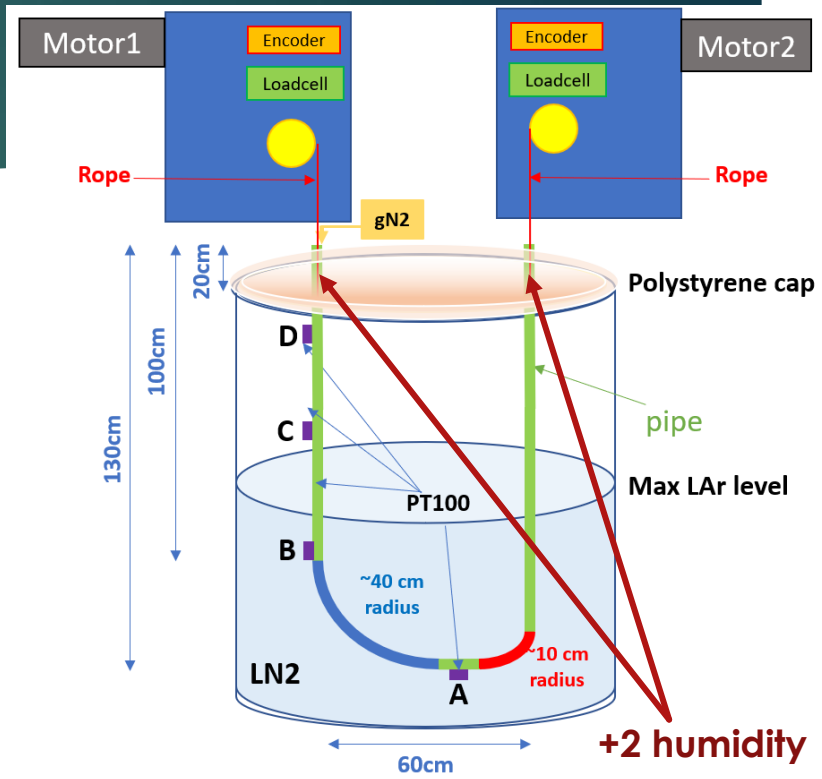
LAr tests

FROM 03/07 TO 07/07

Lucas

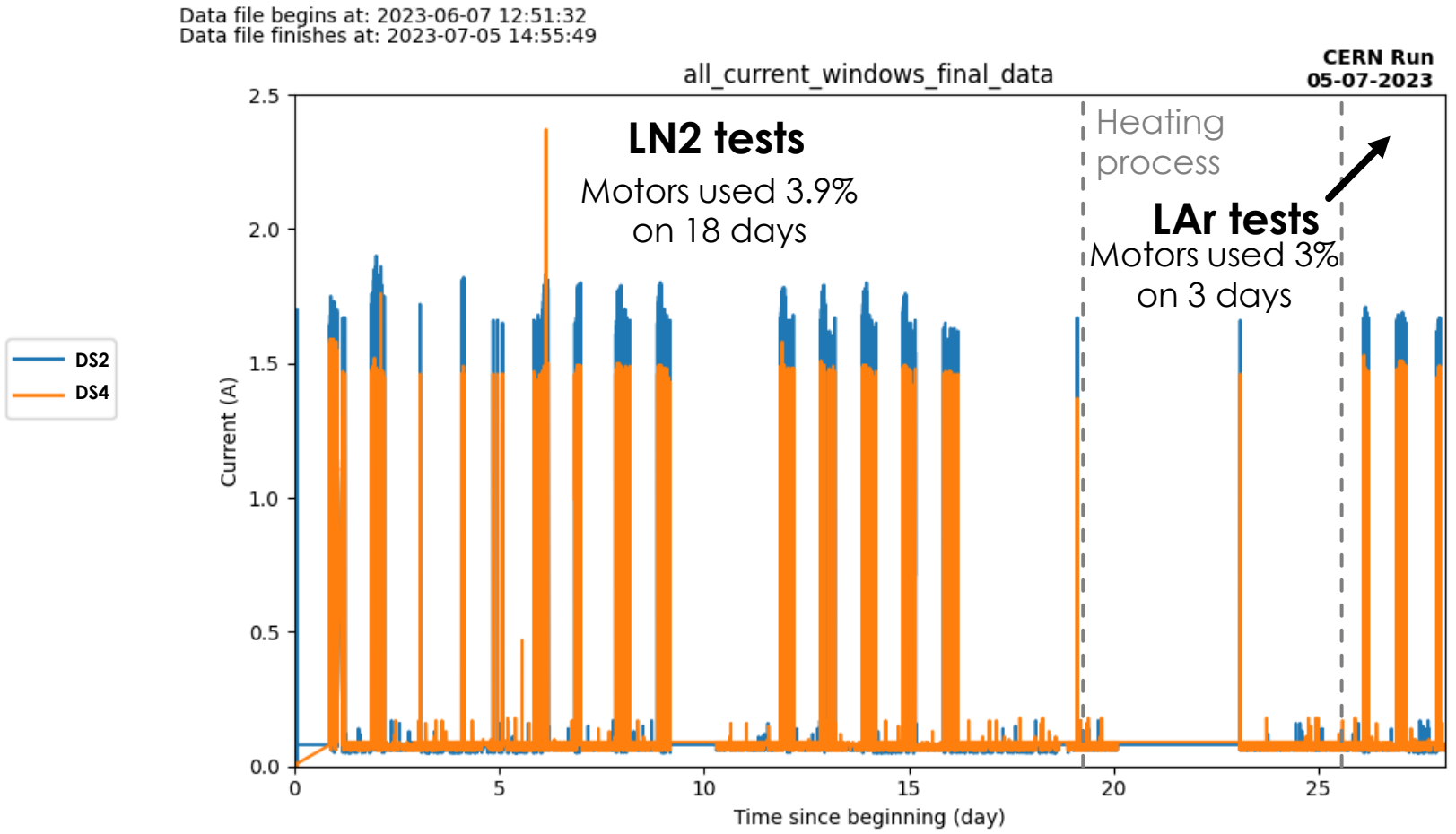
Summary :

Date	Hour	Ice Formation	°C	Tension before any test (N)	Voltage (V)	Current (A)
Mon – 03/07	13:35	None	A,B at -183,95°C (LAr) C -145 D -68	DS2 : 5 DS4 : 5 (relaxed)	DS2 : 24 DS4 : 24	DS2 : 0.08 DS4 : 0.09
Tue – 04/07	10:50	Intended	A, B LAr Temperature C -137.37 °C D -66,51°C	DS2 : 15 DS4 : 5 (not relaxed)	//	//
Wed – 05/07	14:21	Intended	A, B LAr Temperature C -130.71 °C D -63,13 °C	DS2: 20 DS4: 5 (not relaxed)	//	//
Fri – 07/07	14:00	Same	A,B LAr Temperature C -121.33 °C D -60,8 °C	DS2 : 25 DS4 : 7 (not relaxed)	//	//



DS4 (left) | DS2 (right)

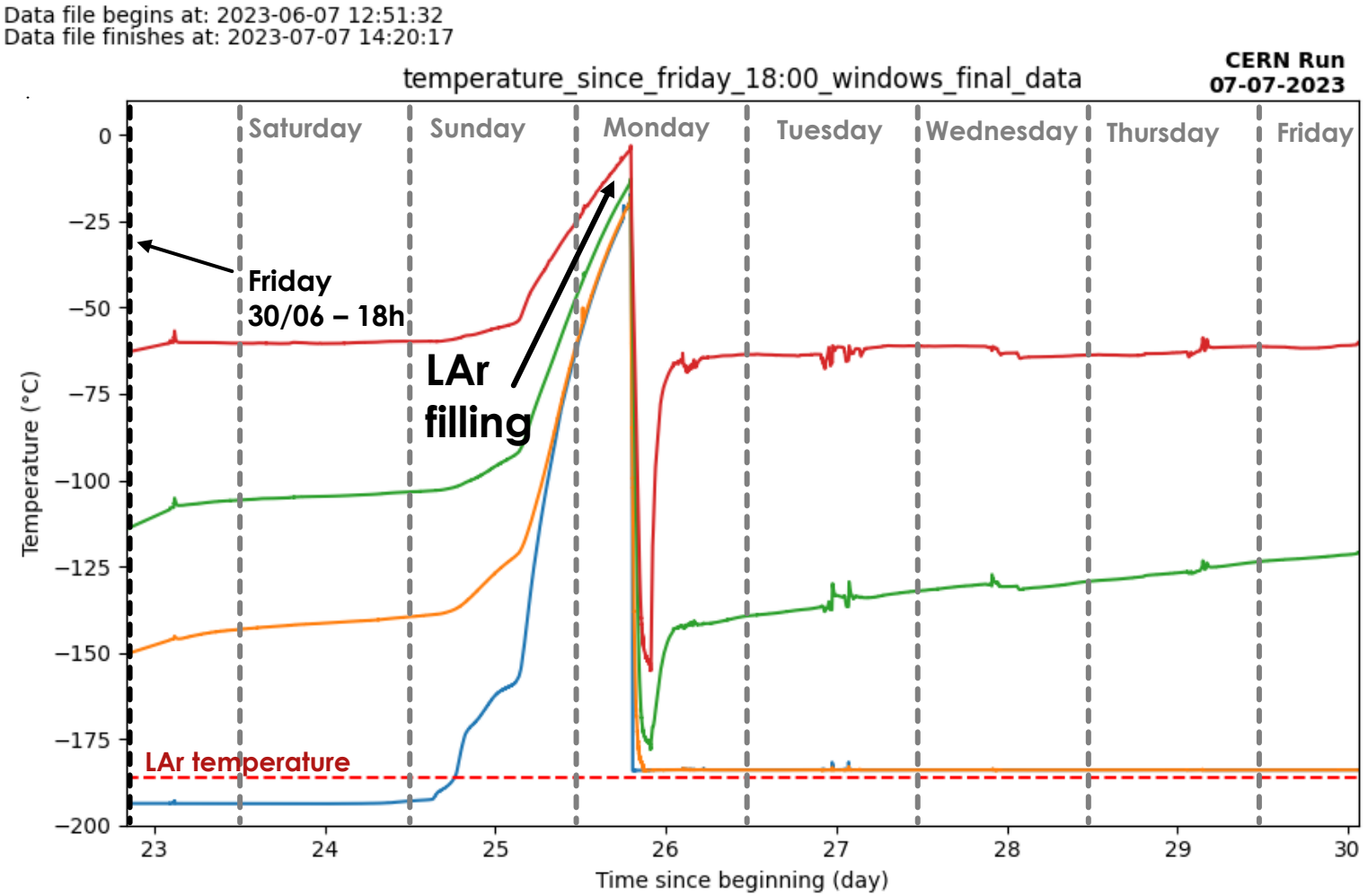
Current analysis



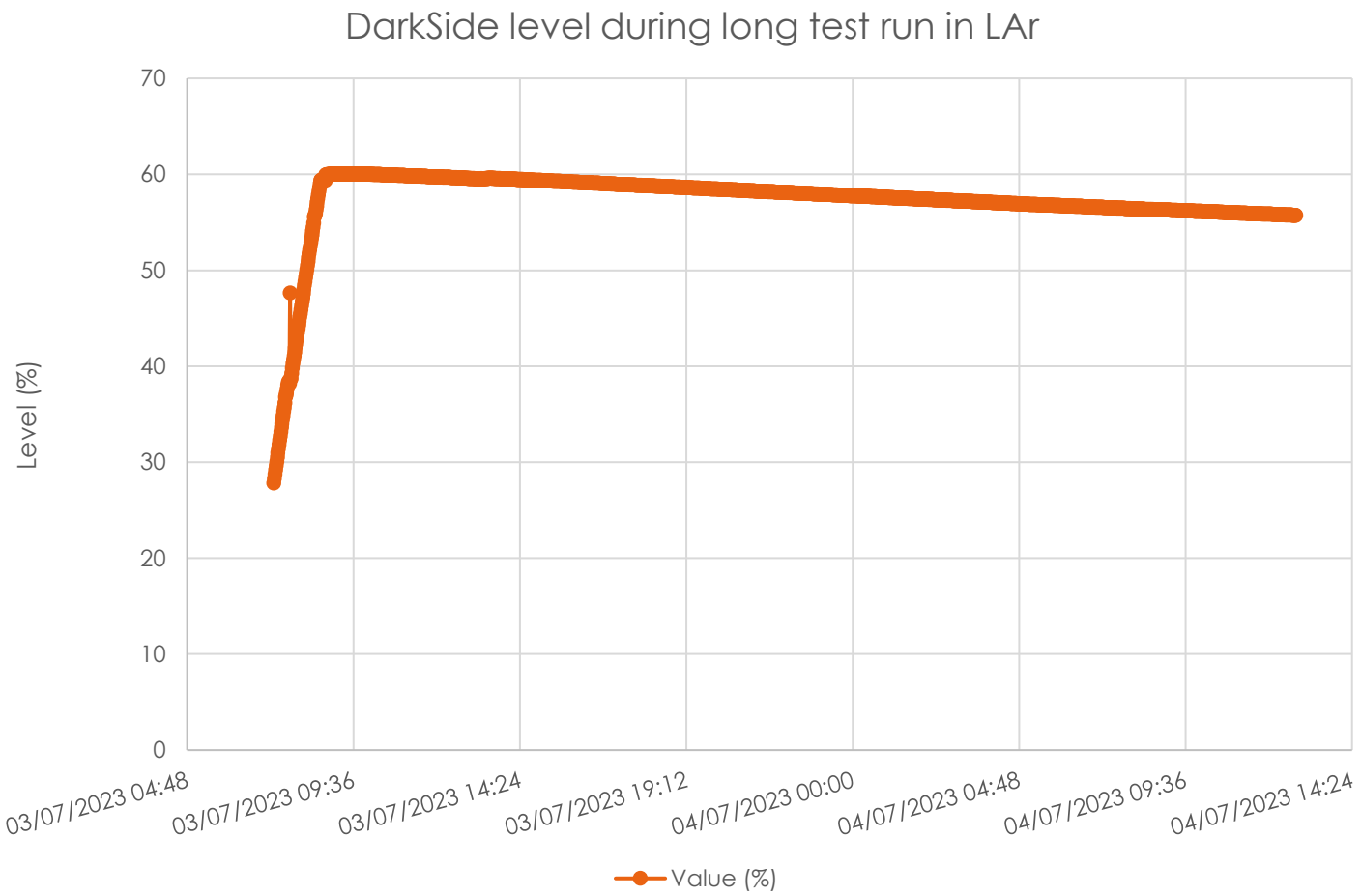
➔ **Motors used ~4% of the total time during LN2 tests**

Temperature changes since Friday 30/06 at 9AM

- Monday 26/06 :
  Start the heating process. Small heater placed in the tank.
- Thursday 29/06 :
  Heating process accelerated : larger heater inside the tank, lid of the tank removed
- Friday 30/06 :
  End of the active heating process, letting tank heat with ambient temperature.
- Monday 03/07 :
  Filling of the cuve with LAr



LAr in tank curve



Tank level **decreasing linearly (around 4%/day)**

Flushing LN2 to see effect on ice :

Time	Monday 03/07	Tuesday 04/07	Wednesday 05/07	Friday 07/07
Right Side (DS2)				
Left Side (DS4)				
T shaped gN2 pipe	NO	NO	NO	NO
gN2 Total flow	**60 L/h**	**60L/h**	**120L/h**	**60L/h**
LN2 in tube	None	None	None	None
%LN2 in tank*	**61%**	**59%**	**54%**	**??**

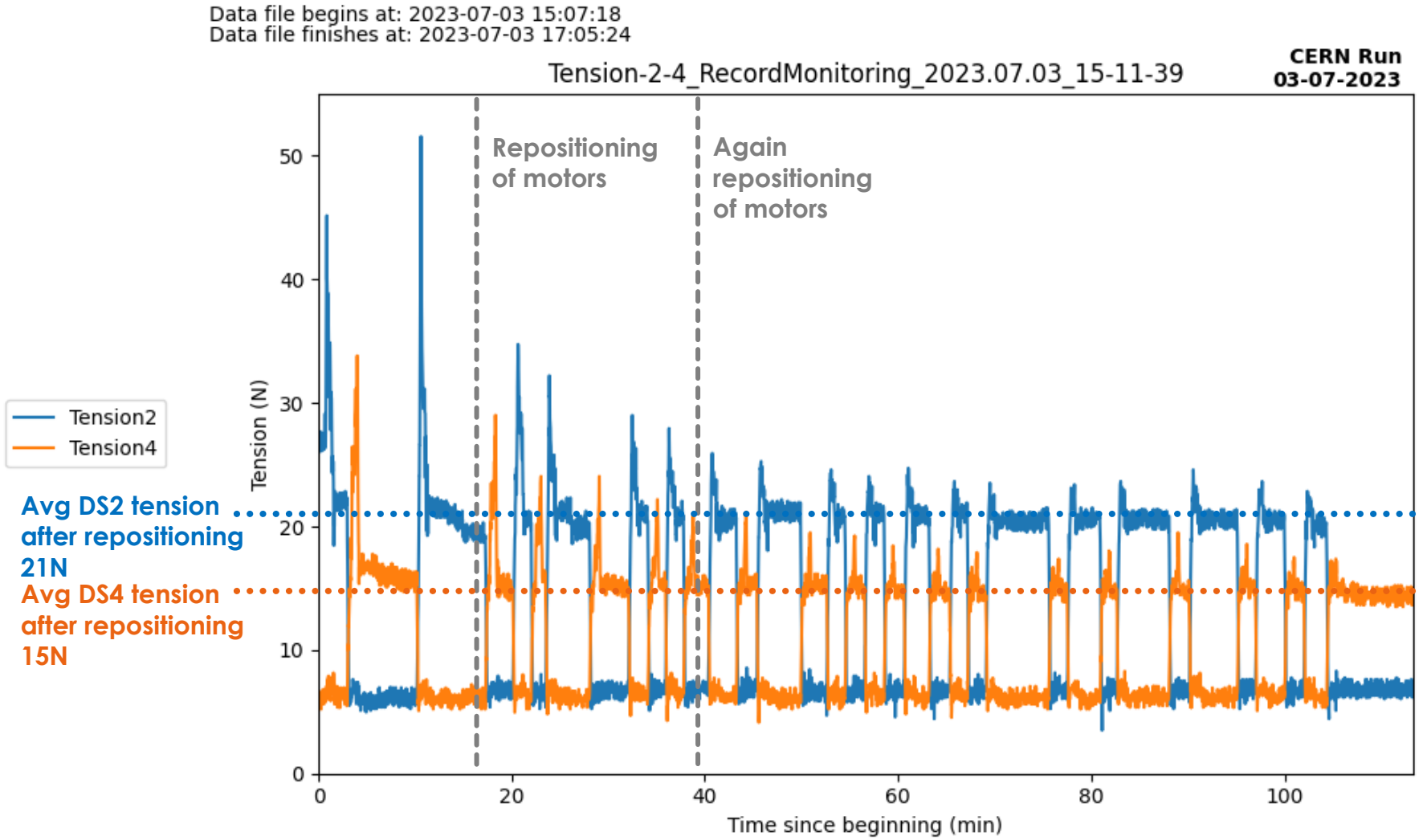
* No refill possible this time

Pictures are cropped to be visible so do not pay attention on sizes, more on shapes.

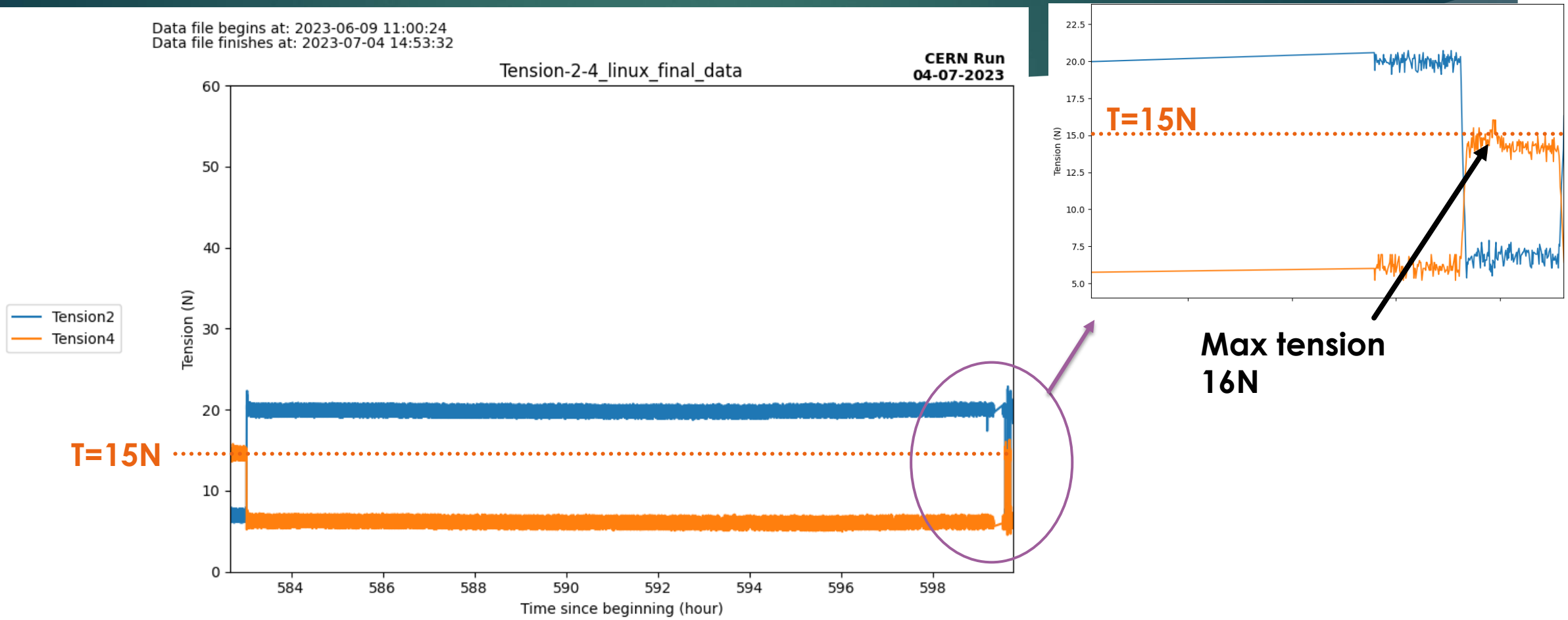
Tension during stress test 03/07

- At beginning, tension very high
  → Reposition of the motors to be in straightly in front of the cap centers
  → Once again after adding humidity sensors
- Tension value about same value as LN2 testing

➔ Tension value stable and comparable to LN2



Long stay test (one night)

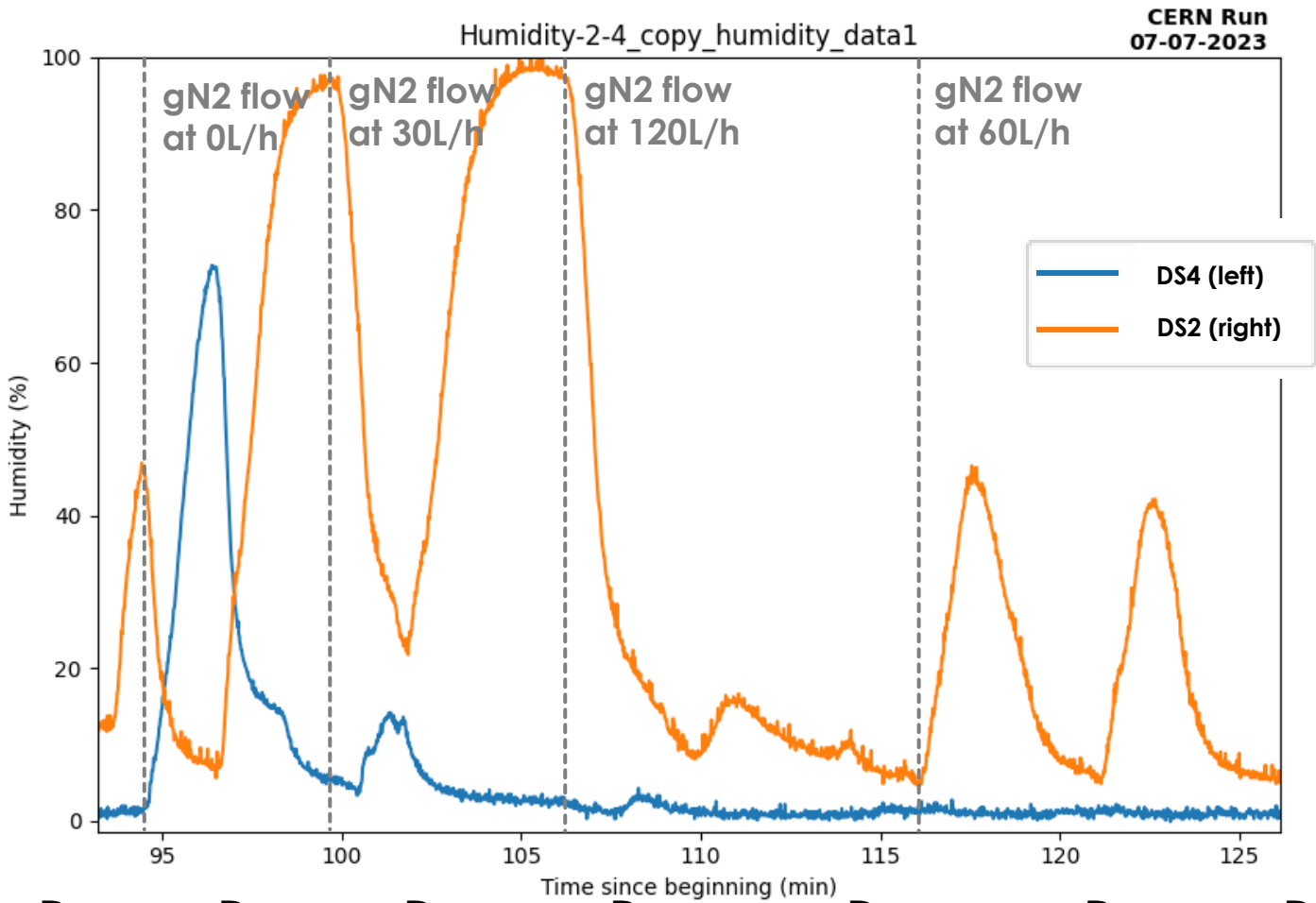


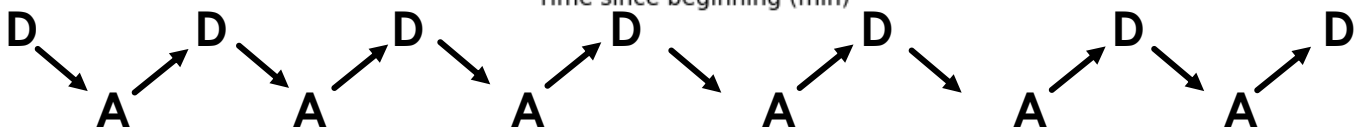
Source left at D for 16h, no high tension after moving it back to A (DS4)

Humidity test 1/3

- Regularly moving source from D to A to D, for different gN2 flow values
- Left Humidity rising only if gN2 < 30L/h
- Right humidity rise only if gN2 < 120L/h
  - No difference 0 and 30 L/h
  - Regular drop from 30L/h (80%) to 120L/h (~0%)

➔ **No humidity changes for gN2 flow at 120 L/h, no matter movement of pseudo-source.**

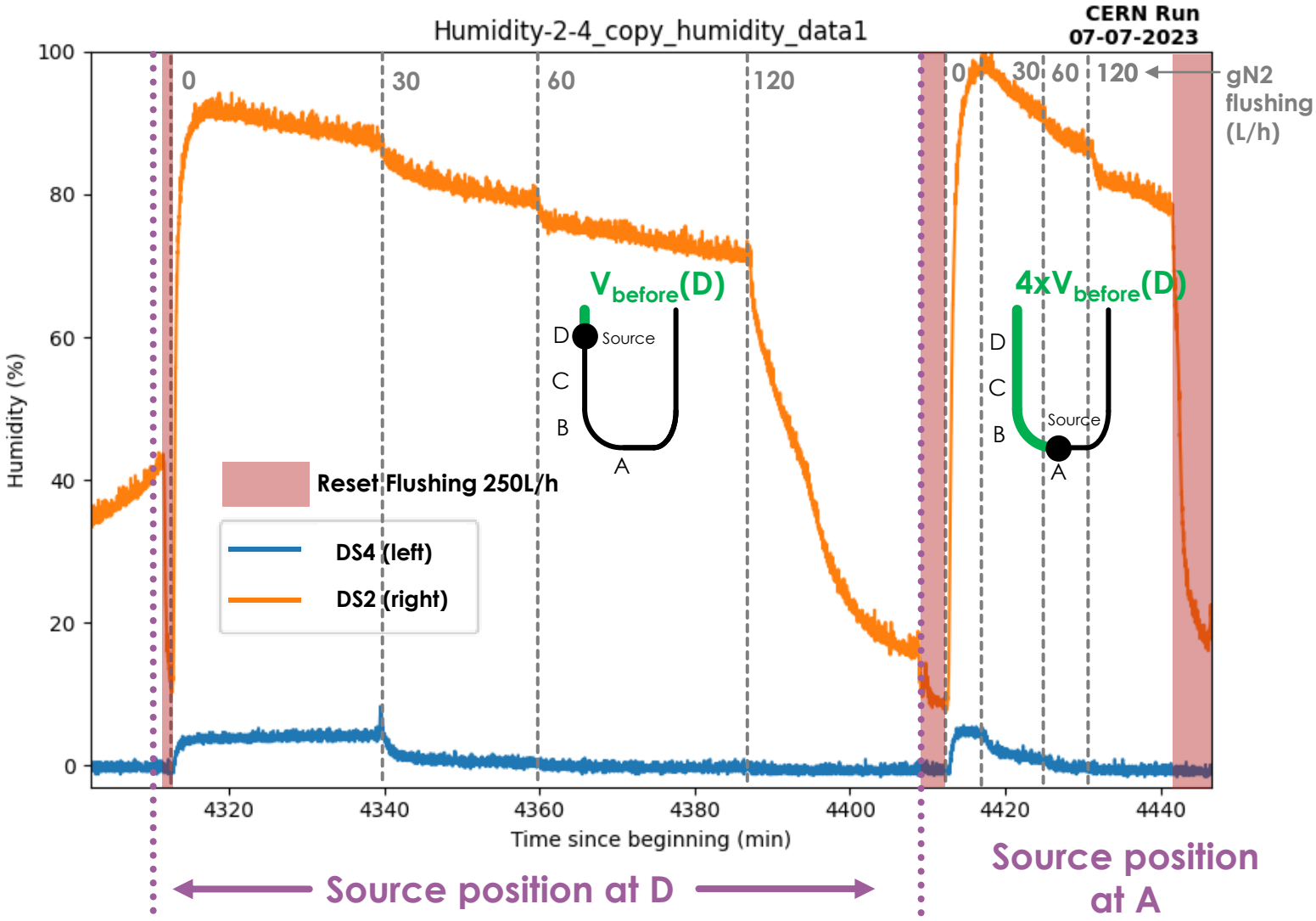




Humidity test 1/3 – Without moving source

- Vary gn2 flushing F and measure humidity when source at two positions : top-left (D), bottom (A)
- Determine F which remove humidity "instantly" (<=10min) → $F_{threshold}$
- Source Top-left : V_{before} small
  → $60 < F_{threshold} < 120$ L/h
  → **Measure : $F_{threshold}$ = 100L/h**
- Source Bottom: V_{before} larger
  → $120 < F_{threshold} < 250$ L/h
  → **Measure : $F_{threshold}$ = 150L/h**

→ **Assuming same scaling, $F_{threshold}$ for DS20k with source at bottom might be around 300L/h**



Humidity test 2/3

- Pseudo-source in position A
- Blow in tube from both sides to increase humidity at maximum and remove gN2
  = Extreme nonrealistic scenario

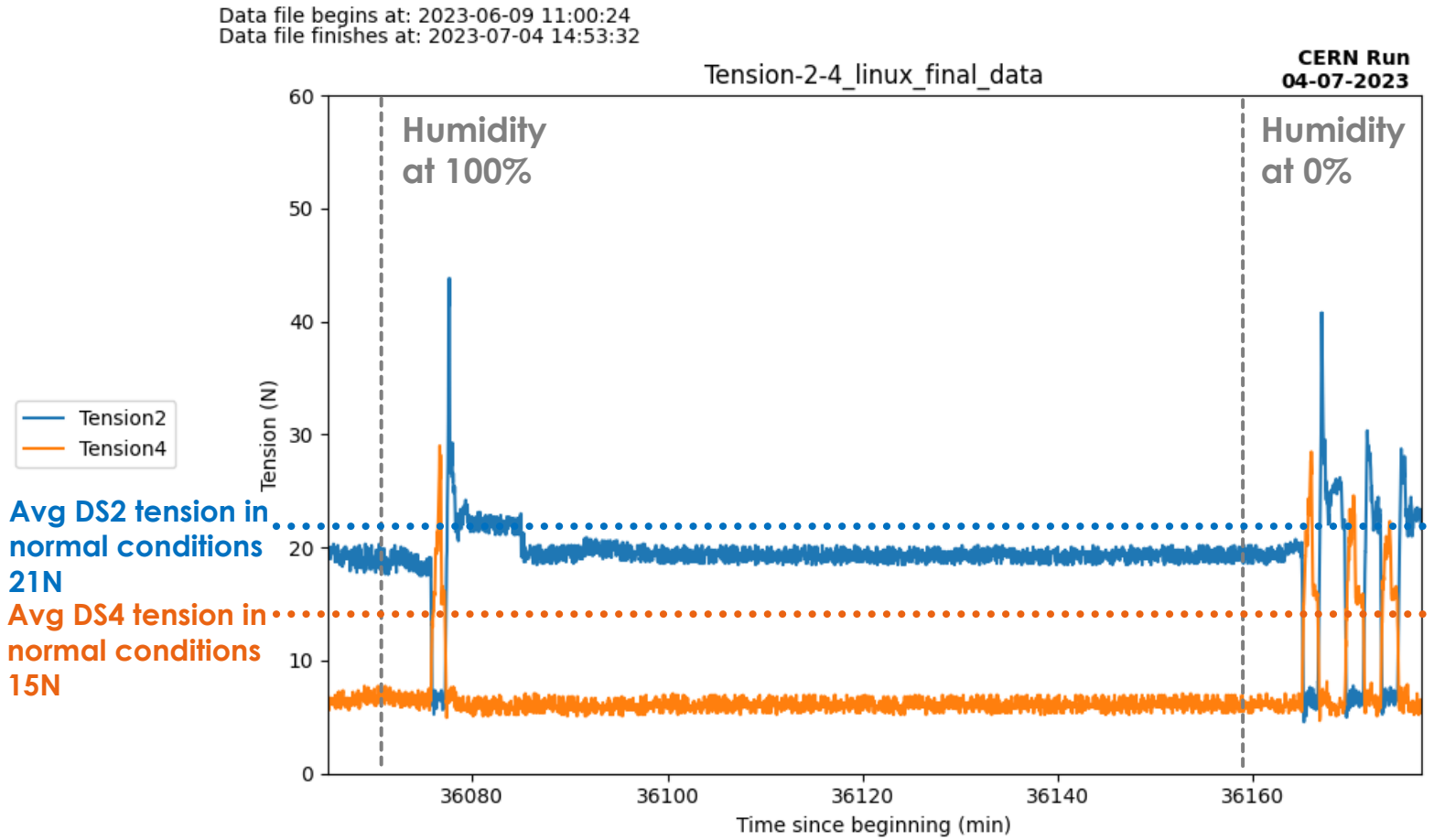
→ **After 5min, both humidity are at 100%**

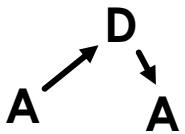
→ **A→ D → A : +23N/+15N wrt normal**

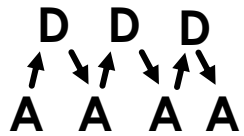
- After 15min, put back the top caps and gN2 at 120L/h

→ **After 1h30, both humidities at 0%**

→ **A→ D → A : +20N/+15N wrt normal but back to normal after 3 times**







Humidity test 3/3

- Pseudo-source in position B
- Blow in tube from both sides to increase humidity at maximum and remove gN2
  = Extreme nonrealistic scenario

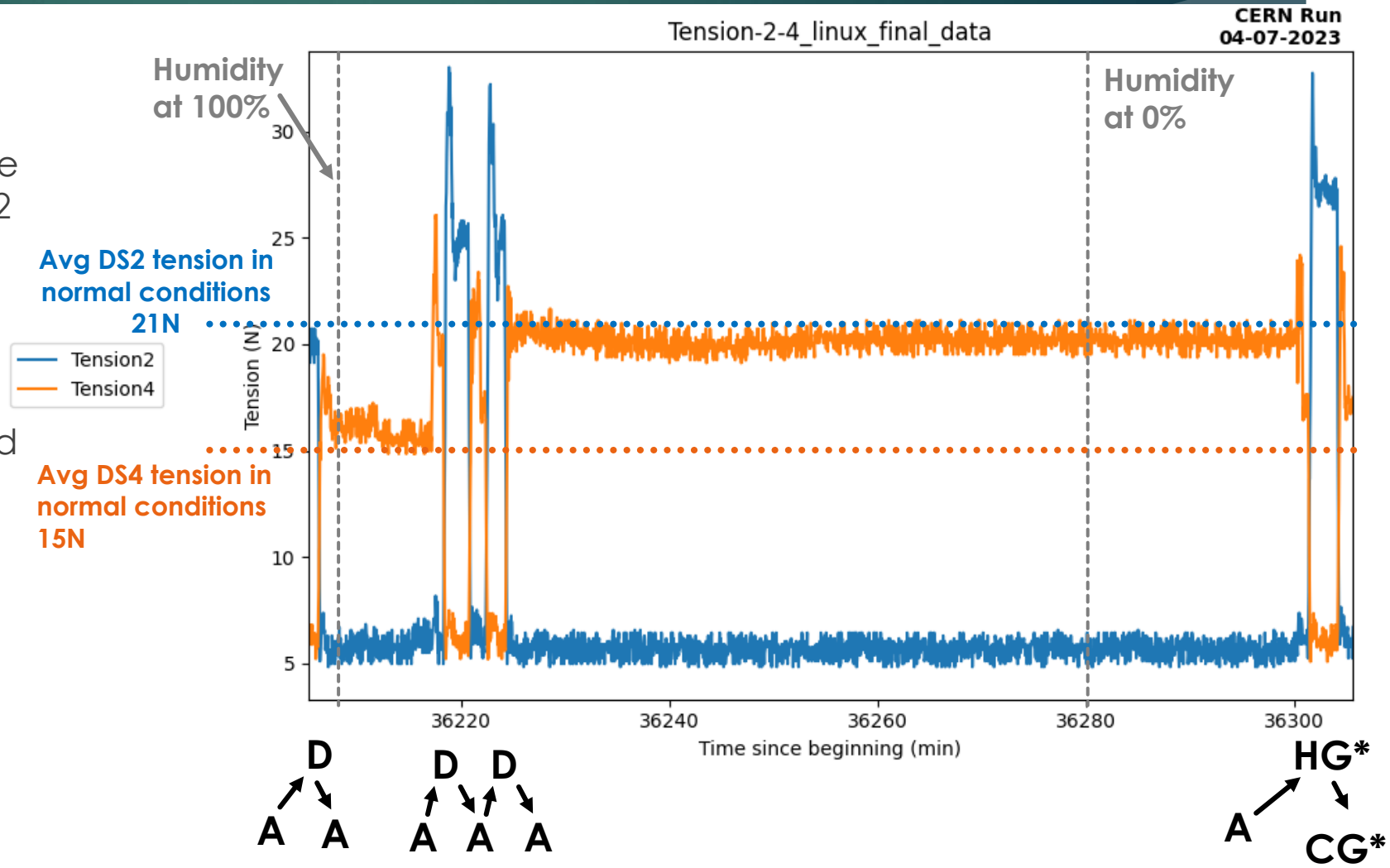
→ **After 5min, both humidity are at 100%**

→ **A→ D → A : +12N/+11N wrt normal**

- After 15min, put back the top caps and gN2 at 120L/h

→ **After 1h30, both humidities at 0%**

→ **A→ HG* → CG* : +12N/+9N wrt normal**



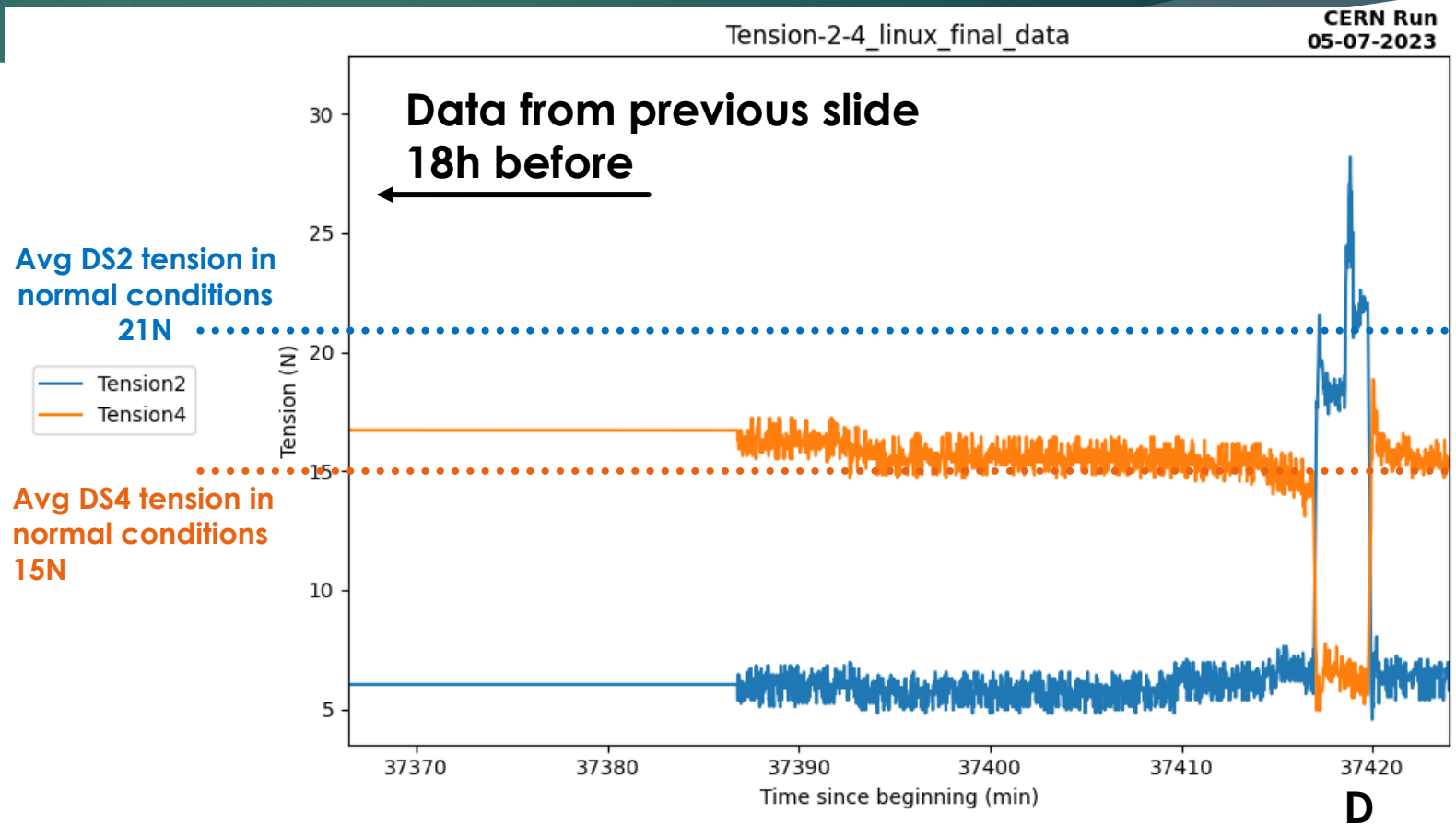
*HG : Hot Garage
*CG : Cold Garage

Humidity test 3/3 – After night

- Pseudo-source in position Cold garage for 1 night

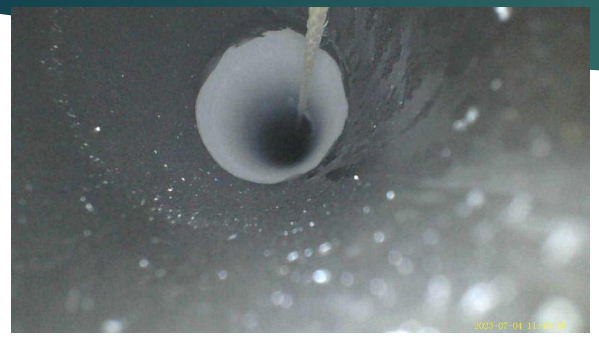
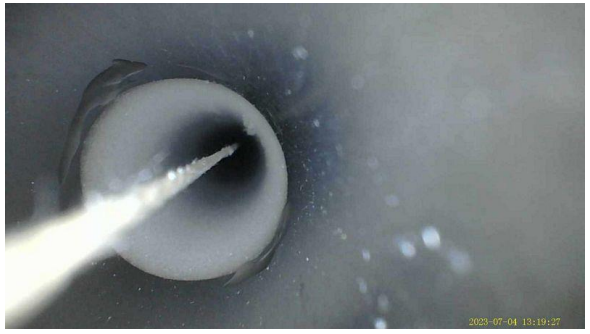
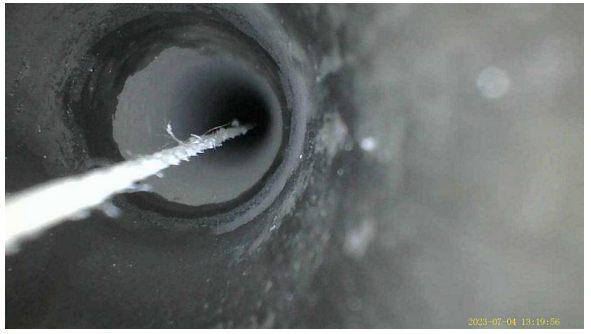
→ **CG* → D → A : +8N/+5N wrt normal**

➔ With long-time flushing, maximum tension due to ice formation decreases



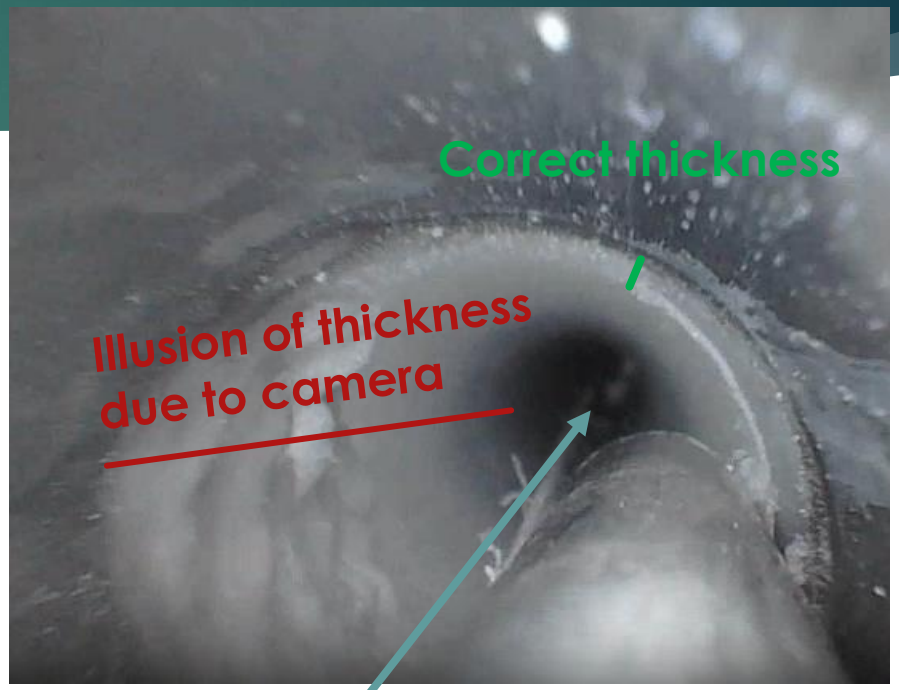
*HG : Hot Garage
*CG : Cold Garage

Endoscope pictures

DS4		DS2
	After long blowing (100% humidity)	
	After 1h 15mn of gN2 @120 l/mn	
	After 2nd long blowing (100% humidity)	

Ice/Frost identification DS2

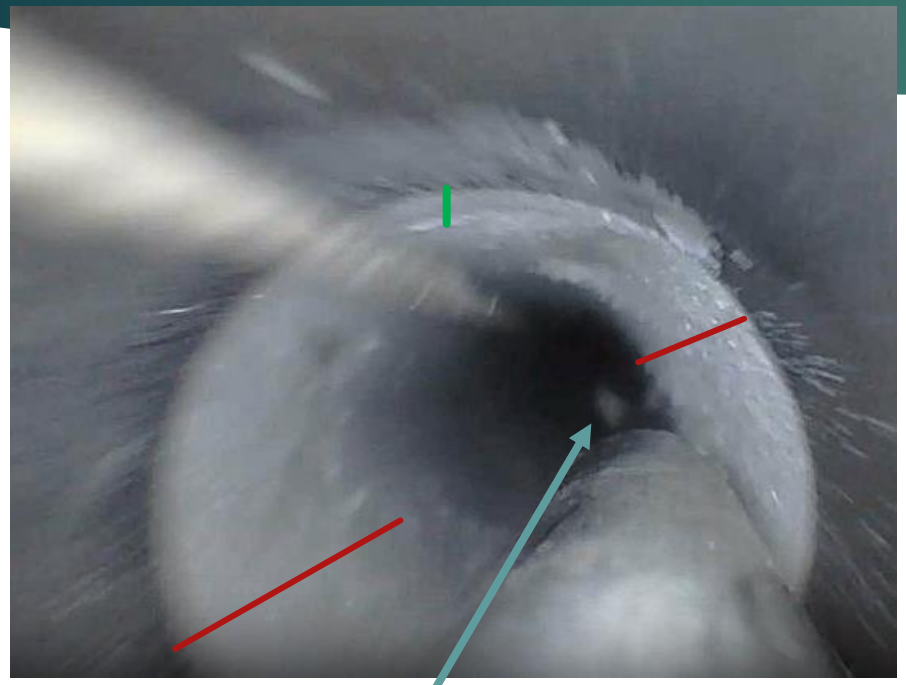
Soft frost removed with the stick

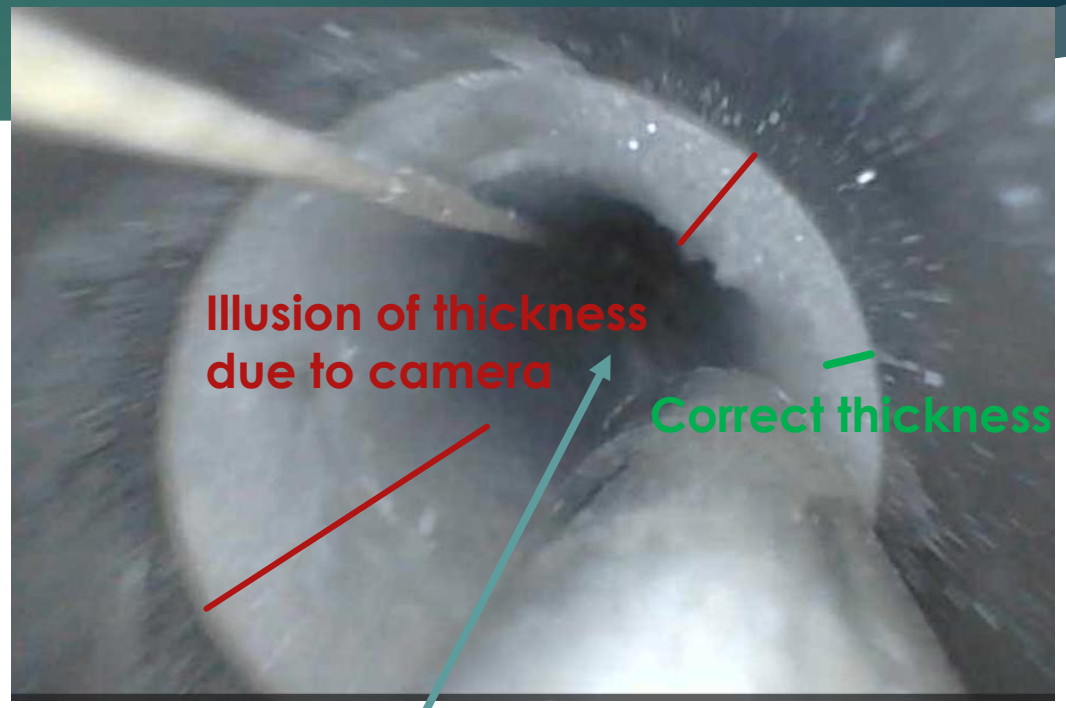


Frost pieces coming off

The top part is frost (~1mm thick)

Ice/Frost identification DS4





The top part is frost (~1mm thick)