



# Update on Background Rates using Bruno simulation

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SuperB Collaboration Meeting, Pisa, ITALY - Bkg Parallel Session

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# Update summary

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- Code development only on the bkg analysis code, not on the Bruno simulation
- Various bugs were fixed, code re-organization has been completed:
  - running is stable and in shorter time (< 1 day)
  - easy to scale if productions size increases
- Updated result were released last night for SVT and ETD <http://www.pi.infn.it/~cenci/bruno/>



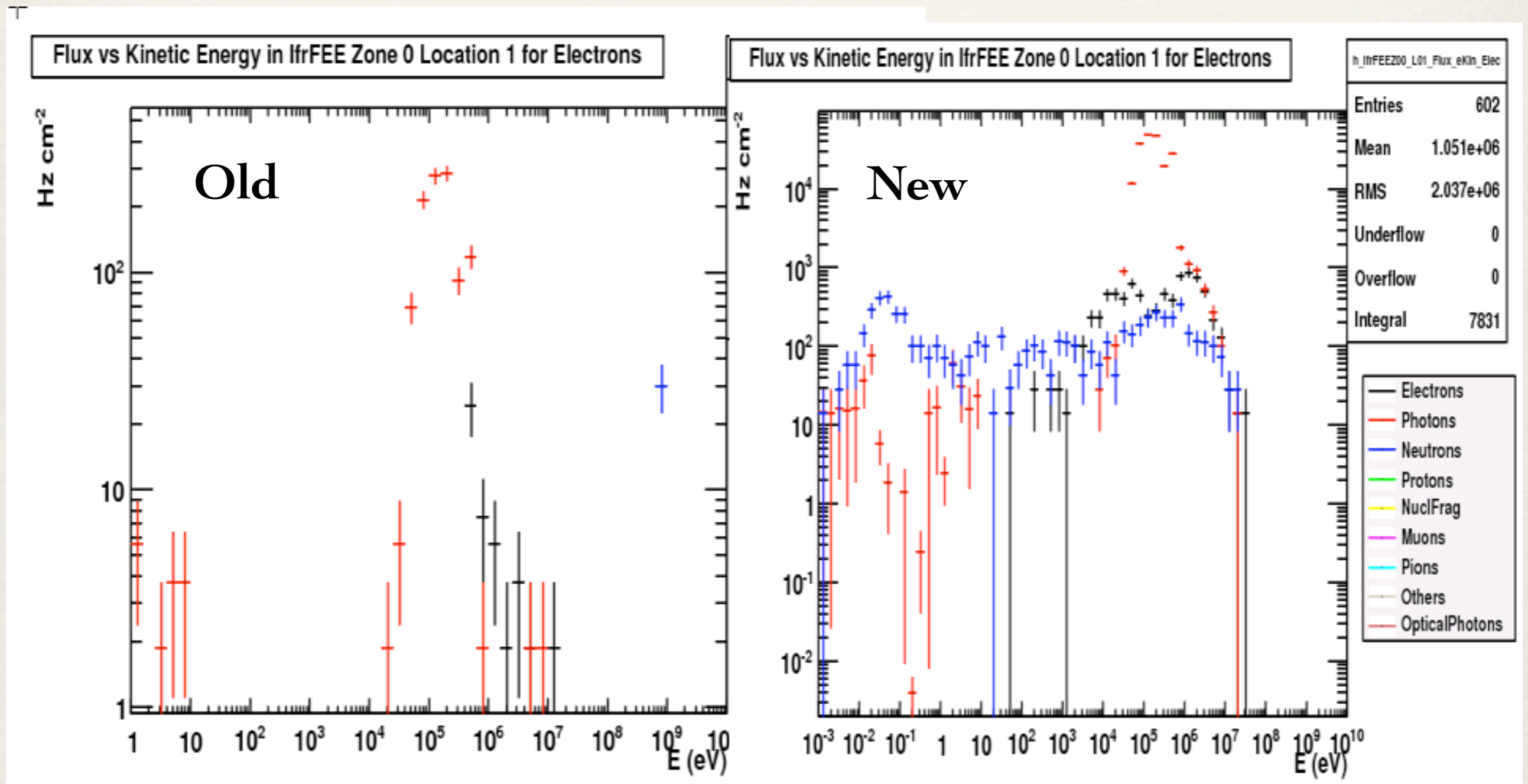
# Bugs

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- Discrepancy on NIEL fluency between my old calculation, values from Alejandro and my new values. Wrong units for energy to compute the damage, fixed
- Error in kinetic energy computation (particles mass not provided with hit information). Now mass is retrieved through Geant4
- Fixing the previous 2 bugs results in a significant decrease of NIEL and SEE fluencies (factor 2-100)
- L0 area for new geometry is different and need a manual fix every time analysis was run. Previous results were ok but some mistake in the following processing. Fixed, constants are retrieved automatically
- Some memory leaks... fixed

# Example: flux

- Effect of bug in mass calculation for flux plot





# Production September 2012

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- Rad-Bhabha ( $\Delta E/E > 30\%$ ): main radiative Bhabha component. Two geometries:
  - Geometry\_CABIBBO-V03: 15k bunch-crossings
  - Geometry\_CABIBBO-V03\_LYSO: 12k bunch-crossings (not analyzed)
- Rad-Bhabha ( $0.5 < \Delta E/E < 30\%$ ): verify that low k radiative-bhabha is negligible. Check for contribution to neutron cloud.
  - Geometry\_CABIBBO-V03: 20k bunch-crossings
- Pairs:
  - Geometry\_CABIBBO-V03: 100k bunch-crossings
- Touschek HER/LER:
  - Geometry\_CABIBBO-V03: 90k (198k) for HER (LER) primaries
- Beam-Gas:
  - Geometry\_CABIBBO-V03: 285k (283k) for HER (LER) primaries
- Synchrotron Radiation: first time this samples is produced. Main contribution on innermost layers of SVT
  - Geometry\_CABIBBO-V03: 9.8k (9.6k) for HER (LER) primaries

**New entry,  
small effect**

**New entry, no contribution**



# Rate comparison, updated

SVT

- Small contribution from new RadBhabha
- L0 lower rate due to different radius (Jun12, Sep12)

LAYER S	2photons				Bbbrem		Touschek HER		Touschek LER		BeamgasHER		Beamgas LER		Bbbrem Low $\Delta E$
	Jan12	May12	Jun12	Sep12	May12	Sep12	May12	Sep12	May12	Sep12	May12	Sep12	May12	Sep12	May12
L0 phi	29.4	30.1	18.7	18.8	0.83	0.54	0.62	0.40	1.70	1.39	0.47	0.37	1.48	1.12	0.013
L0 z	37.2	38.1	20.2	20.3	1.58	0.80	1.94	1.23	4.73	3.7	1.37	1.04	4.27	3.03	0.021
L1 phi	1.56	1.60	1.71	1.66	0.13	0.13	0.19	0.21	0.67	0.93	0.16	0.2	0.58	0.77	0.027
L1 z	0.74	0.76	0.80	0.79	0.08	0.086	0.20	0.23	0.69	0.98	0.18	0.22	0.61	0.80	0.020
L2 phi	0.78	0.81	0.94	0.82	0.079	0.086	0.135	0.13	0.51	0.66	0.12	0.14	0.43	0.56	0.021
L2 z	0.40	0.41	0.49	0.41	0.056	0.056	0.15	0.14	0.55	0.69	0.13	0.14	0.47	0.58	0.018
L3 phi	0.14	0.15	0.26	0.14	0.049	0.023	0.035	0.03	0.165	0.16	0.029	0.028	0.14	0.14	0.009
L3 z	0.13	0.14	0.24	0.11	0.055	0.023	0.057	0.05	0.255	0.25	0.048	0.046	0.21	0.22	0.009
L4 phi	0.022	0.027	0.031	0.023	0.013	0.006	0.0042	0.004	0.014	0.018	0.0035	0.003	0.012	0.016	0.002
L4 z	0.014	0.019	0.019	0.016	0.0081	0.005	0.0031	0.003	0.010	0.014	0.0026	0.003	0.0087	0.012	0.0017
L5 phi	0.012	0.016	0.015	0.014	0.0062	0.005	0.0020	0.002	0.0070	0.011	0.0015	0.002	0.0056	0.009	0.0017
L5 z	0.0082	0.011	0.010	0.010	0.0039	0.003	0.0015	0.002	0.0054	0.008	0.0012	0.002	0.0044	0.007	0.0012

# 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	322	103	83	20	4.9	1.3	N/A
RadBhabha	59	55	42	10	1.7	0.5	N/A
Touschek HER	24.6	12.4	10.0	3.06	0.87	0.34	N/A
Touschek LER	76.9	38.2	34.8	12.1	2.47	0.3	N/A
Beam-gas HER	21.9	9.8	8.3	2.4	0.70	0.31	N/A
Beam-gas LER	61.7	29.9	28.2	9.56	2.0	0.26	N/A
RadBhabha Low $\Delta E$	9	19	12	4	0.72	0.08	N/A
<b>TOTAL</b>	<b>575</b>	<b>266</b>	<b>218</b>	<b>61</b>	<b>13.3</b>	<b>3</b>	<b>N/A</b>
<b>TOTAL (old)</b>	<b>754</b>	<b>163</b>	<b>188</b>	<b>96</b>	<b>25</b>	<b>8</b>	<b>3.1</b>



# Simulated radiation level

- Updated table using new production, all contributions, values are similar
- No MCard hits, but volumes are there and sensitive, still investigating
- Value for L0 are lower, but for outer layer are higher, mostly due to Radiative Bhabha with low  $\Delta E/E$

**May 2012, OLD**

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	Layer0	1.29	1.29	-6	6	46652.9	7.37846e+12	8.58551e+09
SVT	Layer1	3.3	3.3	-10	10	3257.12	8.78512e+11	1.6831e+09
SVT	Layer2	4	4	-15	15	2093.02	5.66709e+11	3.24182e+09
SVT	Layer3	5.9	5.9	-20	20	950.617	3.36038e+11	1.78978e+09
SVT	Layer4	12.2	12.2	-30	30	117.464	2.00954e+11	1.93979e+09
SVT	Layer5	14.2	14.2	-30	35	62.893	1.77166e+11	2.25636e+09

**September 2012**

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	Layer0	1.51	1.51	-6	6	28302.3	4.49872e+12	2.90675e+09
SVT	Layer1	3.3	3.3	-10	10	3969.09	9.07633e+11	1.85912e+09
SVT	Layer2	4	4	-15	15	2433.61	6.30704e+11	3.40431e+09
SVT	Layer3	5.9	5.9	-20	20	872.757	3.87794e+11	4.3366e+09
SVT	Layer4	12.2	12.2	-30	30	126.339	2.62583e+11	2.93964e+09
SVT	Layer5	14.2	14.2	-30	35	76.8514	2.39533e+11	2.42211e+09



# Simulated radiation level

- Updated table using new production, all contributions, values are similar
- No MCard hits, but volumes are there and sensitive, still investigating
- Value for L0 are lower, but for outer layer are higher, mostly due to Radiative Bhabha with low  $\Delta E/E$

May 2012, OLD

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	FEELayer0	1.29	1.29	4.2	4.2	6183.9	1.28557e+12	7.73349e+09
SVT	FEELayer1	3.3	3.3	1	1	1280.96	3.77289e+11	1.27313e+10
SVT	FEELayer2	4	4	1	1	1465.95	5.22858e+11	3.36027e+10
SVT	FEELayer3	5.9	5.9	1	1	757.323	3.71168e+11	3.58198e+10
SVT	FEELayer4	12.2	12.2	1	1	208.5	2.83185e+11	3.29558e+10
SVT	FEELayer5	14.2	14.2	1	1	73.5702	3.34913e+11	4.23269e+10
SVT	MCard	30	30	0.2	0.2	24.4737	2.53619e+11	1.75142e+10

September 2012

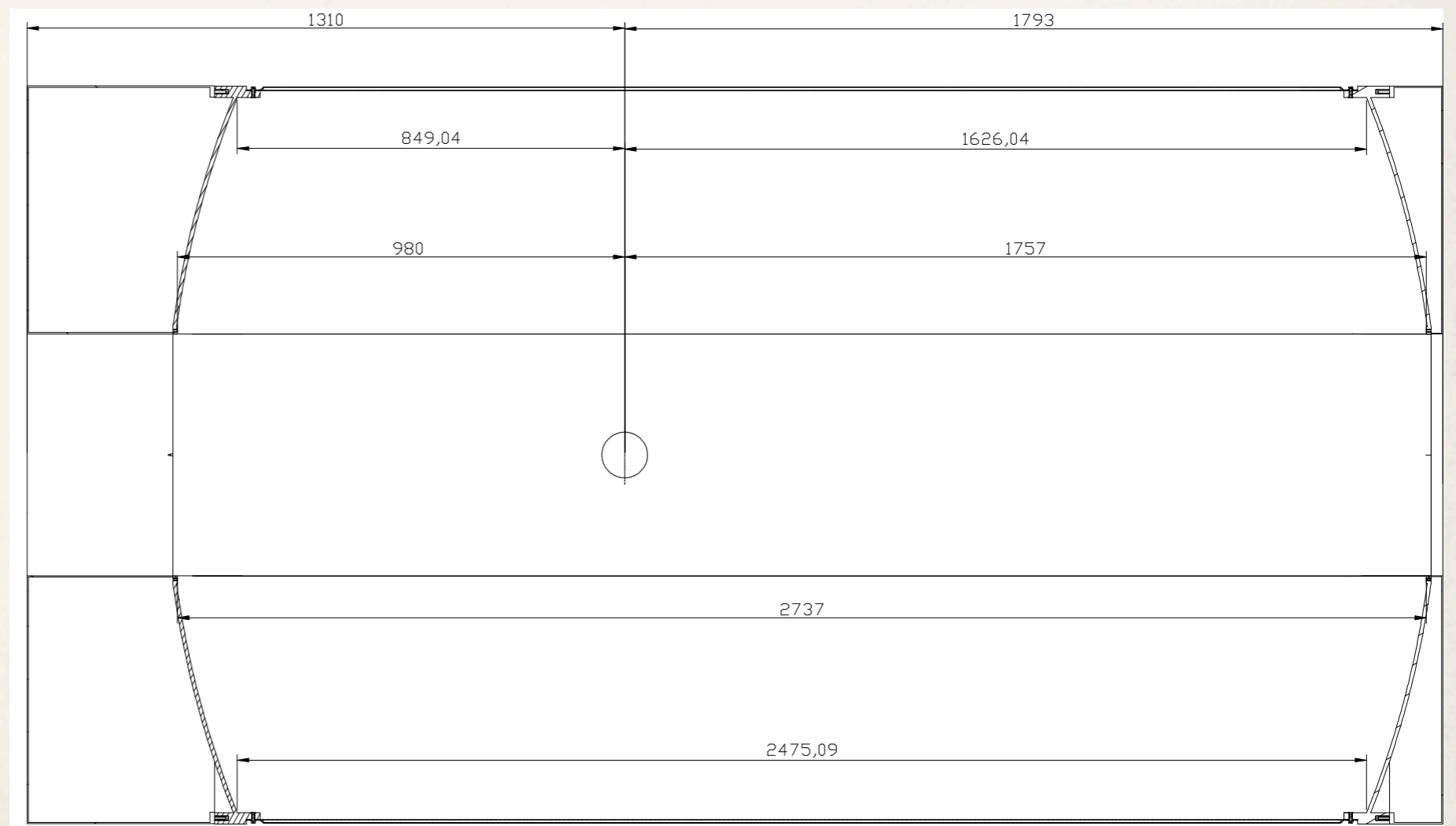
Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	FEELayer0	1.51	1.51	-17	17	5768.48	1.33233e+12	6.23921e+09
SVT	FEELayer1	3.3	3.3	-15	25	2744.8	1.09337e+12	3.32454e+10
SVT	FEELayer2	4	4	-15	20	2204.1	1.17509e+12	3.61821e+10
SVT	FEELayer3	5.9	5.9	-15	20	618.611	6.90401e+11	3.49439e+10
SVT	FEELayer4	12.2	12.2	-20	30	139.936	4.6194e+11	2.51164e+10
SVT	FEELayer5	14.2	14.2	-25	35	75.869	4.71179e+11	2.36979e+10
SVT	MCard	16.8	20	-70	70	0	0	0



# New DCH Geometry

- Updated geometry
- Discussion about backward shift due to upgraded FTOF

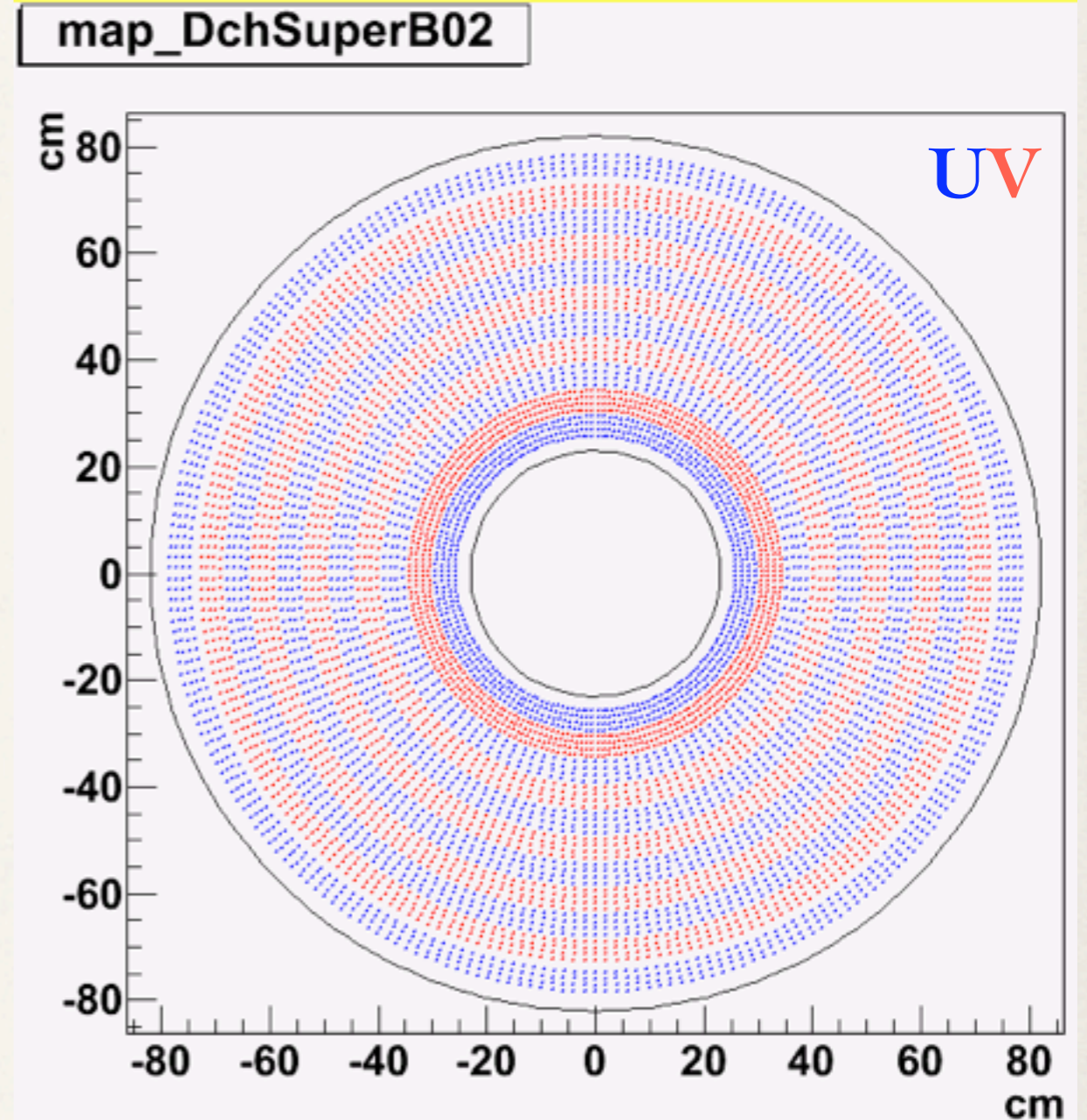
- Convex endplates
- Inner radius: 236  
->265 mm
- Thinner inner plate: 1 -> 0.5mm
- Correct thickness for all the walls plus coating





# Dch configurations

- Inner wall of carbon fiber wall 236-237mm (discussion about thinning down the wall to 0.5mm)
- 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):
  - **SuperB03-06**, very similar
    - Inner wall @264mm (.5mm thick), 1st layer @ 286mm, for a reliable occupancy estimate we need a production with the wall in the right position
    - AA-UVVUVVUVVU-AA (2 layers for each letter)
    - Cell size 1.0-1.2 cm



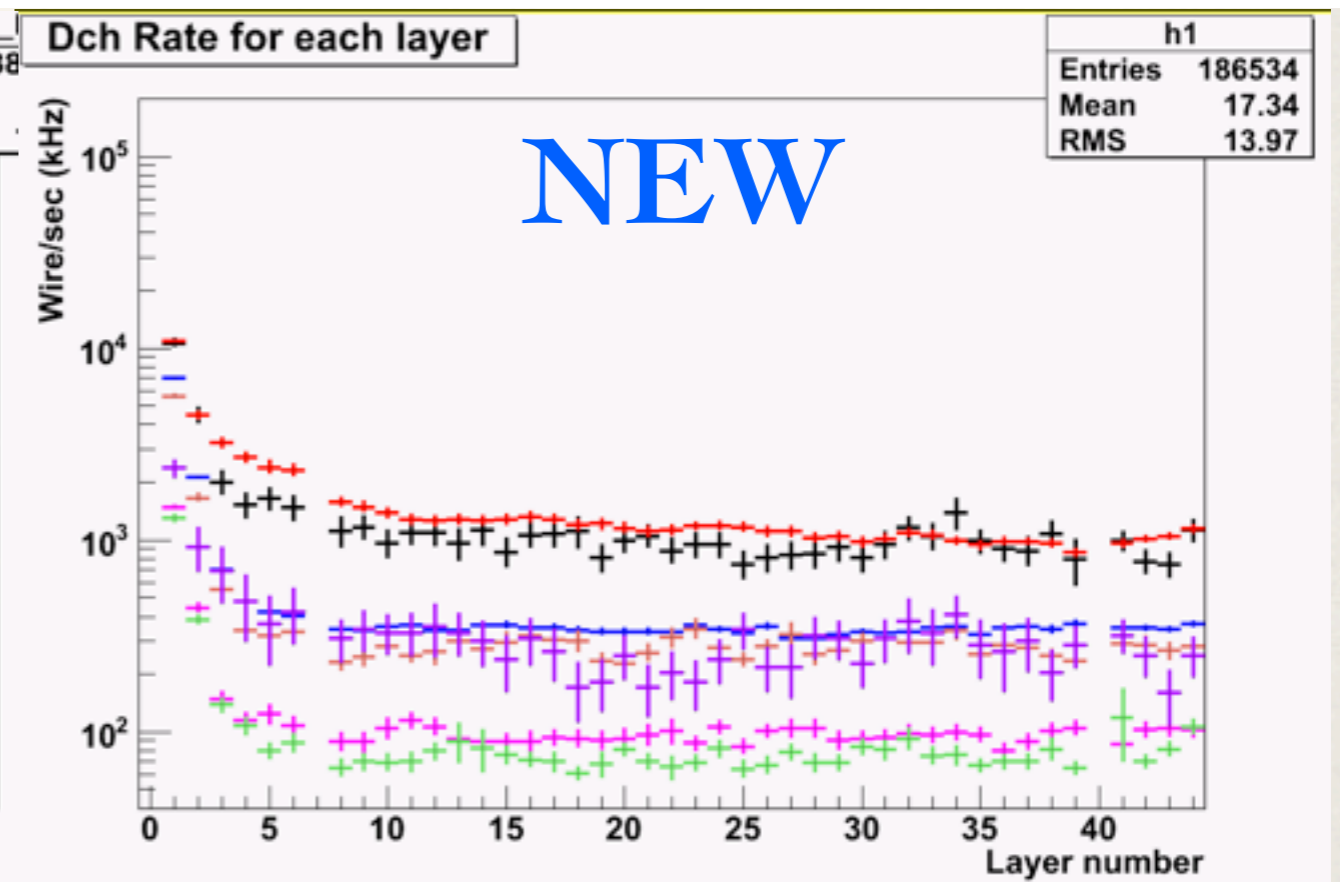
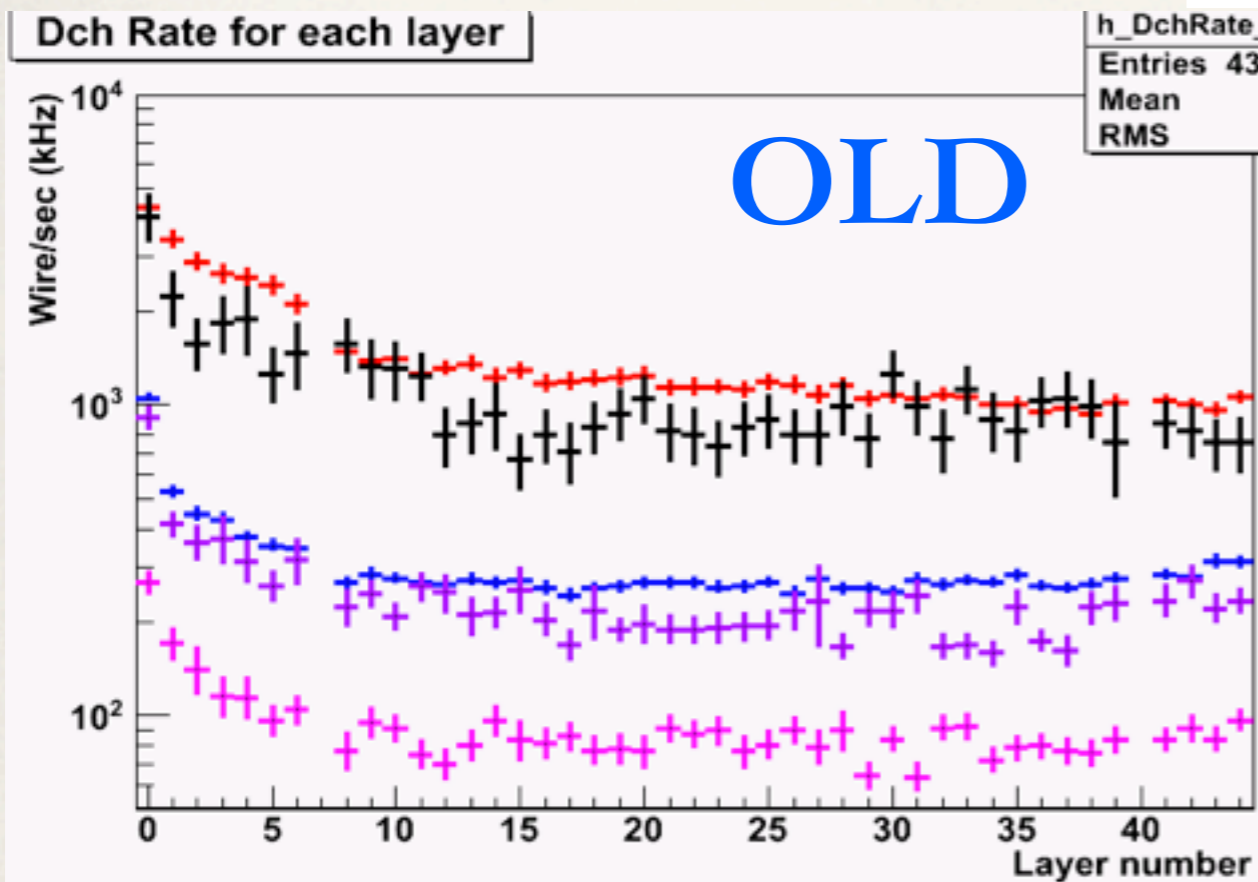


# Dch Rate

DCH

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)

Contributions (Avg. rate)  
 Radiative Bhabha (662 kHz)  
 2photons (781 kHz)  
 Touschek HER (68 kHz)  
 Touschek LER (273 kHz)  
 Beamgas HER (56 kHz)  
 Beamgas LER (219 kHz)  
 Radiative Bhabha Low $\Delta E$ (6974 kHz)





# Dch Rate, stereo

DCH

- Updated table, including normalization correction
- Lower rate due to larger inner radius and additional shielding

Avg. Rate [kHz]	Ax01	SpB1	SpB2	SpB3	SpB4	SpB5	SpB6
Pairs	781	885	981	745	747	753	777
RadBhabha	662	798	874	649	638	653	672
Touschek HER	68	83	97	65	65	65	69
Touschek LER	273	324	362	228	228	230	239
Beamgas HER	56	70	84	54	54	55	59
Beamgas LER	219	260	386	184	186	185	193
RadBhabha Low $\Delta E$	176	208	234	179	176	180	180
<b>TOTAL</b>	<b>2235</b>	<b>2628</b>	<b>3018</b>	<b>2104</b>	<b>2094</b>	<b>2121</b>	<b>2189</b>

<b>TOTAL (old)</b>	<b>3298</b>	<b>3949</b>	<b>4536</b>
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# Dch, Tof, Drc, Emc Electronics

**OLD**

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
DCH	FEEZone0	23.6	40	-111.9	-111.9	7.66696	3.01257e+11	7.59315e+10
DCH	FEEZone1	40	60	-111.9	-111.9	5.49084	1.69857e+11	4.48331e+10
DCH	FEEZone2	60	81	-111.9	-111.9	3.73313	1.05596e+11	3.2304e+10
TOF	FEE	55	92	200	200	2.23669	1.0317e+11	2.27118e+10
DRC	BarCenter	81.7	89.3	-10	10	2.216	9.27939e+10	1.08822e+11
DRC	FEE	103	155	-377	-342	0.783165	2.23769e+10	2.9138e+08
EMC	FwdFEE	70	110	216	236	1.2823	9.40241e+10	6.44386e+08
EMC	BrlFEE	120	120	-155	216	0.146405	2.02892e+10	1.27919e+08
EMC	BrlCtrFEE	120	120	-10	10	0.0151425	1.32686e+10	1.57239e+08

**NEW**

Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
DCH	FEEZone0	23.6	40	-112.8	-112.8	7.69108	2.63079e+11	6.41147e+10
DCH	FEEZone1	40	60	-112.8	-112.8	6.61284	1.8293e+11	4.91622e+10
DCH	FEEZone2	60	81	-112.8	-112.8	4.42703	1.27754e+11	3.42023e+10
TOF	FEE	55	92	200	200	1.68779	1.09059e+11	2.14255e+10
DRC	BarCenter	81.7	89.3	-10	10	3.00009	1.14594e+11	1.2256e+11
DRC	FEE	103	155	-377	-342	0.678448	2.18521e+10	2.77301e+08
EMC	FwdFEE	70	110	216	236	0.928144	1.05235e+11	4.74704e+08
EMC	BrlFEE	120	120	-155	216	0.106681	2.26647e+10	2.35279e+08
EMC	BrlCtrFEE	120	120	-10	10	0.0158816	1.48401e+10	3.0782e+08



# Ifr/Detector Hall Electronics

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	31.1665	2.4284e+10	7.22965e+08
IFR	FEEZone0Loc1	360.555	400.5	-281	-239	21.5881	2.34904e+10	7.27953e+08
IFR	FEEZone0Loc2	300	356.09	-281	-239	32.1758	2.2649e+10	4.28463e+08
IFR	FEEZone0Loc3	300.666	340.588	-281	-239	41.9365	3.98159e+10	7.14166e+08
IFR	FEEZone0Loc4	332.866	325.576	-281	-239	51.1211	3.25244e+10	9.99747e+08
IFR	FEEZone0Loc5	400.5	360.555	-281	-239	38.9051	2.99106e+10	3022.02
IFR	FEEZone0Loc6	356.09	300	-281	-239	45.2372	3.3651e+10	2.85642e+08
IFR	FEEZone1Loc0	325.576	332.866	-21	21	9.52854	9.15578e+09	0
IFR	FEEZone1Loc1	360.555	400.5	-21	21	10.0214	1.25481e+10	2.85642e+08
IFR	FEEZone1Loc2	300	356.09	-21	21	9.21988	1.45044e+10	4.28463e+08
IFR	FEEZone1Loc3	300.666	340.588	-21	21	13.6757	9.5784e+09	2.85642e+08
IFR	FEEZone1Loc4	332.866	325.576	-21	21	13.0335	1.39963e+10	1.42821e+08
IFR	FEEZone1Loc5	400.5	360.555	-21	21	17.0688	1.51639e+10	5.71284e+08
IFR	FEEZone1Loc6	356.09	300	-21	21	16.8349	7.32073e+09	4.28463e+08
IFR	FEEZone2Loc0	325.576	332.866	239	281	16.4018	1.488e+10	5.71284e+08
IFR	FEEZone2Loc1	360.555	400.5	239	281	15.3993	1.37683e+10	1.42821e+08
IFR	FEEZone2Loc2	300	356.09	239	281	14.9135	3.7161e+10	1.42821e+09
IFR	FEEZone2Loc3	300.666	340.588	239	281	42.0685	4.01946e+10	7.14105e+08
IFR	FEEZone2Loc4	332.866	325.576	239	281	26.2764	2.09755e+10	1.42821e+08
IFR	FEEZone2Loc5	400.5	360.555	239	281	36.9835	2.47166e+10	2.85642e+08
IFR	FEEZone2Loc6	356.09	300	239	281	28.4061	2.57001e+10	1.28539e+09

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	35.5415	3.14595e+10	5.24862e+08
IFR	FEEZone0Loc1	360.555	400.5	-281	-239	32.1066	2.75763e+10	3.96366e+08
IFR	FEEZone0Loc2	300	356.09	-281	-239	36.7237	2.73128e+10	5.24862e+08
IFR	FEEZone0Loc3	300.666	340.588	-281	-239	62.5895	3.92851e+10	1.02362e+09
IFR	FEEZone0Loc4	332.866	325.576	-281	-239	70.4446	4.26482e+10	8.60564e+08
IFR	FEEZone0Loc5	400.5	360.555	-281	-239	73.272	3.48311e+10	9.78856e+08
IFR	FEEZone0Loc6	356.09	300	-281	-239	64.7146	3.85524e+10	3.58052e+08
IFR	FEEZone1Loc0	325.576	332.866	-21	21	1.95322	2.66851e+09	2.86855e+08
IFR	FEEZone1Loc1	360.555	400.5	-21	21	0	0	0
IFR	FEEZone1Loc2	300	356.09	-21	21	3.03989	2.97994e+09	0
IFR	FEEZone1Loc3	300.666	340.588	-21	21	3.17473	7.62869e+08	0
IFR	FEEZone1Loc4	332.866	325.576	-21	21	3.74495	1.62685e+09	0
IFR	FEEZone1Loc5	400.5	360.555	-21	21	0	0	0
IFR	FEEZone1Loc6	356.09	300	-21	21	3.01123	1.74442e+09	0
IFR	FEEZone2Loc0	325.576	332.866	239	281	22.7479	2.68286e+10	4.78091e+08
IFR	FEEZone2Loc1	360.555	400.5	239	281	21.8372	1.72995e+10	7.16098e+08
IFR	FEEZone2Loc2	300	356.09	239	281	20.5691	2.21623e+10	4.29244e+08
IFR	FEEZone2Loc3	300.666	340.588	239	281	54.1005	3.9675e+10	1.28773e+09
IFR	FEEZone2Loc4	332.866	325.576	239	281	35.2387	2.89157e+10	6.44904e+08
IFR	FEEZone2Loc5	400.5	360.555	239	281	49.7229	3.39024e+10	9.21228e+08
IFR	FEEZone2Loc6	356.09	300	239	281	40.7733	3.41487e+10	8.01186e+08

OLD

NEW



# Conclusions

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- Development and bug fixing for background analysis code
- New productions with new contributions:
  - **RadBhabha with low  $\Delta E/E$** : small contribution
  - **Synchrotron radiation**: low energy photons, no deposited energy, still under investigation by Eugenio
- SVT Layer 0 new geometry, consistent over all the production
- DCH, updated geometry according the last design available
- ETD, updated map of radiation level for requested locations around the detector, no significant variations

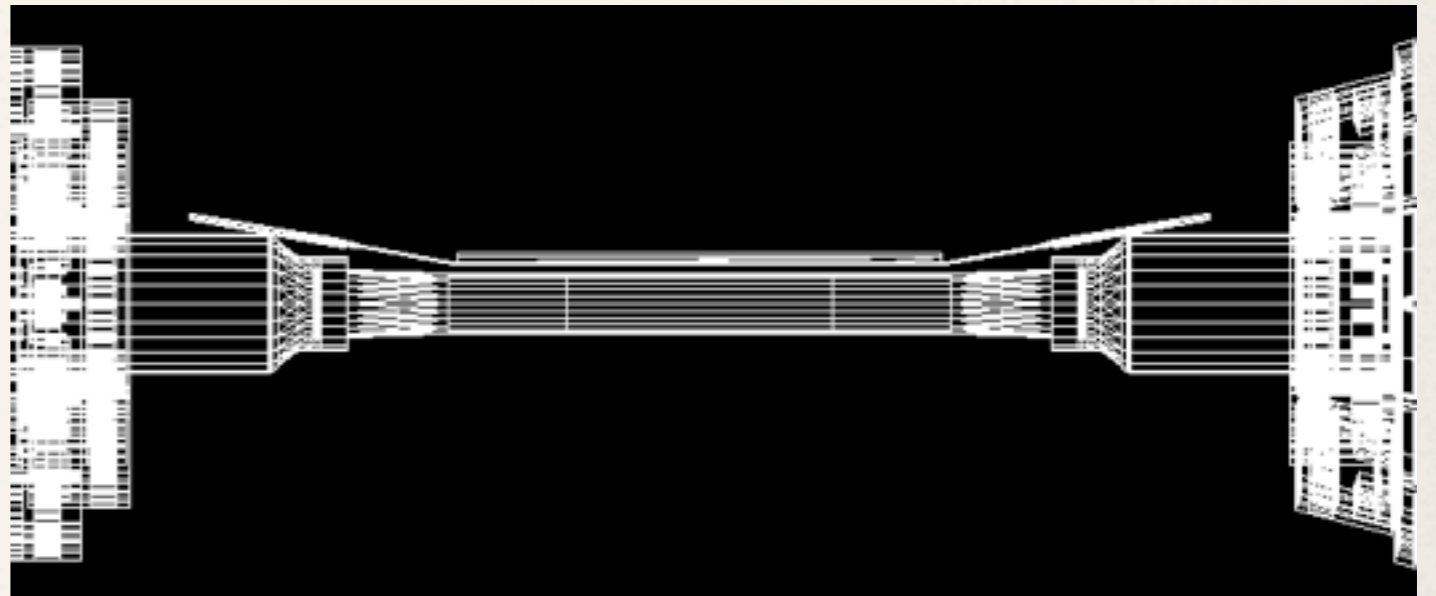
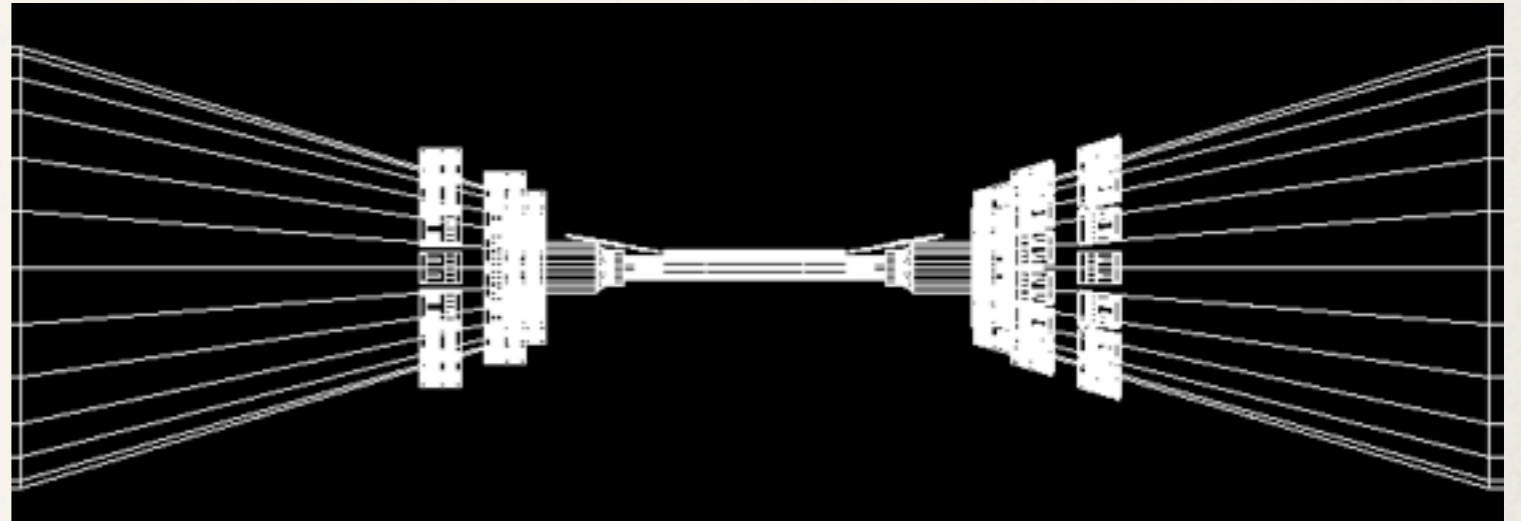






# SVT triplets geometry

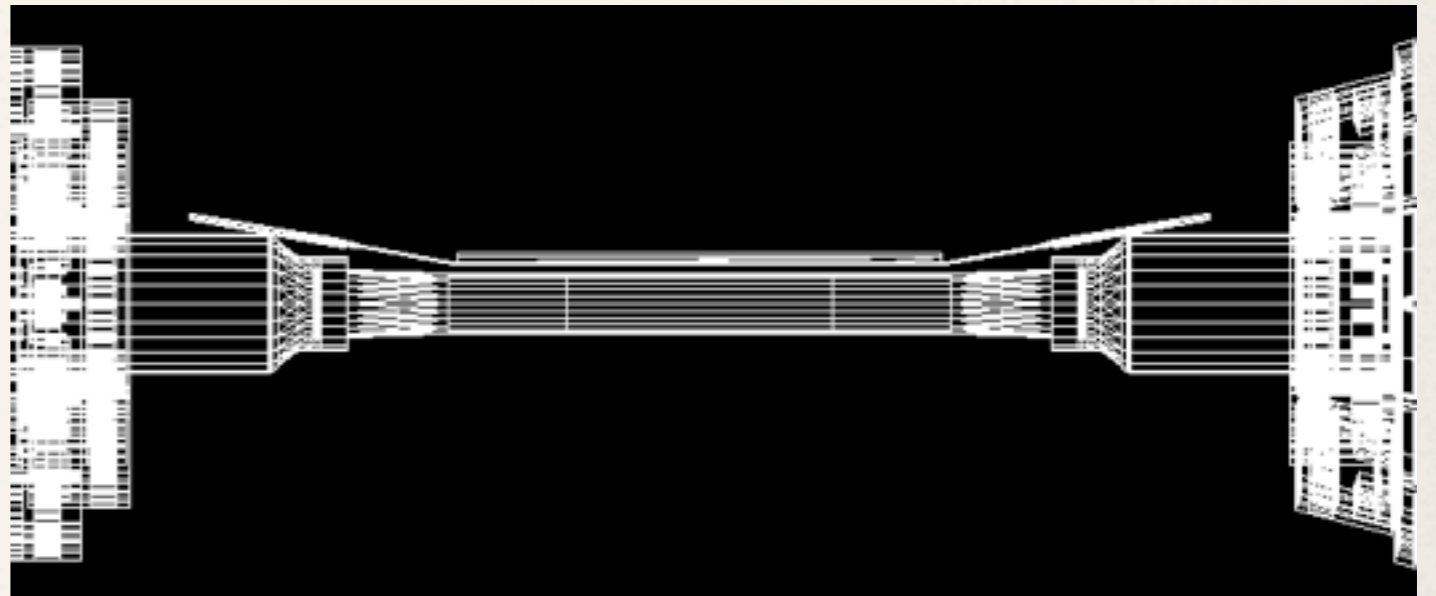
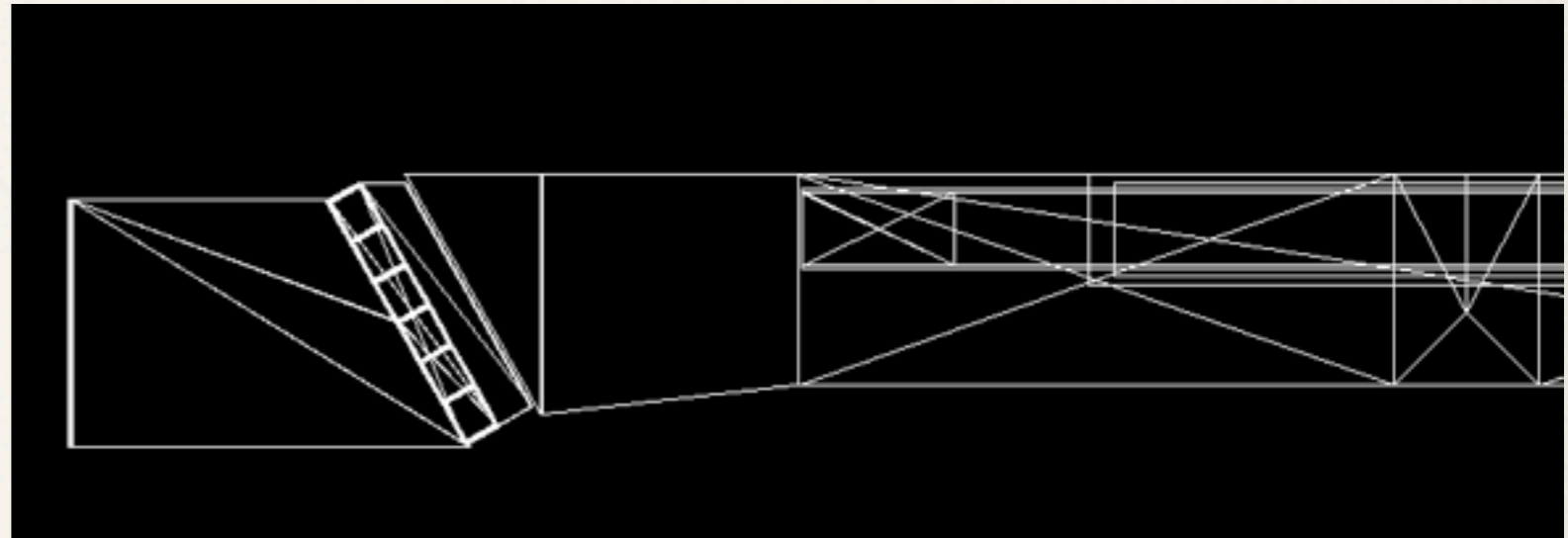
- GDML version is **ready** and tested for overlaps
- Based on Geometry\_CIPE\_V00-00-02 revision 359, tag for V00-00-05
- Beampipe and final focus modifications were easy
- Tungsten shielding is completely symmetric wrt IP
- Relevant changes on how container volumes are implemented but no changes to 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)





# New Productions

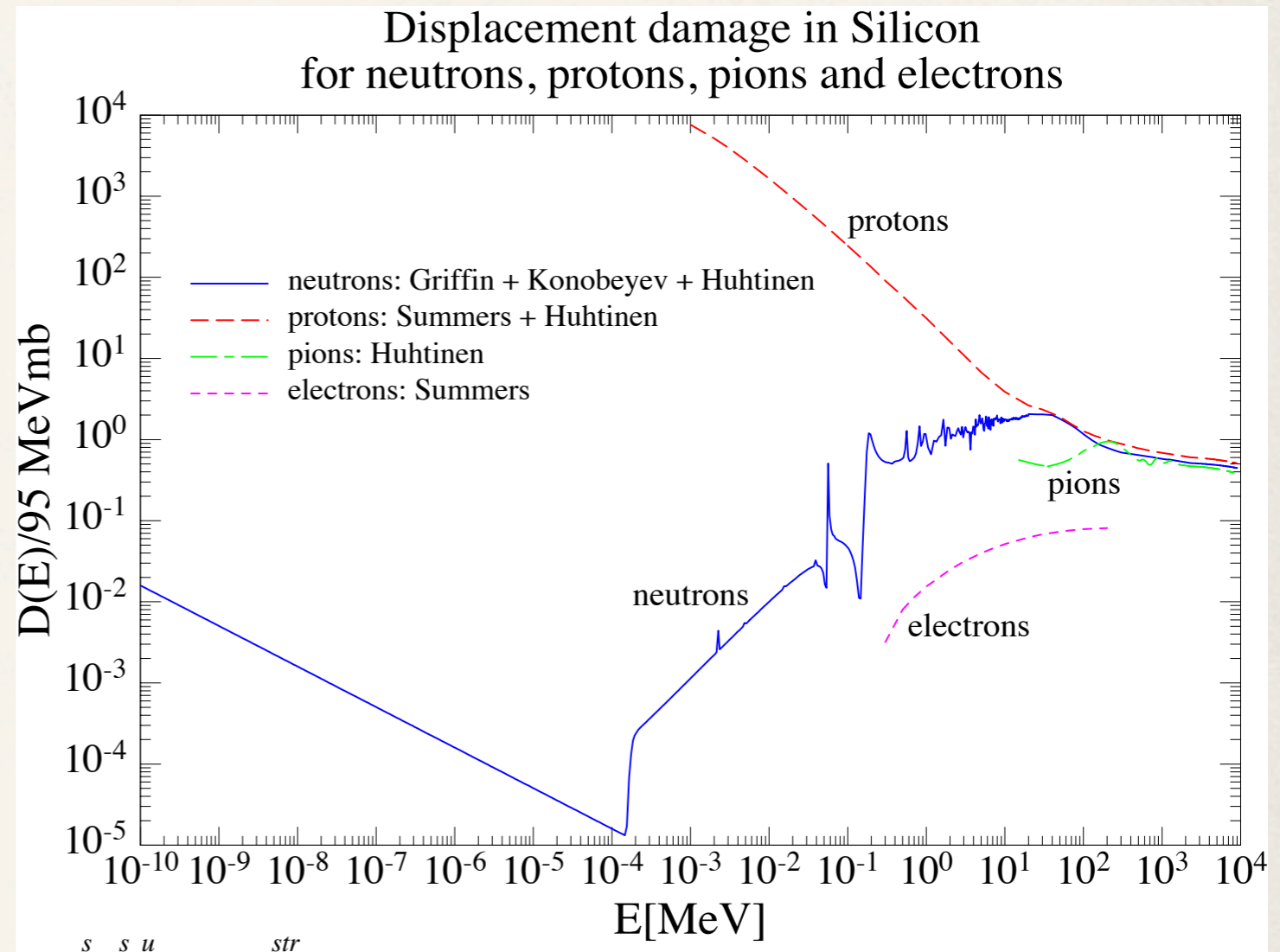
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- 2012 official productions (**thicker tungsten shielding**):
    - **2photons** (~100k evts, 372us) solenoidal field limited in z,  $\pm 40$  cm
    - **RadBhabha** (~10k evts, 37us)
    - **Touschek**: (~87k evts HER, ~198k LER, weighted evts)
    - **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
- 



# 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

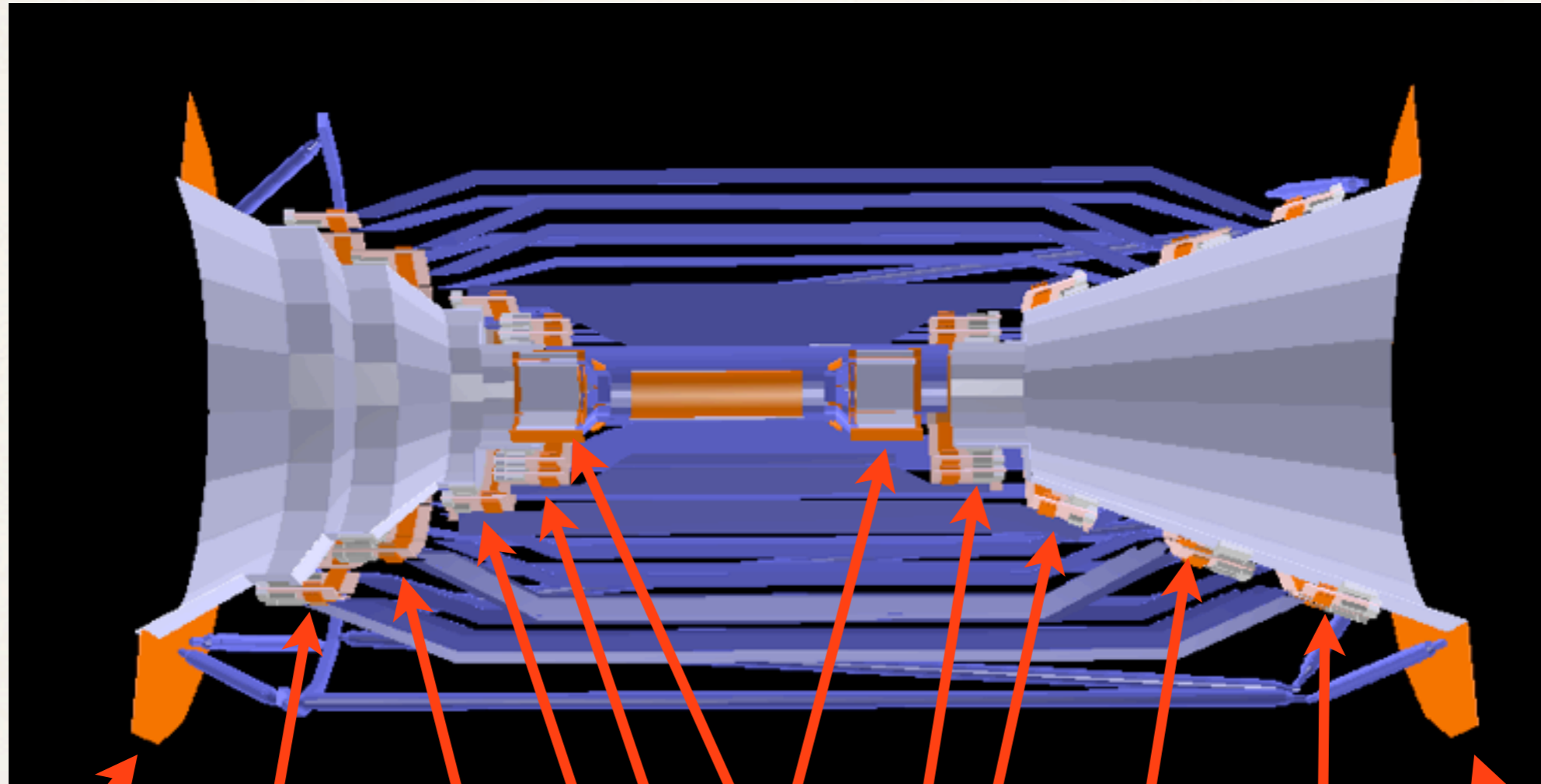


<http://sesam.desy.de/members/gunnar/Si-dfuncs.html>

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



# Simulated radiation level



**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**

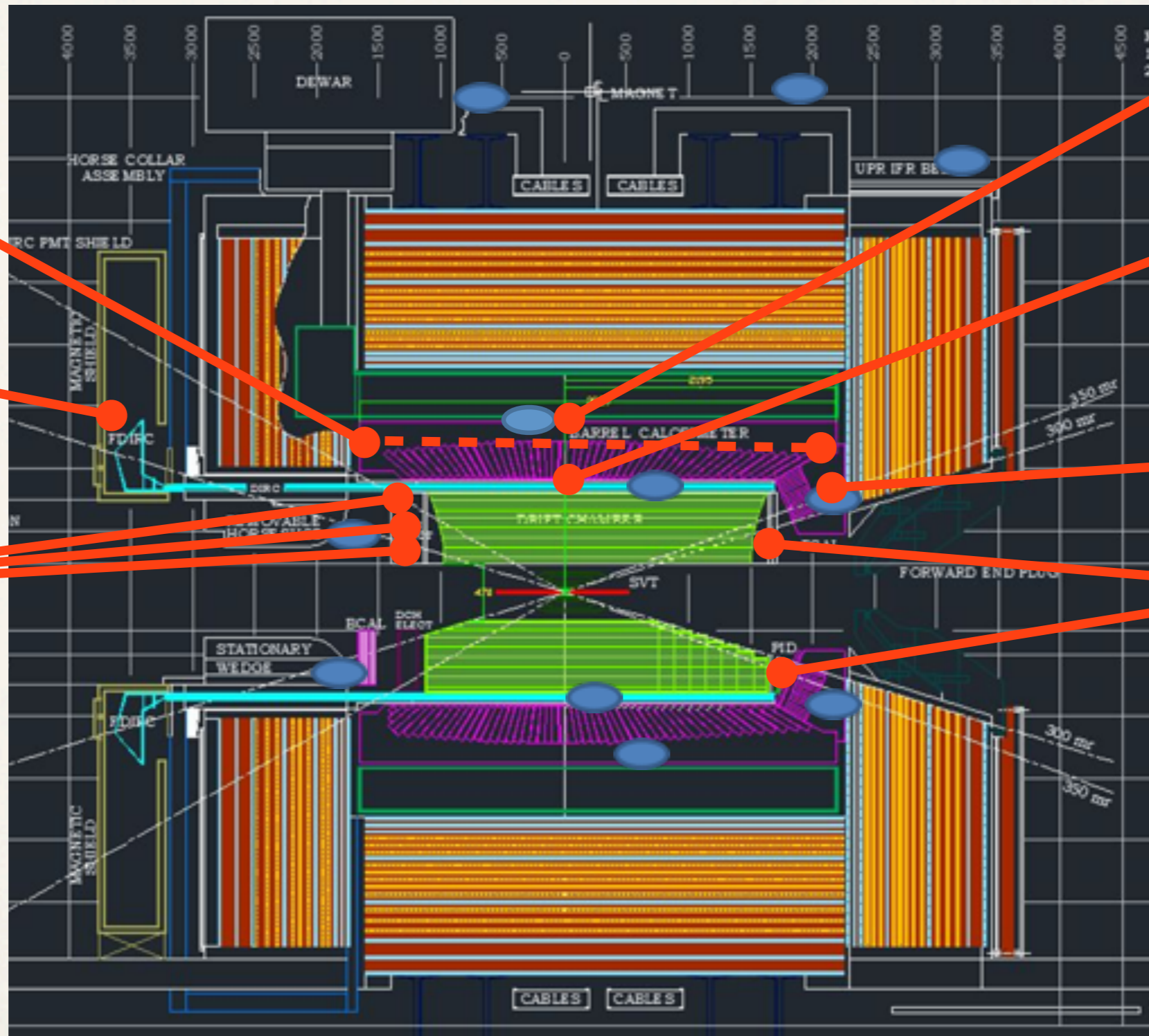
**DchFEE  
(3 zones)**

**EmcBrl  
Ctr**

**DrcCtr  
Bars**

**EmcFwd  
FEE**

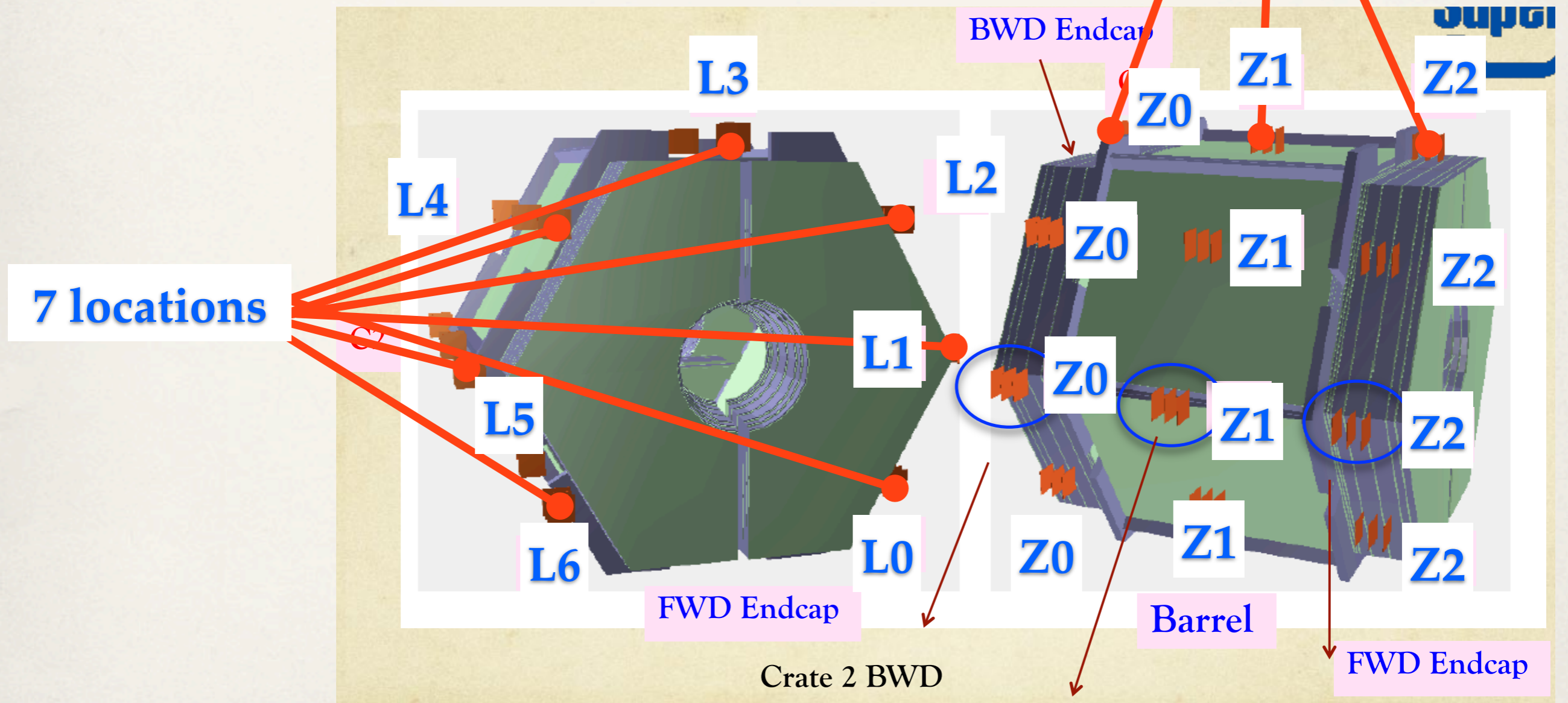
**TofFEE**





# Simulated radiation level

- IFR FEE: 21 locations
- Not integrated over Phi





# Simulated radiation level

- Nice big table (only for 2photons bkg)

SubSystem	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	Layer0	1.292	1.292	-6	6	36059.5	1.20772e+13	0.0257399
SVT	Layer1	3.3	3.3	-10	10	1191.75	4.27953e+11	0.0189185
SVT	Layer2	4	4	-15	15	603.577	2.32608e+11	0.0388765
SVT	Layer3	5.9	5.9	-20	20	209.308	1.00633e+11	0.0454258
SVT	Layer4	12.2	12.2	-30	30	42.4517	5.1101e+10	0.0471571
SVT	Layer5	14.2	14.2	-30	35	25.257	4.36508e+10	0.0492751
SVT	FEELayer0	1.4	1.4	4.2	4.2	3359.8	1.14919e+12	0.157514
SVT	FEELayer1	3.3	3.3	1	1	548.919	2.0831e+11	0.29034
SVT	FEELayer2	4	4	1	1	546.259	2.18287e+11	0.539203
SVT	FEELayer3	5.9	5.9	1	1	236.526	1.20343e+11	0.609714
SVT	FEELayer4	12.2	12.2	1	1	70.0809	8.06467e+10	0.63149
SVT	FEELayer5	14.2	14.2	1	1	31.946	8.02268e+10	1.00651
SVT	MCard	30	30	0.2	0.2	8.2523	6.604e+10	0.471702
DCH	FEEZone0	23.6	40	-111.9	-111.9	0.847235	3.14484e+10	0.698707
DCH	FEEZone1	40	60	-111.9	-111.9	1.07063	2.45461e+10	0.506254
DCH	FEEZone2	60	81	-111.9	-111.9	0.946379	1.90069e+10	0.404555
TOF	FEE	55	92	200	200	0.423339	1.60694e+10	2.69903
DRC	BarCenter	81.7	89.3	-10	10	0.858083	2.19122e+10	3.12543
DRC	FEE	103	155	-377	-342	0.00749921	5.00567e+08	0.0553376
EMC	FwdFEE	70	110	216	236	0.0761059	1.22912e+10	1.40298
EMC	BrlFEE	120	120	-155	216	0.0223998	3.65836e+09	0.427492
EMC	BrlCtrFEE	120	120	-10	10	0	2.96564e+09	0.367001
IFR	FEEZone0Loc0	325.576	332.866	-281	-239	0.173197	2.35243e+08	0.0263963
IFR	FEEZone0Loc1	360.555	400.5	-281	-239	0.106209	3.88004e+08	0.0444569
IFR	FEEZone0Loc2	300	356.09	-281	-239	0.120344	2.58914e+08	0.0319534
IFR	FEEZone0Loc3	300.666	340.588	-281	-239	0.195358	2.8236e+08	0.0388998
IFR	FEEZone0Loc4	332.866	325.576	-281	-239	0.173152	4.05831e+08	0.0444569
IFR	FEEZone0Loc5	400.5	360.555	-281	-239	0.214878	3.12852e+08	0.0319534
IFR	FEEZone0Loc6	356.09	300	-281	-239	0.235287	2.66329e+08	0.0347319
IFR	FEEZone1Loc0	325.576	332.866	-21	21	0.0250389	1.82103e+08	0.0222284
IFR	FEEZone1Loc1	360.555	400.5	-21	21	0.0411469	1.70724e+08	0.0138928
IFR	FEEZone1Loc2	300	356.09	-21	21	0.0434939	1.71252e+08	0.0194499
IFR	FEEZone1Loc3	300.666	340.588	-21	21	0.10929	2.83561e+08	0.0305641
IFR	FEEZone1Loc4	332.866	325.576	-21	21	0.054466	2.33949e+08	0.0291748
IFR	FEEZone1Loc5	400.5	360.555	-21	21	0.0702368	2.79871e+08	0.0208392
IFR	FEEZone1Loc6	356.09	300	-21	21	0.0891178	2.51388e+08	0.0222284
IFR	FEEZone2Loc0	325.576	332.866	239	281	0.0743074	3.02512e+08	0.040289
IFR	FEEZone2Loc1	360.555	400.5	239	281	0.0854958	2.8198e+08	0.025007
IFR	FEEZone2Loc2	300	356.09	239	281	0.12929	2.41521e+08	0.0208392
IFR	FEEZone2Loc3	300.666	340.588	239	281	0.277088	4.19076e+08	0.0430676
IFR	FEEZone2Loc4	332.866	325.576	239	281	0.145233	2.38019e+08	0.0333426
IFR	FEEZone2Loc5	400.5	360.555	239	281	0.154433	2.47619e+08	0.0305641
IFR	FEEZone2Loc6	356.09	300	239	281	0.168629	2.67683e+08	0.0319534