Update on Svt Background simulation with Bruno

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Svt-TDR Meeting

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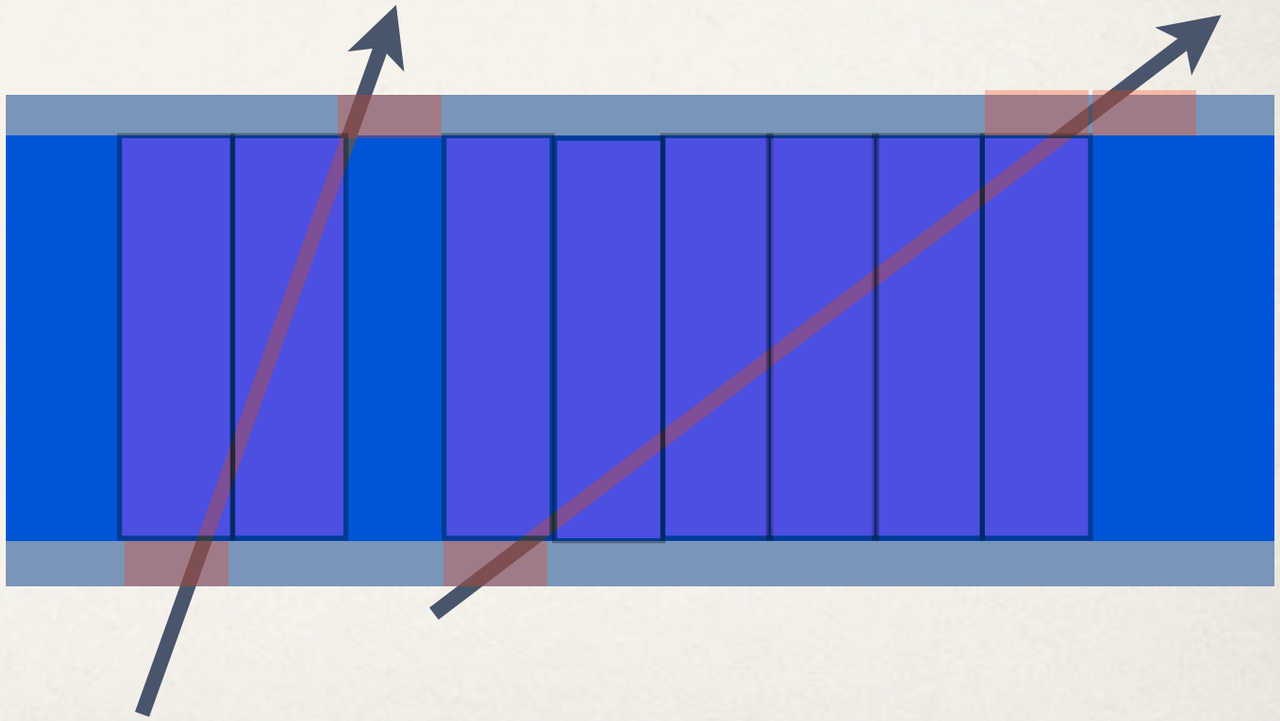
Introduction

- Last update for Svt background last December, new geometry for pixel layer plus cooling and support, no big change in the rates
- Dedicated study from Trieste bring us to discover a bug in the sensitive volumes. A temporary fix was prepared and they could simulate some events correctly
- The events simulated with the fix show some discrepancies with my previous results, specifically in the cluster multiplicity
- Only later, we realize that the bug was affecting also the dose and fluency estimation in L1-5. A definitive fix is now in the repository (rev >= 461)
- In the following new results using events simulated with a more recent version of Bruno (r465) and the December geometry

A little bit of G4 geometry…

- L0 layer is 200um thick, made of **svtSilicon**
- L1-5 layers taken from Babar geometry: 366um thick, with only 300um sensitive/active, made of **svtActiveSilicon**, with two 33um layer (below and above) made of **svtSilicon**
- In Bruno only svtSilicon material was sensitive, so in L1-5 only hit in the surrounding layer were recorded
- Effects:
  - 2 clusters per track instead of one
  - Lower pixel rate due to thickness
  - Volume estimated larger than the real sensitive one, lower estimation of fluency and dose



How we estimate the rate?

- Geant4 hits in each layer from the same track are merged into clusters
- A number of Svt hits is assigned to each cluster based on the size of the cluster in z and phi coordinates. Rate is not separated in z and phi contributions (interesting for outer layers)
- Svt hits are calculated using 50x50 micron pixel/strip everywhere
- Approximations:
  - No information on the position is considered, so two tracks crossing the same pixel or strip are counted twice. This includes daughter tracks are accounted as a cluster separate from the mother cluster
  - Areas and volumes are approximated with a cylinder of radius corresponding to the average radius of modules
- Most of these cannot be removed without consistent modifications, both in the simulation and analysis code

Results L0,1,2

- Same values for L0
- Lower cluster rate, but higher pixel rate, fluency and dose for other layers

LAYER 1	Dec2010	May2011	
Cluster rate	0.43	0.22	MHz/cm2
Cluster multip	2.12	10.88	
Pixel rate	0.91	2.56	MHz/cm2
Fluency	5.40E+10	1.80E+11	cm-2
Dose	0.03	0.11	MRad

LAYER 0	Dec2010	May2011	
Cluster rate	6.44	6.37	MHz/cm2
Cluster multip	8.1	8.1	
Pixel rate	56.1	55.6	MHz/cm2
Fluency	4.79E+12	4.73E+12	cm-2
Dose	3.61	3.58	MRad

LAYER 2	Dec2010	May2011	
Cluster rate	0.23	0.12	MHz/cm2
Cluster multip	1.98	10.54	
Pixel rate	0.48	1.31	MHz/cm2
Fluency	2.91E+10	9.80E+10	cm-2
Dose	0.017	0.057	MRad

Results L0,1,2

- Agreement apart a factor sqrt(2) due to separation in phi and z coordinates

Trieste values, Frascati

Layer	RO PitchZ (or +45°) µm	<n>_Z	RO PitchPhi (or -45°) µm	<n>_Phi
0	50	5.2 (4.1)	50	5.3 (4.0)
1	100	3.8 (4.2)	50	7.3 (2.8)
2	100	3.7 (4.1)	55	7.1 (2.6)

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Results L3-5

- Same increase in pixel rate, fluency and dose

LAYER 3	Dec2010	May2011	
Cluster rate	67.2	37.6	kHz/cm2
Cluster multip	1.91	9.96	
Pixel rate	131	342	kHz/cm2
Fluency	7.95E+09	2.57E+10	cm-2
Dose	5	15	kRad

LAYER 4	Dec2010	May2011	
Cluster rate	7.2	5.8	kHz/cm2
Cluster multip	1.63	7.68	
Pixel rate	11.9	31.6	kHz/cm2
Fluency	5.90E+08	1.88E+09	cm-2
Dose	0.5	1.8	kRad

LAYER 5	Dec2010	May2011	
Cluster rate	3.8	3.4	kHz/cm2
Cluster multip	1.66	6.97	
Pixel rate	6.1	15.3	kHz/cm2
Fluency	2.18E+08	7.00E+08	cm-2
Dose	0.3	1.0	kRad

Rates

- Same agreement for L3, not for 4-5
- But Trieste is applying a threshold (or not?)

Layer	RO PitchZ (or +45◦) µm	<n>_Z	RO PitchPhi (or -45◦) µm	<n>_Phi
3	100	3.9 (4.0)	55	8.2 (2.5)
4	210	1.6 (2.0)	100	3.9 (1.9)
5	210	1.9 (2.1)	100	3.1 (2.4)

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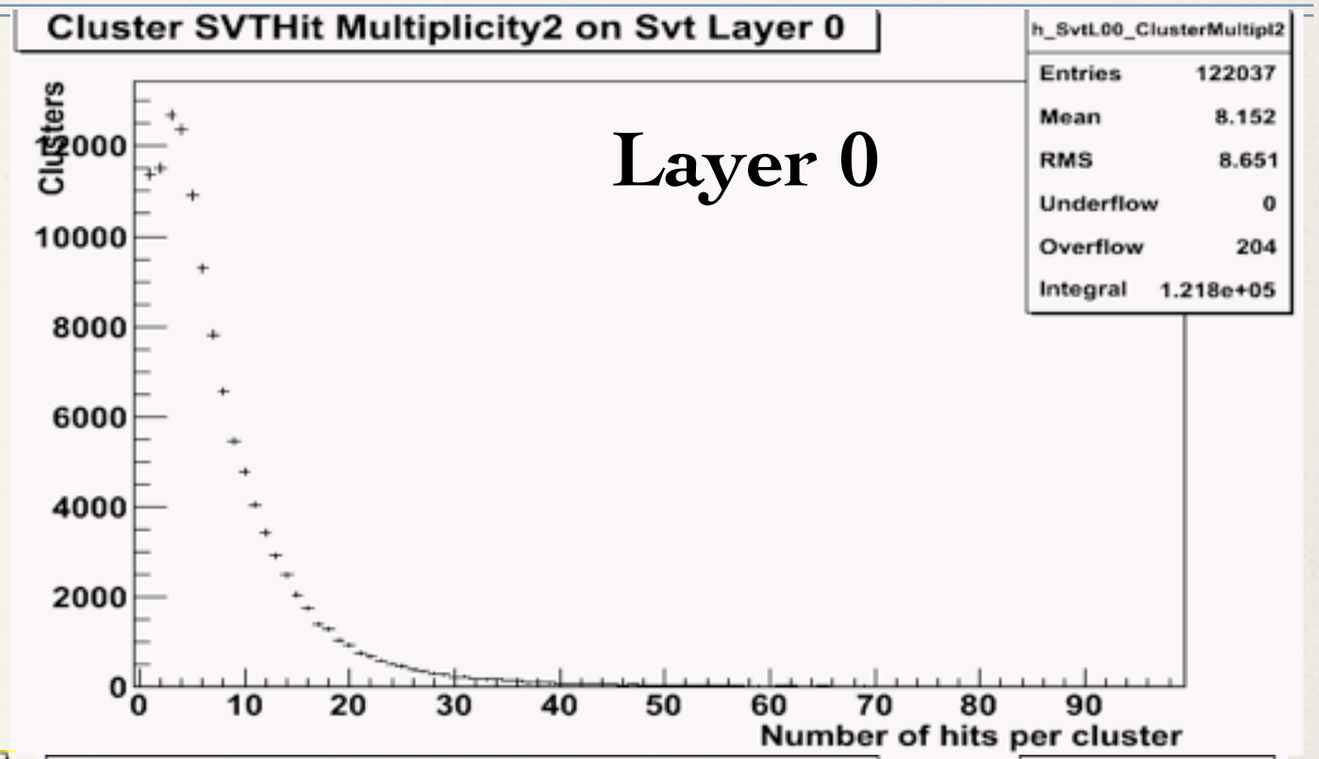
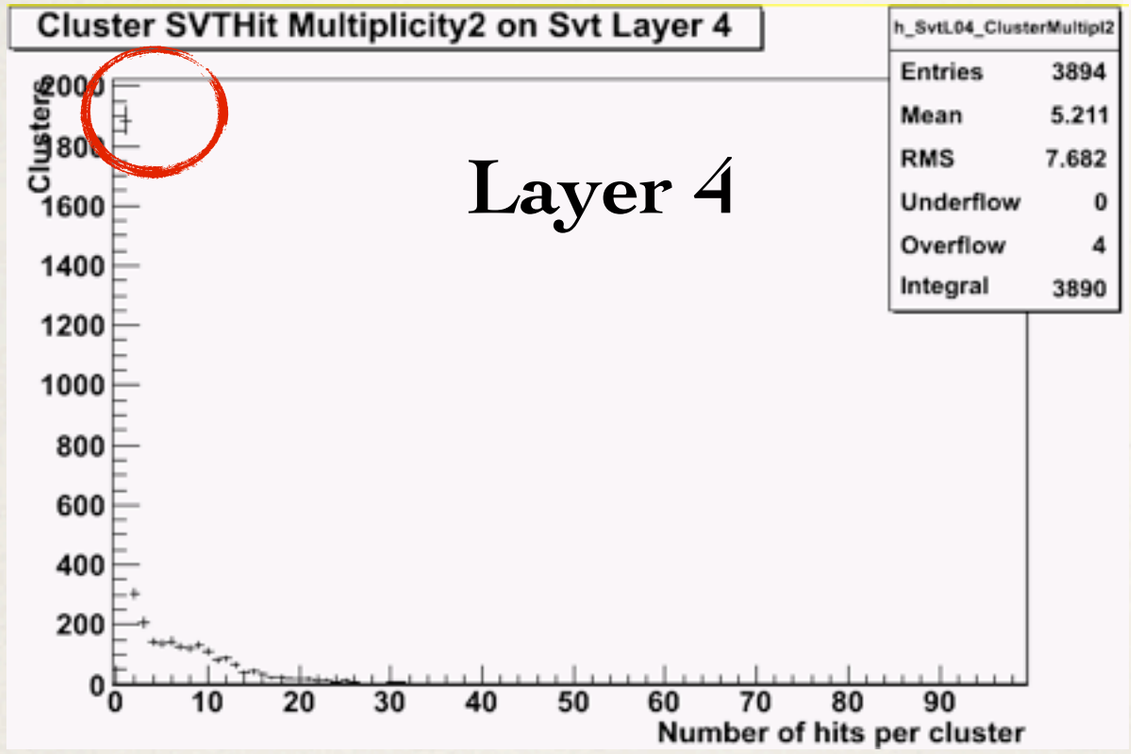
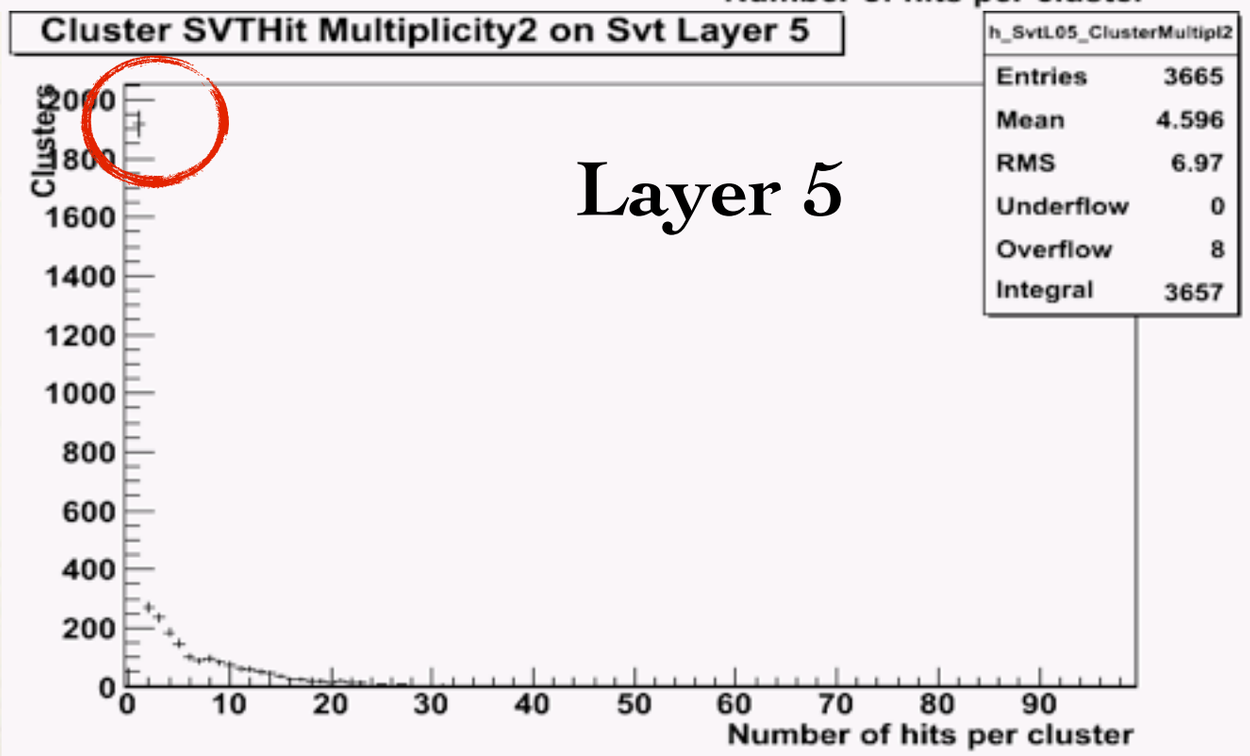
Cluster multiplicity

- Many **one pixel/strip cluster** for L*A*-5, easy to be removed by threshold
- Average multiplicity can be higher with Trieste approach
- Not yet look at energy released per pixel/strip







Conclusions

- Pixel rate, fluency and dose higher than previous estimation due to a bug in the sensitive volumes, factor 3-4
- Cluster multiplicity estimations are in fair agreement, considering different pitches and threshold. Note: analyses are completely independent
- Comparison with Trieste analysis on the new events, next talk (Carlo preliminarily told us that results are consistent with the old ones)
- Things that can be done:
  - More detailed estimations: by module, using the real volume and area, cluster multiplicity on phi and z, different pitches, 45 degree strip, threshold
  - More statistics for 2photon/pairs background, need to implement the generator in Bruno
  - Simulate other backgrounds (work in progress, Eugenio and Alejandro)
- Any priority or request?