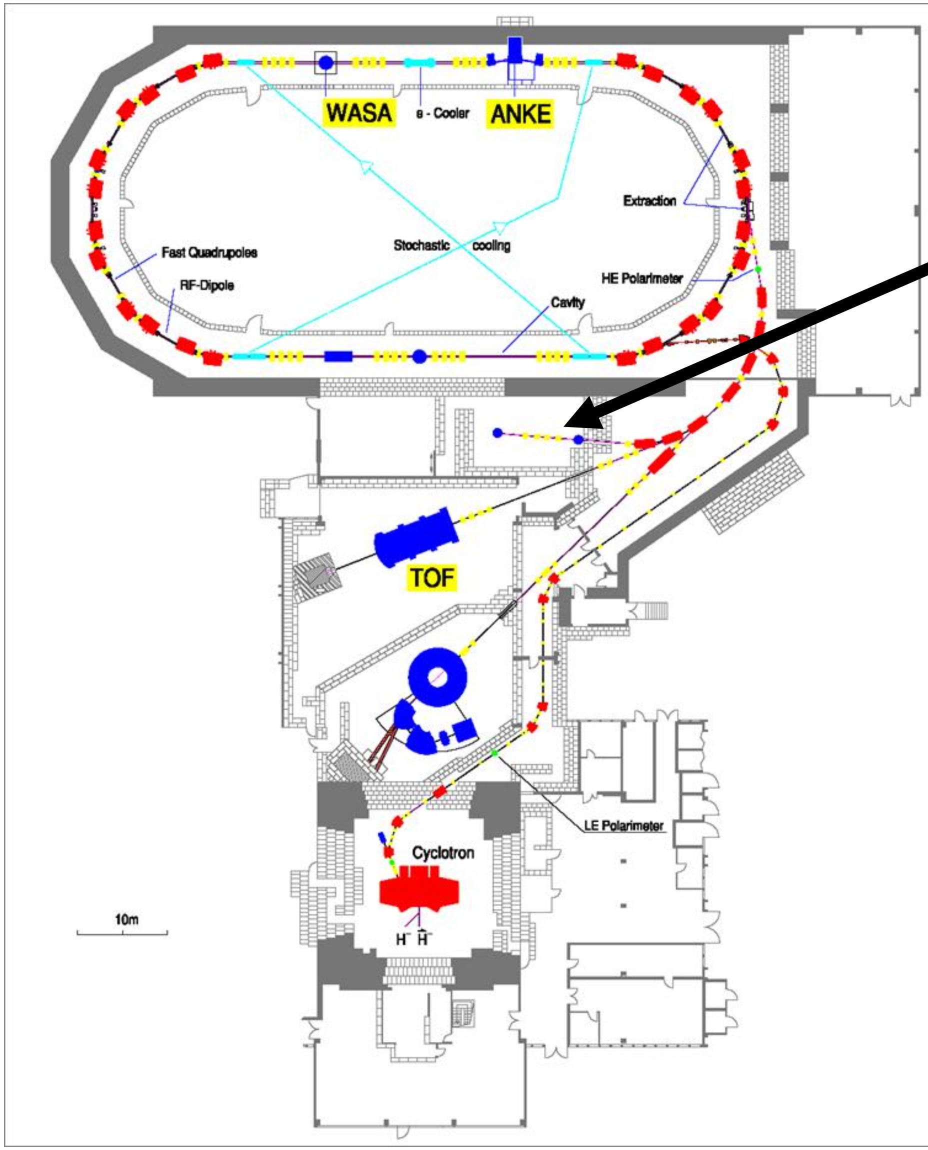
Electronic readout Test

We, 23.11-27.11.2011

- **Setup**
- **Noise Suppression**
- **Hit Pattern**
- **ADC values**

E. Epple, P. Koczoń, R. Lalik

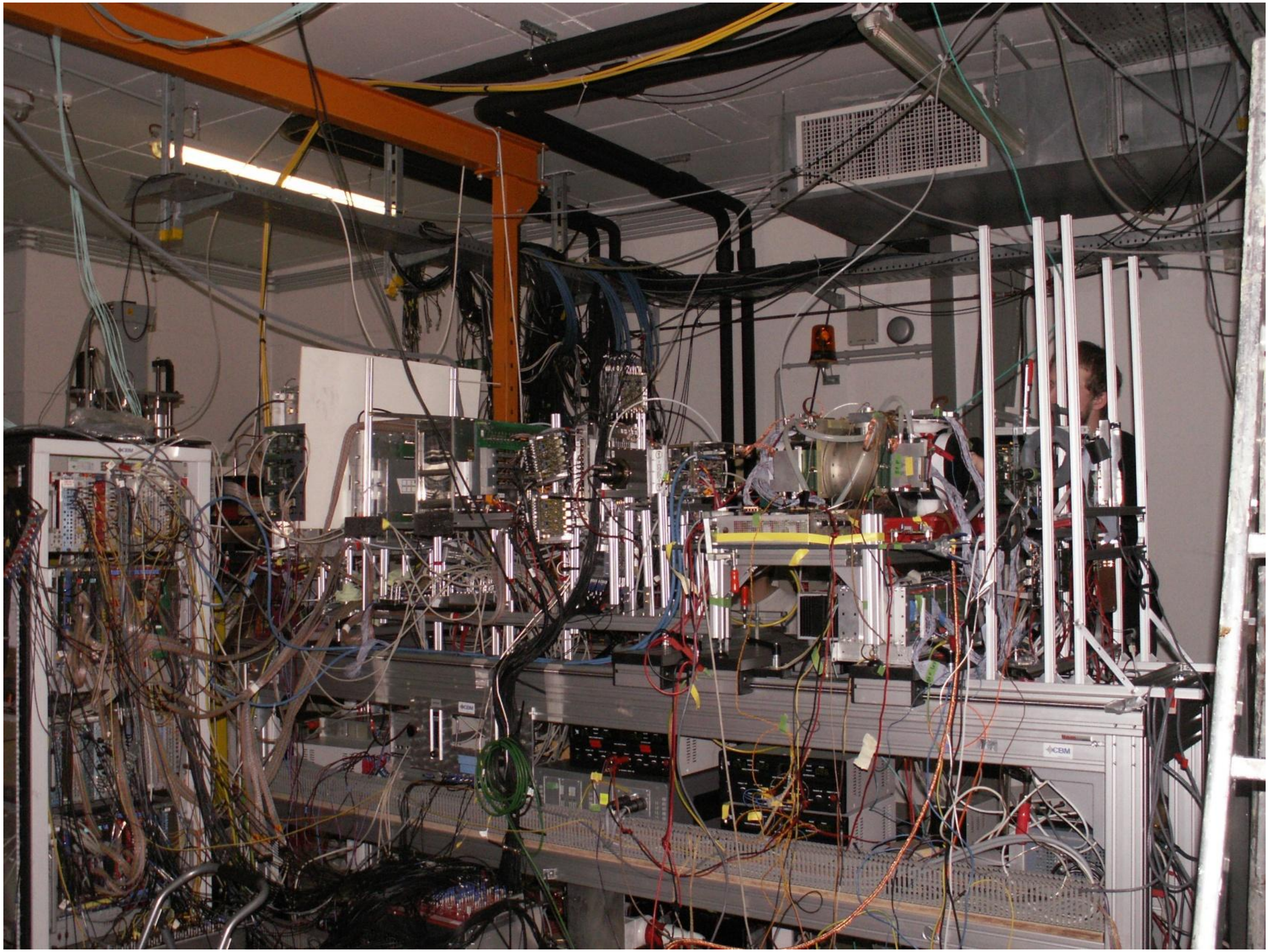
Test at COSY



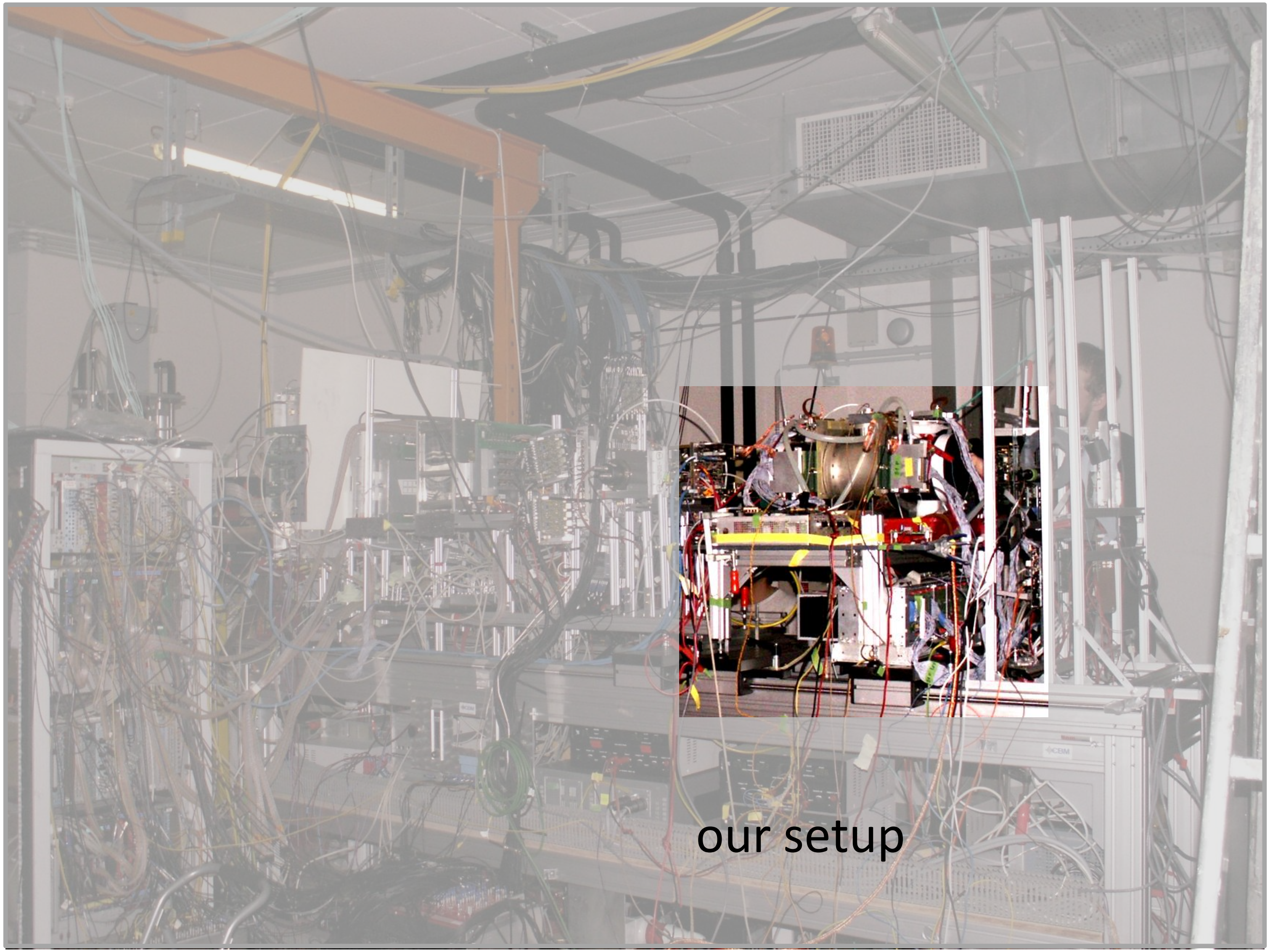
Experimental Hall

E. Epple, P. Koczoń, R. Lalik

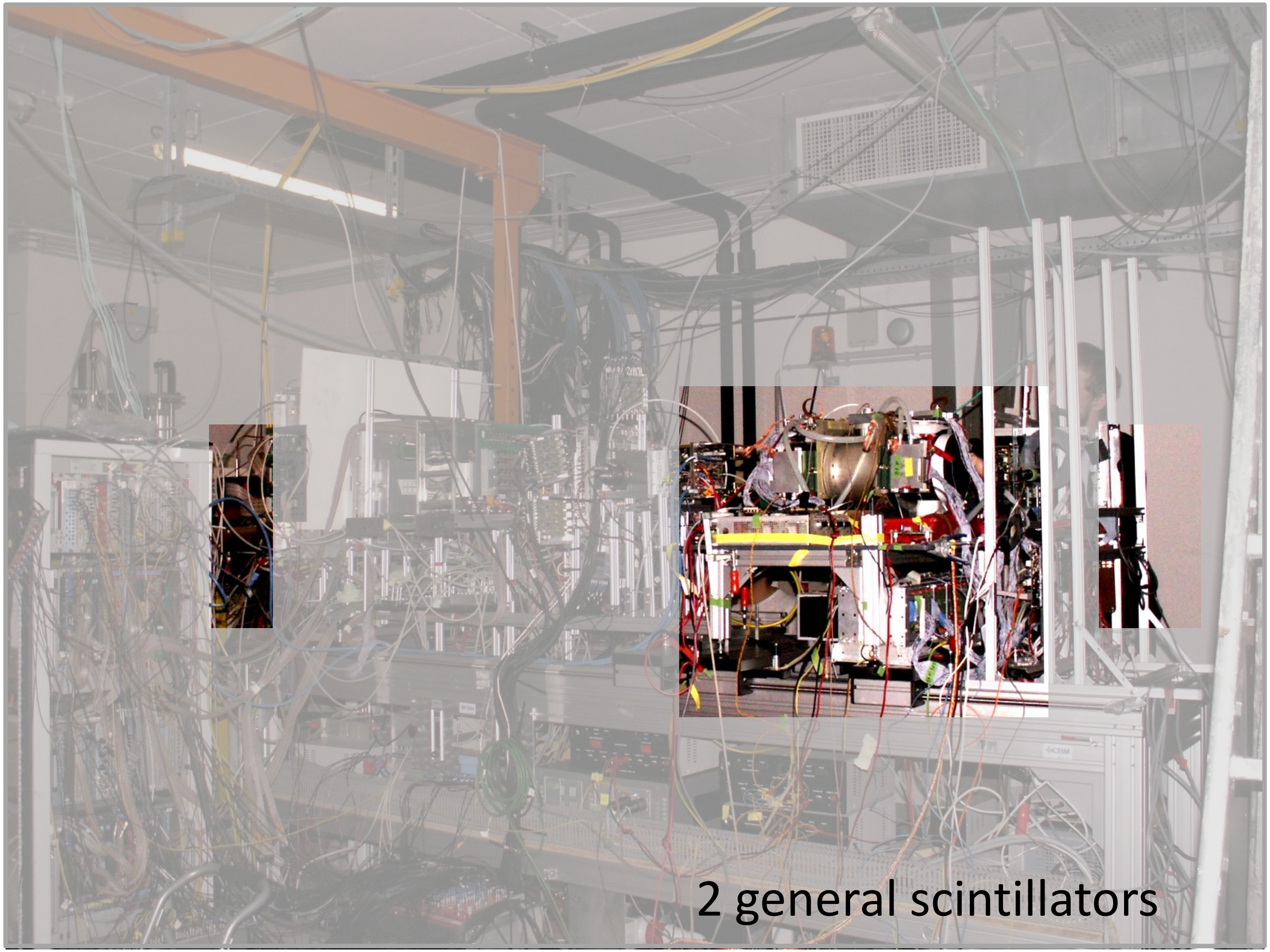
Setup



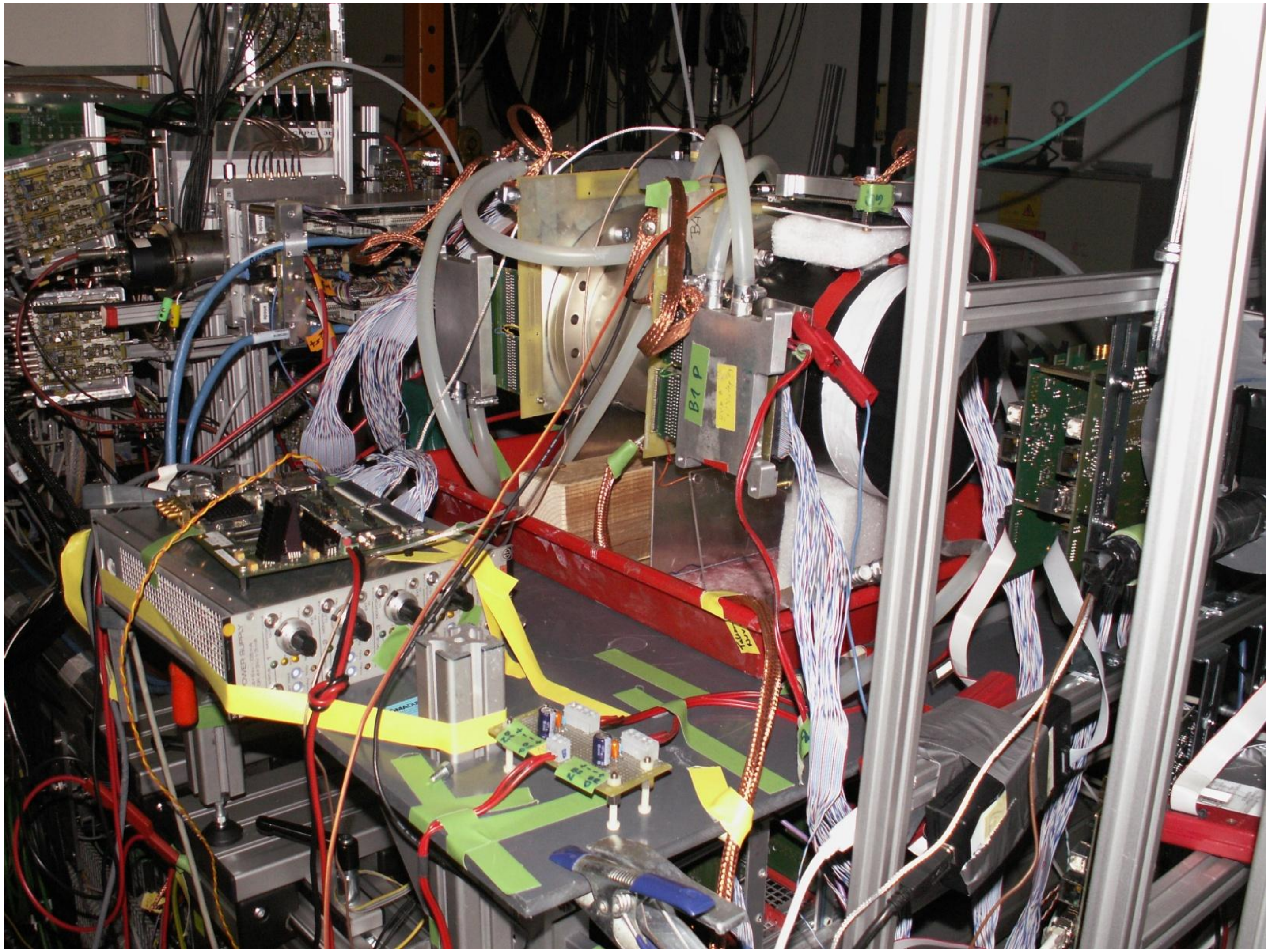
Setup



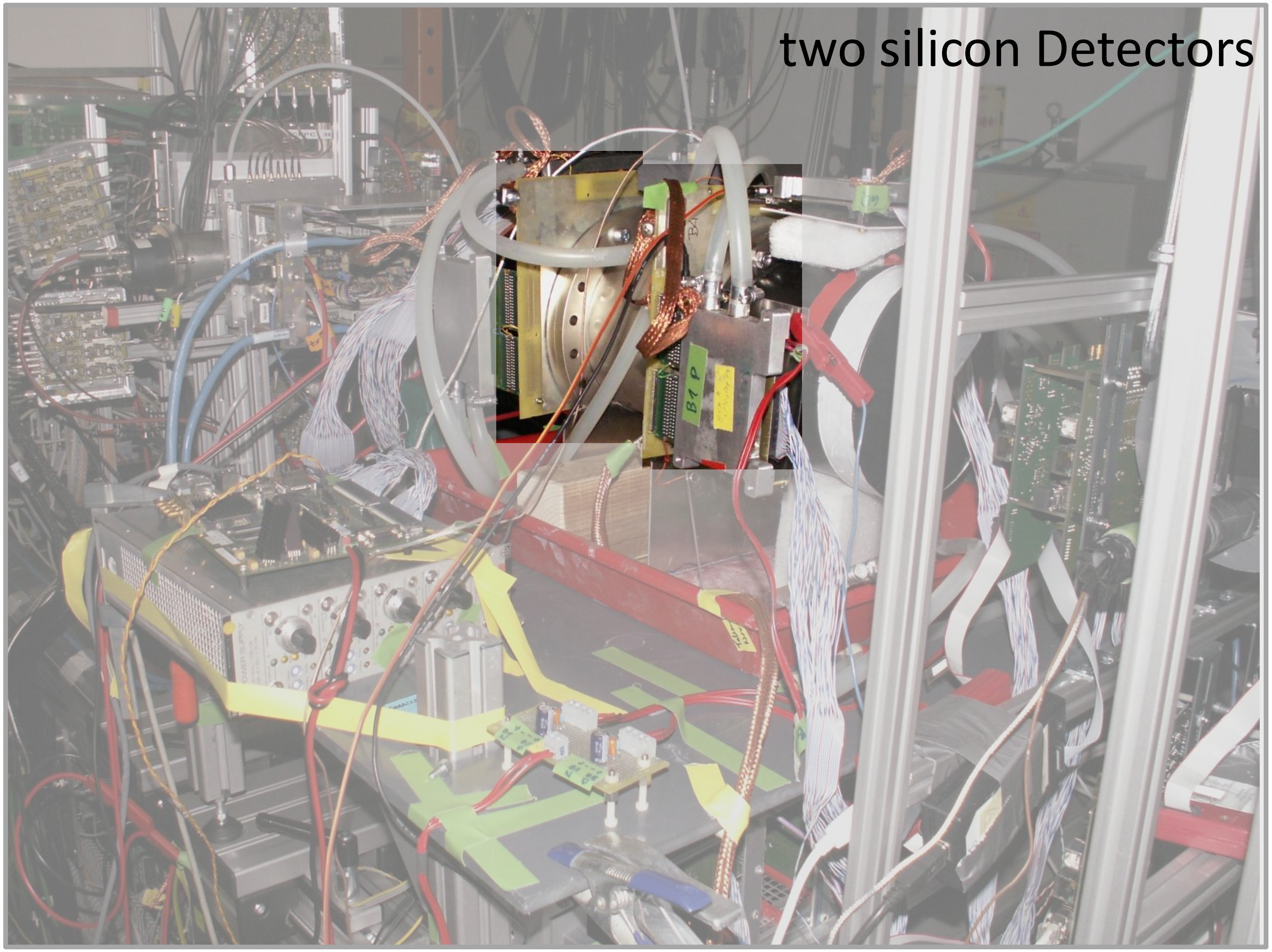
Setup



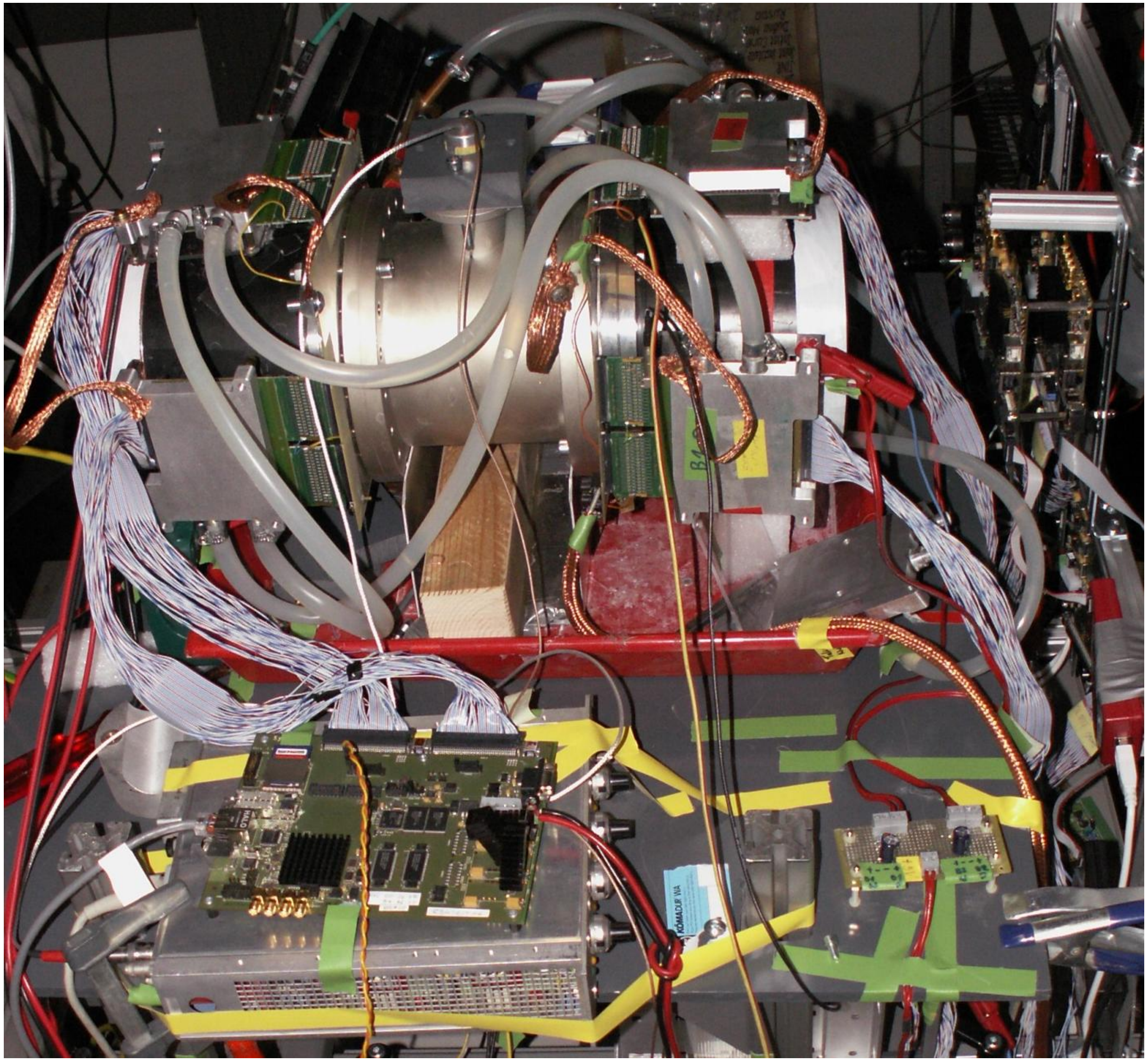
Setup



Setup

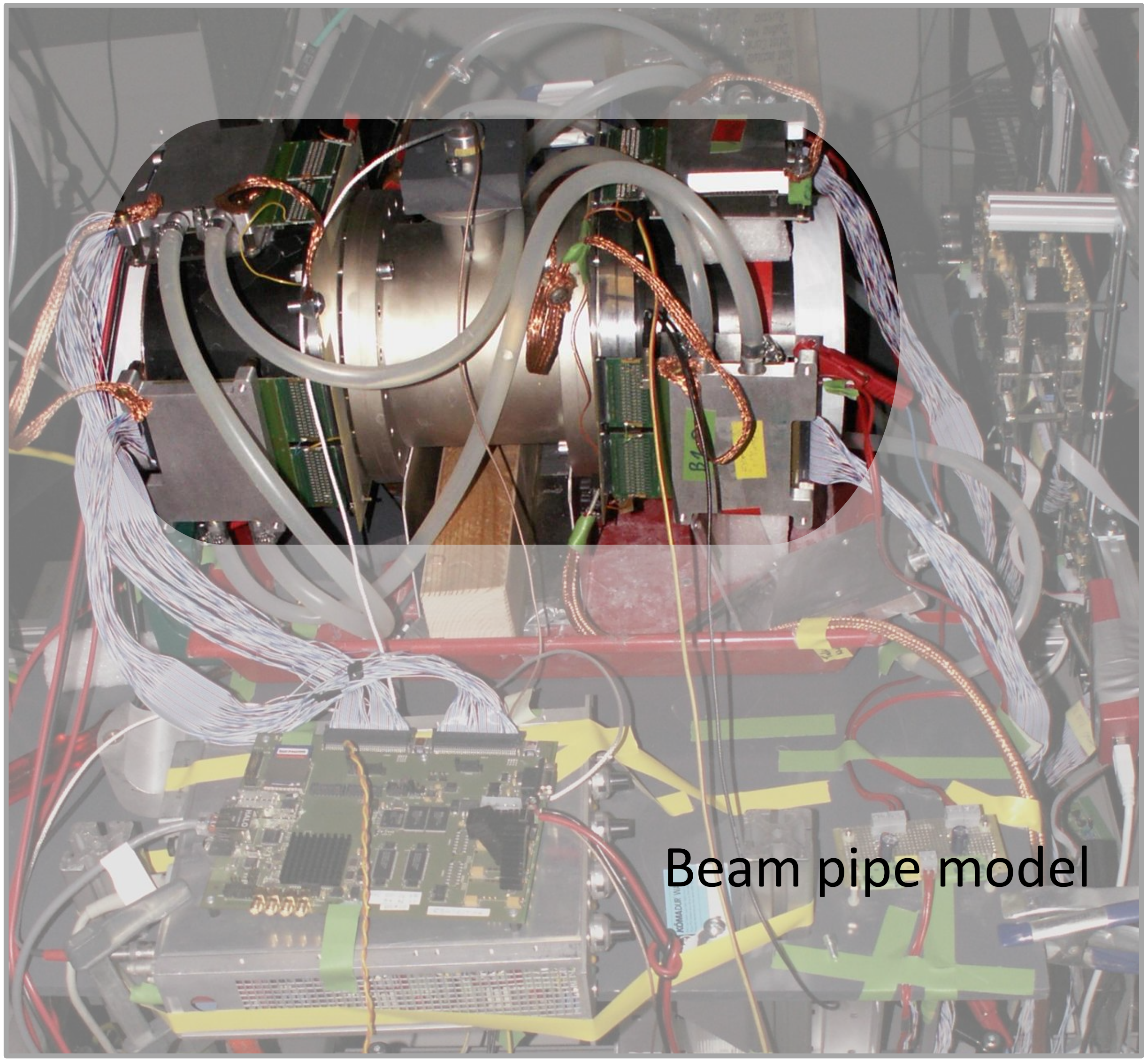


Setup

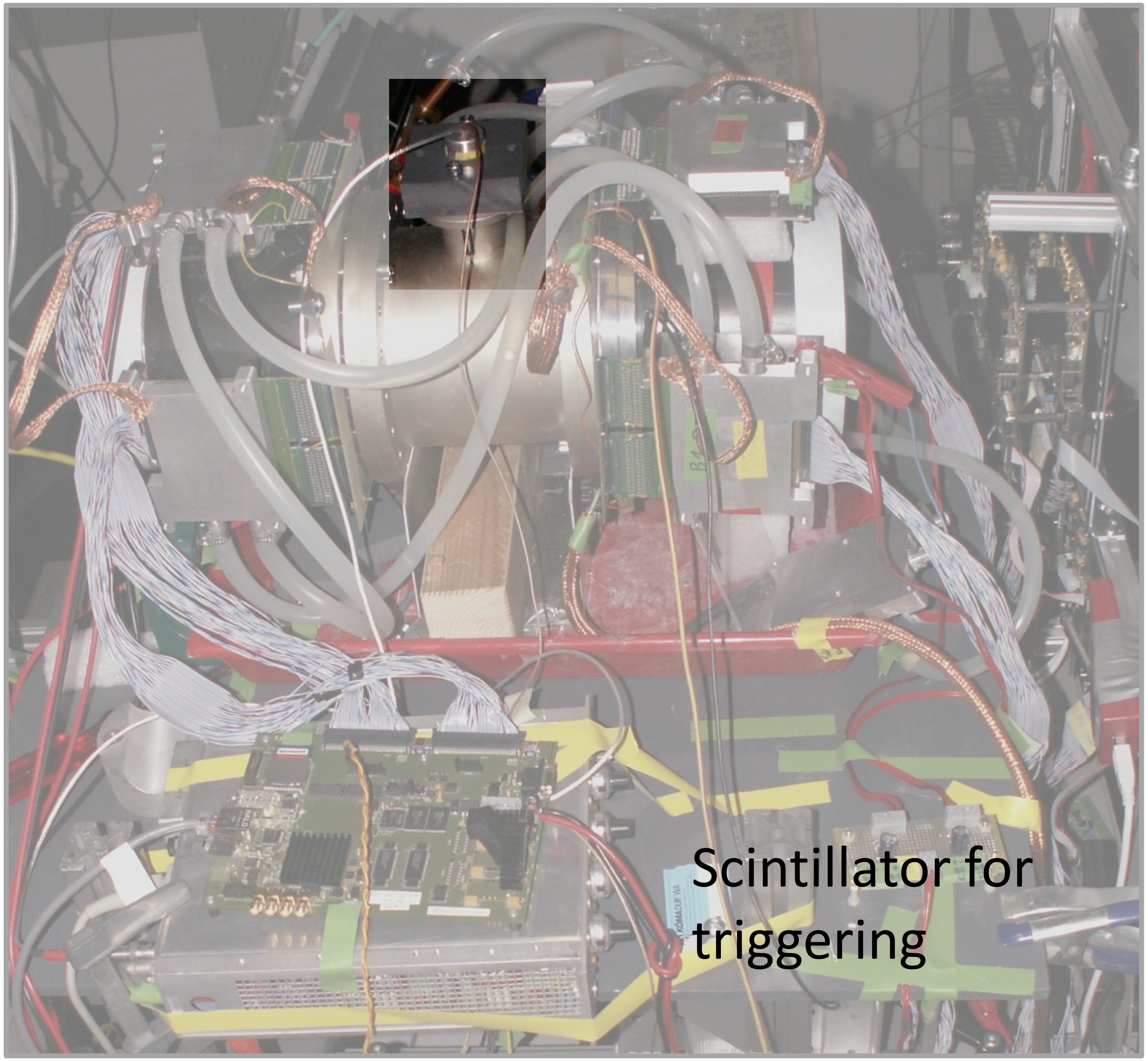


E. Epple, P. Koczoń, R. Lalik

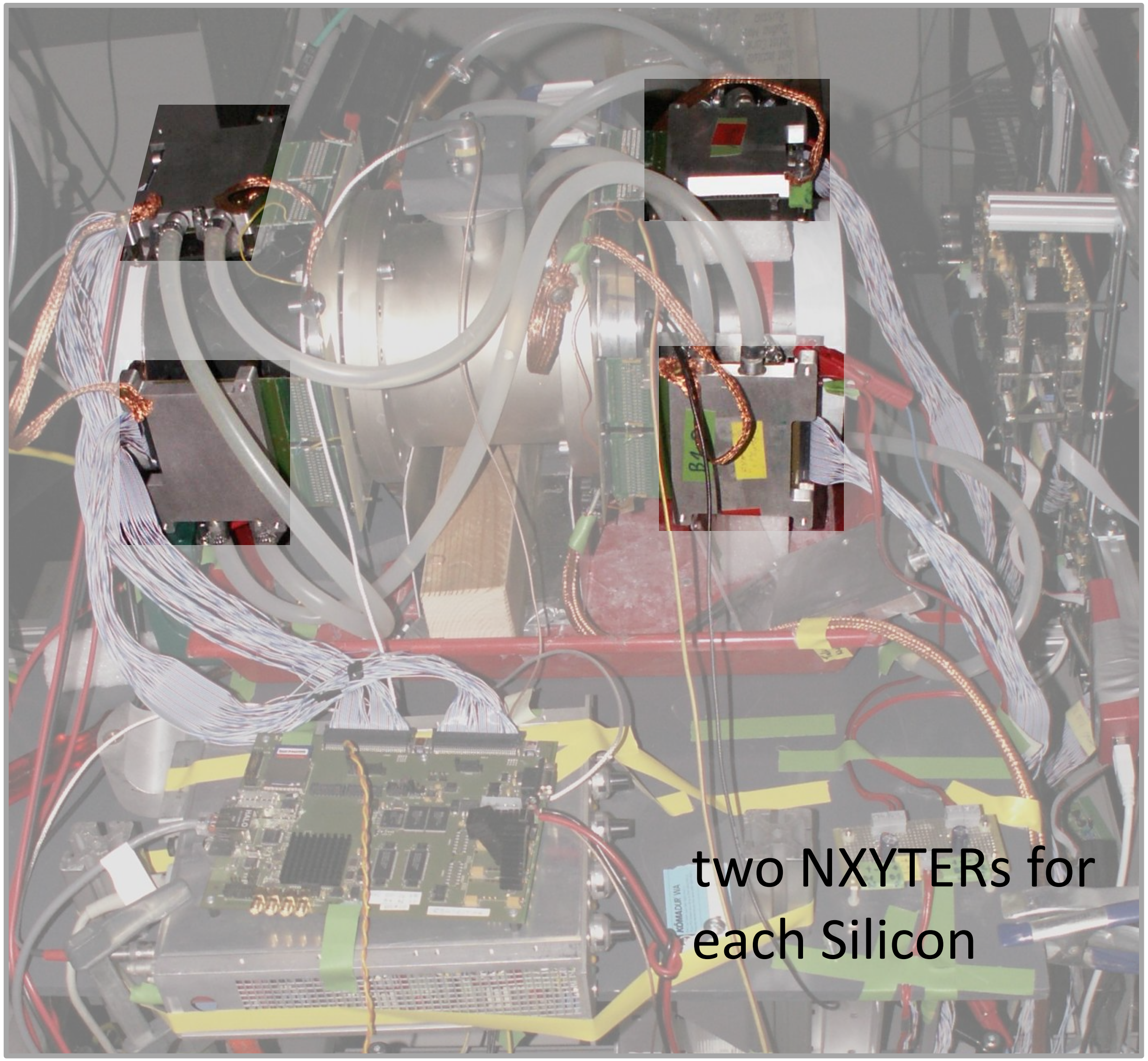
Setup



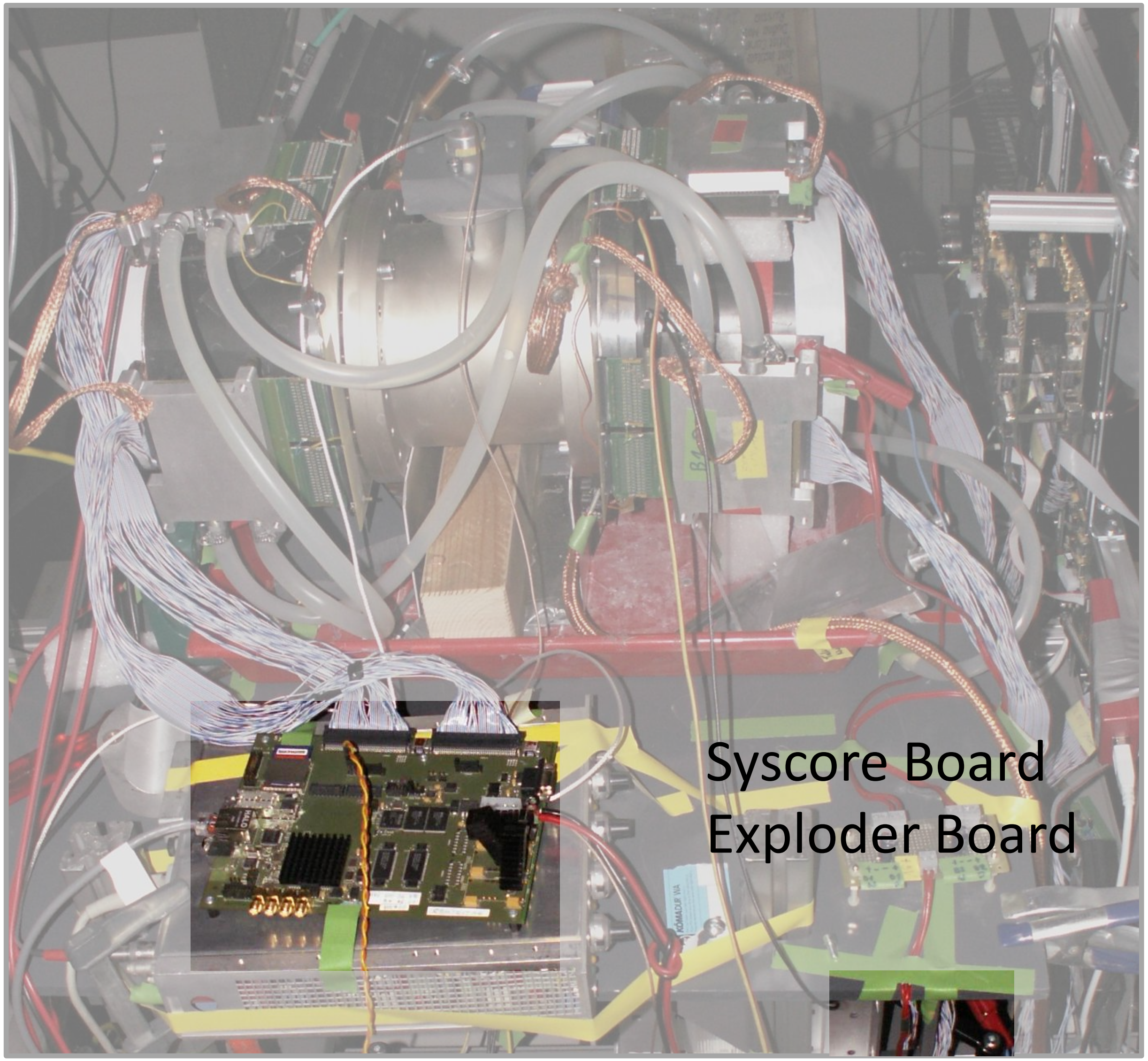
Setup



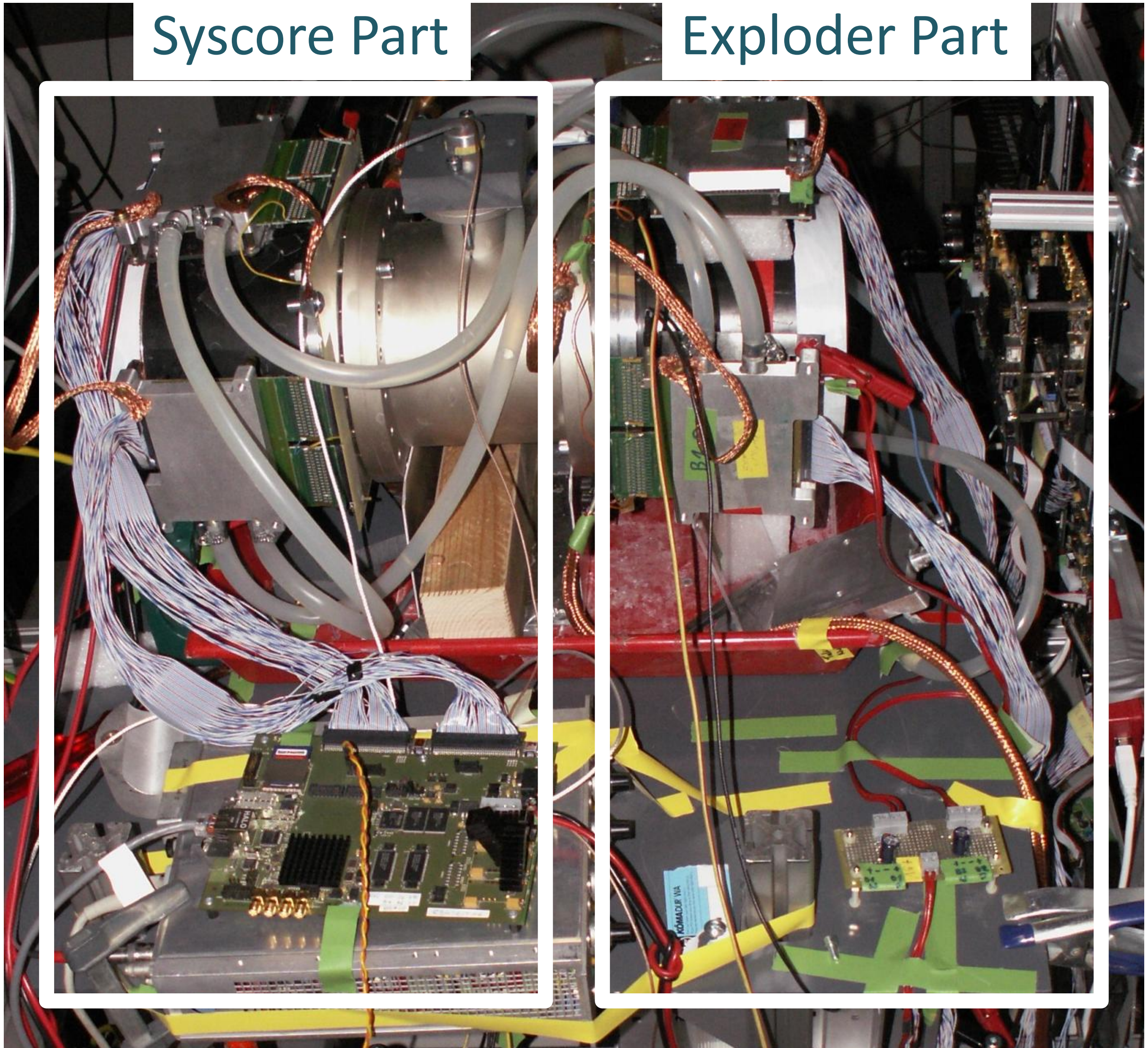
Setup



Setup



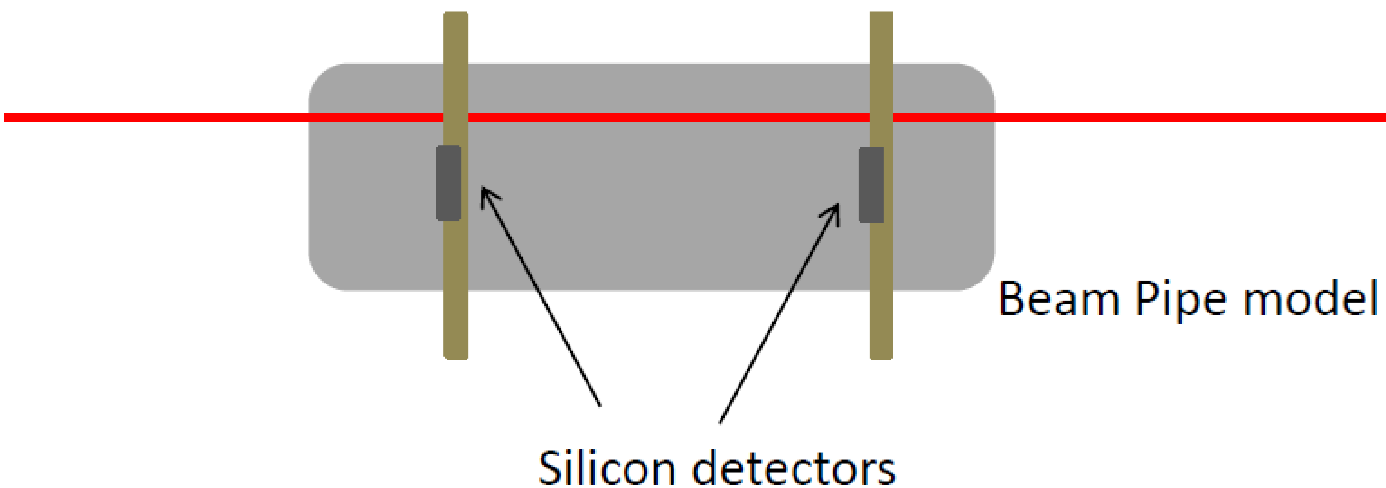
Setup



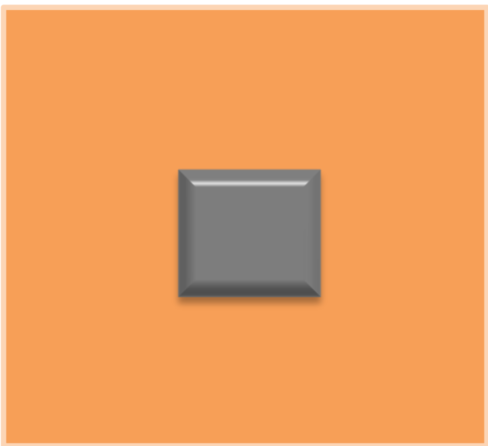
Beam Properties

Beam of: Protons
Energy: 3 GeV
Intensity: 100 Hz - 10 kHz

Most time the detector was 3cm out of the beam line (too high Intens.)



Detector Properties



Double sided strip detector
500 µm thick
2x128 channels
34.5x34.5 mm
Strip width: 200 µm

Each side was read out by one Exploder
Exp0 -> positive polarity
Exp1 -> negative polarity

Definition of Hits

A **Hit** is defined as a signal which is above the internal NXYTER threshold

this Hit gives a signal from the NXYTER
it can be noise or a signal of a particle

?

so the NXYTER writes out almost everything
Additionally there is an external trigger which opens a time-widow

Every **Hit** in this time window is written to tape

Trigger Input

As external trigger
the scintillator in the Beam Pipe model was used
or the pulser signal
This signal was injected in the following channels
Exp0: Channel 124, 120
Exp1: Channel 6,2

Information

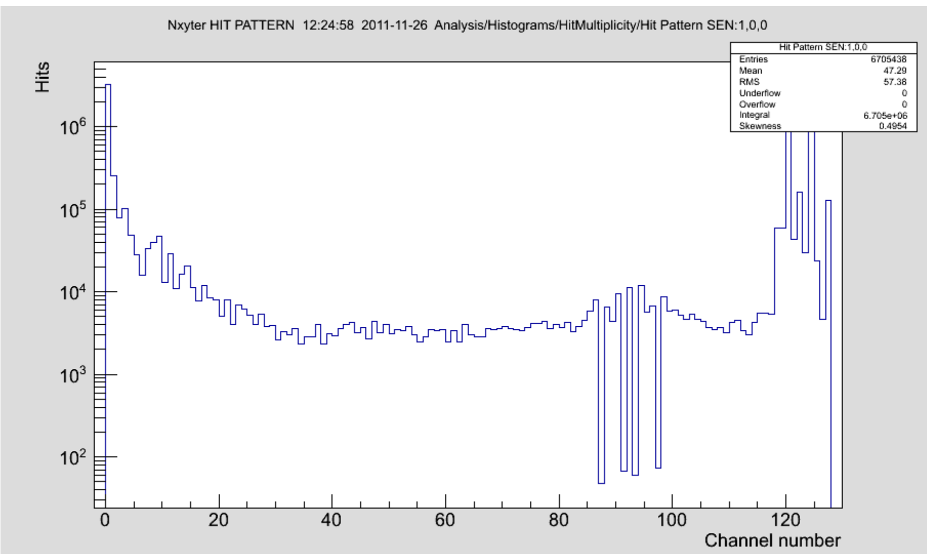
The following pictures are **online pictures** taken on the first day with beam.
The settings for the detector where not yet fine tuned in consequence we had a high noise rate for this analyzed file.
The ADC signal from the NXYTER is already inverted by the analysis.

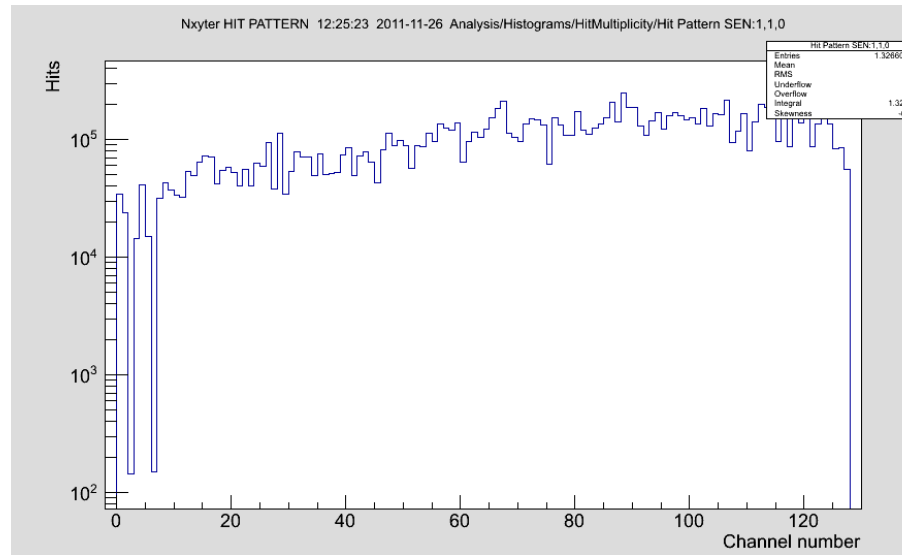
Measurement

File: J111124-00-57

Not in Beam line

Protons:





Exploder 0

Exploder 1

E. Epple, P. Koczoń, R. Lalik

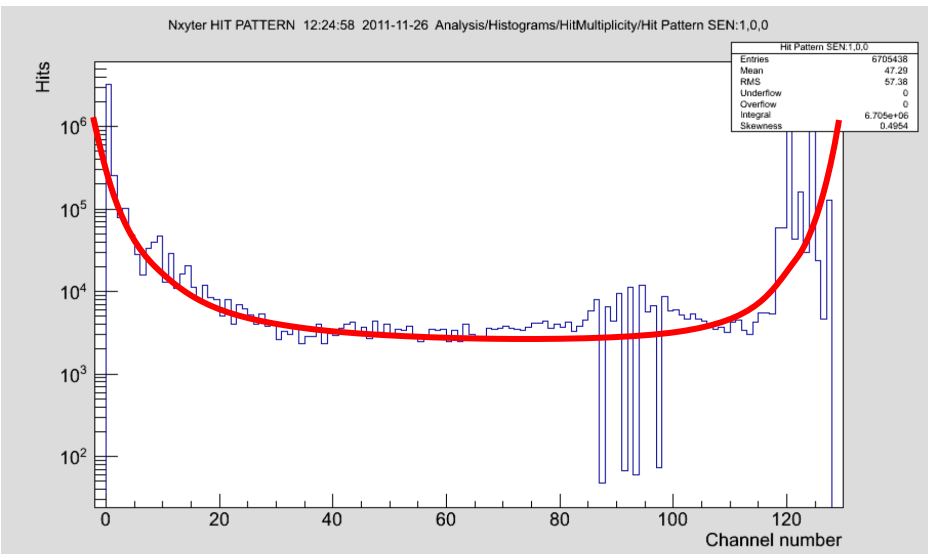
Measurement

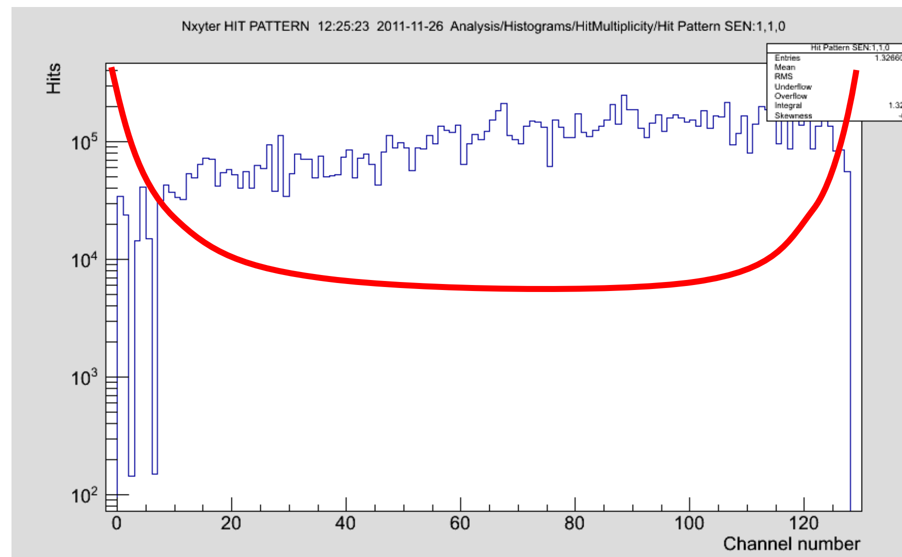
File: J111124-00-57

Not in Beam line

Protons:

Expected shape from noise





Exploder 0

Exploder 1

due to a low threshold and loose time correlations most entries are from noise. They overlay the signal from particles

E. Epple, P. Koczoń, R. Lalik

Noise Reduction

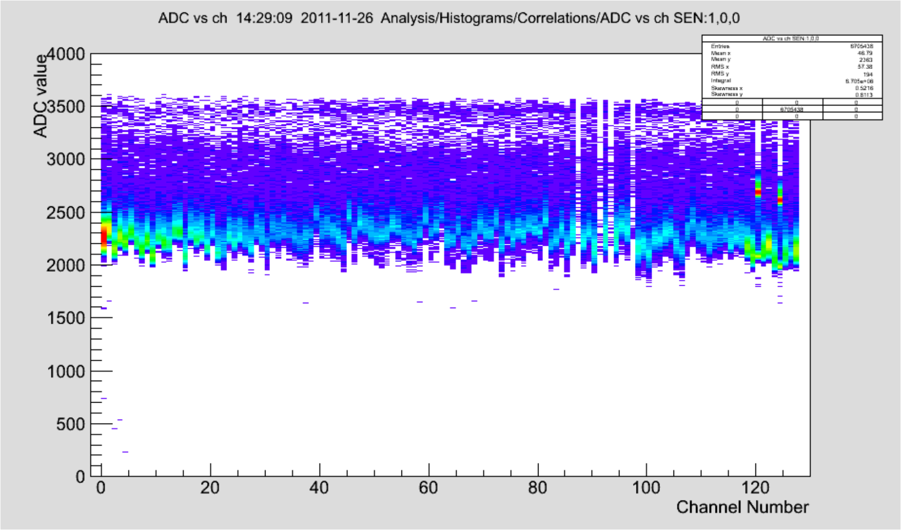
Two possibilities:

1) Noise measurement and cut on ADC channels. Offset has to be corrected for each channel (not possible for us in the online analysis)
2) Noise reduction by cuts on trigger-time correlation and multiplicities on the detector. (possible in the online analysis and shown on the following slides)

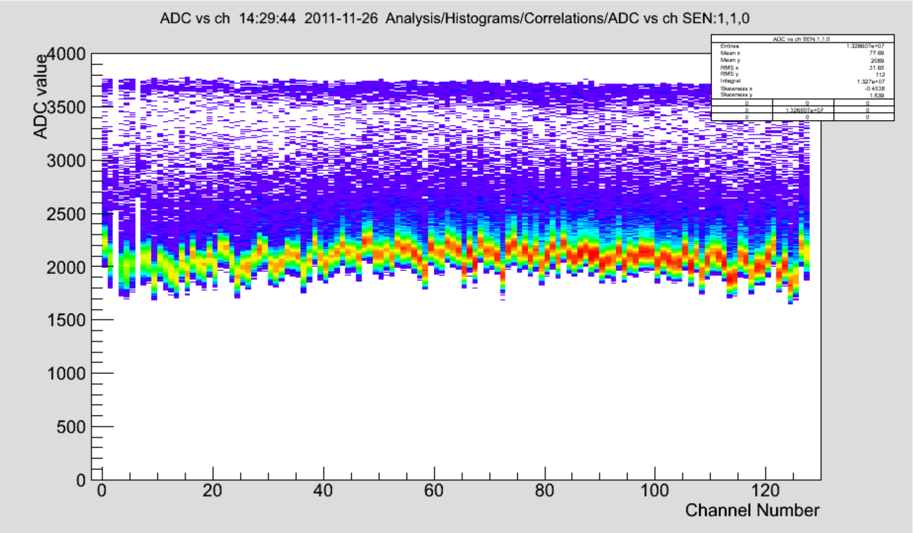
Observables for Noise reduction

Noise occurs in

- low Aux. units (high ADC channels from the FEB)
- high multiplicity events (common noise on detector)
- Events that are not time correlated with the trigger



Exploder 0



Exploder 1

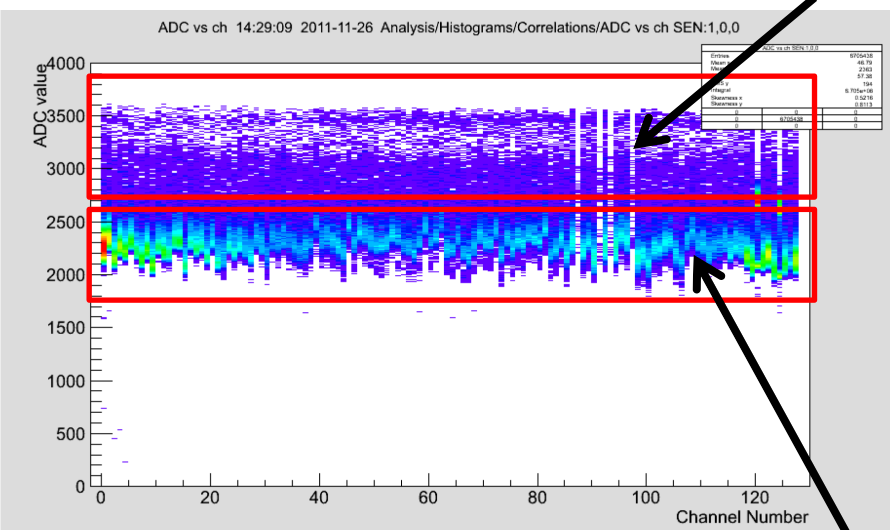
E. Epple, P. Koczoń, R. Lalik

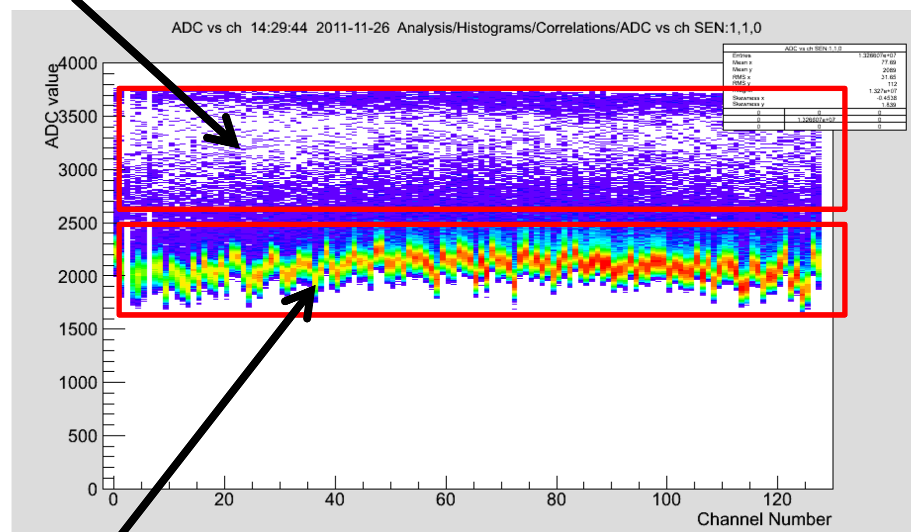
Observables for Noise reduction

Noise occurs in

- low Aux. units (high ADC channels from the FEB)
- high multiplicity events (common noise on detector)
- Events that are not time correlated with the trigger

Expected signal





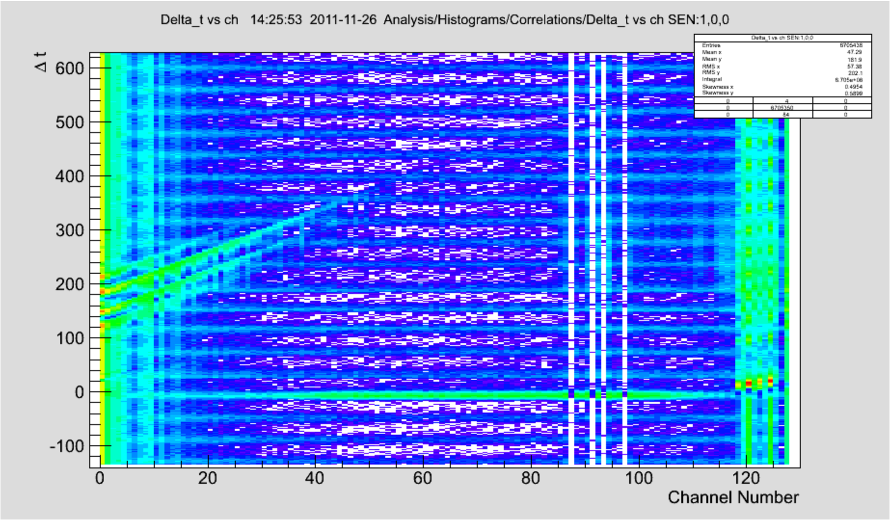
Exploder 0

Expected noise

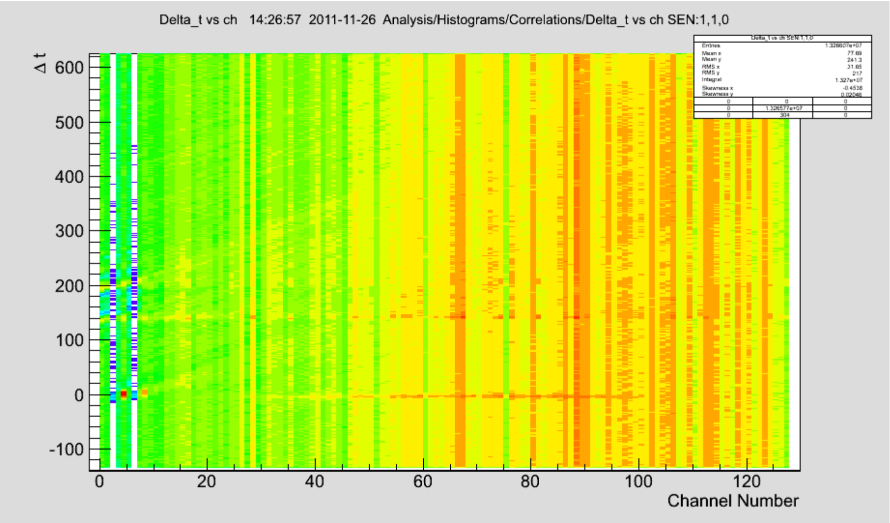
Exploder 1

E. Epple, P. Koczoń, R. Lalik

Trigger Time Correlation



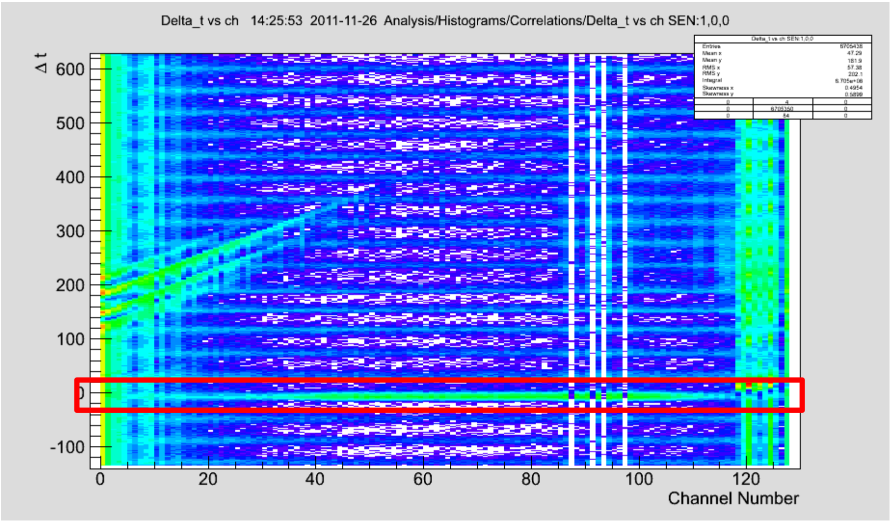
Exploder 0



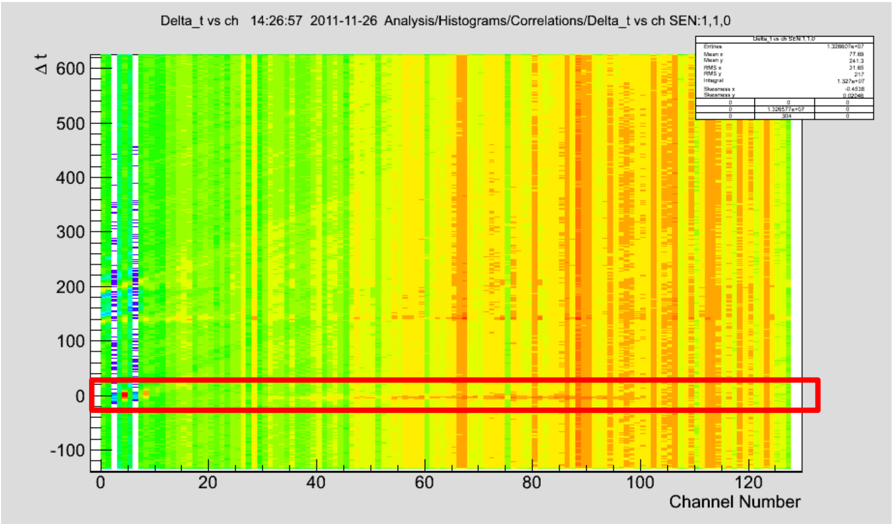
Exploder 1

E. Epple, P. Koczoń, R. Lalik

Trigger Time Correlation



Exploder 0

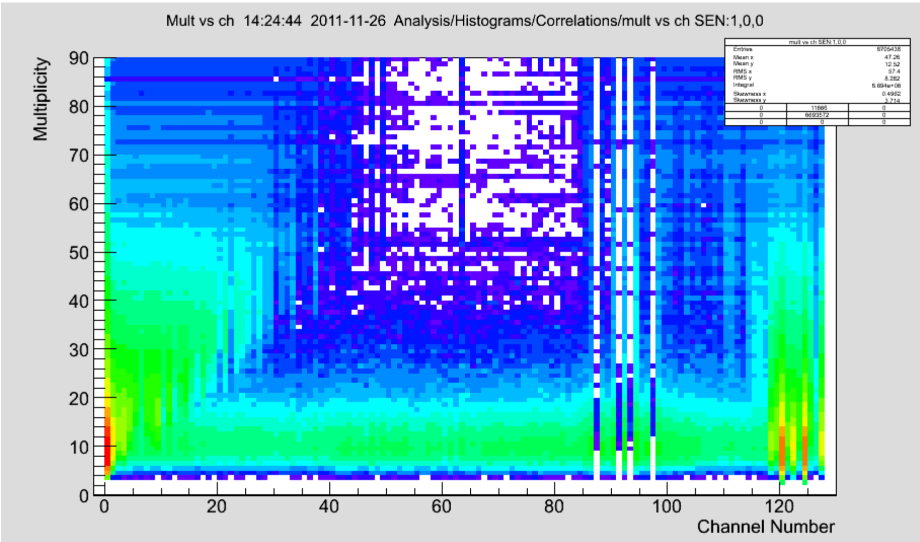


Exploder 1

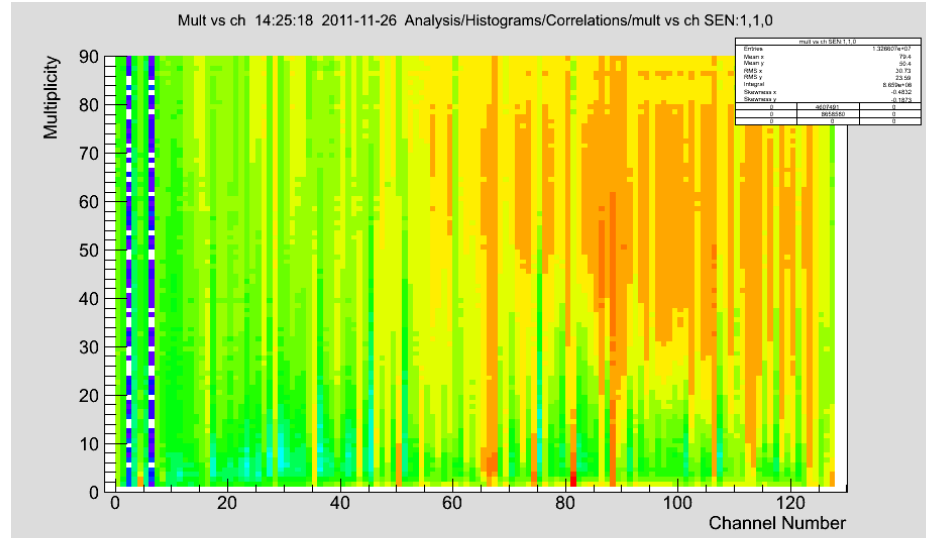
Good signal around +-20ns

E. Epple, P. Koczoń, R. Lalik

Hit Multiplicity



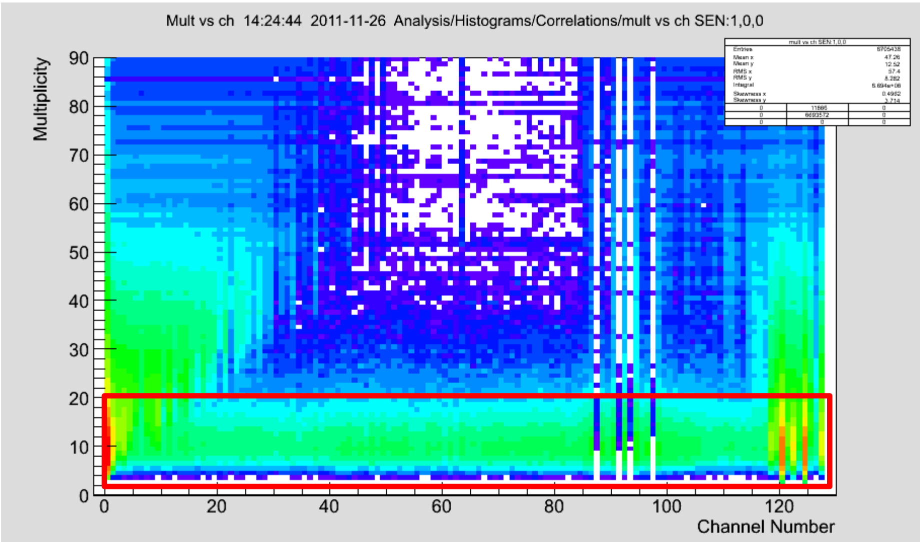
Exploder 0

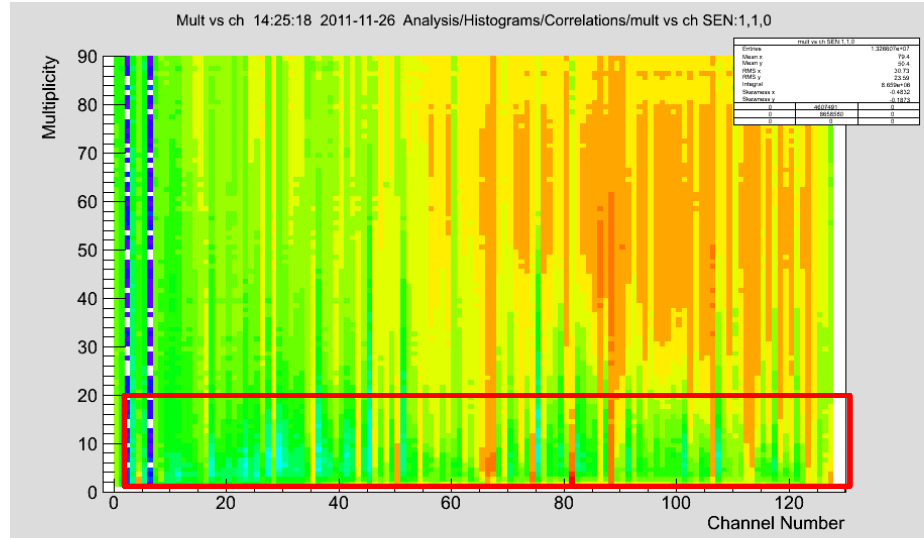


Exploder 1

E. Epple, P. Koczoń, R. Lalik

Hit Multiplicity





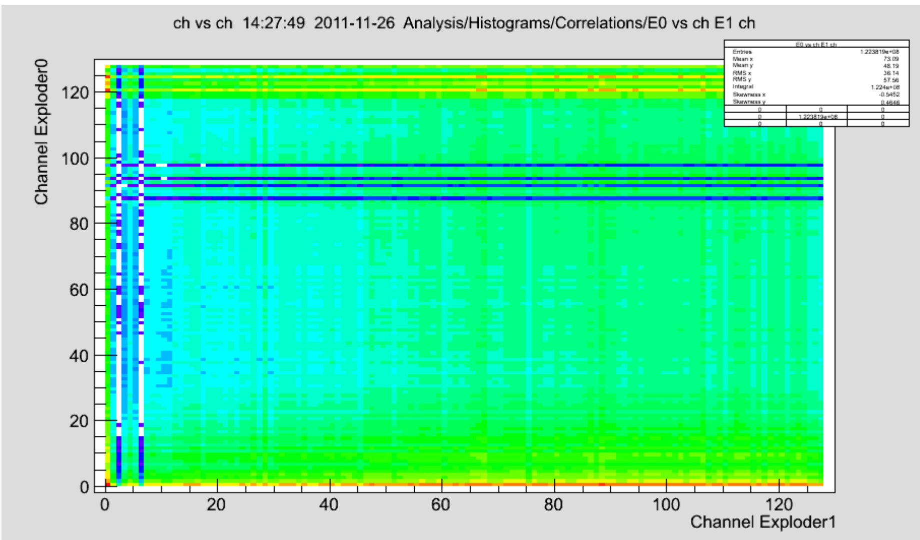
Exploder 0

Exploder 1

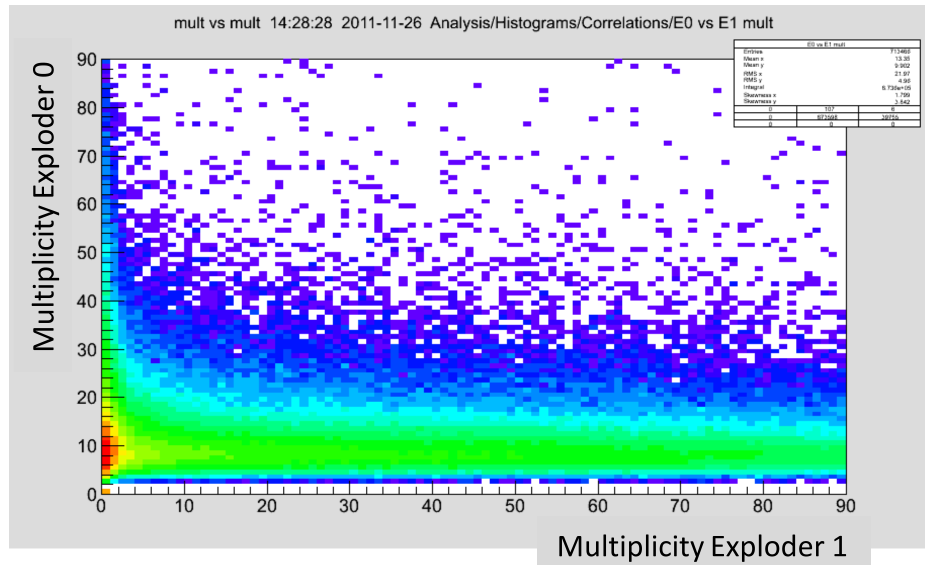
Good Signal Mult. < 12

E. Epple, P. Koczoń, R. Lalik

Raw Exp1 vs Exp 2 correlations



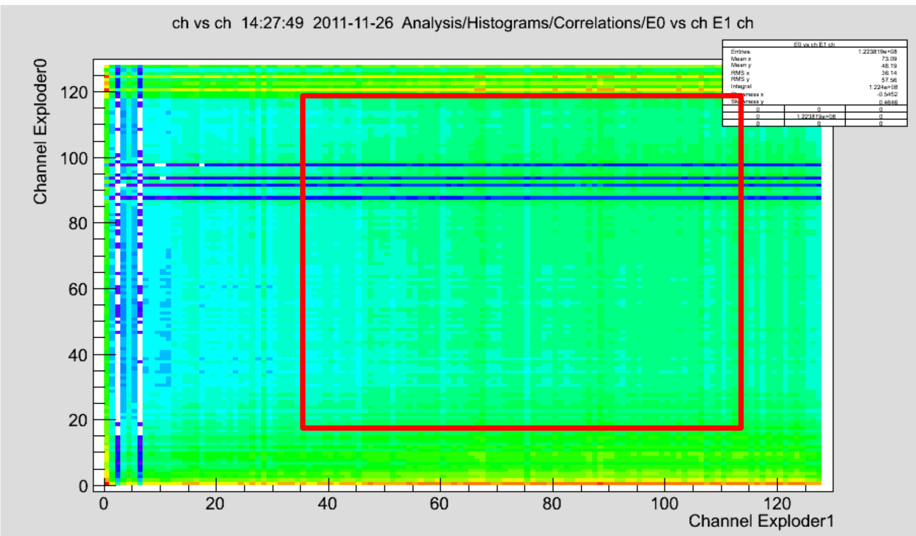
Hit Distribution on the detector



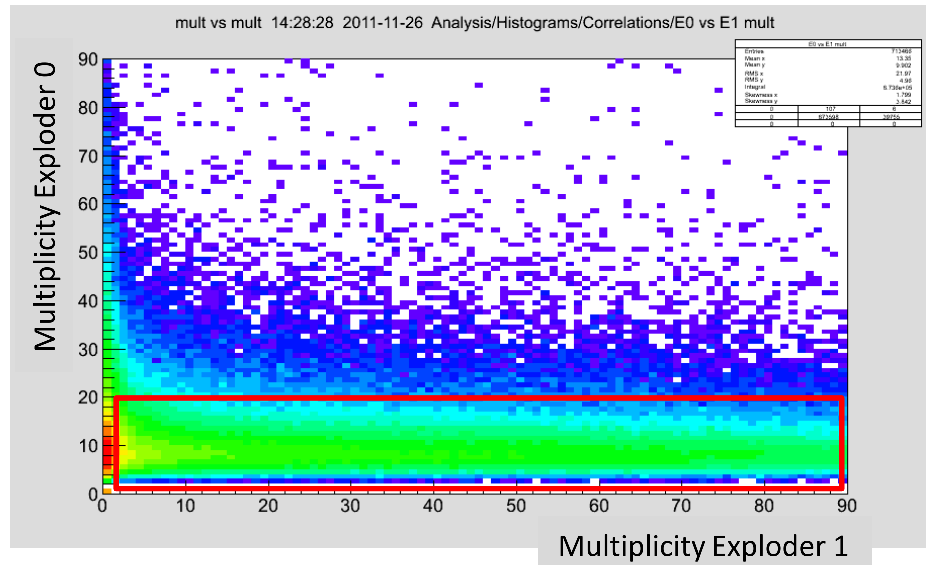
Multiplicity correlation of the two detector sides

E. Epple, P. Koczoń, R. Lalik

Raw Exp1 vs Exp 2 correlations



Hit Distribution on the detector



Multiplicity correlation of the two detector sides

- Where is the scintillator correlation ?

Exploder1 has hits of all multiplicities equally distributed -> high noise

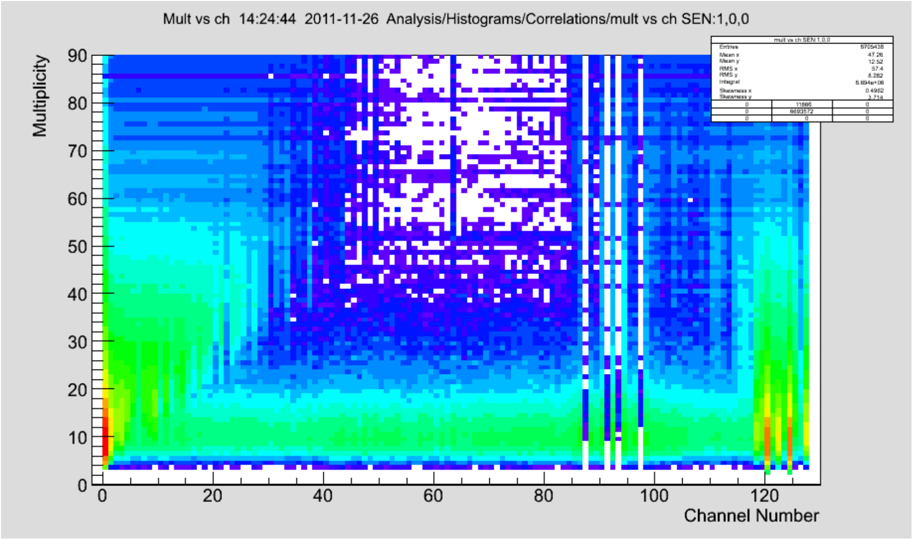
E. Epple, P. Koczoń, R. Lalik

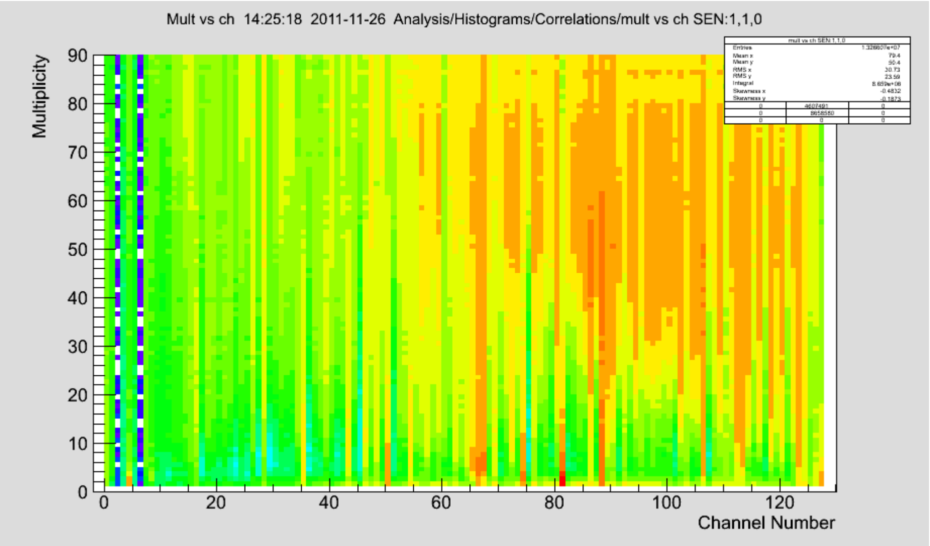
Spectra after time cut

+- 20 ns

Hit Multiplicity

raw data





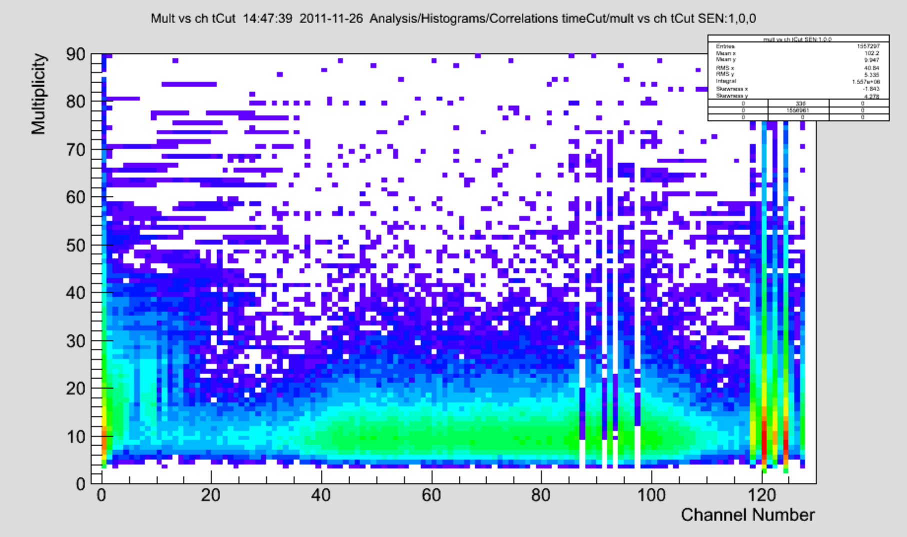
Exploder 0

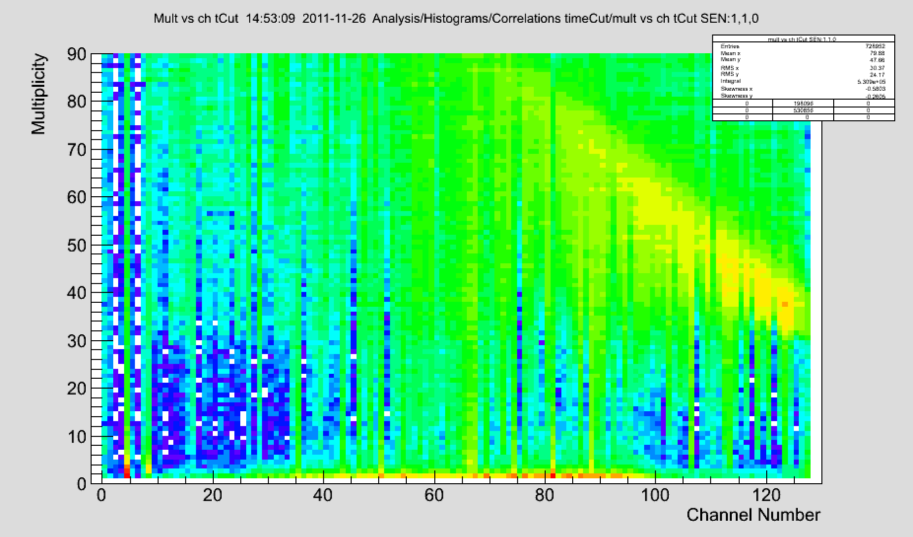
Exploder 1

E. Epple, P. Koczoń, R. Lalik

Hit Multiplicity

Cut on Time correlation of Exp0



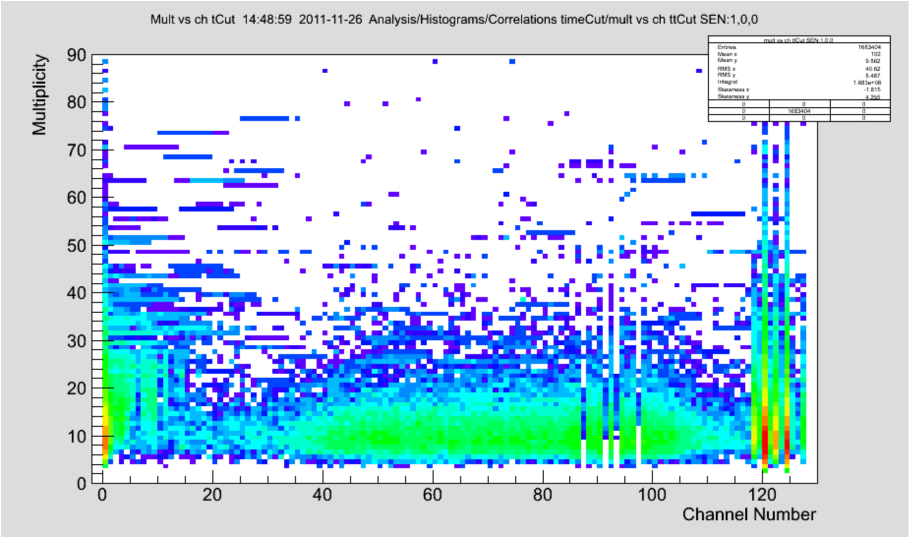


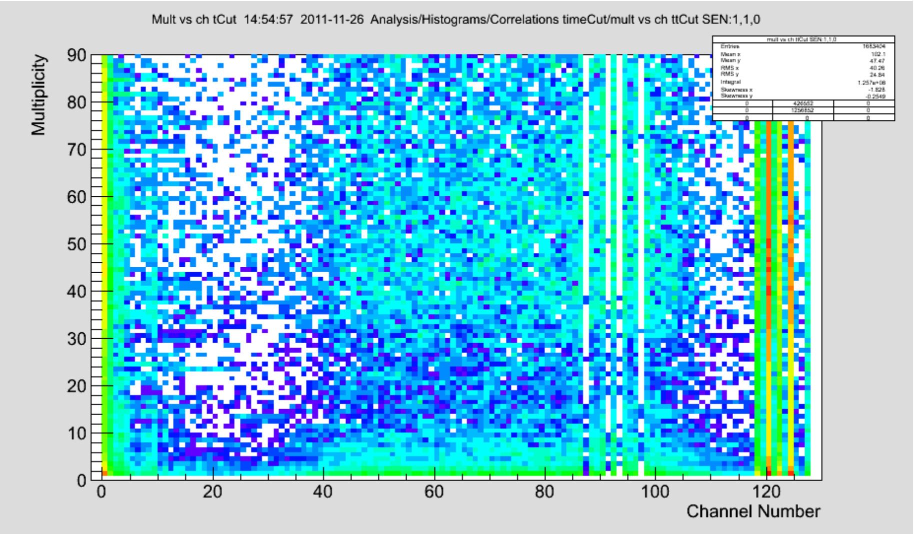
Exploder 0

Exploder 1

Hit Multiplicity

Cut on Time correlation of Exp0 && Exp1





Exploder 0

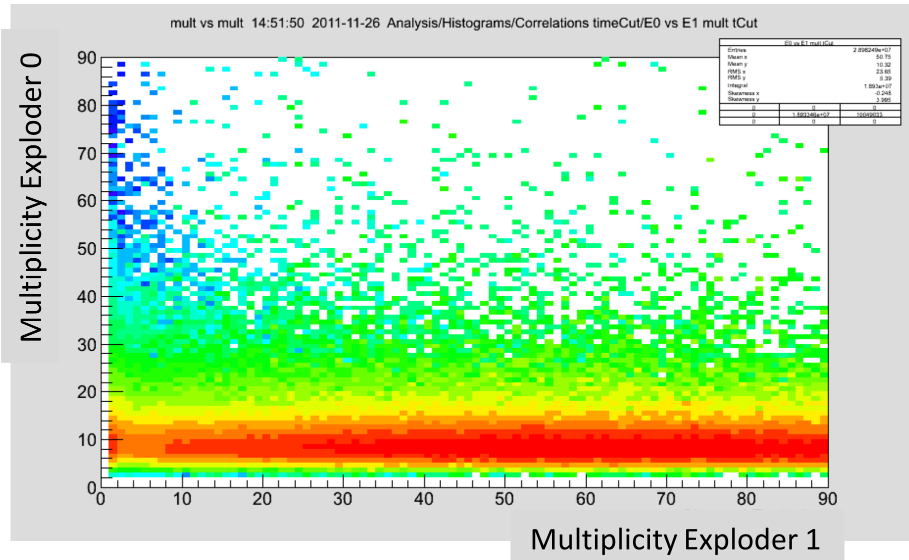
Exploder 1

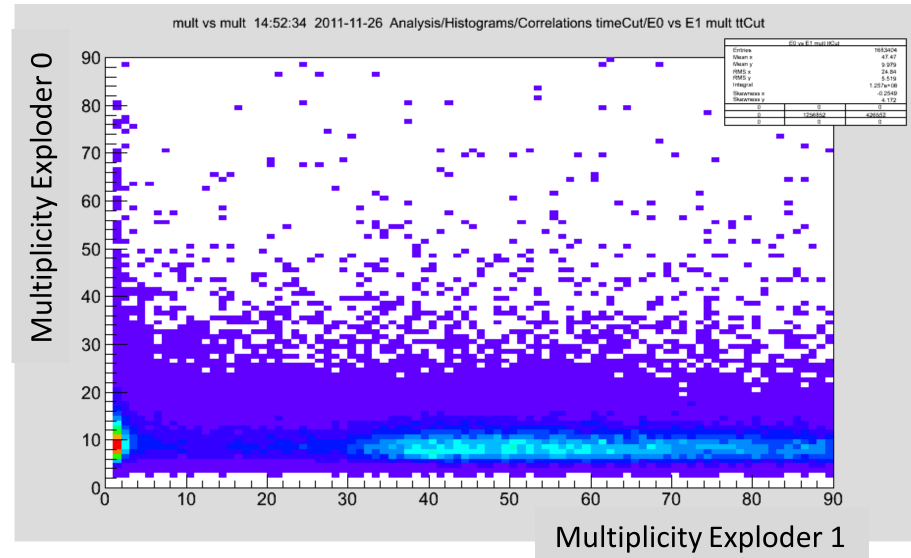
E. Epple, P. Koczoń, R. Lalik

Multiplicity Correlation 2D

Cut on Time correlation of

Exp0 Exp0 && Exp1



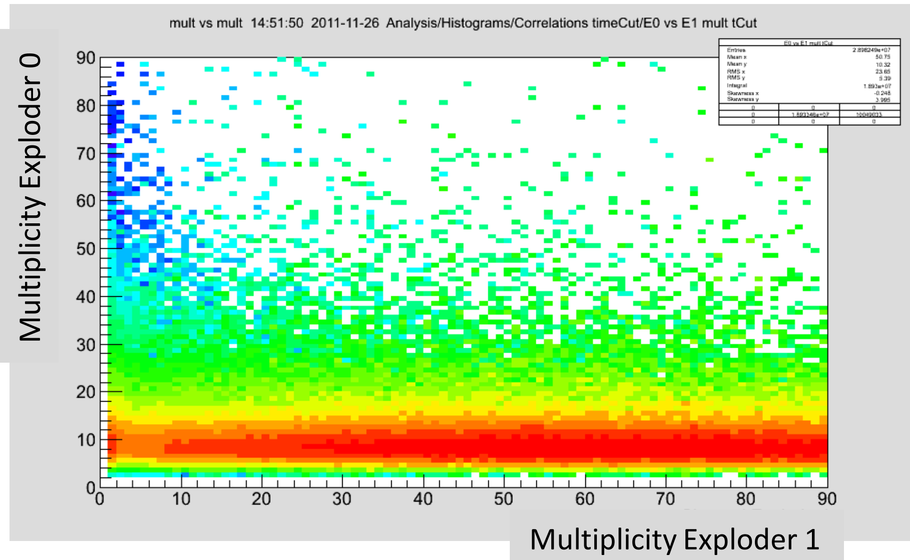


E. Epple, P. Koczoń, R. Lalik

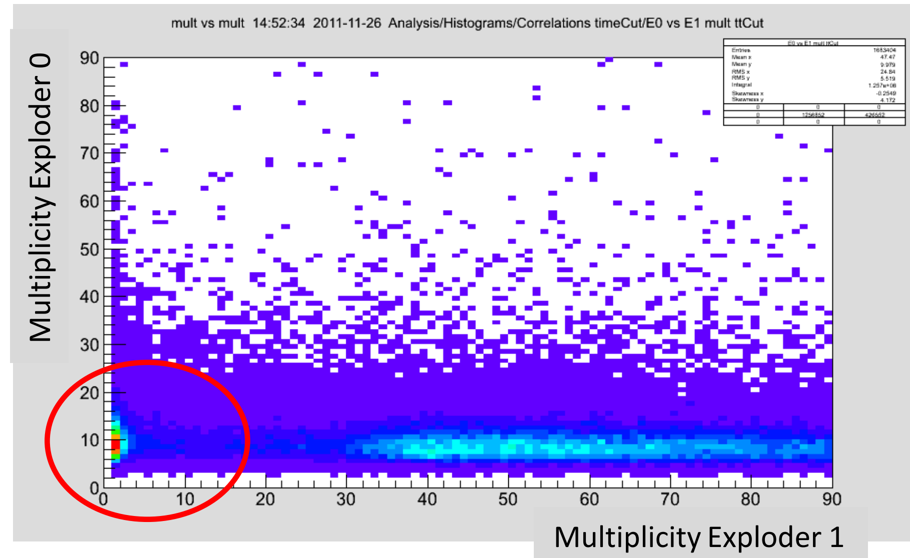
Multiplicity Correlation 2D

Cut on Time correlation of

Exp0



Exp0 && Exp1

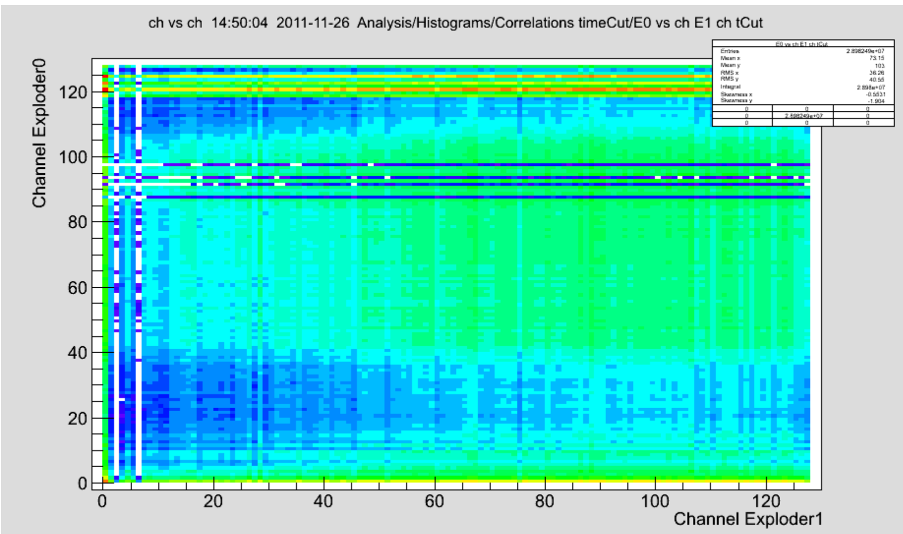


E. Epple, P. Koczoń, R. Lalik

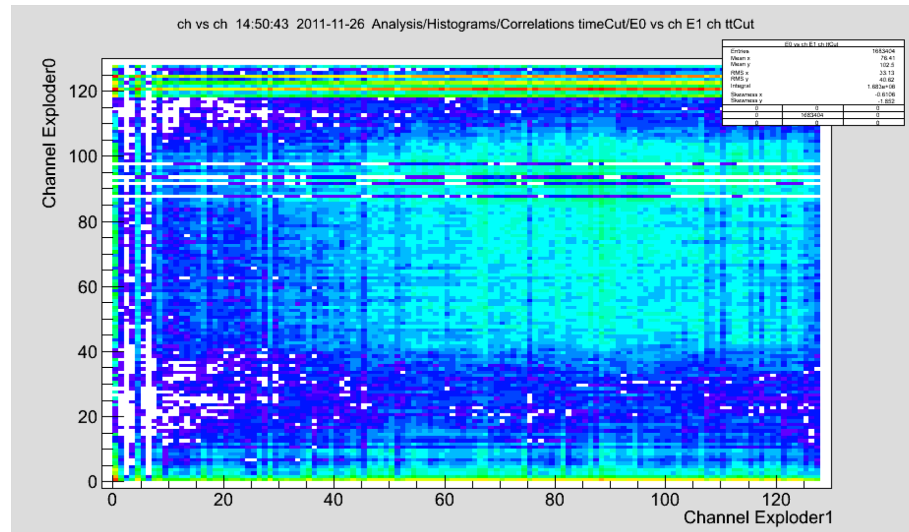
Hit correlation in the Detector

Cut on Time correlation of

Exp0



Exp0 && Exp1



Exploder 0

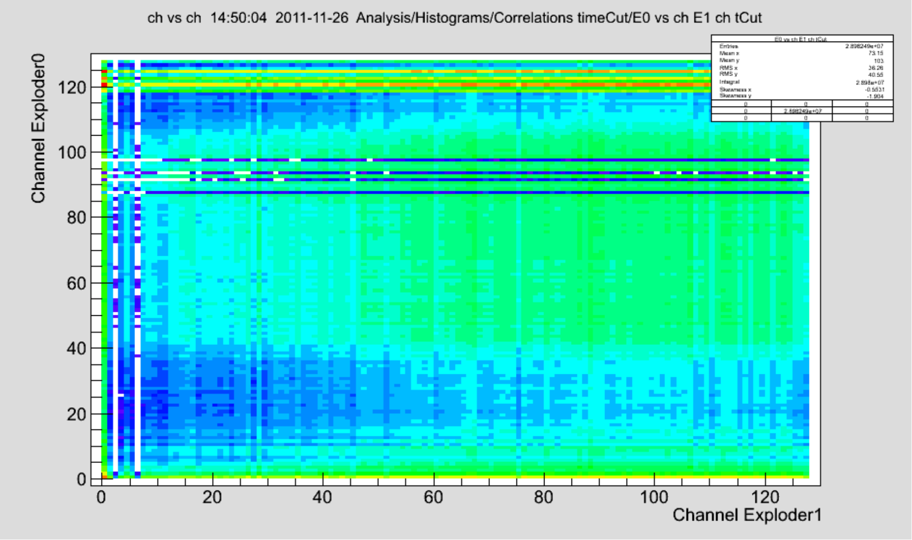
Exploder 1

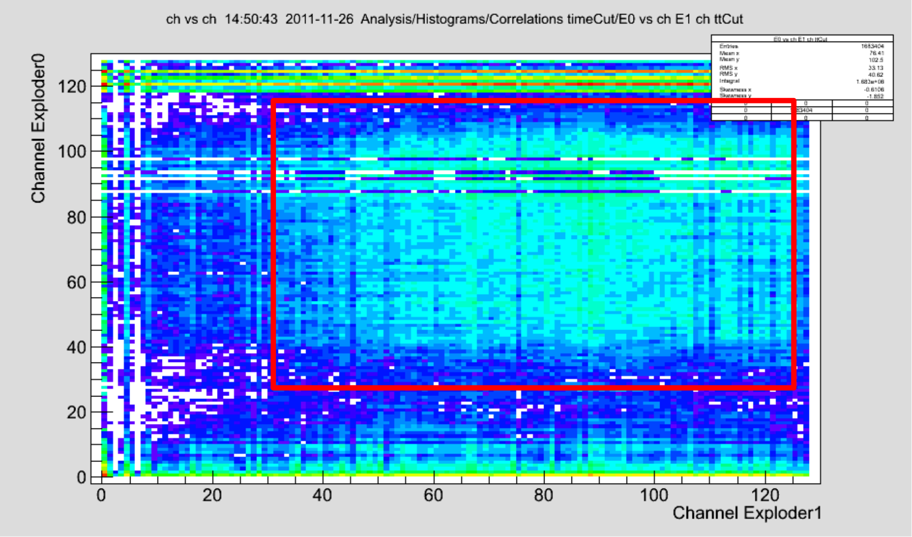
E. Epple, P. Koczoń, R. Lalik

Hit correlation in the Detector

Cut on Time correlation of

Exp0 | Exp0 && Exp1





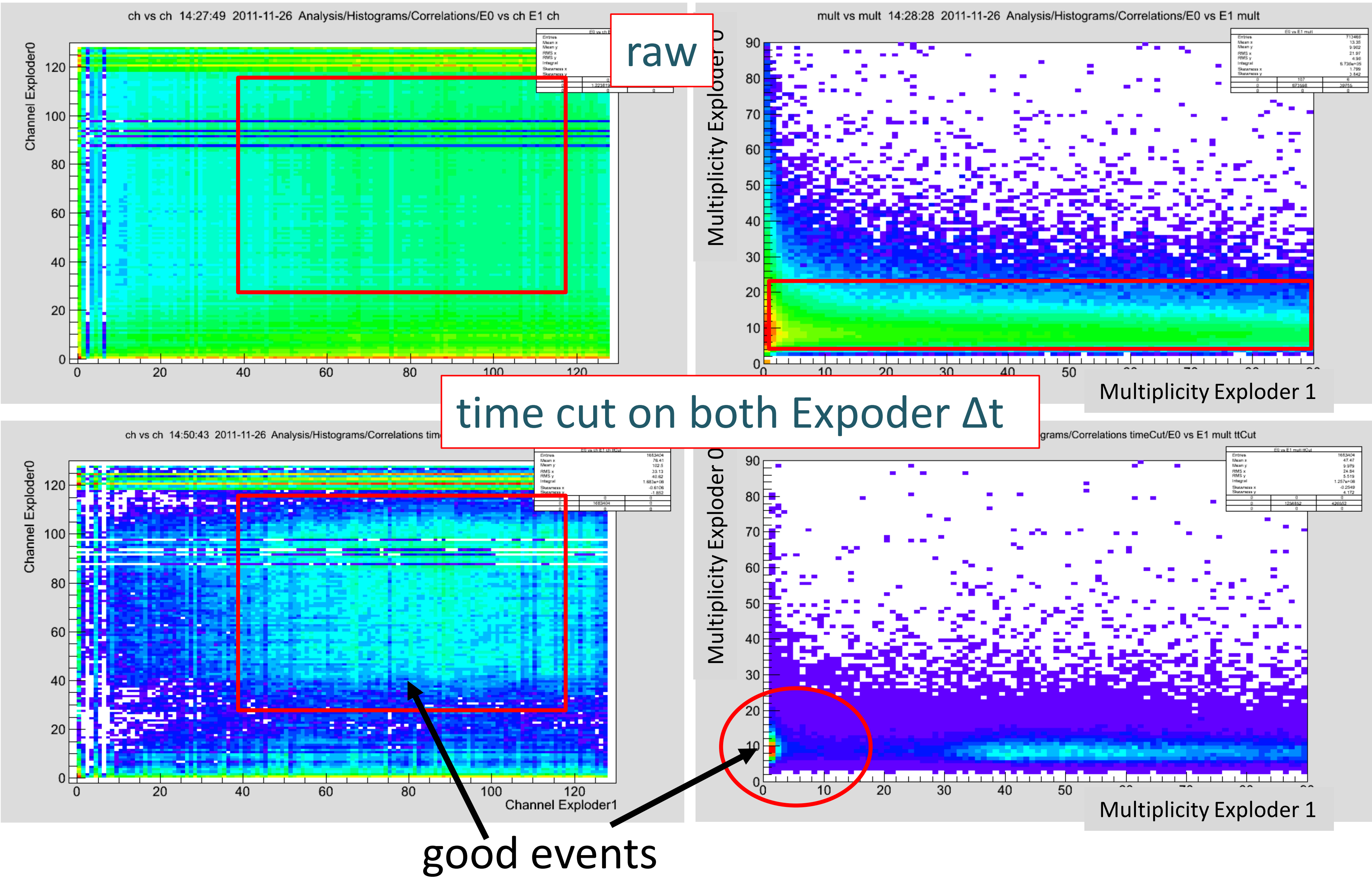
Exploder 0

Exploder 1

After time cut the correlation with the scintillator becomes visible in the hit distribution

E. Epple, P. Koczoń, R. Lalik

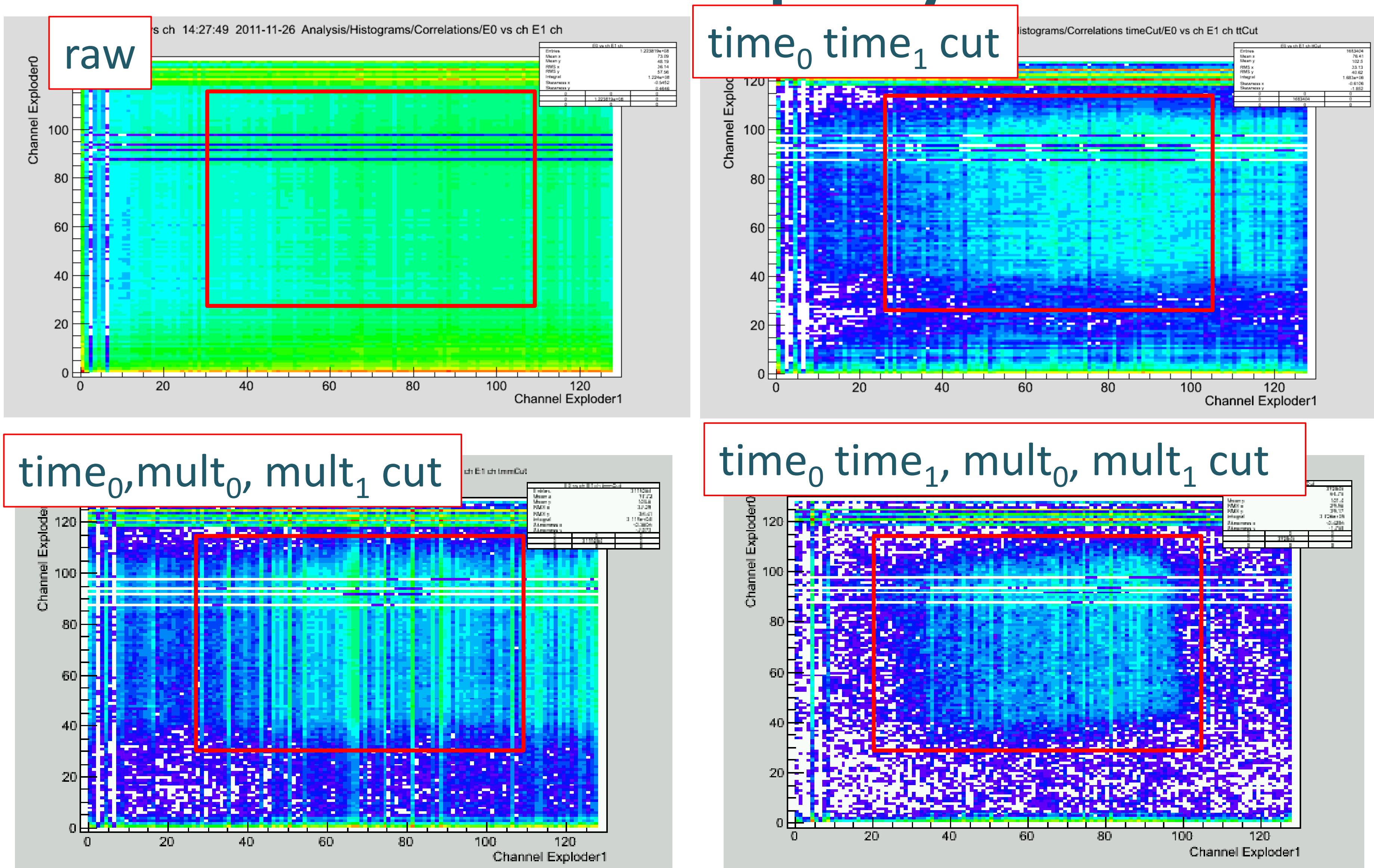
Raw Exp1 vs Exp 2 correlations



E. Epple, P. Koczoń, R. Lalik

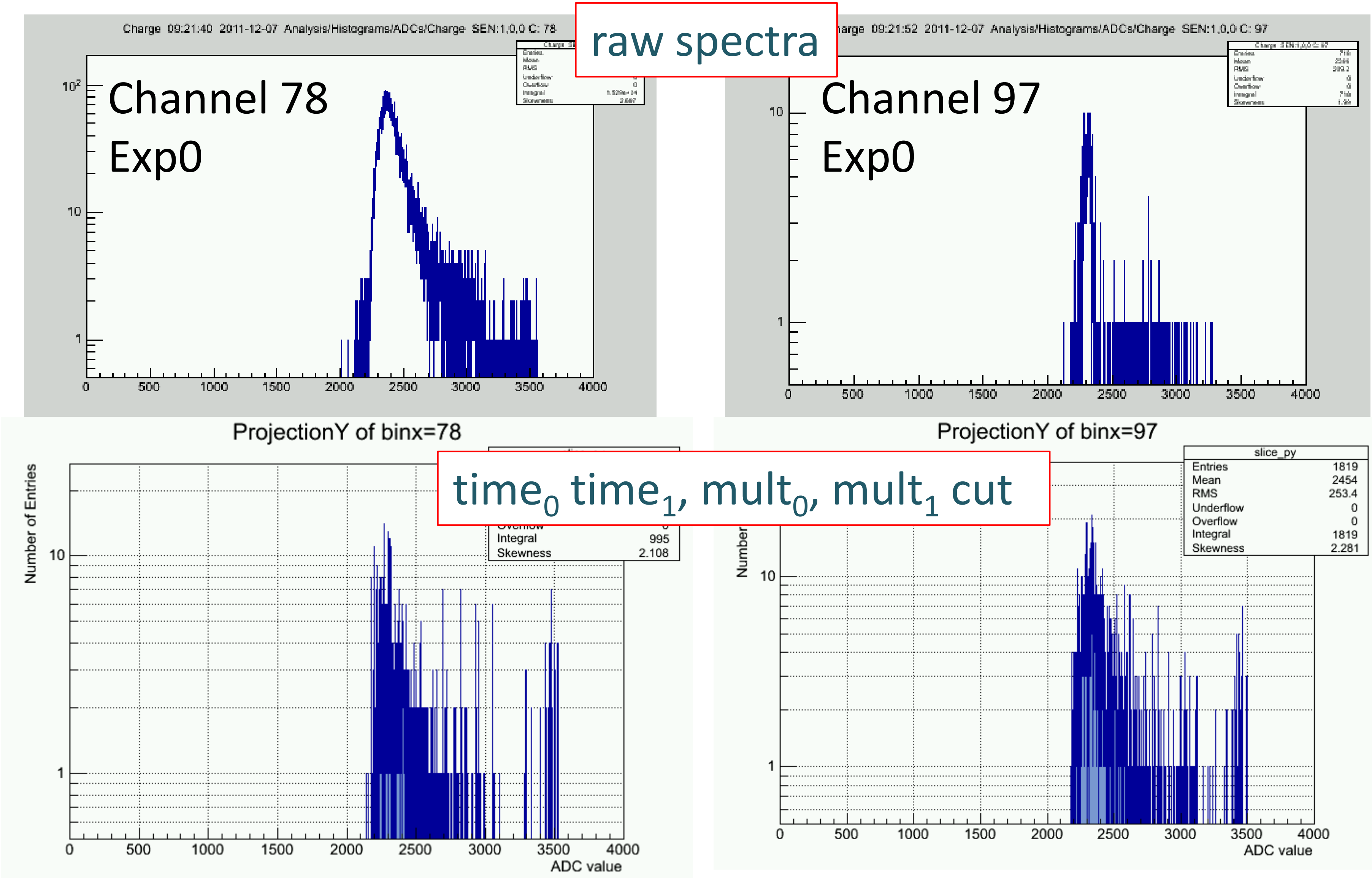
Spectra after multiplicity cut < 12

Time and multiplicity Cut

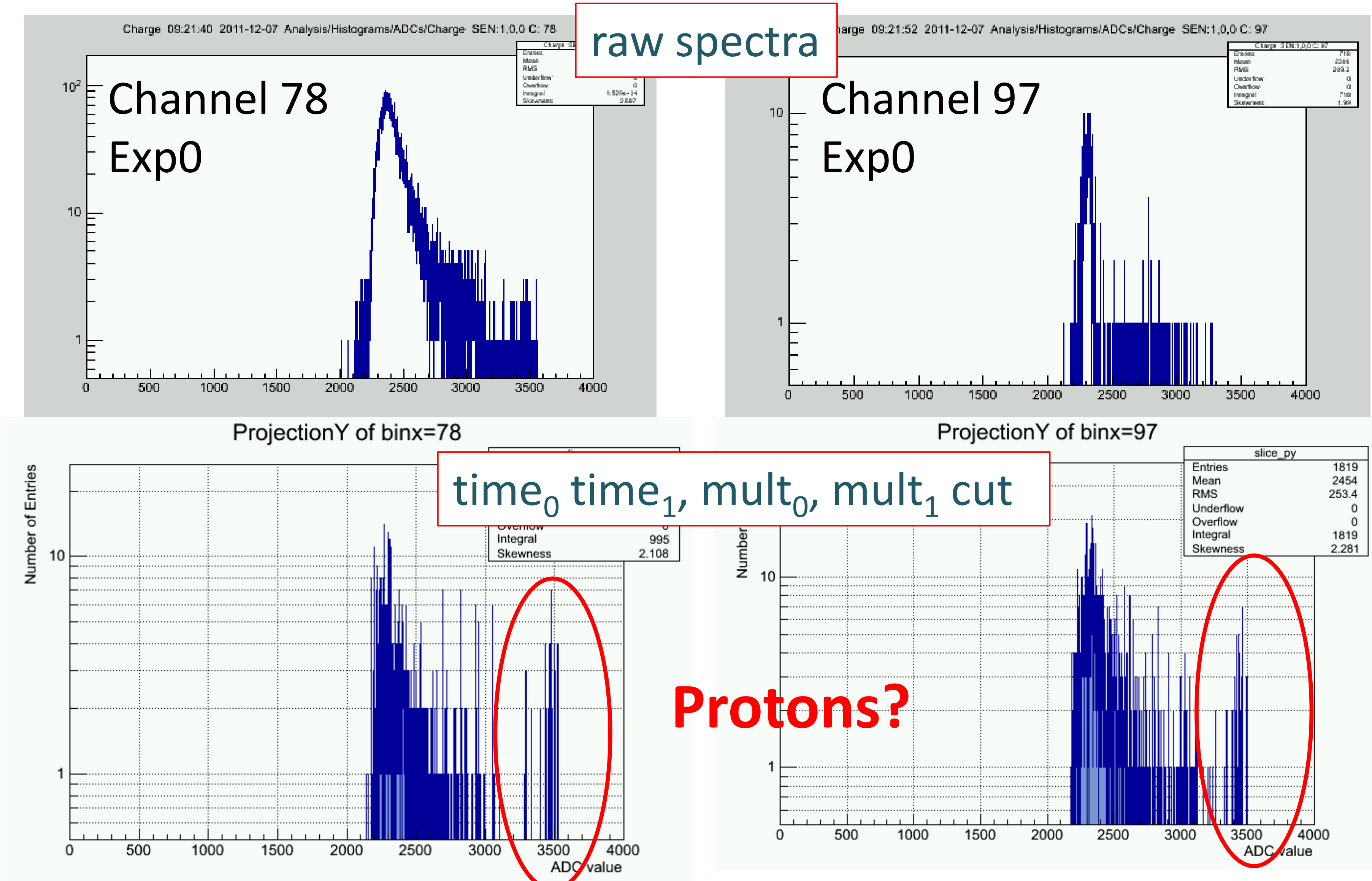


E. Epple, P. Koczoń, R. Lalik

ADC channel distribution

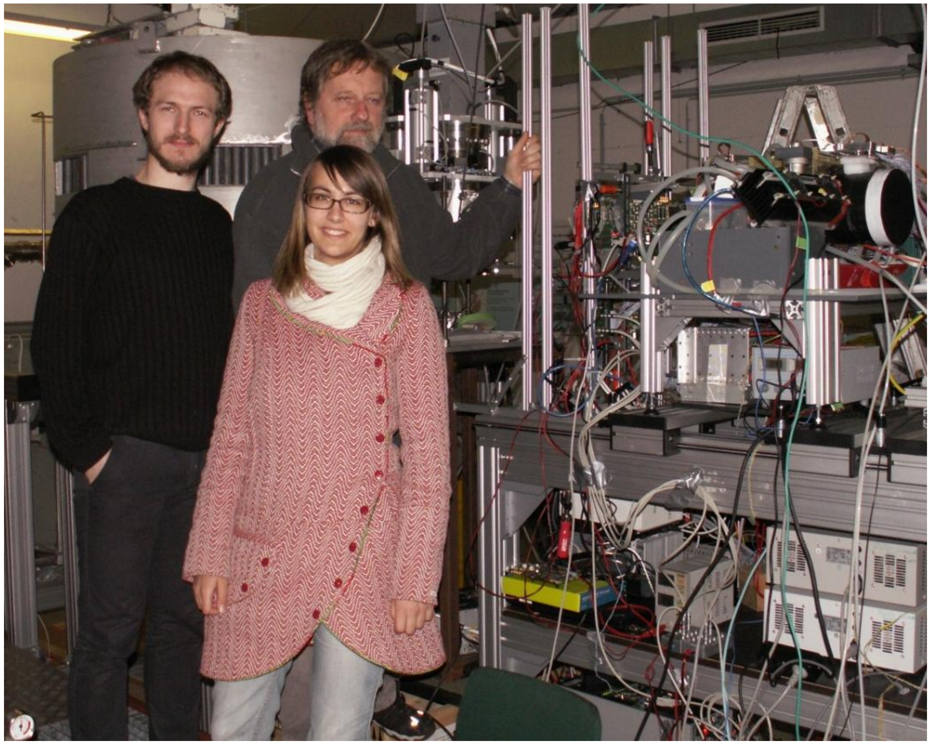


E. Epple, P. Koczoń, R. Lalik



E. Epple, P. Koczoń, R. Lalik

Summary



Two readout Systems were tested

- A clear Time correlation with the trigger is visible from some signals.
- After time and mult. cut a clear correlation with the scintillator is visible in the hit distribution
- The ADC channels show some indication for protons

What remains to be done:

Determination of the efficiency of the electronic readout

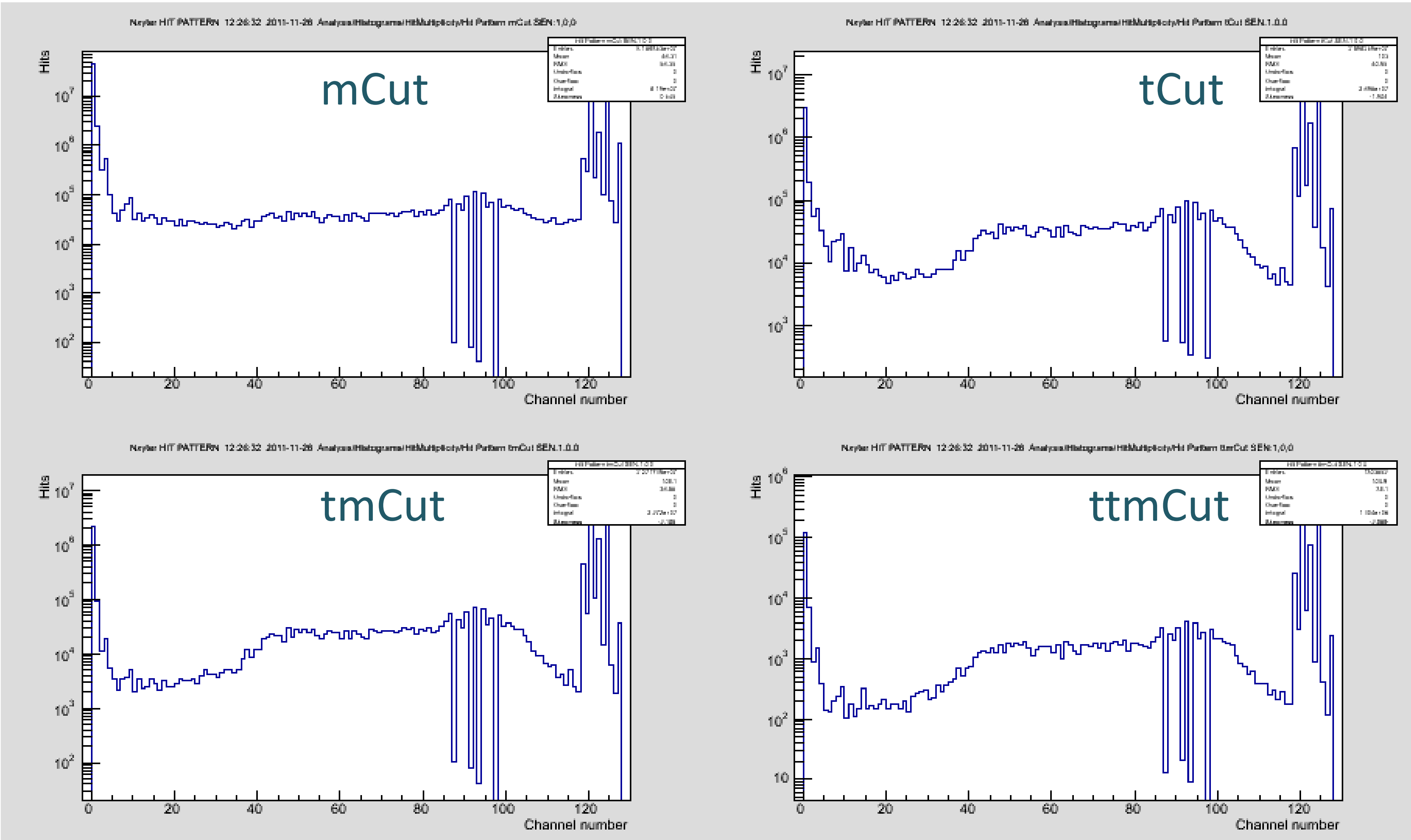
Backup

Hit distribution per channel

tCut = time corr on Exp0
ttCut = time corr. on Exp0&1
mCut = Mult. Cut on this Exp
mmCut= Mult Cut on both Exp

Measurement

Exploder 0

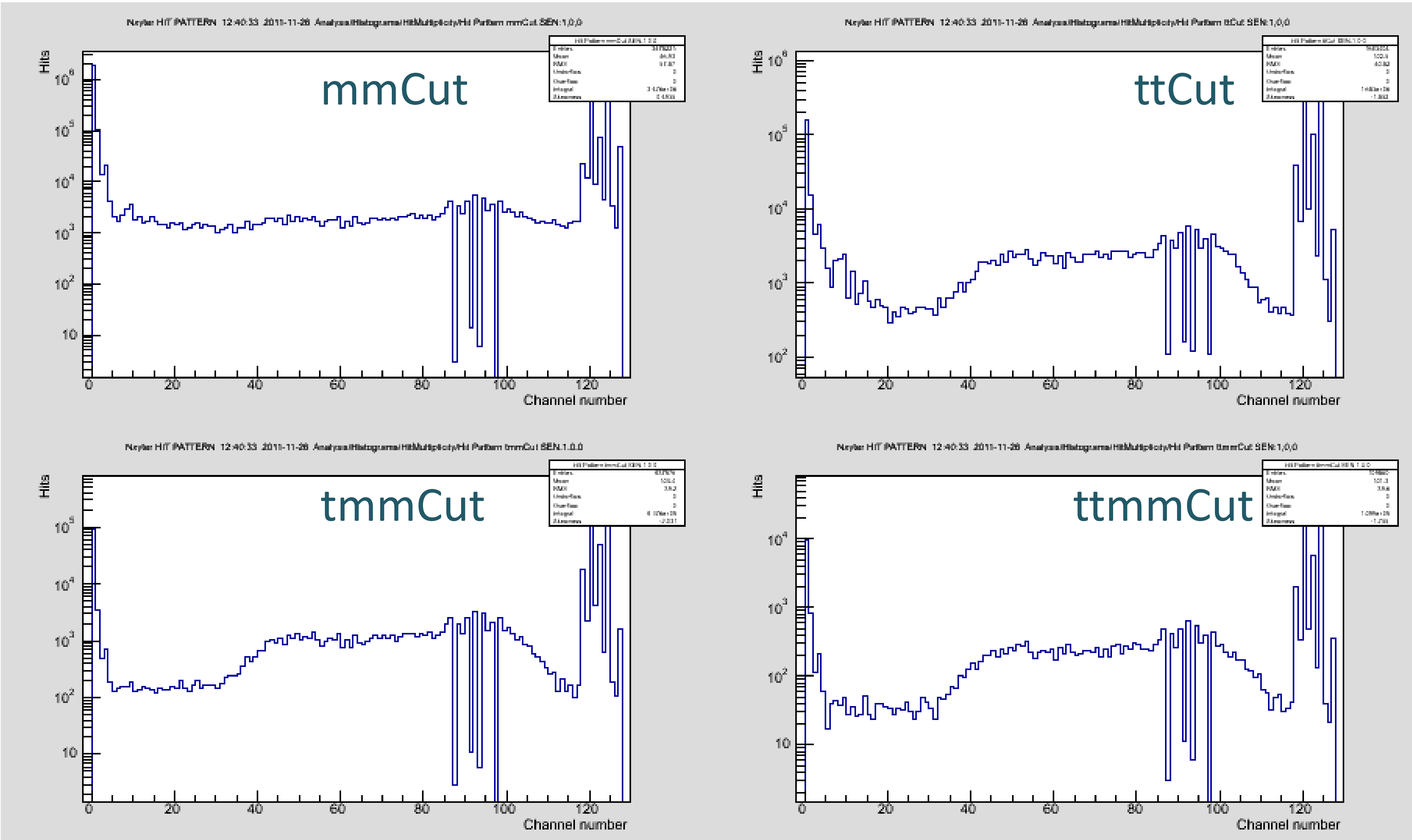


E. Epple, P. Koczoń, R. Lalik

tCut = time corr on Exp0
ttCut = time corr. on Exp0&1
mCut = Mult. Cut on this Exp
mmCut= Mult Cut on both Exp

Measurement

Exploder 0

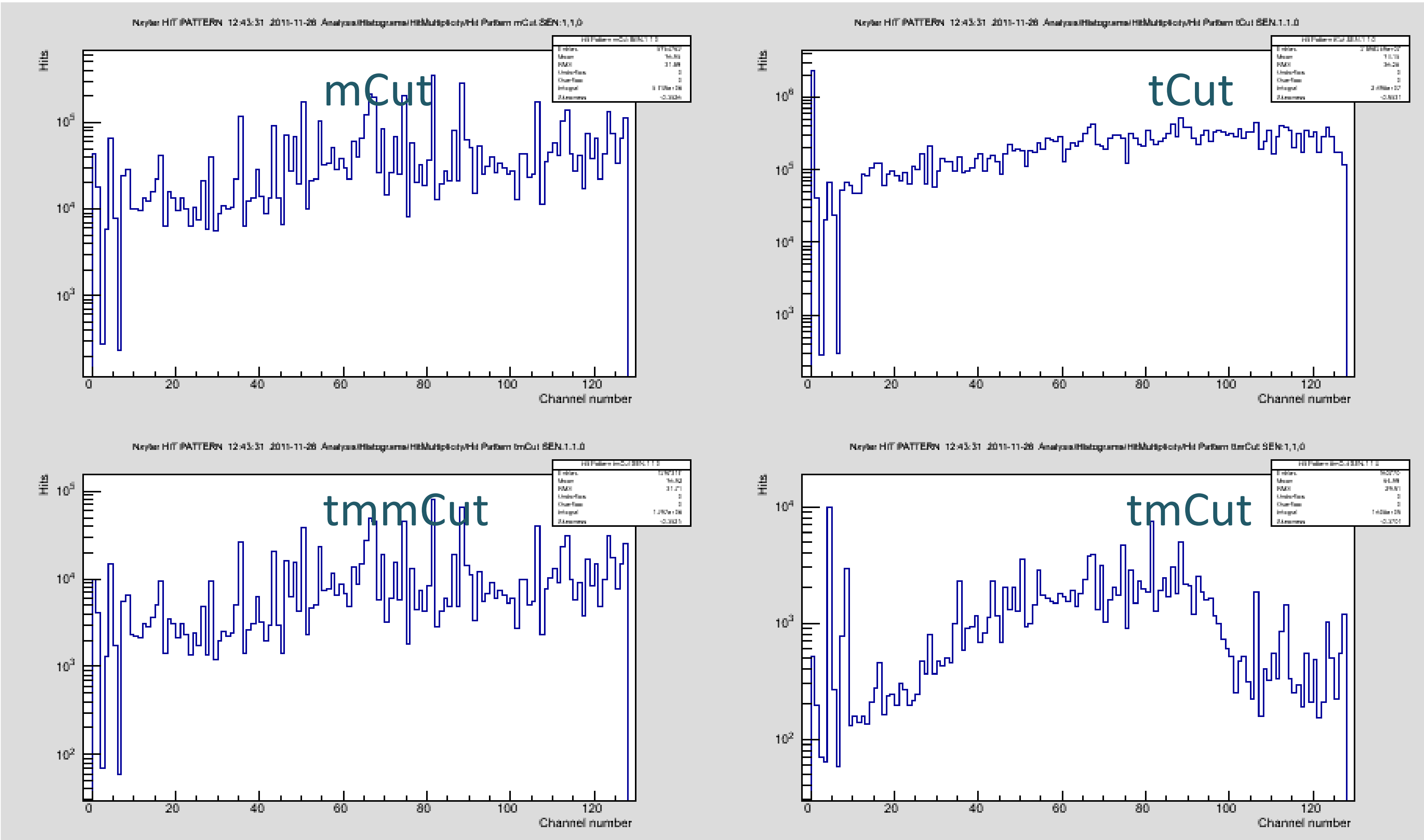


E. Epple, P. Koczoń, R. Lalik

tCut = time corr on Exp0
ttCut = time corr. on Exp0&1
mCut = Mult. Cut on this Exp
mmCut= Mult Cut on both Exp

Measurement

Exploder 1

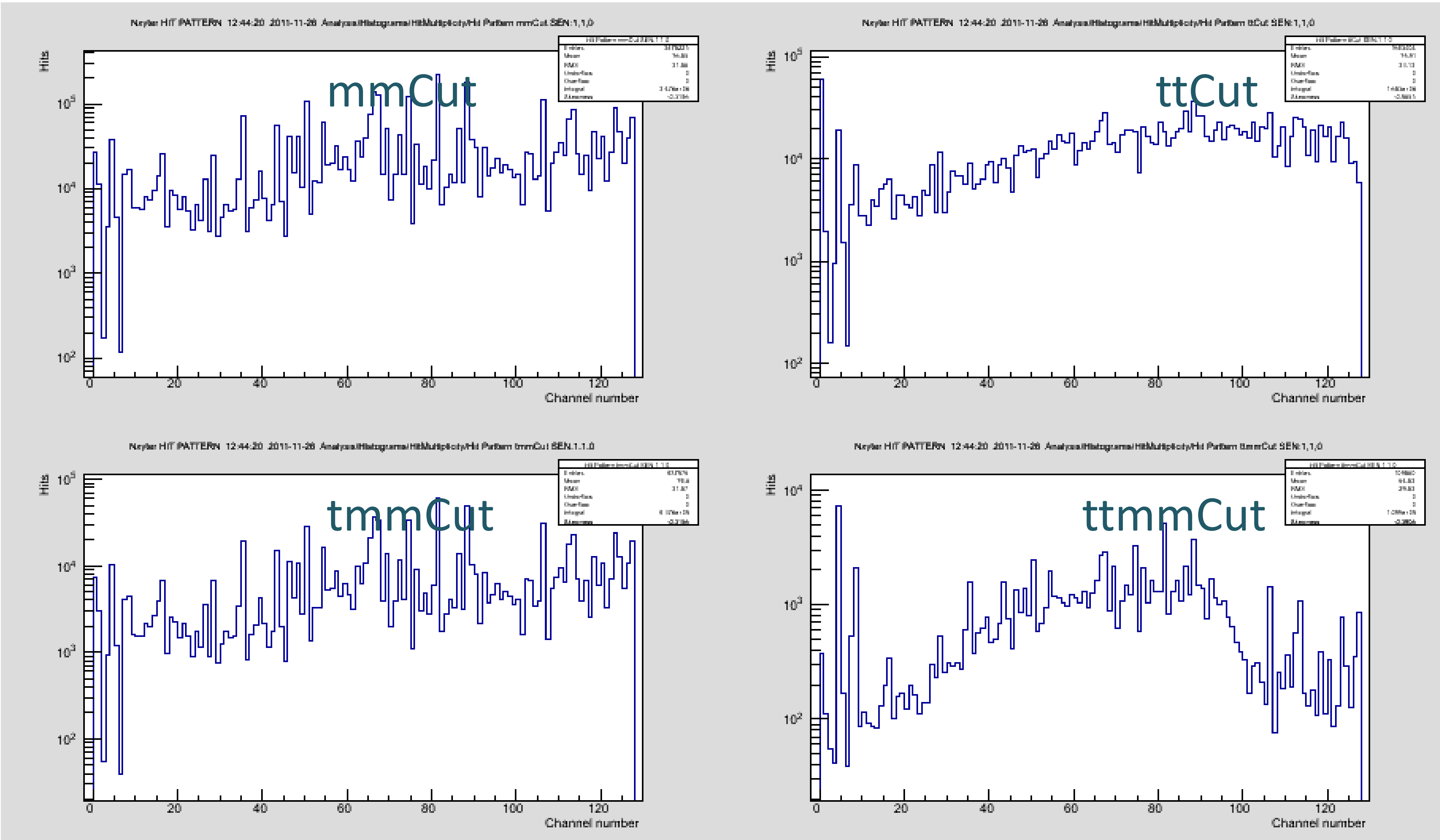


E. Epple, P. Koczoń, R. Lalik

tCut = time corr on Exp0
ttCut = time corr. on Exp0&1
mCut = Mult. Cut on this Exp
mmCut= Mult Cut on both Exp

Measurement

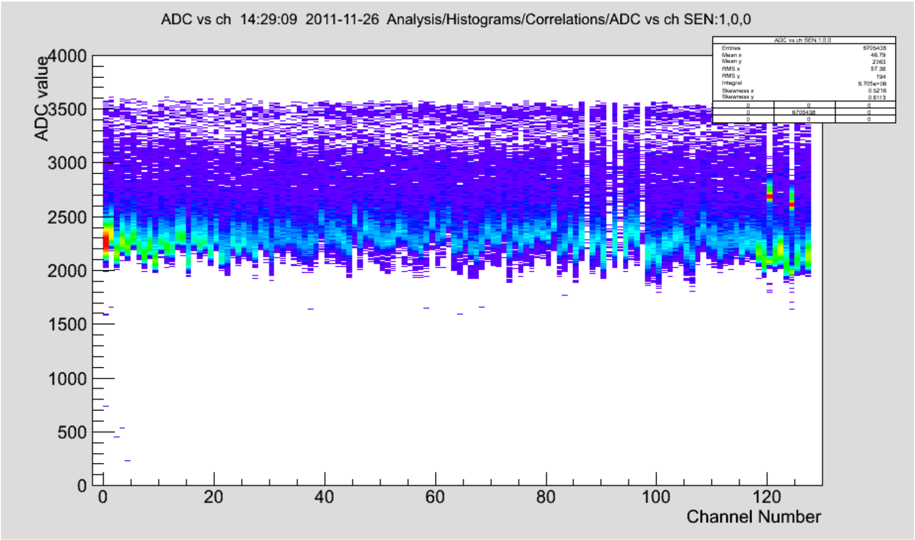
Exploder 1



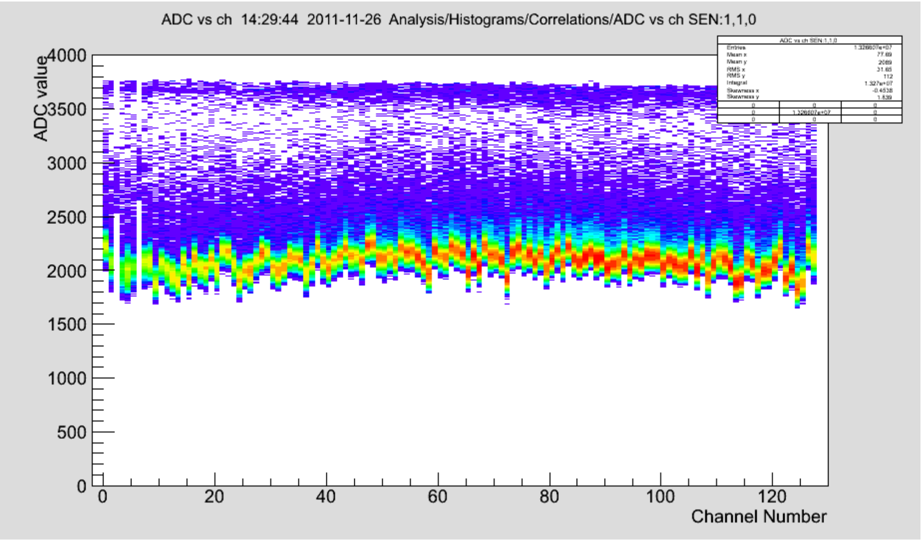
E. Epple, P. Koczoń, R. Lalik

ADC value per channel

Raw ADC vs. channel distribution



Exploder 0

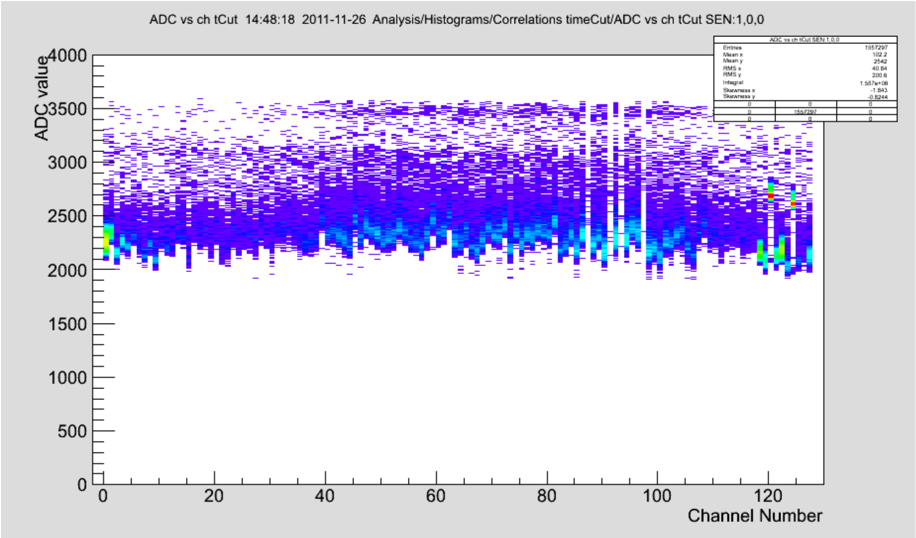


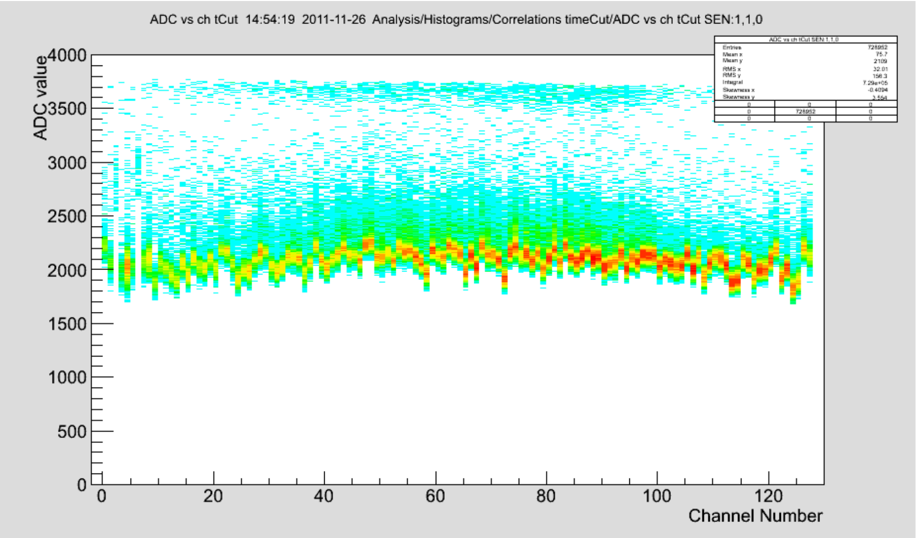
Exploder 1

E. Epple, P. Koczoń, R. Lalik

Distribution with time cuts

Cut on Time correlation of Exp0





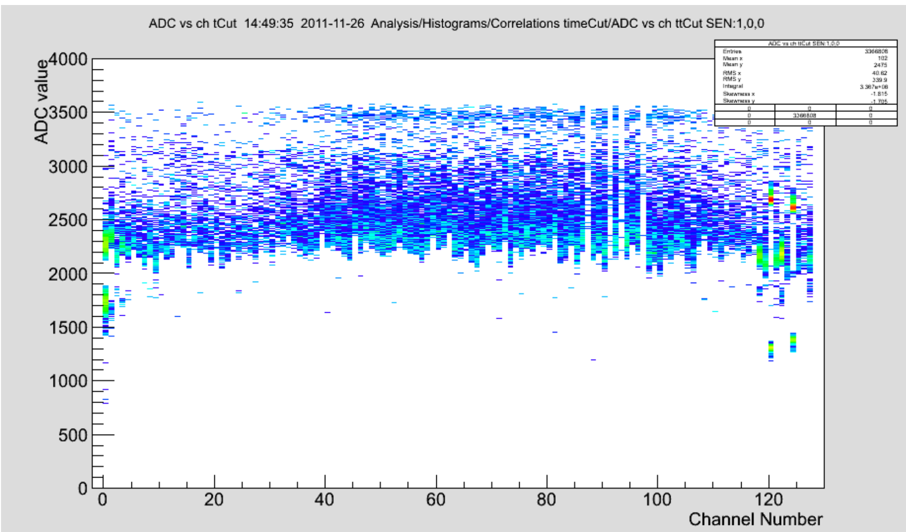
Exploder 0

Exploder 1

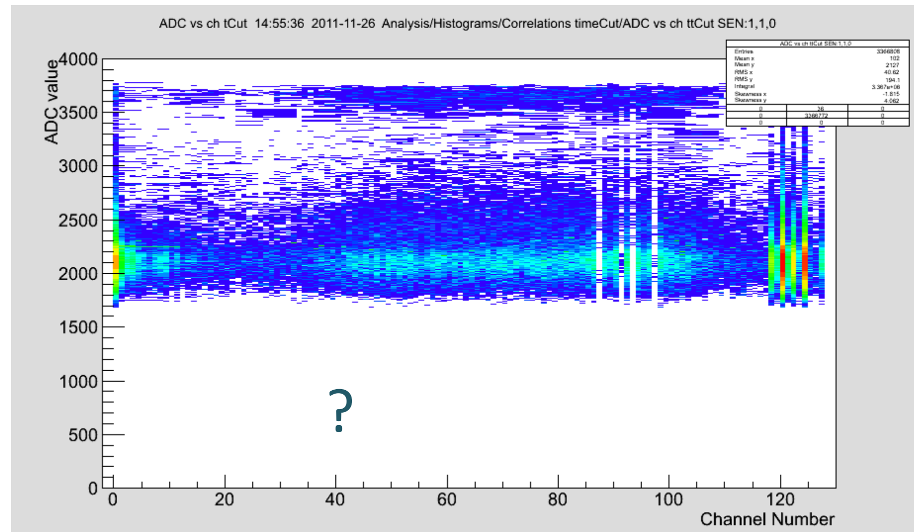
E. Epple, P. Koczoń, R. Lalik

Distribution with time cuts

Cut on Time correlation of Exp0 && Exp1



Exploder 0



Exploder 1