



RunMC

**C++ object-oriented framework for
Monte Carlo models**

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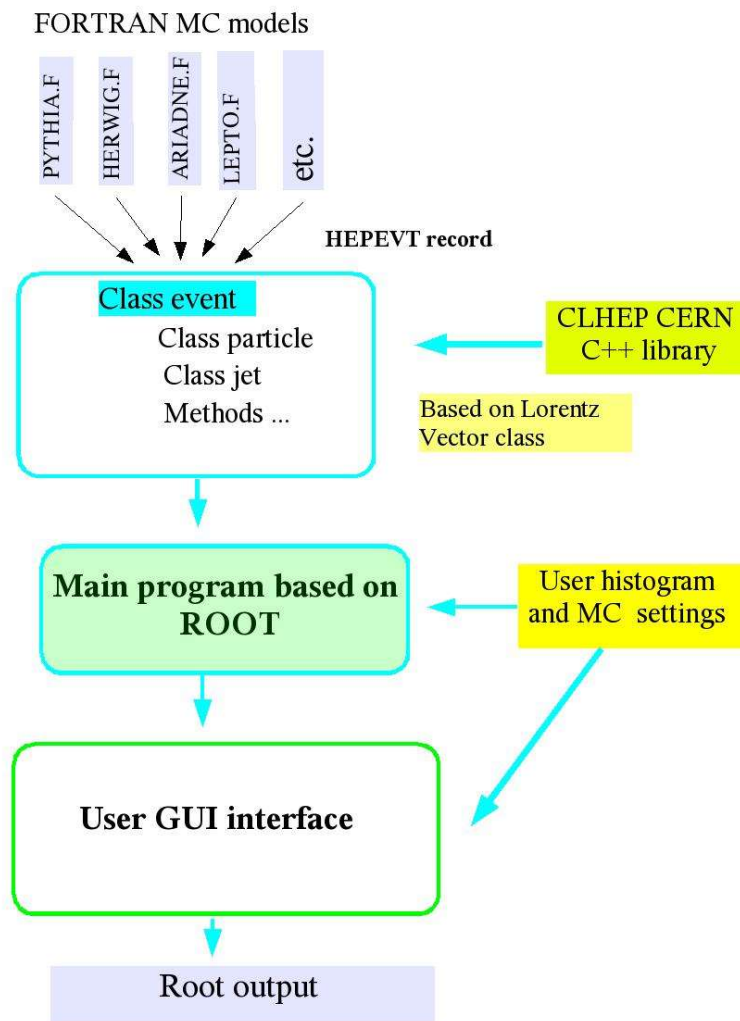
DESY, June 2004

HERA-LHC workshop

General concept-I

- Extending lifetime of FORTRAN Monte Carlo models
 - General idea: run FORTRAN MC - analyze using C++ classes
- Advantage of FORTRAN models:
 - Large choice of Monte Carlo models developed for HERA
 - see HERA Monte Carlo workshop
 - well tested at HERA/LEP etc experiments
 - Fast
- At the same time:
 - Use modern C++ libraries for LHC (CLHEP based)
 - Fully integrated with ROOT analysis environment
 - Standardization of output record

General concept-II



Main features

- Fill histograms (large number of predefined histograms)
 - Event-based ($Q^2, x, E(\text{tot})$ etc)
 - Single particle densities (pt, eta, etc)
 - Two-particle densities (invariant masses)
- "project" file can be saved and restored
- Differential cross section calculations, automatic normalizations
- Status bar, automatic checks of the settings, different presentation styles etc.
- Histograms can be viewed during event generation
- Runs can be terminated at any time (just press "Stop"!)
 - all inputs will be saved
- Different types of output (stable, stable charged, partons)
- Apply cuts in E_t and eta for particles or jets



RunMC input parameters

- Use RUNMC GUI
 - Simple to use
 - Default MC parameters for fully inclusive events
- More complicated settings can be done via steering cards
 - No need to recompile to package
 - But some parameter settings are still missing (for HERWIG)
- Use user initialization subroutines in proj/ini directory
 - set parameters and recompile the project (now - dummy functions)
 - allows maximum flexibility

RunMC outputs

- ROOT based histogram file (8 can be defined via RunMC GUI)
 - Up to 200 histograms using "project file"
 - Use various types of presentations (plain, color etc)
 - Select automatic normalization:
 - Normalized to the number of events
 - Differential cross section in pb or nb
- Event ROOT ntuple (compressed!) - copy of HEPEVT record
 - Use it for "offline" analysis
- A reduced event "RunMC" ROOT ntuple
 - only final-state hadrons + most important information
 - good for most physics analysis



Main features (v 2.0)

- run most recent versions of Monte Carlo models:
 - PYTHIA 6.2
 - HERWIG 6.5
 - ARIADNE 4.12
 - LEPTO 6.5 (DIS only)
 - LEPTO 6.5 & ARIADNE PS (DIS only)
 - AROMA 2.2 (heavy flavor in DIS)
 - CASCADE 1.2

C++ physics-analysis packages

- Included and interfaced with RunMC:
 - HepLorentzVector (part of the RunMC event class)
 - Breit-frame calculations (S.C, HCM is not supported yet)
 - Event shape calculations (C++ library by M.Iwasaki)
 - Also contains JADE & DURHAM algorithms
 - KTjet C++ library (J.Butterworth, J.Couchman, B.Cox, W.Waugh)

Still not well tested

RunMC GUI (based on T.Hirabayashi GUI classes)

Select MC

Stable/partons?

ROOT canvas

Set histograms

LEPTO for all stable particles exit Help RunMC Monte Carlo analysis studio

p +Z e+

920.00 CTEQ 26.00

Energy (GeV)

min max

Q2 10.000 100.000

X 0.00000000 0.99998999

Y 0.00000000 0.99998999

W 0.000 100000.000

hadronic jets

GEV 0.00 < ET < 100000.00

-100.000 < ETA < 100.000

laboratory frame

events No 100000

Running...

TOTAL EVENTS PROCESSED (%)

0 10 20 30 40 50 60 70 80 90 100

Output histograms:

| variable: | min | max | bins |
|-----------|---------|---------|------|
| N(tot) | 1.0000 | 100.000 | 50 |
| Q2 | 10.0000 | 100.000 | 50 |
| @Eta | | | 50 |
| @E | | | 50 |
| | | | 0 |
| | | | 0 |
| | | | 0 |
| | 0.0000 | 0.000 | 0 |

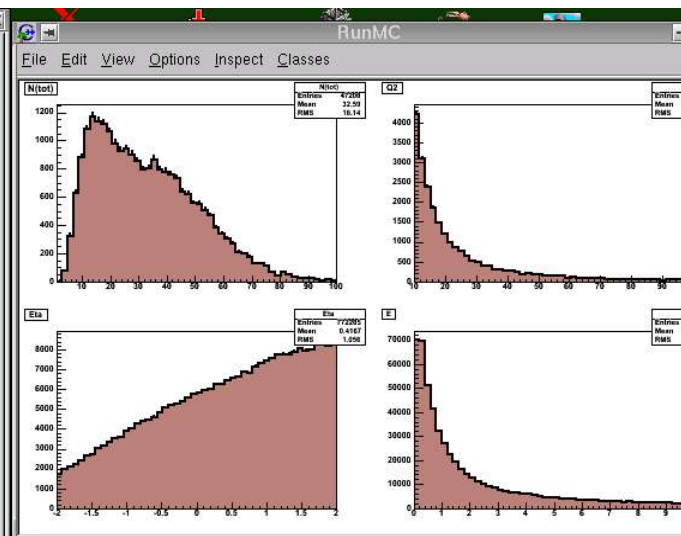
Read project

Select output

23500

analmc .root

Options Stop log



Select

- none
- Q2 $-(q1-q2)^2$ for DIS/ppbar
- X Bjorken X for DIS/ppbar
- Y $y=Q2/(xs)$
- W hadronic invariant mass
- PTtot transverse event momenta
- PZtot longitudinal event momenta
- Etot total event energy
- N(tot) total number of particles in event
- @Px Px of all particles
- @Py Py of all particles
- @Pz Pz of all particles
- @E Energy of all particles
- @Perr? $n_{xx}^2 + n_{yy}^2$ for particles

Selection of jets

Type of jet

- Jade
- Durham
- KT (long. invariant)

Y(cut) 0.0020000

reconstruct 2 jets

1. angle

1. recombination E

OK

About

RunMC Monte Carlo Analysis Studio for High Energy Physics

(c) 2003 Sergei Chekanov

email: chekanov@mail.desy.de

RunMC: version 2.0 (May 20, 2003)

please send bug report to S.Chekanov (chekanov@mail.desy.de)

Web page: <http://www.desy.de/~chekanov/runmc/>

If you do not like GUI

- Just run executables for each MC in shell
- Functionality is the same:

Example of the bash script to run PYTHIA in background:

```
#!/bin/bash
# Link RunMC file
if [ -x ".analmc.ln" ]
then
rm -f ".analmc.ln"
fi
ln -s pythia6.mc .analmc.ln
# allow run
cat > $RUNMC/pipes/pipe_runmc.stop <<!
0
!
#
analmc.pythia6 > pythia6.log &
```

Can be stopped at any time
replacing "0" by "1" in the pipe file
\$RUNMC/pipes/pipe<date>.stop

Note:
"pipe_runmc" should be defined in
analmc.mc file



Summary

RunMC version (v2.0) and user manual (v1.0):

<http://www.desy.de/~chekanov/runmc>

Can be done in future:

- add RAPGAP etc models.
- HzTOOL (need to convert to C++)