Status update of FLUKA radiation study of new VAX installation in CMS & ATLAS

Preliminary results

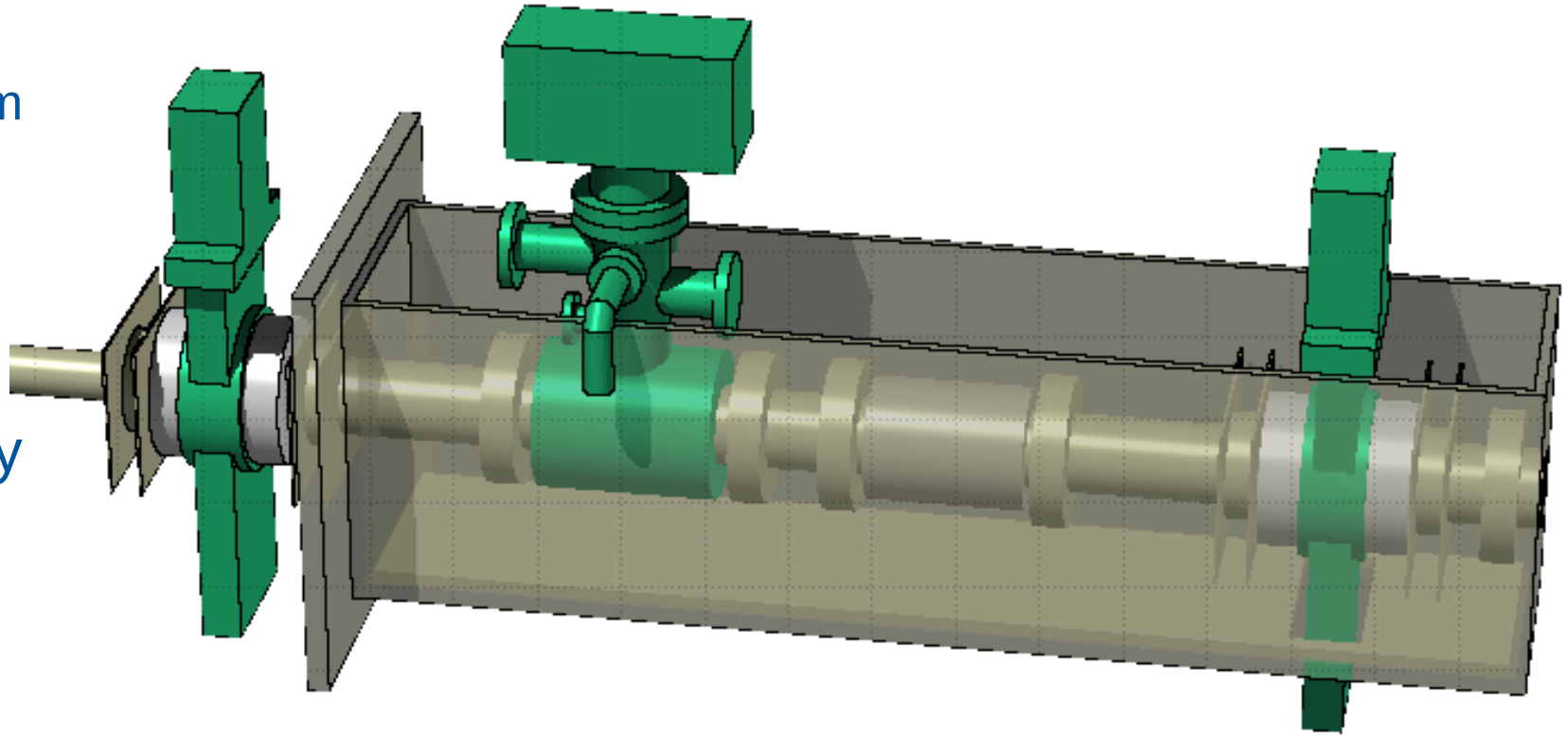
Ida Bergstrom, Heinz Vincke (HSE/RP)

Outline

- FLUKA implementation of VAX
- Preliminary results for activation study of CMS

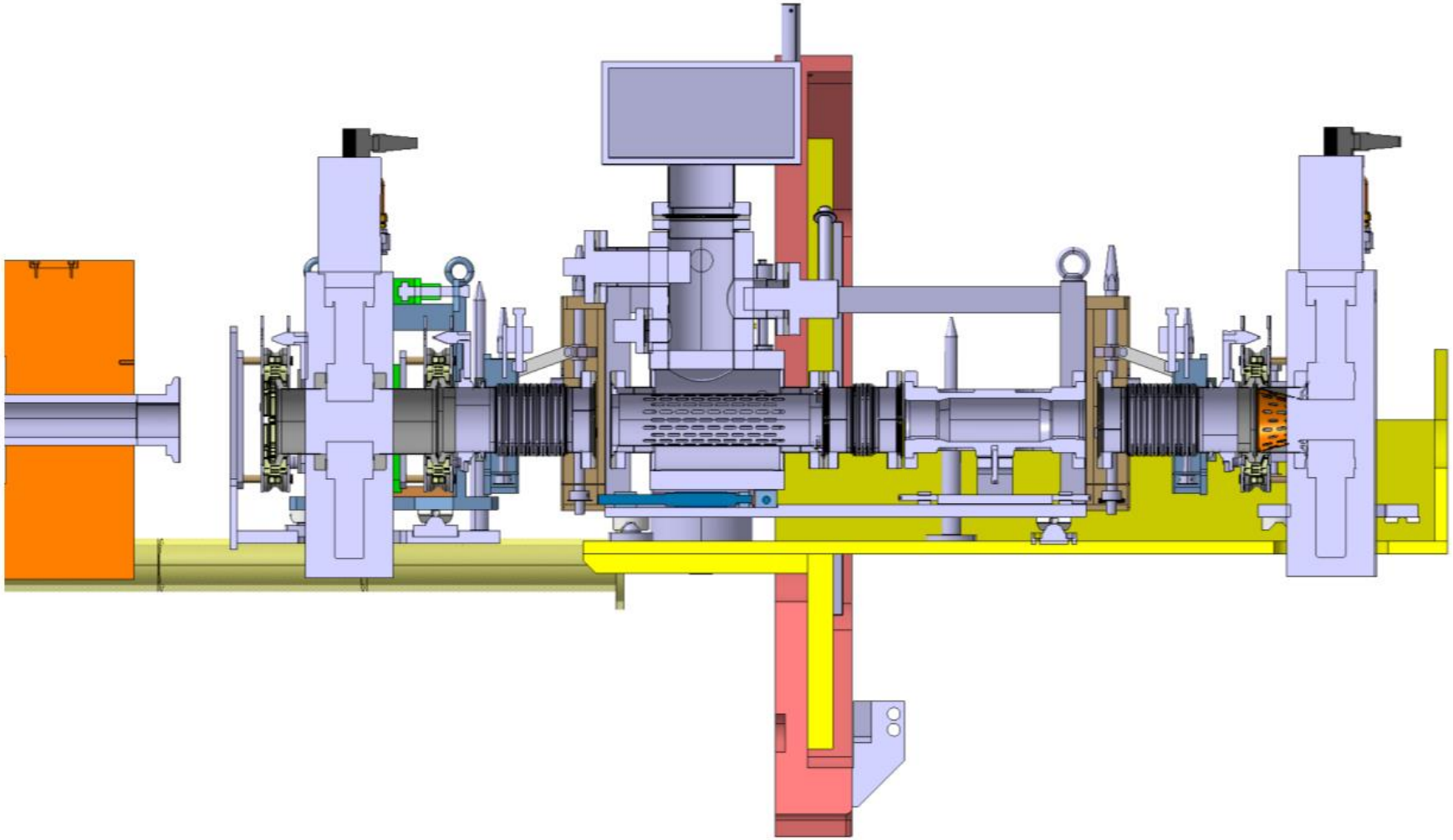
The VAX (2.1) model [1/3]

- 293.4 kg material
  - 181.8 kg aluminium A2219
  - 111.6 kg stainless steel 304L
- Based on model by L.Krzempek



The VAX (2.1) model [2/3]

Model by L.Krzempek (TE-VSC-DLM)



10kg Alu2219 compensation 3.97 g/cm^3

24 kg SS304L compensation for missing mass in VAX (in reality part is aluminium)

12 kg SS304L + 5 kg Alu2219 combined material for BPM, 6.5 g/cm^3 (Cylinder instead of block)

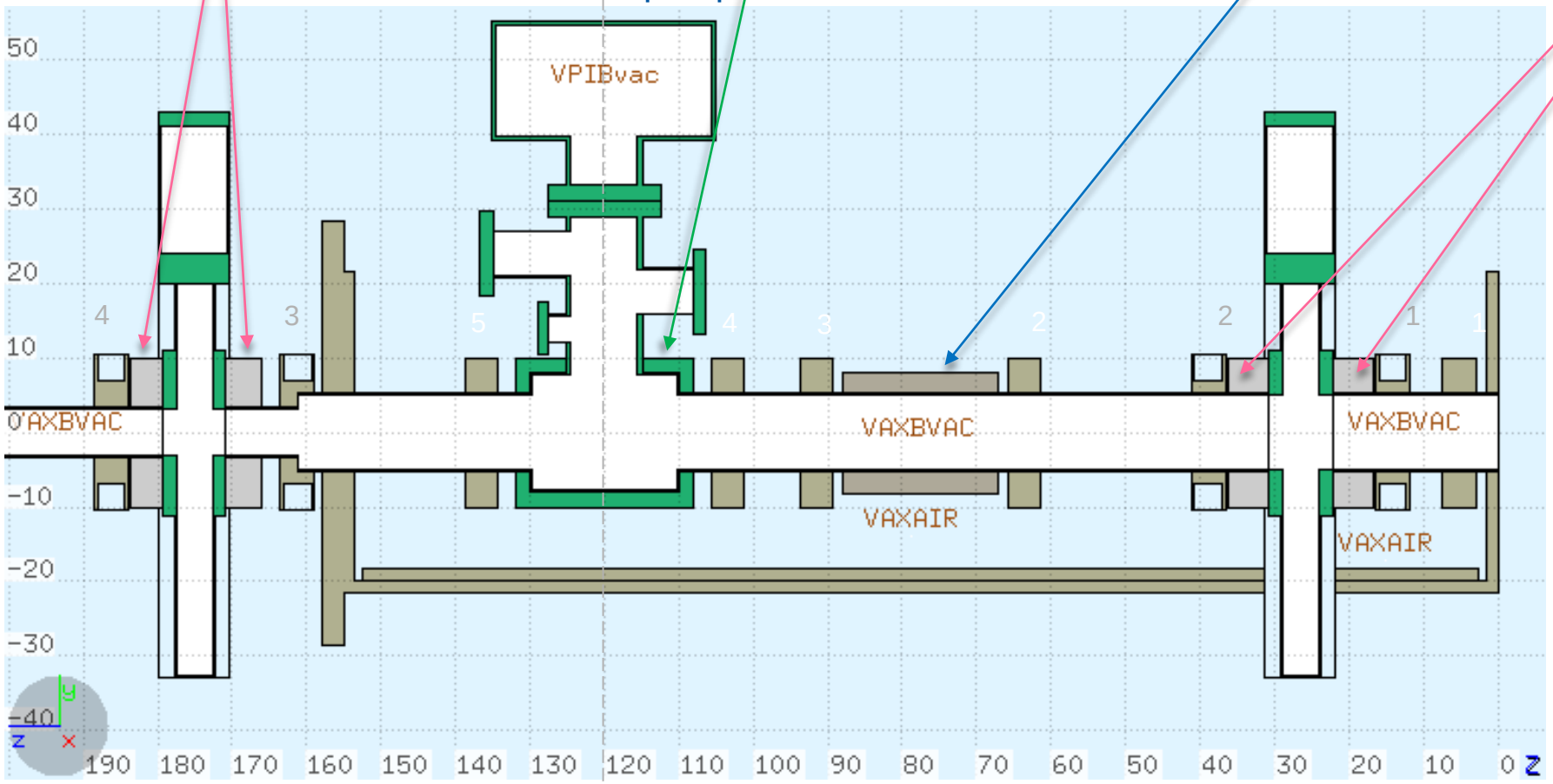
10kg Alu2219 compensation 3.97 g/cm^3

Gate Valve

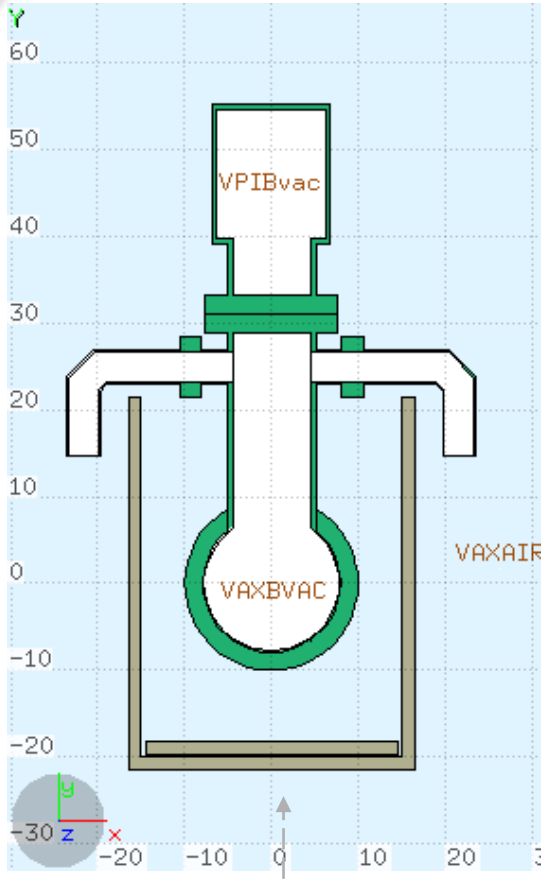
VAX & Ion pump

BPM

Gate Valve

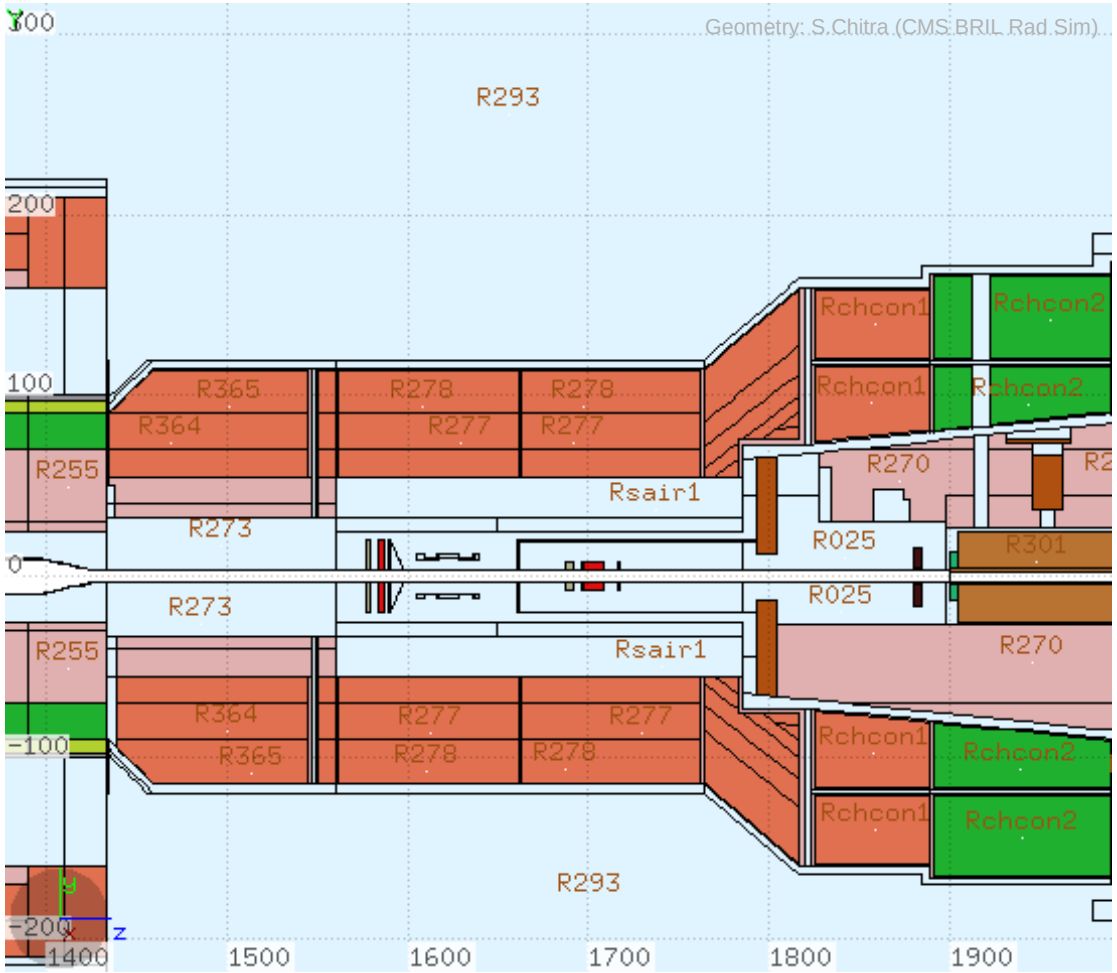


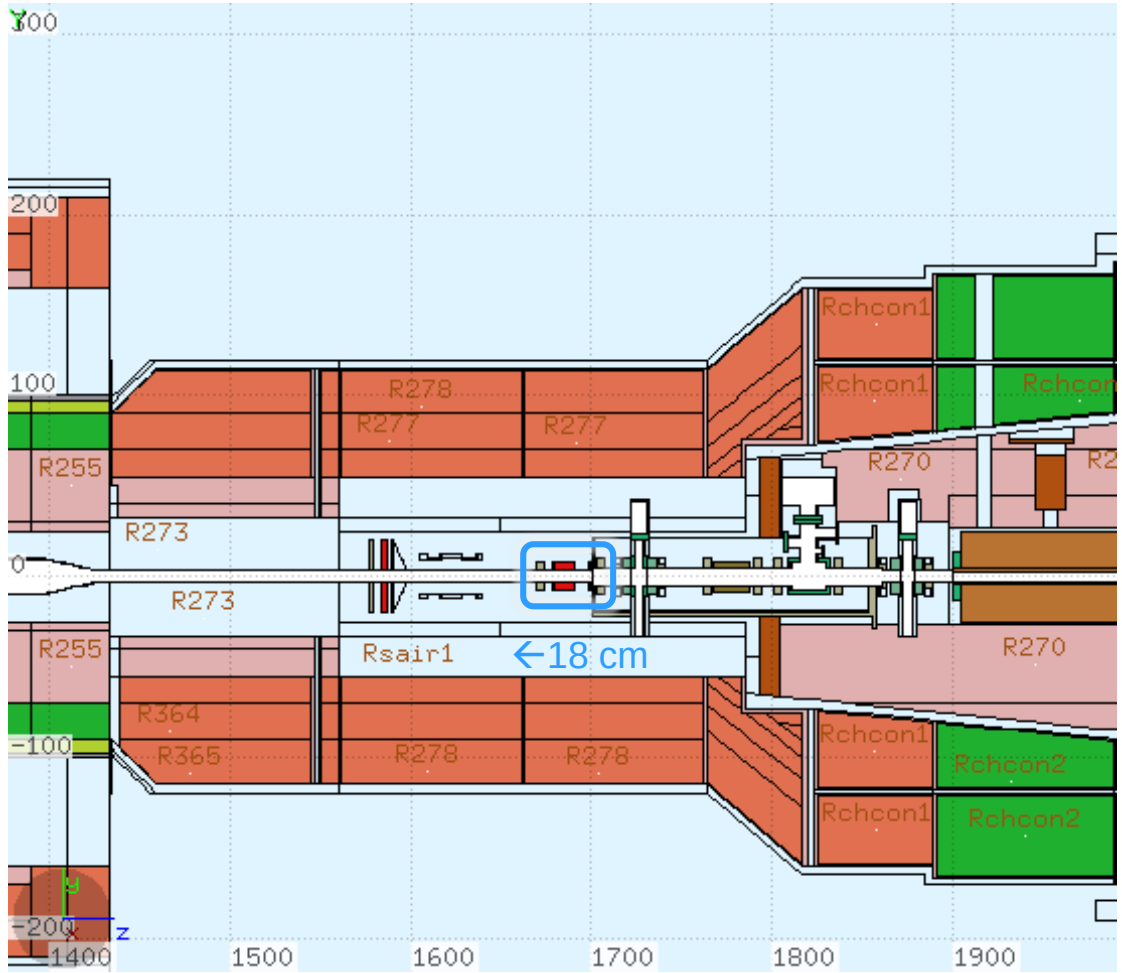
VAX & Ion pump
Front view



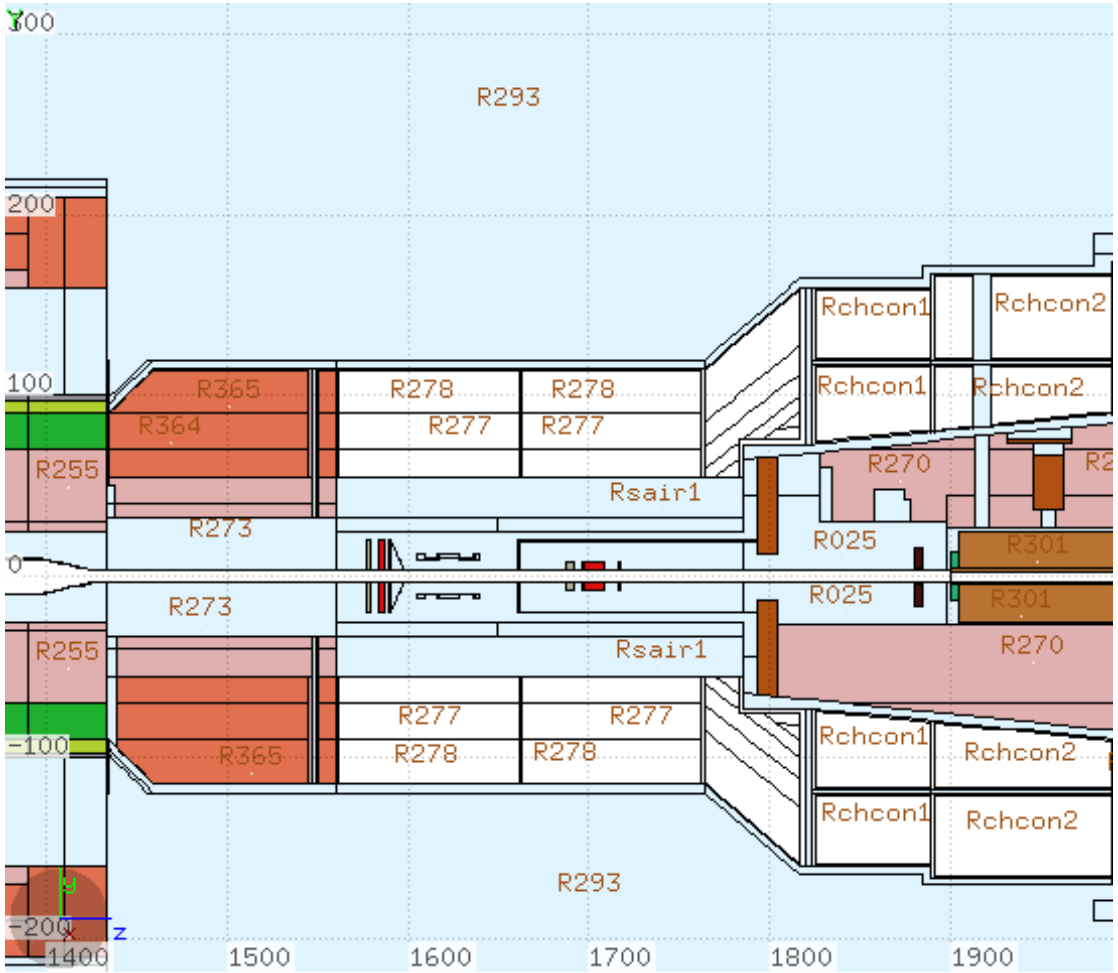
Missing: 30 kg frame for VAX+BPM

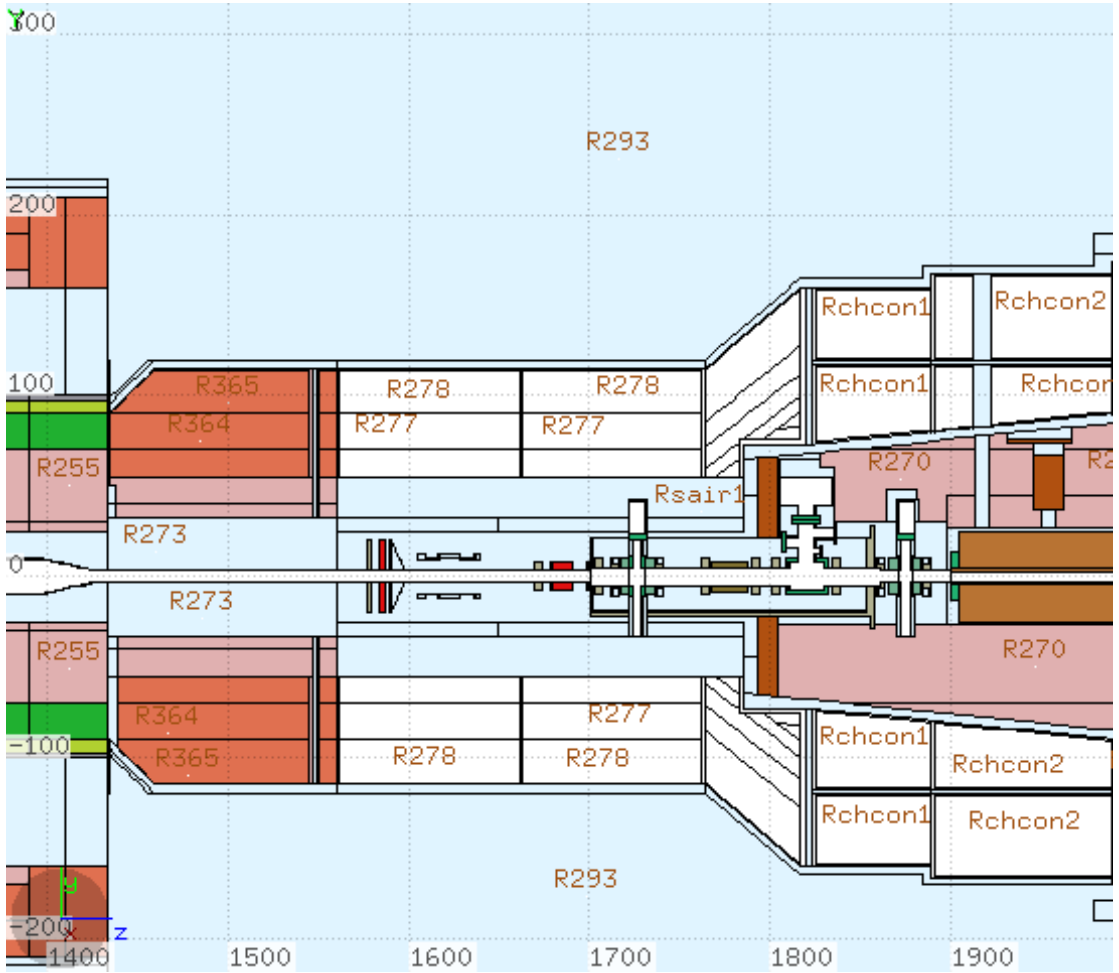
VAX installation in CMS





Rotational Shielding (RS) fully open



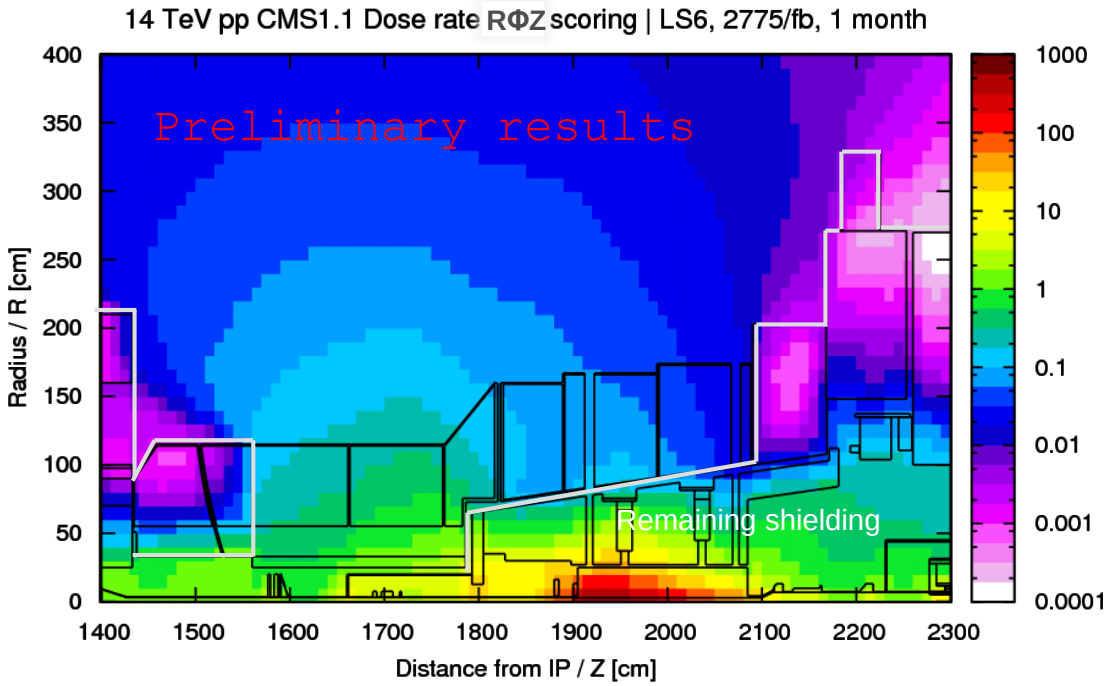


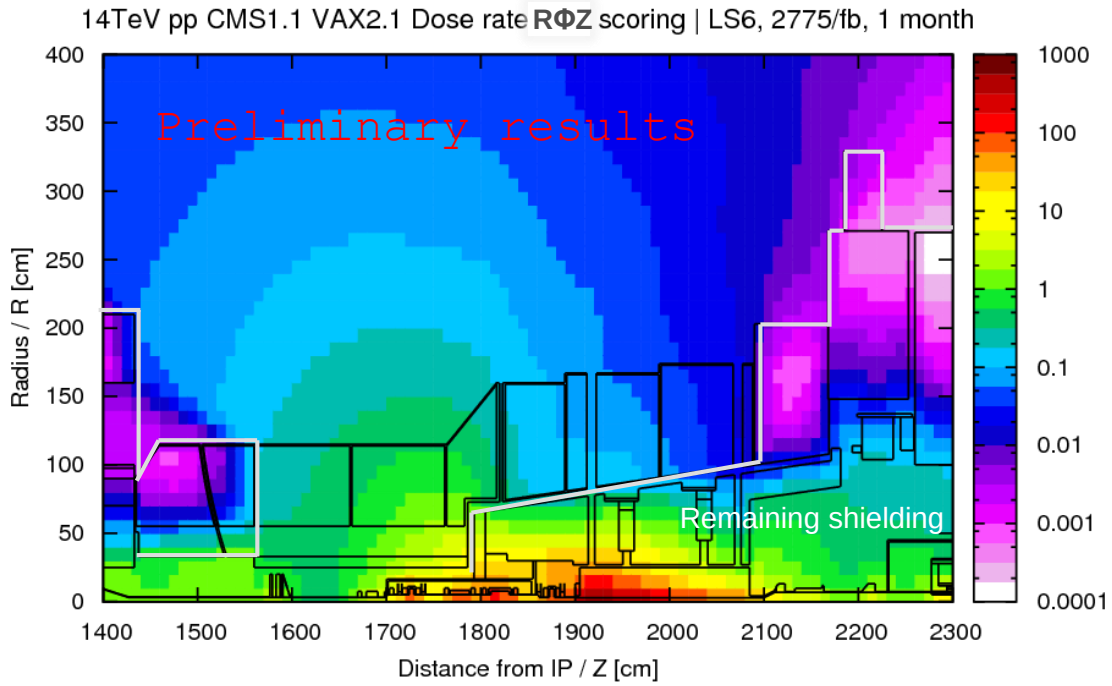
Irradiation assumptions

- Integrated lumi: 300/fb per year in HL-LHC
  - 3 years operation, 1 year shutdown
  - Previous contribution (total 320/fb) ignored.
    H*(10) in HL- shutdowns increase by factor 5-6 compared to LS3[#].
- Peak lumi: 7.5E34 $cm^{-2}s^{-1}$ (levelling)
- 7+7 TeV pp-collisions, 75 mb inelastic cross section
- Cooldown: 1 day, 1 month, 6 months, 1 year

(#) see scaling factor in extra slides

H*(10) in mSv/h, LS6

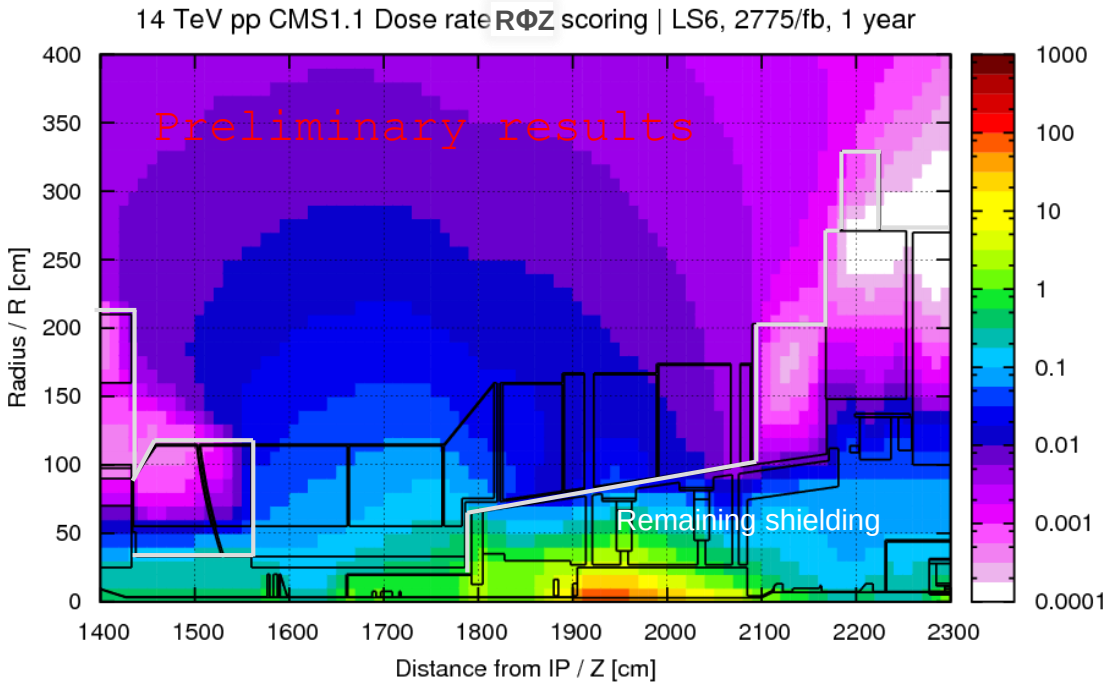


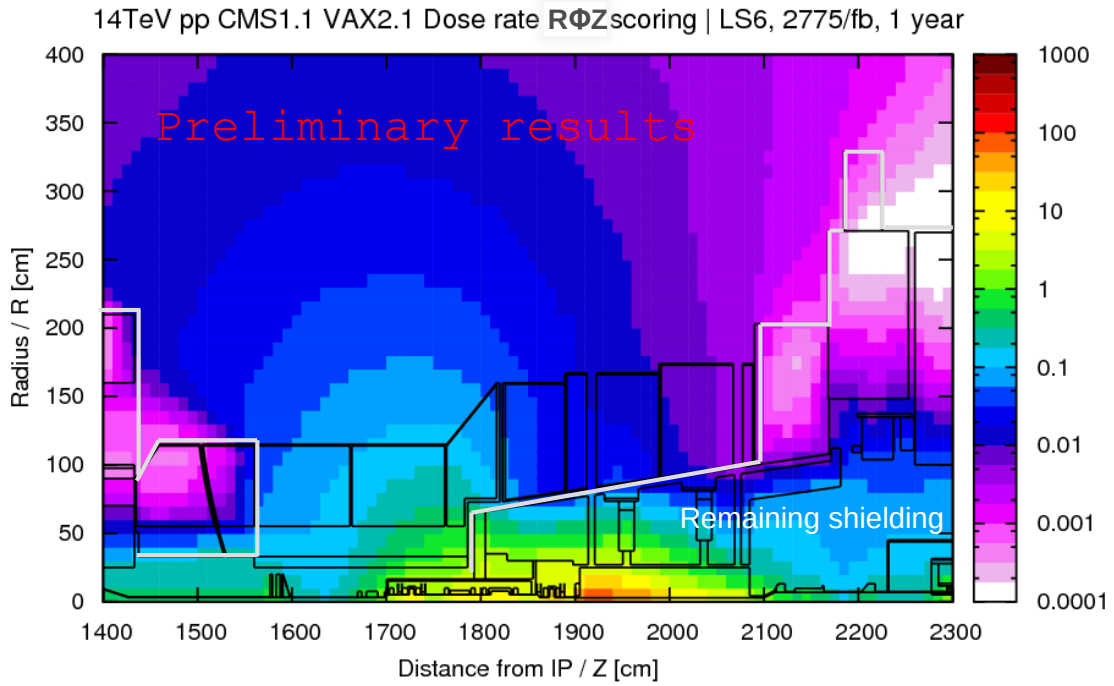


Rotating shielding open…
1 month cooling in LS6

…with VAX installed

H*(10) in mSv/h, LS6

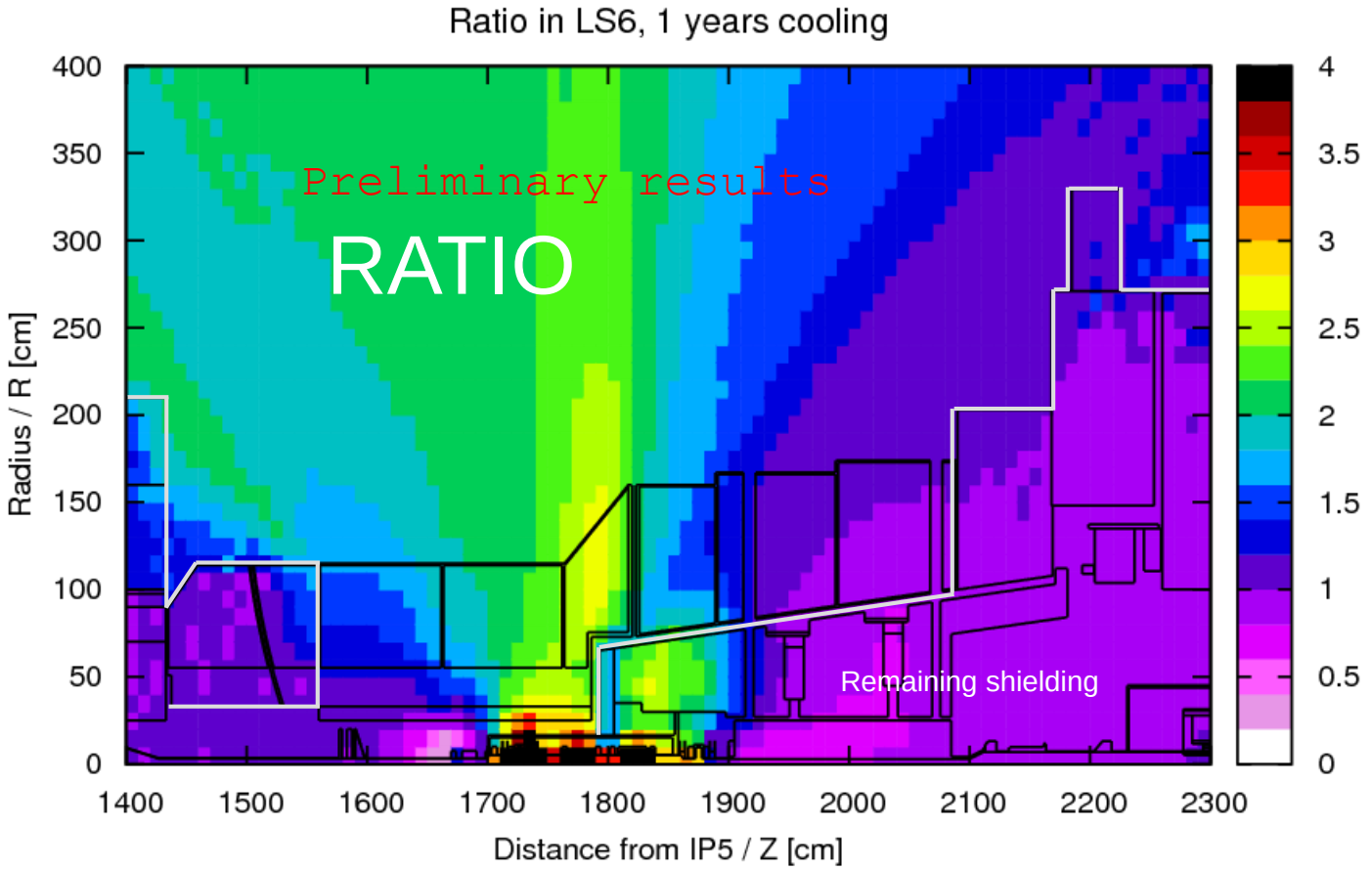




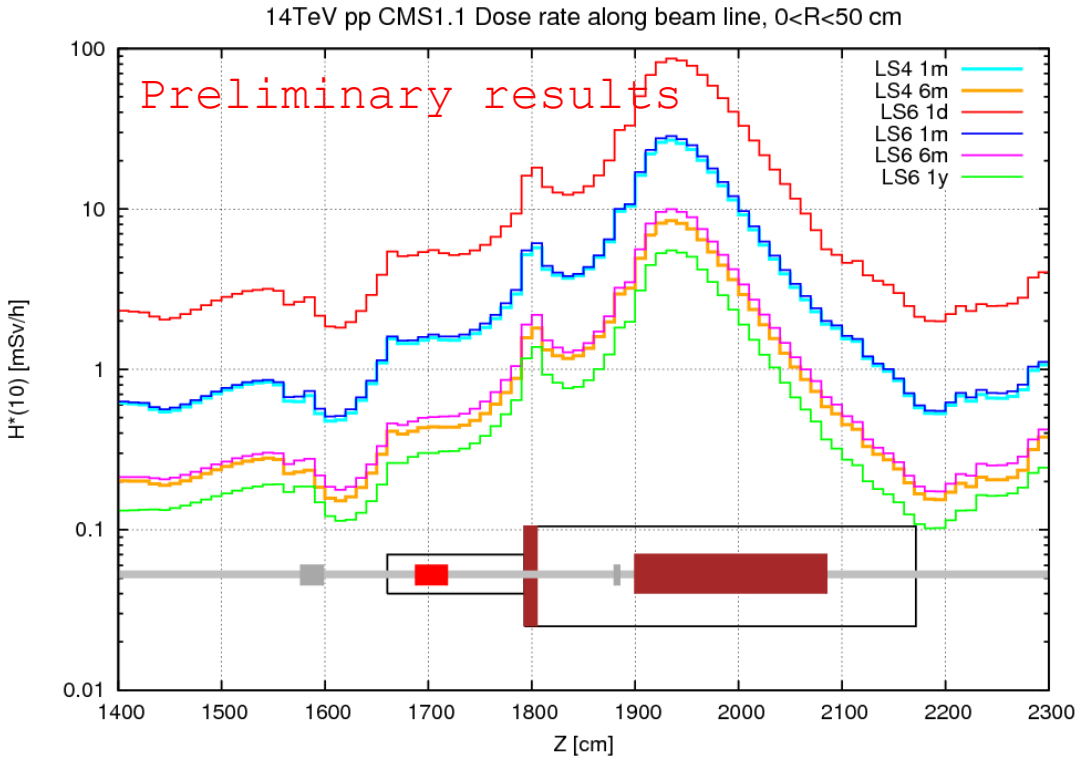
Rotating shielding open…
1 year cooling in LS6

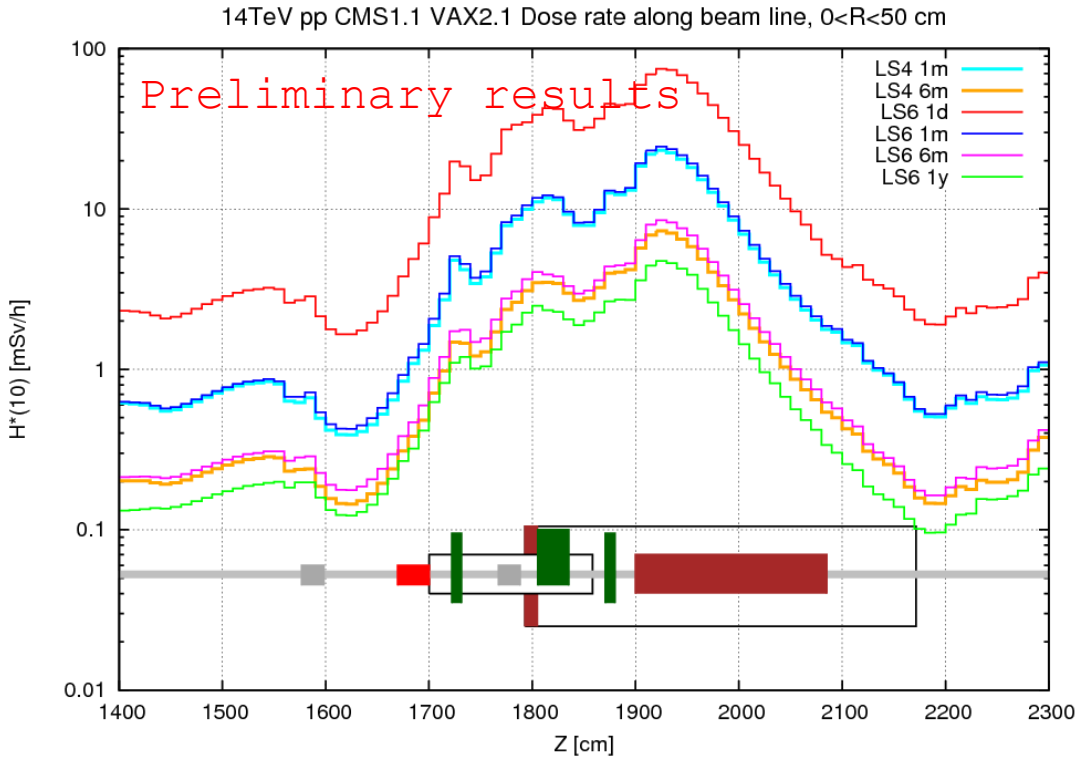
…with VAX installed

Ratio of H*(10) in LS6



H*(10) in mSv/h along beam line [1/2]

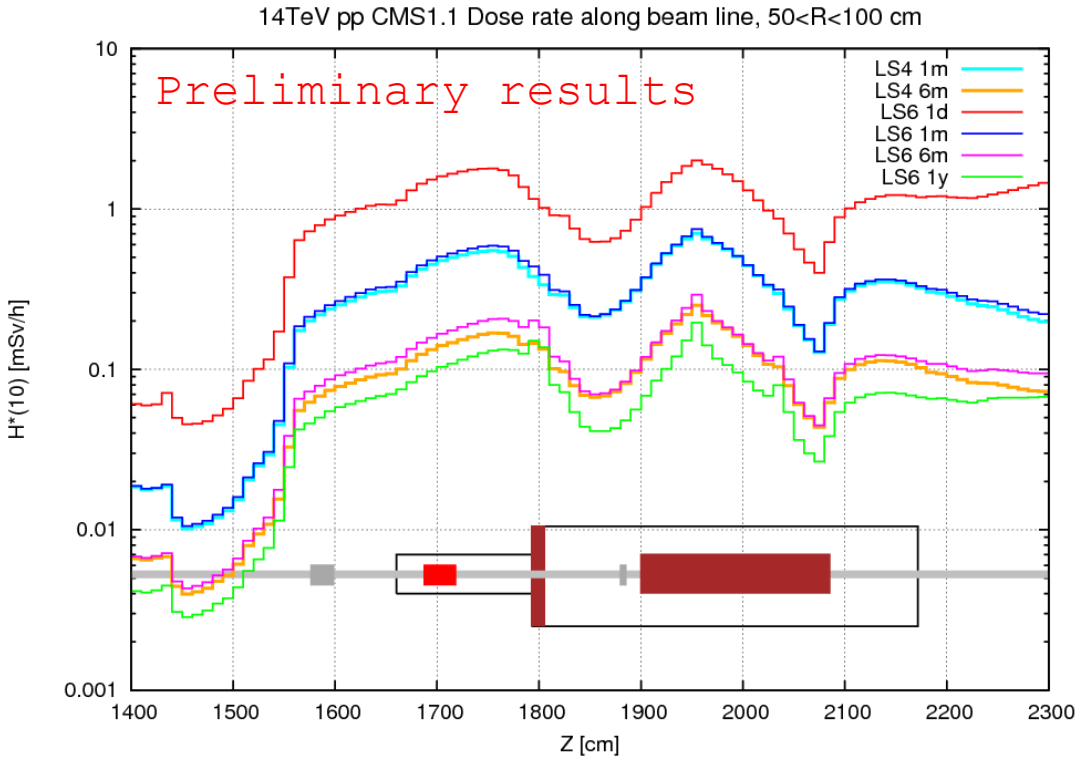


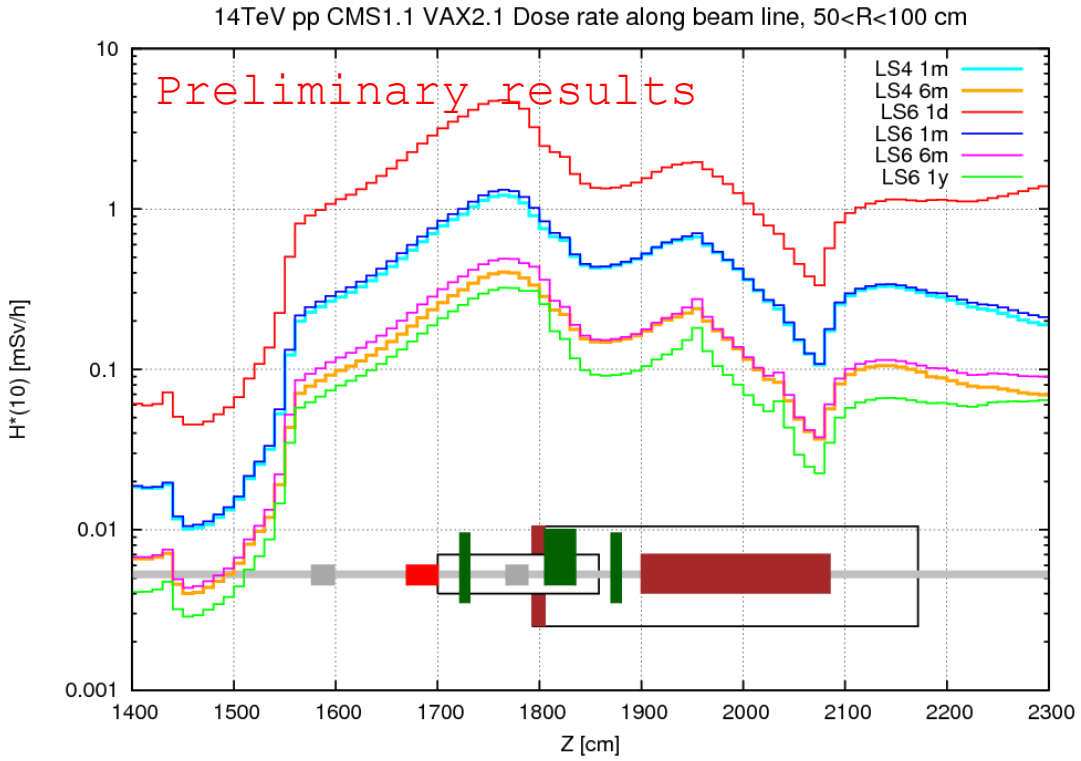


Average dose rate 25 cm from beam line with RS open…

…and with VAX installed.

H*(10) in mSv/h along beam line [2/2]

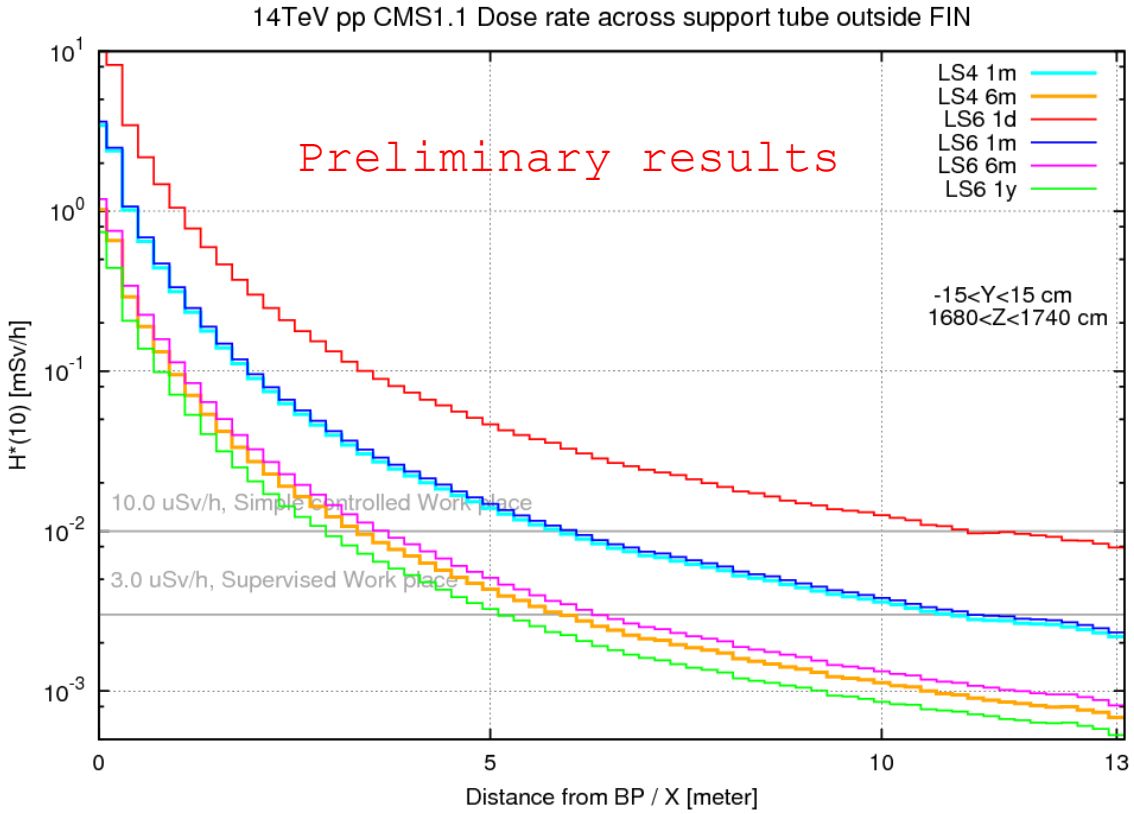


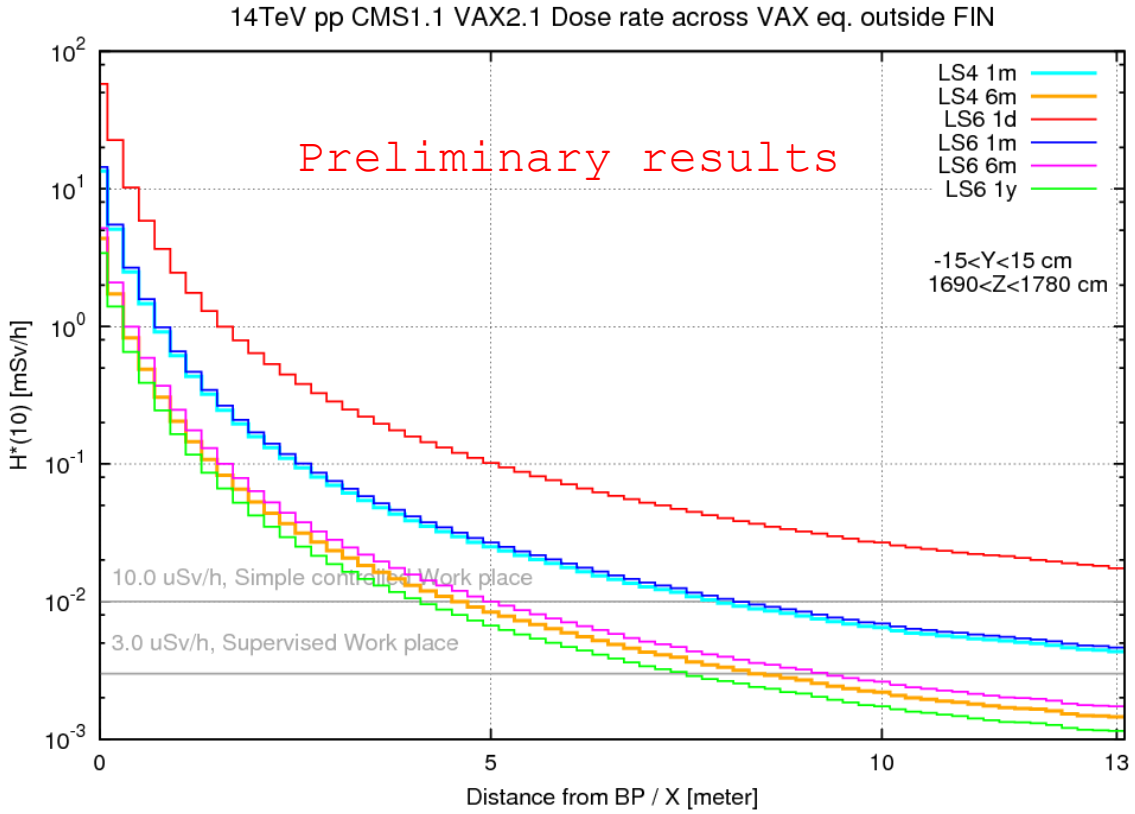


Average dose rate 75 cm from beam line with RS open…

…and with VAX installed.

H*(10) in mSv/h across beam line [1/2]

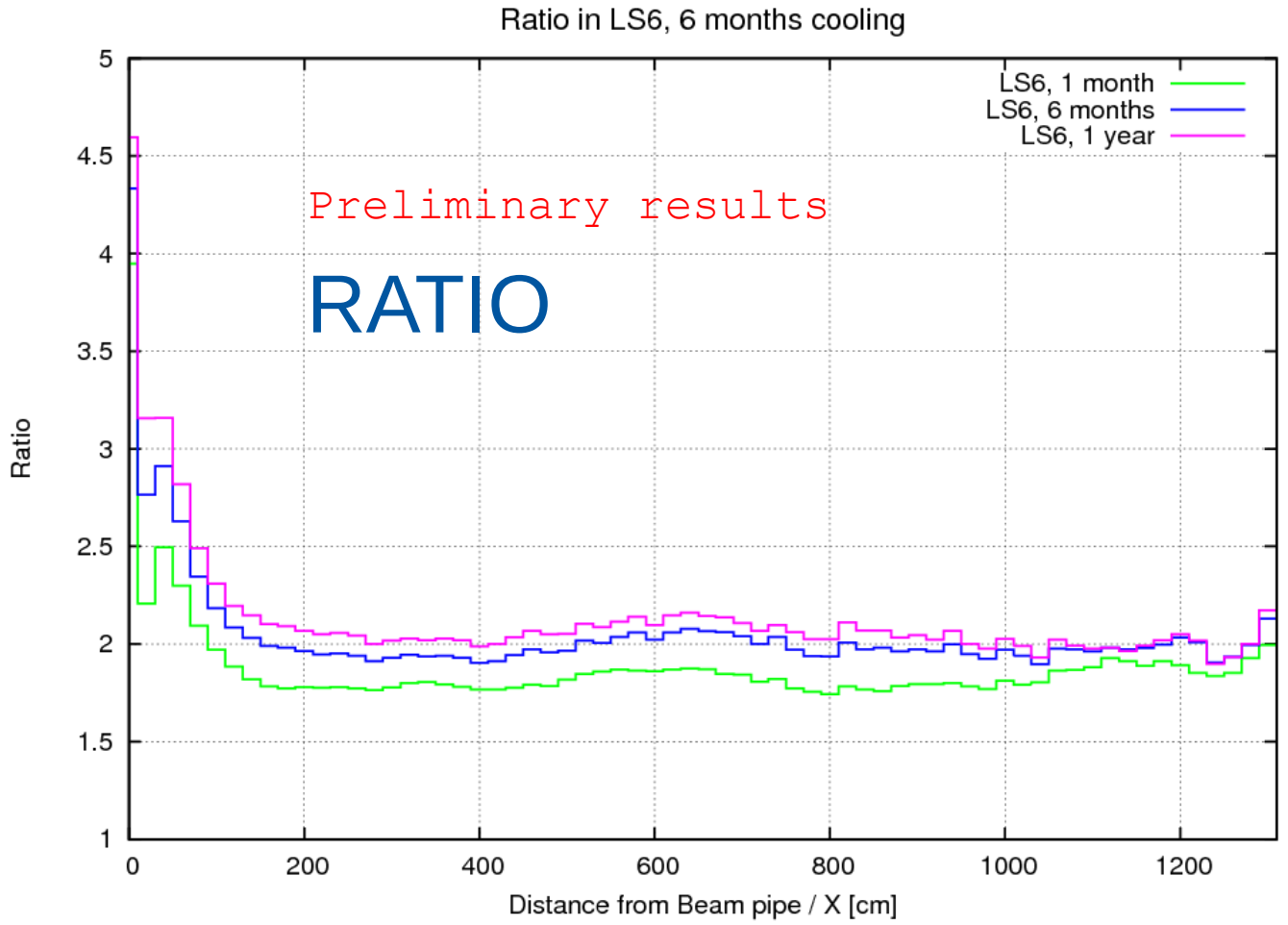




Dose rate in CMS cavern in hottest region with RS open

…. and with VAX installed.

Ratio of H*(10) across beam line [2/2]



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CMS Scaling factors – maximum

(Based on average res. dose rate R<100 cm)

CMS (Maximum luminosity for HL-LHC)

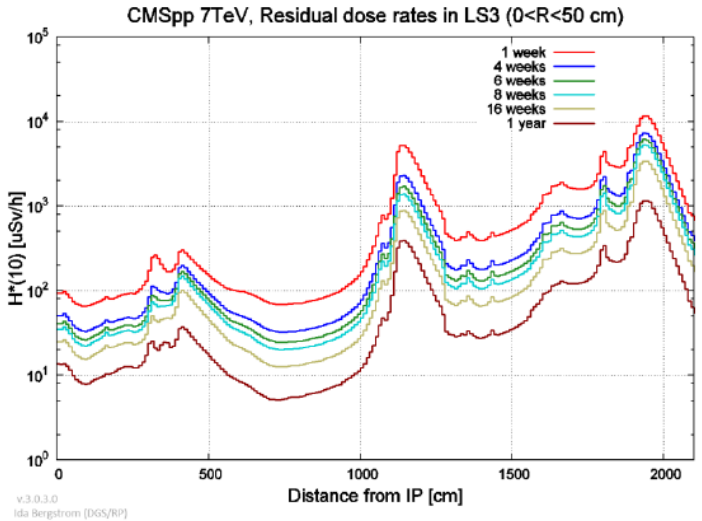
Maximum ratio of dose rates #/LS1	1 week	4 weeks	6 weeks	8 weeks	16 weeks	1 year
LS2	2.0	2.0	2.1	2.2	2.5	3.4
LS3	3.1	3.2	3.3	3.4	3.8	5.0
LS4 (1281 fb^{-1})	17	18	18	19	20	26
3000 fb^{-1}	17	18	18	19	23	34

For Comparison: ATLAS (Maximum luminosity for HL-LHC)

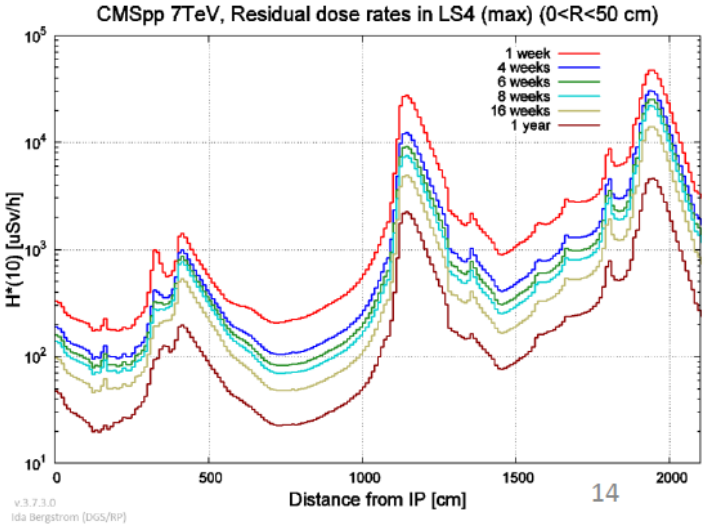
Maximum ratio of dose rates LS#/LS1	1 week	4 weeks	6 weeks	8 weeks	16 weeks	1 year
LS2	1.9	1.9	1.9	2.0	2.3	2.7
LS3	2.9	2.9	3.0	3.1	3.3	4.0
LS4 (1281 fb^{-1})	15	16	16	17	18	21
3000 fb^{-1}	15	16	16	17	21	27

- **CMS results consistent with ATLAS**
- The small difference in *maximum scaling factors* are possibly due to bulky material at various points along the beam line (see next slides)

CMS Dose rates profile – LS3



CMS Dose rates profile – LS4 (Maximum Luminosity)



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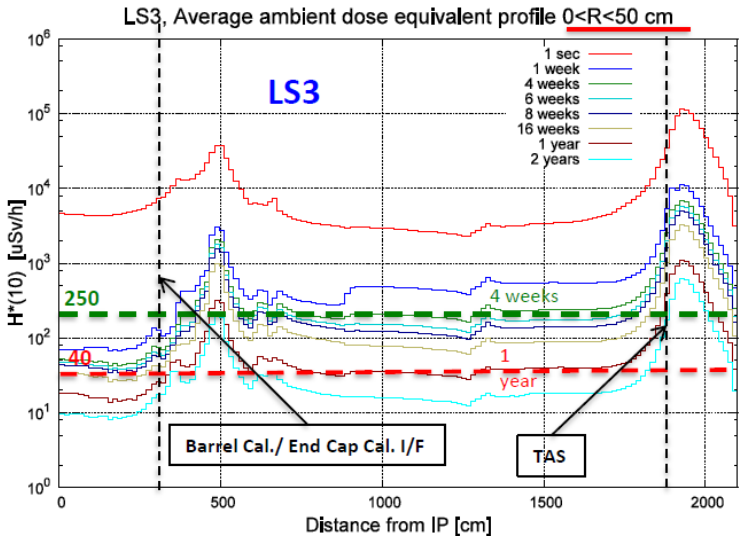
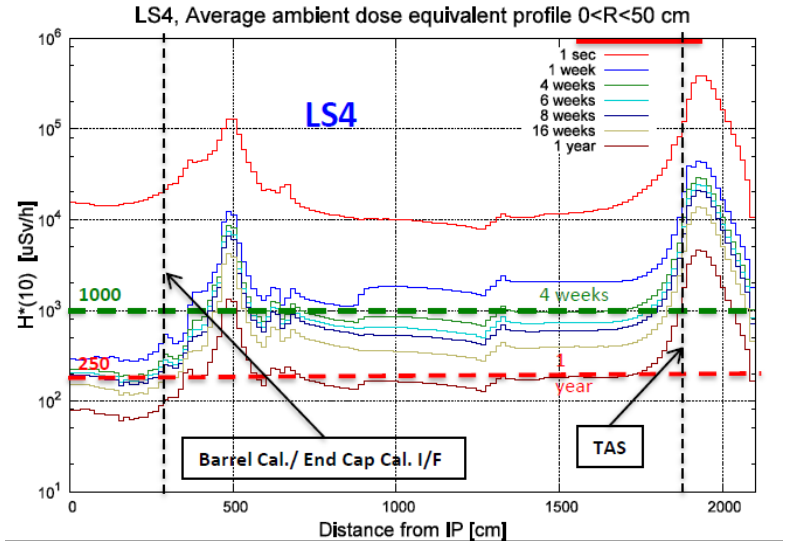
ATLAS Dose rates profile – LS3 – LS4





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