RunMC v3.1

C++ object-oriented framework for Monte Carlo models

(for Linux and Windows)

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Introduction

- A analysis framework to run most popular Monte Carlo model (PYTHIA, HERWIG, ARIADNE, CASCADE, LEPTO, AROMA)
- Good for validations, tuning, comparisons, calculations of correction factors (hadron-to-parton corrections etc.)
- Use modern C++ libraries - CLHEP
- Fully integrated with the ROOT analysis environment

(See introduction to RunMC 2.1, June 2, 2004, HERA-LHC workshop)

Plan of this presentation - discussion of new features:

1) Physics project (RMC) files
2) Histogram and steering card editors
3) Root Tree (Ntuple) analyzer
4) 2D histogram option
5) Platform independence

Physics project files

- Physics project (of any complicity) can be packed to a single "RMC" file

Example: "jets_LHC.rmc" - zipped "proj" directory with several files:

1) steering MC files – set MC parameters
2) user calculation functions: *user-ini, user-run, user-end, user-select*
3) jets_LHC.mc – file to update RunMC GUI & histogram definitions
4) a few (optional) files ..

Using the file selection dialog on RunMC GUI, a user can load this project file

RunMC automatically:

- unzips this file
- recompiles all MC models using user functions
- inserts steering parameters / MC initialization files
- updates RunMC GUI, histogram definitions etc.

in ~ 1 min, a complete analysis framework is ready

Physics project files

- After loading RMC file, a user can modify the project
  - Set different MC, parameters, histograms etc ..
- Using option "save RMC project", RunMC GUI archives the project and copies it to "archive" directory.

Used in the presentation by S.Magill "Jets ET spectra at LHC" (WG2)

Presently available:

default.rmc	No any MC settings and physics calculations. Only dummy functions
dis_kinematics.rmc	DIS kinematic variables for HERA (Q2,x, etc), SC
charm_dis.rmc	Studies of D* cross sections in DIS (HERA), SC
dis_strange.rmc	Strangeness production (cross sections for K0s, Lambda's etc), SC
jets_HERA.rmc	Jets at HERA using longitudinally-invariant KT algorithm (Breit frame), SC
jets_LHC.rmc	Jets at LHC using the longitudinally-invariant KT algorithm (Lab. frame), SC
jets+charm_LHC.rmc	Jets at LHC using + charm production (Lab. frame), SC
invariant_mass.rmc	Invariant masses of two particles in e+e-, SC
event_shapes.rmc	Event shape studies, SC

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

Loadable physics analysis projects (RMC)

Do you need different output, event record, MC tunning, histograms, external calculations (except for those included to RunMC)?

- Make a new RMC file and load it to RunMC

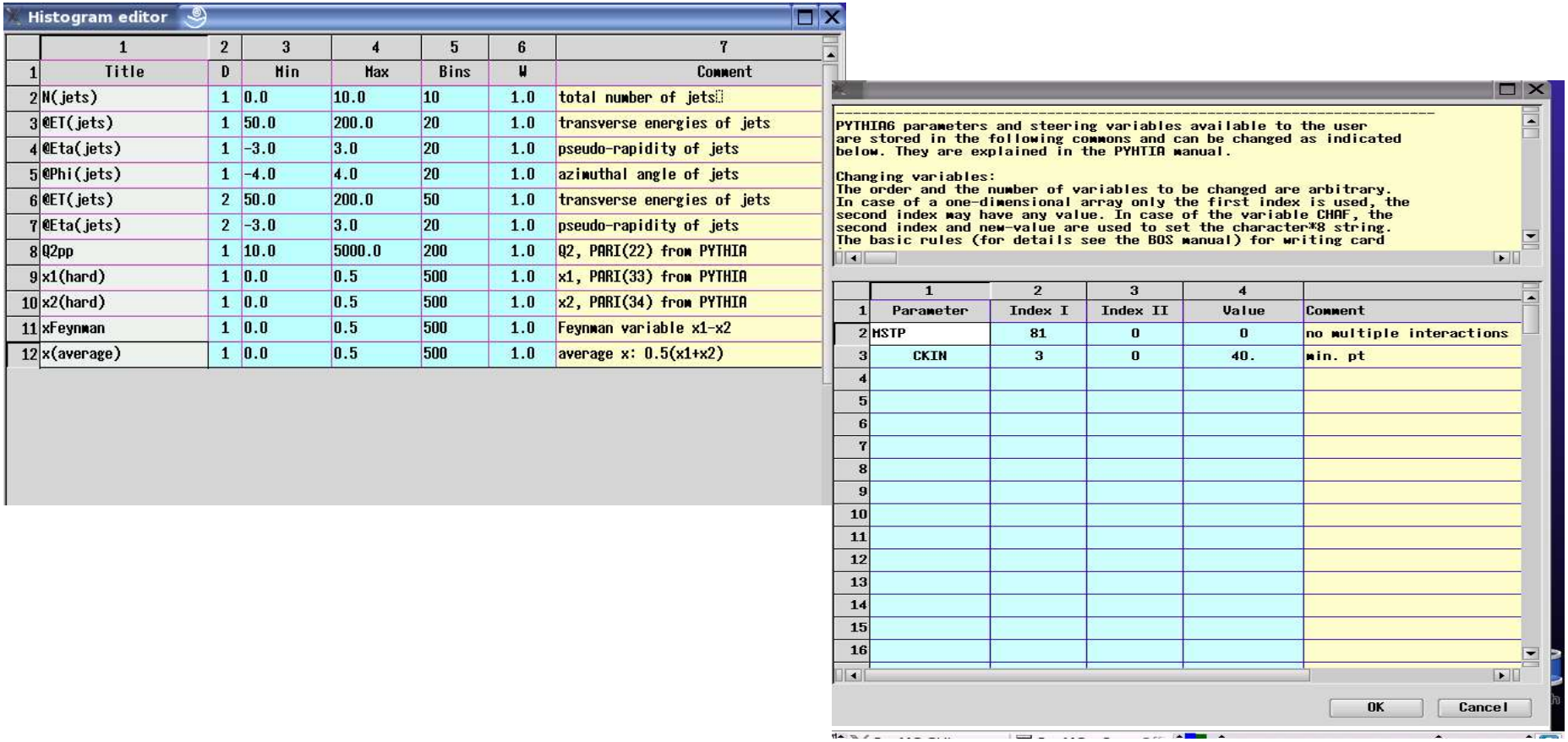
(and sent to chekanov@mail.desy.de to put on the RunMC web)

Advantages of RMC project files:

- Very easy to share complicated calculations
- Platform independents
- Small size - typically each RMC file < 22k Bytes, since main calculations (jet/event shapes algorithms etc..) are inside the RunMC
- No need to recompile the RunMC if you need to change histograms, binning, MC output, MC settings etc.

Histogram/steering cards editors

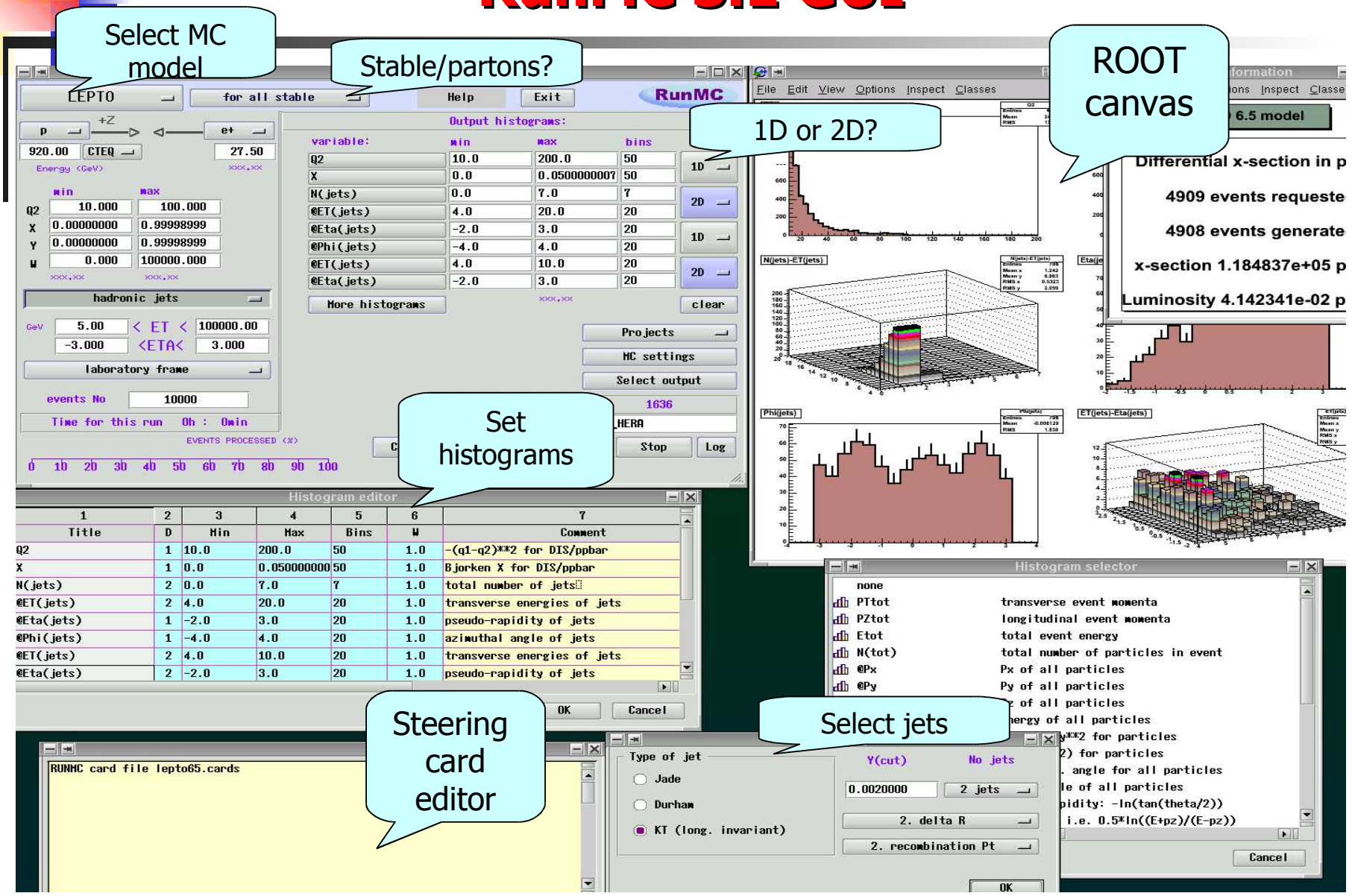
Allows to create / edit histograms or steering cards for each MC using spreadsheet-like GUI interface:



	1	2	3	4	5	6	7
1	Title	D	Min	Max	Bins	W	Comment
2	N(jets)	1	0.0	10.0	10	1.0	total number of jets
3	@ET(jets)	1	50.0	200.0	20	1.0	transverse energies of jets
4	@Eta(jets)	1	-3.0	3.0	20	1.0	pseudo-rapidity of jets
5	@Phi(jets)	1	-4.0	4.0	20	1.0	azimuthal angle of jets
6	@ET(jets)	2	50.0	200.0	50	1.0	transverse energies of jets
7	@Eta(jets)	2	-3.0	3.0	20	1.0	pseudo-rapidity of jets
8	Q2pp	1	10.0	5000.0	200	1.0	Q2, PARI(22) from PYTHIA
9	x1(hard)	1	0.0	0.5	500	1.0	x1, PARI(33) from PYTHIA
10	x2(hard)	1	0.0	0.5	500	1.0	x2, PARI(34) from PYTHIA
11	xFeynman	1	0.0	0.5	500	1.0	Feynman variable x1-x2
12	x(average)	1	0.0	0.5	500	1.0	average x: 0.5(x1+x2)

	1	2	3	4	
1	Parameter	Index I	Index II	Value	Comment
2	MSTP	81	0	0	no multiple interactions
3	CKIN	3	0	40.	min. pt
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

RunMC 3.1 GUI

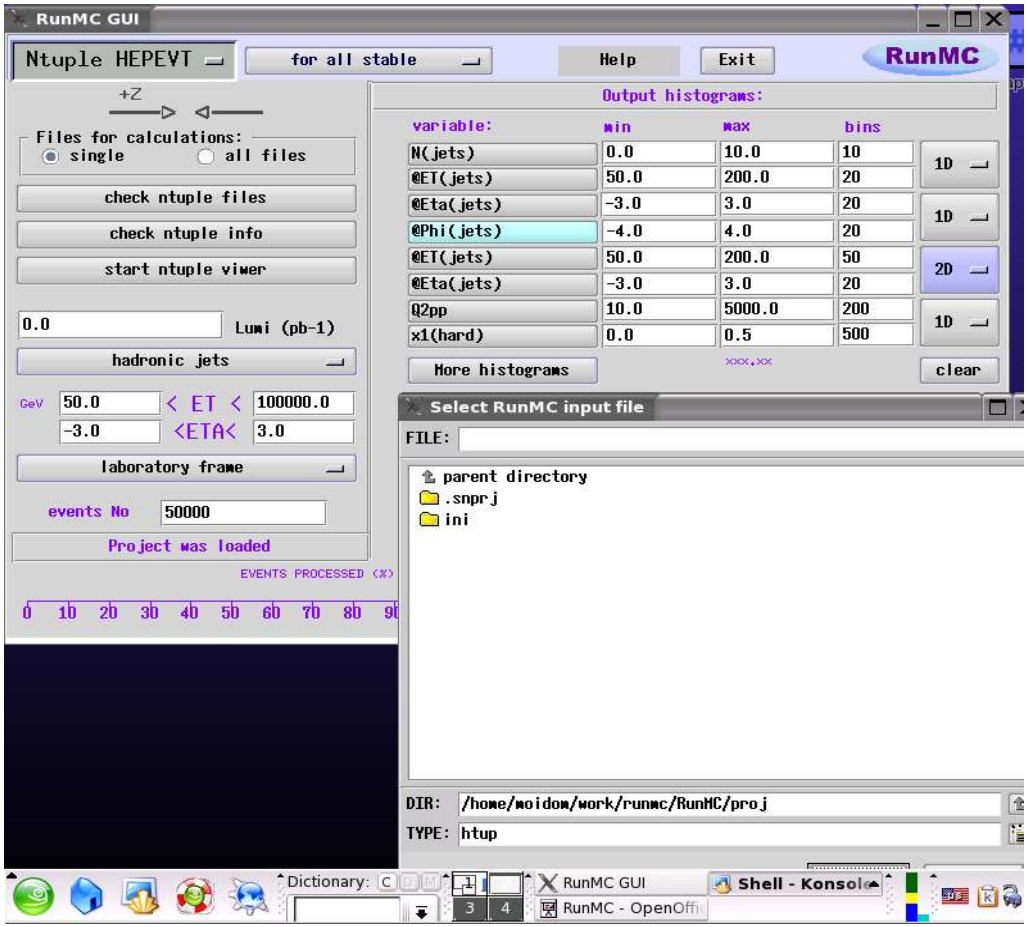

Select MC model
Stable/partons?
ROOT canvas
1D or 2D?
Set histograms
Steering card editor
Select jets
LEPTO
for all stable
Help
Exit
RunMC
Output histograms:
variable:
min
max
bins
Q2
X
N(jets)
@ET(jets)
@Eta(jets)
@Phi(jets)
More histograms
clear
Projects
MC settings
Select output
Stop
Log
hadronic jets
laboratory frame
events No
10000
Time for this run 0h : 0min
EVENTS PROCESSED (%)
Histogram editor
Title
Comment
OK
Cancel
Histogram selector
none
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
RUNMC card file lepto65.cards
Type of jet
Jade
Durham
KT (long. invariant)
Y(cut)
No jets
0.0020000
2 jets
2. delta R
2. recombination Pt
OK
Cancel

Main features (v3.1)

RunMC can create ROOT trees

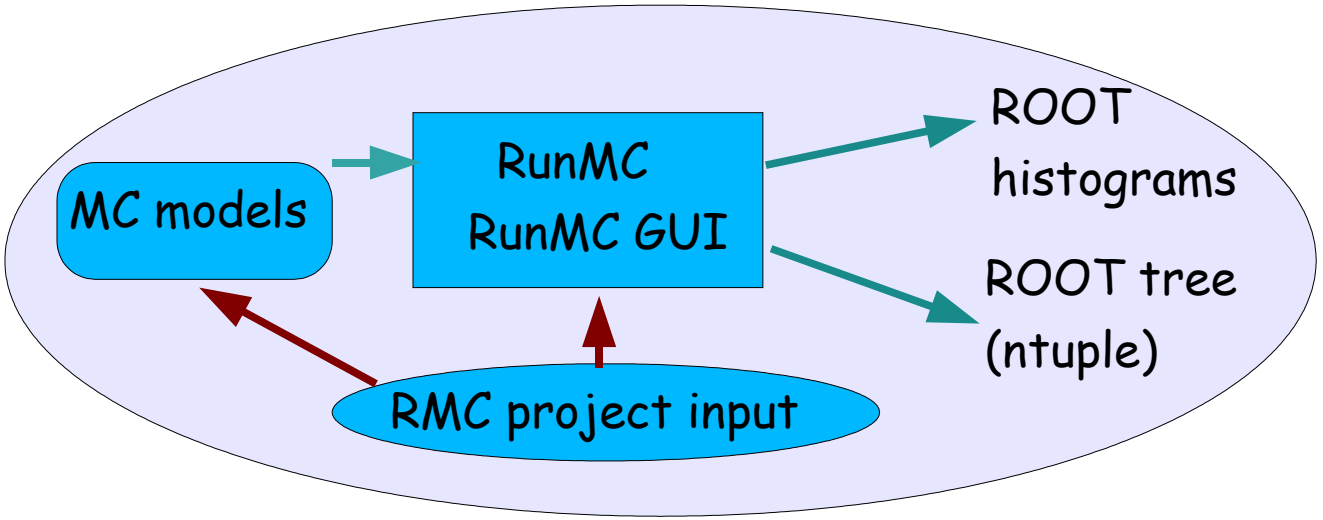
(ntuples)

- Events can be analyzed exactly as as for usual MC runs:
  - Significantly faster
  - Use RMC project files do this



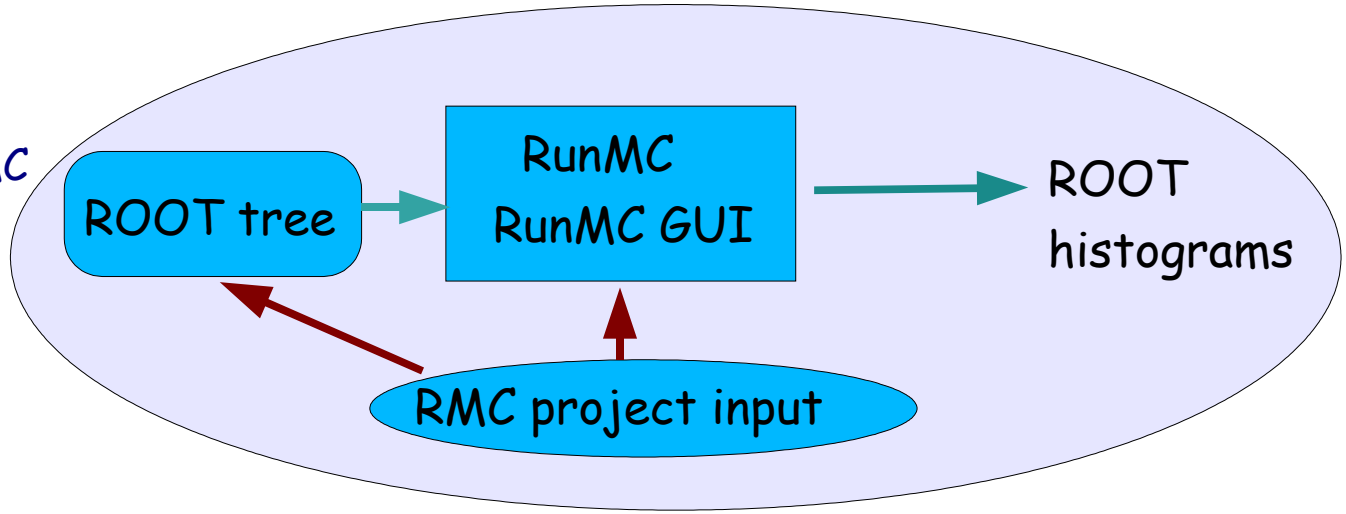
New features: 2 ways to fill histograms

1) Generate events and fill histograms (0.007 sec / event)



Alternatively:

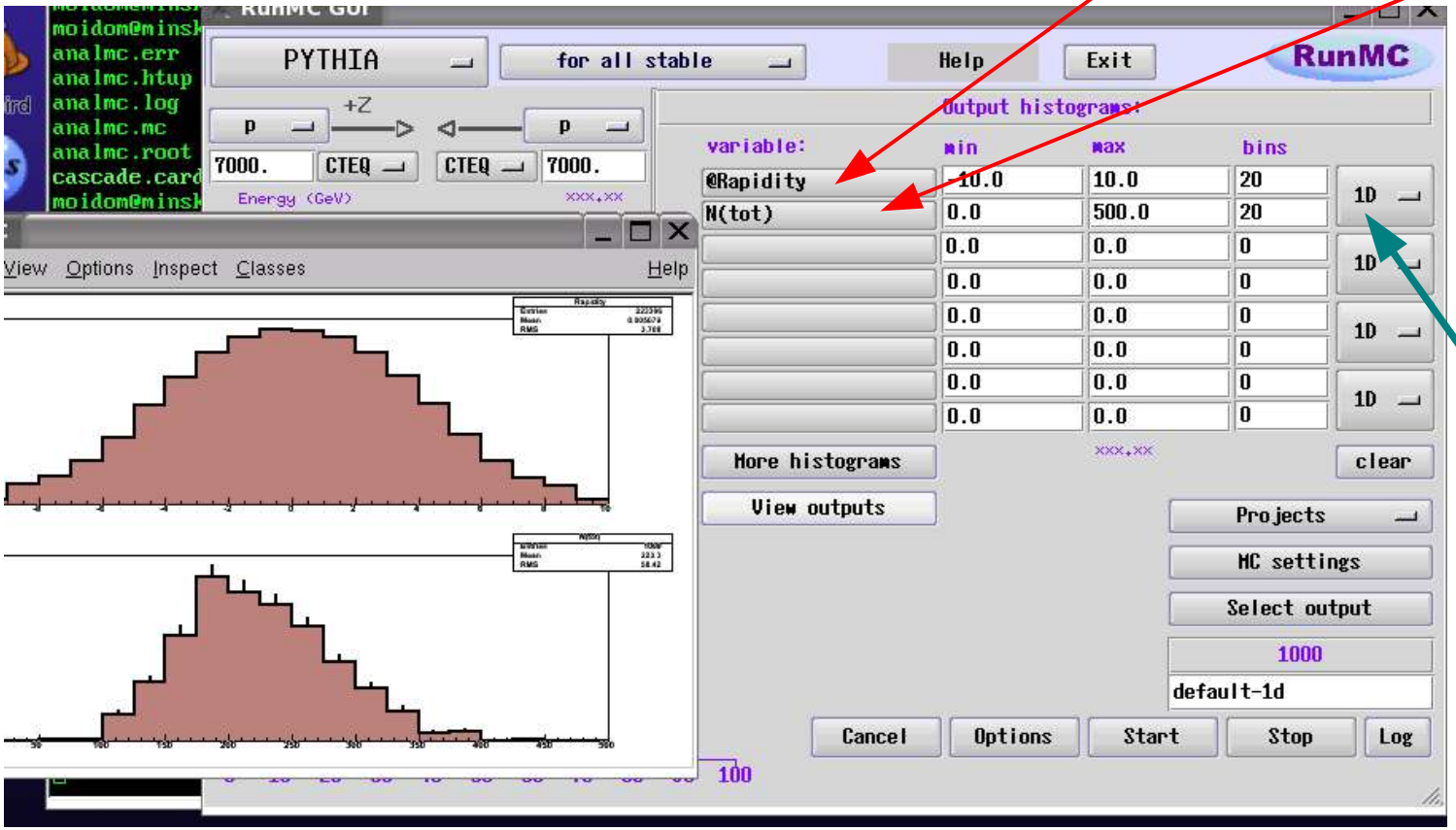
1) Generate events and save event record in ROOT tree
2) Run over the ROOT tree using the same RMC project file
(~ 17 times faster than to generate event & fill histogram)



Useful to validate physics project files

New features: 2D histograms

Example: typical MC run – two 1D histograms

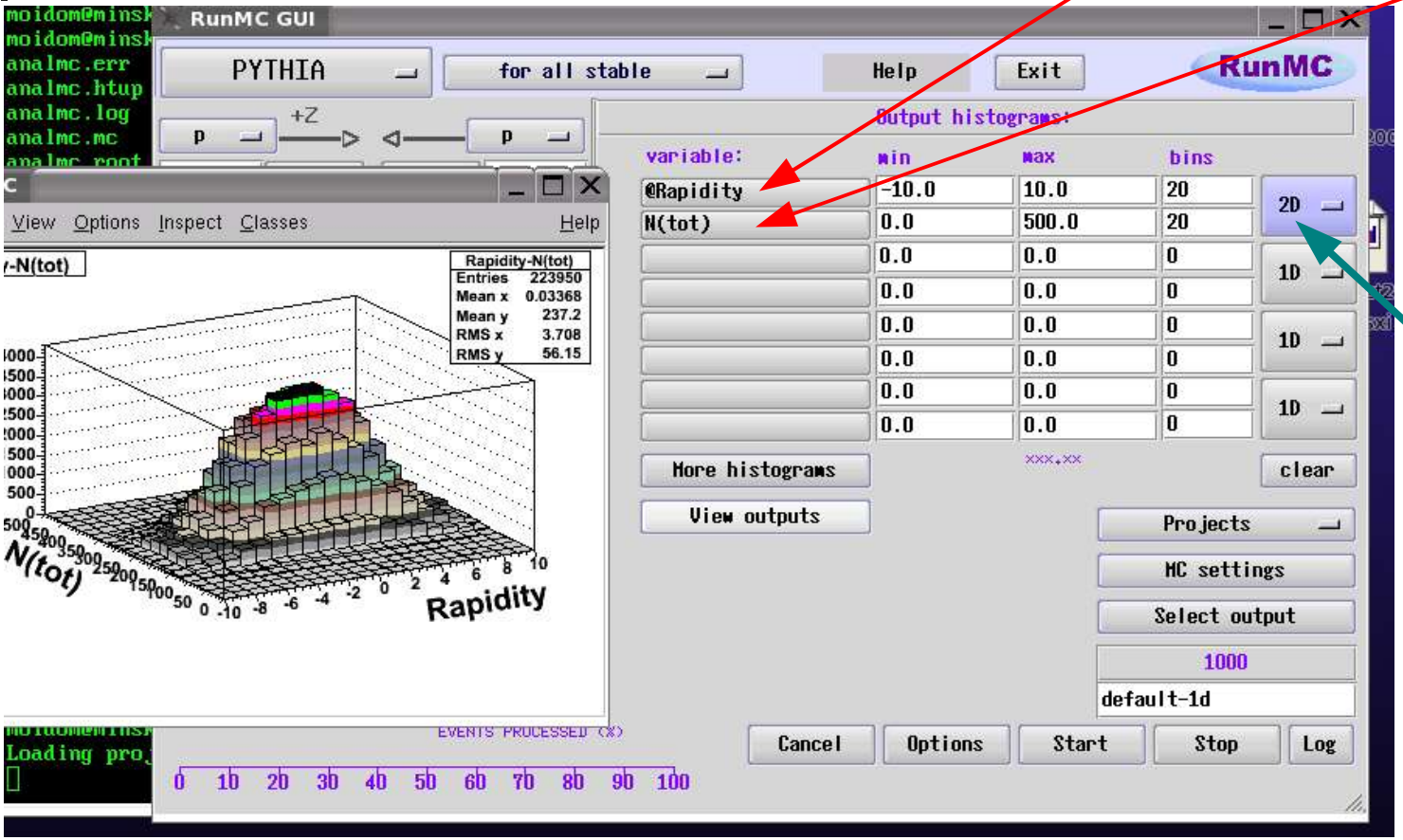


New features: 2D histograms

Example: typical MC run – 2D histograms

Rapidity distribution

Multiplicity distribution



Click here to create one 2D histogram from two 1D histograms

RunMC for Windows/Cygwin

RunMC consists of 2 independent parts:

- ROOT/C++ -based executables (combined with FORTRAN MC)
- RunMC GUI - presently based on Wstudio C++ classes, but can be written in JAVA, QT. GTK etc..or ROOT GUI classes
  - Does not depend on the core of the RunMC

Presently, in addition to Linux, RUNMC is available under Windows/Cygwin:

Cygwin is necessary to have necessary working environment for ROOT & FORTRAN MC (bash, X11, g++, g77, make)

However, RunMC GUI is completely independent of Cygwin and X11 since it uses Wstudio DDL libraries

Comparison with JetWeb

Main difference:

JetWeb – like PowerPoint running on a remote server, user can load/upload files ppt files, but do not have a full control over calculations:

- current focus – jets and heavy flavor production (RunMC – no restriction)
- only PYTHIA and HERWIG (6 models in RunMC)
- includes data for tunings (RunMC has no experimental data)

RunMC – is designed to run on every desktop, but loadable RMC files with physics calculations can be easily shared between users:

- ANY calculations
- flexibility and full control over program
- no heavy maintenance (but RMC files should be "certified" by someone!)
- No data - less power compared to JetWeb for MC tuning

Summary

RunMC version (v3.1) and user manual (v1.4):

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

Can be done in future:

- add RAPGAP model
- HzTOOL can be converted to use with RunMC
  (as RMC project modules)