



First beam test results of “test light source”

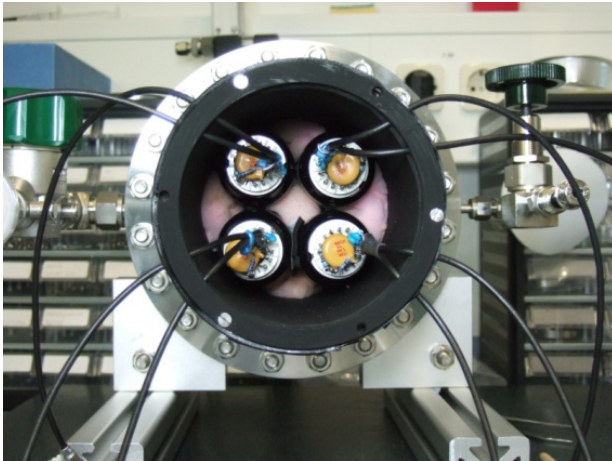
May, 10th, 2010 | Holger Nöldgen
NMI3-Meeting, Barcelona

Overview

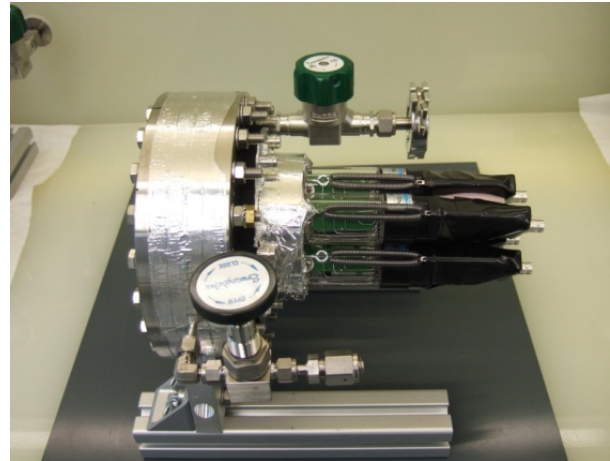
- A gas chamber filled with 1 bar CF_4 + 0,3 bar ^3He was installed for neutron measurements at TREFF at FRM-2
- For photon detection PMT modules from STFC and FZJ were connected to the gas chamber window
- PMT and MSGC output signals were measured with Agilent DAQ-System
- MSGC voltage / gain dependency has been determined
- Measurements at several different beam positions allow a first test of 2-dimensional reconstruction

Setup of the neutron detector with 4 PMT's

STFC-Setup

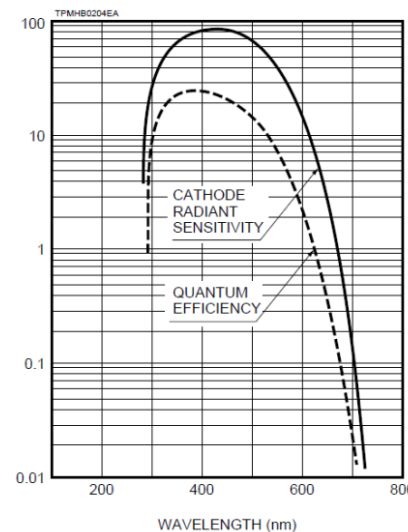
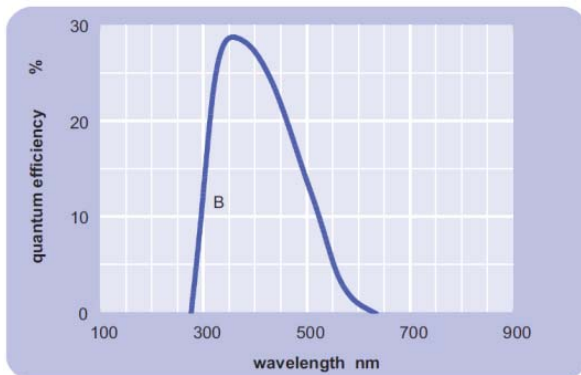


FZJ-Setup



STFC-Setup:

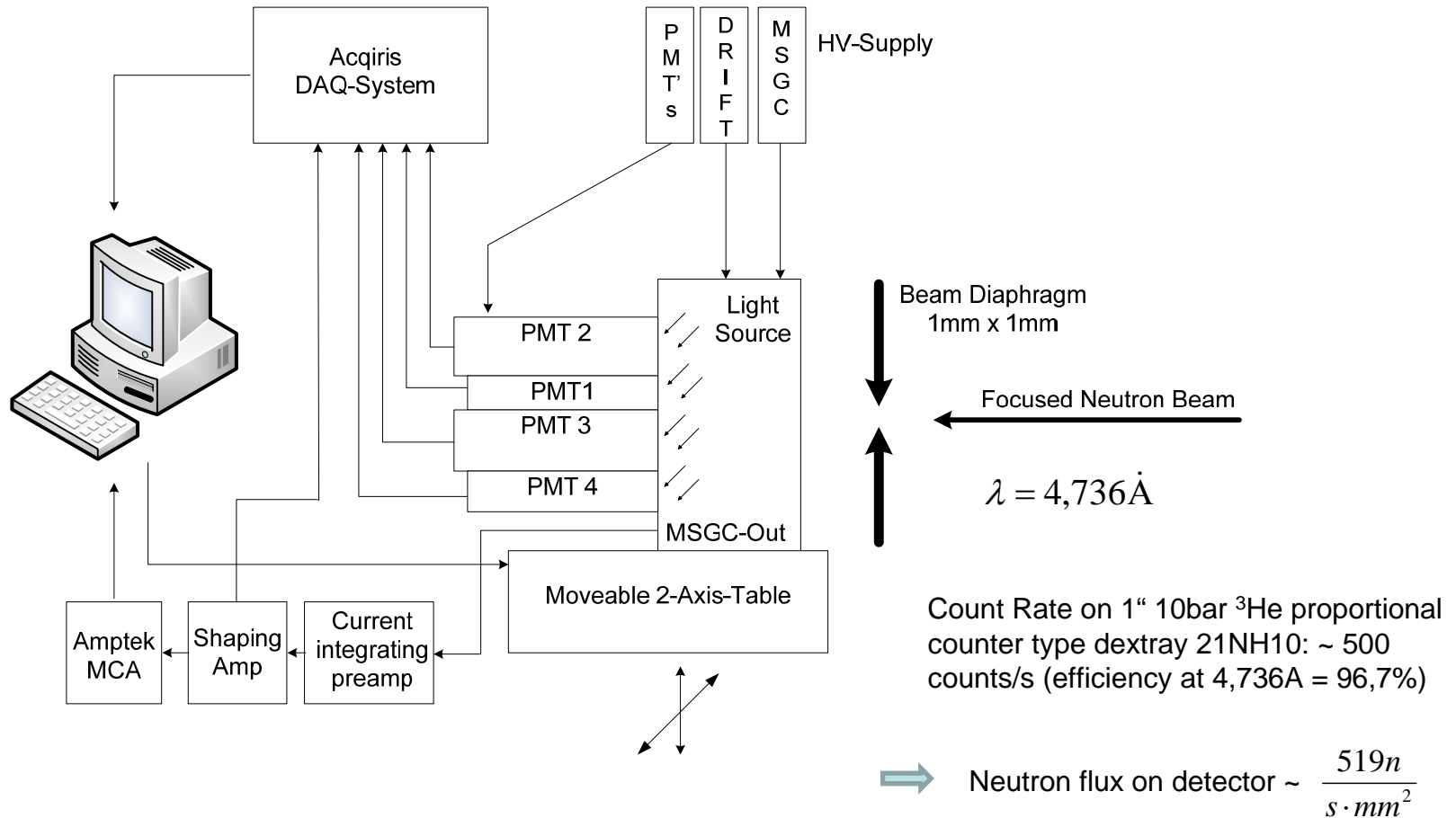
- PMT's: 4 ET Enterprises type 9102SB09
- Spectral range: 290nm-630nm
- Maximum response: 350nm



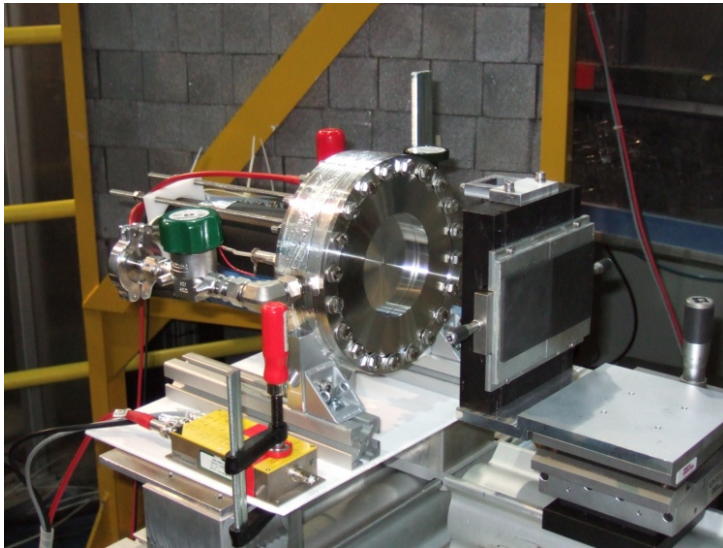
FZJ-Setup:

- PMT's: 4 Hamamatsu type R580
- Spectral range: 300nm-650nm
- Maximum response: 420nm

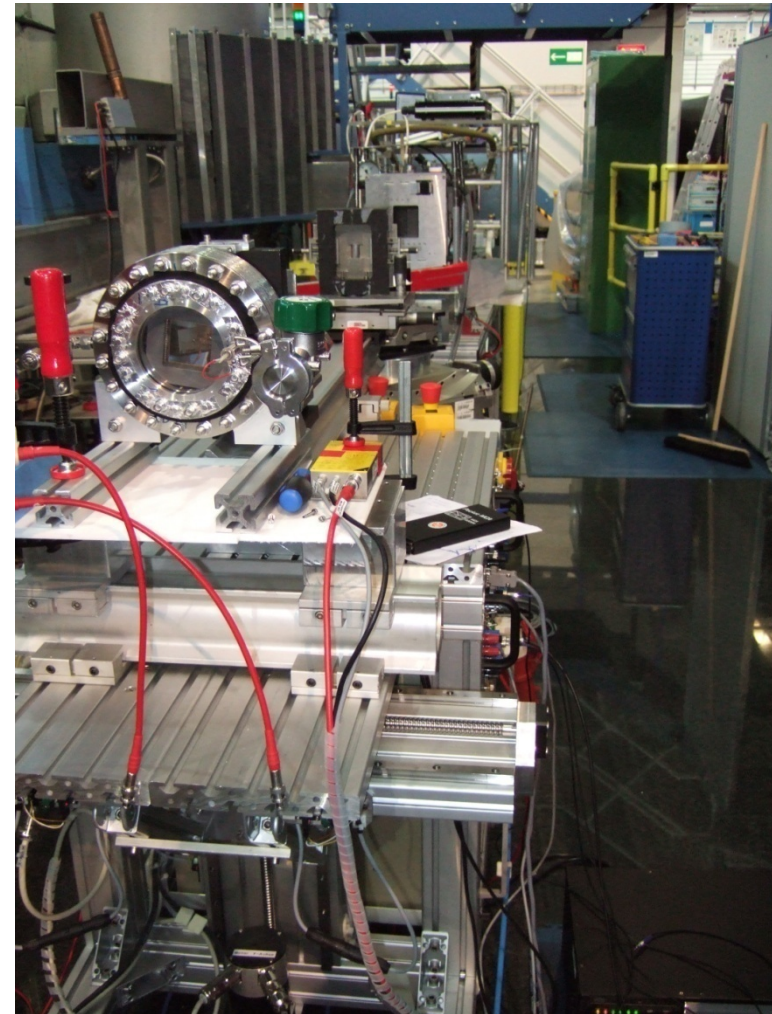
Detector setup at TREFF



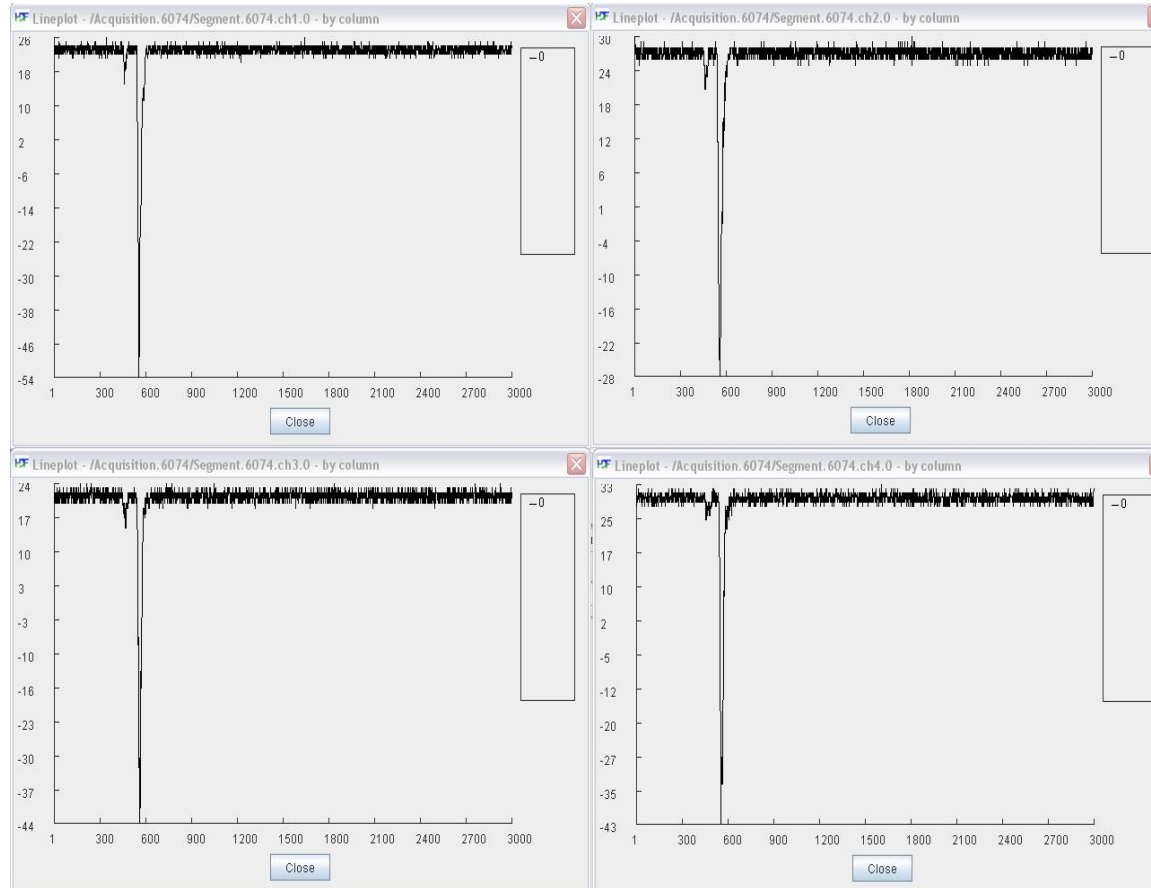
Detector setup at TREFF



- Detector count rate: ~ 50 events/s
- Detector moveable in X- and Y-direction
- Several test runs for position reconstruction were done
- MSGC gain was tested



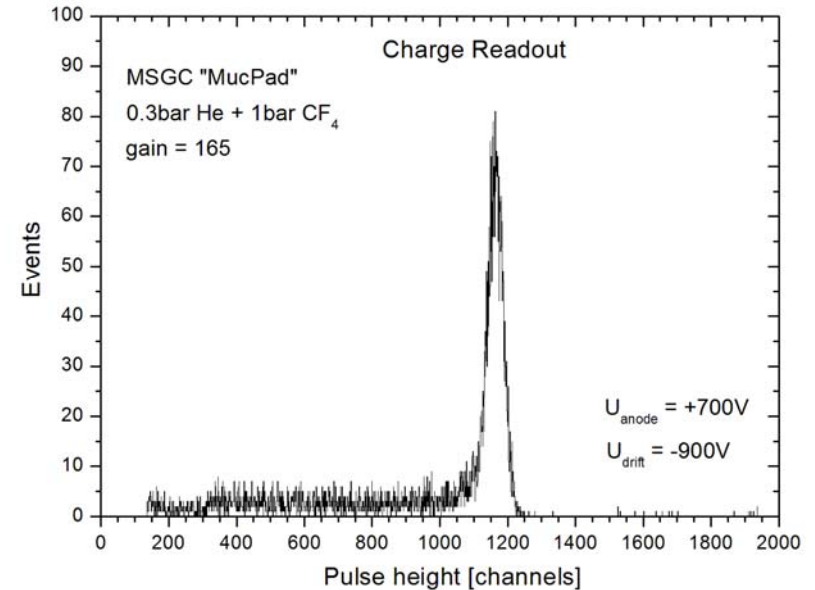
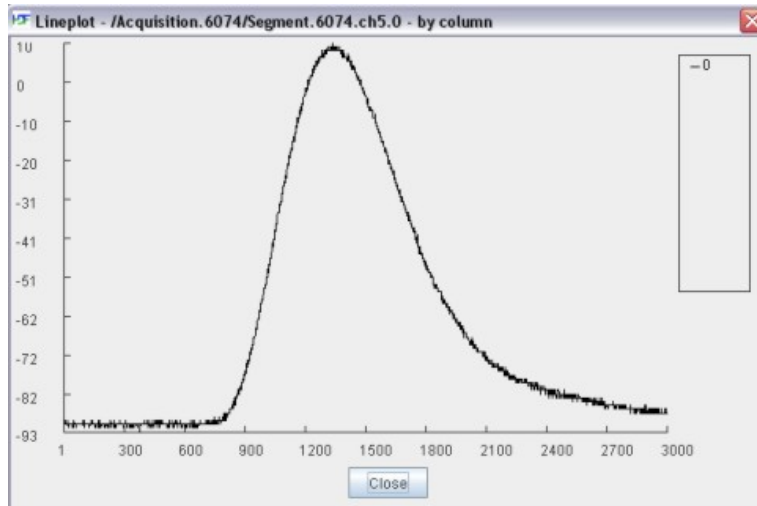
Output signals of PMT's



- 4 PMT outputs were analyzed in parallel with the Acqiris system
- The primary and secondary light peaks could be detected
- Acqiris data sets stored on disk for offline data analysis
- Pulse peak of primary light $\sim 10\%$ of secondary light peak
- Fast PMT pulse width < 100 ns

Output signal of MSGC-Anode

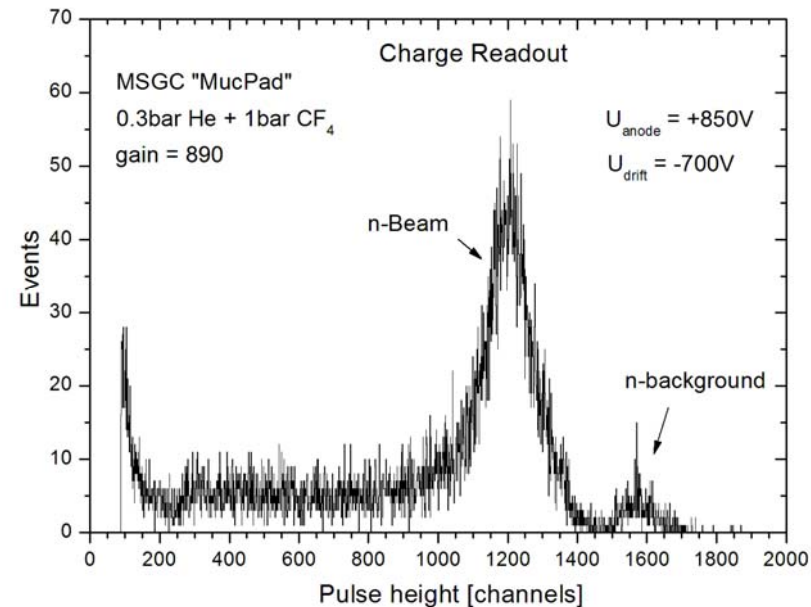
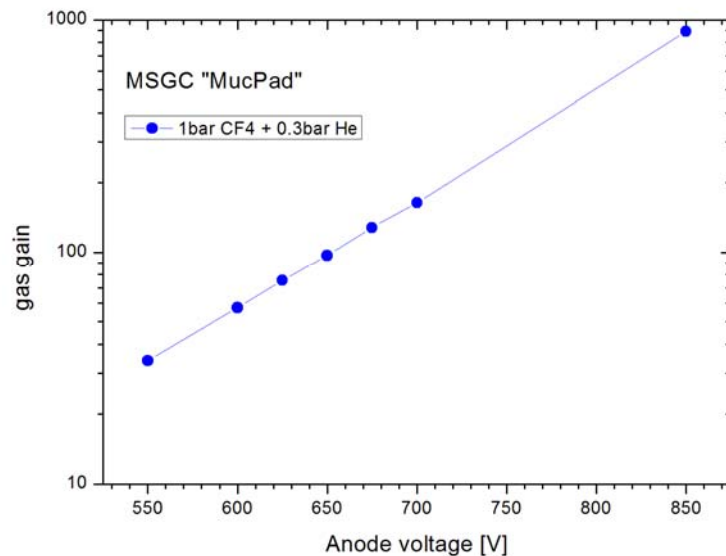
- MSGC output signals have been shaped and registered by a MCA
- MSGC events were used to determine detector count rate and MSGC gain



- Pulse height spectra shows a clear indication of a neutron peak
- The neutron peak position was used to calculate MSGC gain

Measurements with different MSGC-Voltages

- MSGC anode voltage varied from 550V to 850V
- Gain follows an exponential rise
- Voltage variations were only carried out within safe limits



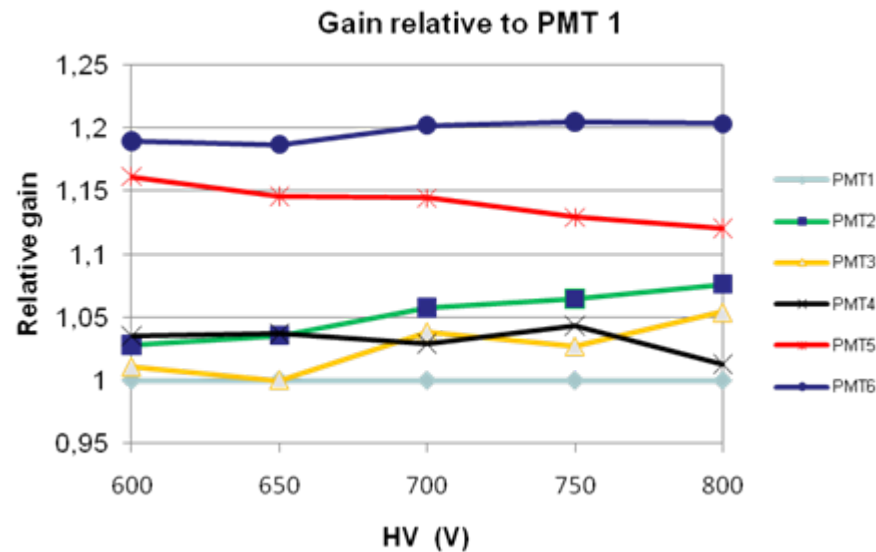
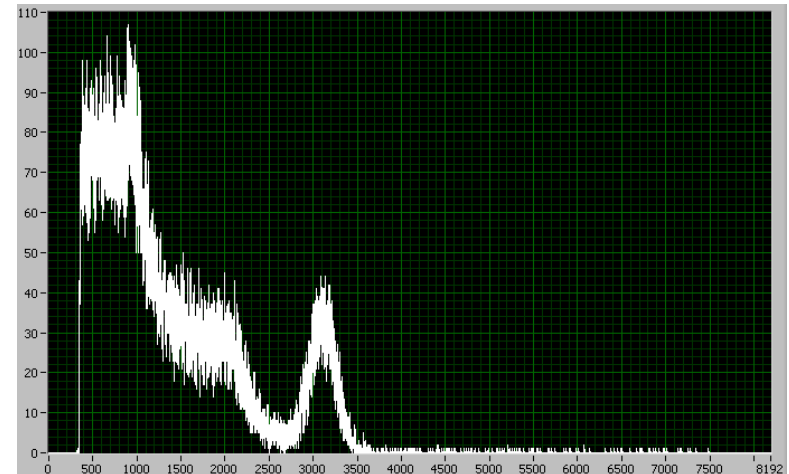
At 850V: descending of n-Beam Peak



Effect of high charge density region on MSGC

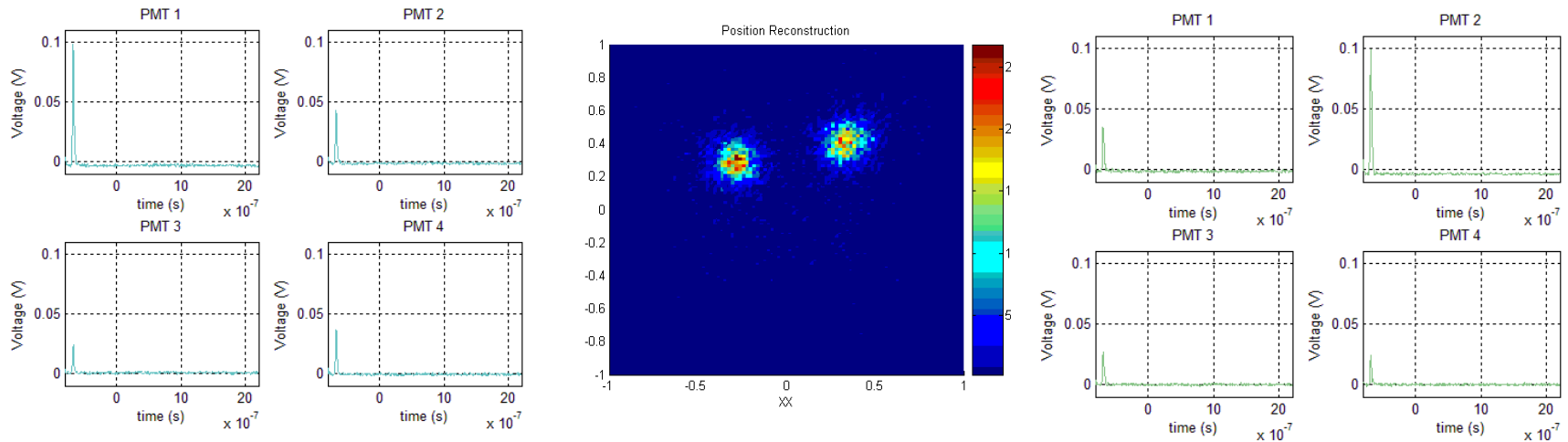
Determining PMT gain variation

- PMT gain variation was tested for proper position reconstruction
- STFC: Tests with GS20 scintillator and neutrons
- FZJ: Tests with NaI scintillator and Cs-137 gamma rays

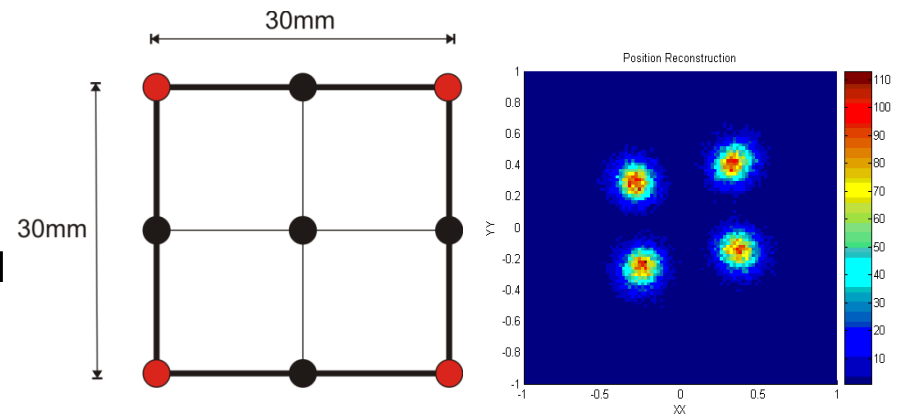


PMT #	Cs-137 peak @ 1,1kV	Calibration factor
1	168	1
2	234	0,7179
3	174	0,9655
4	195	0,8615

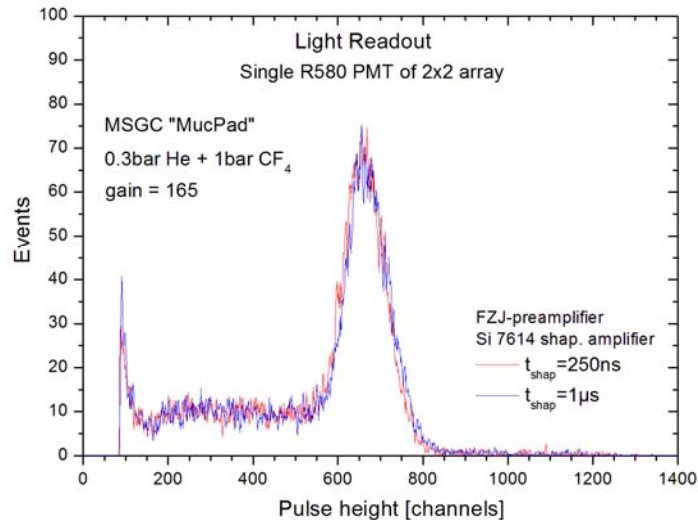
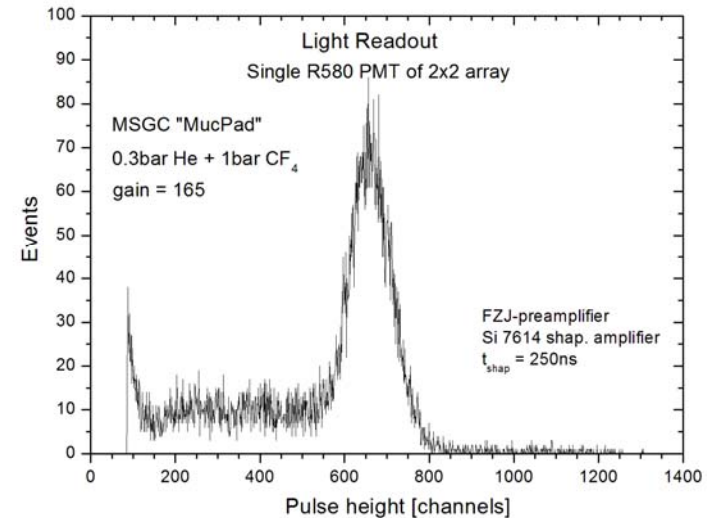
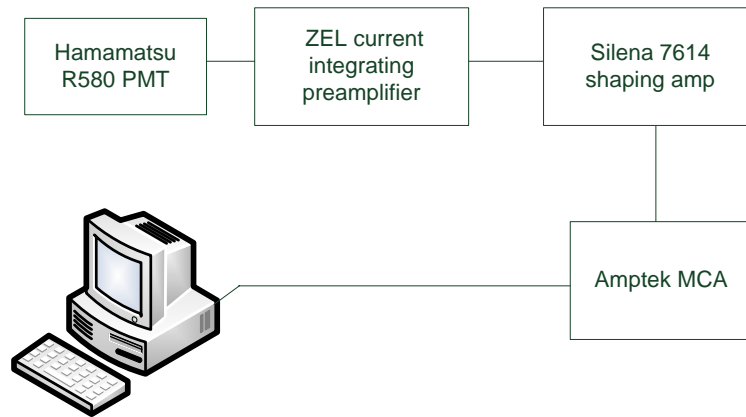
Measurements with different beam positions



- Detectorhead moved 30mm in X- and Y-directions behind beam diaphragm
- First data processing with MATLAB programm modified by Ilario Defendi and provided by Louis Margato at ILL-workshop



Tests with preamplifier and shaping amp



- Pulse height spectra measured with preamplifier and shaping amp
- Shaping time was varied from 250ns to 1μs
- Needs to be tested with 4 PMT's for position recovery

Conclusion and outlook

- Both detector setups were tested at TREFF
 - MSGC (muc-pad) characteristics were determined
 - PMT signals were analyzed with Agilent DAQ system
 - Primary and secondary light were detected
 - Pulse height spectra showed typical neutron peaks
 - First two dimensional data reconstruction has been made with MATLAB
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- New MSGC will be installed in the next version of the gas chamber and will be tested
 - CF_4 and ^3He pressure will be increased
 - Tests with preamps and shaping amps for 4 PMT's will be made

People supporting this measurement

- FRM-II: Karl Zeitelhack, Ilario Defendi
- FZJ-ZEL: Holger Nöldgen, Ralf Engels, Günter Kemmerling
- STFC: Nigel Rhodes, Erik Schooneveldt, Davide Raspino
- ILL: Louis Margato

Thank you!