REPORT ON STUDY BY MOUSTAFA ESHRA

15/08 to 14/11/2013 at LLR

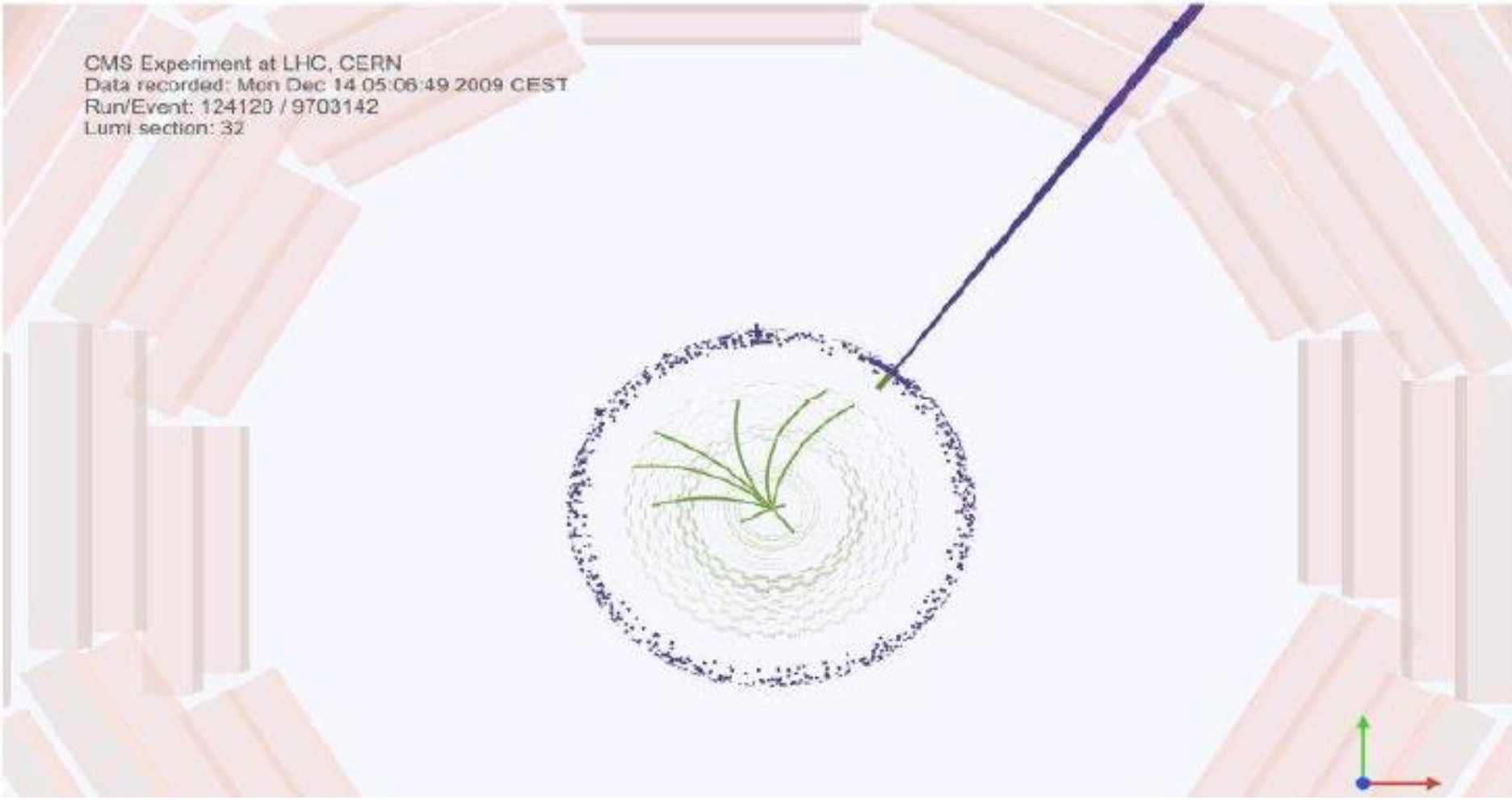
SPIKES IN ECAL

Spike phenomenology

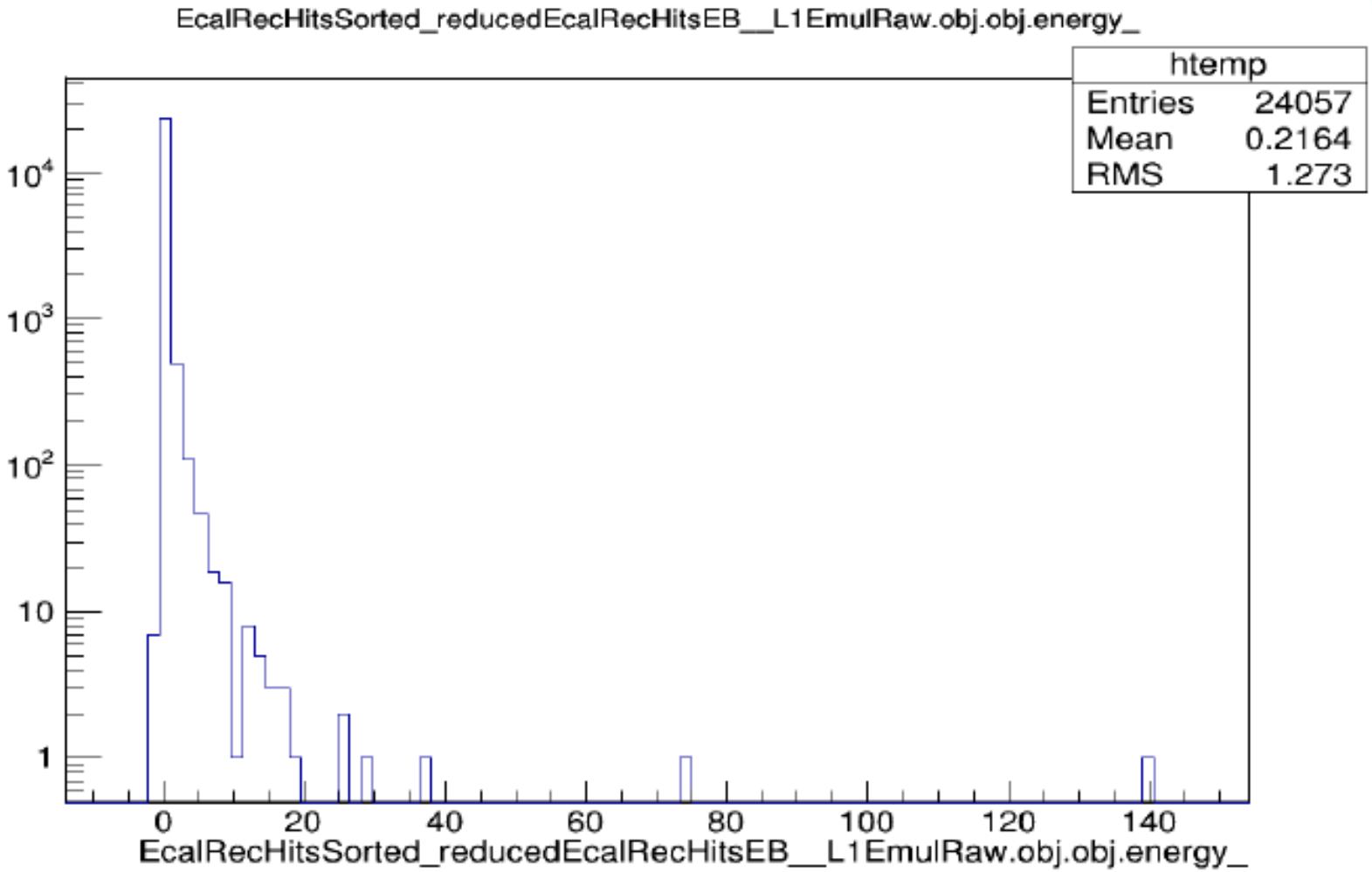
- **Isolated high energy deposits in ECAL Barrel (EB)**
  - o Occur at a rate proportional to the intensity of the proton beams.
  - o Produced by direct ionization of the APD's by particles created in pp collisions.
  - o Presents issues for *triggering CMS at high luminosity.*

- On average, one spike with transevrse energy > 3 GeV is observed per 370 minimum-bias triggers in CMS

CMS Event Display of a pp collision event, showing an isolated ECAL spike corresponding to a **690 GeV** transverse energy deposit.



Rechit energy



Spike can be solved :

1. Online rejection.
2. Offline rejection.

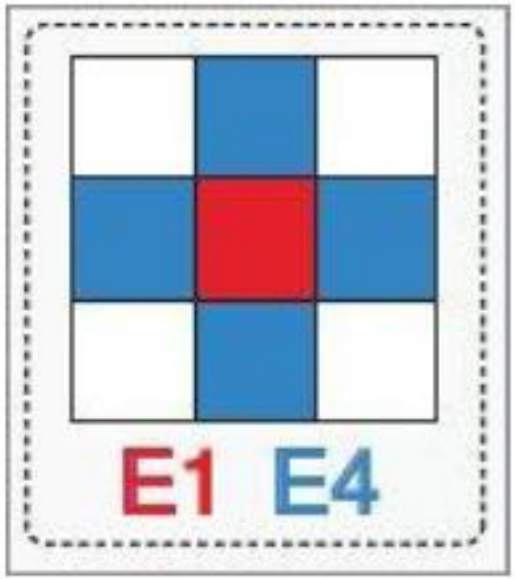
Offline rejection:

- **Cut on topology** (”Swiss-cross” variable).

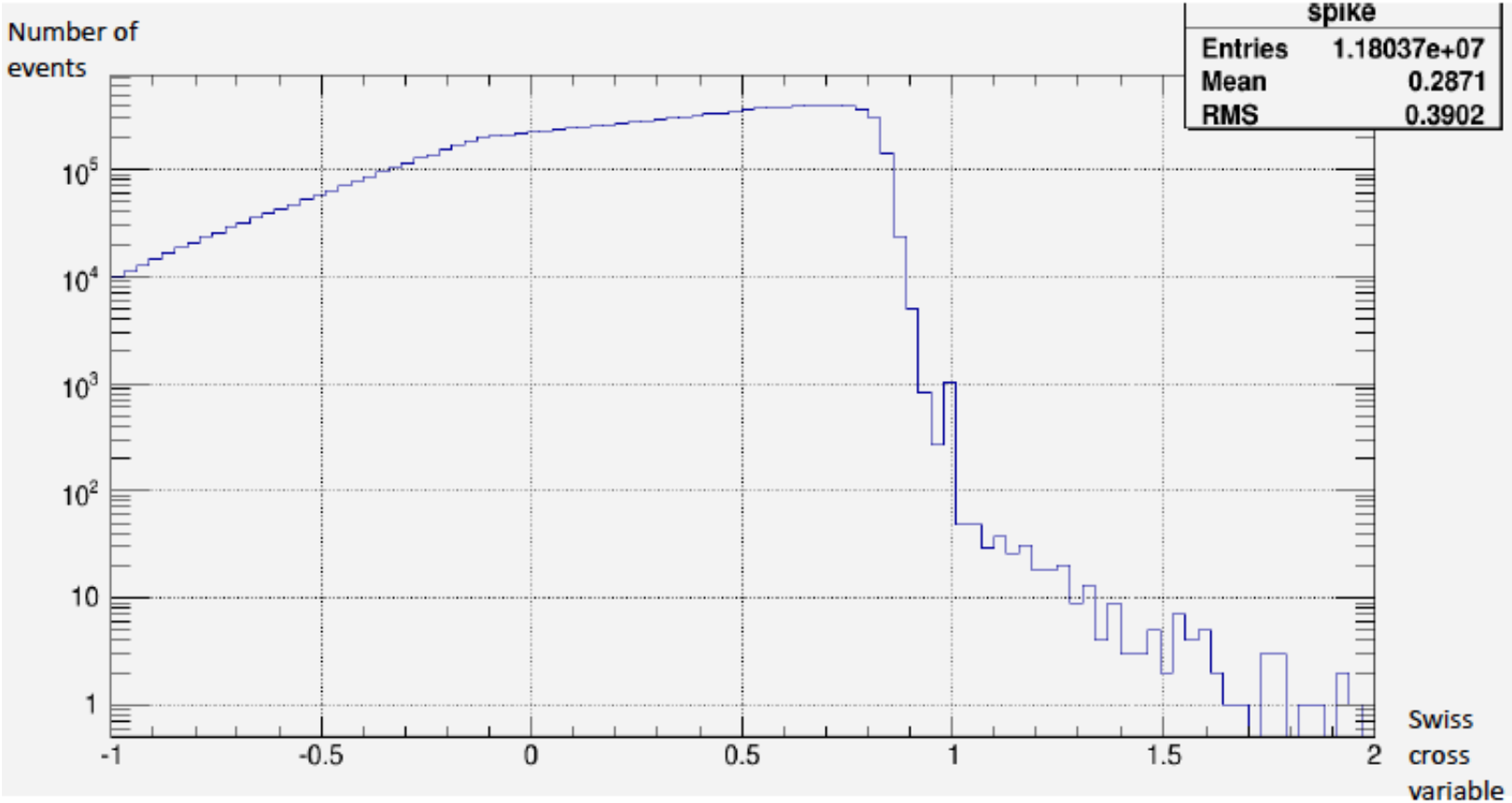
- **Cut on timing.**

Swiss Cross Variable

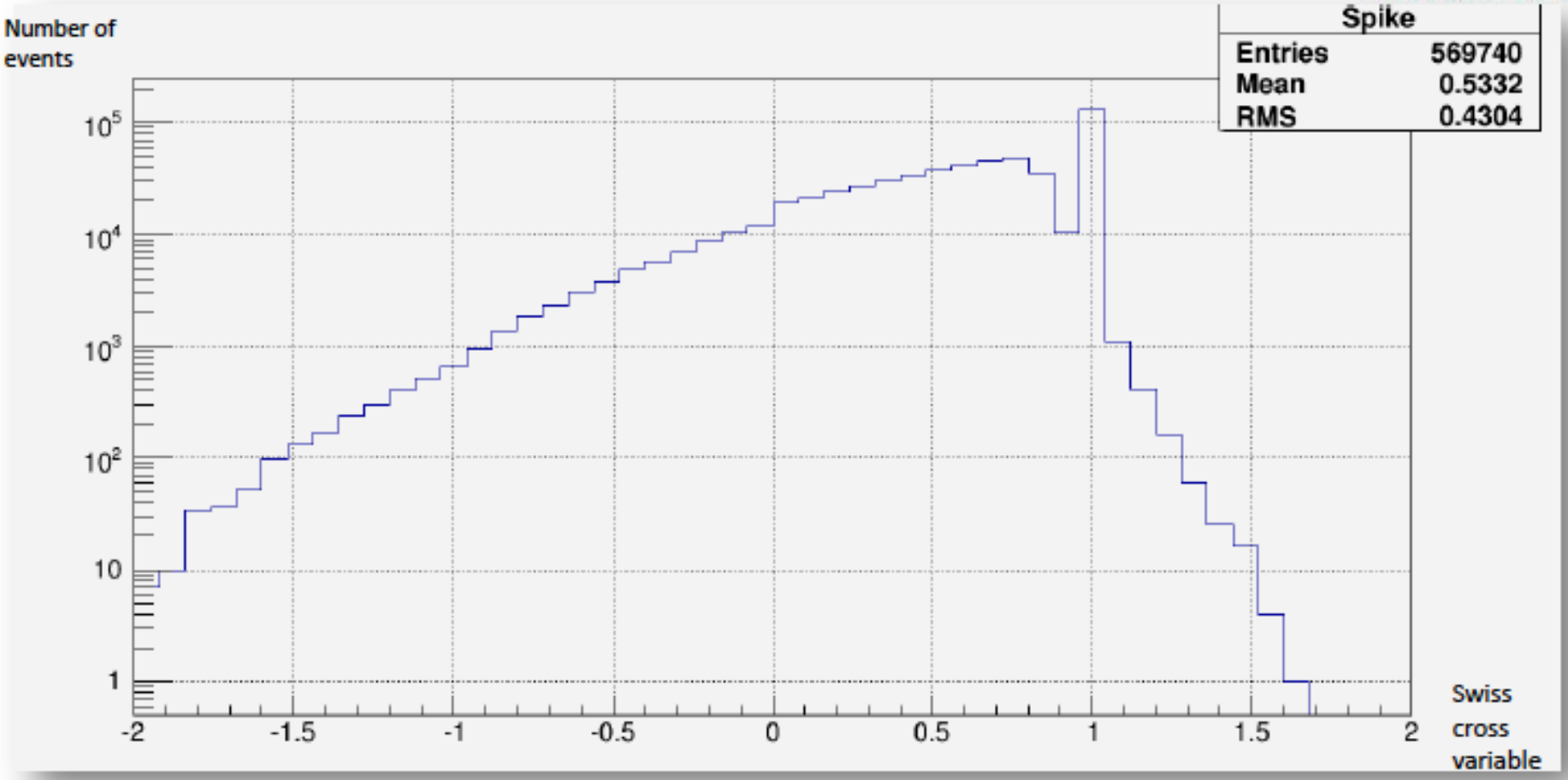
Swiss-cross variable defined as: **1-E4/E1**

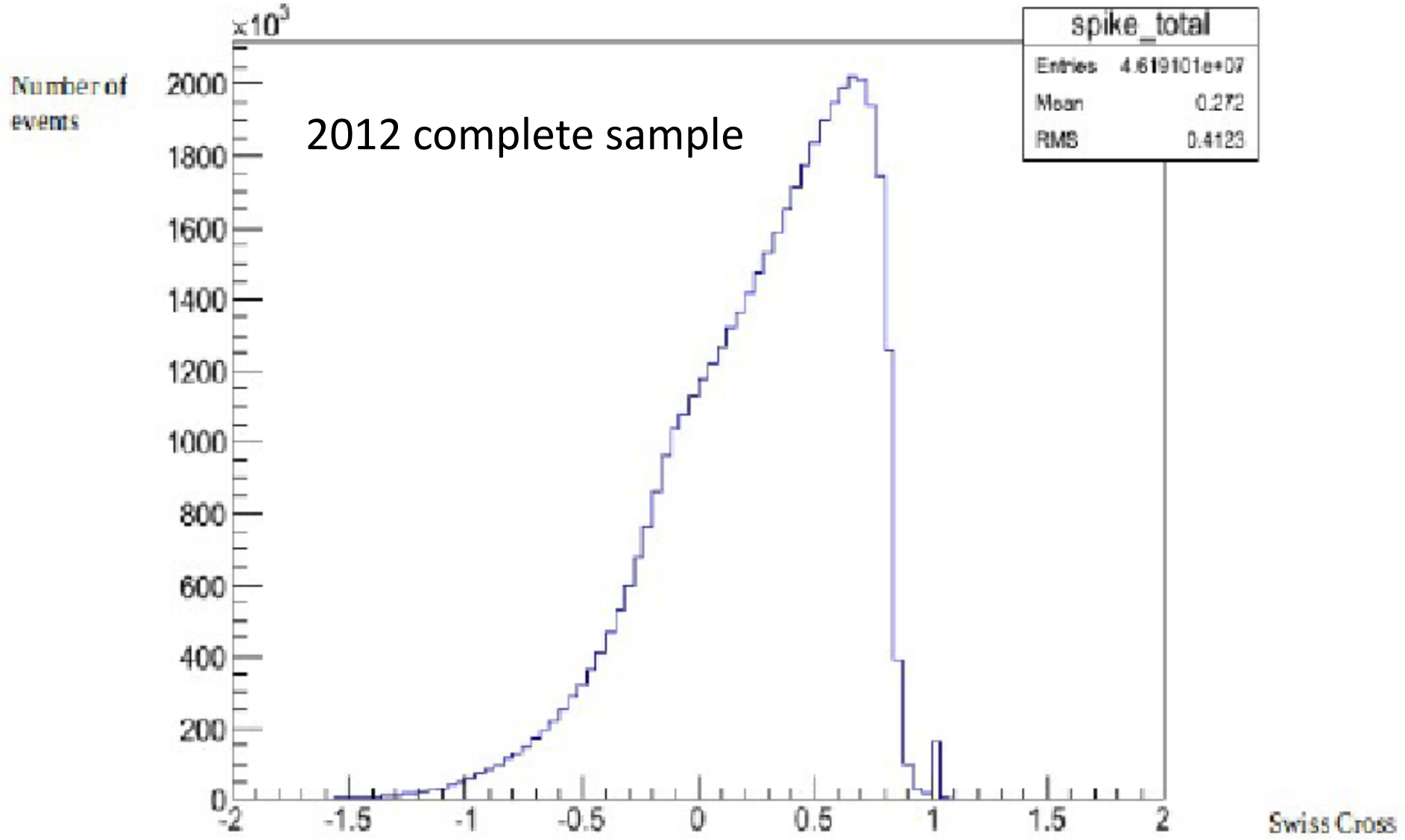


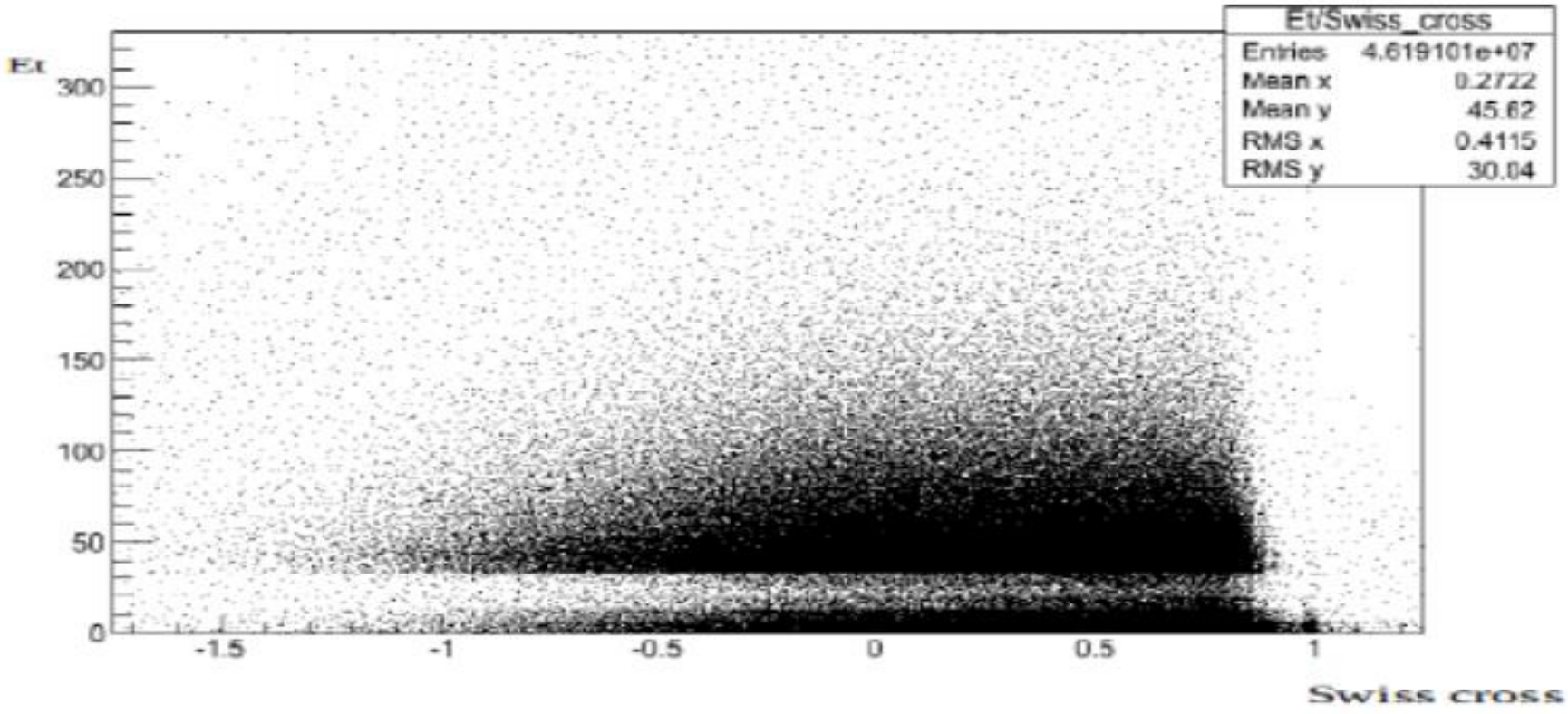
Swiss Cross on 2012D data



2013 MC data


Number of events
Spike
Entries 569740
Mean 0.5332
RMS 0.4304
10^5
10^4
10^3
10^2
10
1
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Swiss cross variable


2012 complete sample
spike_total
Entries 4.619101e+07
Mean 0.272
RMS 0.4123
Number of events
x10^3
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Swiss Cross



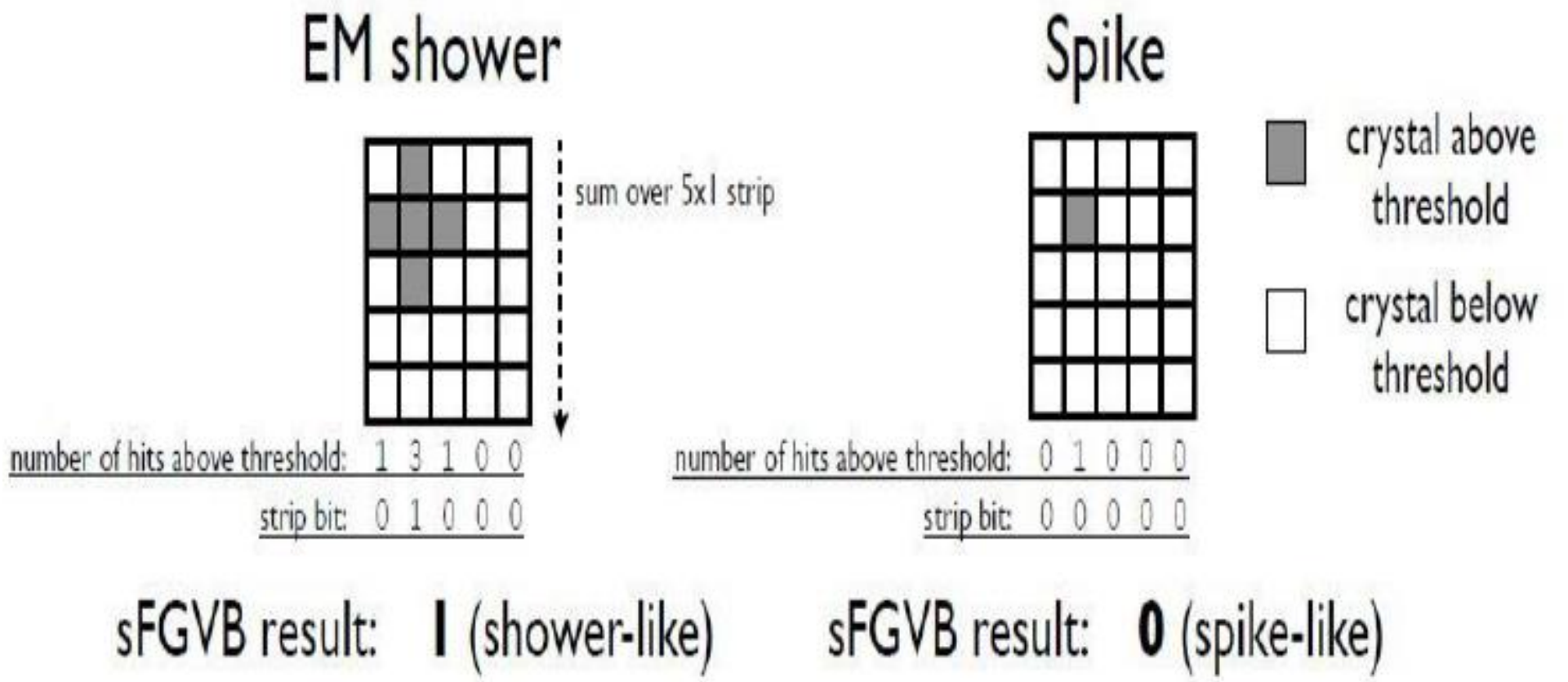
Conclusion of study of full 2012 data

Spikes is a low Pt phenomenon

Safe for high mass resonances ?

Online rejection:

single Fine Grain Veto Bit



Problems:

1. Accessing the online system.
2. Accessing Oracle database that contains the non-event data.

Motivation:

Apply and tuning sFGVB thresholds on the channels and compile it with the emulator on CMSSW. .

-made a script which extract the L1 Trigger parameters from Oracle databases

- applied to CMSSW_6_1_2_SLHC2_patch3

- spikes signal have decreased by 66%.

- production of 100 000 events at high Pt with spikes, work in progress ?

List of the presented talks :

(1) HEEP meeting, 2 September 2013, “Spike in L1 trigger and offline”.
“https://indico.cern.ch/conferenceDisplay.py?confId=268792”

(2) WP1 meeting, 25 September 2013, “Report”
“https://indico.cern.ch/conferenceDisplay.py?confId=274856”.

(3) WP1 meeting, 23 October 2013, “Study Spikes in the offline and elimination online”.
“https://indico.cern.ch/conferenceDisplay.py?confId=279245 ”.

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