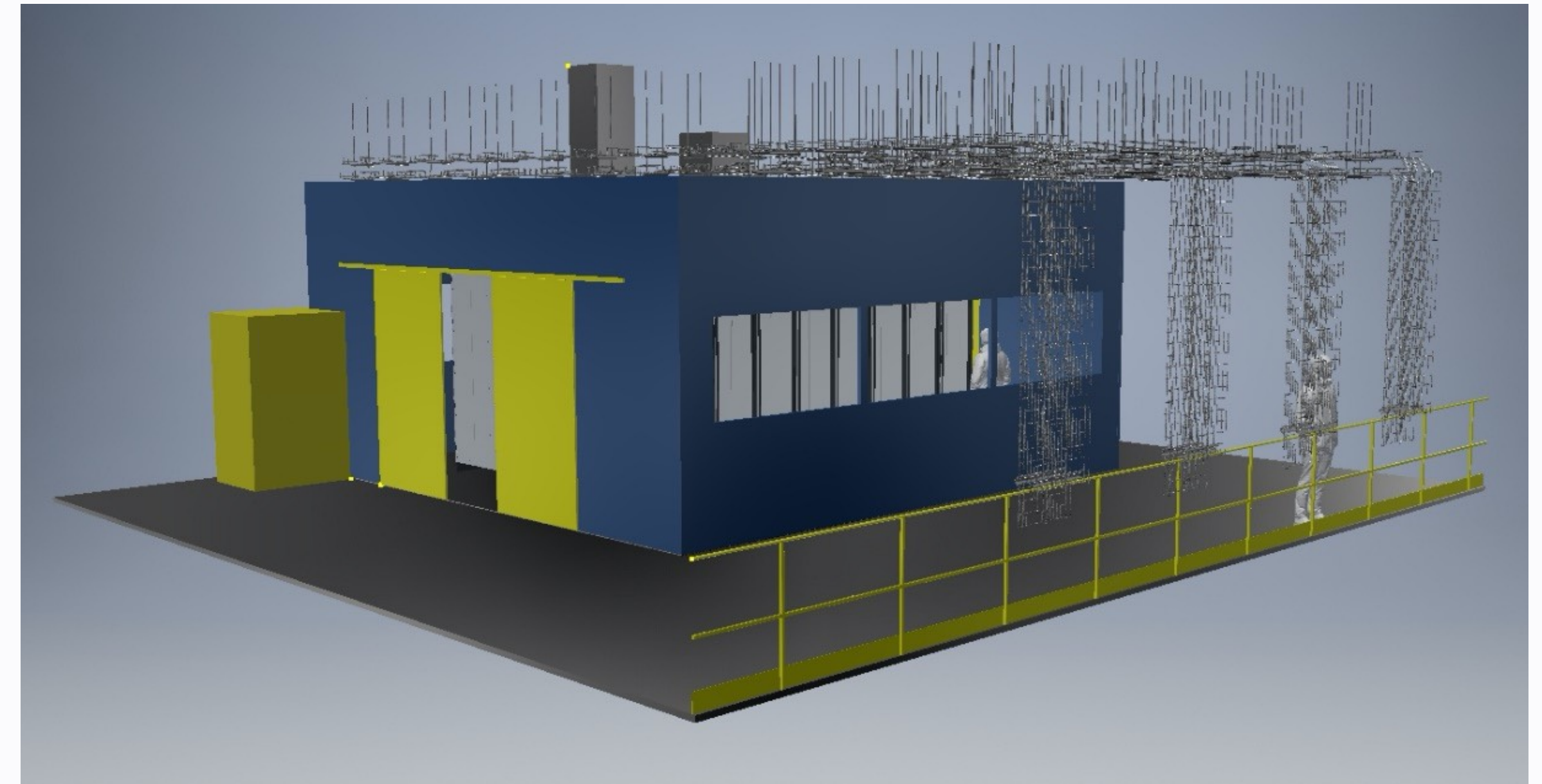
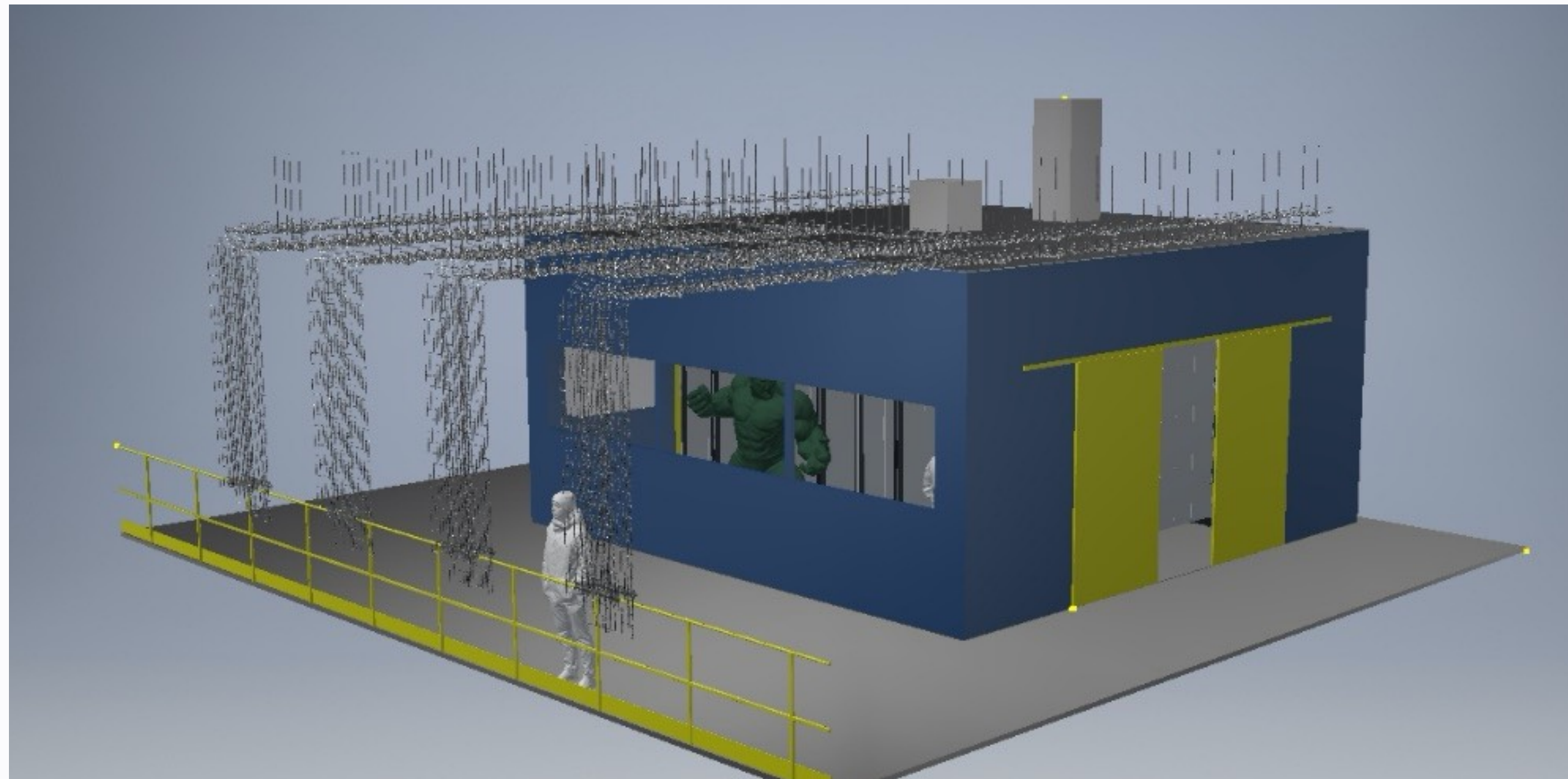


Distribute data center over cryo-mezzanines



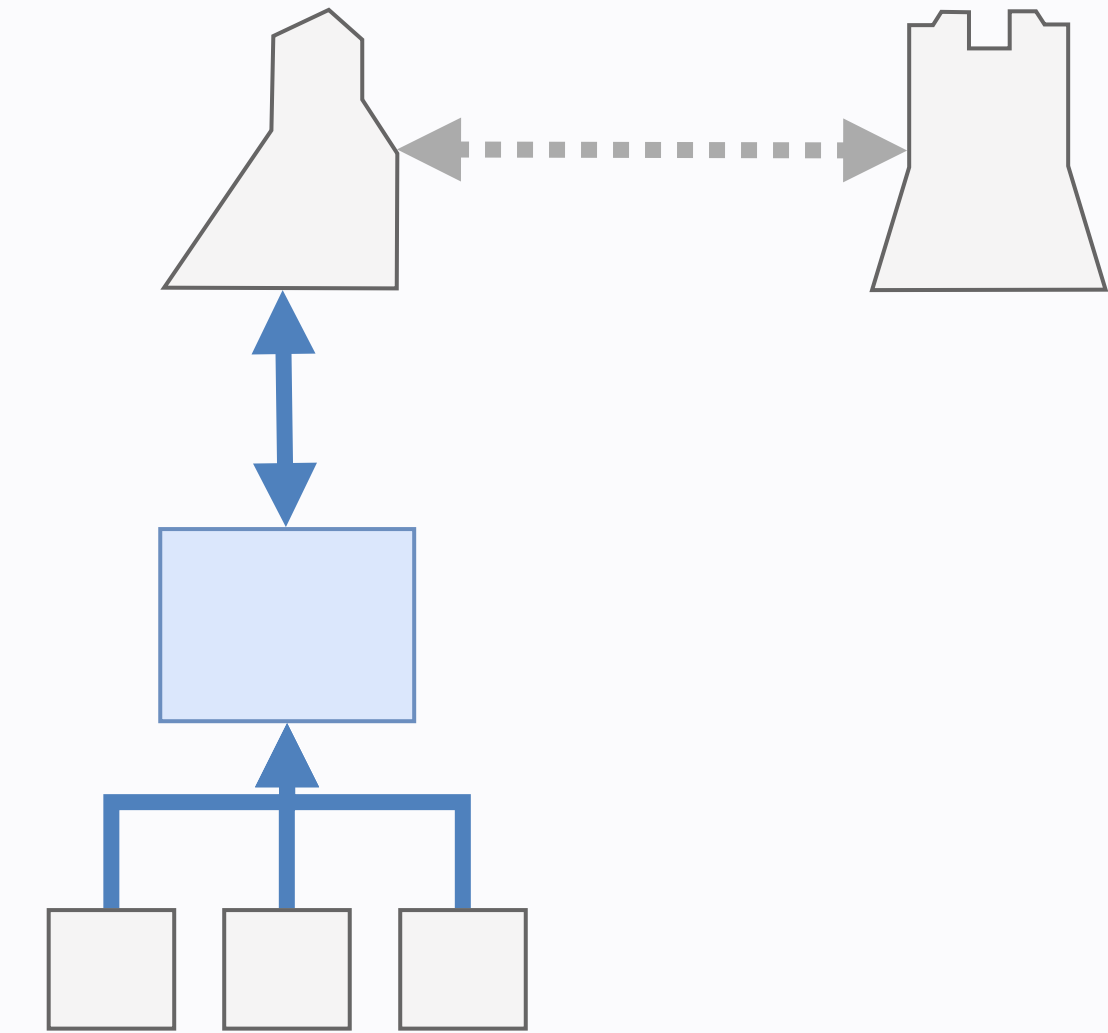
Cryo-mezzanine DAQ barrack

Preliminary sketches



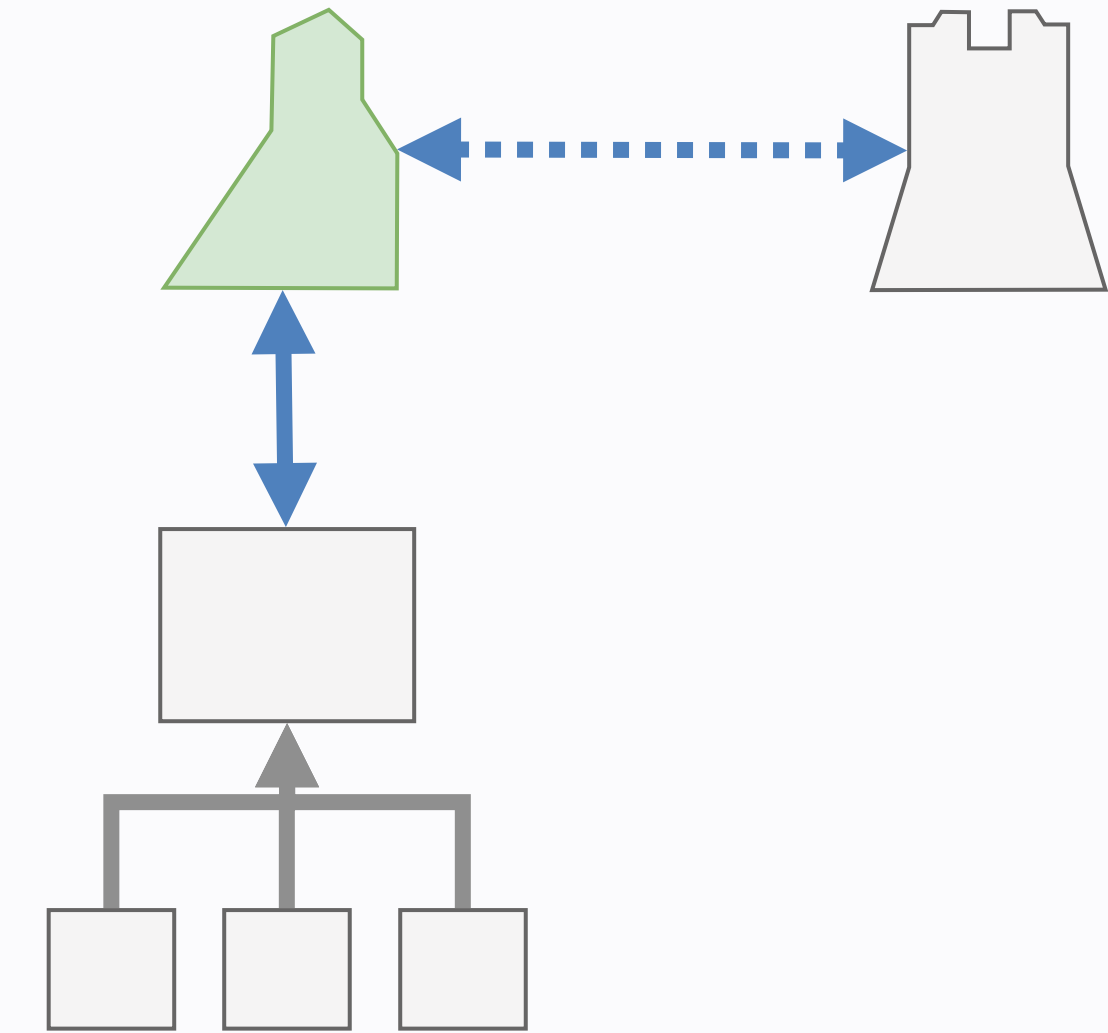
DAQ cryo-mezzanine data center

- **Properties**
 - ▶ 16 racks, 48U, 1200mm depth
 - ▶ 100 kW power
 - ▶ 5 min UPS power
 - ▶ Filtered air cooling
 - 18-27 °C room air temperature
 - ▶ Network connections through the COMM room
 - controls, data
- **Closer to the detector wrt to CUC data centre**
 - ▶ Much larger interaction and interplays with other systems
 - ▶ Key discussion topic for this workshop



Ross-Dry DAQ room

- **Properties**
 - ▶ 320U usable rack space
 - ▶ 50 kW power
 - ▶ 5 min UPS power
 - ▶ Filtered air cooling
 - 18-27 °C room air temperature
- **Limited access to power/cooling**
 - ▶ Is it a hard constraint?



Installation strategy

- The DAQ installation strategy is driven by the detectors integration and installation schedule
 - ▶ CE and PDS electronics: 2-3 months before the first APA is moved into the cryostat
 - ▶ Coldbox support and data taking
- To minimise commissioning times a back-to-front approach is required
 1. Surface room
 2. Underground DAQ barrack(s)
 3. Validation and performance tests
 4. Connection to detector electronics



1. Surface DAQ room

- Expected early availability of the Ross-dry DAQ surface room early w.r.t. the underground areas
- Not subject to underground access schedule and personnel limitation
- Early installation of essential DAQ (and SC) services
 - ▶ Network and local services
 - ▶ Replica of FNAL authentication, management, etc services
 - ▶ Local DAQ services (gateways, etc.)
 - ▶ Remote management
 - ▶ Testing, performance and stability measurement of the uplink to FNAL
- Early data-challenges with COMP possible
 - ▶ Also, database replication tests, etc...
- Incremental capacity
 - ▶ Staged installation



2. Underground: DAQ data center(s)

- **Single-stage hardware installation (per module)**
 - ▶ PDUs, cabling, labelling, network, servers, timing, FELIX units.
 - ▶ Integration step to deliver all the material underground still to be defined
 - ◆ Currently assuming that the material will be delivered next to the DAQ barrack by the installation team
 - ◆ Schedule: to be understood
- **Turn on and setup**
 - ▶ Planning a staged turn-on of all equipment
 - ▶ Turn-on rate depends on available power and cooling
 - ▶ Network connection to surface crucial to complete this stage rapidly
 - ◆ Also on-surface DAQ services being up and running
 - ▶ If network not available, network-less installation is an option at the cost of extended presence of DAQ personnel underground



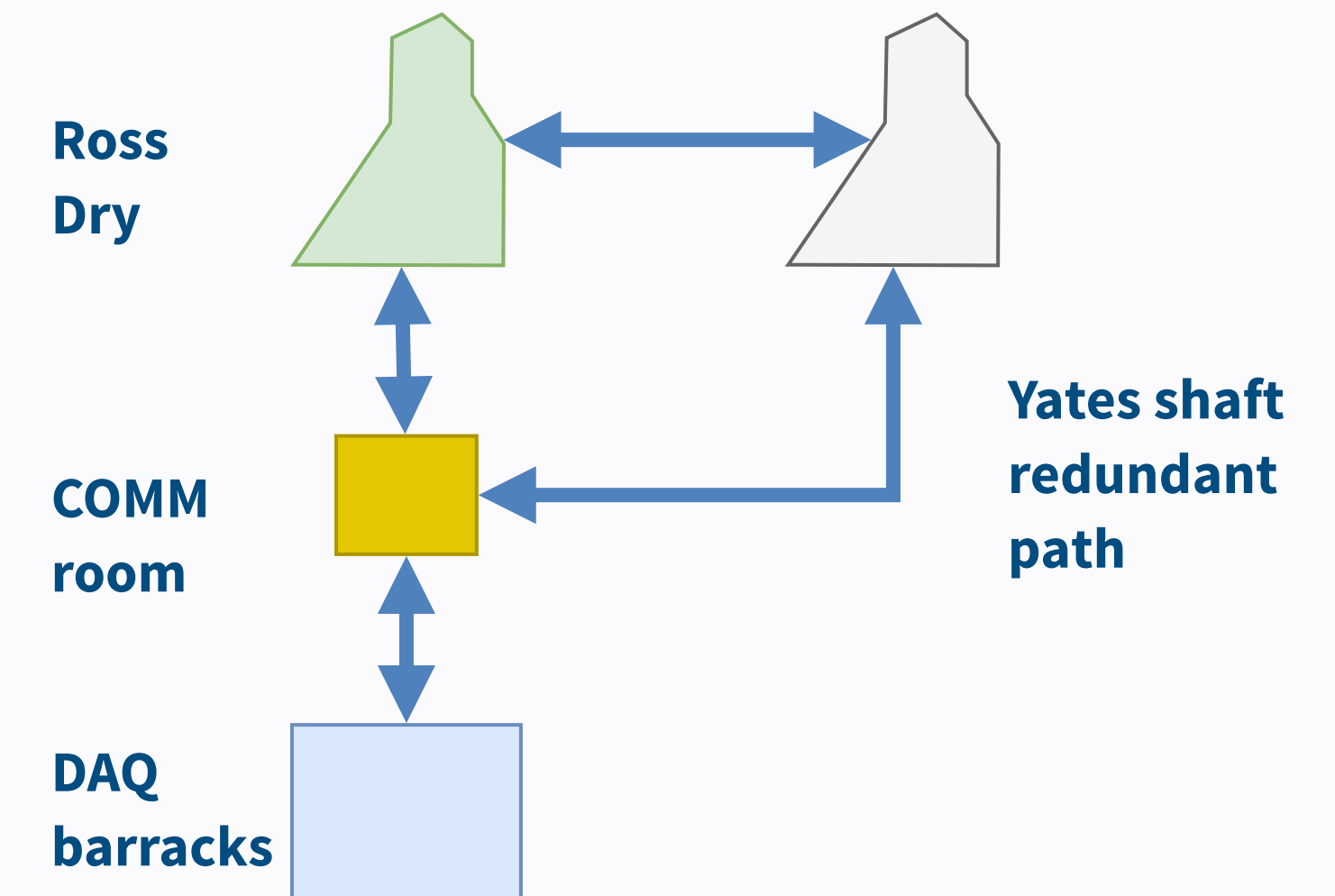
Excursus: fibres

- **Surface-to-underground path**

- ▶ Ross ↔ COMM room (primary)
- ▶ Ross-Yates ↔ COMM (redundant)
- ▶ COMM ↔ DAQ barracks

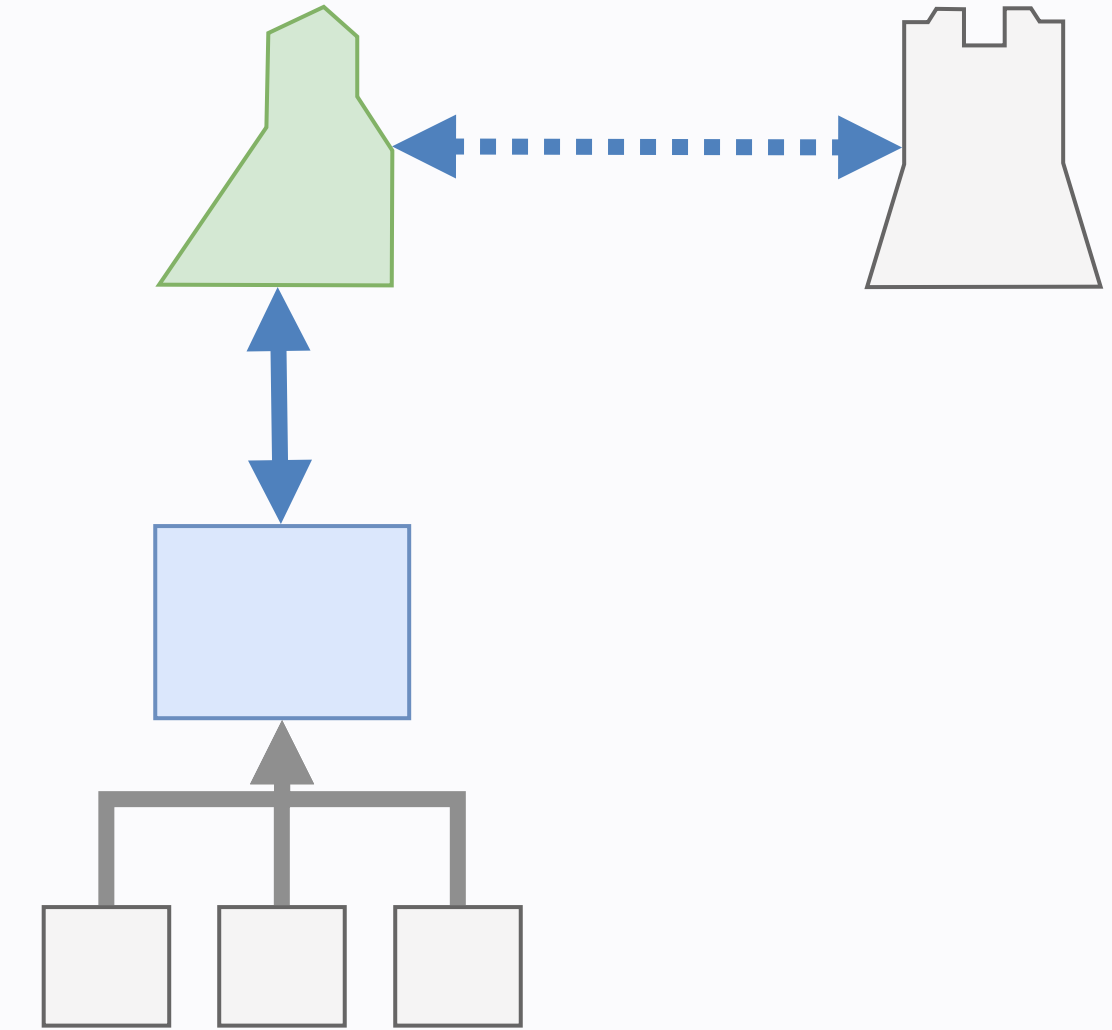
- **COMM-DAQ fibre run(s)**

- ▶ How are the responsibilities divided with the DAQ on the cryo-mezzanine?
 - ◆ Procurement? installation?
 - Installation used to be the responsibility of general facility in the CUC scenario
- ▶ What underground path? What length?
- ▶ Expecting O(30) fibre pairs per module



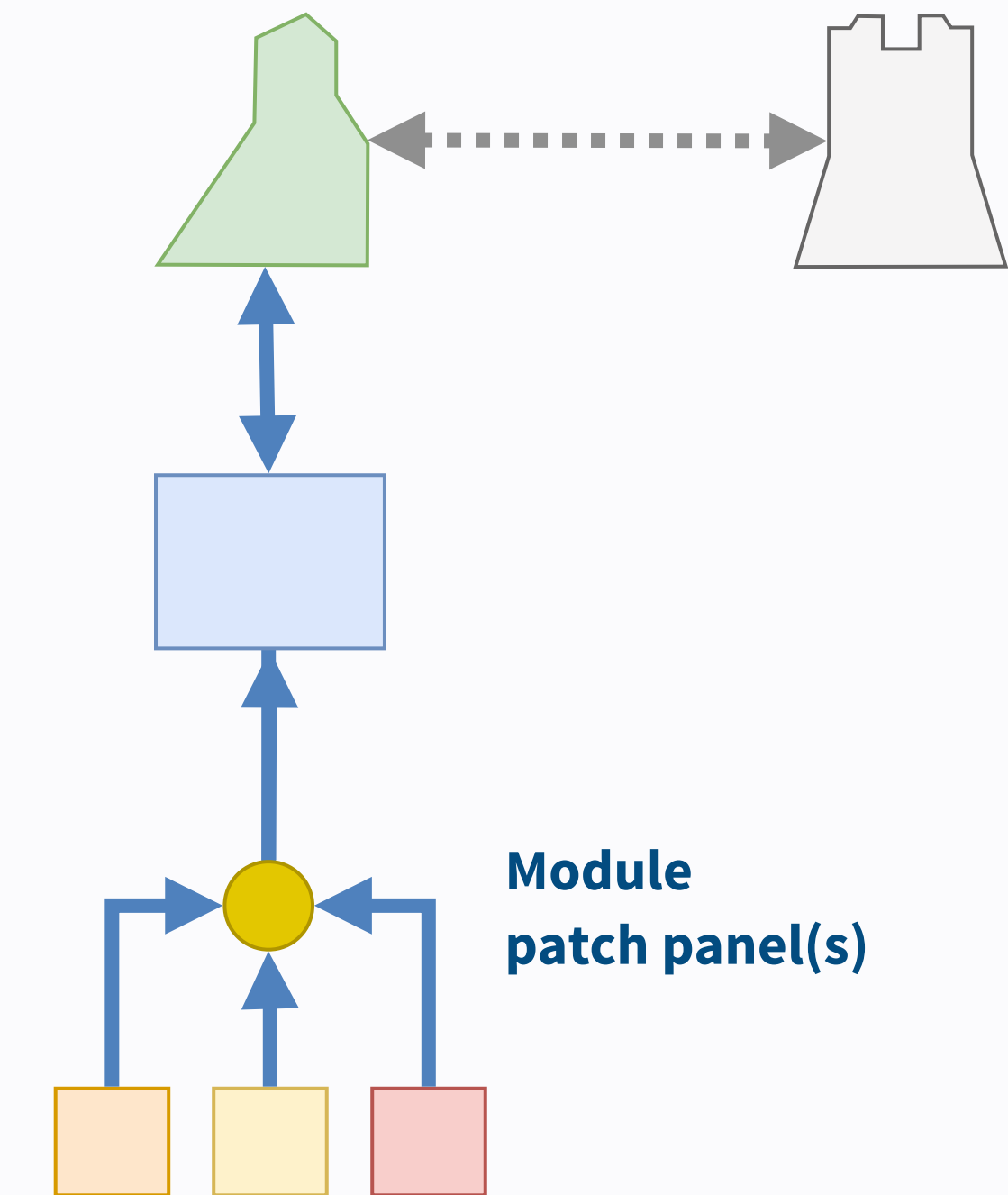
3. Validation and data-path commissioning

- 2 stages of internal DAQ commissioning
- Internal underground barrack tests
 - ▶ Data network, point to point transfers
- Underground-to-surface tests
 - ▶ Primary and secondary path connections
 - ▶ Full bandwidth performance tests



4. DAQ-detector connections

- Functional DAQ commissioning **MUST** be completed before electronics installation
- Requires the DAQ-module pp fibres to be laid
 - ▶ How many patch panels?
 - ▶ Who lays the fibres? When?
- **Single stage fibre installation**
 - ▶ Then staged connection to electronics as it becomes available
 - ▶ Requires: testing all fibres between cryo patch panel to daq pps beforehand
- Then: DAQ ready to support detector installation and cold-boxes



Summary

- The cryo-mezzanine data center scenario has been identified as an alternative to the CUC data center
 - ▶ Integration and installation aspects become crucial for a timely installation of the DAQ system in time for the commissioning of the detector electronics
- The DAQ installation plan aims at delivering a functioning and fully commission DAQ in time for the arrival of the detector electronics in the cavern
 - ▶ Leveraging on early availability of the surface DAQ room to establish base DAQ services at SURF
 - ▶ Concentrating the installation of underground hardware (per module), keeping the DAQ personnel presence underground at minimum
- The timely availability of the cryo-mezzanine DAQ barrack, power and cooling services is essential



Item	Quantity	Height [m]	Width [m]	Depth [m]	Weight [kg]	Origin	Package Type	Tot weight [kg]
Racks	16	3	0.65	1.3	160	UK/company	heat threaten wooden cases	1600
PDUs								
Servers								
FLX cards								
Network								
Fiber trunks								
Timing system								
Patch panels (4U)								
NW RJ45								
Fiber patch cords								

Parts breakdown structure - U

Item	Quantity	Height [m]	Width [m]	Depth [m]	Weight [kg]	Origin	Package type	Tot weight [kg]
3x racks doors	10	3	.9	1.65	600	UK/company	heat treated wooden cases	6000
Racks	60	3	.65	1.3	160	UK/company	heat treated wooden crates	9600
PDUs	30	2	.2	.2	2	UK/company	cardboard boxes	60
Servers	400	.2	.55	1.3	20	company	cardboard boxes	8000
FLX cards	170	.10	.2	.3	.3	institutes	cardboard boxes	51
Network	40	.14	.55	.8	3	Company/ FNAL?	cardboard boxes	120
Fiber trunks	30	.50	.45	.50	75	company	drums (250m)	2250
Timing system	2	.4	.55	.6	15	UK institute	cardboard boxes	30
Patch panels (4U)	30	.4	.55	.6	2.5	company	cardboard boxes	75
NW RJ45	6	.4	.8	.8	20	company	cardboard boxes	120
Fiber patch cords	6	.4	.8	.8	10	company	cardboard boxes	60

Parts breakdown structure - U

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To be updated



