PSI

SoM-CAM test with FW4Y signals

HIPA instrumentation upgrade meeting

November 5th, 2024

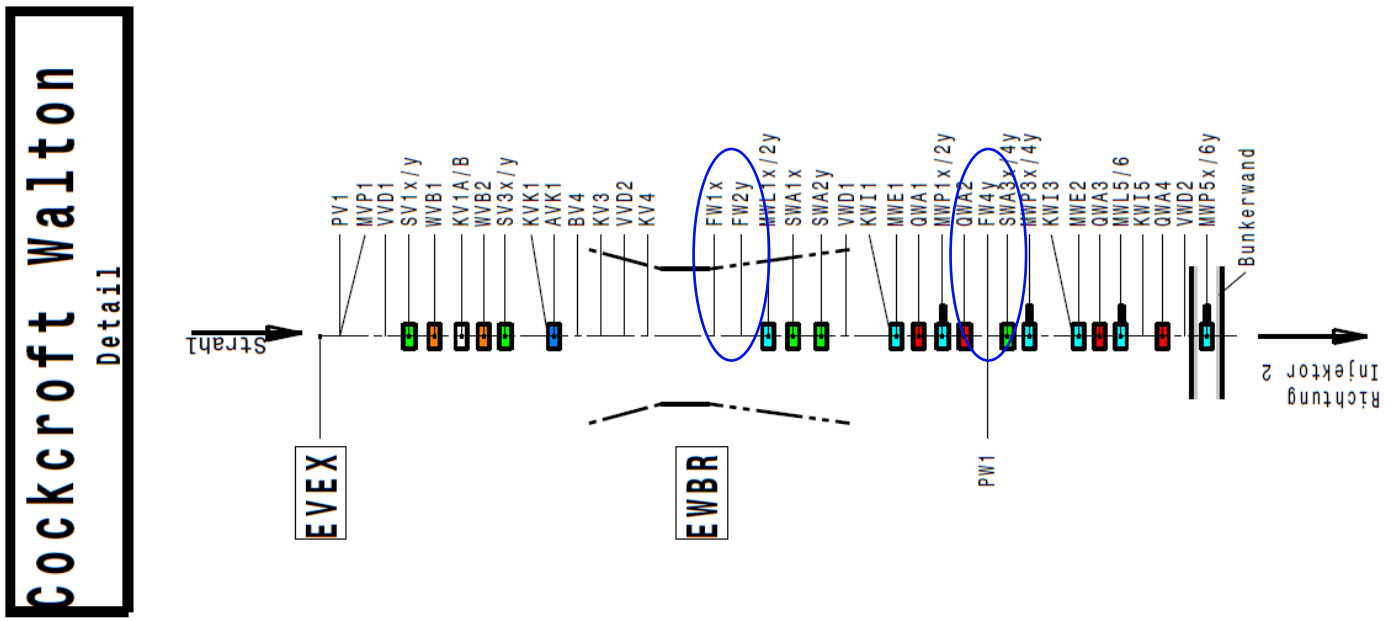
Test by: Shu, Pablo, Mariusz, Raphael, Markus, Mattia, Rudolf, Aaron, control room team
PSI

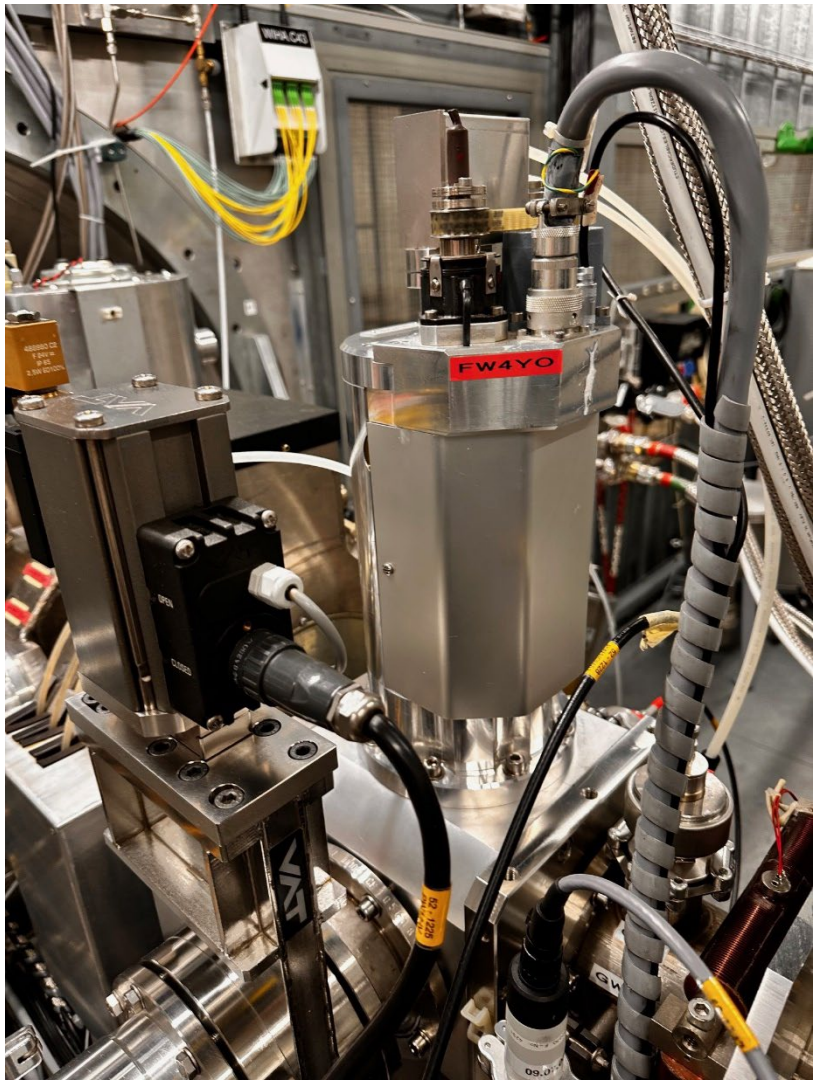
Motivation

1. LLCams are simplest CAMAC modules, their replacement by SoM-CAM should be straightforward
2. They are mostly used by slits and collimators in the 870 keV beamline and Injector2
3. The channels are:
4. Rudolf suggested FW1,2,4 (FW3 does not exists) which are horizontal and vertical slits, because:
   "If FW1 … 4 are not moved far into the beam, what was historically often the case, I assume they are not endangered.
   With the operators, they probably can be moved out.
   For longer operation in this mode, eventually they can be blocked by switching off the driver module and removing the motor plug (Dietmar)."

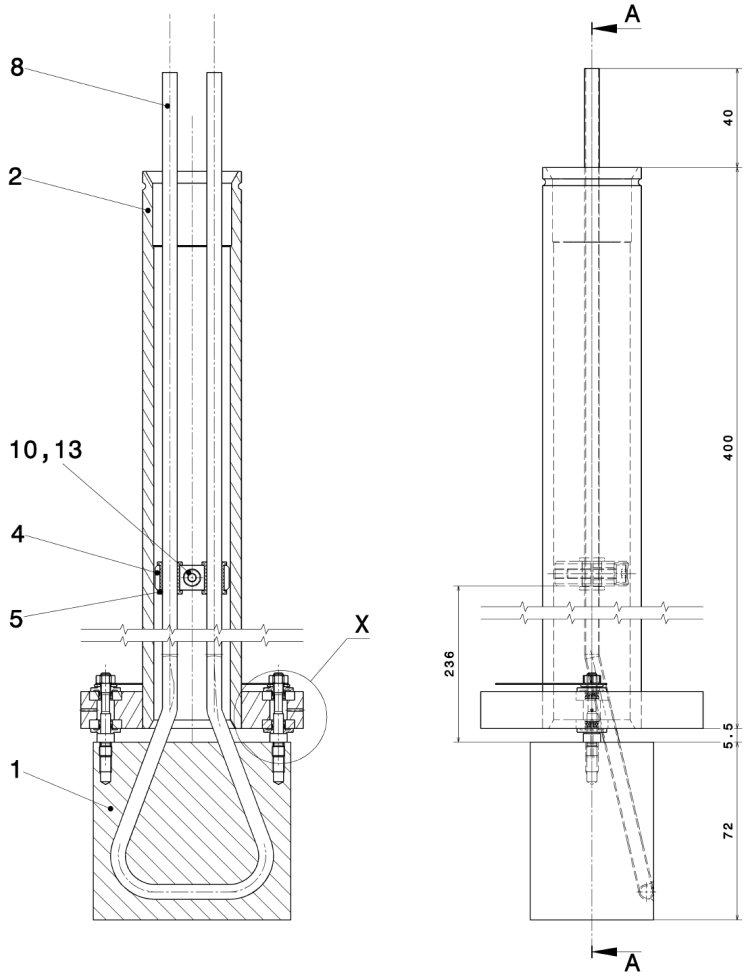
KWI 11
KWI 13
KWI 15
KWI 16
KWI 17
KWI 18
KWI 19
KWI 21
KWI 22 & 23
KWI 24
KWI 25
KWI 26
KWI 27
KWI 28
KWI 29
KWI 30
KIG2 oben
KIG2 unten
KIL1 oben
KIL2 unten
KIS2
KIP1
KIP2
BI1A
KIDE4
KIDK
KIDA5
KXA1
KXA2
KXA3
KXB1
KXB2
KX20
KX1
KX2
KX3
KXT1
KXT2
KXT3
KX6I
KX4A & 4B
KX5
KX8
KX9
BX1.1
KY1 I
KY2 I
KY3 I
KY4 I
BY1 I
KIG1 oben
KIG1 unten
KWI 3
KWI 5
KWI 7
KWI 9
KWI 10
FW4Y unten
FW4Y oben
FW2Y unten
FW2Y oben
FW1X rechts
FW1X links

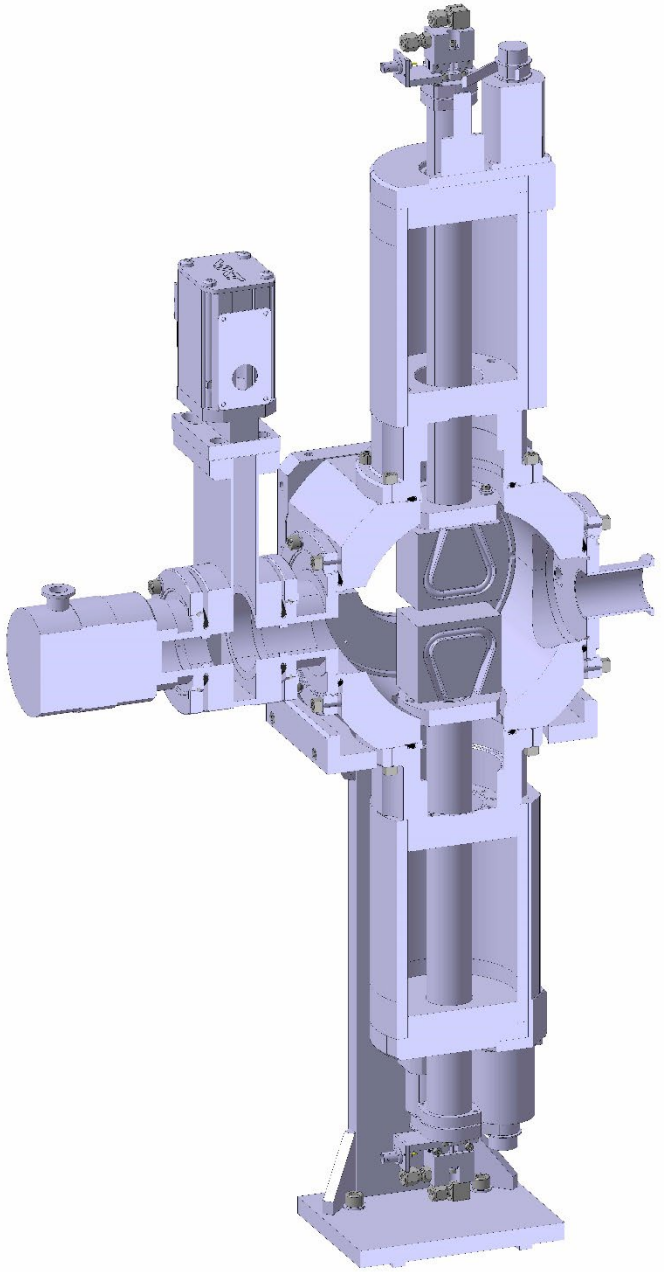
Location of the FW1,2,4 slits





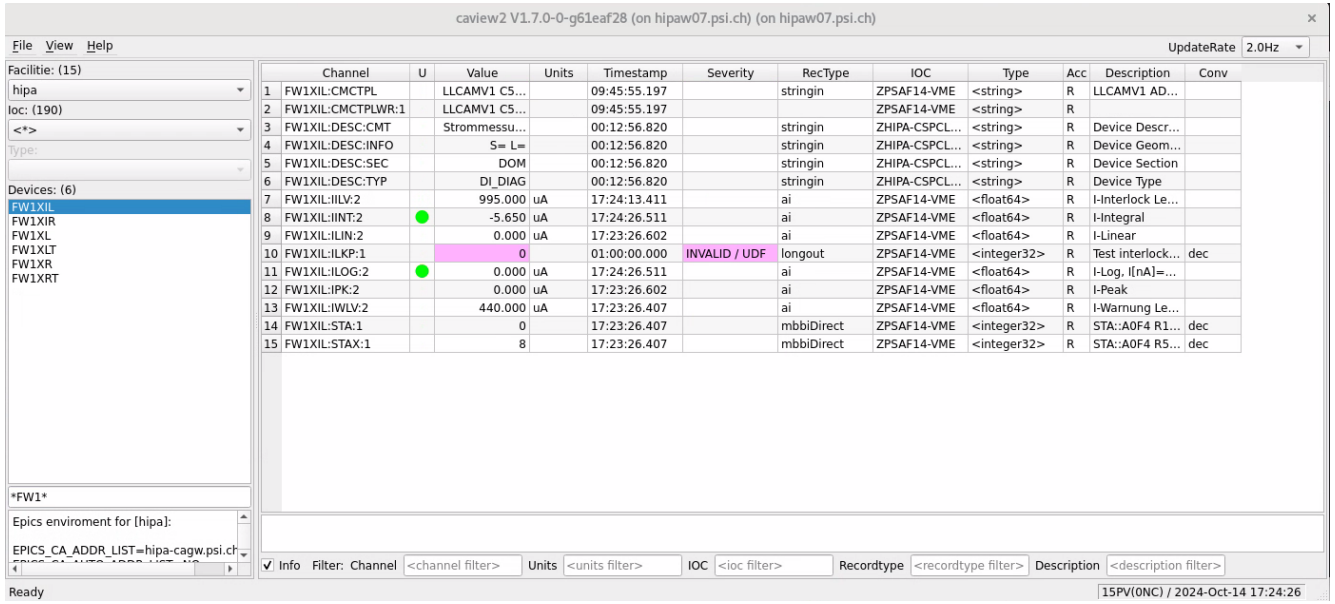
FW4Y interior (thx Tobi)





Slit interlock values

1. SoM-CAM during this test will NOT have interlock, while there are interlocks on LLCam
2. Interlock values (from Hui):
   FX1XIR:IILV:2 960 uA (Interlock limit?)
   FX1XIR:IWLV:2 455/460 uA (Warning limit?)
   FX1XIL:IILV:2 995 uA (Interlock limit?)
   FX1XIL:IWLV:2 440 uA (Warning limit?)
   FX2YIO:IILV:2 975 uA (Interlock limit?)
   FX2YIO:IWLV:2 455 uA (Warning limit?)
   FX2YIU:IILV:2 955 uA (Interlock limit?)
   FX2YIU:IWLV:2 440 uA (Warning limit?)
   FX4YIO:IILV:2 945uA (Interlock limit)
   FX4YIO:IWLV:2 510 uA (Warning limit)
   FX4YIU:IILV:2 955 uA (Interlock limit)
   FX4YIU:IWLV:2 440 uA (Warning limit)



3. FW4Y is after beam profile monitor, but at 870 keV there should be no additional particle shower signal during the scan (no interlock-level shift mechanism).
4. During the test we should NOT cross interlock levels (probable damage to the slit?).

Configuration for test on the beam

FW1 gives weak signals, so it is better to use FW2 or FW4.

We decide to use FW4. CAMAC current variables are called:

FW4YIU:ILOG:2 and FW4YIO:ILOG:2

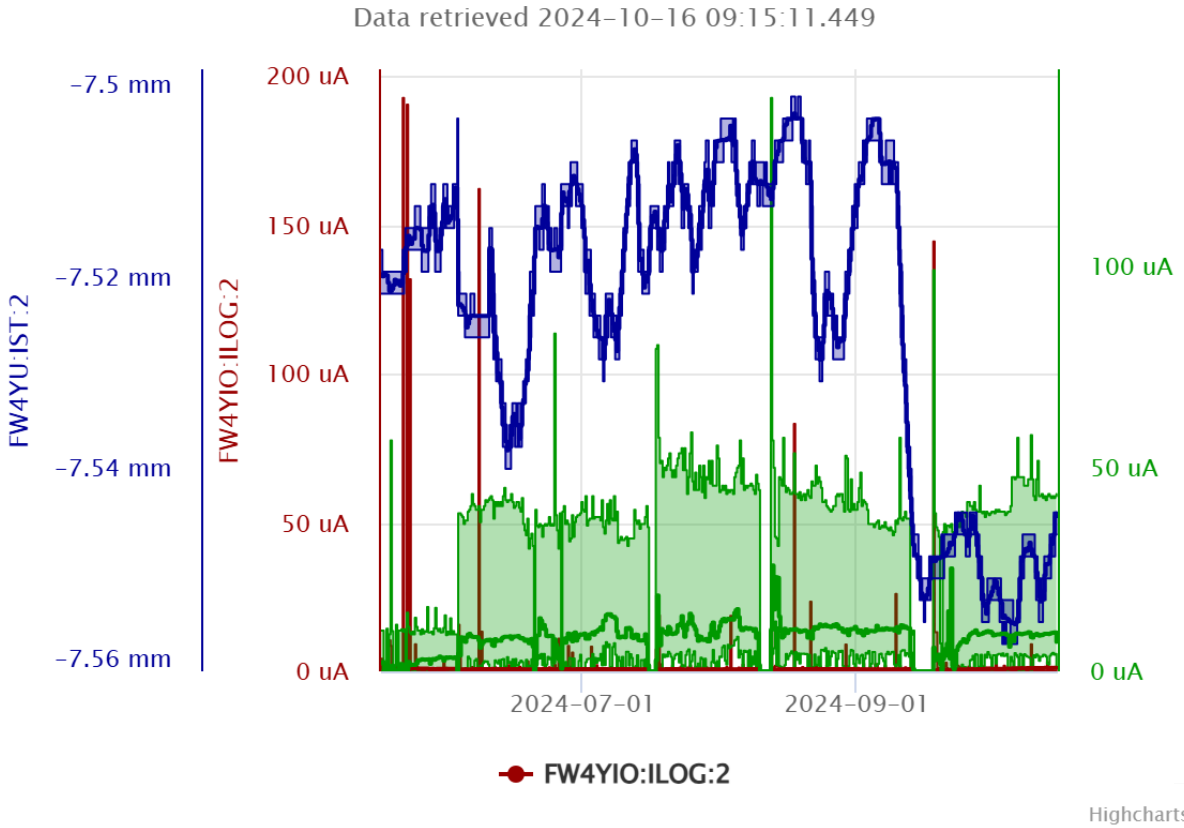
The corresponding SoM-CAM variables will be called:

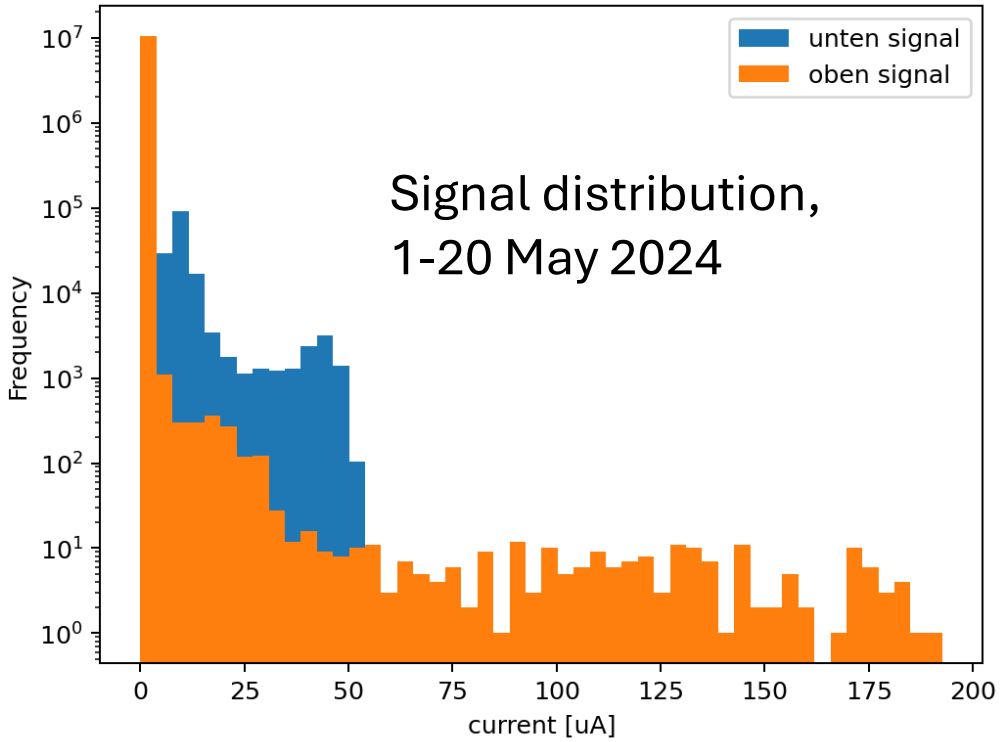
FW4YIU-T:ILOG:2 and FW4YIO-T:ILOG:2

Temperature variable is here:

ZTEST-SOMCAM-DI03:TEMP

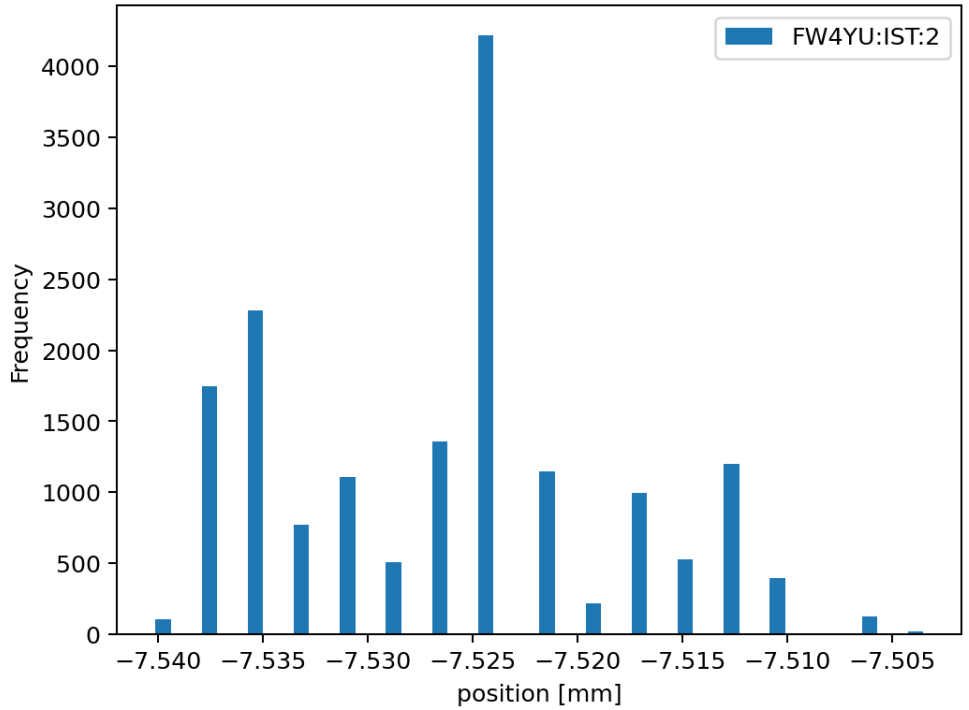
Some slit data from this year, before the test

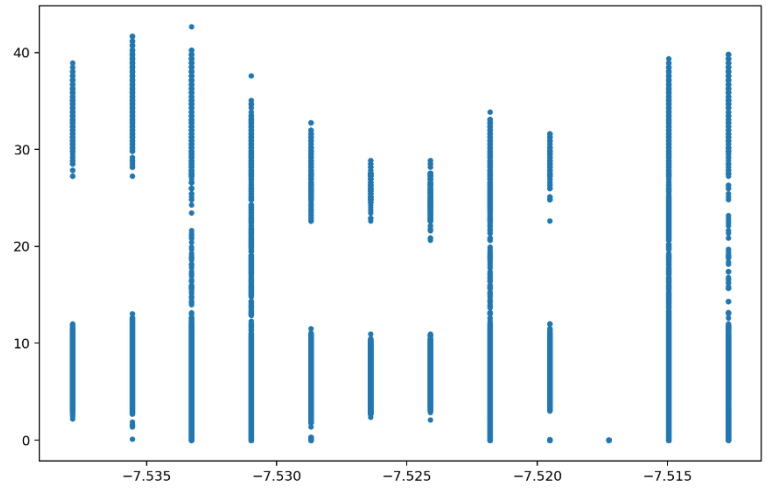




Very small movement of the slits

More data analysis 1H June 2024

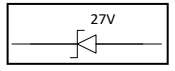




Position versus current

Photo of LLCams in crate (WIHA/C11)

Filter boxes with 27 V Zener diode



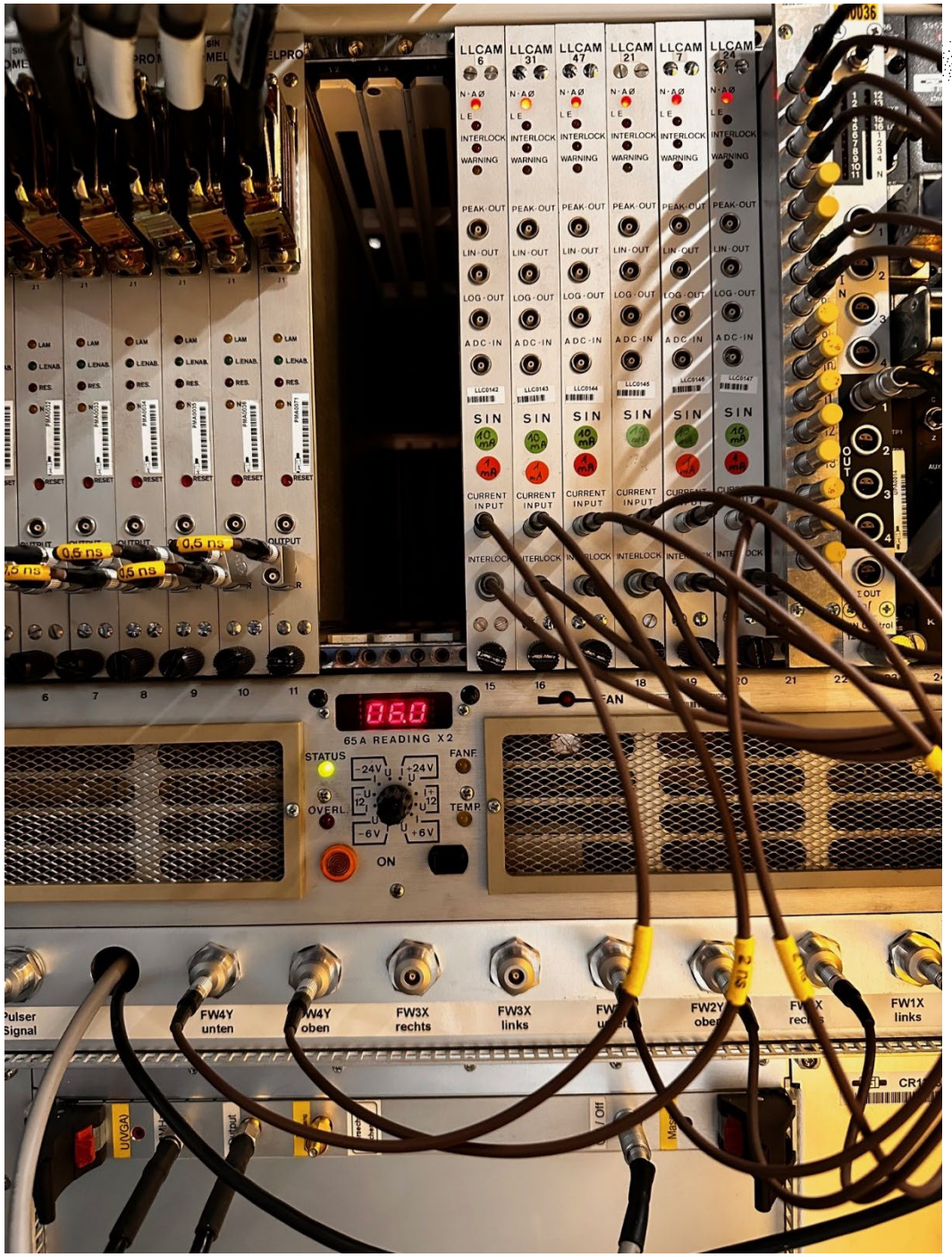
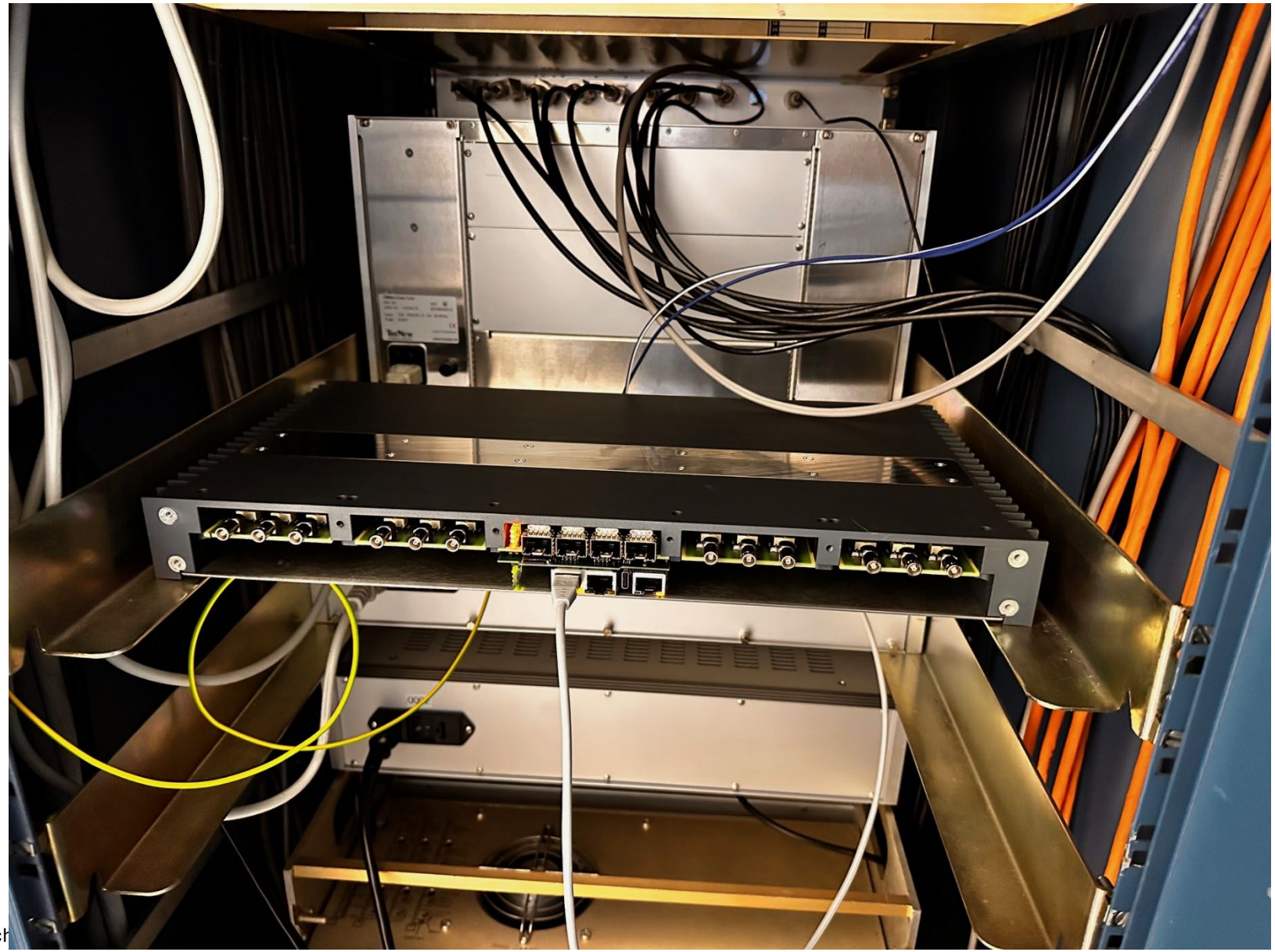


Photo of SoM-CAM installed in crate (WIHA/C11)



Important notice for the SoM-CAM Test from Raphael

I think it is important to draw your attention to the fact that the **CAMAC based current acquisition Modules do not have any input protection circuit** on the current input. **Electric discharge can destroy the input!** This is bad, but in the worst can we do not even notice it!

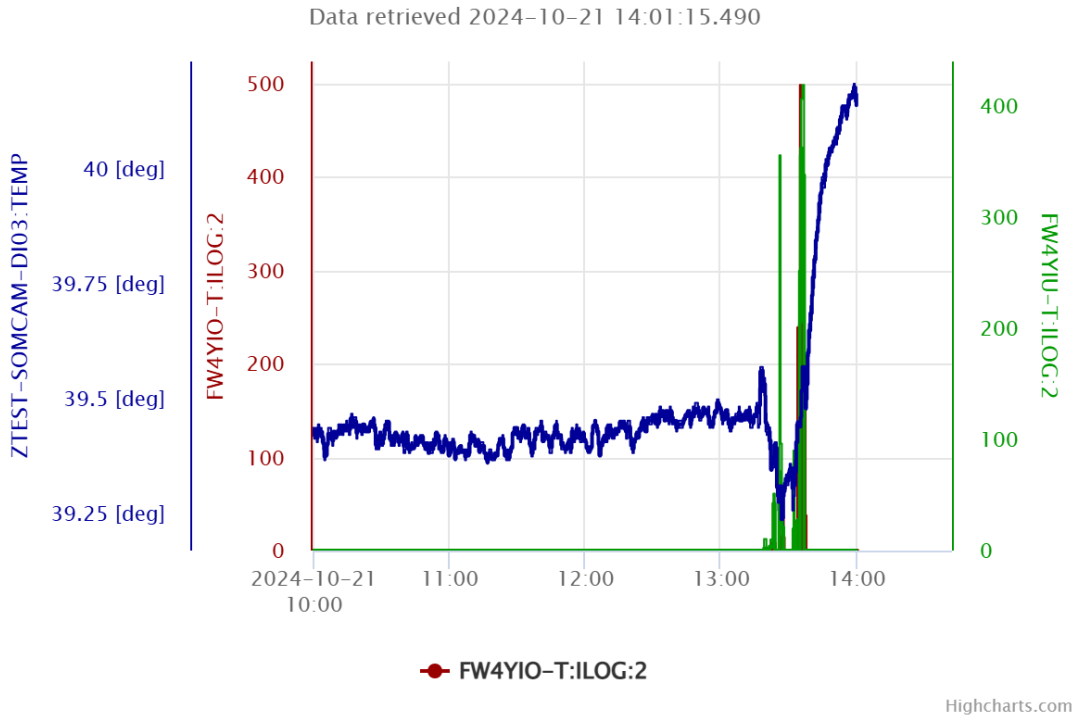
Diagnostic elements that are close to the beam i.e. collimator collect charged particles. Without discharging path this capacitor like circuit is charged up. This is the case if the signal cable is floating i.e. not connected to a current input. Now if the beam is "on" and the floating signal cable gets plugged into the current input of the CAM Modul the capacitor can discharge. Depending on the energy the input circuit can be seriously damaged.

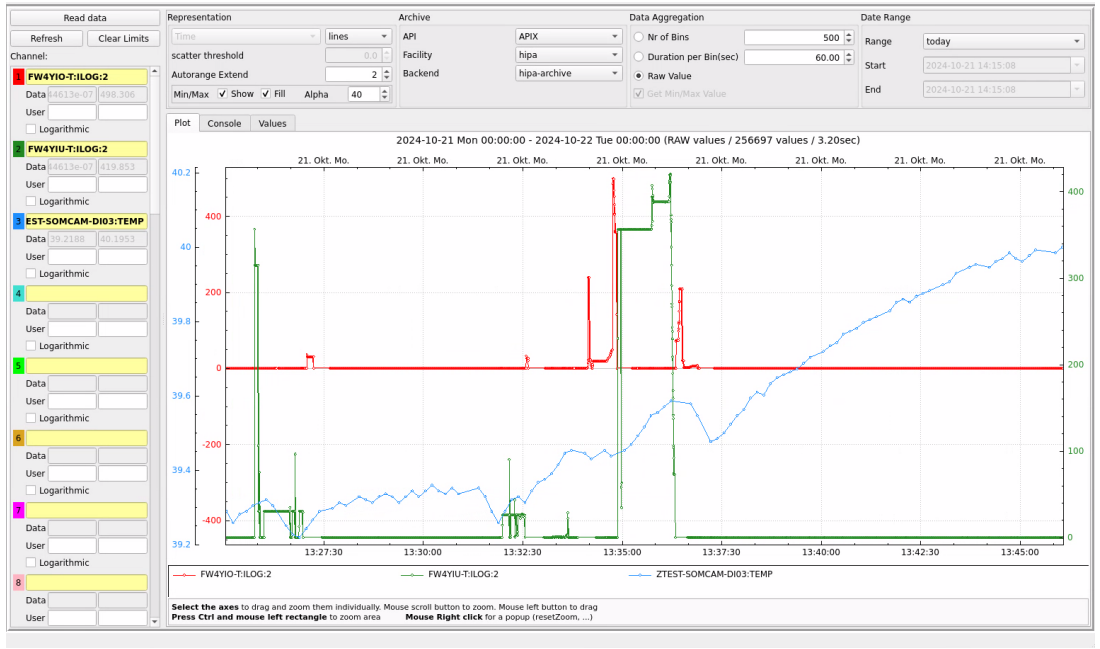
To prevent this, make sure the beam is “off” and measure the Voltage on the Signal cable before you connected it to the CAM Module.

Suggestion:
To connect the signal cable with beam

1. Connect the signal cable to a LEMO T-adapter
2. Connect a 50 Ohm LEMO terminator to the T-adapter
   (the 50 Ohm acts as discharge path)
3. Plug the T-adapter now into the current input of the CAM Modul
   (with 50 Ohm connected it cannot build up dangers charges)
4. Remove the 50 Ohm LEMO terminator
5. Drawback the LEMO T-adapter has to stay in between until safe removal is possible (beam “off”)

Test with battery in the WIHA, October 21st





Panel for Maxv motors controlling FW4 from control room

No current readouts in motor panels! Use tendis!

hard limits for the movement

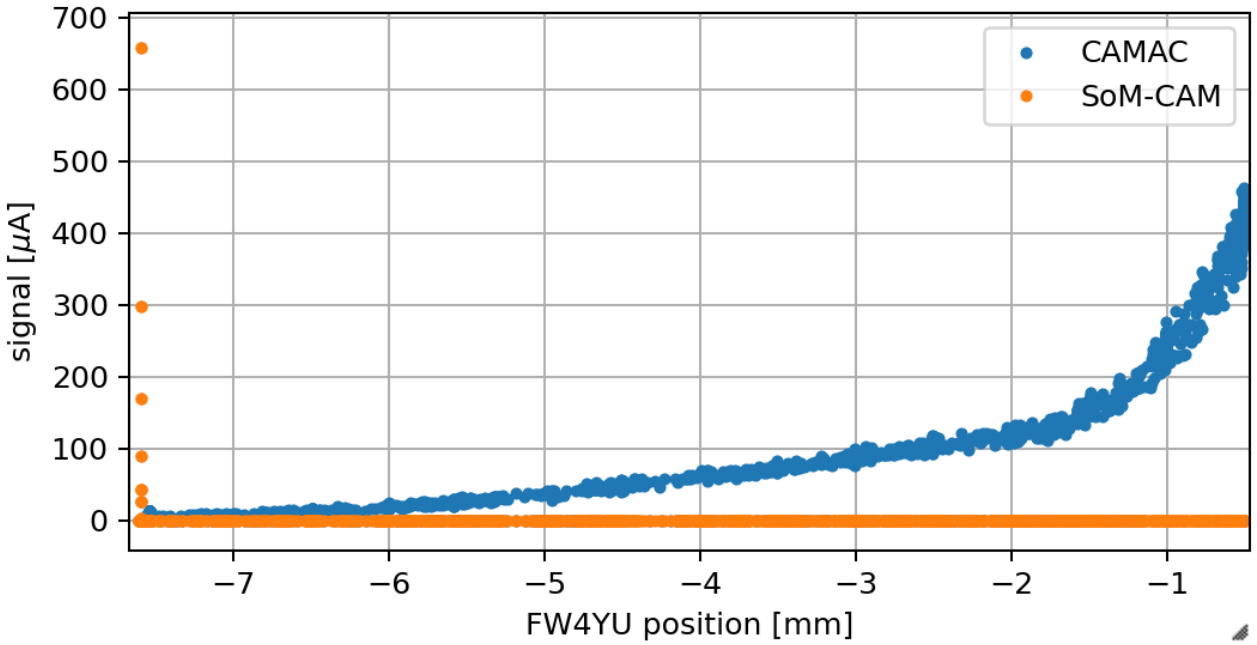
The test on October 24

Timeline

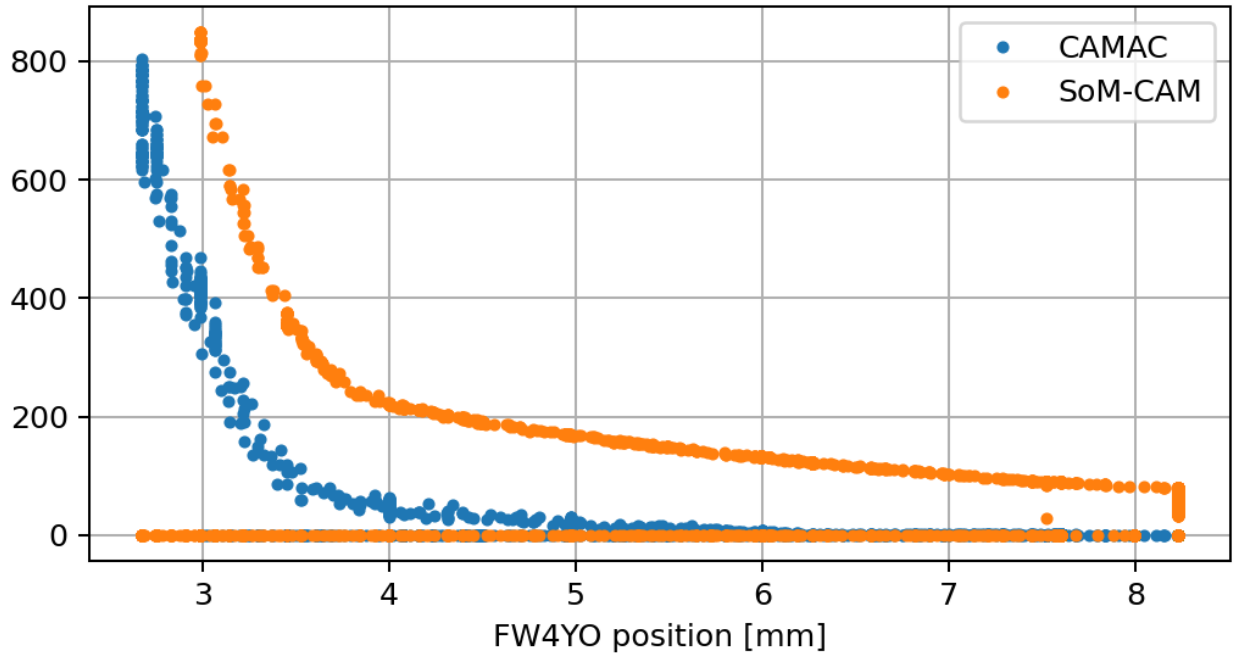
- SoM-CAM installed before the test
- 8:00-9:00 – taking data with CAMAC for various slit positions
- 9:00-10:00 – trying to connect signal cables to SoM-CAM, unexpected 174 V on both, signal wire and shield (?), some got a bit electrocuted fortunately no damage to people/equipment.
- 10:00-10:30 - finally 30 mins of measurements in extra time, some confusion about channels
- 16:00-16:30 – stealing another 30 mins to repeat measurements (SoM-CAM only).

Morning data

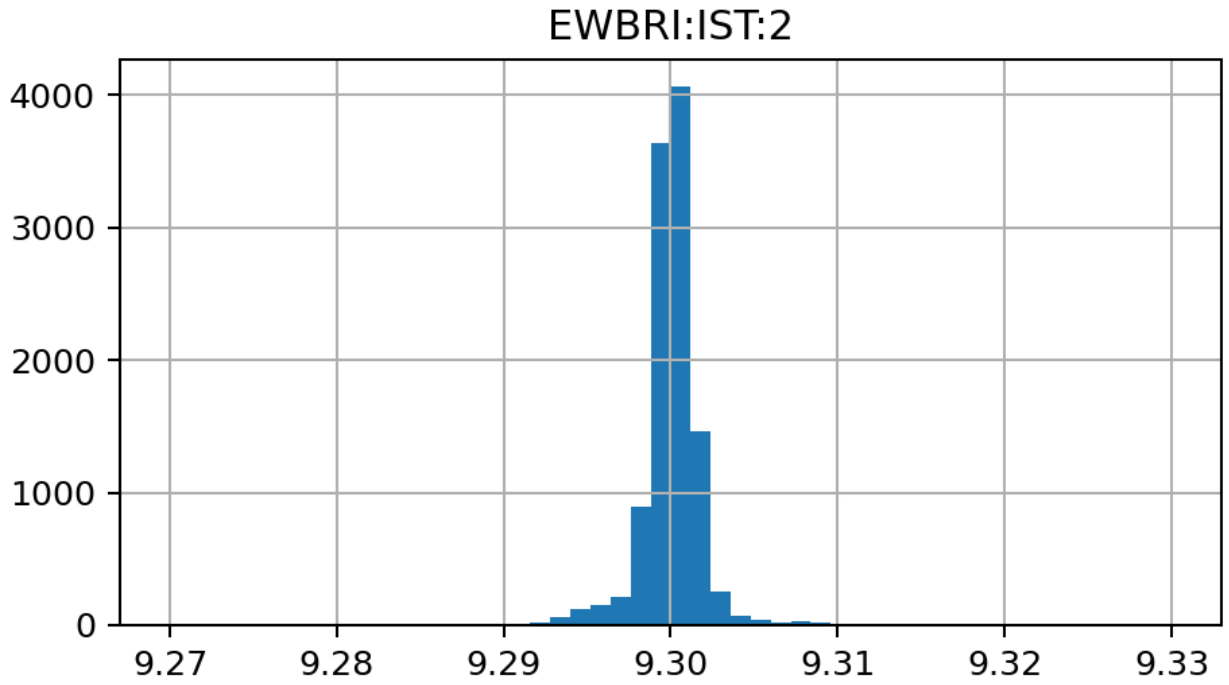
SoM-CAM channel 0, no filters



SoM-CAM channel 1, with both filters

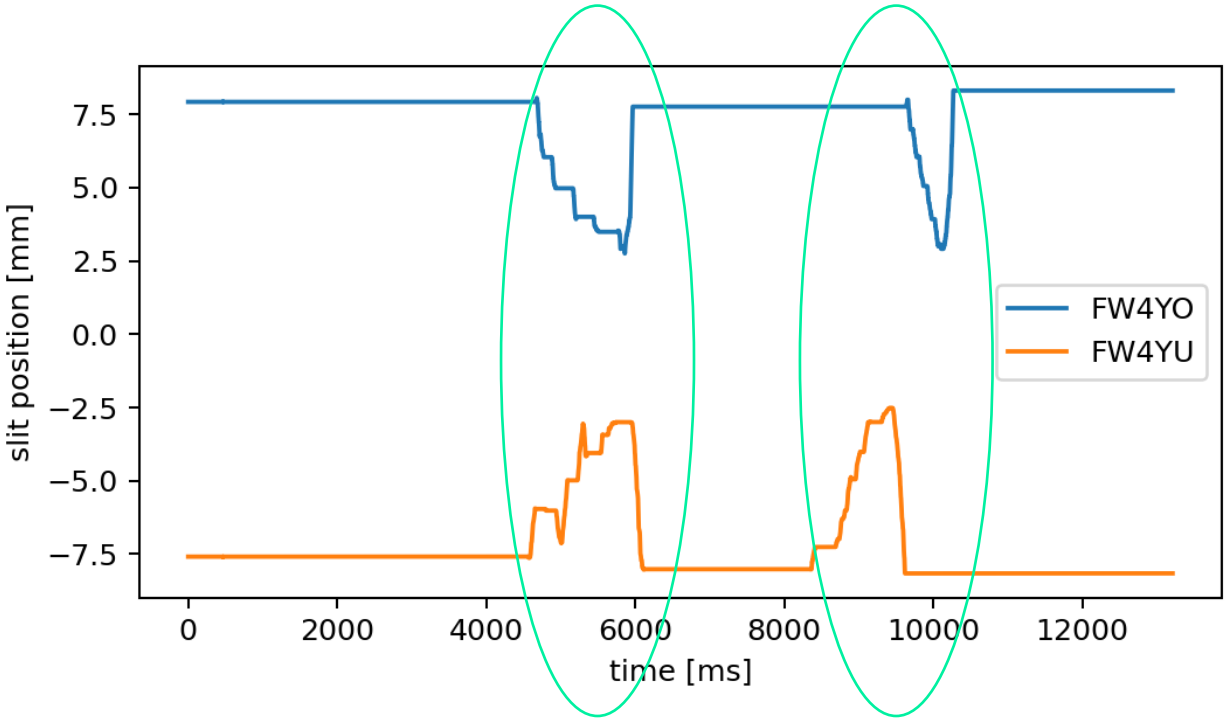


Beam current stability



Beam current is very stable, but maybe beam position/width not?

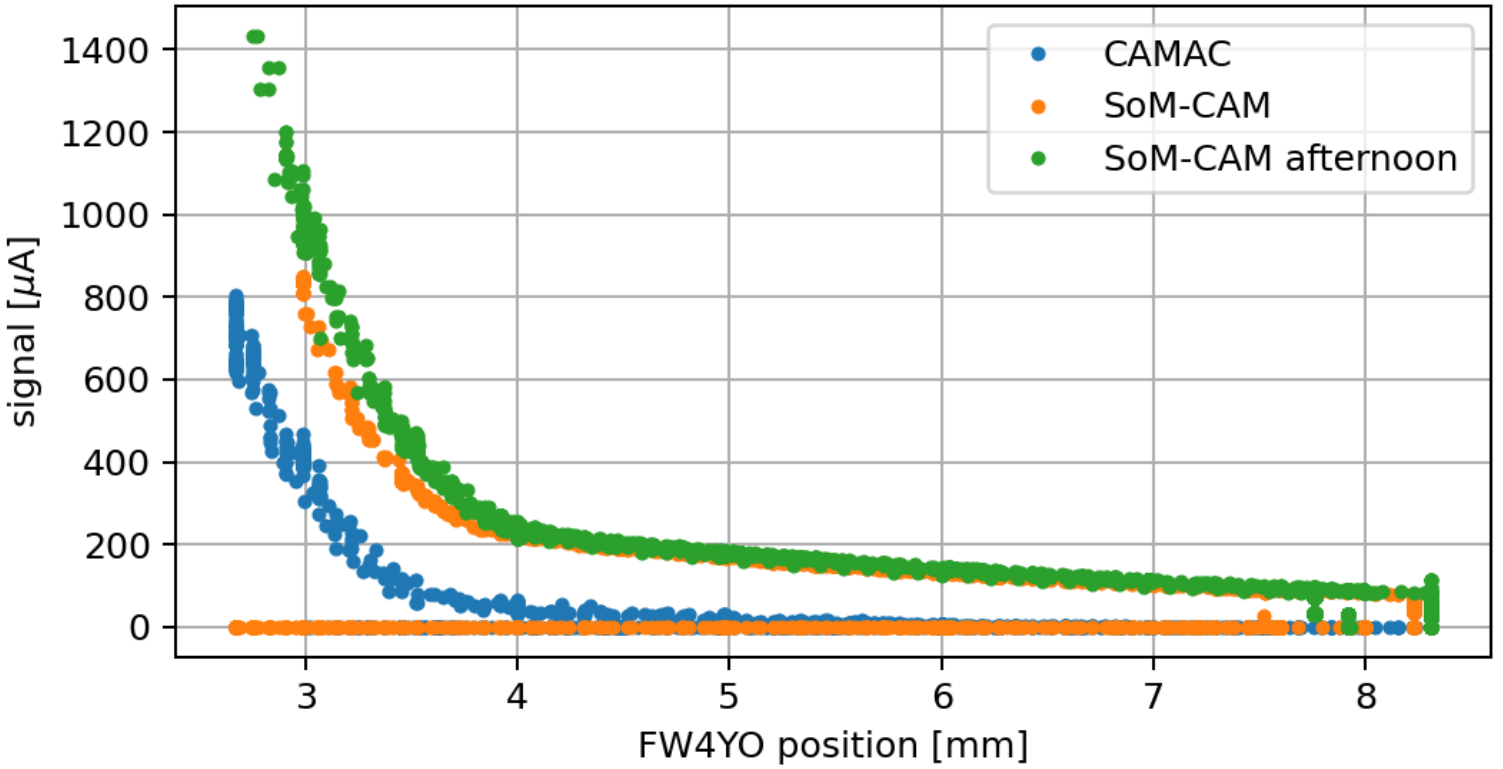
Afternoon data



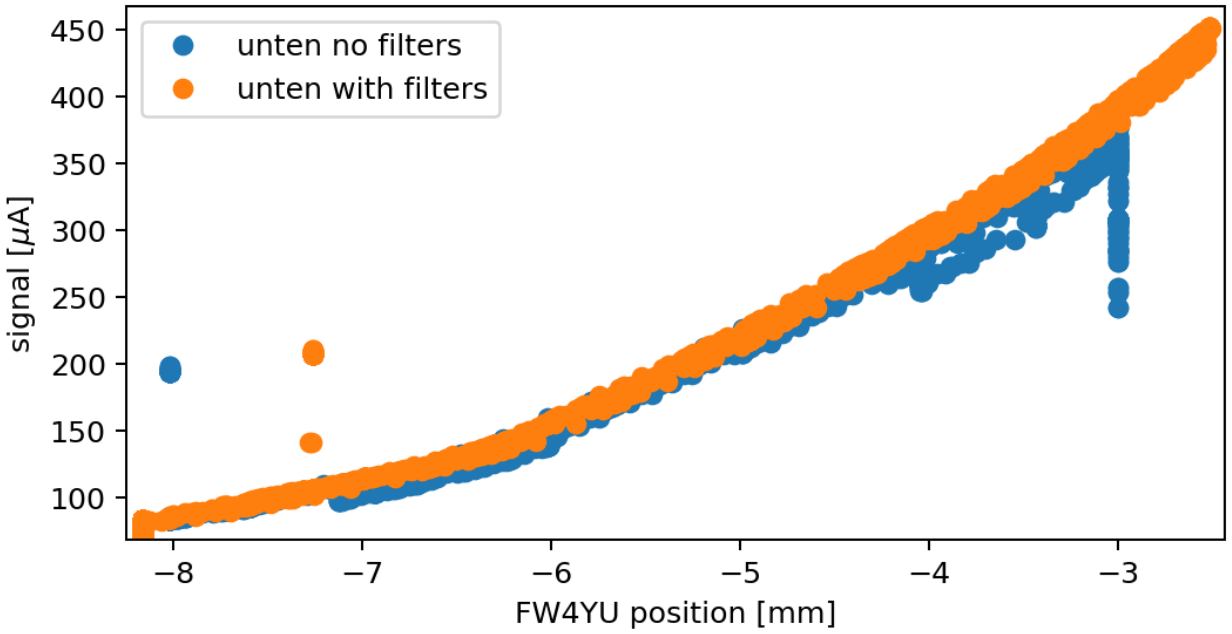
without filters with filters

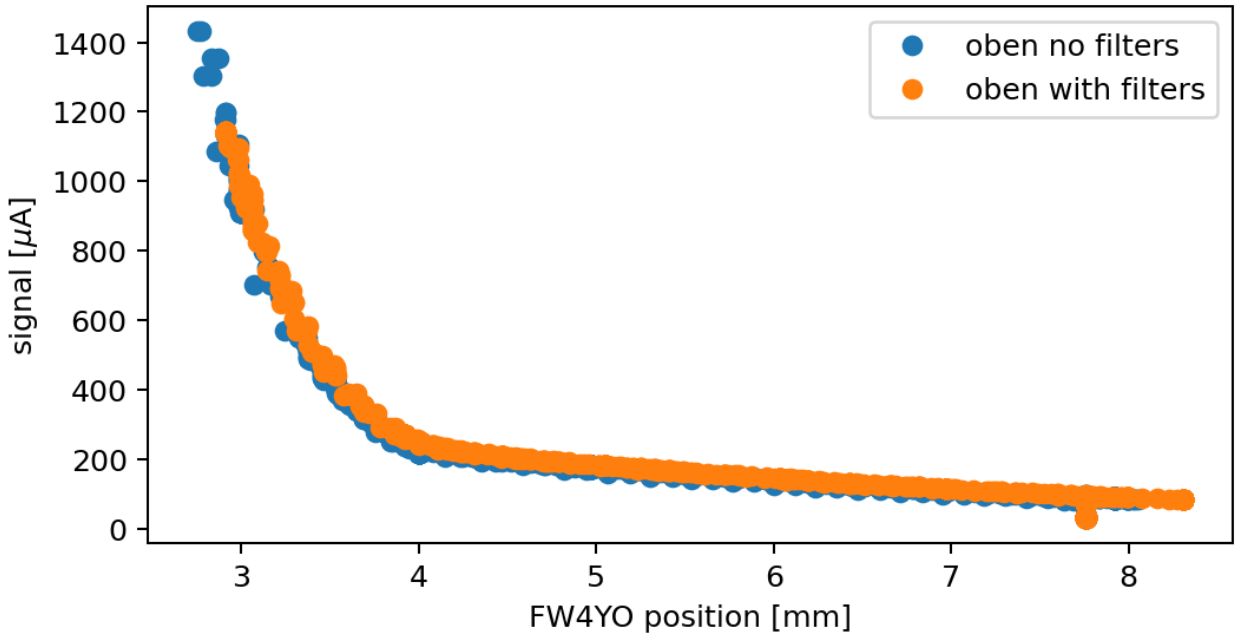
Data analysis

- Green: afternoon data with and without filters together
- Filters seem to make no difference
- SoM-CAM morning and afternoon data similar
- Significantly higher SoM-CAM signals wrt. LLCam



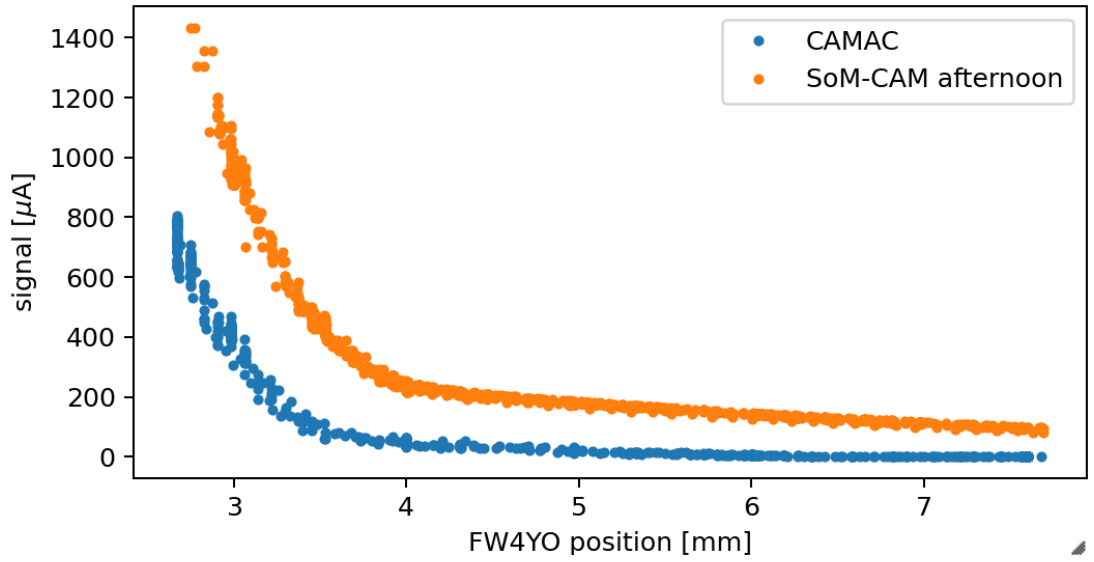
Data analysis – filter effect, afternoon data

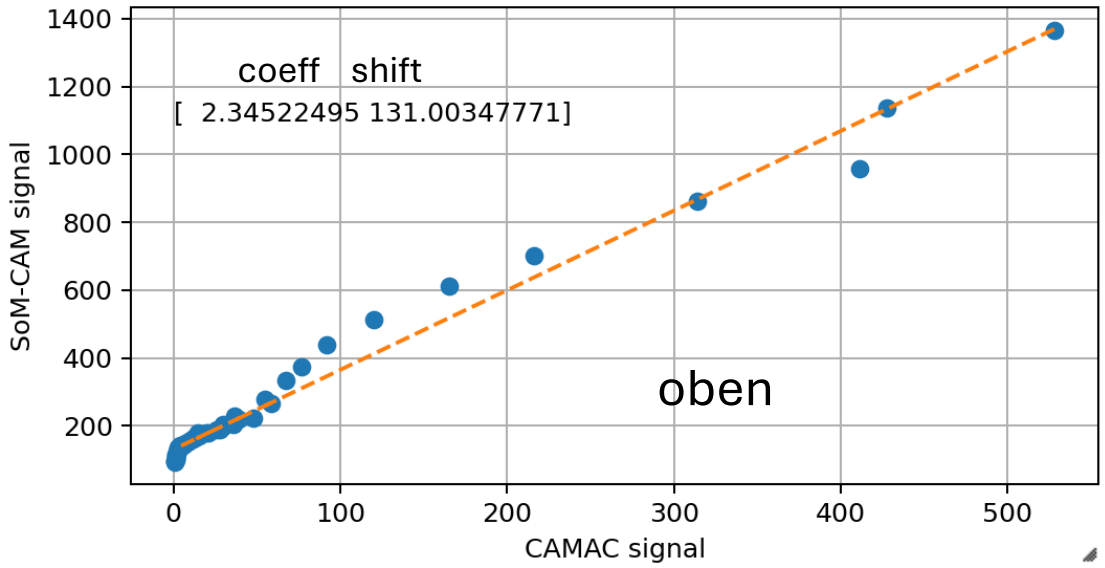




Data analysis – FW4O

- Compare only afternoon SoM-CAM data with morning LLCam data

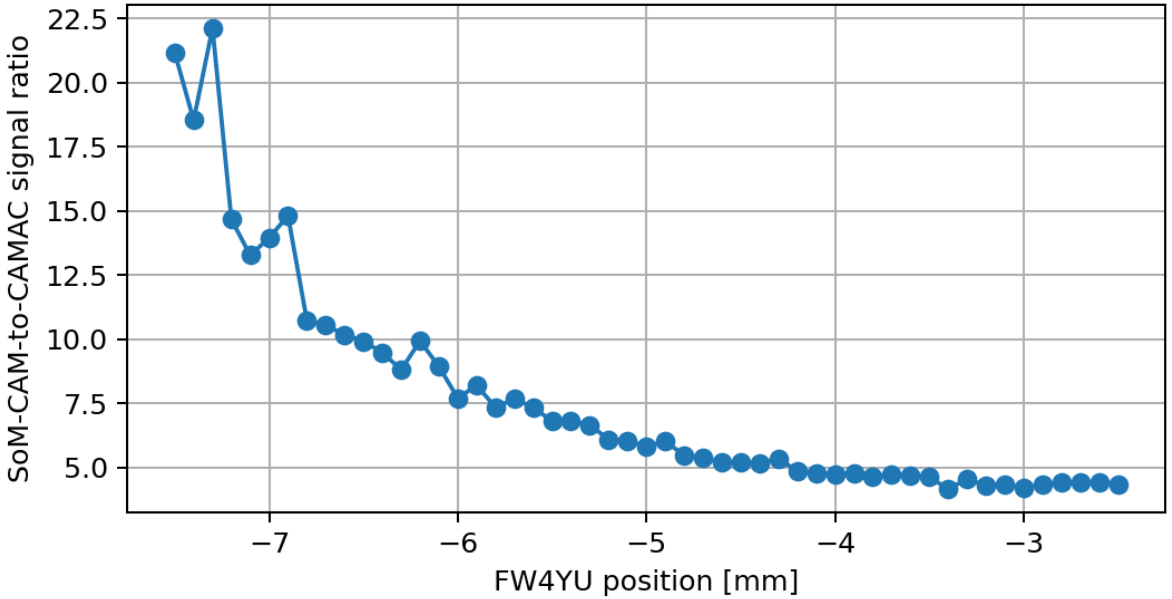


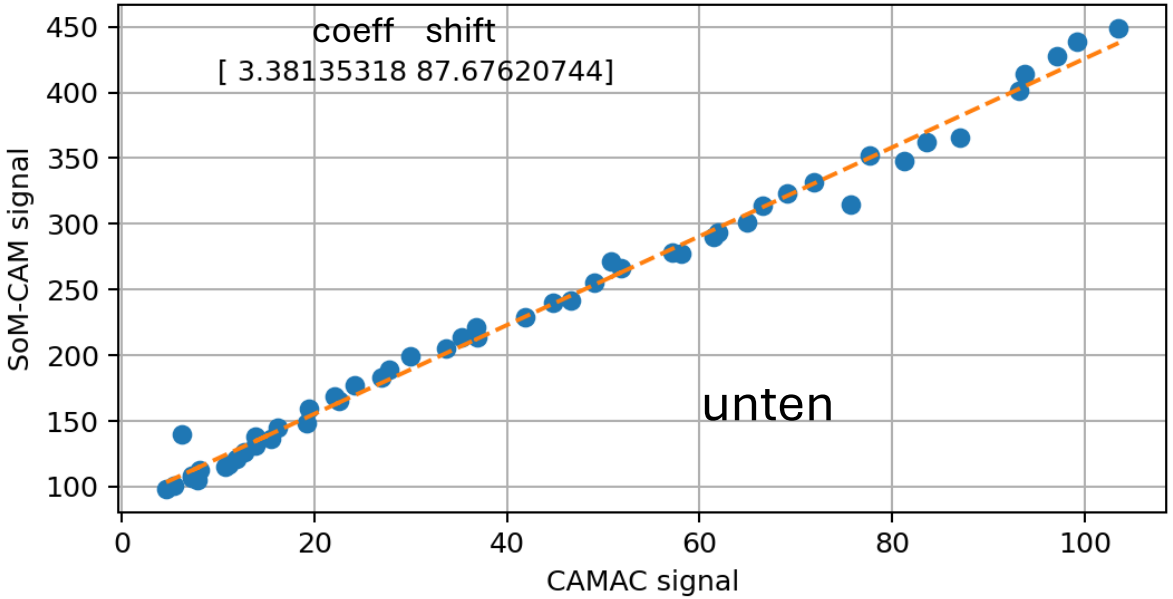


Fit: y=ax+b

Data analysis – FW4U

- Compare only afternoon SoM-CAM data with morning LLCam data





Fit: y=ax+b

Summary

- Very useful test, unpredicted conditions (174 V potential).
- Important lesson concerning human safety! Unpleasent potential even on low-current signal cables!
- (BTW: do we understand this 174 V?)
- SoM-CAM readings are higher than LLCam. There is a shift (88-131 uA) and a coefficient (2.4-3.4)

Next steps:

- Repeat measurements with filter boxes?
- Long-term test with MRI9B – ionization chamber signal including CMC-HV4 card
- Lab verification of specifications