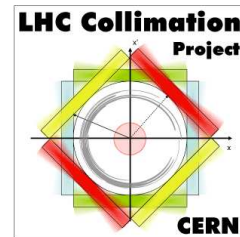
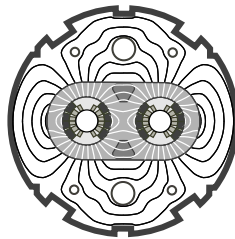


Measuring Beam Size by Scraping with Collimator

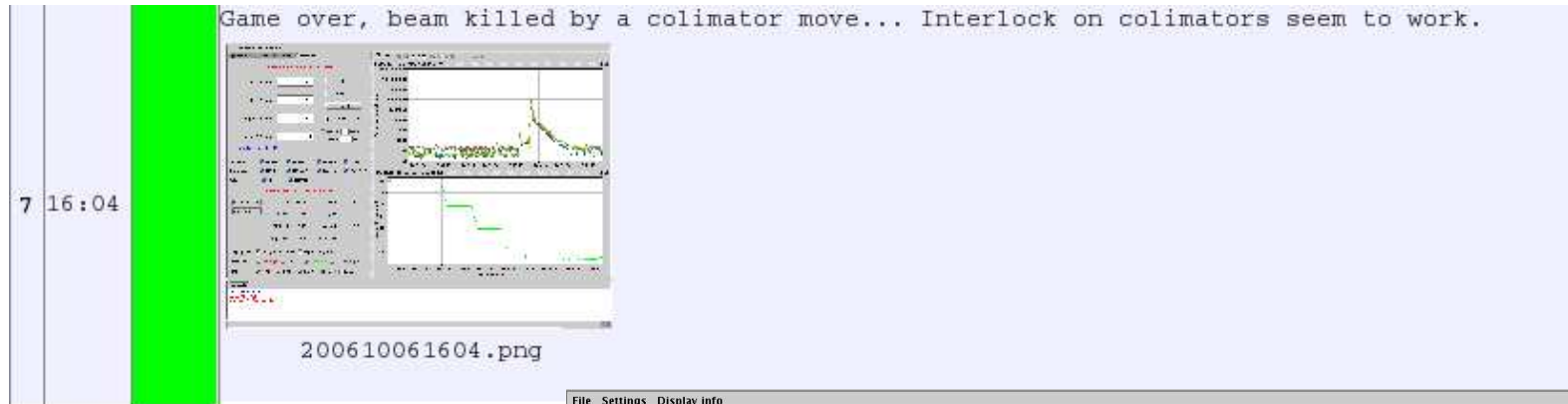
Summary of MD1

Th. Weiler

Accelerator and Beam Department, CERN



SPS - Logbook



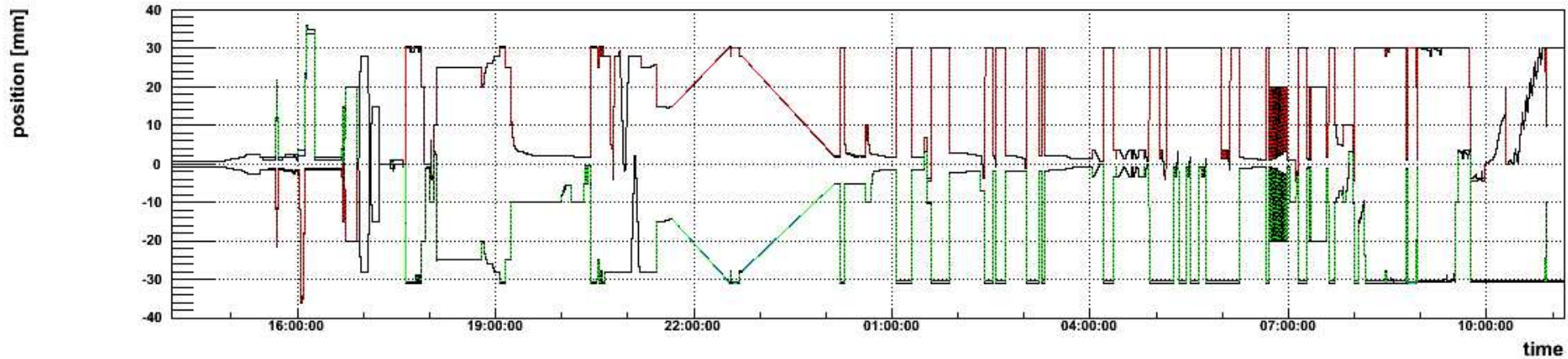
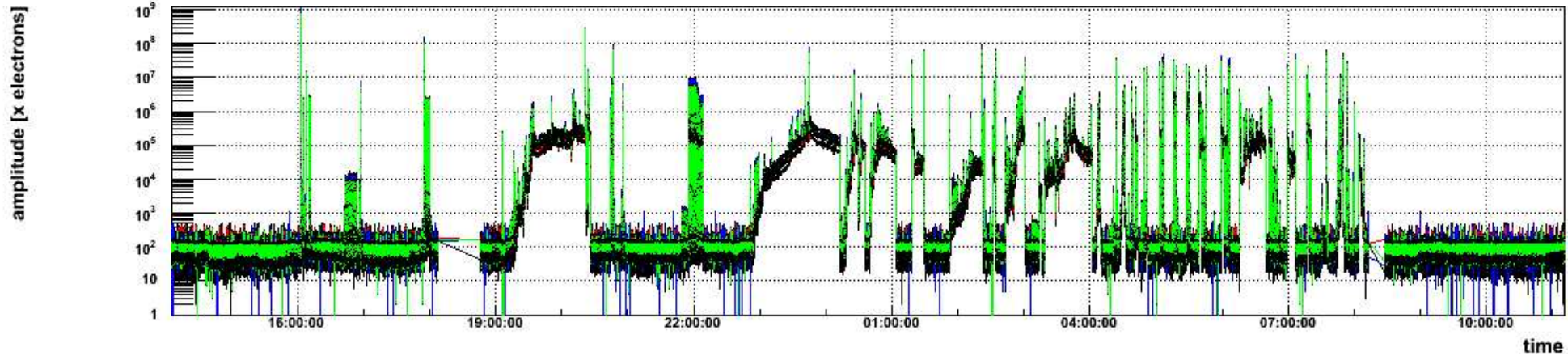
Electronic Logbook:
<http://elogbook.cern.ch/>

The screenshot displays the SPS control software interface. It features several panels and graphs:

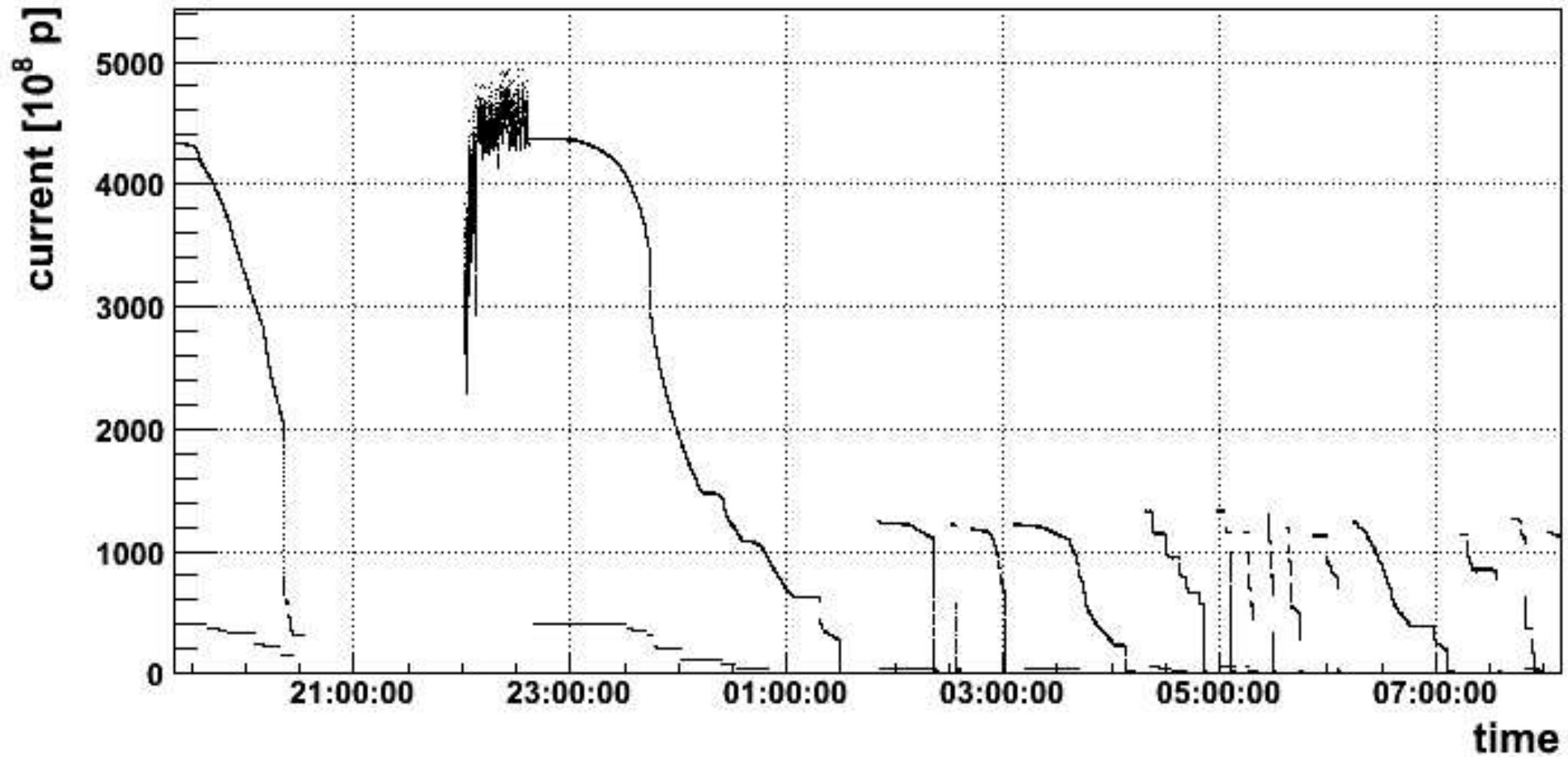
- Jaw corners panel:** Contains input fields for "Left-UP [mm]", "Left-DW [mm]", "Right-UP [mm]", and "Right-DW [mm]", all set to 0.0. It includes buttons for "Apply!", "Cancel last", and "Stop all!". There are also checkboxes for "Repeat" and "every" seconds.
- Positions/Angles panel:** Shows "Positions readout from the low-level" with a table of values for Resolvers and Jaw edges.
- Beam loss data graph:** A semi-log plot of "Beam loss signal [a.u.]" vs "time [hh:mm:ss]" from 16:01:00 to 16:04:30. It shows a sharp peak around 16:03:30.
- Jaw positions graph:** A plot of "Jaw positions [mm]" vs "time [hh:mm:ss]" from 16:01:40 to 16:04:40. It shows a step-wise decrease in jaw positions over time.
- Console panel:** Displays system messages, including "14:05:40 - Ready", "16:03:45 - null", and a "java.lang.OutOfMemoryError".



Overview Collimation SPS-MD1

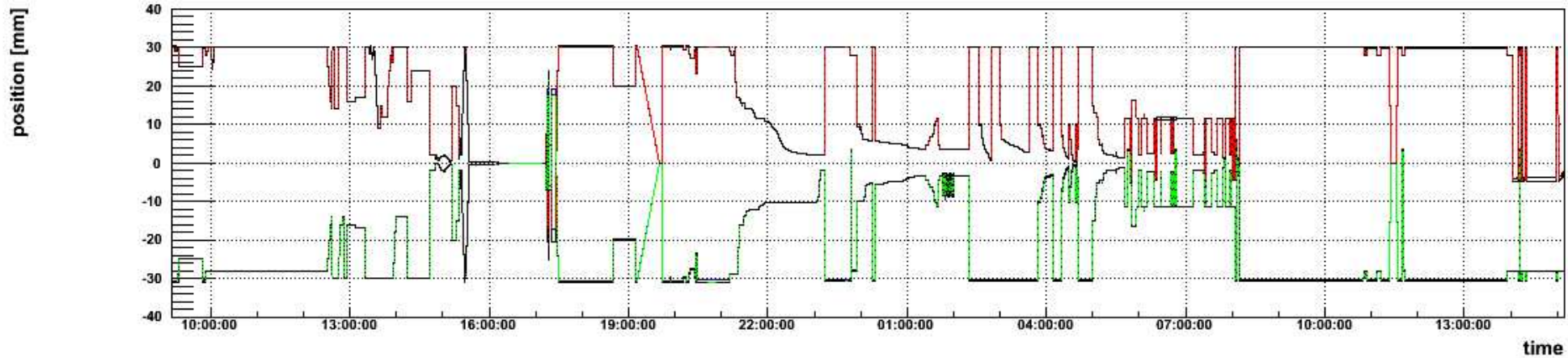
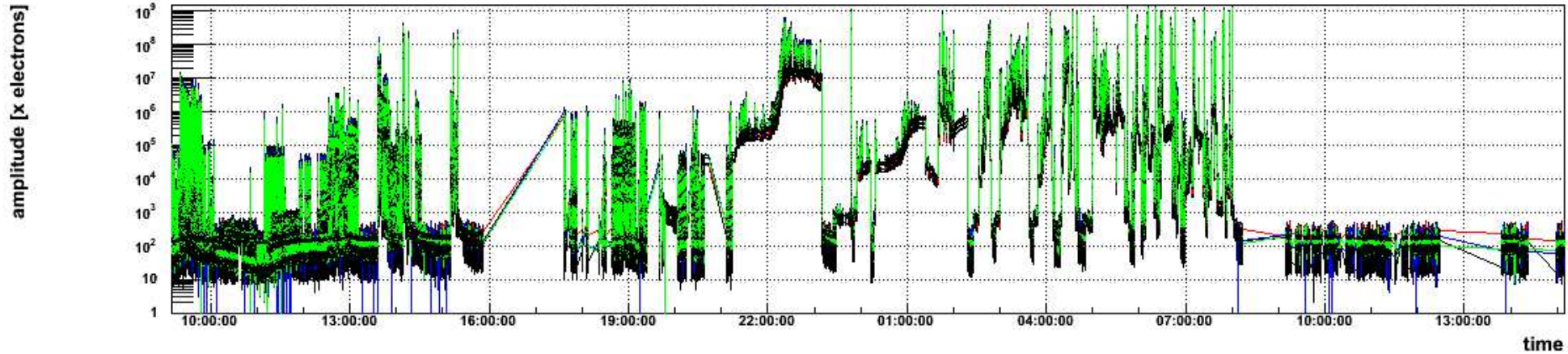


Overview Collimation SPS-MD1

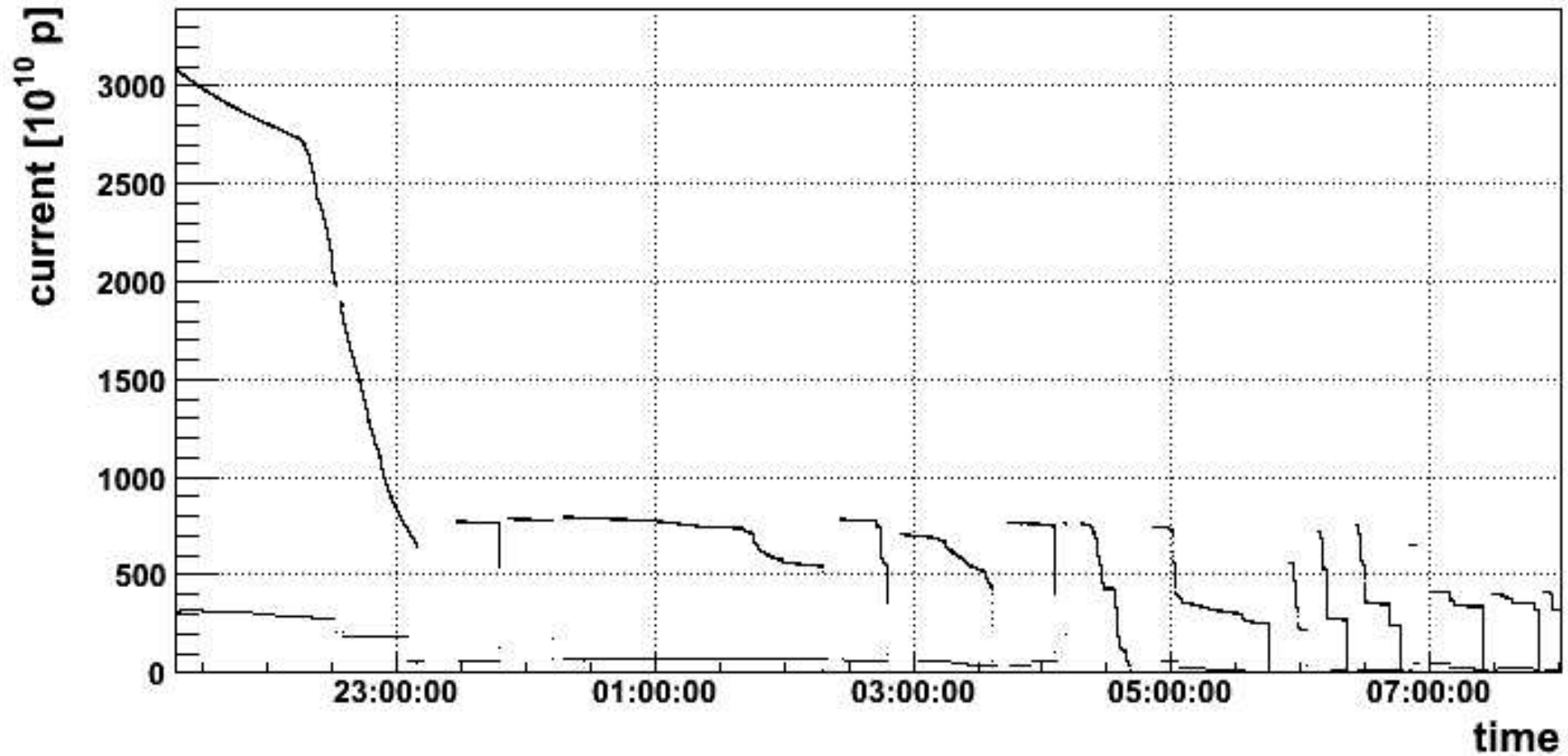


⇒ beam current data from 19:20 to 8:09

Overview Collimation SPS-MD2

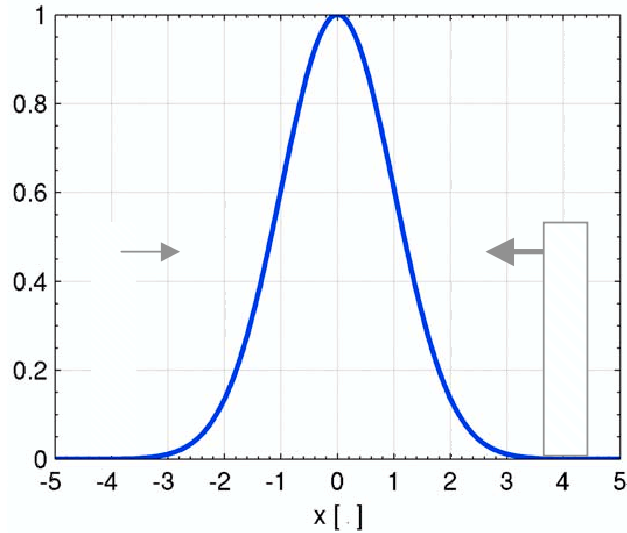


Overview Collimation SPS-MD2

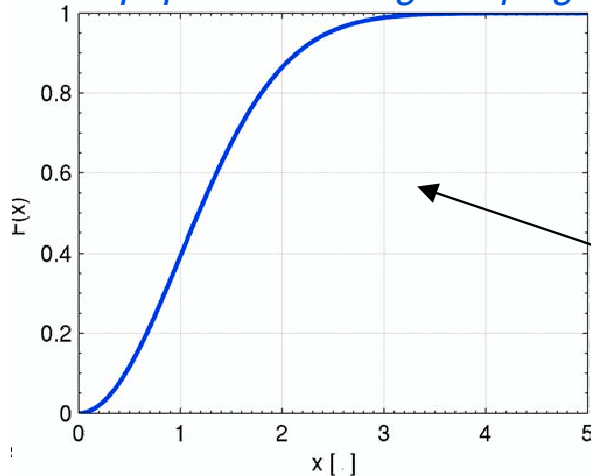


⇒ beam current data from 19:20 to 8:09

Beam Based Alignment: Scraping



Beam population during scraping



f Fermilab

Tevatron beam study report

1.21.2003

A. Jansson *et al*

COLLIMATOR SCANS TO MEASURE TEVATRON EMITTANCE

CERN-AB-2004-032 (ABP)

CERN-AB-Note-2004-054 (ABP)

INTENSITY AND LUMINOSITY AFTER BEAM SCRAPING

H. Burkhardt, R. Schmidt

$$N(x) = \frac{1}{2\pi} \exp\left(\frac{-x^2 - x'^2}{2\sigma^2}\right)$$



Multi-turn scraping slow w.r. to betatron frequency (both sides+x')

Neglect dispersion and coupling

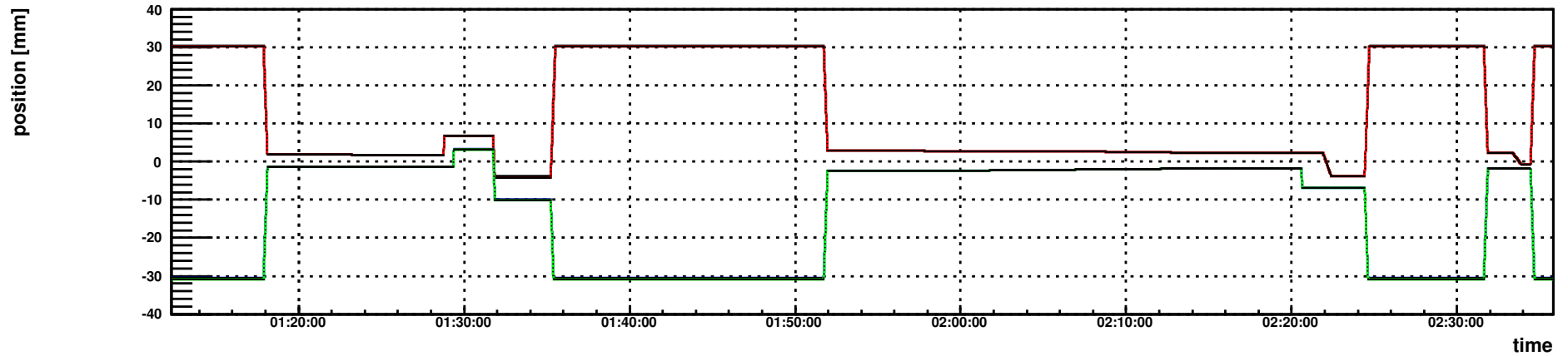
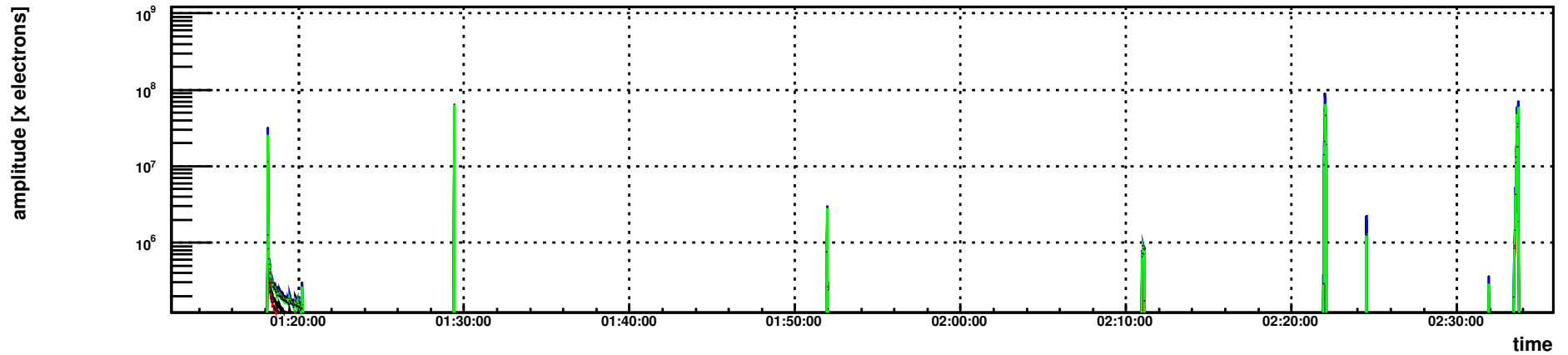


$$F(x) = \frac{1}{N_0} \int_0^{x-x_0} N(t) dt = 1 - \exp\left(\frac{-(x-x_0)^2}{2\sigma^2}\right)$$

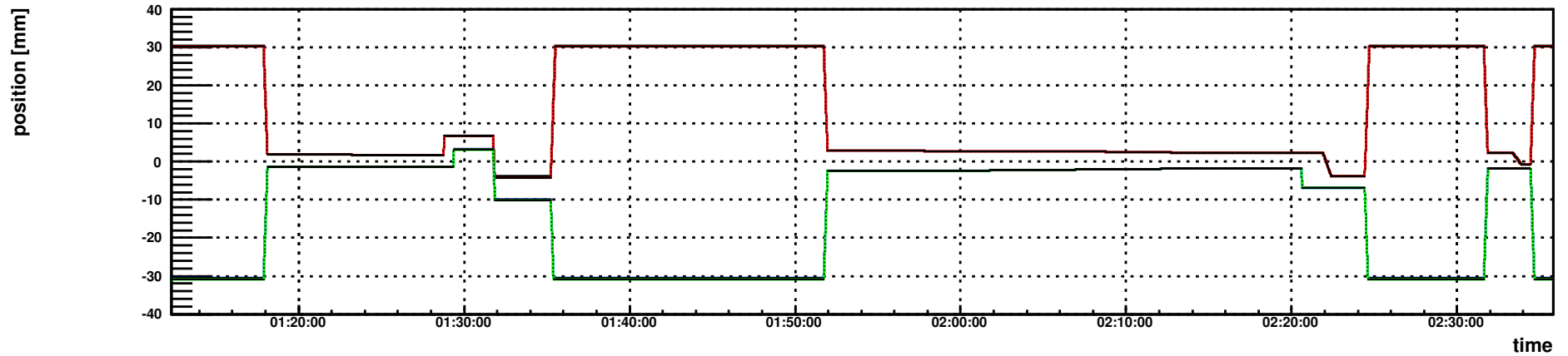
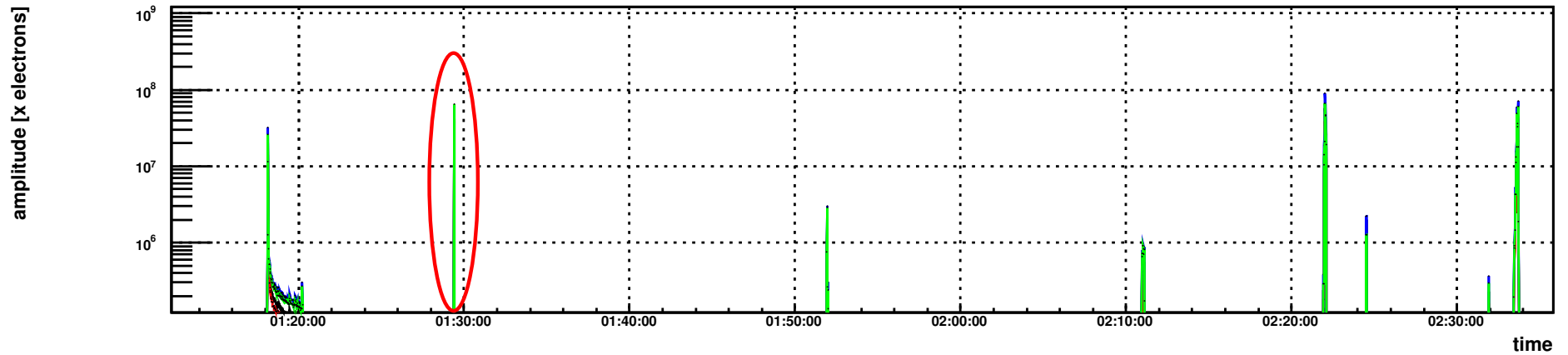
(S. Redaelli)

page 3

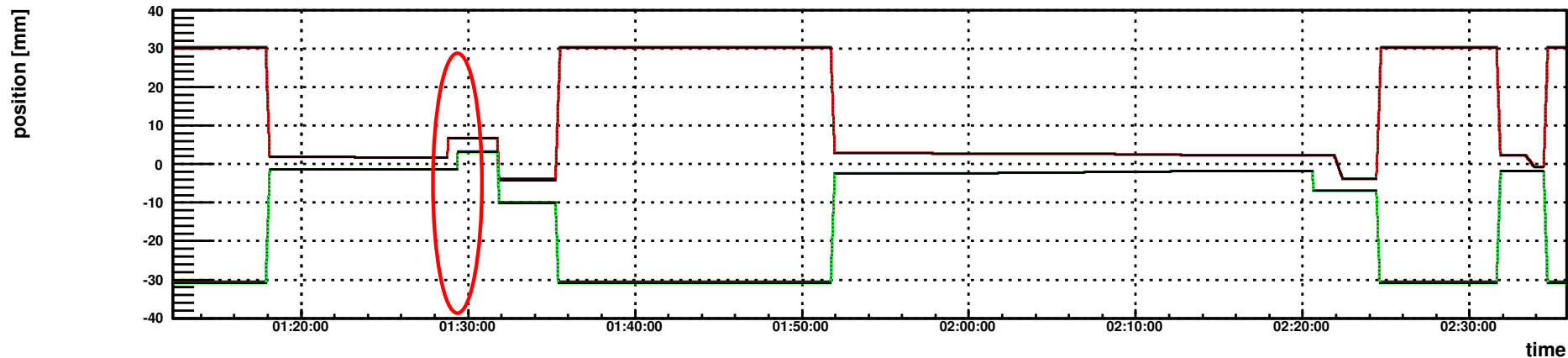
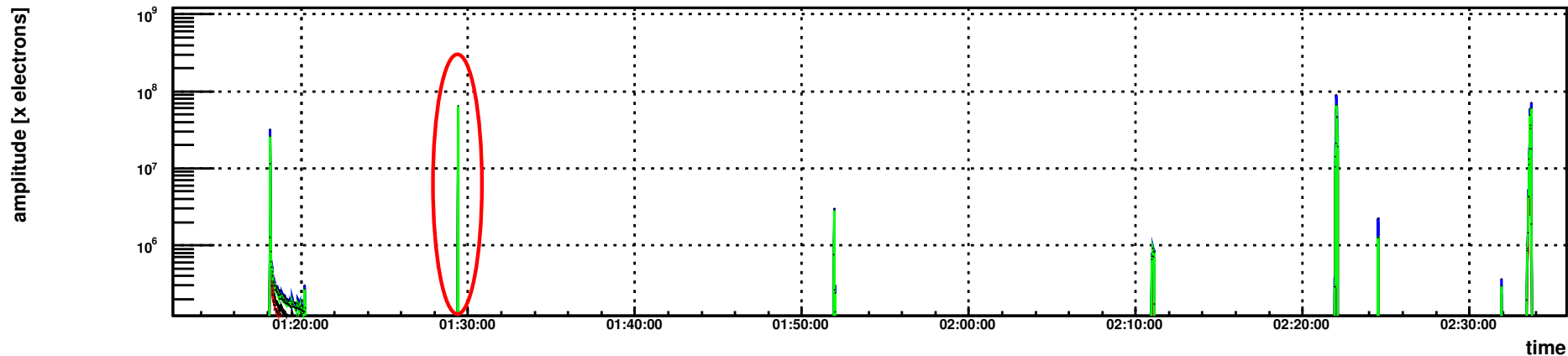
Scraping



Scraping

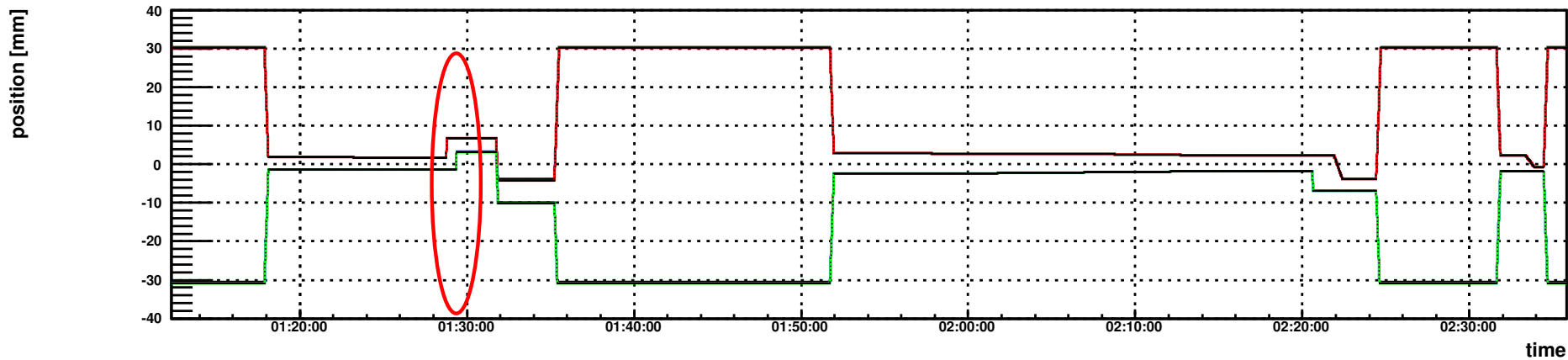
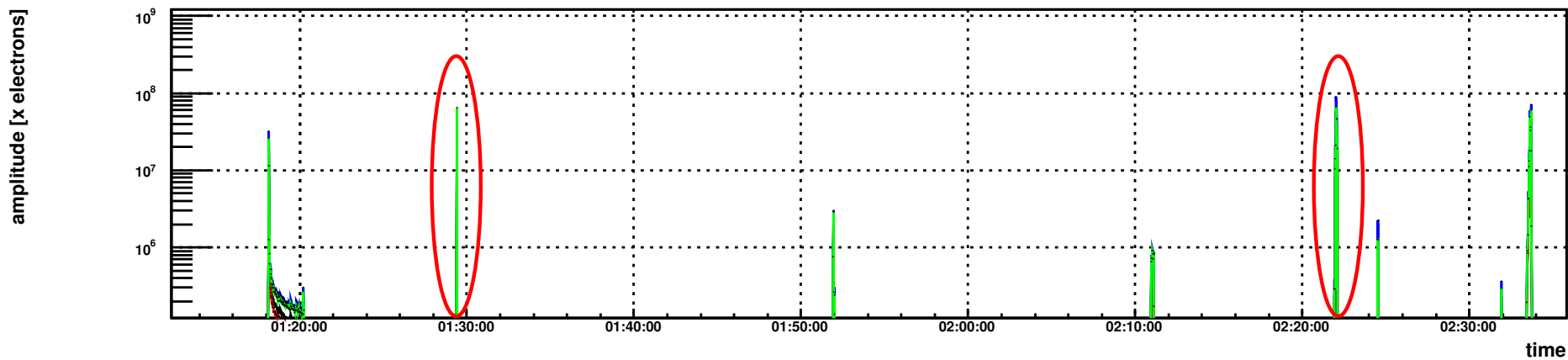


Scraping



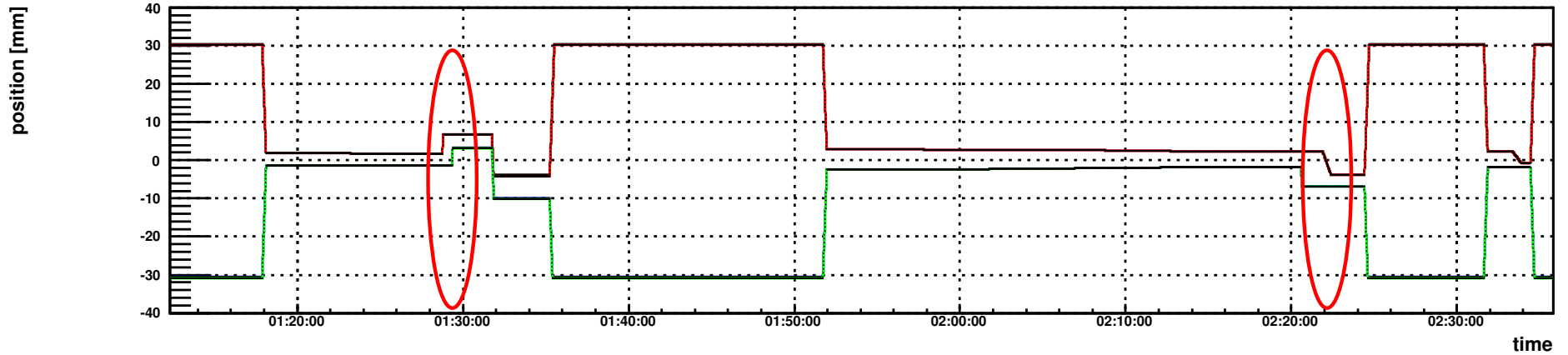
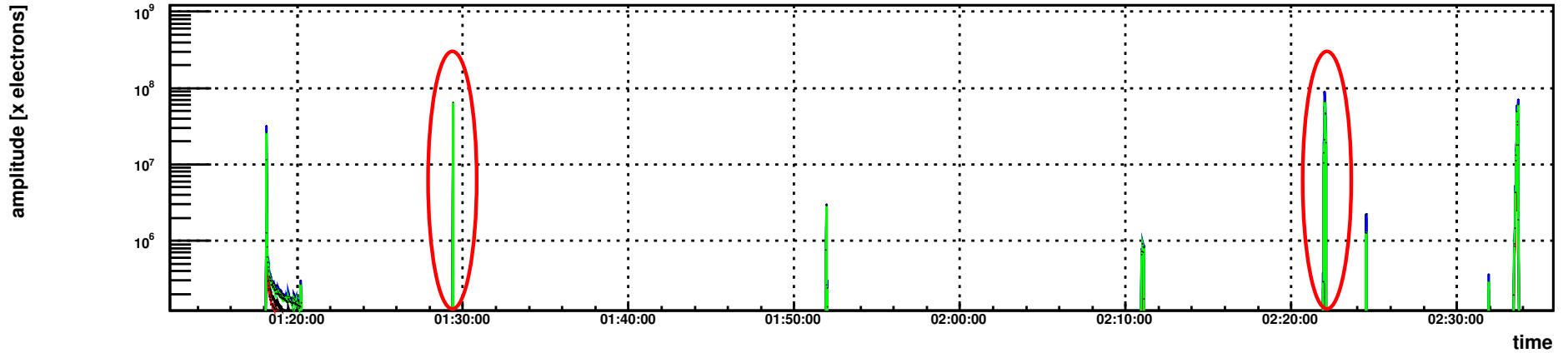
first scraping at 1:28

Scraping



first scraping at 1:28

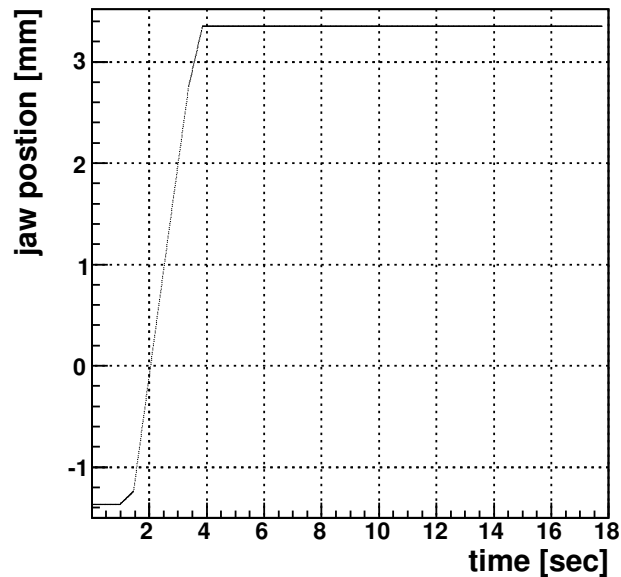
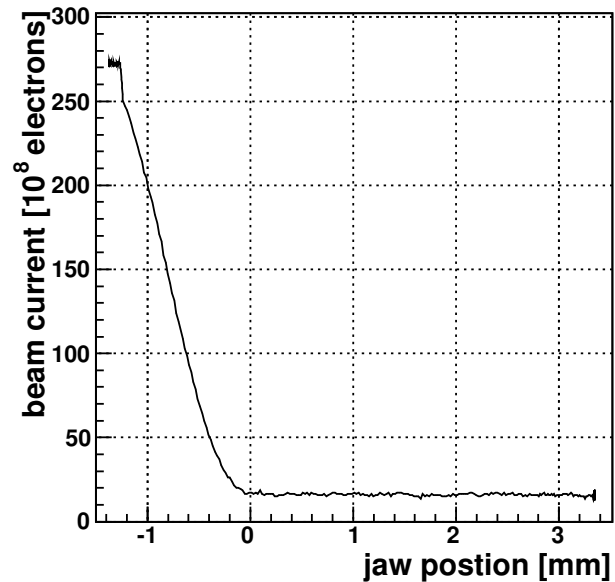
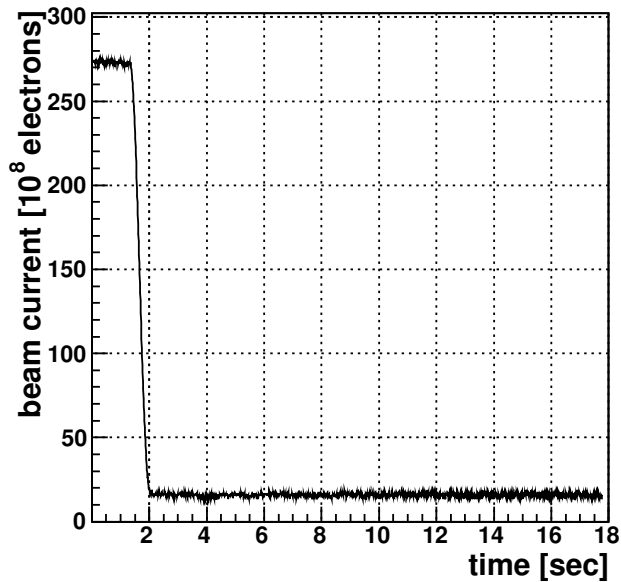
Scraping



first scraping at 1:28

second scraping at 2:22

Scraping Beam Right Jaw



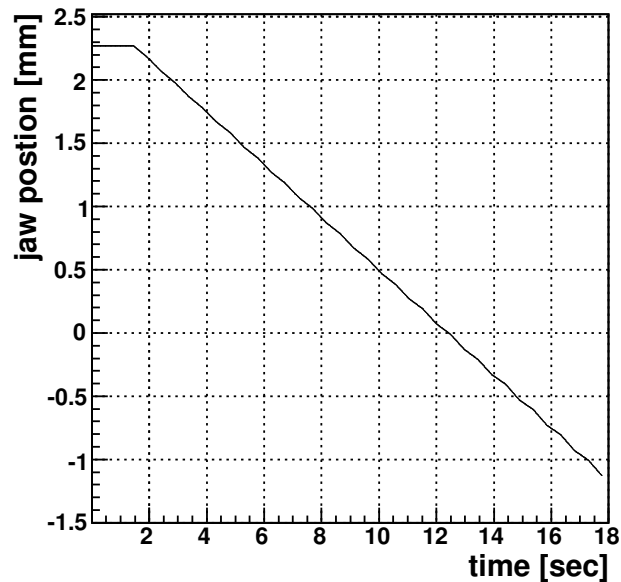
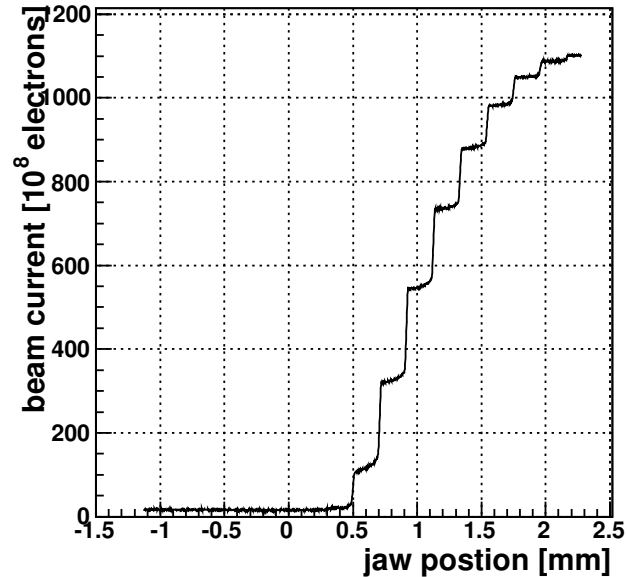
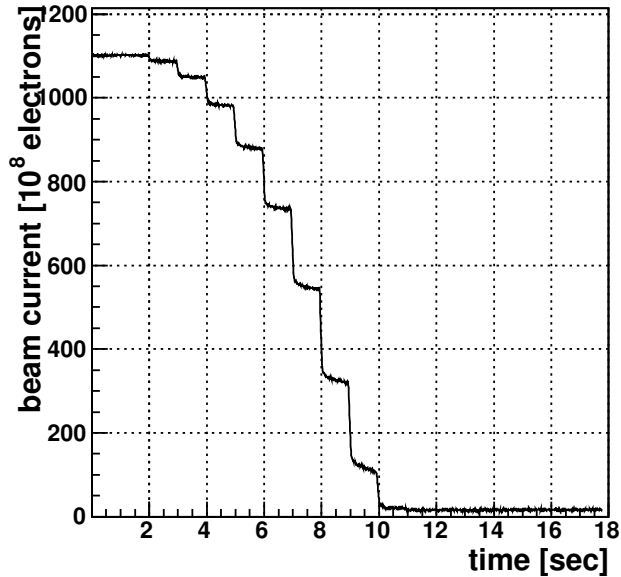
Gaussian fit:

$$\text{mean} = -1474.70 \mu\text{m}$$

$$\text{sigma} = 596.05 \mu\text{m}$$

$$x_c \approx -0.2 \text{ mm}$$

Scraping Beam Left Jaw



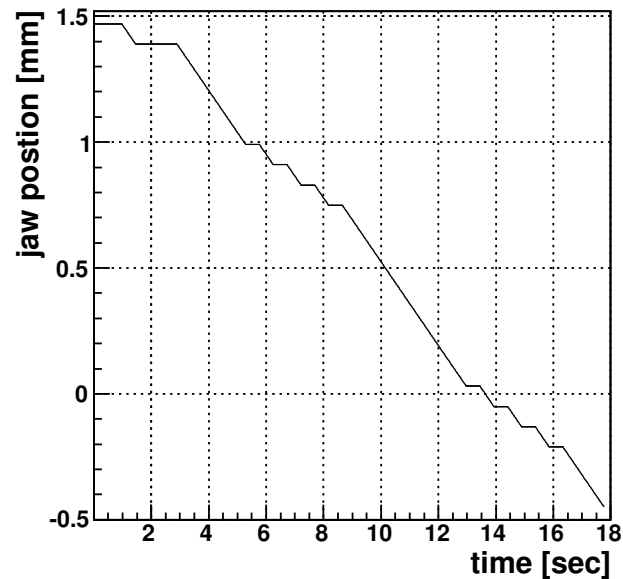
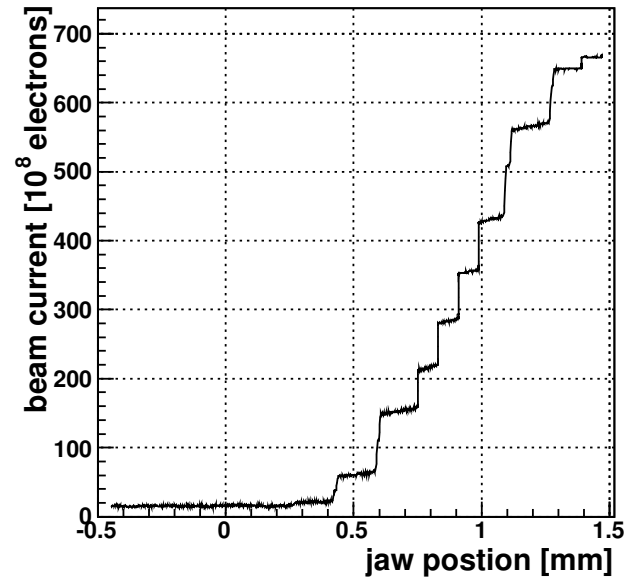
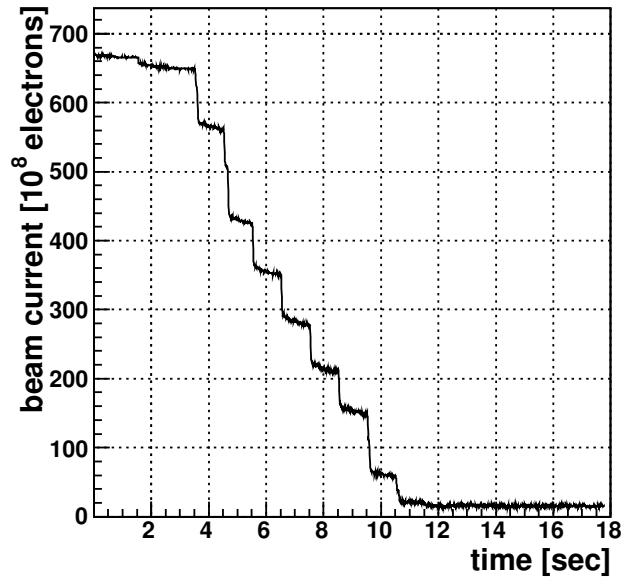
Gaussian fit:

mean = 1998.41 μm

sigma = 748.96 μm

$x_c \approx 0.4 \text{ mm}$

Scraping Beam Left Jaw



Gaussian fit:

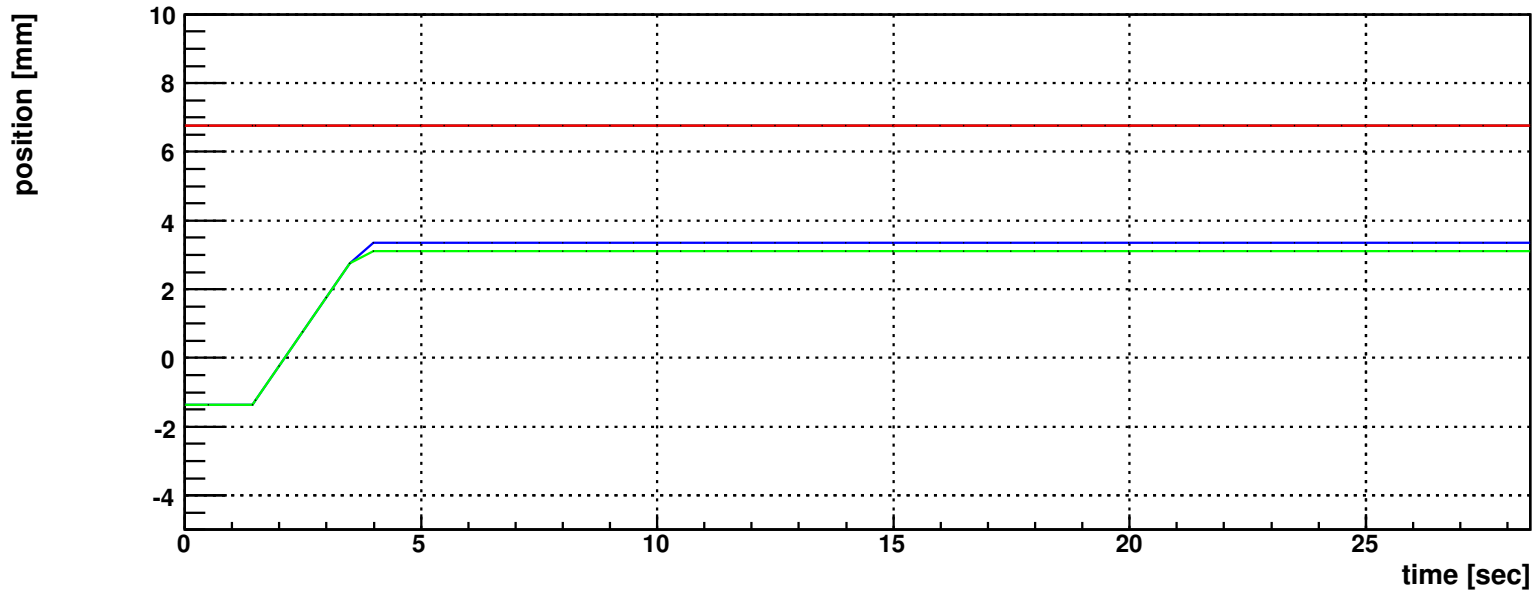
mean = $1441.57 \mu\text{m}$

sigma = $441.53 \mu\text{m}$

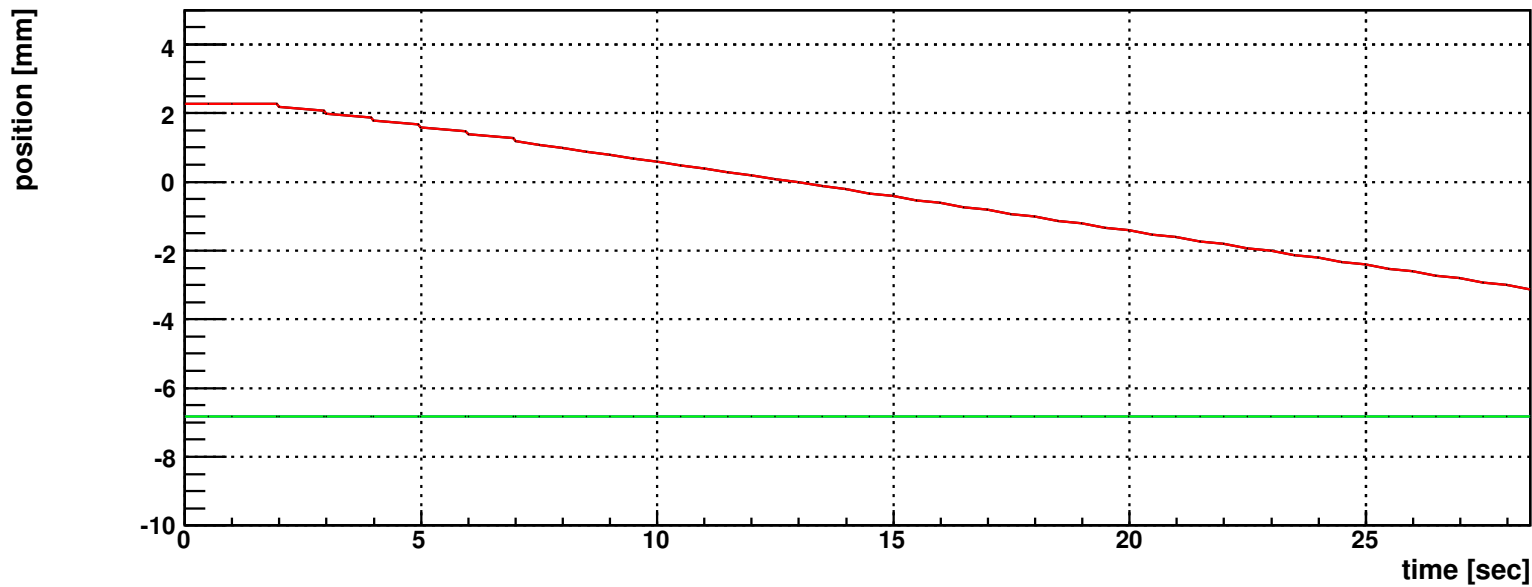
$x_c \approx 0.35 \text{ mm}$

$x_c \approx 0.2 \text{ mm}$ measured by
beam based alignment during MD

Difference in Motor Speed



scraping in
one go



scraping in
 $0.2 \mu\text{m s}^{-1}$ steps

Summary MD1

time	scraping jaw	beam center	beam size
01:29:19	right	≈ -0.2 mm	596.05 μm
02:21:52	left	≈ 0.4 mm	748.96 μm
03:00:42	left	≈ 0.35 mm	441.53 μm
05:06:10	left	≈ 0.45 mm	—
05:30:07	right	≈ 0.05 mm	—
07:06:18	left	≈ 0.67 mm	—

Data Quality MD1

- control software output: data is good to handle, in first MD there are some problems with signal polarity, **acquisition rate** ≈ 2.0 Hz
- beam-loss monitor output: data OK for first MD, one file “BLM_2006-10-31-18-46.txt” contains two headers and some line breaks are not correct.
- beam current data:
sdds file designed for data base issue? missing time-stamp in UNIX time as for other the files, therefore twice GMT time in header (Why?), lot of “0” at the end of data.
- data handling would be easier if BLM data and controls data files start at same timing. BDCT is not straight forward to combine with the other data, different acquisition times

Data Quality MD2

- control software output: in second MD there were a few lines with “NAN” or “INF” position readings, **acquisition rate** ≈ 1.0 Hz
- beam-loss monitor output: much more bad data in file, lines not complete and times-tap directly at the end of the data especially file “BLM_2006-11-07-15-47.txt” (under investigation).

Files with four header lines:

BLM_2006-11-07-13-01.txt

BLM_2006-11-07-17-36.txt

BLM_2006-11-07-23-40.txt

BLM_2006-11-08-02-59.txt

BLM_2006-11-08-03-04.txt

BLM_2006-11-08-03-47.txt

BLM_2006-11-08-09-09.txt