Update on Pairs background

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Outline

- **FastSim generator of backgrounds: The problem**

- **The fix**

- **Possible issues with the current algorithm**

- **Summary**

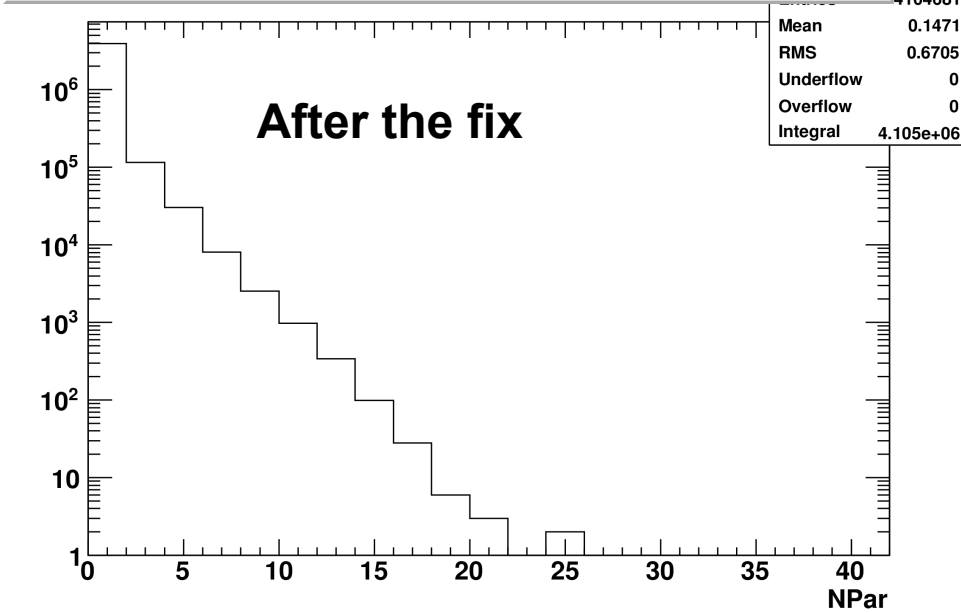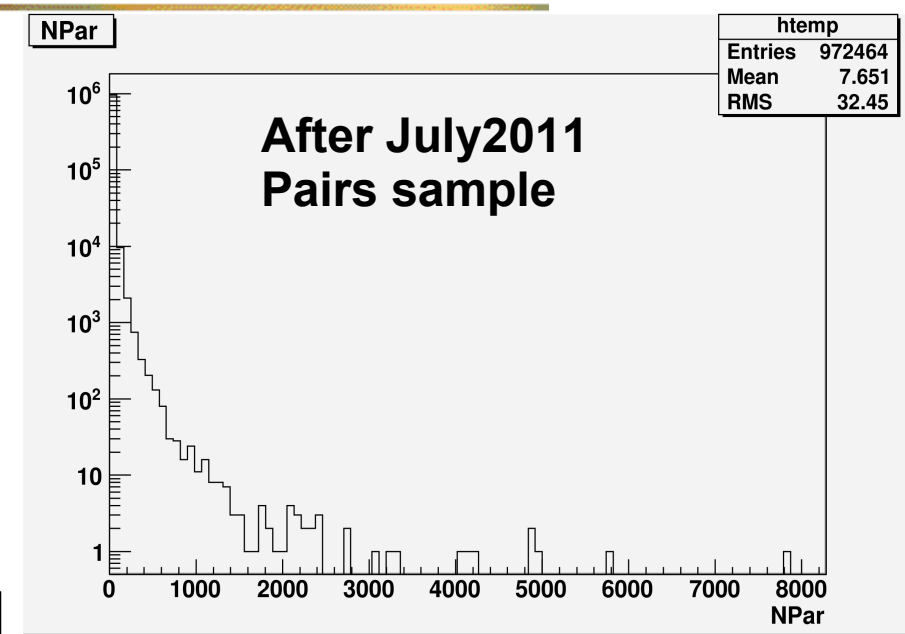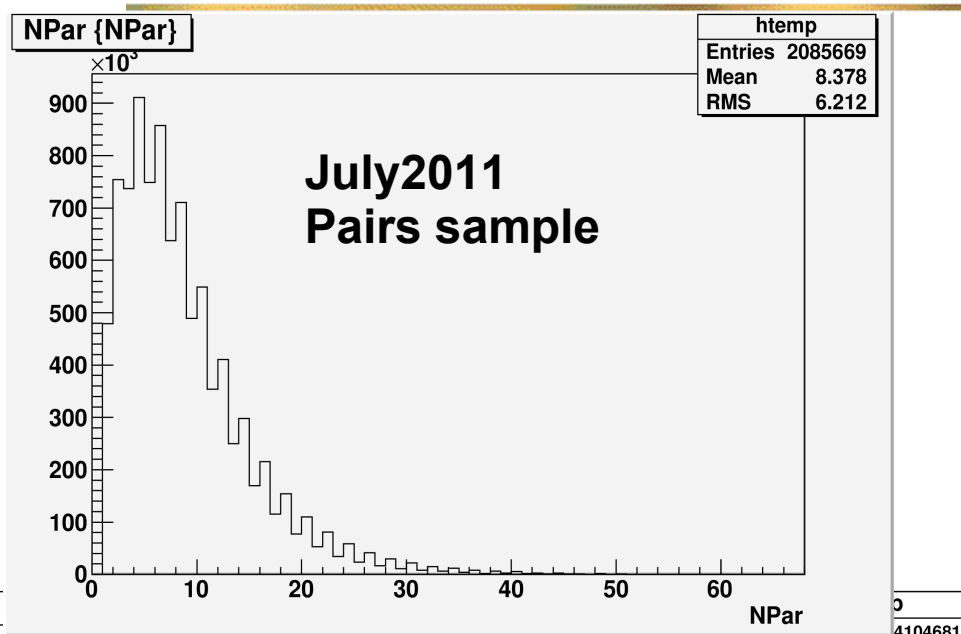# FastSim generator for BhaBha/Pairs: the problem

- **Pairs (diag36) and high angle bhabha (bhwide) bg-frames are generated with fastsim, with PacMC/src/PmcWriteParticles.cc module**

- **Module philosophy:**
  - For each PacSimTracks in the event loop on PacSimHits,
  - Look for hits on,
    - Tracking system (SVT/DCH) for Pairs
    - Calorimeter for elastic Bhabha
  - Save hits as TParticles in an output file to be used by the background mixing module

- **Problem with the PacMC/src/PmcWriteParticles.cc module:**
  - Save all the hits of a given PacSimTrack as a TParticle
  - Running time effect: some events have very long particles saved $\Rightarrow$ event runs out of memory and jobs crashes

- **Problems at input tcl config file:**
  - Cross-section value is given to calculate the average number of interactions per bunch-crossing: n_int = (luminosity)(cross-section)/bunch_crossing_freq
  - Previous values didn't correspond to the kinematic cuts at generator level
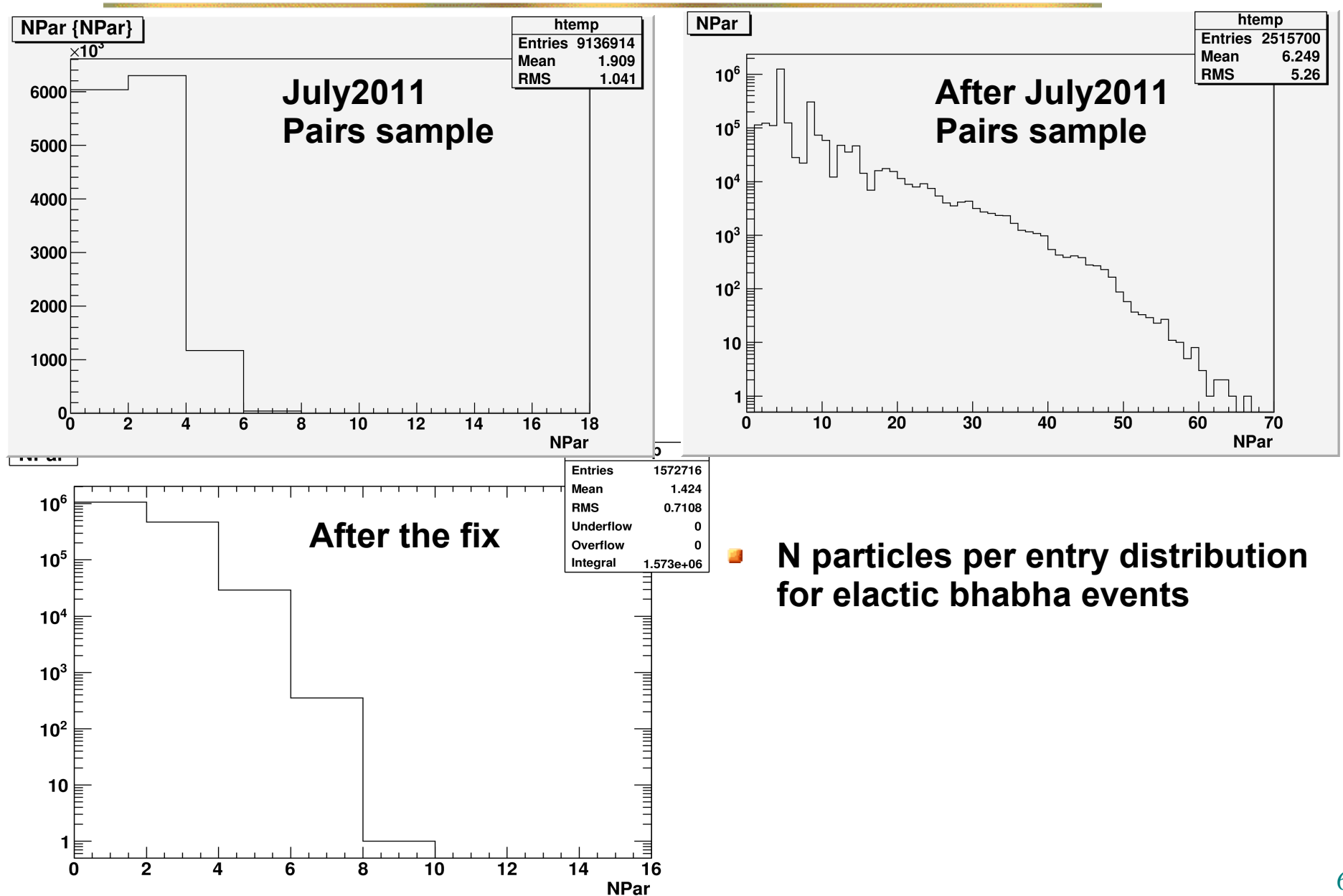
FastSim generator for BhaBha/Pairs: the fix

- **Fix at the PacMC/src/PmcWriteParticles.cc module:**
  - Save only the first hits of a given PacSimTrack as a TParticle
- **Fix at input tcl config file (PacProduction/GenPairBkg.tcl and GenBhabhaBkg.tcl):**
  - Cross-section values:
    - Pairs: $7.3 \times 10^{-27} \text{cm}^2 \rightarrow 7.54 \times 10^{-28} \text{cm}^2$ ($p_t > 2\text{MeV}/c$) $\Rightarrow$ a factor of 10 lower
    - Bhabha: $3.01 \times 10^{-31} \text{cm}^2 \rightarrow 8.34 \times 10^{-30} \text{cm}^2$ ($\theta > 2^\circ$) $\Rightarrow$ a factor of 28 higher!
  - Updated bunch crossing value: $200\text{MHz} \rightarrow 226\text{MHz}$
- **The code seems to be working now, there are no more events with a very high number of particles**
- **Ran 10k events of $B^0 \rightarrow \pi^+\pi^-$, $B^0 \rightarrow$ gen with Pairs mixing and no more ran out of memory**

FastSim generator for BhaBha/Pairs: the fix (II)

N particles per entry distribution for Pair events

FastSim generator for BhaBha/Pairs: the fix (III)

July2011 Pairs sample

htemp
Entries 9136914
Mean 1.909
RMS 1.041

After July2011 Pairs sample

htemp
Entries 2515700
Mean 6.249
RMS 5.26

After the fix

Entries 1572716
Mean 1.424
RMS 0.7108
Underflow 0
Overflow 0
Integral 1.573e+06

N particles per entry distribution for elactic bhabha events

Possible issues with current algorithm

- **Paris background:**
  - Look for fist hit on tracking system only. Forget about hits on calorimeter.
  - Issues:
    - Hits on calorimeter for tracks not seen by tracking system are lost
    - Photons hits are not considered

- **Bhabha background:**
  - Look for fist hit on calorimeter only. Forget about hits on tracking (SVT/DCH)
  - Issues:
    - Hits on tracking not considered

- **Possible solution:**
  - Generate Pairs and bhabha bg-frames with FullSim
  - For this needs to implement diag36 and bhwide generators in fullsim. This doesn't seems to be a very difficult task