JÜLICH FORSCHUNGSZENTRUM

Proposition for the Beam Smearing Implementation inside Pandaroot

December 10, 2009 | T. Randriamalala, J. Ritman and T. Stockmanns

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- Similarly, one can operate by using FairPrimaryGenerator (modified).
- But, the current implementation FairPrimaryGenerator can smear only vertices
  $\Longrightarrow$ *Angular smearing* should be implemented (beam particles do not have identical 4-momemtum)
- Also, the vertex smearing should be modified according to the HESR beam properties.

FairPrimaryGenerator Vertex Smearing

- In the simulation macro:

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FairPrimaryGenerator* primGen = new FairPrimaryGenerator();

primGen->SetTarget(0.0, 0.2);
primGen->SmearVertexZ(kTRUE);


primGen->SetBeam(0.0, 0.0, 0.08, 0.08);
primGen->SmearVertexXY(kTRUE);
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X and Y will be smeared both by a gaussian centered on 0.0, with $\sigma = 0.08 cm$.

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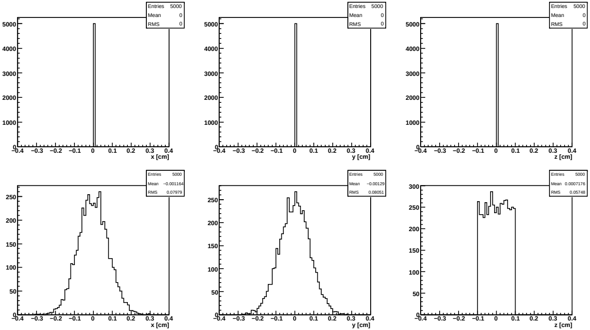
- Run a simulation:

```
fRun->SetGenerator(primGen);
FairBoxGenerator* boxGen =...
boxGen->SetXYZ(0., 0., 0.);
primGen->AddGenerator(boxGen);
```

Smearing Output

- Before vertex smearing
- After vertex smearing



[1] D. Reistad, B. Galnander, K. Rathsman, A. Sidorin, "Calculations on High-Energy Electron Cooling in the HESR", Proceedings of COOL 2007, Bad Kreuznach. and V.Ziemann, NIMA 556 (2006) 641.

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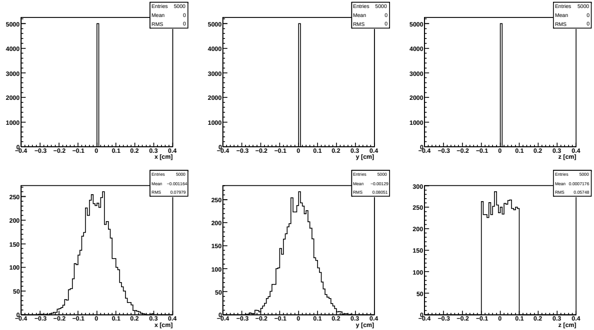

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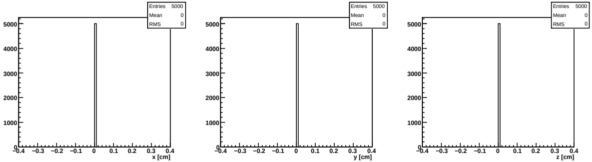

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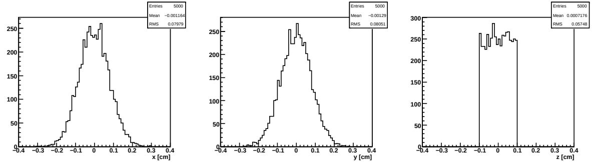

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  + angluar smearing

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  - σ_x : RMS of the transversal divergance of the beam.
  - σ_θ : RMS of the angular divergance of the beam.
- For $\sigma_x \leq 0.8mm$, $\mathcal{L}_{eff} \geq 0.8\mathcal{L}_{max}$ because of the beam-target overlap (pellet target).

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  $\Longrightarrow$ Homogeneous "square" distribution of $\bar{p}$ in the beam with a side of $(2 \times \sigma_x)$.
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- Gaussian smearing in the z-direction with $\sigma_z = R/2 = 1mm$.

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  $\delta\varphi$ is an uniform distribution $[-\pi, +\pi]$.
- No correlation between $\delta\theta$ and $\delta\varphi$.

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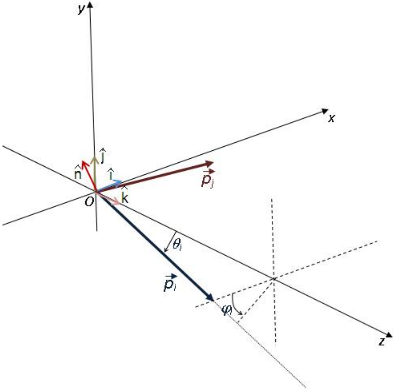

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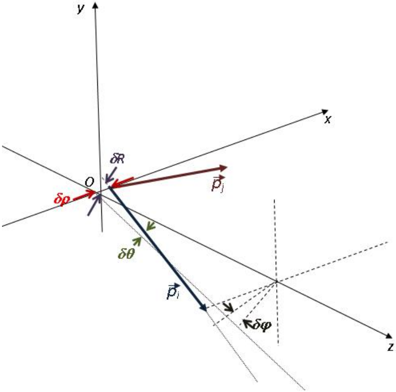

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  - change the flat distribution on Z to a gaussian.
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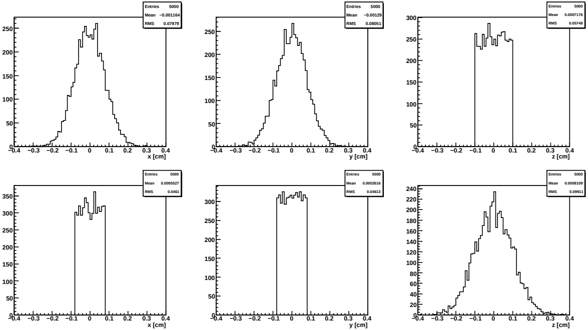
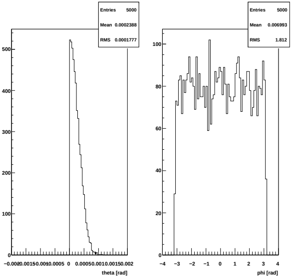
- In simulation macro, add:
  *primGen->SetAngularDivergence(0.3*1E-3);*
  primGen->SmearAngle(kTRUE);
- Use FairBoxGenerator to generate event (5000 event, 1 particle/event)

Results

- Effect of the modification on the vertex (bottom plots) in comparison with the existing one (top plot):



- Angular divergence distribution:



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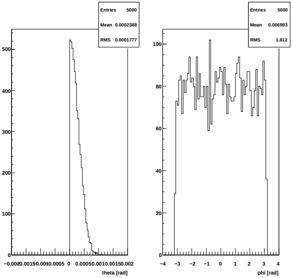
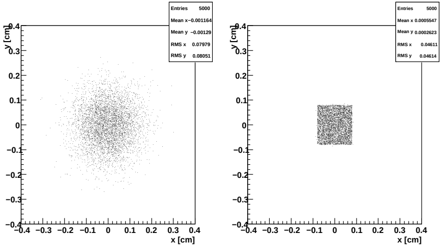


- Beam profile in xy plane at 1m from the IP:



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- If $\varepsilon = 1$ *mm mrad*, the resolution of one subdetector is affected ($\delta\theta \geq$ 0.3*mrad* for the LM).