MC-TESTER:

a universal tool for automated comparisons
of HEP Monte Carlo generators

STATUS REPORT

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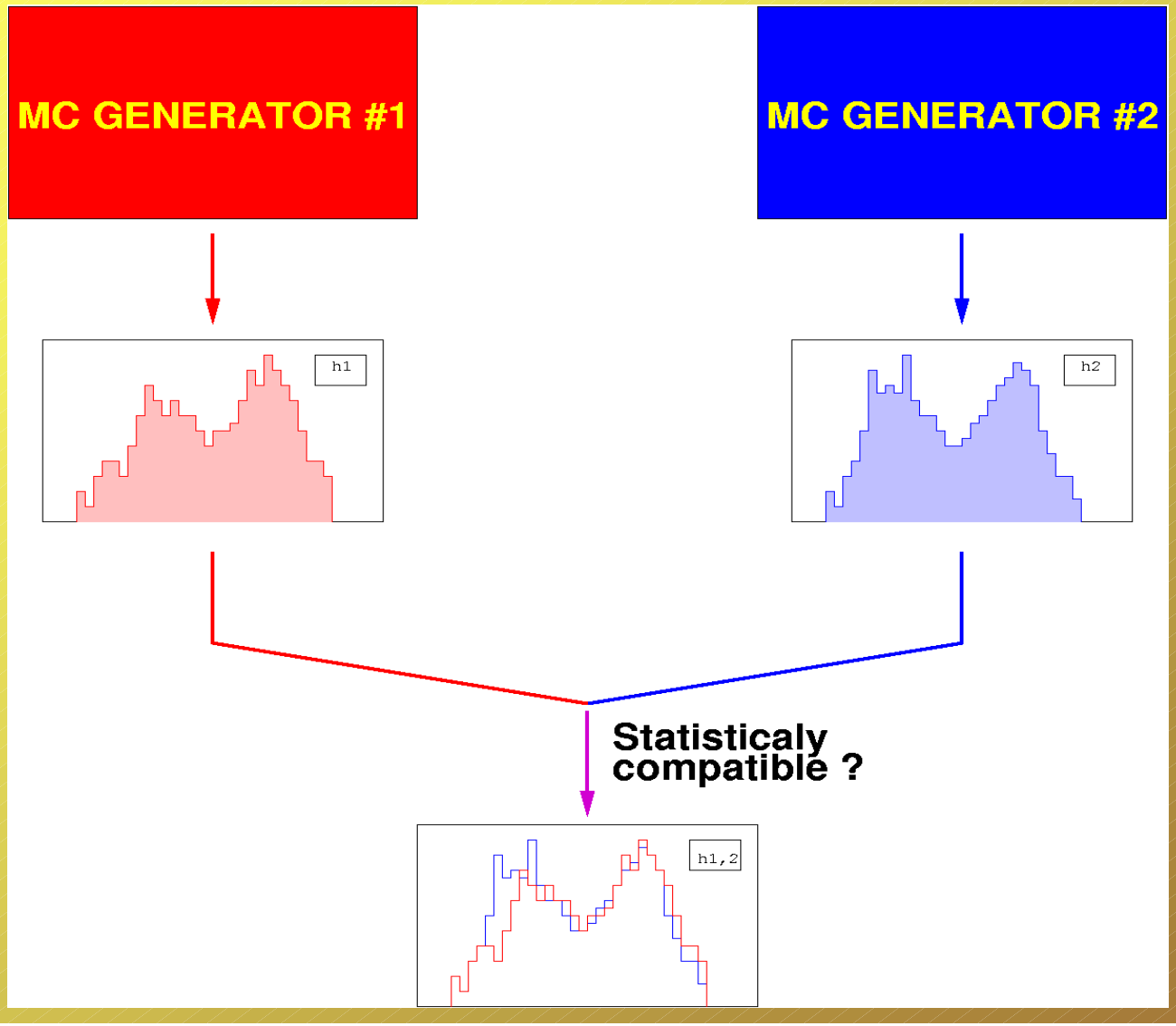
http://cern.ch/Piotr.Golonka/MC/MC-TESTER

Excuses...

- For a computer-scientist point of view of the aspects of particle physics...

MC-TESTER: why?



- Porting MC generators to C++
- Automated tests of installations of large MC systems

MC-TESTER: a tool for comparisons of HEP MC Generators:

- For two (or more) compared MC generators:
  - ***Identifies all decay channels for a given particle, calculates branching ratios***
  - ***Compares distributions of invariant masses of particle decay products in every channel***
  - ***Not limited to decay processes!***

Produces a booklet with comparison analysis of two generators

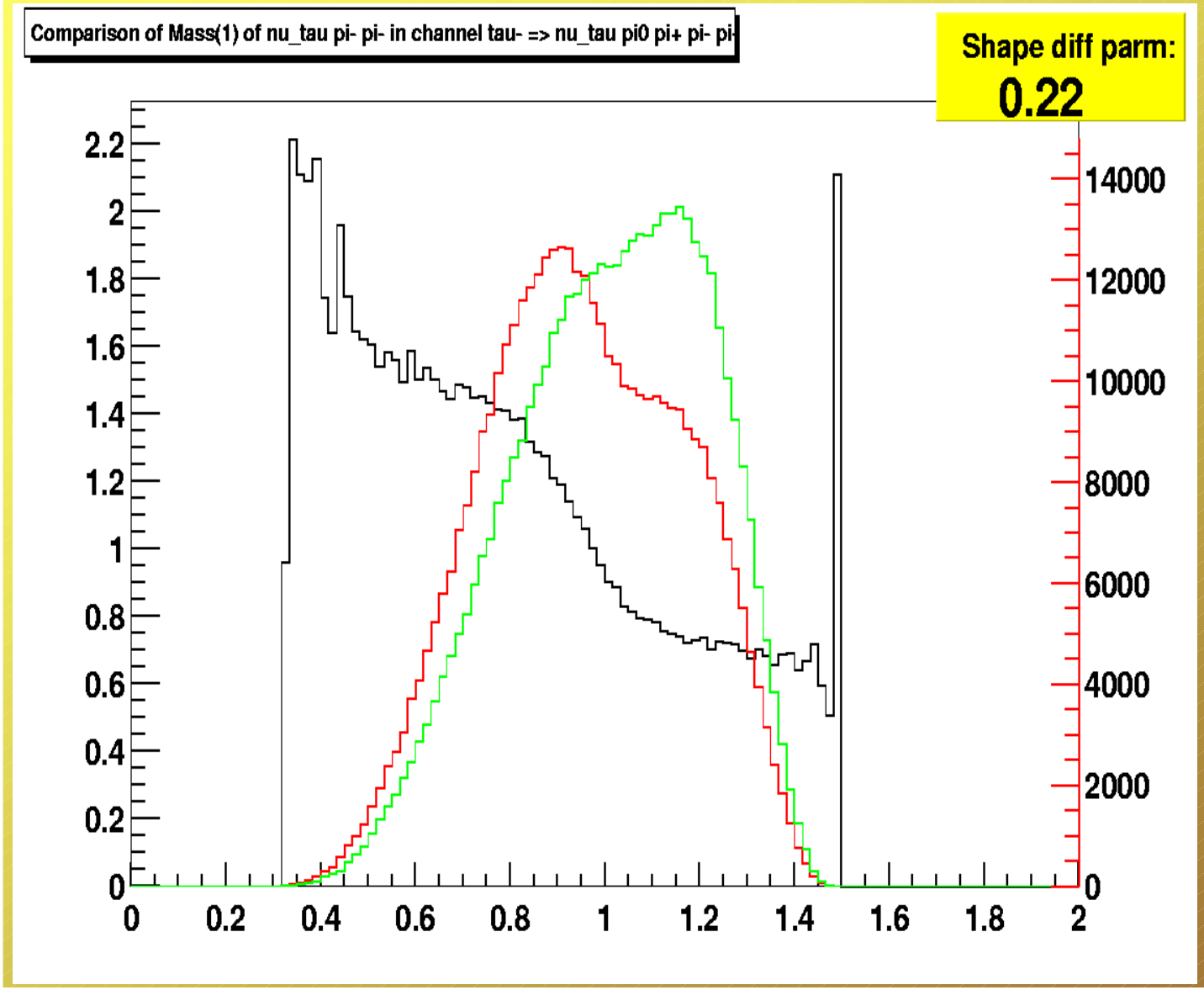
Found decay modes:

Decay channel	Branching Ratio ± Rough Errors Generator #1	Generator #2	Max. shape dif. param.
$\tau^- \to \nu_\tau \pi^0 \pi^-$	25.3683 ± 0.0159%	25.3085 ± 0.0159%	0.04375
$\tau^- \to e^- \widetilde{\nu}_e \nu_\tau$	17.8479 ± 0.0134%	18.1093 ± 0.0135%	0.00000
$\tau^- \to \mu^- \widetilde{\nu}_\mu \nu_\tau$	17.3866 ± 0.0132%	17.6326 ± 0.0133%	0.00000
$\tau^- \to \nu_\tau \pi^-$	11.0768 ± 0.0105%	11.1765 ± 0.0106%	0.00000
$\tau^- \to \nu_\tau \pi^0 \pi^0 \pi^-$	9.1865 ± 0.0096%	9.1171 ± 0.0095%	0.09413
$\tau^- \to \nu_\tau \pi^+ \pi^- \pi^-$	8.9837 ± 0.0095%	8.8828 ± 0.0094%	0.09368
$\tau^- \to \nu_\tau \pi^0 \pi^+ \pi^- \pi^-$	4.2973 ± 0.0066%	4.5319 ± 0.0067%	0.30310
$\tau^- \to \nu_\tau \pi^0 \pi^0 \pi^0 \pi^-$	1.0765 ± 0.0033%	1.0090 ± 0.0032%	0.00724
$\tau^- \to \nu_\tau K^-$	0.7202 ± 0.0027%	0.7138 ± 0.0027%	0.00000
$\tau^- \to \nu_\tau \pi^0 \pi^0 \pi^+ \pi^- \pi^-$	0.4990 ± 0.0022%	0.0897 ± 0.0009%	0.00000
$\tau^- \to \nu_\tau \pi^0 K^-$	0.4785 ± 0.0022%	0.4… ± 0.0021%	0.00000
$\tau^- \to \nu_\tau K_L^0 \pi^-$	0.4624 ± 0.0022%	0.4444 ± 0.0021%	0.00000
$\tau^- \to \nu_\tau \pi^- K_S^0$	0.4610 ± 0.0021%	0.4449 ± 0.0021%	0.00000
$\tau^- \to \nu_\tau \pi^+ \pi^- K^-$	0.3902 ± 0.0020%	0.5051 ± 0.0022%	0.52330
$\tau^- \to \nu_\tau \pi^0 \pi^- \eta$	0.1707 ± 0.0013%	0.1696 ± 0.0013%	0.00000
$\tau^- \to \nu_\tau \pi^- K^+ K^-$	0.1704 ± 0.001…	0.1509 ± 0.0012%	0.07360
$\tau^- \to \nu_\tau \pi^0 K_L^0 \pi^-$	0.1605 ± 0.0013%	0.2745 ± 0.0017%	0.92850
$\tau^- \to \nu_\tau \pi^0 \pi^- K_S^0$	0.1592 ± 0.0013%	0.2734 ± 0.0017%	0.93657
$\tau^- \to \nu_\tau \gamma \pi^0 \pi^-$	0.1559 ± 0.0012%	0.1303 ± 0.0011%	0.00000
$\tau^- \to \nu_\tau K_L^0 \pi^- K_S^0$	0.1510 ± 0.0012%	0.0763 ± 0.0009%	0.00270
$\tau^- \to \nu_\tau K_L^0 K^-$	0.1289 ± 0.0011%	0.0508 ± 0.0007%	0.00000
$\tau^- \to \nu_\tau K_S^0 K^-$	0.1287 ± 0.0011%	0.0507 ± 0.0007%	0.00000
$\tau^- \to \nu_\tau \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^-$	0.1094 ± 0.0010%	0.0506 ± 0.0007%	0.00000
$\tau^- \to \nu_\tau \pi^+ \pi^+ \pi^- \pi^- \pi^-$	0.0803 ± 0.0009%	0.0401 ± 0.0006%	0.00000
$\tau^- \to \nu_\tau \pi^0 \pi^0 K^-$	0.0792 ± 0.0009%	0.0504 ± 0.0007%	0.29196
$\tau^- \to \nu_\tau K_L^0 K_L^0 \pi^-$	0.0760 ± 0.0009%	0.0372 ± 0.0006%	0.00854
$\tau^- \to \nu_\tau \pi^- K_S^0 K_S^0$	0.0756 ± 0.0009%	0.0378 ± 0.0006%	0.01189
$\tau^- \to \nu_\tau \pi^0 K_L^0 K^-$	0.0507 ± 0.0007%	0.0763 ± 0.0009%	0.85321
$\tau^- \to \nu_\tau \pi^0 K_S^0 K^-$	0.0498 ± 0.0007%	0.0746 ± 0.0009%	0.87506
$\tau^- \to \nu_\tau \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^-$	0.0186 ± 0.0004%	0.0293 ± 0.0005%	0.00000

Table of decay modes:

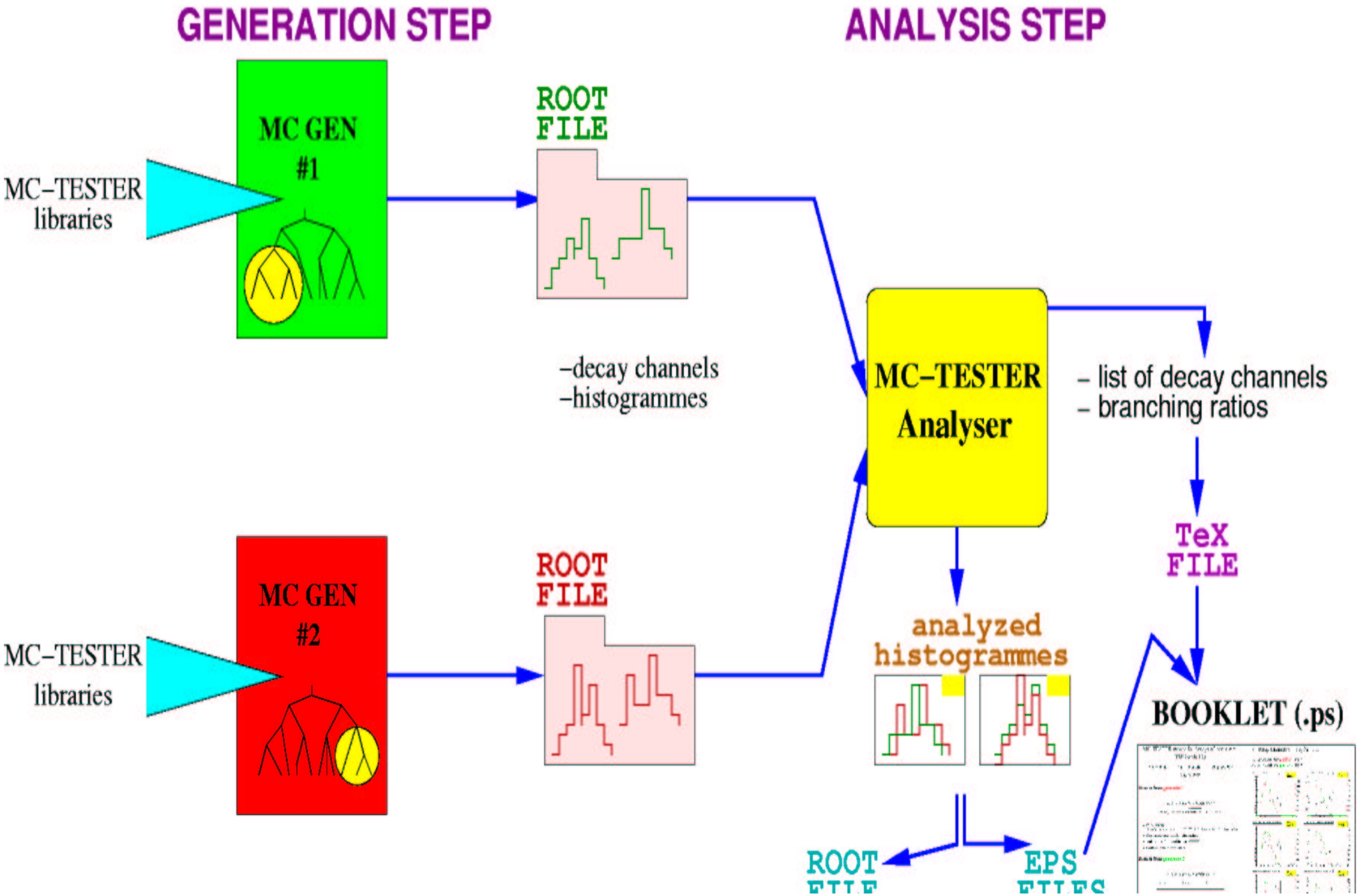
- Decay channel
- Branching ratio for generator #1 and #2
- Rough statistical errors of branching ratios
- Maximal “Shape Difference Parameter”
- Similarity Coefficients

Example of histogrammes:



- Histogrammes of invariant mass from generator #1 and #2
- Ratio of the two histogrammes
- ***Shape Difference Parameter*** value

MC-TESTER analysis:

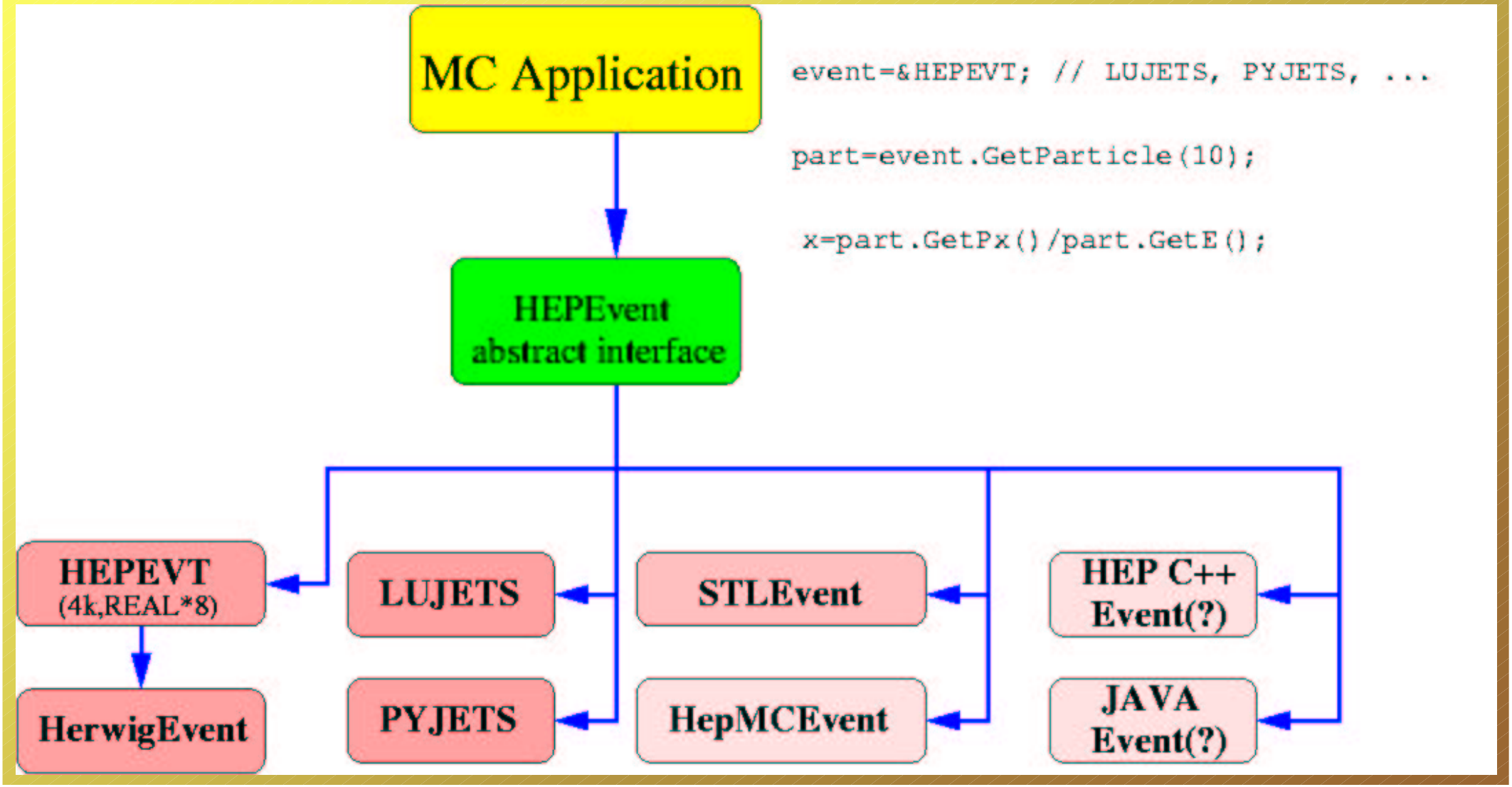


MC-TESTER implementation:

- C++ with F77 interface
- ROOT used for histogramming and data storage
- LaTeX for booklet preparation
- HEPEvent library provides unified access to various event record structures
- Parameters controlled by ROOT/C++ macro files
- Tested with F77 and F90 MC generators
- Linux (RedHat 6/7/8)

HEPEvent library:

a unified interface to event record formats



Extensions:

- Infrastructure created for user-level extensions, e.g.:
  - ***For Linear Collider workshop: 6f production analysis: replaced by***
  - ***Other processes may be implemented in the same way***
  - ***Algorithms for Shape Difference Parameter calculation***
- ***ROOT data files from generation step may be***

Status and Availability:

- ***Version 1.0 released already in October 2002***
- ***Extended versions released for Linear Collider Monte Carlo Workshop***
- ***Version 1.1 released on July 8th, 2003***
- ***Available on the web:***
  http://cern.ch/Piotr.Golonka/MC/MC-TESTER

Documentation:

Preprints:

- ***CERN-TH/2002-271 (ver. 1.0)***
- ***LANL: hep-ph/0210252 (ver 1.1)***

submitted to Comp.Phys.Communications

Also presented at ECFA-DESY LC Workshops (Prague, Amsterdam) and ATLAS Higgs WG

Available on MC-TESTER homepage

Final comments:

- ***MC-TESTER already proven to be useful (LC, ATLAS)***
- ***Easily integrates with existing MC environments in F77 / F90 / (C++?) / (others?)***
- ***We haven't used MC-TESTER with C++ generators yet***
- ***We work on HEPEvent library to provide an interface to HEPMC event record standard***
- ***Other event record standards may also be considered***

Final comments:

We are open
to discussions and suggestions
of new MC-TESTER features
and areas of use .

More information on this topics on the Decay Packages session, Thursday, July 24.

Acknowledgments:

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