Waveform Analysis + Exclusive Pi0 Calibration (Preliminary Results for LH2 and LD2)
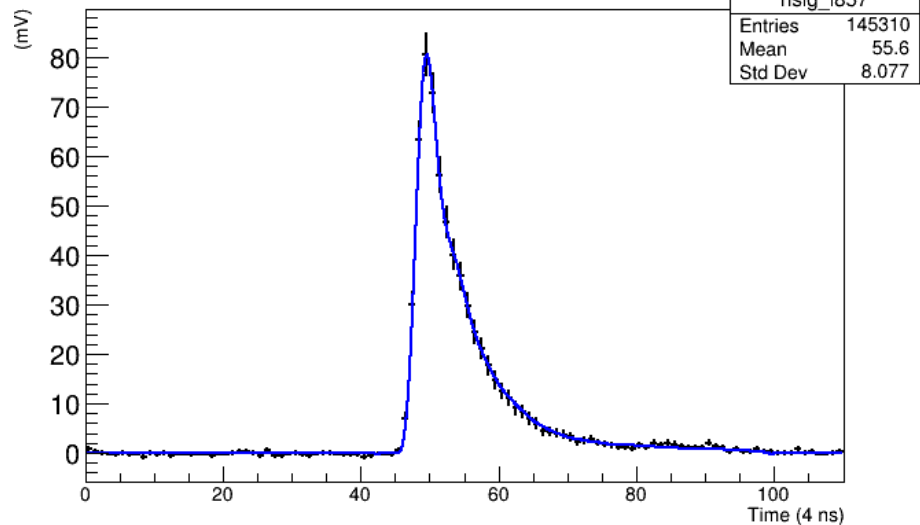
- Kinematics: **KinC_x60_3**

- 6 Runs for **LH2**: 2011, 2013, 2014, 2015, 2016 and 2017

- 4 Runs for **LD2**: 1990, 1991, 1992 and 1993

- Removed **the edge blocks** and the **5 first columns** shaded by the magnet

- Only the **basic** HMS cuts : (|dp|<8% & |ph|<0.04 & |th|<0.08 & |react.z|<4)
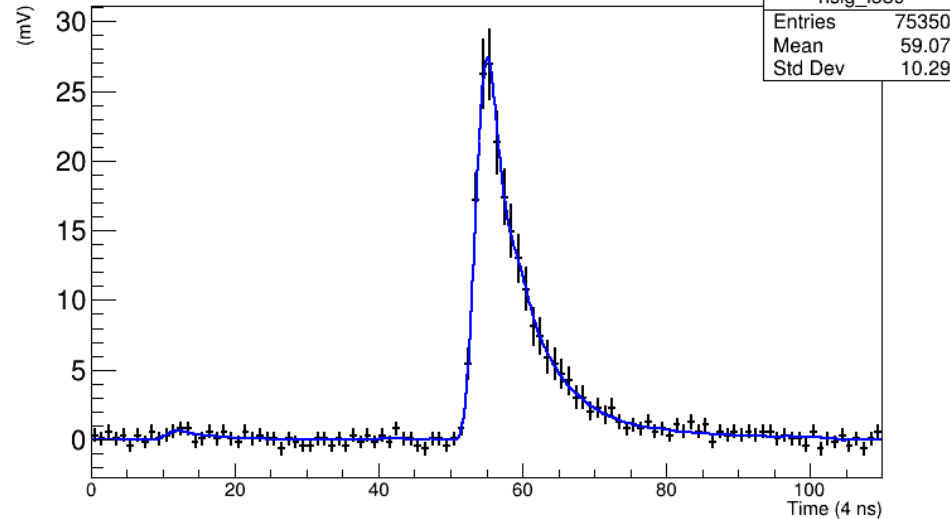
- Shower development correction factor

WAVEFORM FIT

LH2 : RUN 2016

LD2 : RUN 1992
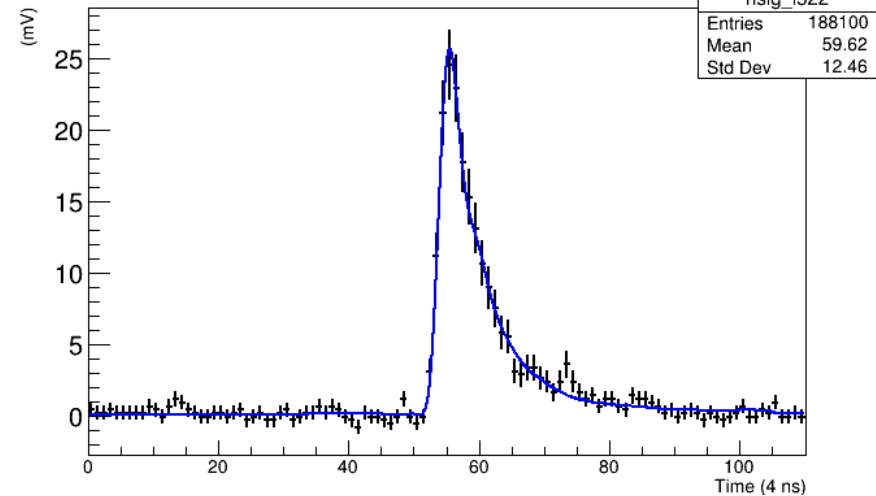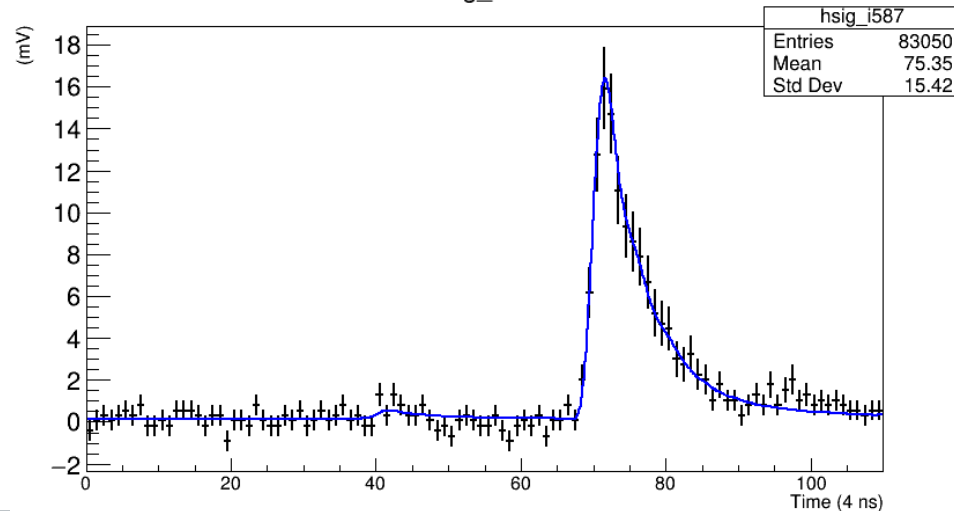
Technical notes

Major issue:

- Takes time to perform the WF analysis for a single run or even a single segment (takes almost **3 days** for just 1M events!)

Solution: **1** run ==> **n** segments ==> **m** jobs per segment

- Divided the segments to **1k** jobs ==>> Each job will take roughly **10 mins**

- Divided the segments to **10k** jobs ==>> Each job will take less than **2 hours**

- Divided the segments to **100k** jobs ==>> Each job will take roughly **16 hours**
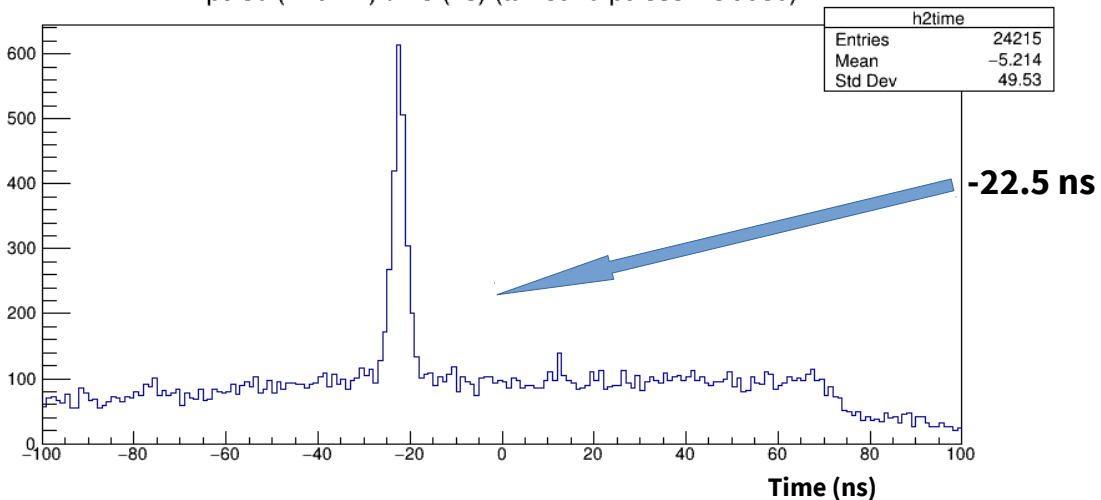
==>> **Used the 10k jobs**

Jobs requirements:

- **2 GB** per job as a volatile Memory is enough (mean used per job is **600 MB**)

TIME RESOLUTION STUDY

LD2 RUN (1992)

-22.5 ns

(with respect to the arrival time of the elastic reference waveform)

LH2 RUN (2013)

LH2 RUN (2016)

-10.25 ns

Didn't find any indication of a change in the spreadsheet or the logbook!

4
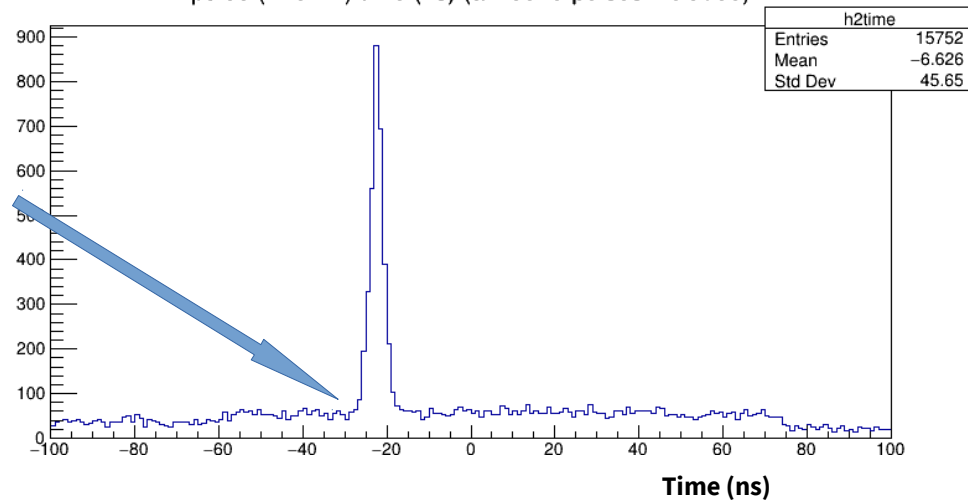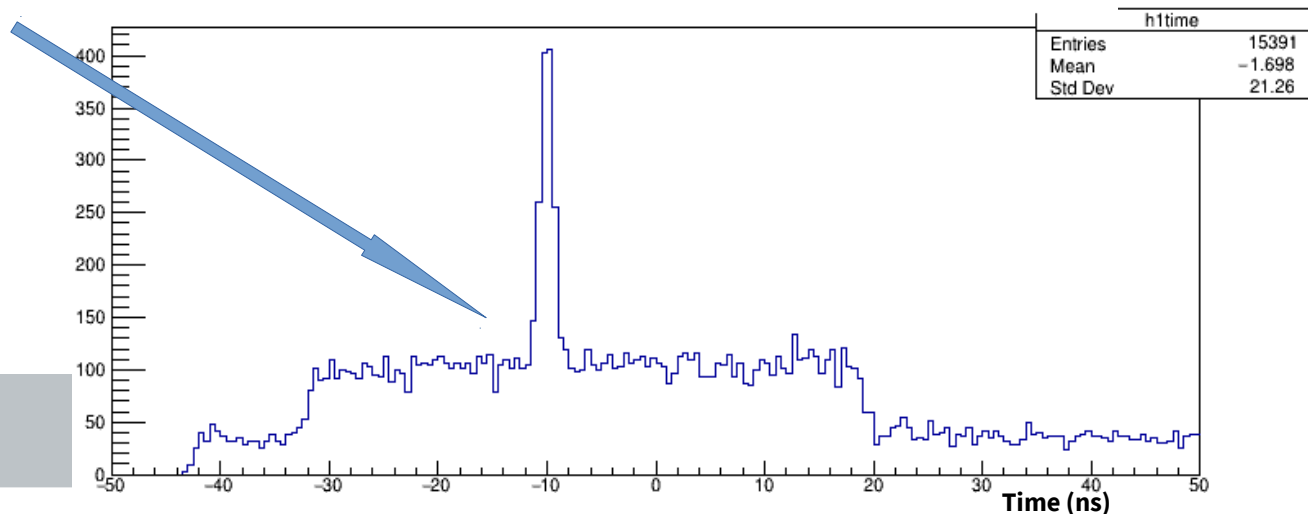
TIME RESOLUTION STUDY

LD2 +LH2 RUNS COMBINED

2 middle columns blocks

Pulse time

0.58 ns
resolution

htime619	
Entries	17007
Mean	−22.33
Std Dev	8.529
χ^2 / ndf	268.5 / 35
p0	−21.42 ± 0.01
p1	0.5851 ± 0.0049
p2	1923 ± 8.5
p3	166.5 ± 3.1

Pulse time

0.60 ns
resolution

htime701	
Entries	24646
Mean	−22.89
Std Dev	9.21
χ^2 / ndf	271.5 / 35
p0	−22.24 ± 0.01
p1	0.6051 ± 0.0047
p2	2088 ± 4.4
p3	270.9 ± 4.0

LD2+LH2 RUNS COMBINED
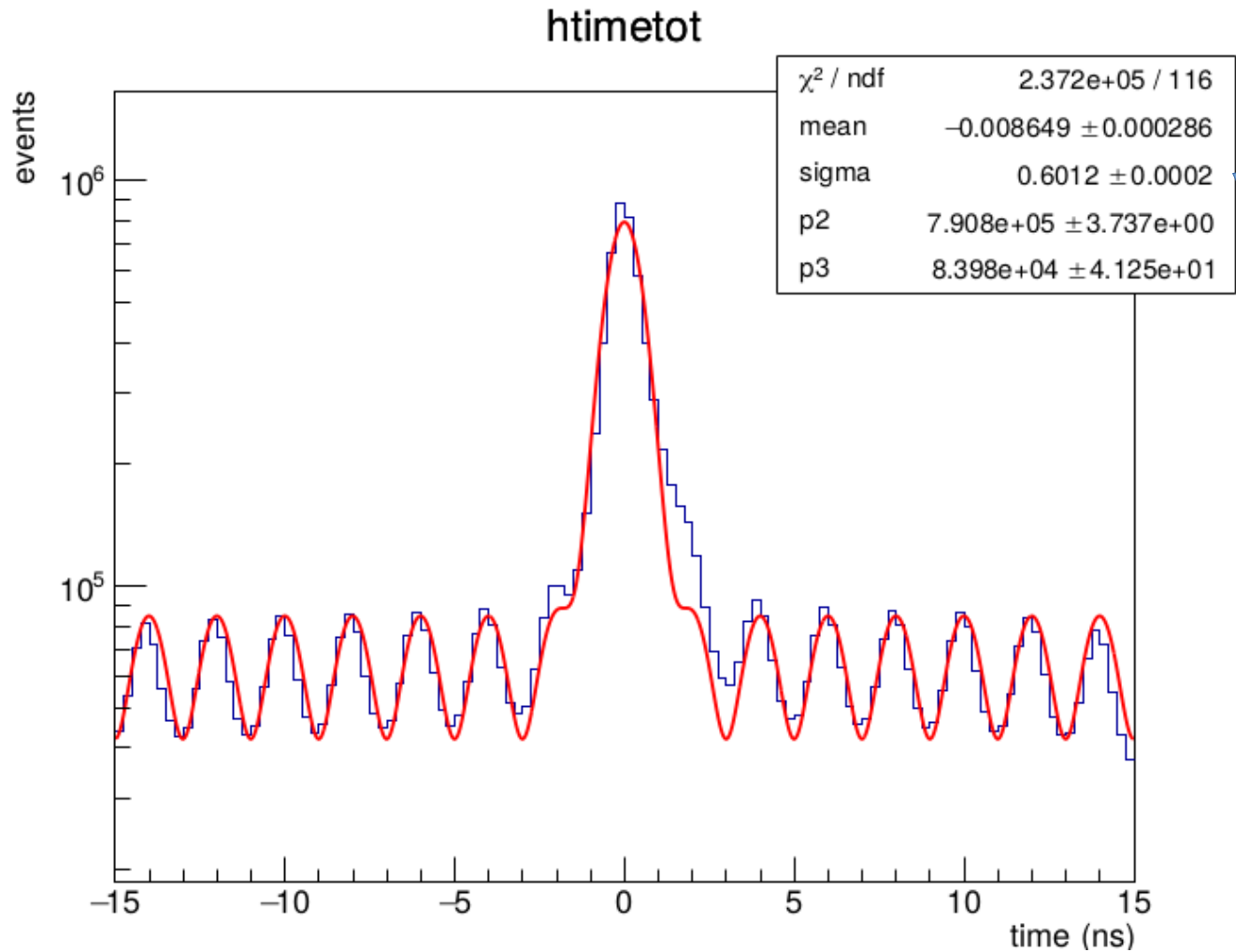
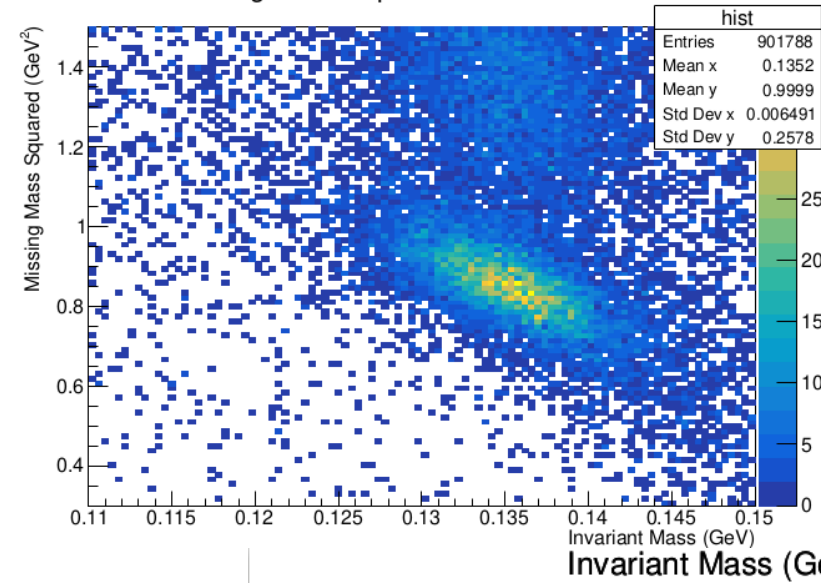

0.6 ns resolution

EXCLUSIVE Pi0 CALIBRATION

Exclusive events selection

2D cut
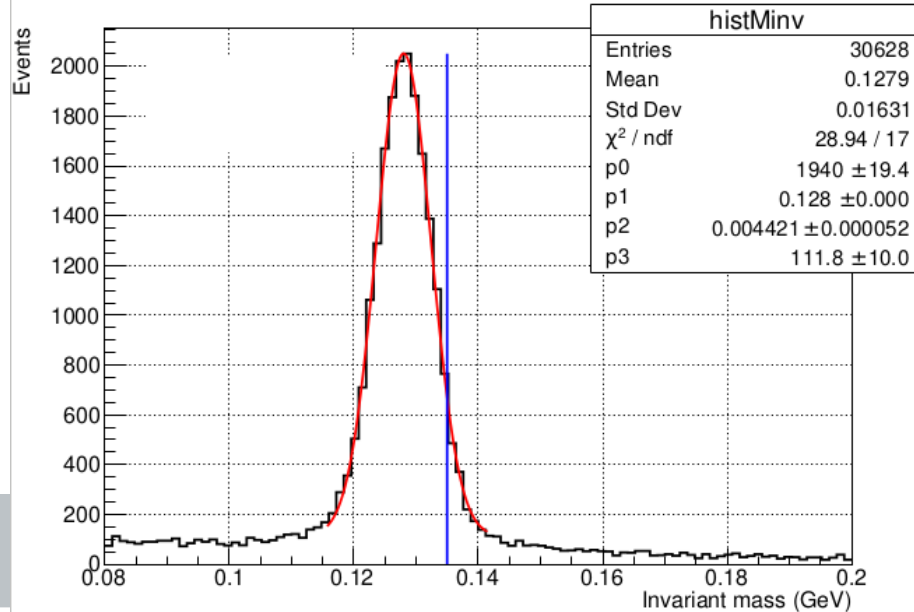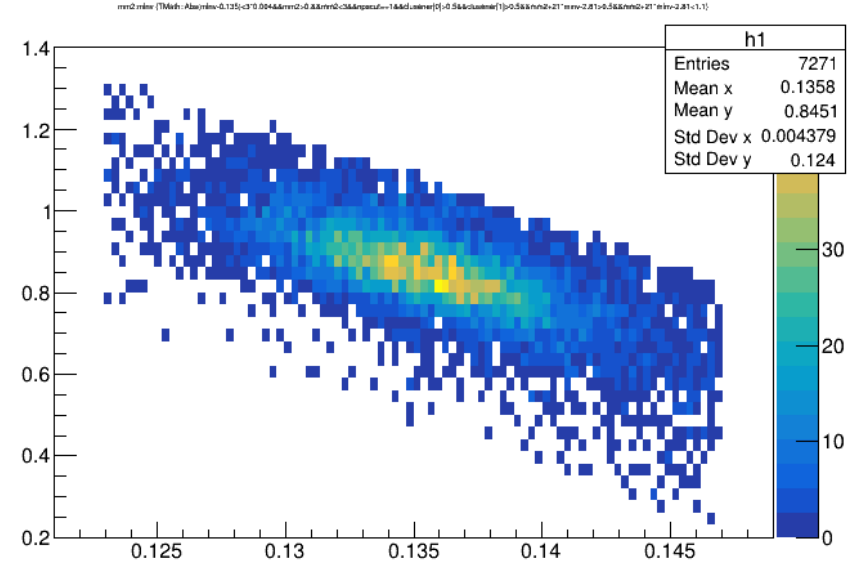
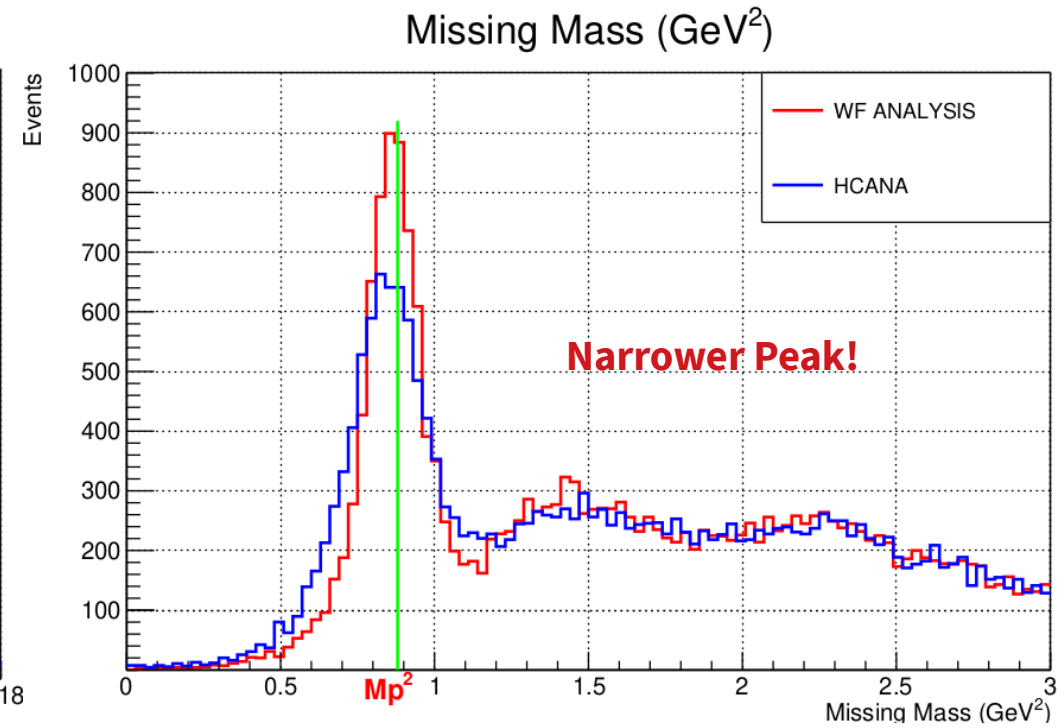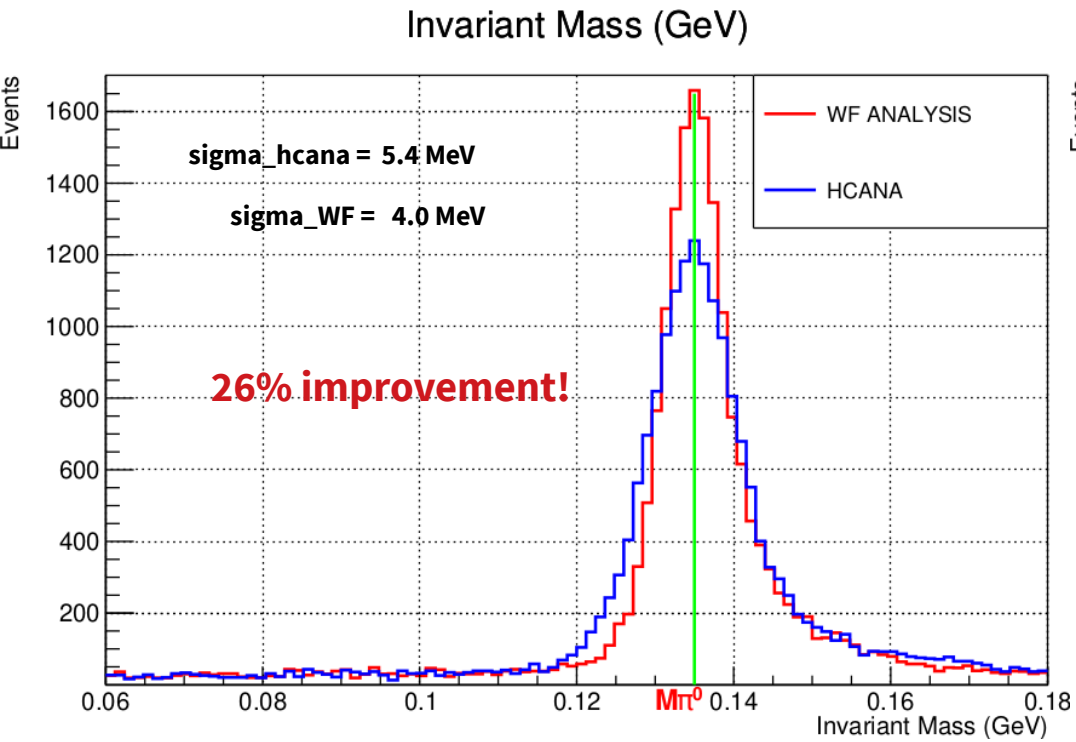**After the waveform analysis of the elastic runs**
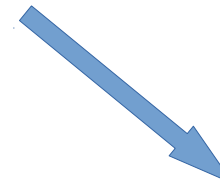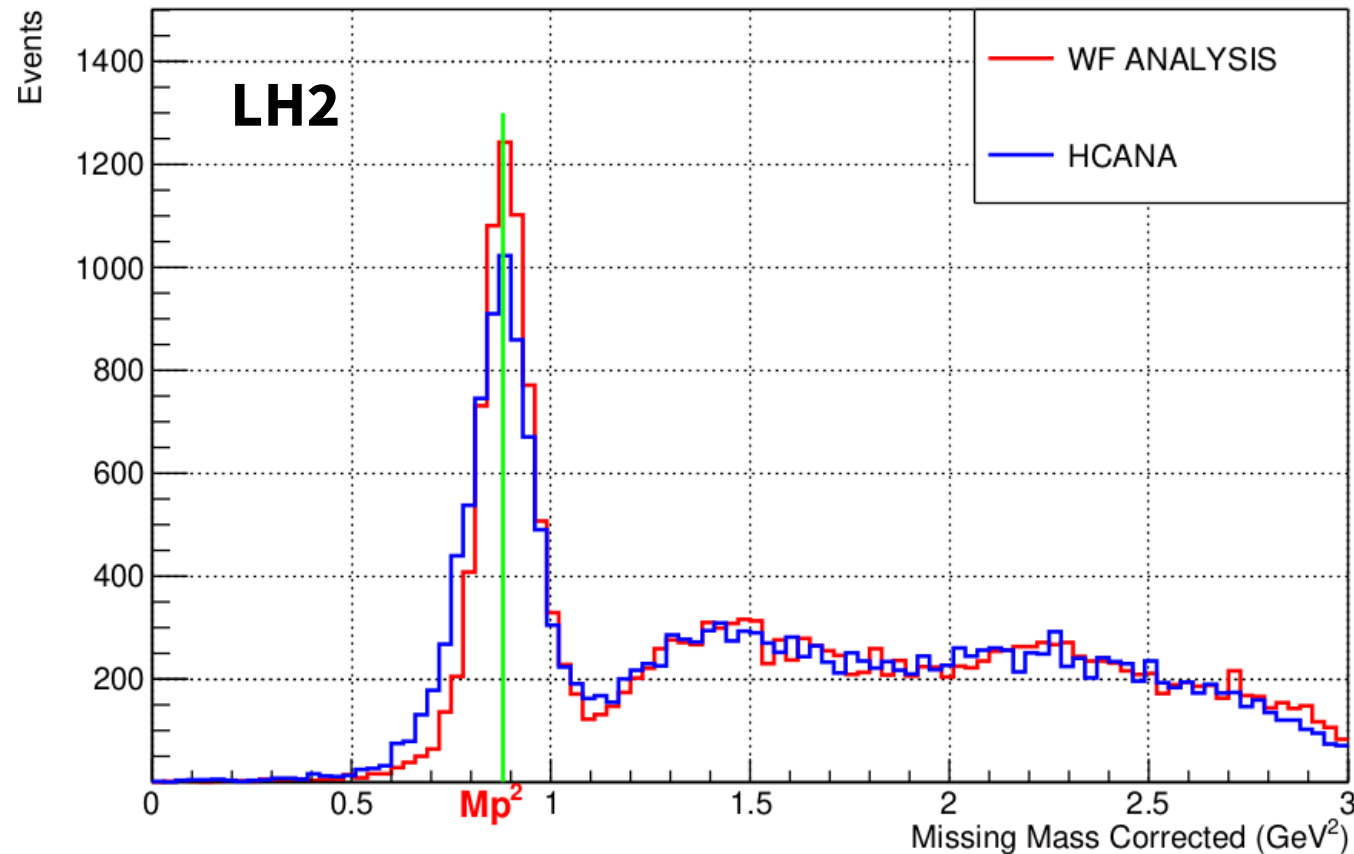
Pi0 calibration needed

EXCLUSIVE Pi0 CALIBRATION

LH2 RUNS

EXCLUSIVE Pi0 CALIBRATION

Corrected Missing Mass (GeV^2)

- **Used the following relationship for the corrected missing mass :**

  mm2+a*minv-b

  - **WF Analysis:**

  a= 21 and b = 2.81
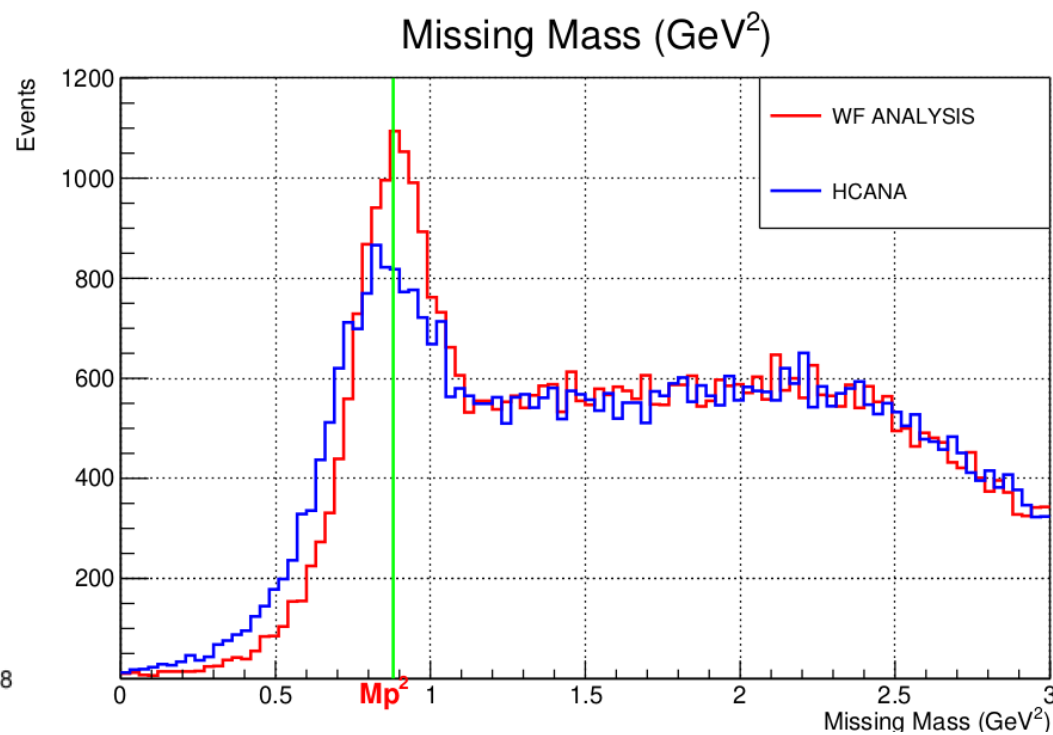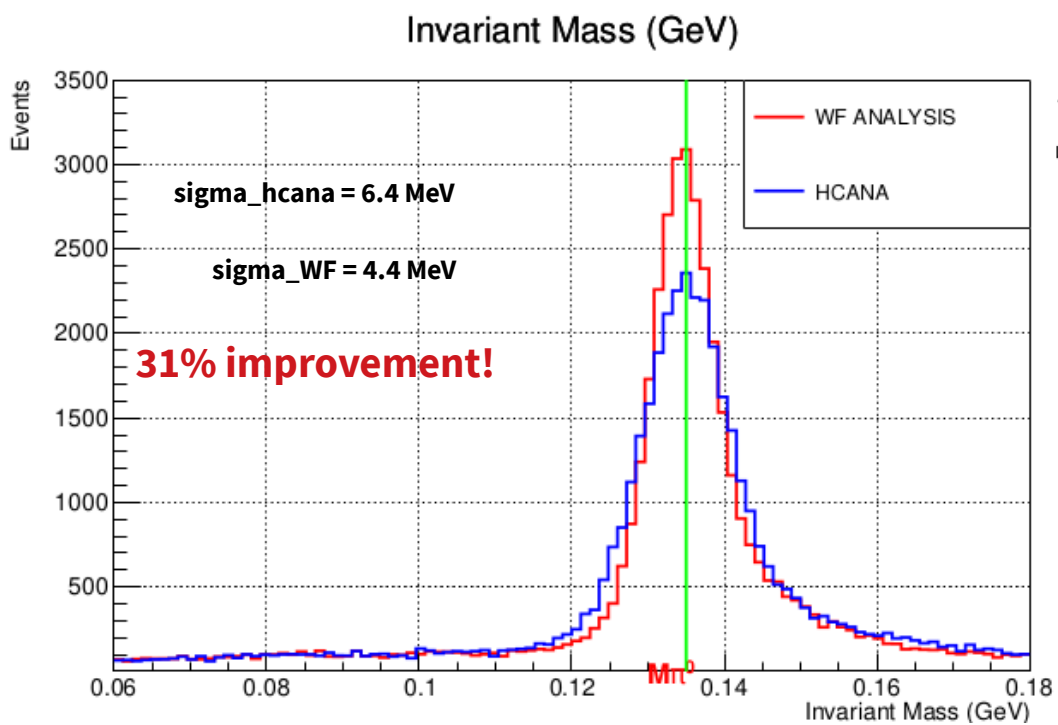
  - **Hcana:**
  a= 23 and b = 3.07

  - **Values used before the last iteration (three iterations in total)**
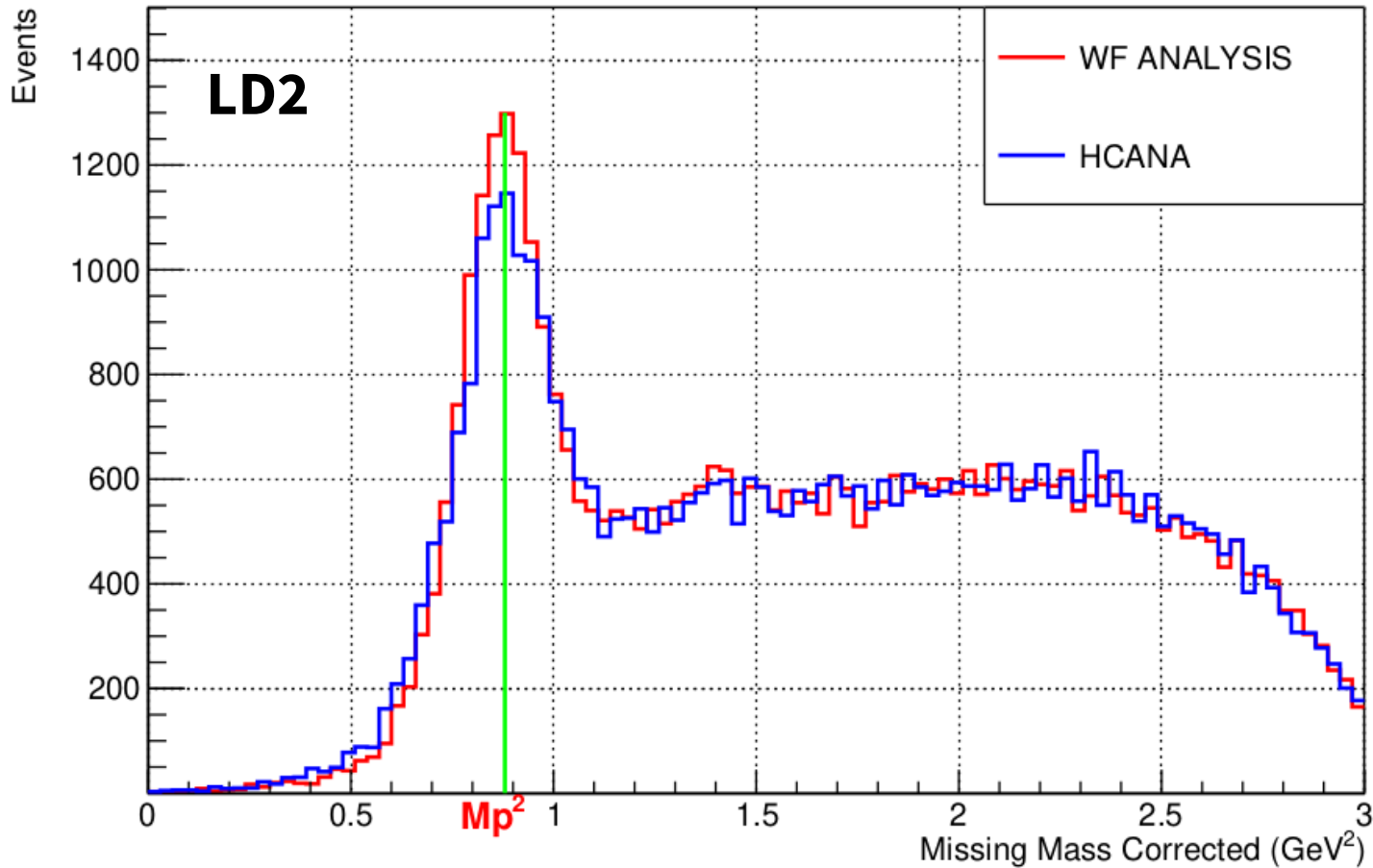
EXCLUSIVE Pi0 CALIBRATION

LD2 RUNS

EXCLUSIVE Pi0 CALIBRATION

Corrected Missing Mass (GeV^2)

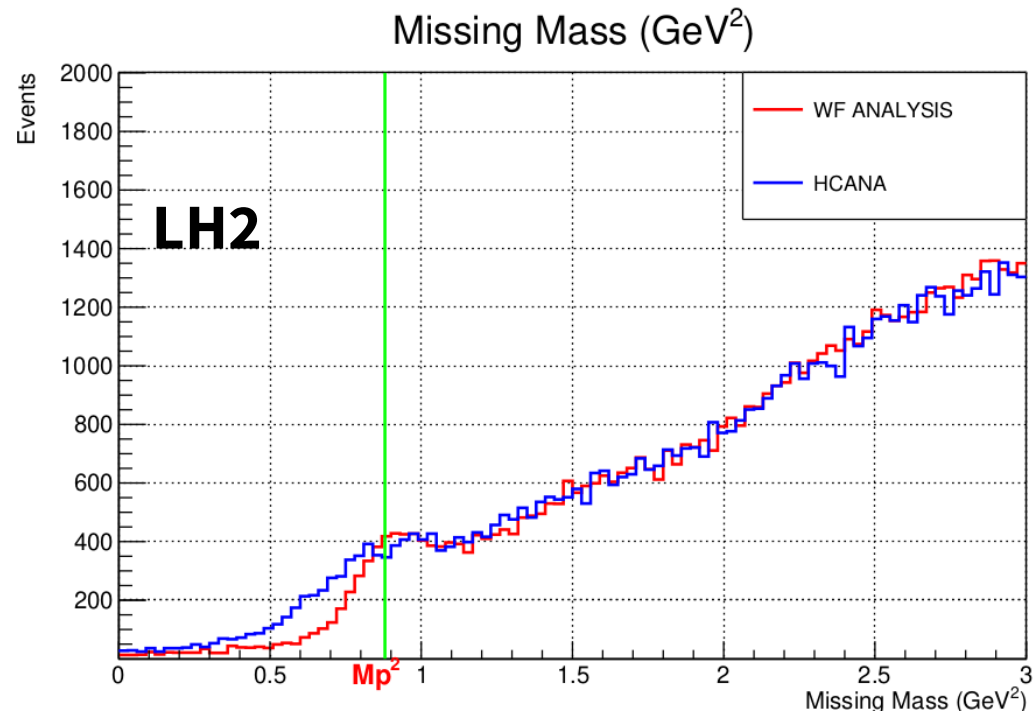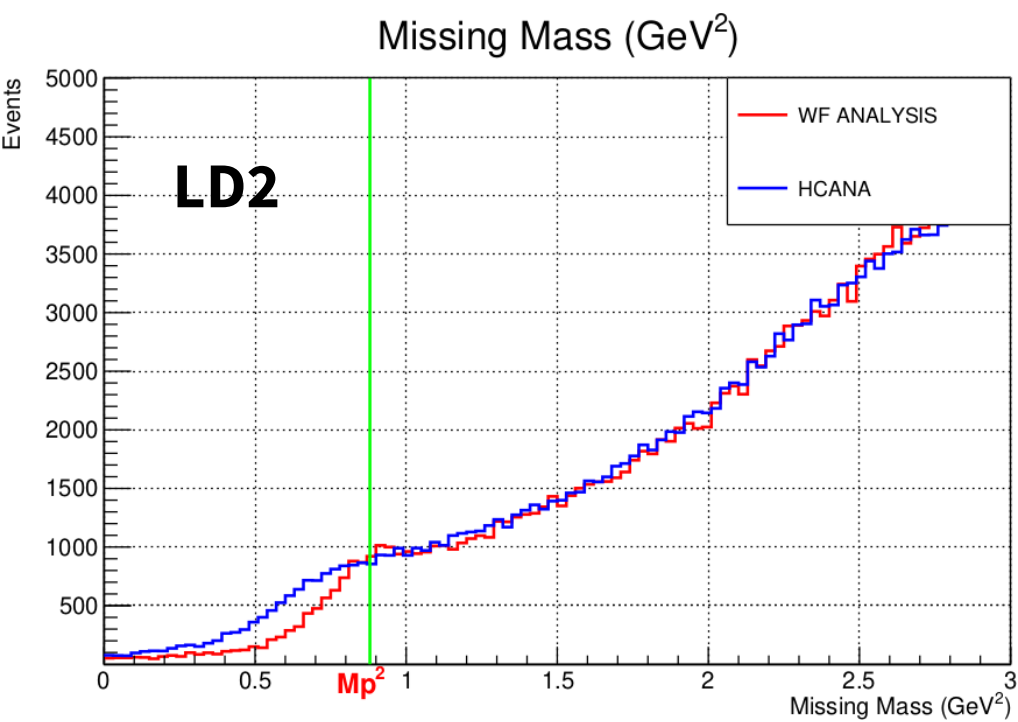- **Used the following relationship for the corrected missing mass :**

  mm2+a*minv-b

- **Hcana**
  a= 22 and b = 2.94

- **WF Analysis**
  a= 20 and b = 2.7

DVCS MISSING MASS

A noticeable improvement especially in LH2

UPCOMING STEPS

- **Apply the non linearity correction (1%)**

- **Apply a more sophisticated Pi0 calibration method**

- **DVCS missing mass with Pi0+ accidentals subtraction**

- **Results on different kinematics**