ESRF | The European Synchrotron

CH07 Aluminium Heating MDT

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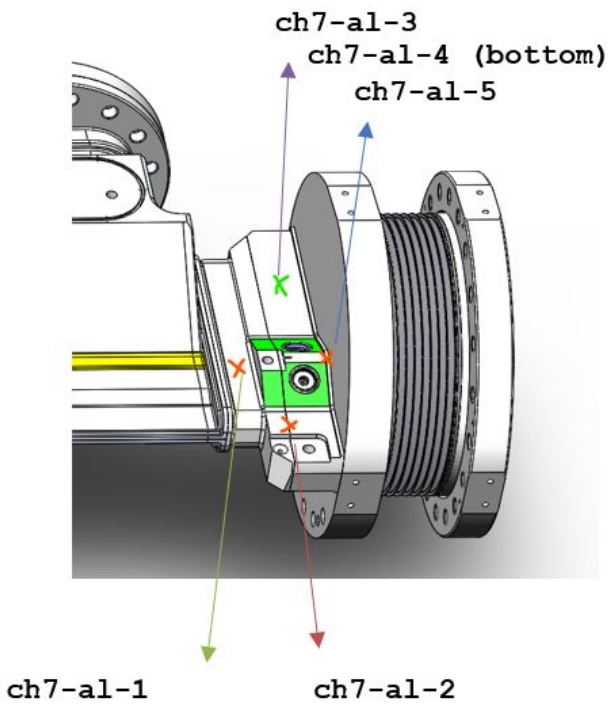
OVERVIEW

- There are 4 CH07 chambers that were built with Aluminium instead of Stainless Steel.
  - Cells 14, 15, 16 and 18.

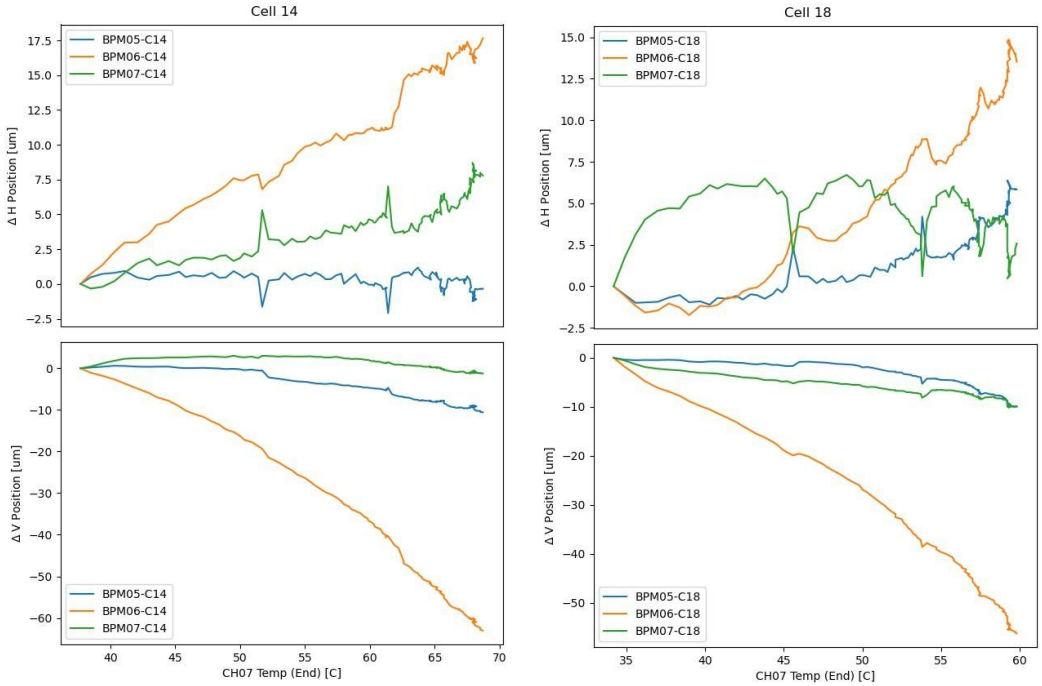
- BM18 regularly complain about source movements after beam loss, pressure increases seen on the ALU chambers.

- Cells 14 and 18 were equipped with thermocouplers -> confirmed heating (From ~27C to ~70C).
  - What is the impact on the BPM positions in this region?
  - How can we manage the situation to keep the source stable for the next run?



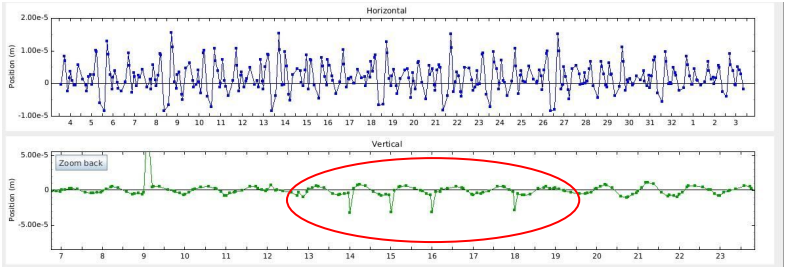
EFFECT OF HEATING ON BPM READINGS

- Cold machine. Inject 75mA in 16b.
- Correct tunes and orbit at high current.
- Switch off AUTOCOR and monitor the BPM readings.



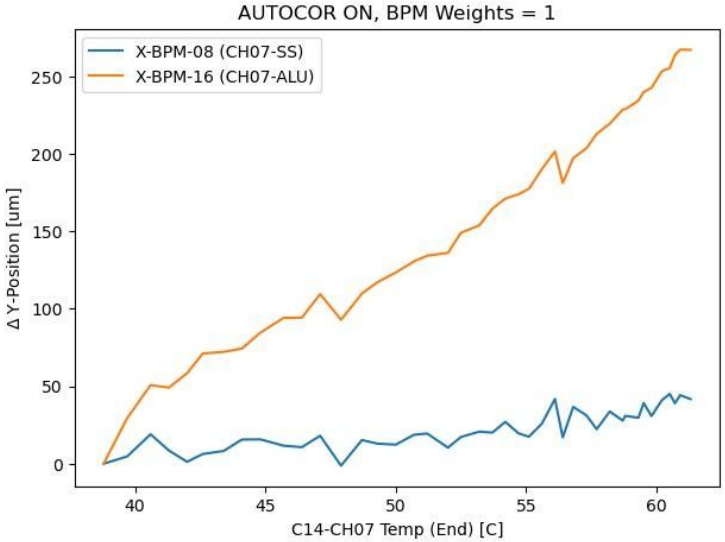
CH07 Temp (End) = CH07-AI-5

- Conclusions:
  - Only the BPM6 is drifting (adjacent to location of heating)
  - It drifts at an approximate rate of -2um/C in vertical.
  - We only made this measurement for 2/4 ALU chambers, but the drift sizes are of similar magnitudes.



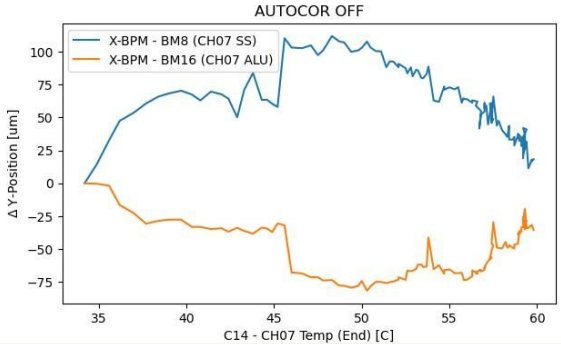
IMPACT ON SOURCE STABILITY

- **We have 2 XBPMs (BM08 and BM16).**
- **Inject 75mA in 16b into a cold machine, AUTOCOR ON**
  - **Monitor the XBPM position (which is at 23m from the source) to see how much the beam is moving.**



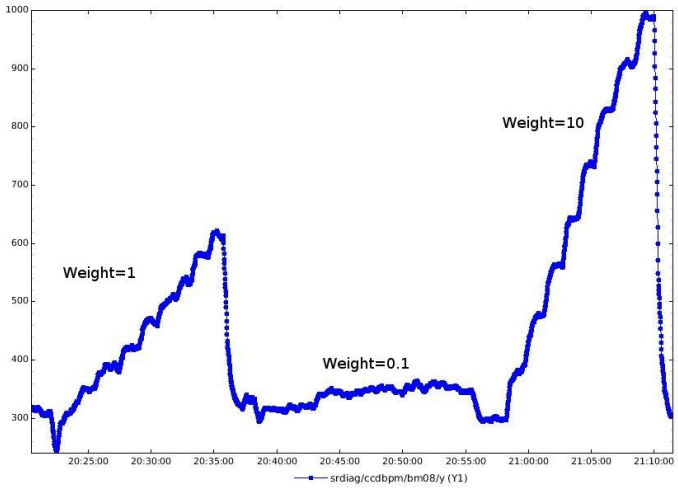
**Having showed that the effect of the temperature increase is similar in all ALU cells. We can plot the C14 temperature as we do not have temperature measurements in C08 or C16.

Machine thermalisation also causes some drifts. This was the XBPM signal taken from the first measurement with AUTOCOR OFF



BPM WEIGHTS

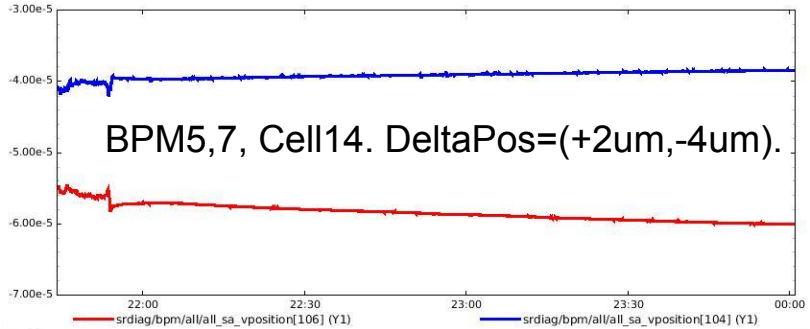
- We know that only BPM6 is drifting, so we can imagine reducing the weight on this BPM to reduce the movement on the source.
- We should not reduce the weight of the BPM6 in Cell16, because we have the BPM7 disabled due to trapped modes. So we artificially drift the BPM6 in Cell08 (where we have the other XBPM) by modifying the BPM offset.
- 4 scans, approximately linear growth in each case. Reducing the BPM6 position by -40um (+20C in delta T) in steps of -5um.
- As expected, if we reduce the weight of this BPM, then the drift is taken into account less and the source position is more stable.

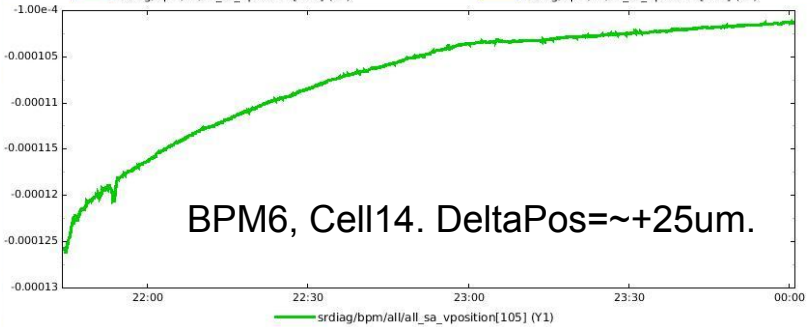


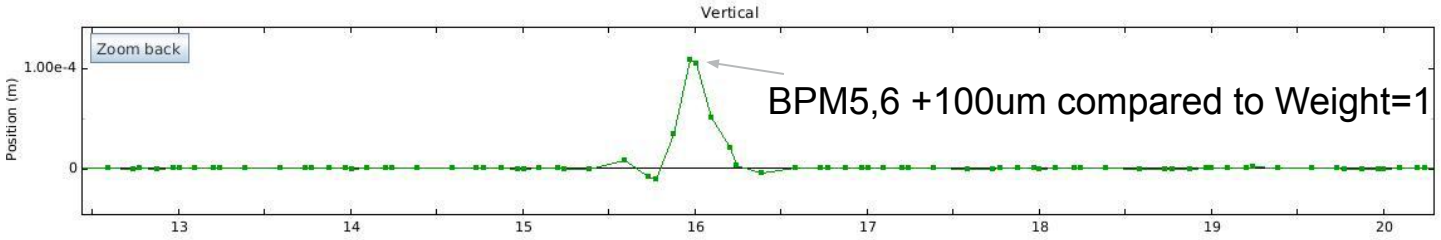
BPM Weight	Total Delta of XBPM [um]
0.1	20
0.5	108
1.0	317
10	691

USM?

- Ran overnight on 24th-25th March with 3/4 of the ALU chambers with BPM6 weight set to 0.1. (Cell 14, 15, 18).
- BPM6 drifts can now be observed as AUTOCOR not taking them into account (mostly). All BPM6s increased by 25um in first few hours of USM
  - Chambers are cooling as 7/8+1 is colder filling pattern than 75mA in 16b.
- No impact on lifetime or orbit seen.
- Reducing weight of BPM6 in Cell16 (with BPM7 disabled), gives large orbit distortion over whole cell.







CAN WE STILL DO THE BUMP WITH BPM6 REMOVED?

- Need to be able to set an angle bump for the BMs without BPM6. Made a test in Cell 08 (as they already have a bump).
- For both BPM weight=0 and BPM6 removed completely, we saw that the bump could be set correctly.
- We recommend to remove the BPM6 from Cells 14, 15 and 18.