MSD Status

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MSD perfomance

- Spatial resolution
- Characterization with IR laser
  - Shaping time measurements
  - Study on electronics saturation
- Work on focused IR laser
  - Charge sharing
  - Position correlation

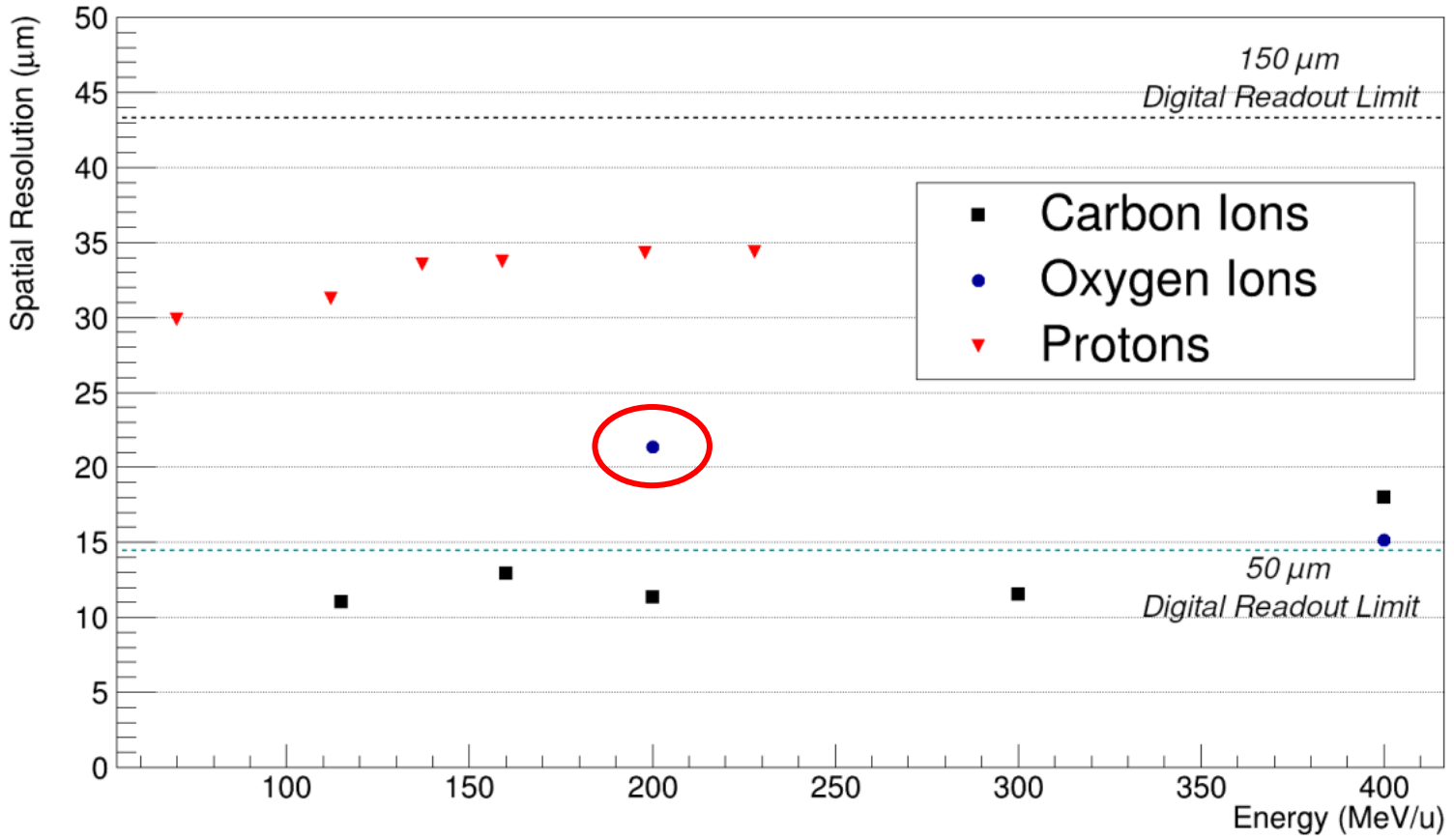
Spatial resolution

- Spatial resolution is within CDR requirements of 35 μm even for Protons

Higher energy deposits give resolution close to the digital readout of a finer readout pitch (readout pitch 150 μm)

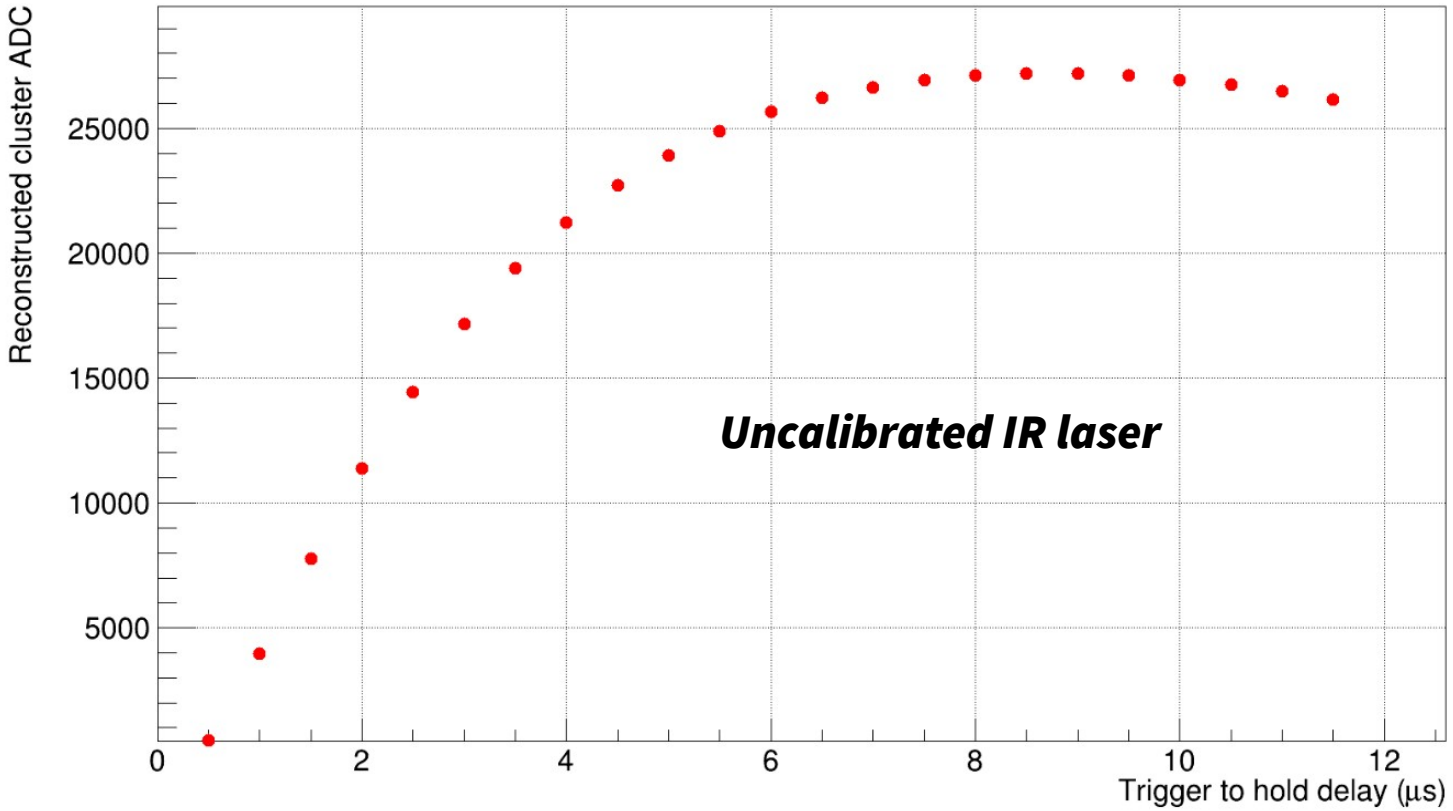
- Anomalous values for O@200MeV/u (possible saturation/ non linearity)

Under investigation



IR laser

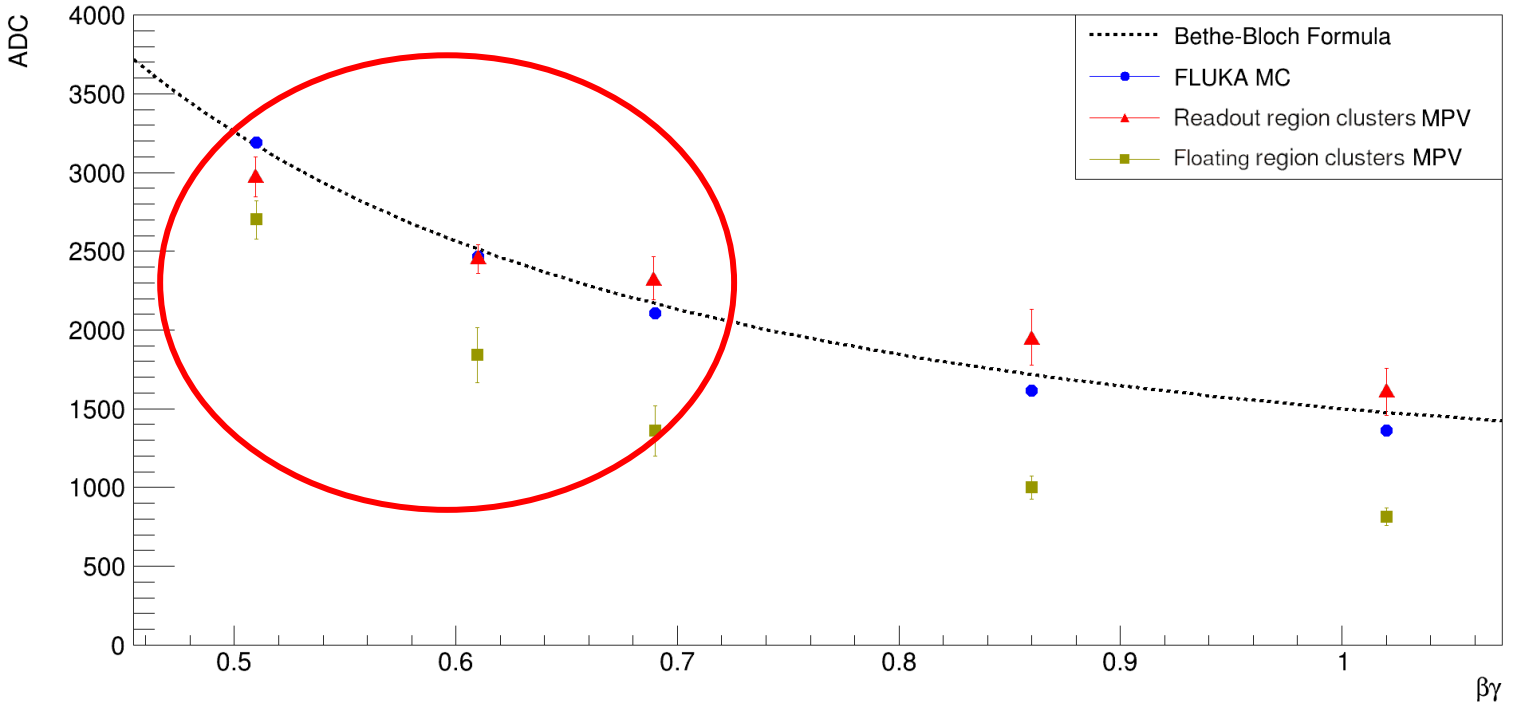
- Attempted a characterization with an IR laser
    - Non-calibrated and unfocused laser source: high signal stimulation
        - Checking for saturation effects
        - Readout ASIC shaping time measurement
- ***In the future: use of calibrated laser source to simulate charged particle data***

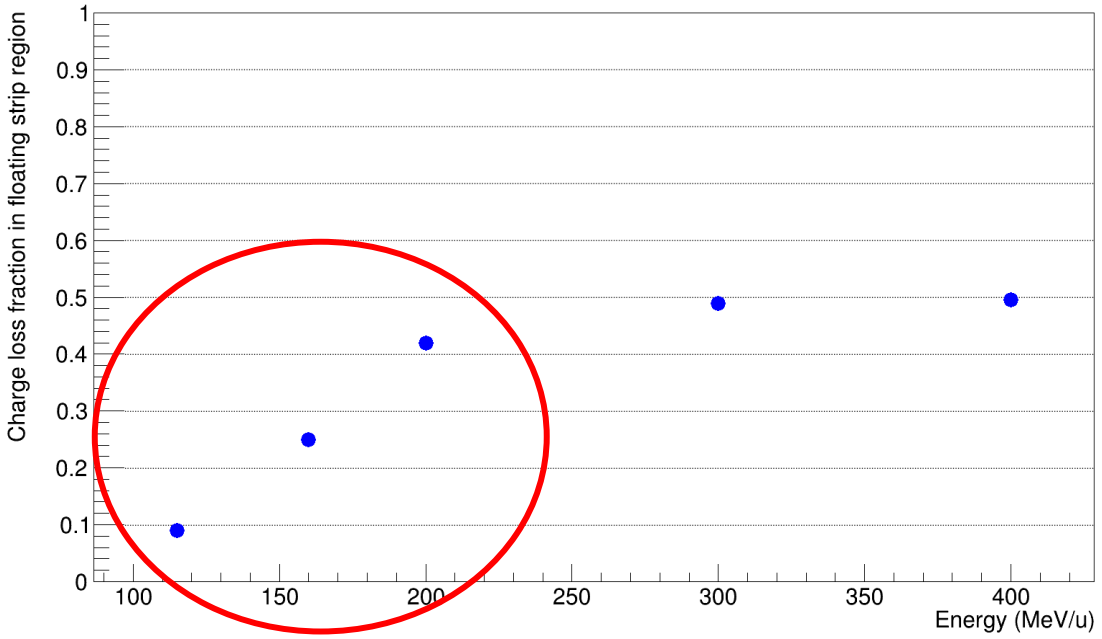


Electronic saturation

- Unexpected deviation from MC for low primary energy (example: 12C @ CNAO 2021)
  - The effect is also seen on Oxygen data at 200MeV/u @ GSI2021
  - Secondary effect: anomalous spatial resolution for 16O @ 200Mev/u
- Charge loss fraction for particles hitting floating strips is reduced at lower energies

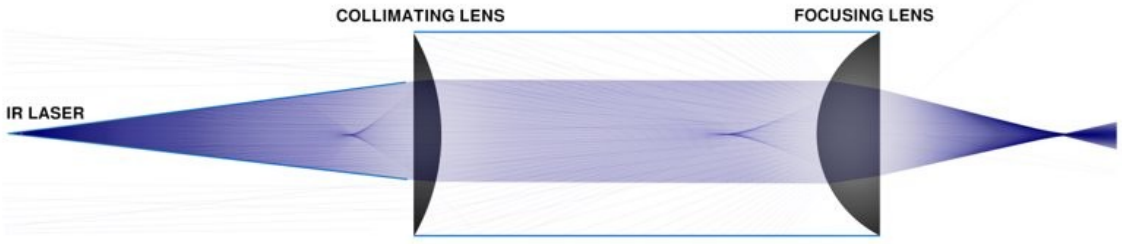
Under investigation

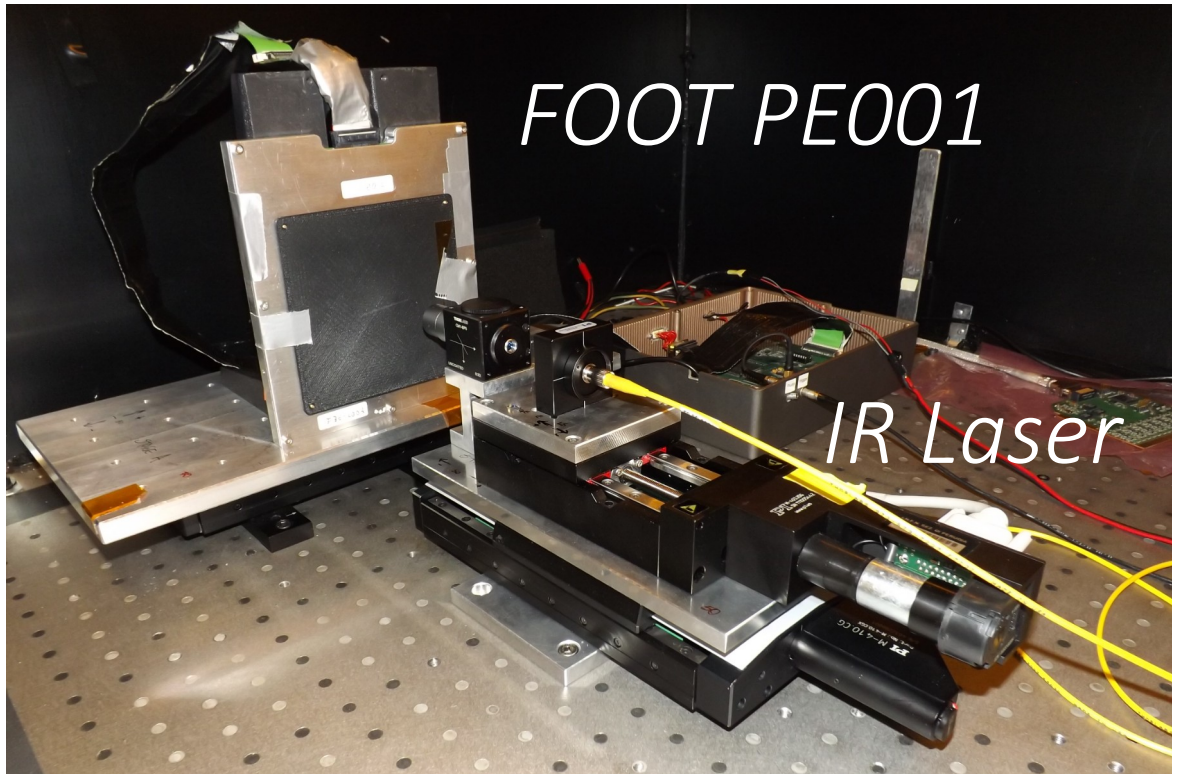




Focused laser

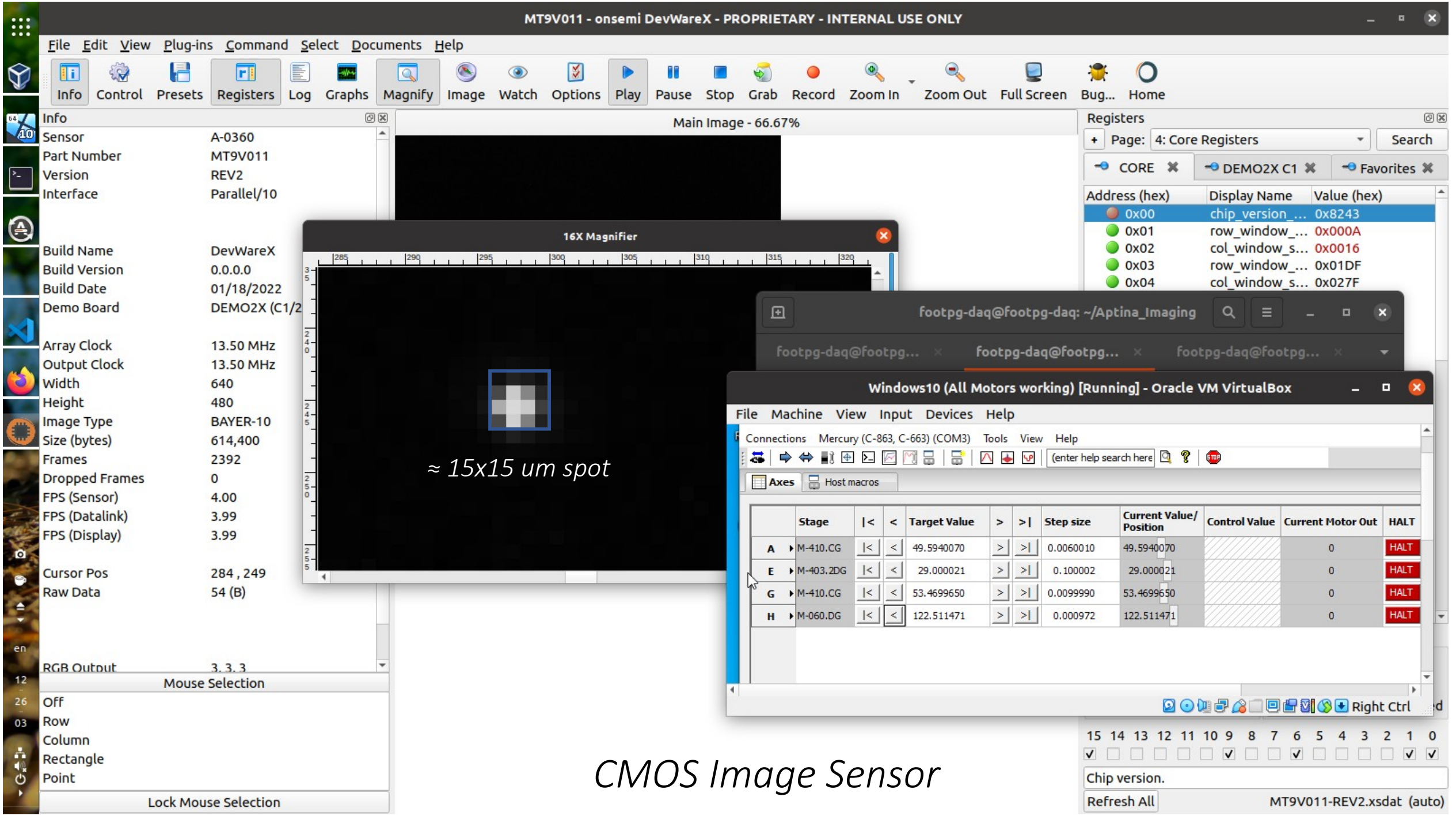
- First results with a focused laser
- IR (1060nm) laser with optical setup
- Micrometer movements to adjust the focus and move the laser spot wrt the strips





Laser spot dimension measurements

Micron CMOS Image Sensor


MT9V011 - onsemi DevWareX - PROPRIETARY - INTERNAL USE ONLY
File Edit View Plug-ins Command Select Documents Help
Info Control Presets Registers Log Graphs Magnify Image Watch Options Play Pause Stop Grab Record Zoom In Zoom Out Full Screen Bug... Home
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Interface Parallel/10
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Build Version 0.0.0.0
Build Date 01/18/2022
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Point
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Main Image - 66.67%
16X Magnifier
≈ 15x15 um spot
Registers
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Search
CORE
DEMO2X C1
Favorites
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Windows10 (All Motors working) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Connections Mercury (C-863, C-663) (COM3) Tools View Help
Axes Host macros
Stage | < Target Value > Step size Current Value/ Position Control Value Current Motor Out HALT
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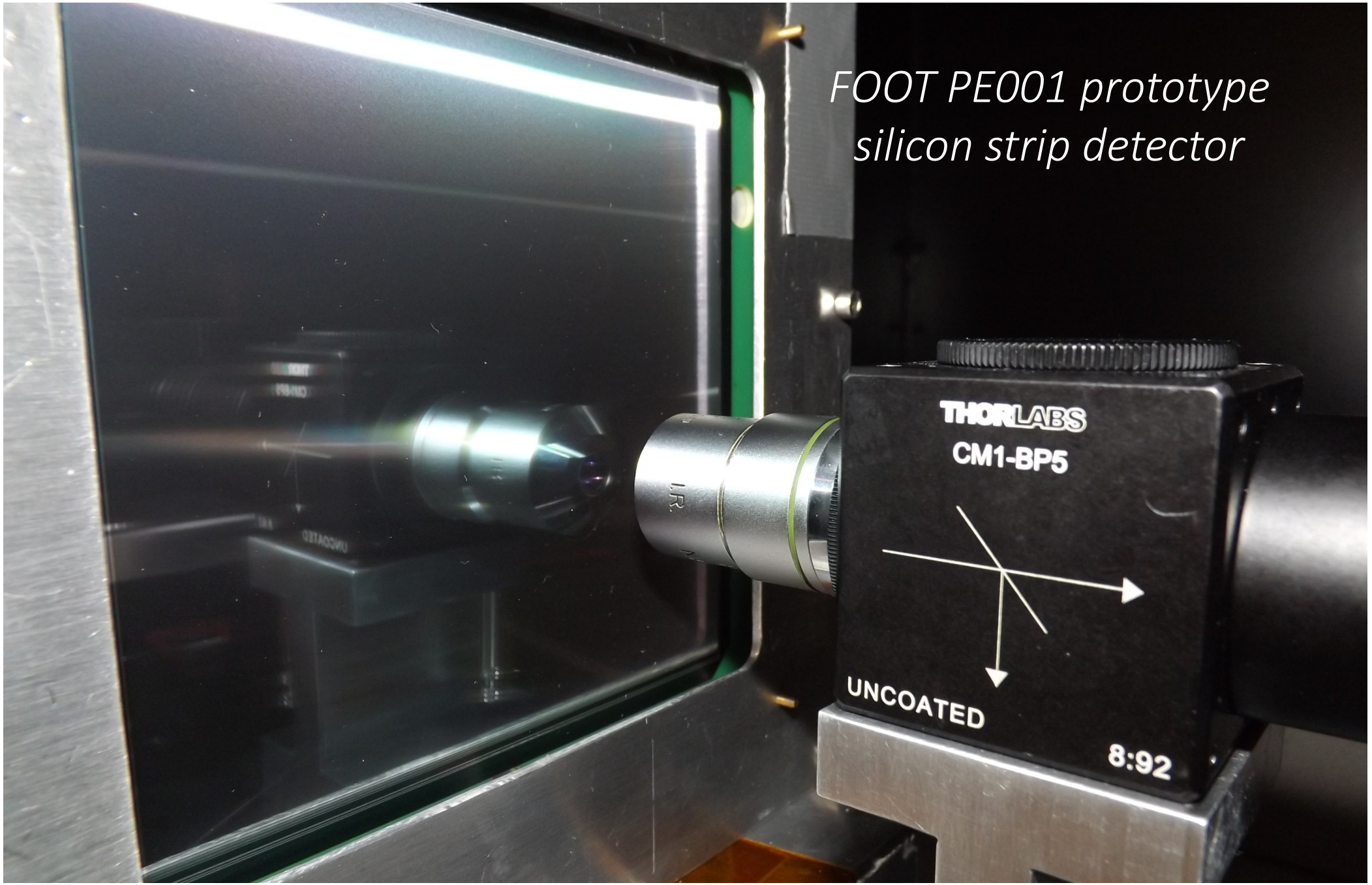
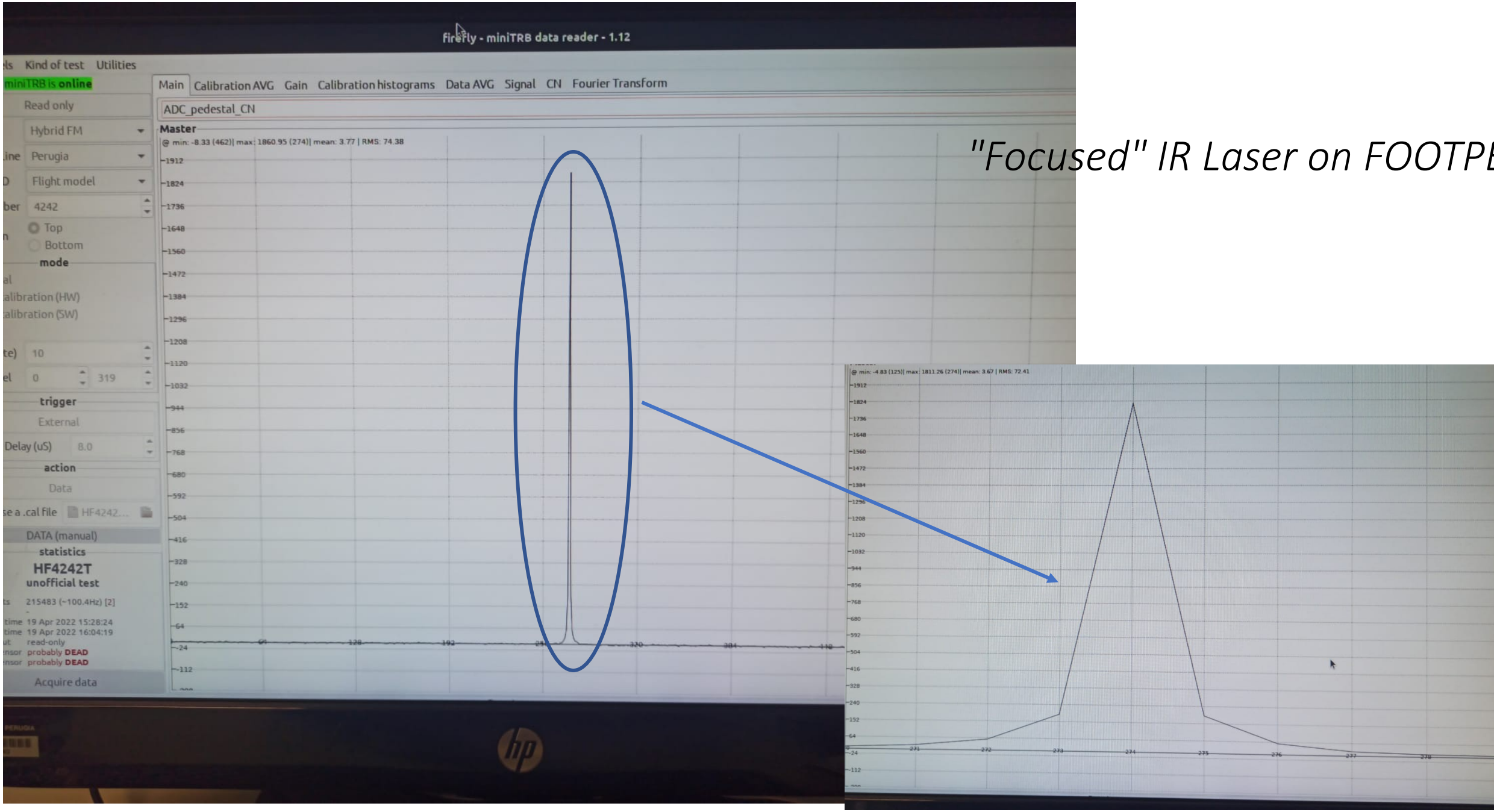
CMOS Image Sensor



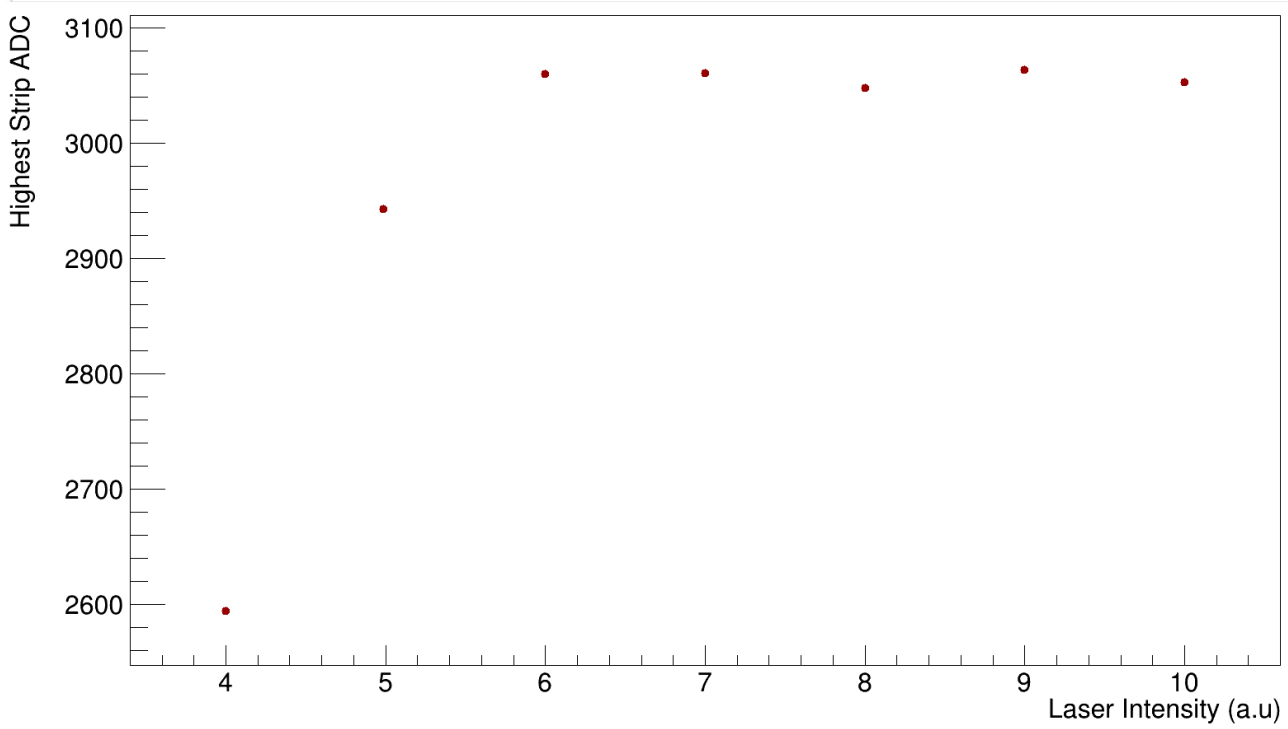
FOOT PE001 prototype silicon strip detector



"Focused" IR Laser on FOOTPE

Test for saturation

- Uncalibrated laser focused near one strip
  - Charge collection maximized on a single strip
  - Max ADC is approx. 3000 (plus a subtracted pedestal of about 300 ADC)
  - Possible problem on the ADC circuitry under study by the electronic engineers



FOOT - L13

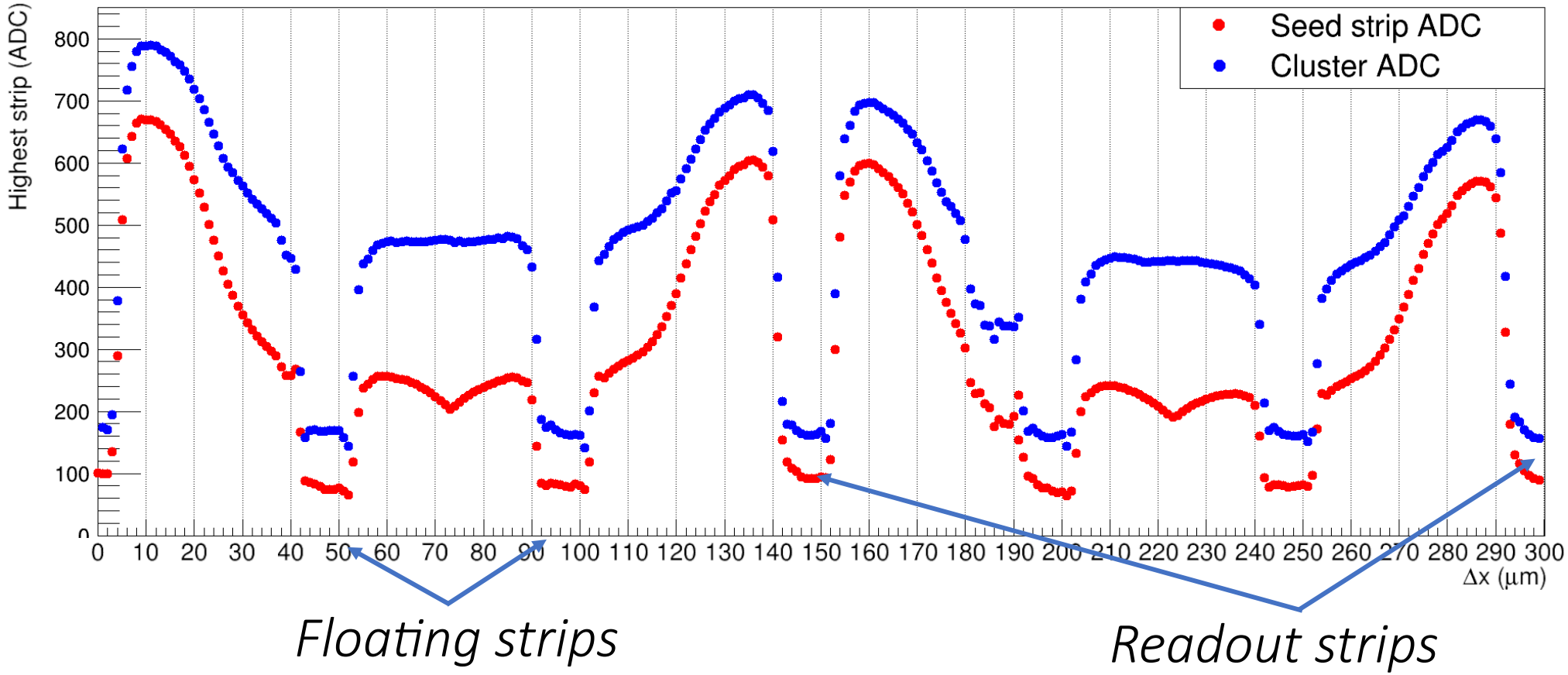
ADC of highest strip after pedestal substraction (approx 300 ADC pedestal)

Reason under investigation → confirmation of previous saturation problems.

Strips scan

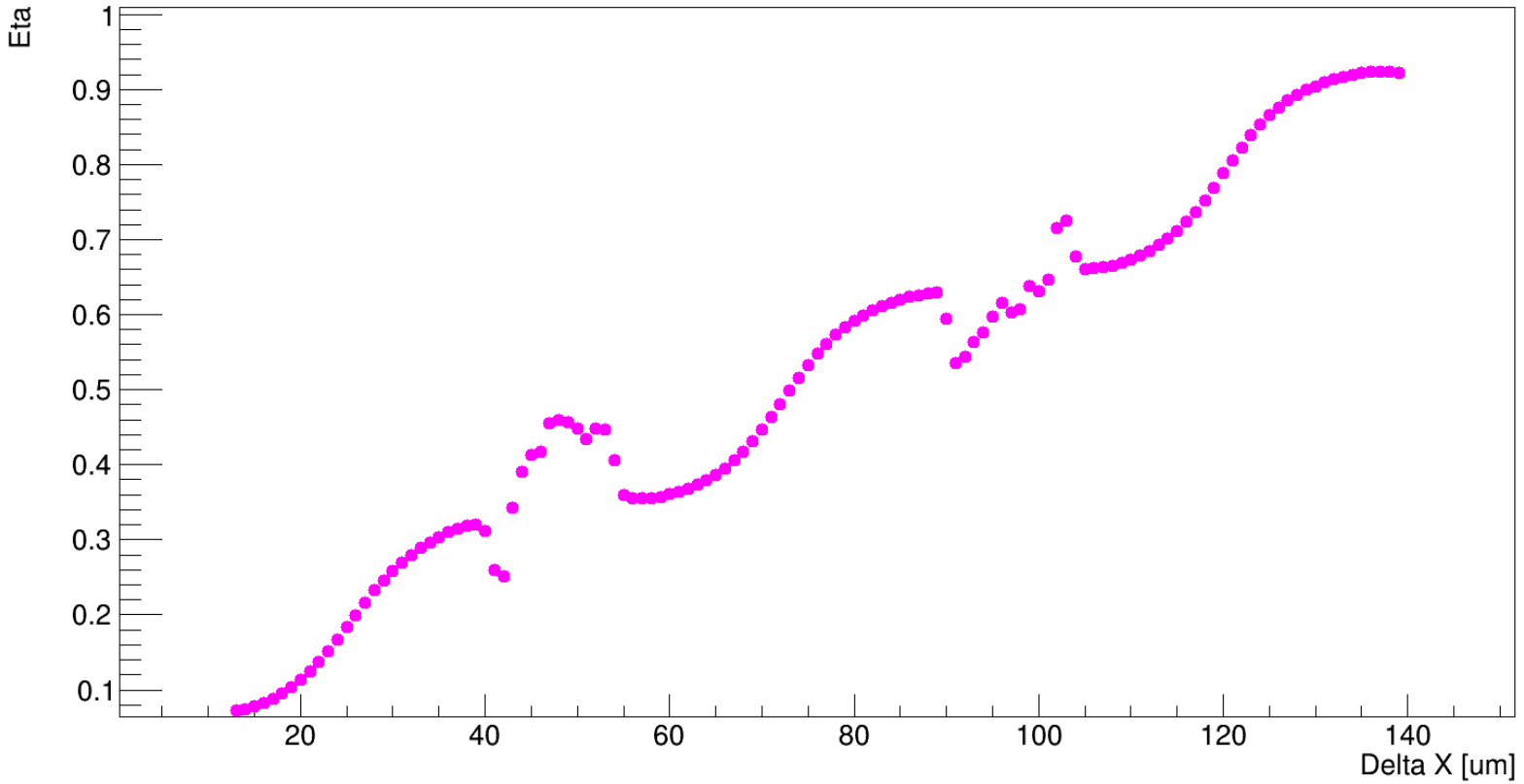
- Scan of the focused laser between 2 strips

- 1um steps for a total of 300um
- Strip implantation appears as a reduction of the collected signal (reflection on metalization)
- Charge loss in the floating strip region appears as expected
- For the future: use of a calibrated laser to correlate with charged particle results on charge loss



Strips scan

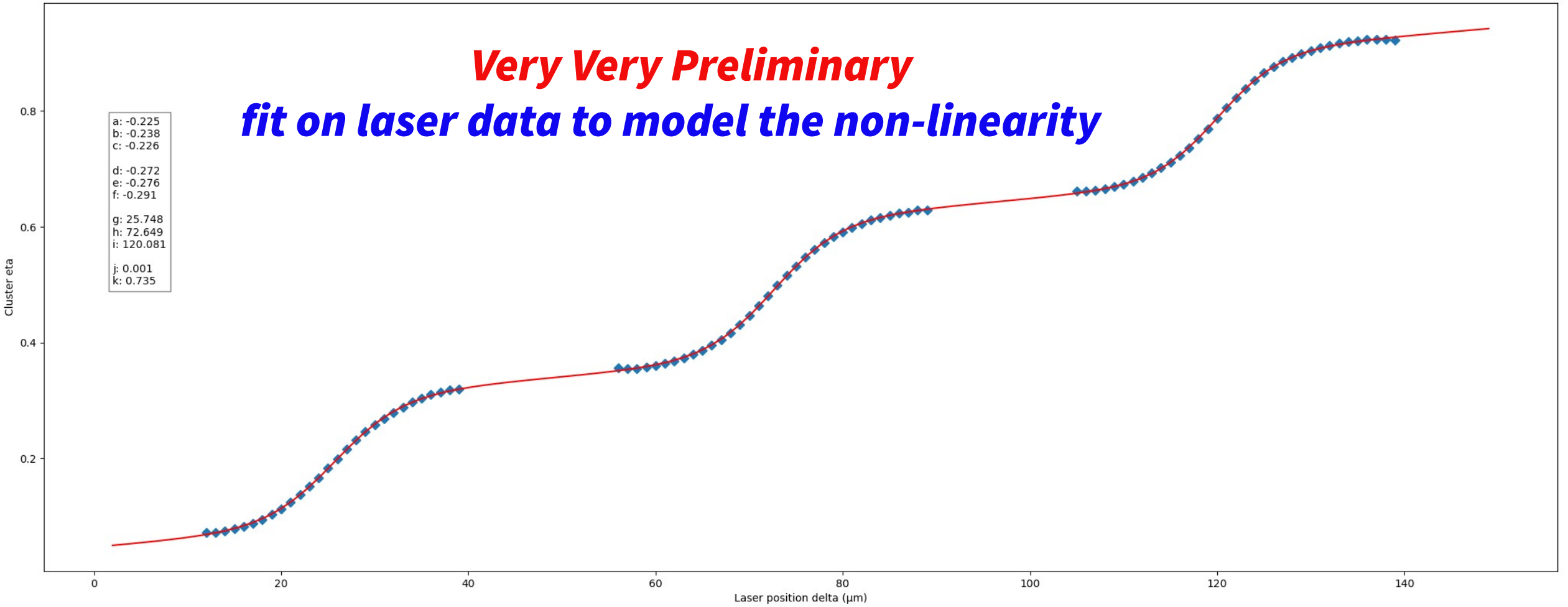
- Correlation between ***eta*** value computed from cluster data and real position
- Non linearity present as expected
- For the future: use of calibrated laser, as in the case of the energy correlation



$$\eta = \frac{ADC_L}{ADC_L + ADC_R}$$

Very Very Preliminary

fit on laser data to model the non-linearity



$$f(x) = \sigma_1(x) + \sigma_2(x) + \sigma_3(x) + pol_1(x) + k = \frac{a}{1 + e^{-d(x-g)}} + \frac{b}{1 + e^{-e(x-h)}} + \frac{c}{1 + e^{-f(x-i)}} + jx + k$$

MSD software activity