

CrossTalkless Detector - An attempt to understand the VFAT2 noise source

F. García

Helsinki Institute of Physics HIP - University of Helsinki - Finland

R. de Oliveira

PCB Electronic workshop - CERN - Switzerland

E. Oliveri

University of Siena - INFN Pisa - Italy

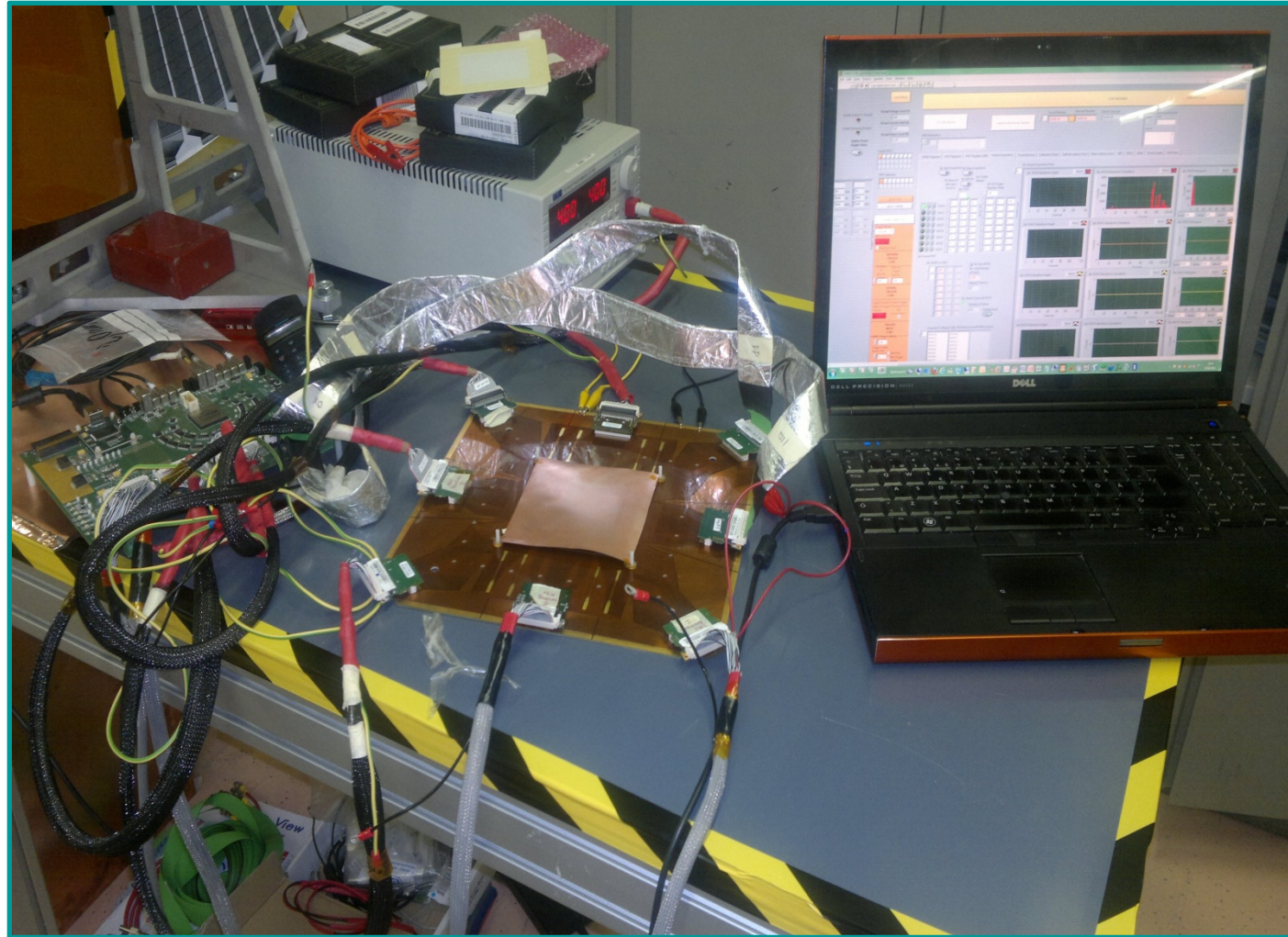
OUTLINE

- Introduction and Motivation
- CrossTalkless readout board
- CrossTalkless - a GEM detector
- Conclusions
- TODO

INTRODUCTION

CrossTalkless is a triple GEM detector that is currently used to better understand the operation of the VFAT2 under conditions of very low noise and crosstalk.

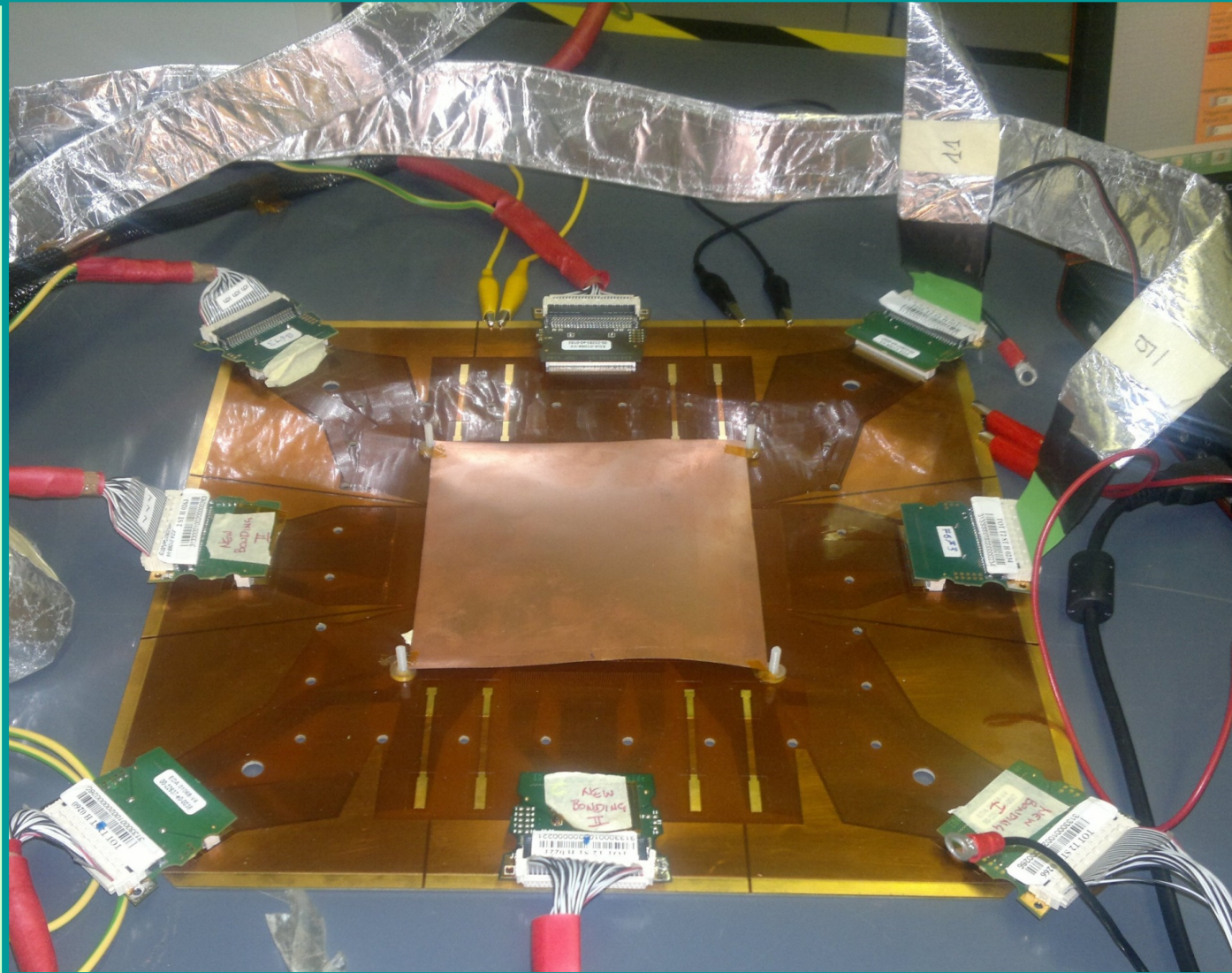
One of the main differences from others 2D readouts is that, this has X and Y strips connected to a single chip.



MOTIVATION

What we wanted to learn

- Can the noise at the channel level be reduced ?
- Will the separation of the grounds play any roll ?
- Will the 2D readout in a single chip be affected by Crosstalk ?
- Will the 2D readout with two chips reproduce the noise and crosstalk previously observed in TOTEM T2 GEM detectors ?
- Can a triple GEM detector with this configuration be operated with one monostable pulse length ?





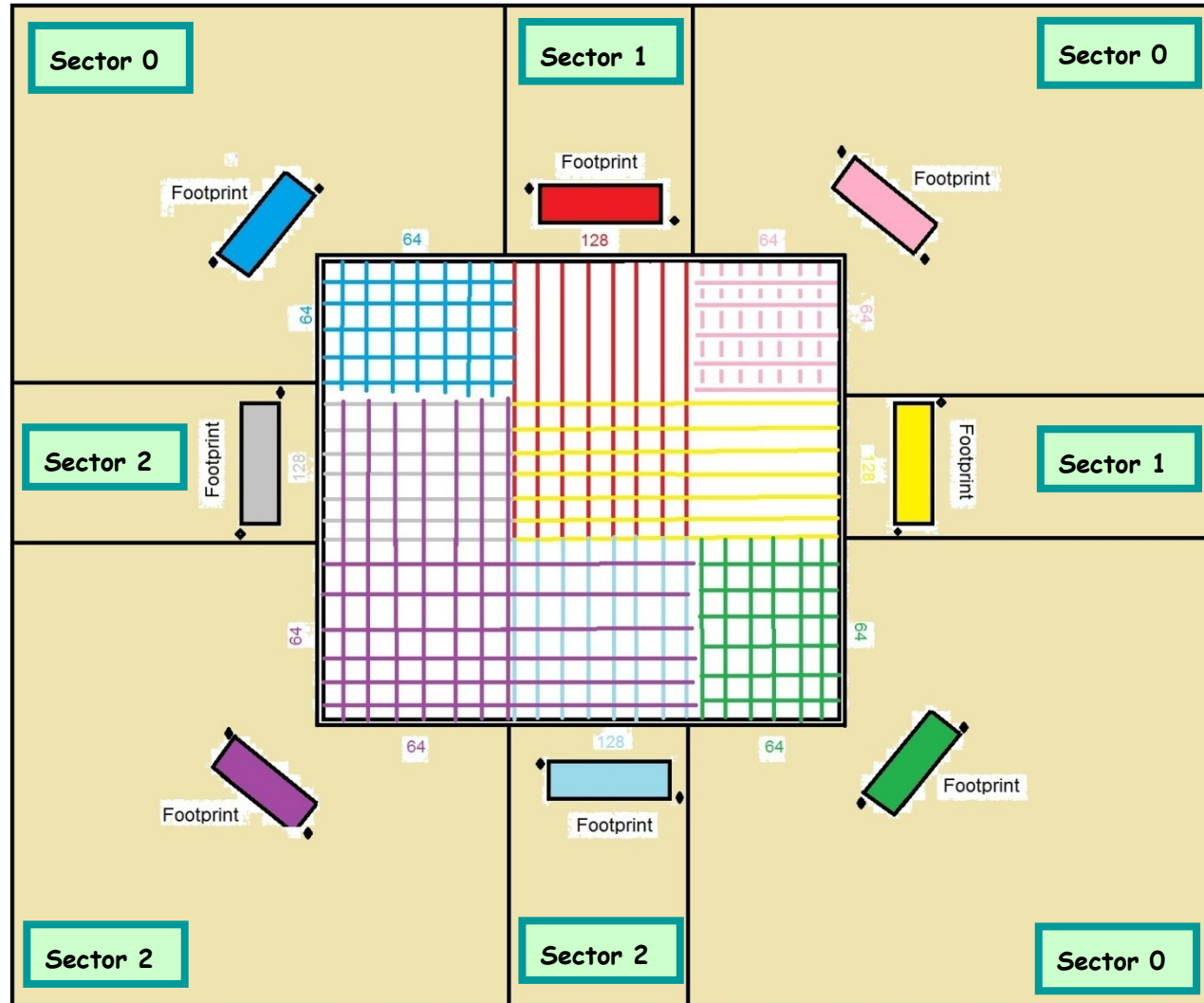
CrossTalkless Readout Board

CrossTalkless Configuration board

There are 3 VFATs, with 64 strips in X and 64 strips in Y directions - Called Sector 0.

There are 2 VFATs, with 128 strips in X and 128 strips in Y directions crossing each other - Called Sector 1.

There are 3 VFATs with 64 Strips on X crossing the 128 strips on another VFAT and similar configuration for the another 64 strips on Y - Called sector 2

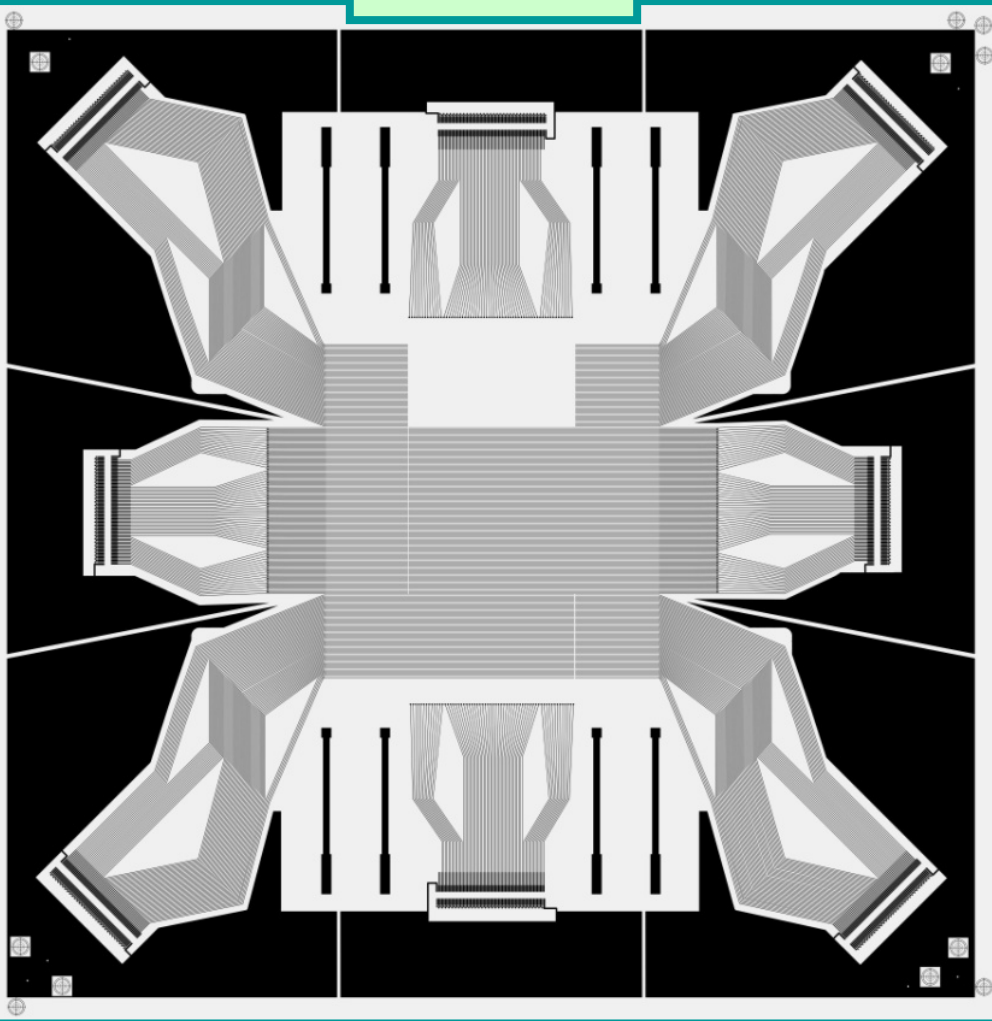


At Rui's workshop

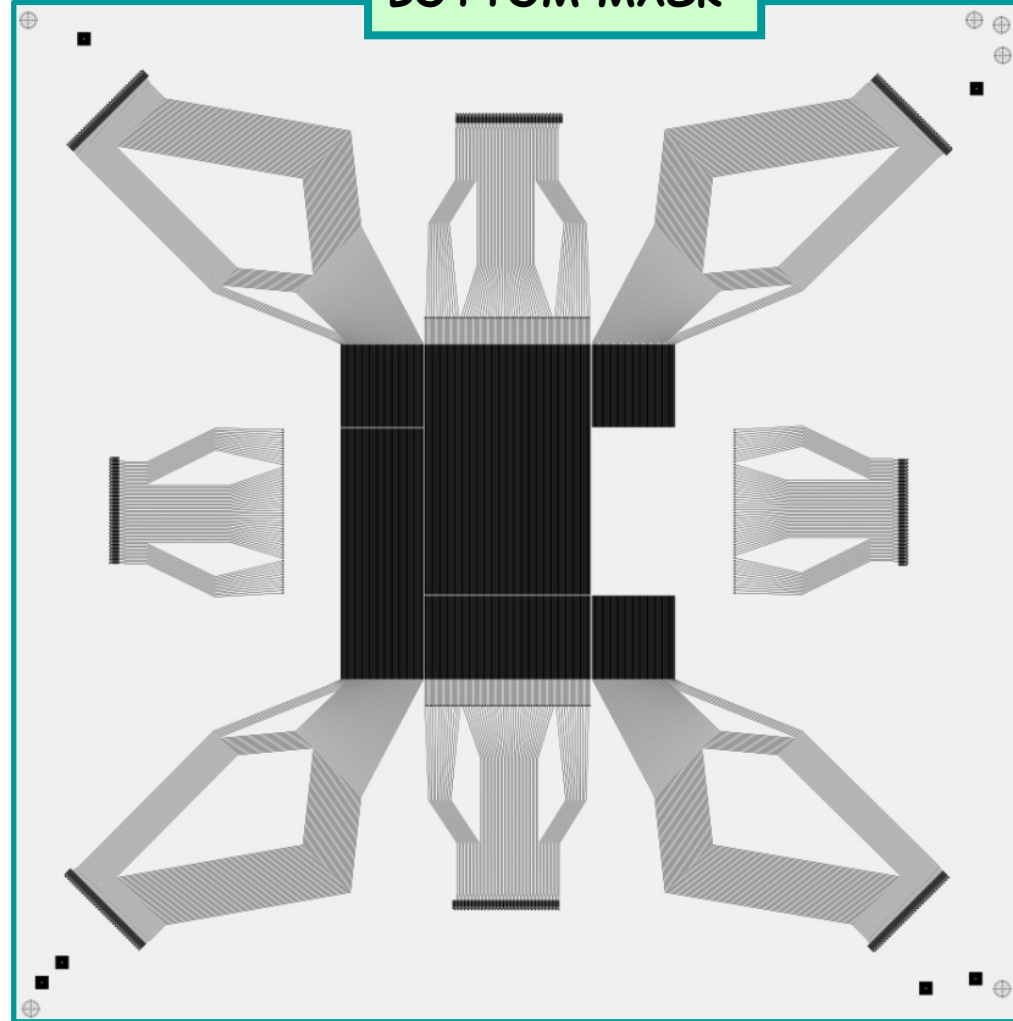


CrossTalkless Readout Board (cont.)

TOP MASK

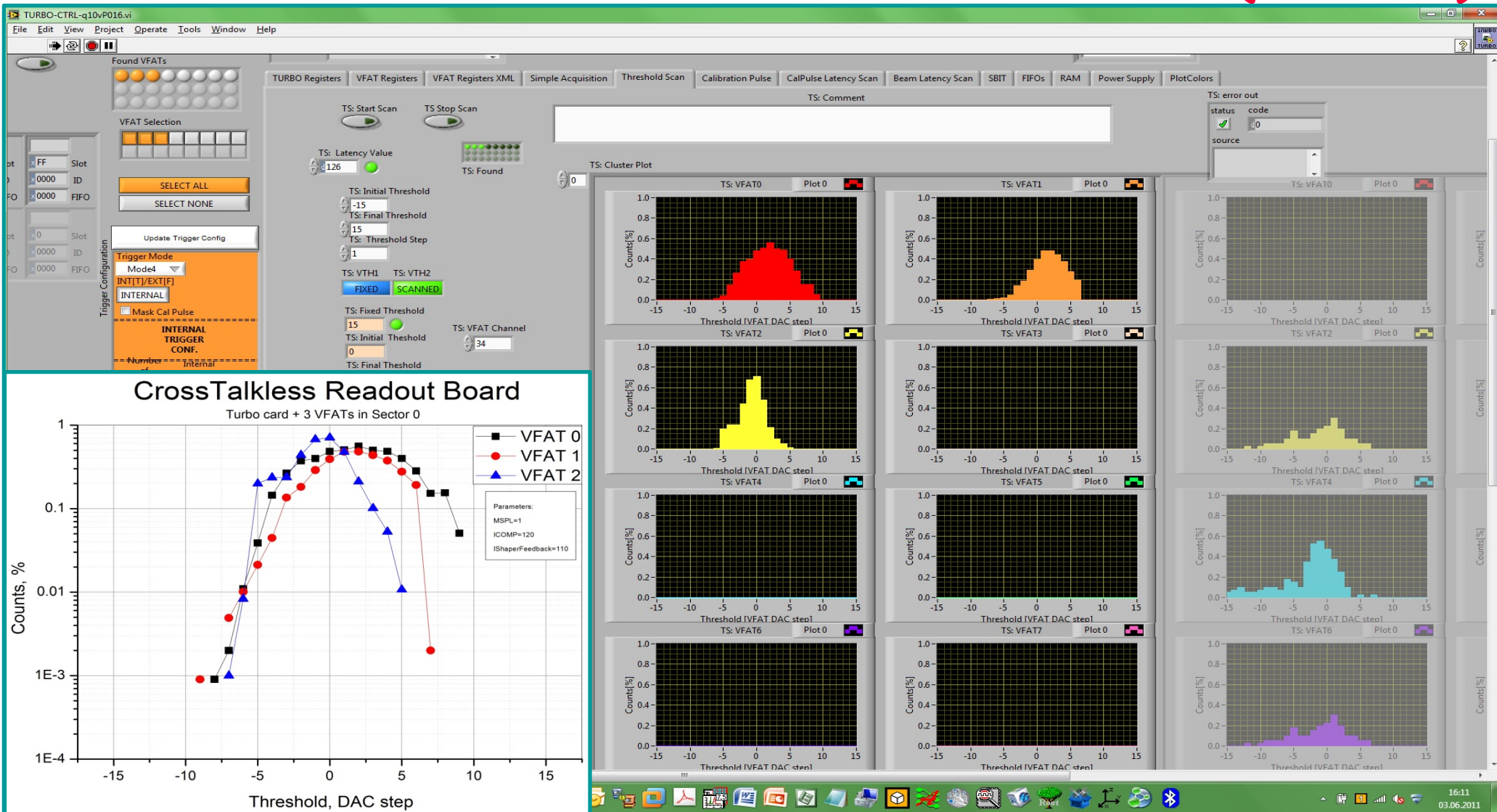


BOTTOM MASK



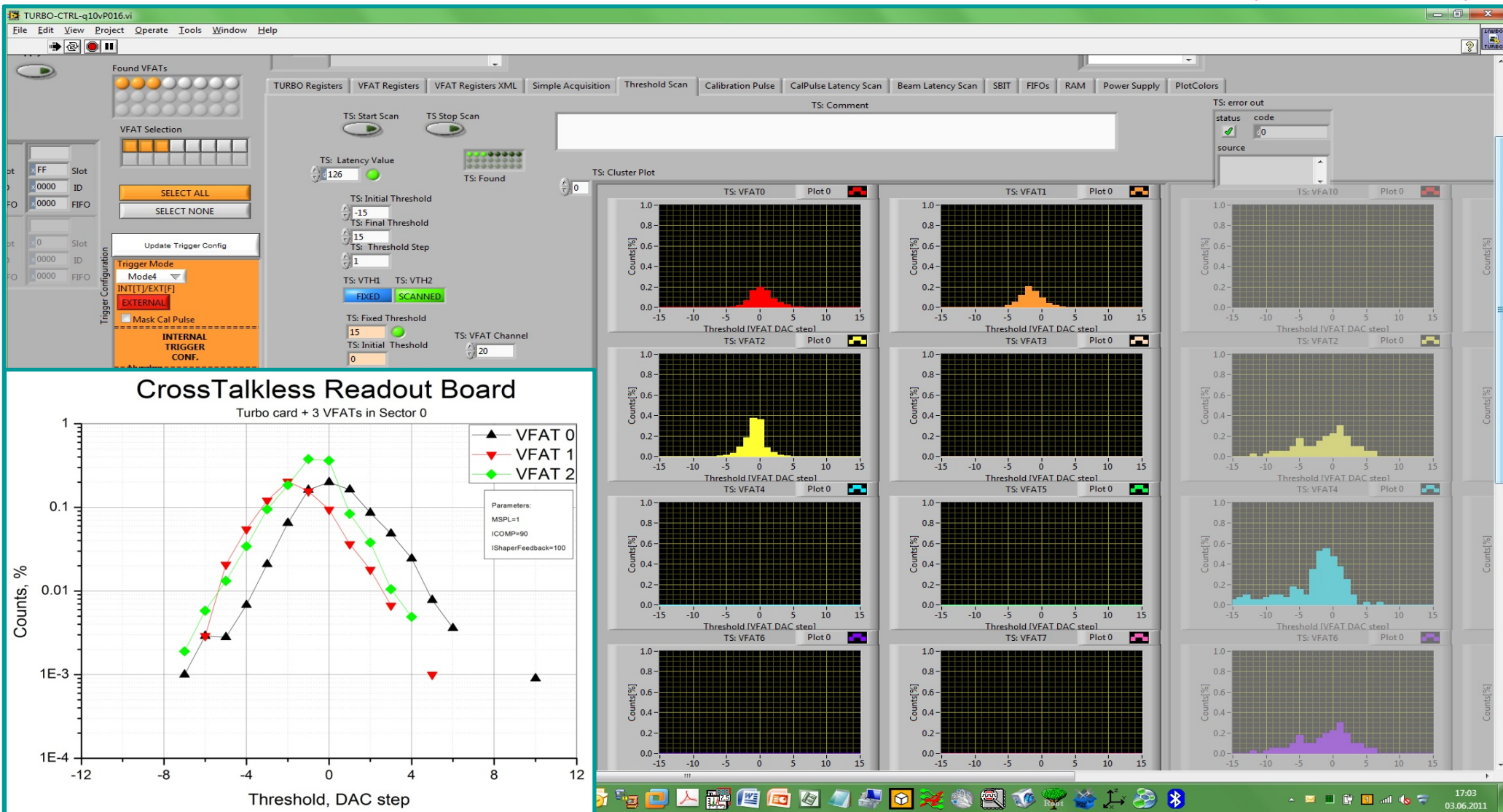


CrossTalkless Readout Board (cont.)



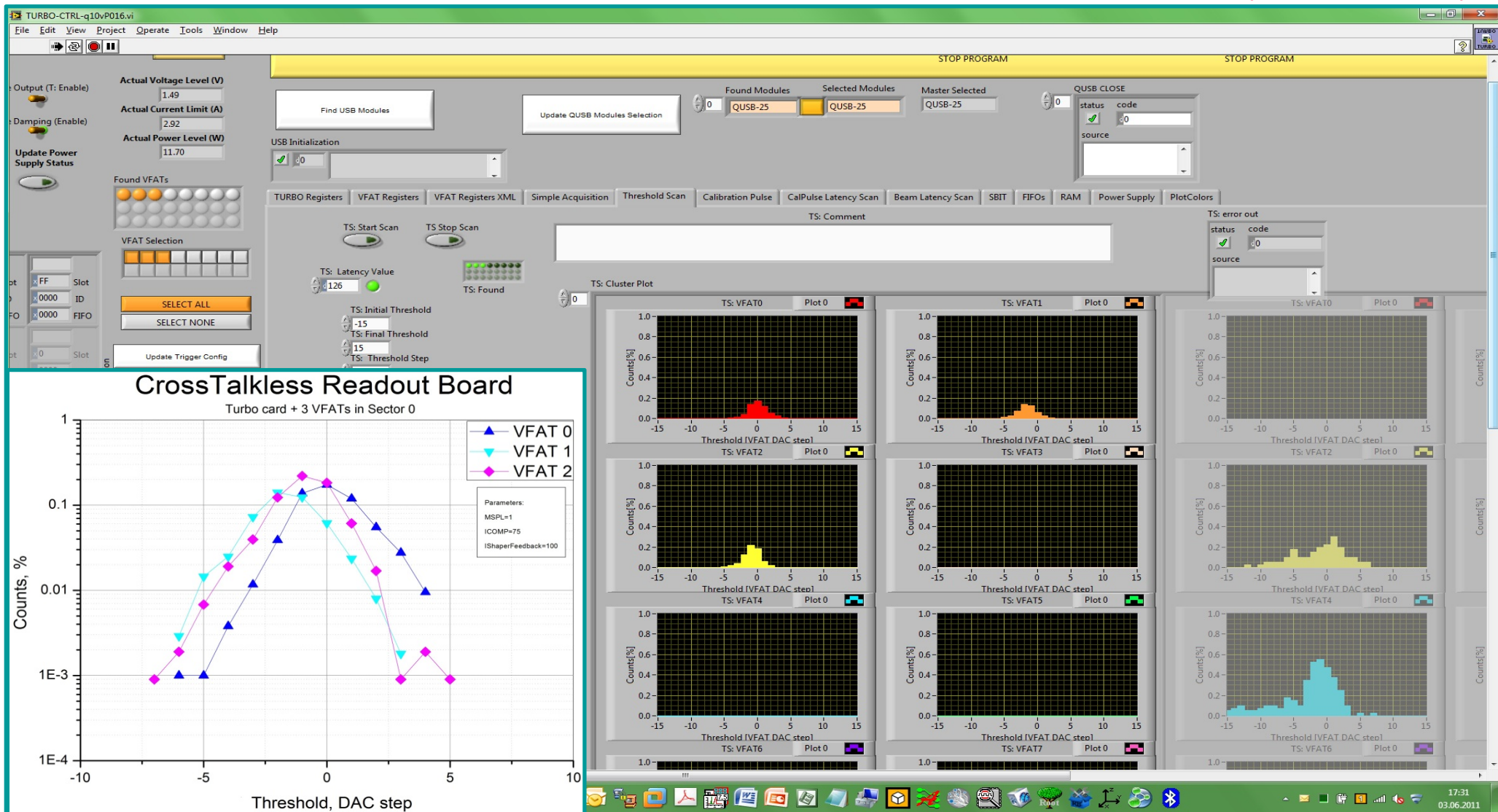


CrossTalkless Readout Board (cont.)





CrossTalkless Readout Board (cont.)





CrossTalkless - a GEM Detector

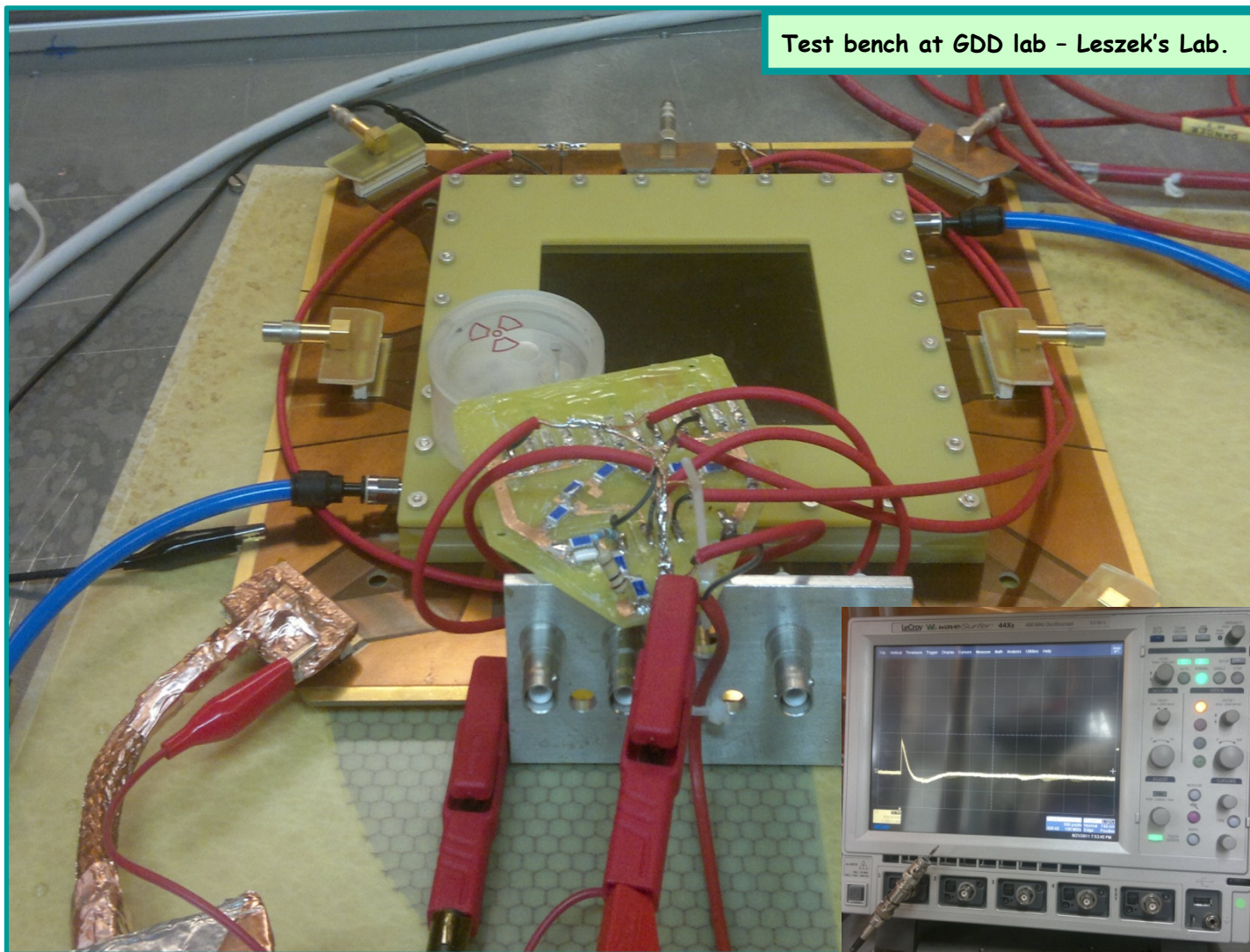
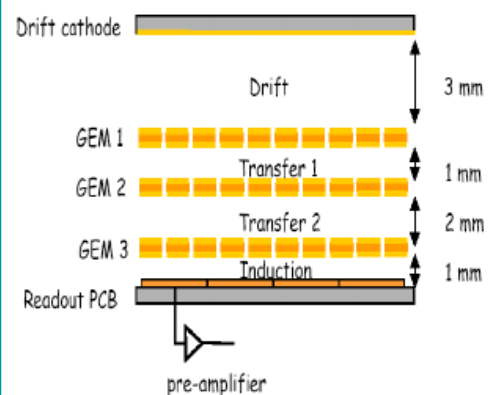
CrossTalkless Lab. Test

First signals obtained in the Lab. for the sector 0.

The configuration for this test was one preAmplifier connected to 128 strips from which 64 strips were in X and 64 strips on Y directions.

HV: 3800V and Gas ArCO₂ (70/30)

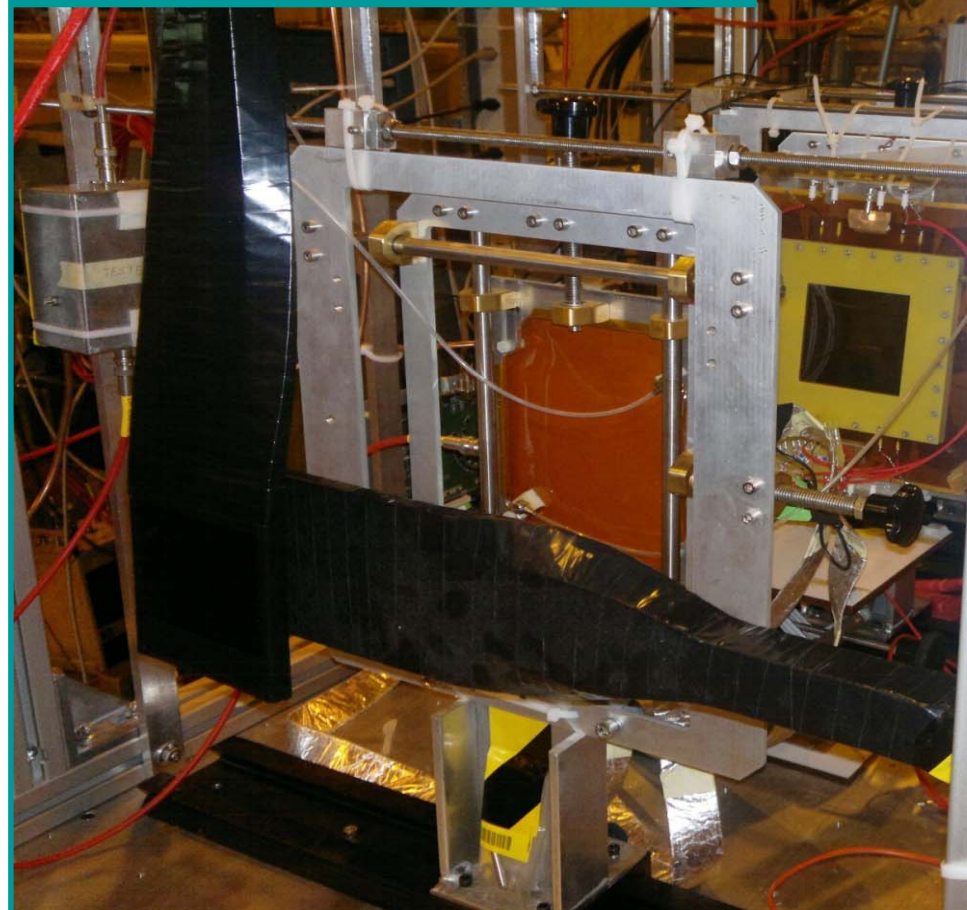
CrossTalkless Detector Layout



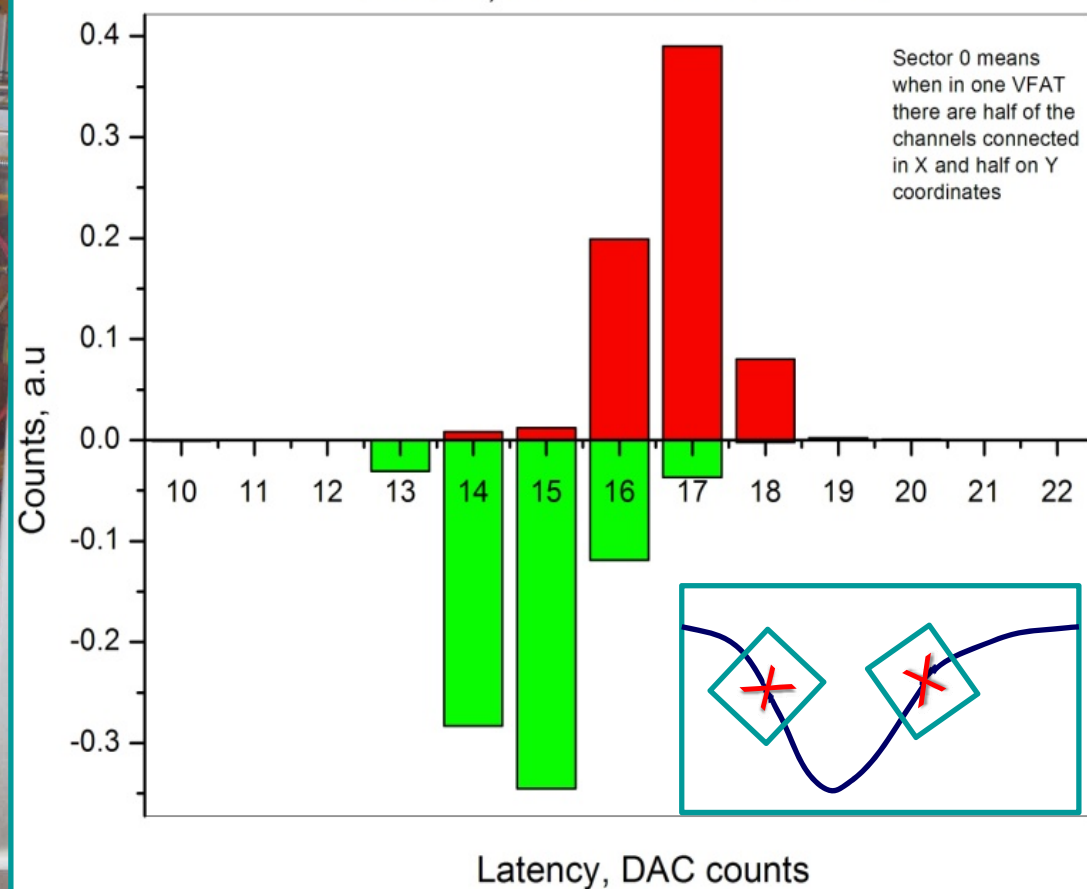
CrossTalkless - a GEM Detector

TOTEM BEAM TEST AT SPS, muon @ 150 GeV/c

The CrossTalkless was the DUT inside the RD51 tracker made of 3 triple GEMs



Latency Scan for the CrossTalkless Triple GEM Detector
Sector 0, MSPL = 1 and Thld = 20





CrossTalkless - a GEM Detector

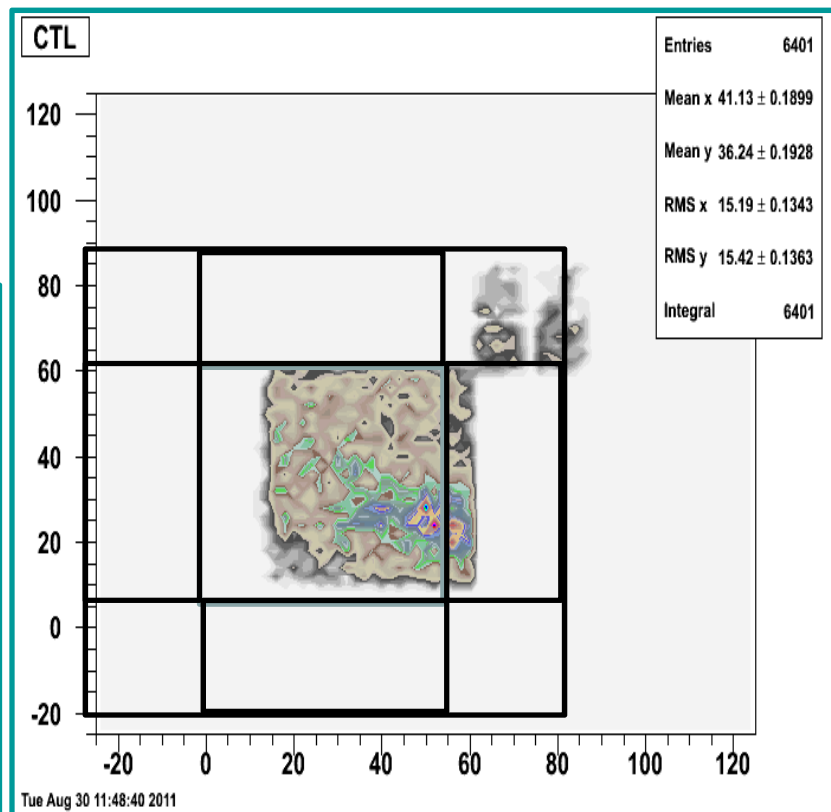
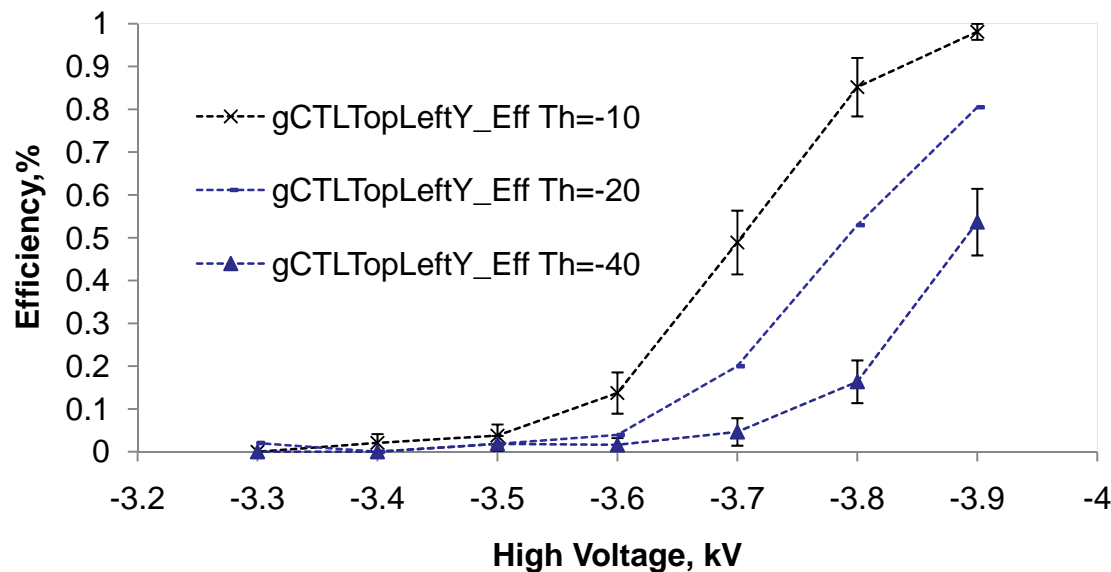
An efficiency of about 100% was reached with the High Voltage at 3.9 kV and with a threshold of 10

PRELIMINARY

High Voltage Scan for the Sector 0

Ar/CO₂ 70/30

MSPL=1clk, Latency=16, Threshold=-10,-20,-40

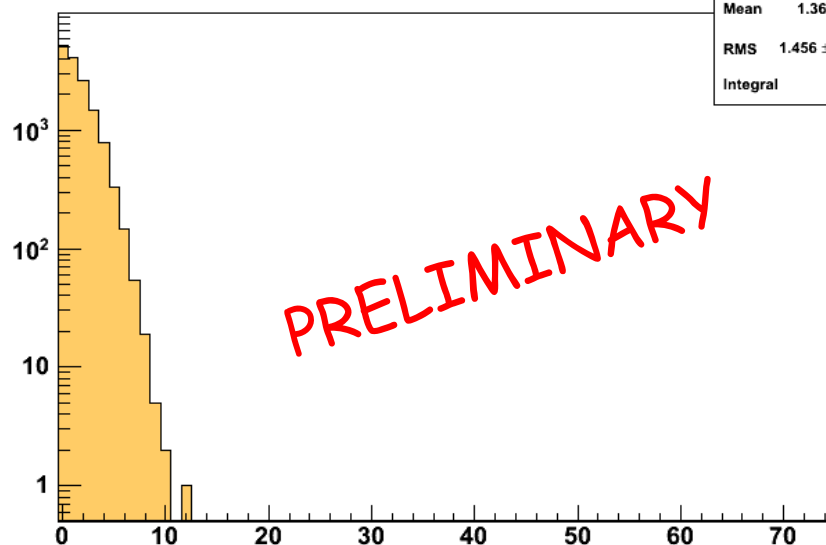


Map of the hits on the CrossTalkless and in black the superimposition of the 10 x 10 GEM detector of the RD51 Tracker



CrossTalkless - a GEM Detector

Number Of Clusters [Sector 0-Top Left X]



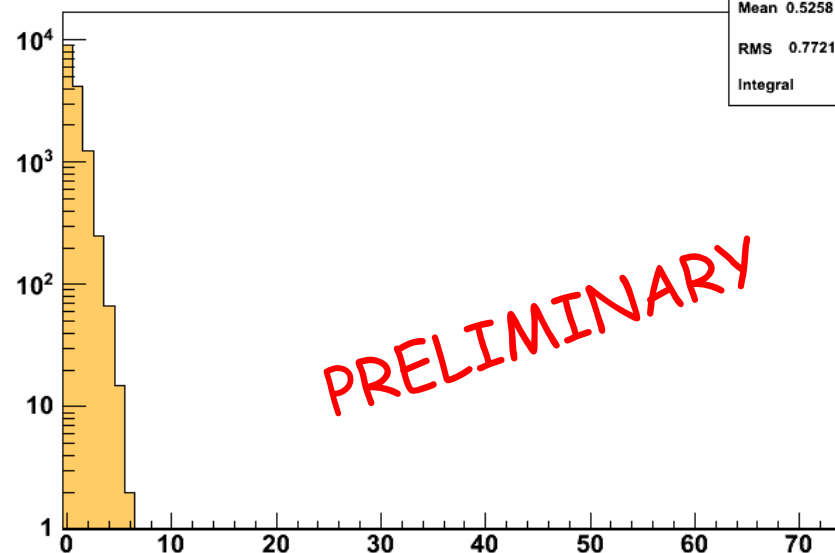
Entries	14797
Mean	1.36 ± 0.01197
RMS	1.456 ± 0.008462
Integral	$1.48e+04$

PRELIMINARY

Wed Aug 31 21:19:45 2011

Cluster Distribution for the X and Y strips of the Sector 0

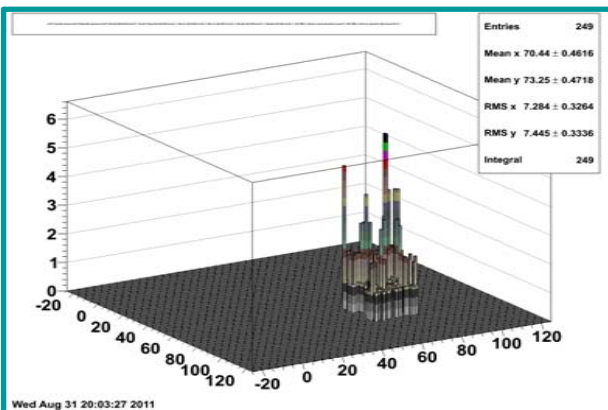
Number Of Clusters [Sector 0-Top Left Y]



Entries	14797
Mean	0.5258 ± 0.006347
RMS	0.7721 ± 0.004488
Integral	$1.48e+04$

PRELIMINARY

Wed Aug 31 21:19:15 2011



Entries	249
Mean x	70.44 ± 0.4616
Mean y	73.25 ± 0.4718
RMS x	7.284 ± 0.3264
RMS y	7.445 ± 0.3336
Integral	249

The threshold was set to 5 DAC steps in order to increase the effect of the noise in the cluster size distribution

CONCLUSIONS

- The reduction of the noise at the channel level was achieved
- The separation of the grounds is not needed, but a thick and common ground is necessary
- Crosstalk between strips in a single chip 2D readout was not observed
- The reproduction of the noise and crosstalk for multiple chips in 2D readout was successful
- The CrossTalkless Triple GEM works well in ArCO_2 (70/30) and $\text{MSPL} = 1$

TODO

- Test CrossTalkless with ArCO_2CF_4
- Test of Frascati HV GEM Module in order to investigate different Fields and Gains
- Measurement of the time resolution for the single chip 2D readout