



# Update on background estimation and future planning

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Background Simulation Meeting

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# New Productions

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- 2012 official productions (**thicker tungsten shielding**):
  - **2photons** (~100k evts, 372us) solenoidal field limited in z,  $\pm 40$  cm
  - **RadBhabha** (~10k evts, 37us)
  - **Touschek**: (~87k evts HER, ~198k LER, weighted evts)
  - **Beamgas** (~284k evts HER, ~282k evts LER, weighted evts)
- 2012, additional productions:
  - **RadBhabha** (~10k evts, 37us) old tungsten shielding
  - **RadBhabha** (~10k evts, 37us) CSI, only for EMC studies

 **New entry**



# Rate comparison, updated

SVT

- Hopefully we definitively fixed the problem with failed jobs
- 2photons with new L0 geometry: 30-50% decrease on L0, slightly higher for outer layers

LAYERS	2photons			Bbbrem		Touschek HER		Touschek LER		BeamgasHER		Beamgas LER
	01/2012	05/2012	06/2012	12/2011	05/2012	12/2011	05/2012	12/2011	05/2012	03/2012	05/2012	05/2012
MHz/cm <sup>2</sup>												
L0 phi	29.4	30.1	18.7	0.87	0.83	0.57	0.62	1.91	1.70	0.635	0.47	1.48
L0 z	37.2	38.1	20.2	1.42	1.58	1.71	1.94	5.06	4.73	1.72	1.37	4.27
L1 phi	1.56	1.60	1.71	0.12	0.13	0.20	0.19	0.81	0.67	0.24	0.16	0.58
L1 z	0.74	0.76	0.80	0.077	0.08	0.22	0.20	0.869	0.69	0.26	0.18	0.61
L2 phi	0.78	0.81	0.94	0.078	0.079	0.135	0.135	0.61	0.51	0.16	0.12	0.43
L2 z	0.40	0.41	0.49	0.059	0.056	0.158	0.15	0.68	0.55	0.19	0.13	0.47
L3 phi	0.14	0.15	0.26	0.047	0.049	0.031	0.035	0.20	0.165	0.045	0.029	0.14
L3 z	0.13	0.14	0.24	0.051	0.055	0.061	0.057	0.32	0.255	0.072	0.048	0.21
L4 phi	0.022	0.027	0.031	0.0135	0.013	0.005	0.0042	0.021	0.014	0.027	0.0035	0.012
L4 z	0.014	0.019	0.019	0.0078	0.0081	0.004	0.0031	0.014	0.010	0.018	0.0026	0.0087
L5 phi	0.012	0.016	0.015	0.0057	0.0062	0.0024	0.0020	0.0094	0.0070	0.0027	0.0015	0.0056
L5 z	0.0082	0.011	0.010	0.0038	0.0039	0.0018	0.0015	0.007	0.0054	0.0020	0.0012	0.0044

# Radiation dose on Electronics

SVT

- Max dose accumulated after integrating  $10 \text{ ab}^{-1}$

Max. Dose (krad)	0	1	2	3	4	5	Card
Pairs	336	55	55	23.7	7.0	3.2	0.8
RadBhabha	47.7	10.2	12.4	15.3	6.5	1.15	0.5
Touschek HER	46.4	11.6	13.1	6.3	1.76	0.62	0.18
Touschek LER	142	38.0	49.3	23.6	3.9	1.8	0.7
Beam-gas HER (old)	31.7	8.45	9.8	4.1	1.5	0.41	0.13
Beam-gas LER	123	33	41	19	3.5	1.56	0.65
<b>TOTAL</b>	<b>727</b>	<b>156</b>	<b>181</b>	<b>92</b>	<b>24</b>	<b>8.7</b>	<b>3.0</b>
<b>TOTAL (old)</b>	<b>838</b>	<b>154</b>	<b>182</b>	<b>145</b>	<b>64.6</b>	<b>15</b>	



# Dch Electronics

- 3 silicon plates behind the backward endplate to simulate the electronics
- Increased tungsten shielding cut half of the dose, mostly from reducing contribution from Radiative Bhabha

Dose [krad] (1y)	Plate 1	Plate 2	Plate 3
Pairs	0.11	0.098	0.097
RadBhabha	0.16	0.18	0.22
Touschek HER	0.0035	0.0027	0.0024
Touschek LER	0.12	0.128	0.148
Beamgas HER	0.003	0.002	0.002
Beamgas LER	0.09	0.10	0.11
<b>TOTAL</b>	<b>0.49</b>	<b>0.51</b>	<b>0.58</b>
<b>TOTAL (old)</b>	<b>1.01</b>	<b>1.13</b>	<b>1.37</b>



# Simulated radiation level

- Updated table, all the background sources
- Fixed problems with normalization for SEE

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	Layer0	1.4	1.4	-6	6	49504.1	1.67205e+13	1.01535e+10
SVT	Layer1	3.3	3.3	-10	10	3261.35	1.28582e+12	1.80098e+09
SVT	Layer2	4	4	-15	15	2095.2	8.59322e+11	3.34264e+09
SVT	Layer3	5.9	5.9	-20	20	951.546	4.81984e+11	1.85344e+09
SVT	Layer4	12.2	12.2	-30	30	117.659	2.25278e+11	1.95276e+09
SVT	Layer5	14.2	14.2	-30	35	63.0025	1.953e+11	2.26889e+09
SVT	FEELayer0	1.4	1.4	4.2	4.2	6195.9	2.23481e+12	9.73206e+09
SVT	FEELayer1	3.3	3.3	1	1	1283.01	5.36121e+11	1.28893e+10
SVT	FEELayer2	4	4	1	1	1468.05	7.02561e+11	3.40679e+10
SVT	FEELayer3	5.9	5.9	1	1	758.553	4.46311e+11	3.59263e+10
SVT	FEELayer4	12.2	12.2	1	1	208.927	2.85998e+11	3.53227e+10
SVT	FEELayer5	14.2	14.2	1	1	73.7066	2.9919e+11	4.24575e+10
SVT	MCard	30	30	0.2	0.2	24.516	2.53584e+11	1.75646e+10
DCH	FEEZone0	23.6	40	-111.9	-111.9	7.68133	3.35314e+11	7.61708e+10
DCH	FEEZone1	40	60	-111.9	-111.9	5.49931	2.26134e+11	4.49679e+10
DCH	FEEZone2	60	81	-111.9	-111.9	3.73973	1.64076e+11	3.24562e+10
TOF	FEE	55	92	200	200	2.2432	1.5446e+11	2.47425e+11
DRC	BarCenter	81.7	89.3	-10	10	2.22071	1.23923e+11	3.11321e+11
DRC	FEE	103	155	-377	-342	0.785693	4.46349e+10	4.88191e+10
EMC	FwdFEE	70	110	216	236	1.28623	1.57721e+11	1.82e+11
EMC	BrlFEE	120	120	-155	216	0.146824	2.78153e+10	3.21886e+10
EMC	BrlCtrFEE	120	120	-10	10	0.0151425	1.92316e+10	2.20612e+10



# Simulated radiation level

- Updated table, all the background sources
- Fixed problems with normalization for SEE

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
IFR	FEEZone0Loc0	325.576	332.866	-281	-239	31.2671	5.34052e+10	6.52095e+10
IFR	FEEZone0Loc1	360.555	400.5	-281	-239	21.6578	5.3249e+10	6.47801e+10
IFR	FEEZone0Loc2	300	356.09	-281	-239	32.2796	6.0146e+10	6.52709e+10
IFR	FEEZone0Loc3	300.666	340.588	-281	-239	42.0719	7.29523e+10	7.87907e+10
IFR	FEEZone0Loc4	332.866	325.576	-281	-239	51.2862	8.56386e+10	7.68175e+10
IFR	FEEZone0Loc5	400.5	360.555	-281	-239	39.0307	6.45381e+10	7.18219e+10
IFR	FEEZone0Loc6	356.09	300	-281	-239	45.3833	7.14955e+10	7.66561e+10
IFR	FEEZone1Loc0	325.576	332.866	-21	21	9.5593	4.72867e+10	4.89399e+10
IFR	FEEZone1Loc1	360.555	400.5	-21	21	10.0537	4.55649e+10	4.52742e+10
IFR	FEEZone1Loc2	300	356.09	-21	21	9.24964	4.39204e+10	4.77832e+10
IFR	FEEZone1Loc3	300.666	340.588	-21	21	13.7199	4.49322e+10	5.13227e+10
IFR	FEEZone1Loc4	332.866	325.576	-21	21	13.0756	5.29123e+10	5.2595e+10
IFR	FEEZone1Loc5	400.5	360.555	-21	21	17.1239	6.20078e+10	4.96569e+10
IFR	FEEZone1Loc6	356.09	300	-21	21	16.8892	4.55399e+10	4.73796e+10
IFR	FEEZone2Loc0	325.576	332.866	239	281	16.4548	5.41525e+10	6.08695e+10
IFR	FEEZone2Loc1	360.555	400.5	239	281	15.4491	5.42349e+10	6.31575e+10
IFR	FEEZone2Loc2	300	356.09	239	281	14.9617	5.99378e+10	6.32563e+10
IFR	FEEZone2Loc3	300.666	340.588	239	281	42.2044	7.82657e+10	8.35389e+10
IFR	FEEZone2Loc4	332.866	325.576	239	281	26.3613	5.70932e+10	6.68192e+10
IFR	FEEZone2Loc5	400.5	360.555	239	281	37.1029	6.0431e+10	6.82231e+10
IFR	FEEZone2Loc6	356.09	300	239	281	28.4979	5.89492e+10	7.09583e+10



# Summary on bkg levels

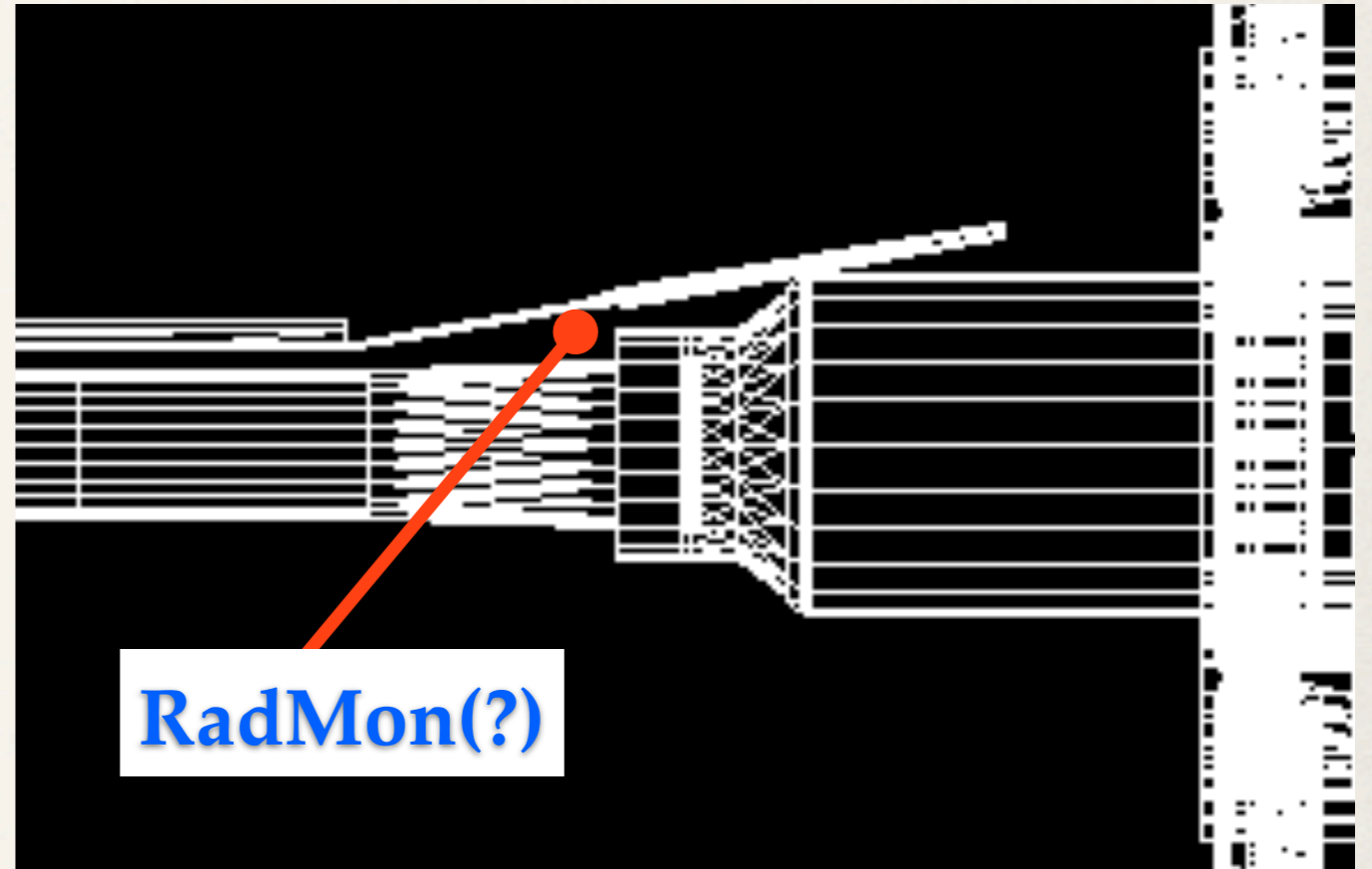
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- SVT:
  - New geometry shows a significant reduction for L0 rates but bkg is still too high for frontend electronics. Under evaluation impact on offline performance with x5 safety factor, first impression is that it should be ok
- DCH:
  - Increased shielding lowered the radiative Bhabha contribution, rate are within tolerance with the present configuration
  - Current internal inner radius of chamber is 237mm, but the first layer starts at 246-252 mm. Increasing this radius could increase the rate in the inner layers. New layer configurations provided by Giuseppe (first layer starts at an even greater radius) can be tested, but for a more reliable result we need to set the chamber inner radius closer to the first layer
- ETD:
  - New detailed map of radiation level for requested locations around the detector, all sources are included. Apart for SVT region, radiation levels look acceptable



# Radiation monitors location

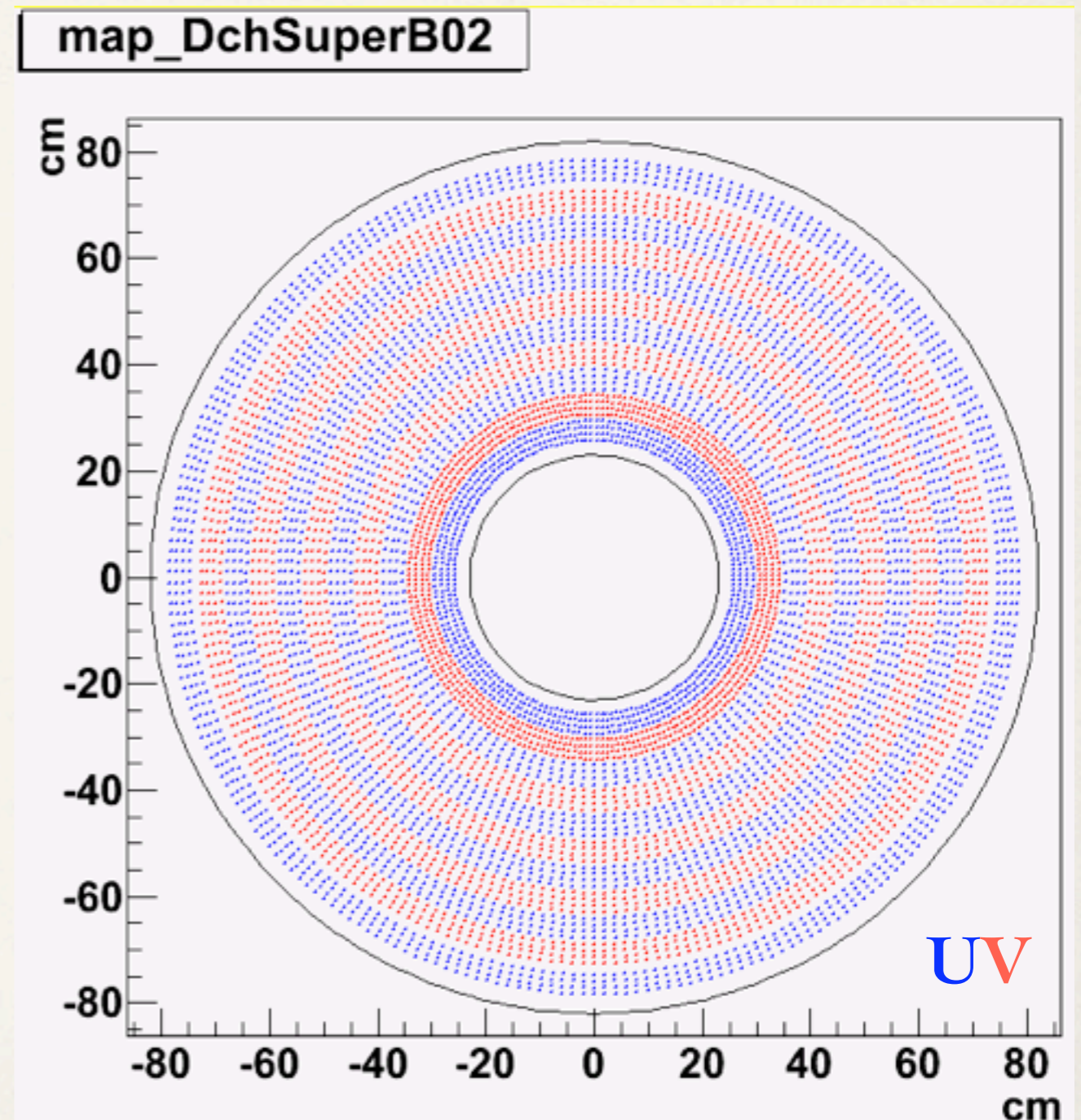
- Used for private production, only 2photon
- Svt L0 striplets plus electronics by F. Bosi
  - Si[200um] (0.2 X0)
  - FanOut x 2, Si[40um]-Kapton [50um]-Si[40um] (0.21 X0)
- Materials can be easily changed, but total X0 is correct
- Carbon fiber support (only ribs over the active silicon), fanout tails, hydrids, FEE chips
- Radiation monitor need to be relocated
- Filippo spot some areas, maybe the shape would change a bit, but in principle should be easy to reinsert them
- I can do that (after discussing with RadMon people) or provide support





# Dch configurations

- Inner wall of carbon fiber wall 236-237mm (discussion about thinning down the wall to .5mm)
- Old configurations:
  - **Axial01** version (1st layer 246mm)
    - AA-AAAAAAAAAA-AA
  - **SuperB01** version (1st layer 246mm)
    - AA-UVUVUVUV-A
  - **SuperB02** version (1st layer 252mm)
    - UVUVUVUVUV-U, fully axial
    - 8 inner layers, cell size ~1cm, then 2cm
    - 1cm empty space before last 4 layers
- New configurations (by Giuseppe):
  - 1st layer @ 264mm



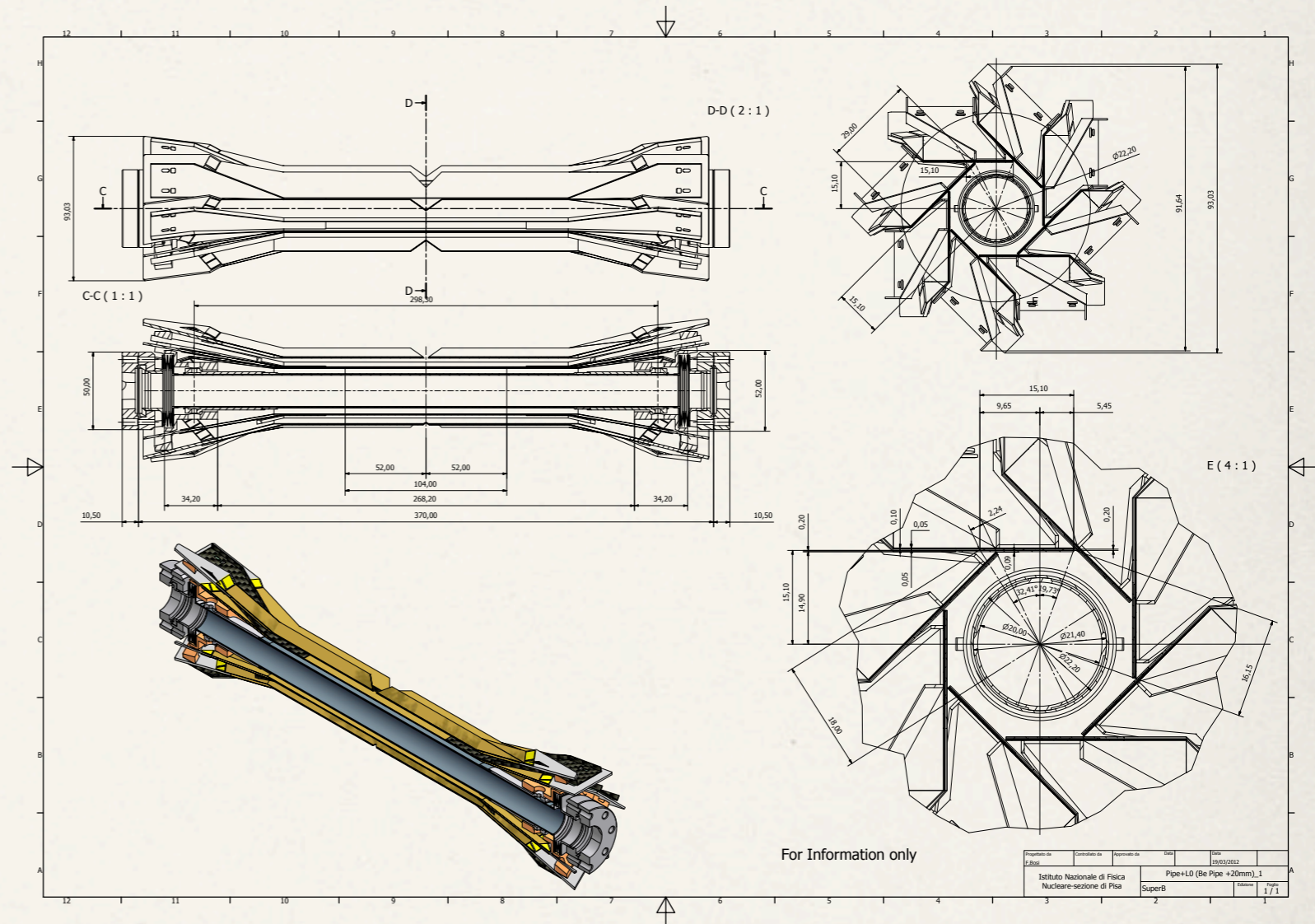






# Future plans

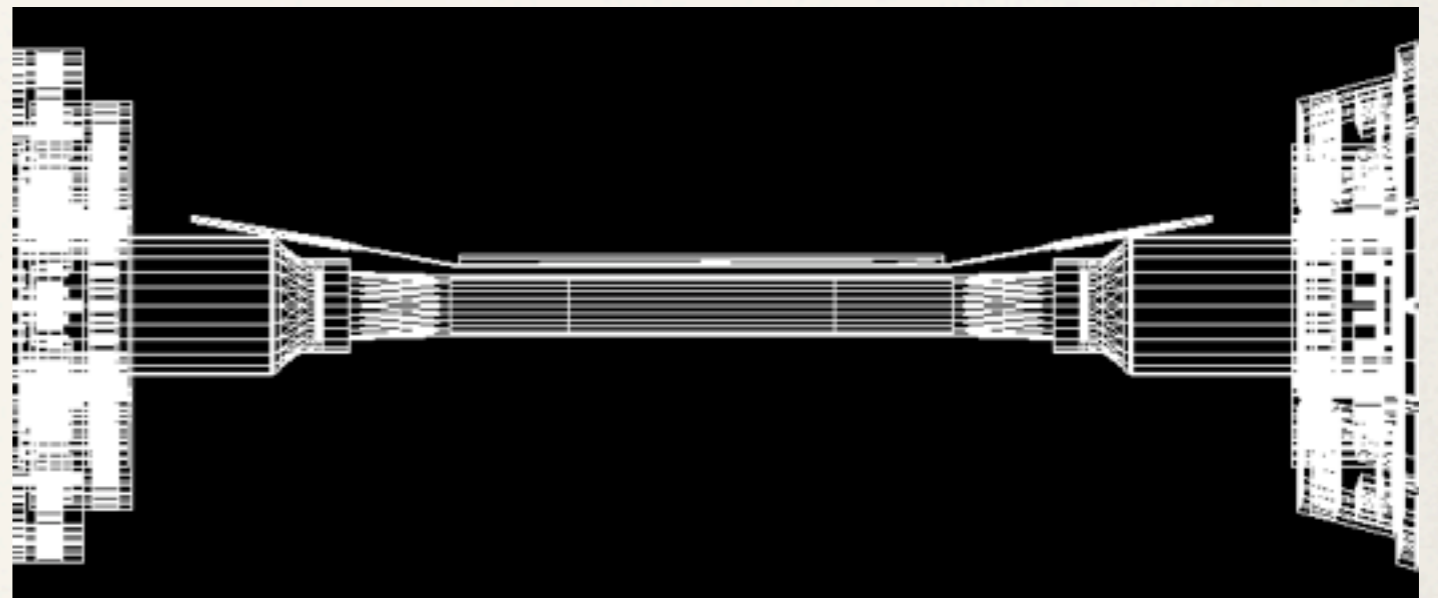
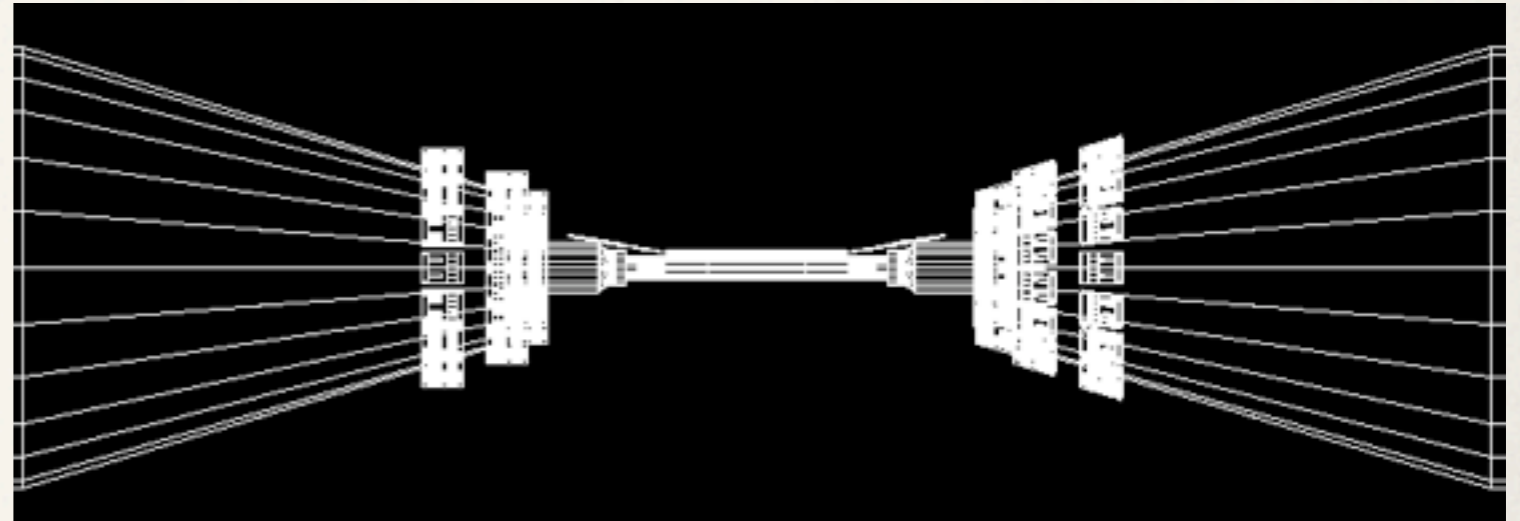
- Not to be used for the next production
- Svt L0 geometry: a new design is ready for L0 with triplets.
  - Longer beampipe, split pipes are going to be shortened. No modification after that point
  - FEE boards for layers 1-2 to be relocated to make room for L0 boards
- Svt geometry for outer layers: outer layers are the same as in Babar, but SuperB acceptance is wider. Need symmetric fwd/bwd modules





# SVT triplets geometry

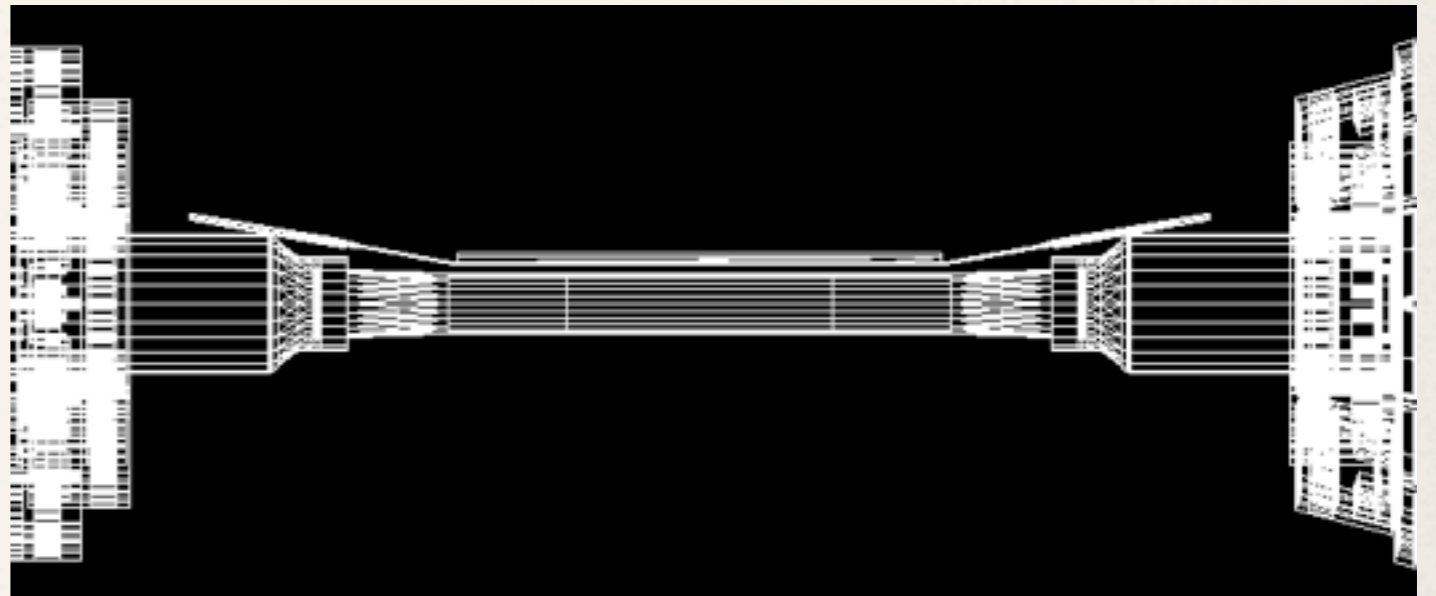
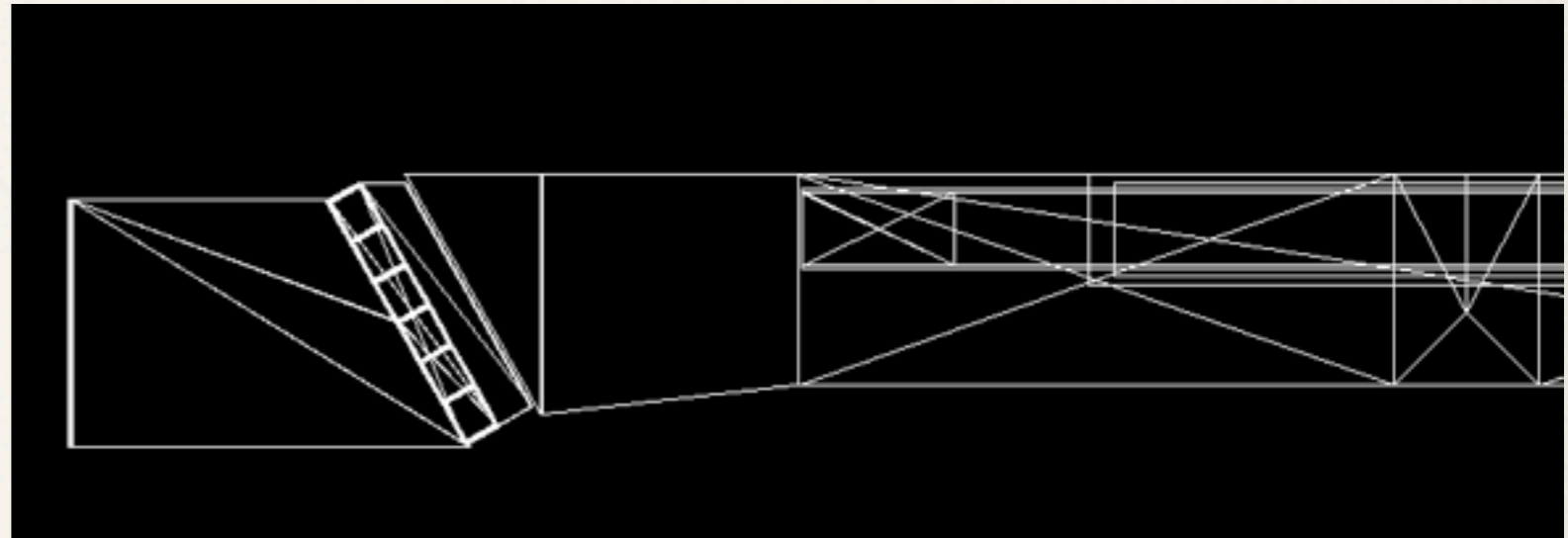
- Not to be used for the next production
- GDML version is **ready** and tested for overlaps
- Based on Geometry\_CIPE\_V00-00-02 revision 359, tag for V00-00-05
- Beampipe and final focus modifications were easy
- Tungsten shielding is completely symmetric wrt IP
- Relevant changes on how container volumes are implemented but no changes to the internal volumes of the final focus (apart for the beampipe and shortened split pipes)
- **IMPORTANT:** RadMon need to be re-inserted





# SVT triplets geometry

- Not used for the May production
- Svt L0 triplets plus electronics by F. Bosi
  - Si[200um] (0.2 X0)
  - FanOut x 2, Si[40um]-Kapton [50um]-Si[40um] (0.21 X0)
- Materials can be easily changed, but total X0 is correct
- Carbon fiber support (only ribs over the active silicon), fanout tails, hybrids, FEE chips
- Missing parts for L0: carbon fiber supports over the hybrids, buttons
- Outer layers: some support parts have been removed due to overlaps, FEE moved out closer to the updated position but silicon is still like in Babar
- Matching cards: monitor volume moved to the correct position (according last drawings)





# Simulated radiation level

- Request from ETD to have coherent map of radiation level for various locations of the detector
- Modeled after Atlas radiation tolerance criteria

$\checkmark$	$\checkmark$	$\checkmark$
fi	†	
$SRL_{tid}$	Particles producing <i>TID</i> (Total Ionising Dose). Example: photons.	Total Dose in 10 years: <i>Gray</i>
$SRL_{niel}$	Particles producing <i>NIEL</i> (Non-Ionising Energy Loss). Example: neutrons.	Total Fluence in 10 years: <i>1 MeV eq. neutron.cm<sup>-2</sup></i>
$SRL_{see}$	Particles producing <i>SEE</i> (Single Event Effects). Example: heavy fragments.	Total Fluence in 10 years: <i>&gt; 20 MeV hadron.cm<sup>-2</sup></i>

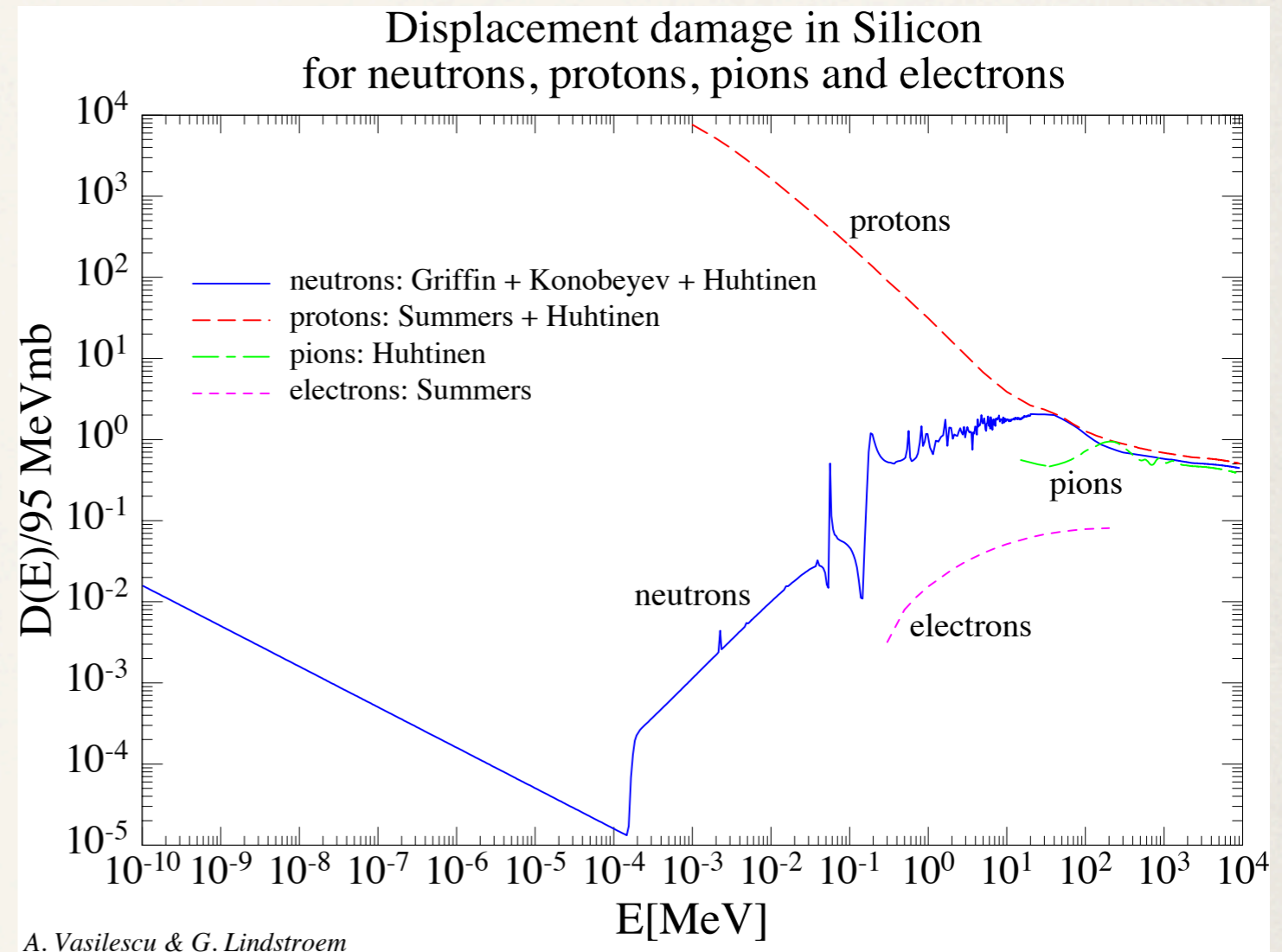
**From Atlas document**

Table 1: Definition of the three types of simulated radiation levels



# Simulated radiation level

- How quantities are computed:
  - **Dose (TID):**
    - total released energy in the sensitive volume divided by the weight
  - **Equivalent 1 MeV neutron flux (NIEL)**
    - each particle that cross the sensitive volume is weighted according the incident angle and using a conversion table (particle type and kinetic energy)
  - **Hadron Flux (SEE)**
    - flux of hadrons (proton, neutron, ions) with kinetic energy greater than 20 MeV



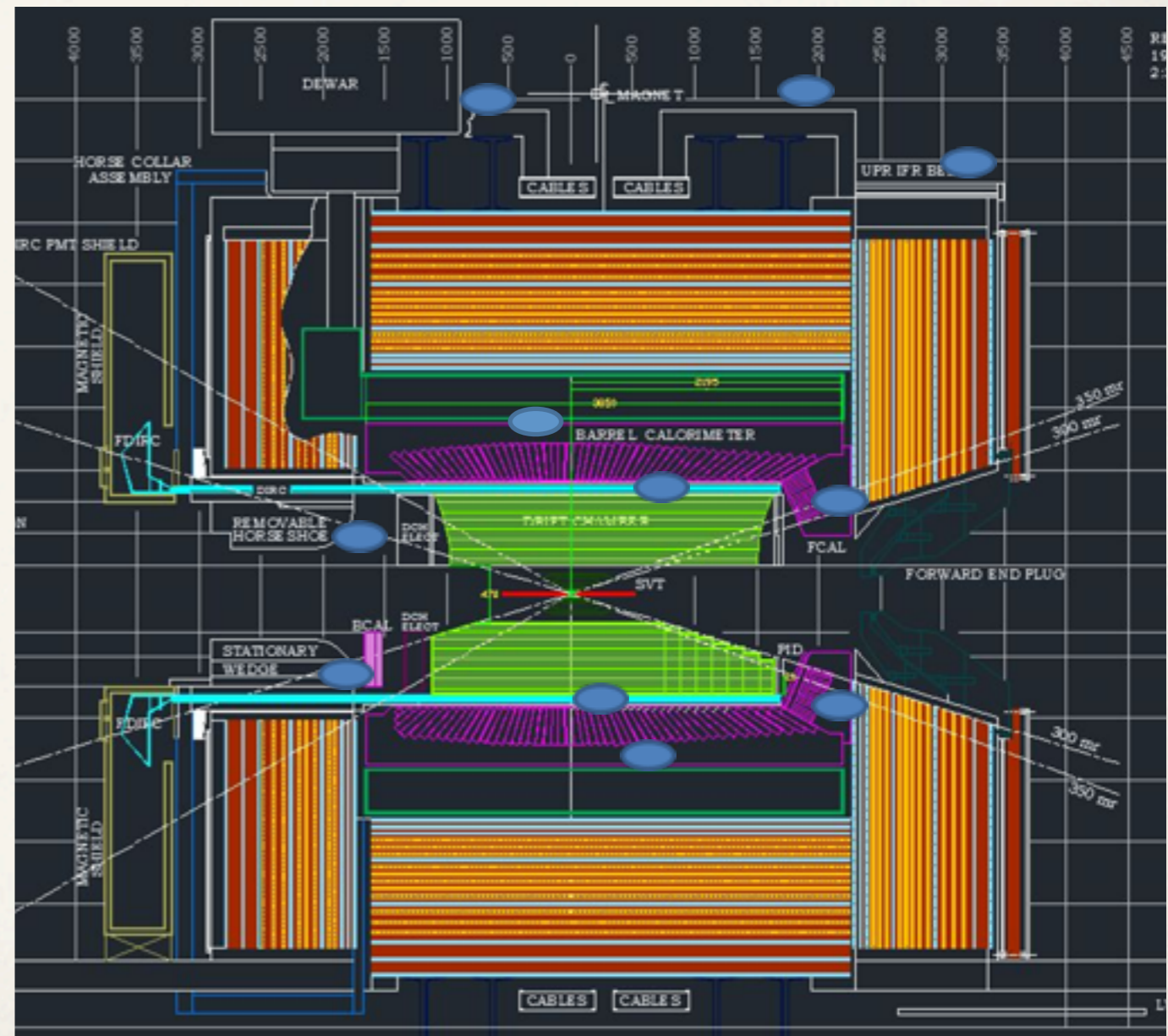
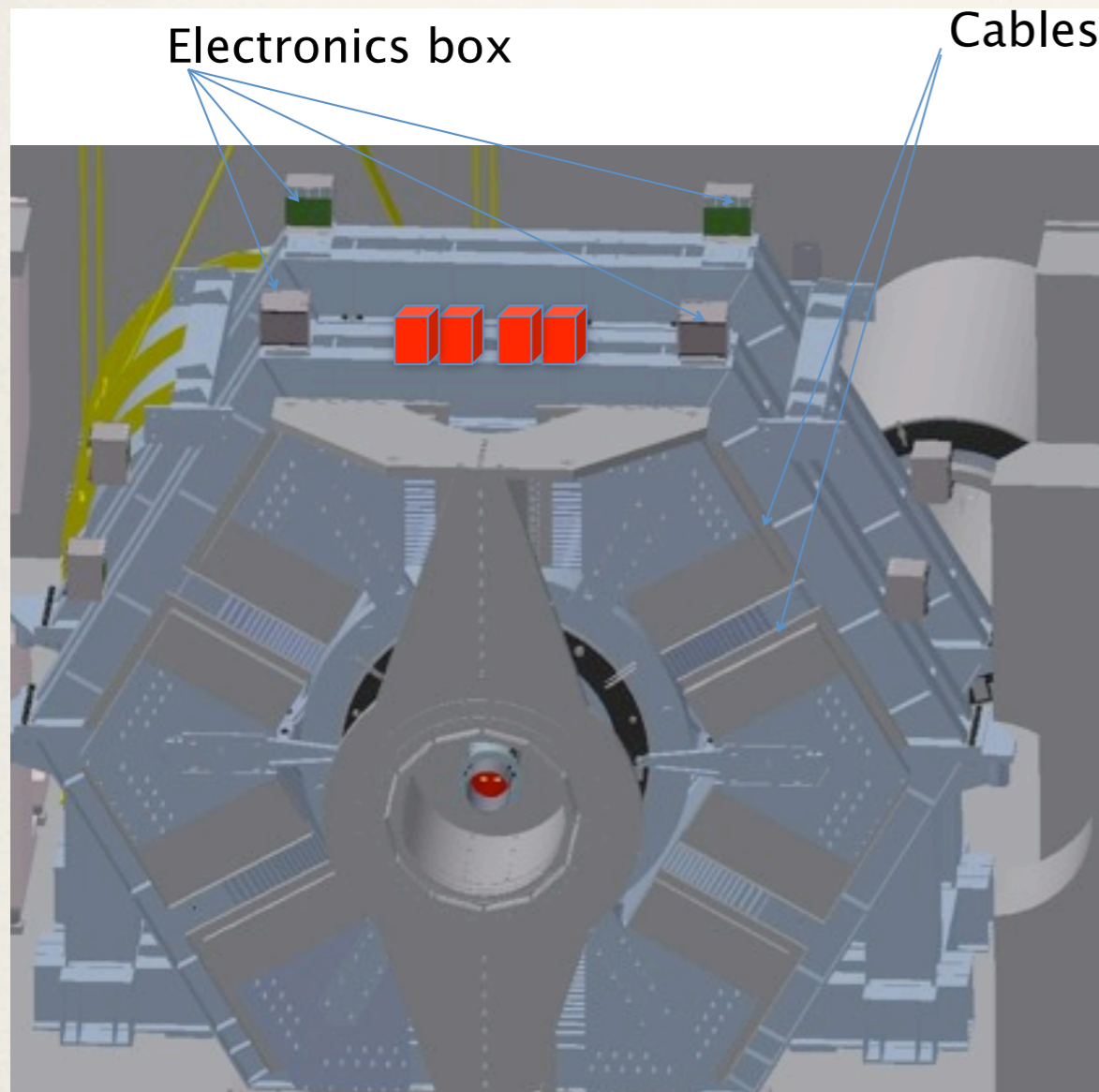
<http://sesam.desy.de/members/gunnar/Si-dfuncs.html>

- For most of the locations the value is integrated over phi (measured over rings)



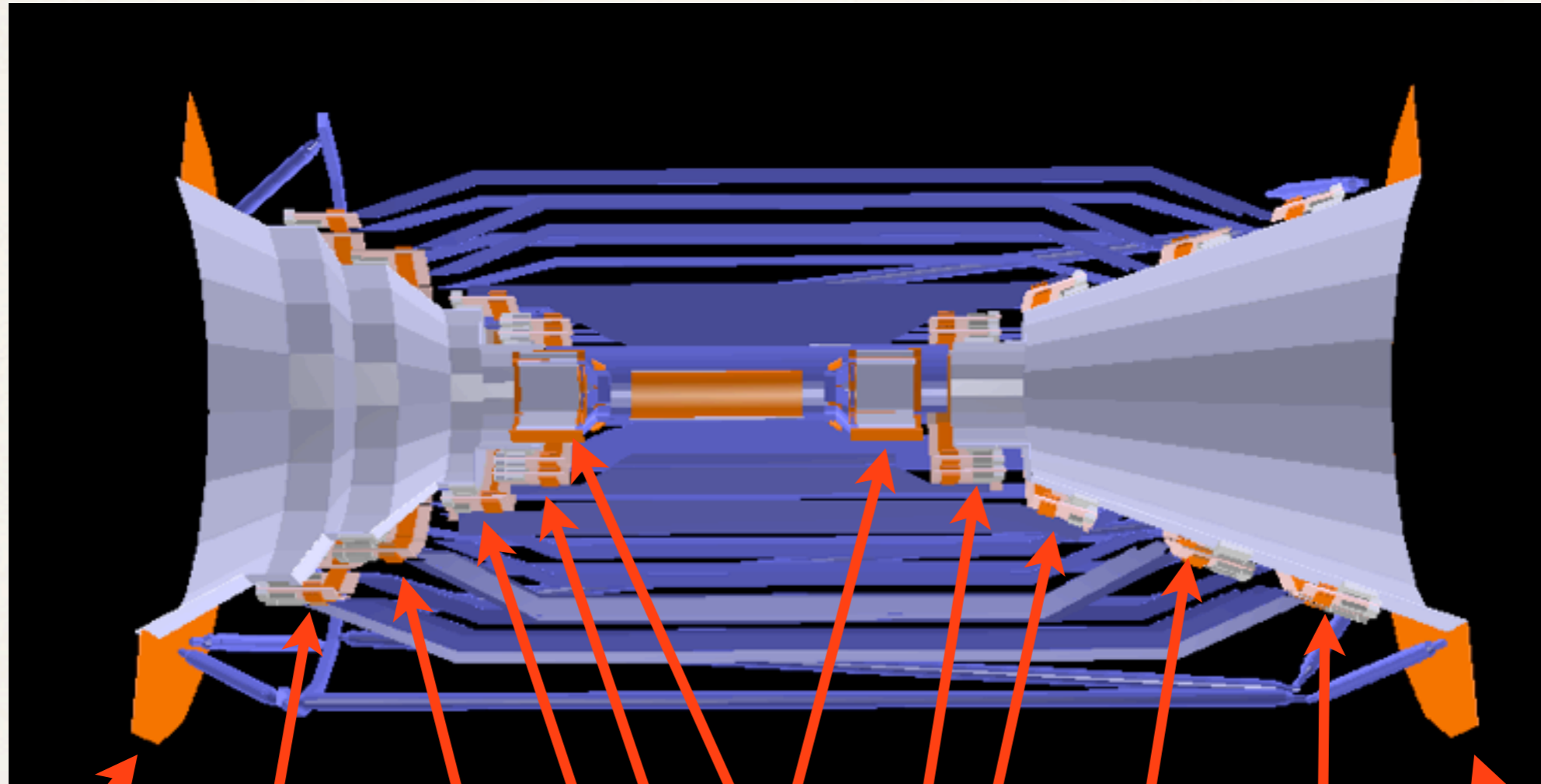
# Simulated radiation level

- Locations requested by ETD people





# Simulated radiation level



**Matching  
Card**

**Layer 5**

**Layer 4**

**Layer 0**

**Layer 1**

**Layer 2**

**Layer 3**

**Layer 4**

**Layer 5**

**Matching  
Card**



# Simulated radiation level

**EmcBrl**

**DrcFEE**

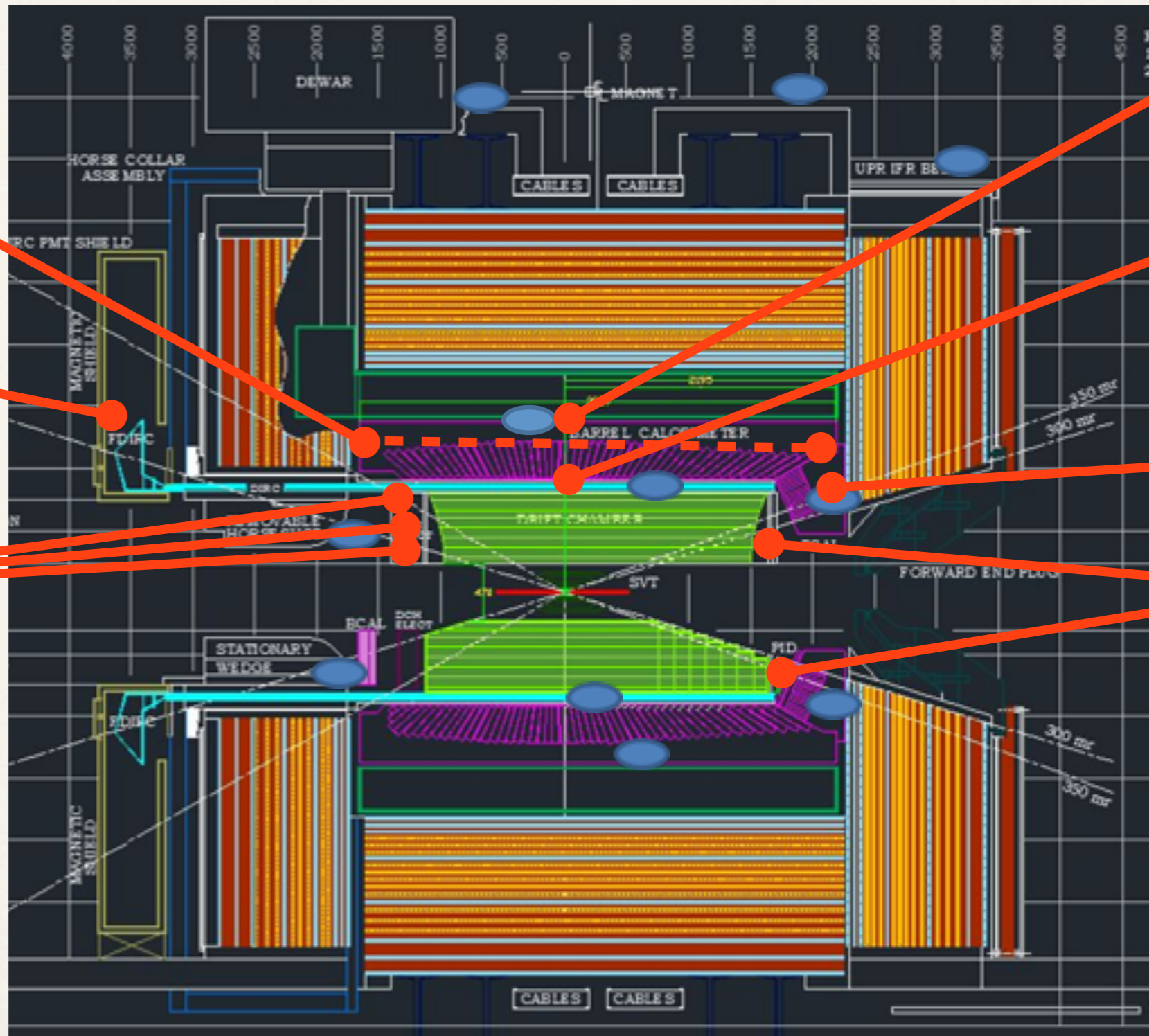
**DchFEE  
(3 zones)**

**EmcBrl  
Ctr**

**DrcCtr  
Bars**

**EmcFwd  
FEE**

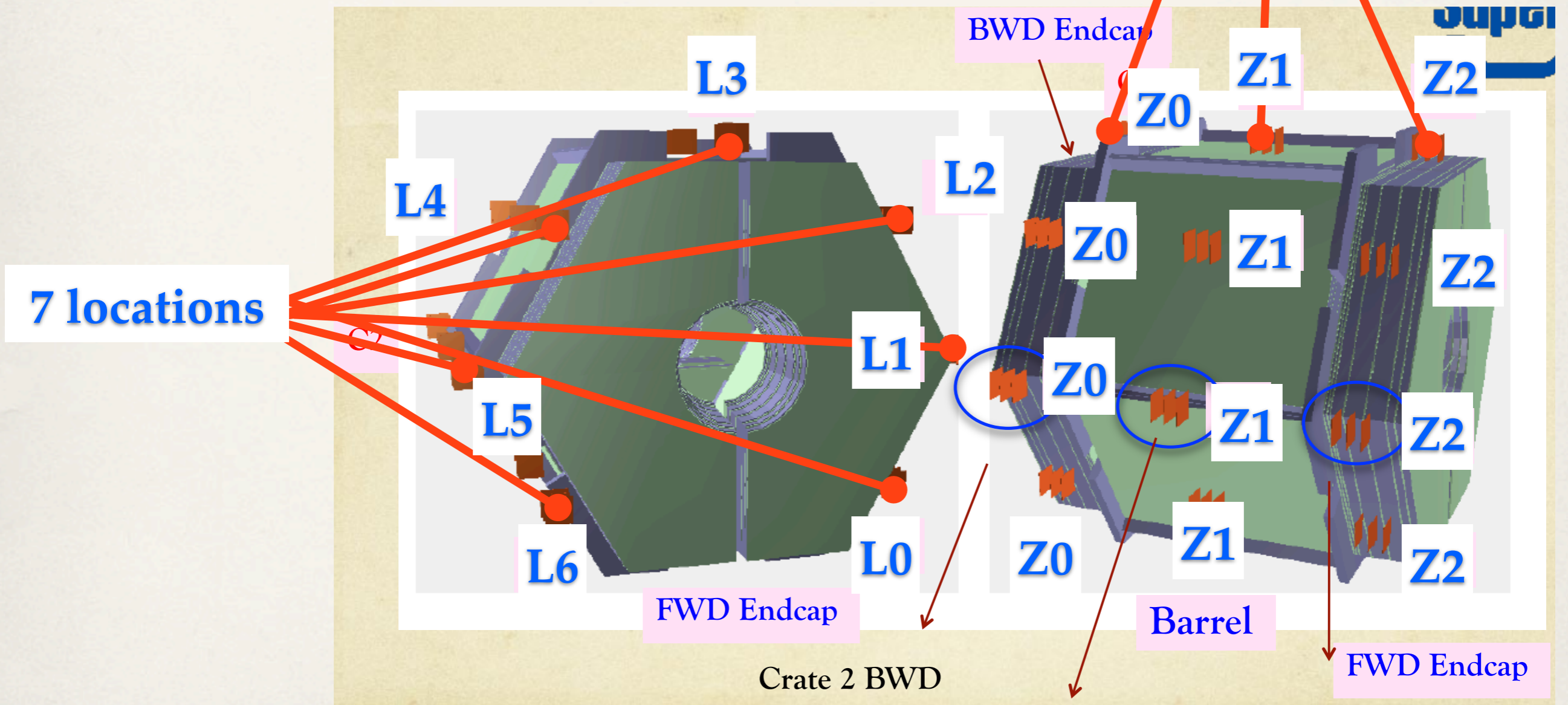
**TofFEE**





# Simulated radiation level

- IFR FEE: 21 locations
- Not integrated over Phi





# Dch Rate

DCH

Contributions (Avg. rate)  
Radiative Bhabha (2784 kHz)

2photons (1672 kHz)

Touschek LER (393 kHz)

Touschek HER (109 kHz)

Beamgas HER (114 kHz) **OLD**

Contributions (Avg. rate)  
Radiative Bhabha (1111 kHz)

2photons (1431 kHz)

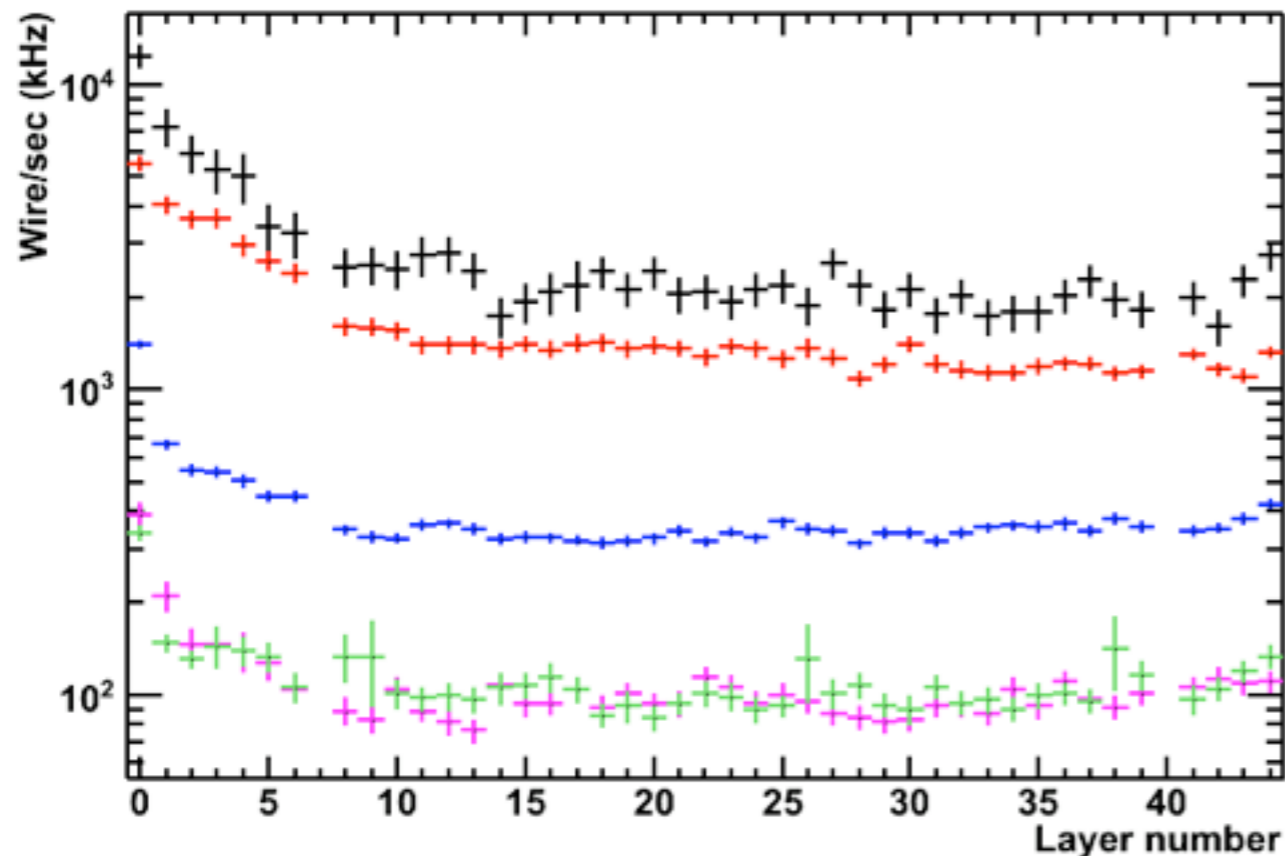
Touschek LER (306 kHz)

Touschek HER (92 kHz)

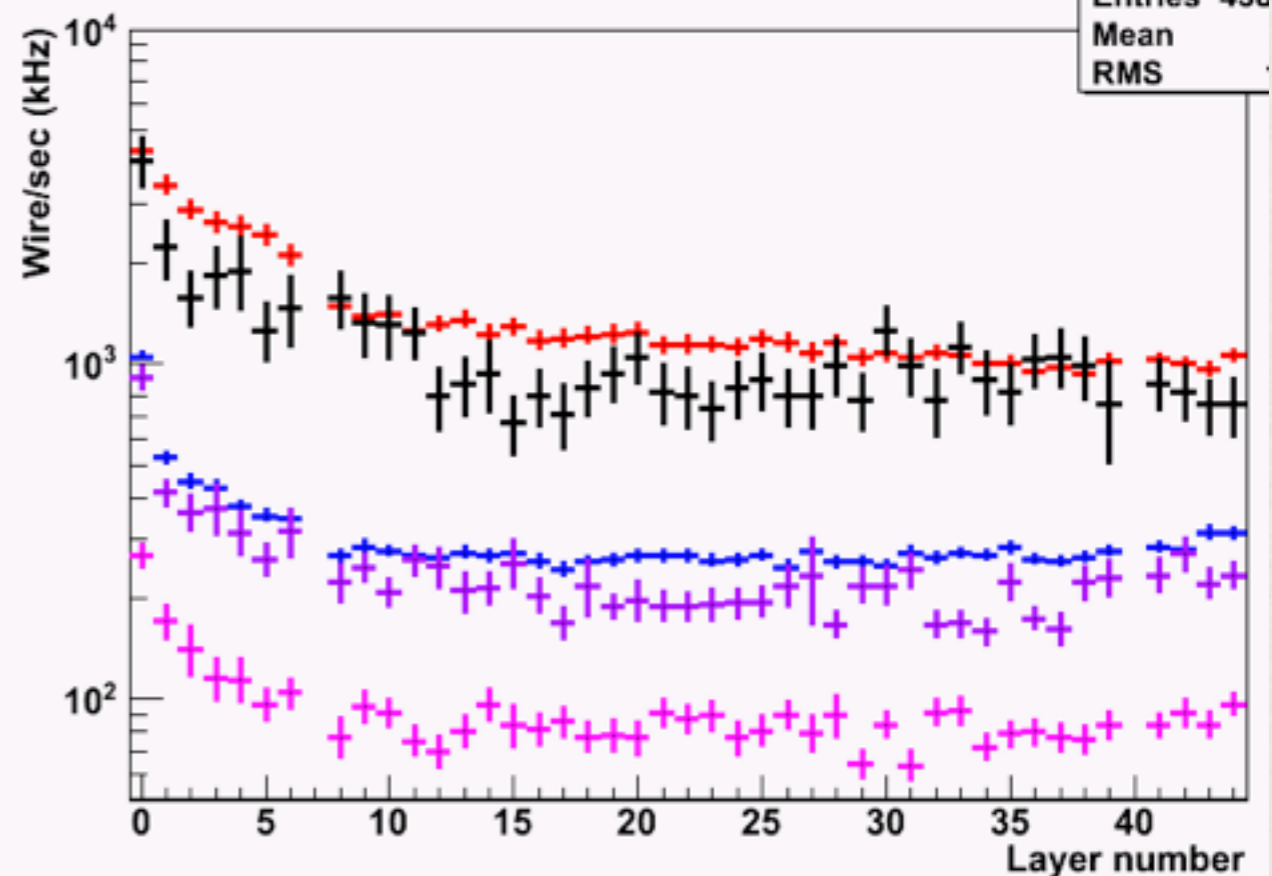
Beamgas HER (xxx kHz)

Beamgas LER (244 kHz) **NEW**

Dch Rate for each layer



Dch Rate for each layer





# Dch Rate, stereo

DCH

- Updated table, including normalization correction

Avg. Rate [kHz](Occ.)	Axial01	SuperB01	SuperB02
Pairs	1431	1613	1792
RadBhabha	1111	1410	1645
Touschek HER	92	117	140
Touschek LER	306	374	440
Beamgas HER (old)	114	144	177
Beamgas LER	244	291	342
<b>TOTAL</b>	<b>3298</b>	<b>3949</b>	<b>4536</b>
<b>TOTAL (old)</b> No BeamgasLER	<b>4403</b>	<b>5721</b>	<b>6810</b>