Management of the Monte Carlo simulation process in the MPD experiment on the NICA cluster

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Outline

- Assigned tasks
- Used tools
- How to run simulations?
- Testing of generated data
- Summary

Assigned tasks

Mass events generation

Automatisation of simulation process to create events

Correctness check of generated events

Comparison of simulation models

Used tools

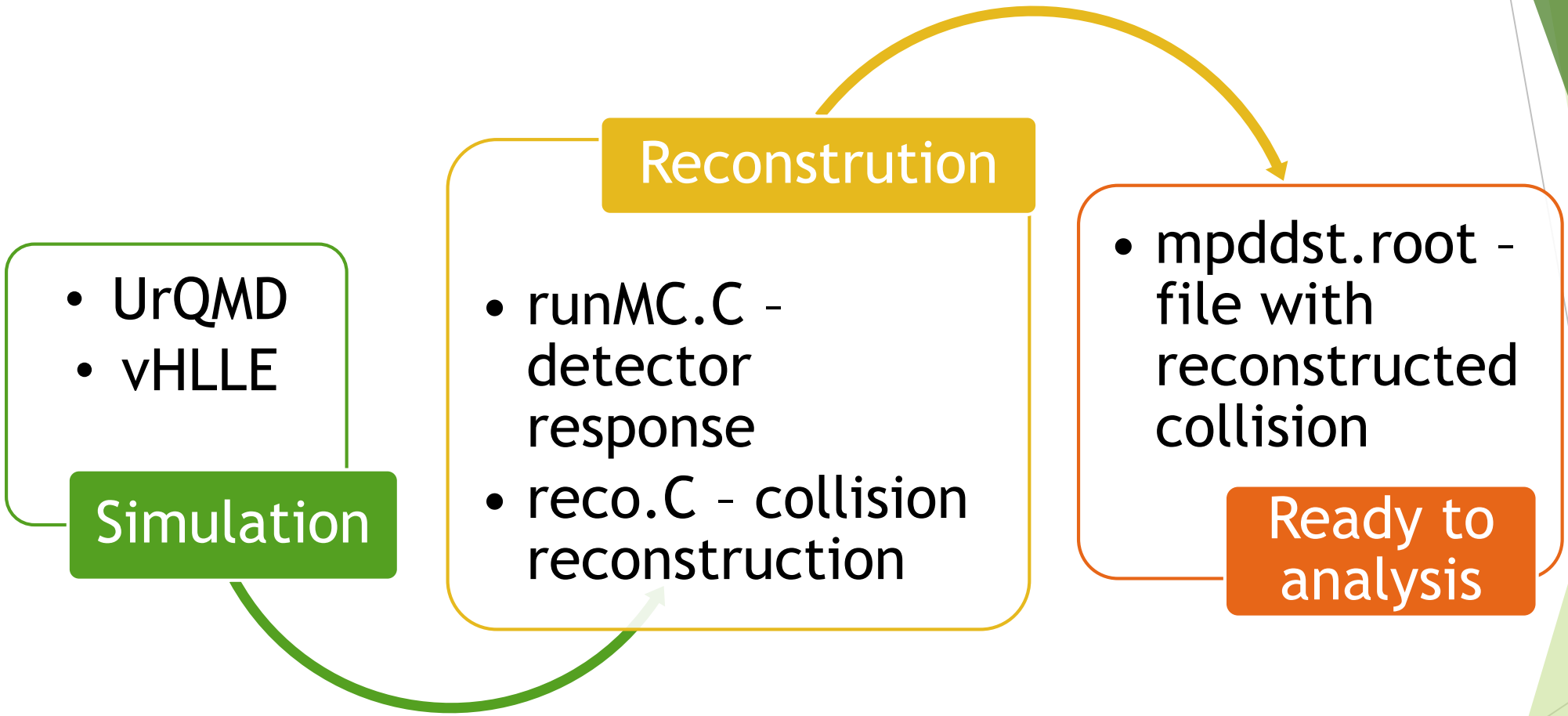
- Simulation models
  - UrQMD 3.4
  - vHLLE
- MpdROOT framework
- NICA cluster

How to run simulations

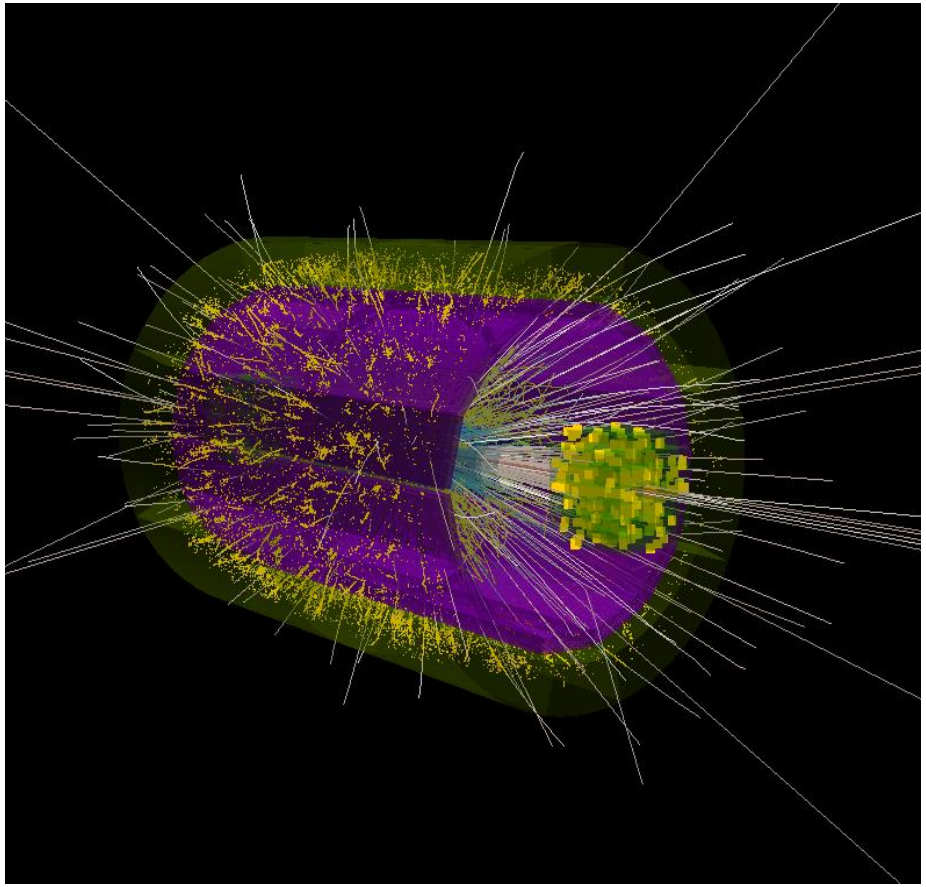
- Required package avaliable on GitHub
- Install MpdROOT UrQMD/vHLLE
- Set your paths
- Necessary access to NICA cluster and data folder

  https://github.com/Lukaszz99/work

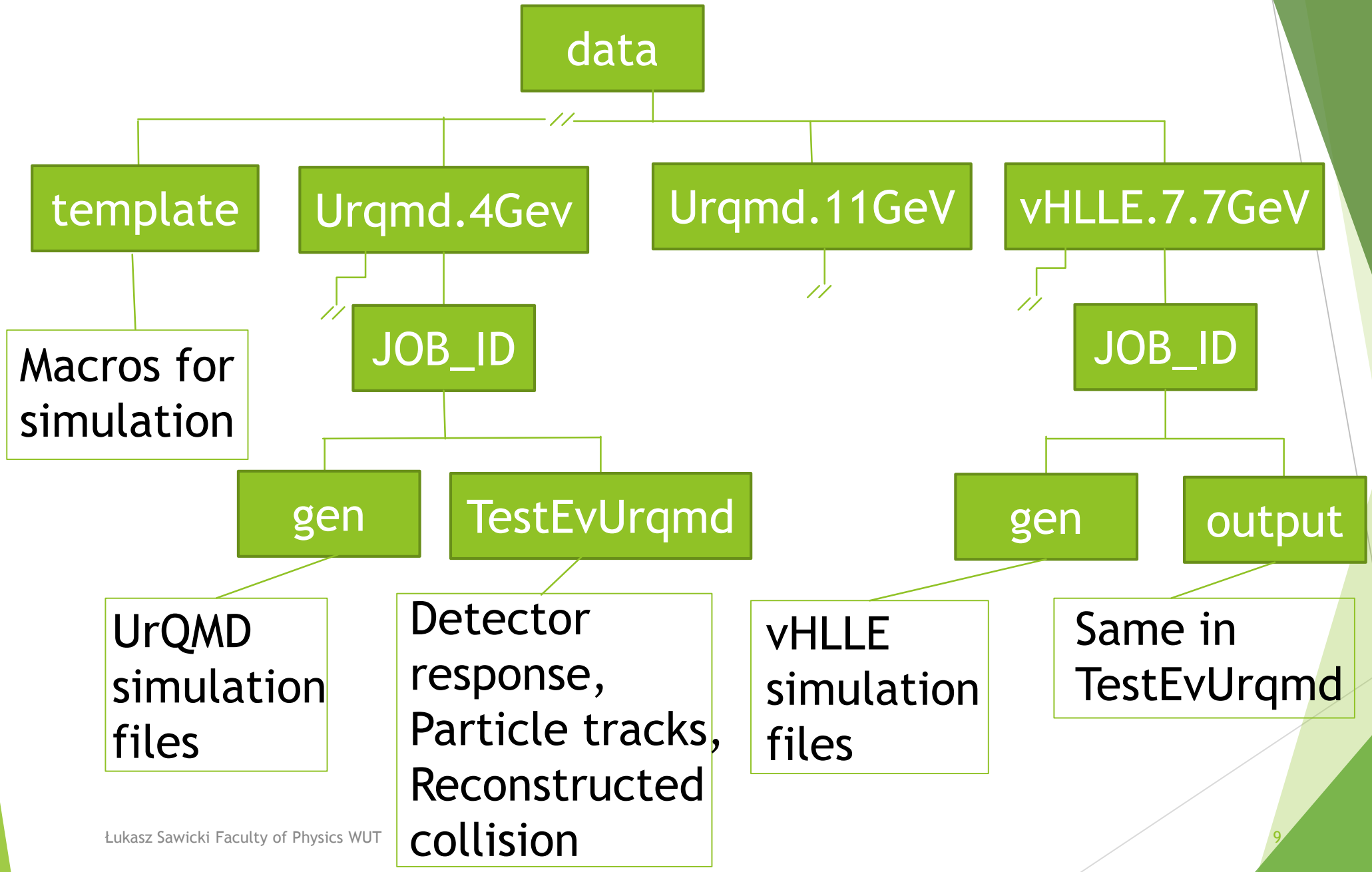
How does it work?



- All generated data is reconstructed
- Stored in /eos/nica/mpd/data folder
- Separate folders for each energy and simulation model
- UrQMD 4, 7, 9, 11GeV
- vHLLE 7.7GeV



- Data folder
  - 7PB of space
  - No quota per user
  - Used as a normal disc of a computer


data
template
Urqmd.4Gev
Urqmd.11GeV
vHLLE.7.7GeV
Macros for simulation
JOB_ID
JOB_ID
gen
TestEvUrqmd
gen
output
UrQMD simulation files
Detector response, Particle tracks, Reconstructed collision
vHLLE simulation files
Same in TestEvUrqmd

```
pro 197 79
tar 197 79

nev 200
imp 5.

ecm 7.
tim 200 200

eos 0
```

inputfile

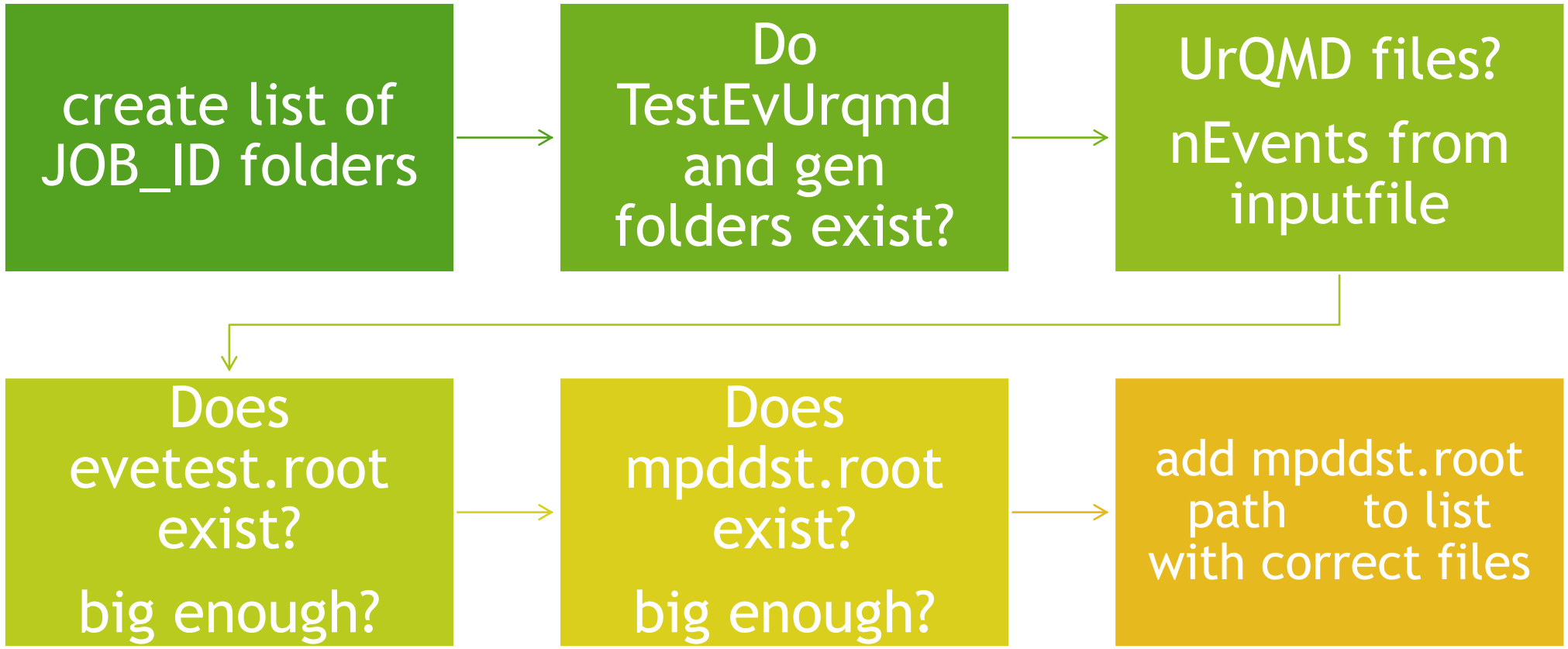
vHLLE.C

```
// Parameters below (6) are considered as those to be set obligatory
gen->SetPathToTheModel("/eos/nica/mpd/users/sawicki/vHLLE/vHLLE+UrQMD"); // Absolute(!) path to the root folder of the model ()
gen->SetOutputDirectory("./"); // Directory where output data stored
gen->SetEnergy(7.7); // Set collision energy [GeV], possible energies are 7.7, 11.5, 19.6, 27, 39, 62.4 GeV
gen->SetImpact(0., 3.3); // Set impact range (min, max) [fm]
gen->SetEoS("XPT"); // Set EoS to be used (1PT - first order phase transition, XPT - crossover)
gen->SetNsamples(500); // nEvents to be sampled in hadronic cascade from one hydro-evolution
```

Testing generated data

- Included in GitHub package
- Works for Urqmd and vHLLE simulations
- Information about type of errors, list of correct mpddst.root files

Scheme of testing



Program output

- errors and error_category lists
- failed jobs list
- correct mpddst.root files list

```
98/3232 - 3.03% of jobs has failed at all
 0 are run_UrQMD errors
 16 are Urqmd errors
 3 are runMC.C errors
 79 are reco.C errors
```

Program output

- List of errors

```
[sawicki@ncx104 Urqmd.11GeV]$ cat errors.11GeV.txt
File mpddst.root in TestEvUrqmd 285832 not found. Macro reco.C has failed
File test.f14 in gen in 285845 not found. Urqmd has failed
File mpddst.root in TestEvUrqmd 285854 is too small. Macro reco.C has failed
File mpddst.root in TestEvUrqmd 285856 is too small. Macro reco.C has failed
File test.f14 in gen in 285872 not found. Urqmd has failed
File test.f14 in gen in 285874 not found. Urqmd has failed
File test.f14 in gen in 285878 not found. Urqmd has failed
File mpddst.root in TestEvUrqmd 285895 not found. Macro reco.C has failed
File test.f14 in gen in 285911 not found. Urqmd has failed
File test.f14 in gen in 285943 not found. Urqmd has failed
File mpddst.root in TestEvUrqmd 285946 is too small. Macro reco.C has failed
File test.f14 in gen in 285986 not found. Urqmd has failed
File mpddst.root in TestEvUrqmd 285987 is too small. Macro reco.C has failed
File mpddst.root in TestEvUrqmd 285990 is too small. Macro reco.C has failed
```

- Commands to run reco.C or runMC.C for failed jobs

Summary

UrQMD				vHLLE
4GeV	7GeV	9GeV	11GeV	7.7GeV
reconstructed events				
203600	448346	593851	721652	151393

2 120 000 reconstructed events – 60 TB

Numbers from 24.08.2019

- Event generation and reconstruction for 500 events – 22h
- 2 120 000 events – 93 280h – 10.6 years on personal computer
- We did it in 4 weeks

Thank you for attention

Contact info

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https://github.com/Lukaszz99/work