Table of Contents

Resources

Git repo

The source code repository in CERN Gitlab is here:
http://gitlab.cern.ch/BL4S/BL4S_MC

After setting up Gitlab, the code can be cloned like so:

```
git clone ssh://git@gitlab.cern.ch:7999/BL4S/BL4S_MC.git
```

Documentation

Automated doxygen
: http://test-bl4s-mc-cherenkov.web.cern.ch/test-bl4s-mc-cherenkov/

Geant4 website
: http://geant4.web.cern.ch/geant4/index.shtml

Developer guide
: https://geant4.web.cern.ch/geant4/UserDocumentation/UsersGuides/ForApplica

Source reference (LXR)
: http://www-geant4.kek.jp/LXR/

Doxygen
: http://www-geant4.kek.jp/Reference/

Geant4 twiki
: https://twiki.cern.ch/twiki/bin/view/Geant4/WebHome

Tutorial
: https://www-zeuthen.desy.de/geant4/g4course2011/day1/overview.html

Instructions

Set up

The simulations need cmake, Geant4 and Root. The iniGeant4.sh script sets up Geant4 and Root from AFS and runs `cmake` and `make`. The outputs go into `./build/`. To rebuild the code, `make` can be run in the build directory or in a simulation subdirectory of build. If adding or removing source files, you may need to rerun `cmake` from the build directory, like so:

```
cd build
cmake ..
```

Execution

The executables in the build directories can be run in interactive mode. E.g:

```
cd build/lead_glass
./lead_glass
```

The number of threads can be specified with "-t " where is the number, e.g. on a quad core PC; "-t 4"

An example macro file is provided for batch runs:

```
cd build/lead_glass
./lead_glass -m e-_3GeV.mac
hadd e-_3GeV.root lead_glass*.root
```

Note that there will be n threads plus one files matching `lead_glass*.root`. The format of species + charge + '_' + energy + '.root' is understood by the plotting macros.

Plotting

In each build directory is a plots.C macro with some histogramming options for various variables of interest. They can be executed with Root like so:

```
cd build/lead_glass
root 'plots.C("+", "3GeV", "interaction_depth")'
```

Note that the macro will try to open Root files with the format specified above, using the charge and energy specified. It will try to plot electrons, muons, pions, protons and neutrons, if Root files are available.

Documentation

Each simulation has a `Doxyfile` to drive doxygen generation of documentation. Just run `doxygen` in the same folder as the `Doxyfile`. The documentation is hosted from AFS (by TimBrooks) at

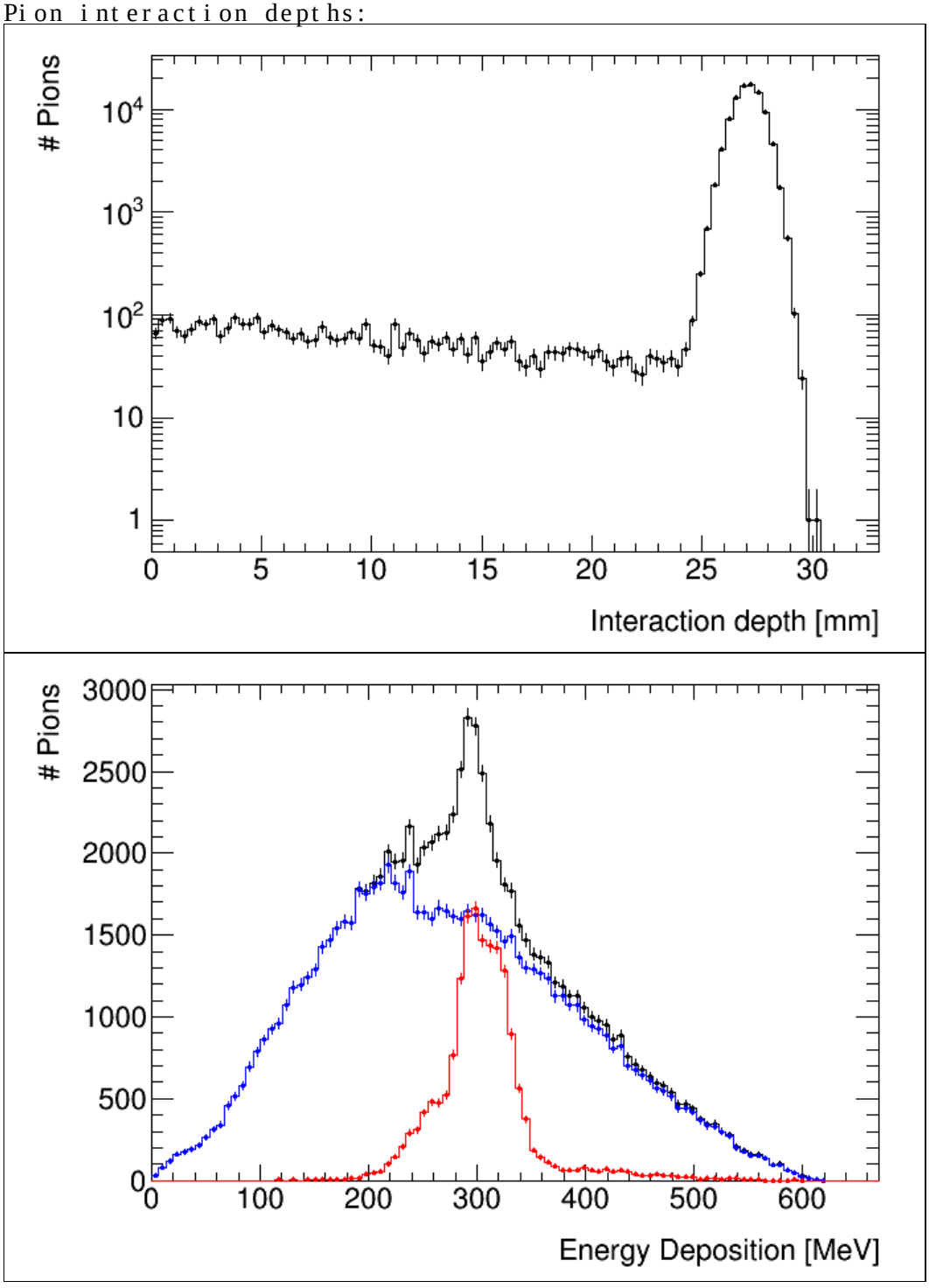
http://test-bl4s-mc-cherenkov.web.cern.ch/

Simulations

LeadGlassCalorimeter

Based on the NA62 MC source code, since they use the same OPAL blocks.

- Pion interaction depths:

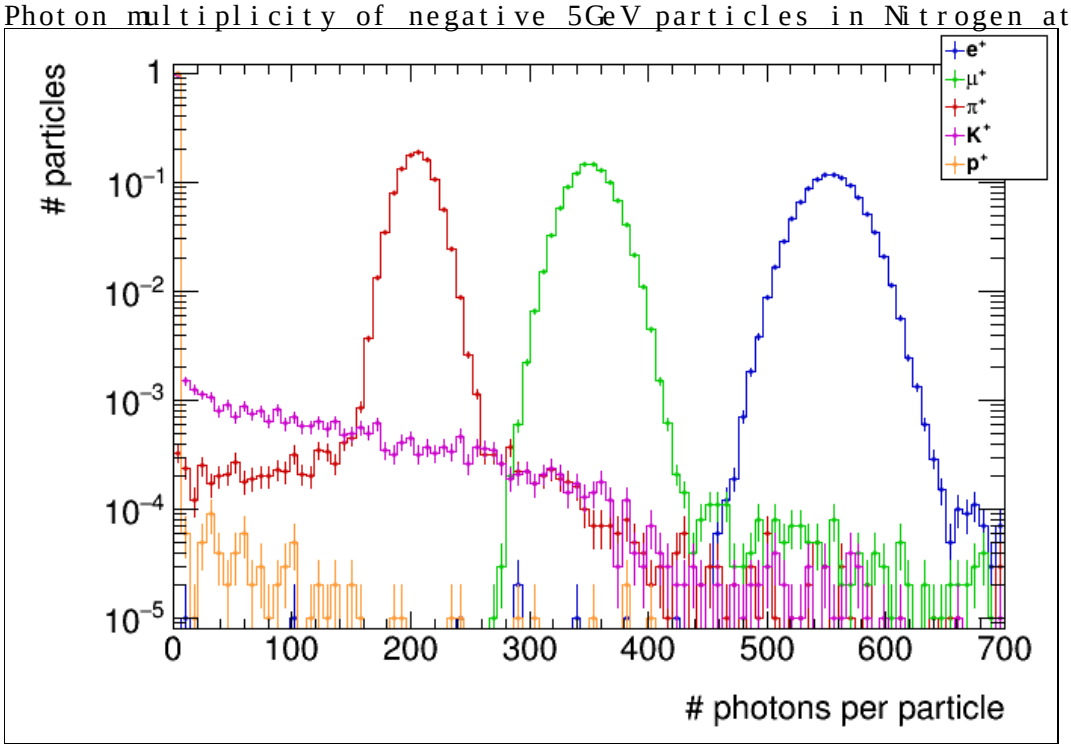


The Bragg peak is visible for 50MeV Pions. In the second image, 500MeV Pions are shown interacting inside the block in blue, and not interacting in the block in red. A narrow peak is found for non-interacting Pions. Note the end point of the energy distribution is $p_{beam}c + m_{\pi^\pm}c^2$.

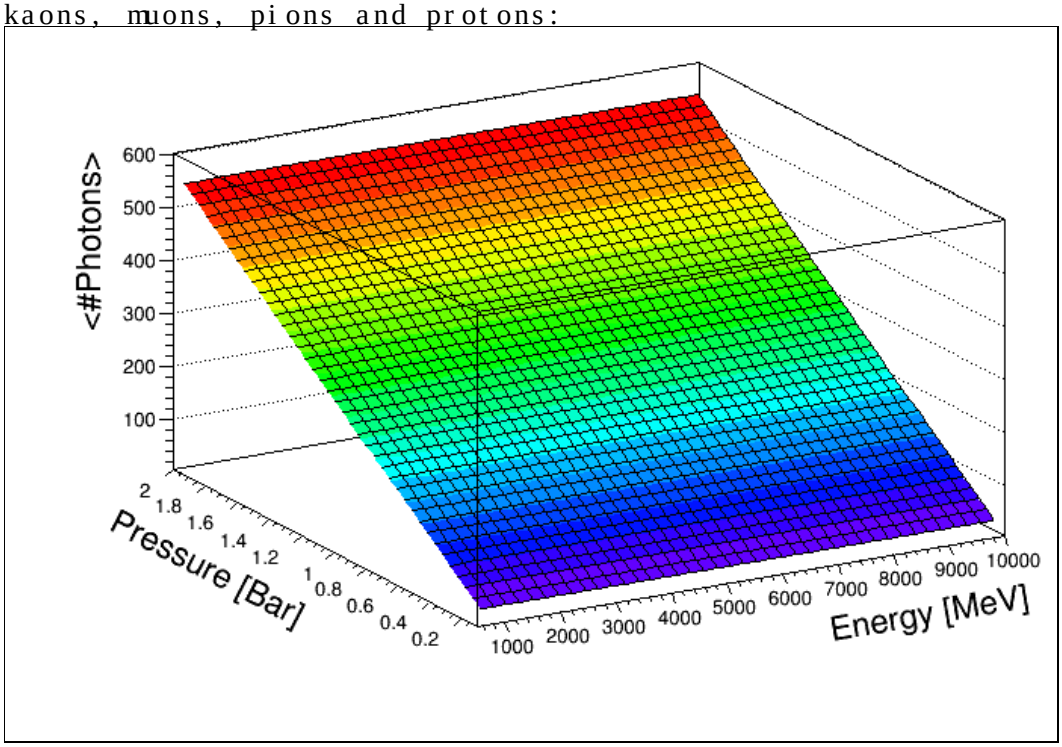
CherenkovCounter

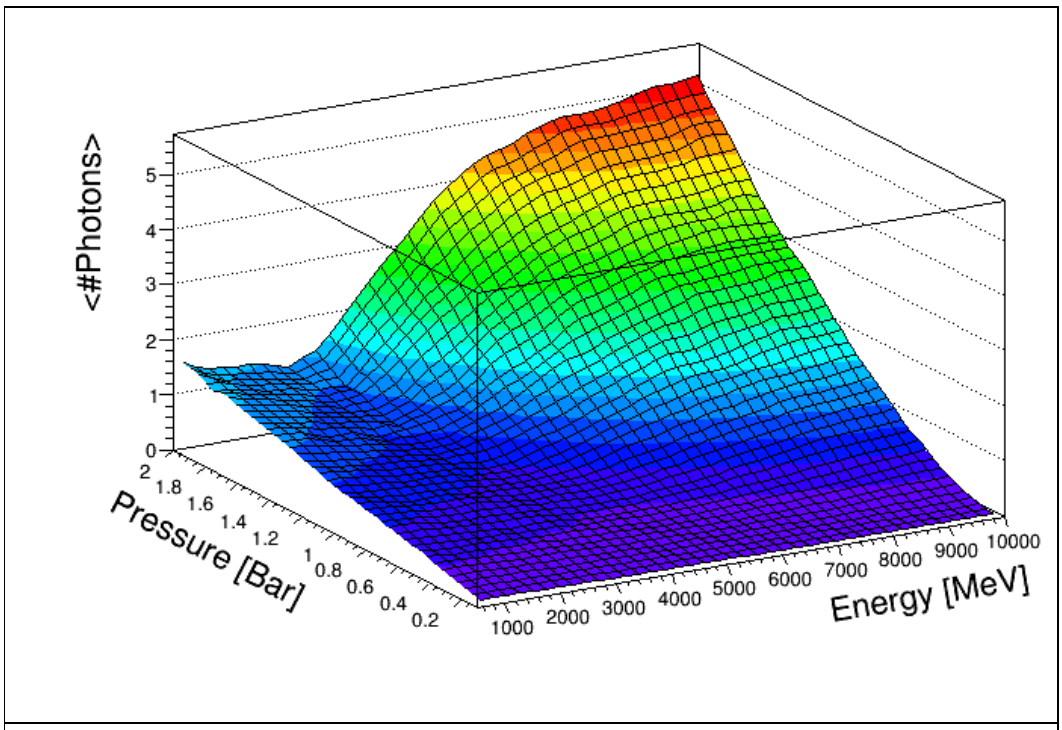
Using some code from the NA62 Cedar detector simulation, but simplified for BCC type detectors.

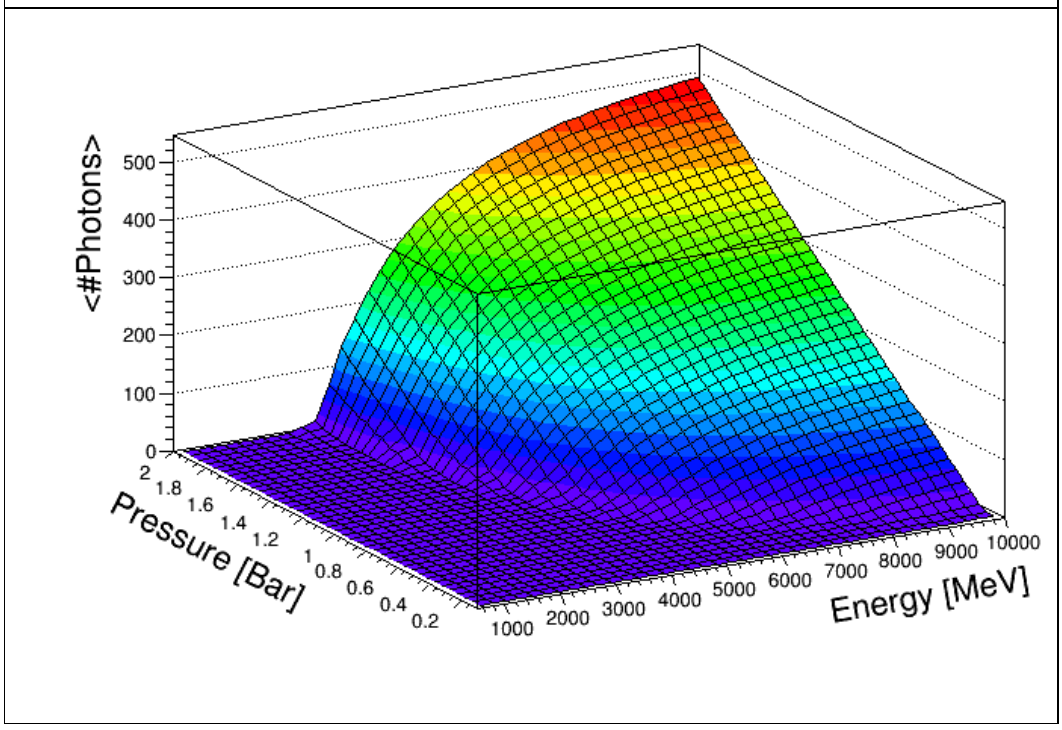
- Photon multiplicity of negative 5GeV particles in Nitrogen at 2bar:

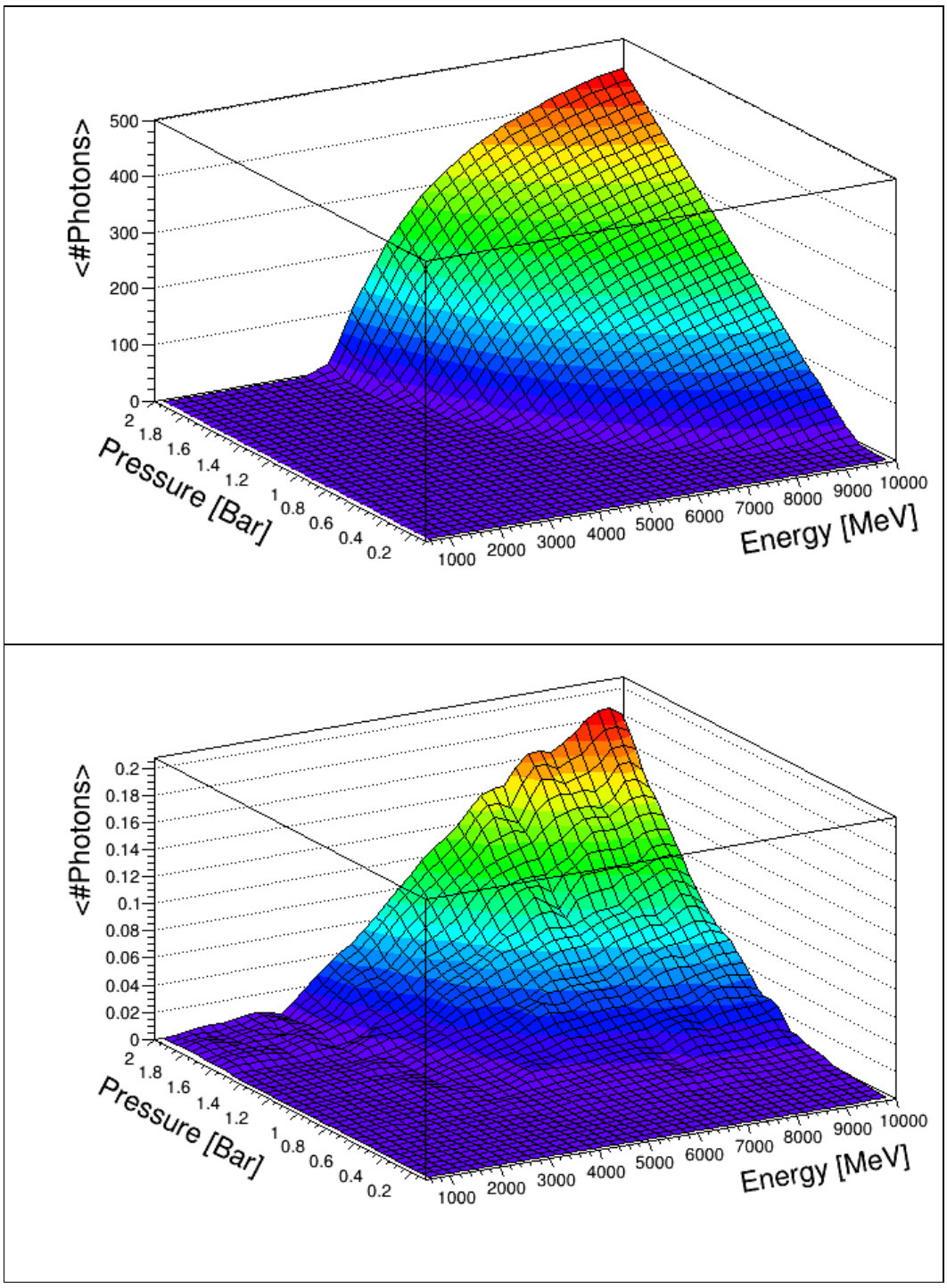


- Parameter scans of photon multiplicity with positive electrons, kaons, muons, pions and protons:

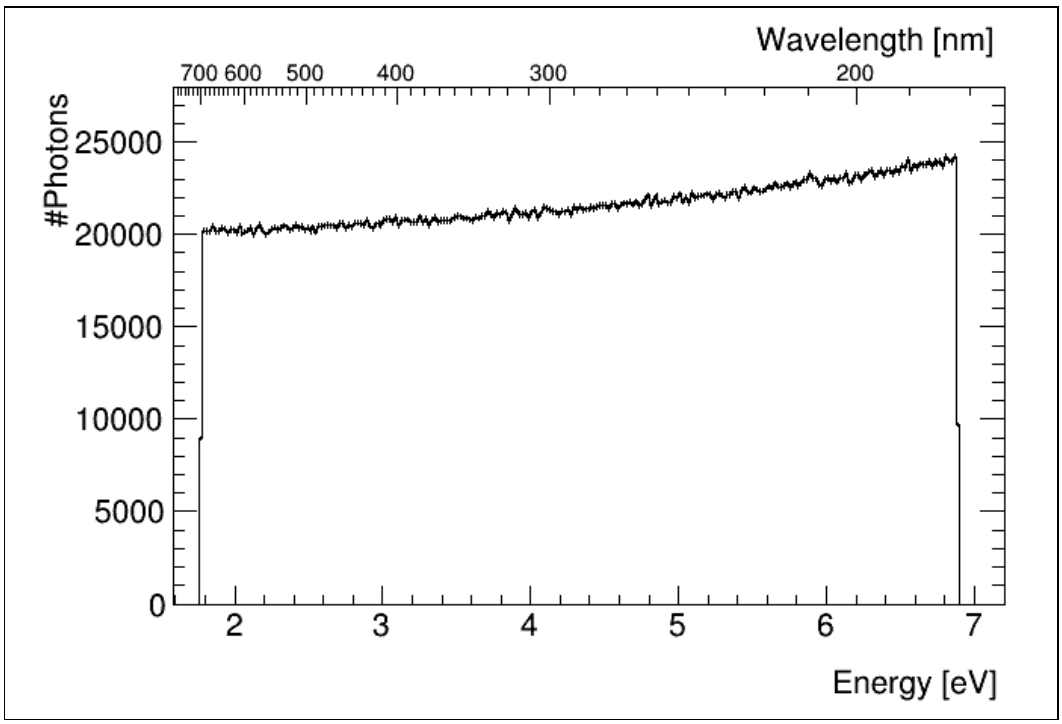



<#Photons>
0
1
2
3
4
5
Pressure [Bar]
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
Energy [MeV]
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

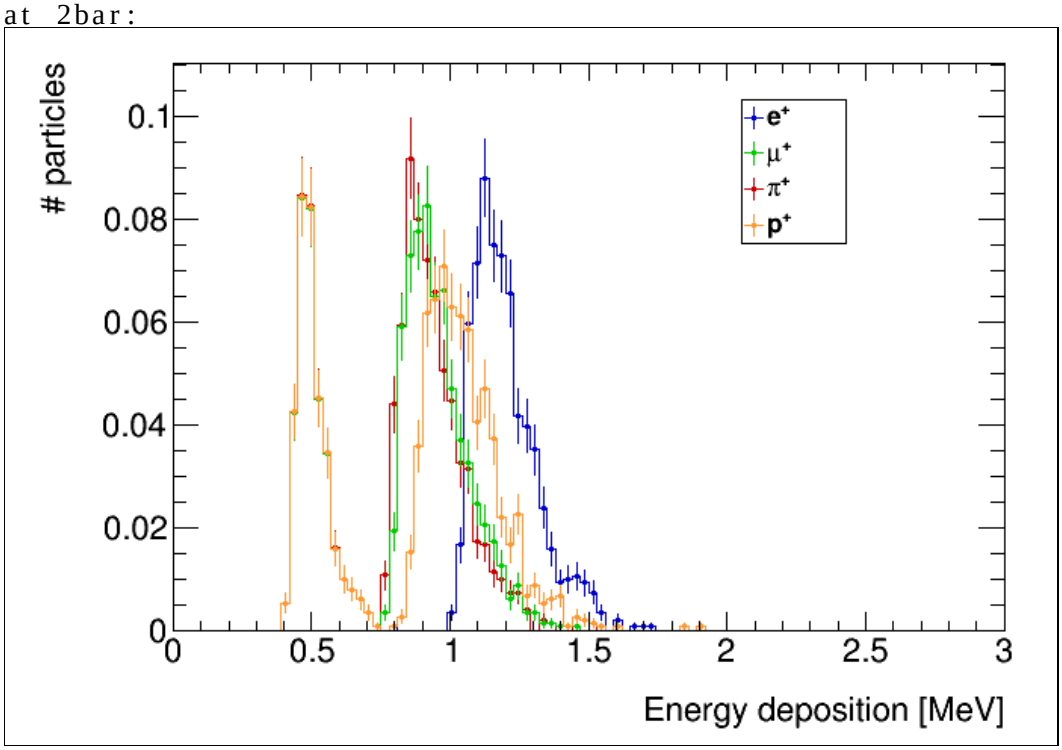

<#Photons>
0
100
200
300
400
500
Pressure [Bar]
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
Energy [MeV]
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

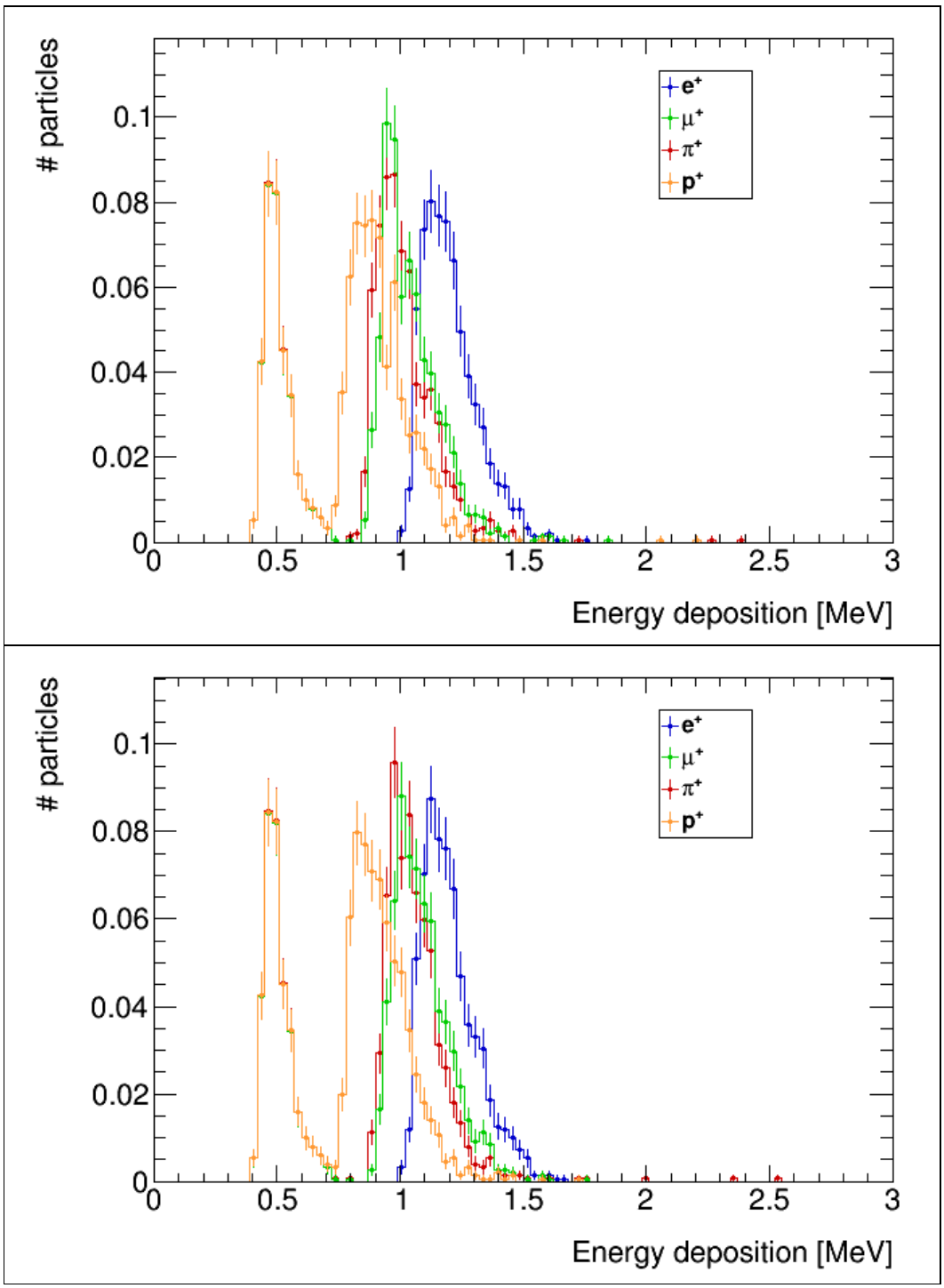


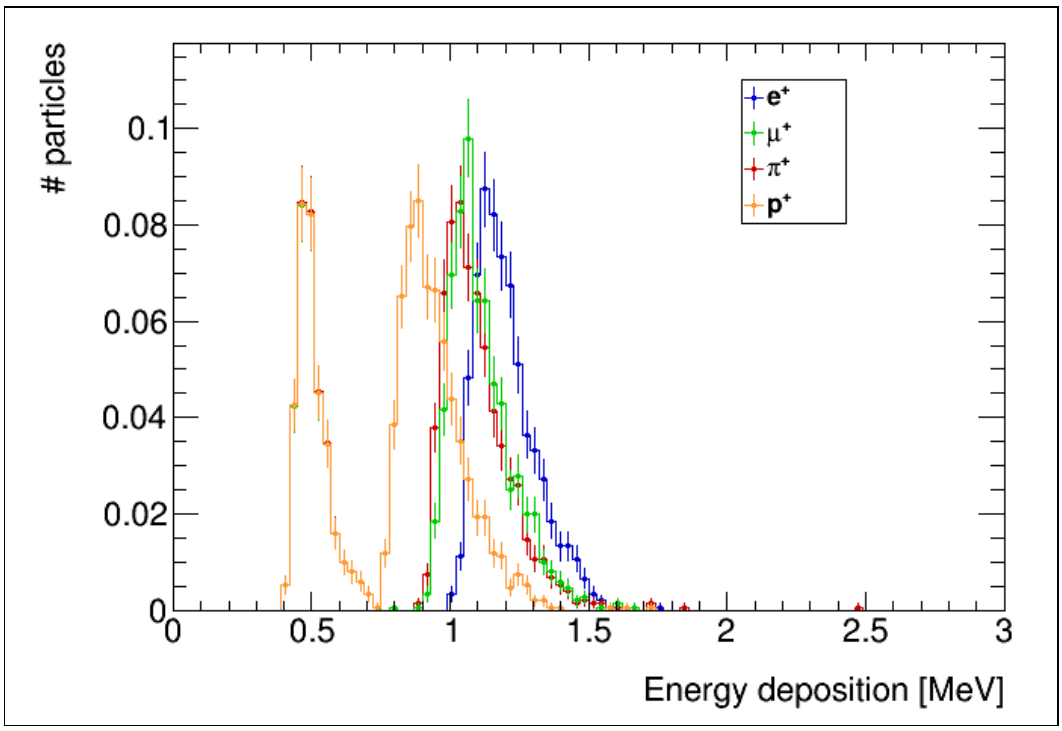
- Photon energy spectrum:



- Total energy loss of positive 1, 3, 5 and 7GeV particles in Nitrogen at 2bar:




particles
0.1
0.08
0.06
0.04
0.02
0
0
0.5
1
1.5
2
2.5
3
Energy deposition [MeV]
e+
μ+
π+
p+
particles
0.1
0.08
0.06
0.04
0.02
0
0
0.5
1
1.5
2
2.5
3
Energy deposition [MeV]
e+
μ+
π+
p+



-- TimBrooks - 2015-11-18

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