MC-TESTER:

a tool for comparisons of HEP Monte Carlo Generators

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ECFA-DESY Linear Collider Workshop

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  - ⋆ purpose
  - ⋆ history
  - ⋆ incarnation

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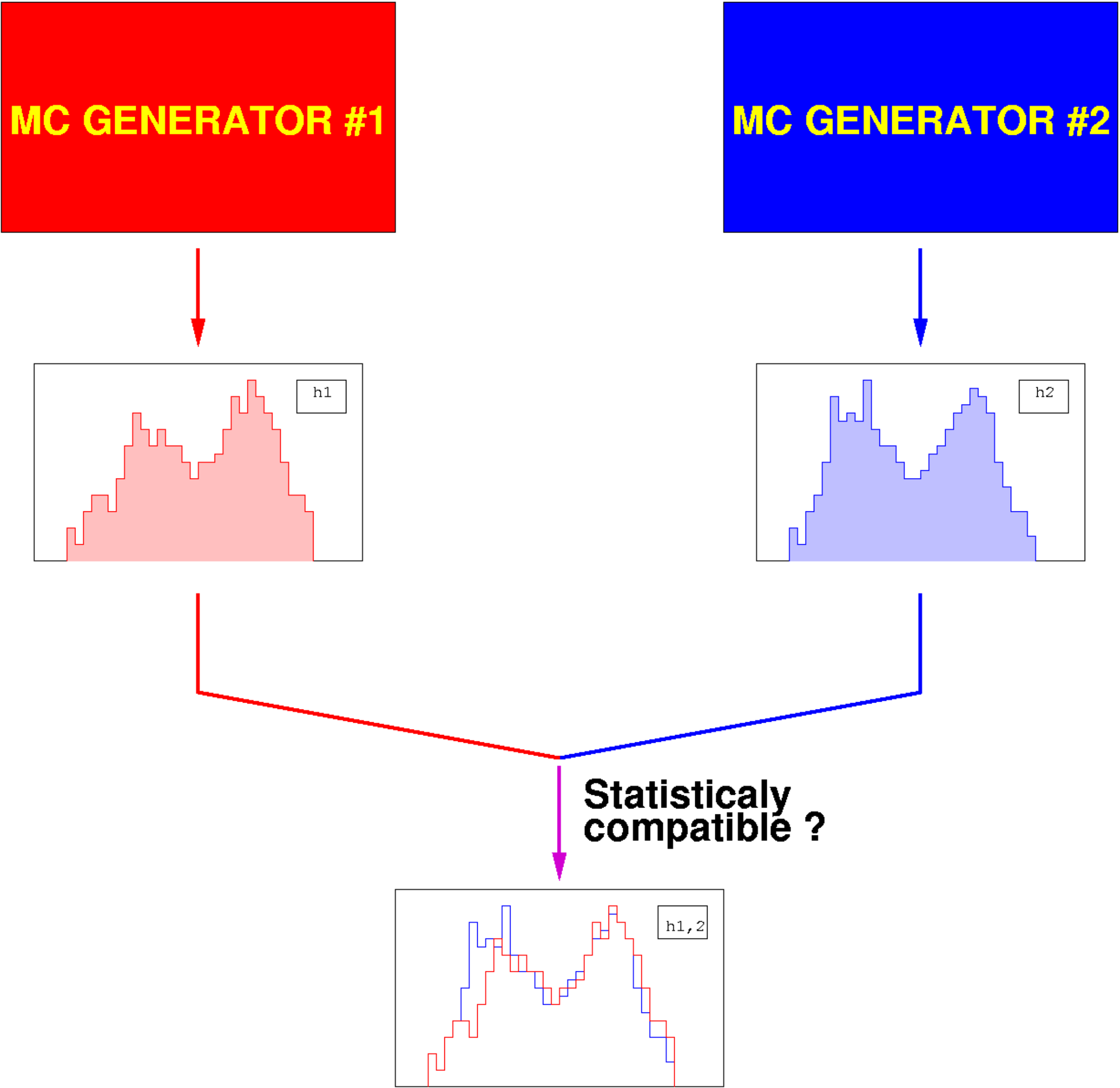
- Example of analysis: τ lepton decay MC generators comparison.
- Future improvements

Excuses ...

.. for computer-scientist view of Physics...

MC-TESTER: why?



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    difference between shape of their division and flat distribution
  - ⋆ performed for all possible mass invariants in every decay channel
  - ⋆ hundreds of histogrammes to be compared!

MC-TESTER incarnation

- authors: ***P. Golonka, T. Pierzchala, Z. Was***
- development: November 2000 - July 2002
- version 1.0 released: September 2002
- documentation: hep-ph\0210252:
  “MC-TESTER: a universal tool for comparisons of Monte Carlo predictions for particle decays in high energy physics”

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- 3 pre-defined algorithms for SDP; user-provided as well

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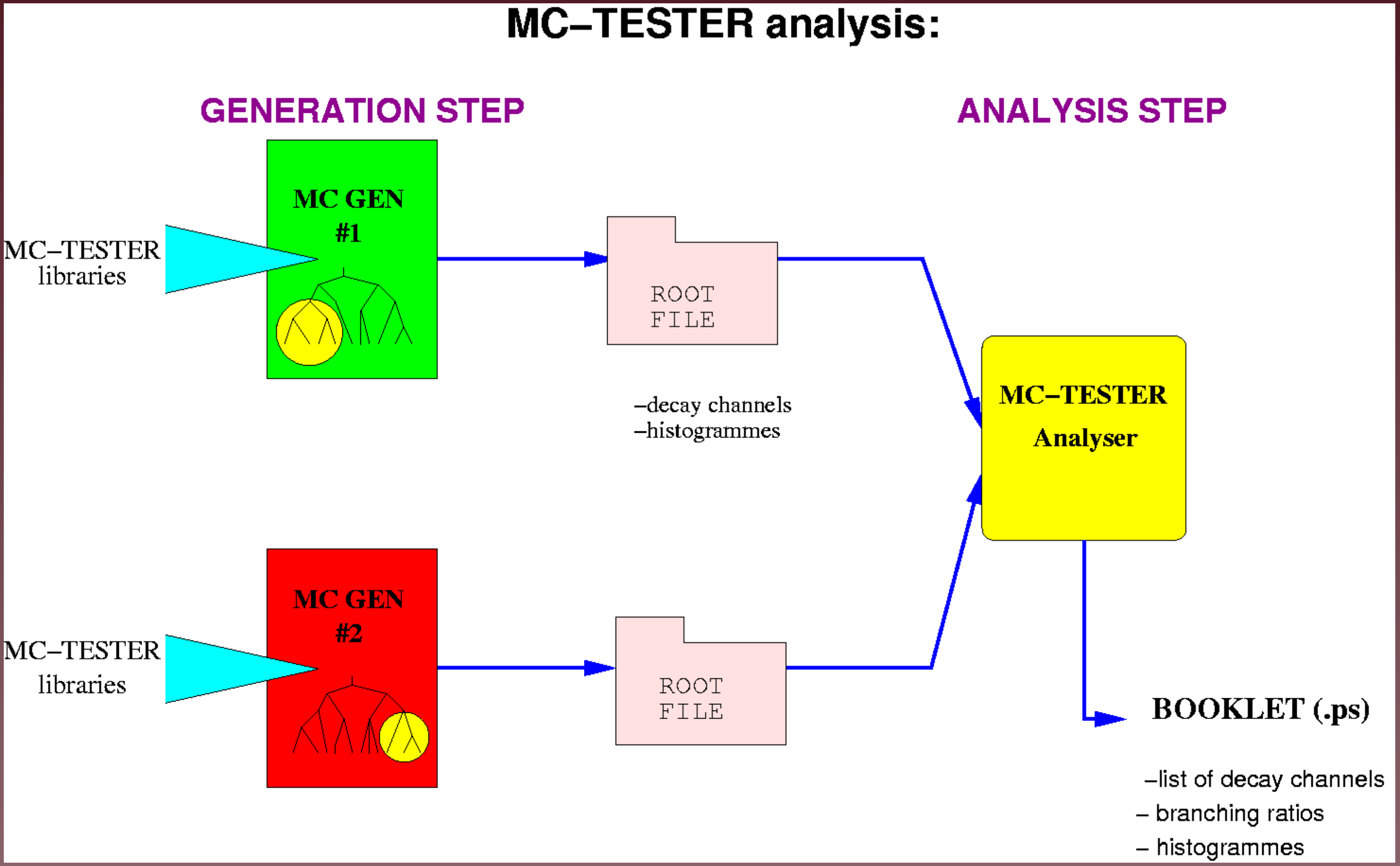
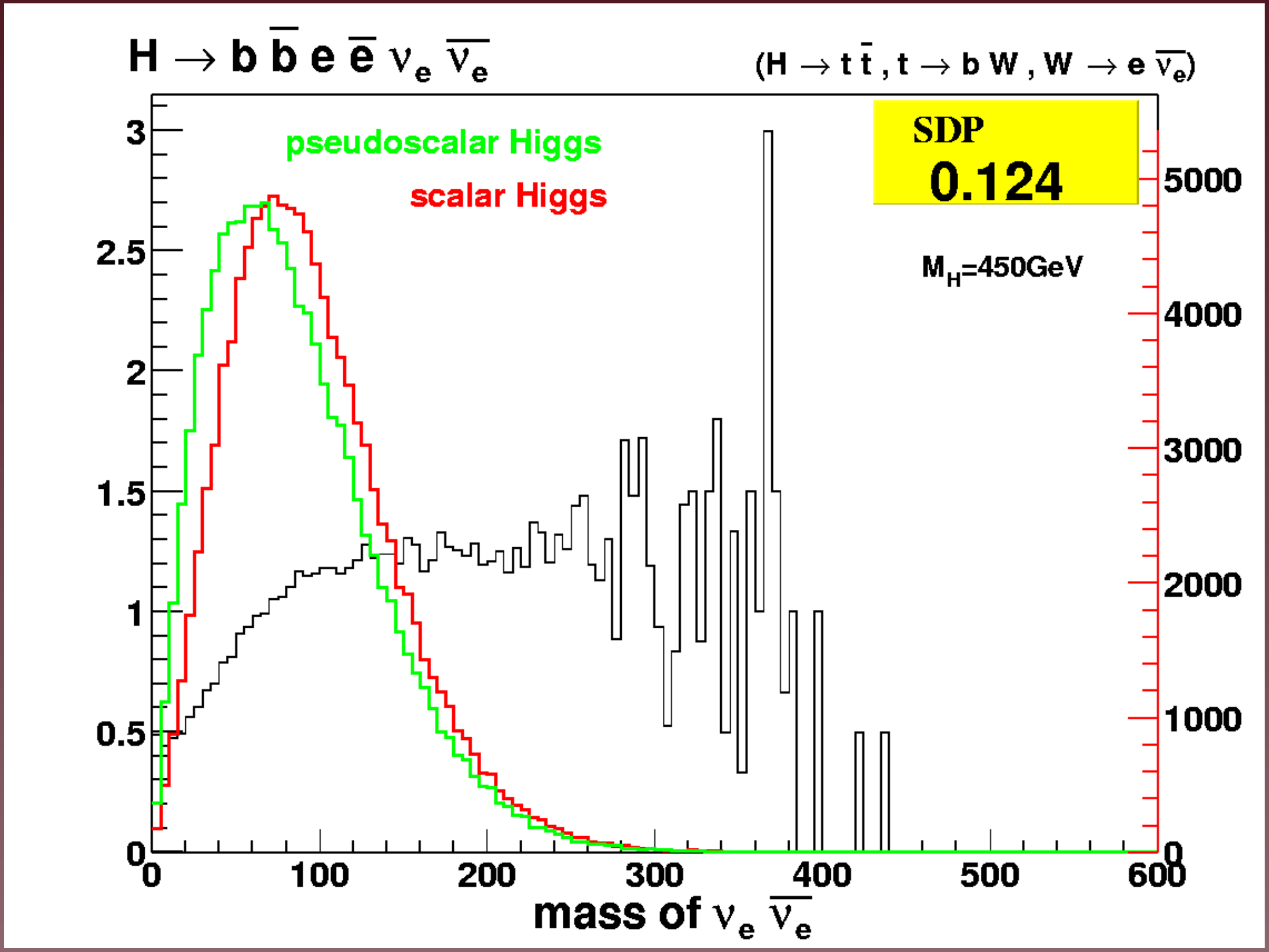
- MC-TESTER analysis step: data files from two production runs are analysed: histogrammes for all matching decay channels analysed, plotted, SDP calculated
- booklet with the results of analysis is produced.


MC–TESTER analysis:
GENERATION STEP
ANALYSIS STEP
MC–TESTER libraries
MC GEN #1
ROOT FILE
–decay channels
–histogrammes
MC–TESTER libraries
MC GEN #2
ROOT FILE
MC–TESTER Analyser
BOOKLET (.ps)
–list of decay channels
– branching ratios
– histogrammes


$H \rightarrow b \bar{b} e \bar{e} \nu_e \bar{\nu}_e$
$(H \rightarrow t \bar{t}, t \rightarrow b W, W \rightarrow e \bar{\nu}_e)$
pseudoscalar Higgs
scalar Higgs
SDP
0.124
M_H=450GeV
0
0.5
1
1.5
2
2.5
3
0
1000
2000
3000
4000
5000
0
100
200
300
400
500
600
mass of $\nu_e \bar{\nu}_e$

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  - ⋆ Experimental C++ event structures
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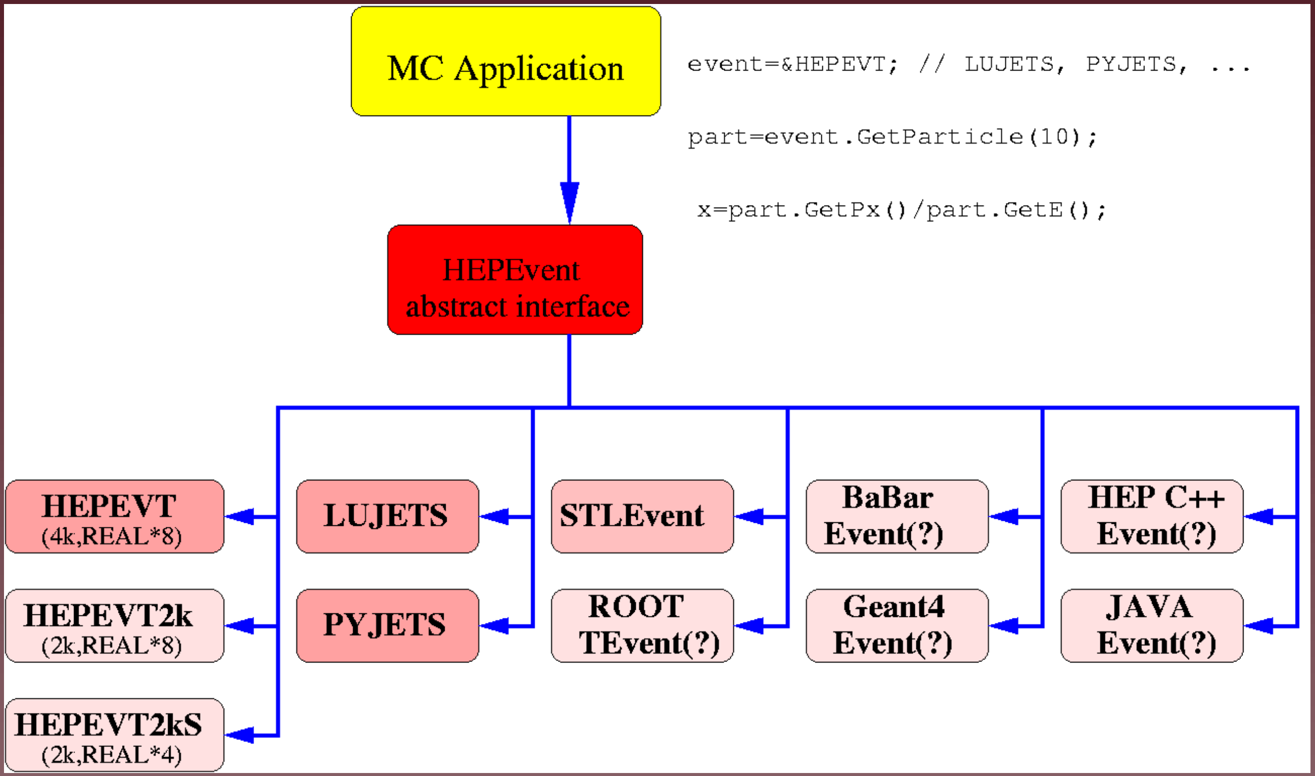
  - ⋆ Experimental C++ event structures
- In future:
  - ⋆ C++, Java(?) event records.
  - ⋆ simplified access to various “flavours” of F77 event records (precision, number of entries)



MC Application

HEPEvent
abstract interface

HEPEVT
(4k,REAL*8)

HEPEVT2k
(2k,REAL*8)

HEPEVT2kS
(2k,REAL*4)

LUJETS

PYJETS

STLEvent

ROOT
TEvent(?)

BaBar
Event(?)

Geant4
Event(?)

HEP C++
Event(?)

JAVA
Event(?)

```
event=&HEPEVT; // LUJETS, PYJETS, ...

part=event.GetParticle(10);

 x=part.GetPx()/part.GetE();
```

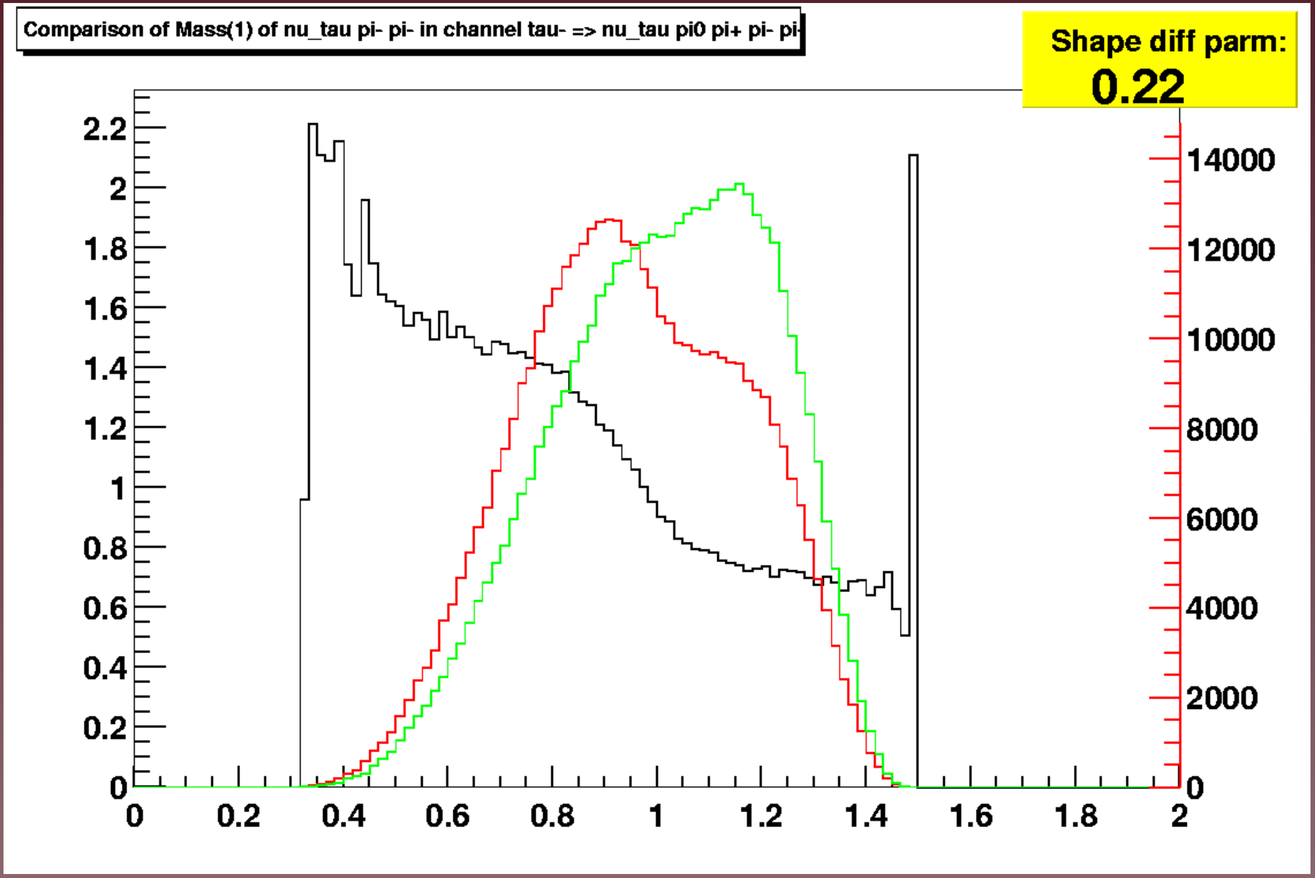
Example:

τ lepton decay generators comparison:

- two versions of TAUOLA library with different initializations:
  - ⋆ CLEO
  - ⋆ ALEPH
- PYTHIA

Task: identify and compare the decay channels of the τ lepton produced by these generators.

Ex: single plot



Accesibility:

- The program and the documentation are available from the webpage:
  `http://cern.ch/Piotr.Golonka/MC/MC-TESTER`

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- Support for other parameters (e.g accolinearity)
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- Switch off analysis of decays of certain particles (e.g. π_0)

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- It easily integrates with already existing Monte Carlo environments
- Support for all major event record standards is provided
- It may help to find observables for physics studies

Acknowledgments

- **Malgorzata Worek**, for providing the Higgs decay library
- **Swagato Bernjee, Stanislaw Jadach and Wieslaw Placzek** for valuable remarks ans suggestions.