Technical Board Meeting:

News, communications & planning

September 4, 2017

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Caroline Riedl

CERN

Communications

- **Next TB meeting**: November 7, 2017
- **TB meeting in December?**
  (Again dedicated to >2020?)
  Suggestions see ? in calendar.
- **TB meetings 2018:** to be suggested after this collaboration meeting, latest at next TB meeting

NOVEMBER 2017

W#	Monday	Tuesday	Wednesday	Thursday	Friday
44			1 All Saints Day	2	3
45	6	7 TB ECT workshop	8	9	10
46	13	14 AM	15 AM	16 CM	17 CM
47	20	21 PBS workshop	22	23	24
48	27	28	29	30	

- **TB composition:**
  Andrea Ferrero will step down as TB member after this year. Candidates?

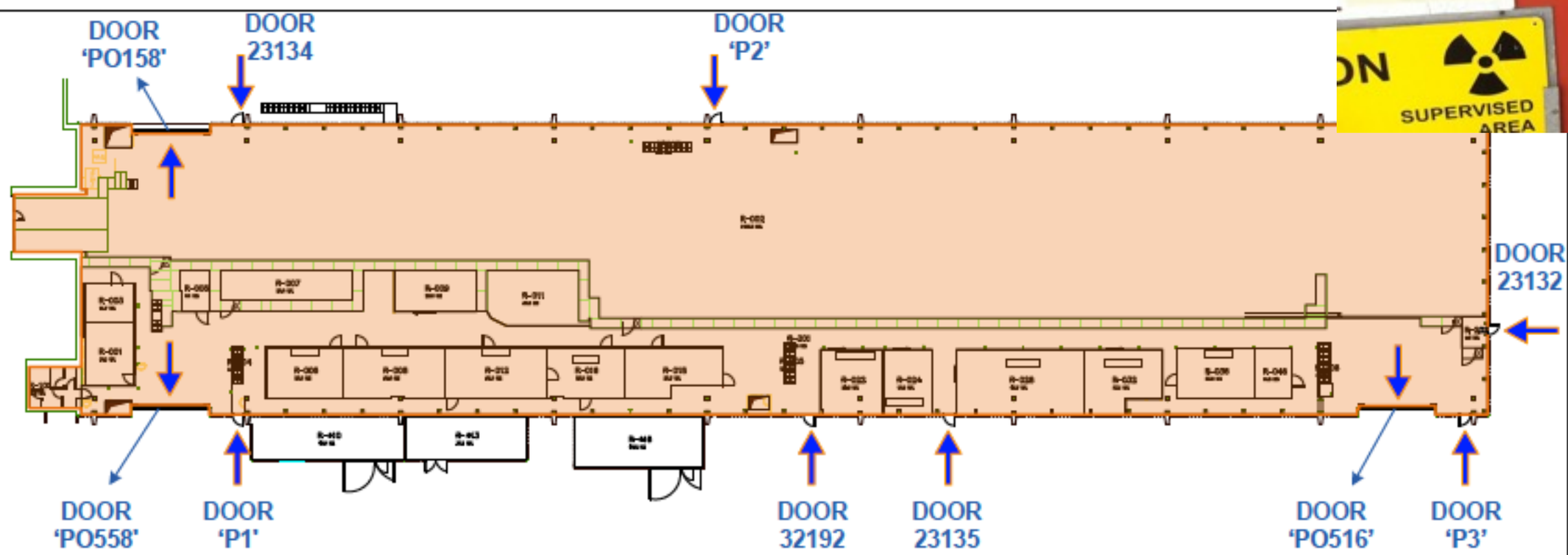
DECEMBER 2017

W#	Monday	Tuesday	Wednesday	Thursday	Friday
48					1 ?
49	4 ?	5 AM	6 AM	7 ?	8
50	11	12 Transversity workshop	13	14	15
51	18	19	20	21	22
52	25 Christmas Day	26	27	28	29

SUSI access to 888

- 888 is being equipped with SUSI system
  = Access control system and video surveillance, requiring the use of your dosimeter

- Some SUSI panels installed, system not yet active.
  (Waiting for main power points and IT sockets to be ready)



- Wear: your dosimeter, closed shoes, helmet

http://dosimetry.web.cern.ch/en/content/personal-dosimeter-employed-or-associated-members-personnel

Personal dosimeter for employed or associated members of the personnel

You can obtain a personal dosimeter if you meet the following conditions:

1. You have a **valid contract** with CERN and, in this context, you are required to work in a CERN *Radiation Area*.
2. You have successfully completed the appropriate CERN **radiation protection training**.
3. You have **read and signed the CERN Personal Dosimeter - Reception Form (pdf)**. You need to sign this document only the first time you request a dosimeter.

c. **Associated members of the personnel (MPA, other than MPA-t)**

If you are an associated member of the personnel other than for the purpose of training, you must provide either:

a. a valid and up to date radiation passport

b. a certificate in the prescribed format signed by your home institution. If you encounter difficulties in filling in and signing the certificate, please contact the Dosimetry Service.

Short-term dosimeter for associated members of the personnel (except MPA-t)

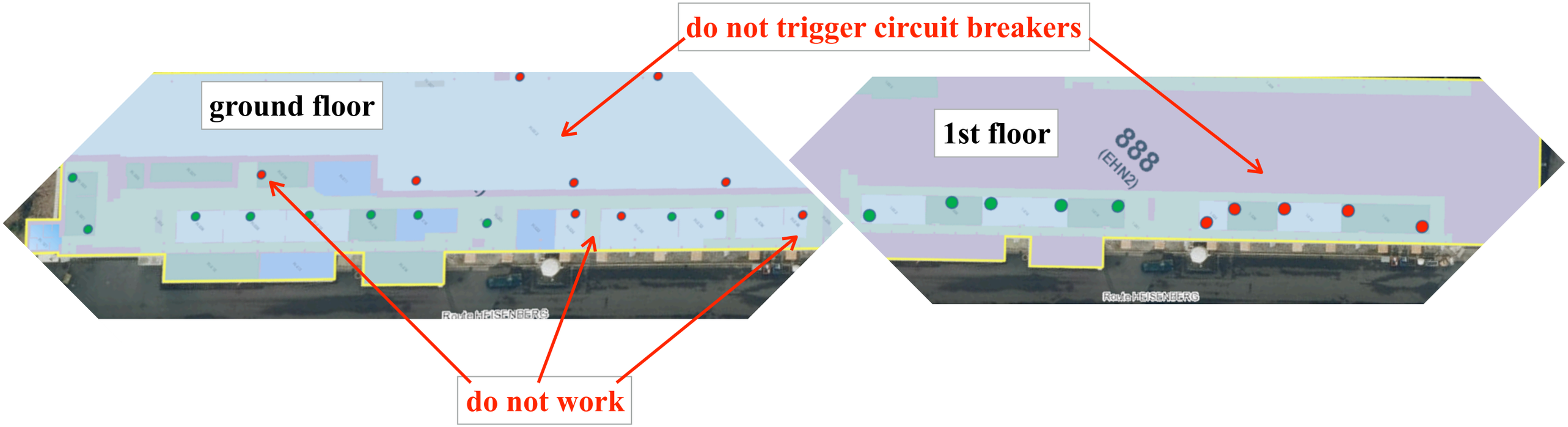
If you stay at CERN for less than 2 months in a calendar year and work only in *Supervised Radiation Areas*, you may request a short-term dosimeter without the need to provide any of the above documents (radiation passport or home institution certificate). In this case your maximum allowed personal dose is limited to 1 mSv per year. The two months period can be fractioned over the calendar year. Please return your dosimeter whenever you leave CERN or when you are absent for several weeks.

dosimetry.web.cern.ch/en/content/personal-dosimeter-employed-or-associated-members-personnel

AULs in 888

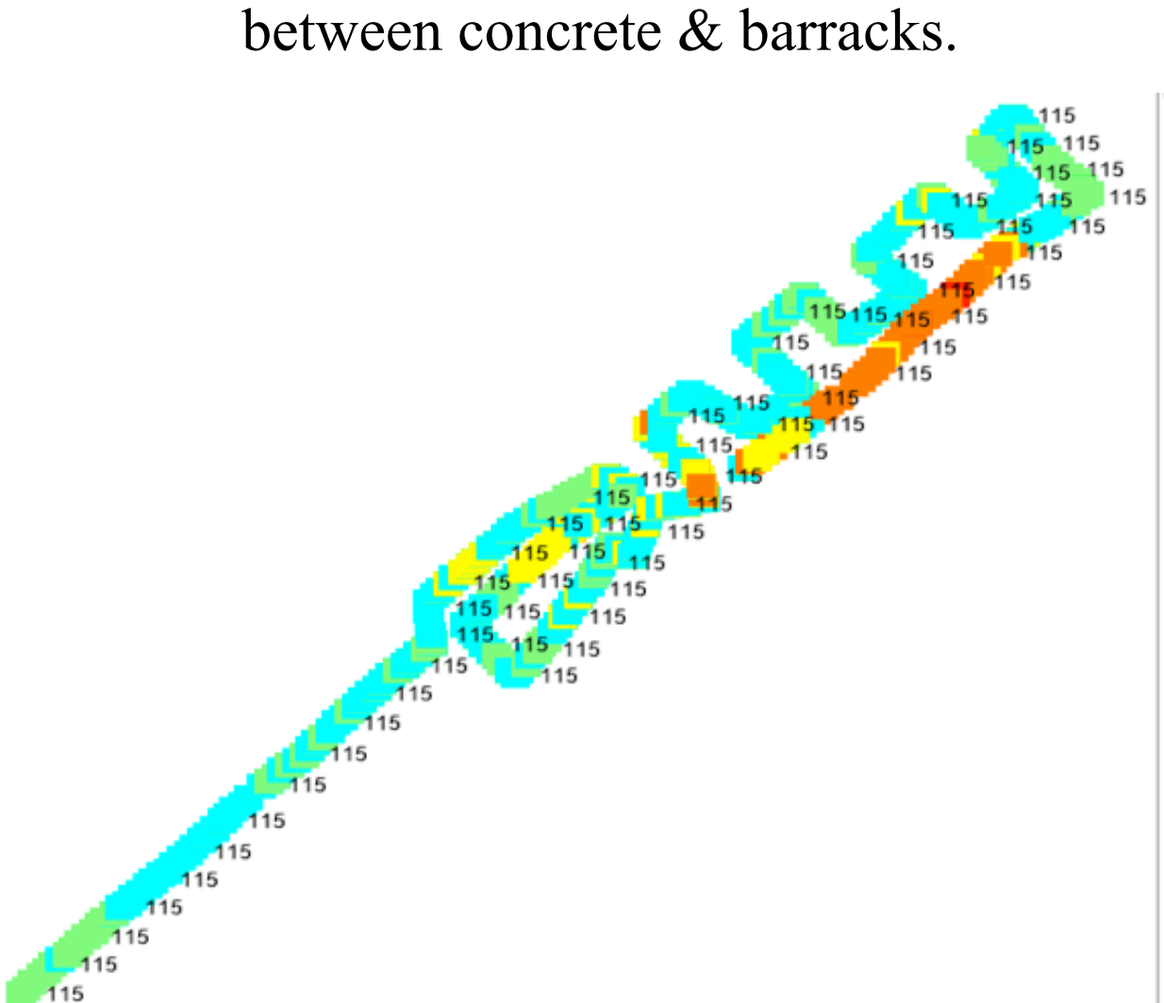
- Test carried out April 6, 2017, faults found
- **Use AUG instead!**
- Faulty AULs will be replaced by EN-EL during YETS.
  Details will be discussed with them this Wed (Sep 6).

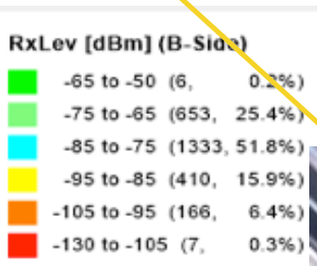
AUG = arrêt d'urgence généraux
(general emergency stop)
AUL = arrêt d'urgence locaux
(local emergency stop)

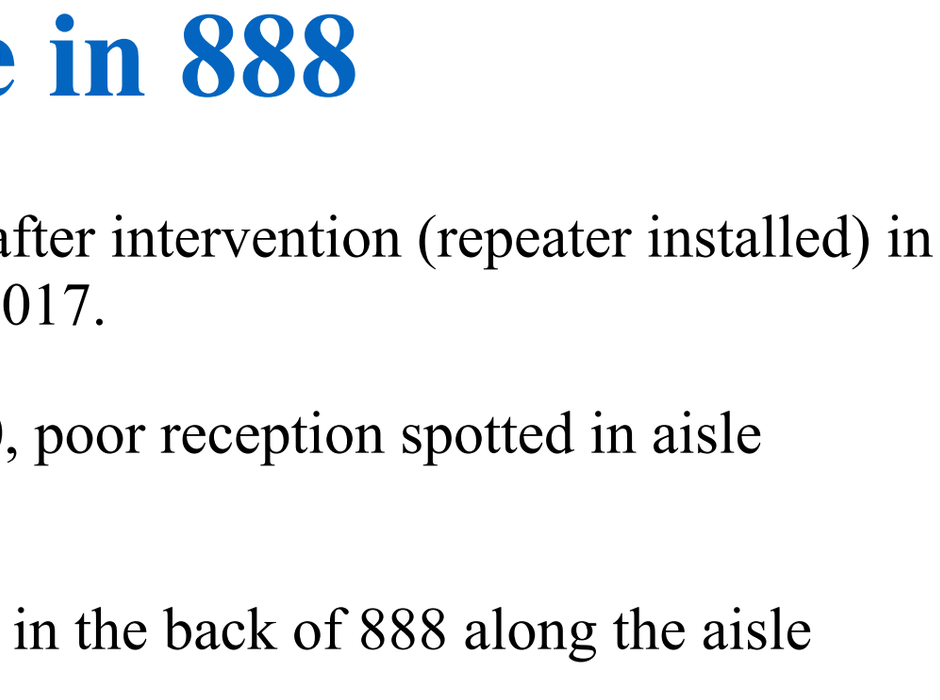


GSM coverage in 888

- Mobile phone coverage poor for many of us, even after intervention (repeater installed) in summer 2016 & further network upgrades in July 2017.
- Meeting with Stefano Agosta (IT-CS) on August 30, poor reception spotted in aisle between concrete wall Saleve and barracks.
- EN-EL will pull additional cable from repeater box in the back of 888 along the aisle between concrete & barracks.



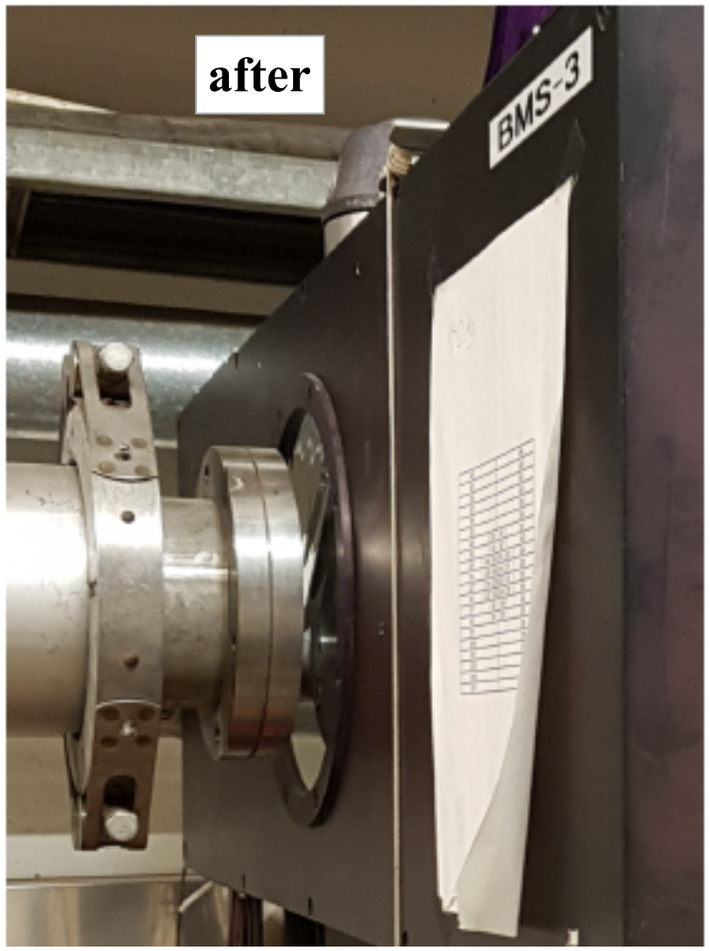


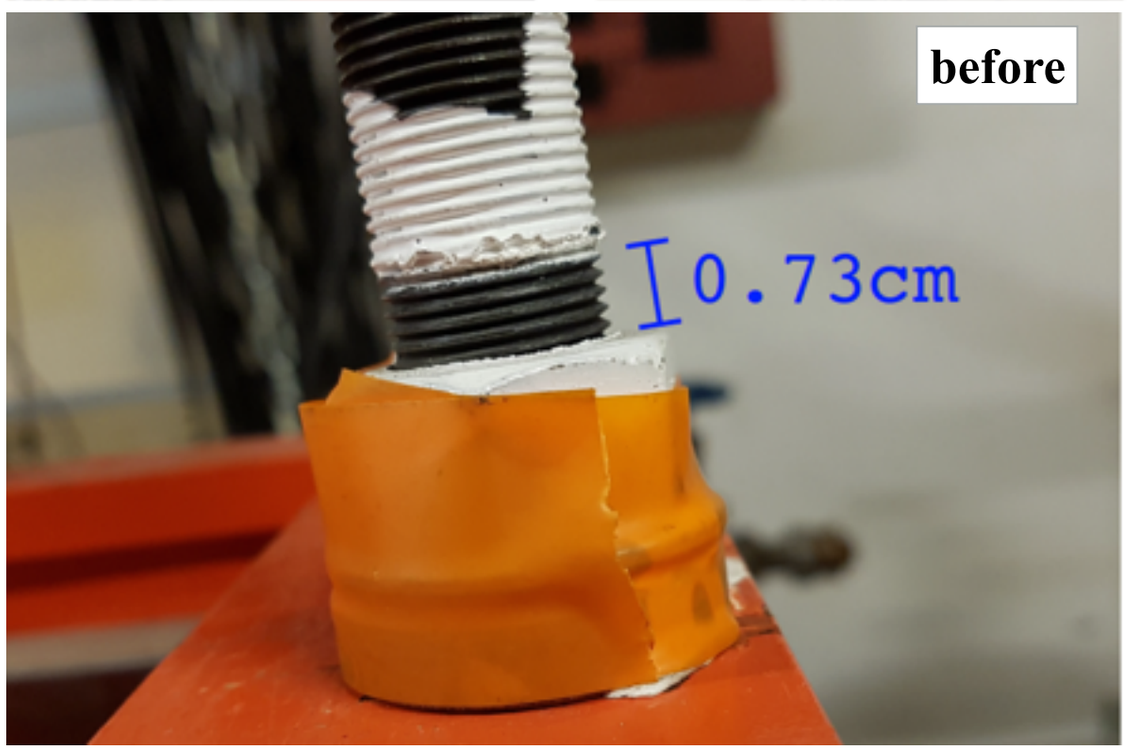


BMS3 correction of forward tilt

Annika & Jens

- BMS3 forward tilted by 1.3º, window touching beam pipe. Very likely since beginning of 2017 run (the last time it was moved).
- One of the positions of the screws on the upstream holder leg was modified.
- August 30, 2017: intervention by Annika and Jens to make it vertical again, fixing screw to its old position.





CEDARs

- Thermal stabilization: EN-MME have started some calculations about the thermal stability of the CEDARs and have requested information about localization of the heat load. Marcin / Robert have provided this information on August 17.

- Funding from Academia Sinica (Taipei), Wen-Chen: *In a new grant approved by MOST (Ministry of Science and Technology) Taiwan, we received an equipment fund of NTD$0.5M (~14K Euro) for purchasing the PMTs in CEDAR upgrade. Since the purchase of PMTs has been covered by our institute equipment fund, this money could be used for buying the readout electronics (commercial modules). This money is available now and until the end of 2018.*

- More and other details in Marcin's talk later today.

Polarized target

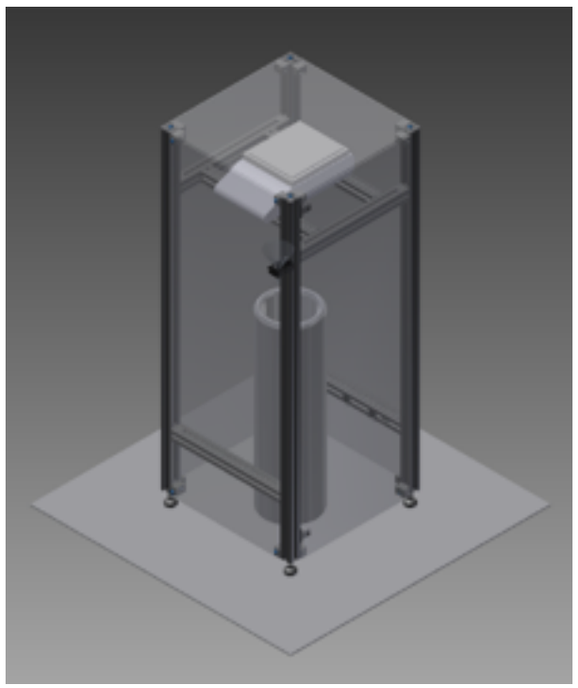
- **New AC units in target pump room**:
  Old unit runs with chemical that is not allowed any longer.
  New units: use chilled water.
  old (on roof): 59 kW, 9,800 m^3/h air flow
  → considered to be overestimated
  new (inside pump room): (2+1) units, each 9.6 kW & 4,060 m^3/h air flow

1m x 0.5m x 0.3m

- **Two new safety valves** (quenching) installed August 30.

- Preparation of target material inspection (Nori, Yaakko): Didier is building a **weighing table.**

- More in Nori's talks later today.



Other news & events

- **Water supply inventory** in 888 upon request with Bill Bannister from EN-CV-OP (Annika, Caroline): August 2017

- **RICH radiator gas** (C4F10)
  - Sample received from LHCb, purity not suitable. Try different batch.
  - Currently ~80% C4F10, ~20% N2. (normally 5% N2)
  - More in Fulvio's talk later today.

- **MCB_error during SM2 ramp down**: assumed to be fixed during MD August 30.

- **Beam-dump experiments**:
  - before Sept. 6: Freiburg, SiPM & fiber (Bachelor project)
  - after Sept. 6: Munich, SiPM irradiation

Storage of detectors not needed in 2018

- CAMERA: request by Saclay group to place it in the ECal0 cage in 888 until the 2018 apparatus is readily commissioned.
- However, also ECal0 will be removed from the spectrometer and will be placed in the caged area.
- An estimate of required space is needed for both detectors!
- Anything else?

Experimental areas are no permanent storage space!

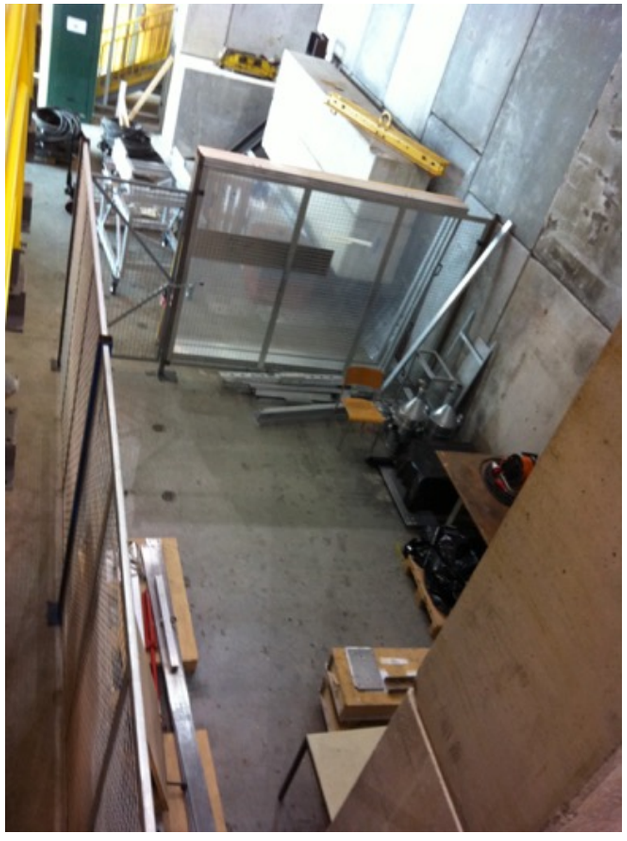
Stored items on the top of the beam tunnel have to be cleaned up and eventually have to be removed. In case of a magnet failure (e.g.QUAD36), there would otherwise be some serious downtime.

(JB reminder 2017-09-01)

New storage area close to 888

(More) Messages from Johannes

- Johannes made contact with EN-ACE to start a project for a new storage area close to 888.
- Idea: similar to the building on your right hand side when walking to R3.
- Can be heated during winter to keep humidity at low level.
- He asks us to send our requests: what do you want to store and how large is it?



- A **new radio protection buffer zone in 888** is planned before LS2.
- Used to measure materials coming from the experimental area and the beam line tunnel before being transported out of 888.
- Some area has to be reserved, ECal0 cage is a popular candidate.

Agenda

- *9:35 - 9:45* Report from the EATM (Annika)
- *9:45 - 10:15* 2017 CAMERA (Andrea F.)
- *10:15 - 10:45* 2017 RICH (Fulvio)

Coffee

- *11:00 - 11:20* 2017 Target LH2 (Nori)
- *11:20 - 11:40* 2018 Target polarized (Nori)
- *11:40 - 12:15* Round table

Lunch

- *13:30 - 14:00* 2018 Planning (Caroline, Vladimir)
- *14:00 - 14:30* 2018 CEDARs (Marcin)
- *14:30 - 14:50* 2018 DAQ requirements (Igor)
- *14:50 - 15:10* 2018 Radio protection (Angelo / Caroline)
- *15:10 - 16:00* 2018 Modifications of setup (Caroline et al.)

DM

continue if not finished yet

Round Table

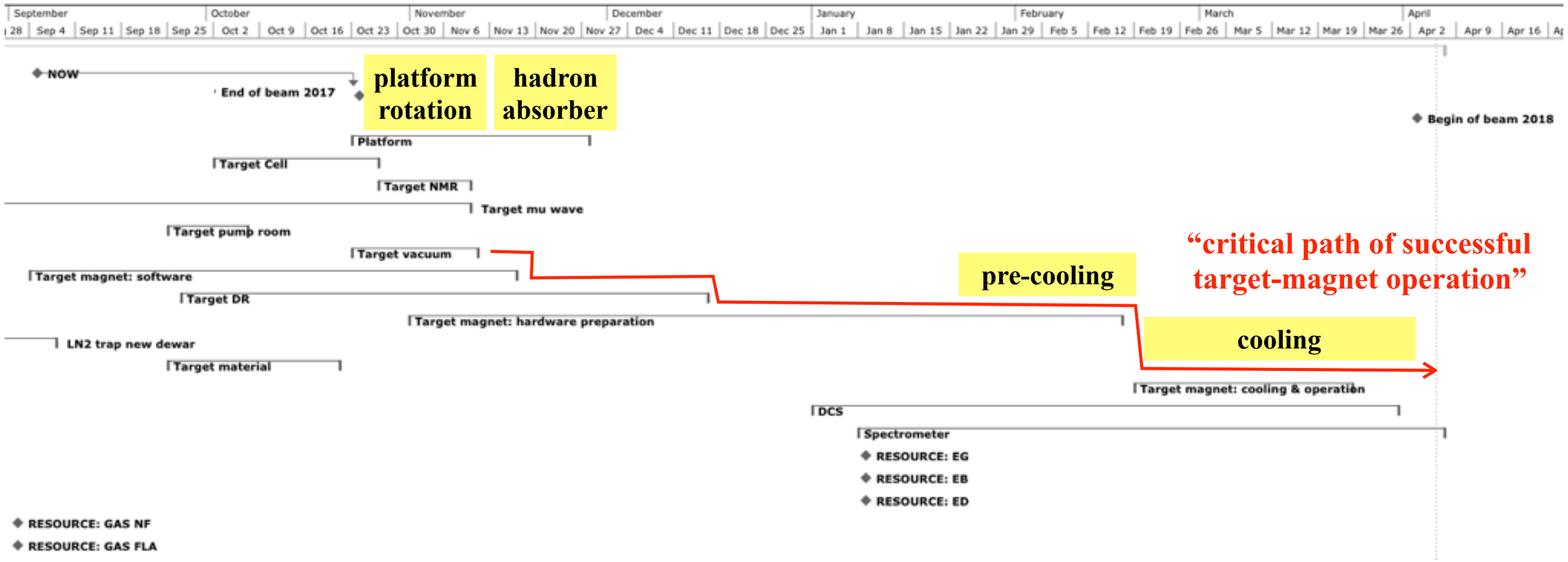
- **Clean area:**
  - DC4 repair is canceled
  - Target material inspection (& cleaning) late September / early October (close to gate): Nori and Jaakko
  - Disassembly of stretching machine?
  - Other requests?
- **RICHwall repair**
- 2018: **remove MT** to free space for calo trigger?

2018 planning

Modifications of 2018 compared to 2015 will be discussed later this afternoon.

Changeover GPD ⇒ DY

Overview



- EP-DT (Detector Technologies) is essential in commissioning target magnet.
- Recent meetings with EP-DT: July 21 (spokespersons, Gerd, Nori, CKR), August 22 (CKR) to synchronize the planning and optimize communication.

Changeover GPD ⇒ DY

CAMERA, LH2 target & platform

Wed Nov 1: all Saints Day, no Saclay technicians Wed-Fri

Platform rotation: last days of October

hadron absorber: start Nov 20

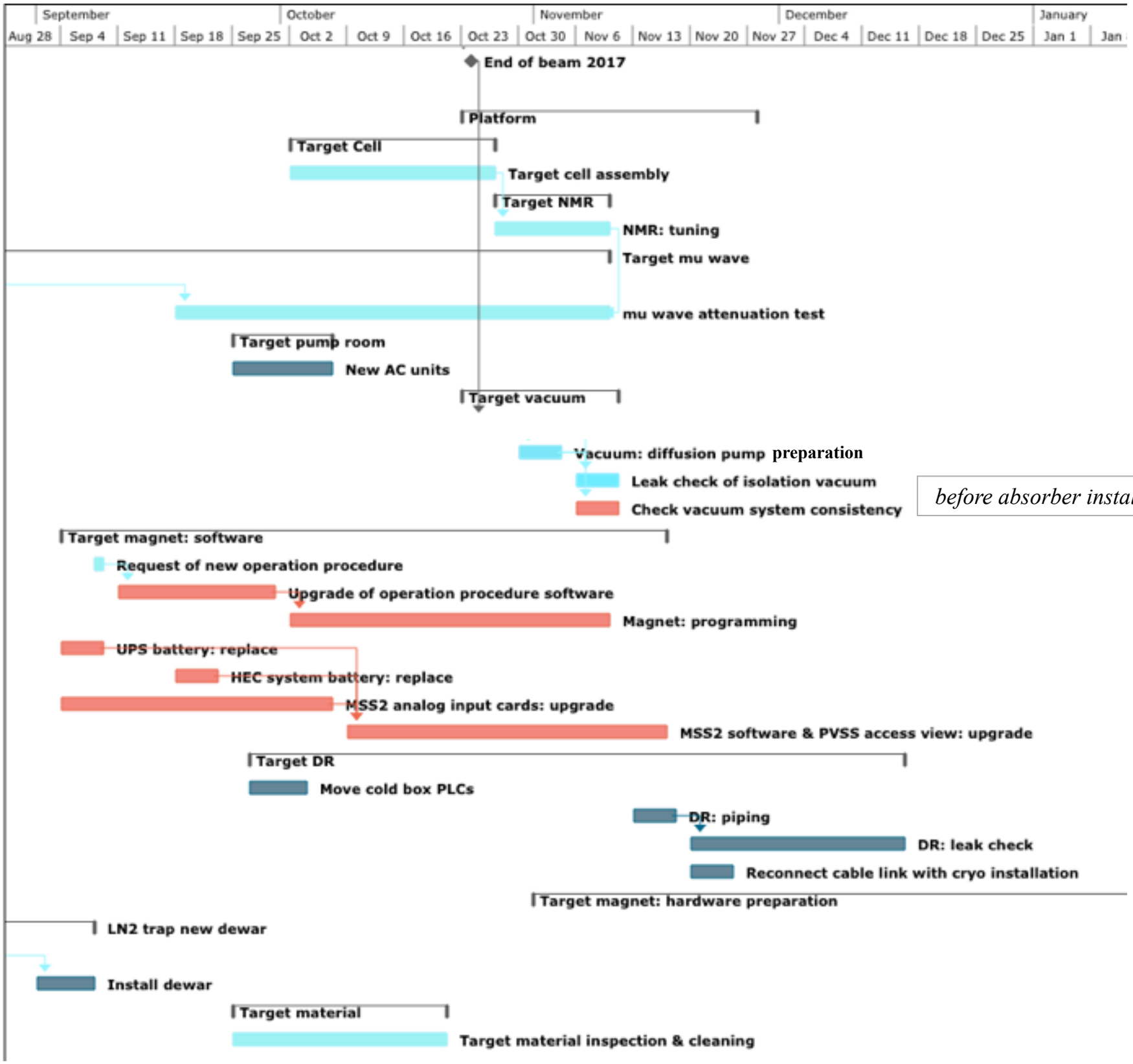
COMPASS
EP-DT
TE-CRG (cryo)
EN-HE (engineering)
EN-ACE-SU (survey)
TE-EPC (power converters)

*** including re-connection of main power for target magnet by EN-EL**

Any more interactions by EN-EL?

Changeover GPD ⇒ DY

Target preparation

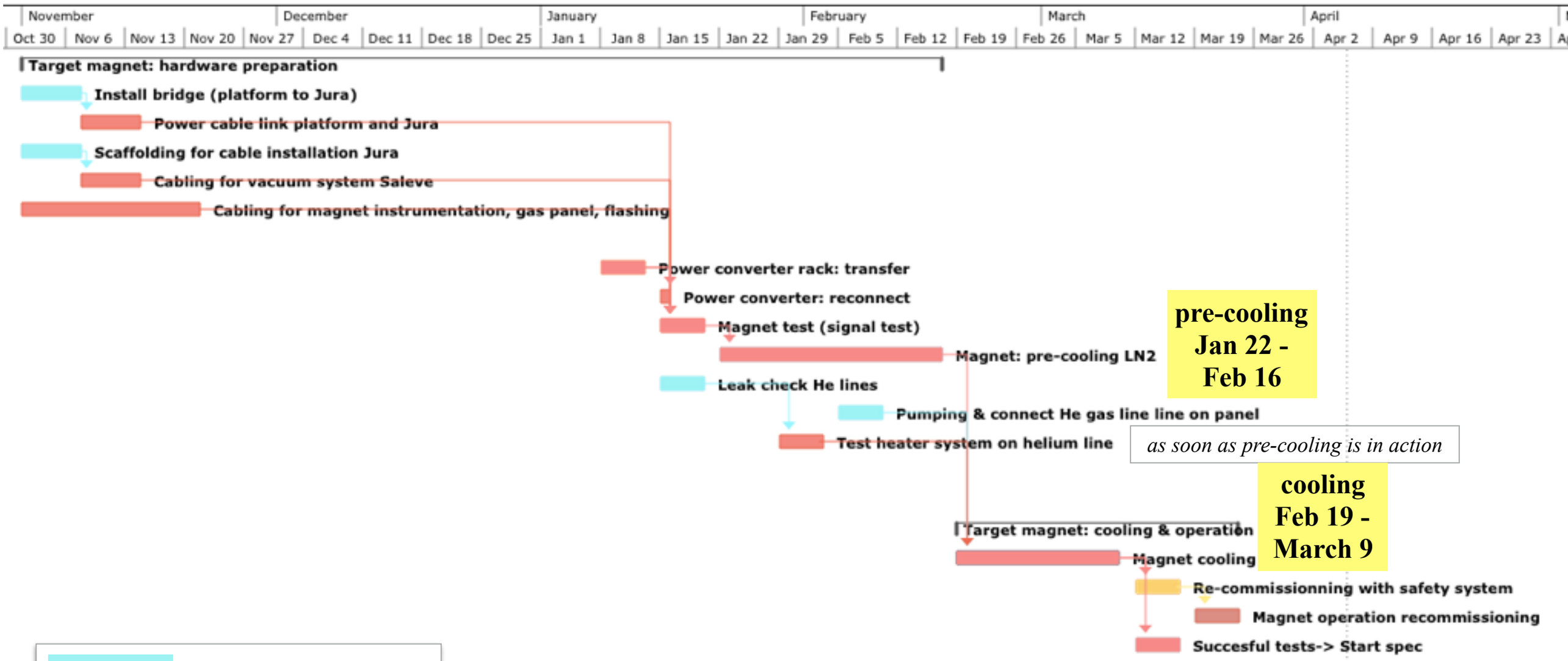


before absorber installation

COMPASS
EP-DT
TE-CRG (cryo)
EN-HE (engineering)
EN-ACE-SU (survey)
TE-EPC (power converters)

Changeover GPD ⇒ DY

Target magnet



- COMPASS
- EP-DT
- TE-CRG (cryo)
- EN-HE (engineering)
- EN-ACE-SU (survey)
- TE-EPC (power converters)

CERN support for change-over

(slide taken from Nick)

Group	function	name	comment	Contacted?
Various TE-CRG-ML	Helium, piping, magnets	L. Stewart, O. Pirotte	Reserve people, Check availability	yes
EN-EL	Electricity, cabling	N. Bellegarde	400V, 48V, AUL	yes
TE-EPC-LPC	Power supplies	Y. Thurell	Ready Jan. 2018	yes
DT-DI	Programming, connection	Ravat, Deront, Blanc, Pons		yes
EN-HE	Platform, rotation, shielding	Bertone, Vallet		yes
TE-CRG-OD	Helium consumption Cold box Dewar LN_2	Wagner, Bremer	Check for larger Dewar Check piquet service	yes
EN-EA	CEDAR/magnet support	F. Gautheron, J. Bernhard		Asking soon

Our COMPASS experts:

Target coordinator → **Nori**
MW → **Kaori** and **Yuri**
888 stuff, Transport, crane, etc. → **Vladimir**
Shielding → **Angelo**

Target magnet → **Nori, Jaakko**
Cryo → **Nori, Jakko**
Spectrometer → **TC**
Beam line etc. → **Beam Coordinator** and **TC**

EP-DT for polarized target : Giovanna.Lehmann, Laurent Deront, Sylvain Ravat, Pascal Blanc

2018: Radio protection

Angelo Maggiora's material

Angelo Maggiora

2018: shield optimization

- Goal: decrease radiation dose in the environment around 888.
  Request by radio protection group: decrease dose by 30% in 2018.
- 10^9 π^-/spill, SPS SC 33.6s.

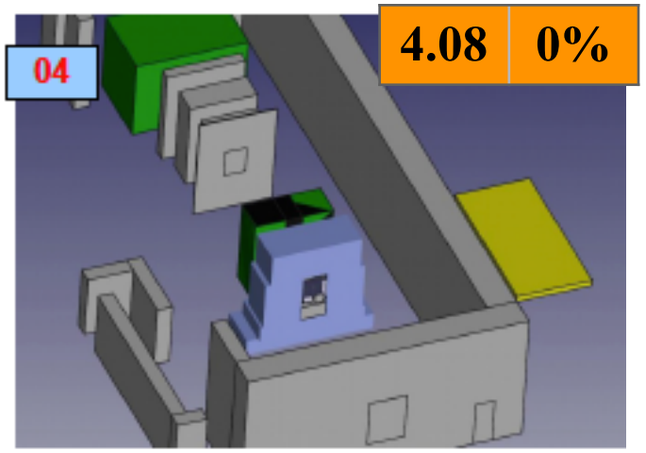
1.) Decrease the beam intensity

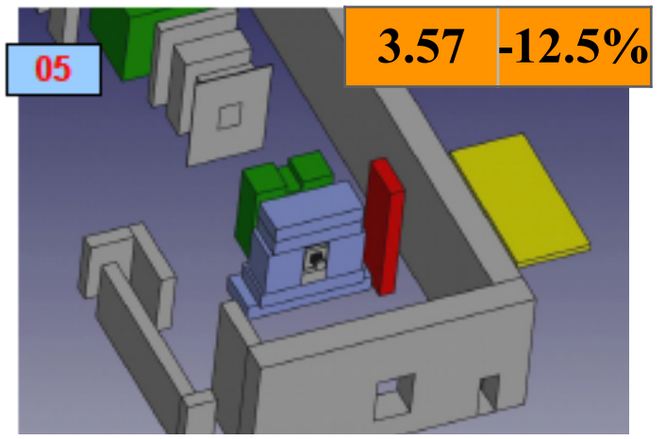
Mean dose in control room (μSv/	Dose reduction

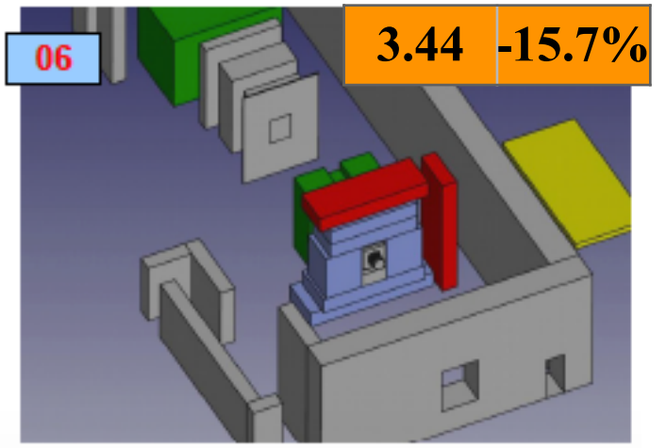
2.) Increase the thickness of concrete around the absorber or

3.) Replace the concrete with borated polyethylene or

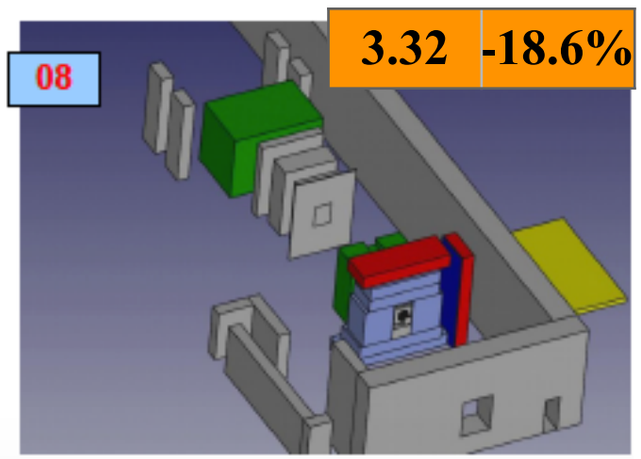
4.) Use a combination of polyethylene and concrete

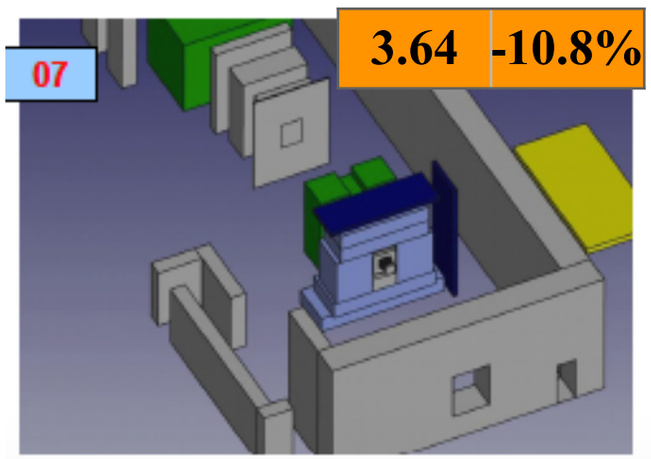






Final-04	configuration of 2015 run
Final-05	Final-04 + 80cm of concrete blocks on the Saleve side only
Final-06	Final-06 + 80cm of concrete blocks on top
Final-07	Final-06 but with 20cm of borated polyethylene (5%) instead of concrete
Final-08	Final-06 + 10cm of polyethylene on the concrete side blocks





2018: shield optimization, results

Angelo Maggiora

configuration	Mean dose in control room (μSv/h)	Dose Reduction	note
Final-04	4,08	0%	configuration of 2015 run
Final-05	3,57	-12.5%	Final-04 + 80cm of concrete blocks on the Saleve side only
Final-06	3,44	-15.7%	Final-06 + 80cm of concrete blocks on top
Final-07	3,64	-10.8%	Final-06 but with 20cm of borated polyethylene (5%) instead of concrete
Final-08	3,32	-18,6%	Final-06 + 10cm of polyethylene on the concrete side blocks

radioprotection group check required

- 50% of particles outside concrete shield are low energetic neutrons
- The dose can be considerably reduced in the DAQ floor (beam level) adding 80 cm of concrete on Saleve side
- The concrete top help to lower the dose under the ceiling, small effects on DAQ floor
- 20-25 cm of borated polyethylene are more or less equivalent to 80cm of concrete
- Absorbtion by the buiding walls is unknown
- Other radical solutions are possible, but with costs and work enourmous

10

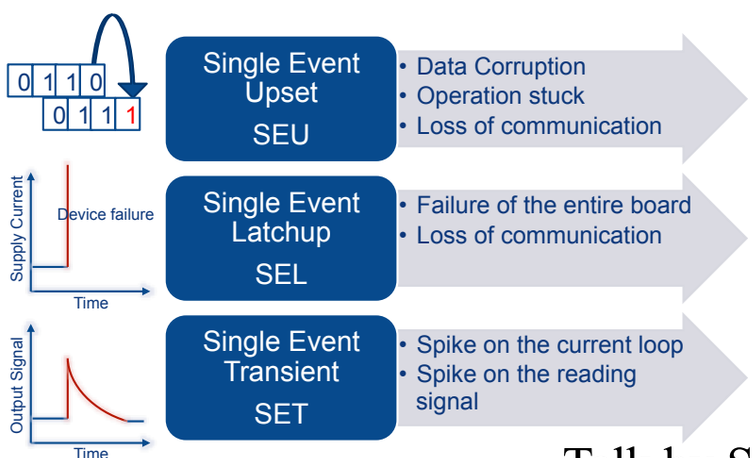
2018: modifications of setup wrt 2015

- PLC shielding
- Beam Telescope
- Vertex detector
- Nuclear targets
- Li6 absorber

2018: improved shielding of He coldbox PLC

- PLC units will be moved from upstairs Jura side to ground level behind concrete wall to reduce radiation & Single Event Effects (SSE).

What are the effects of concern?

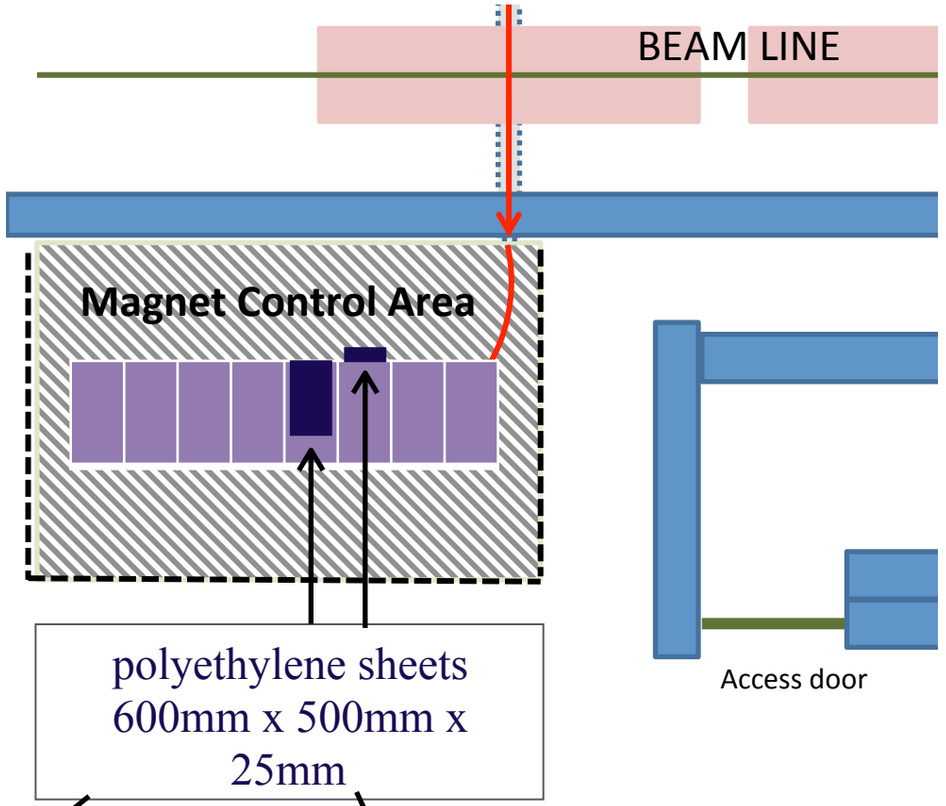


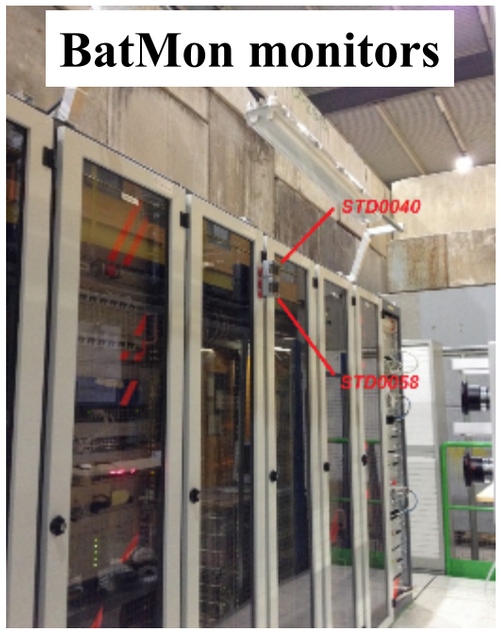
$$N{\downarrow}Failure = N{*}\sigma * fluence$$

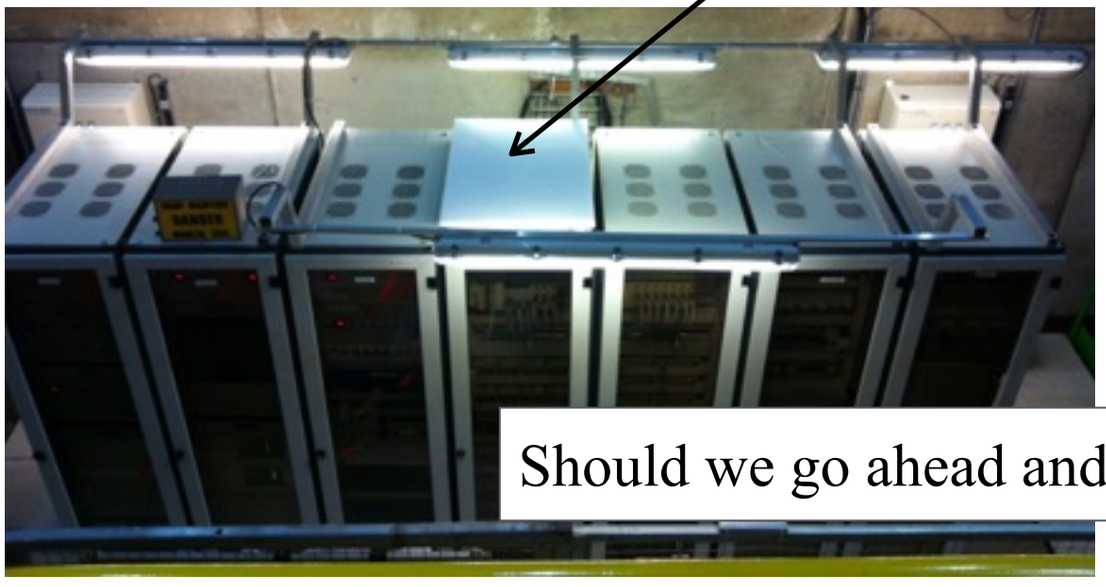
Talk by Salvatore Danzeca at Oct. 2015 TB meeting

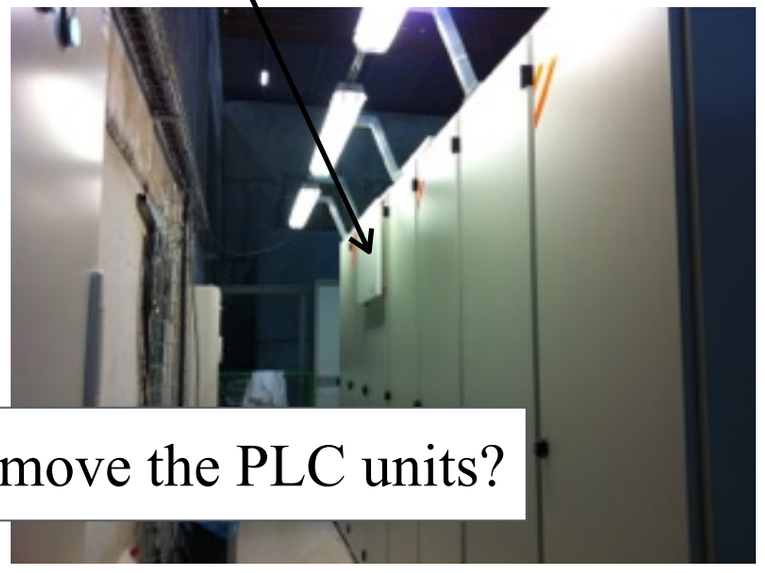
2018: improved shielding for magnet PLCs?

- **Multiple SEEs during 2015 magnet operation.**
- **BatMon monitors** installed August 2015.
- PLCs were shielded in October 2015 with sheets of polyethylene. Failures still present afterwards.
- Instead of adding more shielding, the preferred solution seems to be **to move the PLCs (up to 100m),** across the street in clean area or BA82 or…
- Angelo's FLUKA geometry file does not include PLC area (only experimental area, starting from end of beam line). In principle this geometry could be extended but secondary beams and halo very difficult to simulate.









Should we go ahead and move the PLC units?

2018: improve redundancy in Beam Telescope

- 2015: 8 SciFi planes were installed, FI01 (X,Y), FI15 (X,Y,U), FI03 (X,Y,U).
- 2015: ⟨BT/event⟩=2.1 (≥5 hits required). If 1 plane is lost: ⟨BT/event⟩=1.7
- **Move FI04** to beam telescope (from downstream of absorber), z=-675
  - FI04 does not contribute to 2015 tracking (Catarina's simulation)
  - Recent MC simulation (Vincent) shows that this option has a significant impact on the redundancy of beam track reconstruction in the BT.
- Alternatively: build additional U-layer for FI01.

2018: move Vertex Detector (FI35)?

- 2015: FI35 suffers from high multiplicity, being illuminated by showers from the hadron absorber. Its hits are not included in the track reconstruction.

- **Move FI35** to downstream of hadron absorber (from upstream of hadron absorber) = FI04 position of 2015?

- In addition, rotate by 90º to allow access to FEE.

- The simulation (Vincent) shows that:
  - 30% of events have ≥1 hit in FI35 (at new position), which is certainly more than what FI04 saw.
  But: what is the overall impact on track reconstruction?
  - $\chi 2$ only marginally improved
  - sigma of track time slightly improved

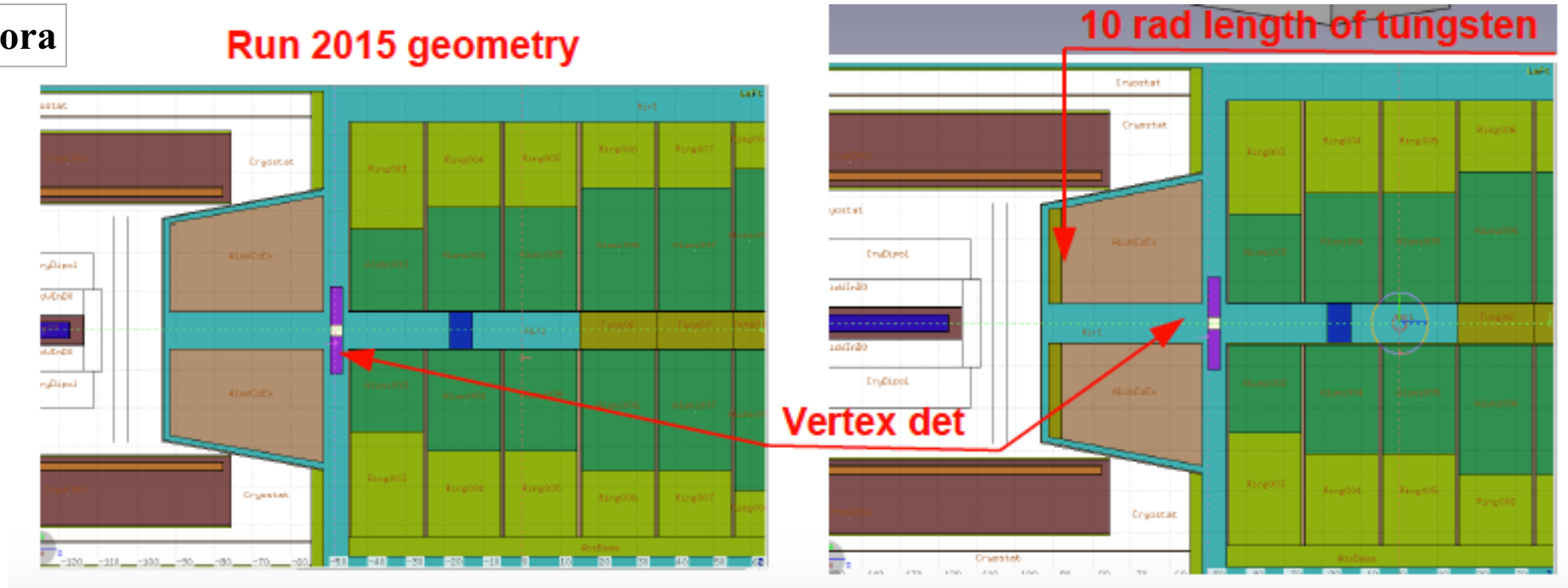
- One selling argument of the original FI35 position was to have a point upstream of the absorber, for better target pointing, to avoid multiple scattering in the absorber.

- Is it worth the effort? Rainer will need ~ 1 manpower month for the movement.

- Mounting has yet to be discussed with Vladimir and the Saclay group.

2018: better protection of FI35 from γ radiation?

Angelo Maggiora



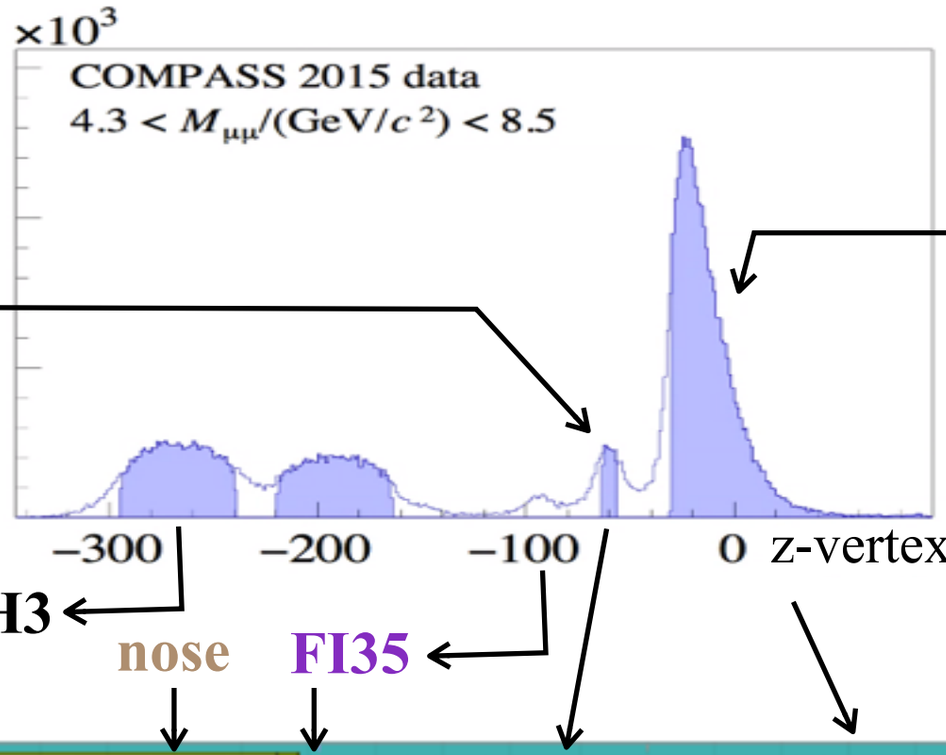
name	Cone geometry	Charged part	Photons
VTX01-ntg-01	Alu cone, 2015 configuration	21.2 part/pr	193.3 part/pr
VTX01-ntg-02	10 rad length of W, 3.5 cm	12.6 part/pr	117.9 part/pr

Warning

- **Vertex resolution, to be studied with comgeant**
- **Cradle equilibrium: the change the center of gravity of the cradle, risk of cone falling on the solenoid closing cap**
- **Check the cone activatoion level before machining**
- **Feasibility study with TB**

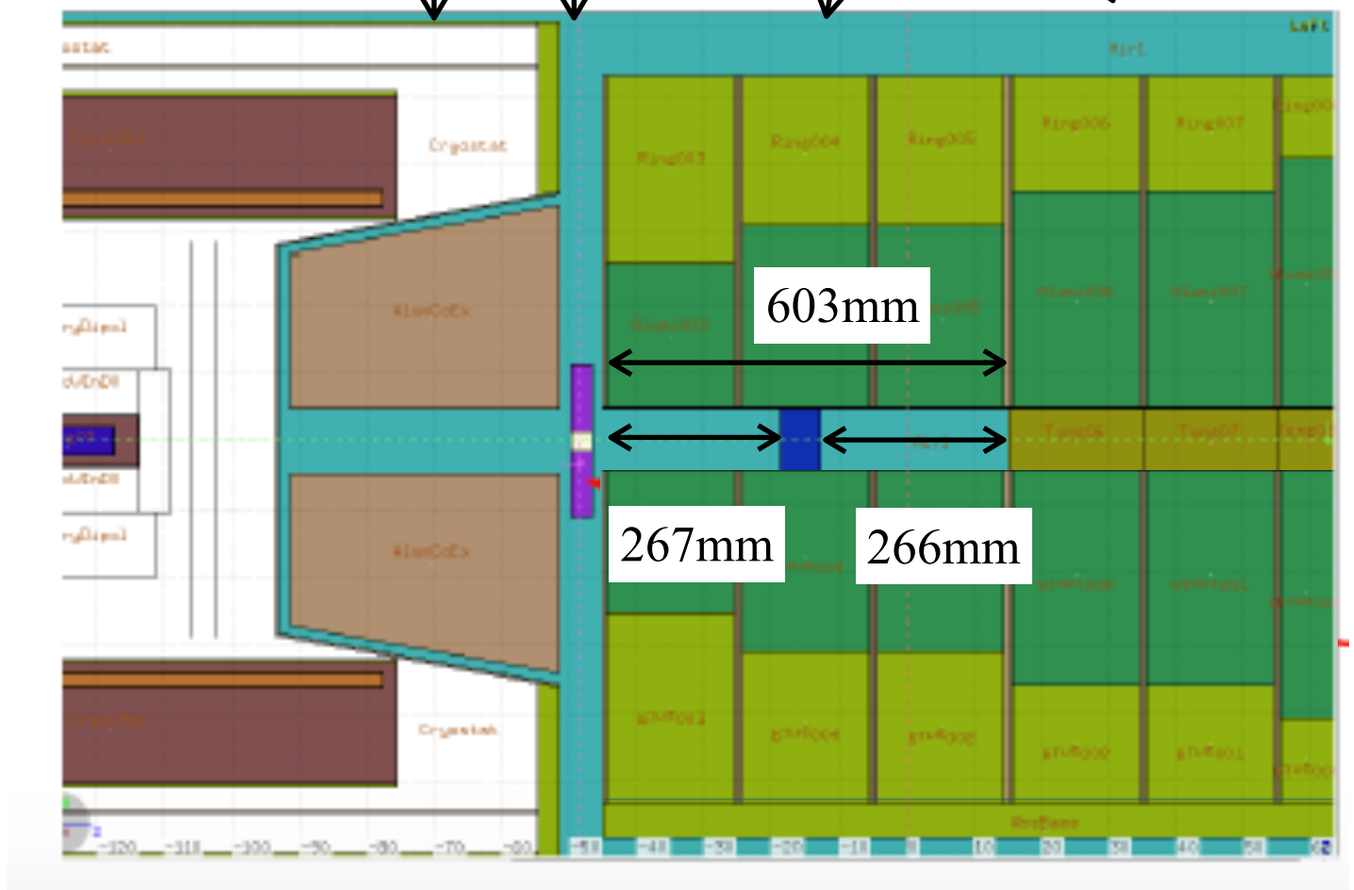
2015 nuclear targets

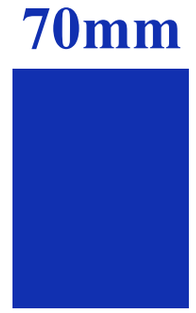
Al target:
poor statistics,
shadowed by W plug



W target (plug):
re-interactions (DY events induced by secondary pions), z-resolution

After removal of FI35: gain more freedom to position Al target





2018: improvement of nuclear targets?

Idea 1: Replace Al target by W target, to improve W statistics,
& move ~6cm upstream, to avoid tail of events from W plug,
& add 6cm disk of aluminum, to minimize escaping radiation
(with a hole in the center to let beam pass)

→ Angelo's study August 2017

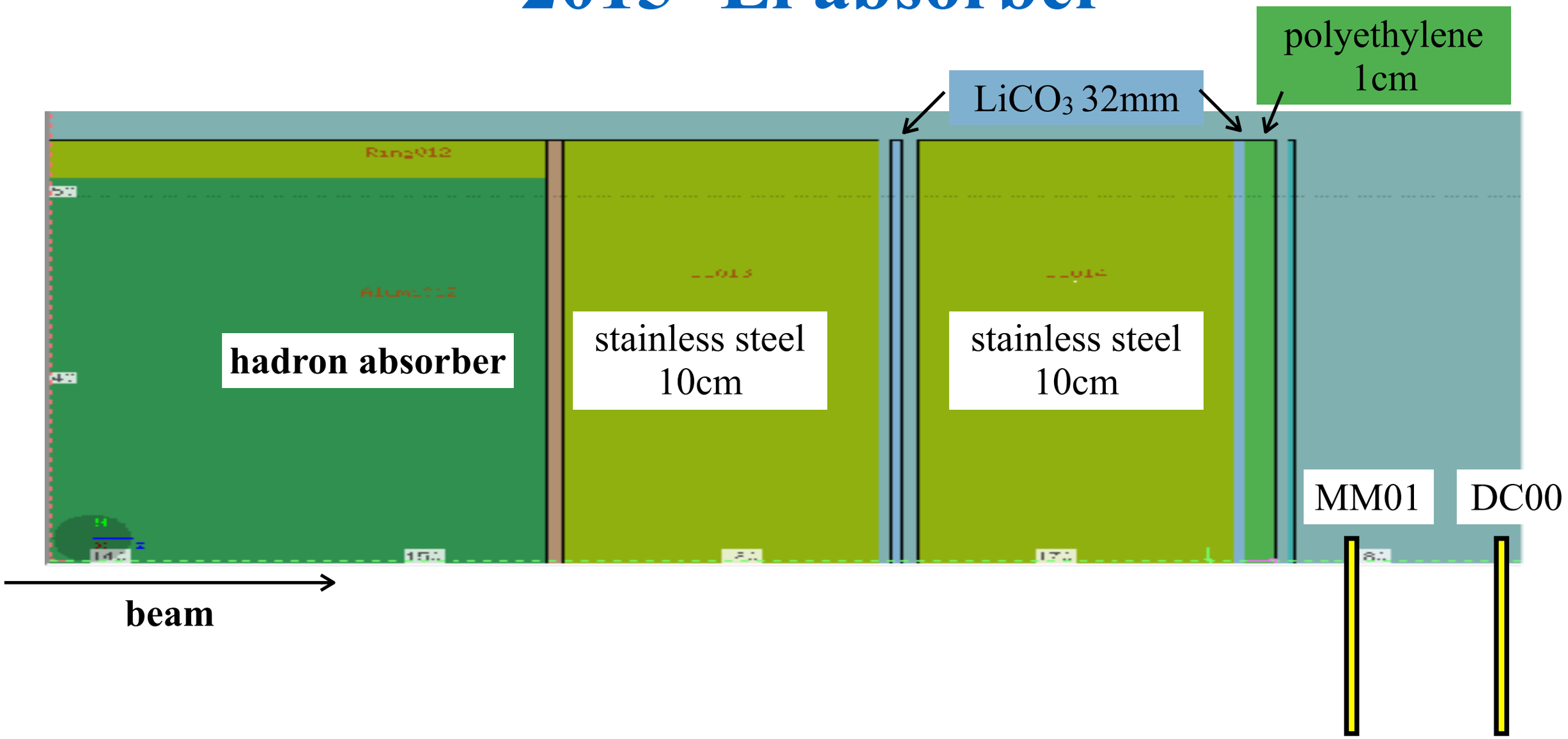
configuration	Mean dose in control room (µSv/h)	Dose Increment	note
Final-04	4,08	0%	configuration of 2015 run
Final-09	4,12	1%	Final-04 + alu target
Final-10	4,53	11%	Final-06 + w target

- Angelo: Disk will not decrease radiation in the environment around the absorber.
- Can reduce a little bit the backward scattering but not in the polarized target. The radiation in the target must be minimized to avoid loss of polarization.
- Main problem is radiation orthogonal to the W plug (side radiation).
- ~10% increase of radiation, while we must reduce the radiation!

Discussion at DY meeting August 31:
Idea 2a: Move Al target as much as possible upstream, make it thicker.
Idea 2b: as 2a, but make it Ca, Ni, Fe target.

For the sake of the nuclear Drell-Yan effect!

2015 ^{6}Li absorber

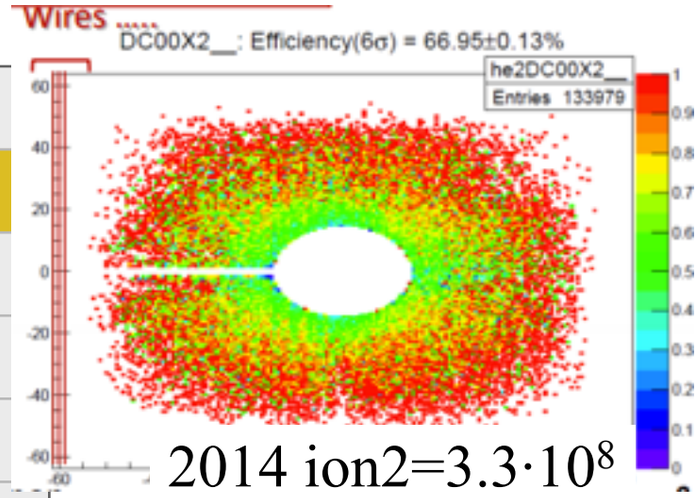


- Purpose: absorption of neutrons, which might be captured and emit γ→e+e-
- Installed after 2014 DY run because of suffering efficiency in DC0.

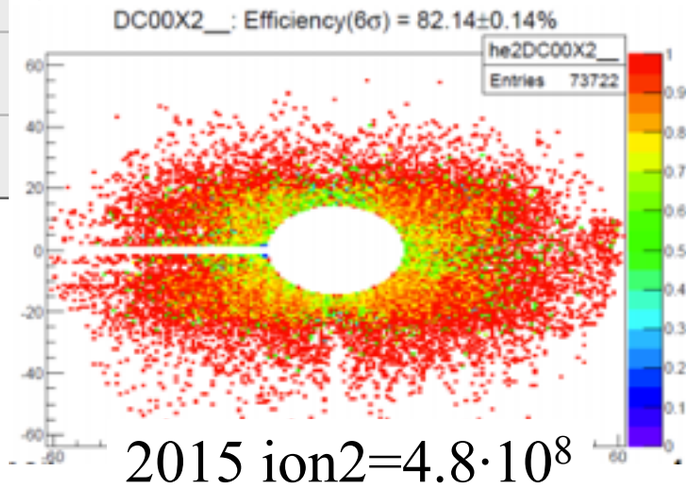
DC0 efficiency & MM rates 2014 vs. 2015

	no ^{6}Li		2 ^{6}Li sheets	
DC0-eff [%]	2014	2015	2015	2015
ion2 [10^8]	3.3	3.4	4.8	1.8
X1	83.0	91.5	89	92.3
X2	**66.9**	84.6	**82**	91.5
Y1	83.0	90.1		
Y2	83.3	90.6		
U1	74.7	84.6		
U2	72.1	84.1		

efficiency numbers based on one example run.



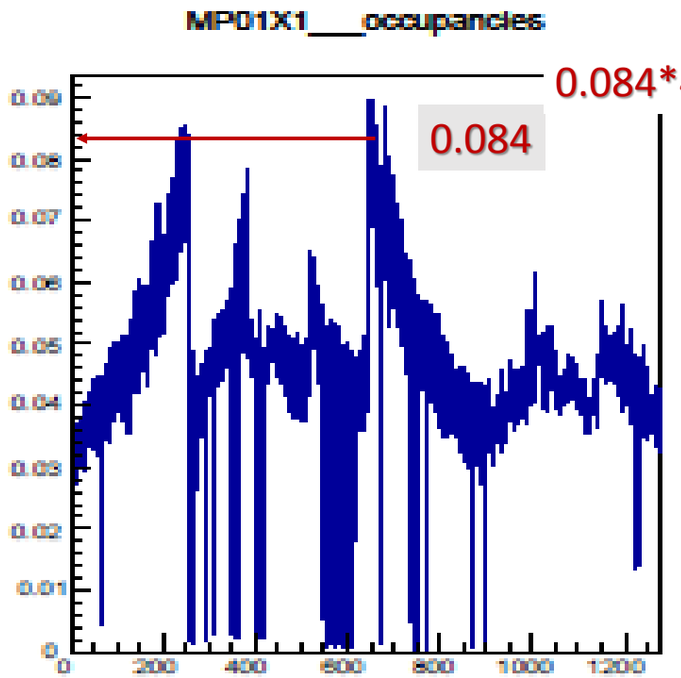
2014 ion2=$3.3 \cdot 10^8$



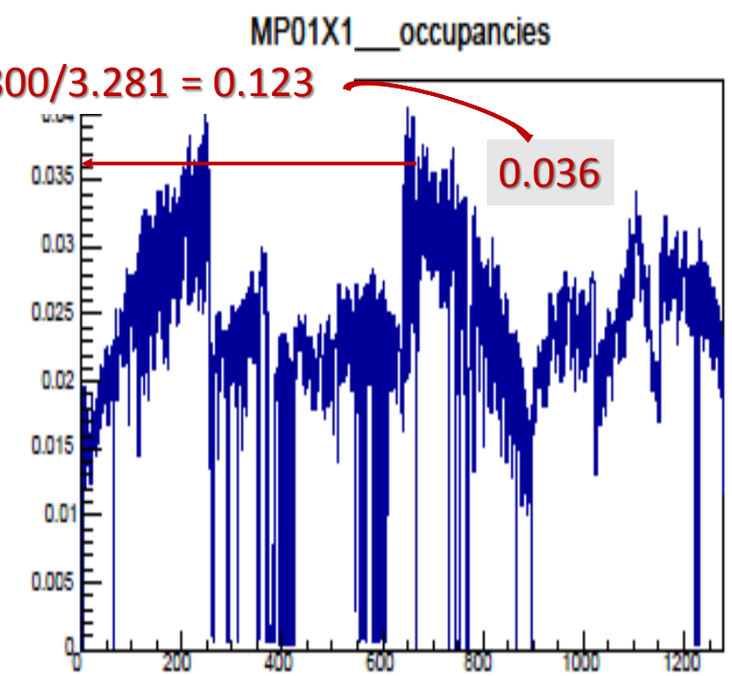
2015 ion2=$4.8 \cdot 10^8$

plots from Alain

DY 2014
Run 255039 μ_IonCh = $3.281 \cdot 10^8$



DY 2015
Run 258283 μ_IonCh= $4.800 \cdot 10^8$



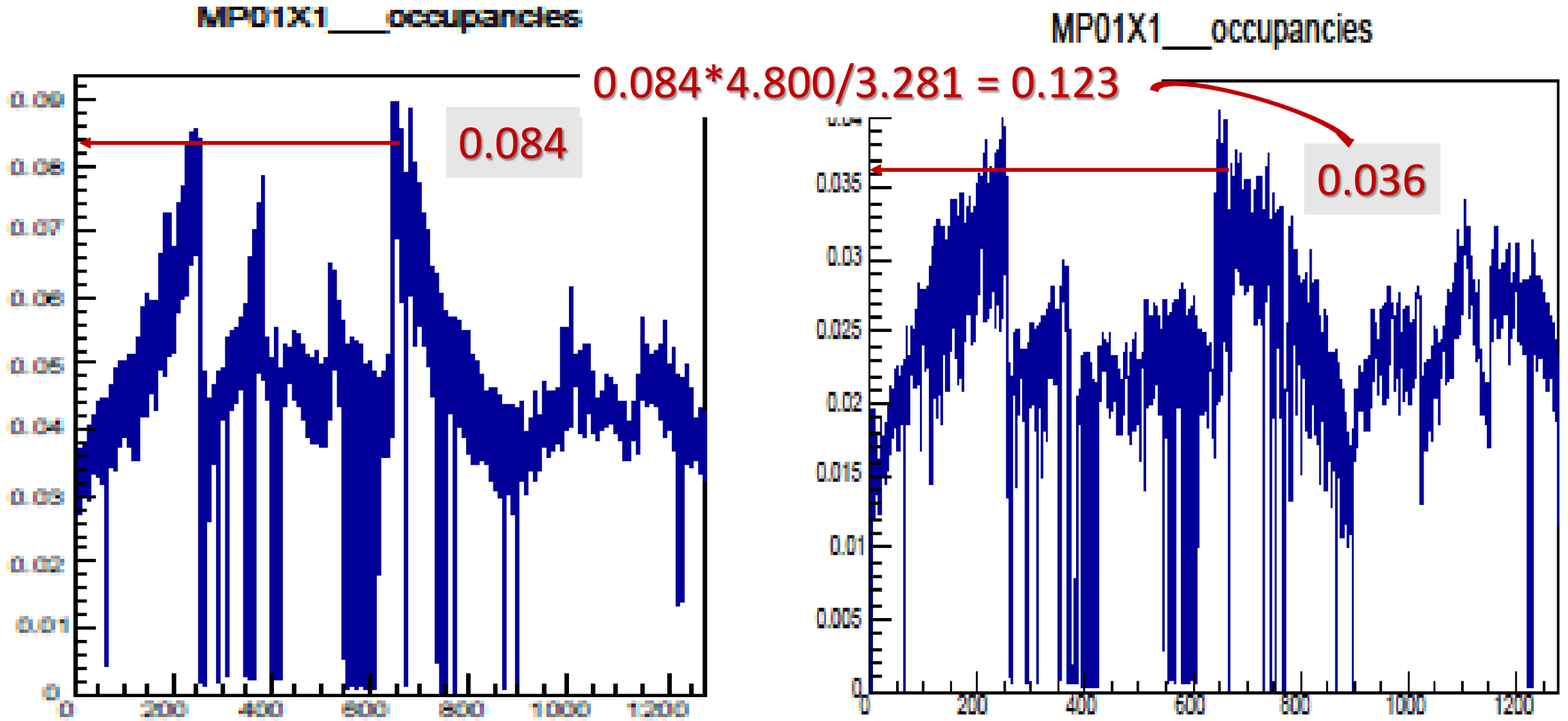
Might be difficult to judge because also protection resistors of DC0 were exchanged - before or at the beginning of the 2015 run (?).
But: MM rates! (left)

Rates in micromega with / without Li6

courtesy Alain

DY 2014
Run 255039 μ_IonCh = $3.281*10^8$

DY 2015
Run 258283 μ_IonCh= $4.800*10^8$



FLUKA simulations for neutron absorbers

Angelo Maggiora, presented at DY meeting July 13, 2017

simulation	Additional sheet	Thickness [cm]	phot/Pr	neutron/Pr	e-/Pr/cm^2	charg/Pr
MM01-ntg-10	Air (run 2015)	0.32+0.32+1	2.145	1.762	0.109	0.219
MM01-ntg-11	Carbonated Lithium + polyethylene (run 2015)	0.32+0.32+1	2.259	1,600	0.119	0.230
MM01-ntg-12	Borated polyethylene (B = 30%)	0.32+0.32+1	2.383	1.328	0.108	0.230
MM01-ntg-13	Gadolinum+ polyethylene	0.32 + 1.32	2.411	1.616	0,127	0.234

Neutral = neutrons + photons + other

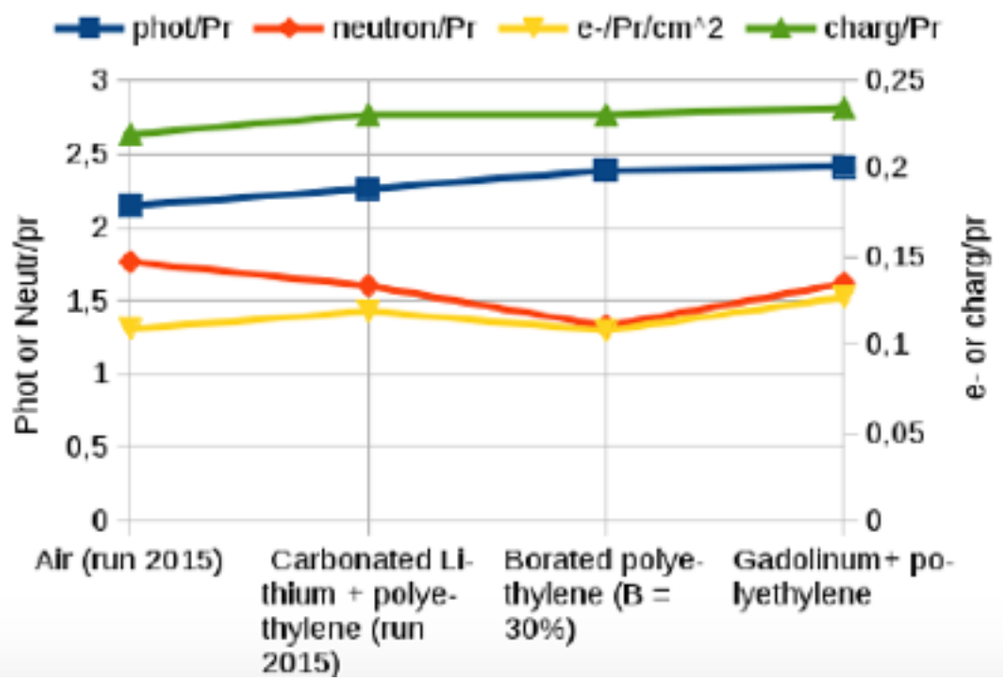
Check with standard flka scoring

Neutrons crossing MM1

- Lithium -9%
- Borated polyethylene -25%

Photons crossing MM1

- Lithium +5%
- Borated polyethylene +11%



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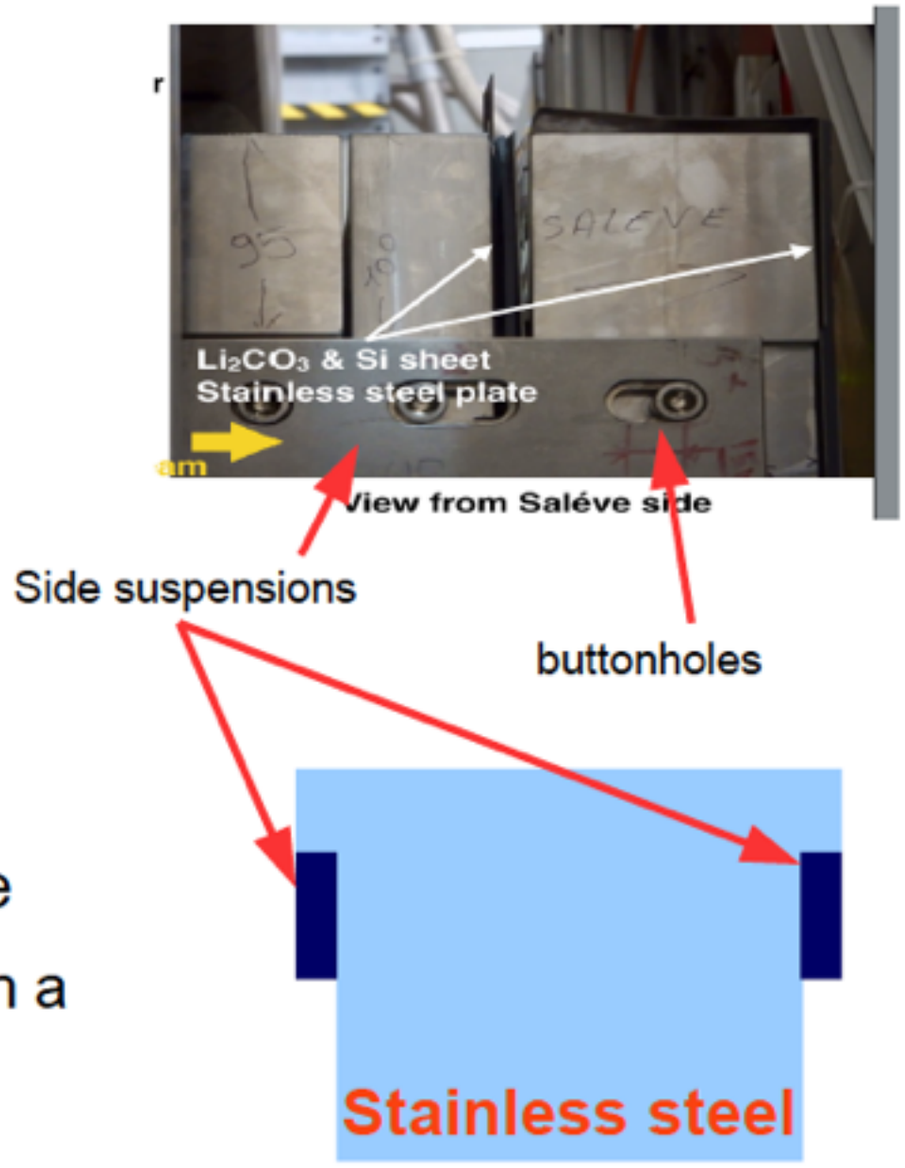
Suggestions from cheap to expensive

- Reshouffle the downstream stainless steel layers
  - Motivation: leave more material in the neutron source direction
    - Now: 5cm + 5cm + airgap + 10cm
    - Reshouffled: 10cm + 5cm + airgap + 5cm
  - Check the side bar suspensions and its buttonholes
- Remove the downstream Li layer and polyethylene
  - Simply wrong: always, put the moderator first and then a neutron absorber
- Replace the side suspensions with longer one
  - Leave more air gap between the last two layers
- Use natural borated polyethylene instead of Li



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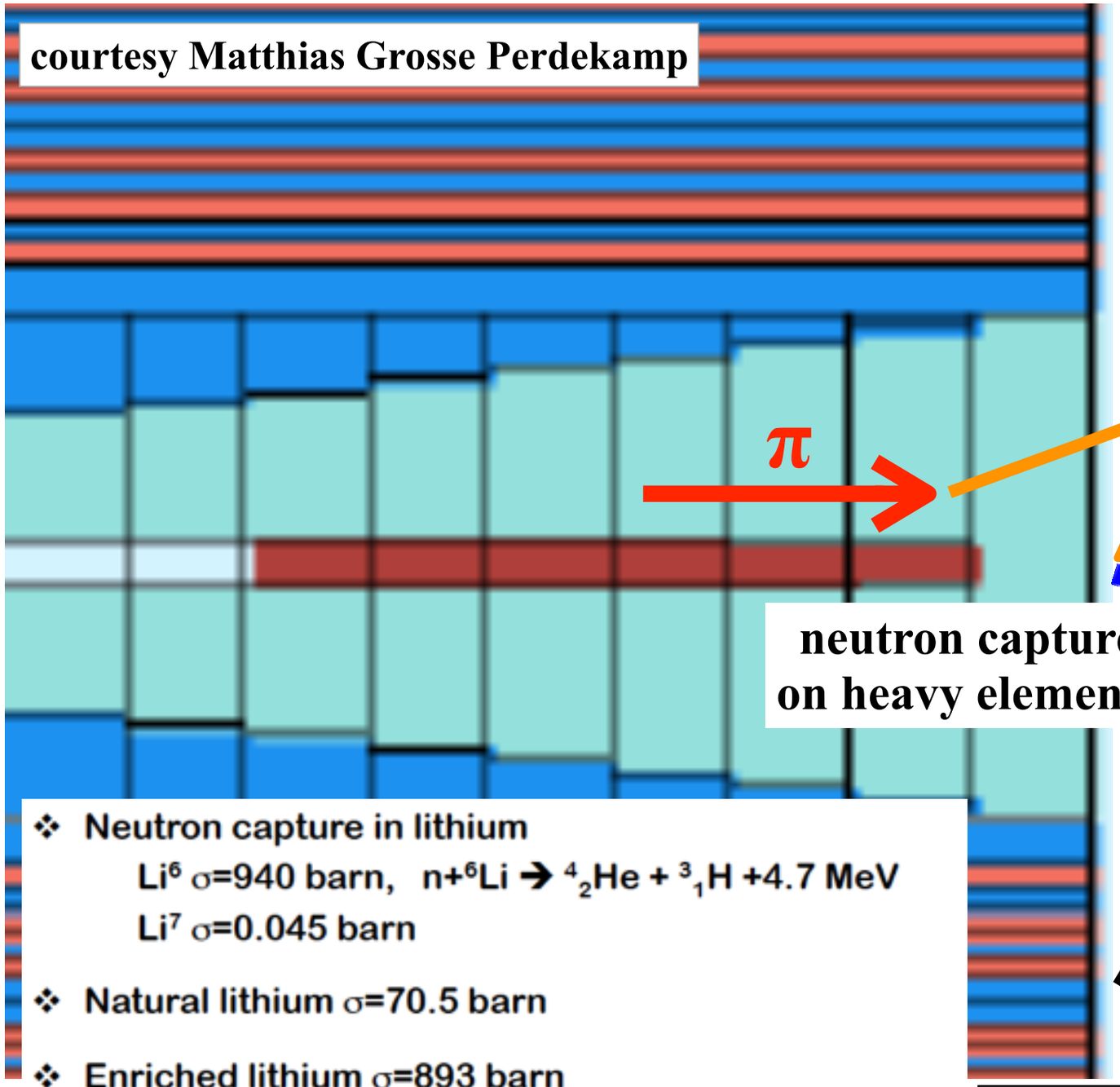
conclusions

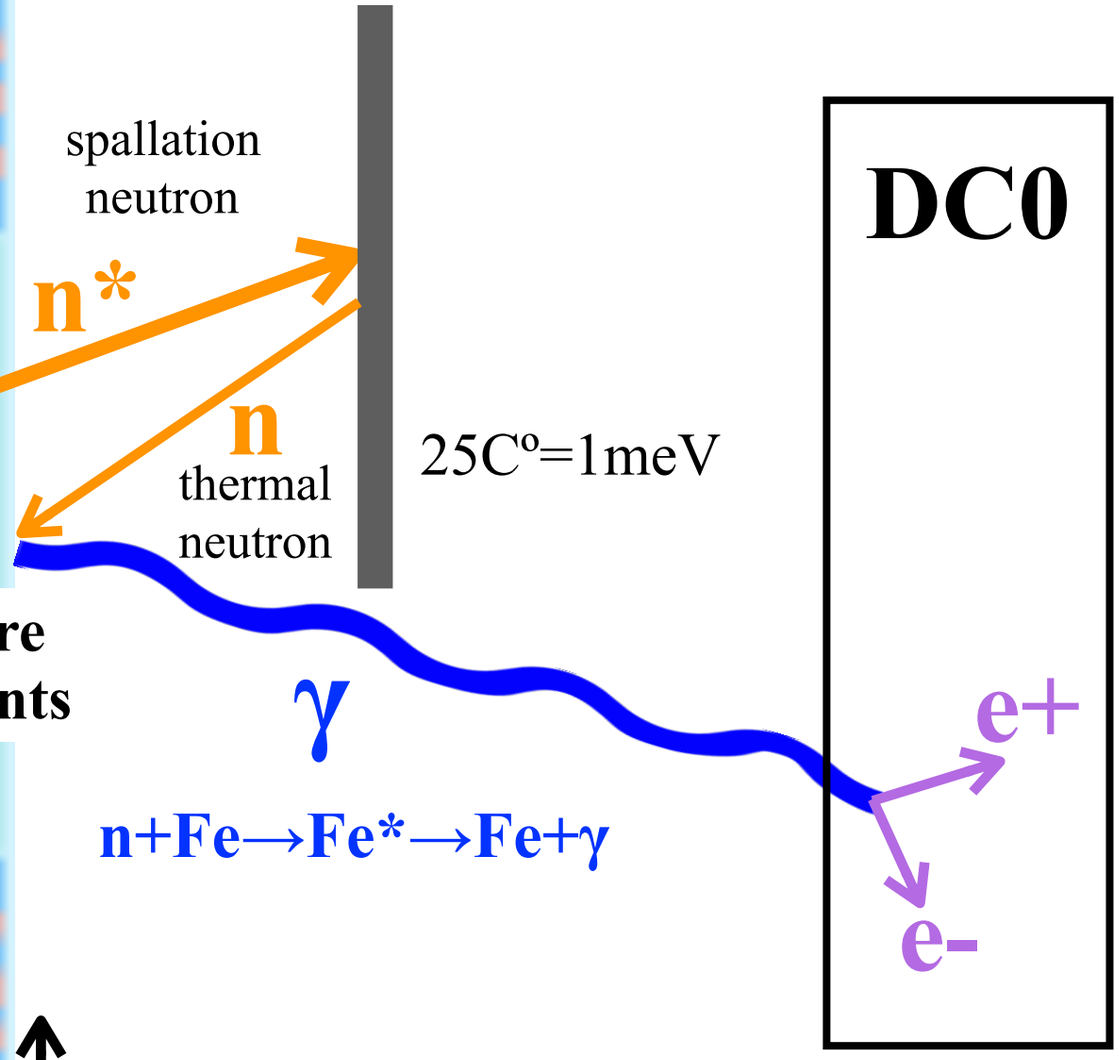
- No impressive neutrons reduction even with the best neutrons absorbers (in theory)
- No relevant difference in XY distribution
- For neutrons flux reduction, borated polyhethylene is better than carbonated lithium sheet
- For photons flux reduction, carbonated lithium is better tha borathed polyethylene
- Check of vertex, momentum resolution etc, must be done using the standard Compass simulations tools.

But the basic question is:
The high rates is due to neutrons or photons interaction?

$^6LiCO_3$: principle



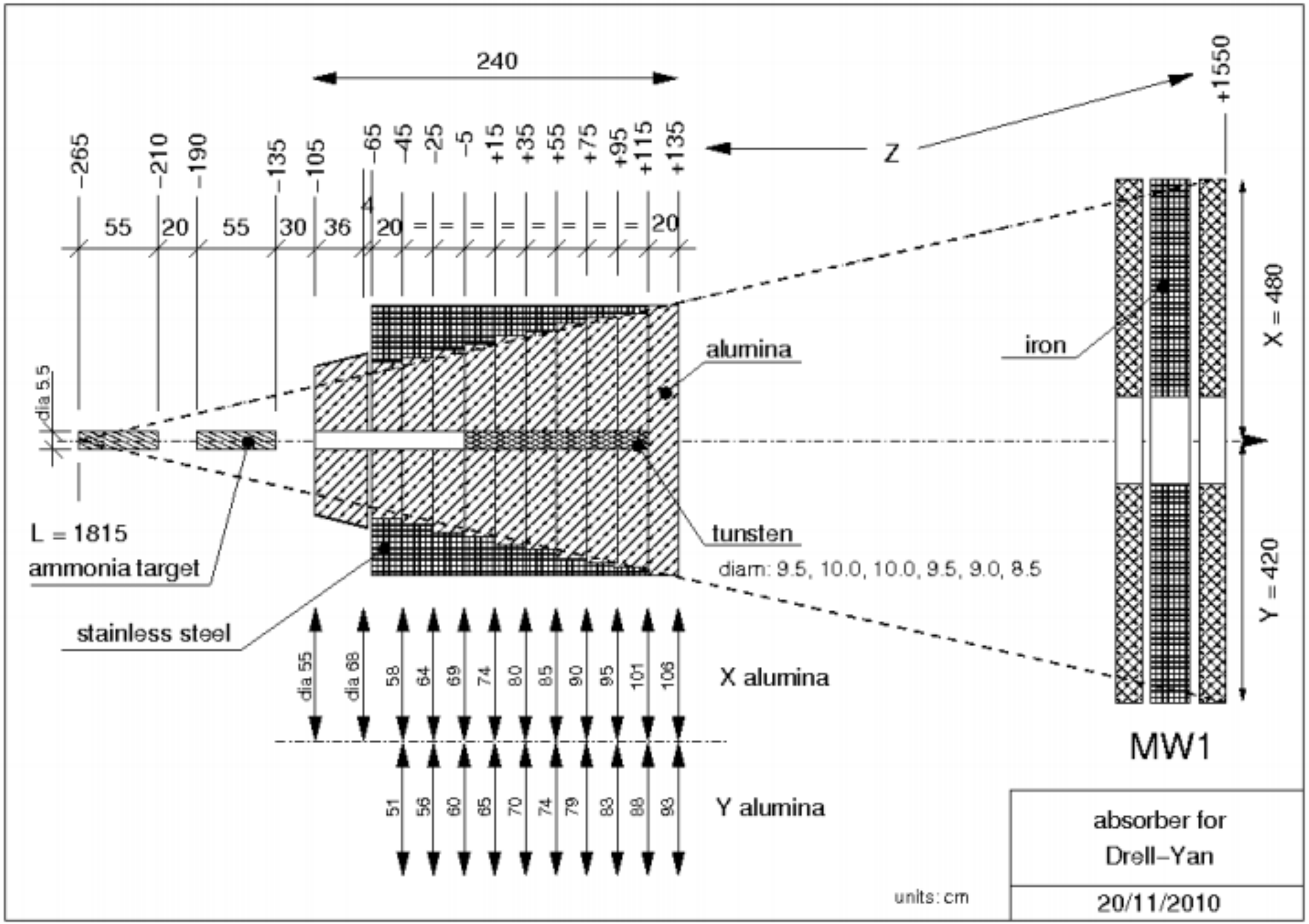
Thermalization on heavy elements
(concrete blocks, steel support frames, …)



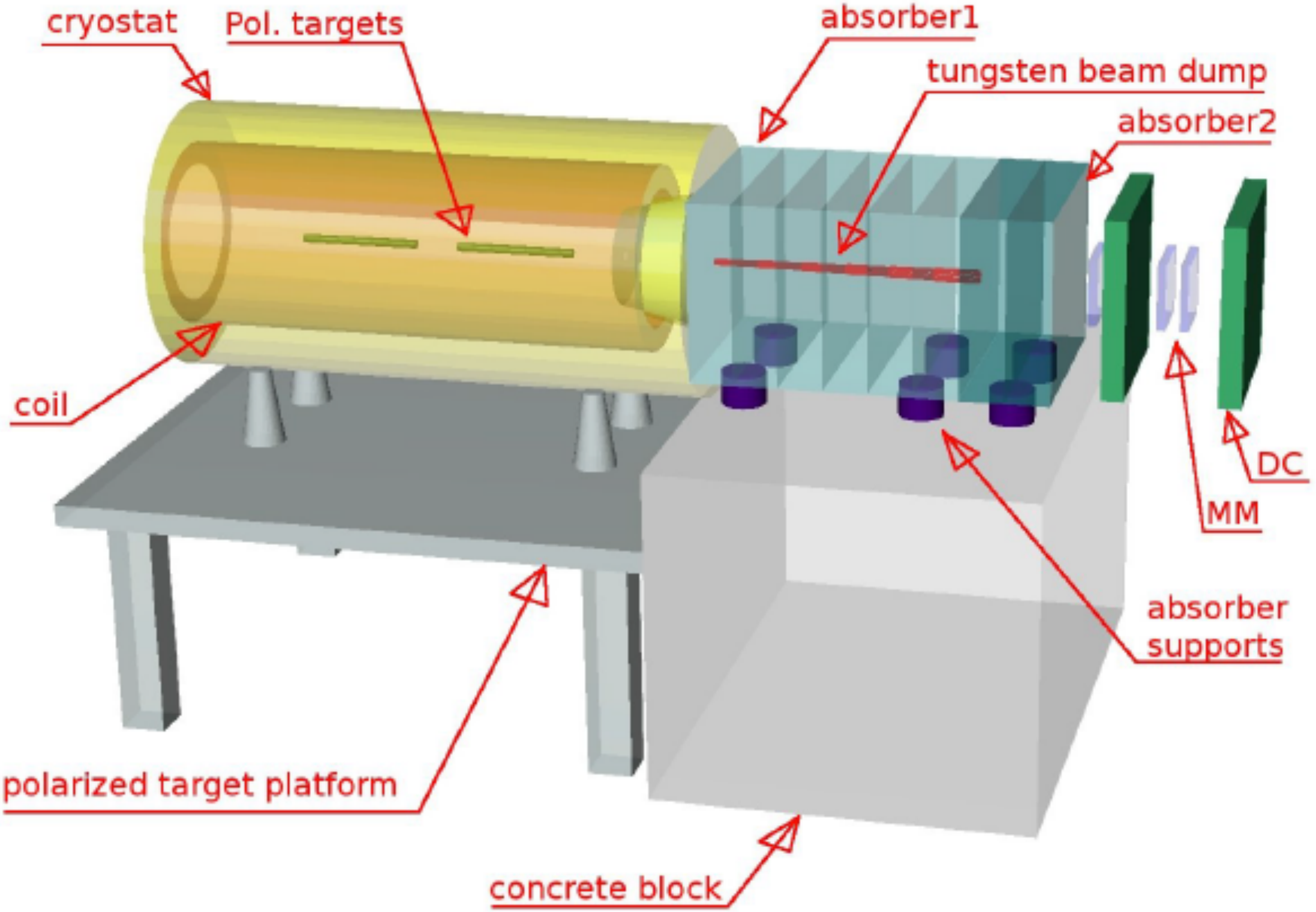
- Neutron capture in lithium
  - Li^6 σ=940 barn, $n+^6Li \rightarrow {}^4_2He + {}^3_1H + 4.7$ MeV
  - Li^7 σ=0.045 barn
- Natural lithium σ=70.5 barn
- Enriched lithium σ=893 barn
- Absorption length
  - Enriched d=1.5 mm reduce th. neutron flux to 1%
  - Natural λ=20mm reduce th. neutron flux to 1%

Insert neutron absorber here:
- Both Li and Bo are good in absorbing low-E neutrons
- **$n + {}^6Li \rightarrow {}^3H + {}^4He$: *stop in air, do not reach DC0***
- **$n + B \rightarrow B^* \rightarrow B + \gamma\_500$ keV : *reaches DC0***

Extra slides

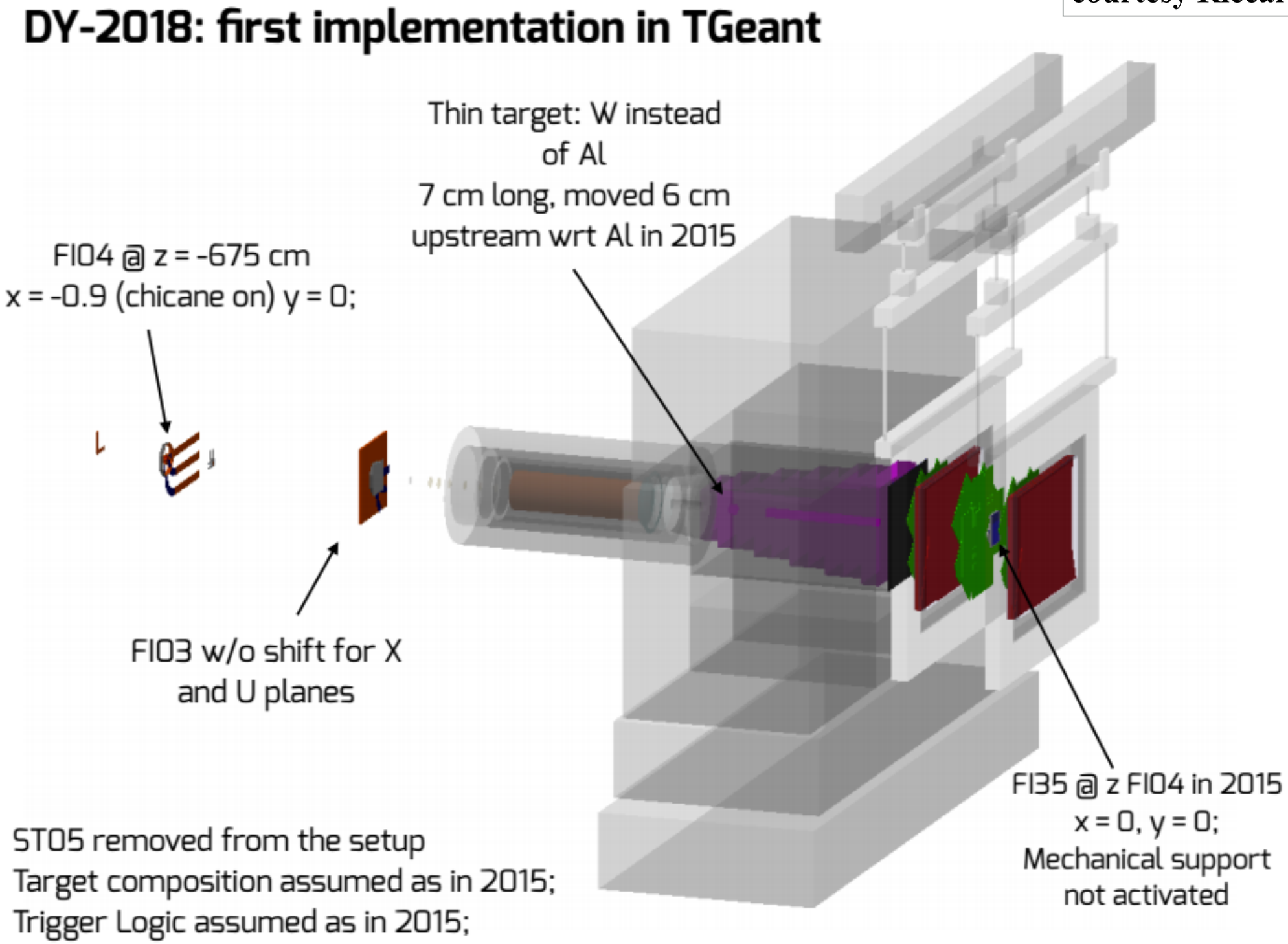

240
Z
+1550
−265
−210
−190
−135
−105
−65
−45
−25
−5
+15
+35
+55
+75
+95
+115
+135
55
20
55
30
36
4
20
20
dia 5.5
L = 1815
ammonia target
alumina
iron
tunsten
diam: 9.5, 10.0, 10.0, 9.5, 9.0, 8.5
stainless steel
X = 480
Y = 420
dia 55
dia 68
58
64
69
74
80
85
90
95
101
106
X alumina
51
56
60
65
70
74
79
83
88
93
Y alumina
MW1
absorber for
Drell–Yan
20/11/2010
units: cm

2015 setup (Al target missing)



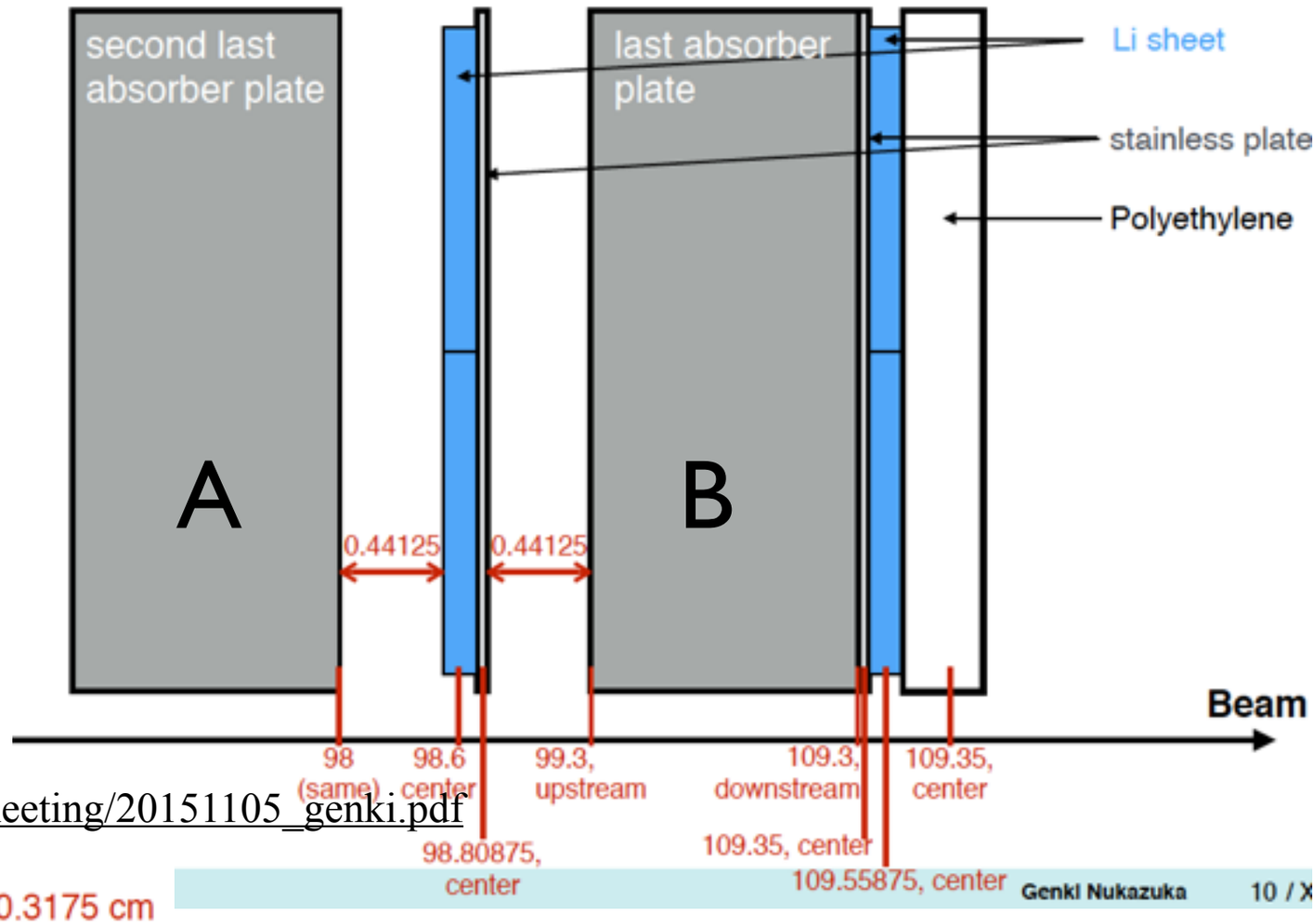
2018: proposed modifications

courtesy Riccardo Longo

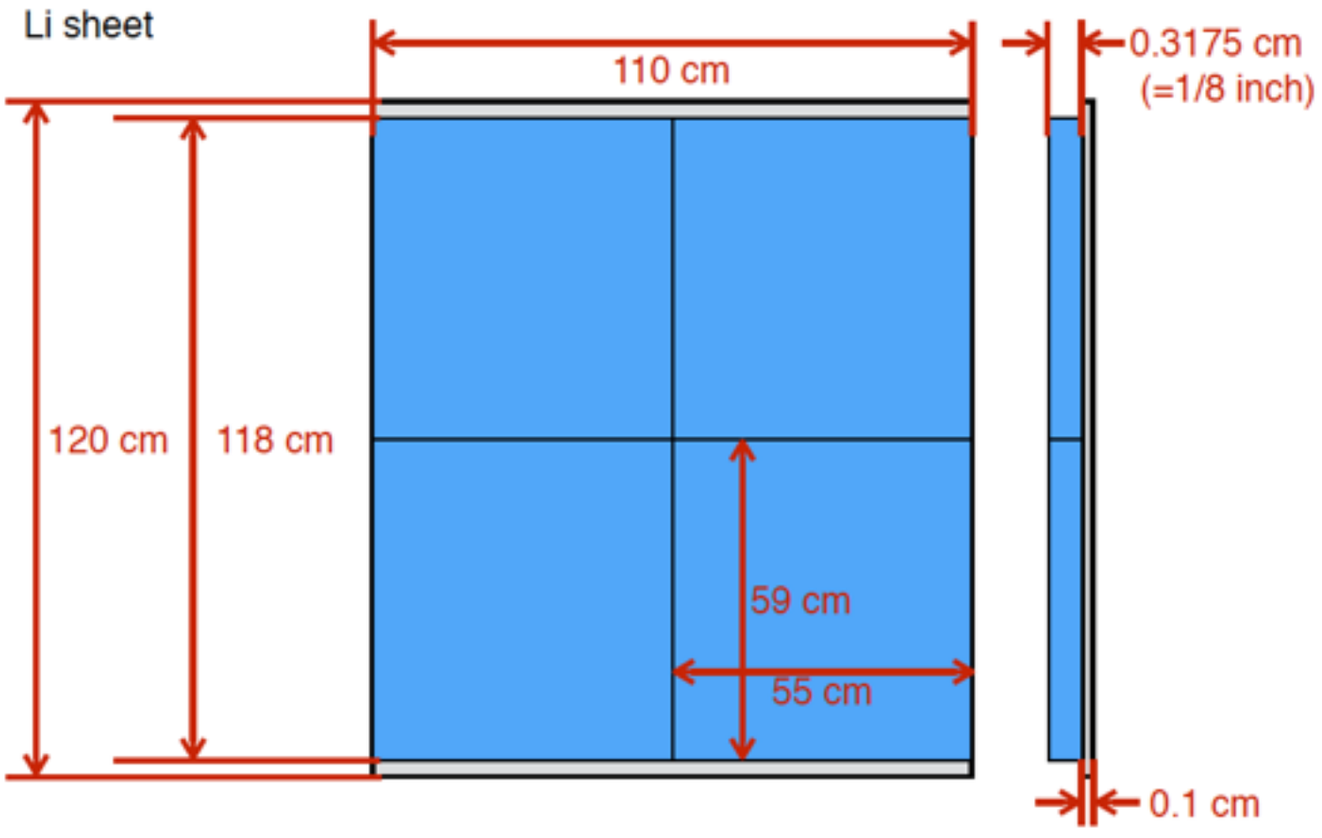


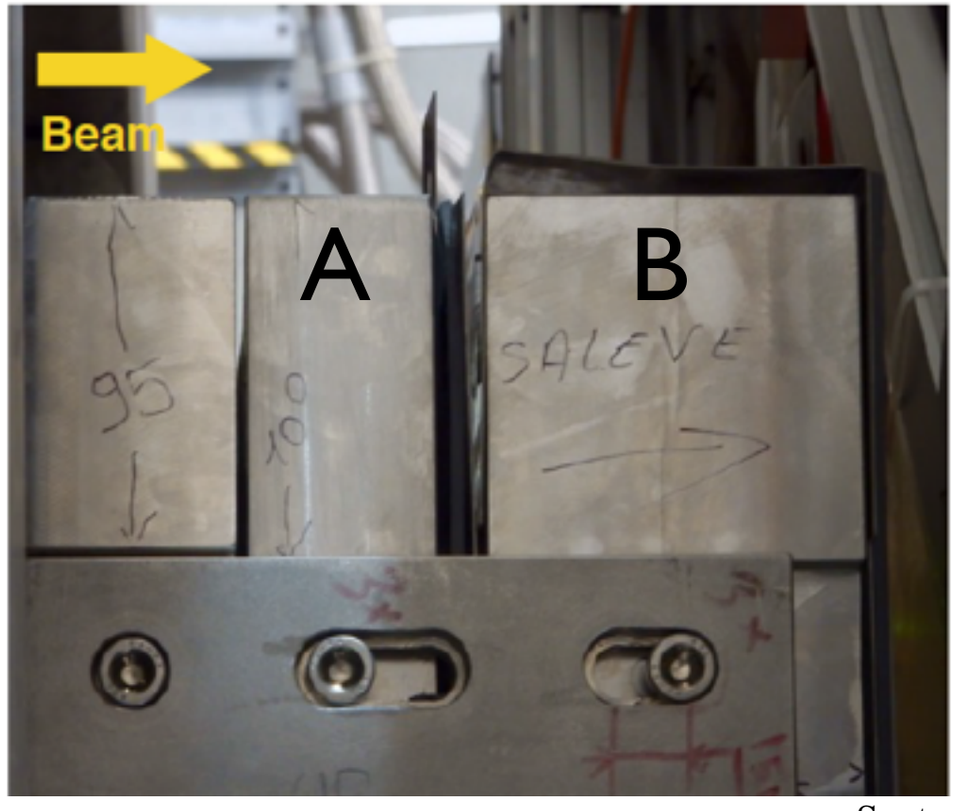
^{6}Li absorber 2015

photos & sketch courtesy Genki Nukazuka



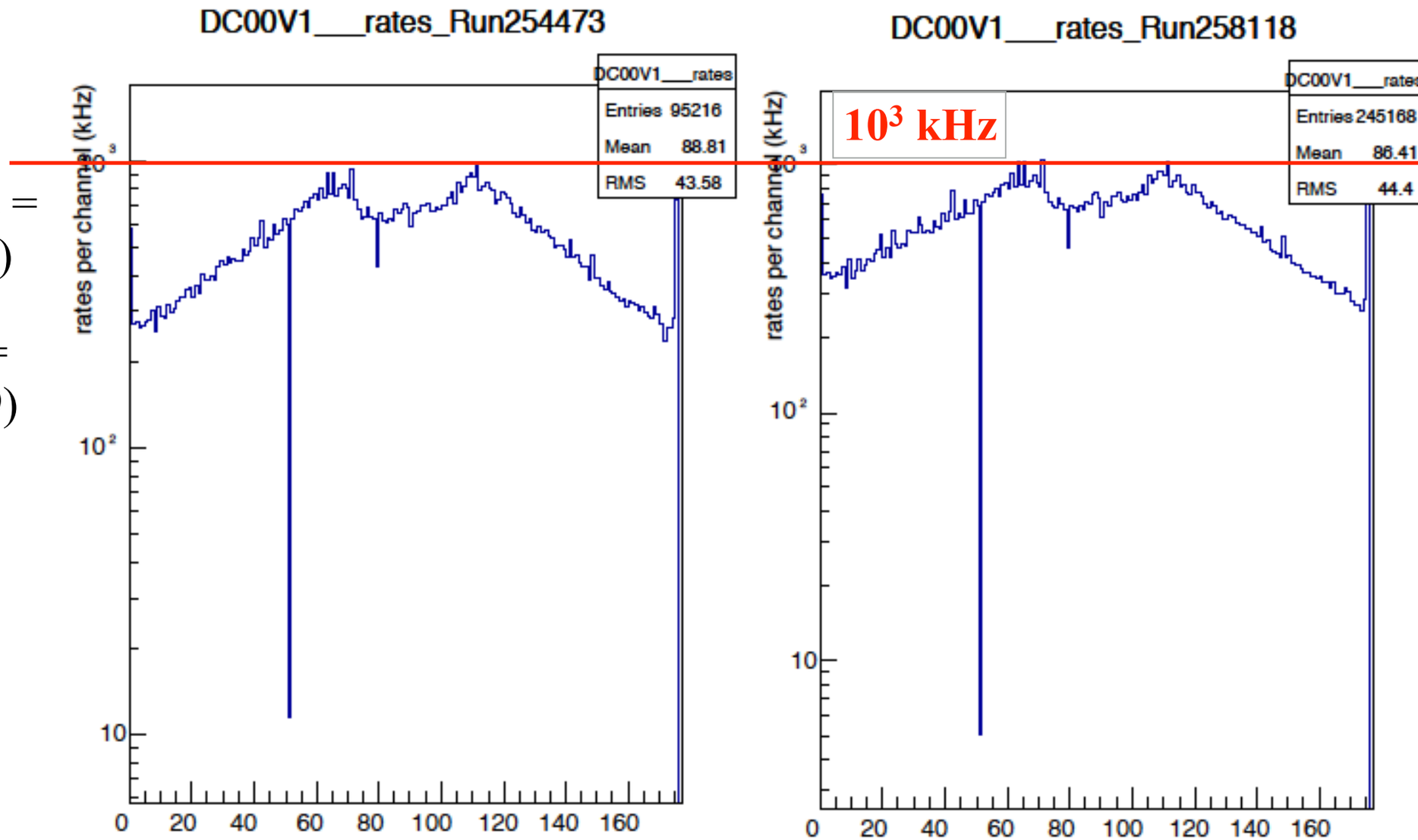
https://twiki.cern.ch/twiki/pub/Compass/Drell_Yan/Subgroupmeeting/20151105_genki.pdf





Reference runs before / after 6Li installation

- Before: 254473, ion2 = $3.93 \cdot 10^8$ (2014-11-29)
- After: 258118, ion2 = $4.10 \cdot 10^8$ (2015-06-09)



Bibliography: talks by AM, Stephane or Genki in spring & summer 2015

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https://twiki.cern.ch/twiki/pub/Compass/Drell_Yan/Subgroupmeeting/Genki_Efficiency_vs_Hit_rate_DC00.pdf

After removal of 2nd layer of Li sheet (June 10, 2015)