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)

**TT40 prototype**
Overall look - Data selection

-- Acquisition time of temperature sensors: 30 seconds

-- measurements were done for different:
  * beam intensities: from $7.0 \times 10^{12}$ to $3.13 \times 10^{13}$ 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)
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:

Temperature Variation on the front side of the Left Jaw Vs. Beam Intensity (MD, 08-11-2004)

- Solid line: Up Left 1
- Dashed line: Up Left 2

Left Jaw
Temperature rise vs. Beam Intensity

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

- Down-Right 1
- Down-Right 2

Temperature Variation on the end side of the Right Jaw Vs. Beam Intensity (MD, 08-11-2004)
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:

Temperature Variation of the Up-Left 2 sensor Vs. Position of the Left Jaw (MD, 08-112004)
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