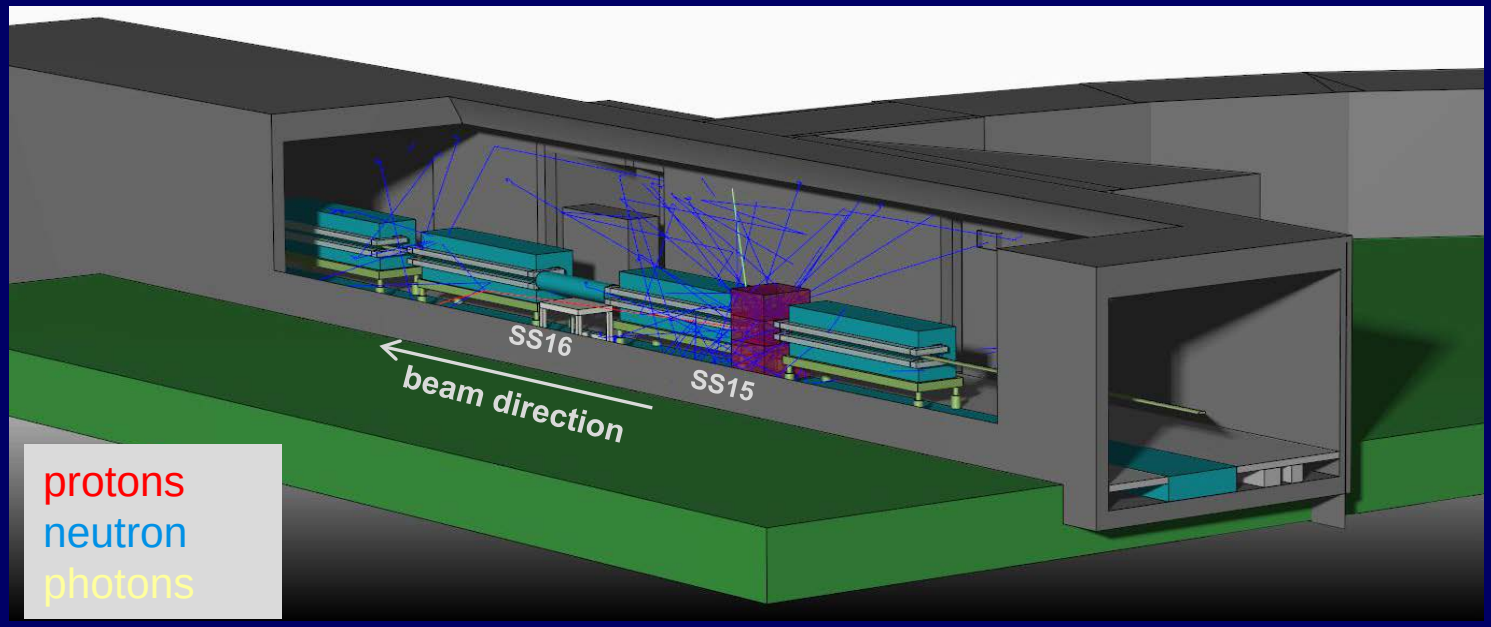
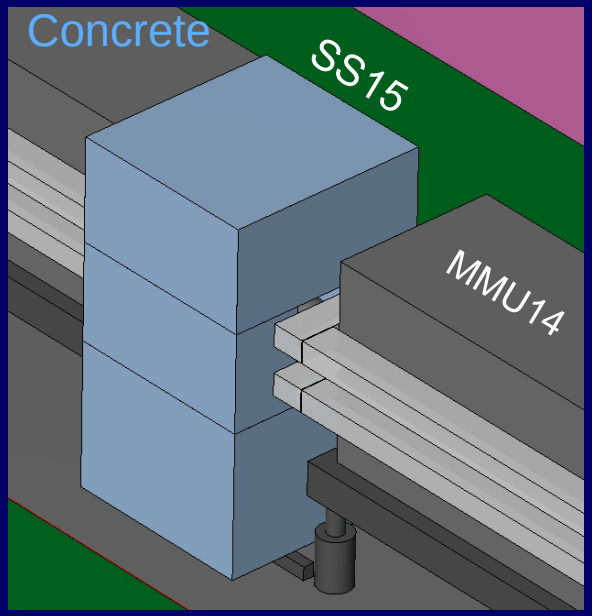
Shielding around the Dummy Septum15: Original vs. Final design

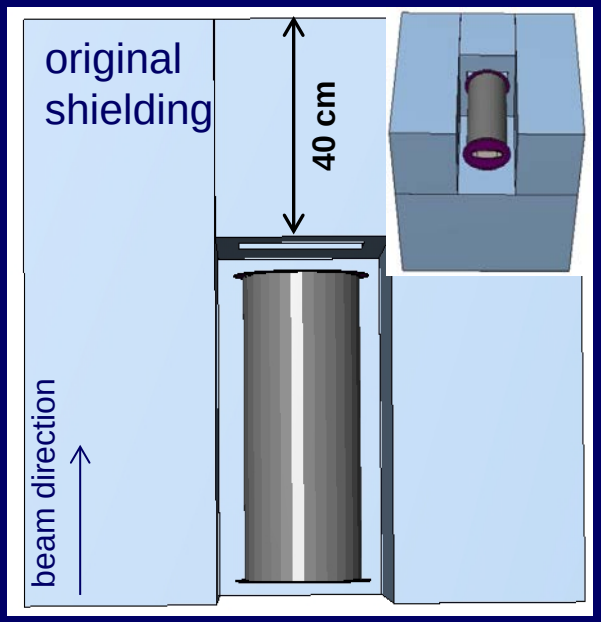
Sanja Damjanovic, DGS-RP

CERN, April 11, 2013

PS Ejection Region with Local Shielding around the Dummy Septum





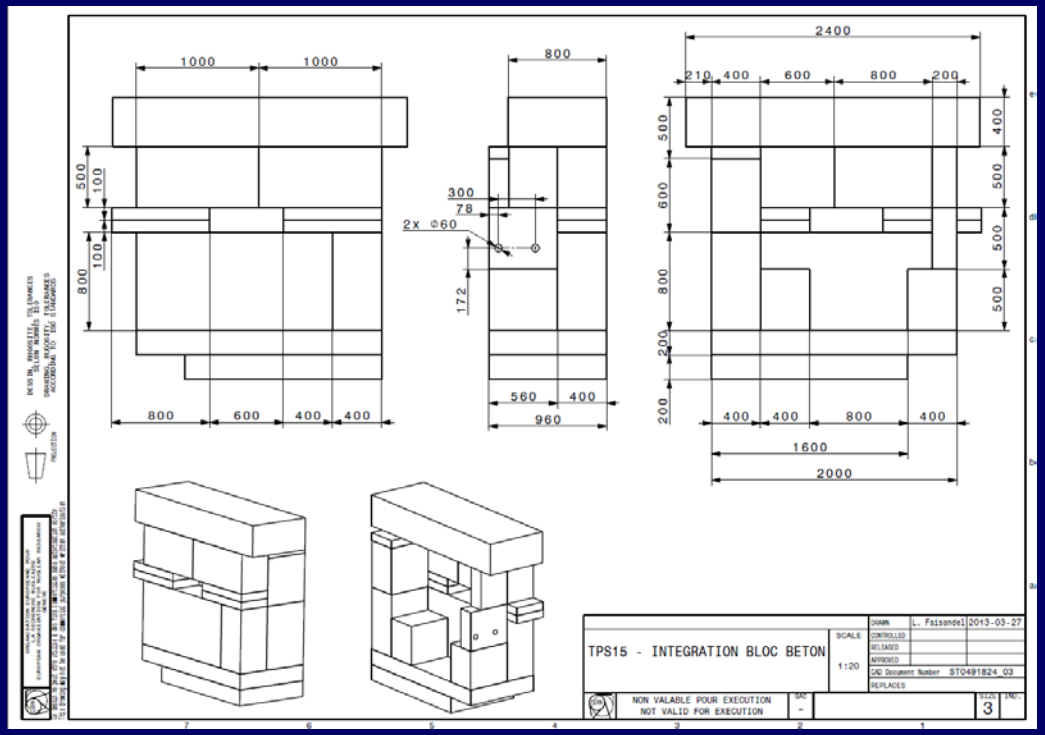


Original Shielding, optimized by FLUKA:

- lateral dimension: 120 cm
- longitudinal dimension: 110 cm
- vertical dimension: 210 cm
  - 60 cm top part
  - 60 cm middle
  - 90 cm lower part

Material: Concrete

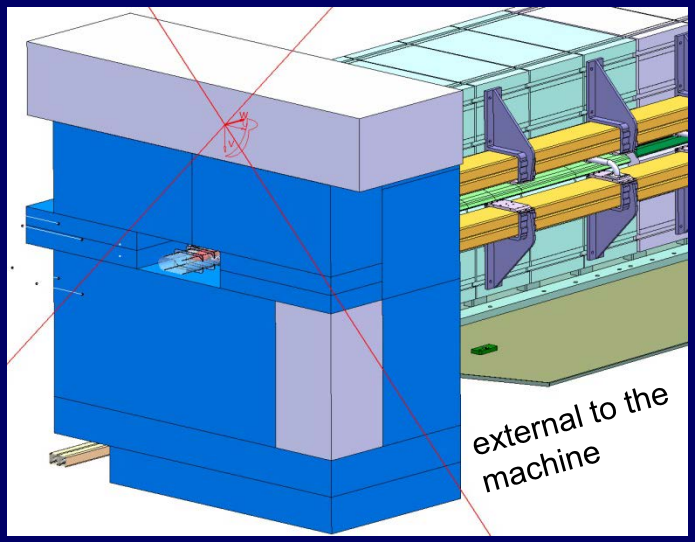
Final Design for the Local Shielding around the Dummy Septum

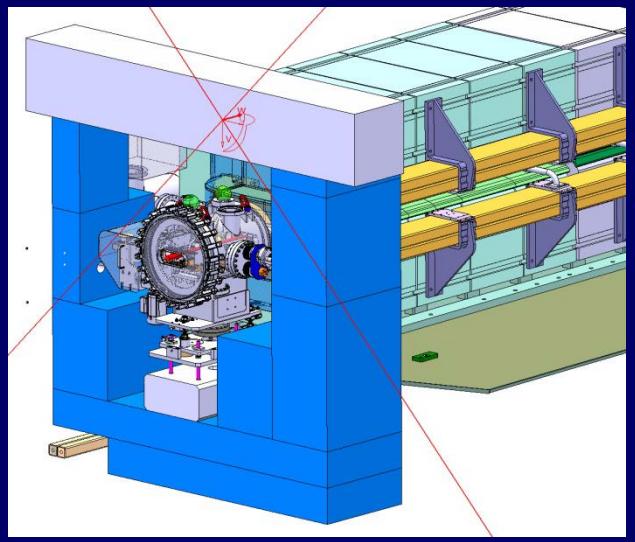


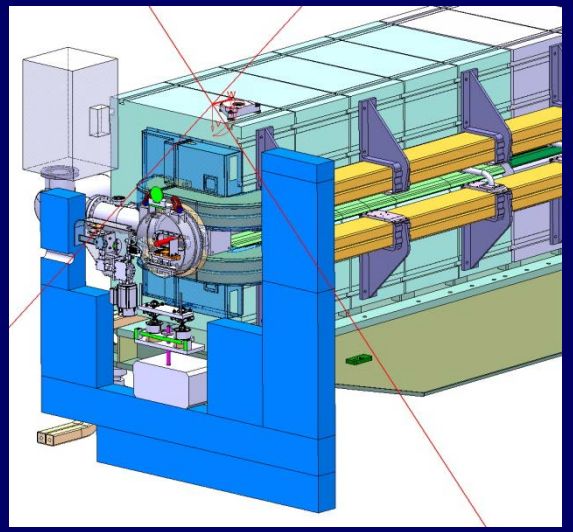
R.F. Ortega

- lateral dimension: 200-220 cm
- longitudinal dimension: 98 cm
- vertical dimension: 220 cm

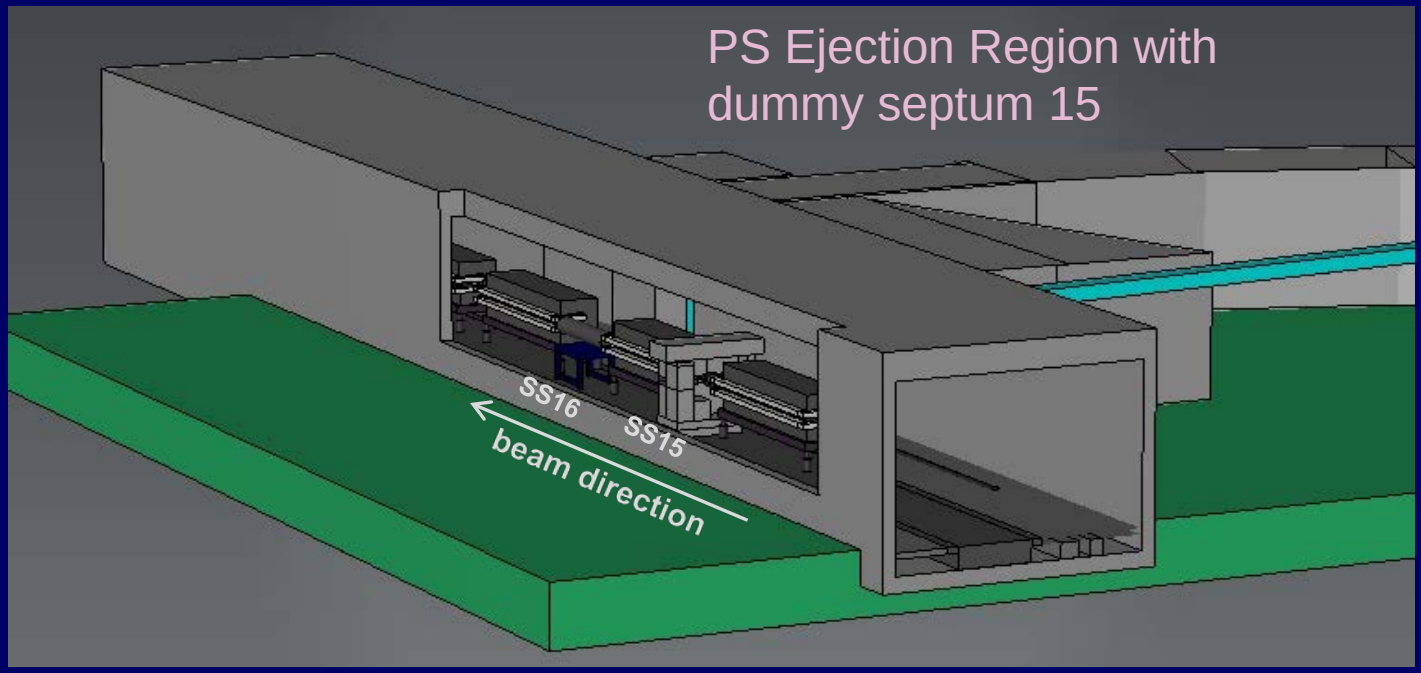
Less compact than the original shielding



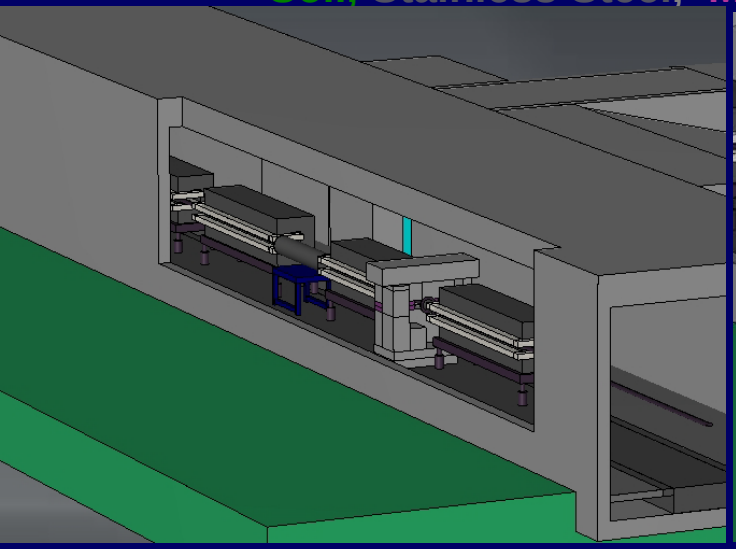




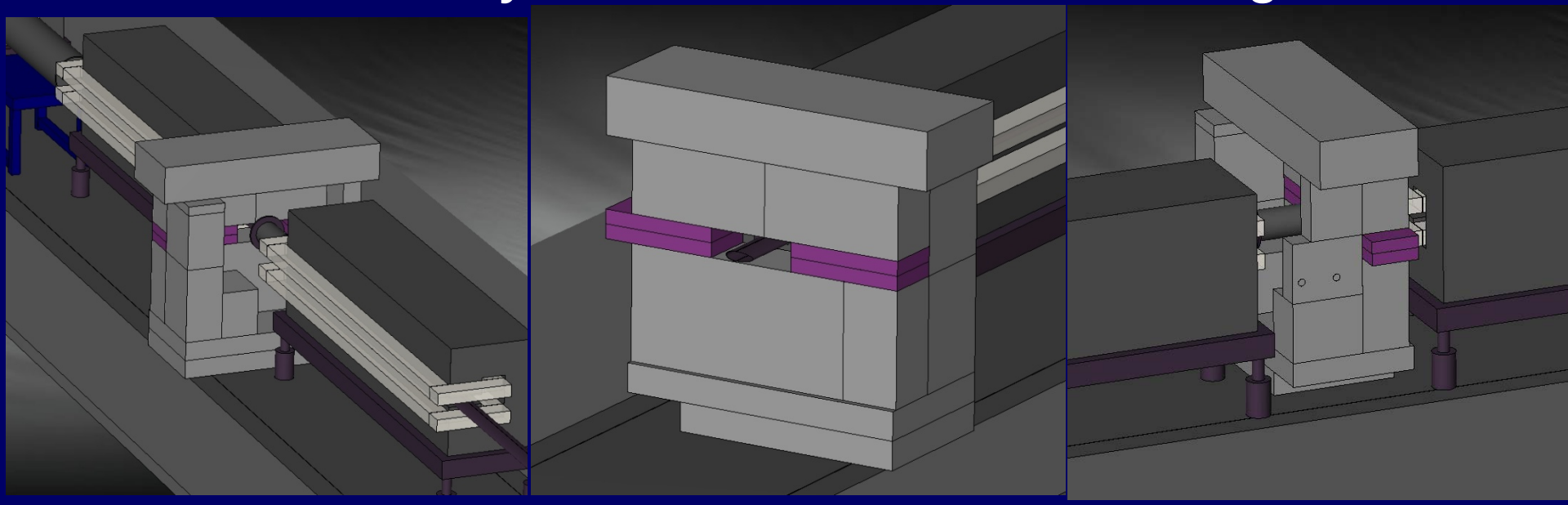
FLUKA Geometry of the Final Shielding Design in SS15



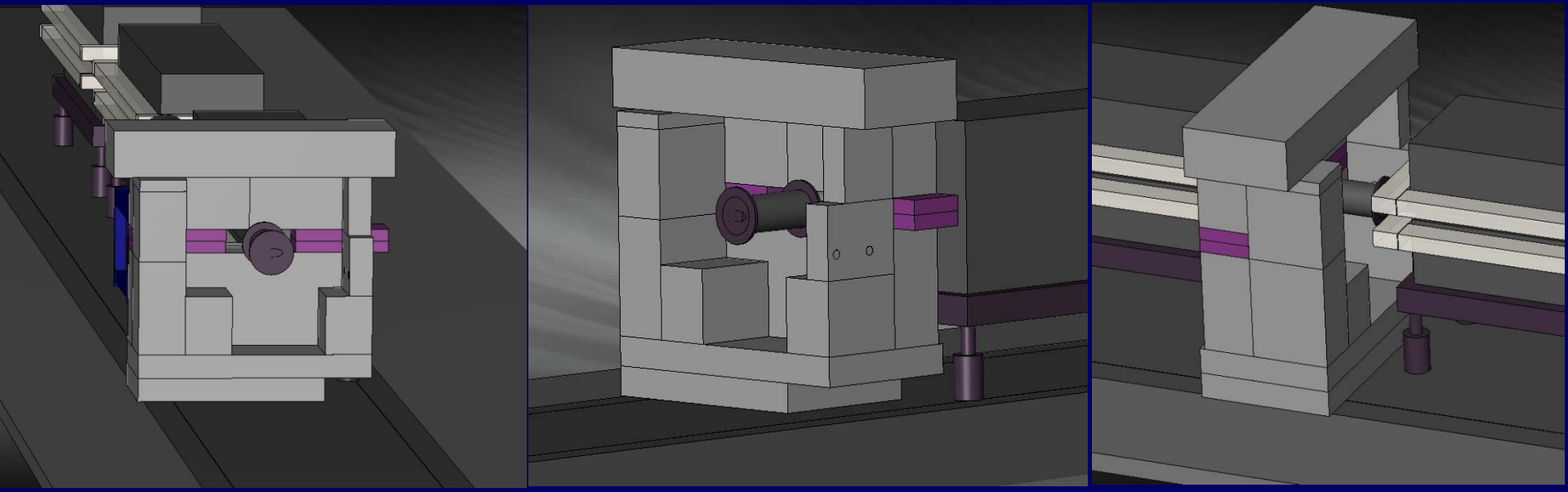
Soil, Stainless Steel, Marble, Aluminum, Concrete, Air, Stainless Steel



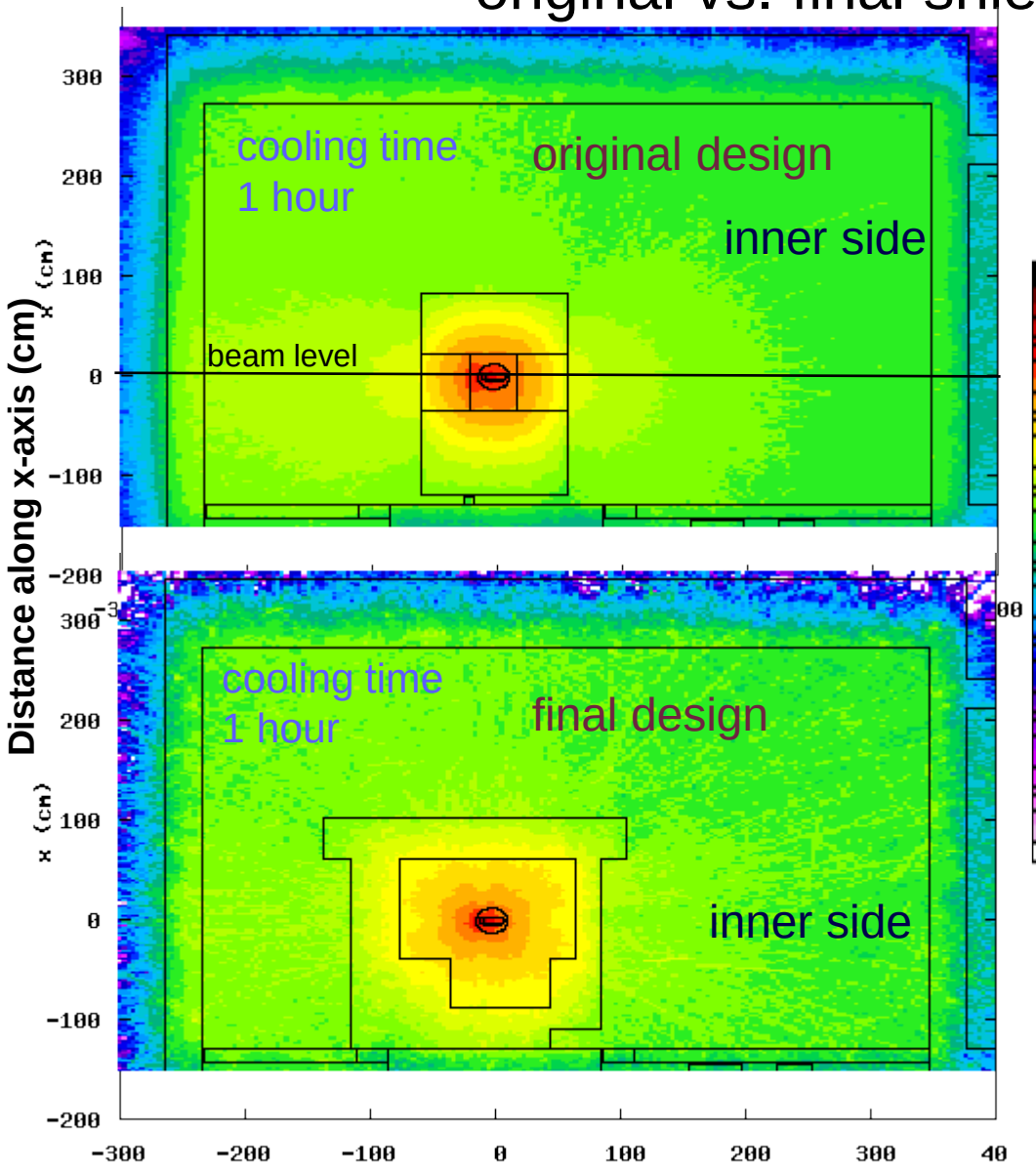
FLUKA Geometry of the Final Local Shielding in SS15



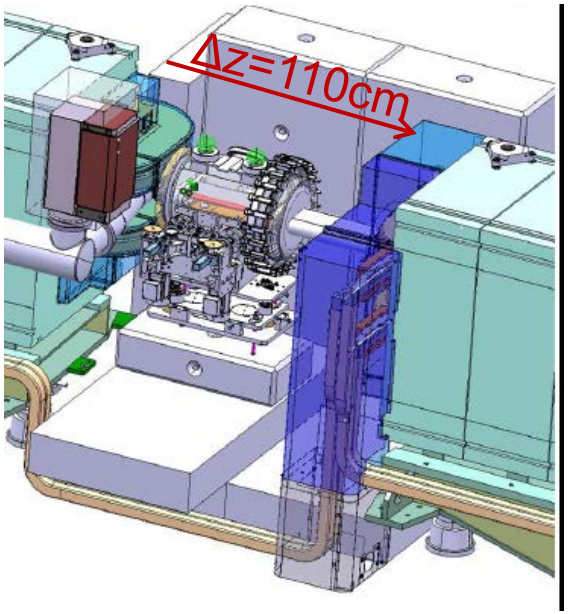
Stainless Steel , Stainless Steel, Marble, Aluminum, Concrete



Residual dose rates with local shielding in SS15
- original vs. final shielding design -



2-dim projections in x-y plane, averaged over Δz=110cm (middle of SS15) and over ±30 cm in x (around the beam level)

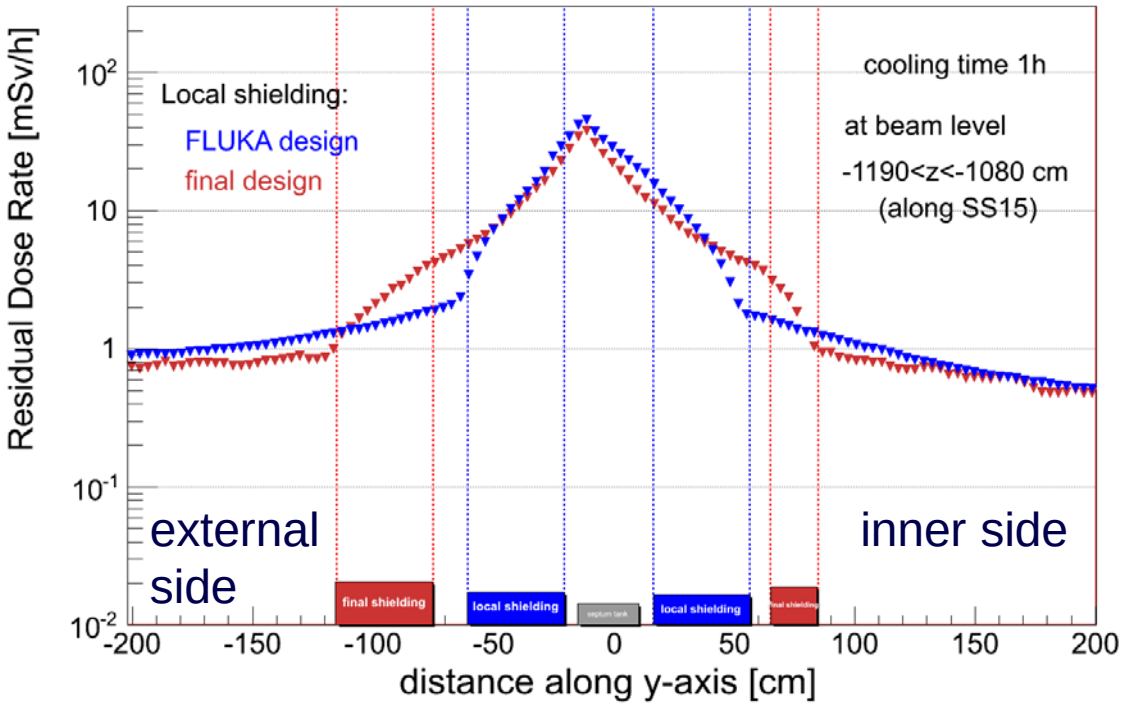


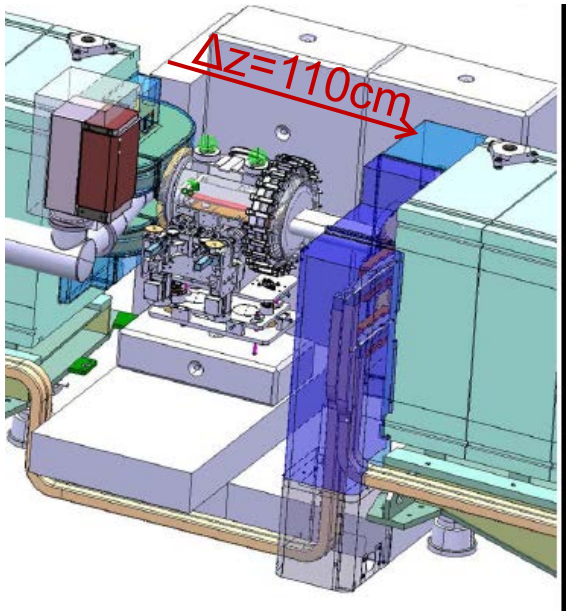
Residual dose rates outside the local shielding qualitatively similar for the two shielding designs

z-beam direction, x-vertical, y-horizontal direction

Residual dose rates with local shielding in SS15 - original vs. final shielding design -

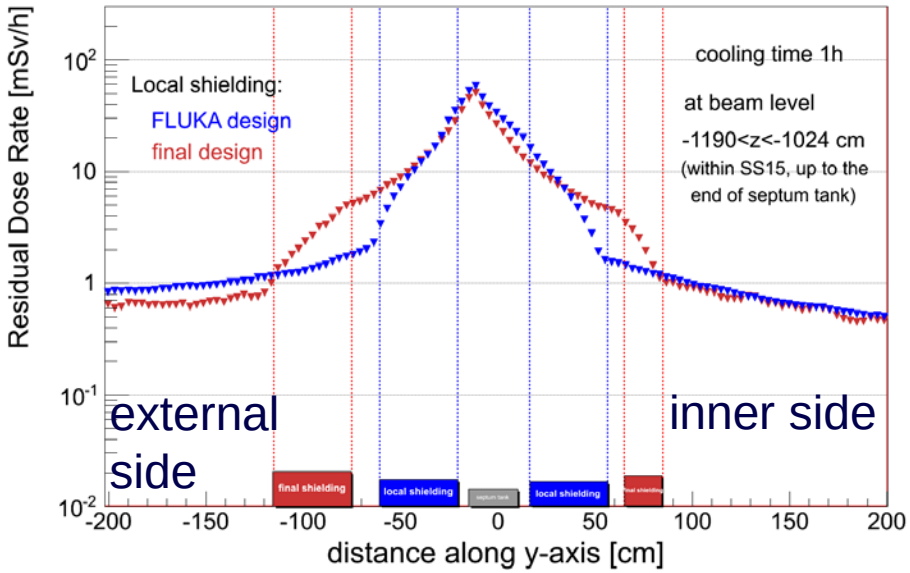
1 dim projections along y (horizontal) at the beam level, averaged over Δz=110 cm (-1190<z<-1080cm, middle of SS15)

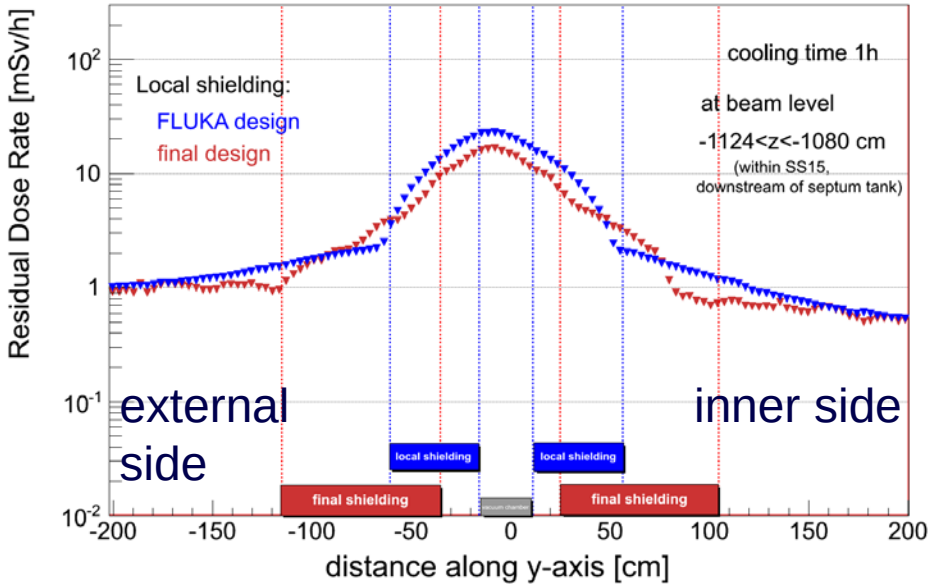




Residual dose rates outside the local shielding the same for the two shielding designs

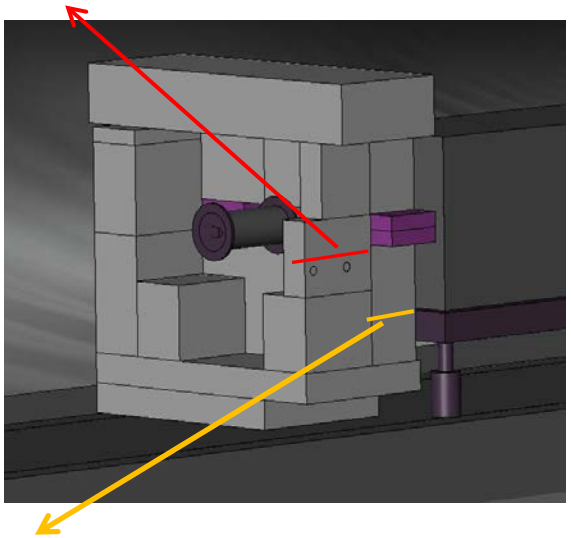
Residual dose rates with local shielding in SS15
- original vs. final shielding design -





1d projections along y (horizontal)
at the beam level within SS15:

a) averaged over Δz=70cm, -1190<z<-1120 cm, up to the end of the septum tank



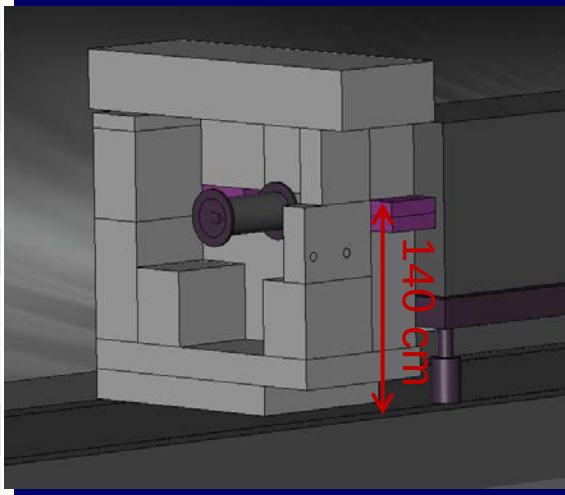
b) averaged over Δz=40cm, -1120<z<-1080cm, from the end of the septum tank

Residual dose rates outside the local shielding very similar for the two shielding designs

- Individual and Collective Dose Estimates for Interventions at the PS SS15 should be evaluated with the final shielding

- Updated information on intervention processes and duration required

1 & 2, REPLACEMENT OF COMPLETE SYSTEM	Specialist	Time and distance	Comments
Venting of sector	TE-VSC	10 mins, remote intervention	
Dismantling of shielding	EN-HE-HH	1 hour, distance >1m	3 persons, 1h/person
Disconnection of upstream and downstream flanges	TE-VSC	5 mins, contact	2 persons, 2.5min/person
Disconnect cabling, compressed air, water cooling, etc	TE-ABT, BE-BI, TE-VSC	10 mins, distance -contact	2 persons, 2.5min/person 1 person (TE-VSC), 5min/person
Removal of tank assembly	TE-ABT, EN-HE-HH	10 mins, distance 1m 2 persons, 2min/person – contact, 8min/person - 1m	Includes removal of support locking mechanisms
Installation of spare	TE-ABT, EN-HE-HH	15 mins, contact	This spare is non radioactive 3 persons, 5min/person
Reconnection of flanges	TE-VSC	10-15 mins	2 persons, 7.5min/person
Reconnection of cables, air, and water cooling.	TE-ABT BE-BI TE-VSC	10 mins	3 persons, 10min/person
Leak test	TE-VSC	30 mins	1 person, 30min/person
Installation of shielding	EN-HE-HH	1 hour	3 persons, 1h/person
Testing			

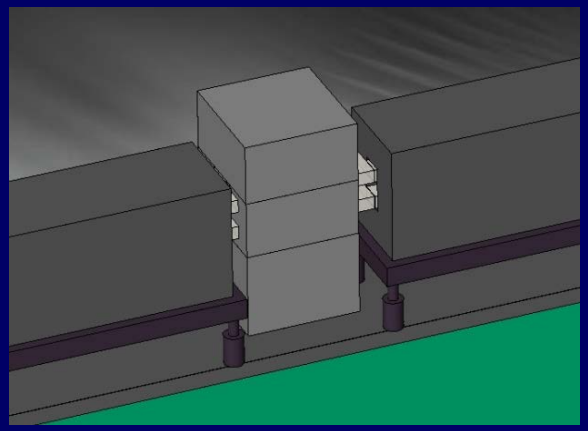


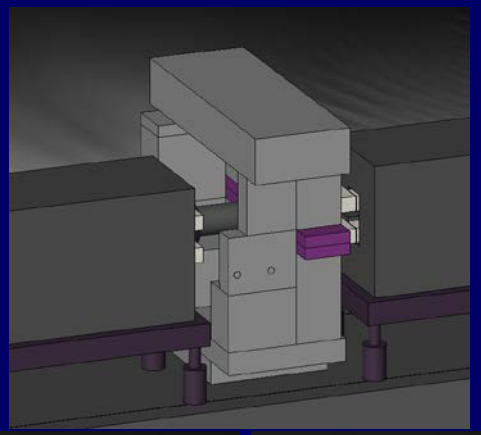
- Identification of all the blocks to be removed for the intervention

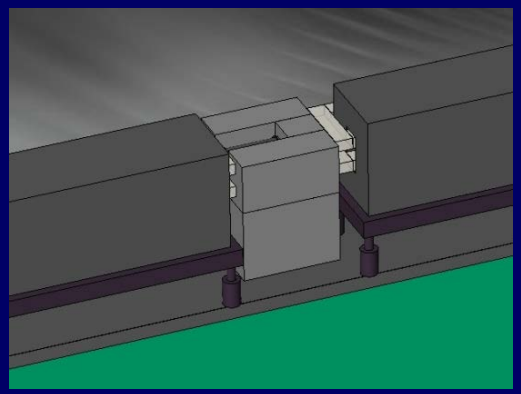
Blocks to be removed for the intervention

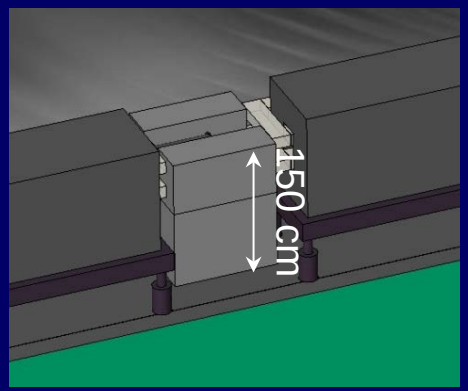
Original shielding design

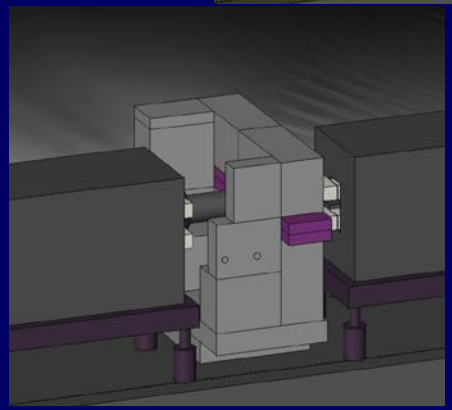
Final shielding design

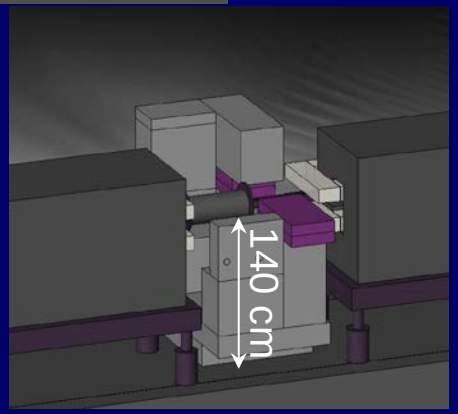








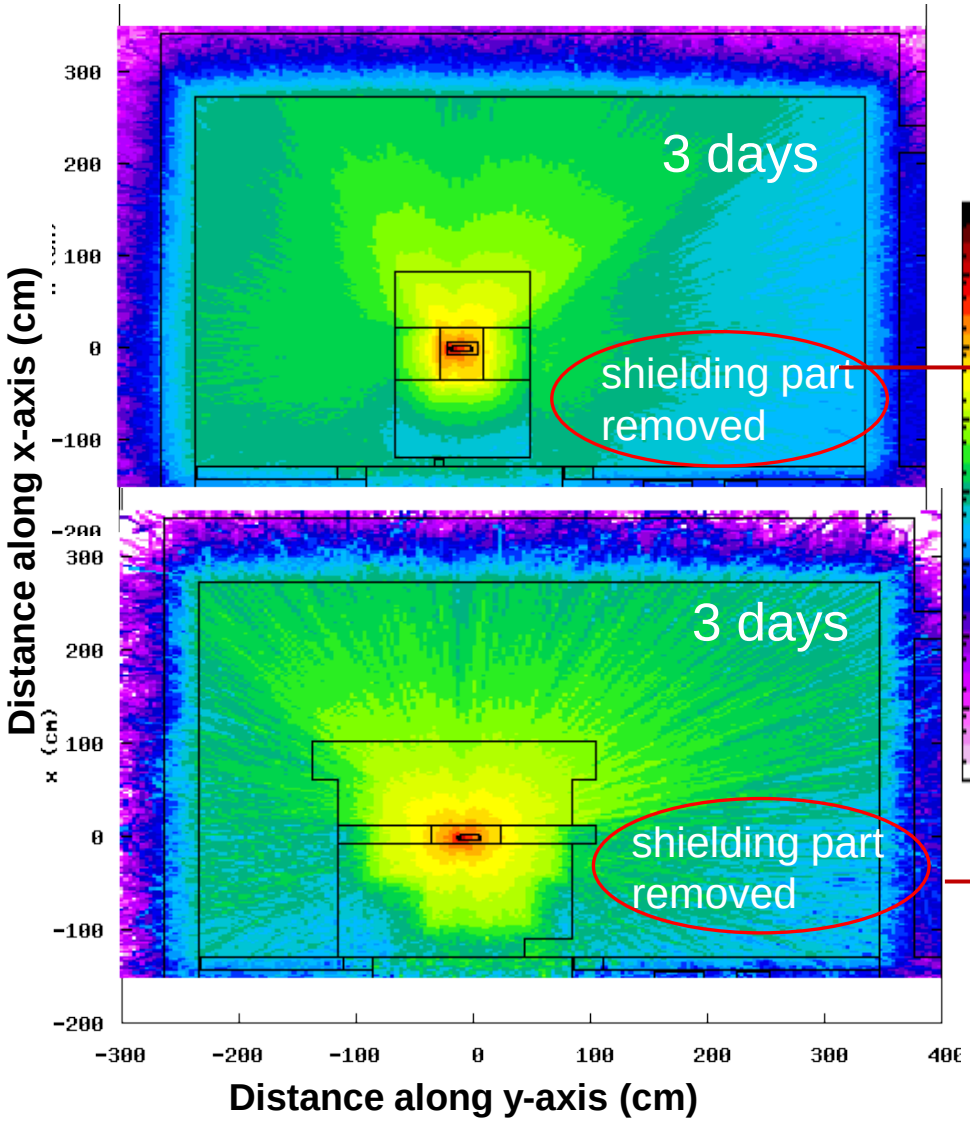


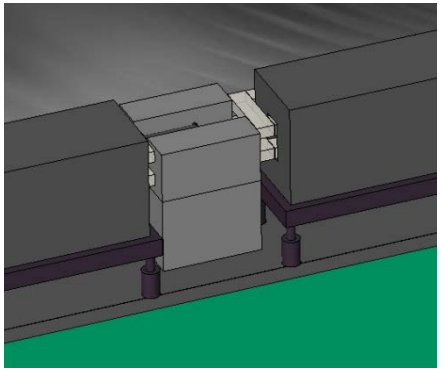


Stainless Steel , Stainless Steel, Marble, Aluminum, Concrete

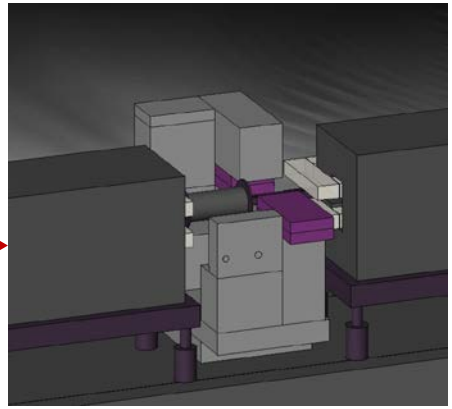
Intervention Scenario 1&2; Action – Disconnection of downstream flange – original vs. final shielding design

1 person (TE-VSC specialist) involved, time/person = 2.5 min, contact





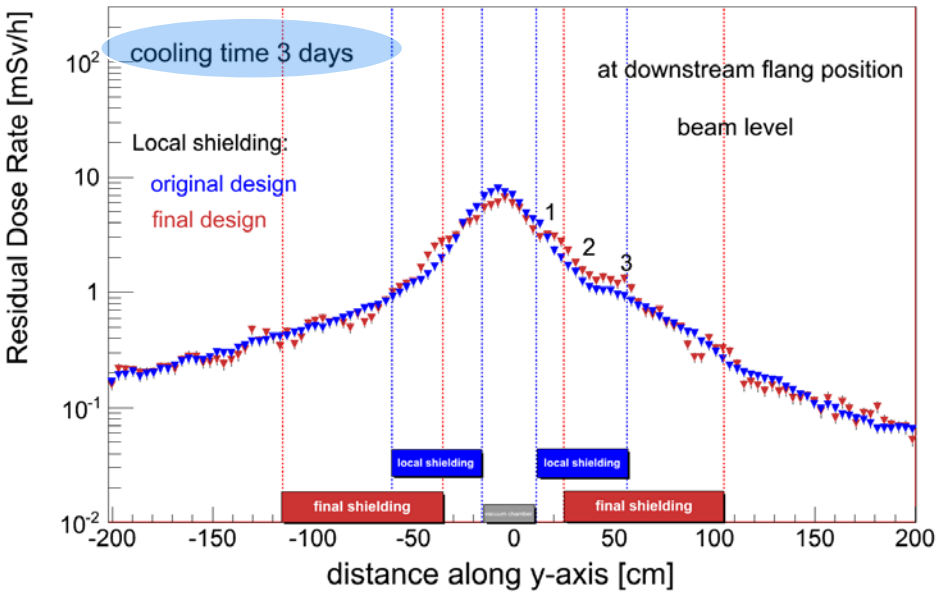
Original design



Final design

2-dim projections in x-y plane, averaged over Δz=110cm (middle of SS15) and over ±30 cm in x (around the beam level)

Intervention Scenario 1&2; Action - Disconnection of downstream flange – Original vs. Final Shielding



projections along y for the z positions
of the downstream and upstream flanges

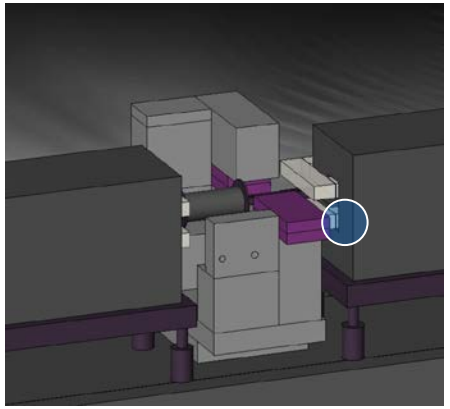
1 person (TE-VSC specialist) involved, time/person = 2.5 min, contact

example - cooling time 3 days

position of 1st person: x=beam level, z=-1075cm; 3 different y-options considered:
1) y=20 cm; 2) y=30cm; y=40cm

accumulated dose by 1st person:

1) 3.2mSv/h×2.5min = 0.13 mSv
2) 1.4mSv/h×2.5min = 0.06 mSv
3) 0.86mSv/h×2.5min = 0.036 mSv



Residual dose rates at the position of the downstream flange the same for the two shielding designs → same values for the accumulated dose by a person during the intervention

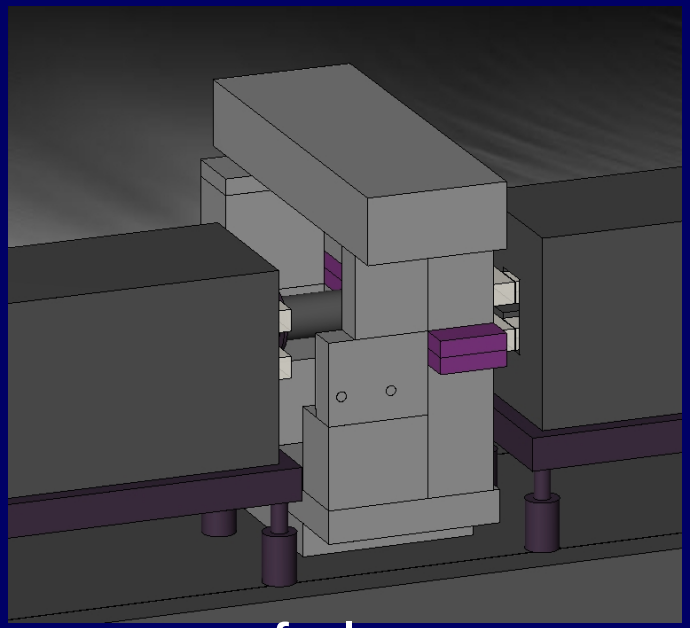
BKP

Individual and Collective Doses Estimated for the Intervention -Replacement of the complete system- at PS SS15

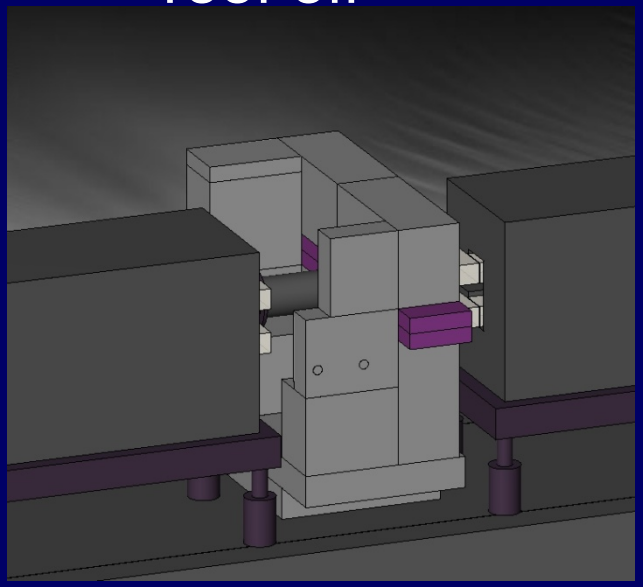
Specialist from Dep/Grp executing	cooling time								
	Accumulated Dose / Person [mSv/person]								
	1h	8h	1 day	3 days	1 week	2 weeks	1 month	40 days	4 months
TE-VSC-1st	5.86	4.16	2.41	1.12	0.81	0.68	0.57	0.52	0.33
TE-VSC-2nd	0.68	0.49	0.29	0.15	0.1	0.09	0.07	0.07	0.04
EN-HE-HH-1st	3.06	2.08	1.22	0.59	0.45	0.39	0.3	0.27	0.15
EN-HE-HH-2nd	2.24	1.47	0.87	0.44	0.34	0.29	0.22	0.19	0.12
EN-HE-HH-3rd	2.24	1.47	0.87	0.44	0.34	0.29	0.22	0.19	0.12
TE-ABT-1st	2.26	1.62	0.95	0.45	0.33	0.28	0.22	0.2	0.125
TE-ABT-2nd	0.44	0.32	0.17	0.05	0.033	0.028	0.025	0.023	0.017
BE-BI	1.4	1.0	0.58	0.28	0.2	0.17	0.13	0.13	0.08
Collective Dose [mSv] – '8 persons'	**18.2**	**12.6**	**7.4**	**3.5**	**2.6**	**2.2**	**1.8**	**1.6**	**1.0**

Minimum waiting time of at least 3 days required

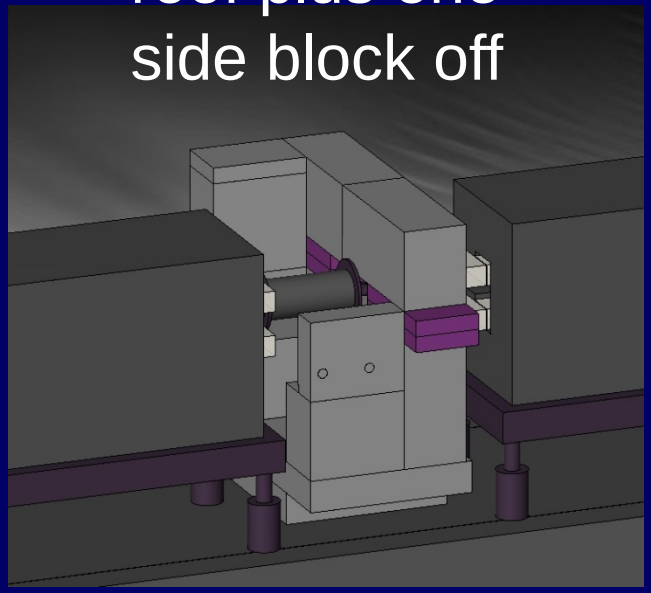
Blocks to be removed for the intervention



roof off



roof plus one side block off



roof plus two side blocks off