# CBM Electronic Components Beam Test

April 2014, GSI Cave C

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EE-Meeting

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# Overview

CBM Beam Test at Cave C

- Primary beam: Ni, 1.5 GeV/AMU
- Lead scatter target (25µm) ~3m before setup ➔ Proton/Pion
- 20.-25.4.2014

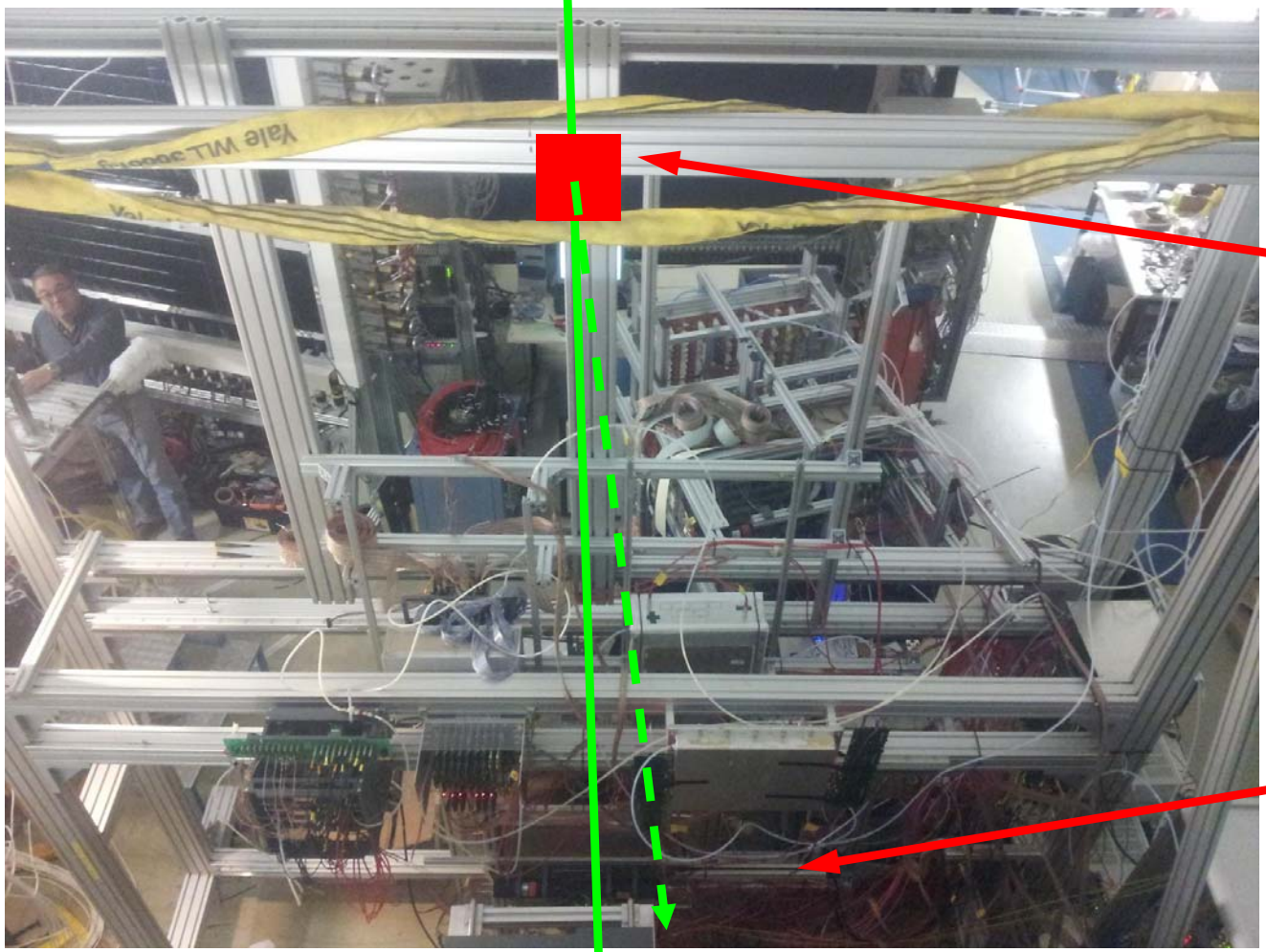
Main aim of beam test:

- Test of power regulators (started already at COSY 2013)

Participants:

- Piotr Koczon (Planning, Setup, Mechanics)
- Sven Loechner (Electronics, Monitoring, Software, Measurements)

# CBM Test Setup at Cave C



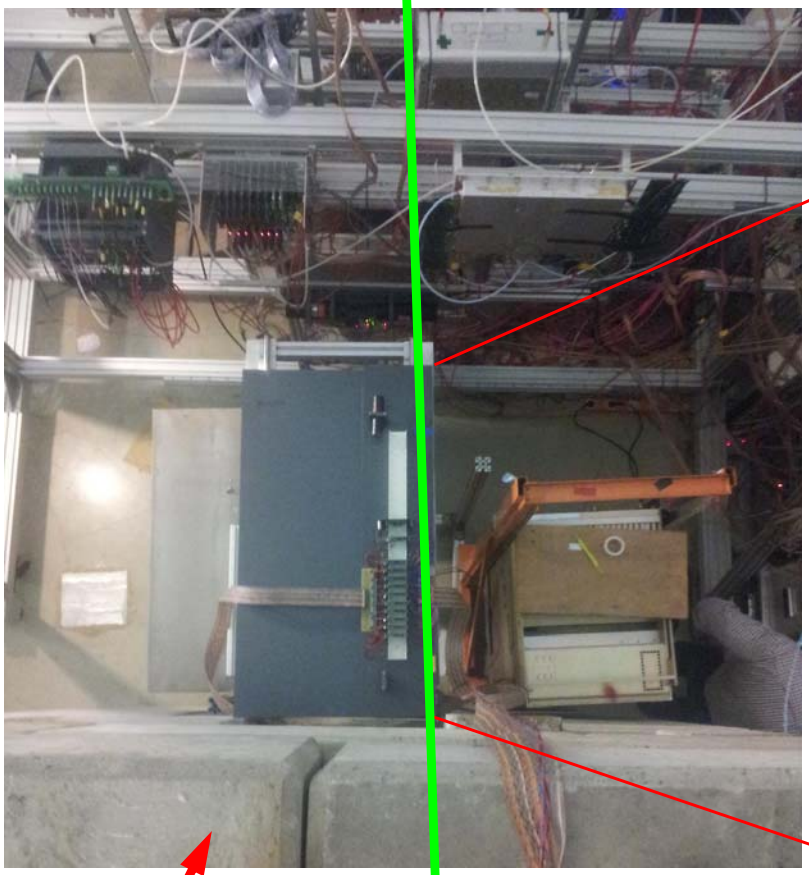
Pb Target

ToF Setup

Ni-Beam

Scattered Protons

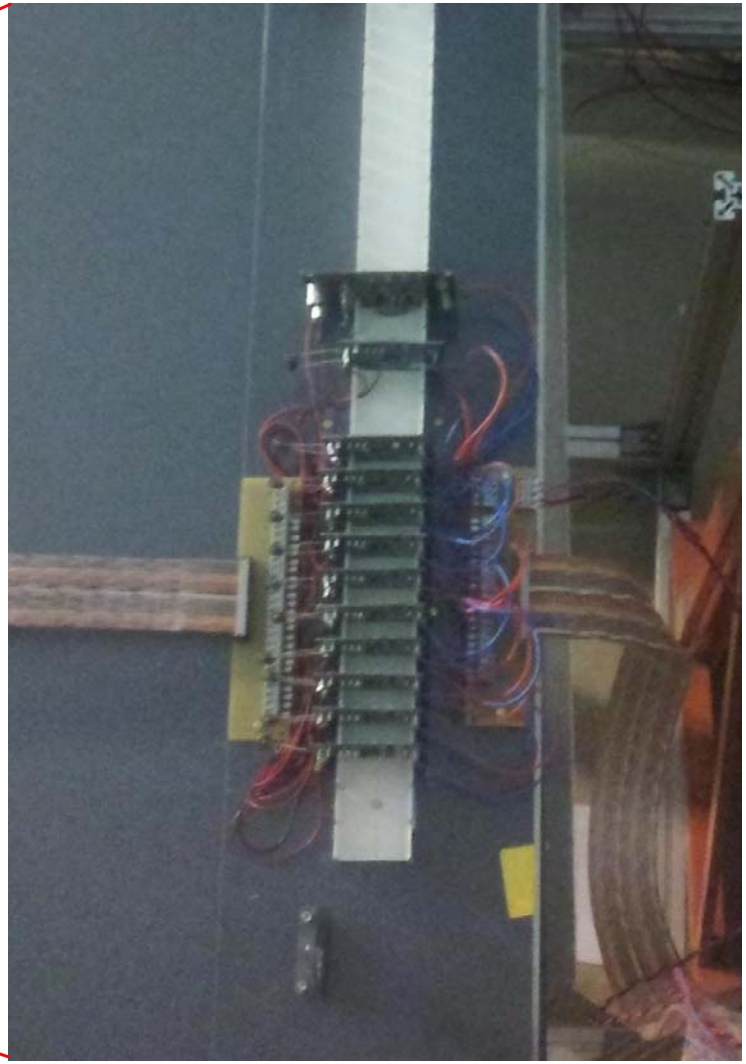
# CBM Test Setup at Cave C



Beam Dump

Ni-Beam

Electronic Setup



# Device under Tests

Device under Tests:

- 11 x LTC 3605A, mounted on LTC demo board 1215A
  - 5A Synchronous Step-Down Regulator DC/DC Converter
  - $V_{in}$: 4V to 20V
  - $V_{out}$: 0.6V to 5V
- 1 x LTC 3610
  - 12A Synchronous Step-Down Regulator DC/DC Converter

All devices were operating at:

- $V_{out}$ = 2.5V
- $I_{out}$ = 2.5 A

# Requirements for Monitoring

Requirements for the monitoring of the beam test:

- Online monitoring of the test setup in Cave C,
  - Output voltage of each power regulator
- Switchable input voltage for each power regulator
- Automatic control of test setup
  - Monitoring voltages, in case of “unusual” output voltages, switch off/on of input voltage of power regulators
- Logging of measured data

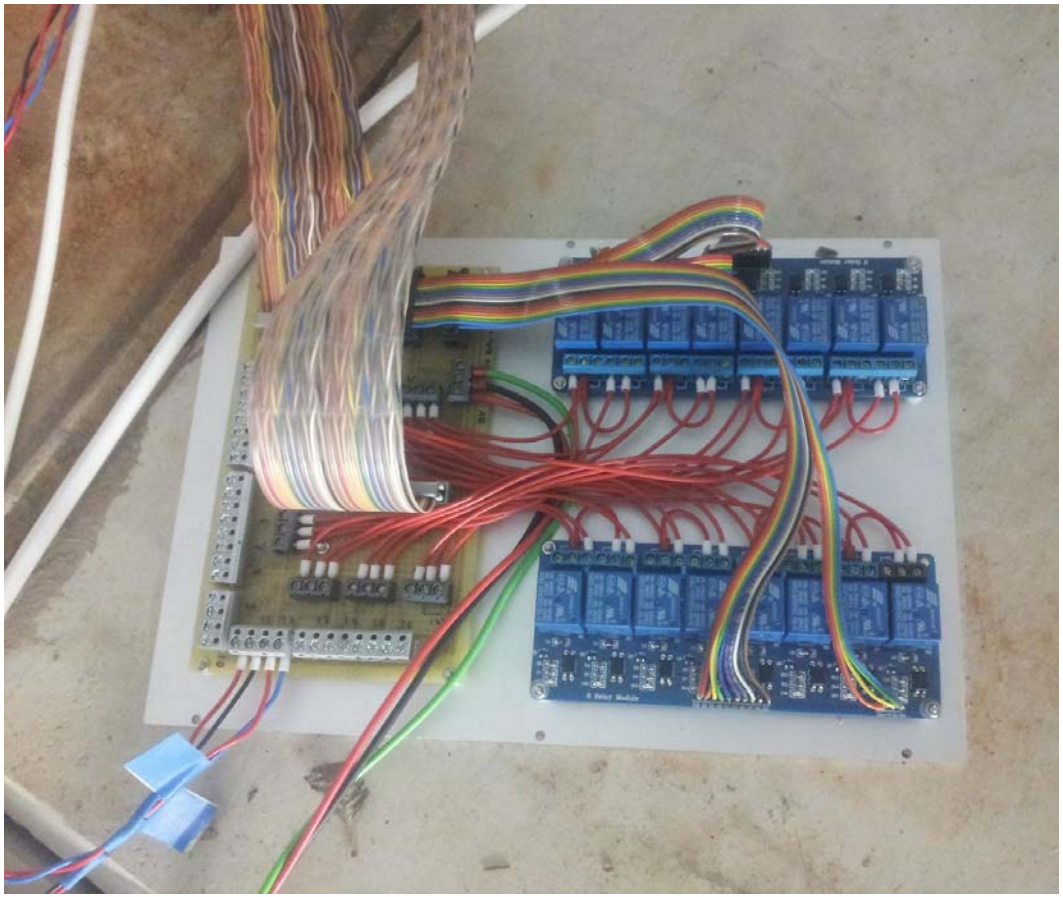
➔ “Quick” setup solution: use of an Arduino microcontroller

# Arduino Setup

Idea for the concept with the Arduino microcontroller based on some developments of Lasse Niebuhr (scholar student in January 2014)

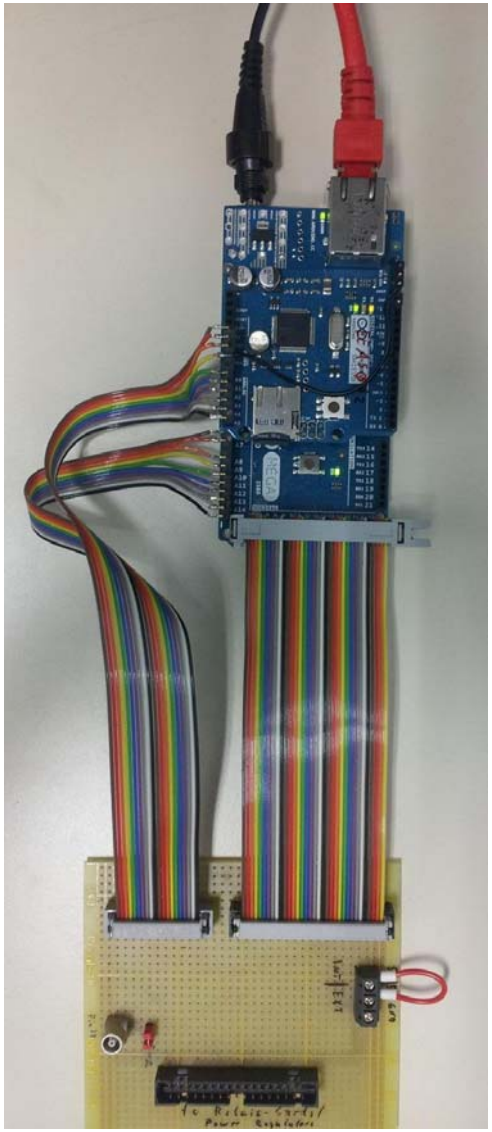
- Arduino Mega 2560 as microcontroller
  - 16 ADC channels (10 bit)
  - 54 IO pins
  - ~18 €
- Arduino Ethernet Shield add-on board
  - RJ45 Ethernet connector
  - micro SD card slot
  - ~20 €
- Arduino 8 channel relay card (used 2 of them)
  - 10A, $30V_{DC}/250V_{AC}$)
  - ~6 €

# Setup



Relay cards

Arduino

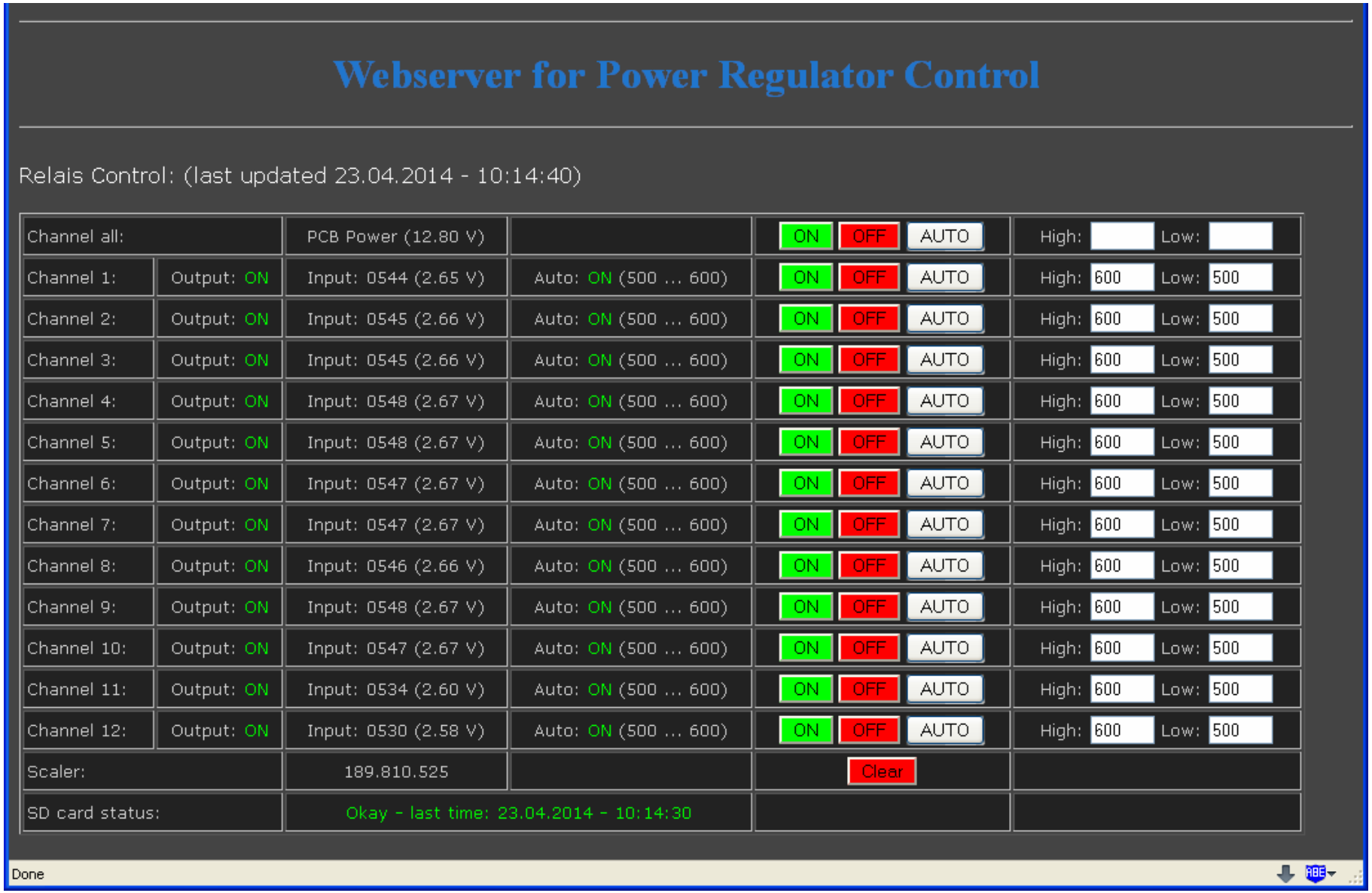


# Setup

Setup:

- Web server for:
  - Output status control
  - Input Voltage monitoring
  - Auto operation (min/max range)
  - Counter for coincidence of photo multipliers
- Time synchronization (for data logging)
  - via Ethernet NTP protocol
- Data logging
  - to micro SD card

# Webserver for Power Regulator



## Webserver for Power Regulator Control

Relais Control: (last updated 23.04.2014 - 10:14:40)

| | | | | | | |
|---|---|---|---|---|---|---|
| Channel all: | | PCB Power (12.80 V) | | ON OFF AUTO | High: | Low: |
| Channel 1: | Output: ON | Input: 0544 (2.65 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 2: | Output: ON | Input: 0545 (2.66 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 3: | Output: ON | Input: 0545 (2.66 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 4: | Output: ON | Input: 0548 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 5: | Output: ON | Input: 0548 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 6: | Output: ON | Input: 0547 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 7: | Output: ON | Input: 0547 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 8: | Output: ON | Input: 0546 (2.66 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 9: | Output: ON | Input: 0548 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 10: | Output: ON | Input: 0547 (2.67 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 11: | Output: ON | Input: 0534 (2.60 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Channel 12: | Output: ON | Input: 0530 (2.58 V) | Auto: ON (500 ... 600) | ON OFF AUTO | High: 600 | Low: 500 |
| Scaler: | | 189.810.525 | | Clear | | |
| SD card status: | | Okay - last time: 23.04.2014 - 10:14:30 | | | | |

Done

# Results

First results:

- Due to problems with SIS accelerator, the targeted beam current could not be reached
- For Protons:
  - accumulated 1.75 x $10^9$ p/$cm^2$ , equivalent to only 50rad ($SiO_2$)
  - for comparison (COSY 2013):
    - LTC 3605: 7.70 x $10^{11}$ p/$cm^2$ (died at this point)
    - LTC 3610: 2.49 x $10^{12}$ p/$cm^2$
- For Ni:
  - accumulated 2.56 x $10^8$ p/$cm^2$ , equivalent to 5.7krad ($SiO_2$)
  - SEE: expect no “impact”, because LET = 1.407 MeV $cm^2$ / mg is below the critical LET (data expected from other processes)

➔ All devices “survived” the beam test