Current Status of G4 Validation and File Structure

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1 File Structure in the GEANT4 Simulations

Below are a few figures that explain the flow of the data files that originate from a Monte Carlo Simulation run.. The data files are named *.dat, and they are processed by different Perl scripts (extension .pl). All the perl scripts can presently be found under /afs/slac.stanford.edu/u/gl/sjogren/perlscripts/.

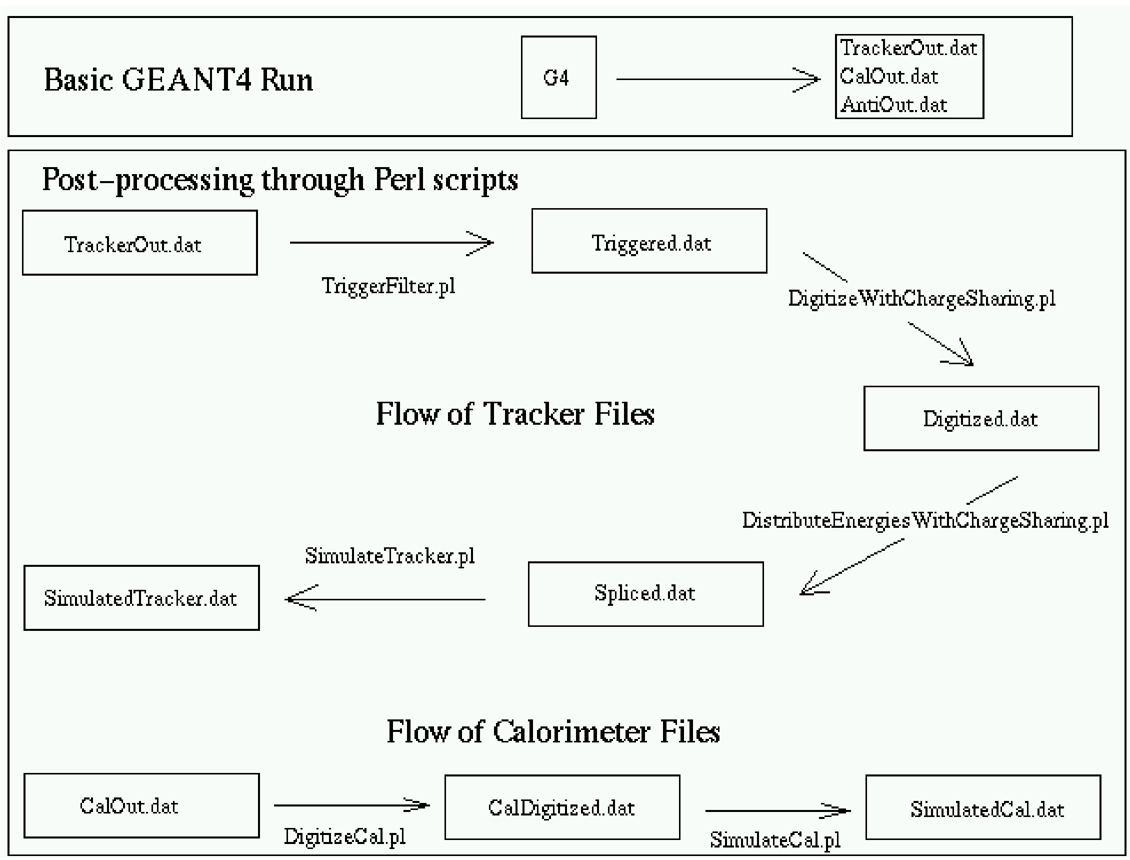

Figure 1.1: Flow chart for tracker and calorimeter files.

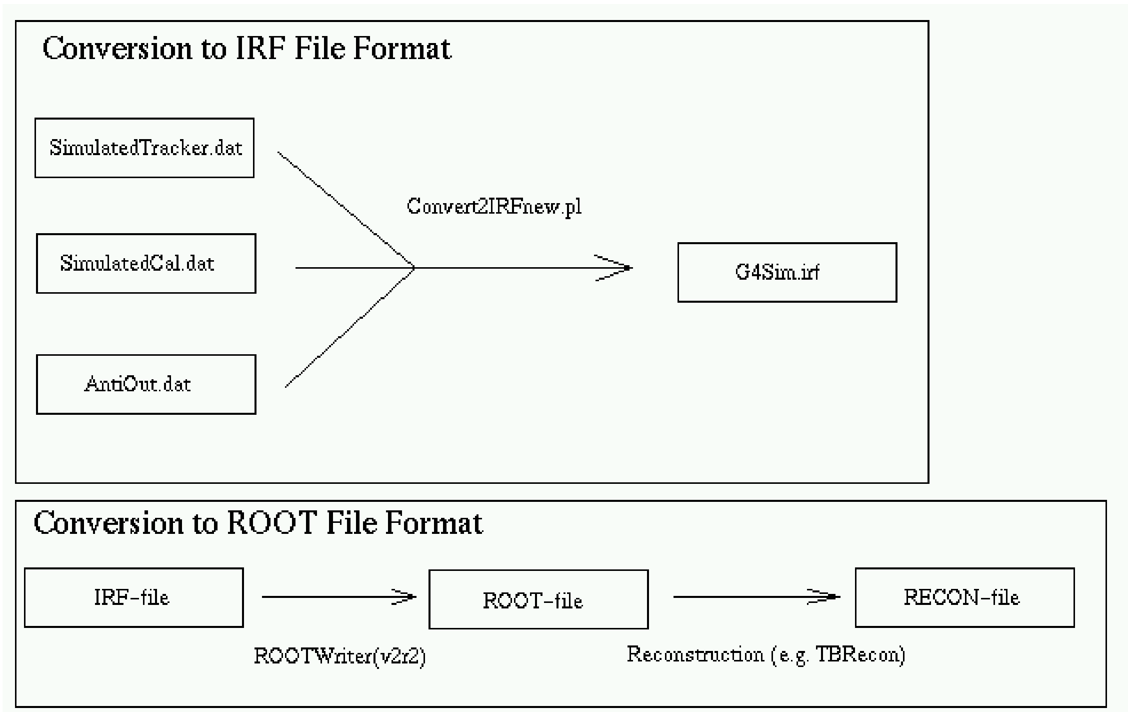

Figure 1.2: Conversion to IRF and ROOT format.

The variable parameters in the perl scripts are currently:
In DigitizeWithChargeSharing.pl and DistributeEnergiesWithChargeSharing.pl:
STRIP_PITCH = 0.194 mm
LAYER_THICKNESS = 0.395 mm
EFFECTIVE_LADDER_GAP = 2.12 mm, i.e. the distance between the outer edges of the channels next to a ladder gap.
SSD_GAP = 0.1 mm
The following are variable charge sharing area parameters:
BASE_SHARE_CHARGE_AREA = 0.02 mm, The total base length of the charge sharing trapezoid is 2 times this.
TOP_SHARE_CHARGE_AREA = 0.01 mm, The total top length of the charge sharing trapezoid is 2 times this.

In SimulateTracker.pl, function SetEnergyThreshold():
CHARGE_DEPOSIT_THRESHOLD = 1.290 fC, the threshold value for the collected charge in the tracker strips.

ConversionFactor = 3.4875e-5 GeV/fC, the convertion factor between deposited energy and freed charge in the form of electrons and holes.

In DigitizeCal.pl, function EndEnergies():
AttenuationFactor = 2/3, The factor that determines the light attenuation in the calorimeter logs.

2 Charge Sharing Analysis

We ran some simulations with 5 GeV positrons at 0° incidence with varied charge sharing area parameters and compared these to the data from the beam test.

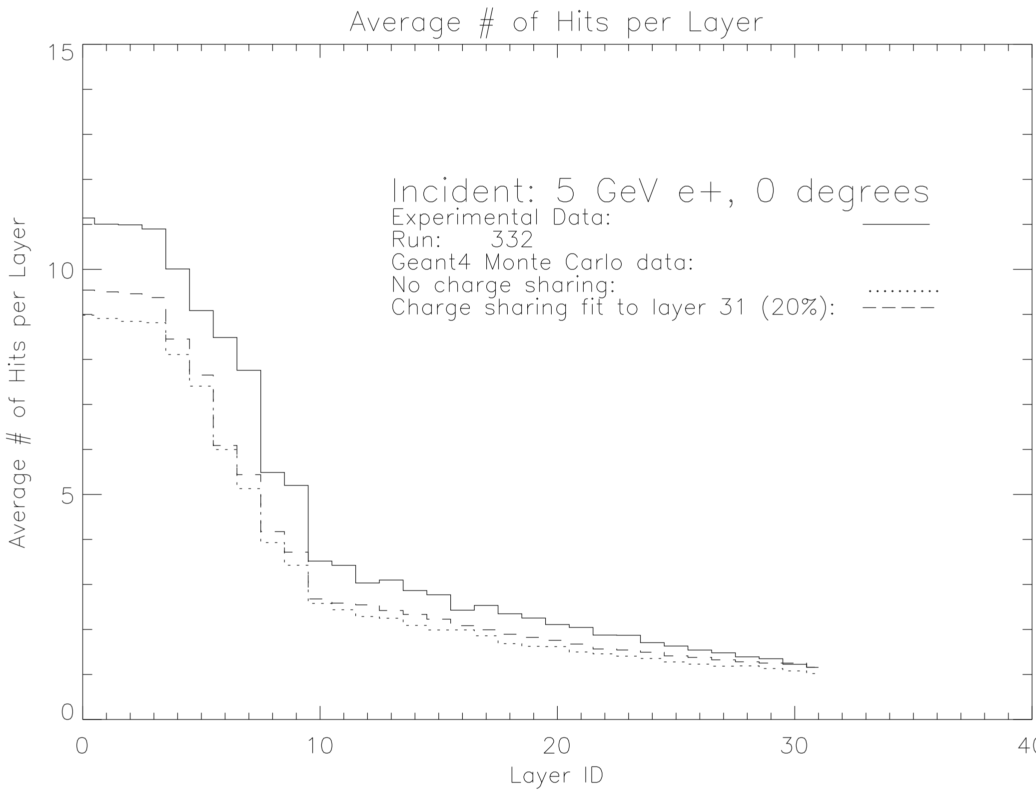

Figure 2.1: Hit multiplicity for different charge sharing parameters; no charge sharing and 20% charge sharing.

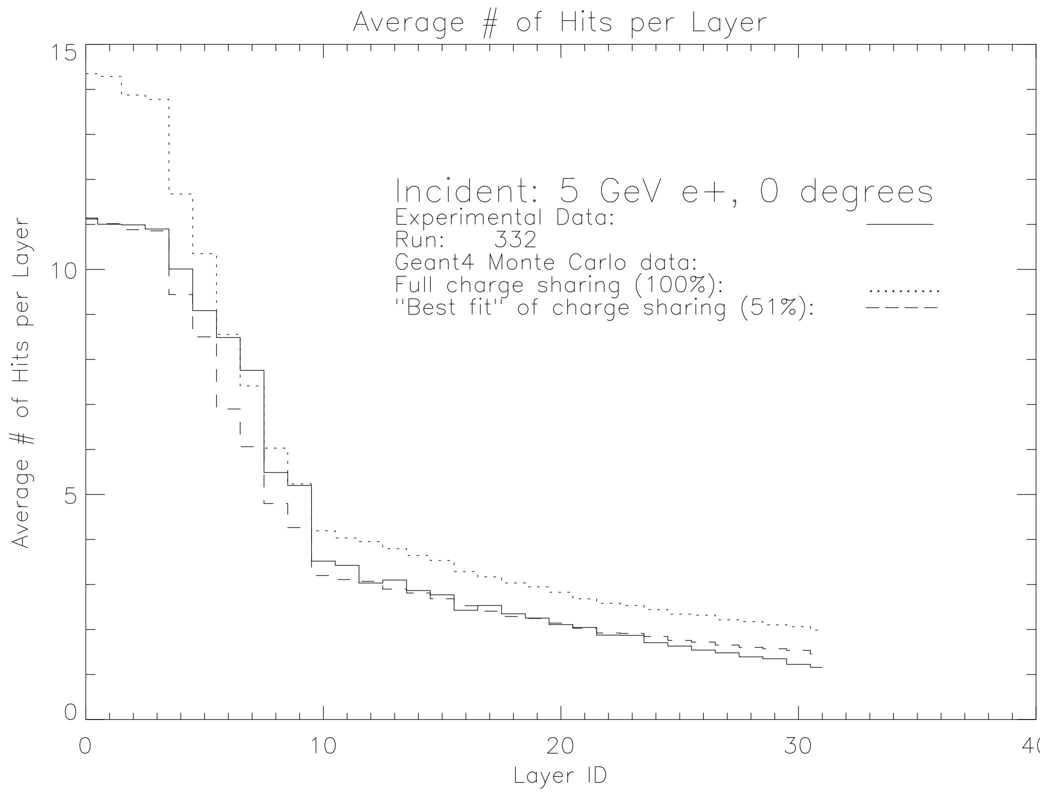

Figure 2.2: Hit multiplicity for different charge sharing parameters; full charge sharing and 51% charge sharing.

The addition of charge sharing clearly improves the hit multiplicity, but it does not account for all of the discrepancy. A reasonable charge sharing should be about 10-20 %, not around 50 % that we get for our so-called best fit. Something else seems to be wrong. If there is missing material in the simulator geometry, this might account for the apparent offset of the curves due to delayed showers.

Takanobu Handa did a charge sharing analysis with TBSIM. However, he only added a 10%-charge sharing effect to the hit multiplicity curves, no actual physical implementation in the TBSIM code was made as in our case. Some of the results of the TBSIM analysis are here below.

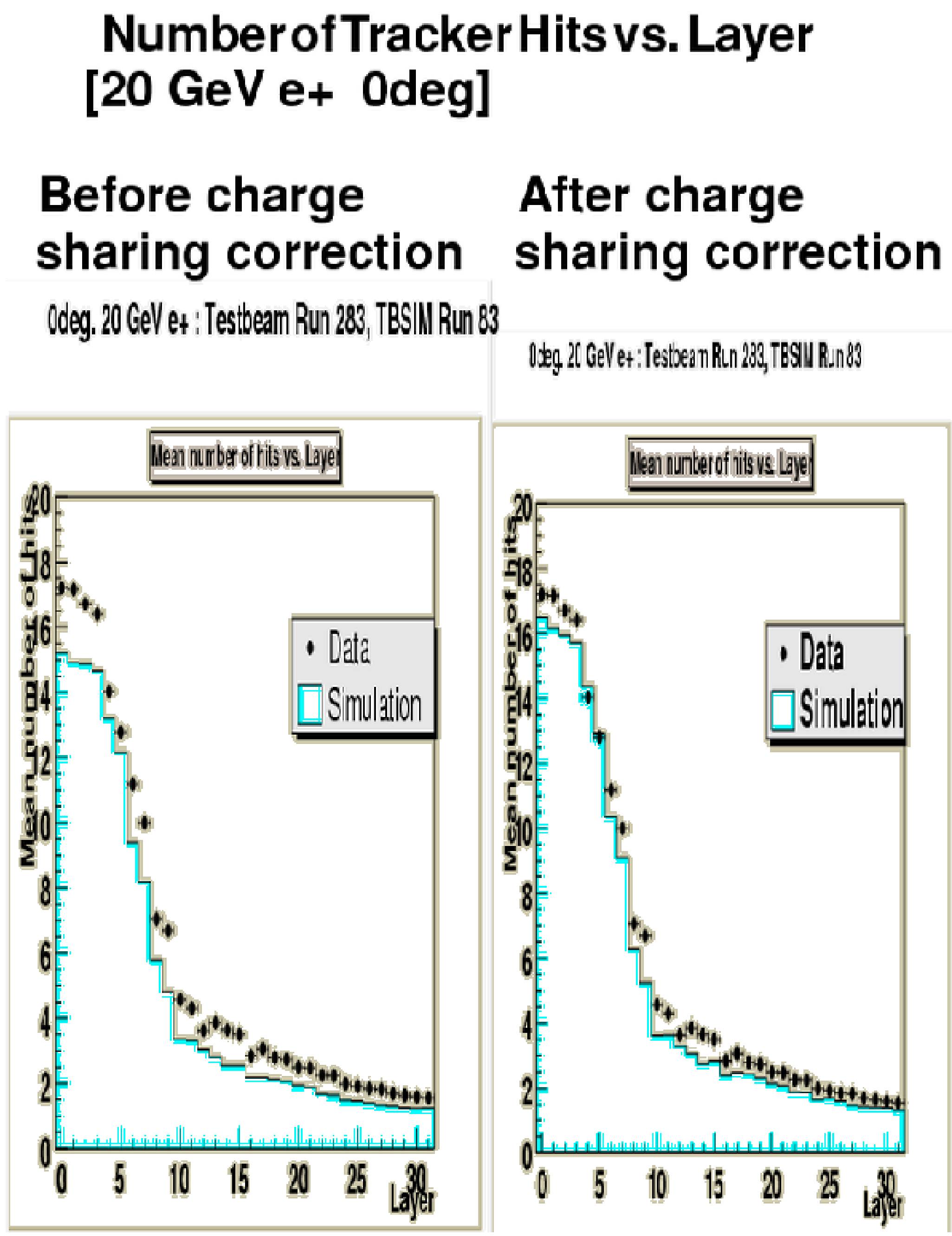

Figure 2.3: Hit multiplicity for TBSim