



*Event biasing in Geant4*  
*- status and plan -*

Makoto Asai (SLAC)

Geant4 Users' Workshop @ SLAC

Feb. 22<sup>nd</sup>, 2002

# *Event biasing in Geant4*

- ❖ Event biasing (variance reduction) technique is one of the most important requirements, which Geant4 collaboration is aware of.
- ❖ This feature could be utilized by many application fields such as
  - Radiation shielding
  - Dosimetry
- ❖ Since Geant4 is a toolkit and also all source code is open, the user can do whatever he/she wants.
  - CMS, ESA, Alice, and some other experiments have already had their own implementations.
- ❖ It's much better and convenient for the user if Geant4 itself provides most commonly used event biasing techniques.

# *Event biasing techniques*

- ❖ Primary event biasing
  - Biasing primary events and/or primary particles in terms of type of event, momentum distribution, etc.
- ❖ Leading particle biasing
  - Taking only the most energetic secondary
- ❖ Physics based biasing
  - Biasing secondary production in terms of particle type, momentum distribution, cross-section, etc.
- ❖ Geometry based biasing
  - Importance weighting for volume/region
  - Duplication or sudden death of tracks

→ Weight on Track / Event

# *Current features in Geant4*

- ❖ Partial MARS migration
  - n, p, pi, K ( $< 5$  GeV)
  - Since Geant4 0.0
- ❖ General particle source module
  - Primary particle biasing
  - Since Geant4 3.0
- ❖ Radioactive decay module
  - Physics process biasing in terms of decay products and momentum distribution
  - Since Geant4 3.0
- ❖ Cross-section biasing (partial) for hadronic physics
  - Since Geant4 3.0
- ❖ Leading particle biasing
  - Since Geant4 4.0

# *Plans (works in progress)*

- ❖ Full interface to MARS
  - For fully biased mode
  - Available before end of 2002
- ❖ Cross-section biasing for physics processes
  - Available at end of 2002 or early in 2003
- ❖ Geometry based biasing
  - Weight associating with real volume by summer 2002
  - Weight associating with artificial volume end of 2002 or early in 2003
- ❖ General geometrical weight field
  - In continuous process for geometrical, angular, energy biasing and weight window.
  - Doable since Geant4 0.0 as a users process
  - Full documentation by fall of 2002

→ User's contribution is welcome.