RIVET in LHCb

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Outline

• What is RIVET?
• Rivet Implementation in LHCb
• LHCb plugins
• Ideas for the future & Conclusions
What is RIVET?

• **Robust Independent Validation of Experiment and Theory** (rivet.hepforge.net) – toolkit for Monte Carlo (MC) generator validation.

• Generator abstractization layer based on *projections* – filter particles of interest and compute observable once per event for a suite of plugins.

• Expects events in HepMC format (2.05 or later – propagate xsection information); use **A Generator Interface Library & executable** for Fortran MC generators.

• Histogram reference data in bundled files – may be extracted from external databases – HepData (http://hepdata.cedar.ac.uk/).

• Used by both theoreticians and experimentalists for MC generator tuning & validation, analysis prototyping, MC-data comparisons.

• May be run locally and in distributed system (CERNVM; Test4Theory - **LHC@home 2.0**); on lxplus available through GENSER project (http://sftweb.cern.ch/generators/).

• RIVET plugin == piece of C++ code (Rivet::Analysis derived class) + meta and reference data + histogram style information – stored in separate files.

• Main component of the Professor tuning tool for MC event generators.
What is RIVET?

Theoretical Models

(Theoretical Models)

Exp. Data

Analysis

Results

Theoretician Community

Experimentalist Community

(new) MC Generators

MC Generator Tunes

RIVET

What is RIVET?
RIVET implementation in LHCb

- interface in package Gen/GenTune part of GAUSS project
- using Rivet from GENSER repository through MC Generator Interfaces
- offers ability to run RIVET plugins through RivetAnalysisHandler Gaudi algorithm (credit to Andy Buckley for providing the skeleton interface)
- new package (v1r0) released with GAUSS v42r2
- only available in Gauss Generator phase (HepMC 2.06.05 input)
- instructions to run and design new plugins to appear on twiki (by the end of 2012) https://twiki.cern.ch/twiki/bin/view/LHCb/GenTuneWithRivet
- $GENTUNEROOT/options/example for basic instructions and working example
- code tested daily thanks to QMTTest(s)
RIVET implementation in LHCb

*RivetAnalysisHandler* initializes *libRivet.so*, controls the run and adjust HepMC events according to options:

- **MCEventLocation** – HepMC data location in Transient Event Store (TES)
- **BaseFileName** – the name of the file (w/o extension) where histograms are saved
- **RunName** – the AIDA directory where output histograms are stored
- **Analyses** – list of analysis names that one wants to run (invalid ones are automatically discarded)
- **StreamName** – should control the AIDA axis/path where data is stored
- **AnalysisPath** – supplemental paths to be searched for analysis plugins
- **CorrectStatusID** – flag to enable code that corrects the status ID of particle to match Pythia's status code scheme (bug to be solved in v1r1 !)
- **CorrectCrossingAngles** – flag to enable/disable code that detects at run-time the beam crossing angles from *BeamParameters* class and perform the boost back to center-of-mass system accordingly

What AIDA?!

Still AIDA?!
RIVET implementation in LHCb

RivetAnalysisHandler initializes libRivet.so, controls the run and adjust HepMC events according to options:

- **XsectionNeeded**, **xSectionValue** – flags to force the algorithm to check that cross-section value is provided and the alternative value of the cross-section if not provided in HepMC (obsolete)

Logging level is set automatically according to Gaudi log level using a simple mapping.
LHCb Rivet plugins

Released plugins (Rivet 1.8.1, July 2012)

- **LHCB_2011_I917009** - Measurement of $V^0$ production ratios in pp collisions at $\sqrt{s}=0.9$ and 7 TeV, JHEP08:034,2011


- **LHCB_2010_S8758301** - Prompt $K_{\text{short}}$ production in pp collisions at $\sqrt{s}=0.9$ TeV, Phys.Lett.B693:69-80,2010
**LHCb Rivet plugins**

Plugins in final phase of development

- **LHCB_2010_I867355** - Measurement of $\sigma(pp\rightarrow b\bar{b}X)$ at $\sqrt{s}$=7 TeV in the forward region, Phys.Lett. B694 (2010) 209-216

On wish list:

Thanks to P. Skands, Sercan Sen and corresponding authors from LHCb...
Ideas for the future & Conclusions

• Use Professor and Rivet to create/test/validate new LHCb tunes
• Use Rivet as alternative MC validation tool for GAUSS
• Deploy Rivet on grid via LHCb software framework
• Write some Python scripts to help developers (e.g. hardcoding LHCb particle table - lifetime)
• Convince LHCb members to submit new and more complex analysis plugins for published results
• Where are your plugins currently used? (Quick example – if local connection doesn't break)
BACKUPS
Who is this guy?

“The Thinker of Hamangia and his consort”
Clay figurines iconic for the Late Neolithic Hamangia culture (~5200 BC) discovered in present day Baia (Tulcea county), Dobrogea, Romania (1952).