

Hadronic 1 - Cross Sections and Long Standing Issues  
*15:00-16:00 Monday, 17 September 2007.*

## Summary of Hadronic 1 by Aatos Heikkinen



12<sup>th</sup> Geant4 Collaboration Workshop, 13-19 September, 2007.  
Hebden Bridge, West Yorkshire, UK.

(These slides available at <http://geant4hadronics.wikispaces.com>  
→ 'Summary from Hadron 1 ...'.)

## Hadronic 1 - Cross Sections and Long Standing Issues

15:00–16:00 Monday, 17 September 2007.

Parallel session talks:

- *Calculation of elastic and inelastic ion-ion cross-sections* by Mikhail Kosov
- *Study of Multiplicity in Geant4 Hadronic Models* by Dennis Wright
- *Bertini Cascade Problems and Fixes* by Dennis
- *Charge Exchange in Low Energy hadron models* by Fred Jones
- *(Implementation of Isotopic Cross Sections* by Dennis  
→Talk skipped due to lack of time. Not summarized here. Slides are available in Indico Workshop page.)

Reference: [Hadronic 1 in Indico](#) ↗

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(Slides in Indico <http://indico.cern.ch/sessionDisplay.py?sessionId=20\&slotId=0\&confId=10311#2007-09-17.>)

## Calculation of elastic and inelastic ion-ion cross-sections

by Mikhail Kosov

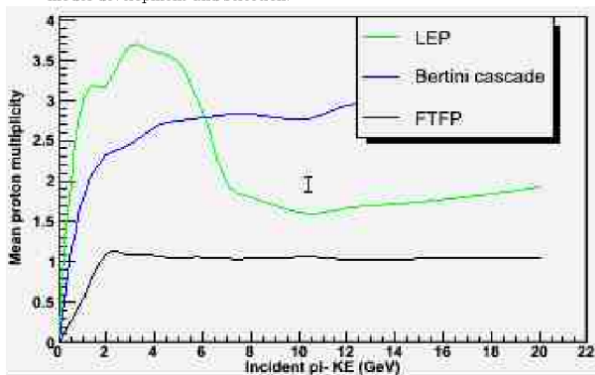
Situation of Mikhails conclusions:

- CHIPS is prepared for the Ion-Ion transport.
- As an  $SU(3)$  package CHIPS supports hypernuclei.
- Interaction cross-sections are provided.
- Ion-Ion elastic scattering is already supported for all energies, providing a narrow diffractive cone.
- Low energies inelastic interactions of the most of the nuclear fragments are already supported.
- High energy inelastic interactions must be implemented in  $SU(3)$  form.

# Study of Multiplicity in Geant4 Hadronic Models

by Dennis Wright

- Significant particle multiplicity differences between models.  
→ *Difficult to combine different models in physics lists without bumps in multiplicity.*
- Must collect more experimental evidence, and physical insight to guide model development and selection.



## Bertini Cascade Problems and Fixes

by Dennis Wright

- **Problem Report 896:** 4 GeV/c protons on Be, two proton invariant mass shows a large peak at  $\sim 3.1$  GeV  
→ *Removing quasi-elastic scattering, still embedded, in Bertini cascade helps.*
- **Angular distribution problems:** Validations at 4 and 10 GeV/c show large discrepancy with data for several nuclei; effect is largest at most forward angles.  
→ *Tuning of angular parametrization helps, but this must be done carefully, so that we don't introduce new problems elsewhere.*

## Charge Exchange in Low Energy hadron models

by Fred Jones

Fred critically review Geisha-based models:

- Several bugs were found.
- More seriously, Fred pointed out cases were 'ad hoc' –fixes seem to have introduced new problems and inconsistency to models.
- Proposed that we review general strategy for Geisha-based models.

**His list for things to do next:**

- Fix the obvious errors.
- Trace the CX problem in G4LEPionMinusInelastic.
- Test the other 3 inelastic classes which have CX.
- Restore missing CX to the other classes where relevant, to be consistent with Gheisha cascade routines.
- Review role of CX in G4LElastic.

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### In Conclusion

Themes emerging in Hadronics I parallel session:

- CHIPS R&D for Ion-Ion is proceeding
- It seems that we still need **clarify model separation** of elastic, quasi-elastic and inelastic scattering.
- Improvement in understanding of Bertini problems.  
→ *Removing quasi-elastic helps, but parameter tuning should be done carefully.*
- Review of LEP showed fixes that have introduced additional problems.  
→ *We should sharpen our general strategy for Geisha-based models.*



**Cheers, John! 12<sup>th</sup> Geant4 Collaboration Workshop  
in Hebden Bridge was a great success.**