
GeVSim Event Generator

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Content

- **Motivation**
- **Features**
- **Event-by-Event capabilities of *GeVSim***
- **Implementation**
- **Quality Assurance**
- **Web page survey**

Motivation

- *GeVSim* is a simple Monte-Carlo event generator
 - 2 (two) classes, 400 lines of the (good) code
- **Applications** of *GeVSim*
 - testing algorithms
 - detector performance measurement
- *GeVSim* is based on *MevSim* definition but do not inherit the code
- Rewritten to Root/C++ to avoid
 - unnecessary interfaces (*TMevSim*)
 - problems in stack size (in big multiplicities)
 - 'private' random number generation
- Improved flexibility (event-by-event)

Features

- Partices in *GeVSim* are generated from a thermal distribution
 - no dynamics
 - parameters of a distribution are set **explicite** by the user
- Momentum distribution in (p_T, Y)
 - user defined plugged by TF2 named "gevsimPtY"
 - four generic distribution (the same as in *MevSim*)
- Azimuthal distribution
 - deconvoluted form (P_t, Y) distribution
 - Direct and Elliptical flow (more to come)
- Carefully tested, documentation in development

Momentum distribution

- In first generic model transverse momentum and rapidity is deconvoluted
- Formula

$$\frac{d^2 N}{dp_T dy} = A p_T e^{-m_T/T} e^{-y^2 / 2\sigma_y^2}$$

- Parameters
 - multiplicity
 - inverse slope parameter (sometimes called temperature)
 - rapidity width distribution

Momentum distribution

- Second and Third model - thermalised ball
- Formulae

$$\frac{d^2 N}{dp_T dy} = A p_T E e^{-E/T}$$

$$\frac{d^2 N}{dp_T dy} = \frac{A p_T E}{e^{E/T} - 1}$$

- Parameters
 - multiplicity
 - inverse slope parameter

Expansion

- In first generic model transverse momentum and rapidity is deconvoluted

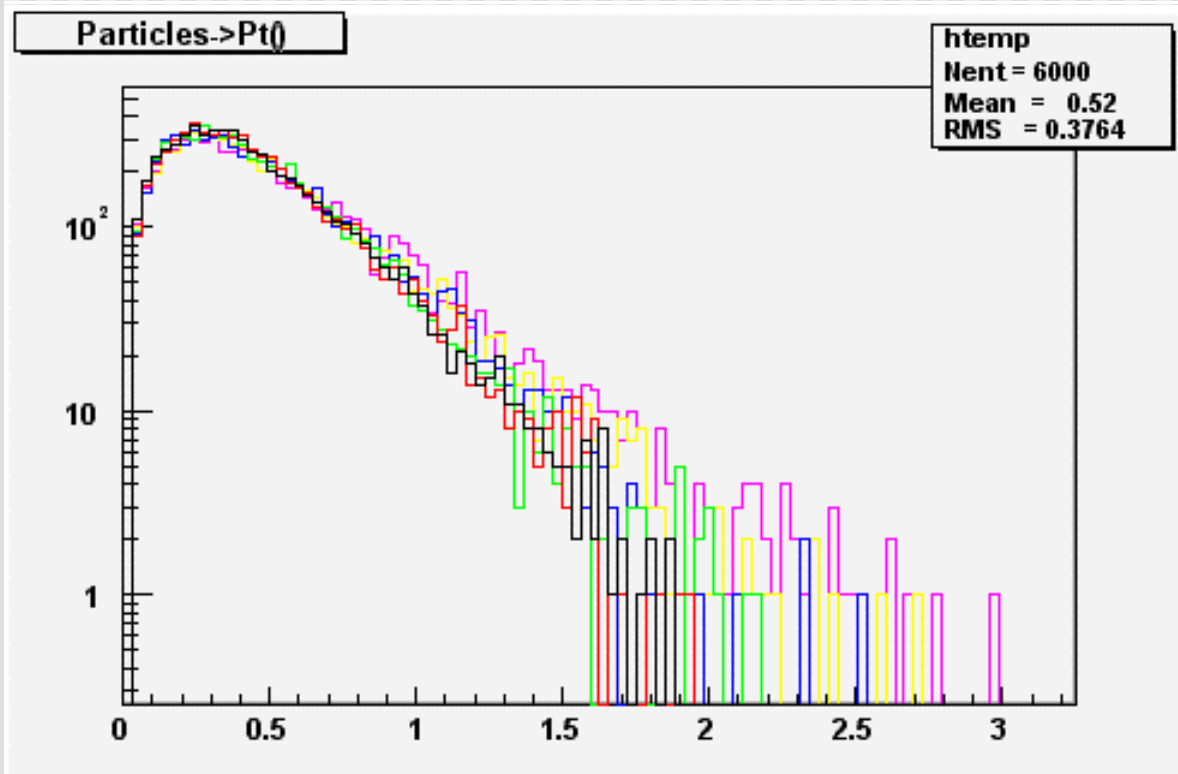
- Formula

$$\frac{d^2 N}{dp_T dy} = A p_T E e^{-\gamma E/T} \times \left[\frac{\sinh(y_p)}{y_p} + \frac{T}{\gamma E} \left(\frac{\sinh(y_p)}{y_p} - \cosh(y_p) \right) \right]$$

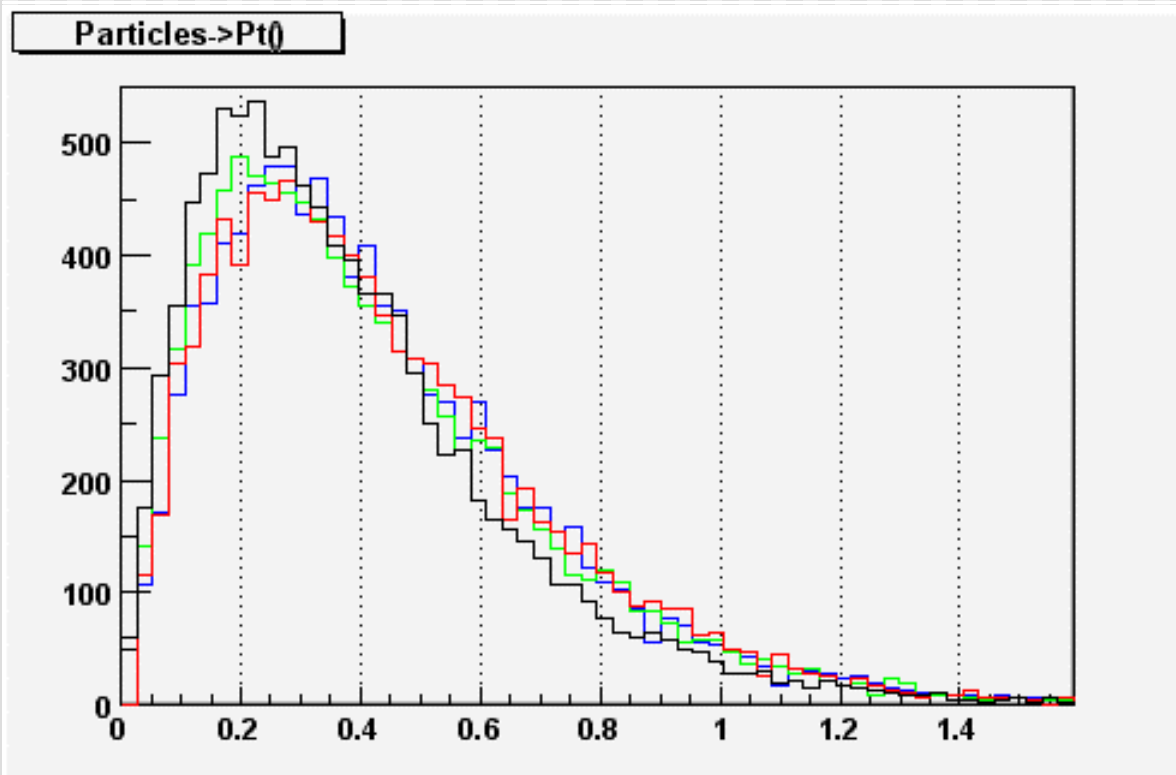
- Parameters

- multiplicity
- inverse slope parameter (sometimes called temperature)
- expansion velocity

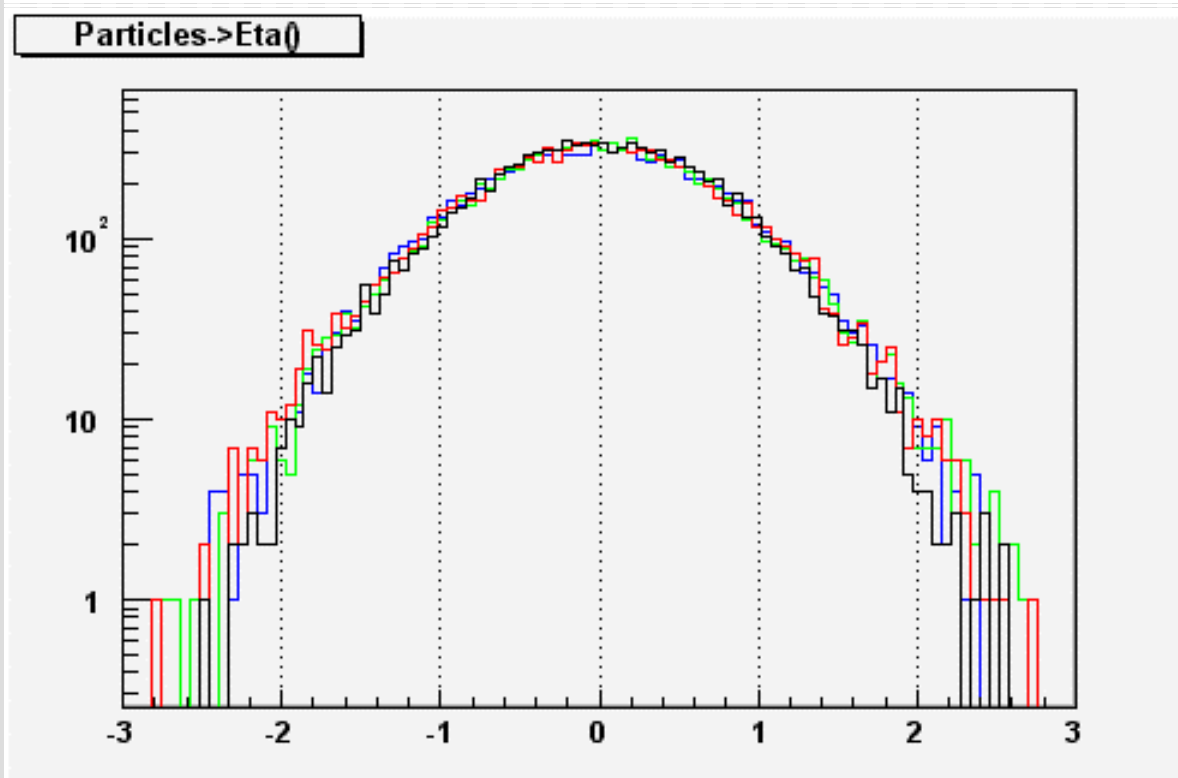
Expansion spectra



Spectrum comparison



Spectrum comparison



Azimuthal distribution

- Azimuthal is described with the use of Fourier transformation
 - first coefficient - direct flow
 - second coefficient - elliptical flow
- Formula:

$$\frac{1}{2\pi p_T} \frac{d^2 N}{dp_T dy} \left[1 + \sum_{n=1}^6 2V_n(p_T, y) \cos[n(\phi - \Psi_R)] \right]$$

- Fourier coefficients defined on the particle type level
 - independent of the momentum
 - this will evolve

Parameter determination

- Parameters of distributions are determined on the event-by-event basis
 - determination with the use of named functions (TF1)
 - discovery of formula by `gRoot->GetFunction("gevsimMult")`
- Product of five numbers gives actual parameter
 - base value -from AliGeVSimParticle object
 - particle type level scaller
 - particle type level random number
 - event level scaller
 - event level random number
- Applications
 - systematic study of multiplicity dependance
 - the same for any other parameter (yelds, T, v2, expansion)
 - meaurments of the fluctuations

Parameter determination

- Parameters name patterns
 - global level - "gevsimParam" - eg. **gevsimMult**
 - global level random - "gevsimParam" - eg. **gevsimMultRndm**
 - local level - "gevsimPdgParam" - eg. **gevsim211Temp**
 - local level random - "gevsimPdgParamRndm" - eg. **gevsim211V2Rndm**
- Names of parameters
 - Mult, Temp, SigmaY (1), ExpVel (4)
 - V1, V2 - flow parameters
 - Psi - Reaction plane angle on global level only

Implementation

- Two classes - *AliGeVSimParticle*, *AliGenGeVSim*
- **AliGeVSimParticles** corresponds to one particle type
 - multiplicity
 - slope parameter, rapidity width, expansion velocity
 - flow coefficients
 - parameters in "*AliGeVSimParticle*" are subject to scaling
- **AliGenGeVSim** inherits *AliGenerator* and do actual job
 - Contain definitions of used formulae
 - "*gevsimPt*", "*gevsimRapidity*" (TF1)
 - "*gevsimPtY_1*" (TF2)
 - "*gevsimPhi*" (TF1)

Code Quality Assurance

- *GeVSim* was tested before submitted
 - bug in TFormula
- Results on Web page
 - <http://home.cern.ch/radomski>

Conclusion

- *GeVSim* is working and tested
- Extensive documentation with examples in preparation
- *MevSim* is deprecated and will disappear in future release
- Please **use it** - do not **reinvent it**
- If You need more information - ask
- If You need something special - *GeVSim* is extensible