

SVT Background study using FullSim



Riccardo Cenci
University of Maryland

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Update on SVT background study

- A bit of history...
 - Last meeting SVT L0 rate **40-60MHz/cm²**, too high compared to simple estimation by Eugenio (10MHz/cm²)
 - Eugenio discovered **B field was not activated** on BP/L0 region
 - Simulate again bkg pairs events
 - Need to understand better rate dependency from step size in G4 and check cluster algorithm
 - New rate estimations in this talk

FullSim version and geometry

- **Bruno v00-01-04, r247**

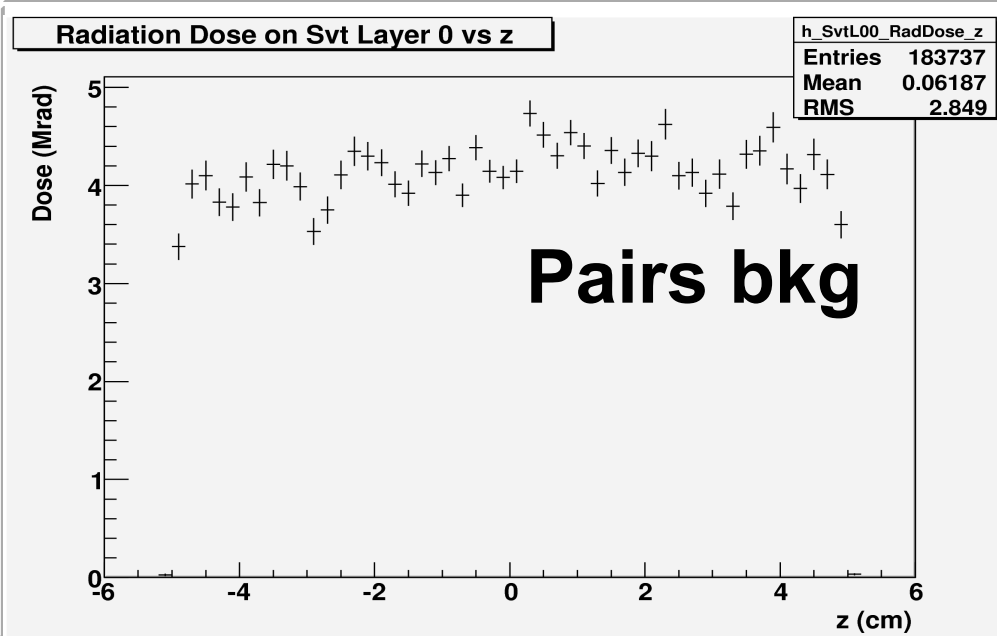
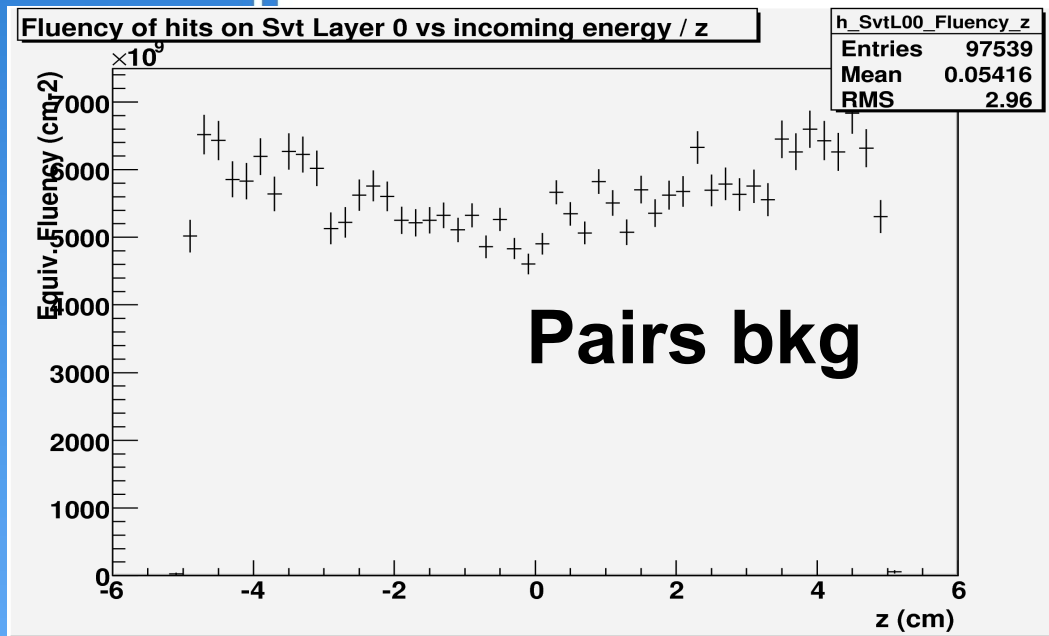
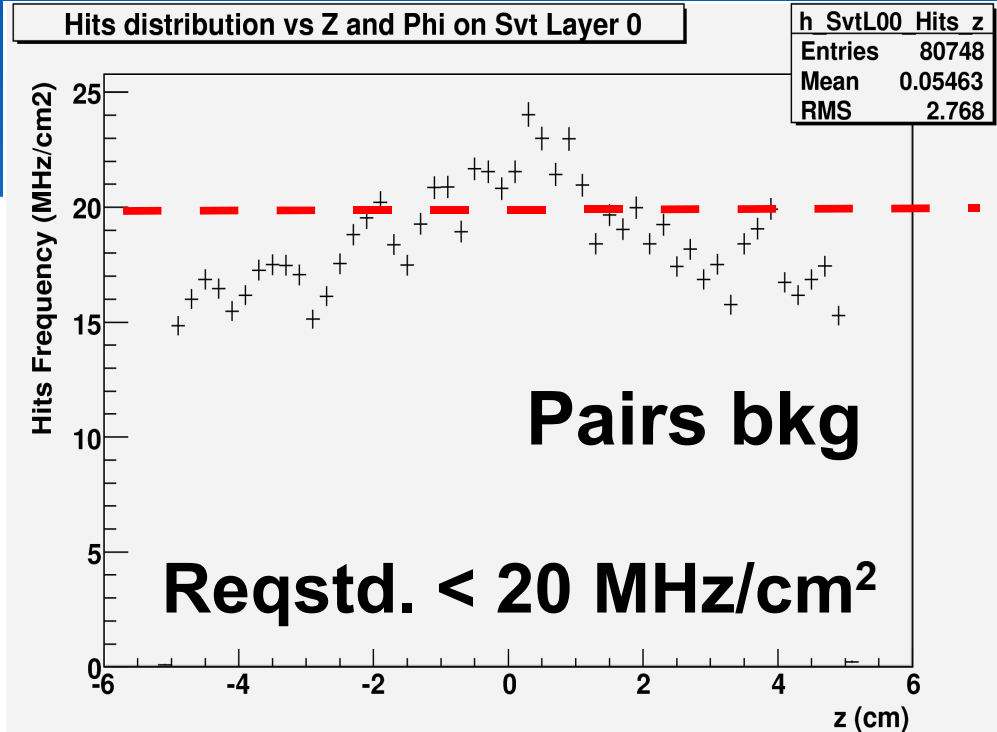
- Old version, no committing or updating for work in progress on splitting in packages and fixing bugs

- **Geometry:**

- Beampipe (BP): 1mm thick, Rmin 10mm
- Gold foil inside BP: 10um
- SVT Layer 0 is a tube, not a pin-wheel
- SVT L0 length 10 cm, thickness 300um, Rmin 1.3cm
- BP and L0 centered at $z = 0$
- BaBar SVT

Results with B field

- Basic configuration
 - BP @ 10mm
 - L0 @ 13 mm
- Z on x axis



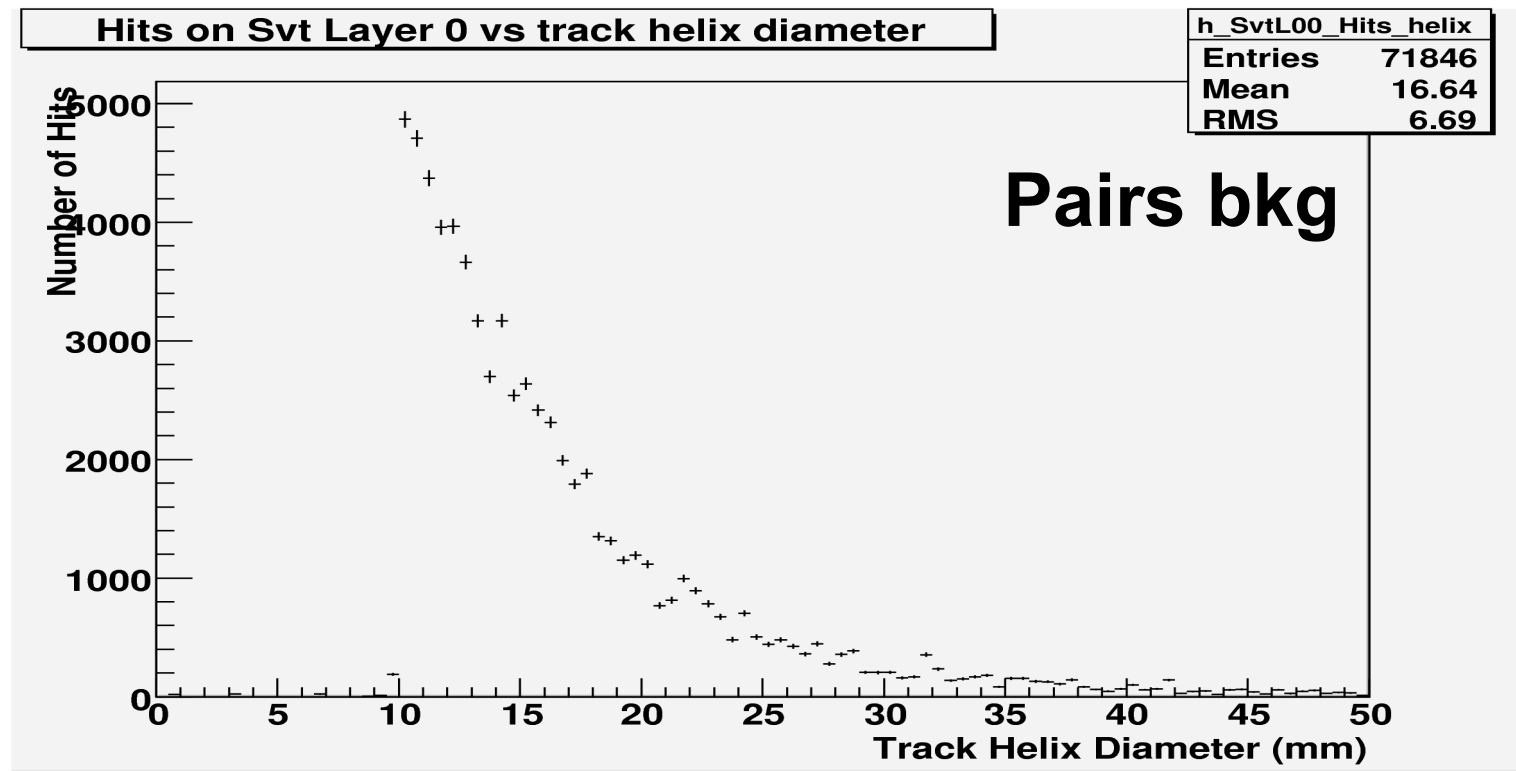
- General improvement of bkg quantities (2-3 times)

Problem with G4 step size

- Simulations with different step sizes in IR region: 0.5, 1, 2 mm, big changes in the rate $\pm 10\%$ (21, 18, 17 MHz/cm²)
- Multiple checks on G4 simulation
- Additional information added in Bruno hit class:
 - Starting and ending point of the step
 - Vector momentum before and after the step
 - Step status (entering, leaving, fully included in a volume)
- New algorithm for rate calculation
 - Avg hit length 150um, 1 through 3 pixels, the particle incident angle should be taken in account

Helix diameter

- From transverse momentum for each hit, we can get helix diameter in 1.5T B field
- Looking at primary particles, only the ones with enough transv mom arrive on L0



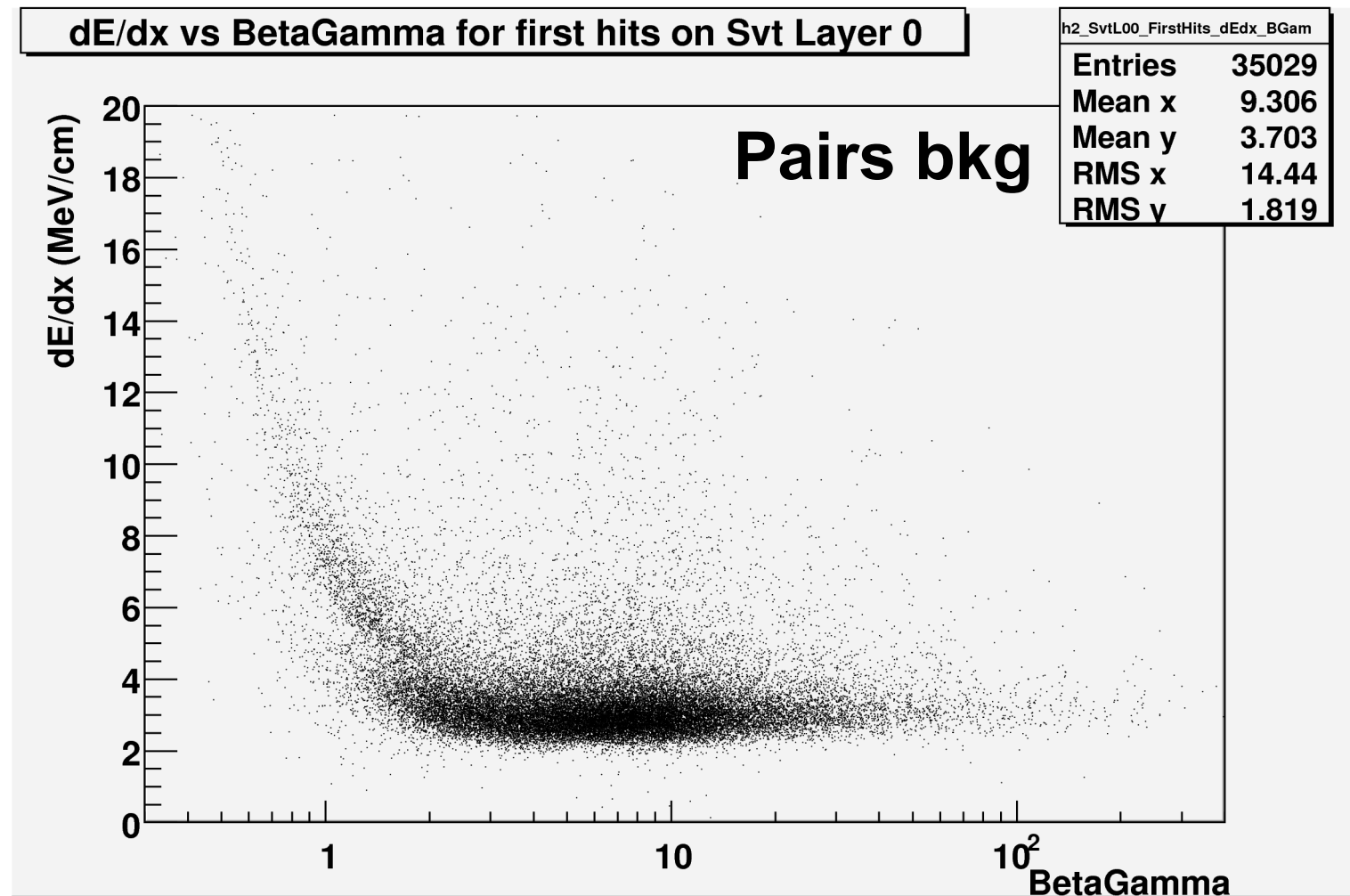
- Secondary particles can have also smaller mom

New clustering algorithm

- Not easy, different cases, particles can be created also inside silicon
- Cluster = group of G4Hits
- Algorithm steps:
 - Find the first hit, not belonging to the previous cluster
 - Add following hits if trkID and PDG are the same, and if the end point of previous hit is the same as the begin point of current hit
 - Calculate # pixels using the starting and end points of the cluster (energy cut?)
- Note: pixel rate can be really different from G4 hits rate (more than one pixel per hit)

dE/dx vs BetaGamma

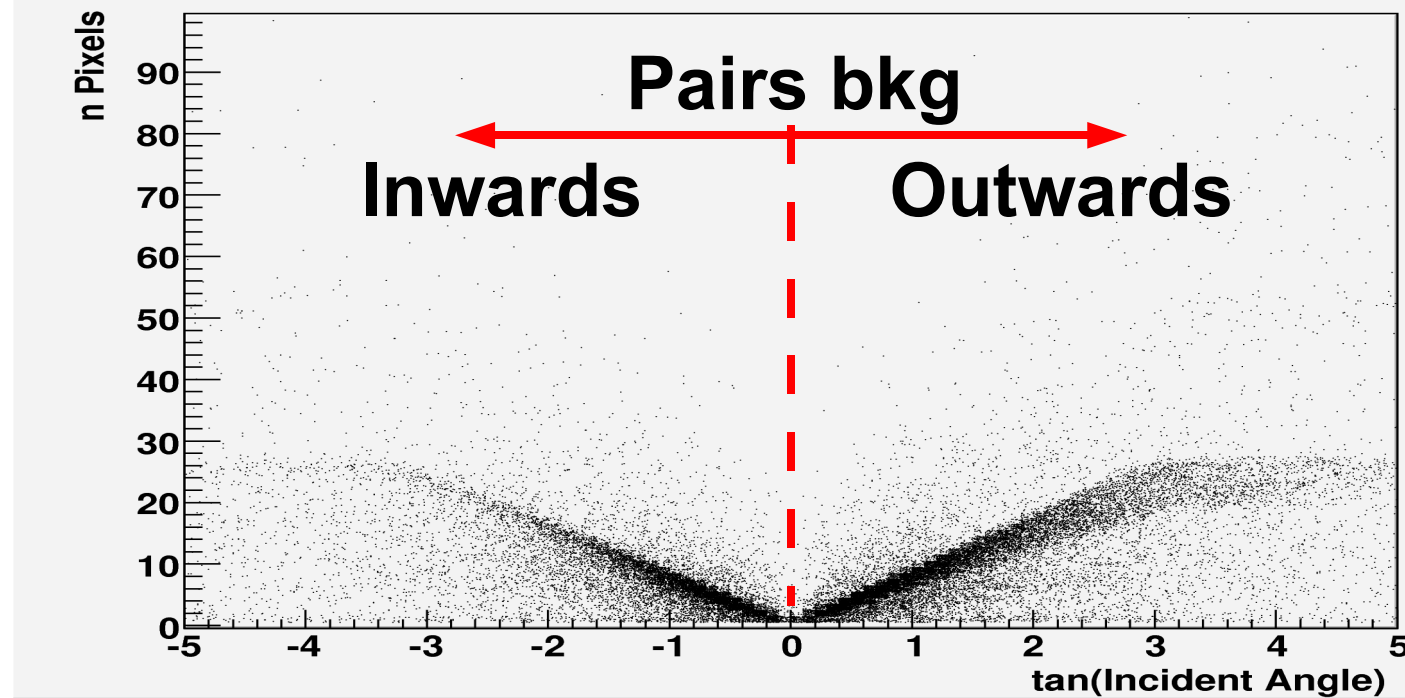
- For each cluster we have steps length, deposited and incident energy



Pixels vs tan Incident angle

- For each cluster we can compute the number of pixels using track direction
- # pixels should be proportional to the tangent of incident angle on silicon plane

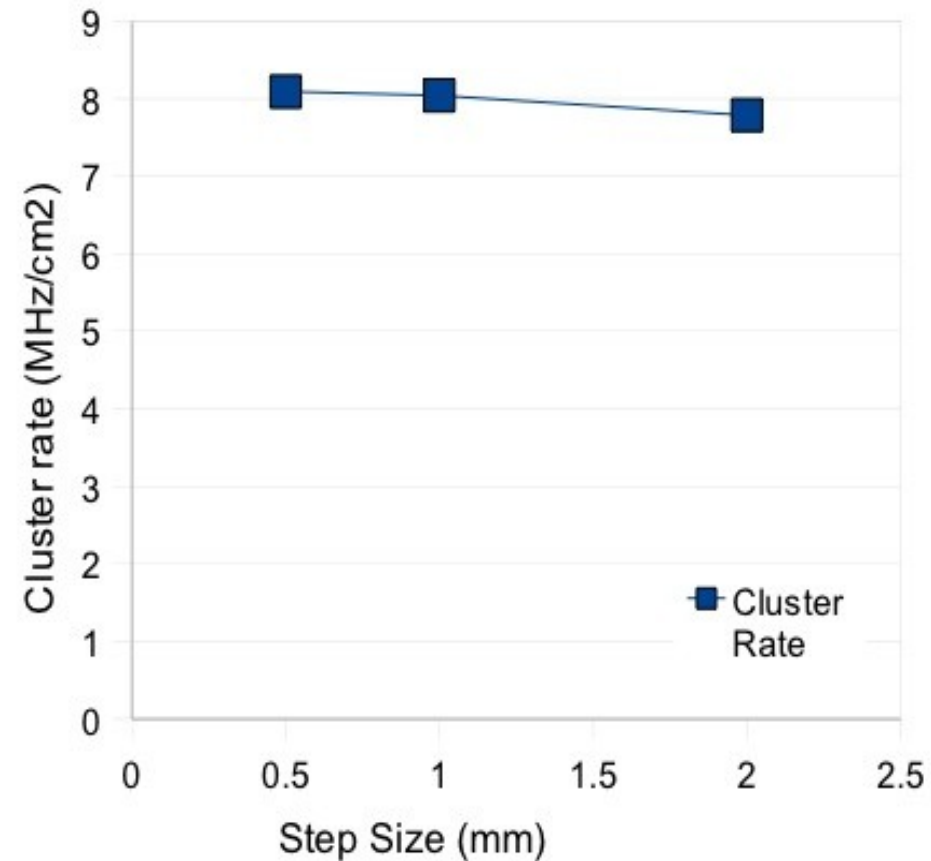
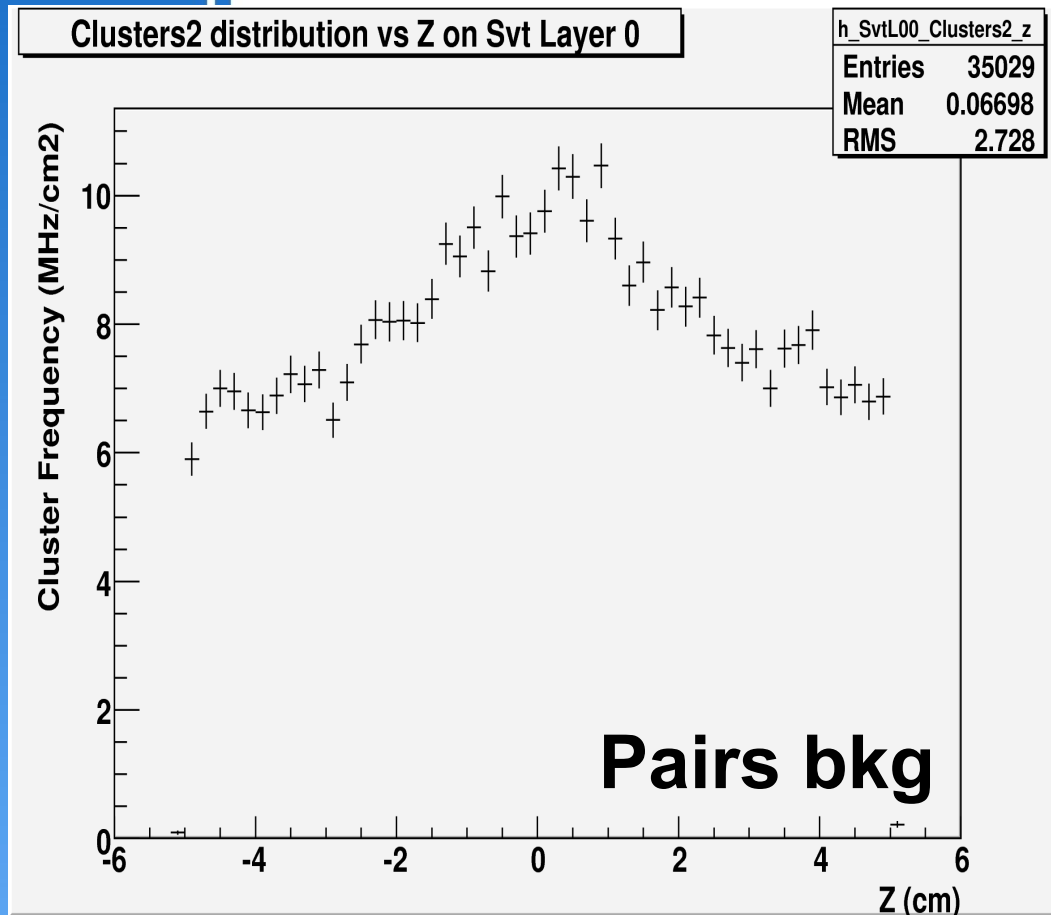
nPixels vs tanAngInc for cluster on Svt Layer 0



- Threshold at 26 pixels (1.3mm), to be understood

Clusters rate

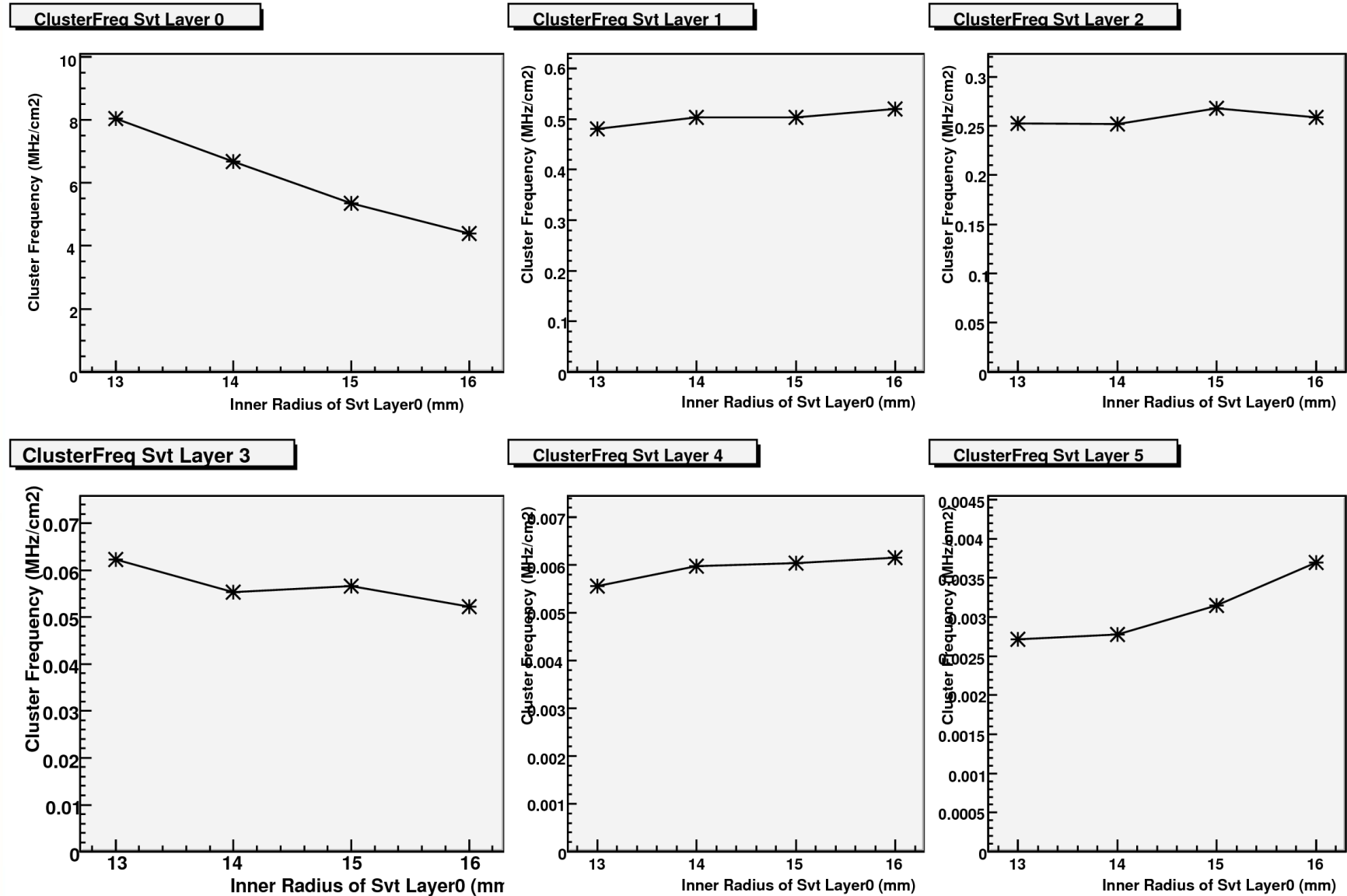
- Cluster rate now is similar to what we expect from a simple calculation, **8.0 MHz/cm²**



- Not depending too much from step size

Cluster rate vs L0 radius

- BP @ 10mm, L0 13- \rightarrow 16mm

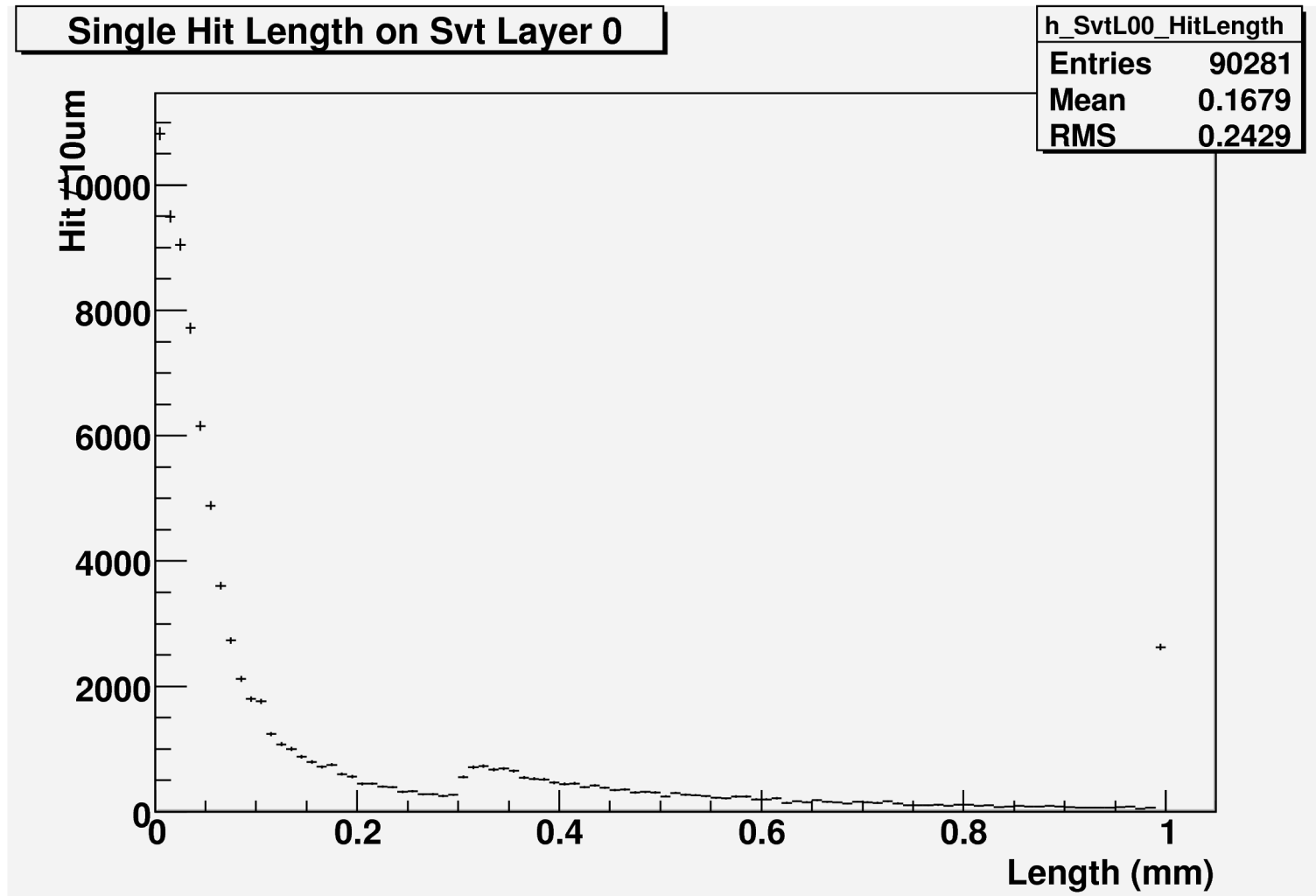


Conclusions

- Wrong settings in Bruno cause higher estimation of hits rates
- Easy to fix and, at the same time, many work to fully understand physics results and simulation settings dependence
- Cluster rate **8MHz/cm²** but Cluster rate is expected to be much lower than Pixel rate
- Work in progress for cluster multiplicity and pixel rate...

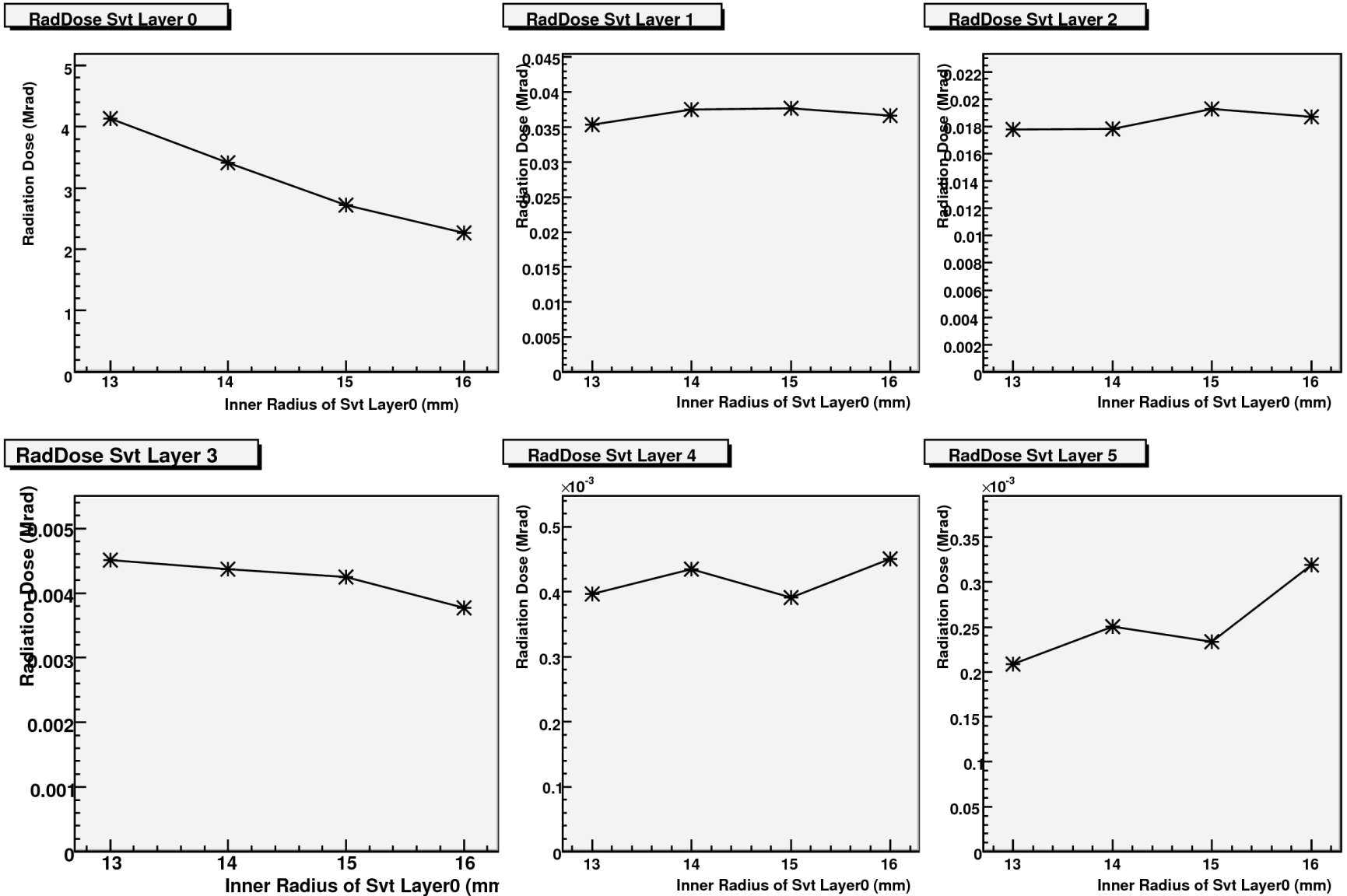
Hit length

- Max step length 1mm



Radiation dose vs L0 radius

- BP @ 10mm, L0 13->16mm



Fluency vs L0 radius

- BP @ 10mm, L0 13->16mm

