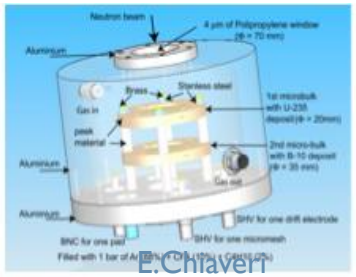
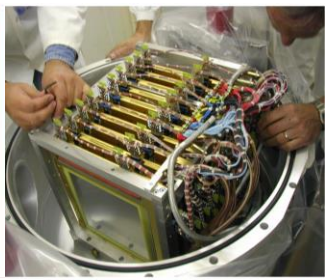
The n_TOF Collaboration,
http://www.cern.ch/nTOF

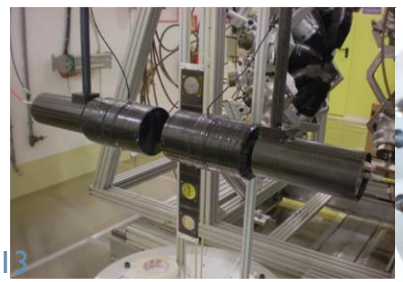
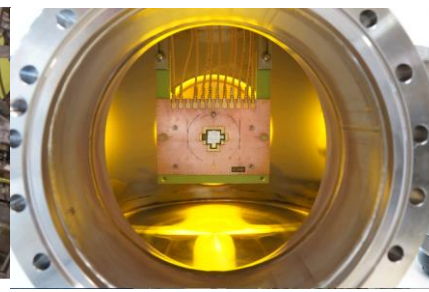
Status of Experimental Area 2(EAR2) Project

Enrico Chiaveri

Spokesperson of n_TOF Collaboration





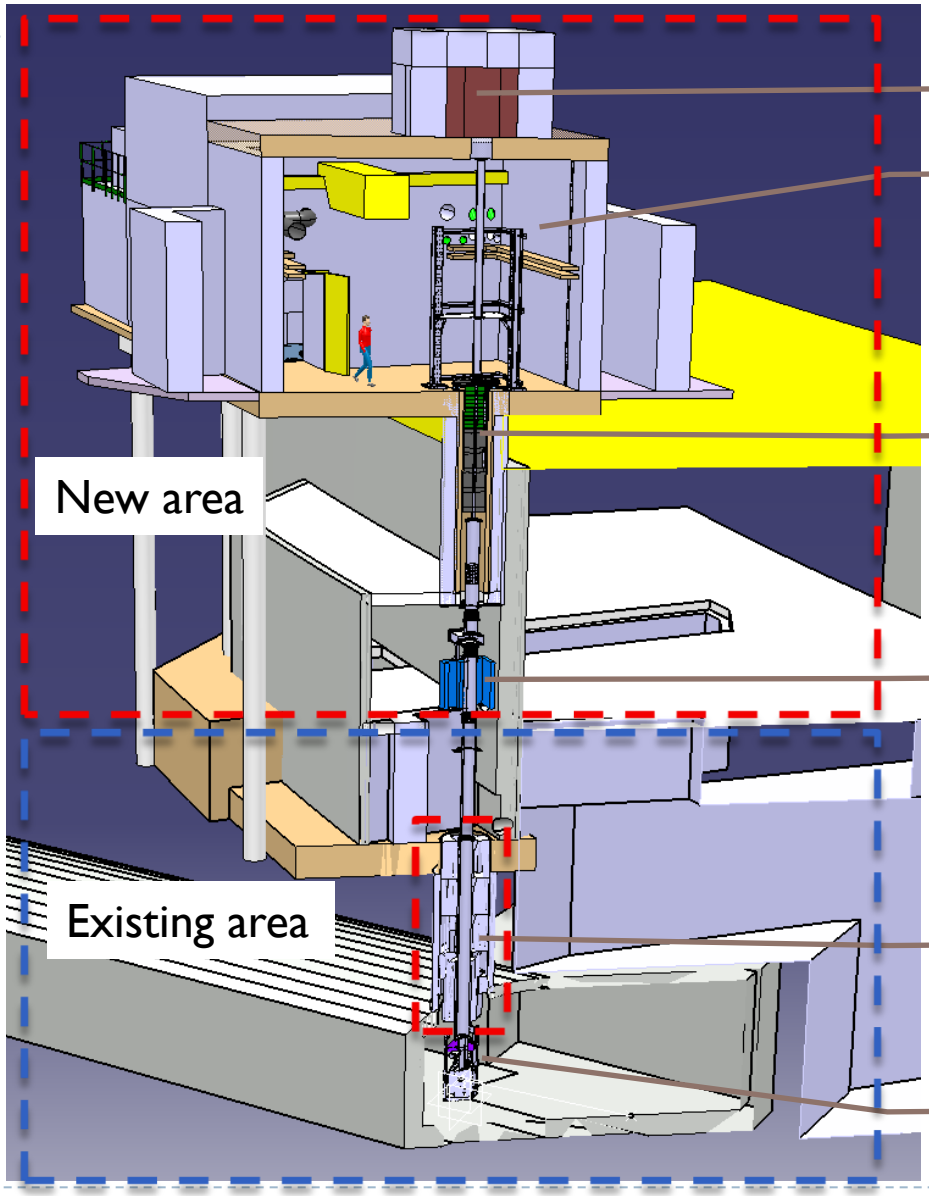



EAR2 design

Start of construction work by May 2013.

Ready in April 2014.

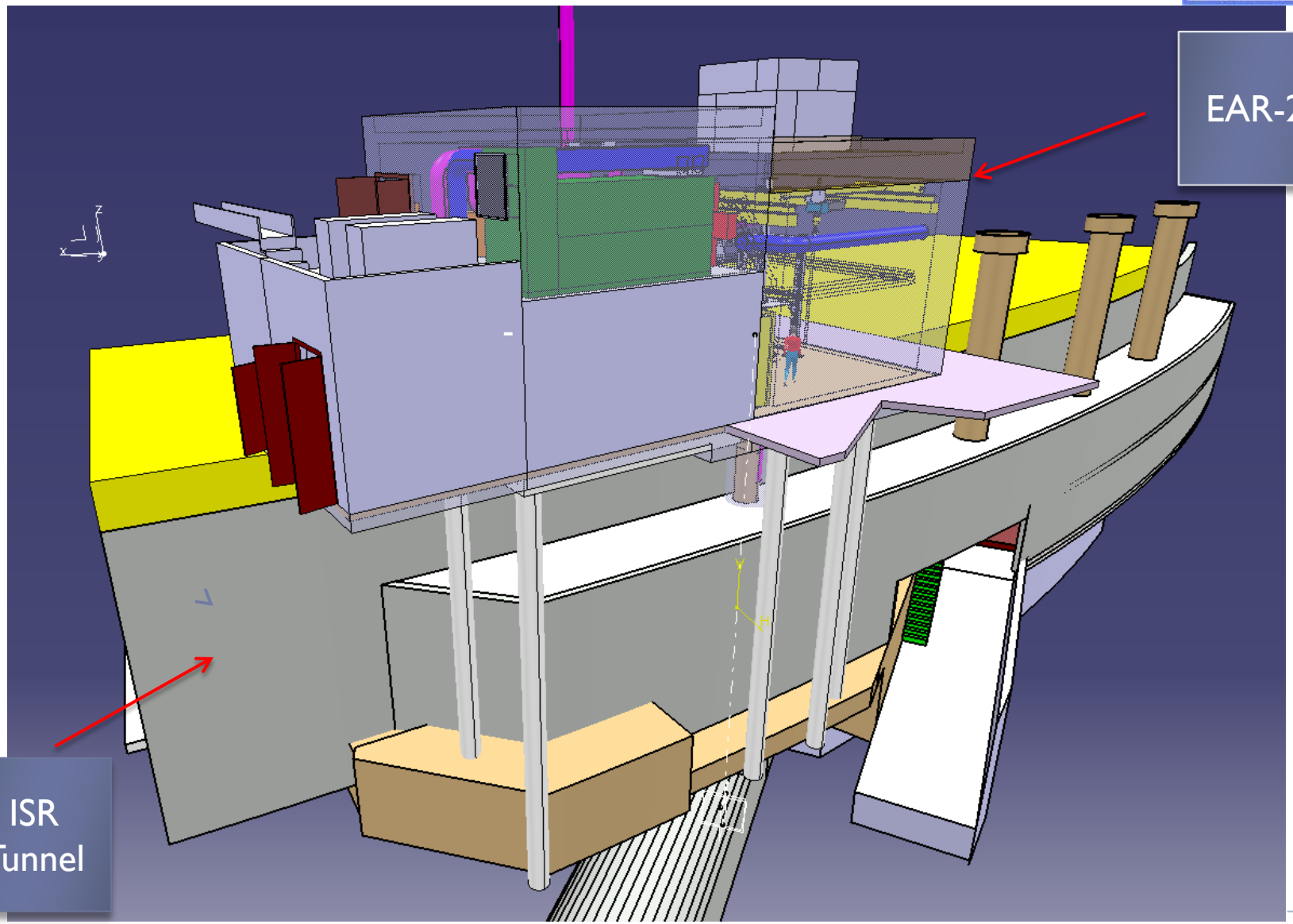
Neutron fluence increase by a factor 18-25 wrt. EAR-1



Experimental Area(EAR 2) Project

- Civil Engineering ✔
- Cooling & Ventilation ✔
- Electrical Infrastructure ✔
- Permanent Magnet ✔
- Simulations work ✔
- Beam Line to EAR2 ✔
- Safety file ✔

Experimental Area 2 design



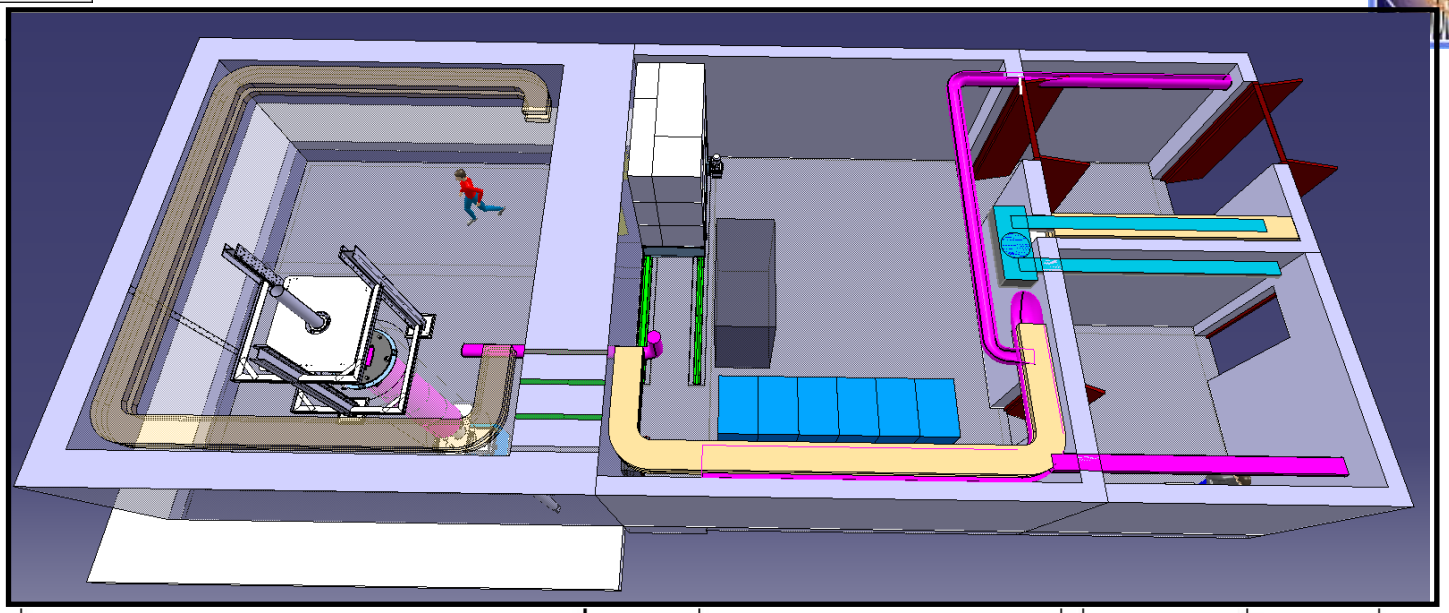
Concreting works

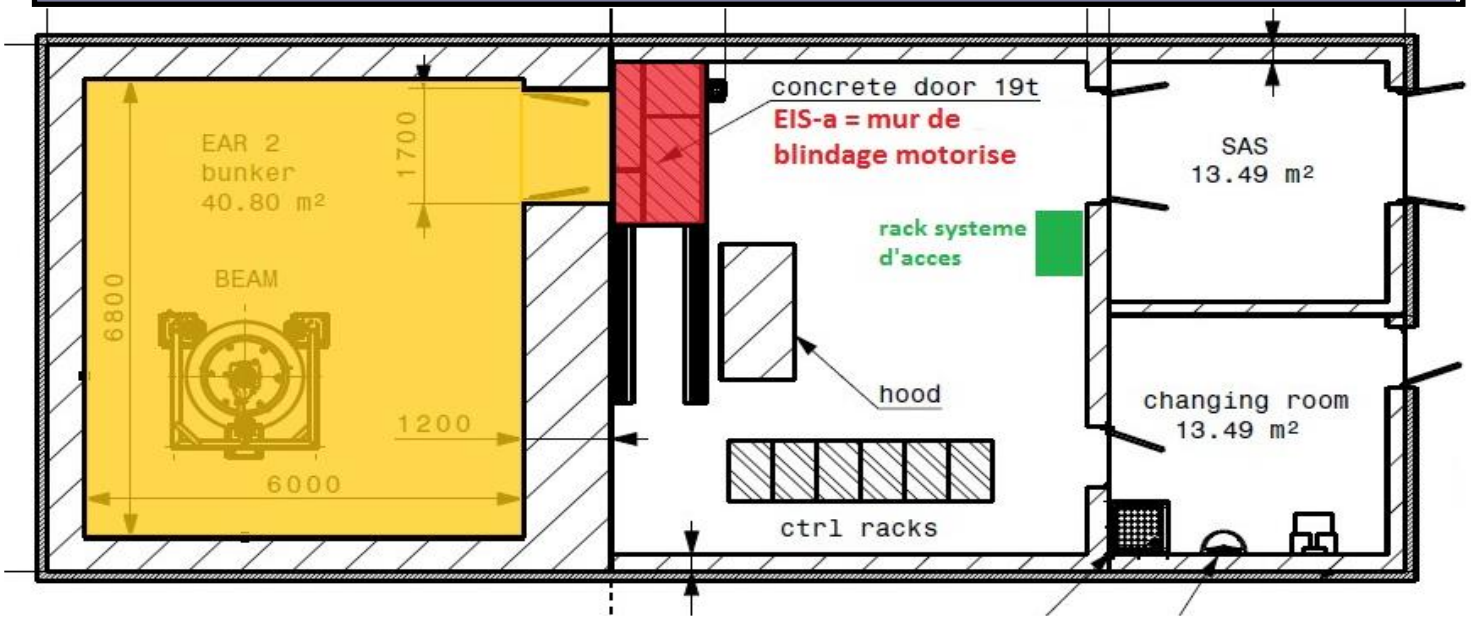
Finishing works : waterproofing and insulation

Next steps

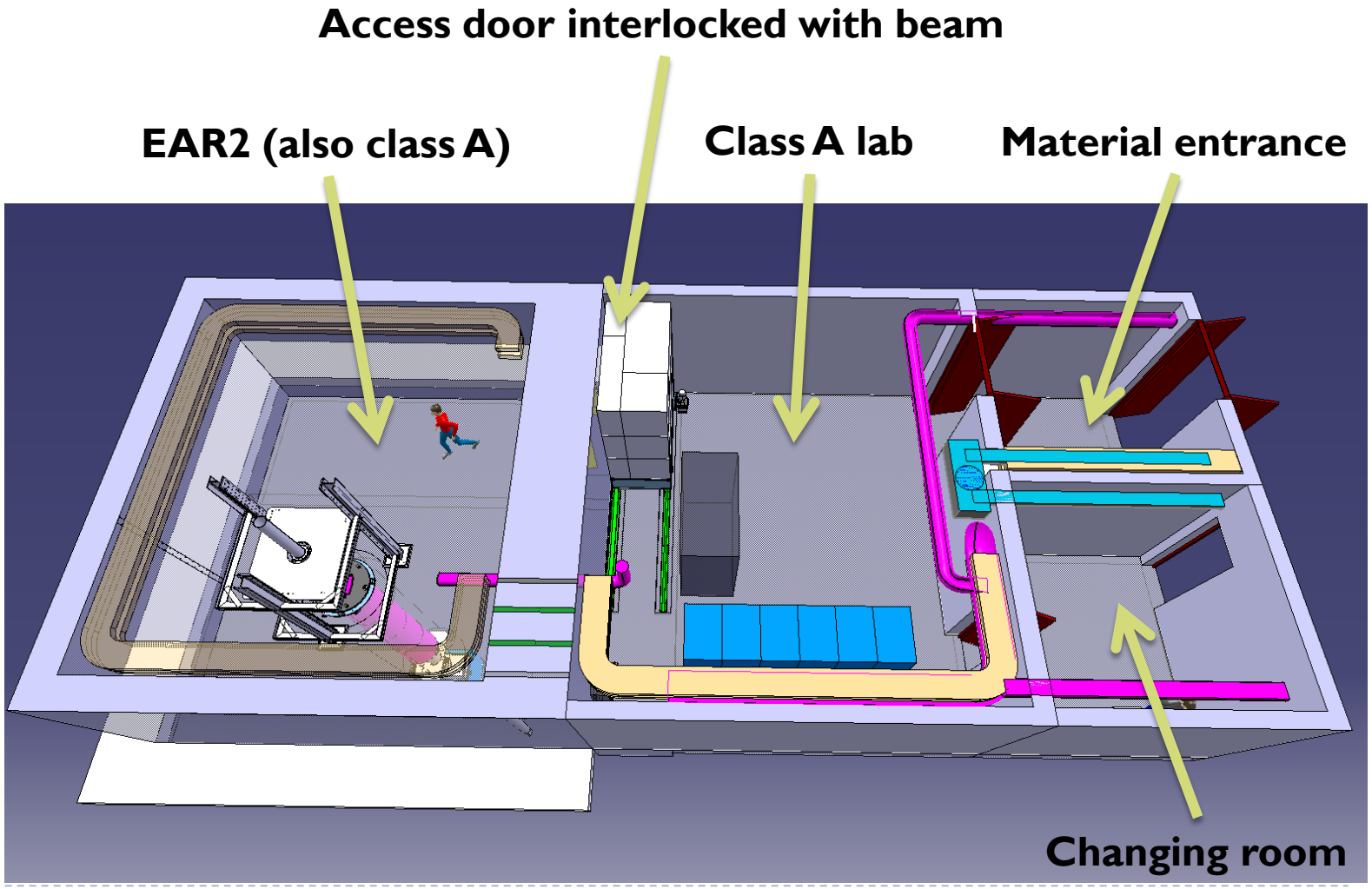
- Completion of finishing works (waterproofing, insulation, doors, « chape », painting) → October-November 2013
- Landscaping → November – December 2013

EAR2 access & configuration

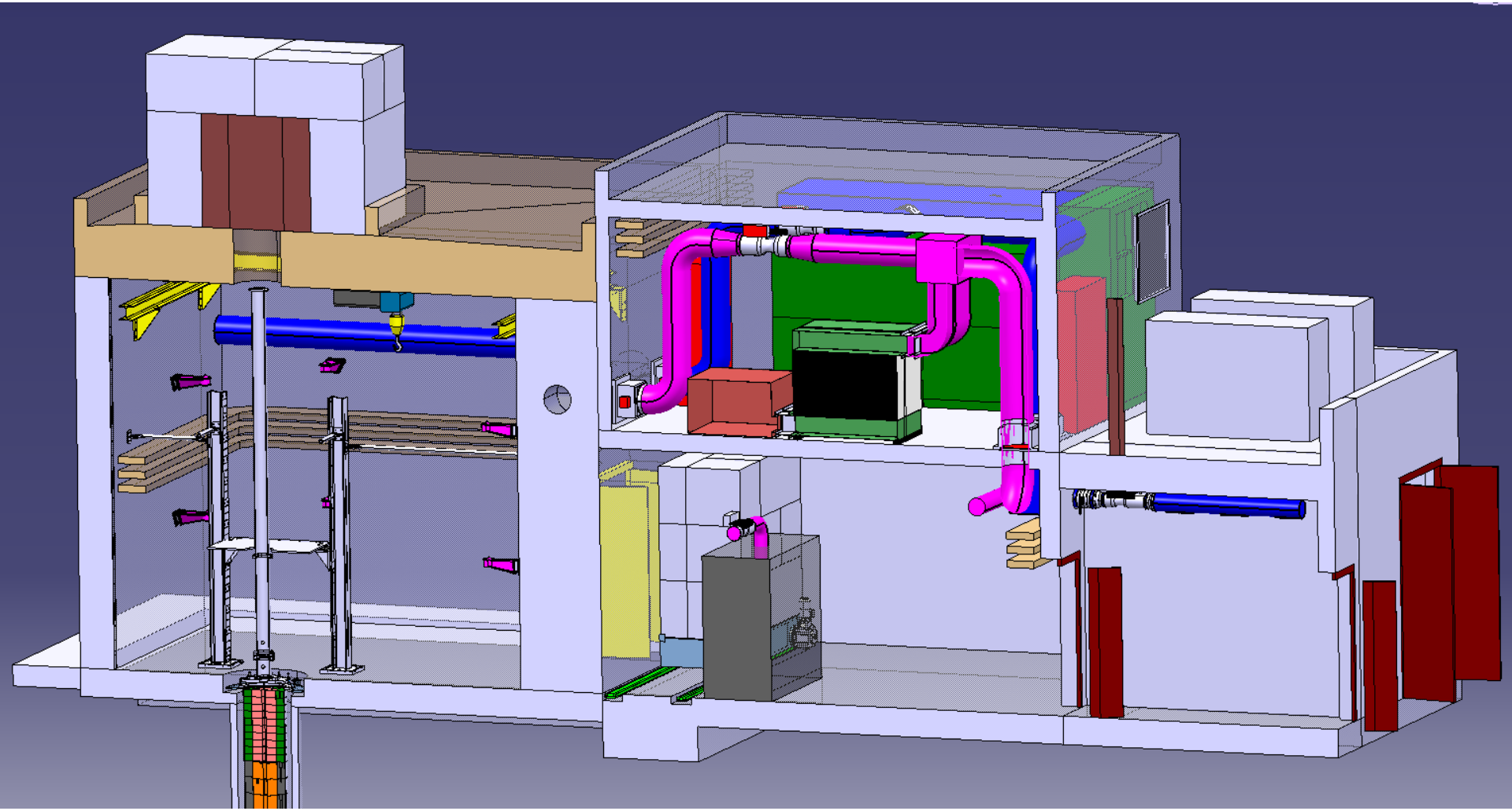




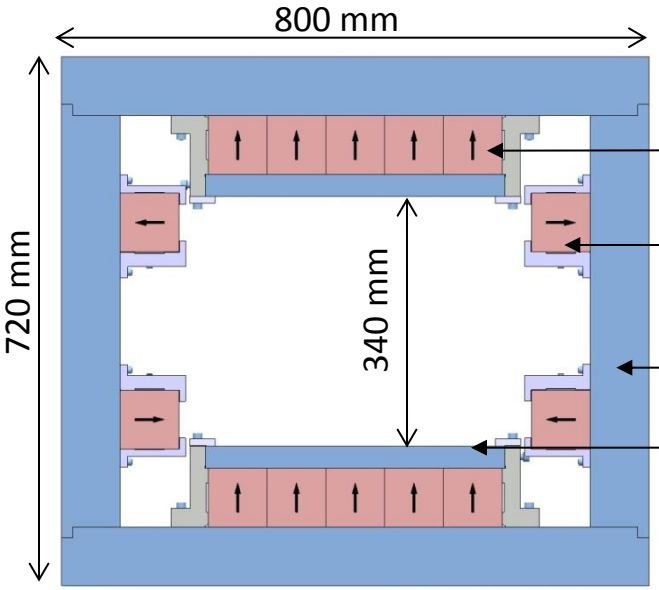
EAR2 access & configuration



EAR2 access & configuration



Permanent magnet dipole n_Tof EAR2



Permanent magnet blocks Sm_2Co_{17}, as a flux generator.

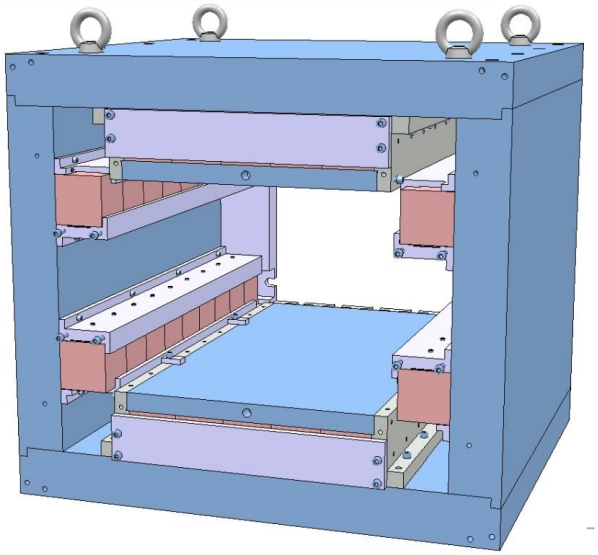
Permanent magnet blocks Sm_2Co_{17}, compensate radial stray field to improve field quality in Good Field Region.

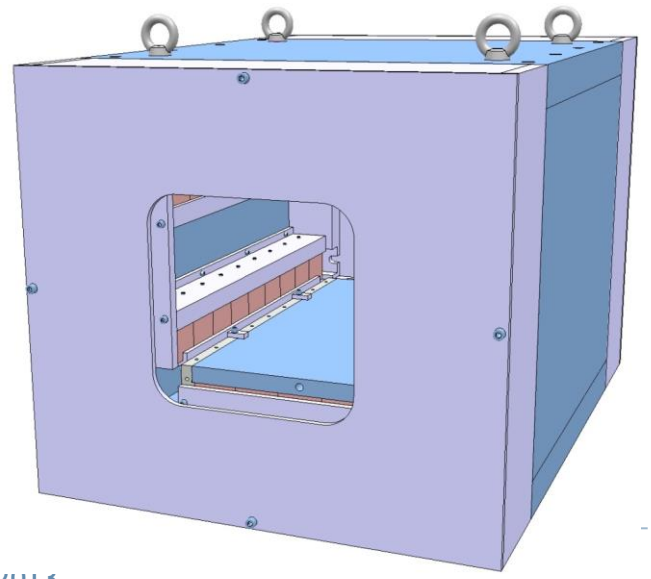
Return yoke C10R steel.

Pole tip C10R steel, smooth the possible differences on the easy axis orientation of the permanent magnet blocks.

Magnet weight ≈ 2000 kg

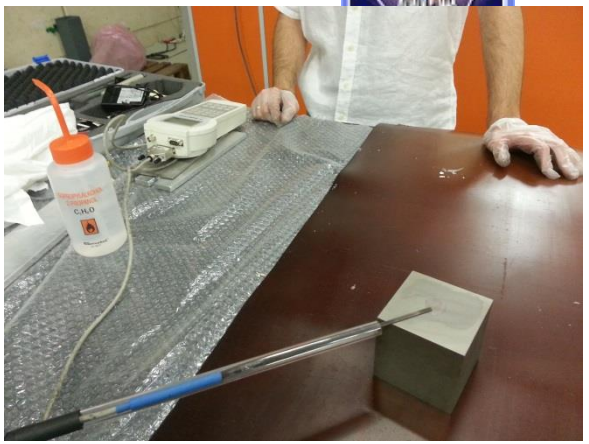
Picturea



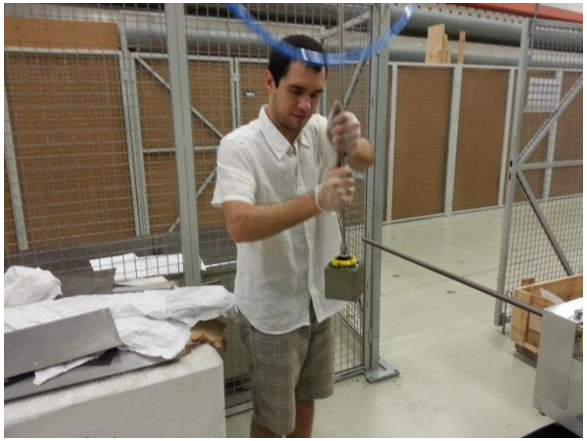


Assembly tests done at CERN

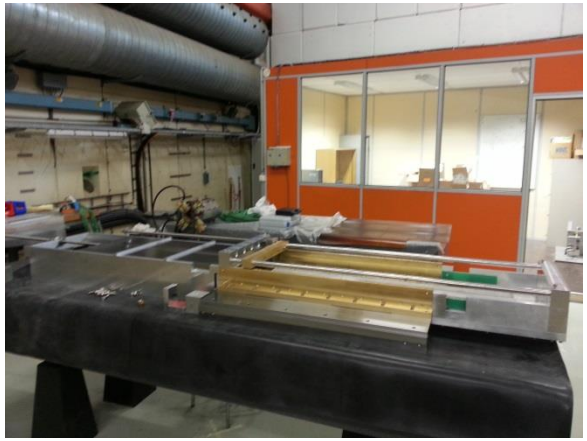
Pictured: Separation of permanent magnet blocks

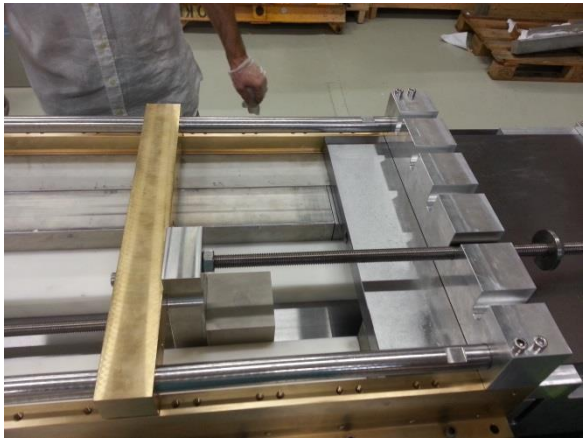


Pictured: Polarity check



Pictured: Permanent magnet block manipulation with suction cup





Pictured: insertion of the permanent magnet block in the magnet yoke

Work progress and future milestones

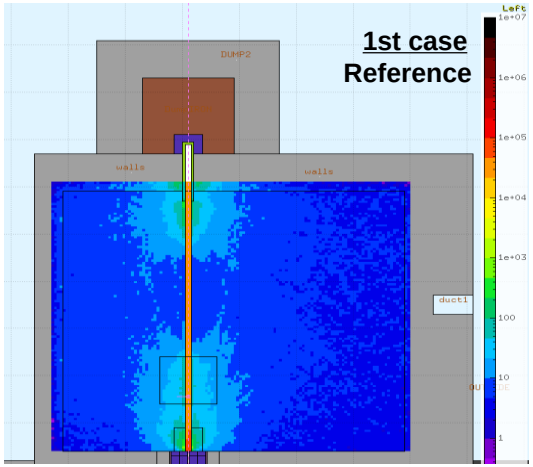
- A quarter of the dipole yoke as well as 50 permanent magnet blocks were ordered in order to validate the assembly procedure.
- The assembly procedure was validated in July.
- The rest of the dipole components was ordered in July.
- All permanent magnets ordered to China Rare Earth Magnets (China) were already delivered at CERN.
- The magnet yoke ordered and is going to be delivered at CERN end of October.
- The assembly of the magnet will start beginning of November at CERN (expected time 2 weeks).
- Magnet measured and ready for installation by end of 2013.

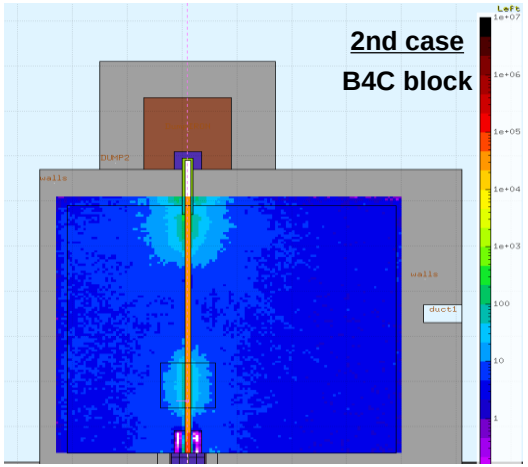
EAR2 Challenges

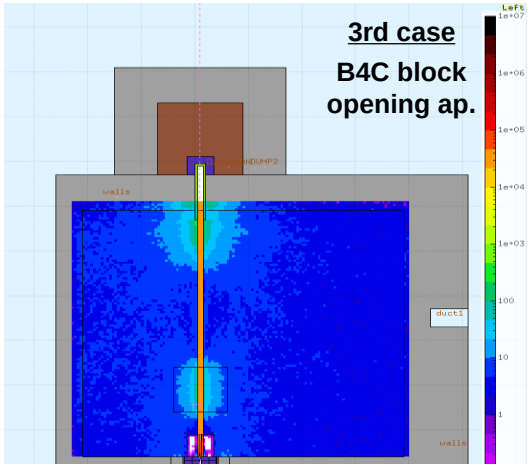
- Vertical neutron time of flight (unique in world) is “a lot” more complicated than horizontal
- Everything has to be carefully planned ahead
  - Vertical collimators
  - Vertical magnet (with huge aperture)
  - Vertical supports in the experimental area
  - Alignment subject to ground movements
  - Safety (objects falling)
  - …
- After installation the intervention possibilities are minimal

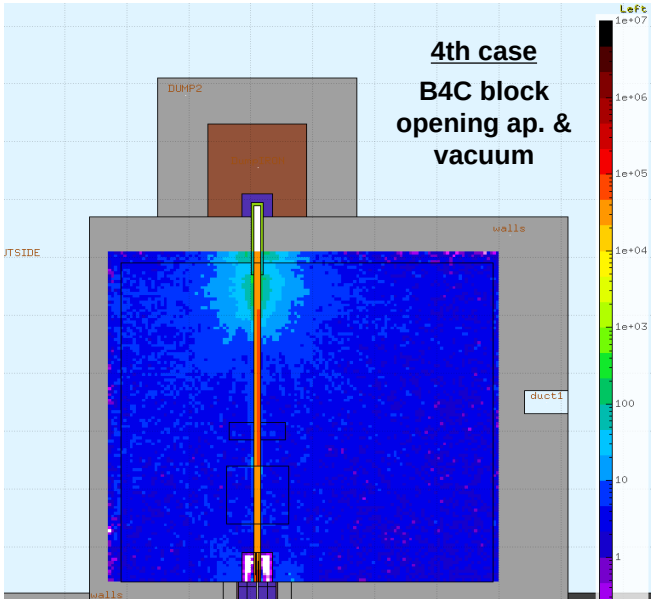
SIMULATION WORK

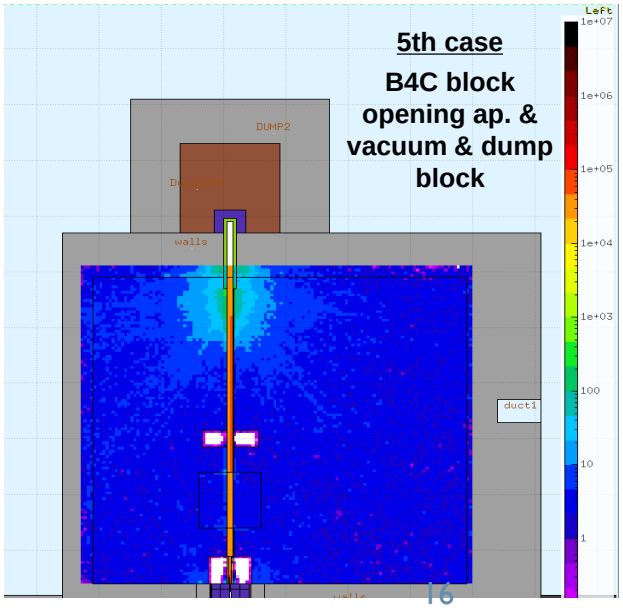
- Comparison of the several configurations







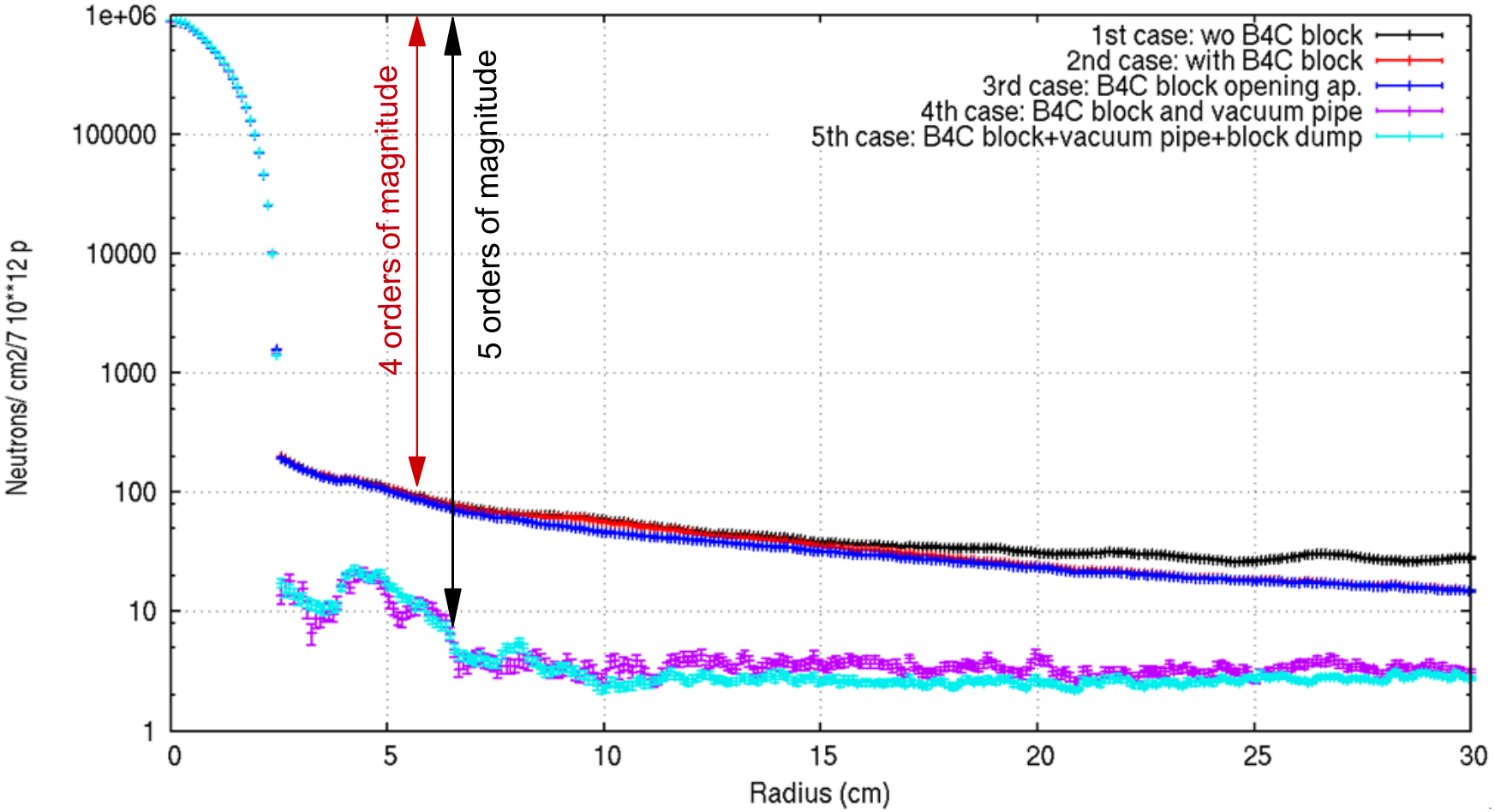




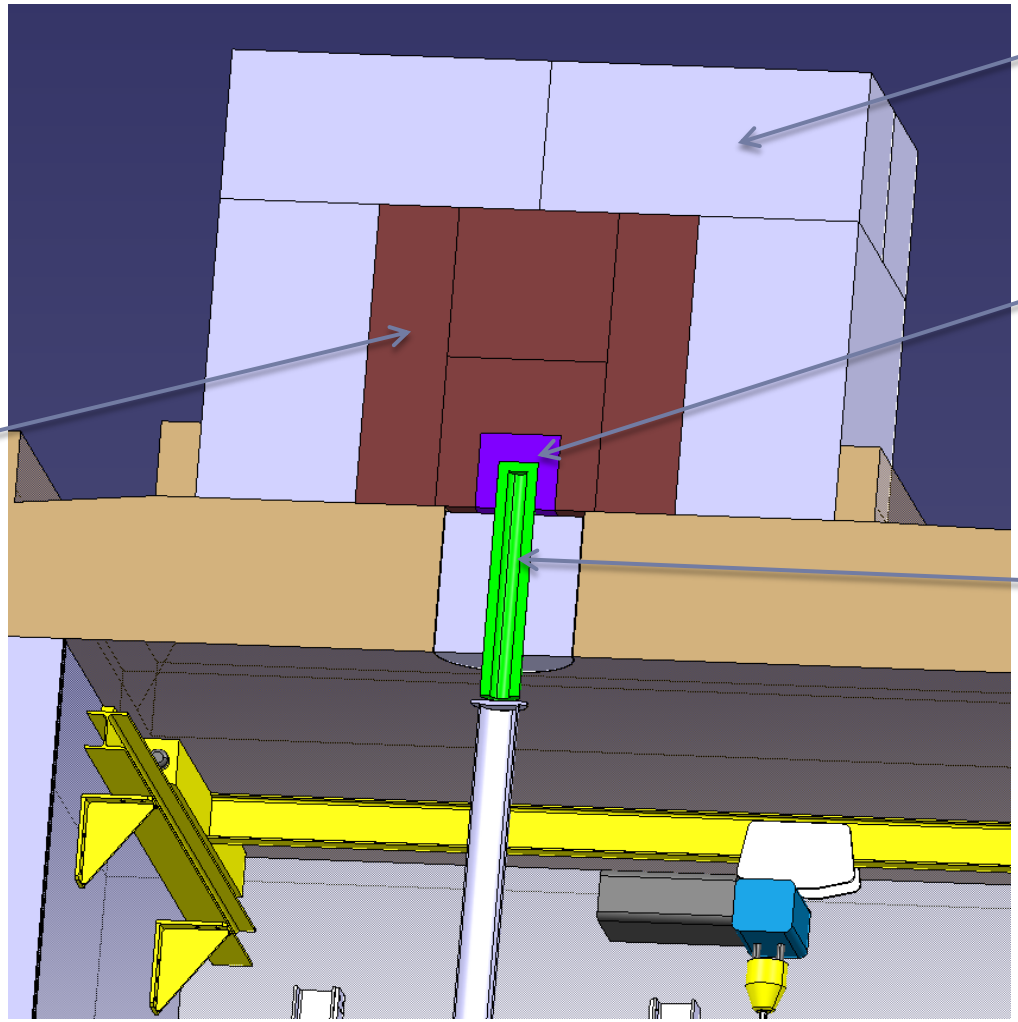
SIMULATION WORK

- Comparison of the several configurations

Relative neutron fluence (200 eV – 20 keV)



Optimized beam dump for capture measurements



SIMULATION WORK

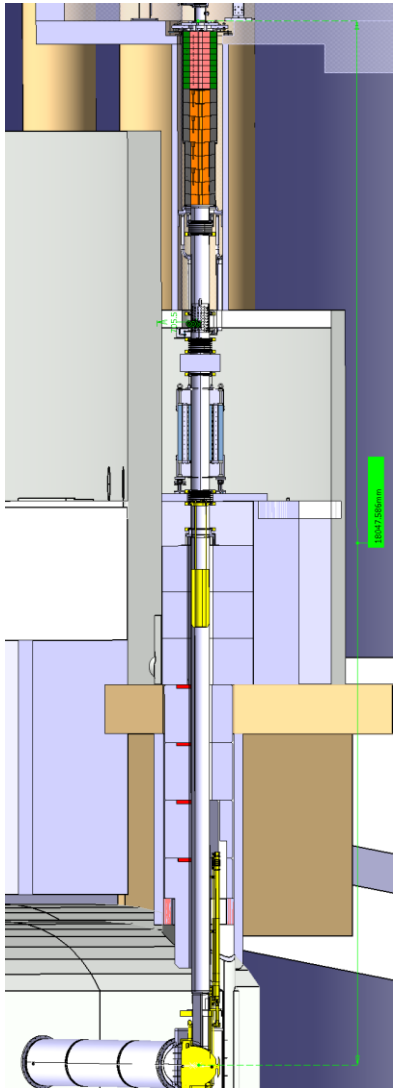
- Introducing B4C block reduces the background at the detector location
- background **4 orders of magnitude lower than neutron fluence**

- Beam Line under Vacuum
  - background **5 orders of magnitude lower than neutron fluence**

Next steps:

- Optimize upper B_4C block to reduce background coming from Beam DUMP
- Full simulation for the Fission setup (w/o the 1st collimator)
- Full simulation of the C6D6 response
- Background comparison with full simulation of EAR1 (with C6D6, old and new window configuration)

Beam Line to EAR2



General Activities:

- Integration of monitoring systems (SiMon, PPAC, MGAS)
- Planning of beam line installation

Design Activities:

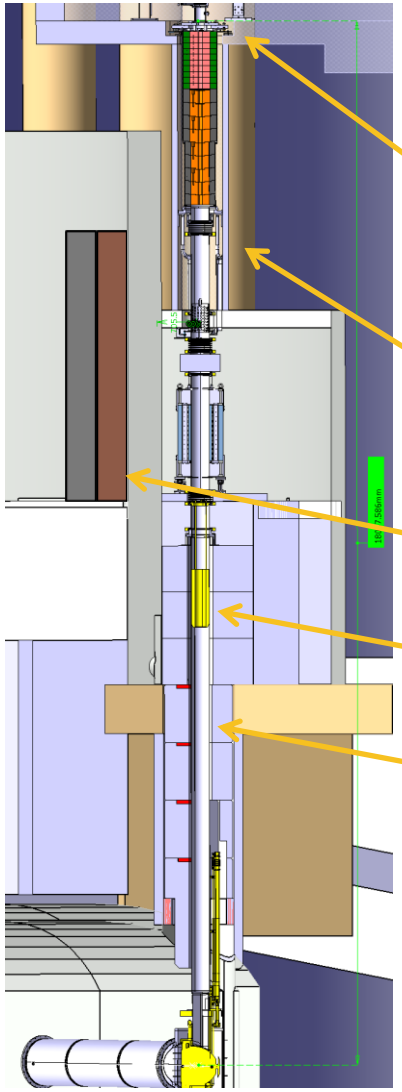
To be finished by Dec. 2013:

- 1st collimator (beam shaping + shielding)
- 2nd collimator (optimize signal to background ratio)
- Beam dump (optimize for background to experiment)
- Filter Box – replica of existing filter box of EAR1
  (next step: technical drawings)
- Support structure and alignment system in EAR2

In production:

- ✓ Magnet (assembly at CERN)
- ✓ First vacuum chamber (8.9 m long)
- ✓ All flanges for the beam line

Beam Line to EAR2



- Shielding configuration for the new beam line, taking into account the needed flexibility for a possible upgrade during LS2 (new spallation target):

  → Additional shielding layer at the floor of EAR2 for background reduction

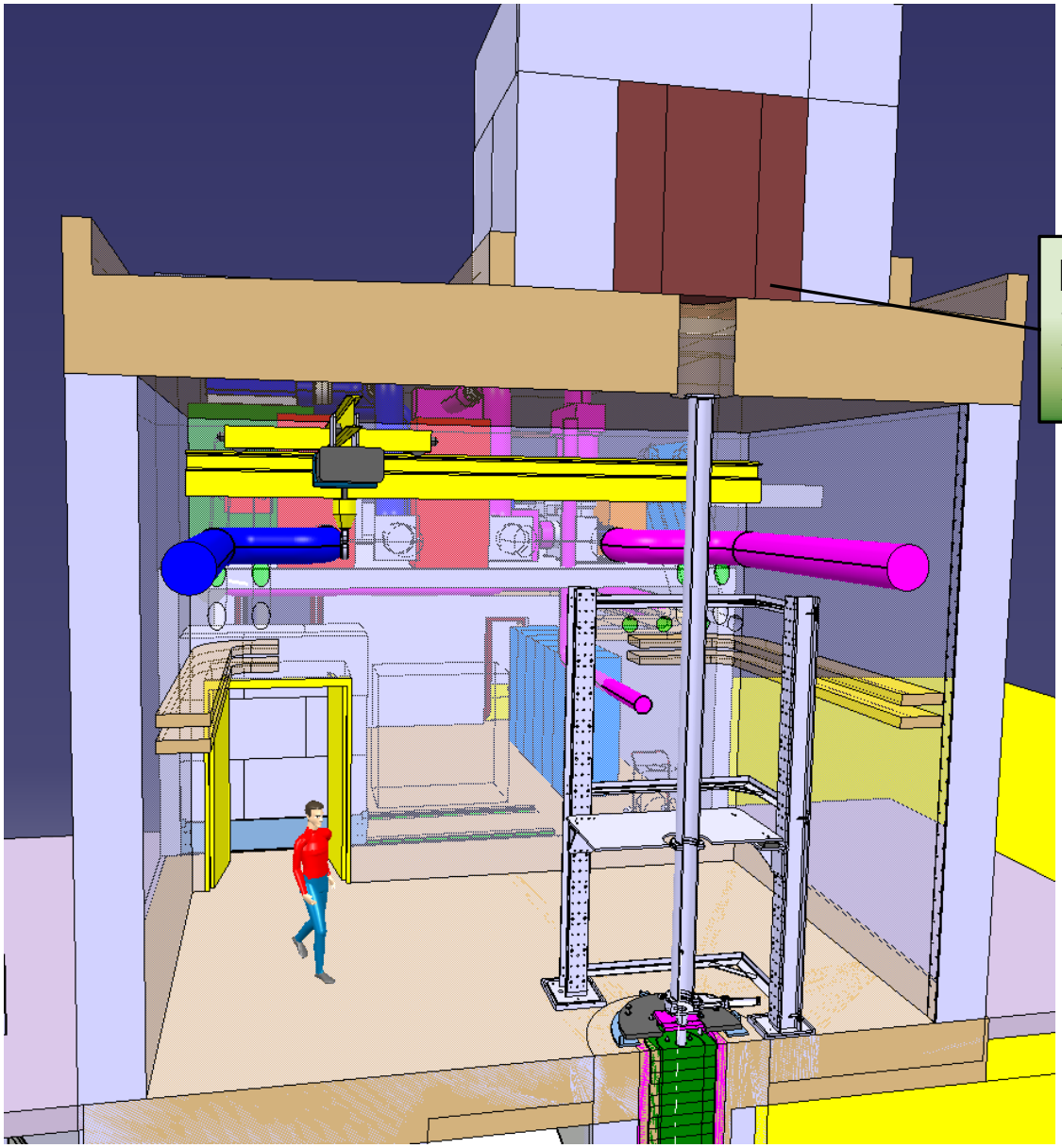
  → Steel balls above service gallery

  → Fe + Concrete wall in ISR tunnel

  → Fe collar at the level of 1st collimator

  → Concrete around beam pipe up to service gallery

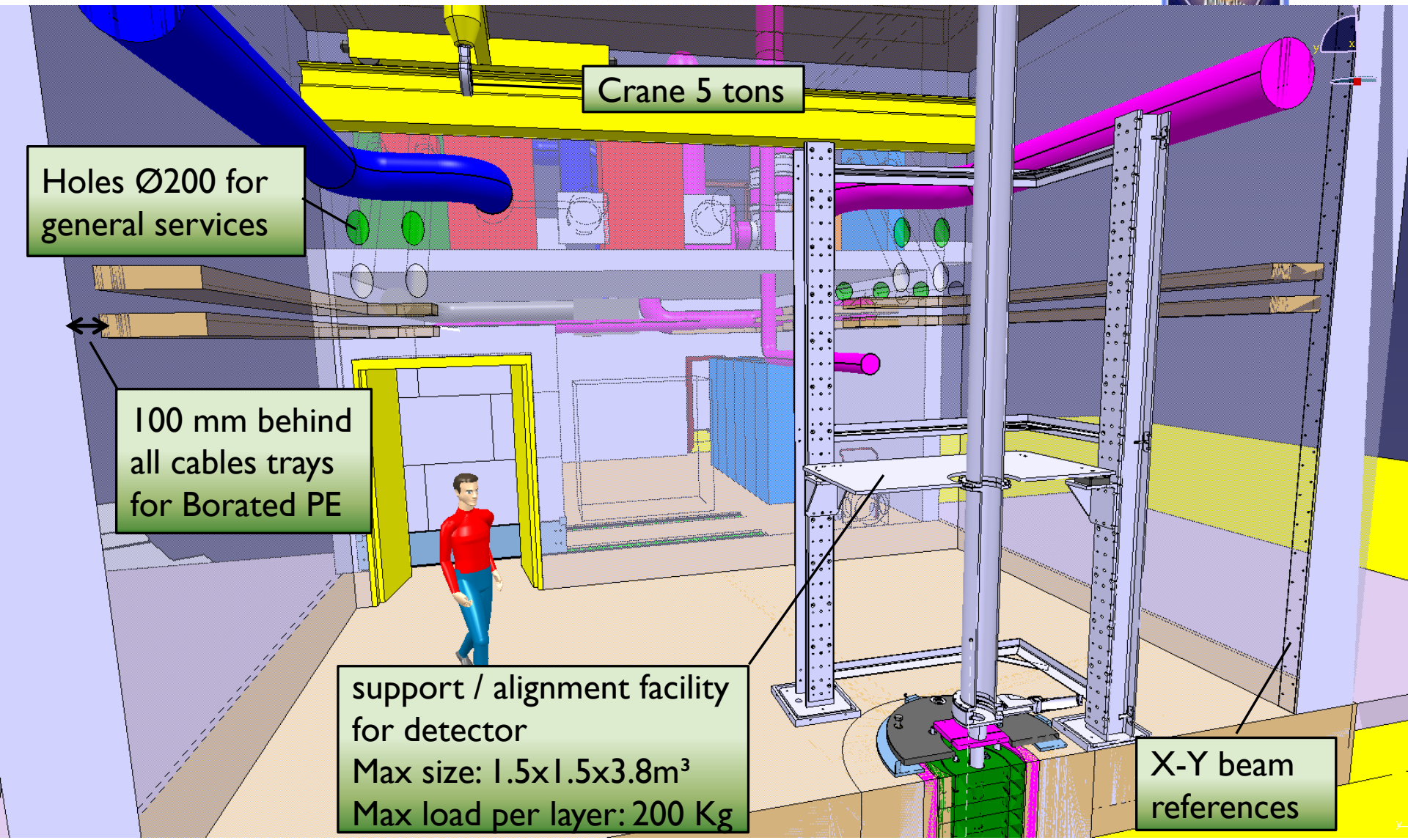
- FLUKA simulations on-going in parallel, concerning:
  1. Background reduction in EAR2 (measurements)
  2. Dose reduction in ISR tunnel (permanent work place)



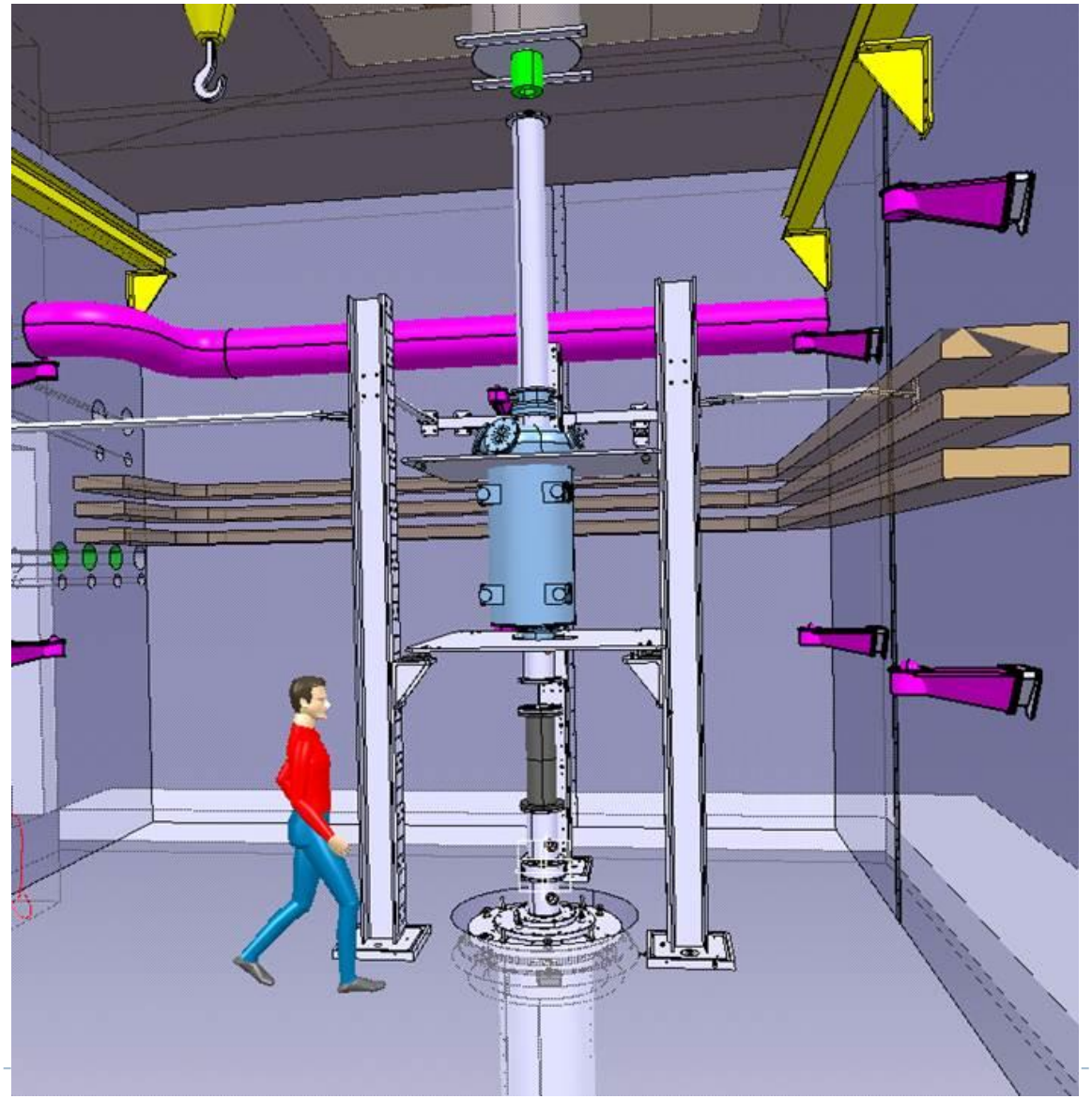
Dump:

- 1.6x1.6x1.6 m³ steel
- 0.8 concrete all around

EAR2 bunker


Crane 5 tons
Holes Ø200 for general services
100 mm behind all cables trays for Borated PE
support / alignment facility for detector
Max size: 1.5x1.5x3.8m³
Max load per layer: 200 Kg
X-Y beam references

Sketch of possible installation of Detectors



Status of safety file

The edition process of the Safety File is on-going :

- Continue the interview process to improve the Descriptive Part: need more elements related to the final design,

  Dead line to complete 80% of the descriptive part: 13.12.13

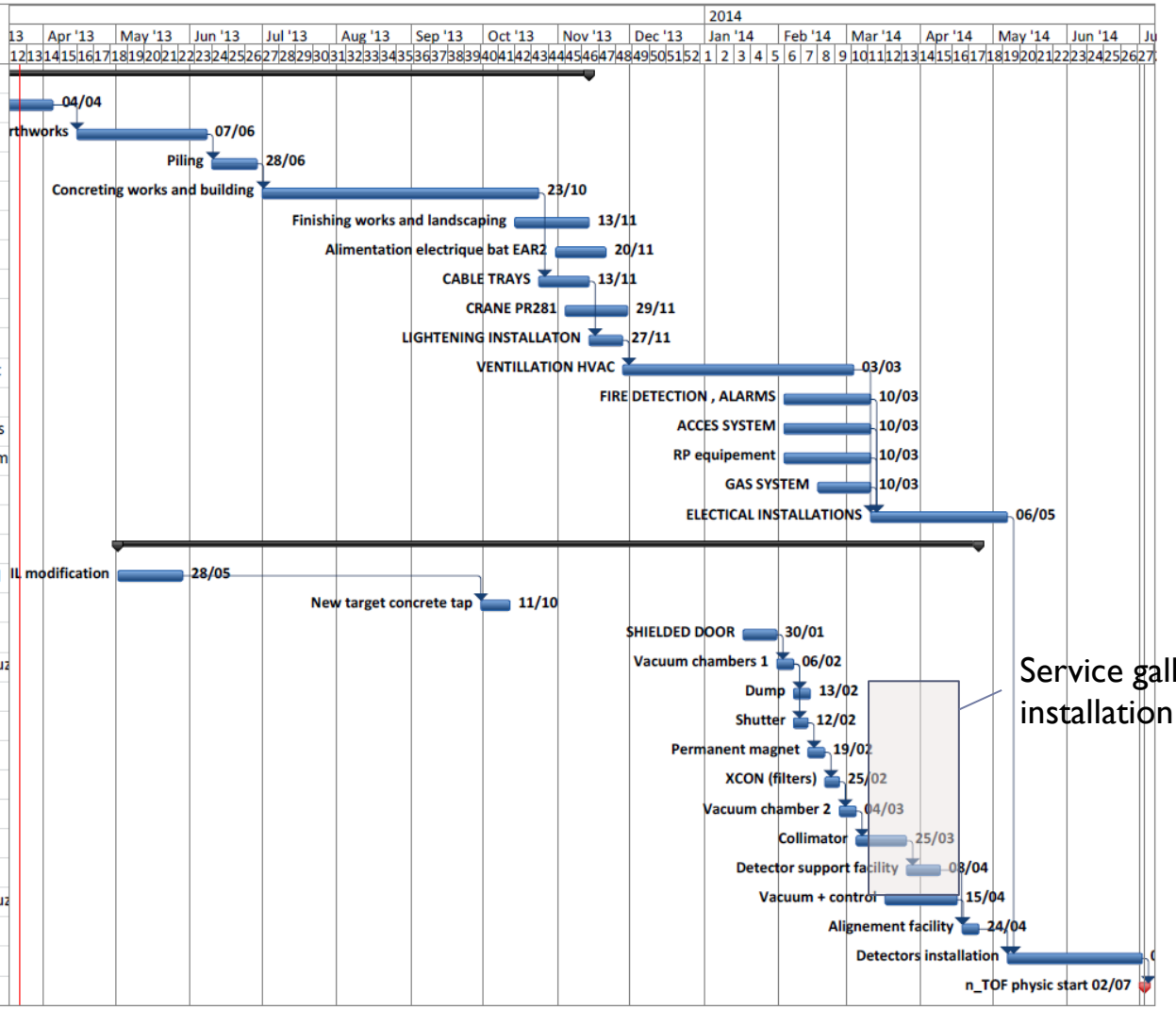
- Use the Descriptive Part and interviews to initiate Hazard Inventory (within end of January 2014)
- Get operational elements for the 3rd part of the Safety File: how do we operate the exp. area, how do we maintain the infrastructures, foreseeable issues…

  Procedures shall be defined for the safe operation of the beam line

- Initiate R.E.M Part in link with the existing infrastructures.

General Planning EAR-2

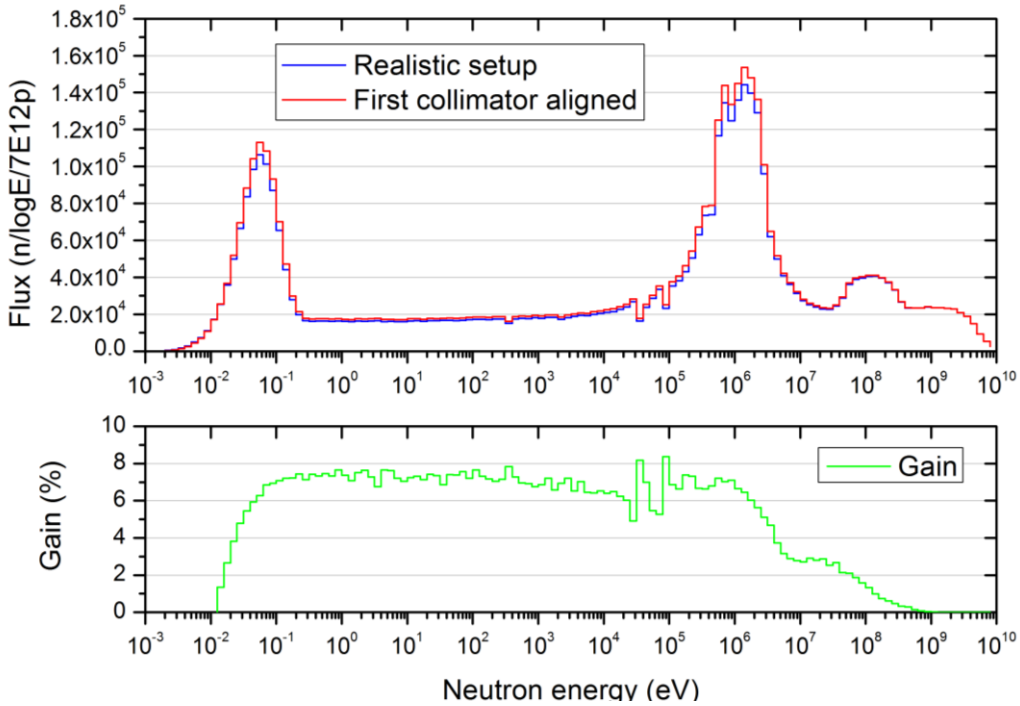
ID	Task Name	Dep-Grou	In charge
1	**CIVIL ENGINEERING**	**GS-SE**	**N. Lopez**
2	Abesto removel build 559		
3	Demolition and earthworks		
4	Piling		
5	Concreting works and building		
6	Finishing works and landscaping		
7	**Alimentation electrique bat EAR2**	EN-EL	J. Gomez
8	**CABLE TRAYS**		
9	**CRANE PR281**	EN-MEF	C. Bertone
10	**LIGHTENING INSTALLATON**	EN-EL	J. Pierlot
11	**VENTILLATION HVAC**	EN-EL	M. Obrecht
12	**FIRE DETECTION , ALARMS**	EN-CV	D. Raffour
13	**ACCES SYSTEM**	GS-ASE	D. Chappuis
14	**RP equipement**	GS-ASE	E. Berthoum
15	**GAS SYSTEM**	PH-UNT	F. Fayet
16	**ELECTICAL INSTALLATIONS**	EN-EL	J. Gomez
17	**BEAM LINE INSTALLATION**	EN-MEF	S. Girod
18	MONORAIL modification	EN-MEF	J-L Grenard
19	New target concrete tap	EN-HE	S. Girod
20	SHIELDED DOOR	EN-MEF	S. Girod
21	Vacuum chambers 1	TE-VSC	T. Mongelluz
22	Dump	EN-MEF	S. Girod
23	Shutter	EN-MEF	S. Girod
24	Permanent magnet	TE-MSC	A. Thonet
25	XCON (filters)	EN-MEF	S. Girod
26	Vacuum chamber 2	EN-MEF	S. Girod
27	Collimator	EN-MEF	S. Girod
28	Detector support facility	EN-MEF	S. Girod
29	Vacuum + control	EN-MEF	T. Mongelluz
30	Alignement facility	BE-ABP	T. Dobers
31	**Detectors installation**	EN-STI	n_TOF
32	n_TOF physic start 02/07	EN-STI	n_TOF



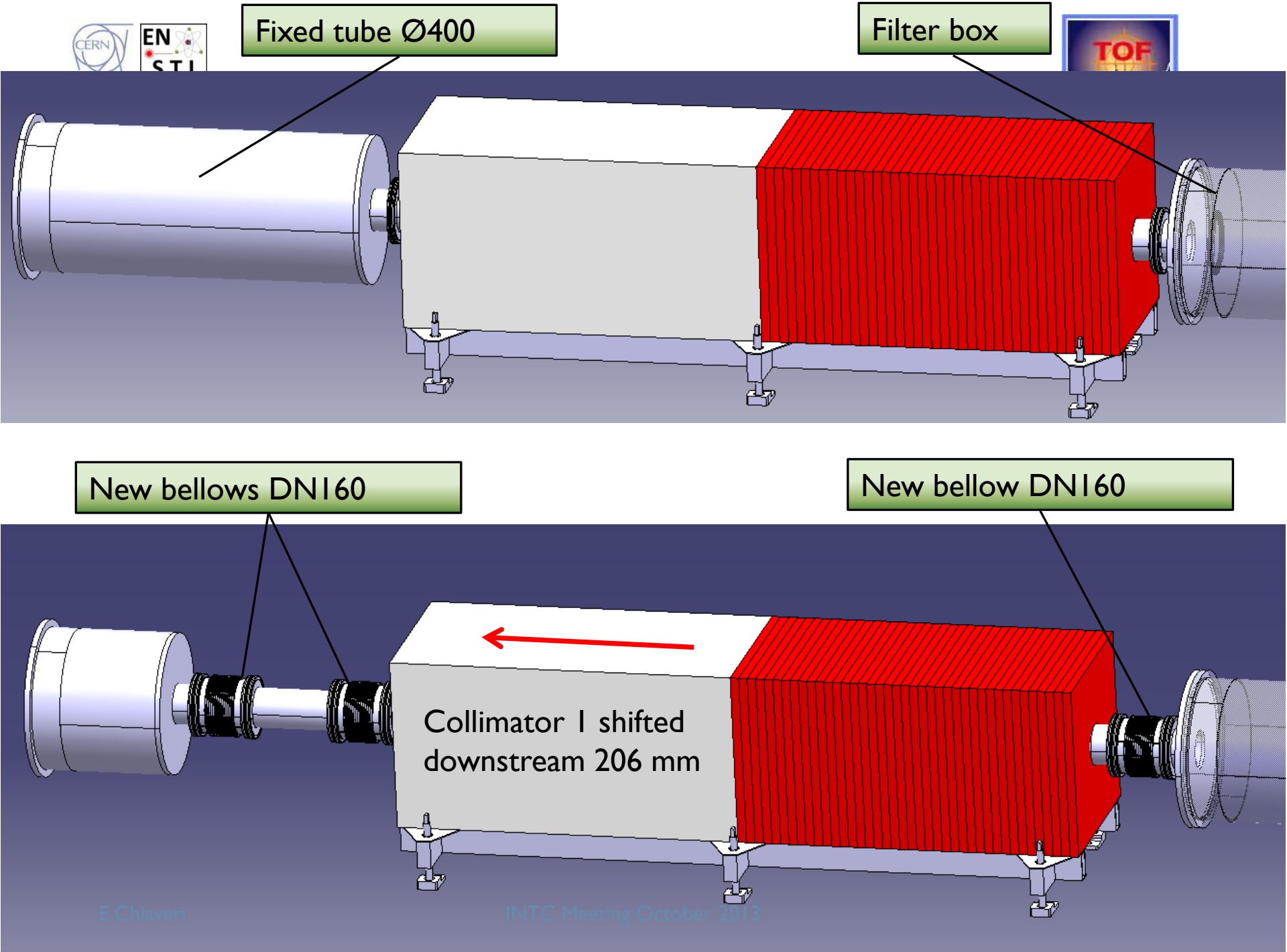
First collimator on Beam Line 1

Courtesy Andrea Tsinganis

- Estimated gain in flux with perfectly aligned collimator: ~ 5-8%

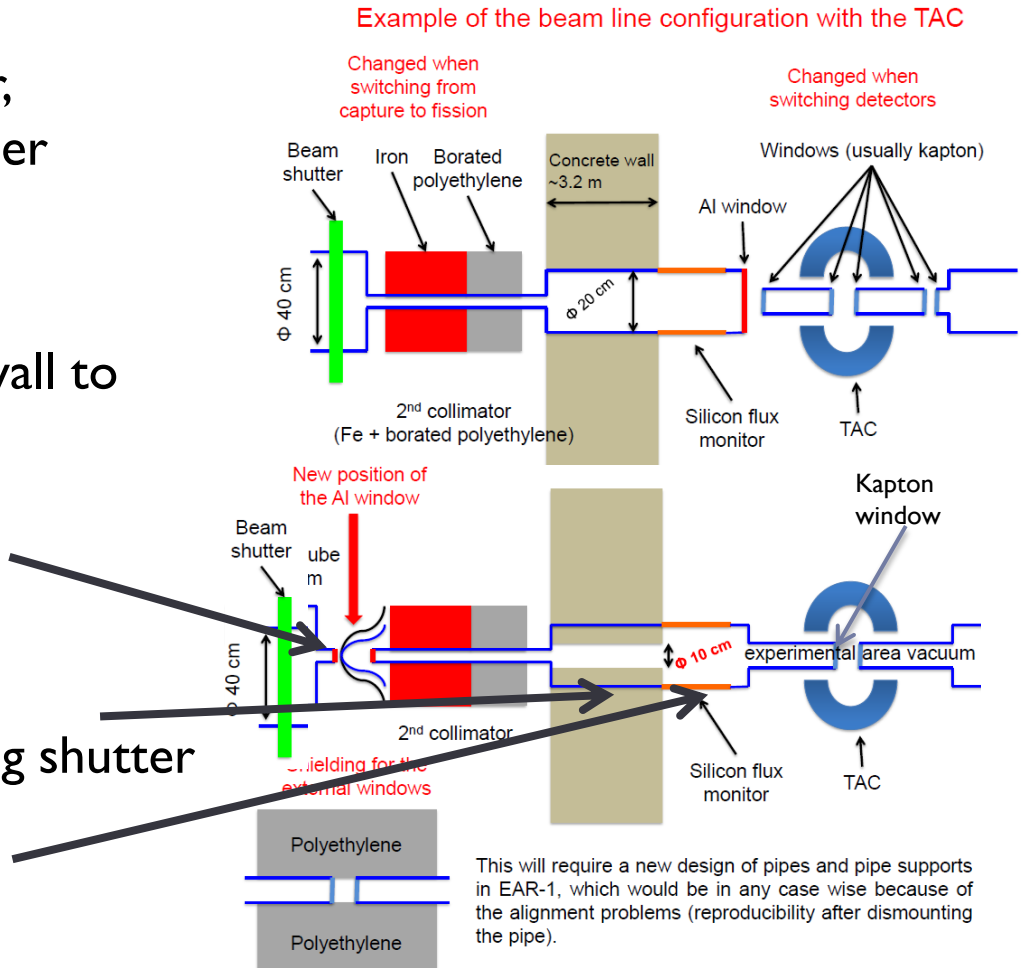


- Actions:
  - Modify the part of the beam pipe just upstream of the first collimator: insert a bellow & improve the alignment of the collimator.


Fixed tube Ø400
Filter box
TOF
New bellows DN160
New bellow DN160
Collimator 1 shifted
downstream 206 mm

Background improvement on EAR1

1. New window, smaller diameter, upstream of collimator 2, thinner (e.g. 0.3 mm,Al)
2. Reduce free passage through wall to ~10 cm
3. Kapton Windows in EAR1
4. No fast valve, keep only existing shutter



Conclusions

- The n_TOF **2nd experimental area EAR2 is under construction according to the planning. Ready for commissioning preparation April 2014**

- **Proposals for EAR1 and commissioning EAR2**
- CERN-INTC-2013-043 / INTC-P-399 Commissioning of n TOF EAR2
- CERN-INTC-2013-027 / INTC-P-387 Radioactive capture on 242Pu for MOX fuel reactors
- CERN-INTC-2013-041 / INTC-P-397 Measurements of neutron induced capture and fission reactions on 233U (EAR1)
- CERN-INTC-2013-021 / INTC-P-381 Neutron capture cross sections of 70,72,73,74,76Ge at n TOF EAR-1

- **Proposals for EAR2 will be presented at INTC February 2014 meeting**
- **Proposal for EAR1 commissioning at INTC February 2014 meeting**