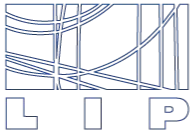
ROOT intermediate tutorial

LIP Summer Internships, July 7th 2021



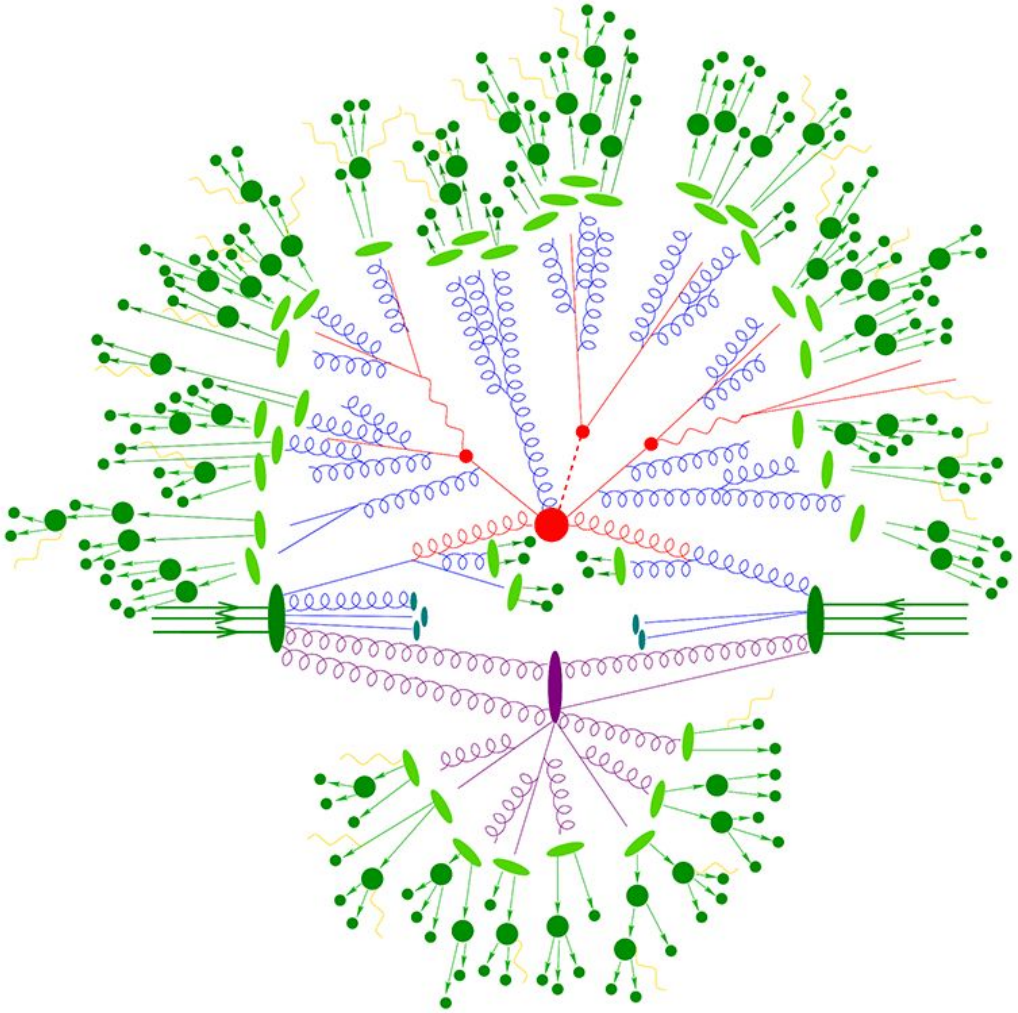
LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS

Program of the tutorial

- Very short introduction covering the goal/idea of the tutorial and brief explanation of the data file
- Independent work following a list of exercises
  - Less detailed instructions than in previous tutorials (on purpose)
- As in previous tutorials, help will be available on slack and zoom
  - Slack channel: **root-intermediate-tutorial**

Some words on Monte Carlo event generators

- Monte Carlo event generators provide detailed simulations of high-energy collisions (events) and are used in almost all high energy physics analysis
- Each event is simulated in several steps
  - Signal process
  - Final state parton shower
  - Fragmentation
  - Hadron decays
  - Underlying event
- For each event, they return a list of the generated particles and their kinematic properties
- The data file for today's tutorial is a simplifies version of this



Structure and content of the data file

```
*******************************************************************************
*Tree    :Tdata     : zedjet_oldpythia_200.cmndTdata                          *
*Entries :   663048 : Total =      4051393563 bytes  File  Size = 3263504642 *
*        :          : Tree compression factor =   1.24                       *
*******************************************************************************
*Br    0 :px        : vector<double>                                          *
*Entries :   663048 : Total  Size=  720320231 bytes  File Size  =  696582956 *
*Baskets :      323 : Basket Size=    6620672 bytes  Compression=   1.03     *
*.............................................................................*
*Br    1 :py        : vector<double>                                          *
*Entries :   663048 : Total  Size=  720320231 bytes  File Size  =  696579788 *
*Baskets :      323 : Basket Size=    6620672 bytes  Compression=   1.03     *
*.............................................................................*
*Br    2 :pz        : vector<double>                                          *
*Entries :   663048 : Total  Size=  720320231 bytes  File Size  =  698719314 *
*Baskets :      323 : Basket Size=    6620672 bytes  Compression=   1.03     *
*.............................................................................*
*Br    3 :En        : vector<double>                                          *
*Entries :   663048 : Total  Size=  720320235 bytes  File Size  =  689999546 *
*Baskets :      323 : Basket Size=    6620672 bytes  Compression=   1.04     *
*.............................................................................*
*Br    4 :m         : vector<double>                                          *
*Entries :   663048 : Total  Size=  720320098 bytes  File Size  =  423388281 *
*Baskets :      325 : Basket Size=    6620160 bytes  Compression=   1.70     *
*.............................................................................*
```

Branch: stores information about a specific property **of the event**

For each event, there are multiple particles, whose properties are stored in a vector

Your job today is to go through the list of particles in each event and **find the muons that come from the decay of a Z boson**