SVT L0 backgrounds from pairs production.

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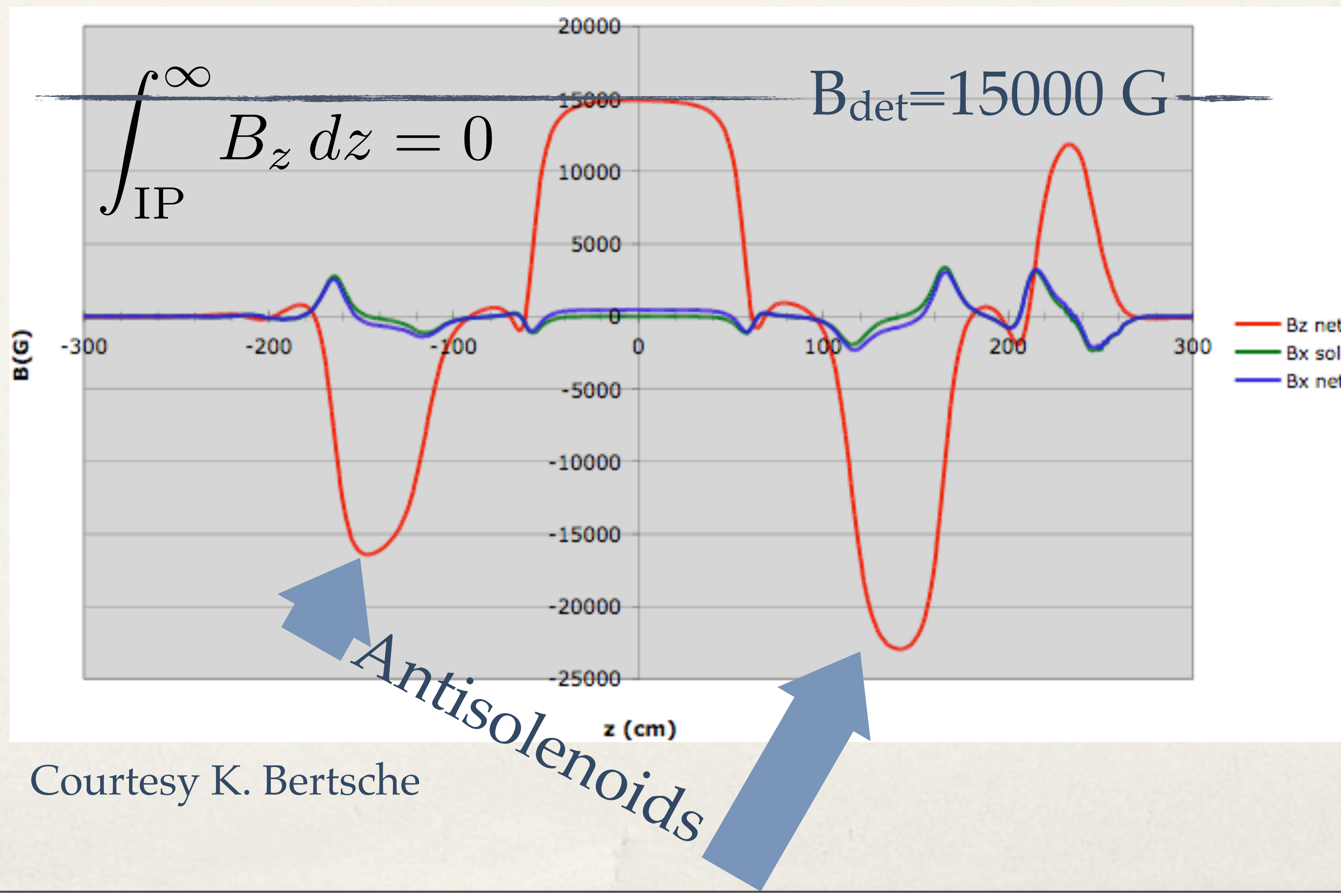
Presentation outline

- The pair production background rates presented at SLAC were wrong
  - Nature of the mistake
  - Results from the new correct simulations

On the solenoid compensation

- The solenoid compensation scheme is based on a set of anti-solenoids around the beam line that cancels the integrated longitudinal B field.



Courtesy K. Bertsche

Crude approximations made by Bruno (me)

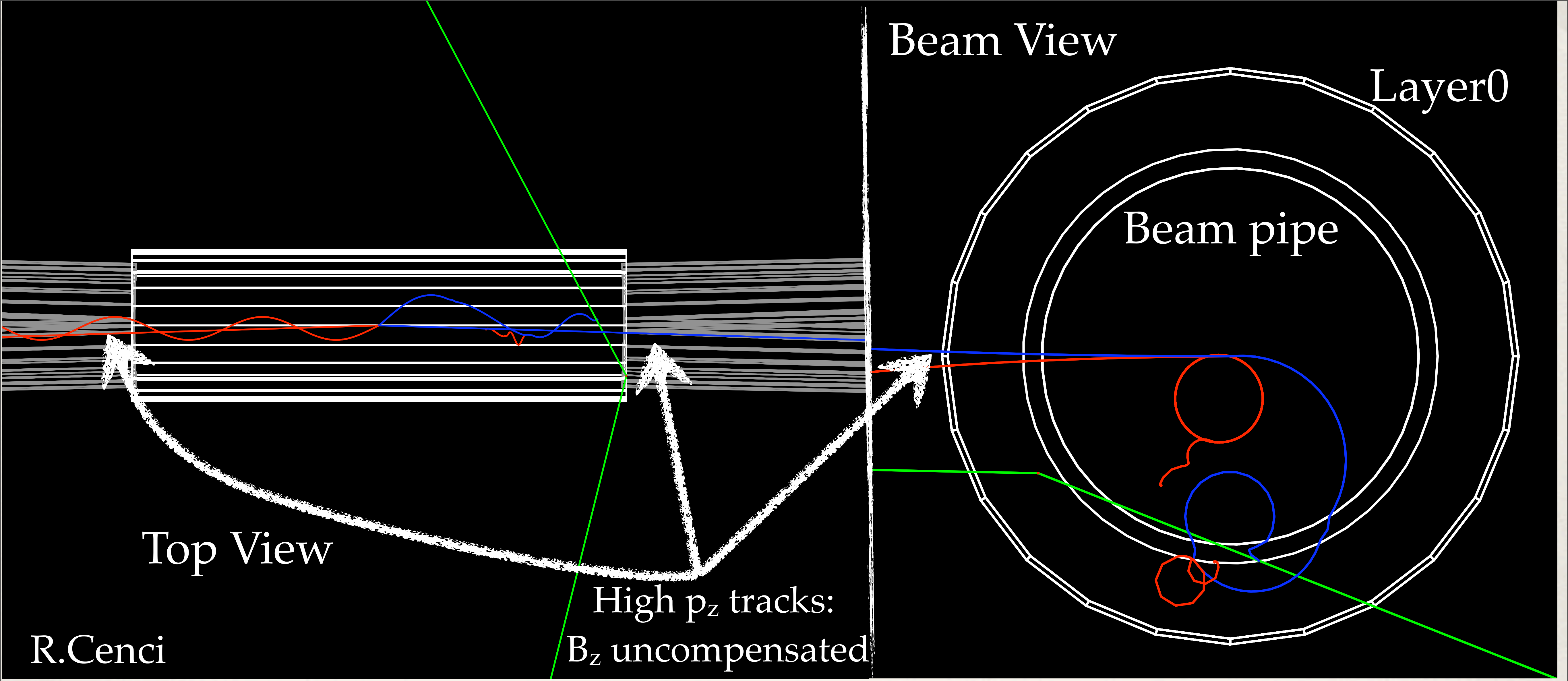
- $B_z = 0$ everywhere inside the accelerators G4Volumes for radiative Bhabha backgrounds.
  - Conservative: less showering particles are trapped by B_z
  - Assumption: marginal contribution from fringing fields
- $B_z = 1.5$ T for pairs production background
  - Assumption: downstream showering negligible w.r.t. rad. Bhabha
  - Crucial and beneficial confinement effect for low p_t particles
- The two configurations are hardcoded in C++

Nature of the mistake.

- Bruno out of the box is configured for Radiative Bhabha production
- I forgot to tell Riccardo to modify Bruno to correctly handle pairs production backgrounds. Consequently :
  - the magnetic field inside the beam pipe was erroneously switched ***off*** (still $B_z = 1.5$ T inside the tracking volume)
  - all the beneficial magnetic confinement of low p_t particles went away
  - the backgrounds rate on Layer 0 overestimated by a factor ~ 4

Correct procedure

- Switch ***ON*** the magnetic field
- Event display to visually inspect the curly tracks
- Perform again the analysis
- Control and compare with previous results/CDR

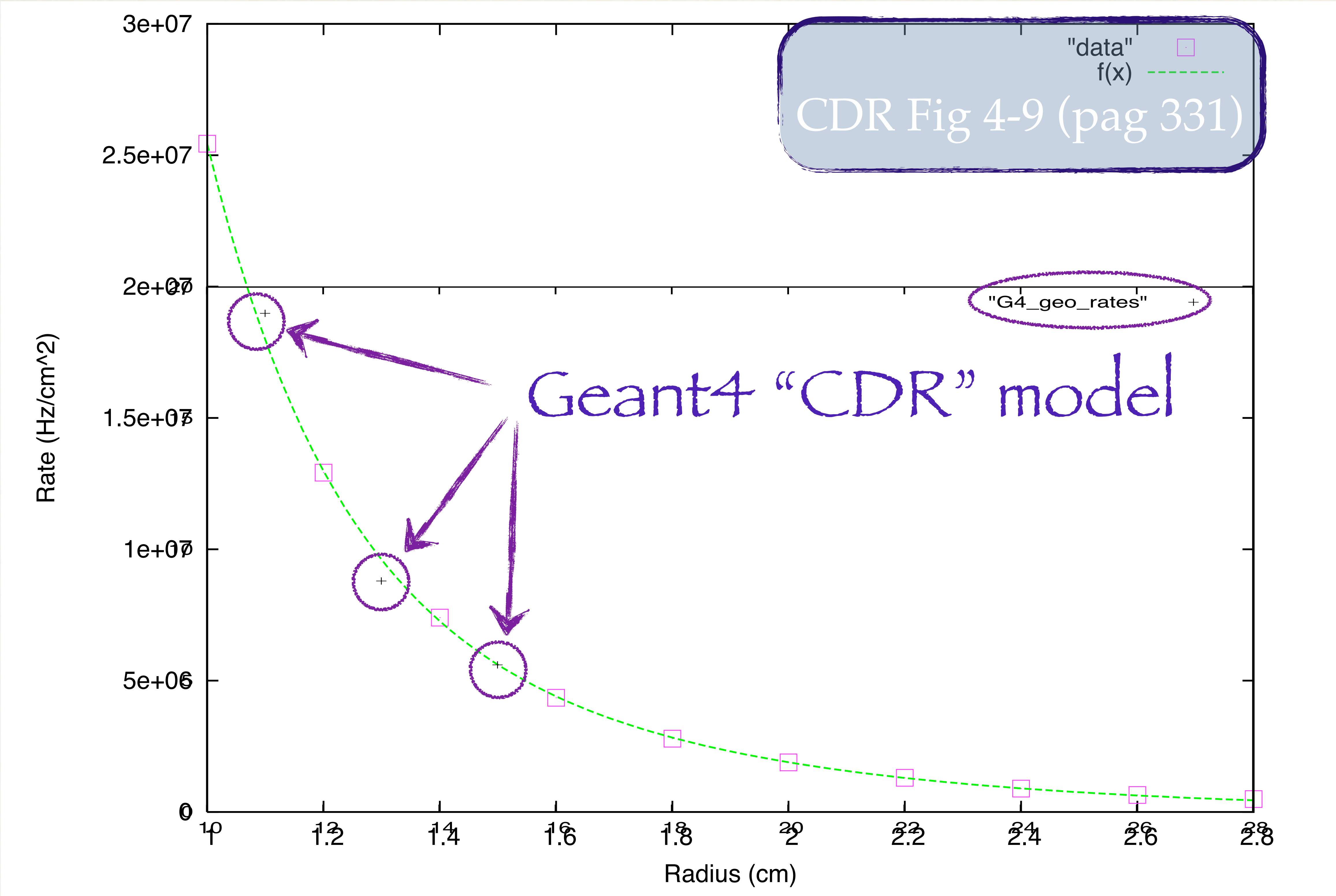


Event Display

$B_z = 1.5$ T everywhere

Cross check with CDR numbers: Geant 4 simplified model

- CDR predictions were made algebraically under the naif assumptions:
  - perfect helical trajectory (No multiple scattering nor energy loss)
  - unit hit multiplicity (i.e. 1 fired pixel/track crossing)
- Comparable G4 model ("CDR" model)
  - Beam pipe removed
  - Layer 0 thickness reduced to 0.1 μm



Good agreement: overall cross check of normalization and G4 tracking.

General consideration: "CDR" G4 model L0 @ 13 mm

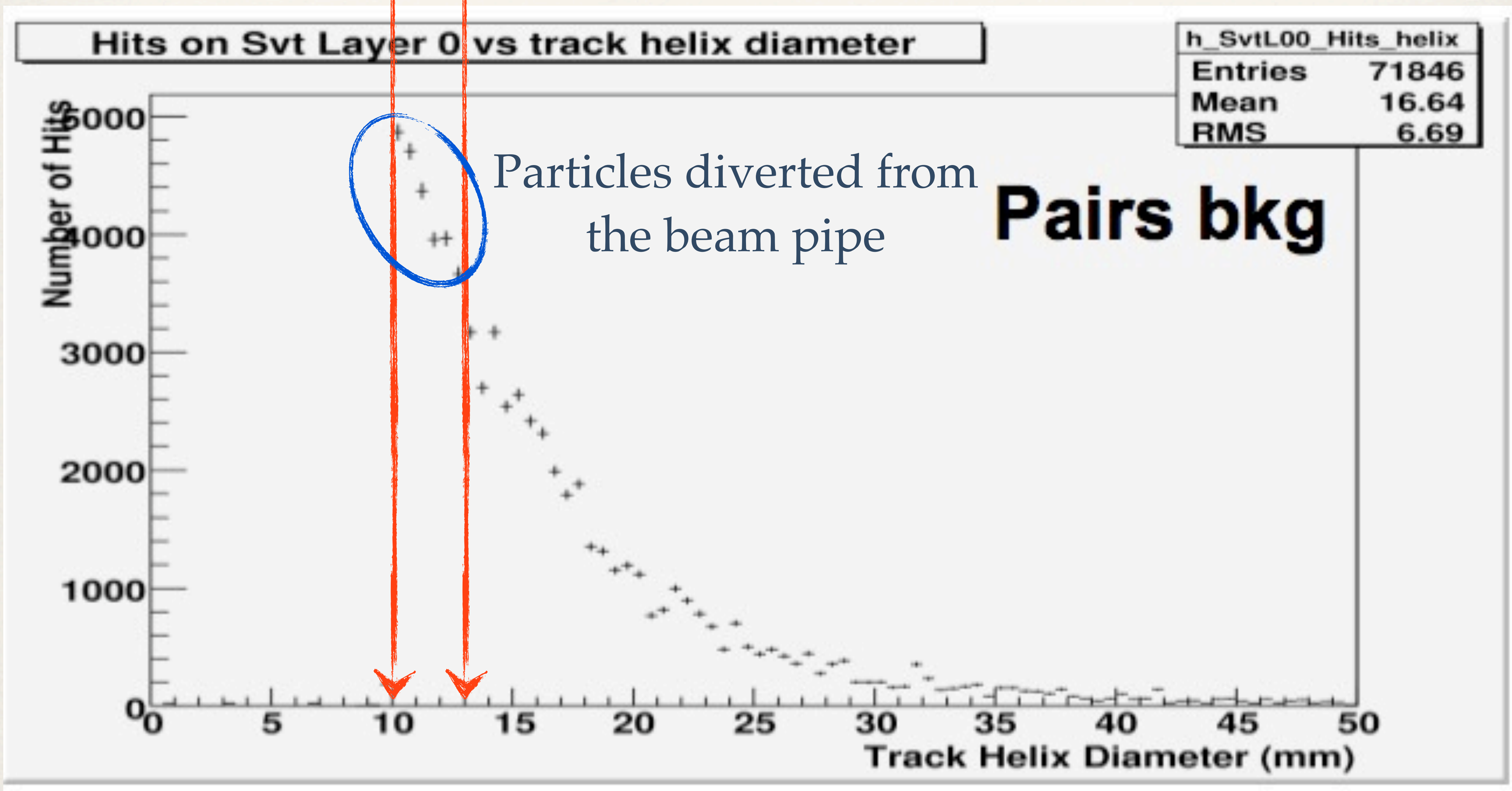
- The track rate @ 13mm in the "CDR" model is 8.8 MHz/cm^2
  (Track rate: number of particles hitting the unit surface/unit time)
- In the "CDR" model : track rate = pixel rate
- "CDR" model with thick Si (300 μm) "thick CDR":

  pixel rate= 16.9 MHz/cm^2

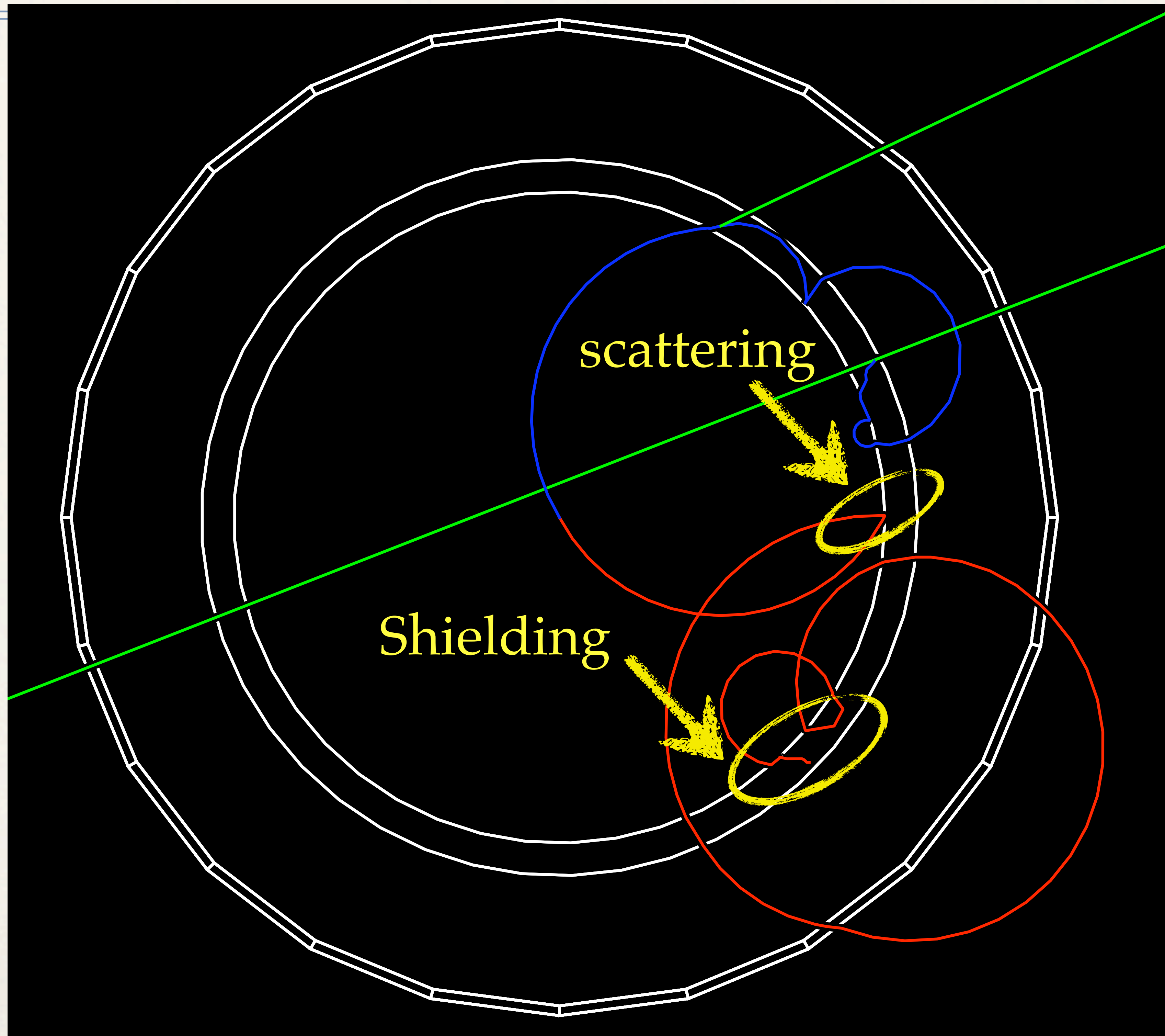
  hit multiplicity = 1.9 (i.e. each track crossing fires 2 pixels) reasonable?
  apparently underestimated...

P_t distribution

Beam pipe SVT L0



Overall the beam pipe effect is beneficial: Track rate down to 7MHz/cm^2



SVT L0 rate (preliminary):

- Track rate @ 1.3 cm ~8.0 MHz/cm^2 (Full Geant 4 model)
- Cluster multiplicity still under study. First indications are indicating ~10 pixel/track :' (
- More detailed simulations of the charge collection needed to reduce the uncertainties on this later critical parameter

Spares

The bloody gory details:

this function gives **B** in the Final Focus

```
class MagneticIR : public G4MagneticField,
                   public unary_function< MagneticCylinder, void >
{
public:  // with description

        MagneticIR( void );
        virtual ~MagneticIR(){};
        // Constructor and destructor. No actions.


        virtual void  GetFieldValue( const G4double Point[4],
                               G4double *Bfield ) const
                {
                        Bfield[0] = 0;

                        Bfield[1] = 0;
                        Bfield[2] = 0*1.5 * tesla;

                        for_each( _quadrupoles.begin(),
                                  _quadrupoles.end(),
                                  MagneticAdder( Point, Bfield));
                }
```

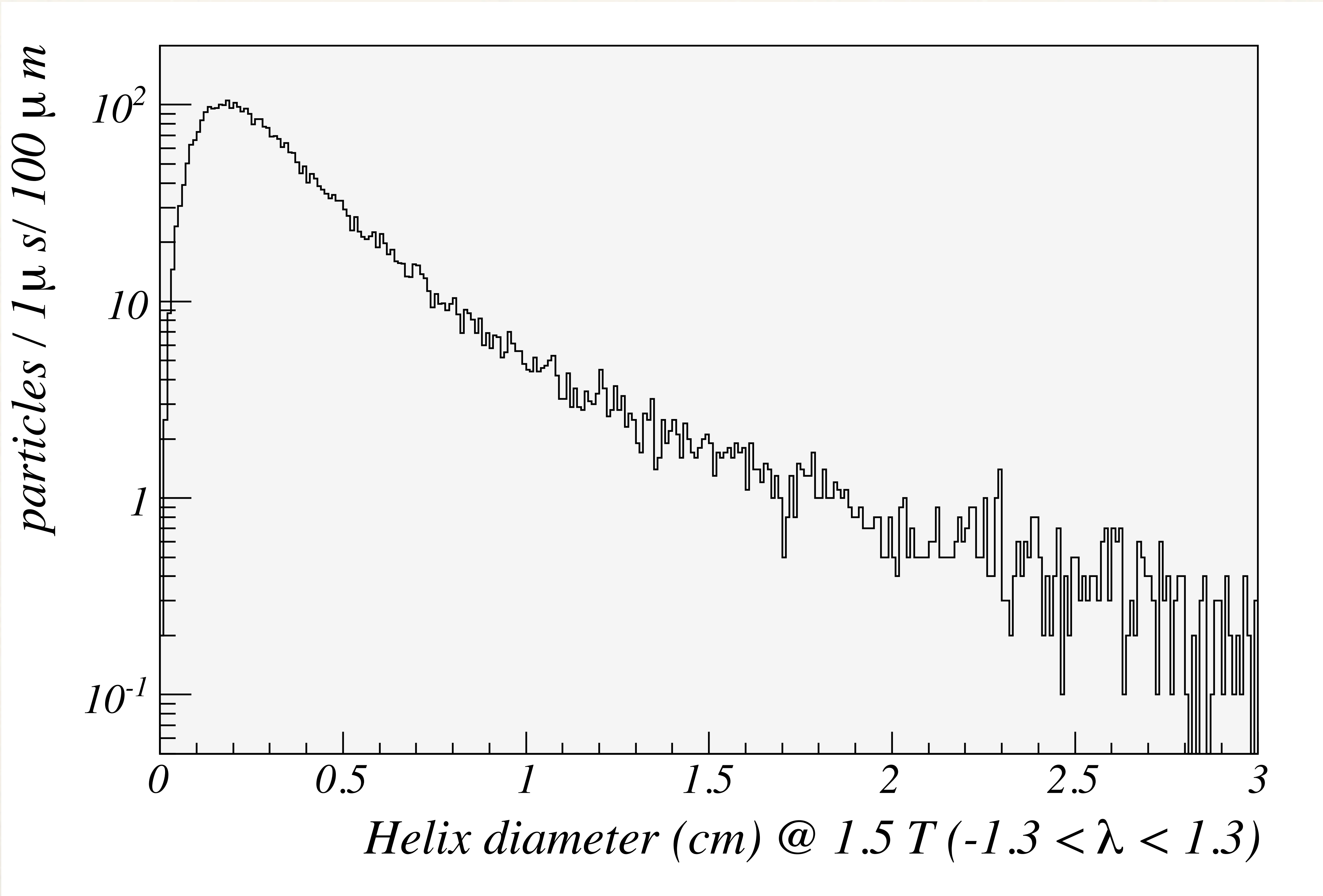
Get Bfield at a given Point

B_z contribution from detector solenoid

Beam lines quadrupoles

Bz “naive compensation”

Tracks radial span



Dip angle distribution