Measured temperature of the TT40 collimator with different beam intensities

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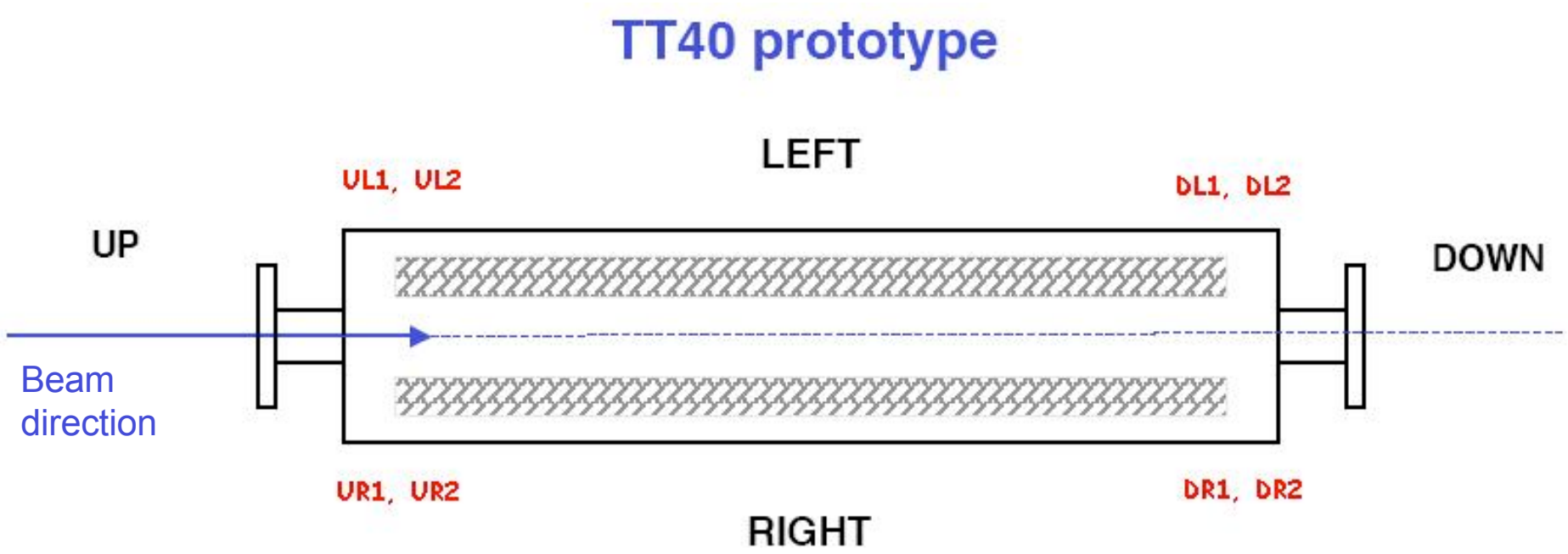
Outline

- Set-up of the measurement devices
- Overall look – Data selection
- Analysis of temperature rise vs. Beam intensity
- Conclusion

Set-up of the measurement devices

4 pairs of temperature sensors are placed on each side (up, down) of each jaw of the prototype; sensor 1 is placed on the top of the jaw, sensor 2 on the bottom (depth in the jaw ~ 1 mm)



Overall look - Data selection

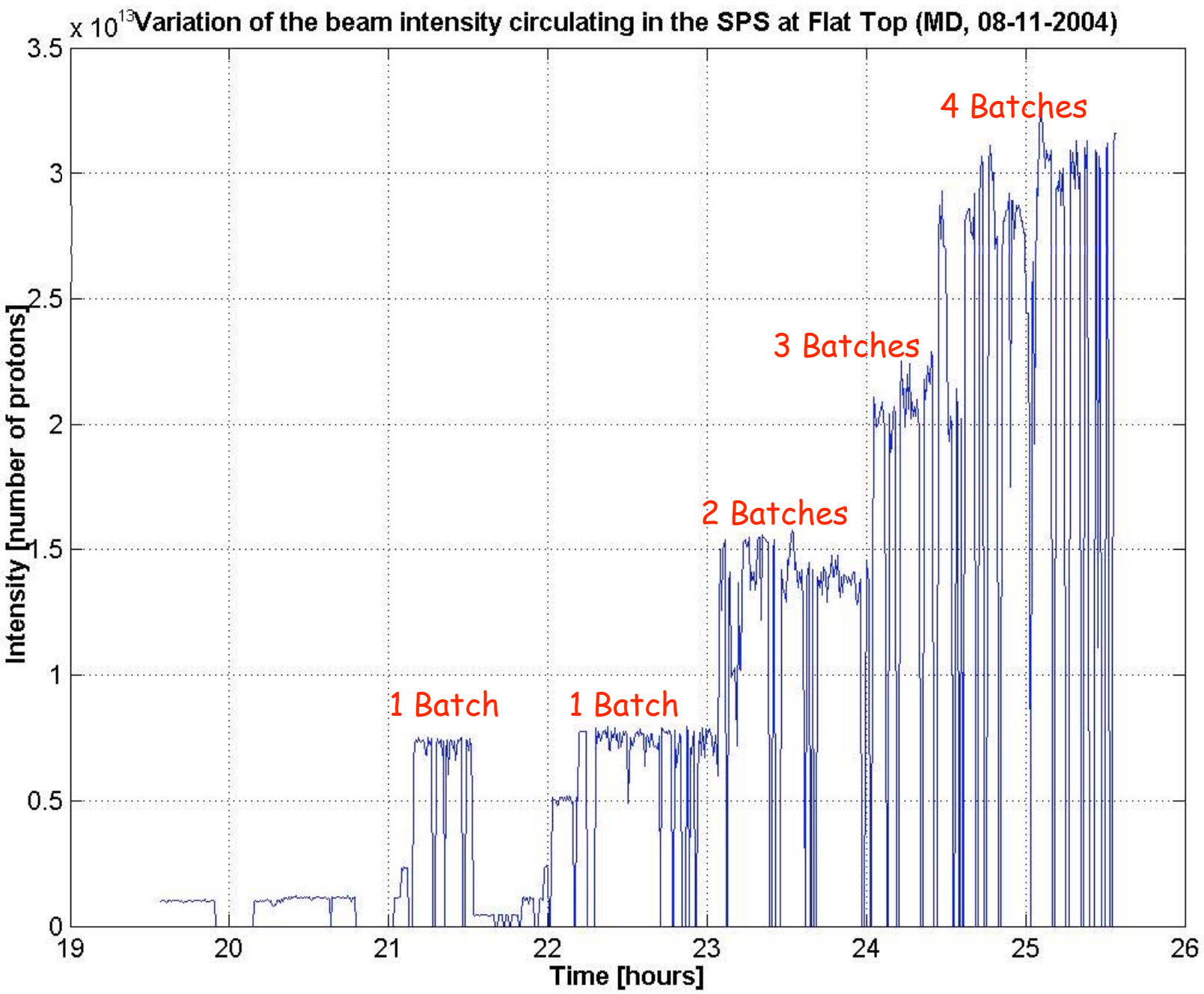
-- Acquisition time of temperature sensors: 30 seconds

-- measurements were done for different :

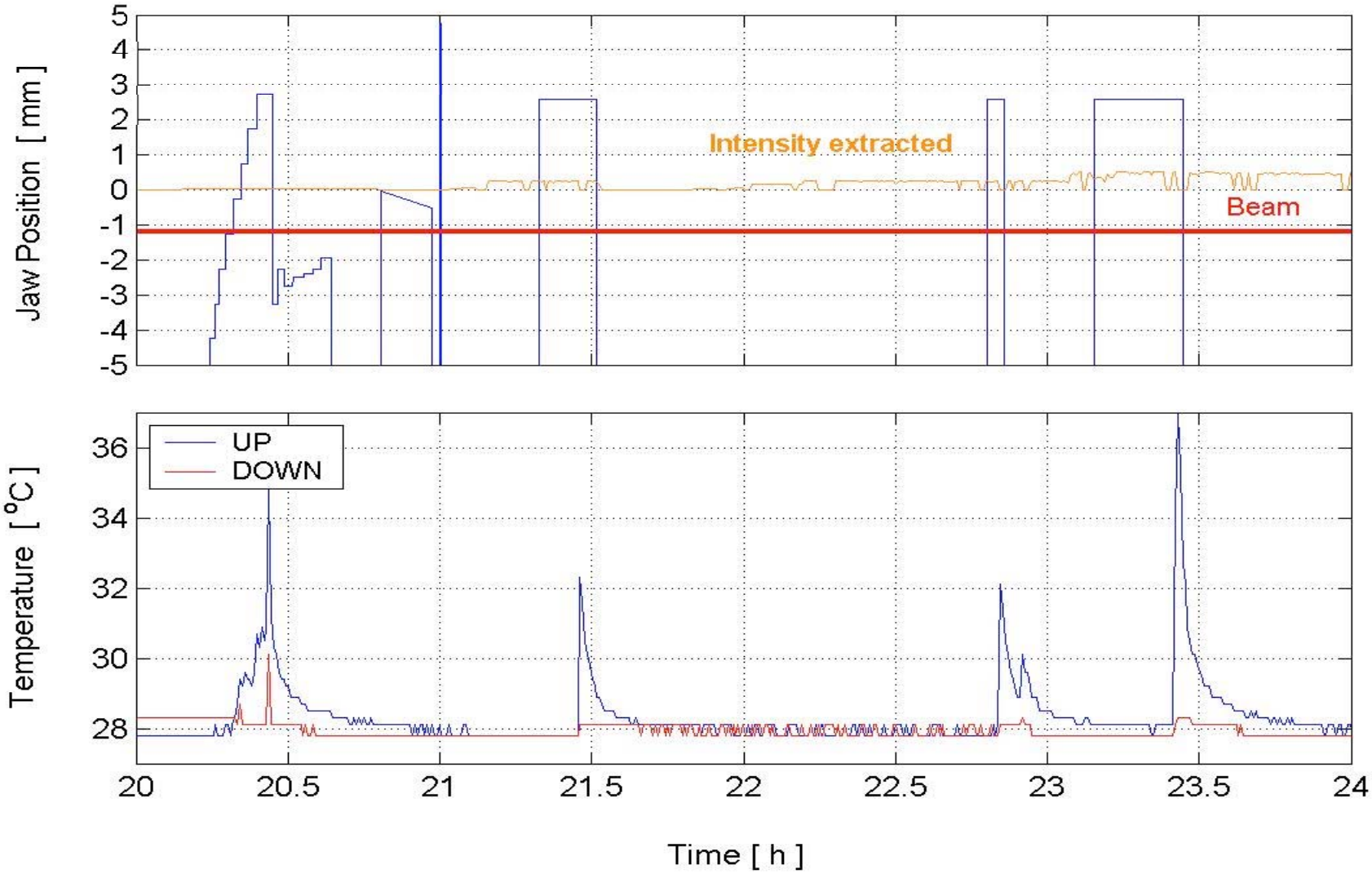
*beam intensities: from 7.0e12 to 3.13e13 protons per batch

*jaw positions: moving by 1 mm steps closer to the beam

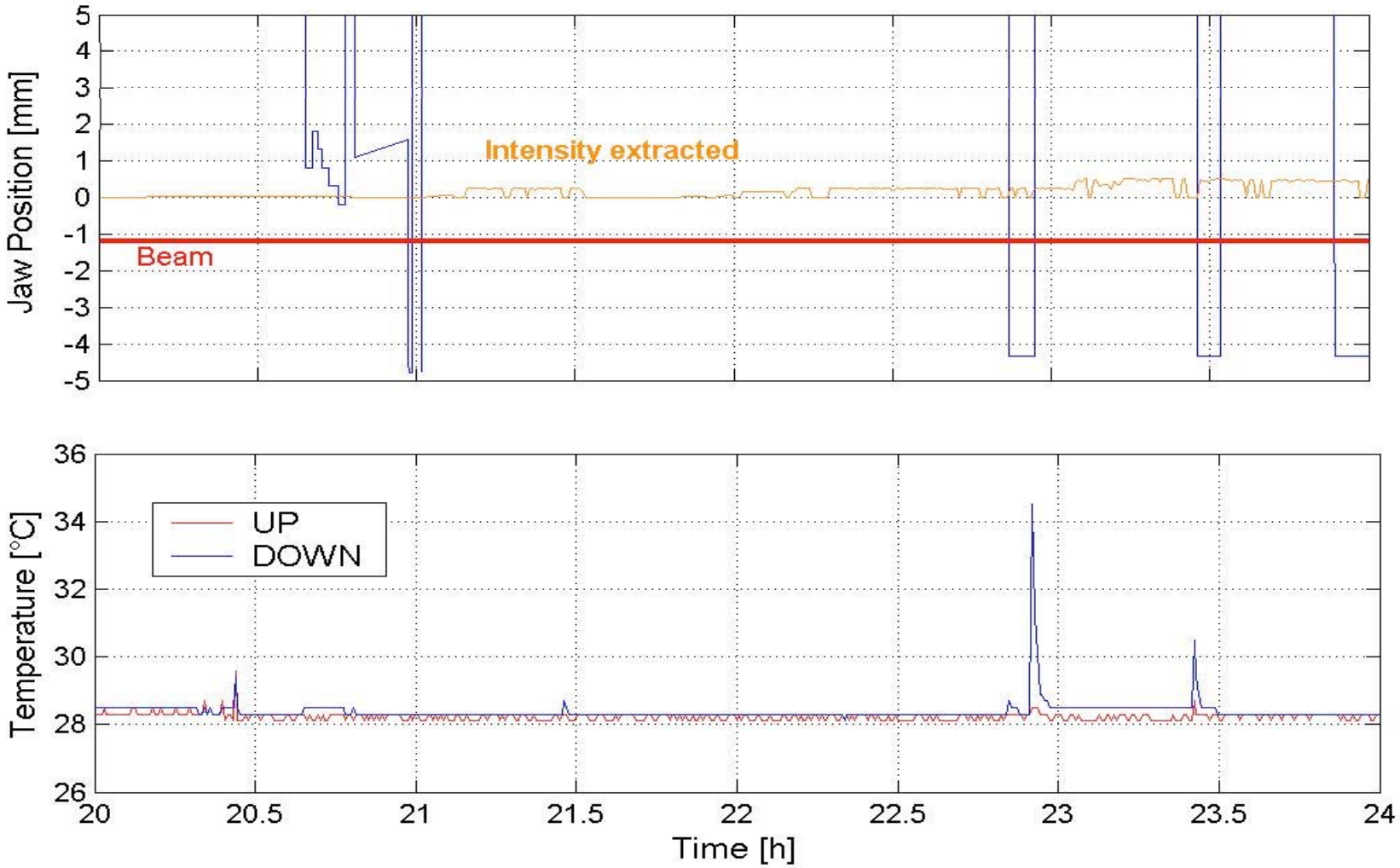
=> Main objective: check the influence of the beam intensity over the temperature rise over the collimator jaws


Variation of the beam intensity circulating in the SPS at Flat Top (MD, 08-11-2004)
x 10^13
Intensity [number of protons]
Time [hours]
1 Batch
1 Batch
2 Batches
3 Batches
4 Batches
0
0.5
1
1.5
2
2.5
3
3.5
19
20
21
22
23
24
25
26

Temperature behavior for the left jaw:



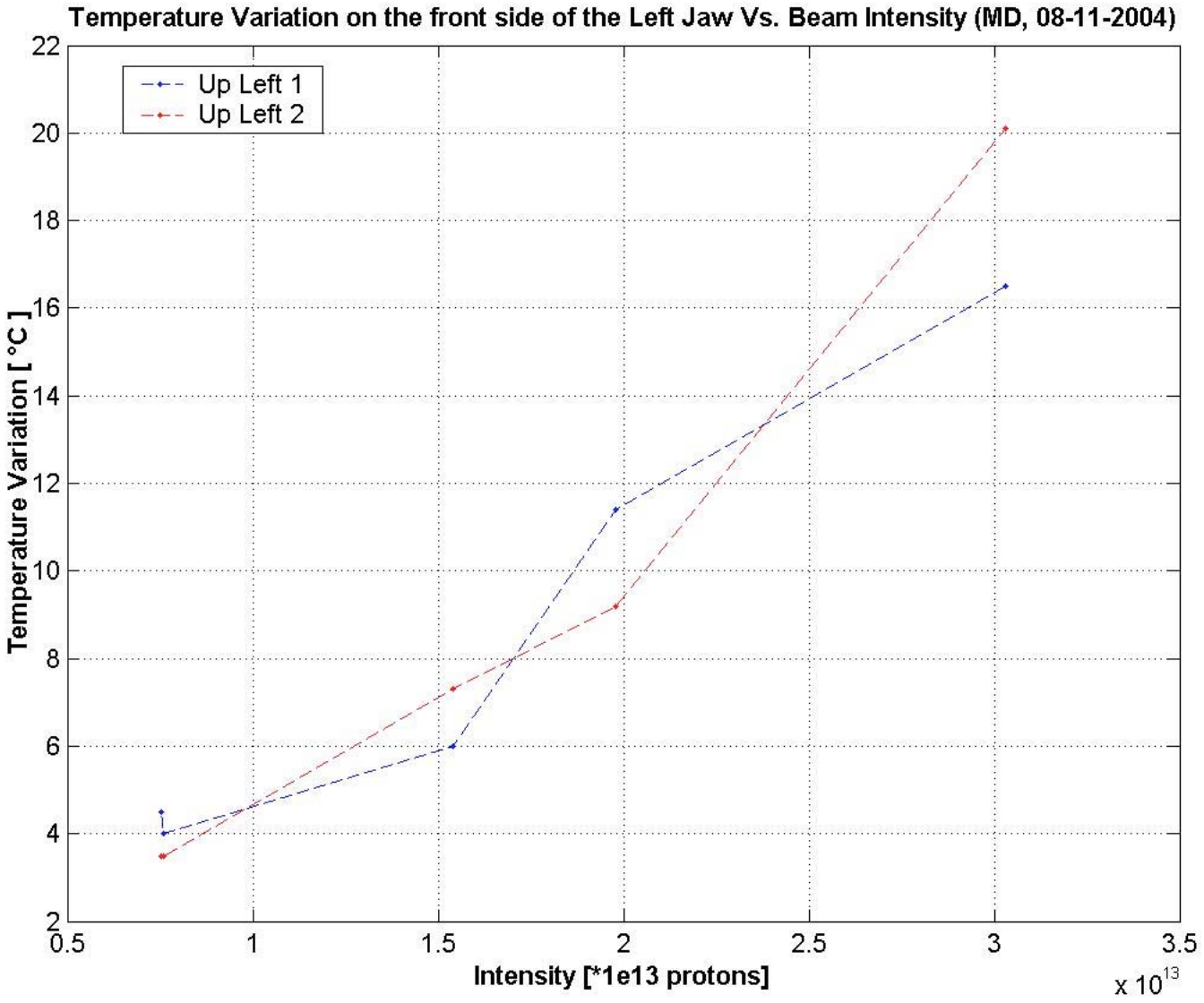
Temperature behavior for the right jaw:



Temperature rise vs. Beam Intensity

For each extracted beam, we look at the variation of temperature of the impacted jaw:

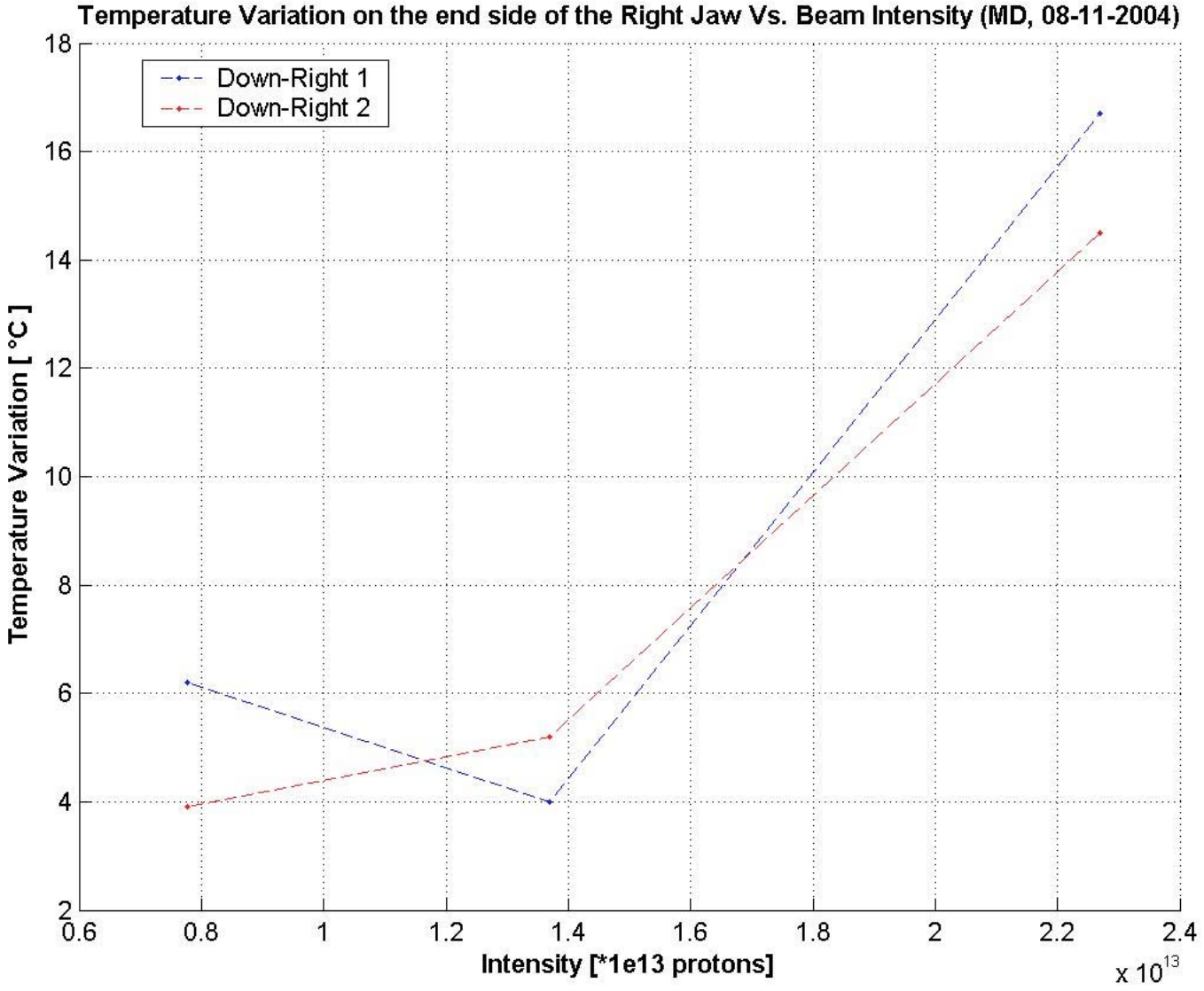
Left Jaw



Temperature rise vs. Beam Intensity

For each extracted beam, we look at the variation of temperature of the impacted jaw:

Right Jaw

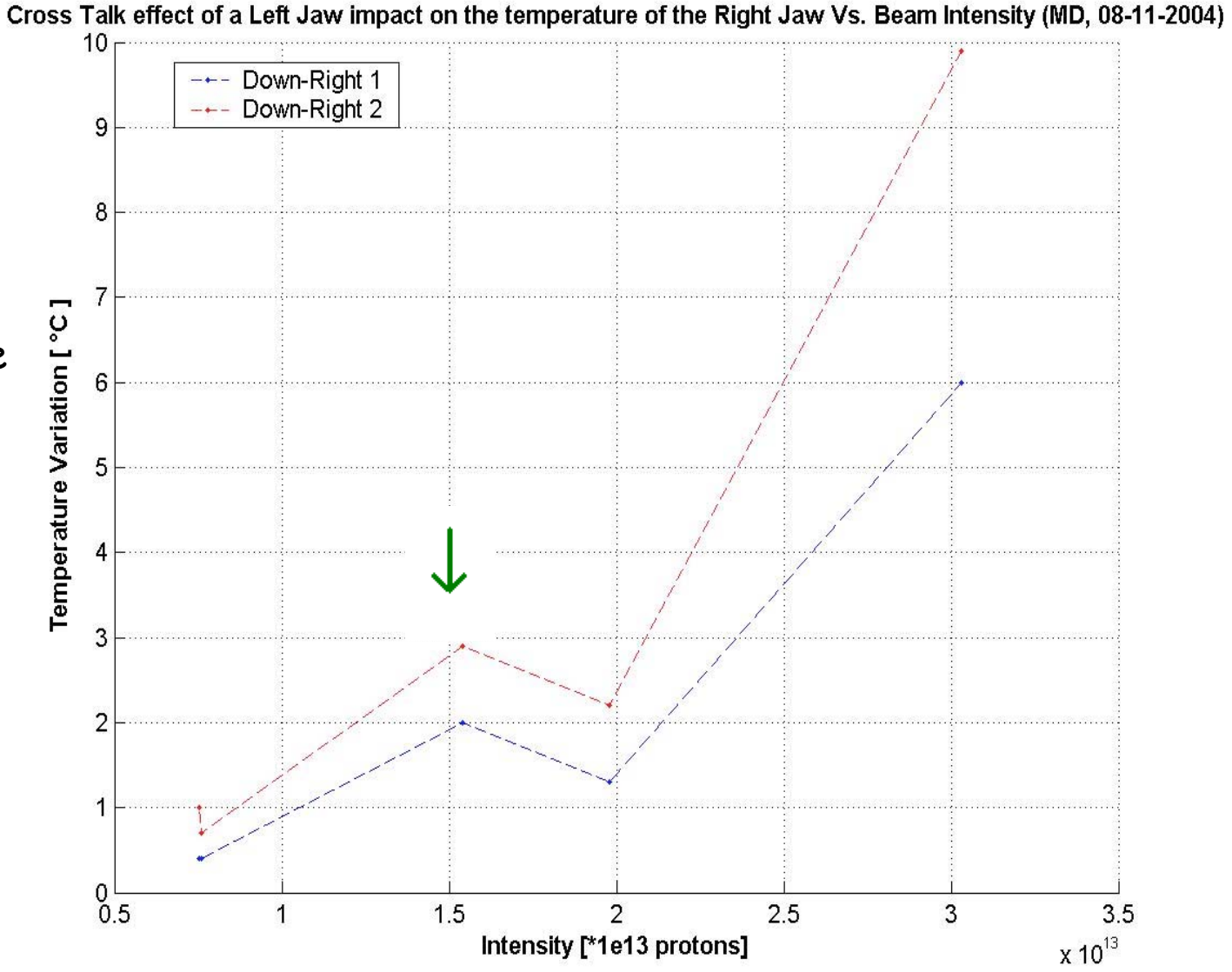


Cross Talk ?

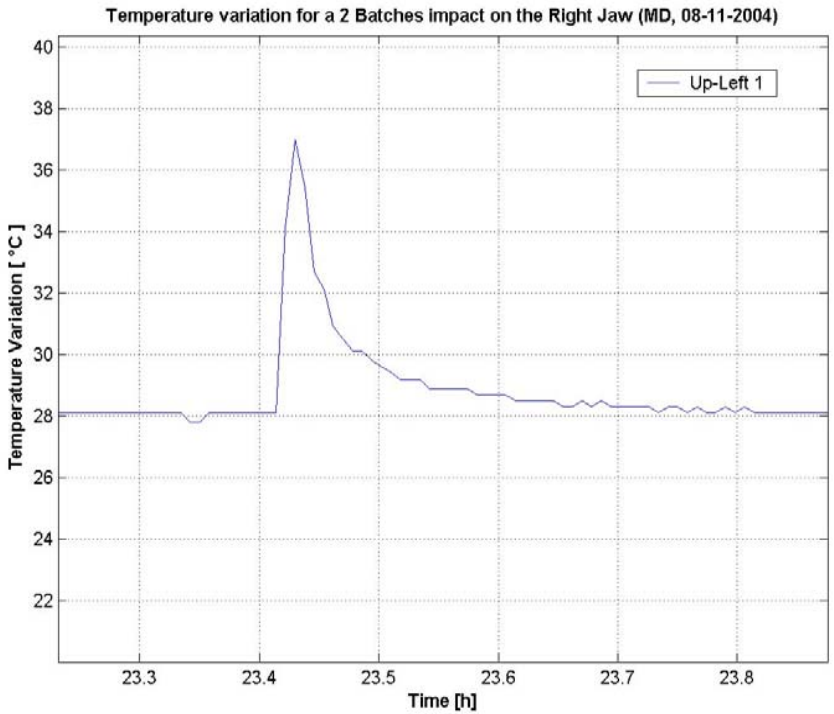
If we check the influence of an impact on the Left Jaw on the Right one:

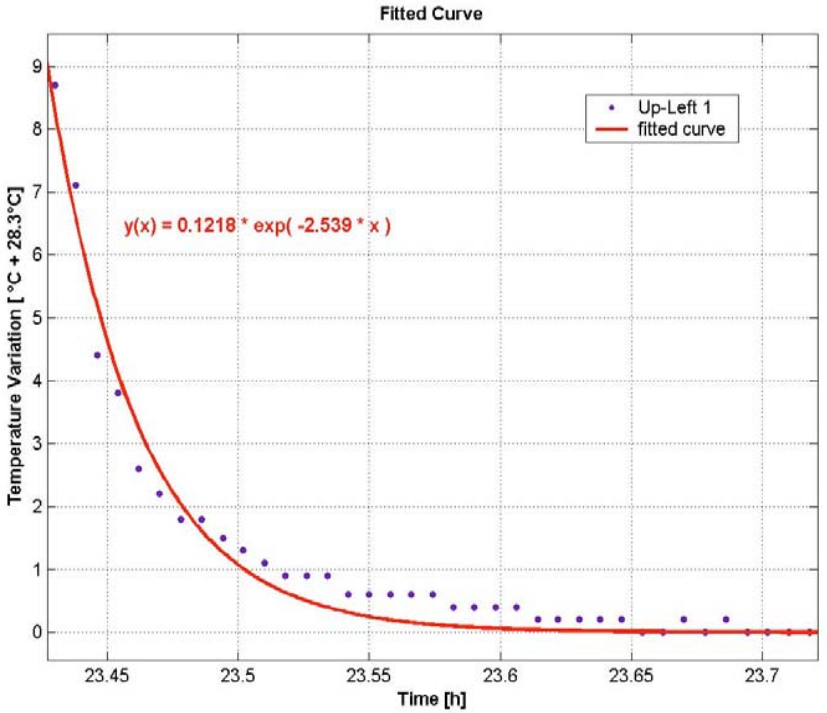
for the same beam intensity, we'll have lower temperature increase due to this cross-talk effect

=> most probable reason of the relative fall observed on the Right Jaw plot



Temperature decay after impact

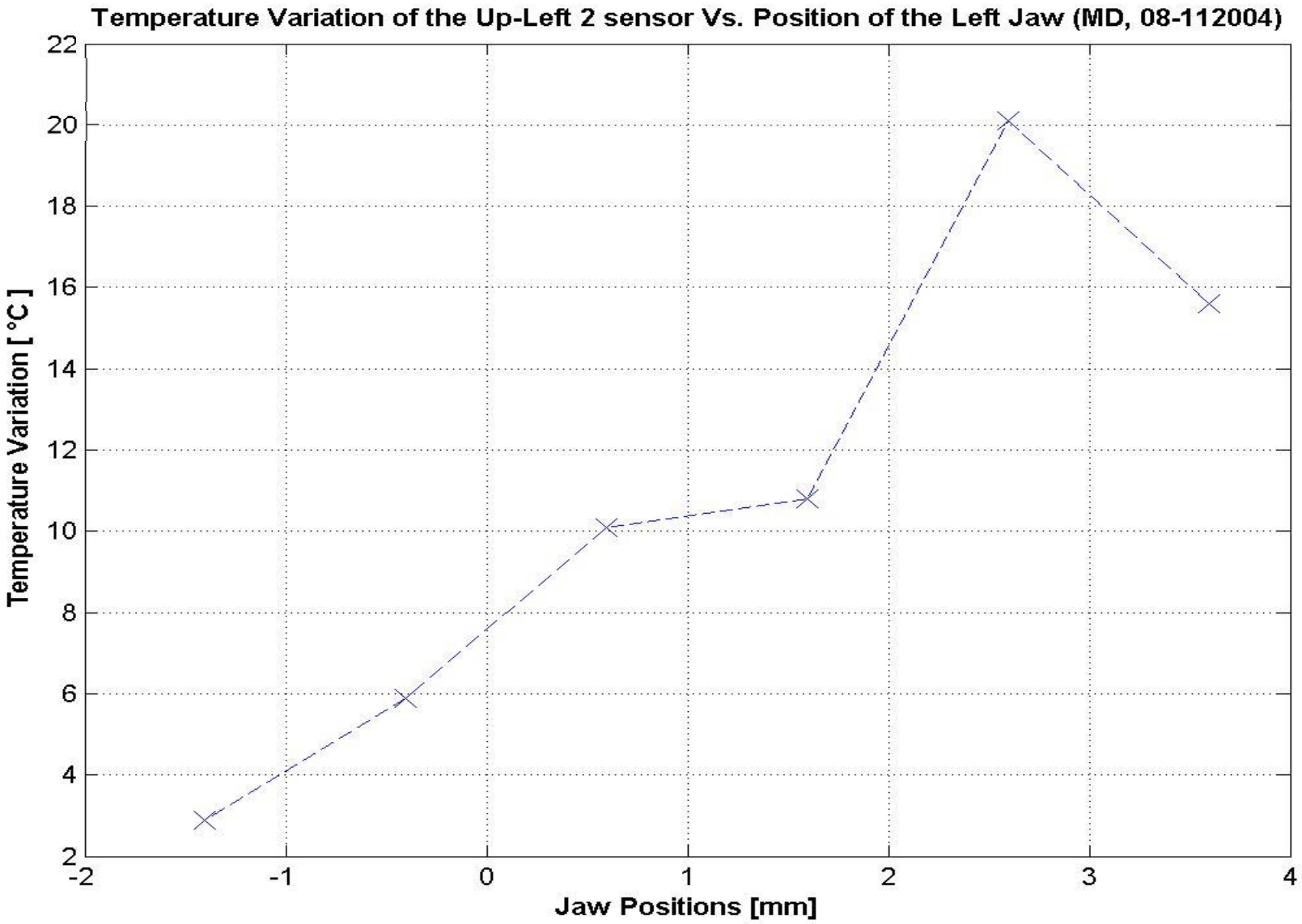




=> temperature behavior after impact close to an exponential decrease, with a decay time of ~24 minutes.

Temperature Vs. Jaw Position

- Beam impacting on the Left Jaw at full intensity:



Conclusion

- Out of the 4 pairs of sensors, two of them seemed not to work properly: investigate if it's a mechanical matter or if it's due to the sensors themselves. Also most of the sensors "died" after first shot at full intensity.

- -- Temperature variation vs. Intensity appeared to be fairly linear

  -- cross-talk issue between jaws has been pointed out

  -- temperature max: 49.9°C (4 Batches impact on Left Jaw)

  -- delta max: 20.1 °C (same impact)

- After impacts, sensors show that temperature follow an exponential decrease; decay times = ~15 min for 1 batch, ~24 min for 2 batches