



Beam based alignment and tail repopulation

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Outline

Data analysis for SPS MDs:

MD1: from 8:00 a.m. 31th October until 8:00 a.m 1st November

MD2: from 8:00 a.m. 7th November until 8:00 a.m 8th November.

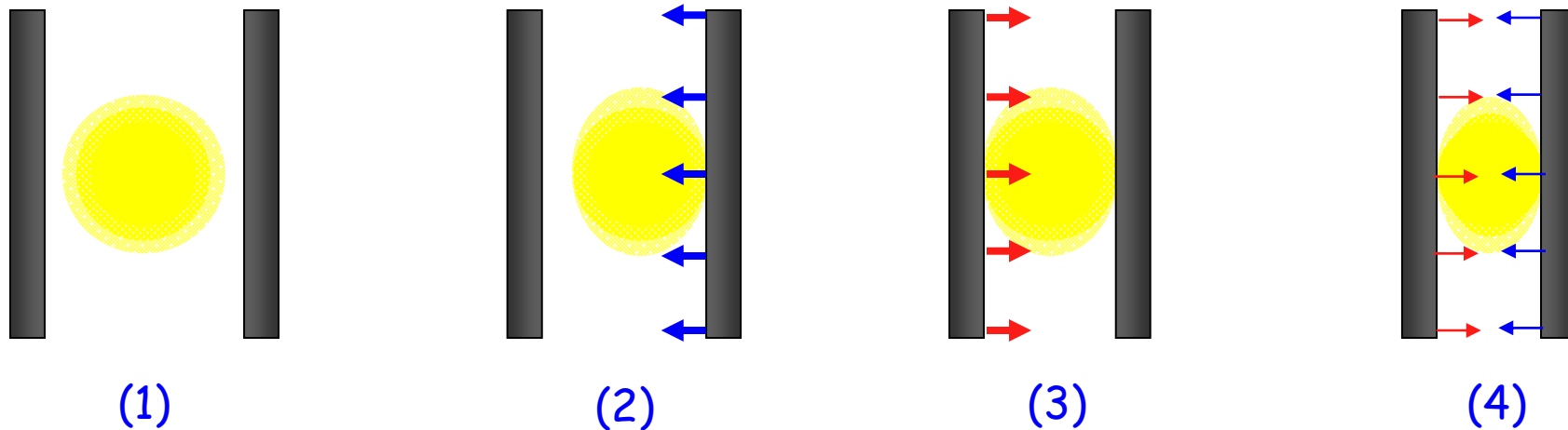
❖ Beam based alignment:

- General description
- Detailed analysis of the procedure adopted during the MDs.

❖ Tail repopulation:

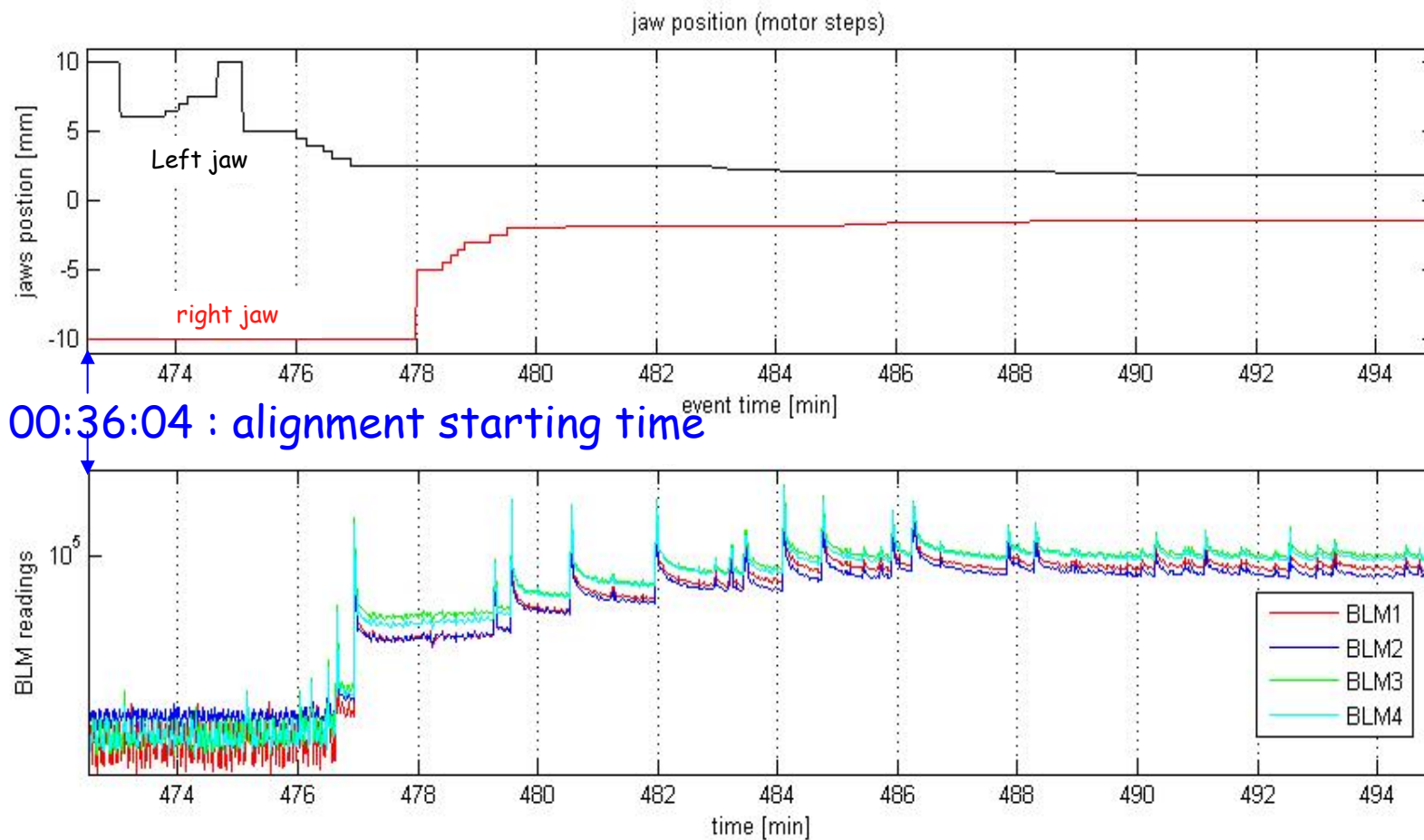
- Preliminary studies on different tail shapes observed

Beam based alignment



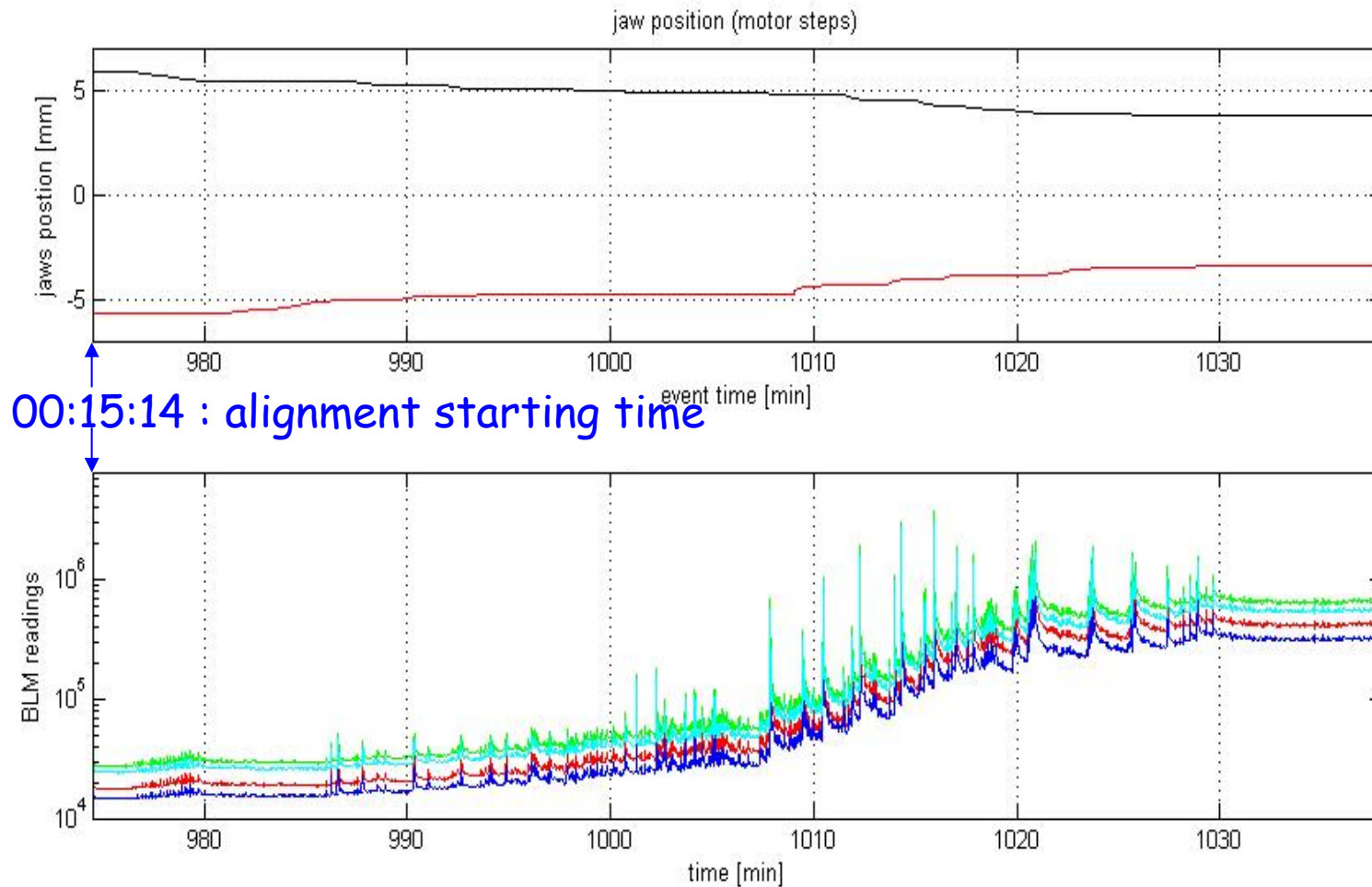
- 1) Two jaws retracted (out-switches)
- 2) One jaw moved in steps towards the beam until losses are recorded by the BLMs → sharp edge beam.
- 3) Second jaw moved in steps towards the beam.
- 4) Fine alignment (smaller steps).

MD1: first beam based alignment



ABSOLUTE STARTING TIME: 16:43:30 (31st October)

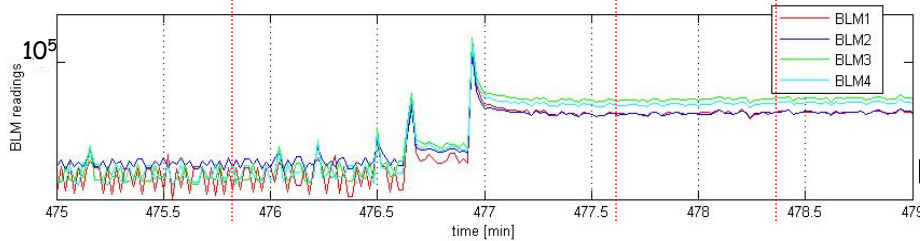
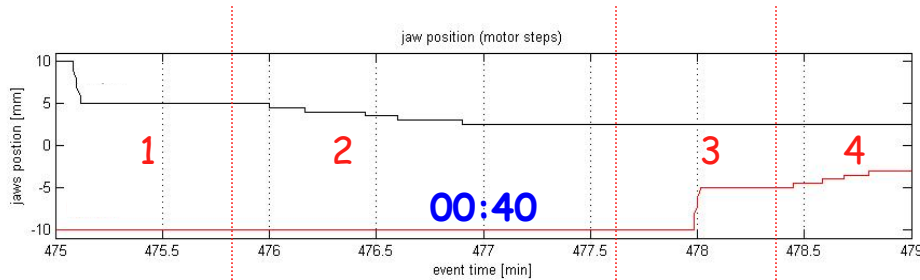
MD2: beam based alignment



ABSOLUTE STARTING TIME: 08:05:14 (7th November)

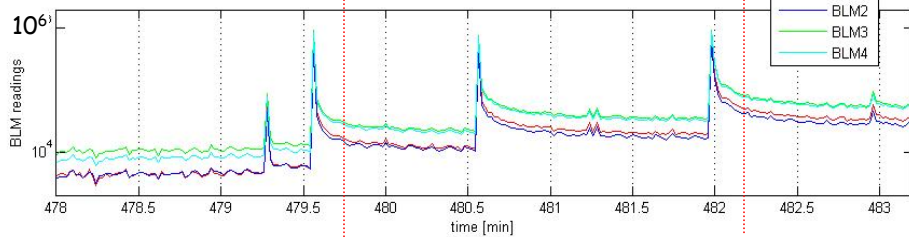
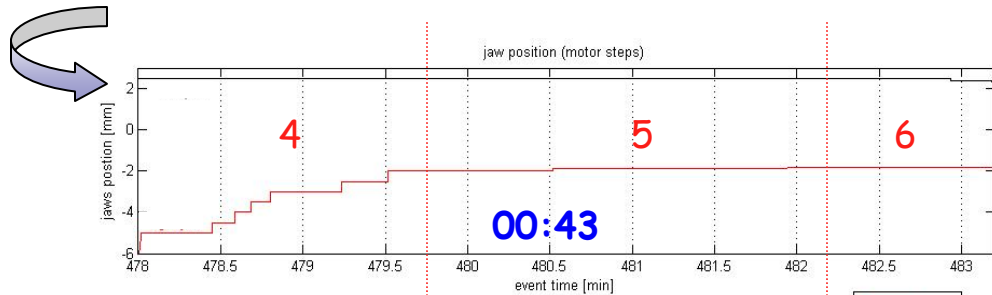


Step by step alignment (MD1) 1/2

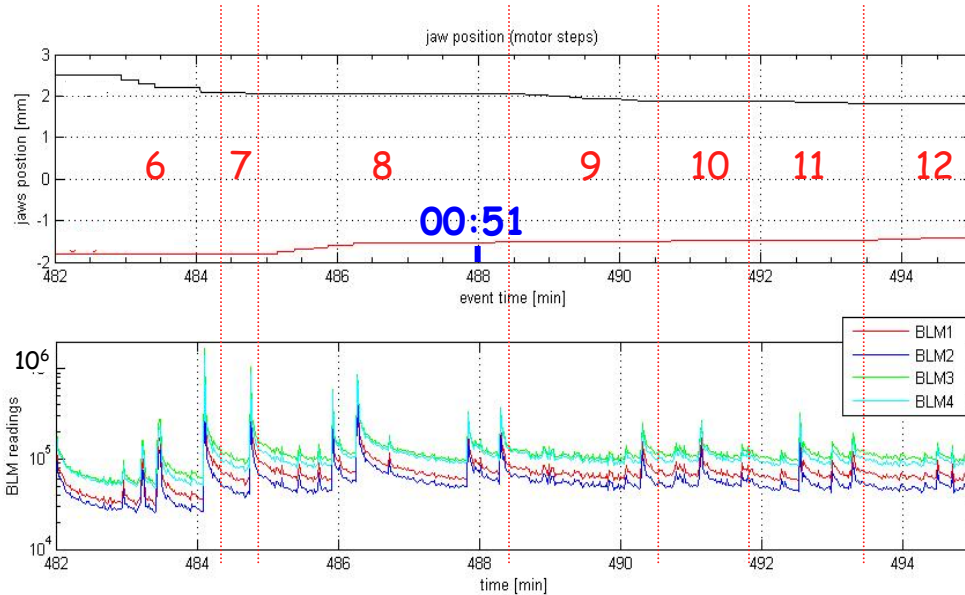


Summarizing table of jaws movement (first part)

	Jaw	In. pos. [mm]	Steps [mm]	Fin. pos. [mm]
1	left	10	5	5
2	left	5	0.5	2.5
3	right	-10	5	-5
4	right	-5	0.5	-2
5	right	-2	0.1	-1.8
6	left	2.5	0.1	2.1



Step by step alignment (MD1) 2/2



Summarizing table of jaws movement (second part)

	Jaw	In. pos. [mm]	Steps [mm]	Fin. pos. [mm]
6	left	2.5	0.1	2.1
7	left	2.1	0.05	2.05
8	right	-1.8	0.05	-1.55
9	left	2.05	0.02	1.85
10	right	-1.55	0.02	-1.47
11	left	1.85	0.01	1.81
12	right	-1.47	0.01	-1.42

Jaws aligned within 20 μm at:

Left 1.81 mm
 Right -1.42 mm

} Beam centre: 0.195 mm

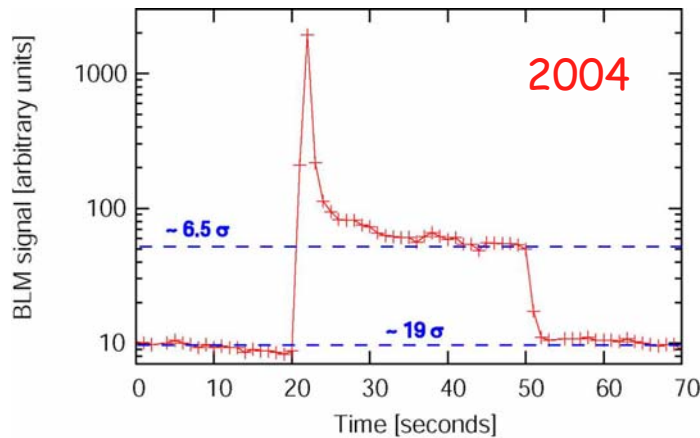


Final positions

	Left jaw [mm]	Right jaw [mm]	Beam Centre [mm]
MD1	1.81 mm	-1.41 mm	0.200 ± 0.010
	1.76 mm	-1.37 mm	0.195 ± 0.010
	2.27 mm	-1.82 mm	0.225 ± 0.010
	1.19 mm	-0.79 mm	0.200 ± 0.020
	1.12 mm	-0.77 mm	0.175 ± 0.020
MD2	Left jaw [mm]	Right jaw [mm]	Beam Centre [mm]
	3.73 mm	-3.45 mm	0.140 ± 0.010
	1.49 mm	-1.31 mm	0.090 ± 0.050



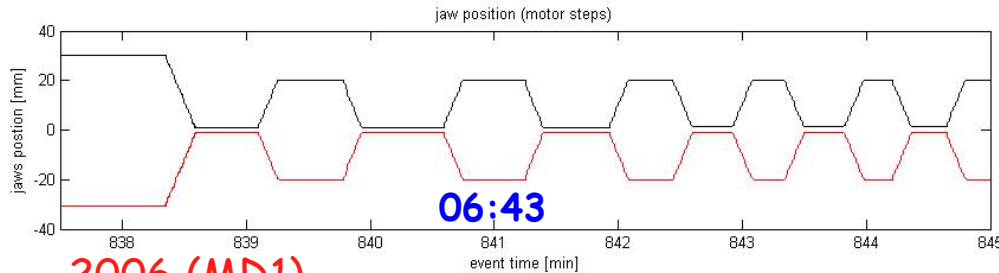
Tail repopulation



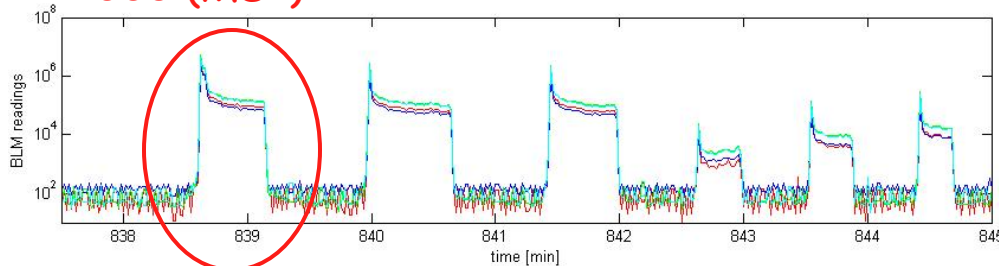
G.Robert-Demolaize

In 2004 it was observed that the BLM signal doesn't go back instantaneously to zero as expected. An exponential tail of about 30 seconds persists until then the collimator is retracted. 2006 results generally confirm this behaviour.

Such tail repopulation is **too fast** to be due to **diffusion of the core particles**.



2006 (MD1)



f(t)

Possible explanation:

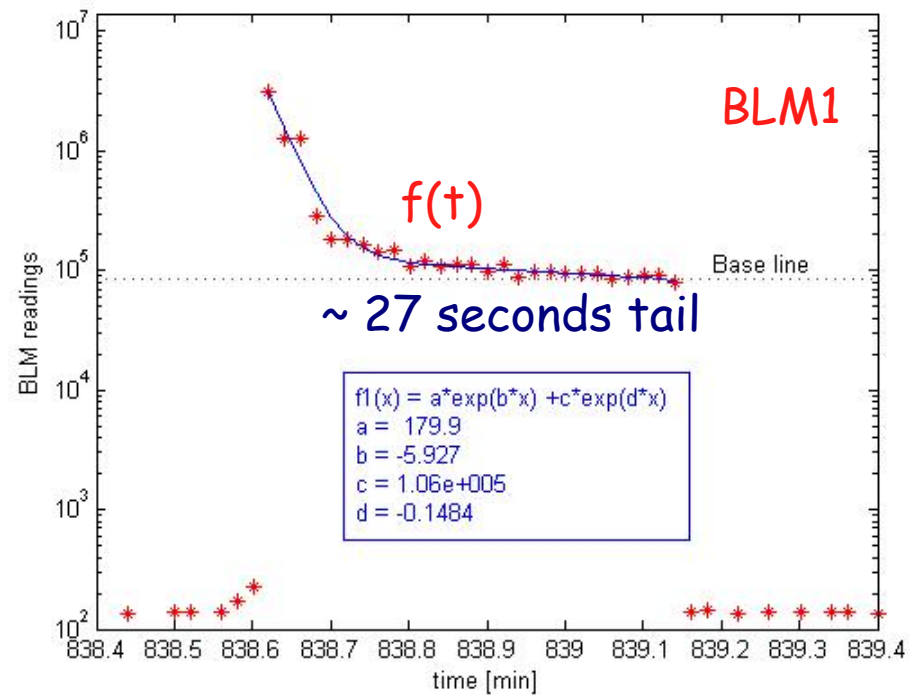
Slight x-y "coupling"!

Particles from the vertical halo.

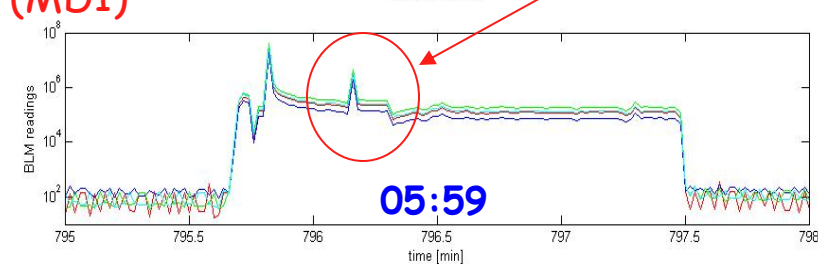
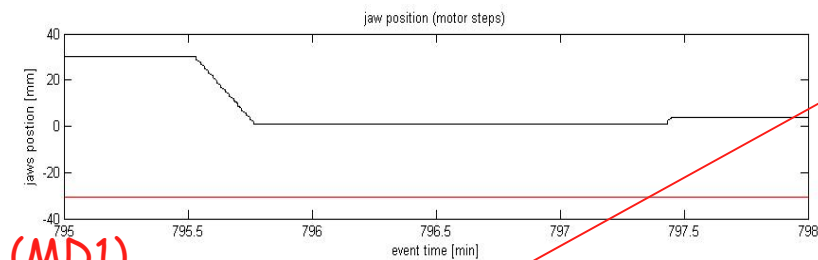
"Regular" tail

Best fit for regular tails:

$$F(t) = a \cdot \exp(b \cdot t) + c \cdot \exp(d \cdot t)$$

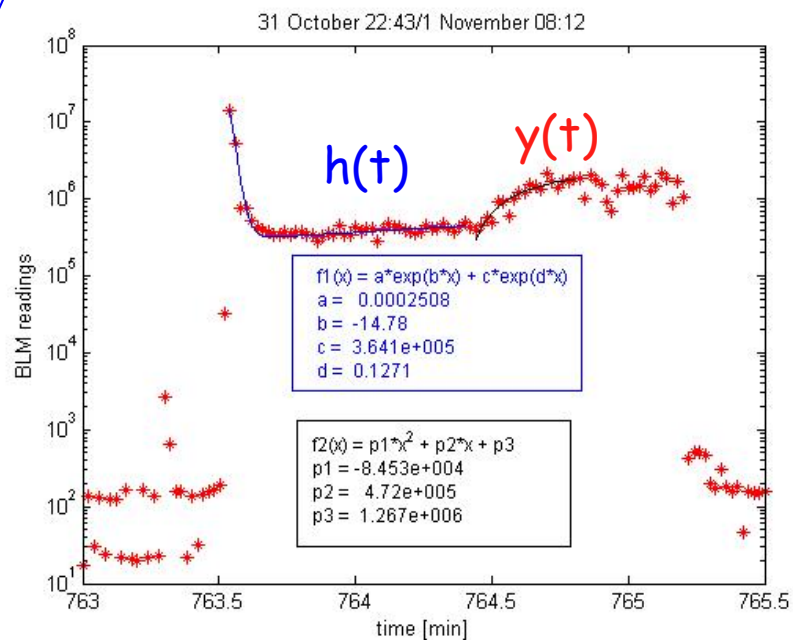
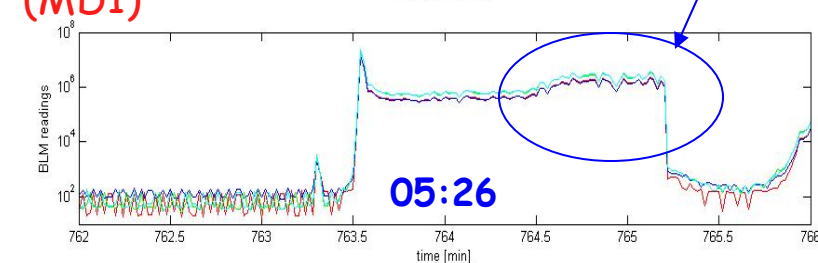
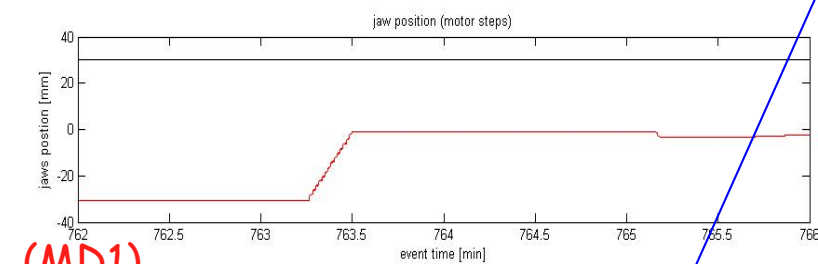


"Irregular" tails

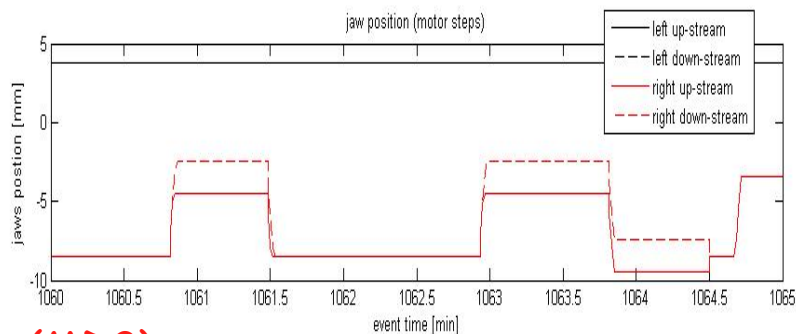


Spike without jaw movements:
orbit bump?

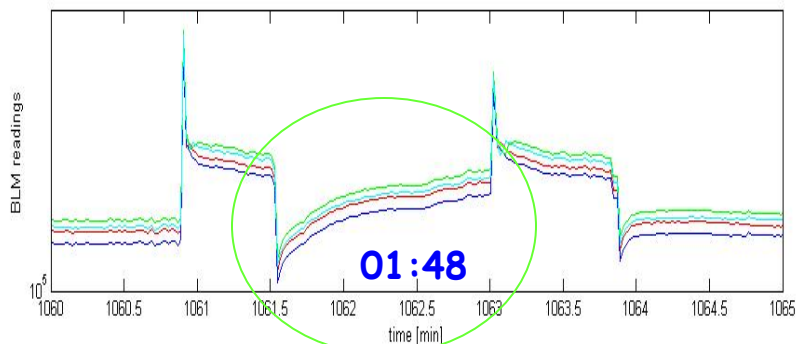
Slightly increasing signal about 1
minute after the jaw movement.
Fit with a 2nd degree polynomial.



Increasing signal

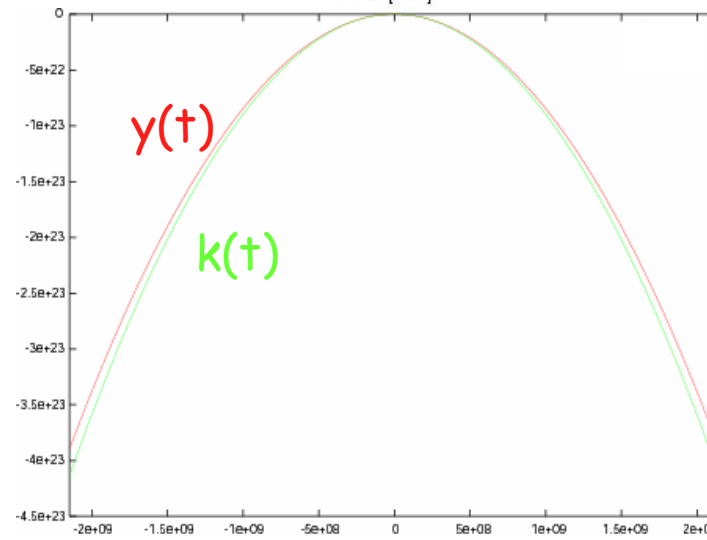
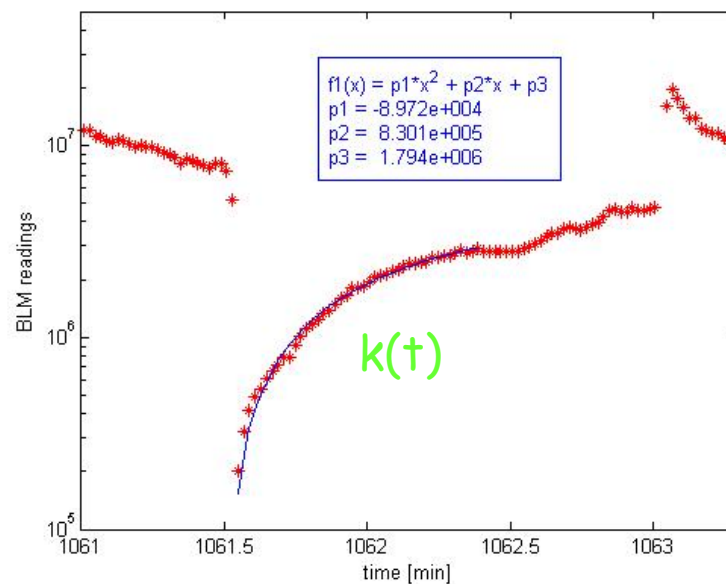


(MD2)



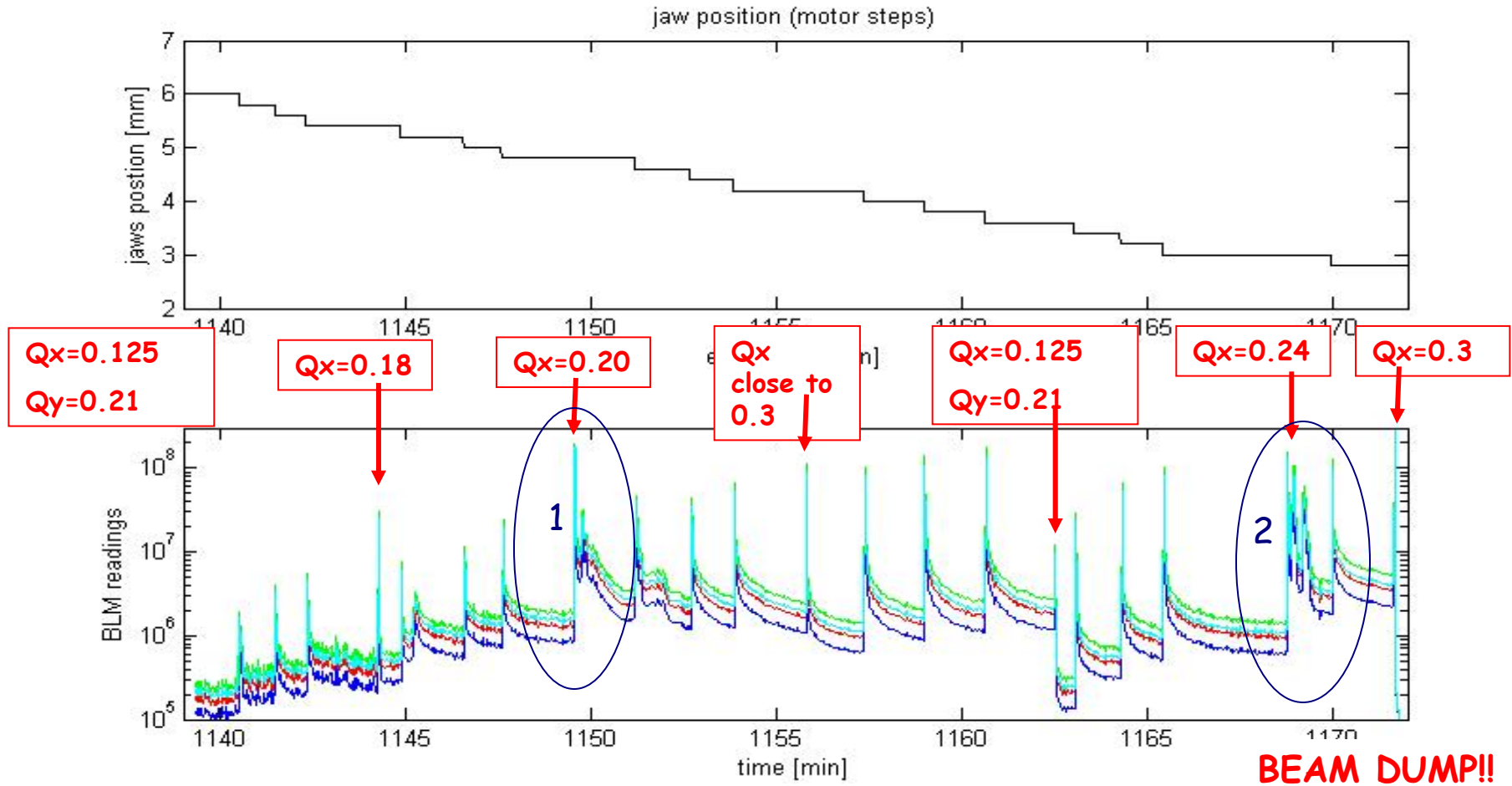
Keeping the jaws open the BLM signal increases. Unexpected good agreement between the fit evaluated for this data $k(t)$ and the previous one $y(t)$.

Chance or Physics?????

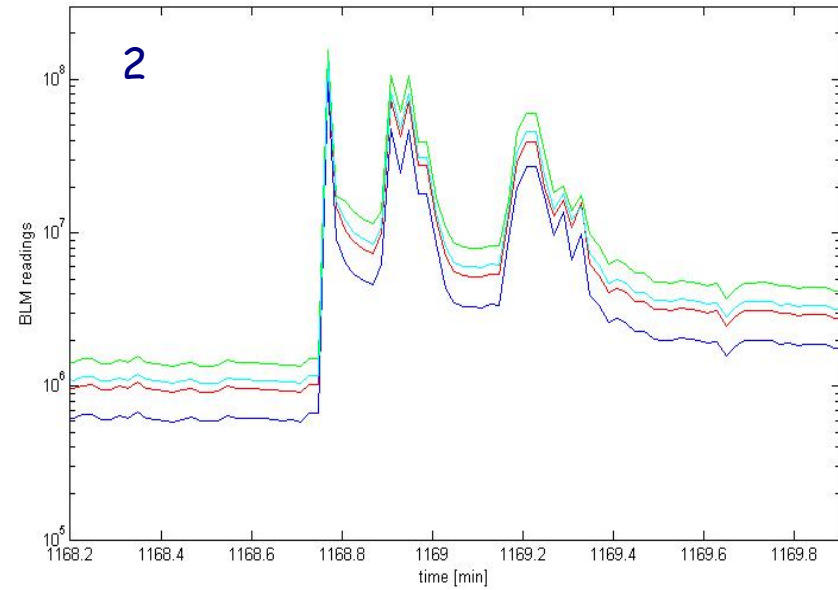
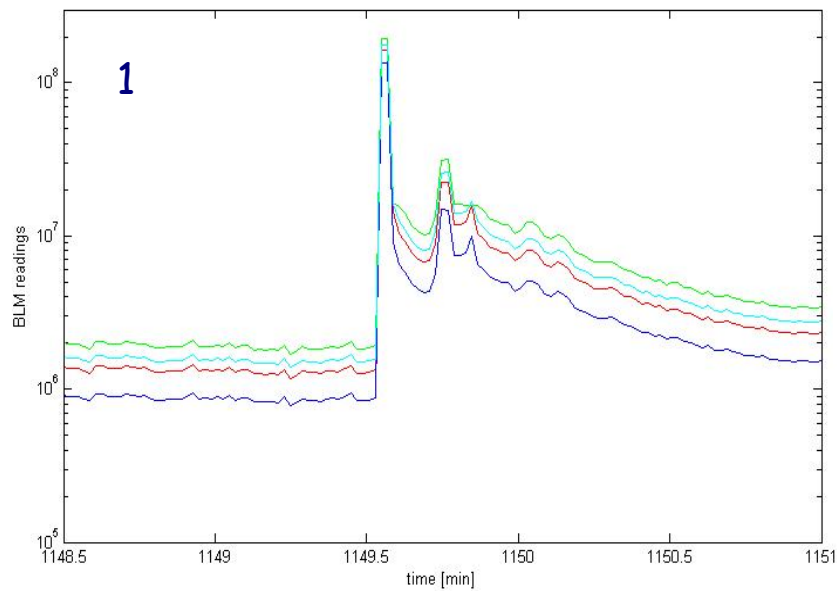


Tune Change (MD2)

BLM signals corresponding to tune change.



Tails with "echo"



Unexplained phenomena!!!



Conclusions

- ❖ During the MDs the feasibility of the beam based alignment with an accuracy of 20 μm has been confirmed.

- ❖ New tail features, with respect to 2004, have been observed. Preliminary studies highlighted potentially interesting behaviors. Deeper studies are necessary to understand the physical meaning.