LHAPDF on HPC

What is LHAPDF?

LHAPDF (Les Houches Accord PDFs) is a software library that provides access to a large collection of parton distribution functions (PDFs). PDFs are mathematical functions that describe the probability of finding a particular type of subatomic particle (called a "parton") inside a hadron (such as a proton or neutron) as a function of its momentum and other variables. PDFs are important for predicting the outcomes of high-energy particle collisions, such as those that occur at particle accelerators like the Large Hadron Collider (LHC). LHAPDF allows users to easily interpolate between the various PDFs in its library and evaluate them for specific values of the variables of interest. It is used in a wide variety of applications, including particle physics, astrophysics, and cosmology.

Links:

[Official Website](#)

[Manual](#)

Versions Available:

The following versions are available on the cluster:

- LHAPDF-v6.1.5

How to load LHAPDF?

To load LHAPDF, use the following commands:

```
#Load the LHAPDF module
module load lhapdf/6.1.5
```

To verify if the module and dependencies are loaded correctly, use the following command.

```
#Show all the modules loaded
module list
```

This should list all the LHAPDF dependencies that are loaded – gcc and gcc-utils.

How to use LHAPDF?

To use the LHAPDF, user must write their own C++ or python code using LHAPDF library. For this example, use the following sample code,

```cpp
#include "LHAPDF/LHAPDF.h"

int main() {
  // Set up the PDF set and get the PDF at a particular x and Q2 value
  LHAPDF::PDF* pdf = LHAPDF::mkPDF("CT10", 0); // Specifiy path to PDF
  double x = 0.1;
  double Q2 = 100;
  double val = pdf->xfxQ2(2, x, Q2);

  // Do something with the PDF value...
    std::cout << "Calculated val: " << val << std::endl;

// Clean up
  delete pdf;
  return 0;
}
```

To install LHAPDF, use the following command,

```
# Install PDF | needs appropriate permissions
lhapdf install <pdf_name>
```

To compile above code, use the following command,

```
# Complie above code
g++ -std=c++11 testpdf.cc -o myexe `lhapdf-config --cflags --ldflags`
```

The lhapdf-config automatically generates the needed compile time flags to be passed. User ca wrap all of these in a slurm script. Use the following sample script,

```
#!/bin/bash
#SBATCH --job-name=myjob
#SBATCH --output=myjob.out
#SBATCH --error=myjob.err
#SBATCH --nodes=1
#SBATCH --ntasks=1
#SBATCH --cpus-per-task=1                              # No of required
processers if multithreaded
#SBATCH --time=00:10:00
#SBATCH --mem=1GB
#SBATCH -p main
#SBATCH --qos main

module load lhapdf/6.1.5

# Compile
g++ -std=c++11 testpdf.cc -o myexe `lhapdf-config --cflags --ldflags`

# EXECUTE
./myexe
```

See the official documentation for more information about the software.

Where to find help?

If you are confused or need help at any point, please contact OIT at the following address.

https://ua-app01.ua.edu/researchComputingPortal/public/oitHelp