



Update on SVT Background rates using Bruno simulation

Riccardo Cenci
University of Maryland

SuperB Collaboration Meeting, Pisa, ITALY - Svt Parallel Session

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Update summary

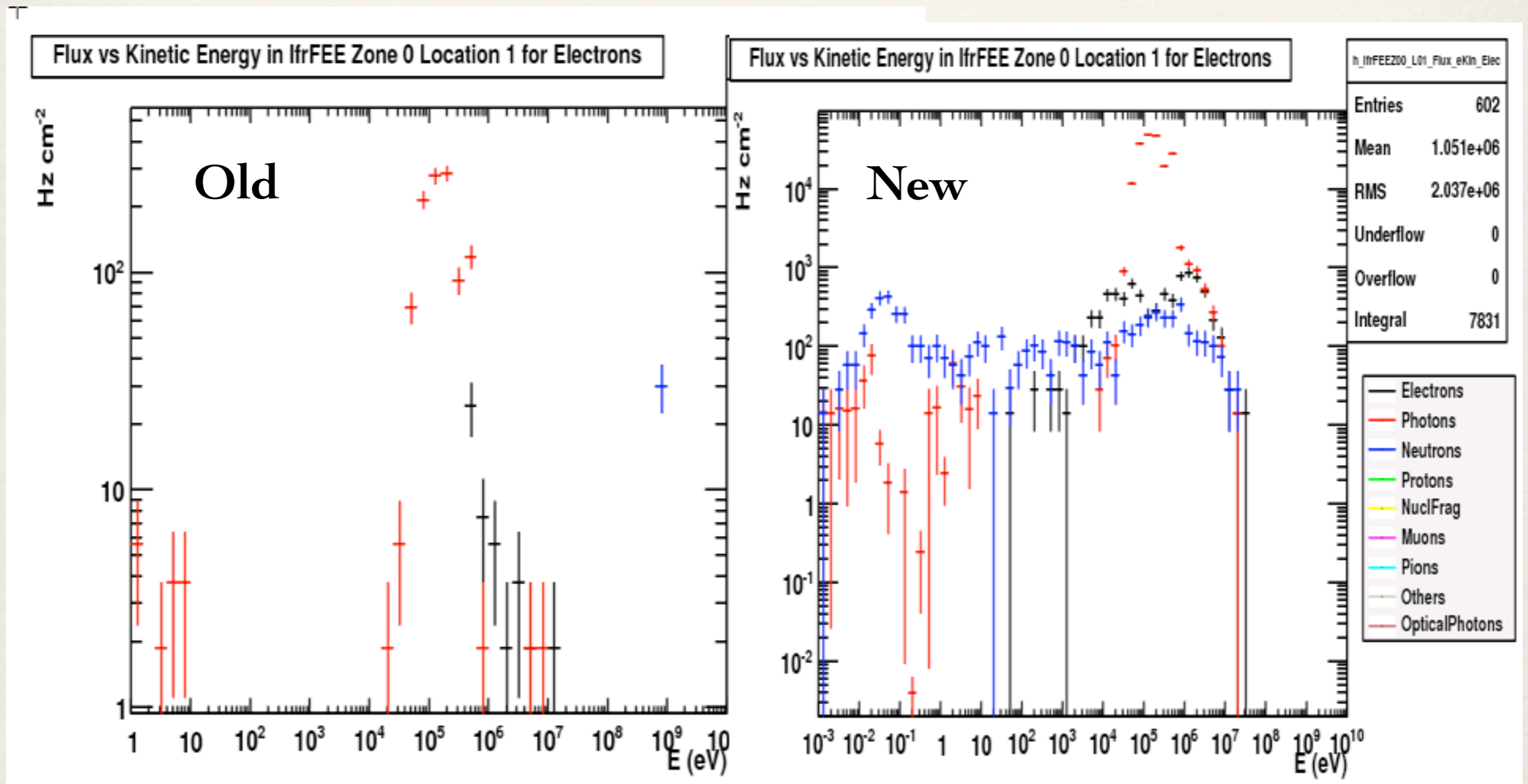
- Code development only on the bkg analysis code, not on the Bruno simulation
- Various bugs were fixed, code re-organization has been completed:
 - running is stable and in shorter time (< 1 day)
 - easy to scale if productions size increases
- Updated result were released to SVT and ETD managers (still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

Bugs

- 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

- 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,
Significative effect**

New entry, no contribution

Rate comparison, updated

SVT

- New RadBhabha significant on outer layers
- L0 lower rate due to different radius (Jun12, Sep12)

LAYER S	2photons				Bbbrem		Touschek HER		Touschek LER		BeamgasHER		Beamgas LER		Bbbrem Low ΔE
	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	0.52
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	0.84
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	1.07
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	0.82
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	0.86
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	0.70
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	0.35
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	0.37
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	0.09
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	0.07
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	0.07
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	0.05

Radiation dose on Electronics

SVT

- Max dose accumulated after integrating 10 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 ΔE	360	779	481	158	28	3	N/A
TOTAL	566	1027	679	214	41	6	N/A
TOTAL (old)	754	163	188	96	25	8	3.1

Simulated radiation level

- Updated table using new production, all contributions
- No MCard hits, but volumes are there and sensitive, still investigating

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	29086.6	5.99974e+12	2.90675e+09
SVT	Layer1	3.3	3.3	-10	10	5182.63	2.71958e+12	1.85671e+09
SVT	Layer2	4	4	-15	15	3363.9	2.14723e+12	3.39691e+09
SVT	Layer3	5.9	5.9	-20	20	1394.05	1.64799e+12	1.33301e+10
SVT	Layer4	12.2	12.2	-30	30	285.177	1.82748e+12	2.52559e+10
SVT	Layer5	14.2	14.2	-30	35	199.066	1.59024e+12	2.24998e+10
SVT	FEELayer0	1.51	1.51	-17	17	9266.09	3.69709e+12	8.27263e+10
SVT	FEELayer1	3.3	3.3	-15	25	10322	7.37986e+12	2.38717e+11
SVT	FEELayer2	4	4	-15	20	6893.63	7.67558e+12	4.06093e+11
SVT	FEELayer3	5.9	5.9	-15	20	2160.26	5.96509e+12	4.08963e+11
SVT	FEELayer4	12.2	12.2	-20	30	428.283	3.97475e+12	2.84053e+11
SVT	FEELayer5	14.2	14.2	-25	35	218.639	4.48013e+12	2.92225e+11
SVT	MCard	16.8	20	-70	70	0	0	0

Simulated radiation level

- Value for L0 are lower, but for outer layer are higher, mostly due to Radiative Bhabha with low $\Delta E/E$
- For outer layer values are up to one order of magnitude higher than before

May 2012, OLD

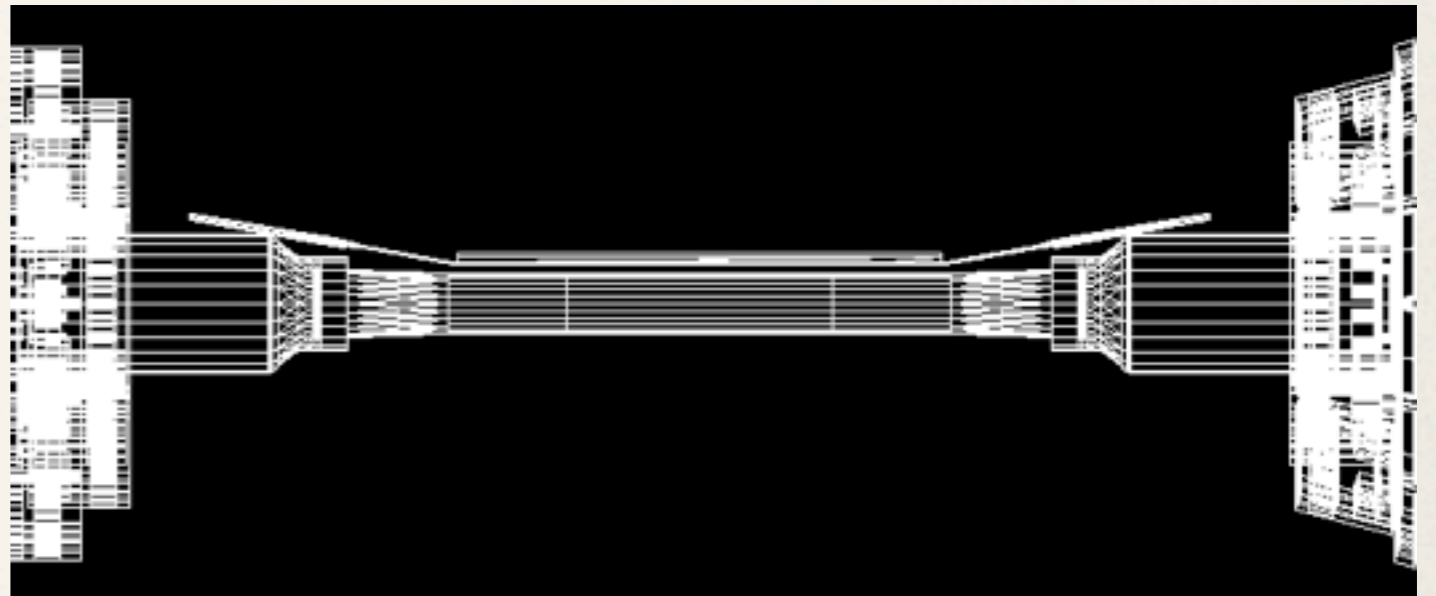
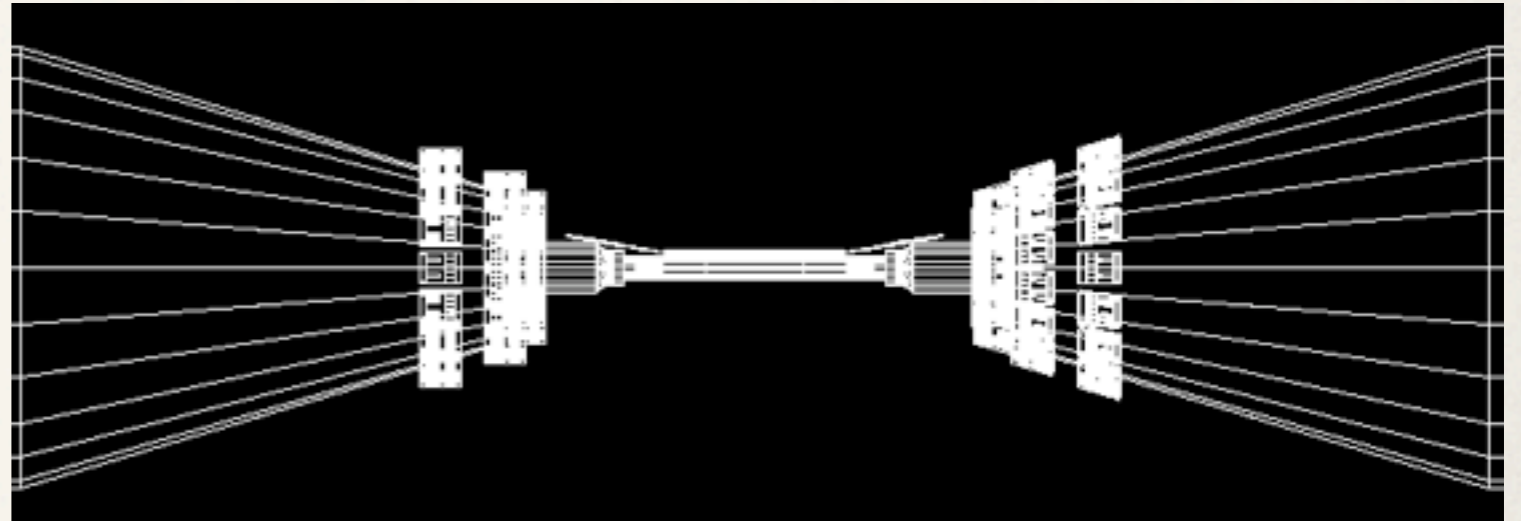
Syst.	Location	rMin(cm)	rMax(cm)	zMin(cm)	zMax(cm)	TID(Gy)	NIEL(cm-2)	SEE(cm-2)
SVT	Layer0	1.29	1.29	-6	6	46652.9	7.37846e+12	8.58551e+09
SVT	Layer1	3.3	3.3	-10	10	3257.12	8.78512e+11	1.6831e+09
SVT	Layer2	4	4	-15	15	2093.02	5.66709e+11	3.24182e+09
SVT	Layer3	5.9	5.9	-20	20	950.617	3.36038e+11	1.78978e+09
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
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

Conclusions

- New contributions
 - RadBhabha with low $\Delta E/E$: important for outer layers
 - Synchrotron radiation: low energy photons, no deposited energy, still under investigation by Eugenio
- Layer 0, rate with same geometry from all bkg sources
- Updated detailed plots are available: <http://www.pi.infn.it/~cenci/bruno/svt/plotV5>

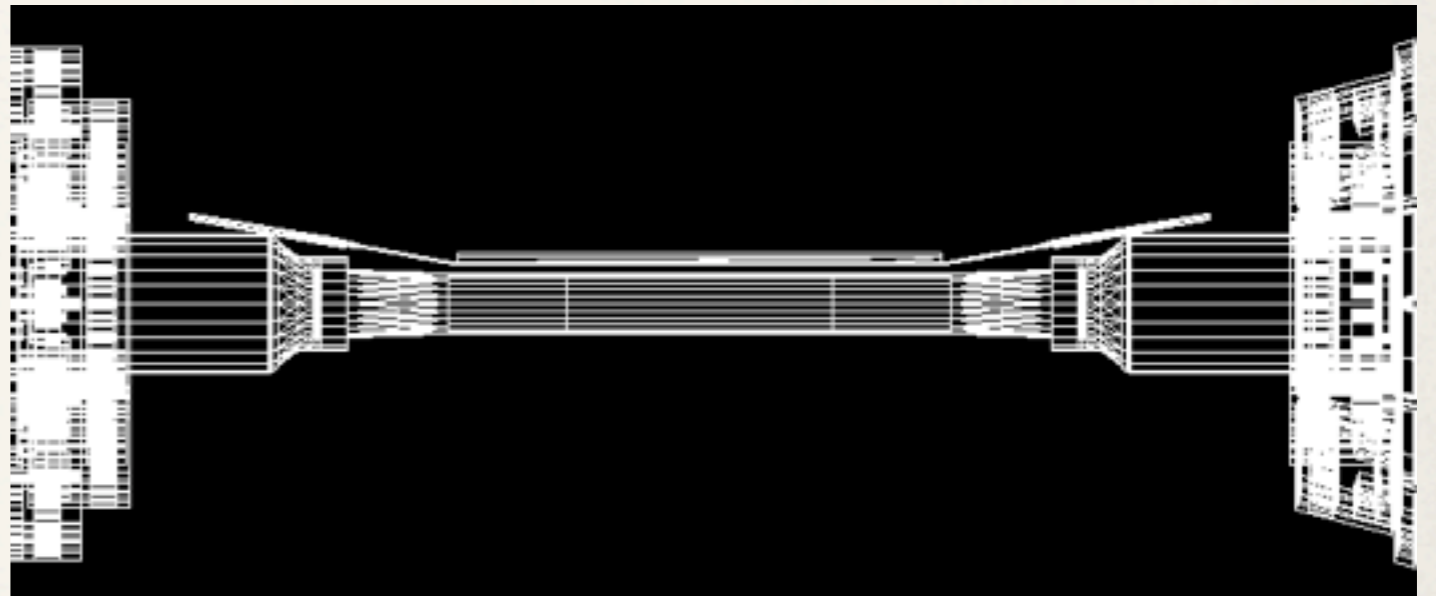
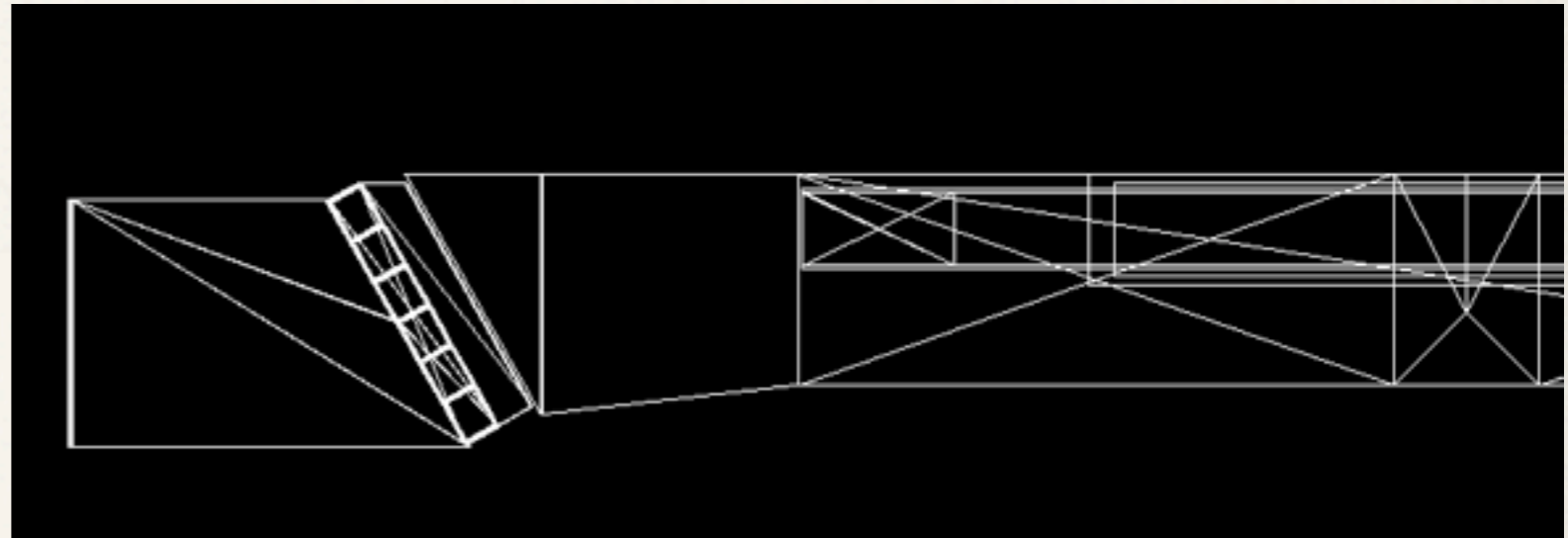
SVT triplets geometry

- **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)



Radiation dose on Electronics

SVT

- Max dose accumulated after integrating 10 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)	59.3	15.3	17.2	7.74	2.41	0.8	0.26
Beam-gas LER	123	33	41	19	3.5	1.56	0.65
TOTAL	754	163	188	96	25	8	3.1

TOTAL (old)	838	154	182	145	64.6	15
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No BeamgasLER

Productions

- 2012 official productions (**thicker tungsten shielding**):
 - **2photons** (~100k evts, 372us) solenoidal field limited in z, ± 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**