FASER update

TREX meeting

J. Boyd (12/2/25)

Apologies I cant join the meeting today…

FASER YETS 24/25

- Planned activities before YETS
  - Main activity installation of preshower upgrade
    - Allows separation of closely spaced photons (increase sensitivity for axion-like-particle searches)
    - Approved by CERN in March 2022
    - Technical Proposal: https://cds.cern.ch/record/2803084/
    - ECR for installation approved by LMC in Aug 2024
      - LHC-X1FP-EC-0012
  - Move detector sideways 6cm to follow change in crossing angle to horizontal in IP1
  - Routine maintenance
- New activities
  - Add simple muon ID to back of FASER
  - Add veto panels to FORMOSA demonstrator

CERN
Esplanade des Particules 1
P.O. Box
1211 Geneva 23 - Switzerland

LHC

EDMS NO.	REV.	VALIDITY
3137960	1.0	RELEASED

REFERENCE: LHC-X1FP-EC-0012

Based on template: EDMS 1271880

Date: 2024-08-29

ENGINEERING CHANGE REQUEST

FASER Pre-shower upgrade installation

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

In order to improve the physics reach of the experiment, FASER will install a high granularity silicon pixel / tungsten preshower during the EYETS 24/25. The preshower detector will fit into the existing detector envelope and most of the changes will be inside the FASER detector. Work from external CERN teams will include the laying of cables from the detector to the racks (to be done by BE-EA), the modification of one of the electrical circuits in the FASER switchboard (EN-EL) and a survey of the installed detector position (BE-GM).

DOCUMENT PREPARED BY:	DOCUMENT CHECKED BY:	DOCUMENT APPROVED BY:
Jamie Boyd (EP-ADE) Brian Petersen (EP-ADT) Stefano Zambito, Didier Ferrere, Franck Cadoux (Geneva Uni)	G. Arduini, M. Barberan, M. Bernardini, A. Bardon, O. Beltramello, M. Brugger, J. Blanc, J. Bernhard, C. Bertone, S-M. Benmehdi, G. Canale, C. Colloca, J. Coupard, O. Crespo Lopez, S. Danzeca, D. Delikaris, J. De Voght, L. Di Giulio, E. Duret Bourgoz, J. Etheridge, J-F. Fuchs, J-M. Fernandez, C. Gaignant, R. Garcia Alia, G. Georgiev, G. Girardot, S. Grillot, A. Infantino, R. Jones, M. Krupa, D. Letant-Delrieux, M. Lazzaroni, Y. Loertscher, S. Pelletier, L. Pereira, H. Mainaud Durand, Y. Maurer, A. Onnela, T. Pauly, S. Roesler, R. Steerenberg, B. Schmidt, C. Tromel, H. Vincke, W. Vandelli, J. Wenninger, C. Vendeuvre, M. Wolf, T. Wengler, M. Yougil.	M. Lamont (on behalf of LMC) Approved at the 492nd LMC meeting on 28th August 2024 F. Sanchez Galan (on behalf of TREX) Discussed at TREX meeting on 19th July 2024 [6] Discussed in CERN-LHCC-2022-006

DOCUMENT SENT FOR INFORMATION TO:

ATS Group Leaders, R2E.

SUMMARY OF THE ACTIONS TO BE UNDERTAKEN:

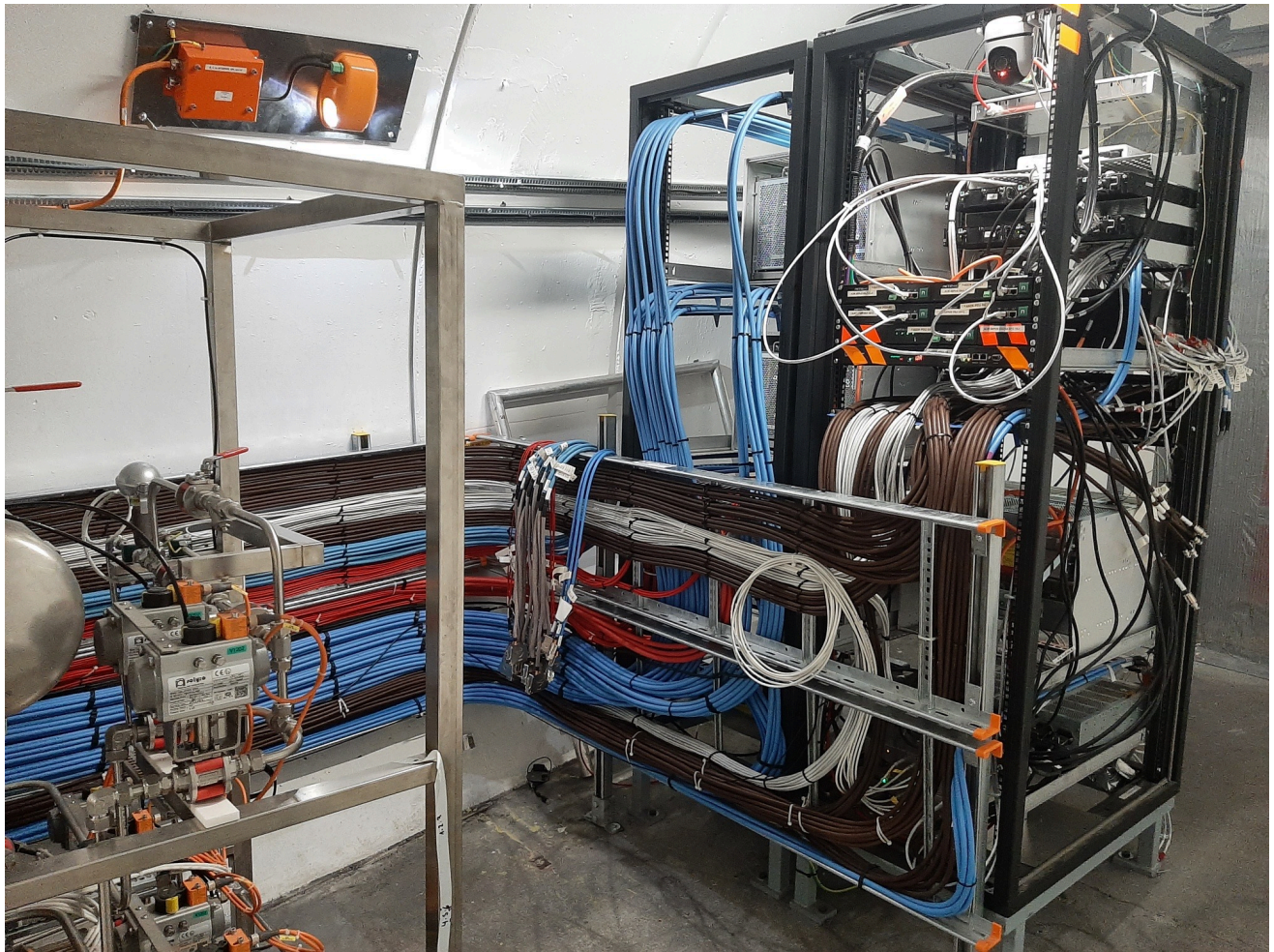
Installation of a new detector system (the upgraded preshower detector) into the FASER experiment.

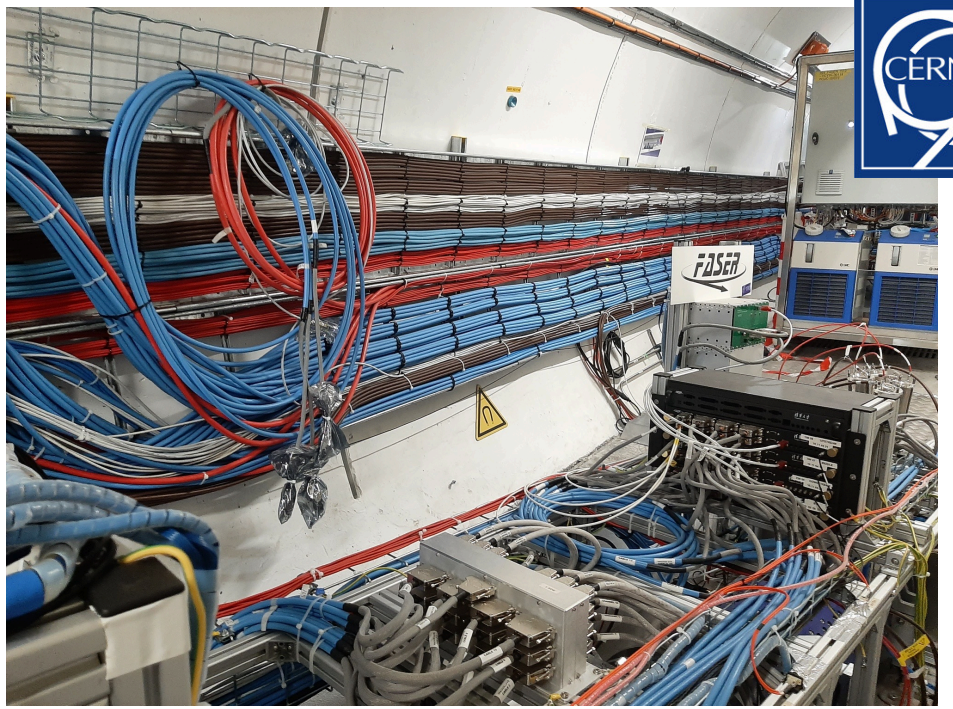
Note: When approved, an Engineering Change Request becomes an Engineering Change Order.

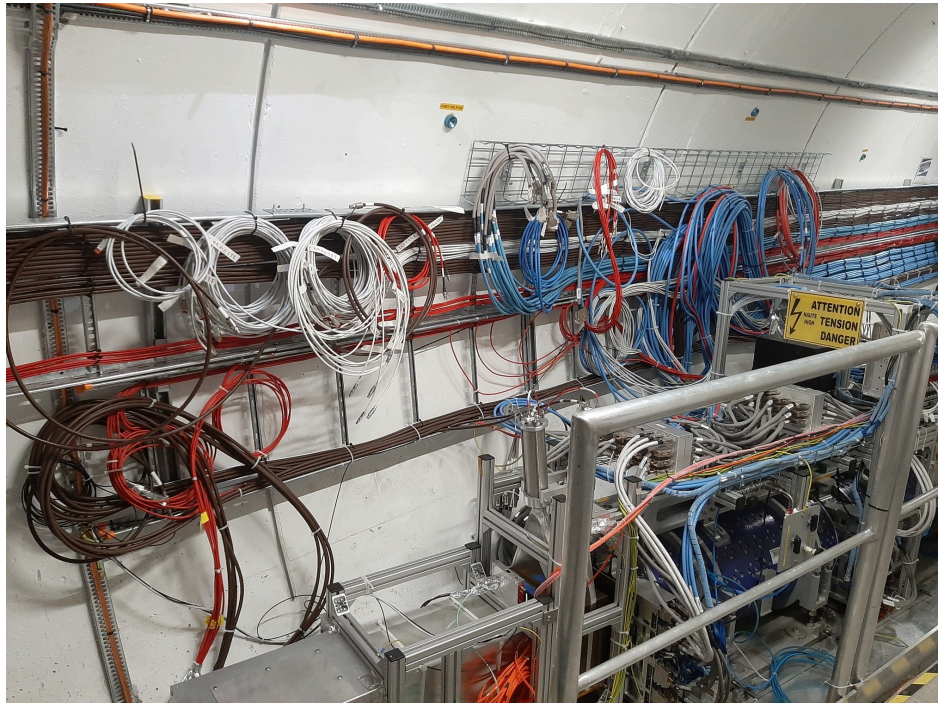
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use.

Cabling for preshower up BE-EA-EC cabling team at start of yets (end of Nov 2024). Went very smoothly – many thanks to the team!

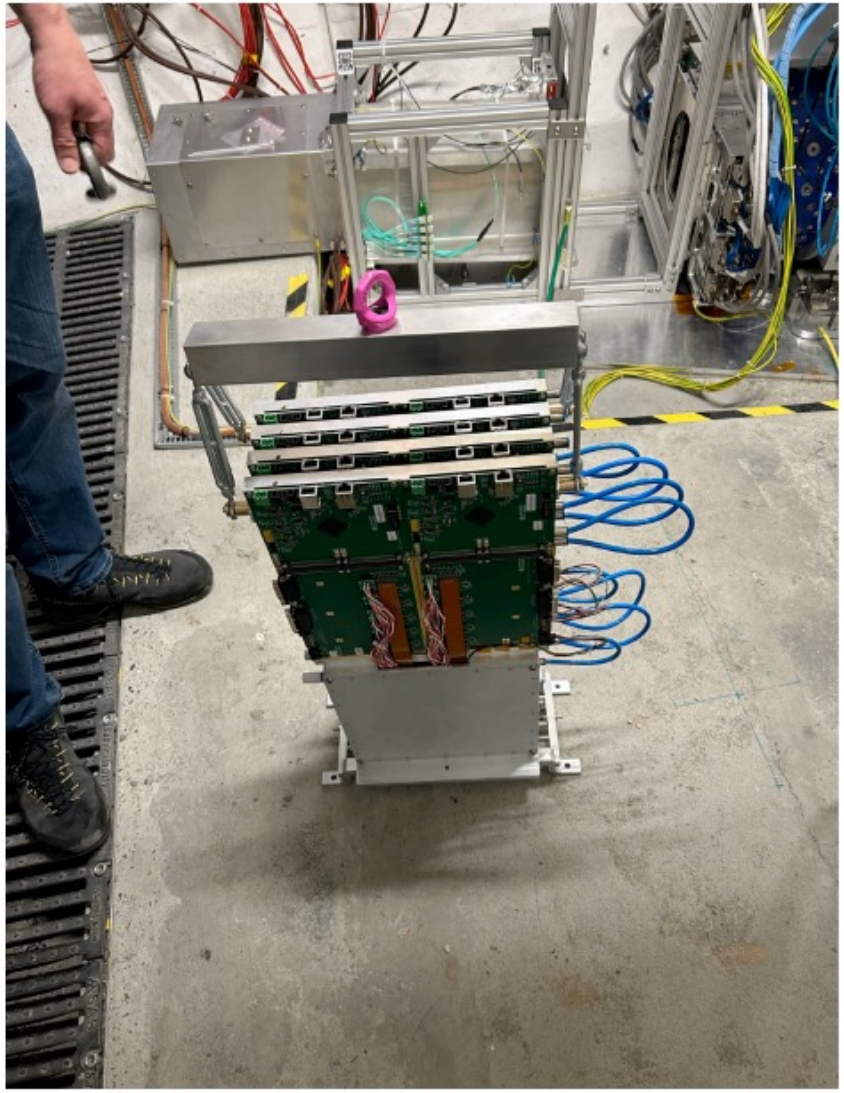
Cabling for preshower up BE-EA-EC cabling team at start of yets (end of Nov 2024). Went very smoothly – many thanks to the team!

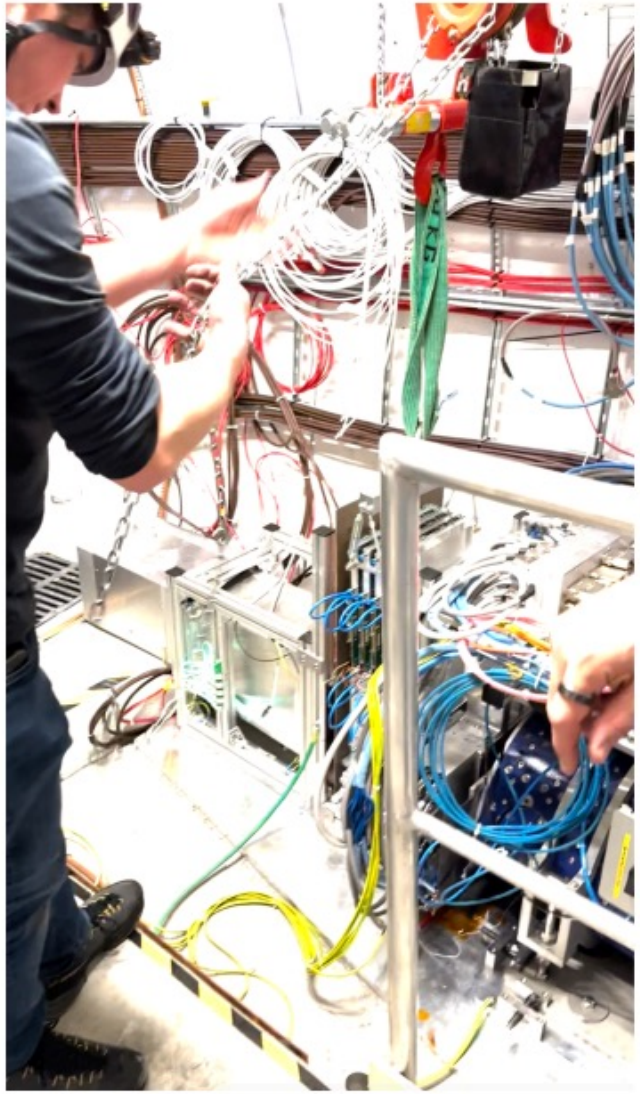


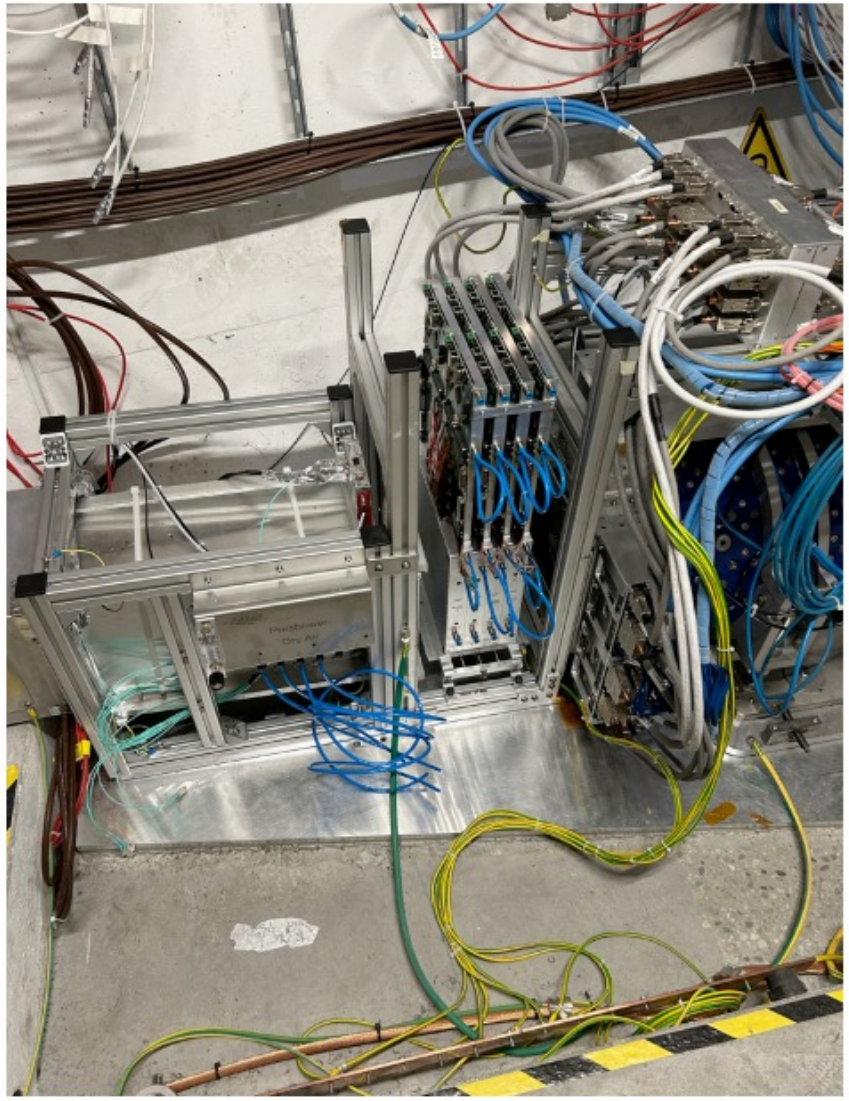




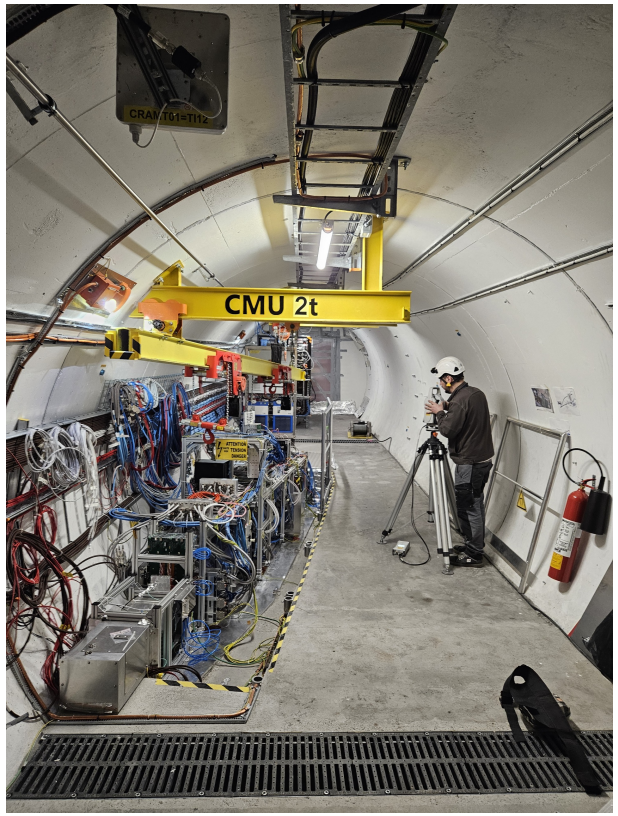
Installation of the preshower into FASER on Feb 10th.
Went very well. Many thanks to EN-HE-HH for their support with transport/handling



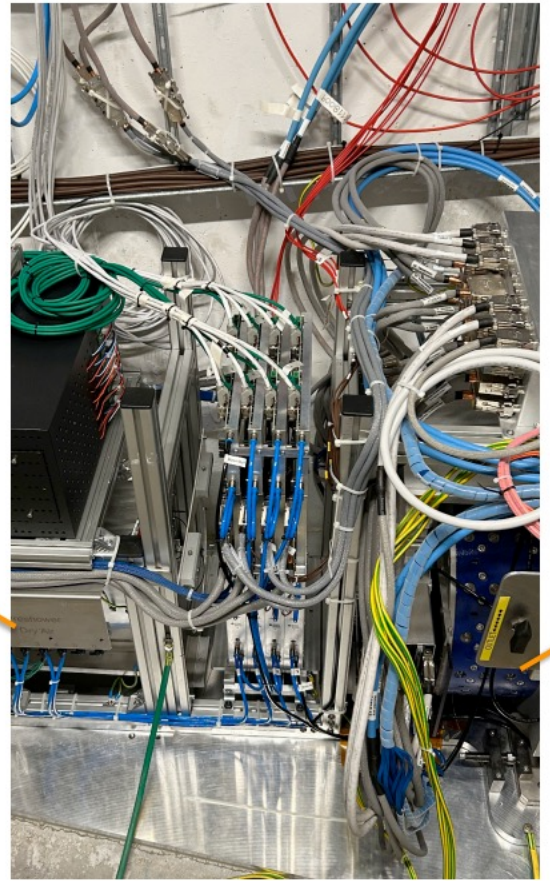




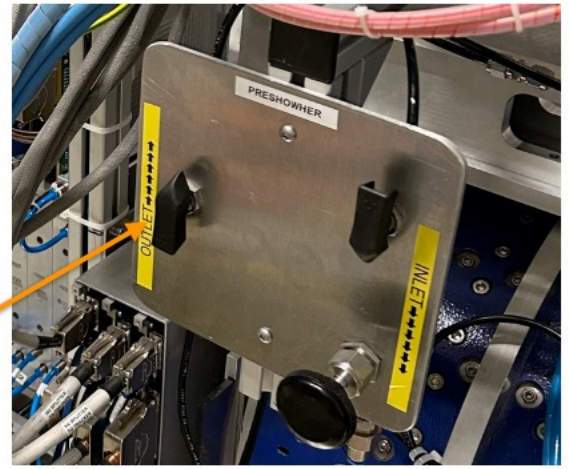
Survey of the preshower on Feb 11th (many thanks to: BE-GM-ASG).
Feb 12th: Cabling of detector and connection to cooling and dry-air (thanks to EN-CV-LHC)



Dry air (nitrogen) controlled by dedicated manifold; planes connected in parallel

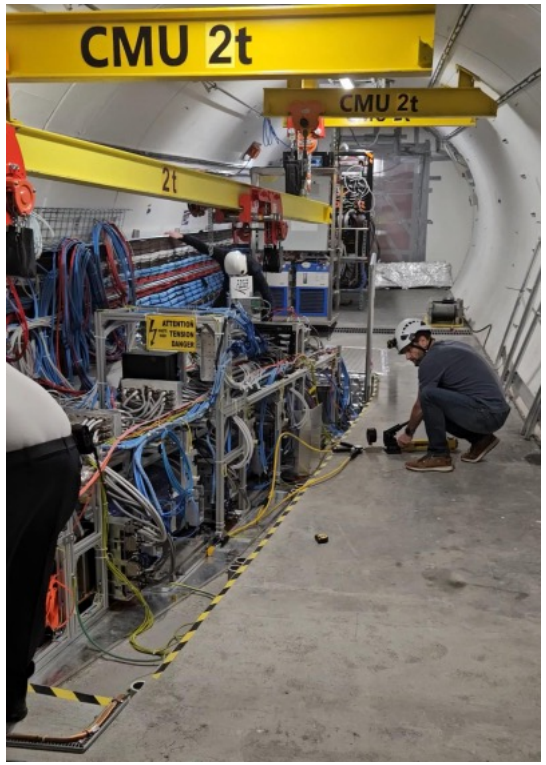


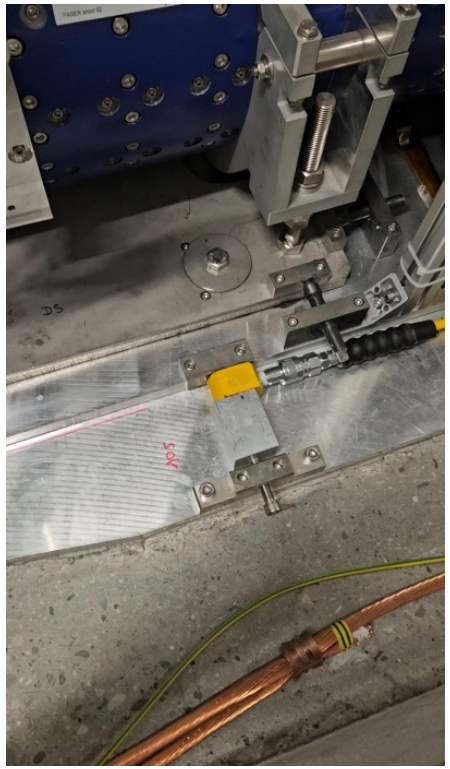
Cool water (15°C) from chiller circulating in series along planes

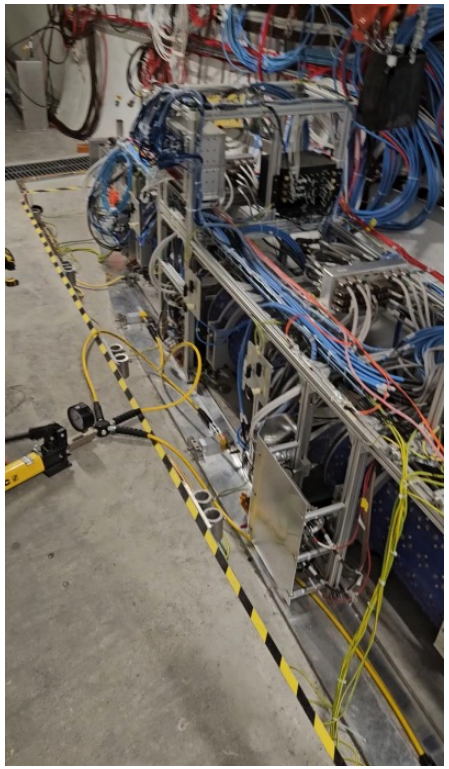


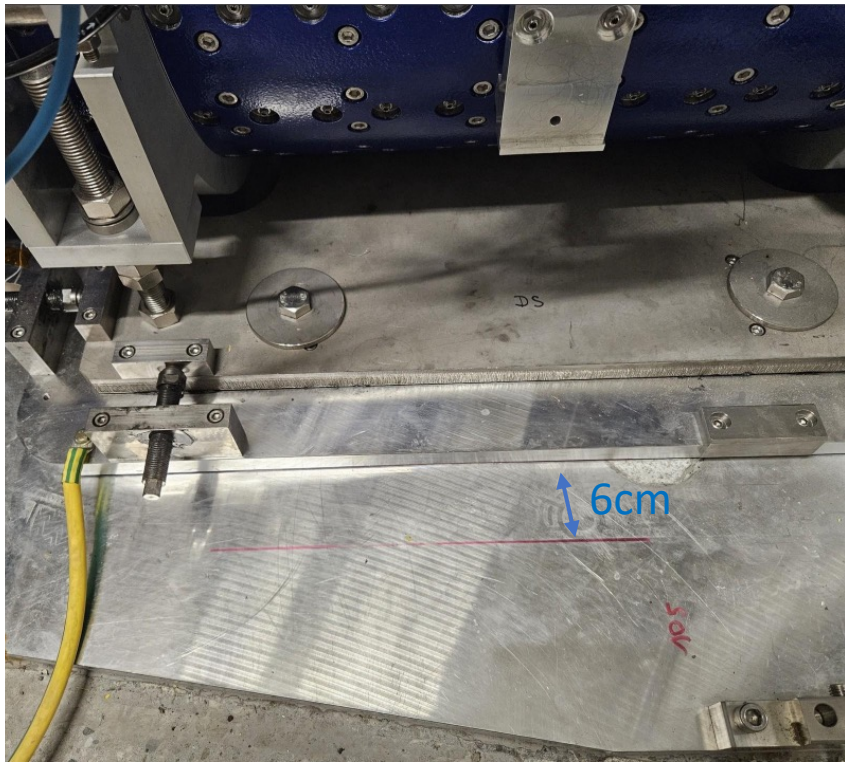
Since then we have been commissioning the detector, so far everythign looks good.

Moving the detector sideways to follow crossing angle.
Carried out on 17/12/25
Procedure tested on surface during FASER test construction in LS2.
Uses 3 hydraulic jacks powered by manual pump to push detector in 3 places simultaneously.
Detector moved about 6cm and within 2mm paralell to LOS across full length.



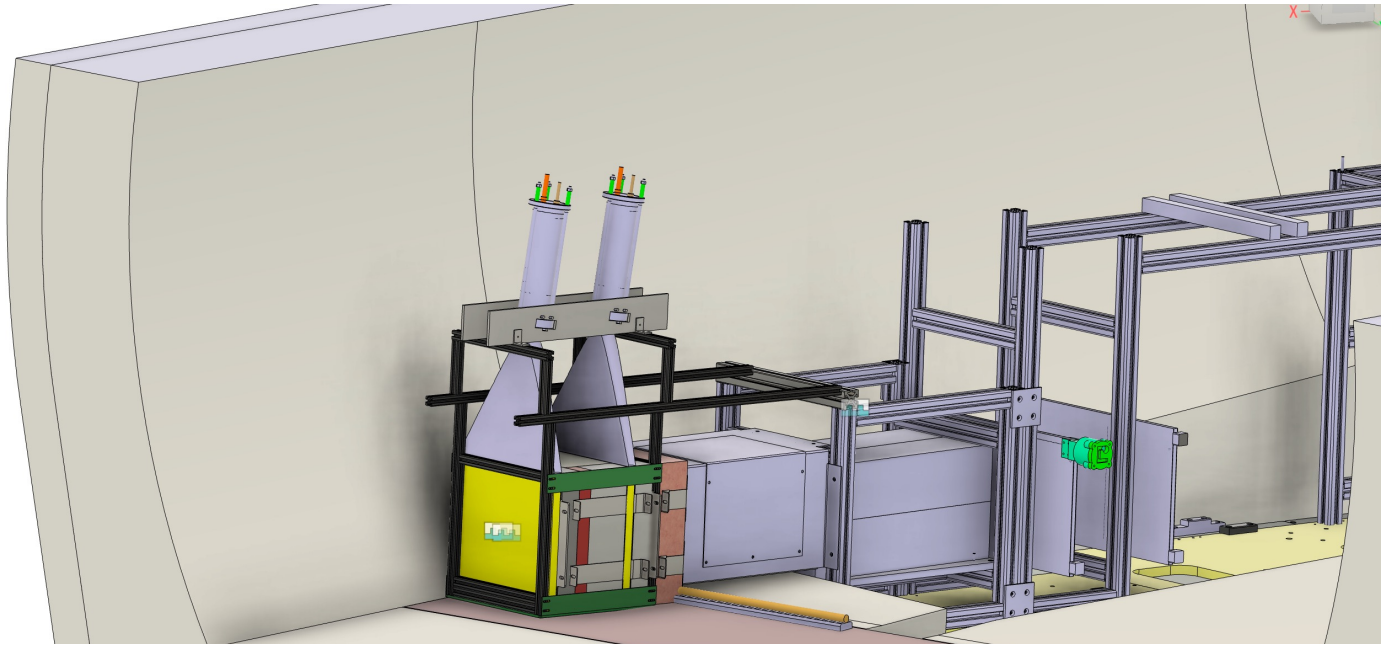


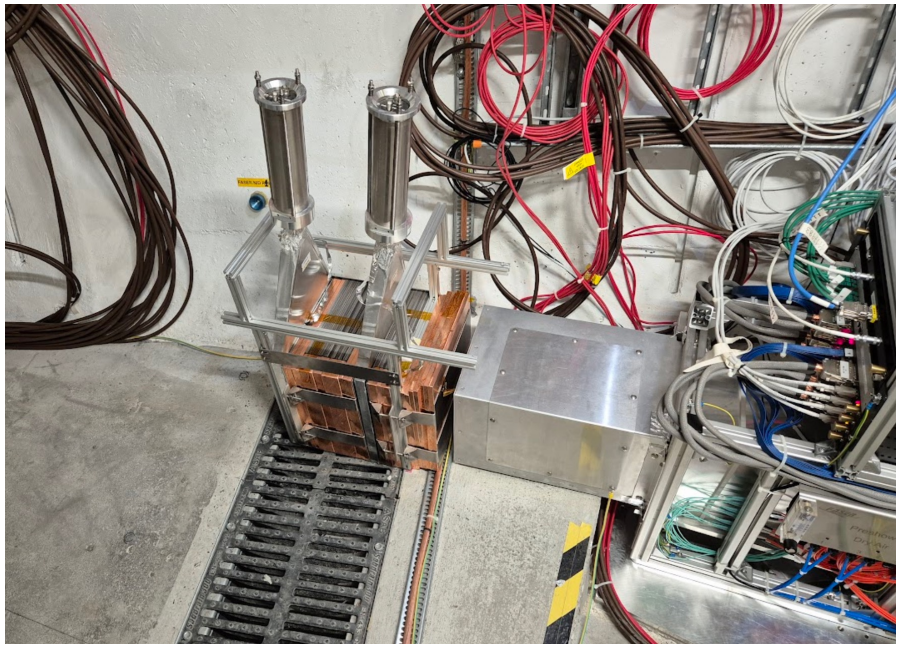




Muon ID at back of FASER

- Idea to use scintillators removed from old preshower to make a simple muon ID at the back of FASER
- No additional services needed (cables and readout already in place)
- Presented at ICL on Feb 12th.
- JP Corso is intregrating into official LHC model.
- Detector installed earlier this week.
- Bruno Feral suggested to update preshower installation ECR to include this





The new detector is on a grill of the drain system. This is segmented so most of it can be removed with the detector still in place.

Muon ID at back of FASER

4. Muon Detector

The two scintillators removed from the old preshower will be re-used to form a small muon detector at the back of FASER. The scintillators will be placed as shown in Figure 8, with tungsten plates and copper placed between FASER and the downstream scintillator and also between the downstream and upstream scintillators. In total 225 kg of tungsten plates and 100 kg of copper will be used. The muon detector extends 28cm at the back of FASER and is supported by an aluminium profile frame, attached to the main FASER frame. A more detailed view of just the new parts can be seen in Figure 9.

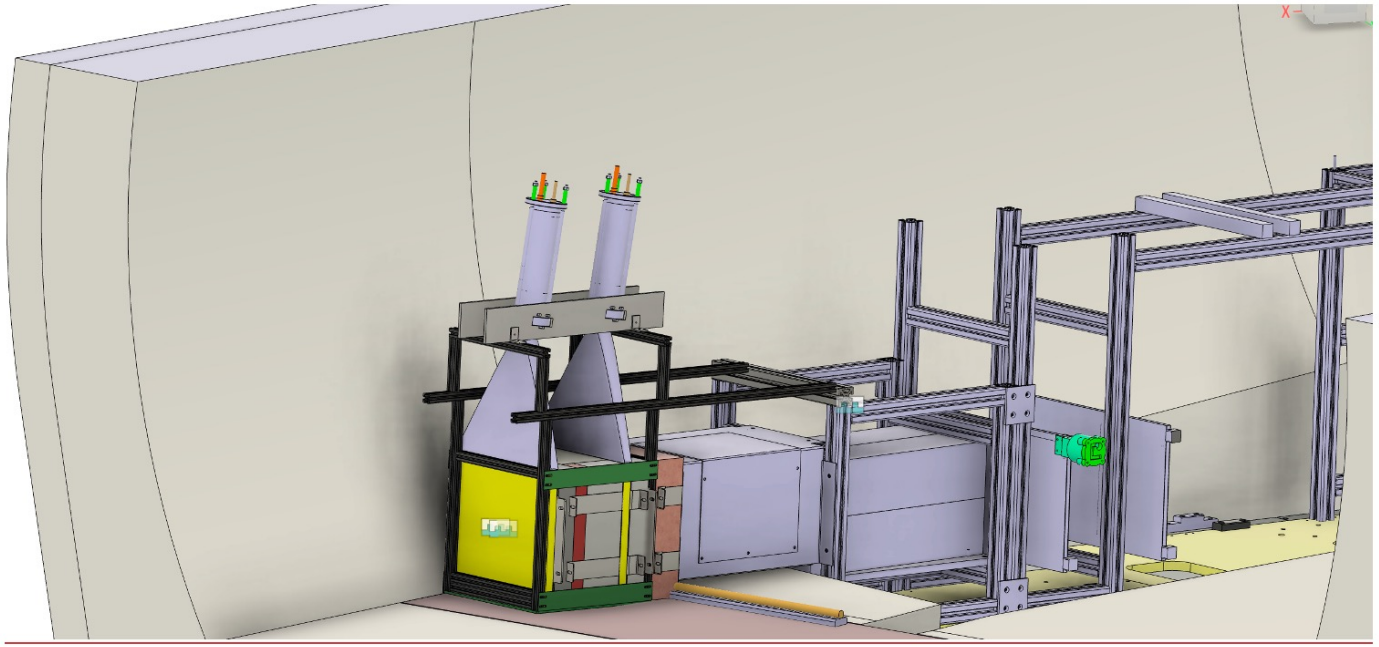


Figure 8 – 3D model of the back of FASER showing the new muon detector at the back of the FASER calorimeter.

Draft update to ECR being discussed by JP Corso, B. Feral

Add veto panels to FORMOSA demonstrator

Reminder:

CERN
Esplanade des Particules 1
P.O. Box
1211 Geneva 23 - Switzerland

EDMS NO.	REV.	VALIDITY
2914326	1.0	RELEASED

REFERENCE: LHC-X1FP-EC-0011

LHC

Date: 2023-08-03

ENGINEERING CHANGE REQUEST

Installation of FORMOSA demonstrator detector in UJ12

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

Installation of a small scintillator-based detector in the UJ12 cavern (behind the FASER experiment). This is to study muon backgrounds along the collision axis for the FORMOSA experiment in the proposed Forward Physics Facility, under study within the context of the PBC.

DOCUMENT PREPARED BY:	DOCUMENT CHECKED BY:	DOCUMENT APPROVED BY:
Jamie Boyd, (EP-ADE) Matthew Citron, (EP-UCM) J.P. Corso, (EN-ACE)	G. Arduini, M. Barberan, M. Bernardini, A. Bardon, O. Beltramello, M. Brugger, J. Bernhard, C. Bertone, S-M. Benmehdi, P. Bonnal, G. Canale, C. Colloca, J. Coupard, O. Crespo Lopez, S. Danzeca, D. Delikaris, L. Di Giulio, E. Duret Bourgoz, J. Etheridge, J-F. Fuchs, J-M. Fernandez, C. Gaignant, R. Garcia Alia, G. Girardot, S. Grillot, A. Infantino, R. Jones, M. Krupa, D. Letant-Delrieux, M. Lazzaroni, Y. Loertscher, M. Modena, T. Otto, S. Pelletier, L. Pereira, S. Roesler, R. Steerenberg, C. Tromel, H. Vincke, J. Wenninger, K. Weiss.	M. Lamont (on behalf of LMC) F. Sanchez Galan (on behalf of TREX) 469th LMC Meeting on 02nd August 2023.

DOCUMENT SENT FOR INFORMATION TO:

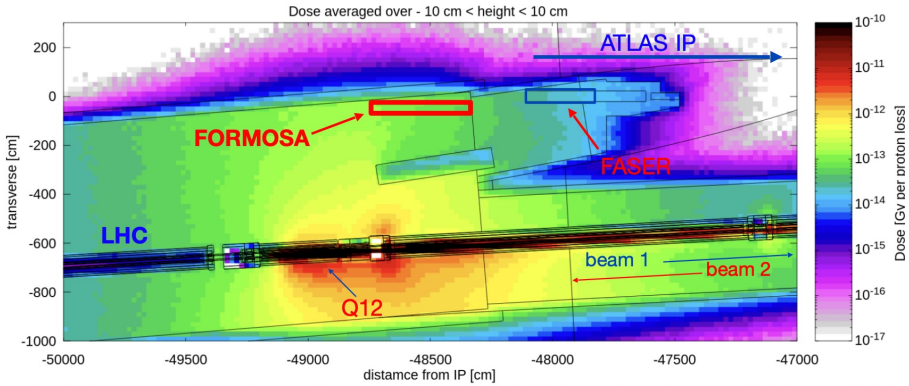
ATS Group Leaders, R2E.

SUMMARY OF THE ACTIONS TO BE UNDERTAKEN:

Installation of a small (4m x 20cm x 20cm) detector demonstrator, made up of 16 scintillator bars and 2 scintillator slabs, each with PMT readout, in the UJ12 cavern, behind FASER. The detector will use existing power and readout from FASER. For the detector to be positioned close to the collision-axis line of sight, the fire extinguisher in UJ12 will be moved to the other side of TI12. For the cables for the detector an additional cable ladder will be installed along the wall of UJ12 above the existing FASER cable ladder.

Note: When approved, an Engineering Change Request becomes an Engineering Change Order.
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use.

FORMOSA demonstrator:
Small scintillatro detector installed behind FASER in YETS 23/24
Taking data in 2024, see background from beamline
Need to install side/top scintillator to be able to veto background particles.



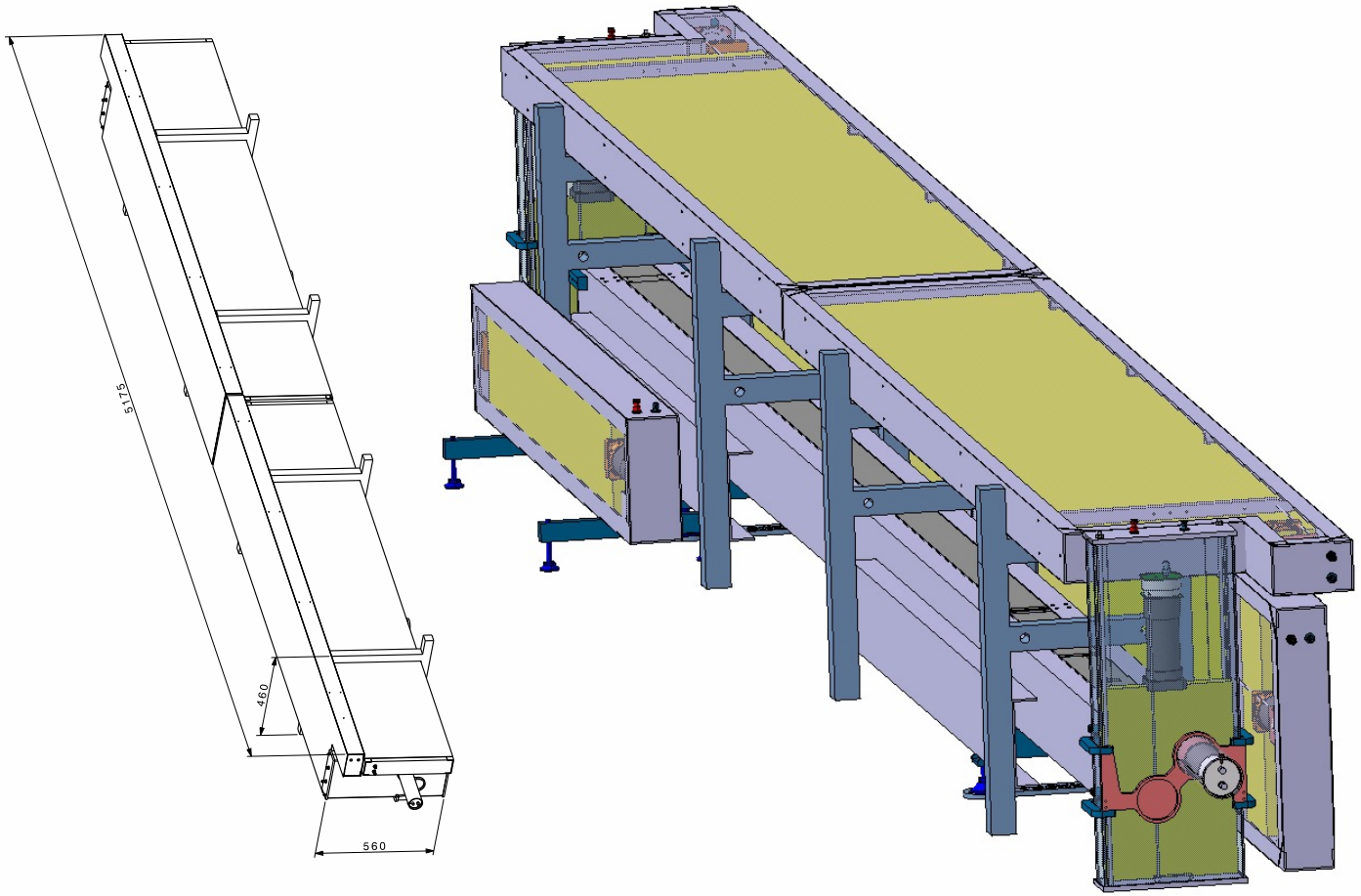
Absolute average dose due to proton loses at Q12 (simulation provided by FASER)

Add veto panels to FORMOSA demonstrator

Plan to add 5 additoinal scintillators:

- 2 on top (2.5m long)
- 2 on LHC side (2.5m long)
- 1 on wall side (1.3m long)

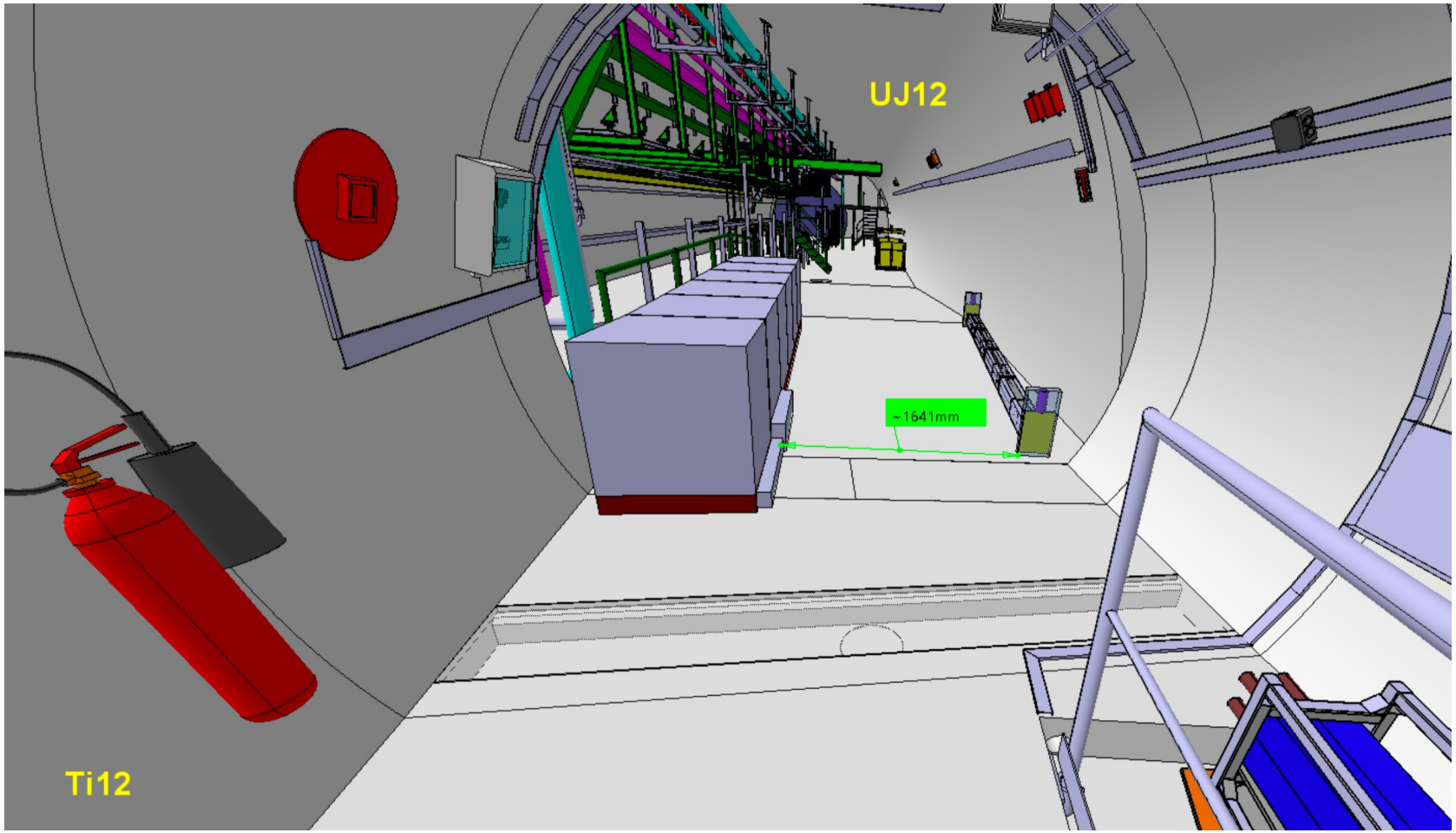
Cables and readout already existing in tunnel. No additional services needed.



Presented at ICL on Feb 12th.
JP Corso integrating into LHC model.
B Feral suggested to make a new ECR to cover this.
Scintillators transported to UJ12 today (needed to be done before chicane installed). To be assembled next week.

Add veto panels to FORMOSA demonstrator

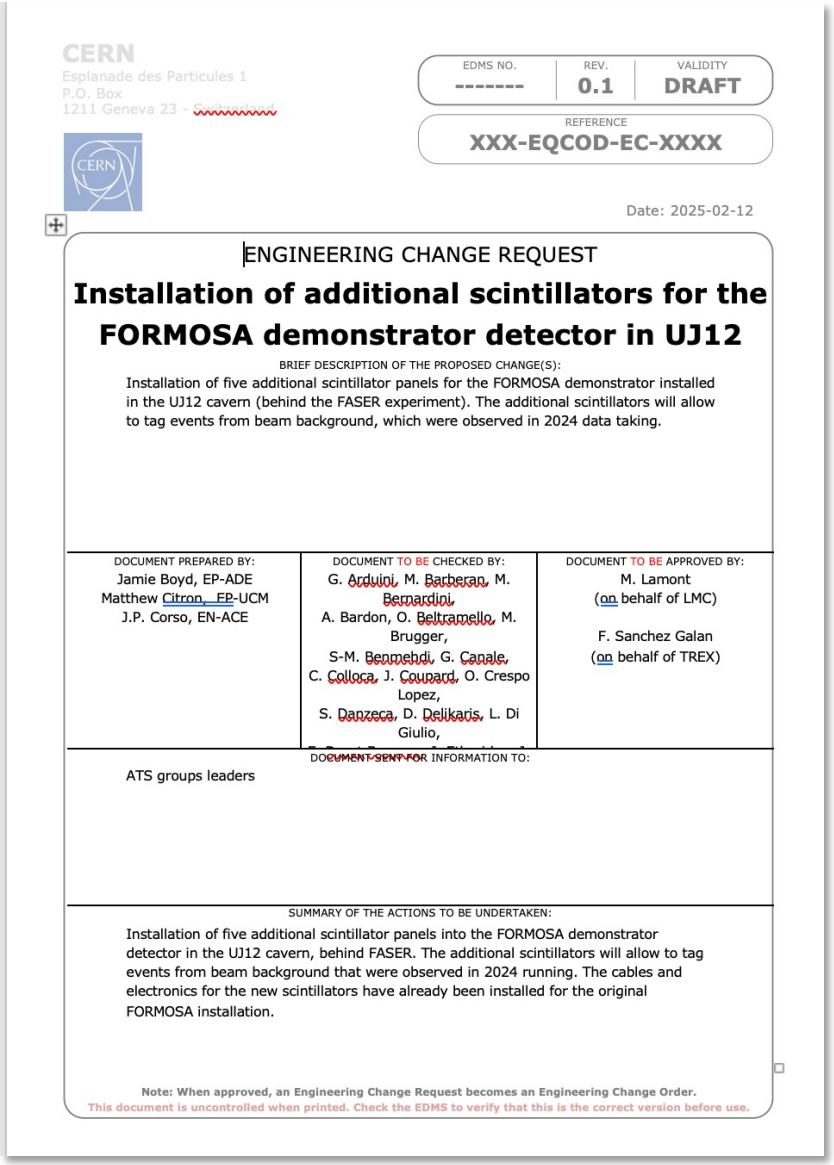
Transport corridor:



Picture from original FORMOSA demonstartor ECR.

With current FORMOSA detector the transport corridor between the detector and the shielding blocks is 164cm.
New detector pieces will reduced this to ~150cm, which is still plenty of room for transport (e.g. of the FASERnu box which is transported on a standard pallet (80cm wide)).
In addition the detector can be easily moved to be closer to the wall for a specific transport activity if needed.

Add veto panels to FORMOSA demonstrator



CERN
Esplanade des Particules 1
P.O. Box
1211 Geneva 23 - Switzerland

EDMS NO.	REV.	VALIDITY
--------	0.1	DRAFT

REFERENCE
XXX-EQCOD-EC-XXXX

Date: 2025-02-12

ENGINEERING CHANGE REQUEST

Installation of additional scintillators for the FORMOSA demonstrator detector in UJ12

BRIEF DESCRIPTION OF THE PROPOSED CHANGE(S):

Installation of five additional scintillator panels for the FORMOSA demonstrator installed in the UJ12 cavern (behind the FASER experiment). The additional scintillators will allow to tag events from beam background, which were observed in 2024 data taking.

DOCUMENT PREPARED BY:	DOCUMENT TO BE CHECKED BY:	DOCUMENT TO BE APPROVED BY:
Jamie Boyd, EP-ADE Matthew Citron, EP-UCM J.P. Corso, EN-ACE	G. Arduini, M. Barberan, M. Bernardini, A. Bardon, O. Beltramello, M. Brugger, S-M. Benmehdi, G. Canale, C. Colloca, J. Coupard, O. Crespo Lopez, S. Danzeca, D. Delikaris, L. Di Giulio,	M. Lamont (on behalf of LMC) F. Sanchez Galan (on behalf of TREX)

DOCUMENT SENT FOR INFORMATION TO:

ATS groups leaders

SUMMARY OF THE ACTIONS TO BE UNDERTAKEN:

Installation of five additional scintillator panels into the FORMOSA demonstrator detector in the UJ12 cavern, behind FASER. The additional scintillators will allow to tag events from beam background that were observed in 2024 running. The cables and electronics for the new scintillators have already been installed for the original FORMOSA installation.

Note: When approved, an Engineering Change Request becomes an Engineering Change Order.
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use.

Draft ECR written and under review.

Summary

- FASER YETS work has progressed as planned so far
  - Preshower installed on Feb 10th
    - Many thanks to all teams involved for their support!
    - Commissioning in progress (so far so good!)
  - Detector movement successfully carried out in December
- Two additional activities have come up
  - Installation of simple muonID detector at back of FASER
    - Installed this week
  - Installatoin of additional veto scintillators for FORMOSA demonstrator
    - To be done next week
  - Both discussed at ICL on 12/2
  - New ECR / ECR update in progress