



3rd Annual Meeting
26-28 March 2014
Vienna University of Technology

The new Gamma Irradiation Facility at CERN




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(on behalf of the PH GIF team)




PH-DT
Detector Technologies




Overview

-  Introduction to GIF/GIF⁺⁺
-  Planned Infrastructure
-  Status of the Construction








A New Irradiation Facility

-  The current CERN-Gamma Irradiation Facility (GIF) has been intensively used to simultaneously expose detectors to the photons from a $^{137}\text{Cesium}$ source and high energy particles from the X5 beam line in SPS West Area. From 2004 onwards, only the $^{137}\text{Cesium}$ ($\approx 0.5 \text{ TBq}$) source was available.

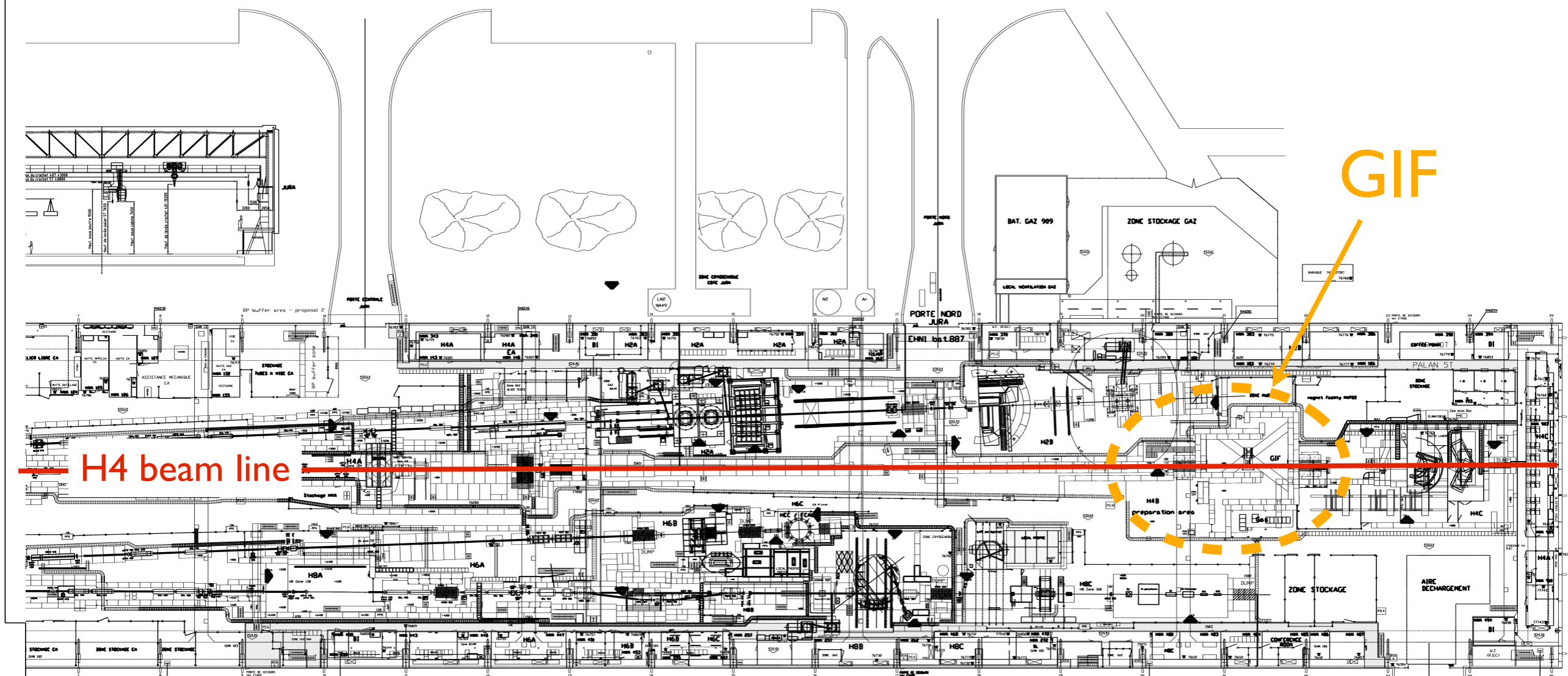


-  The high-luminosity LHC upgrade is setting a new challenge for particle detector technologies. Increase in luminosity will produce a higher particle background with respect to present conditions.

A New Irradiation Facility

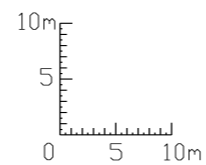
-  GIF⁺⁺ will be a unique place where high energy charged particle beams (mainly muon beam) are combined with a **14 TBq ¹³⁷Cesium source** (a factor 30 more intense than that at current GIF).
-  High energy Muon beam from T2 target, on H4 beam line (few weeks dedicated muon beam & around 30% of the beam time halo muon beam)
-  The 100 m² GIF⁺⁺ irradiation bunker has two irradiation zones making it possible to test real size detectors, of up to several m², as well as a broad range of smaller prototype detectors and electronic components.
-  2 independent wide irradiation field ($\pm 37^\circ$). Independent attenuators up to 50.000 (Pb, Fe). Angular correction filter for both fields (exchangeable)
-  Fixed installed beam-trigger & cosmic-trigger
-  Central Control System : record of environmental parameters, beam parameters, filter settings, gas,... provides interlocks (e.g. for wrong gas mixtures)
-  Wide range of available gases (+ custom gases), gas patch panels in bunker & service area (6.5 km of piping)

887 EHNI



H4 beam line

GIF

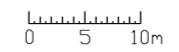
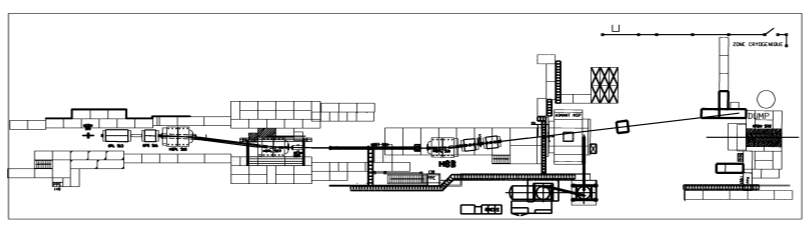


LEGENDE :

- MUR ET BOISERIE
- MUR SECOURS
- MUR ANTISISMIQUE II
- ▼ SERRURE
- Poutre d'attribution générale avec appui différent
- Coffret de 1 prise 30A (10A)
- Coffret de 1 prise 16A (10A)
- Coffret de 1 prise 32A (10A)
- Coffret de 2 prises 16A et 1 prise 16A
- Coffret de 2 prises 25A
- Coffret de 2 prises 32A
- Coffret de 2 prises 16A et 1 prise 32A
- S.C.F.
- Serrure d'alarme
- Serrure SBC / 30A
- Interrupteur
- Interrupteur général torret d'urgence
- Arrêt d'urgence local
- Interrupteur d'urgence
- Tour d'éclairage L50-50 avec réflecteur
- Zones de stockage tenues 300h couvert

Hauteur théorique des Faisceaux
 H2 : 2460mm
 H4 : 2060mm
 H6 : 2060mm
 H8 : 2860mm

Charge maxi 50 tonnes/m²
 Charge maxi sur galeries 30 tonnes/m²



Hauteur théorique des Faisceaux
 H2 : 2460mm
 H4 : 2060mm
 H6 : 2060mm
 H8 : 2860mm

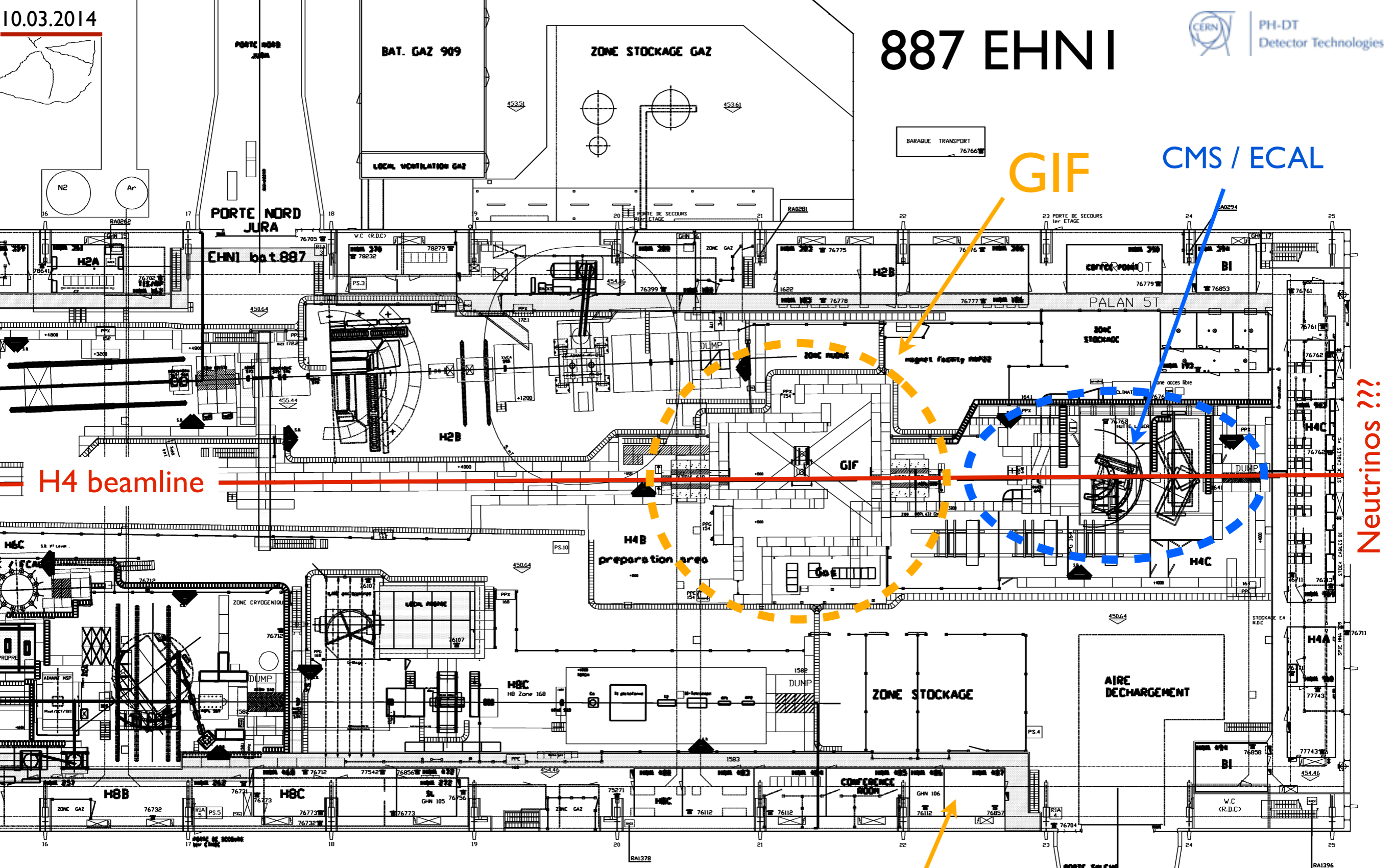
DESIGN: BUREAU D'ETUDES
 DRAWING: BUREAU D'ETUDES
 CHECKING: BUREAU D'ETUDES
 APPROVAL: BUREAU D'ETUDES

IND	DATE	NOM/NAME	ZONE	MODIFICATION
D	2013-12-05	S. GIBOD		update with GIF
C	2013-09-24	S. GIBOD		general update
B	2013-05-03	S. GIBOD		Mise à jour des faisceaux H2 - H6 - H8
A	2013-04-16	S. GIBOD		mise à jour 2008

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SPSXLHN1003

887 EHNI



GIF

CMS / ECAL

H4 beamline

Neutrinos ???

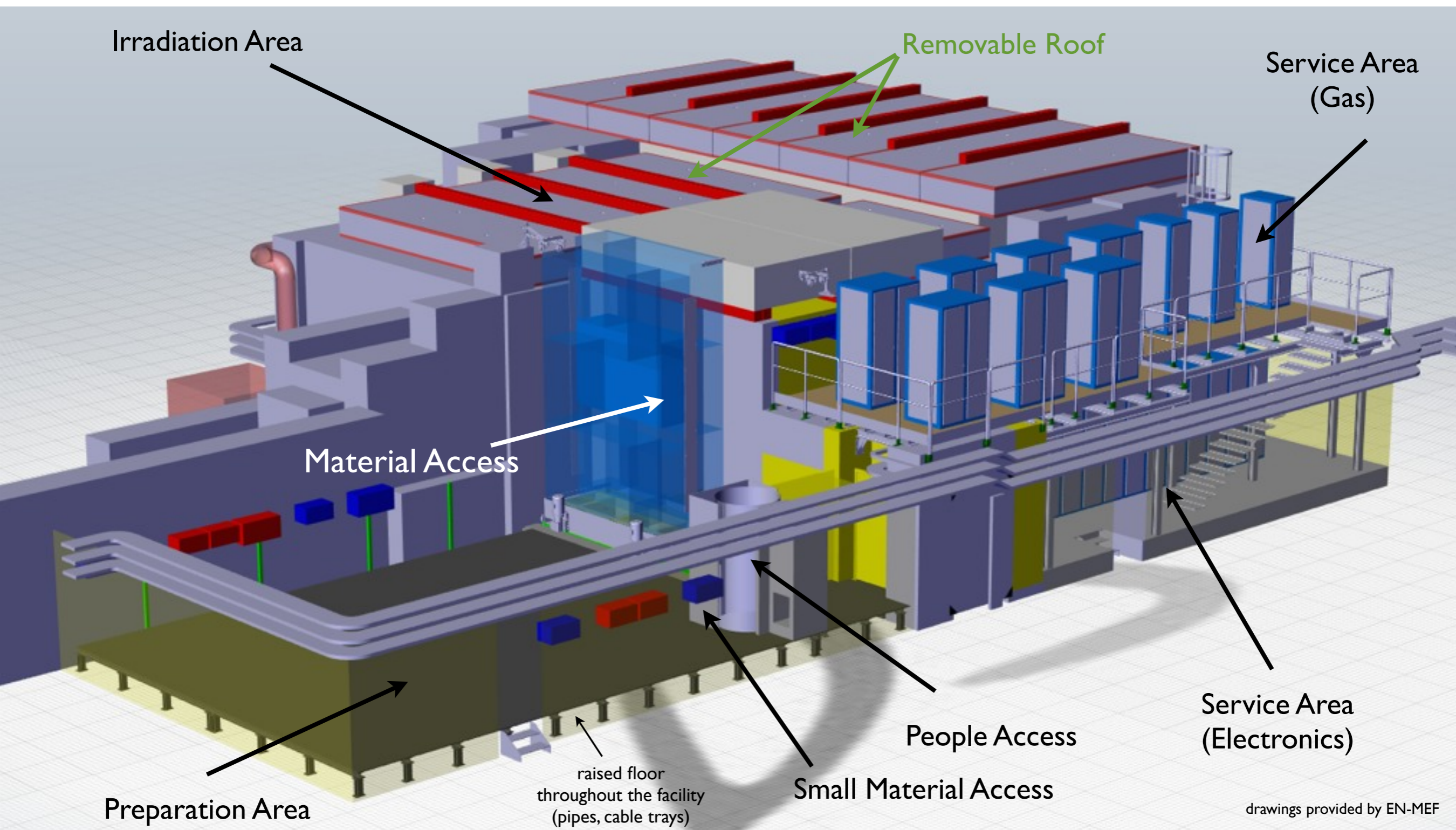
GIF Control Room

LEGENDE :

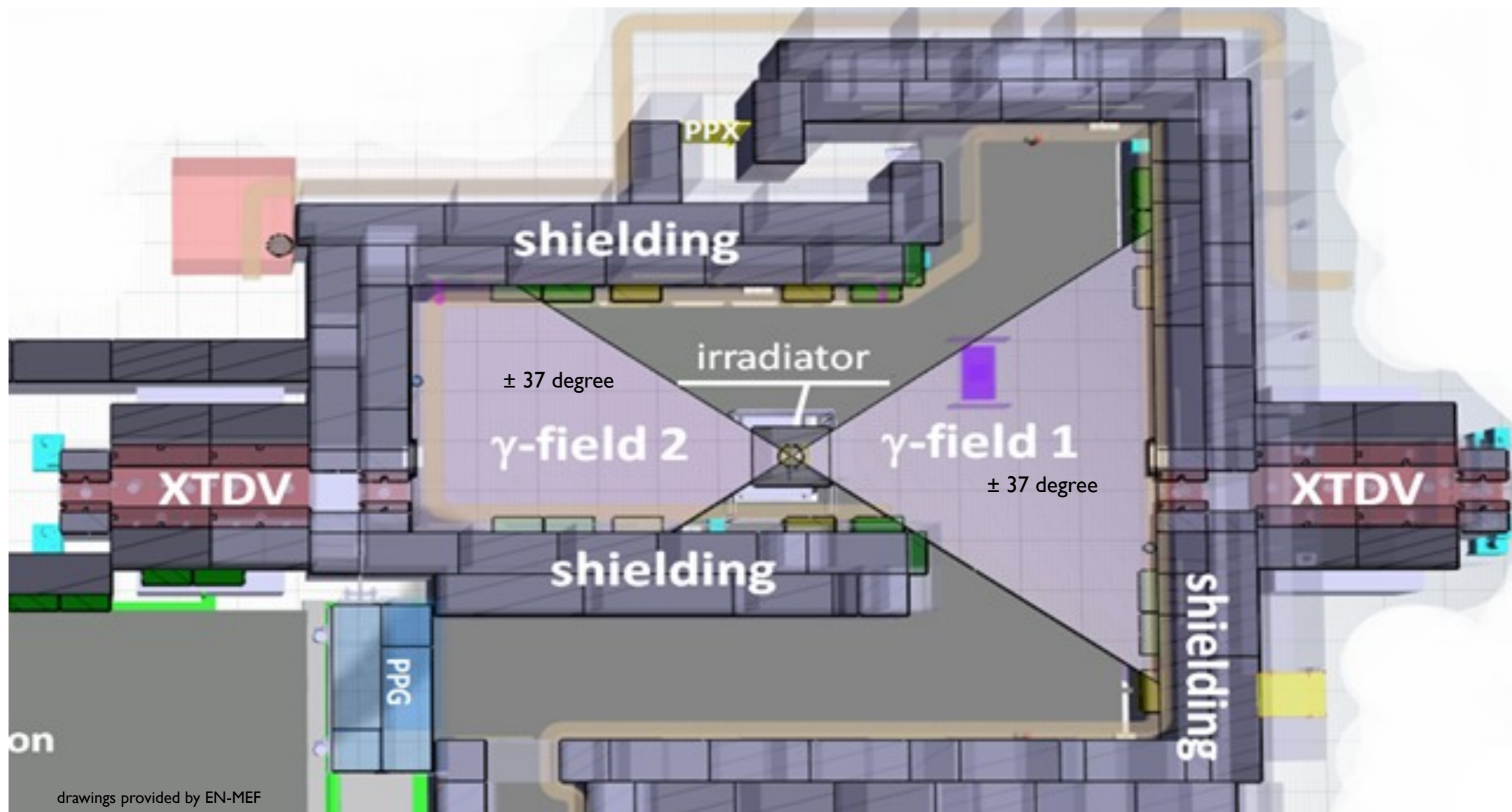
- PRODUIT MECANIQUE AME
- PORTE SECOURS
- DETECTION EQUIPEMENT
- AME INFRASTRUCTURE BI
- RECHERCHER
- Parties d'equipement generale avec des jonctions differenciees
- Collecteur de 4 points 43m tube
- Collecteur de 1 point 43m tube
- Collecteur de 1 point 16m tube
- Collecteur de 1 point 32m tube
- Collecteur de 2 points 16m et 1 point 16m
- Collecteur de 2 points 16m et 2 points 32m
- Collecteur de 4 points 32m
- Collecteur de 2 points 16m et 1 point 32m
- BCF
- Soutie 'CABLES' et ducte d'amenagement
- Sonde temperature
- Sonde air conditionne

Hauteur theorique des Faisceaux
 H2 : 2460mm
 H4 : 2060mm
 H6 : 2060mm
 HB : 2860mm

Charge maxi: 50 tones/m2
 Charge maxi sur galeries: 30 tones/m2

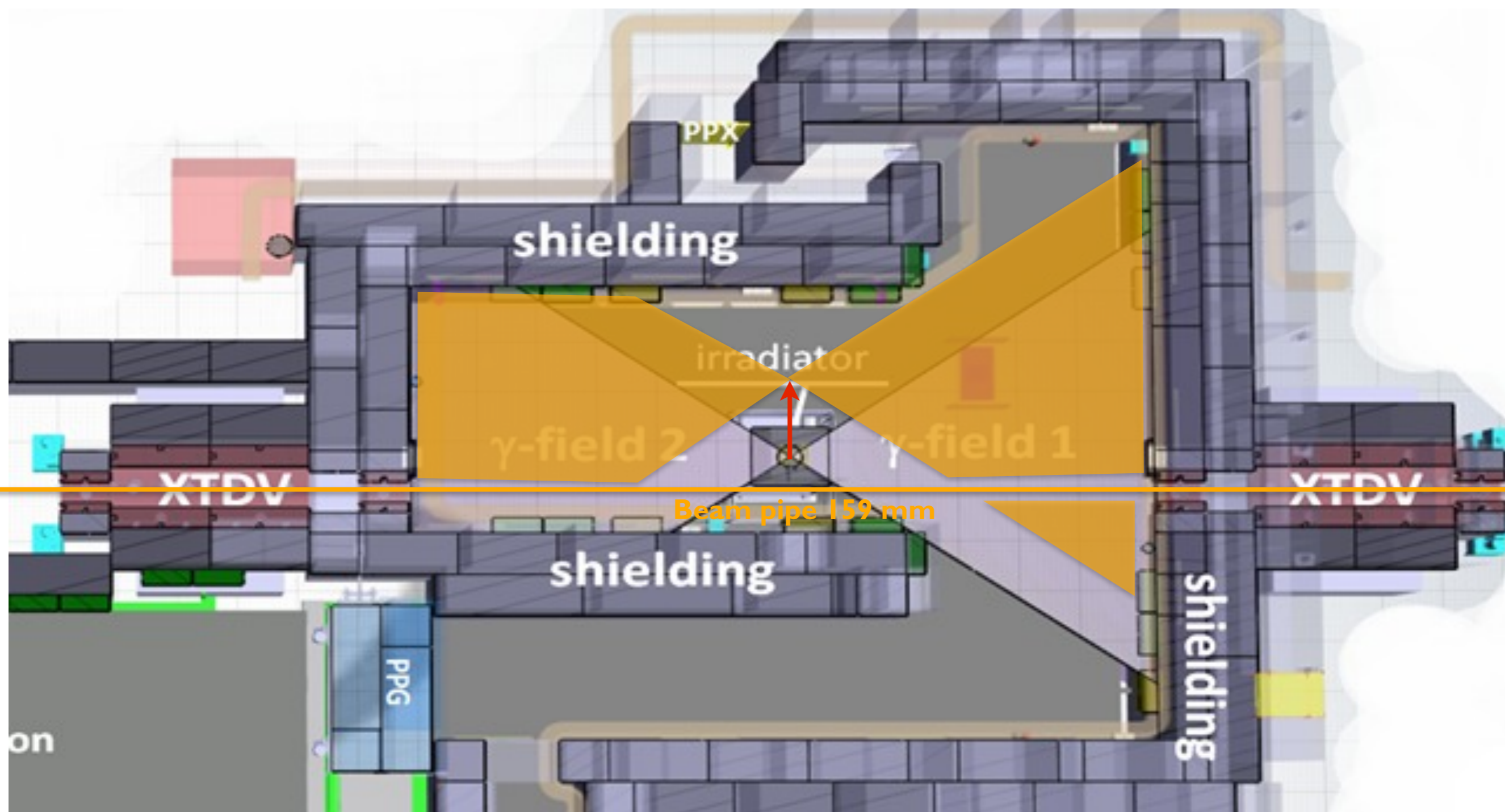








Irradiation Fields



drawings provided by EN-MEF

Irradiation Fields - beam pipe



-  CMS ECAL requires e^- beam for ≈ 3 weeks per year.
-  Installation of beam pipe necessary
-  No local shutters available
-  Irradiator can be moved by 1.5 m
-  Access limitations
-  beam pipe can block installations

The Source

1.Nov.2011 = 14.91 TBq
260 μ Gy/s at 1 meter

Attenuator

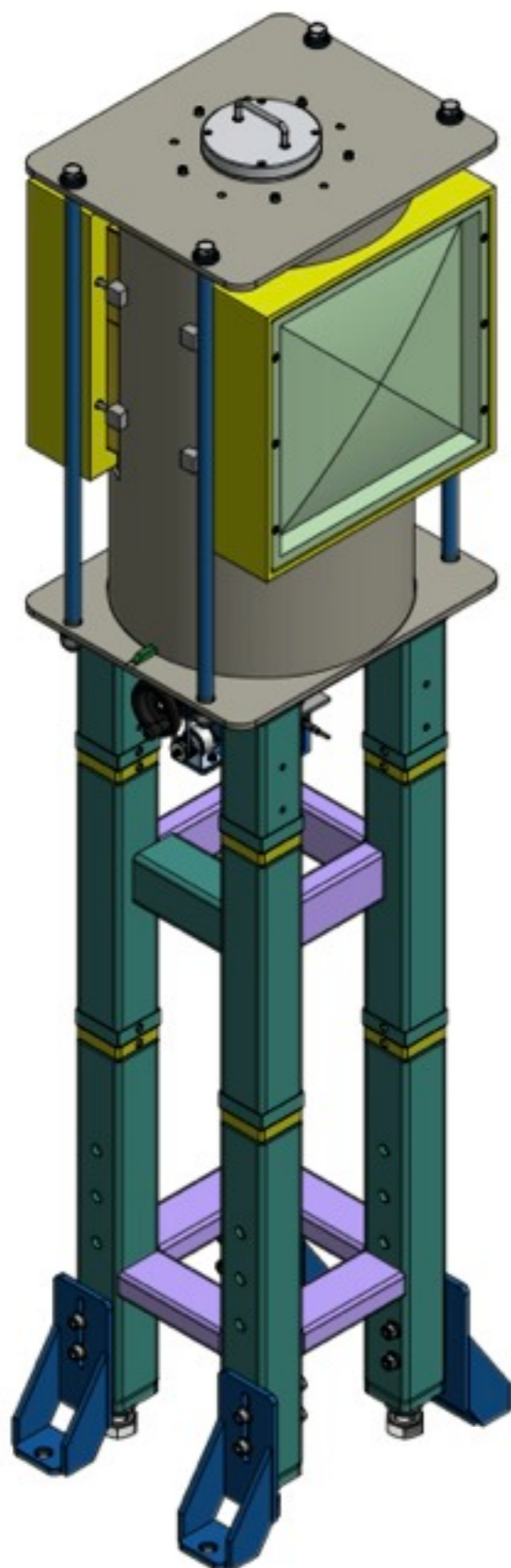
3 planes of Pb (Fe) plates
flexible, up to 50.000
(independent on both sides !)

Second field

(same characteristics as primary)

Angular correction filter

Two rods showing the position of source

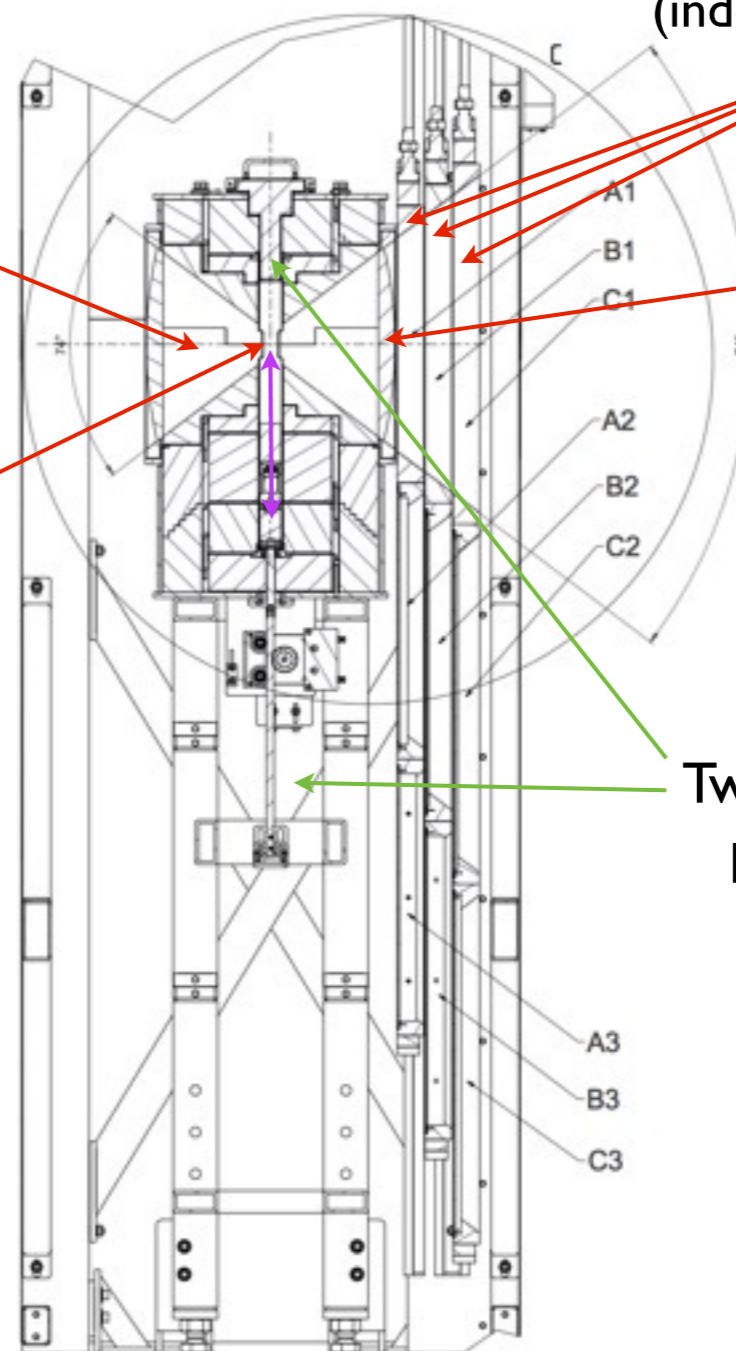


14 TBq Cs¹³⁷

Source available in Prague Hot-Cell, certificate received.



Source stacked with two cylinders of ⁷⁴W while in Irradiator

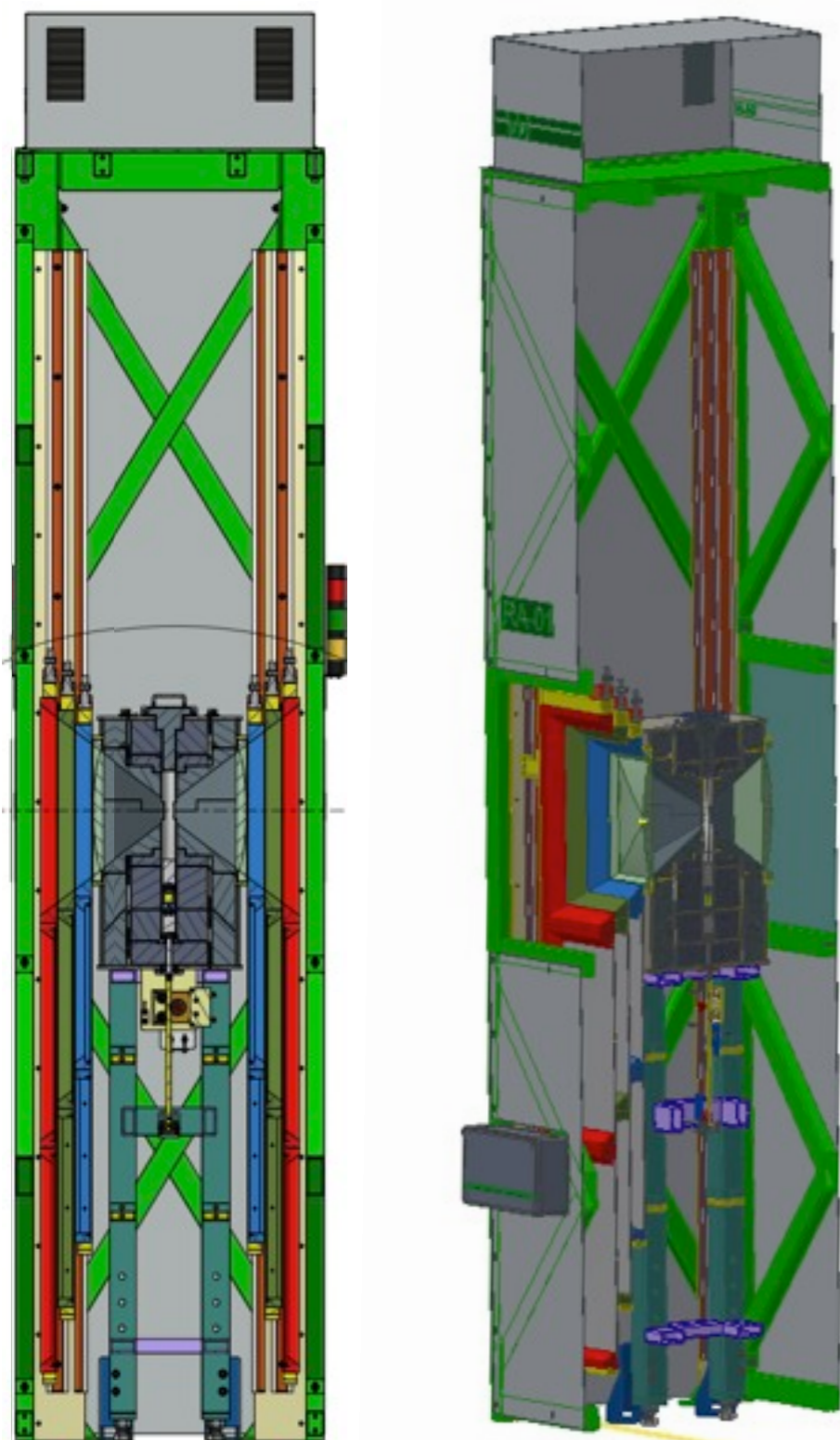


The Irradiator






Two finished similar irradiators...



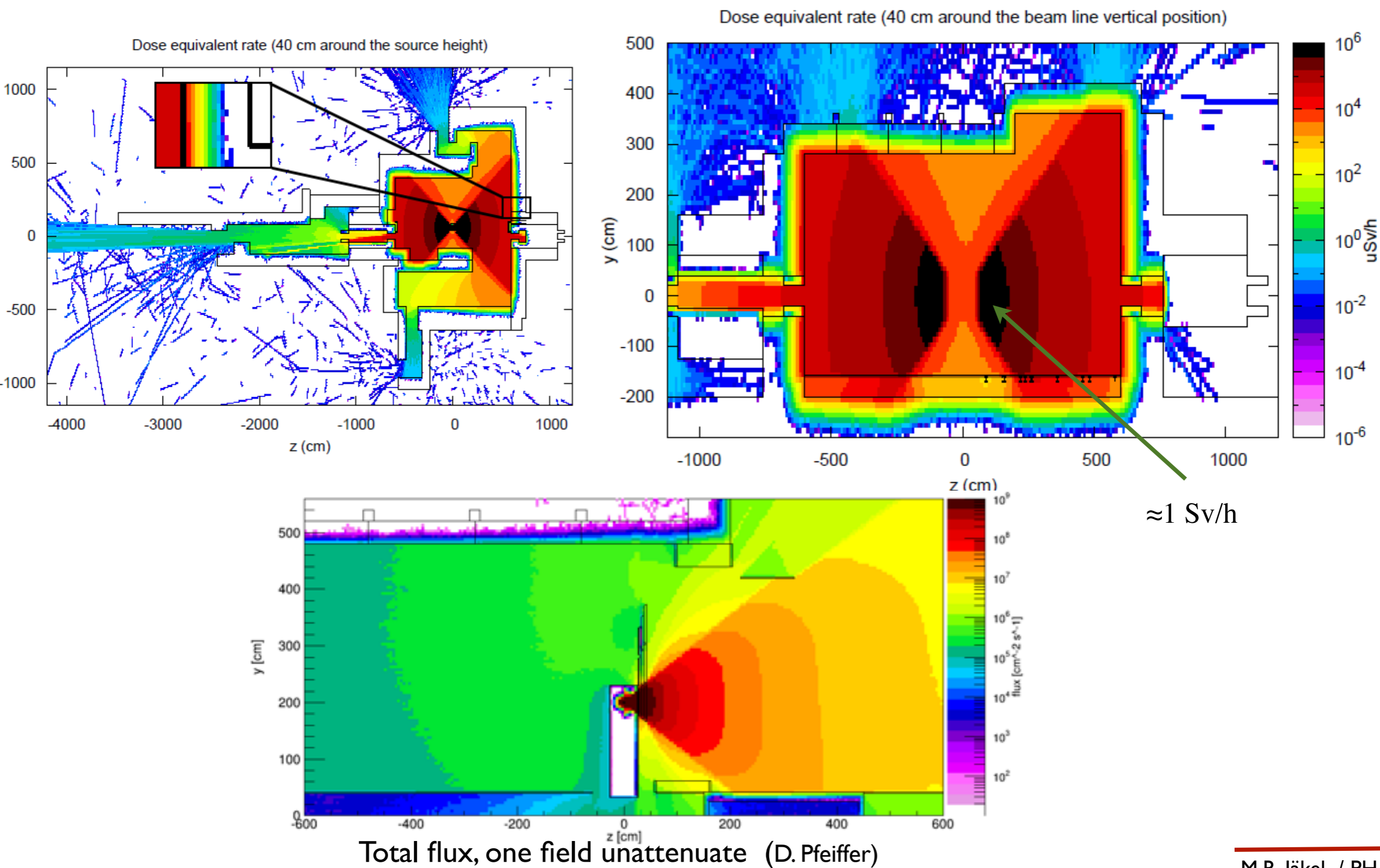
.. but bigger, due to internal multiple source carousel



The Irradiator - Status

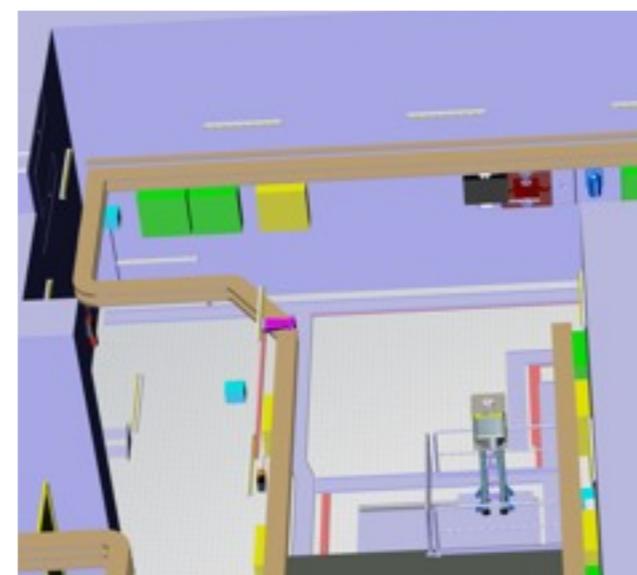
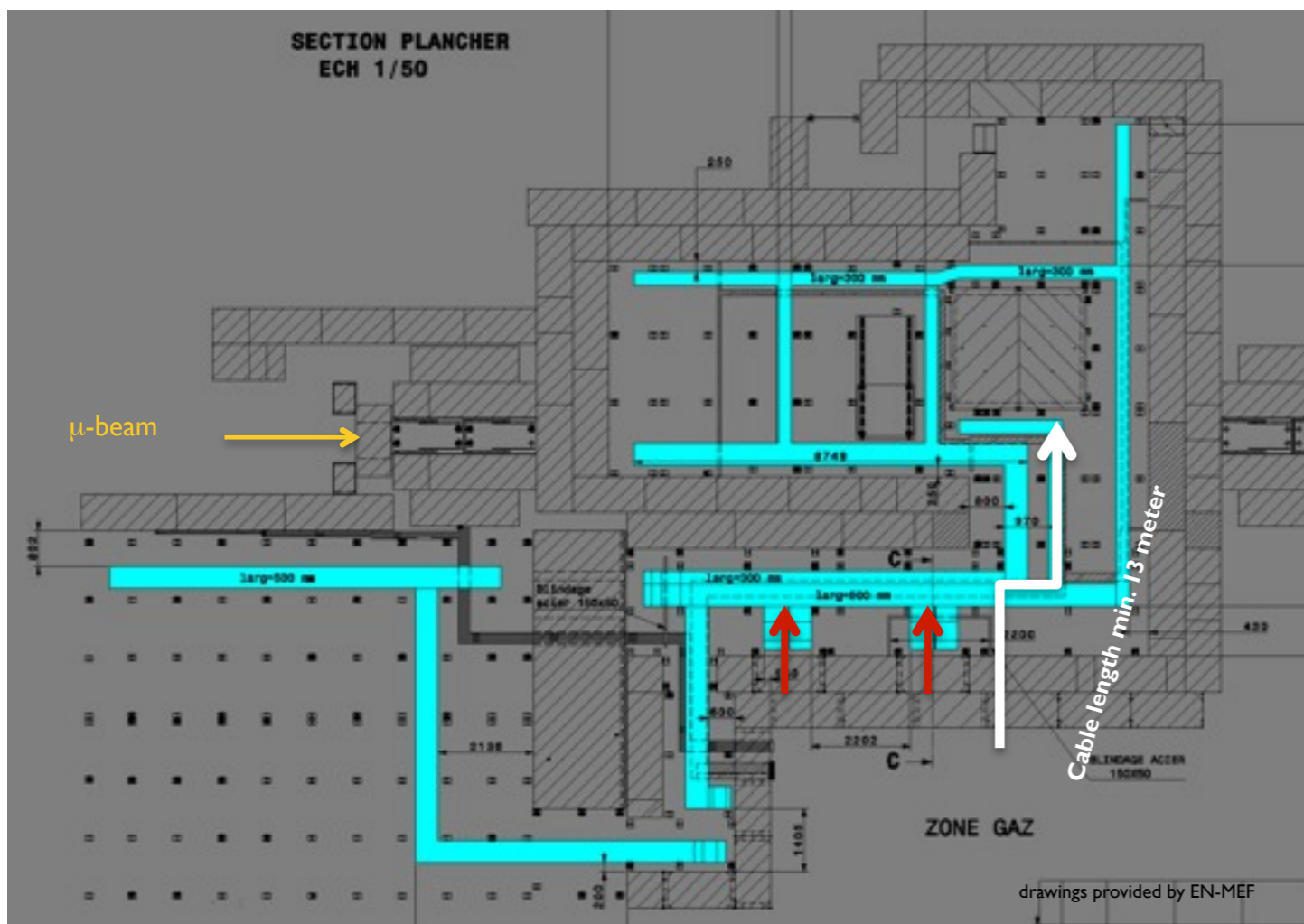
-  Design of Irradiator practically finished
(based on existing and well tested model)
-  Design of attenuator is in late stage
-  Delivery on track for september
-  Decommissioning of old GIF starts 2-3 weeks
before new source arrives (exact date will be announced)
-  Clean-up of Bld. 190 started, some mechanical
work can happen before september

Radiation Simulation

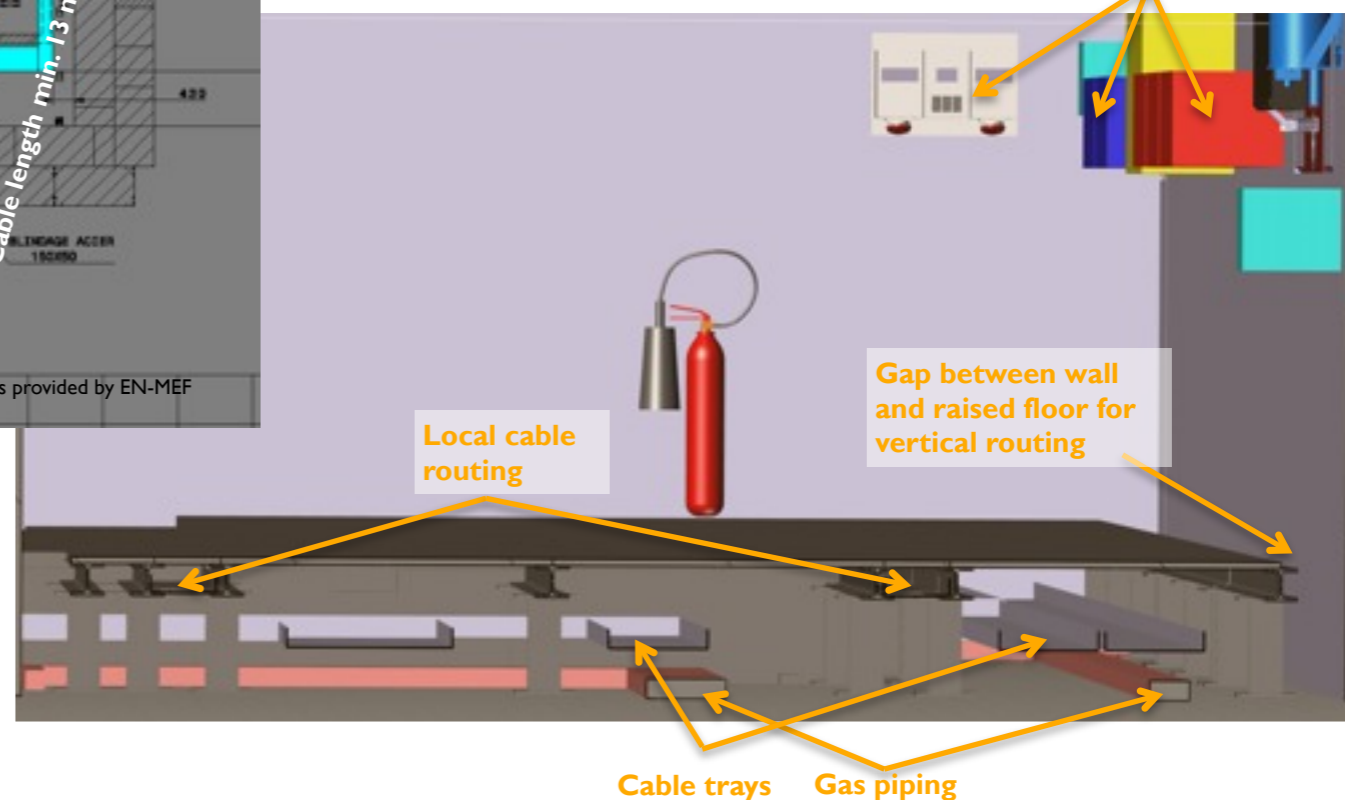


Cable Paths

drawings provided by EN-MEF



Distribution panels
along walls



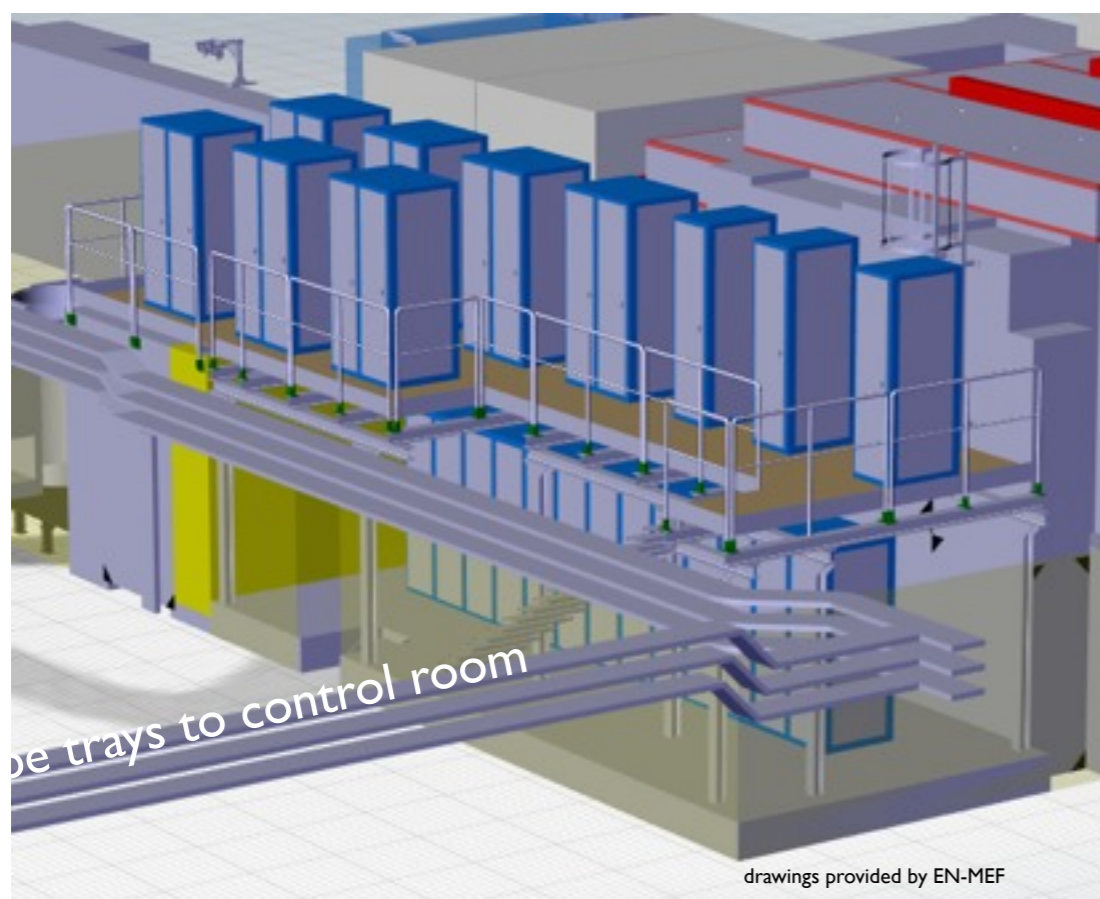
 Cable trays under false floor



 Short path $\geq 13\text{m}$




 Normal path $\approx 25\text{ m}$

Please check with us
for your cable length

Service Area



-  Ground floor : Irradiator controls, DCS, electronic racks
-  Top Floor : 17 gas racks and distribution panels. 40 m² net area

-  9 neutral gas lines : Ar, CO₂, N₂, He, SF₆, CF₄ and 3 spare pipes
-  6 lines for flammable gases or gases with very low vapor pressure : iC₄H₁₀, CH₄, Ar/H₂(optional), C₂H₂F₄ and 2 spares. Lines and room heated.
-  One normal exhaust and one exhaust for potentially flammable gases



Gas supply panels

- Neutral gas distribution:

2 x 2 (gas zone) + 1 preparation zone gas distribution panels will be installed in the gas mixing zone. Each panel will contain five gas types (CERN standard panel for neutral gas 59.70.60.010.2).

- Flammable gas distribution:

1 (gas zone only) gas distribution panel will be installed in the gas mixing zone. It will contain five gas types. This panel will be instrumented with retention box and flammable gas detection head as it is normally done at CERN (CERN standard panel for neutral gas 59.70.60.020.0).



Gas mix zone

- At full capacity the gas mixing zone will contain
 - 6** mixing racks,
 - 3** closed loop gas systems,
 - 2** analysis racks
 - 1** control rack.
 - 5** spare racks
- Gas analysis:
 - 1** O₂ and H₂O analysis rack with possibility of automatic scan between all gas lines. In a second phase (just after the start-up of the main installations), a gas chromatograph will be integrated in the O₂-H₂O analysis rack.
 - 1** infrared analysis rack with several (at least three) gas channels in order to monitor permanently the flammable gas concentration in non flammable mixtures. For each channel a hardwired interlock signal will be available in order to stop the corresponding mixer when required.



Gas mix distribution

- Gas mixture distribution:
distribution panel: 6 supply (outer diameter 8 mm) and 6 return (outer diameter 10 mm).

The gas distribution is divided in:

panels for neutral mixtures (hereafter panel A)

panels for mixtures that might contain flammable gases (hereafter panel B).

In the gas mixing zone **6** panels type A (36 supply + 36 return) and **6** panels type B (36 supply + 36 return) will be installed.

In the irradiation bunker the corresponding **6** panels type A and **6** panels type B will be installed.

Gas supply zone



sup Gas supply panel neutral gases 80 cm x 40 cm x 35 cm

sup Gas supply panel flammable gases 80 cm x 40 cm x 35 cm

mix mix Mixture distribution panels 60 cm x 30 cm x 35 cm



Gas mix distribution

4 panels of type A and **1** of type B will be equipped with three way valves allowing to supply also the preparation area.

In fact in the preparation area the corresponding number of panels will be installed (2 type A and 3 type B).

In total there will be at least:

96 pipes (48 supply and 48 return) from the gas mixing zone to the irradiation bunker

60 pipes (30 supply and 30 return) from the gas mixing zone to the preparation zone.

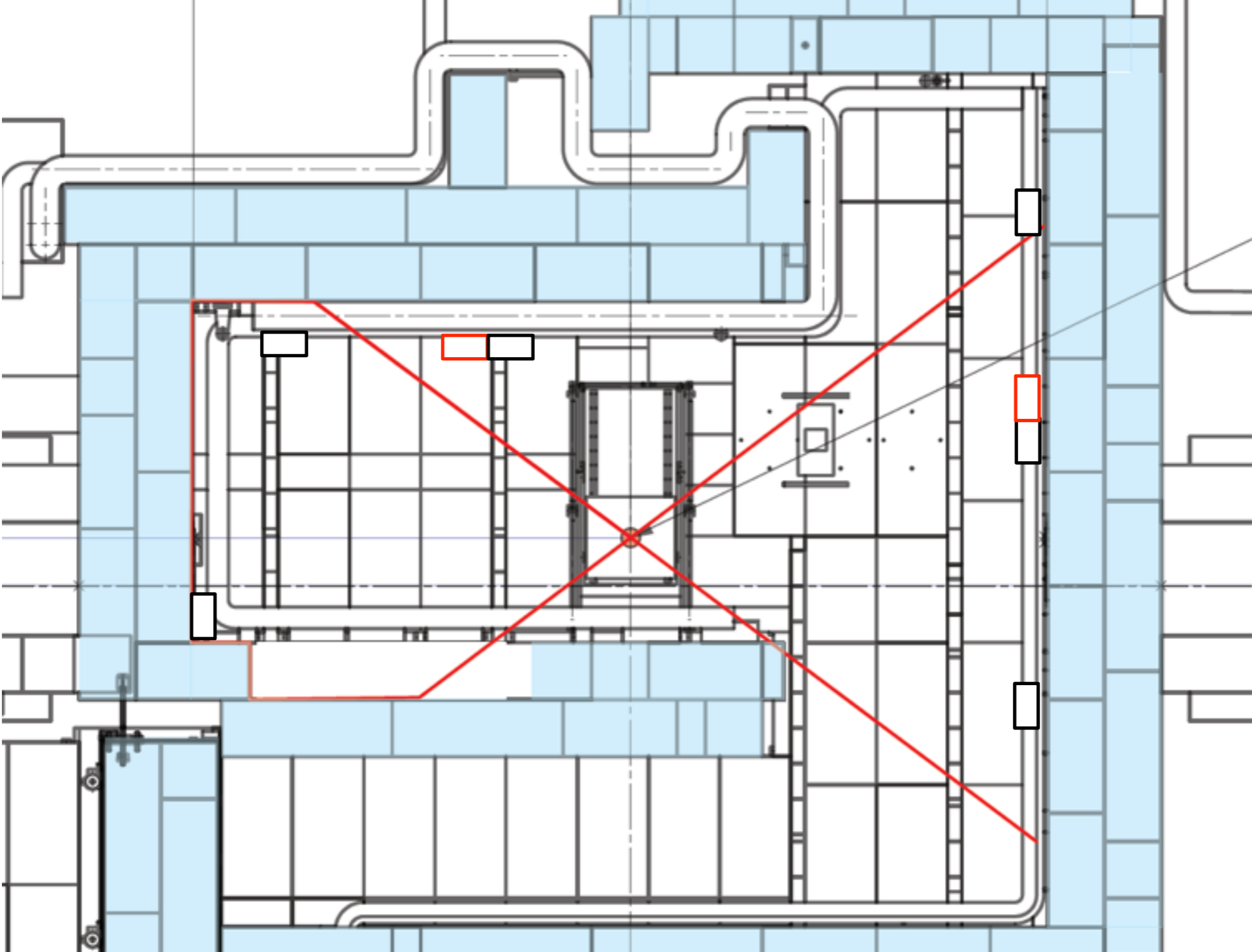
These pipes should be in stainless steel cleaned at CERN following standard cleaning procedure for the gas distribution systems.



Gas mix distribution



Gas mix distribution





Gas systems – start-up version

First version to start-up the facility:

1. 21 distribution panels
2. Simplified version of control rack (basic functionality like connection to remote pvss interface for recording flows, gas systems status, ...most probably available)
3. 2 gas mixing racks for the fixed installations (beam and cosmic trigger setups). Any additional mixer for users will cost about 15-20 kCHF (not included in the present list).
4. 1 IR analysis rack (needed to operate cosmic trigger gas system). It will be recuperated from GIF.
5. 1 analysis rack (O₂+H₂O+ gas chromatograph). It will be recuperated from GIF (currently used by CMS-GEM).
6. 1 closed loop gas system. It will be recuperated from old GIF systems (now at 904 or ATLAS).



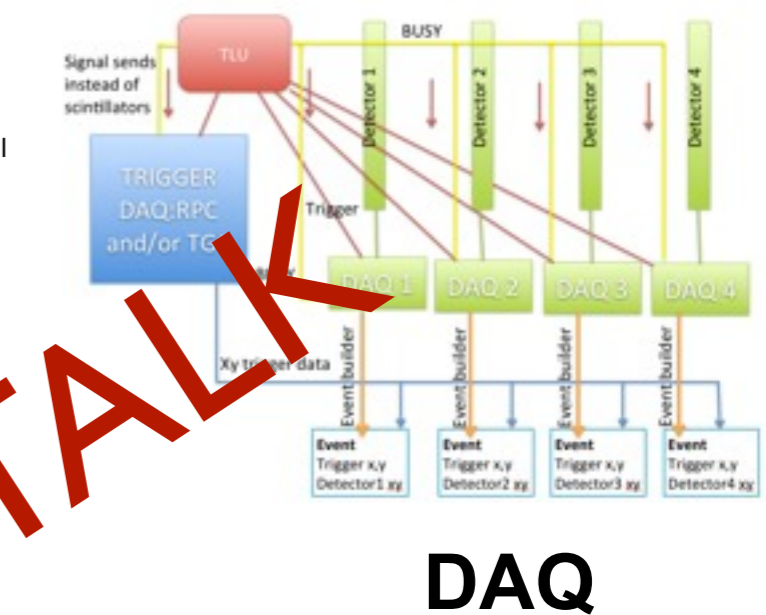
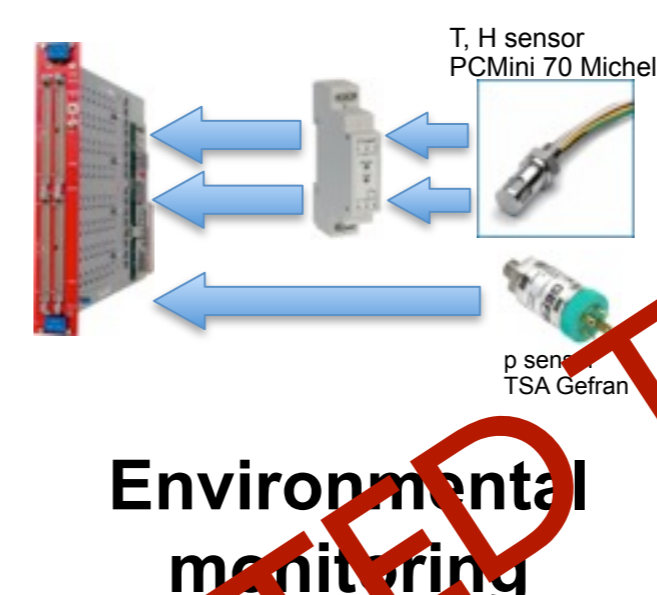
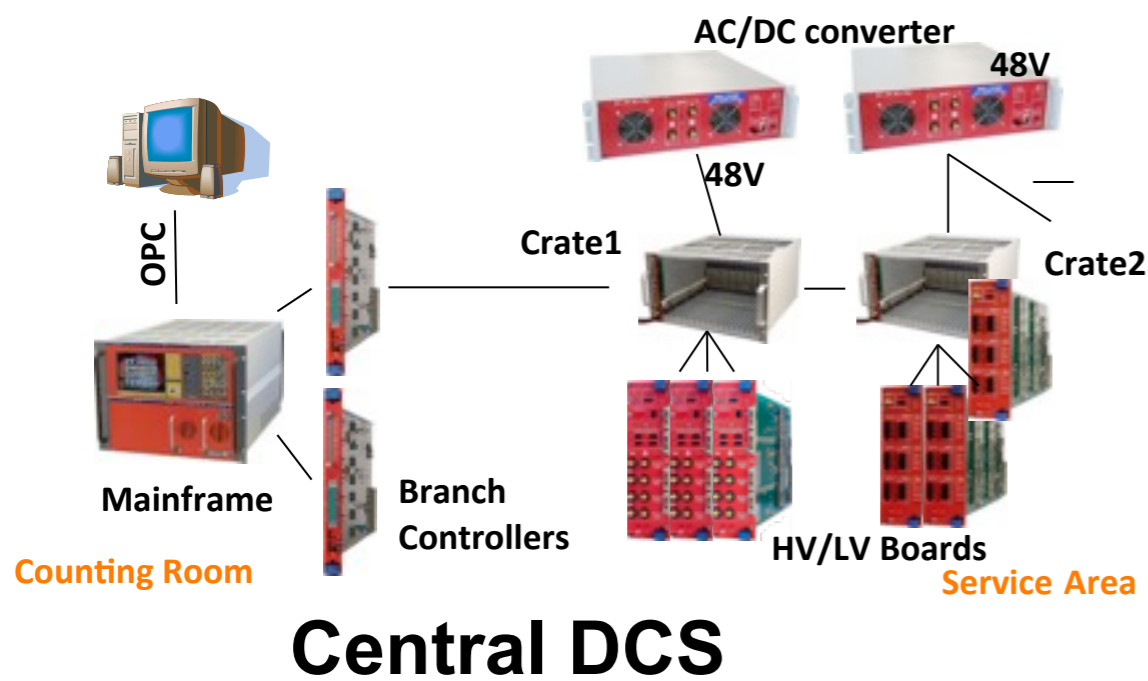
Gas systems – future upgrades

Many possibilities for future upgrades to be discussed with users for resources:

1. Upgrade control rack for more units (mixers, analysis, re-circulation systems, ...)
2. Additional IR analysis rack for second mixer using flammable gas
3. 3 mixers for users (15-20 kCHF each)
4. 3 new gas recirculation systems for users
5. Install more distribution panels (?)

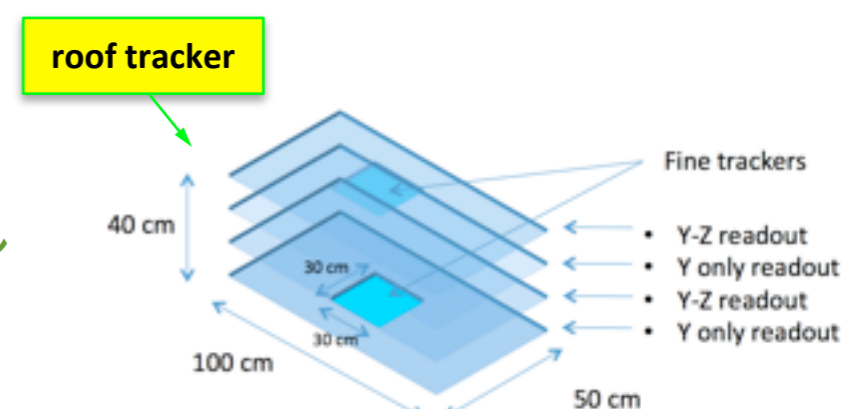
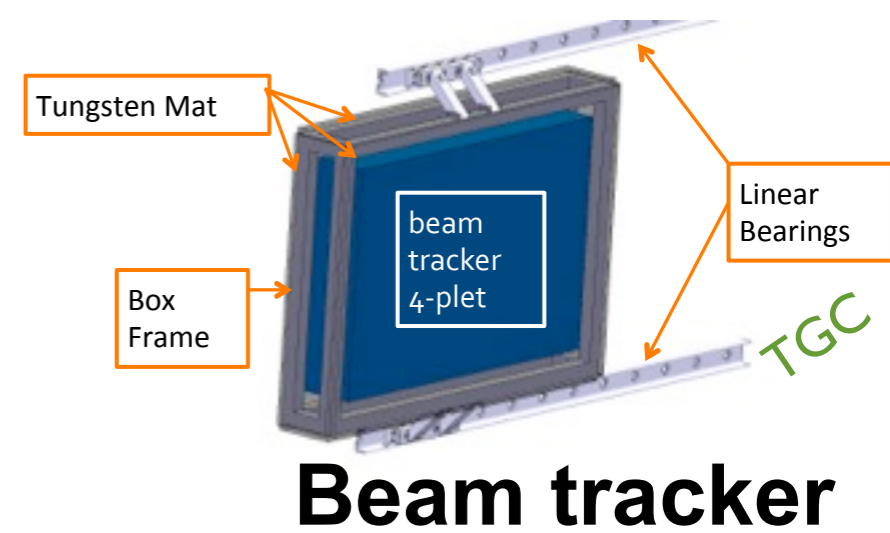
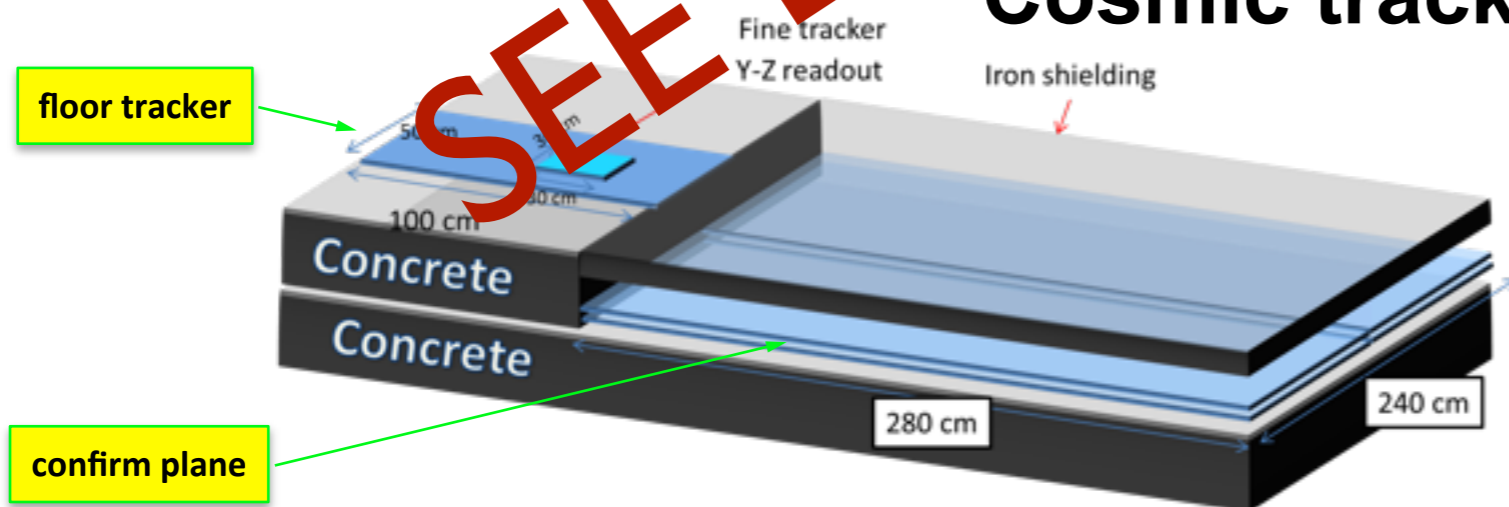


User Infrastructure



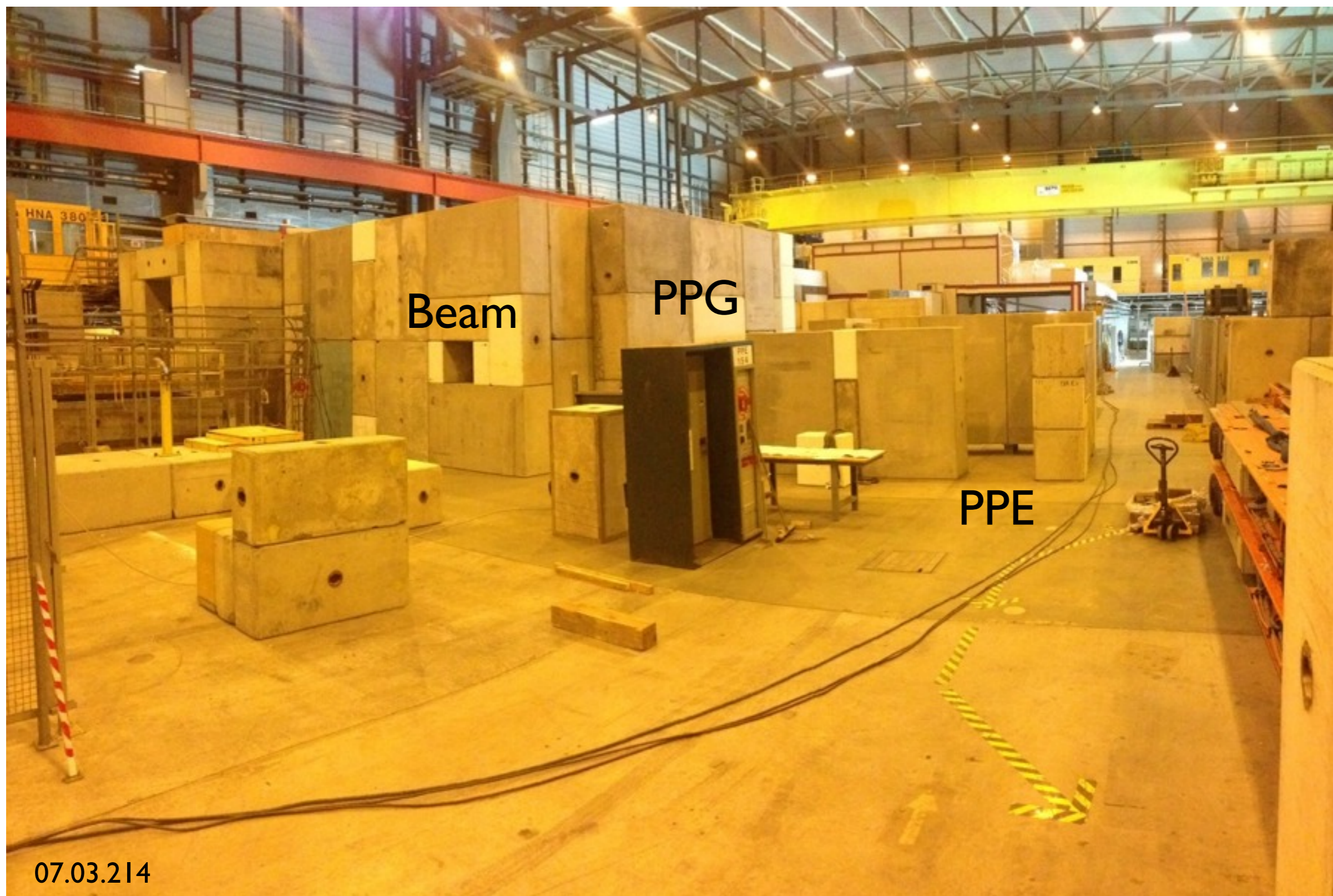
8 RADMON sensors

Cosmic tracker



SEE DEDICATED TALK

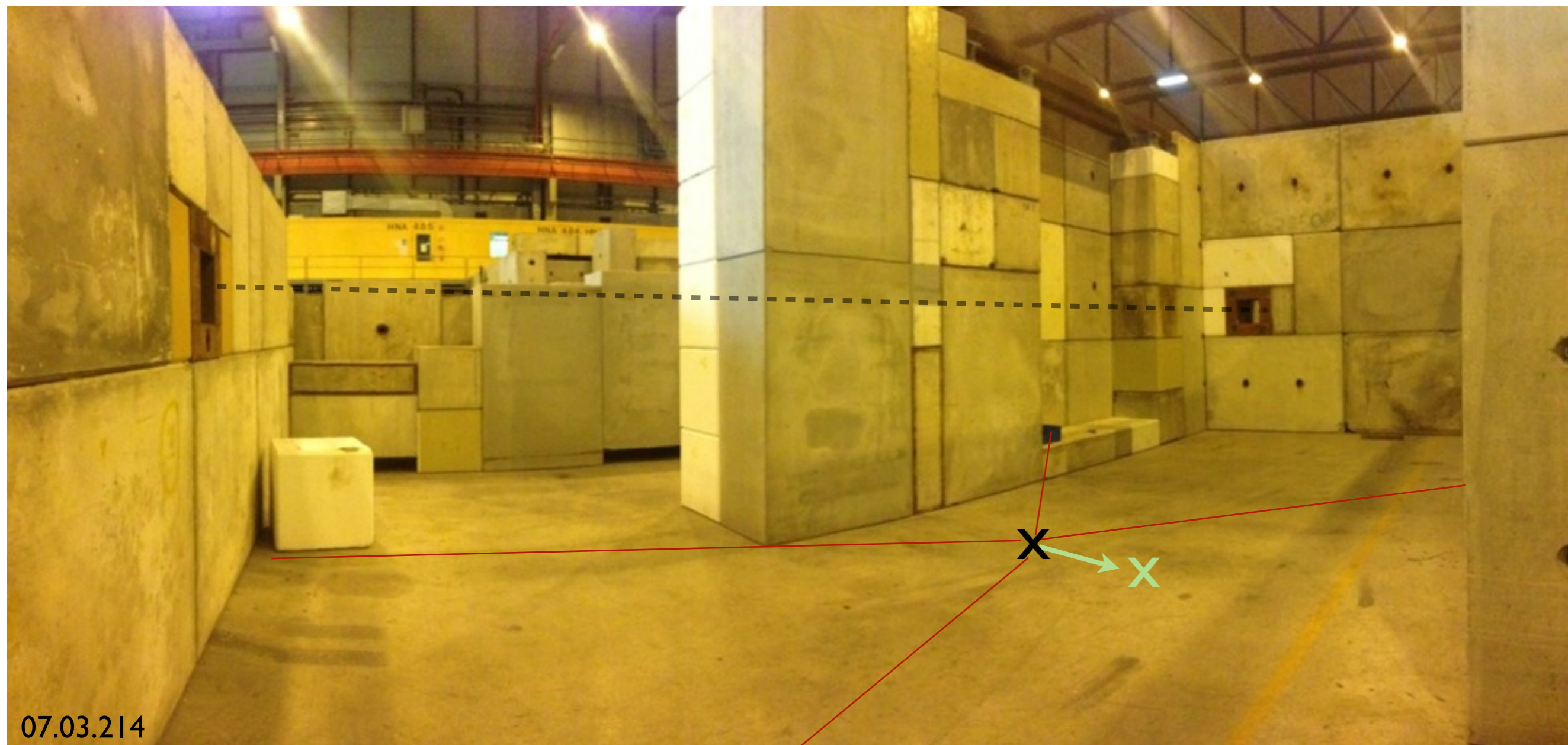
Status of Construction



07.03.214

By last friday, the concrete structure of bunker was practically finished.

Status of Construction Irradiation Fields



Next : gas pipes, cable trays, cables, false floor, painting....

Control room HNA486/487



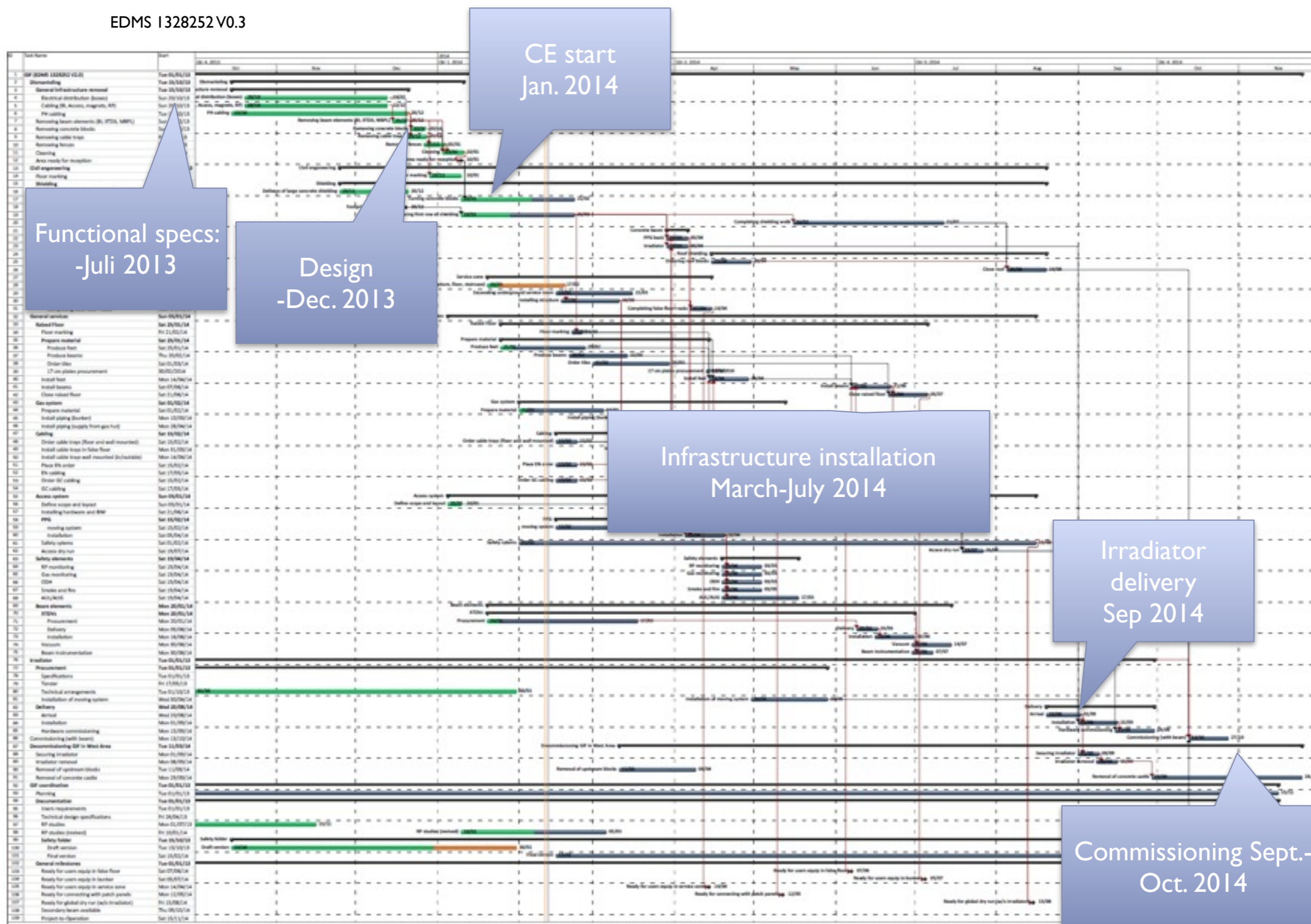
Cleanup has started



Next : painting, electricity check.....

Schedule (EN)






EDMS I328252 V0.3



29. Oct.- 12 Nov. 2014 : beam time CMS/ECAL

1-2. December 2014 : dedicated beam

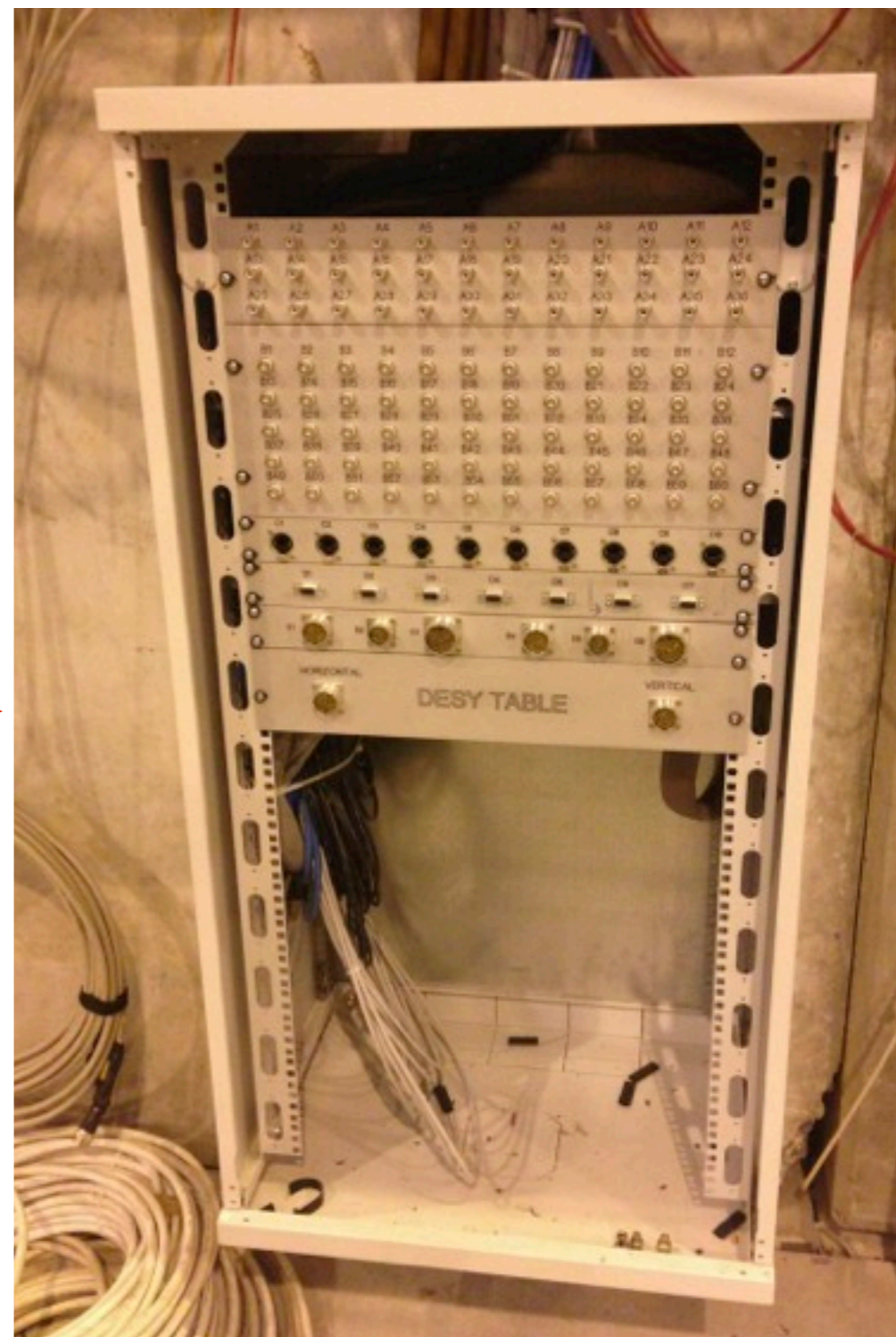
Points of attention....

-  Construction is ongoing and progressing well
-  Last chance to provide feedback on infrastructure (patch panel cables, rack space, max. cable length...)
-  Some needs are mentioned, but never specified (e.g FE cooling, rack monitoring, humidity control...)
-  Next : allocate racks, define cable paths, commissioning plans (including requirements)
-  We are building the facility for the users. Unless they tell us what they really need, we have to guess **as good as we can.**

We need to know your needs !



If we still want to avoid this...



...and have something like this !