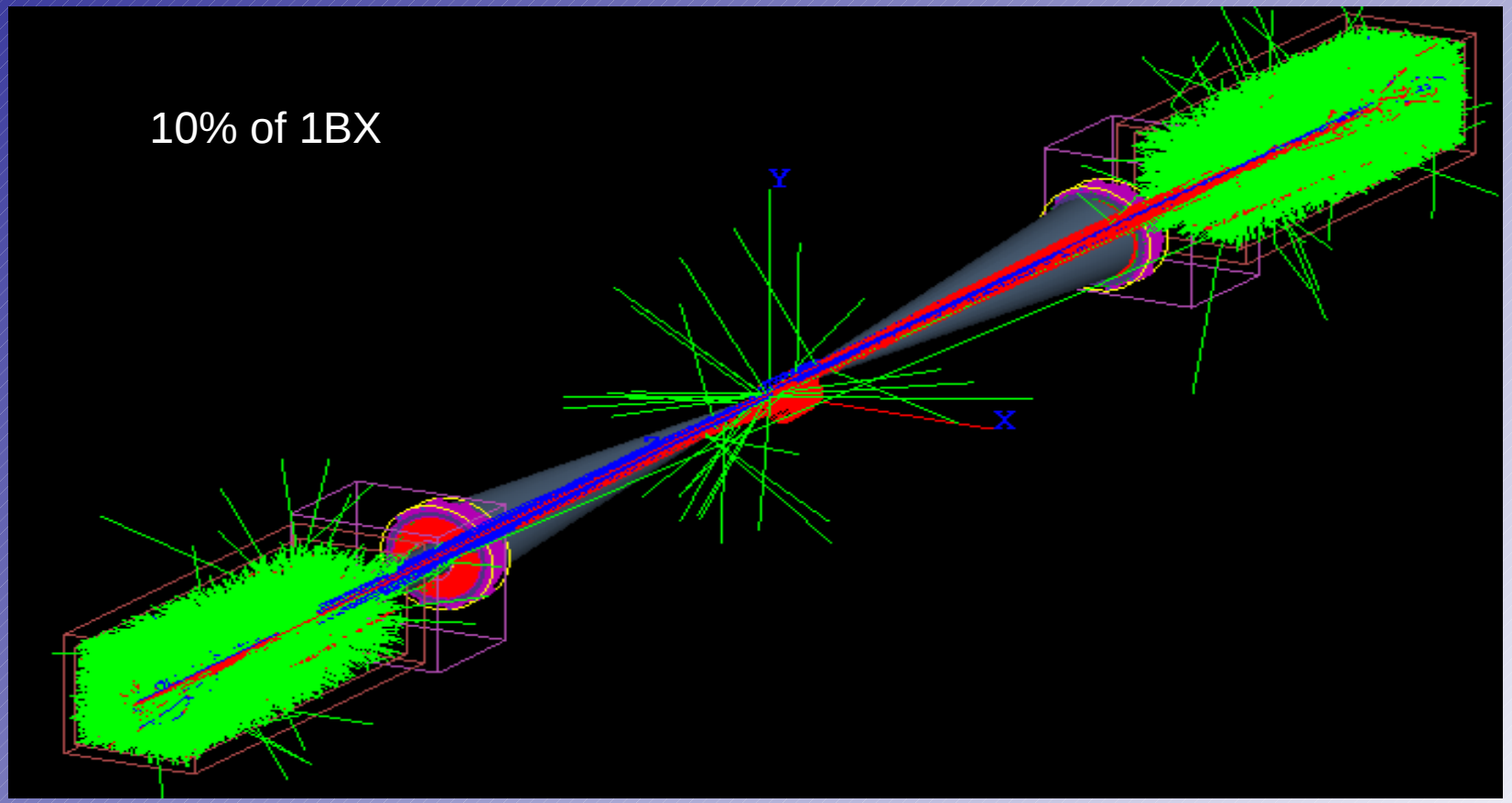
FE electronics simulation with recent LCAL geometry

B. Pawlik FCAL-Zeuthen 29-30 Jun 2009

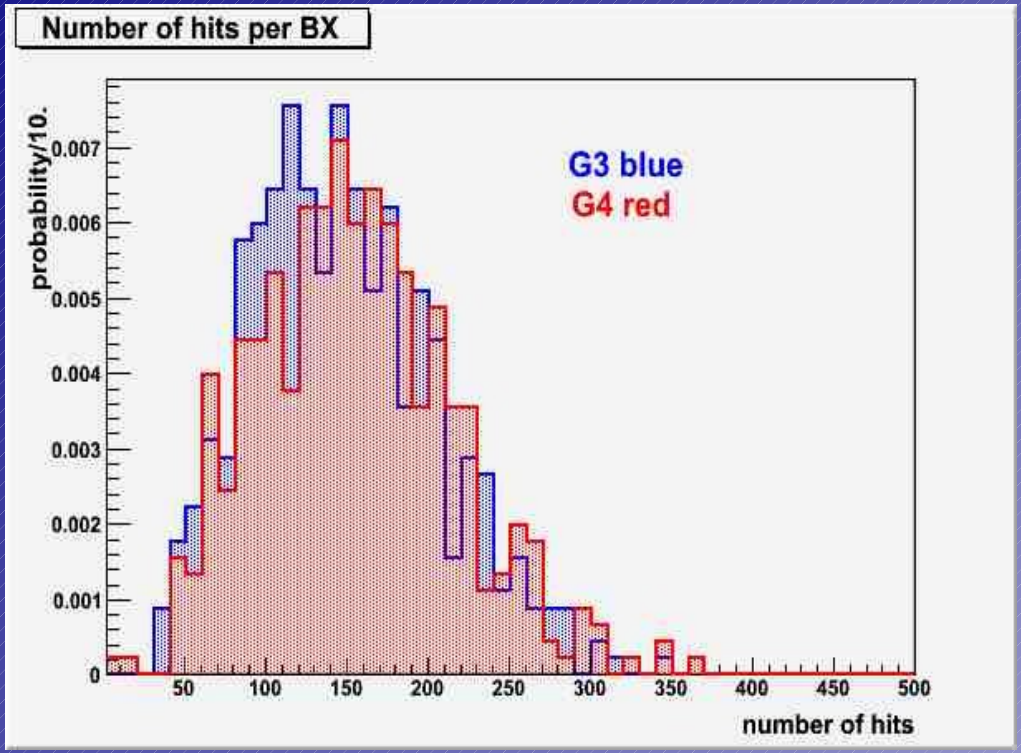
- Data sample (beam-background, Bhabha events)
- Charge deposit range Q_{max} (puzzle)
- Occupancy, data volume
- Pile up

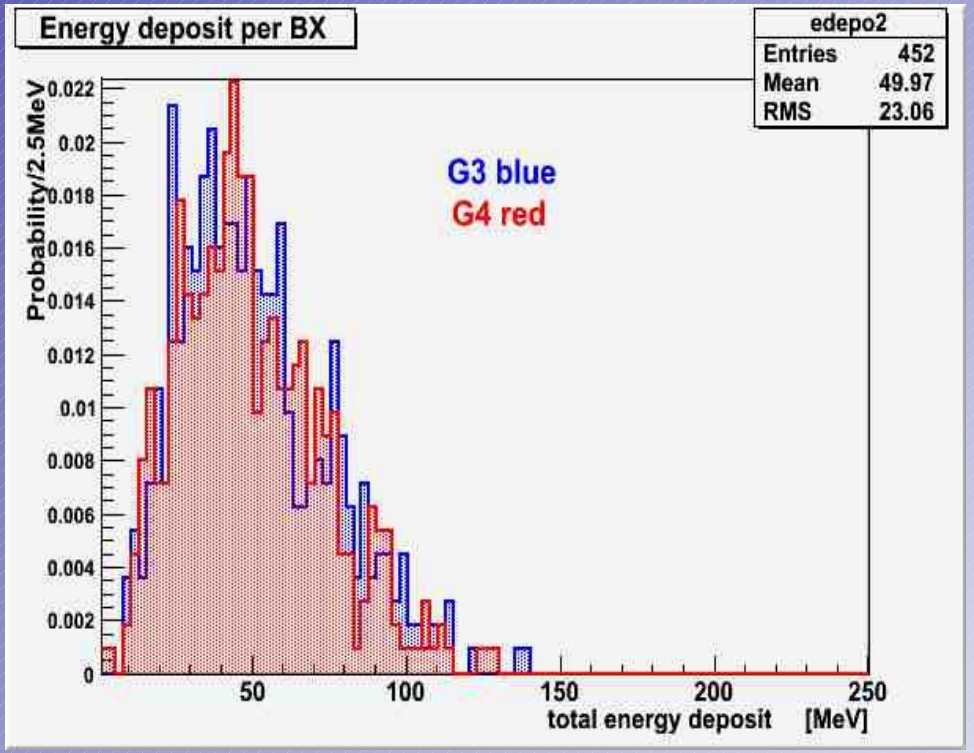
Data sample (1)

- Beam Background - 3000 BX, Guinea-Pig with nominal Tesla machine parameters
  - detector setup -> FCAL (Tube, LCAL, LHCAL, BCAL, MASK)
  - crossing angle 14 mrad
  - field Solenoid+DID maps



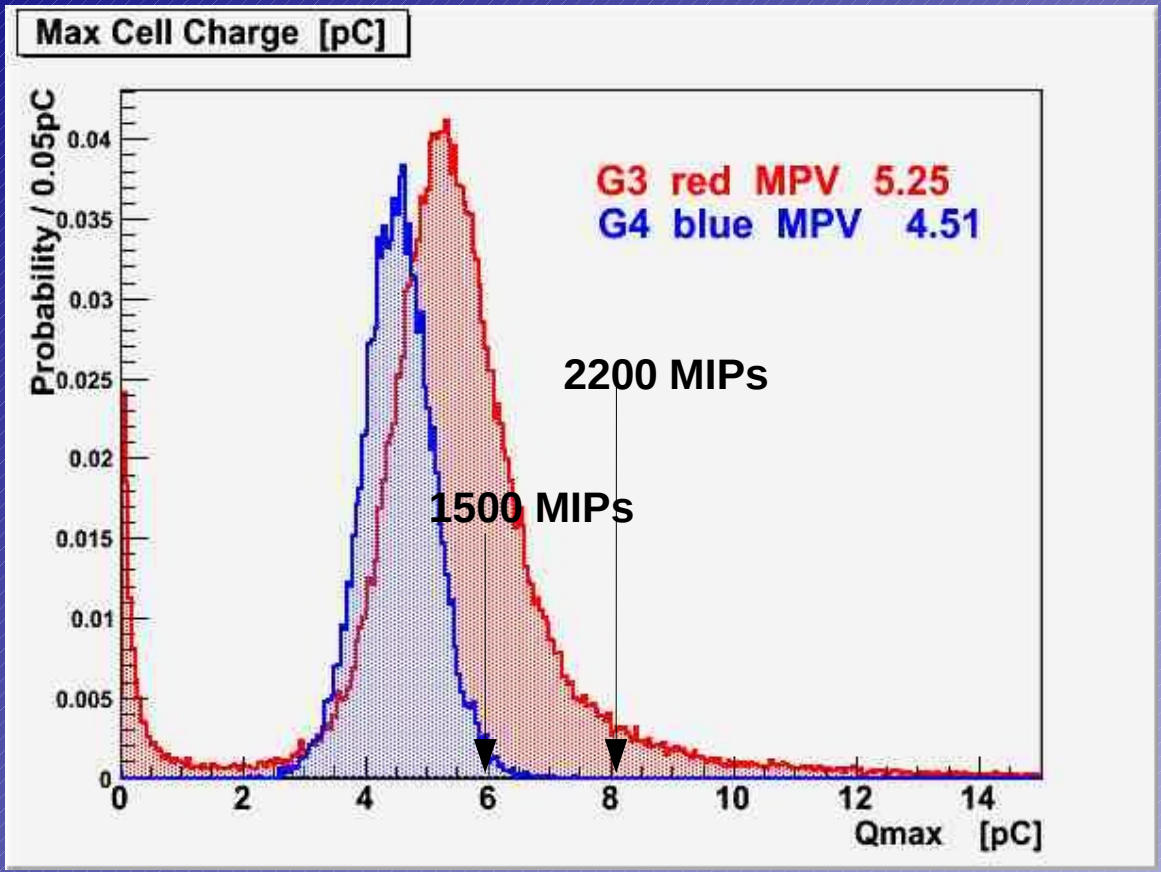
Data sample (2)





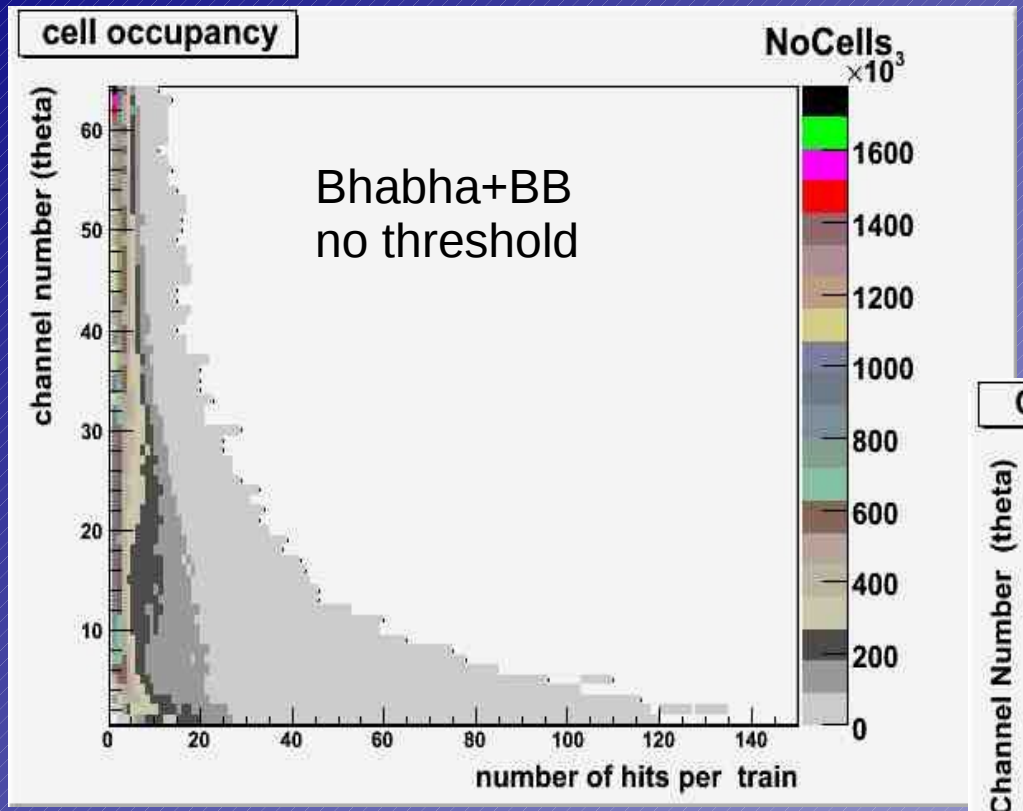
- Results of simulation performed with G4 and G3 are consistent
- Beam-Background data sample used was generated with G3
  (G3 -> ~6min CPU /BX, G4 -> 6000 min CPU/BX)
- Bhabha events data sample 2×10^5 events = 50 pbarn^{-1}, BHLUMI, $0.031 < \theta < 0.077$ rad,
  $\sigma \approx 4.4$ nbarn, frequency = 105 Hz
- the final sample used for analysis consists of Bhabha events overlay
  with one out of 3000 randomly chosen beam-background BX

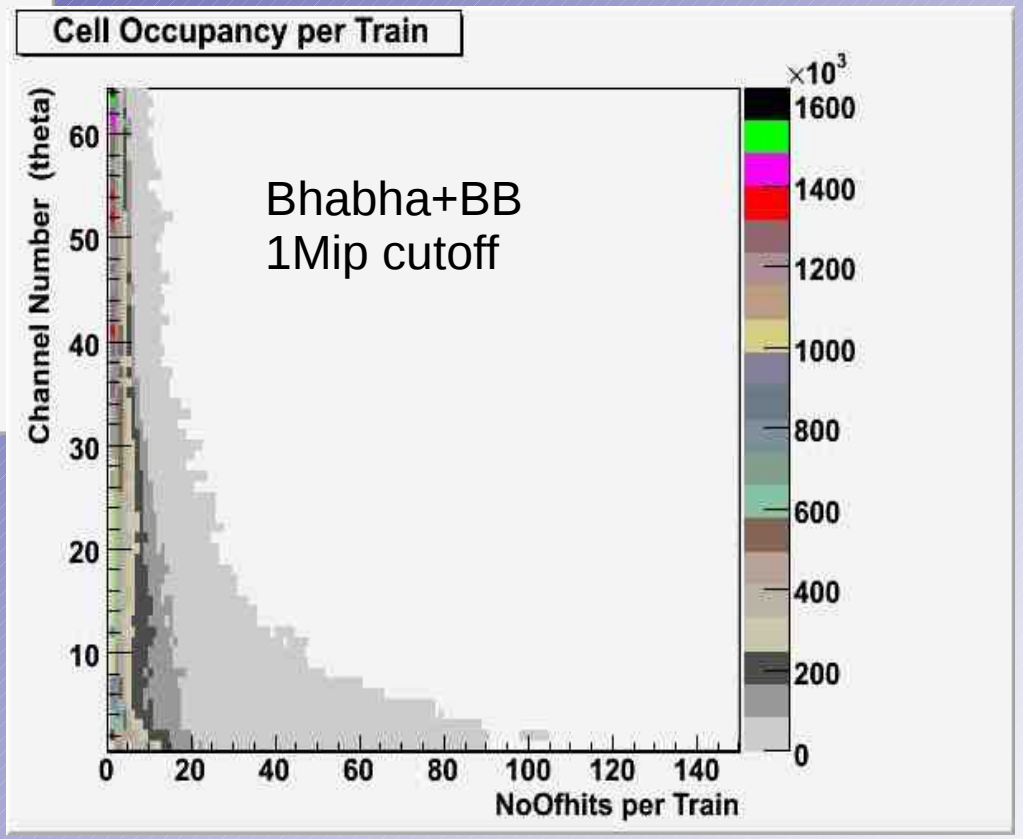
Charge deposit Q_{max}



- significant difference between G3 and G4 simulation, both MPV and RMS larger for G3.

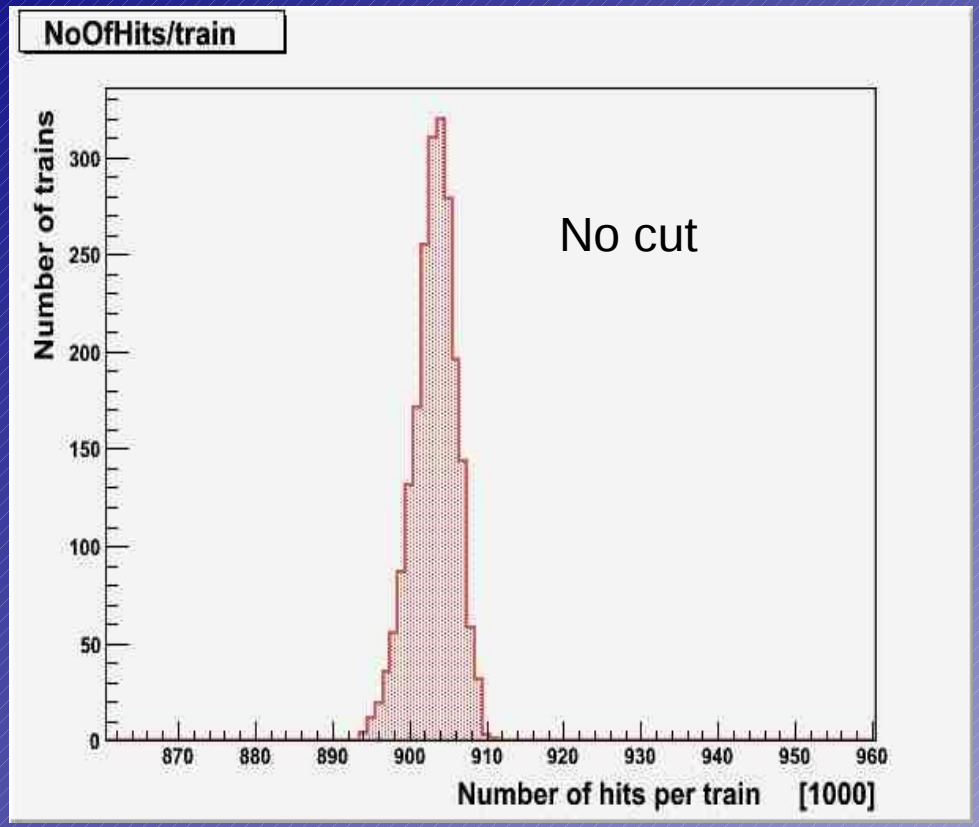
Occupancy and Data Volume(1)

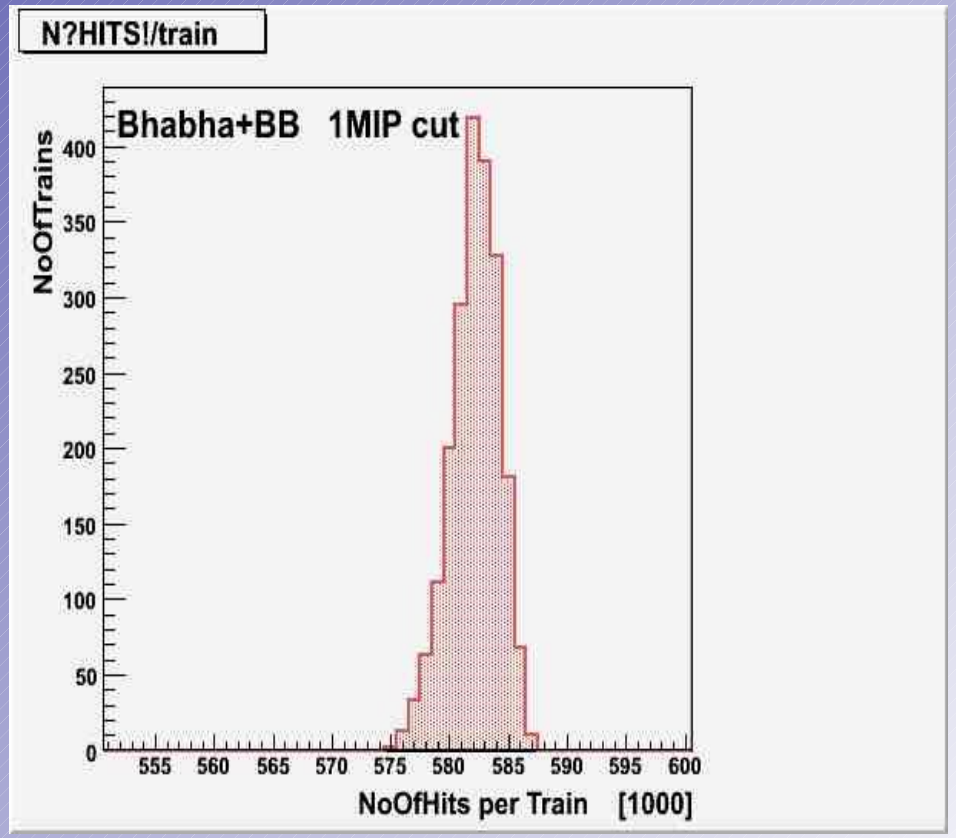




- on board memory depth required is ~ 100

Occupancy and Data Volume(2)





- 1MiP threshold cut reduces data volume by ~40 %

Pile-up

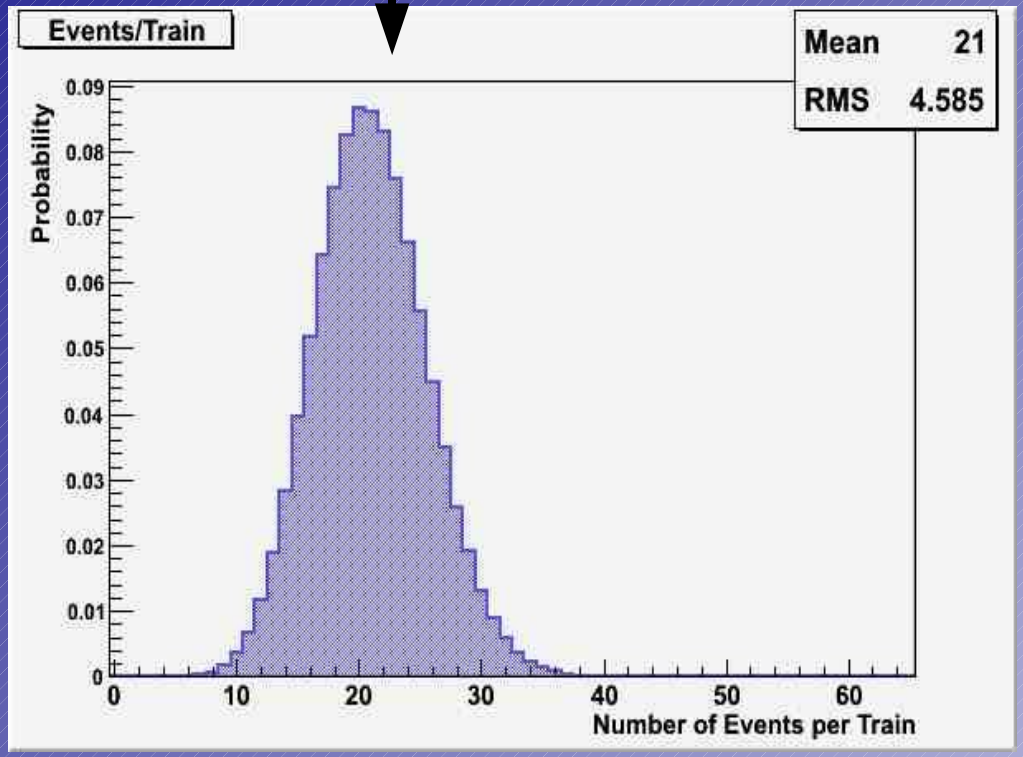
σ ≈ 4.4 nbarn, frequency = 105 Hz -> average number of events ~ 21 / Train

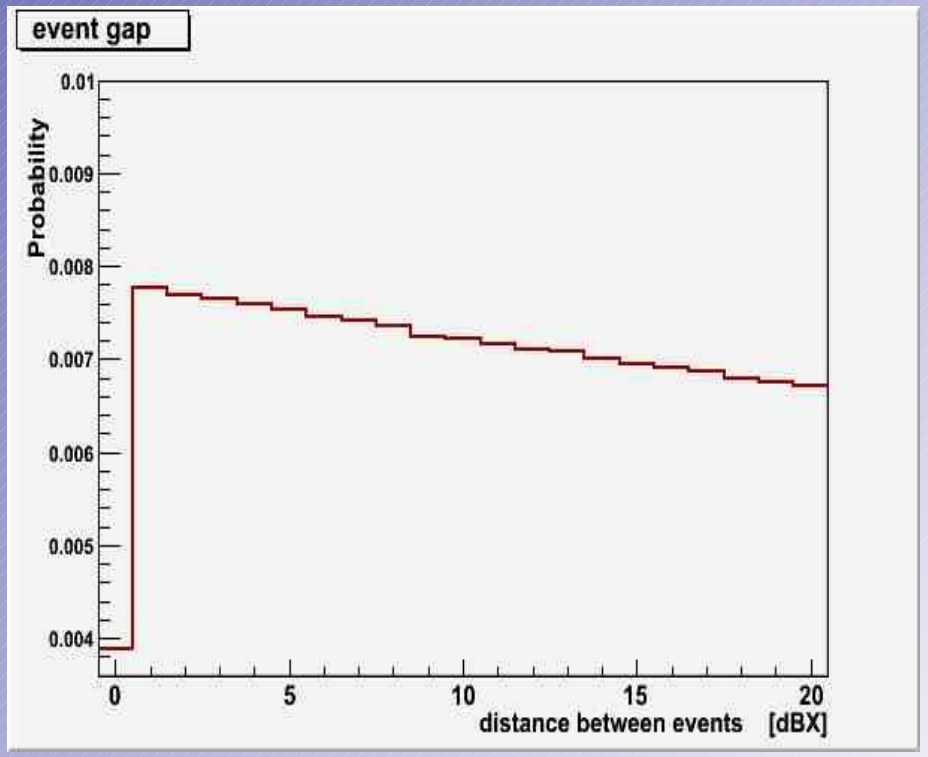
actual number

assuming Poisson distr.

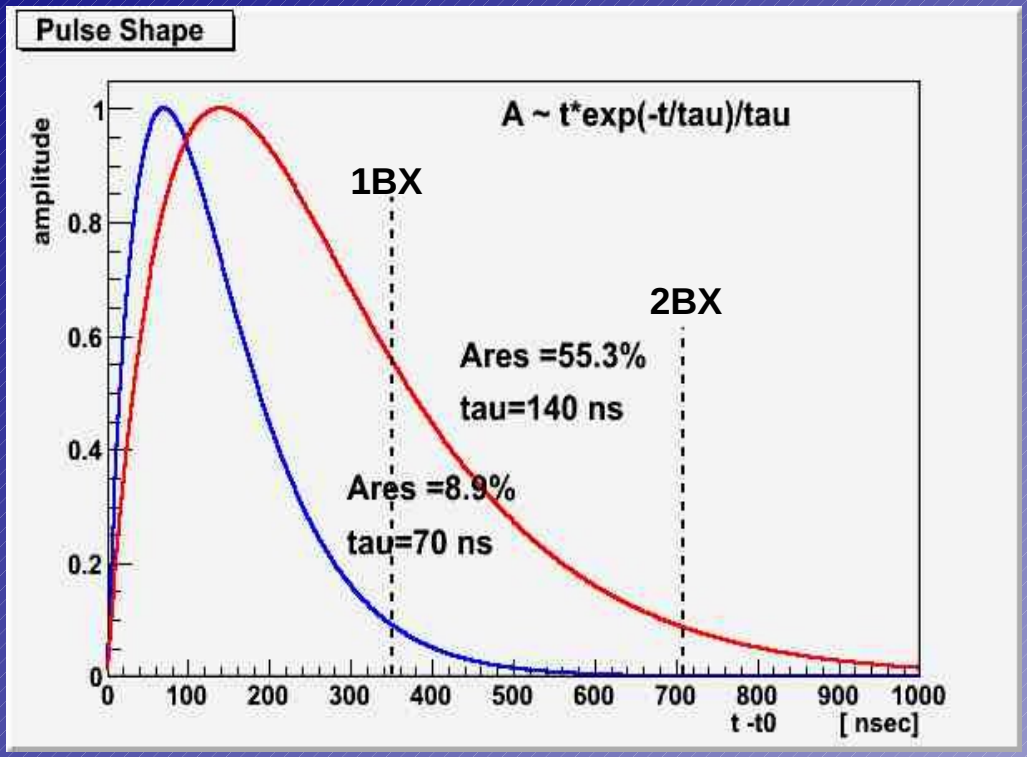
Distance between 2 events

uniform distribution





Pile-up (cont.)



Simulation procedure:
(for each event in turn)

- *Get number of events in the train*
- *Get distance to previous event*
- *Calculate pulse residue*
- *Overlay actual hits with remnants from previous BX*
- *Add "cross-talk" ~1%*

Procedure was repeated for pulse shape width
- 70 nsec
-140 nsec

Pile-up (cont.)

Summary

- Simulation done for Bhabha events overlay with Beam-Beam background
- Dynamic range fo charge deposit found is 1MIP – 1500MIP (2000 MIP for G3 simulation)
- Cell occupancy ranges up to 150 per train
- Data volume per train found to be ~ 8x105 (5x105) hits
- Impact of pile-up (pulse residual contribution) was estimated and no significant was found
- Cross-talk at the level 1% is negligible
- Further study those effects is to be continued