

PRATSTARS

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Abstract

PRATSTARS is an event display. The program reads Les Houches Event files for parton level event visualization, and DAOD files for particle level event display visualization. The program works both as a GUI and a command line executable.

1 Introduction

Data at the LHC is a constant issue. The complicated nature of high energy collision data requires multiple file types. While this may ease data analysis downstream, it can make visualizing events quite difficult. Currently, CERN employs the use of programs such as Atlantis and iSpy. These are comprehensive event displays that generate beautiful graphics ready for publication. However, the software requires turning each event within a DAOD file into a single specialized file (for example, iSpy requires events to be in the "ig-event'file" format). This process can be tedious when one wishes to quickly visualize multiple events for analysis purposes. PRATSTARS hopes to fill this gap. The software was developed to quickly visualize events in .lhe and DAOD files.

2 Visualization for .lhe Files

Les Houches Event (.lhe) files contain parton level information for an event. Such events are only possible to generate through simulation and do not reflect real detector data. The LHE event display is similar to a feynman diagram in that it portrays the full scope of an event's decay pattern. However, PRATSTARS also shows transverse momentum magnitude and direction.

2.1 Arguments

The following are the arguments required when running PRATSTARS on the command line:

`--file` - specify the full path to the LHE file you wish to analyze

`--event` - specify the specific event within the file you wish to analyze

Contrary to the DAOD display, the LHE display labels the events sequentially as they appear in the file. Therefore, if there are 100 events in your file. the possible values

for event number are 1,2,3...100.

--output - the full path to the folder where you would like to save out the generated figure.

2.2 Examples

```
<User-Computer>$ pratstar_LHE.py --file=file.lhe --event=10  
--output=/Path/To/Folder/Outputs
```

The above example code will open "file.lhe" and generate a figure for the 10th event in the file, then save said figure in a folder called "Outputs"

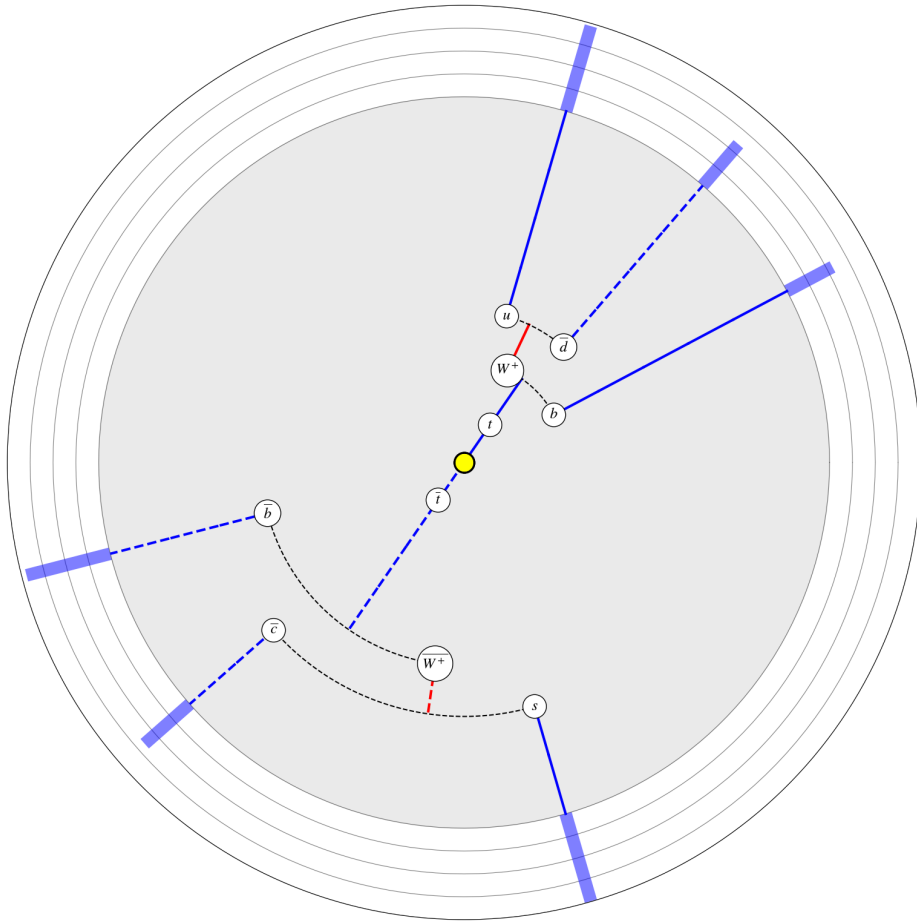


Figure 1: Example: A T-TBar production event

3 DAOD Visualization

Derived Analysis Object Data (DAOD) files are subdivisions of processed data that comes out of the detector. An AOD consists of "Branches", each containing various Data and Meta-Data about a run. A DAOD takes only the branches that are pertinent to the user from the AOD. A typical DAOD can store any number of events but usually contains the thousands. D of events from a single run. AODs can be created from simulation data, but reflect data coming out of the detector. Therefore, each event within the file will have a run number and event number associated with it. This is different than indexing LHE files because one must know the event number of the desired event in order to generate its figure. Another important difference to note is that DAOD files contain only three types of particles: Muons, Jets, and Electrons. Therefore it is likely that most shown tracks will be jets, and therefore hard to identify specific particles from a simple glance. The program does, however, include information on the missing momentum and thus possible neutrino productions.

3.1 Arguments

The following are the arguments required when running PRATSTARS on the command line:

`--file (string)`- specify the full path to the LHE file
you wish to analyze

`--event (integer)`- specify the specific event within the file you
wish to analyze.

Contrary to the LHE display, DAOD files specify a specific event and run number. often they are long integers associated with the time of data capture. It is required that one know the specific event number.

`--output (string)`- the full path to the folder where you
would like to save out the generated figure.

`--show (Boolean)`- tells the code whether to open the image
after it is generated. It is recommended
to turn this off for batch processing.

`--view (string)`- Options: Transverse, Longitudinal, or Both.
Tells the program which view you would like
to visualize the event in.

`--thersh (float)`- Threshold transverse momentum in MeV.
Particles with momentum below the specified
thershhold will not be shown.

--labels (0 or 1) - If set to 1, the program will label the particles with the top 5 highest transverse momentum. Particularly useful when comparing longitudinal and transverse views.

3.2 Example

```
<User-Computer>$ prastar_DAOD.py --file=file.root.1
--event=1234567 --output=/Path/Outputs
--view=Transverse --show=True --thresh=10
--lables=1
```

The above example code will open the file "file.root.1", and generate a transverse plane display for the event numbered 1234567. It will only show the vectors of particles of transverse momentum greater than 10MeV, and label the top 5 tracks with the highest transverse momentum. The program will also open the image after it is generated.

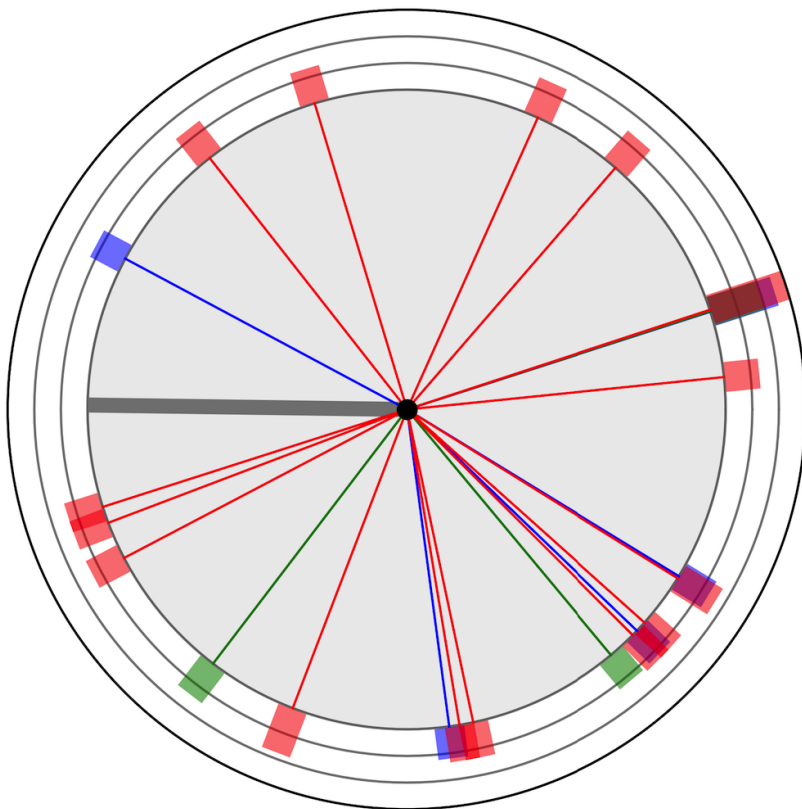


Figure 2: Example: Figure from a DAOD file

4 Graphical User Interface

To ease use of PRATSTARS, the program also has a Graphical User Interface (GUI). However, it is important to note the simplicity of this application. It merely "generates" the proper command line script in the terminal for the desired command. If one knows how to run the command line version, it is highly suggested to use that version.

4.1 installation

To begin, one must have the following files in a single directory:

Pratstar_LHE.py, Pratstar_DAOD.py, Parent_GUI.py, setup.sh

Begin by opening terminal and navigating to the folder that contains these files and running the "setup.sh" file:

```
ex. $ cd Path/to/Pratstars
    $ source setup.sh
```

After this, simply enter the command "pratstar" into the command line, and the GUI should appear. From here, select the desired file and output folders. One important thing to note is that the GUI runs a bit differently for LHE and DAOD files. When running the DAOD event display, it is necessary to specify a momentum threshold and a display view. However, for LHE files, there is no Longitudinal view nor momentum threshold. So, the toggle for such options on the GUI can be ignored.

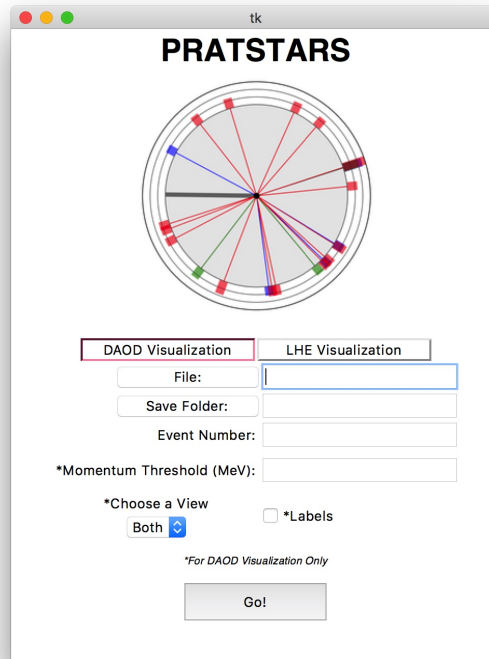


Figure 3: PRATSTARS Graphical Users Interface