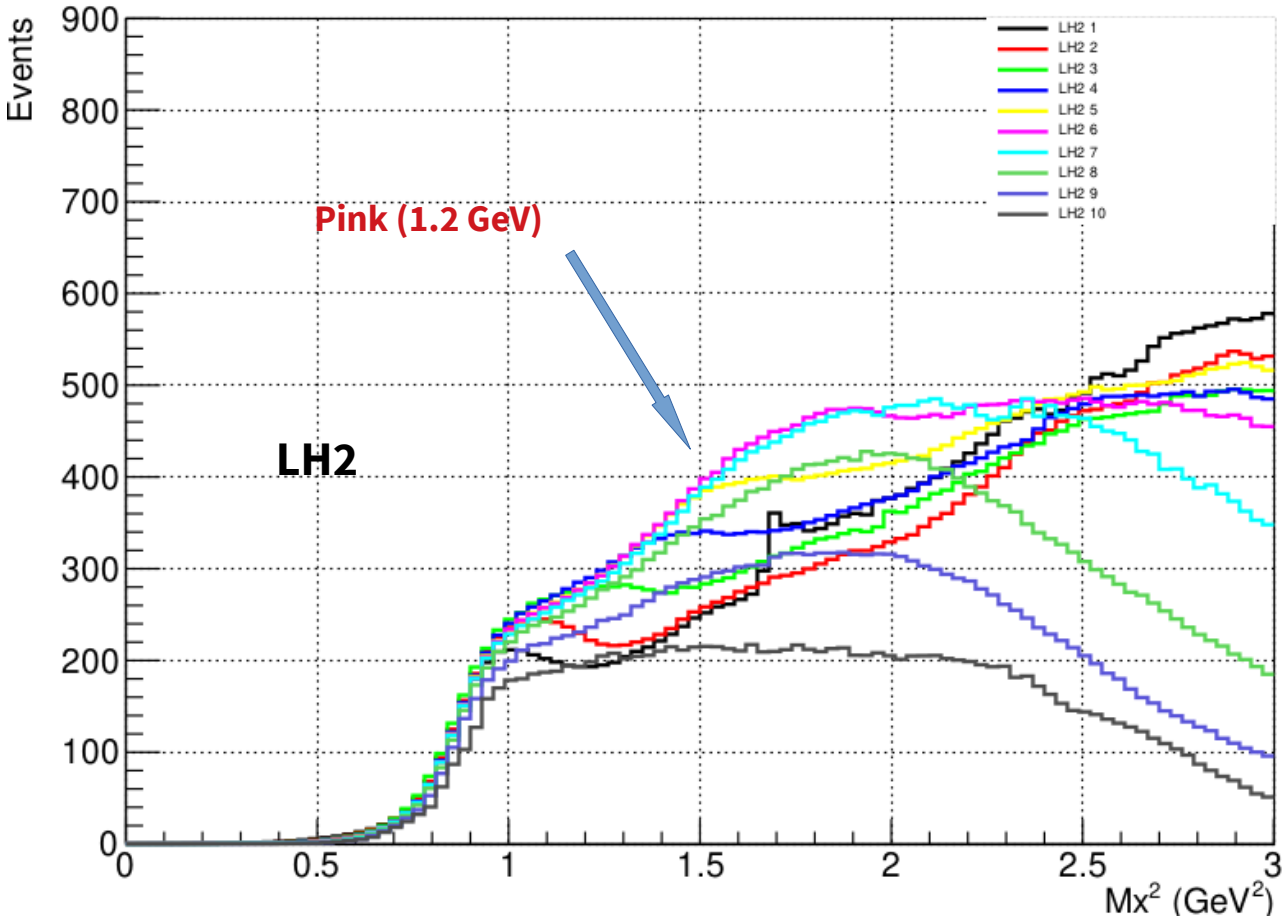
DVCS PRELIMINARY ANALYSIS RESULTS

- 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 edges (2blocks)** 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

Pi0 Contamination
(LH2 TARGET)

Threshold Study

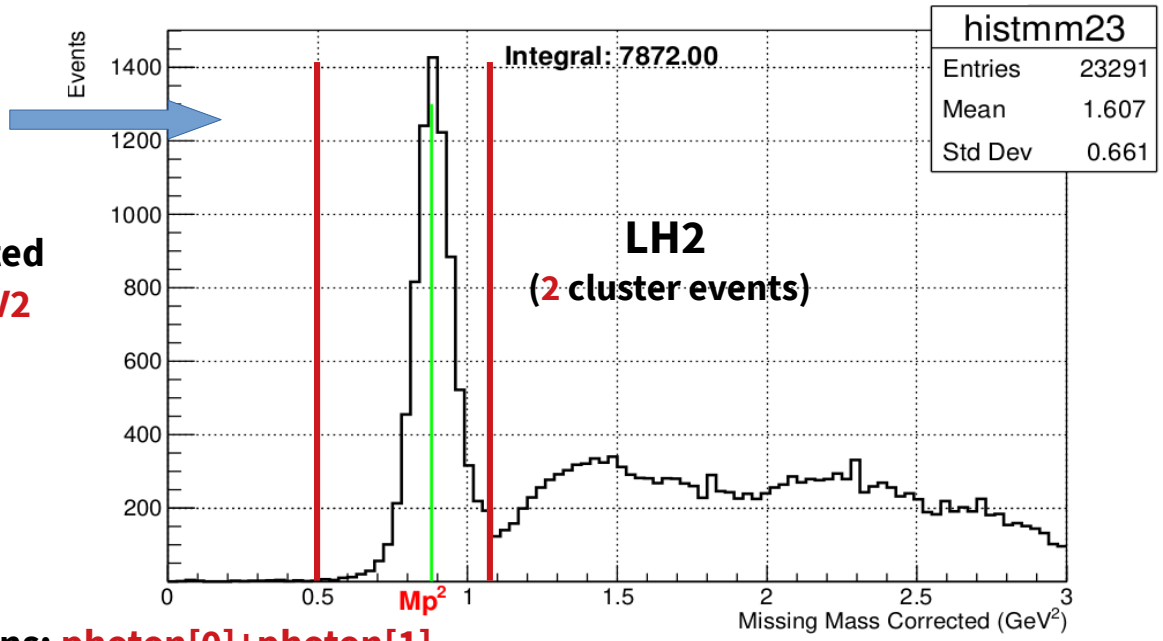


- Used 5000 randomized decays for each pi0 detected in the calormieter
- Pair trigger threshold 0.75 GeV
- From 0.2 GeV (Plot in black) to 2 GeV (Plot in gray)
- Step of 0.2 GeV
- Chose the contribution with 1.2 GeV (Pink Plot) threshold since it's more stable between 0.5 GeV2 and 1.5 GeV2

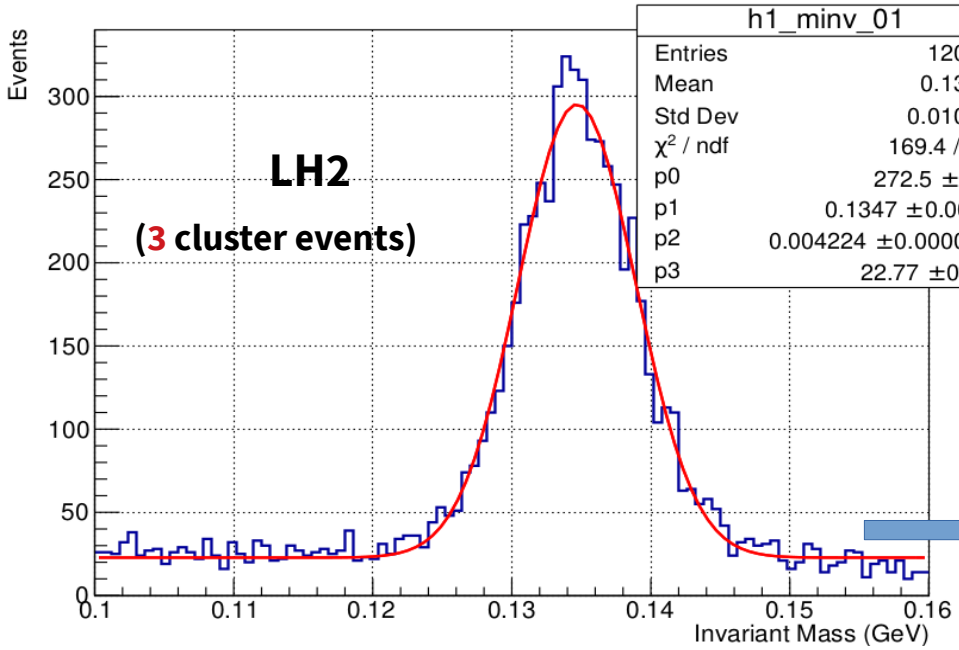
- Calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for the case of 2 clusters events
  ==> 7872 events

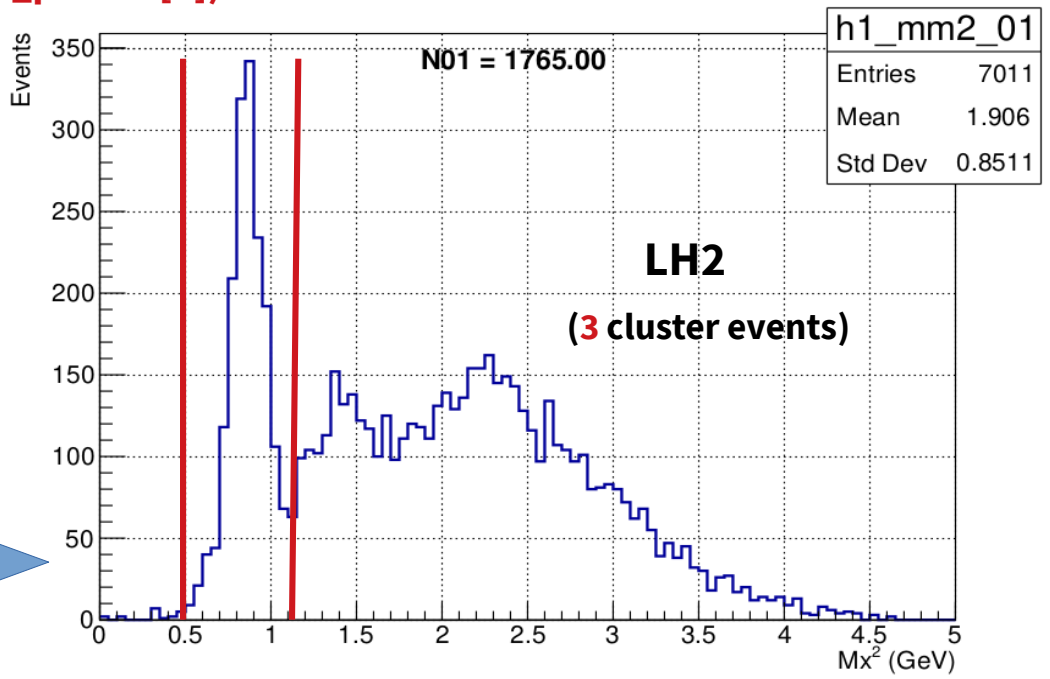
- Did a study for the case of 3 clusters and calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for 3 combinations with the 3 photons:

  - Found 1882 events!(all combinations)
  - 23.9% exclusive pi0 events missed!



One of the combinations: photon[0]+photon[1]
(E_photon[0]>E_photon[1]>E_photon[2])





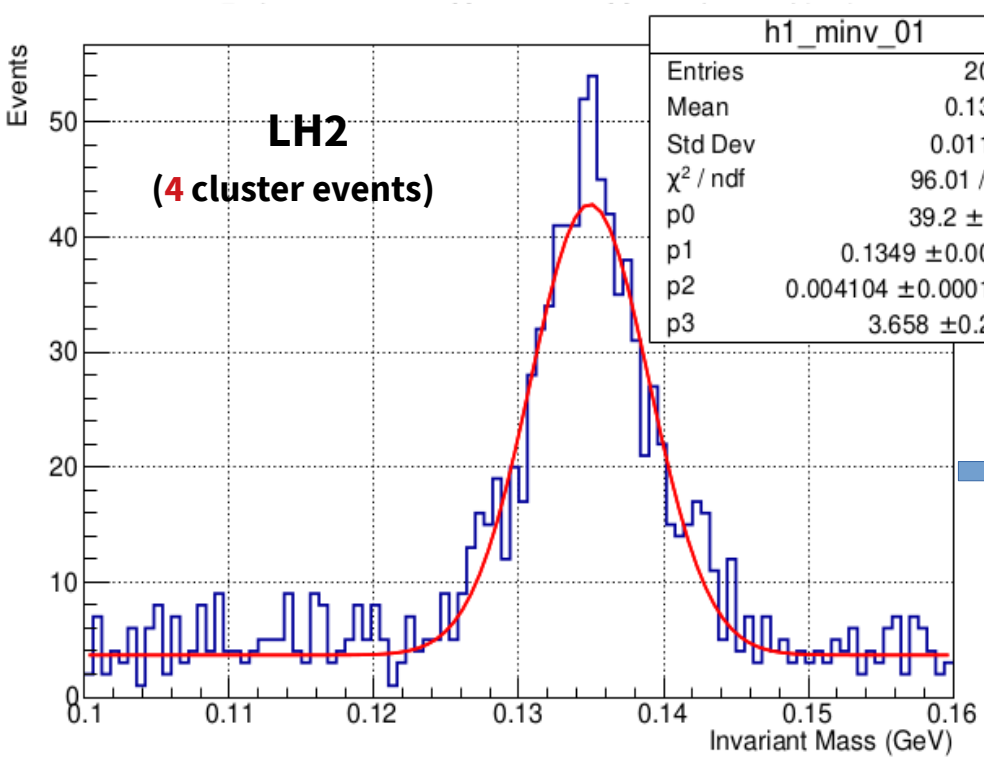
- **Did a study for the case of 4 clusters and calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for 6 combinations with the 4 photons:**

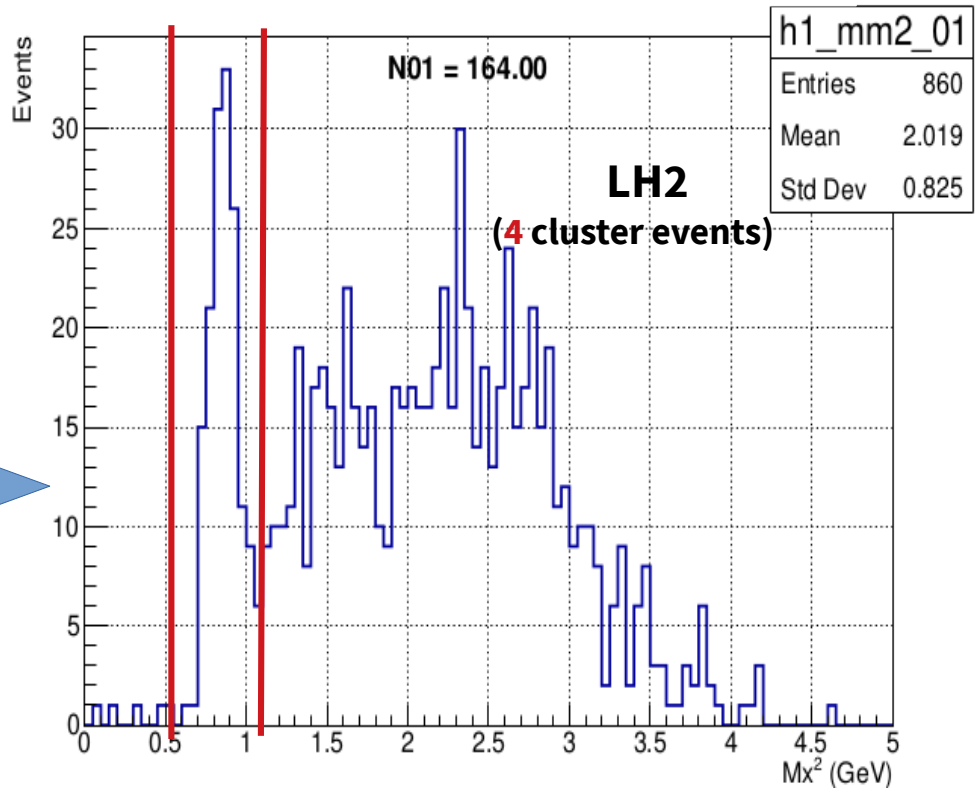
- Found 282 events!(all combinations)

- 3.6% exclusive pi0 events missed!

One of the combinations: photon[0]+photon[1]

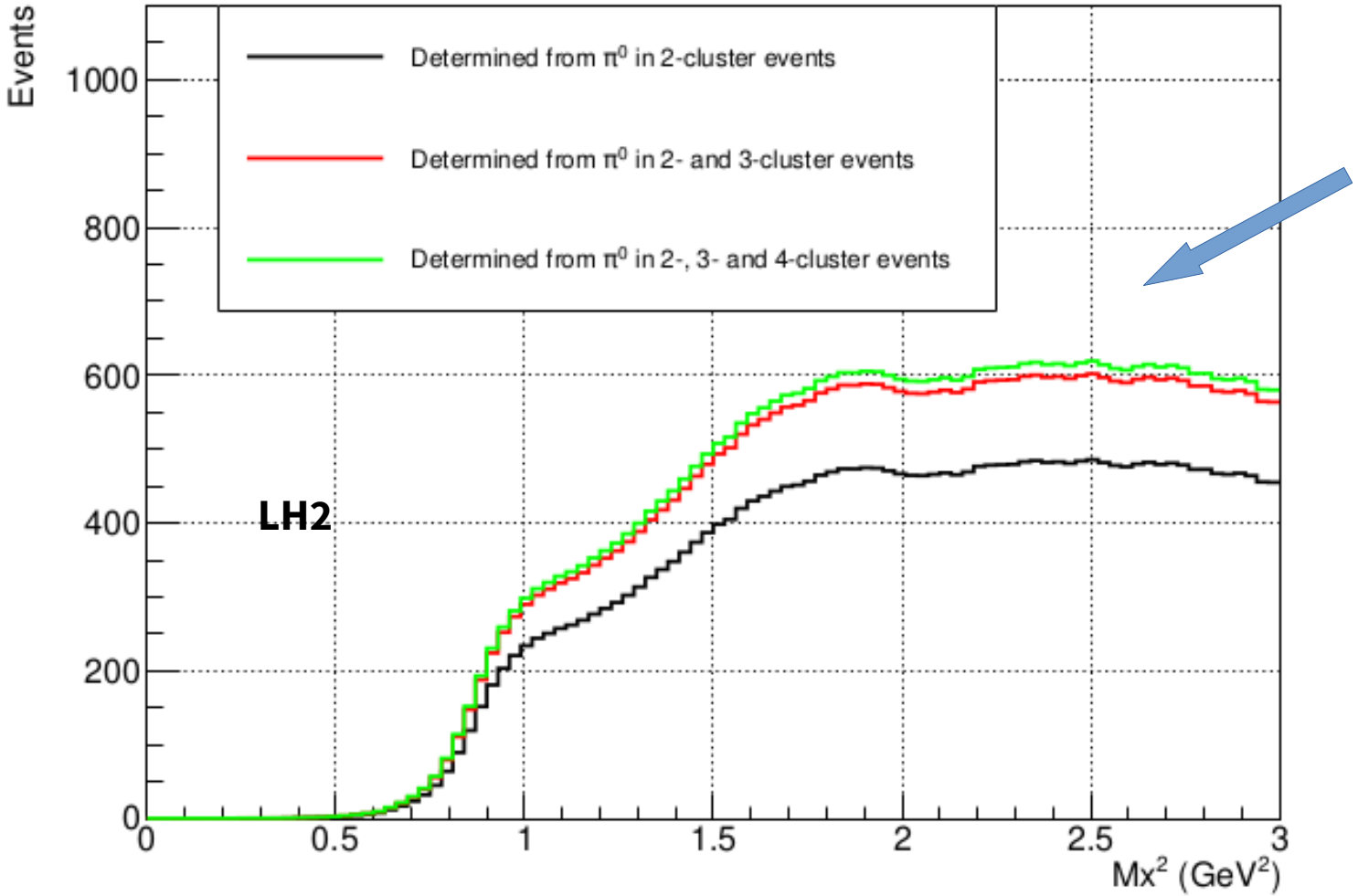
(E_photon[0]>E_photon[1]>E_photon[2]>E_photon[3])





Missed 27.5% exclusive pi0 events in total!! (3 and 4 clusters)

Pi0 Contamination
(LH2 TARGET)



The green plot is the final plot that will be subtracted from the raw DVCS missing mass squared

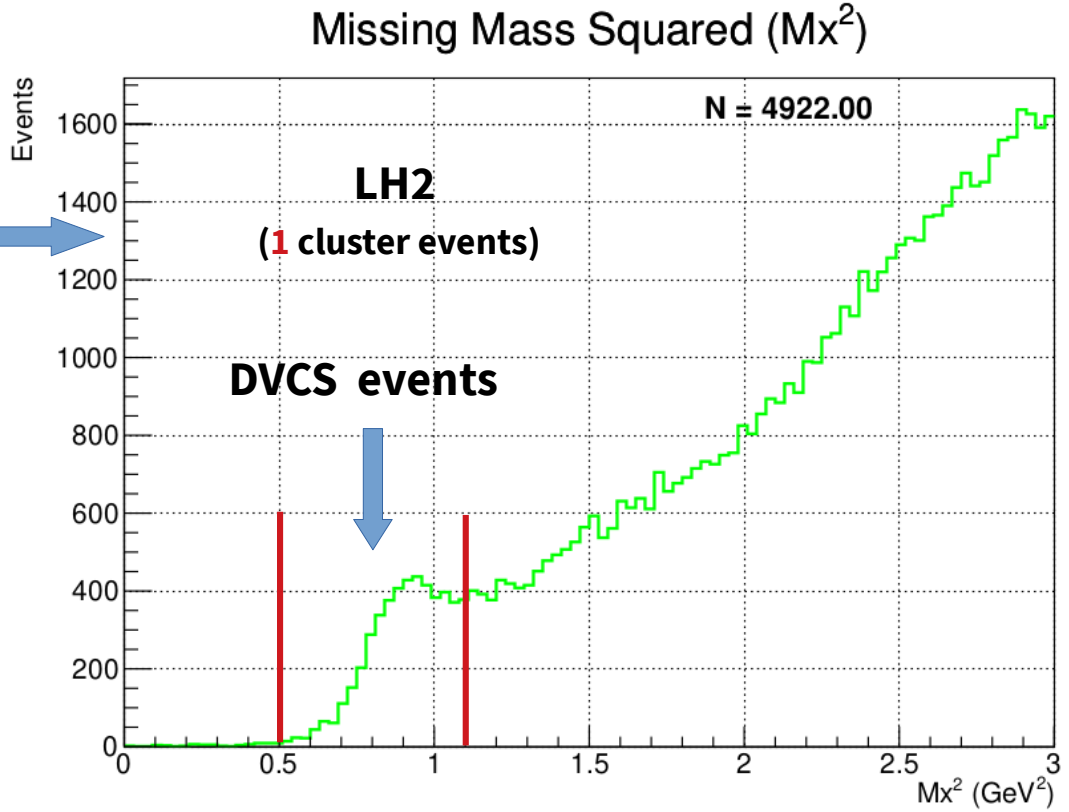
DVCS YIELD STUDY

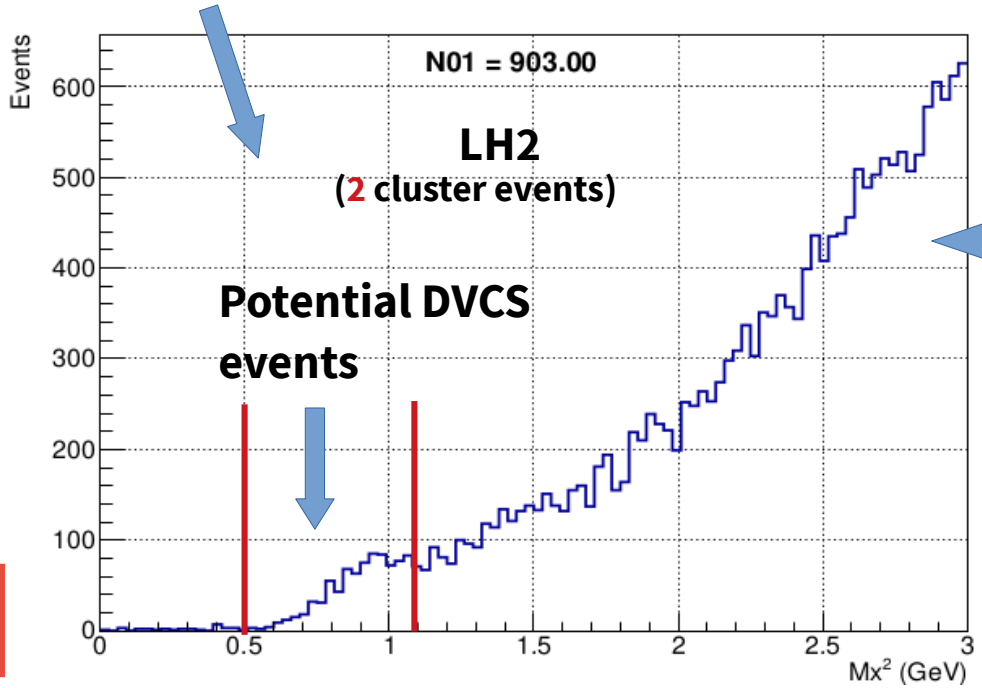
- Calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2 for the case of 1 cluster events ==> 4922 events

- Did a study for the case of 2 clusters and calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2:

  - Found 903 events!
  - 18.3% DVCS events missed!

- This histogram is added to the previous 1-cluster Mx2 raw spectrum





- Each cluster in a multi-cluster event is systematically considered as a potential DVCS event if it does not originate from a pi0 decay (the invariant mass of that photon when combined with another photon is different from the mass of the pion)

- Did a study for the case of 3 clusters and calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2 for 3 combinations with the 3 photons:

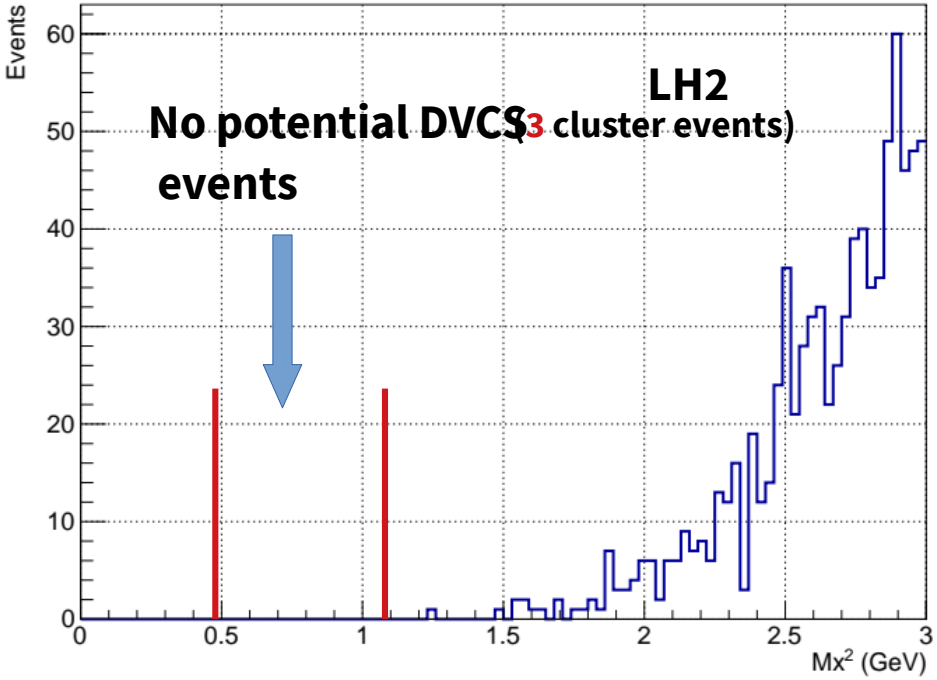
  - Found 158 events!(all combinations)
  - 3.2% DVCS exclusive events missed!

- If no events in the exclusive region are found, the contribution in the histogram is NOT added to the previous 1-cluster Mx2 spectrum

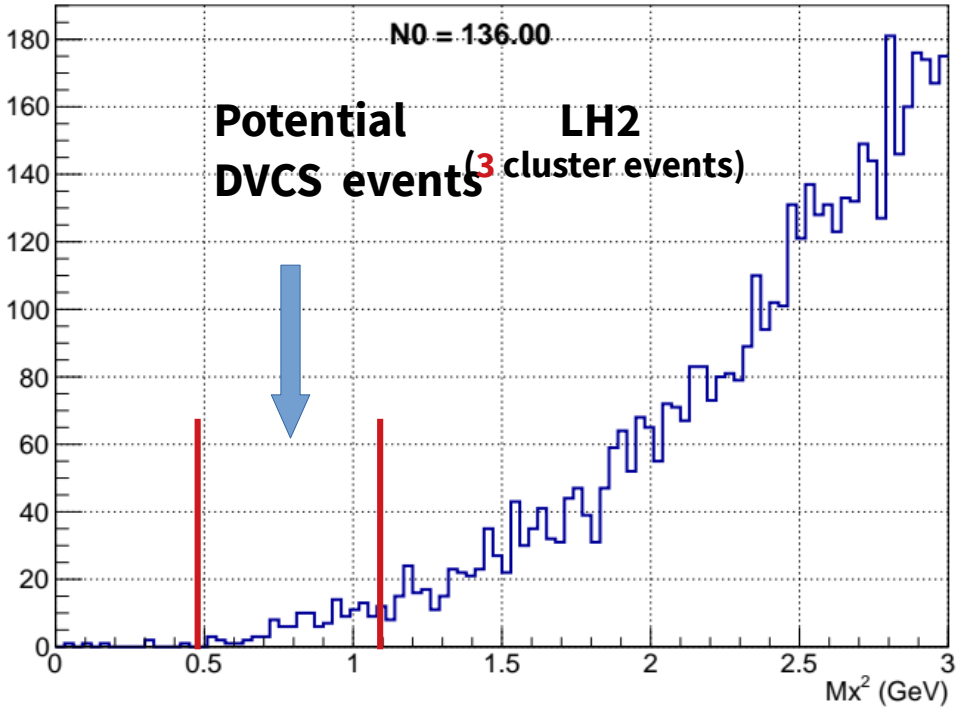
Contribution

(E_photon[0]>E_photon[1])

Photon[1]

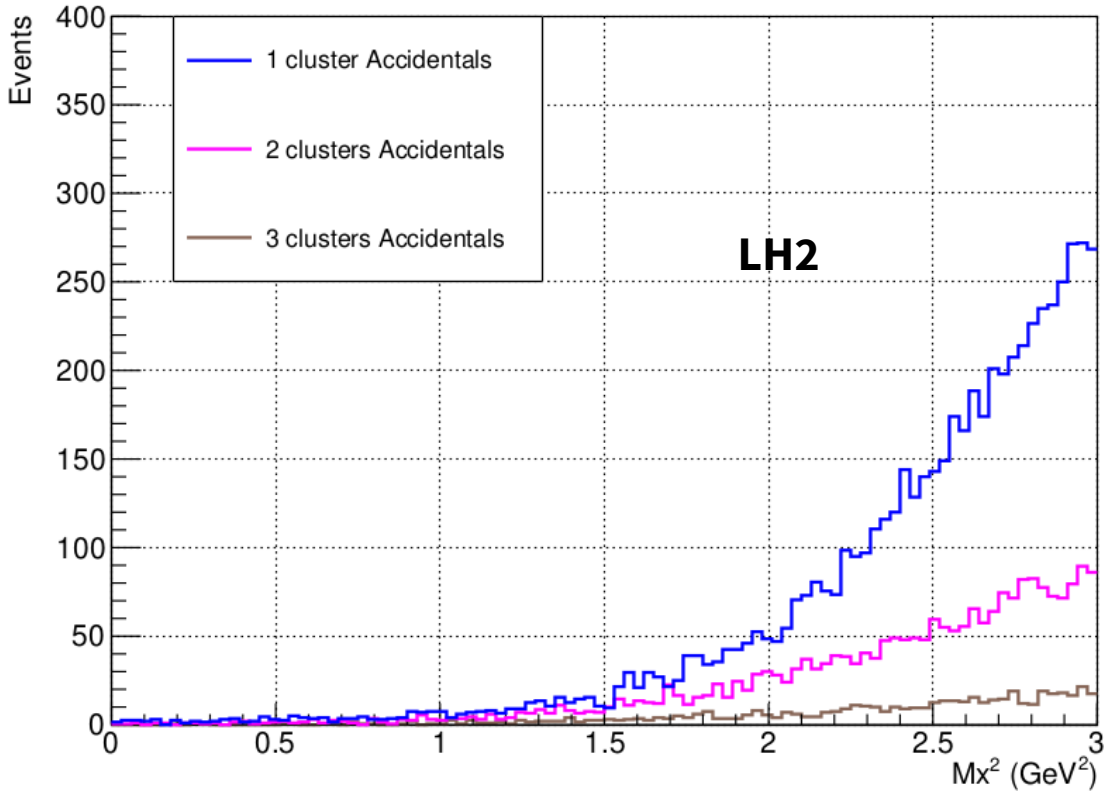


Photon[0]



→ Missed 21.5% exclusive events in total!! (2 and 3 clusters)

ACCIDENTALS
(LH2 TARGET)



- **Window =>+- 10 ns from the coincidence pulse time**

- **For each block:**

  |time[i]-10|<5*rmstime[i]
  |time[i]+10|<5*rmstime[i]

Where:

time[i] =pulse time

rmstime[i] => the time resolution of the block

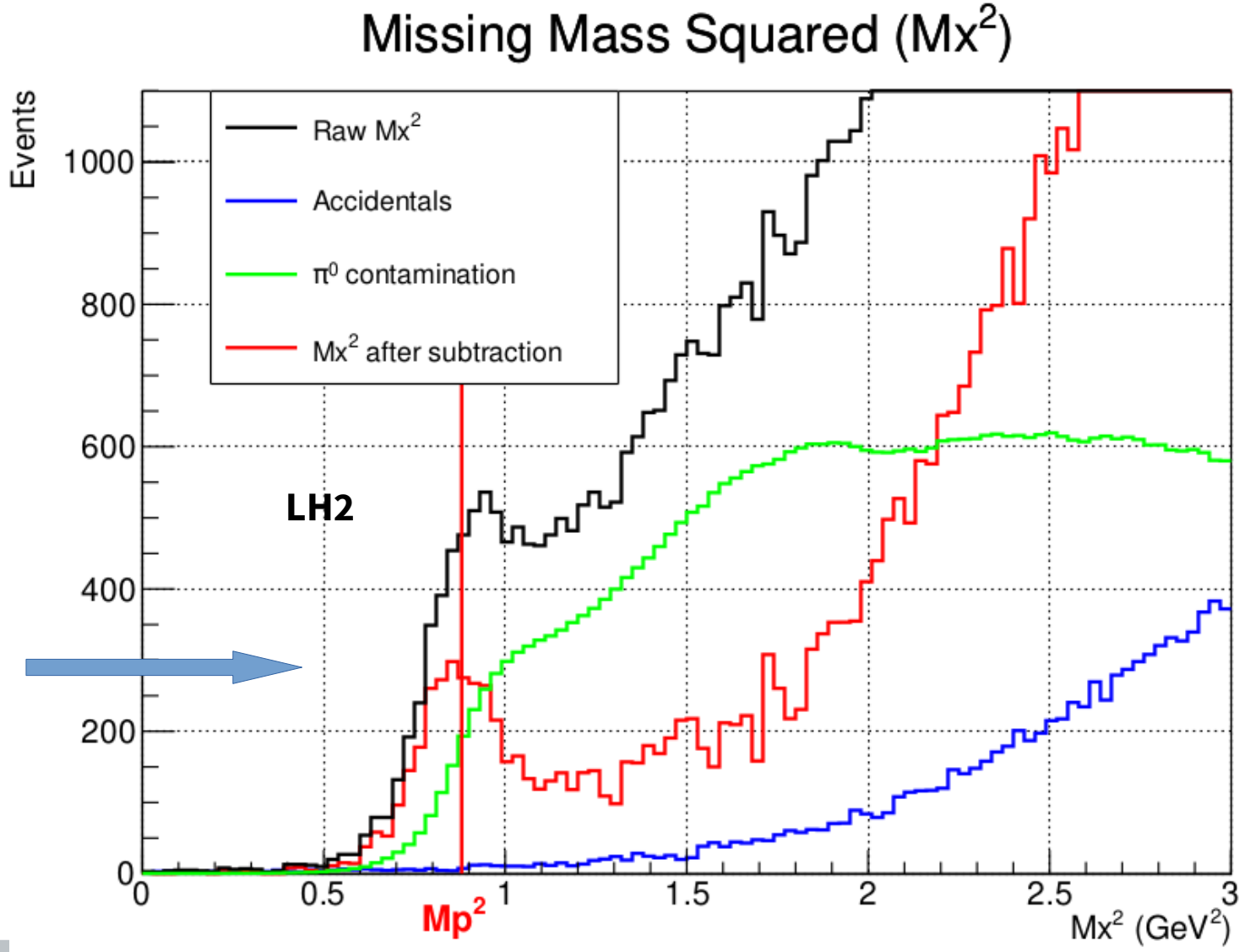
- **The accidental are obtained with the same method used for coincidence events (if cluster number 0 (highest energy cluster) in 2-cluster events contributes to the coincidence Mx2 spectrum then its contribution is also determined and added to the total accidental Mx2 spectrum).**

DVCS Missing Mass Squared

(LH2 TARGET)

- All histograms contain all the contribution from the multiple clusters events discussed in the previous slides

Peak at the right position!!



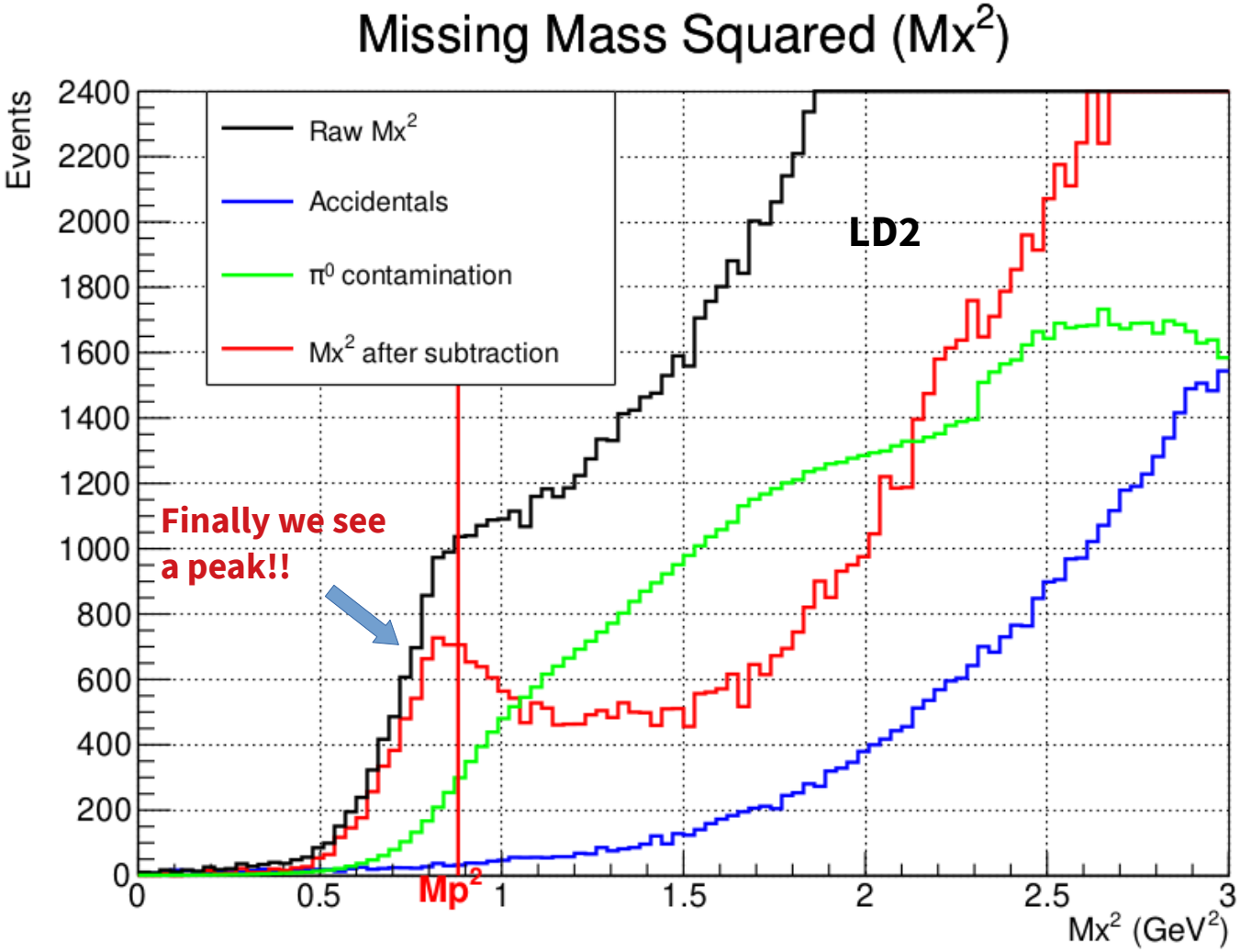
DVCS Missing Mass Squared

(LD2 TARGET)

- 14230 exclusive pi0 events in total
- 19% exclusive pi0 events missed in 3-cluster events!
- 2.3% exclusive pi0 events missed in 3-cluster events!
- 21.3% exclusive pi0 events missed in total!

- 12812 DVCS events in total
- 13.3% DVCS events missed in 2-cluster events!
- 1.7% DVCS events missed in 3-cluster events!
- 15% DVCS events missed in total!

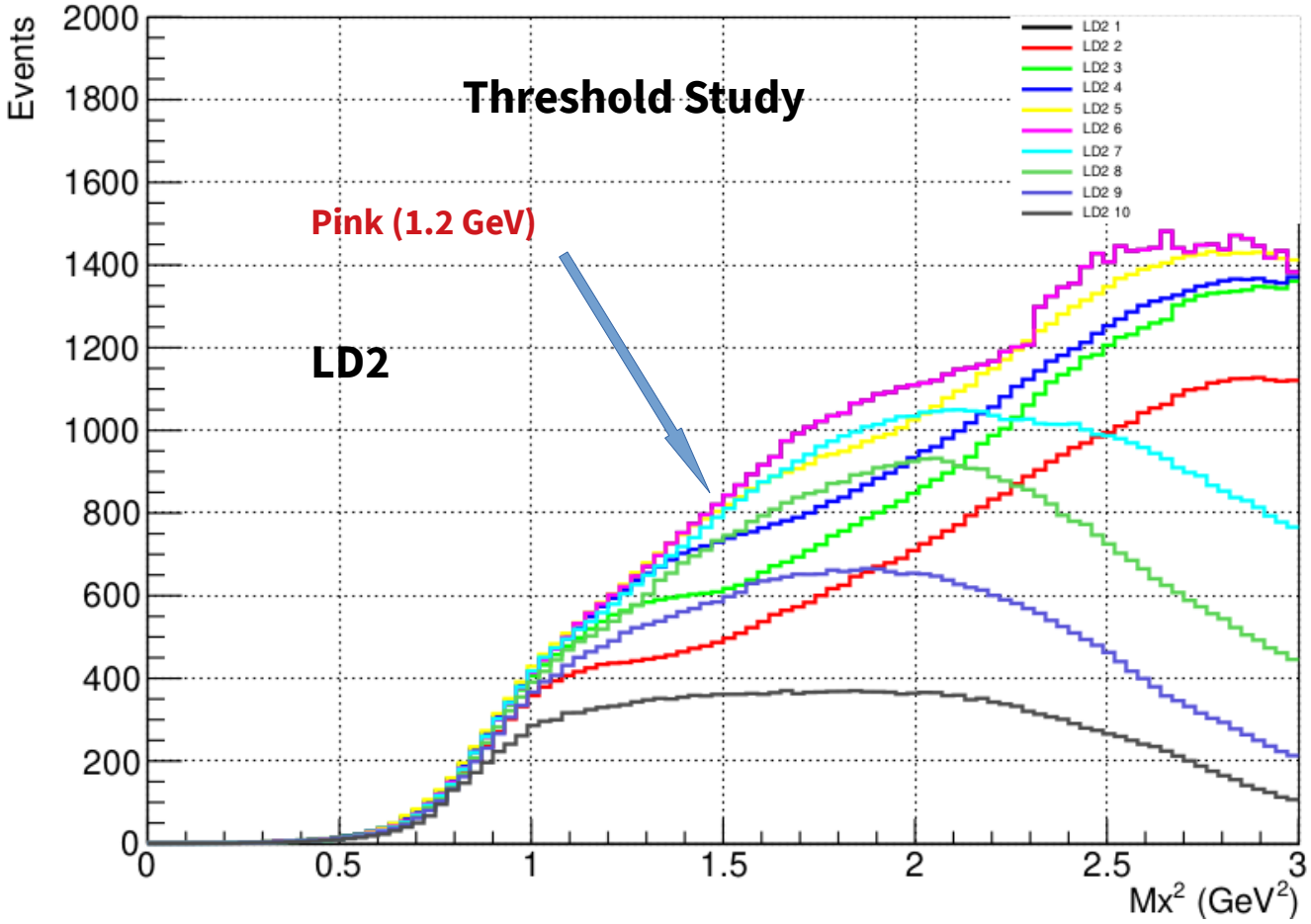
- All histograms contain all the contribution from the multiple clusters events discussed in the previous slides but applied on LD2 target (see backup slides)



BACK UP SLIDES

(LD2 TARGET)

Pi0 Contamination

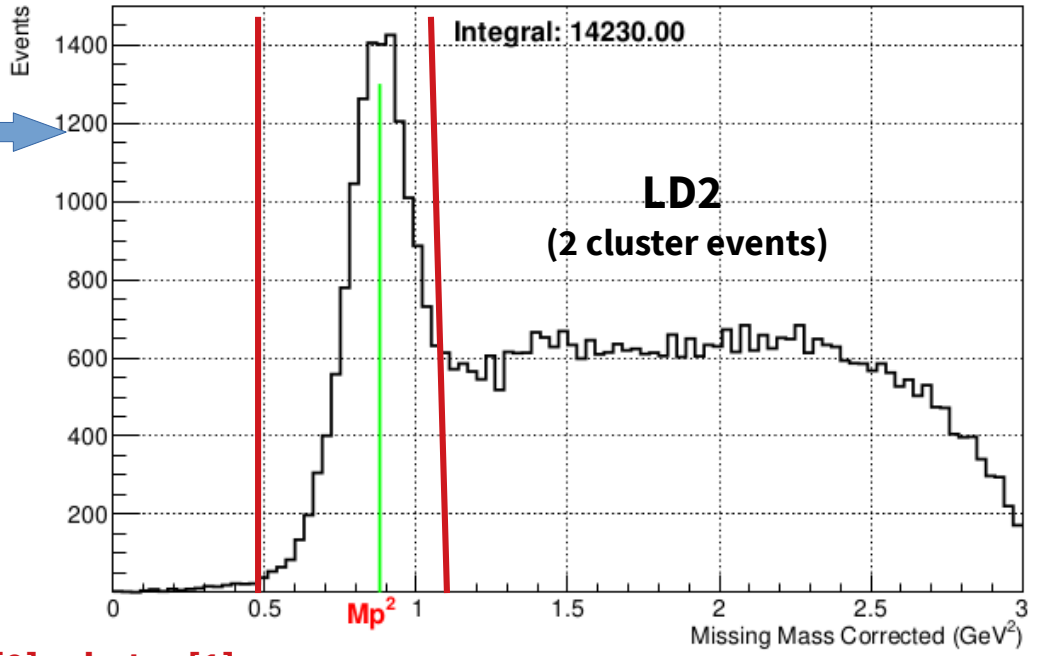


- Used 5000 randomized decays for each pi0 detected in the calormieter
- Pair trigger threshold 0.14 GeV
- From 0.2 GeV (Plot in black) to 2 GeV (Plot in gray)
- Step of 0.2 GeV
- Chose the contribution with 1.2 GeV (Pink Plot) threshold since it's more stable between 0.5 GeV2 and 1.5 GeV2

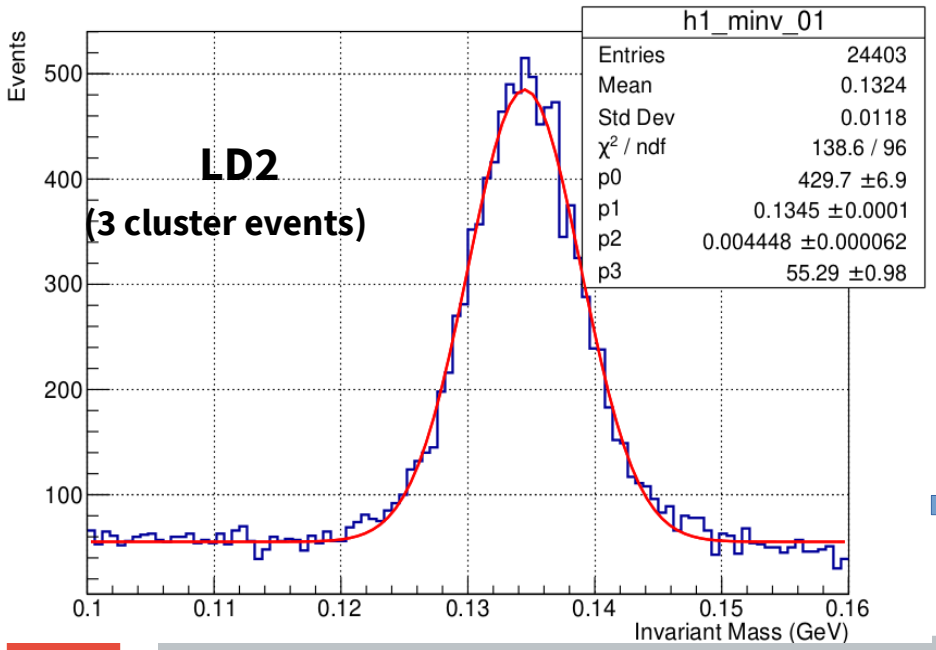
- Calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for the case of 2 clusters events
  ==> 14230 events

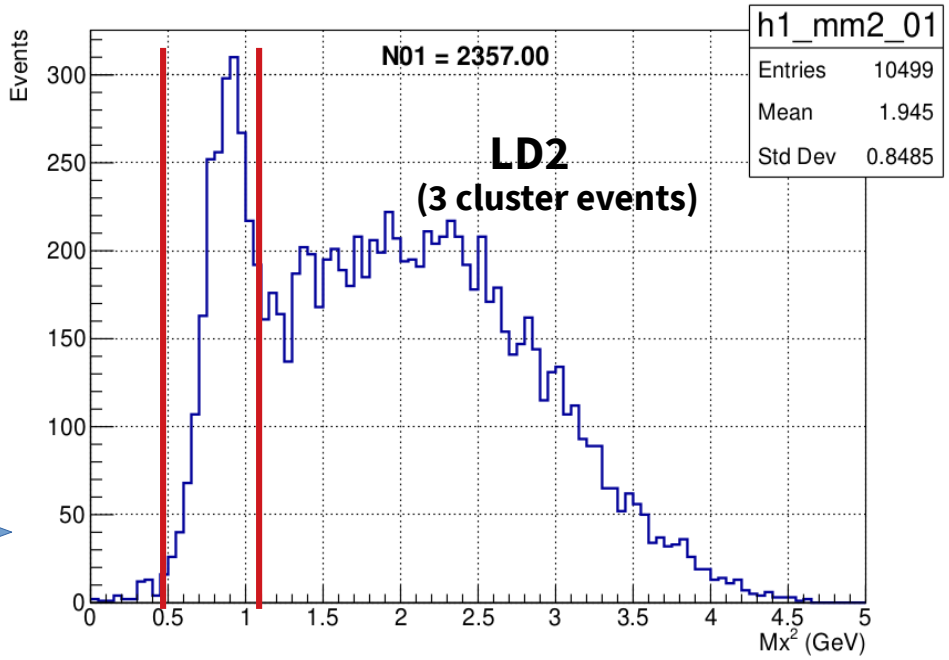
- Did a study for the case of 3 clusters and calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for 3 combinations with the 3 photons:

  - Found 2700 events!
  - 19% exclusive events missed!



One of the combinations: photon[0]+photon[1]

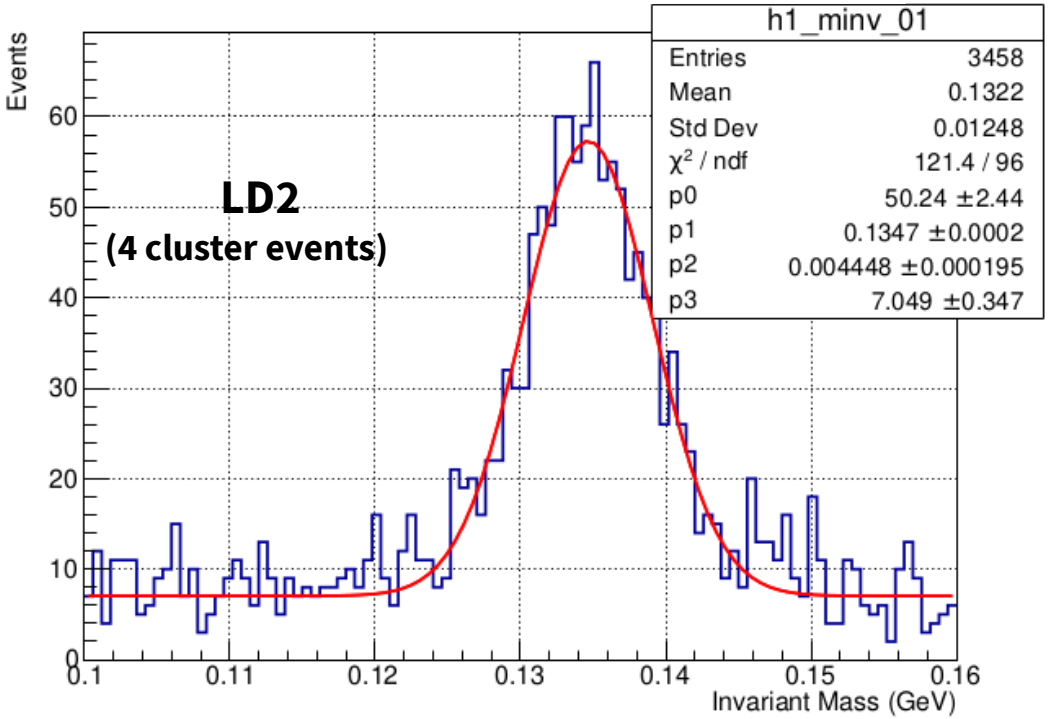


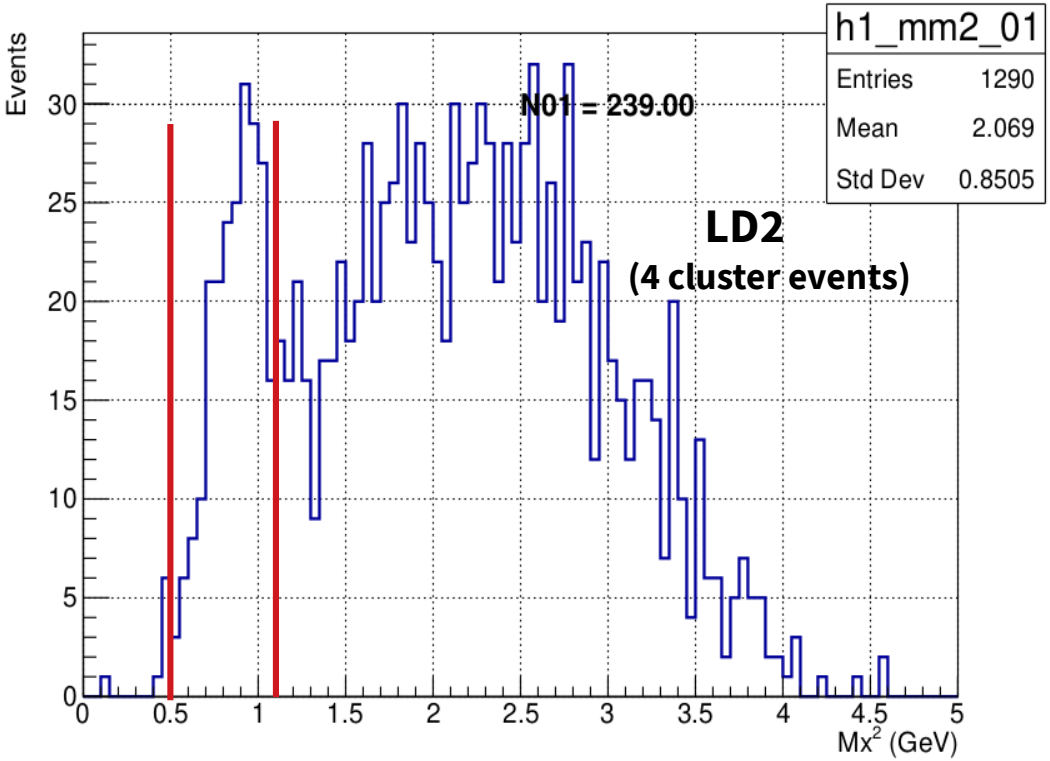


- **Did a study for the case of 4 clusters and calculated the yield of exclusive pi0 events between 0.5 GeV2 and 1.1 GeV2 for 6 combinations with the 4 photons:**

  - 327 Found events!
  - 2.3% exclusive pi0 events missed!

One of the combinations: photon[0]+photon[1]

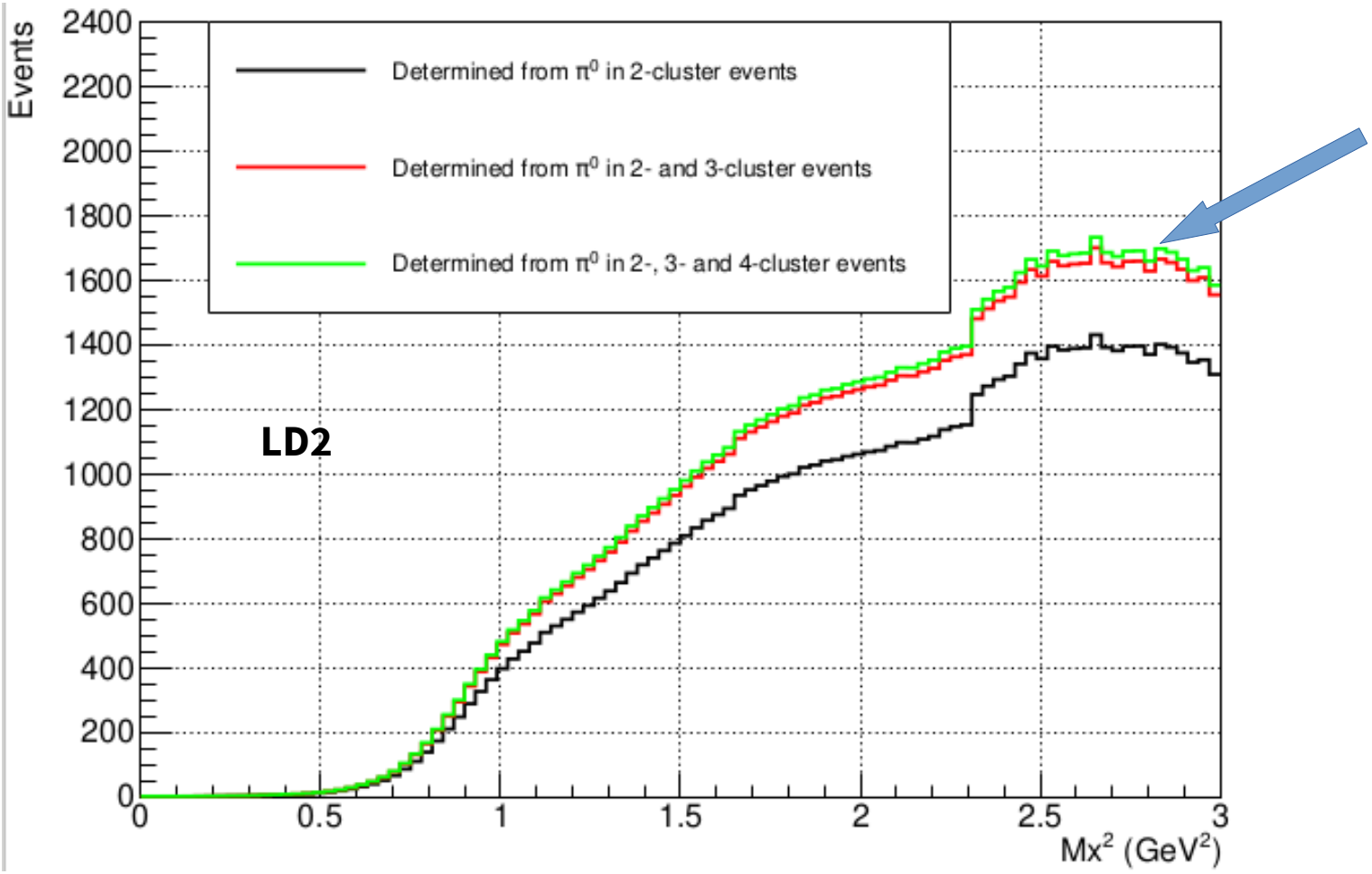




Missed 21.3% exclusive pi0 events in total!! (3 and 4 clusters)

Pi0 Contamination

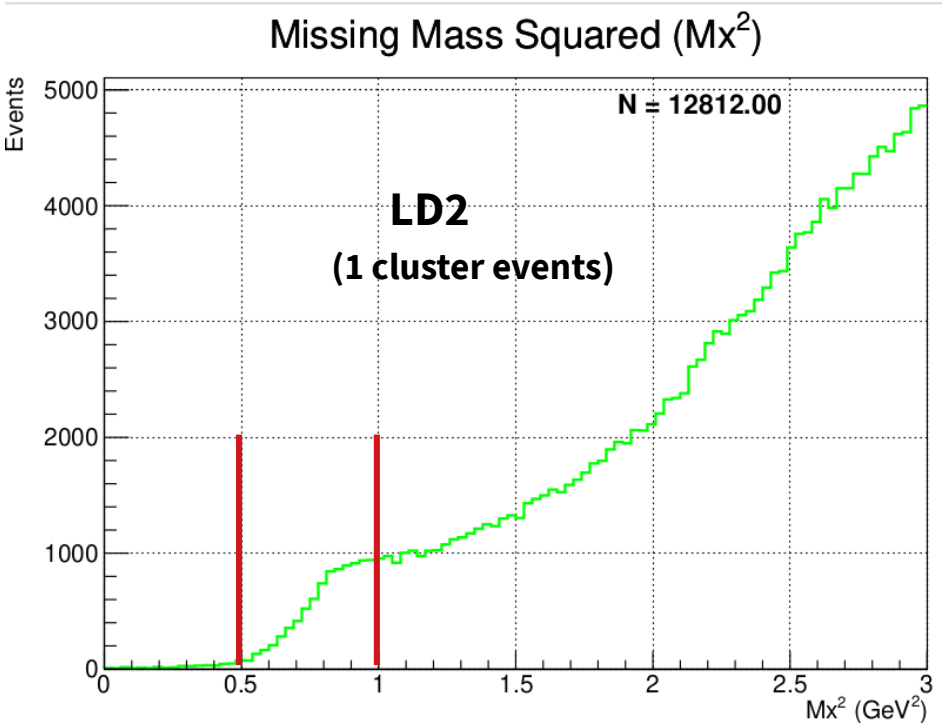
(LD2 TARGET)



The green plot is the final plot that will be subtracted from the raw DVCS missing mass squared

DVCS YIELD STUDY

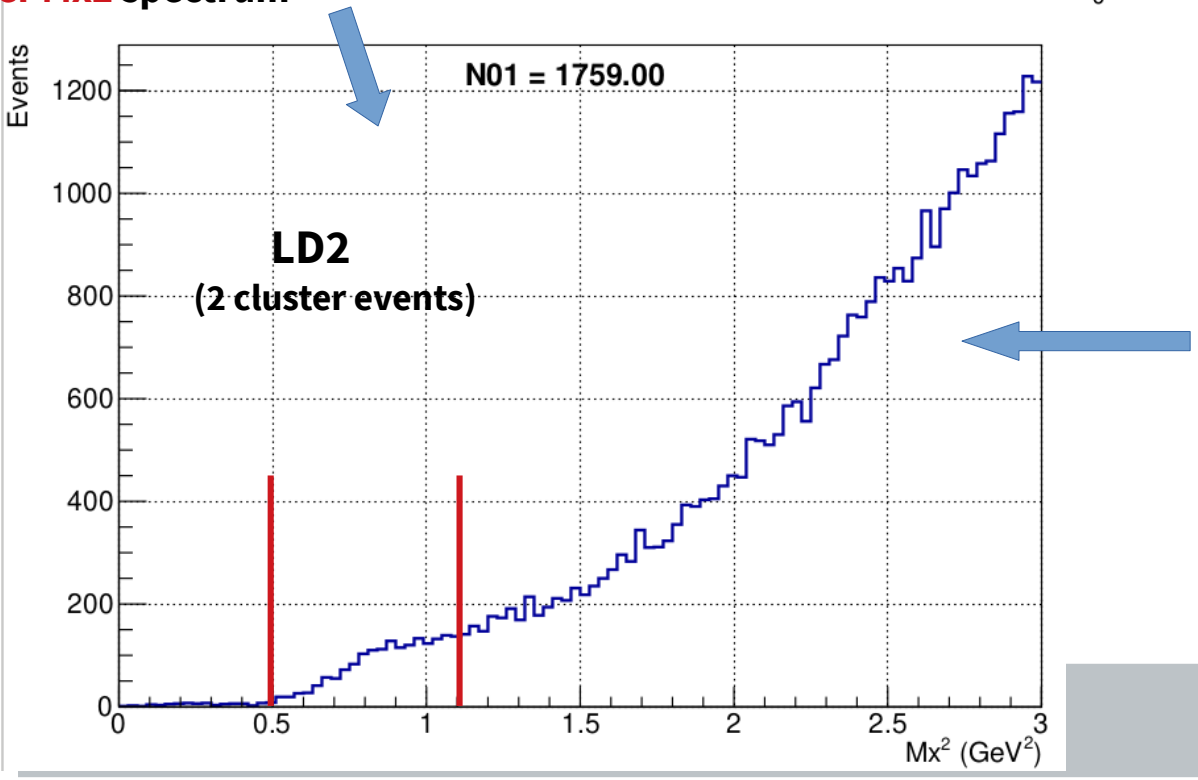
- Calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2 for the case of 1 cluster events
  ==> 12812 events



- Did a study for the case of 2 clusters and calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2:

  - Found 1759 events!
  - 13.3% DVCS events missed!

- This histogram is added to the previous 1-cluster Mx2 spectrum



- Each cluster in a multi-cluster event is systematically considered as a potential DVCS event if it does not originate from a pi0 decay (the invariant mass of that photon when combined with another photon is different from the mass of the pion)

- **Did a study for the case of 3 clusters and calculated the yield of exclusive events between 0.5 GeV2 and 1.1 GeV2 for 3 combinations with the 3 photons:**

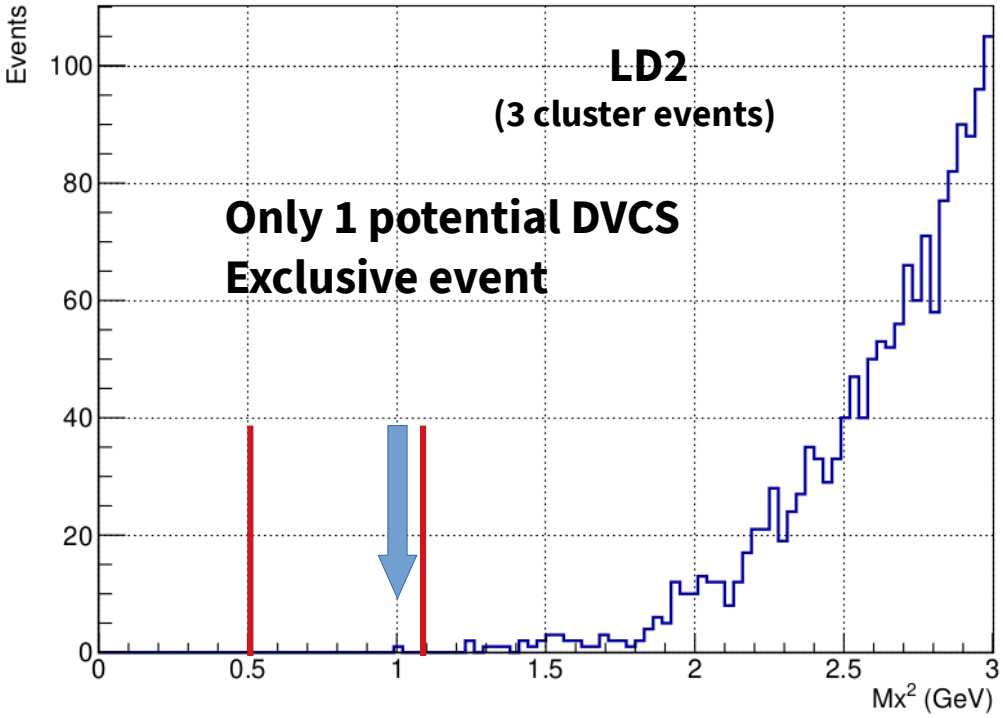
  - Found 219 events!

  - 1.7% DVCS exclusive events missed!

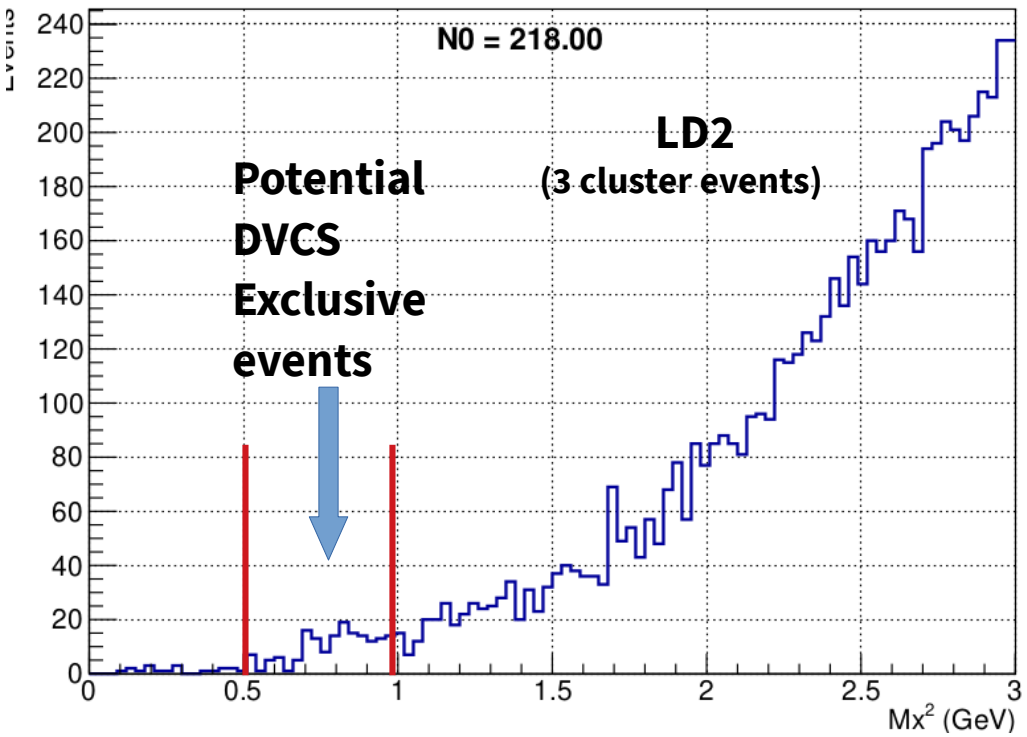
Contribution

(E_photon[0]>E_photon[1])

Photon[1]



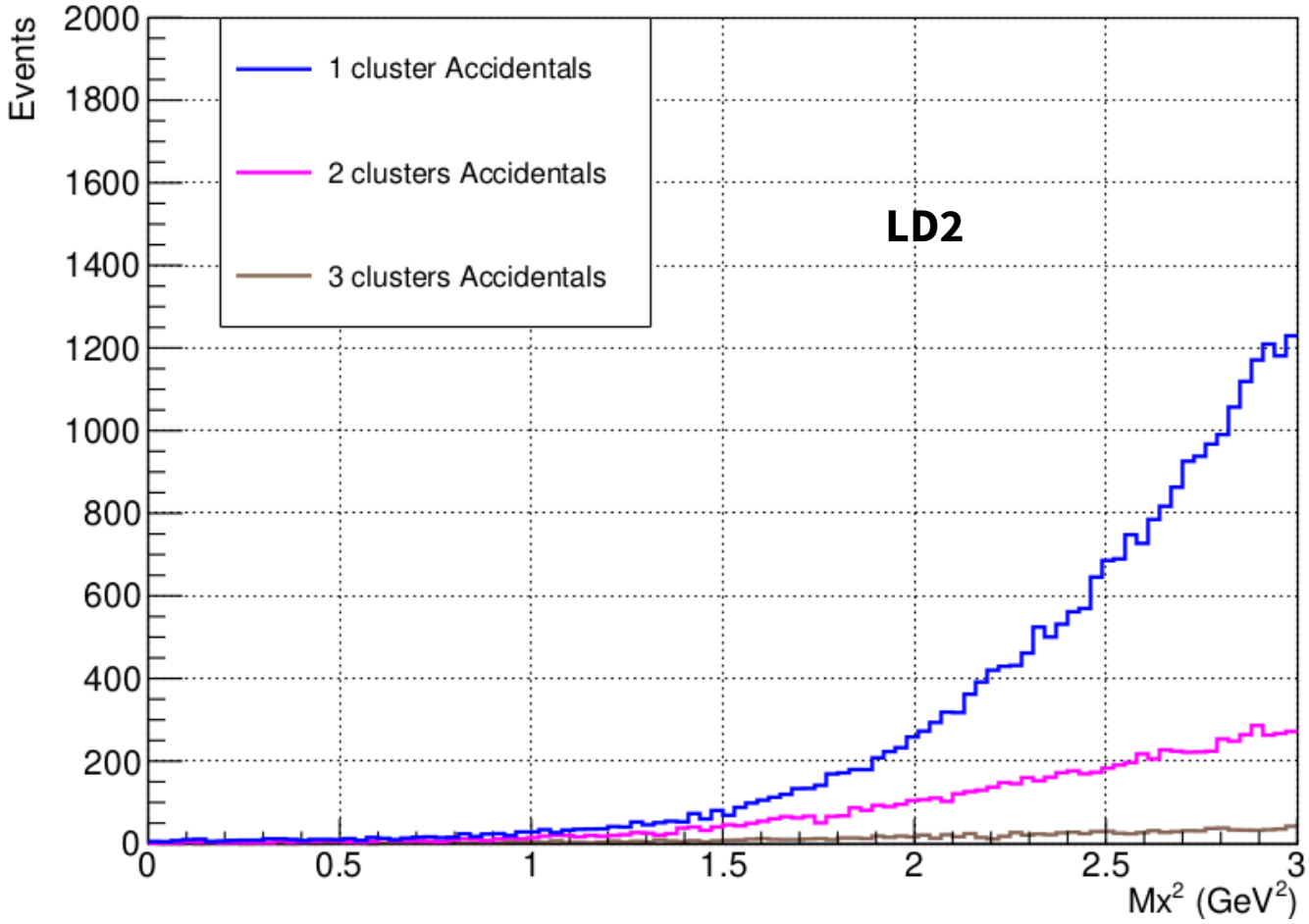
Photon[0]



Missed 15% exclusive events in total!! (2 and 3 clusters)

ACCIDENTALS

(LD2 TARGET)



- **Window =>+- 10 ns from the coincidence pulse time**

- **For each block:**

  |time[i]-10|<5*rmstime[i]
  |time[i]+10|<5*rmstime[i]

Where:

time[i] => coincidence pulse time

rmstime[i] => the time resolution of the block