Exercise 1: Search for H -> gamma gamma

Instructions:

- **Introduction and setup**
  - We want to perform a search for H -> gamma gamma using the invariant diphoton mass.
  - The H -> gamma gamma channel has a tiny branching ratio (10^-3) but is very pure and has a great mass resolution due to the distinct signature of two photons with good energy resolution.
  - Untar `Ex1.tar`, you will find three files `PseudoData_Histogram_100fb.root`, `Signal_1fb.root` and `Background_1fb.root`
  - Advice: it might be a good idea to copy your sequence of successful commands into a macro as you go so you can re-run quickly in case root crashes
- **Plot the data**
  - `PseudoData_Histogram_100fb.root` is the data we have measured corresponding to 100 inverse fb
  - Inside the data file is a TH1D histogram called `signal`, which shows the invariant diphoton mass, plot it.

We have measured some data, let's read it in:

In [1]:

```
TFile *histoFile = new TFile("PseudoData_Histogram_100fb.root", "READ");
TH1D  *hData     = (TH1D*) histoFile -> Get("signal");
```

Let's see how many events we have in the data:

In [2]:

```
std::cout << hData -> Integral() << std::endl;
```

```
601683
```

Now we want to have a look at it, so lets plot it! We will need a canvas for this, which we already divided into two pads:

In [3]:

```
TCanvas *c = new TCanvas("c", "c", 600, 600);
TPad *pad1 = new TPad("pad1","main",  0, 0.3, 1, 1.0);
pad1->SetFillColor(0);
pad1->Draw();

TPad *pad2 = new TPad("pad2","ratio",  0, 0.05, 1, 0.3);
pad2->SetFillColor(0);
pad2->Draw();
pad1->cd();
```

Now we can plot our data and draw the canvas!

In [4]:

```
hData -> SetLineColor(kBlack);
hData -> SetMarkerColor(kBlack);
hData -> SetMarkerStyle(2);
hData -> SetMarkerSize(1.5);
hData->Draw();
c->Draw();
```