The LAS Trigger

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Outline

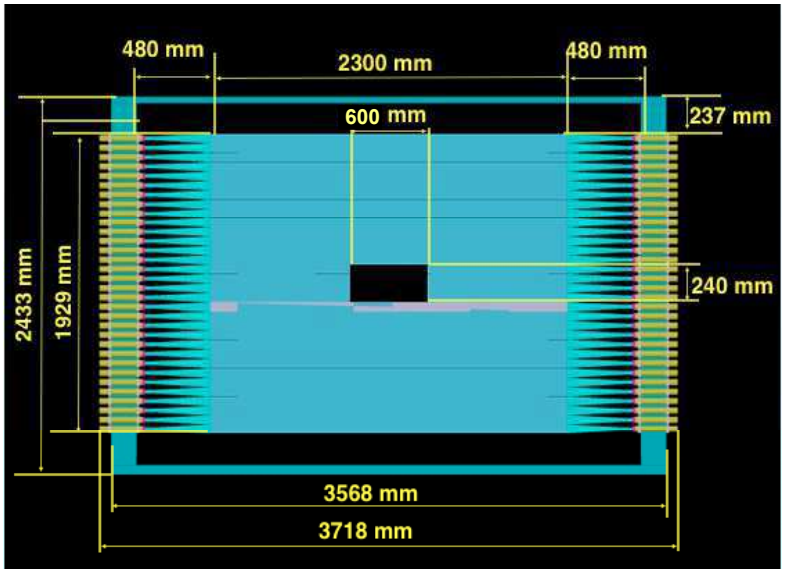
The LAS Trigger

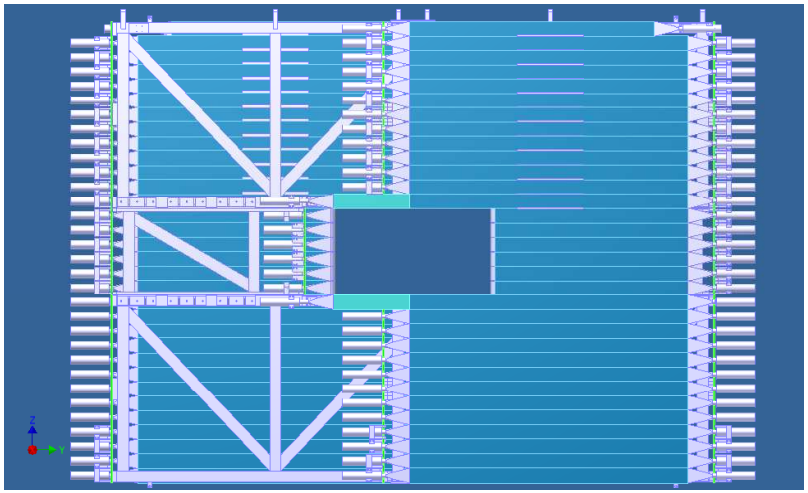
- Enlarge the trigger acceptance towards large Q^2
- Using target pointing in vertical direction

  $\Rightarrow$ Two new hodoscopes in the LAS with a large distance
- H1 in front of the RICH
- H2 behind the Muon Filter

Problem: High trigger rate

H1 and H2





H1

- Size: 230 $\times$ 192cm
- 32 elements
- Rohacell casing
- In Front of the RICH

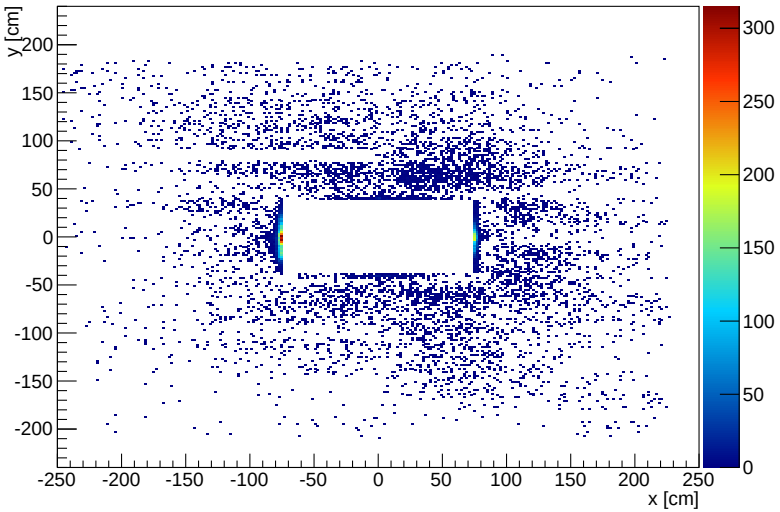
H2

- Size: 500 $\times$ 420cm
- 2 parts with 32 elements
- Aluminium frame
- Behind the muon filter

Runs with inclusive LAST

- 3 runs on 26. August 2011
- LAST runs as inclusive trigger
- No solenoid
- Runs:
  - 93621 (166 Spills)
  - 93622 (105 Spills)
  - 93625 (89 Spills)

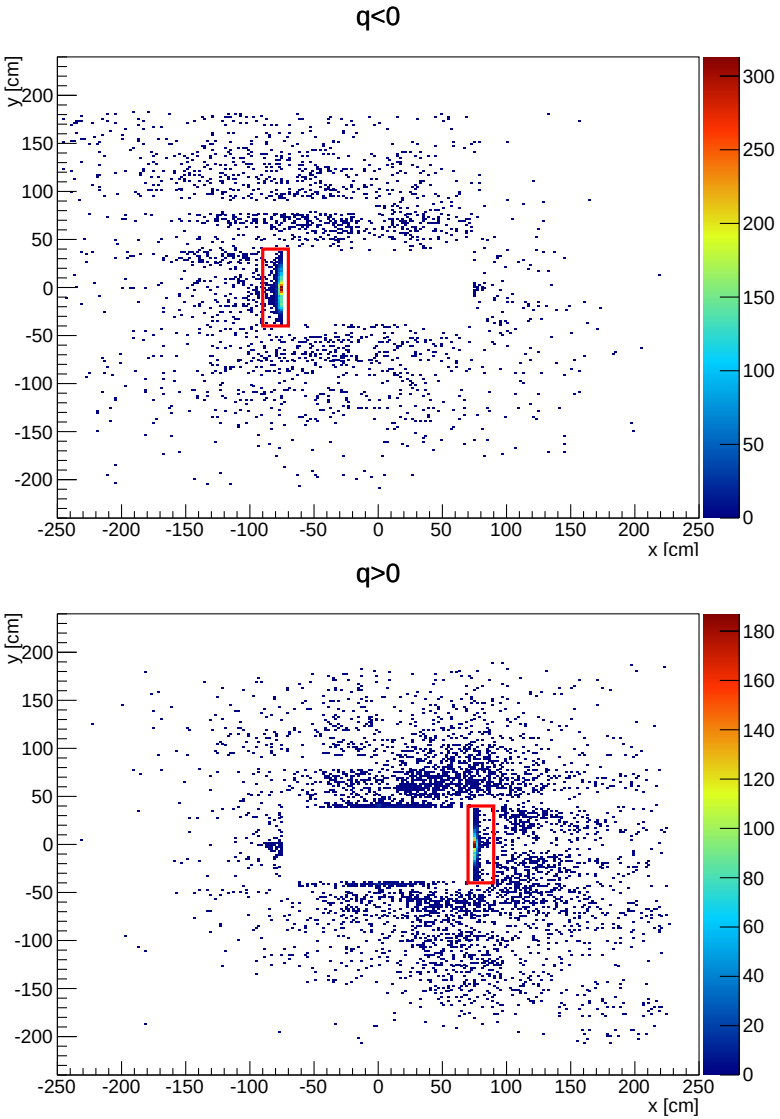
Hits on H2



- Reconstructed tracks from a primary vertex
- LAS triggerbit set
- Last measured position behind the muon filter
- Time information in corresponding H2 element

  $\Rightarrow$ Increased number of hits next to the hole

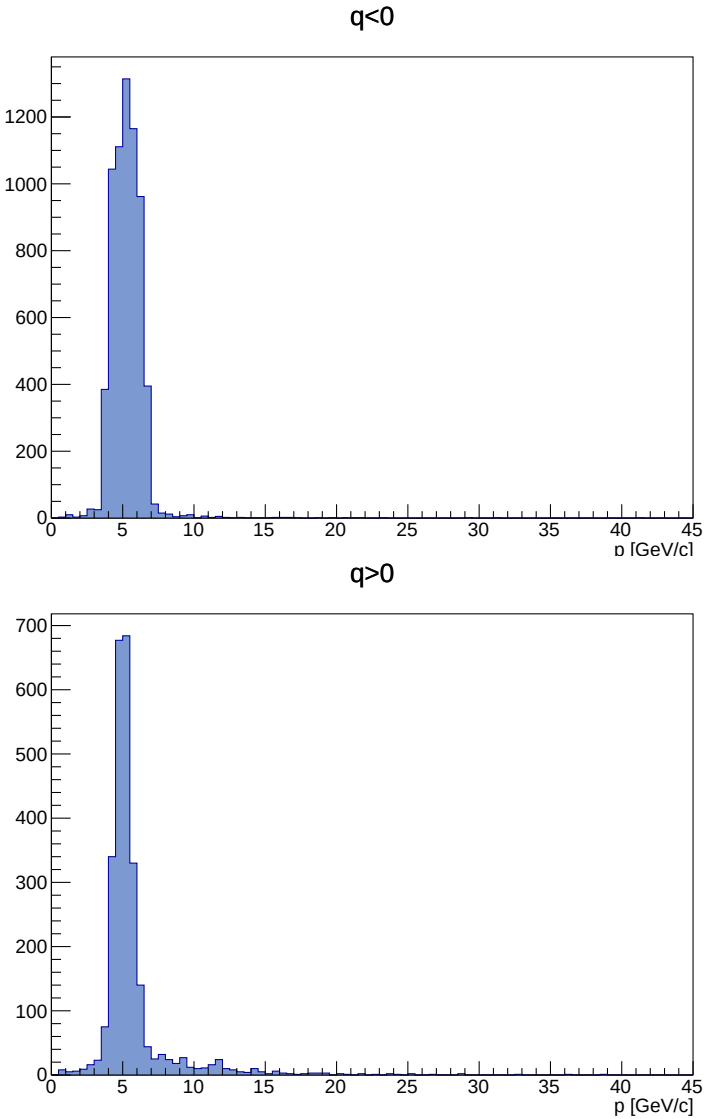
Hits on H2



- Left peak is caused by neg. particles
- Right peak is caused by pos. particles

  $\rightarrow$ Which particles are these?
- look at the momentum distribution
- $|p| \approx 5\mathrm{GeV}/c \rightarrow$ Using the RICH for particle identification
- mainly caused by $e^{\pm}$

Hits on H2



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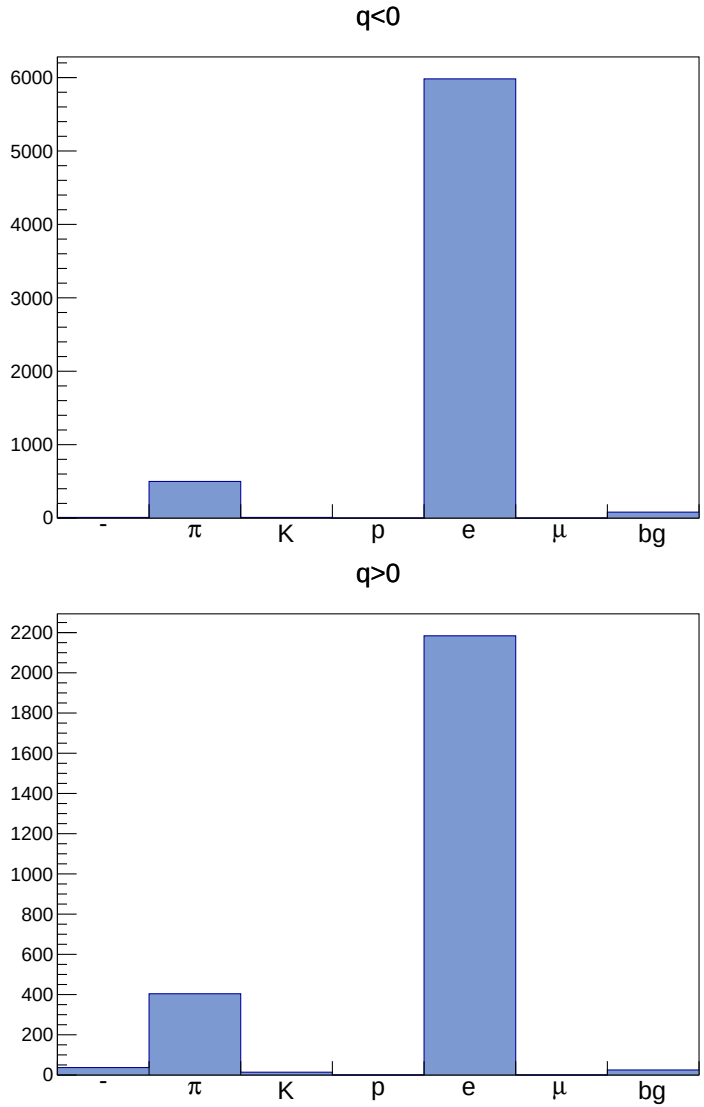

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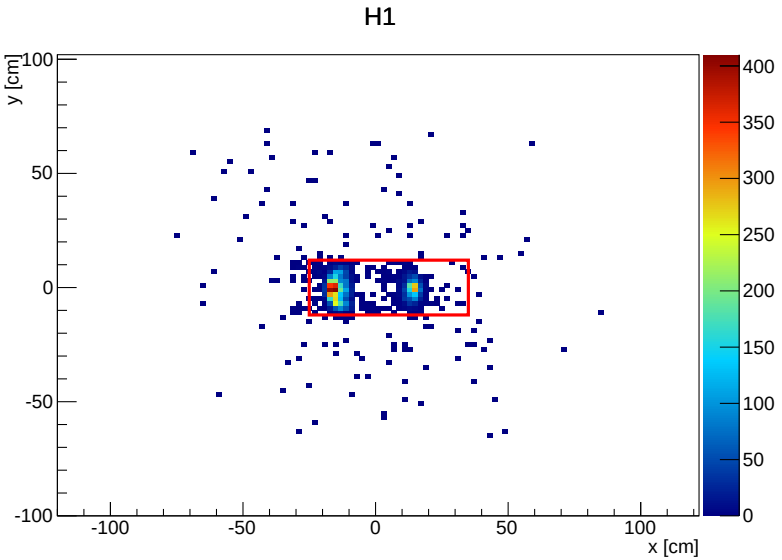
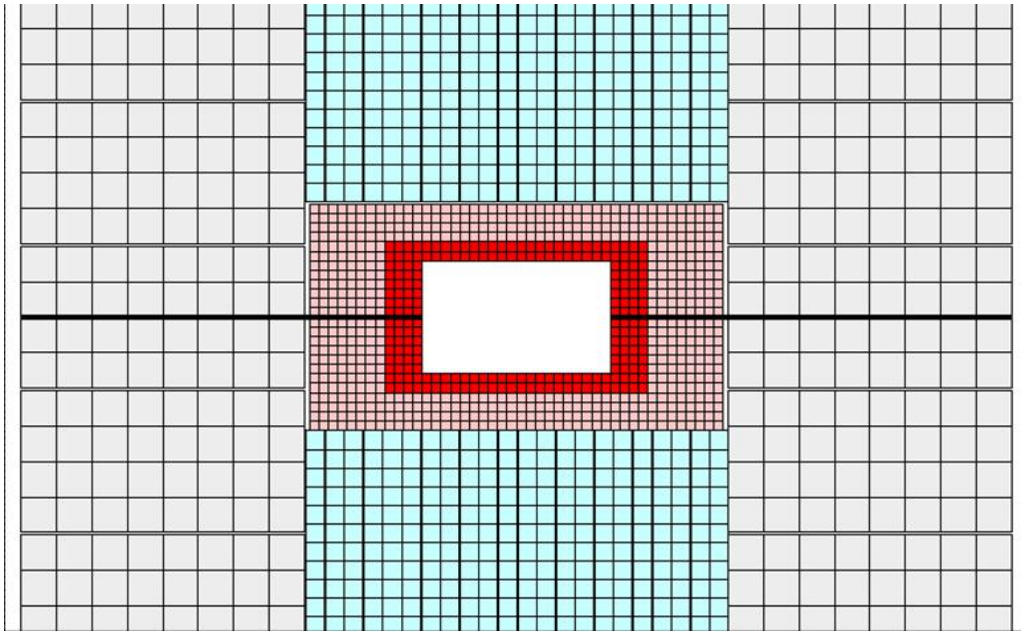
Hits on H1



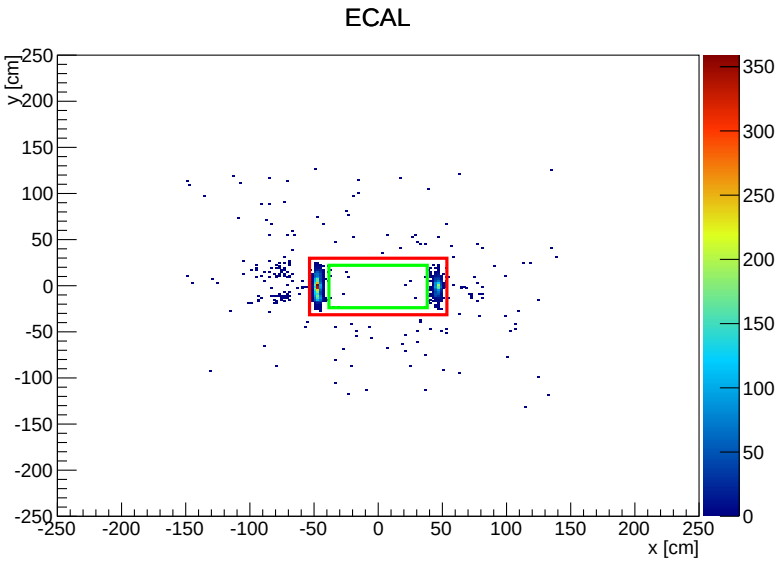
- $e^{\pm}$ from H2 are not in H1
- Hits on H1 in those events
- Other particle causes the second hit

New ECAL1 hole in 2012



- Change of the hole size of ECAL1
- 2 new columns on the top and bottom of the hole
- 4 new rows on the left and right side
- Could this solve the problem with the $e^{\pm}$?

Position of the electrons at ECAL1 and HCAL1



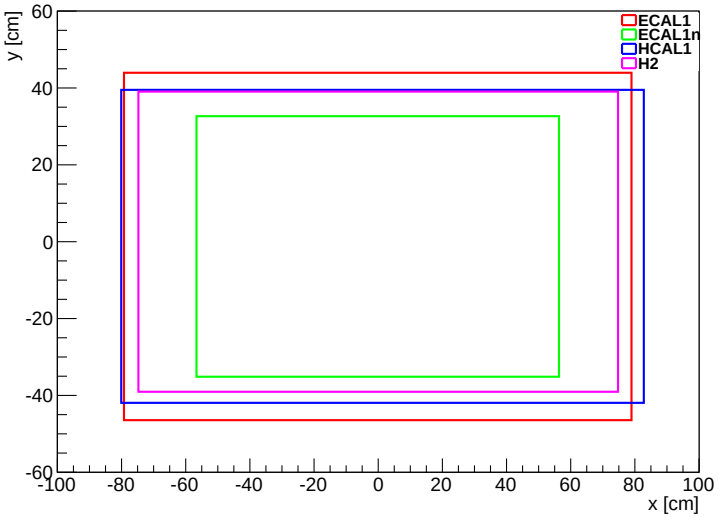
Old ECAL1 hole (red)

- $e^{\pm}$ could pass the hole in ECAL1
- Also pass the hole in HCAL1

New ECAL1 hole (green)

- Seems to solve the problem
- $e^{\pm}$ now in ECAL1
- Reduce the trigger rate

Holes at H2



- Old ECAL1 and HCAL1 hole slightly larger then H2 hole

  $\Rightarrow$ Hits on the left and right side of H2

- New ECAL1 hole smaller than H2 hole

  $\Rightarrow$ Reduces the trigger rate

Multiplicity

Question

Is it possible to identify good events by using multiplicities?

2 Samples are needed:

Good events

- LAS triggerbit
- Primary vertex with incoming and scattered muon
- Muon track in H1 and H2
- Muon has hits in muonwall

$\Rightarrow$ 1775 Events

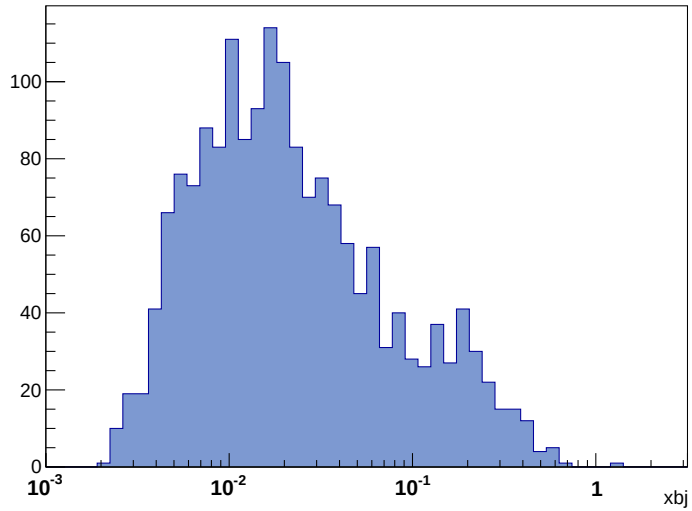
All events

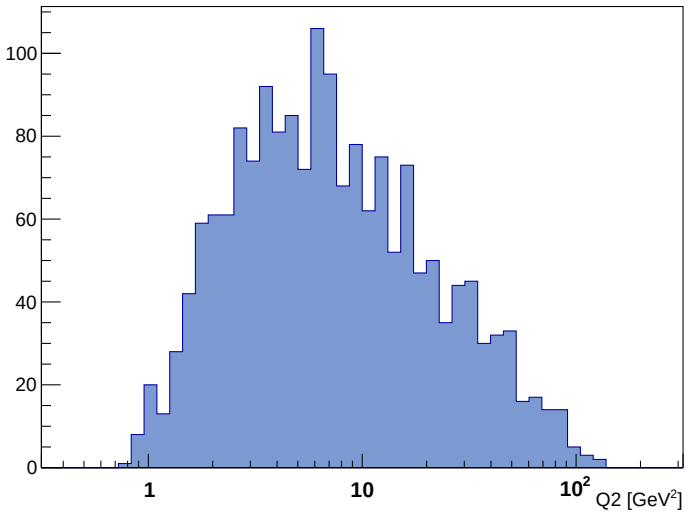
- LAS triggerbit

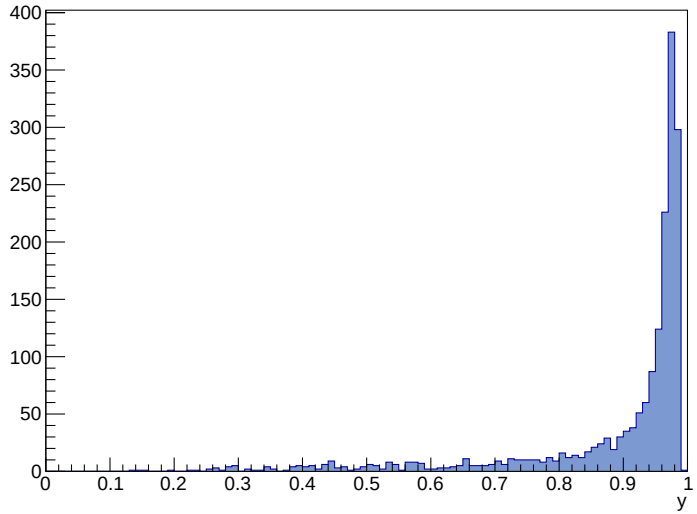
$\Rightarrow$ 443545 Events (from 20 chunks)

Kinematic distribution

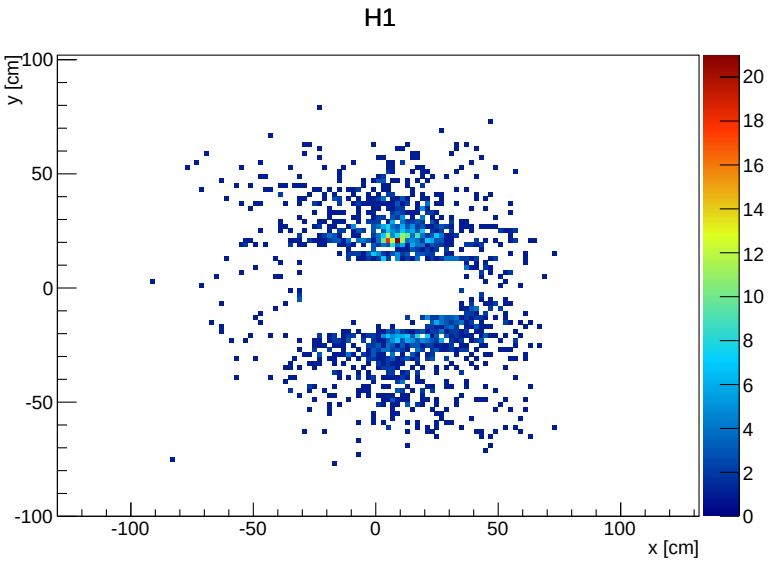
- Kinematic distribution of good events
- Only high Q^2 and y

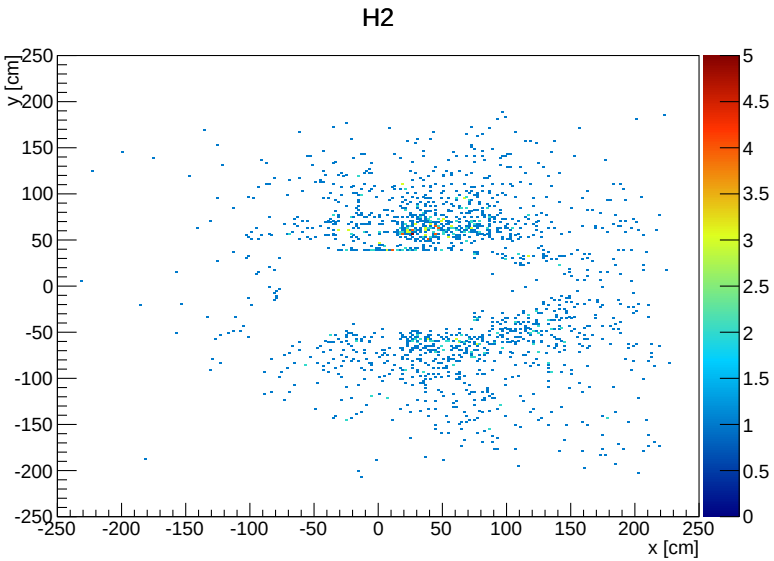






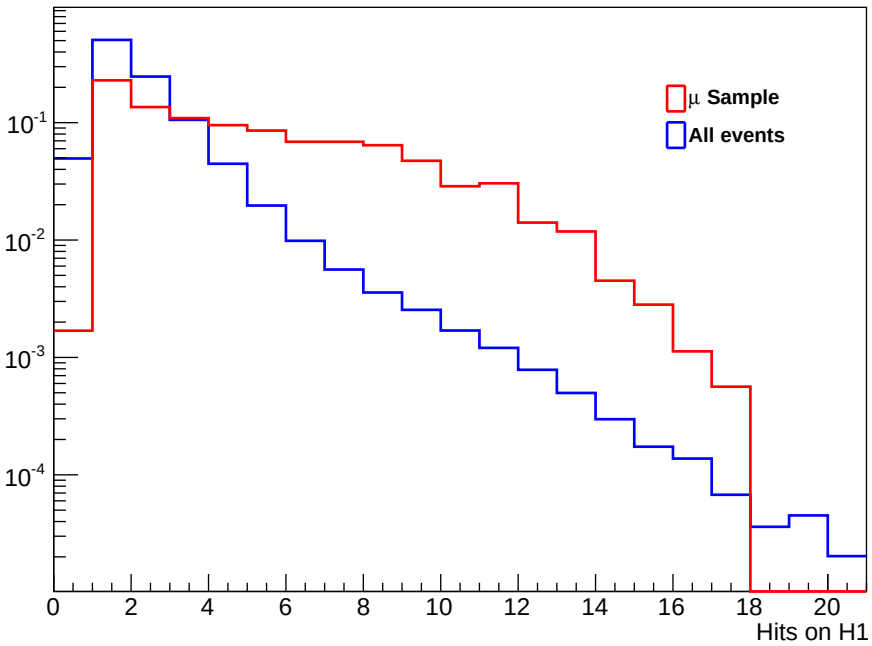
Hit distribution of the muons





- Hits from good muons on H1 and H2
- Hits are mainly on the top and bottom of the holes
- No timing information used

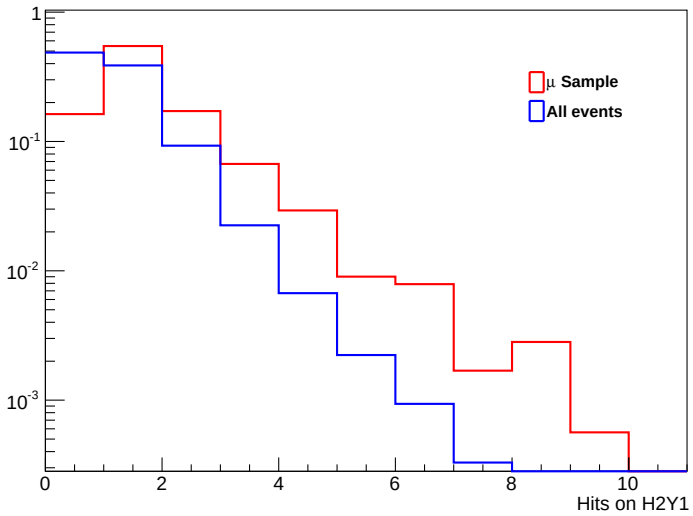
Multipicities H1

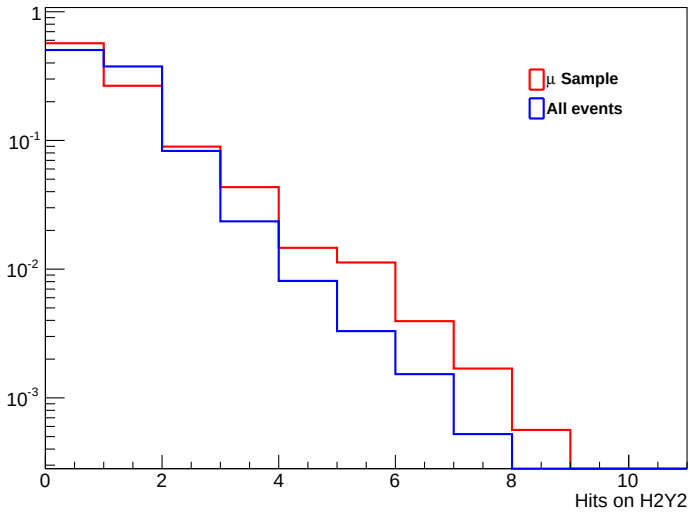


- Hit defined by time information on both sides of one element
- $\left|\frac{t_j + t_s}{2}\right| < 5\text{ns}$
- Good events have higher multipicities

  $\Rightarrow$ No possibility to cut on the multiplicity in H1 as expected

Multiplicities H2





H2Y1 (Jura)

- Mainly one hit in μ case
- Same dependency in both cases

  $\Rightarrow$ No possibility to cut on the multiplicity in H2Y1

H2Y2 (Salève)

- Mainly zero hits
- Same dependency in both cases

  $\Rightarrow$ No possibility to cut on the multiplicity in H2Y2

Statistics

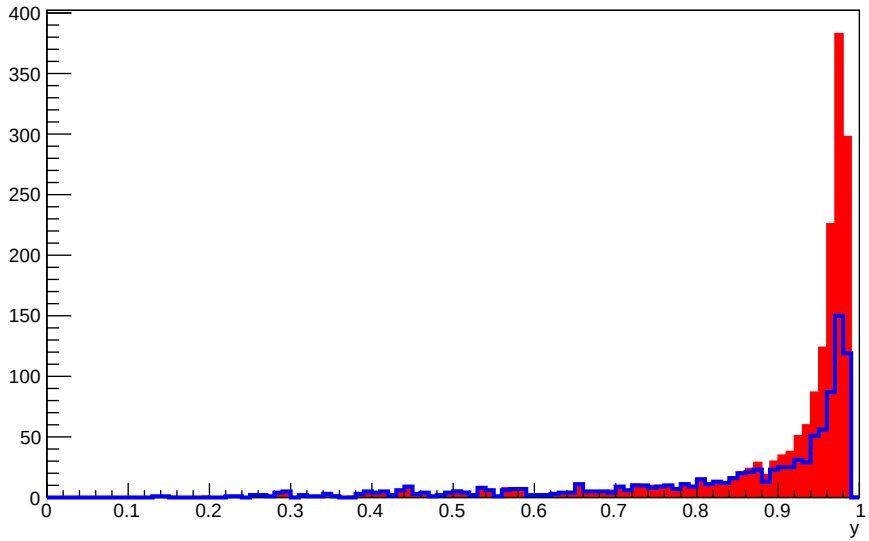
Classes of reconstructed events in the sample

- Has a primary vertex 79.7%
- Has a scattered muon 2.9%
- Scattered muon in H1 and H2 $7.2 \cdot 10^{-3}$%
- Electron / Positron in H2 0.06%
- Incoming beam with no primary vertex 14.2%

Summary

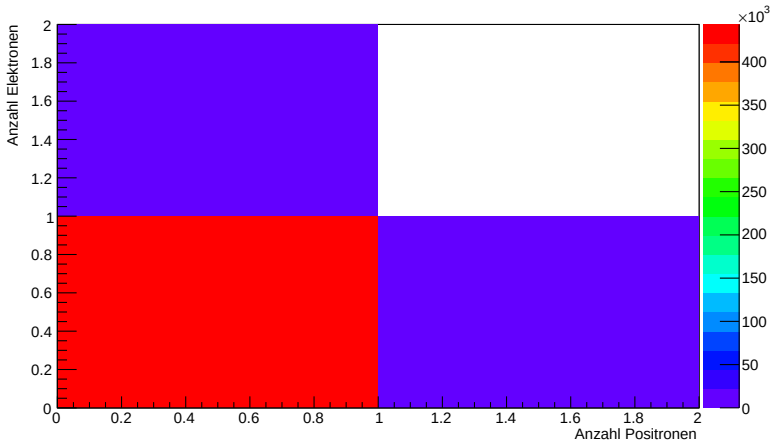
- Mainly $e^{\pm}$ at the edges of the hole of H2
- New ECAL1 hole solves the problem
- No possibility to identify good events duo to their multiplicity

Kinematic distribution II



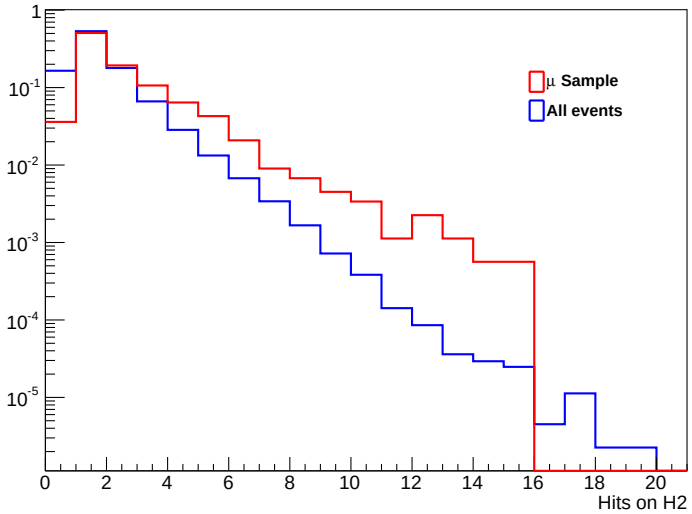
- y distribution with 2 additional hadrons
- Reduce radiative events

Correlations between electrons and positrons



- Only one electron or positron in H2
- No pairs

Multiplicity H2



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