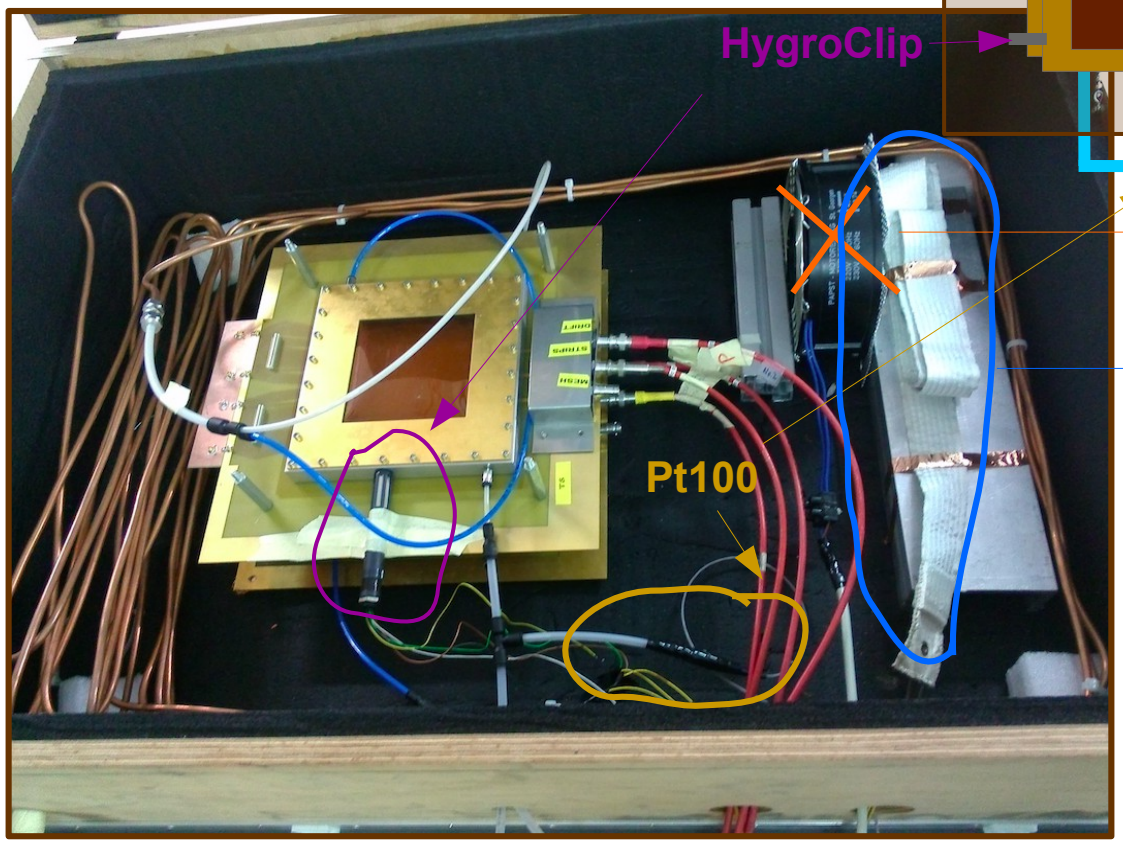
Temp test

Luigi Longo
Università del Salento Dipartimento di Matematica e Fisica "Ennio De Giorgi"
and Istituto Nazionale di Fisica Nucleare - Sezione di Lecce

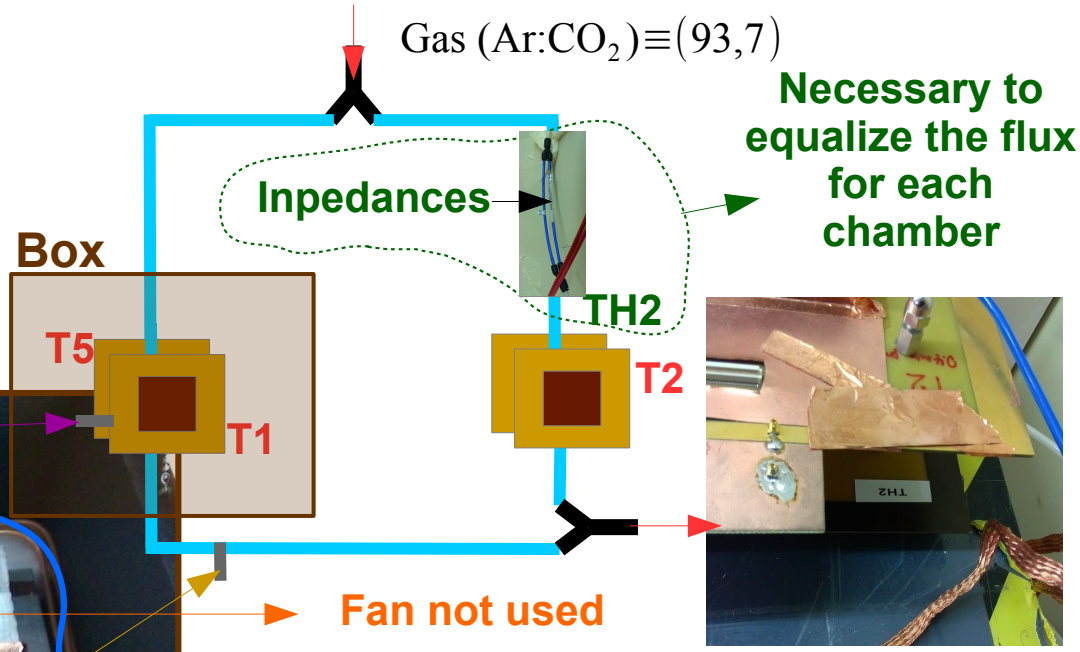
Temperature Test: Experimental Setup

MEASUREMENTS DONE @ RD51

- **Chambers** considered:
  T1, T2 and T5
- **HV:**
  520V for the resistive strips
  300V for the drift panel
- **Radiactive sources:**
  Fe55
- **Flux:**
  1l/h for T1,T2,T5



Gas Distribution Setup



thermoelectric strip-device connected to a potentiometer

T5:
- Resistivity of 5-10 MOhm/cm
- Irradiated @ GIF++

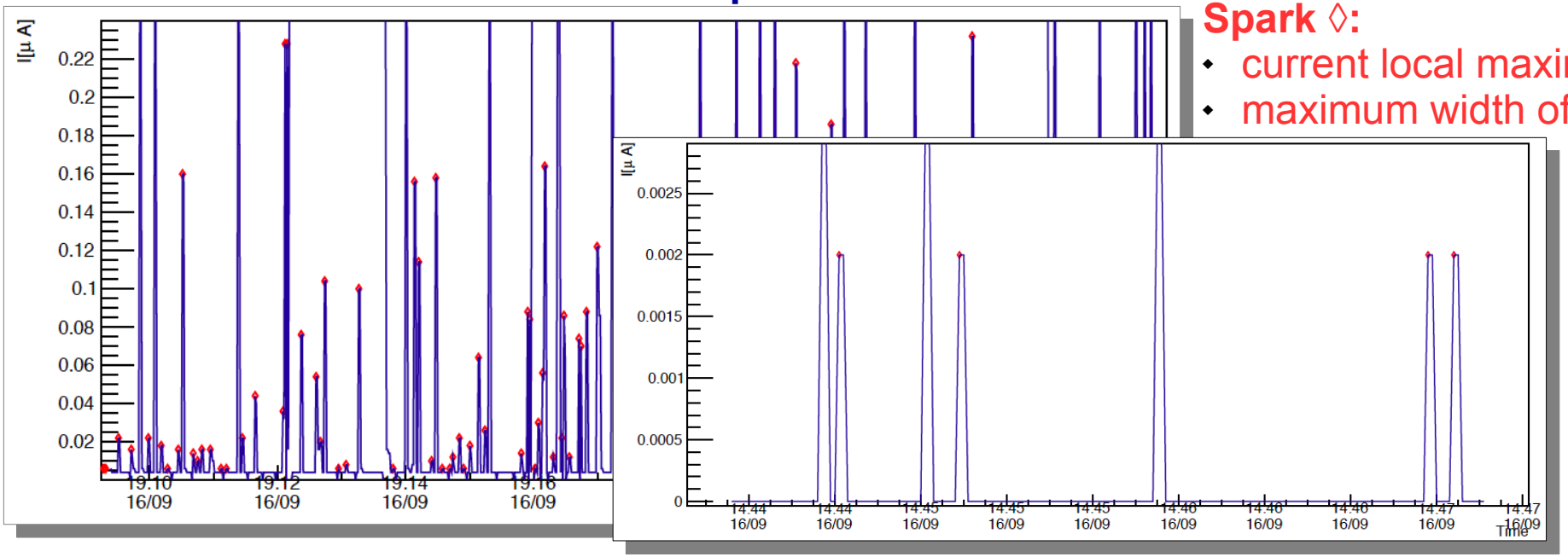
T1:
- Resistivity of 20-30 Mohm/cm
- Not Irradiated @ GIF++

Remark: A temperature gradient has been observed inside the box

Temperature Test: Data taking procedure

- Three heating and cooling cycles for T1 and T5:
  - 1st cycle:
    - Sparks rate measured for both the chambers while the temperature (**T**) increases (**RISE PHASE1**) or decreases (**DROP PHASE1**) [T5 on top]
  - 2nd cycle:
    - Sparks rate measured for both the chambers while the temperature increases (**RISE PHASE2**) or decreases (**DROP PHASE2**)
    - Iron 55 spectrum measured using T5 chambers as function of the temperature [T5 on top]
  - 3rd cycle:
    - Sparks rate measured for both the chambers while the temperature increases (**RISE PHASE3**), is stable (**PLATEAU PHASE3**) or decreases (**DROP PHASE3**)
    - Iron 55 spectrum measured using T1 chambers during RISE PAHSE3 and DROP PAHSE3 [T1 on top]

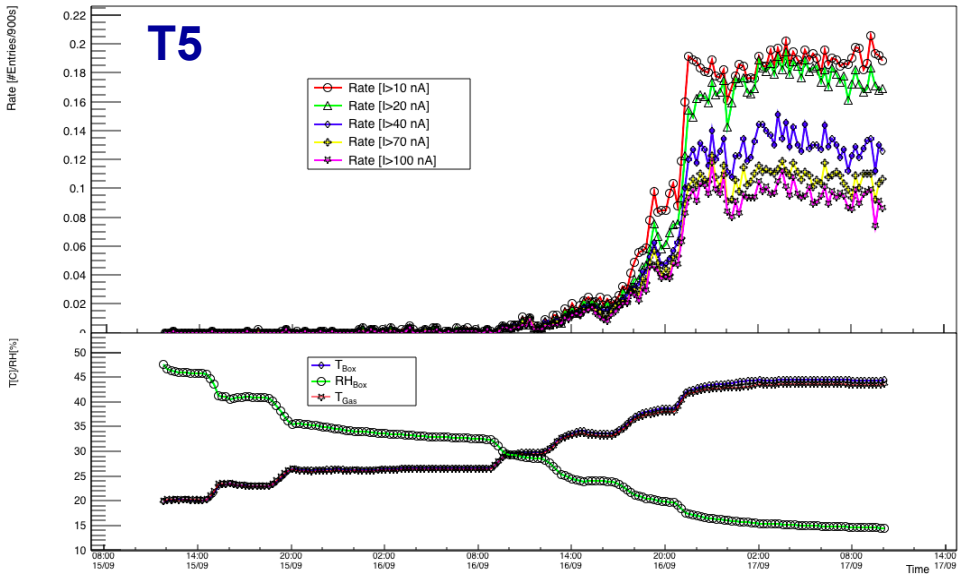
Sparks definition

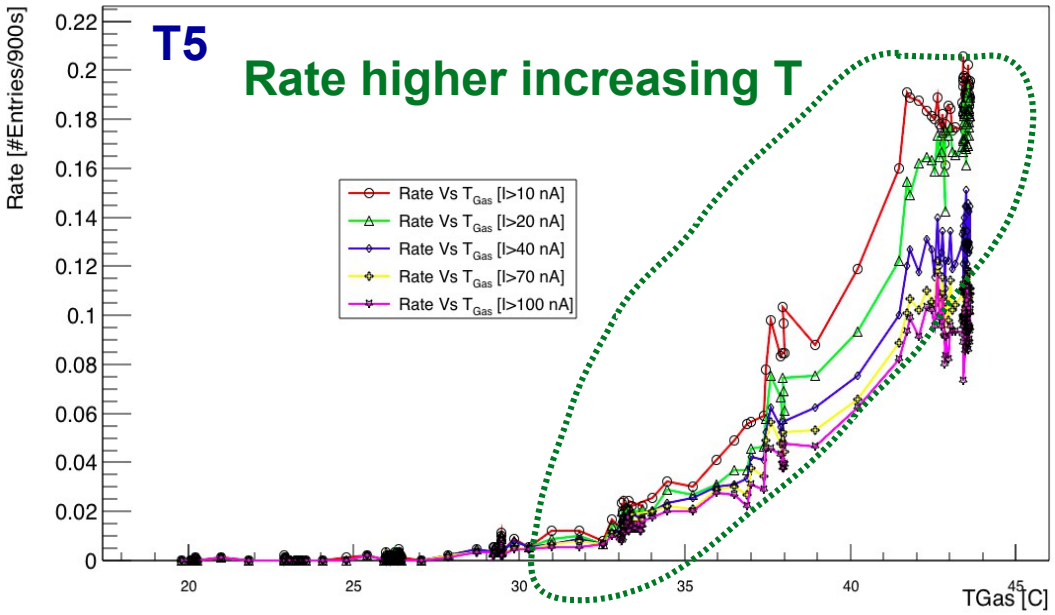


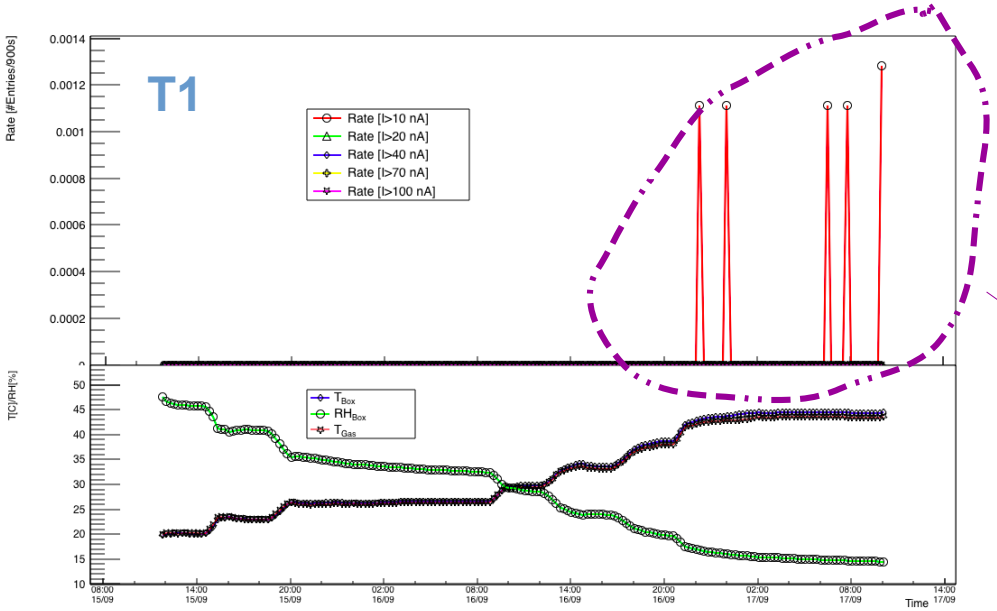
Spark ◊:

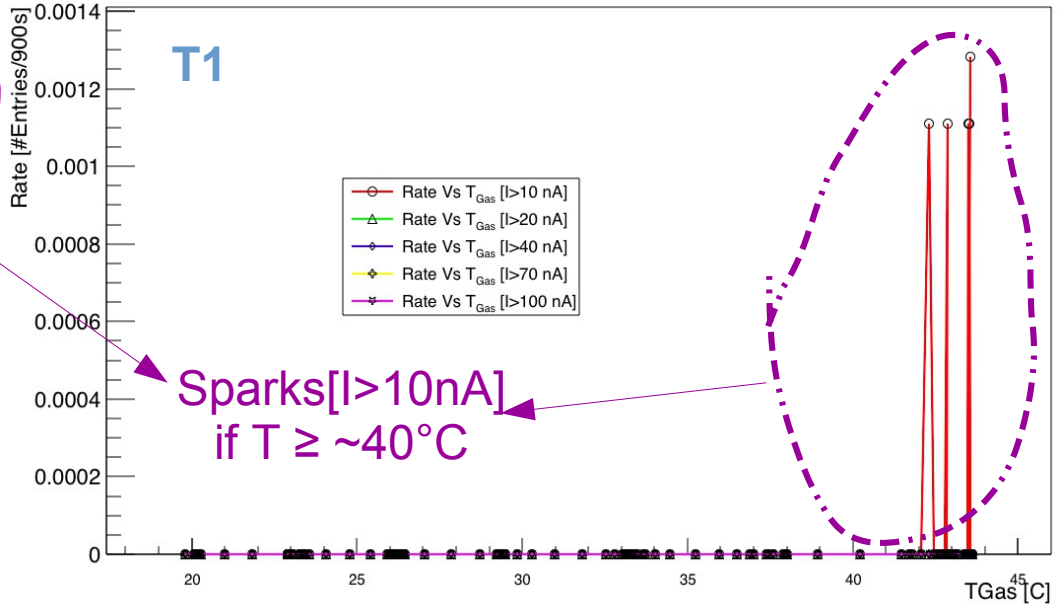
- current local maximum
- maximum width of 5 sec

Temperature Test: 1st cycle – RISE PHASE1



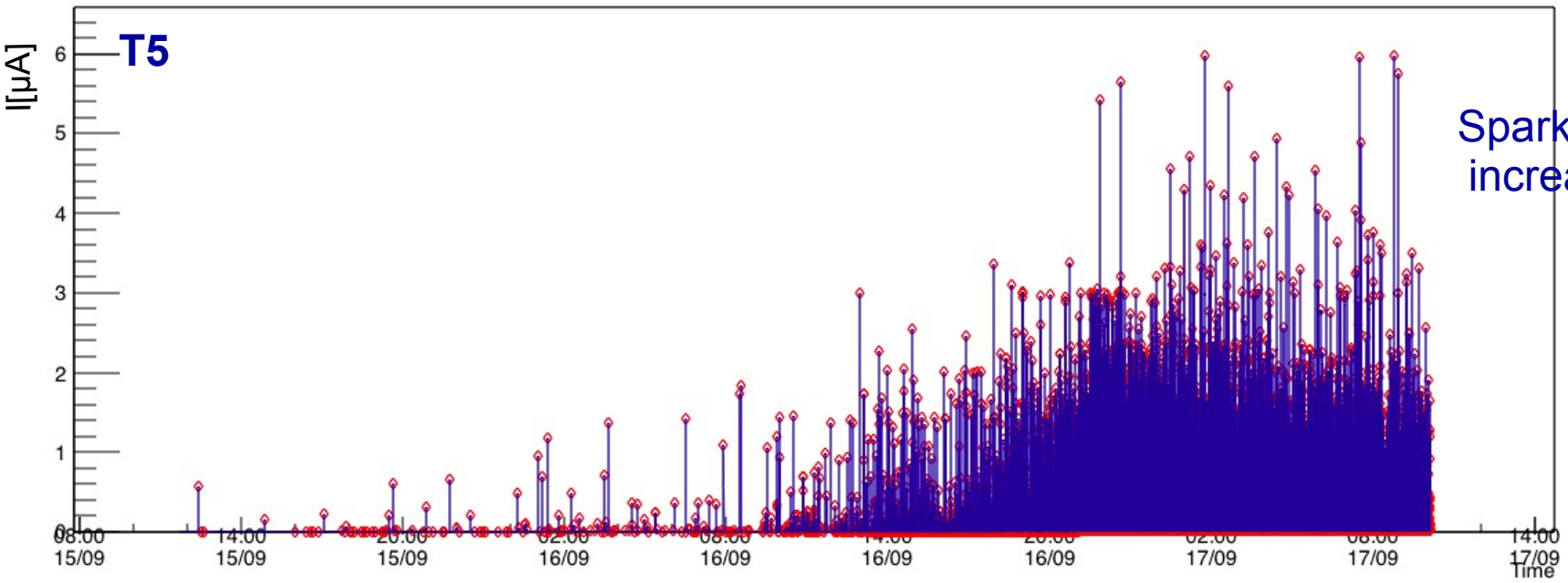




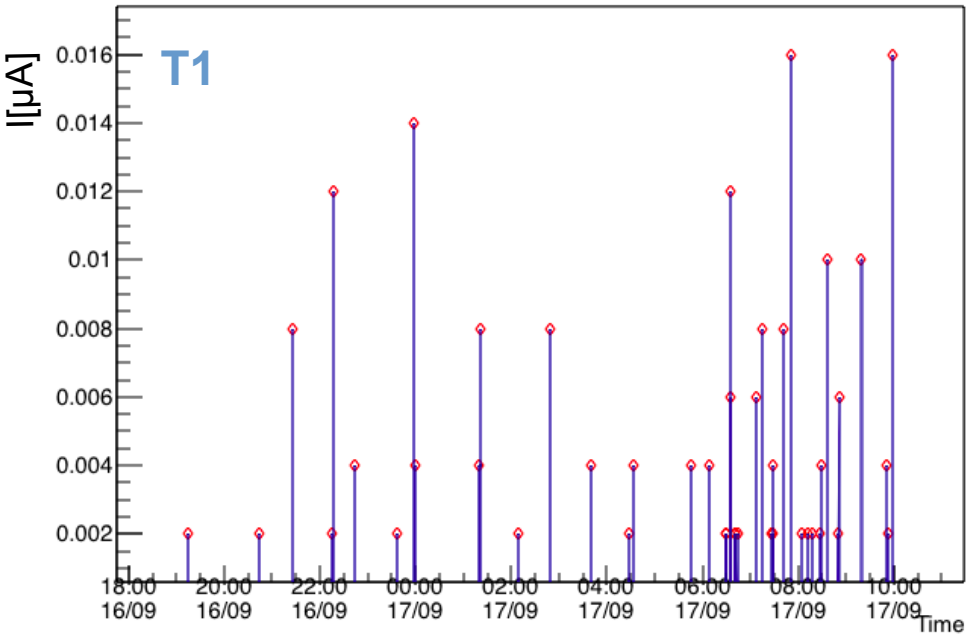


Remark: T1 at the bottom of the box → T1 should be at lower temperature wrt T5

Temperature Test: 1st cycle – RISE PHASE1



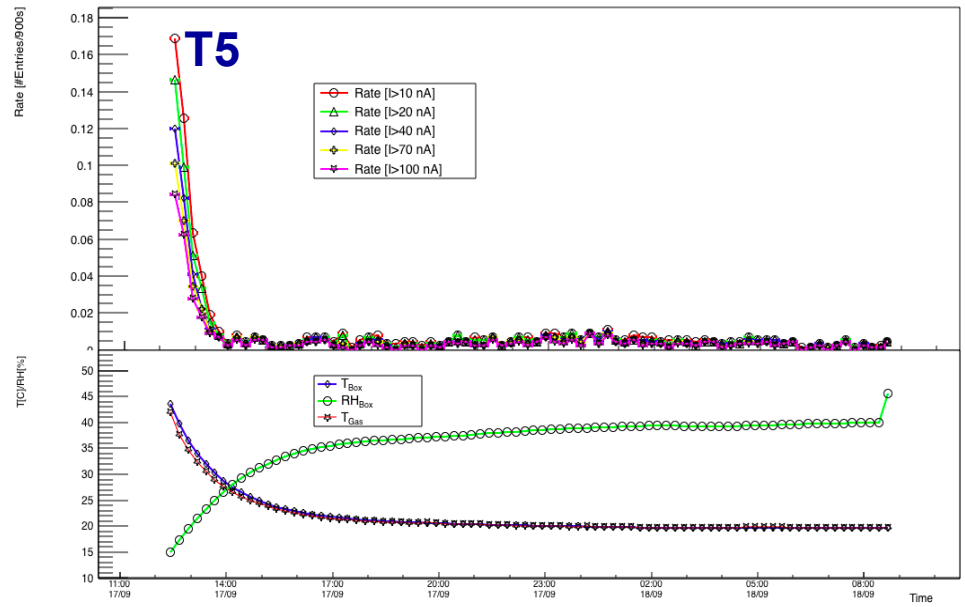
Sparks amplitude increases with T

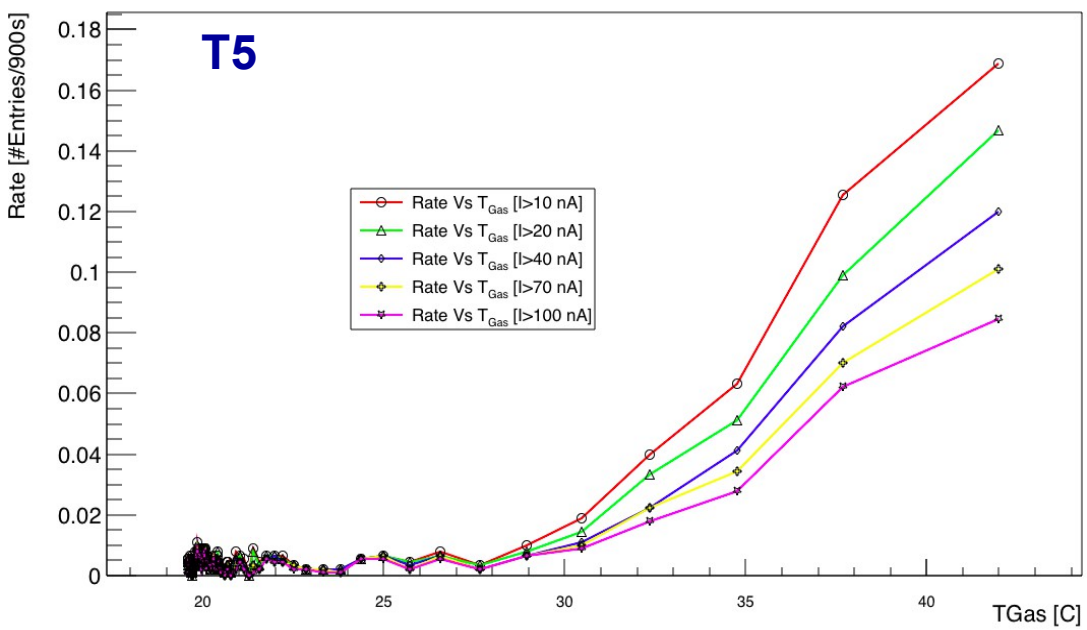


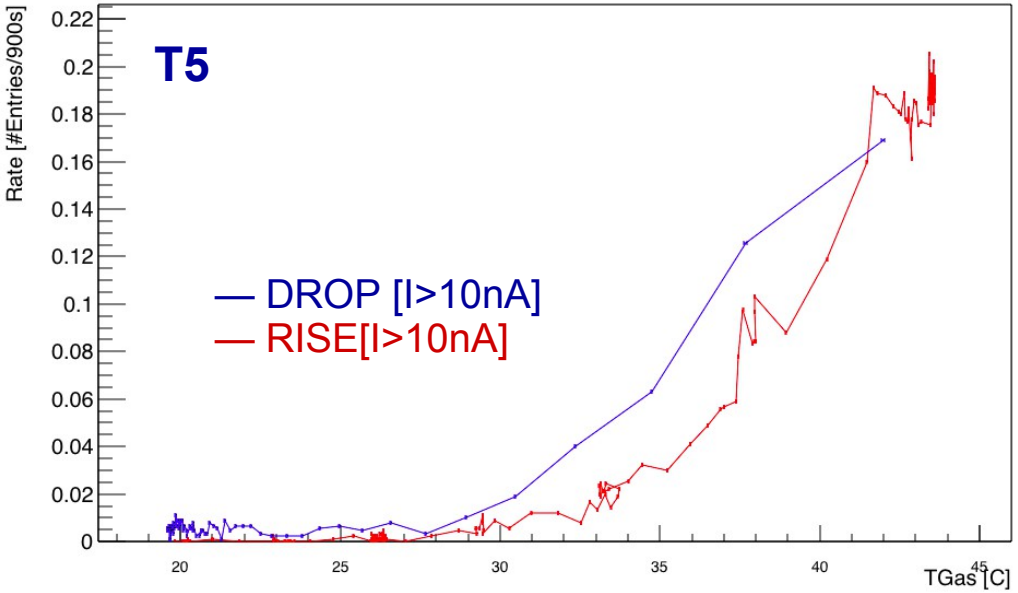
- Few nA for each spark
- Different order of magnitude

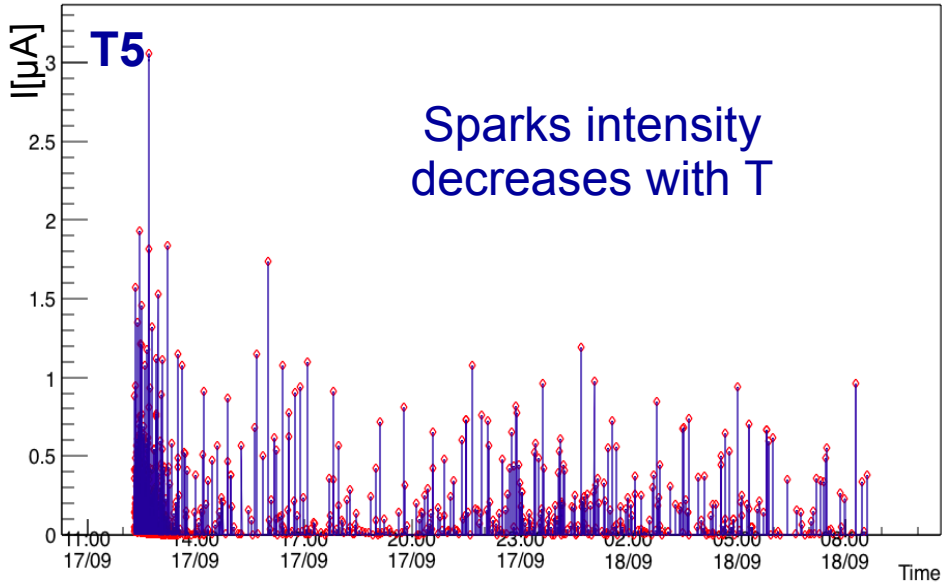
Temperature Test: 1st cycle – DROP PHASE1

Chambers kept at high temperature for more or less 12 h before the DROP PHASE1





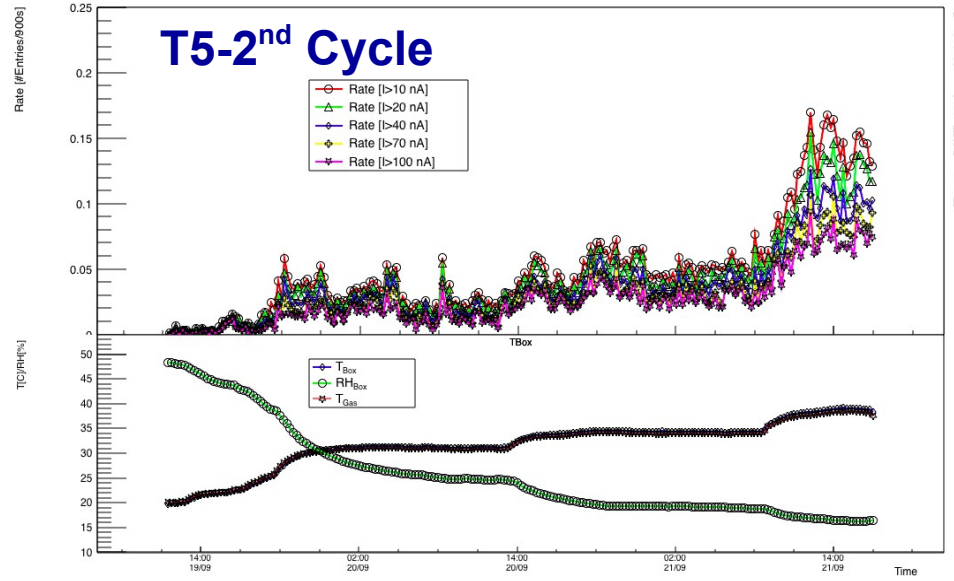


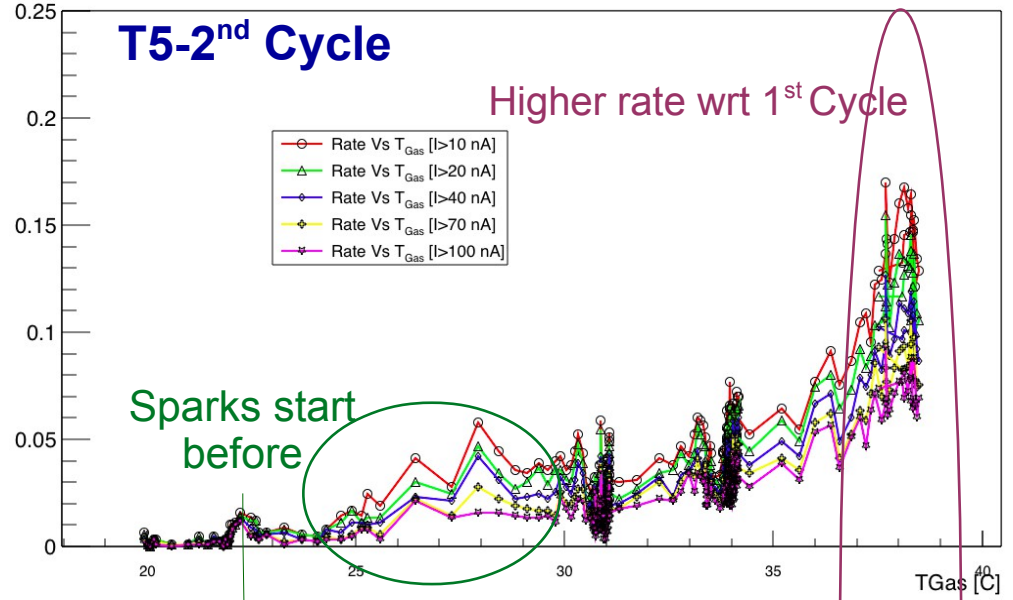


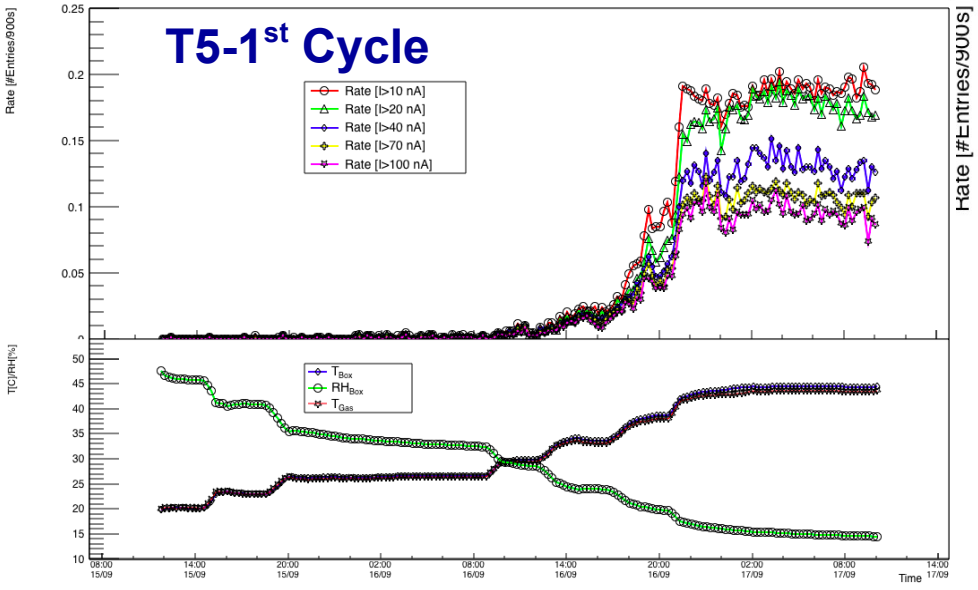
!!! T1: too few sparks to see a trend

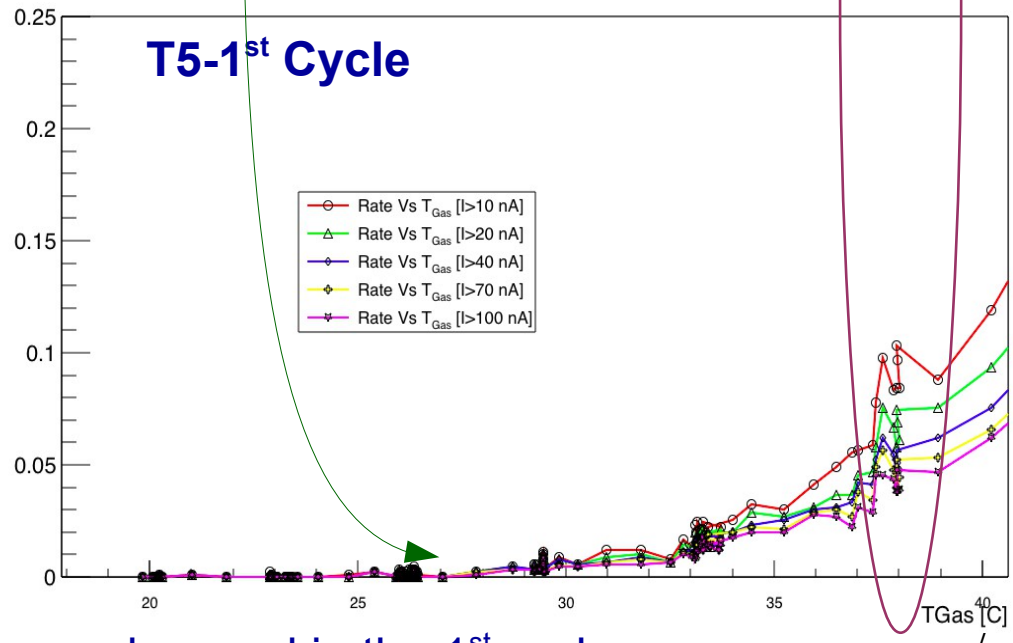
Temperature Test: 2st cycle – RISE PHASE2

55Fe on top of T5





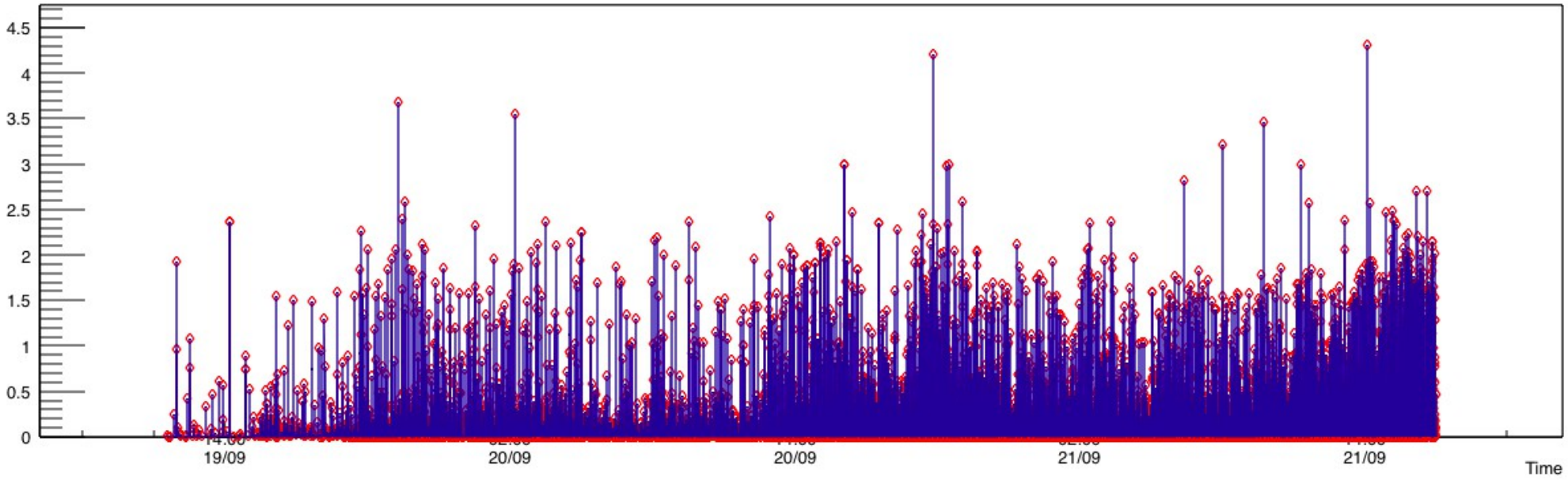




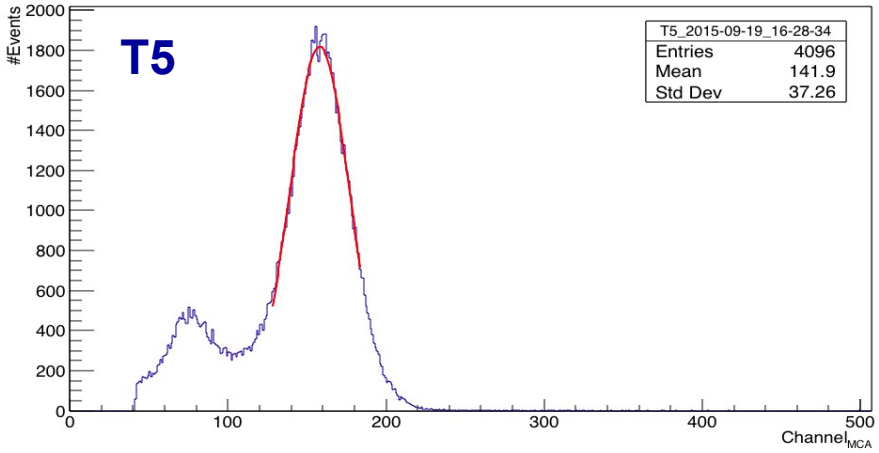
T1 behaviour similar to what was observed in the 1st cycle

Temperature Test: 2st cycle - Spikes RISE PHASE2 plots

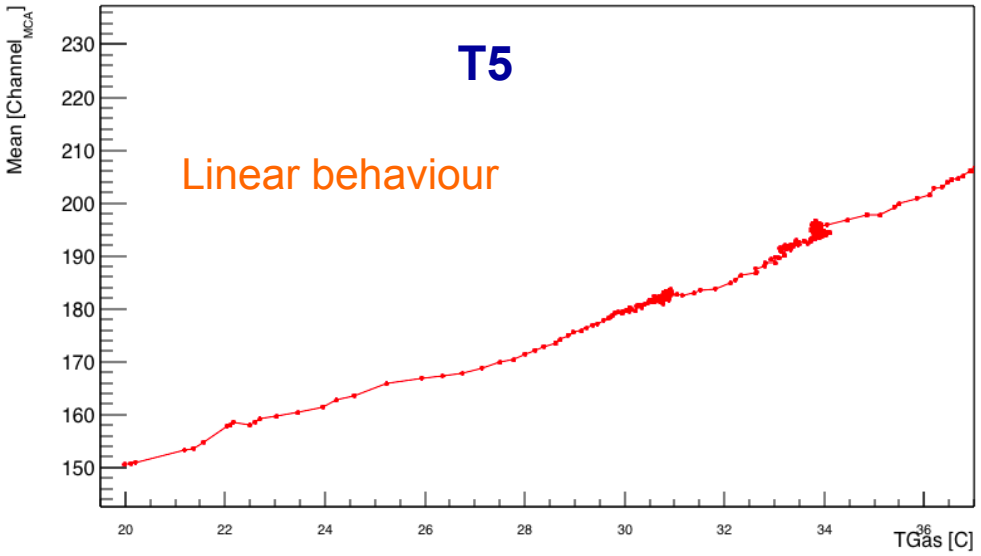
T5-2nd Cycle

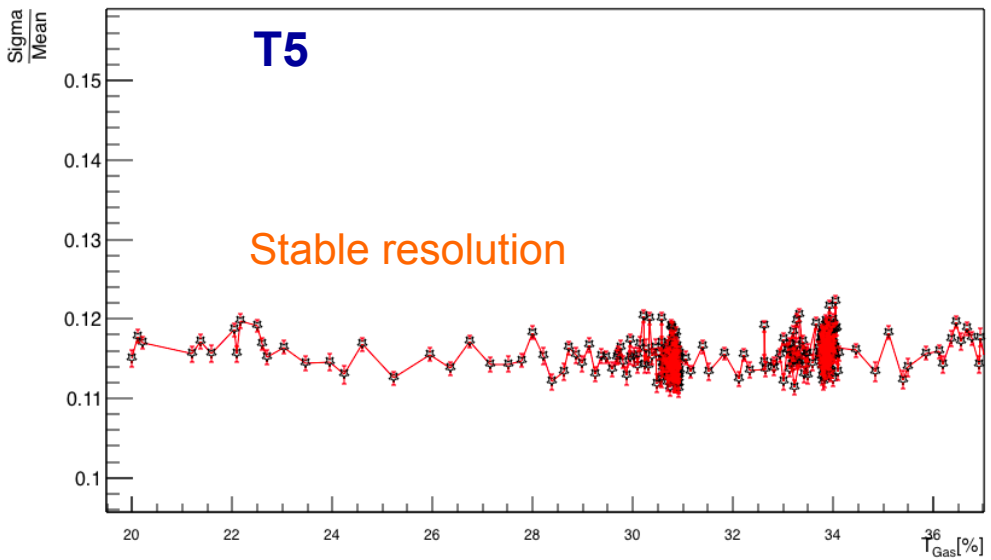


Temperature Test: 2st cycle - RISE PHASE2 Gain Vs Temp

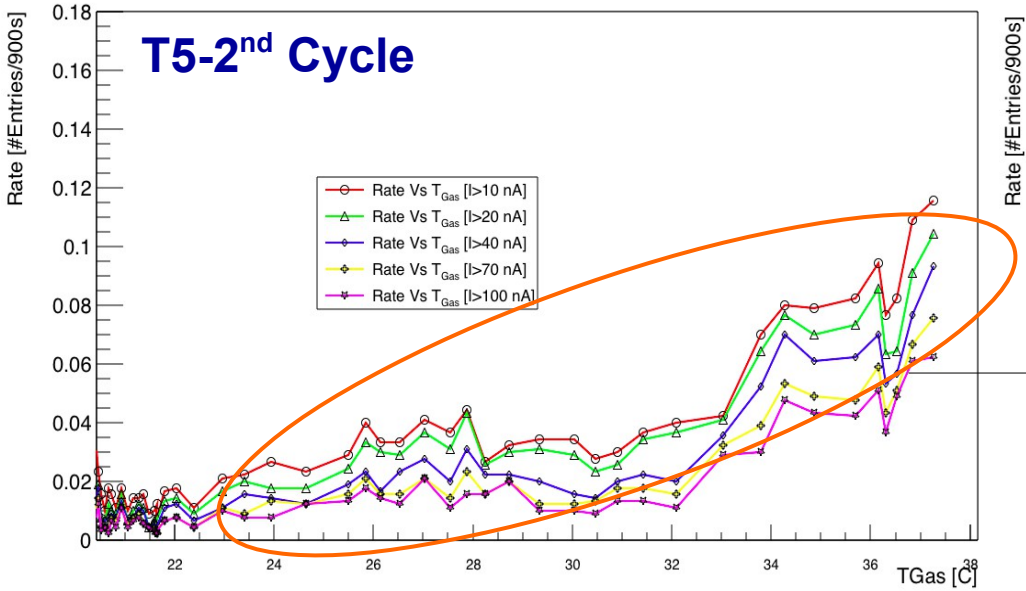


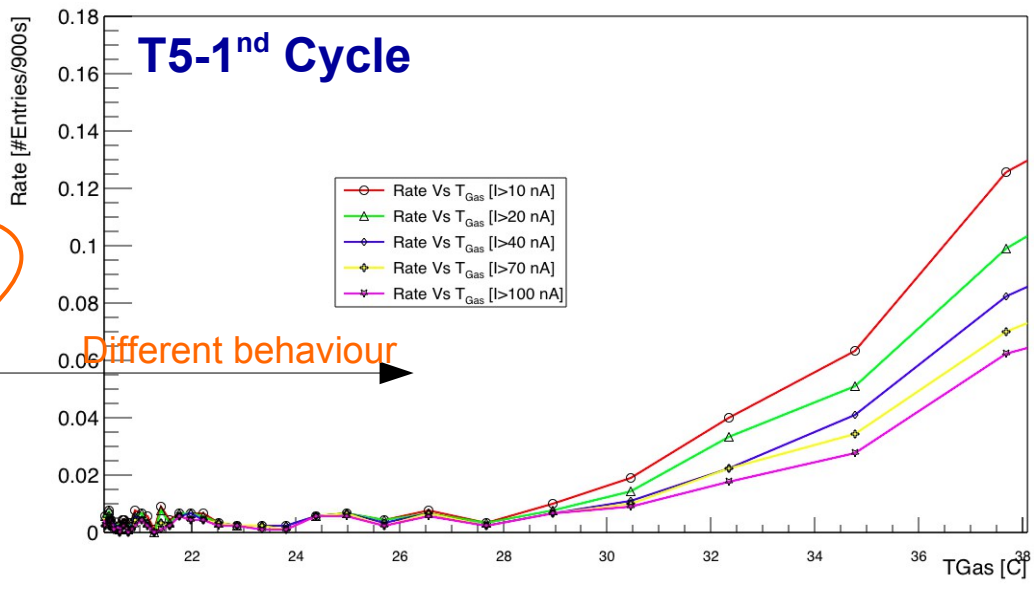
- Iron55 spectrum measured in a 120s window
- Considered the RH, T_{box}, T_{gas} avarage for the 120s
- Gaussian Fit performed on each Iron55 spectrum



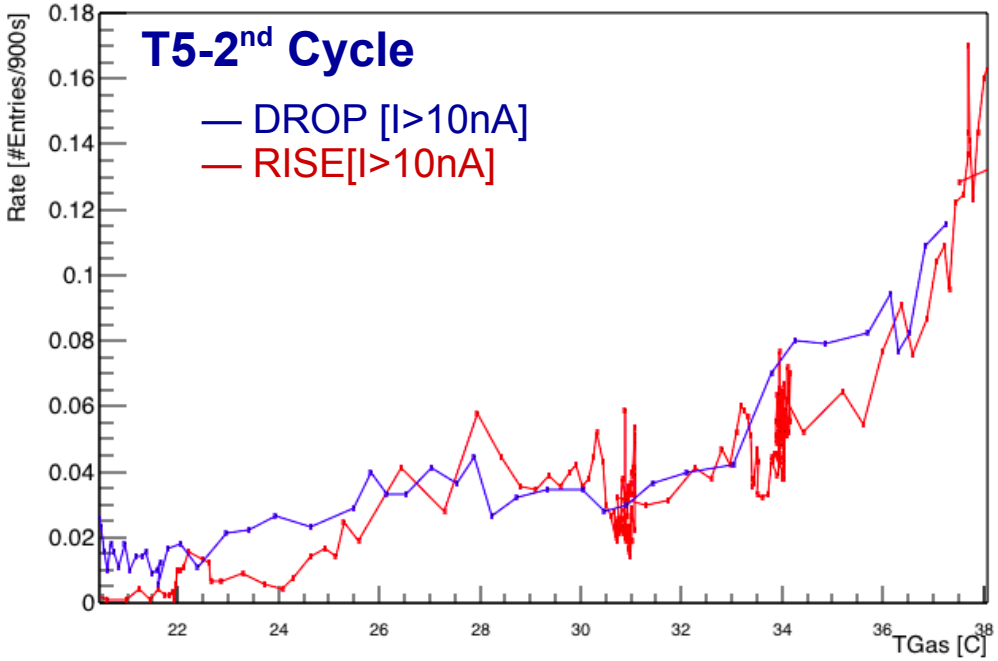


Temperature Test:2nd cycle – DROP PHASE2





Different behaviour



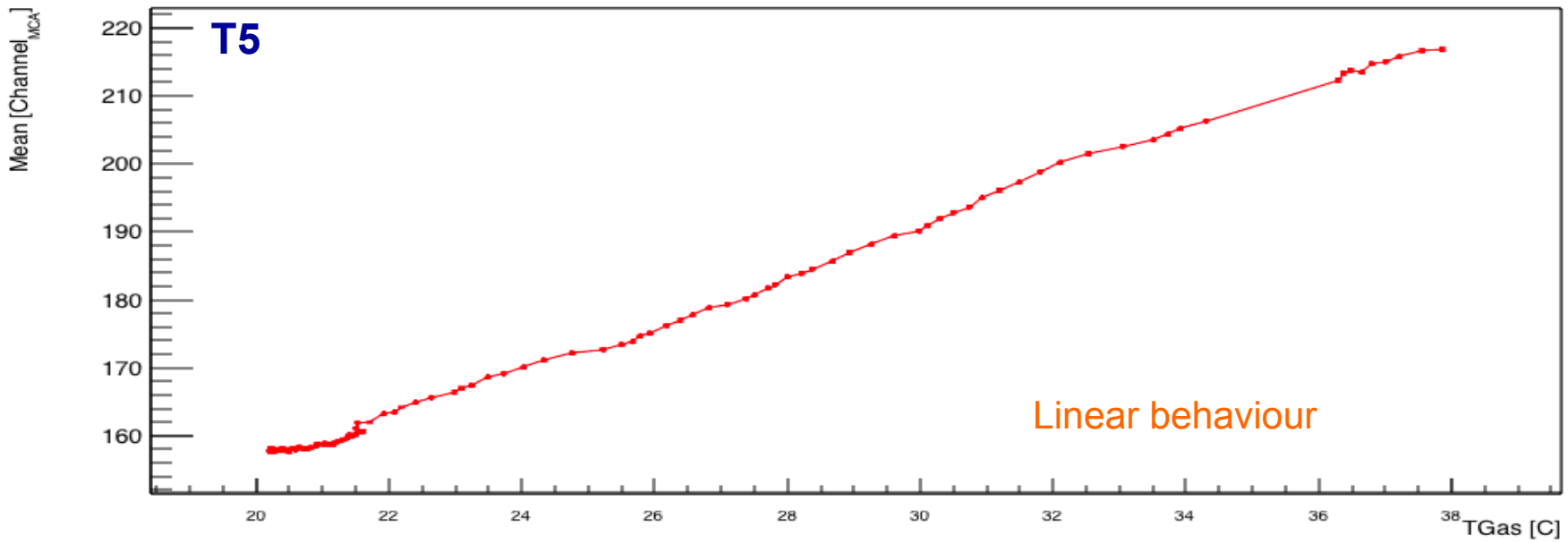
It seems that there is no hysteresis effect if one concentrates only on 2nd cycle

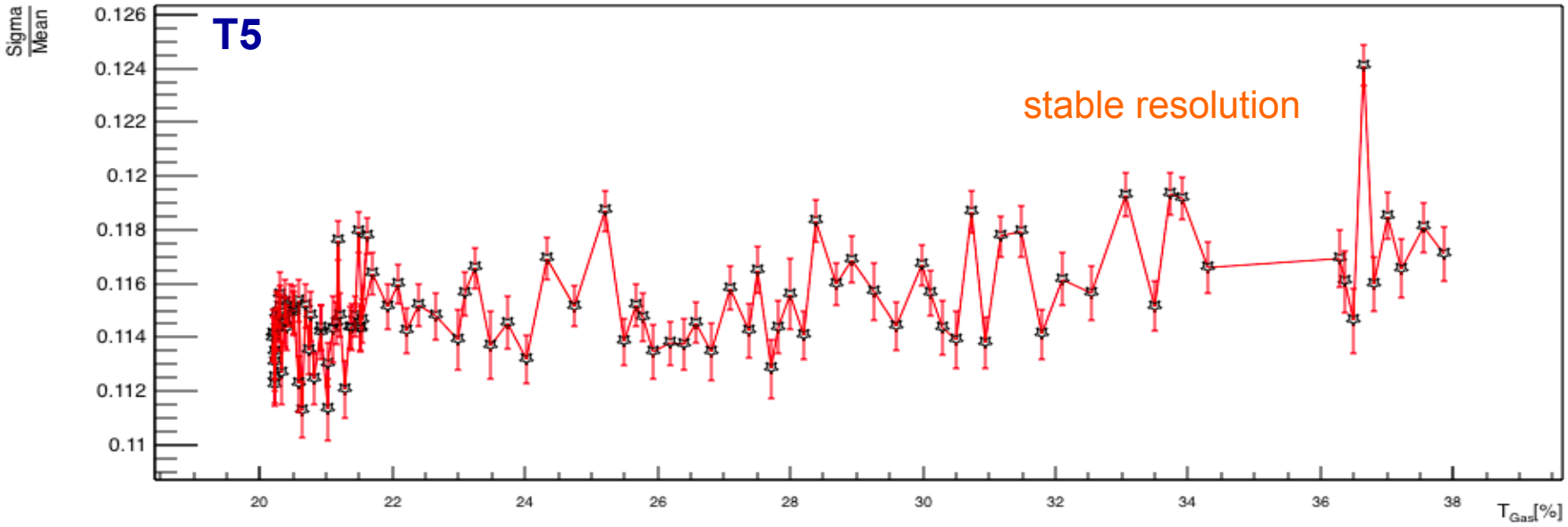
BUT

BEHAVIOUR DIFFERENT FROM 1ST CYCLE

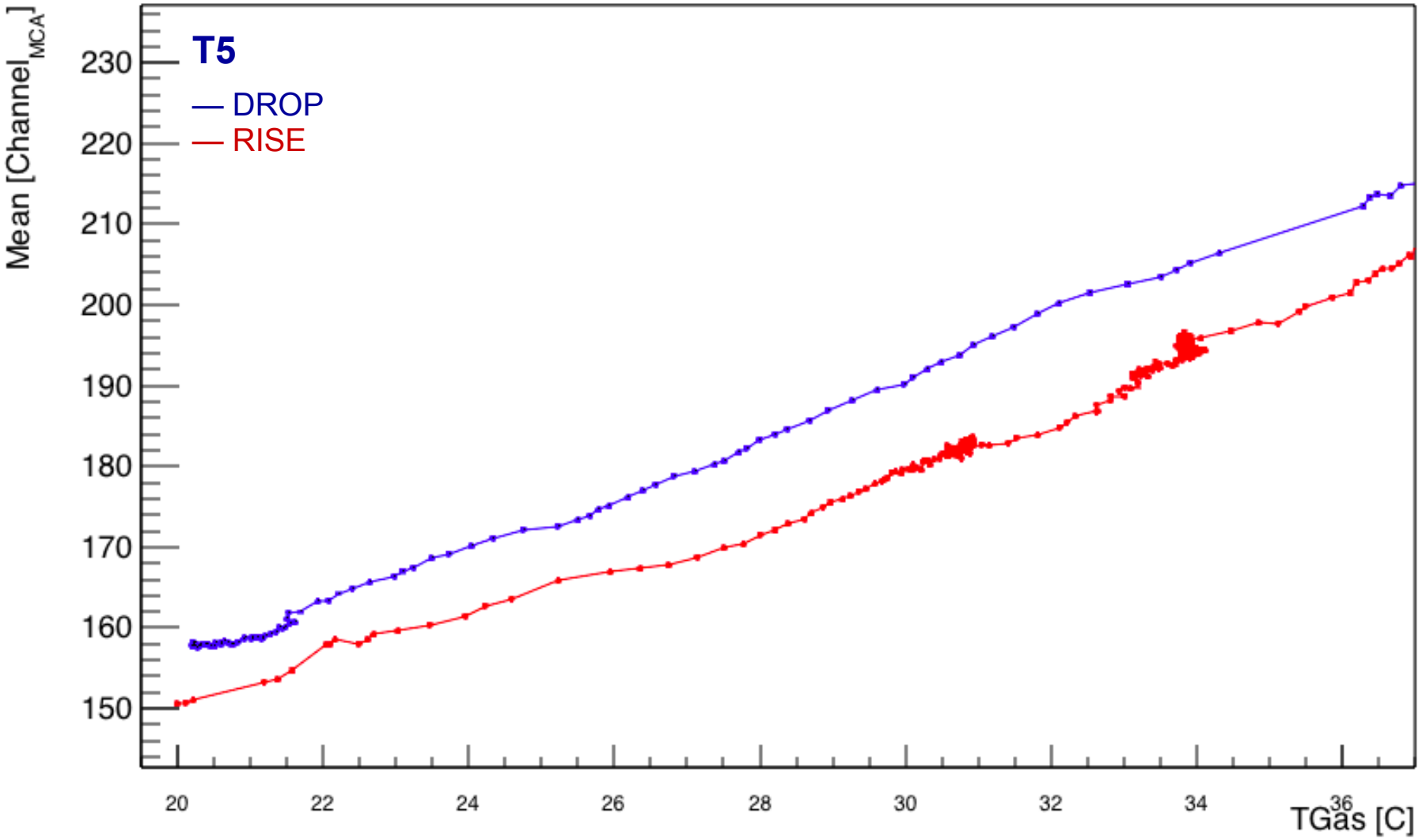
!!! T1: too few sparks to see a trend

Temperature Test: 2st cycle - DROP PHASE2 Gain Vs Temp





Temperature Test: 2st cycle - Gain Vs Temp

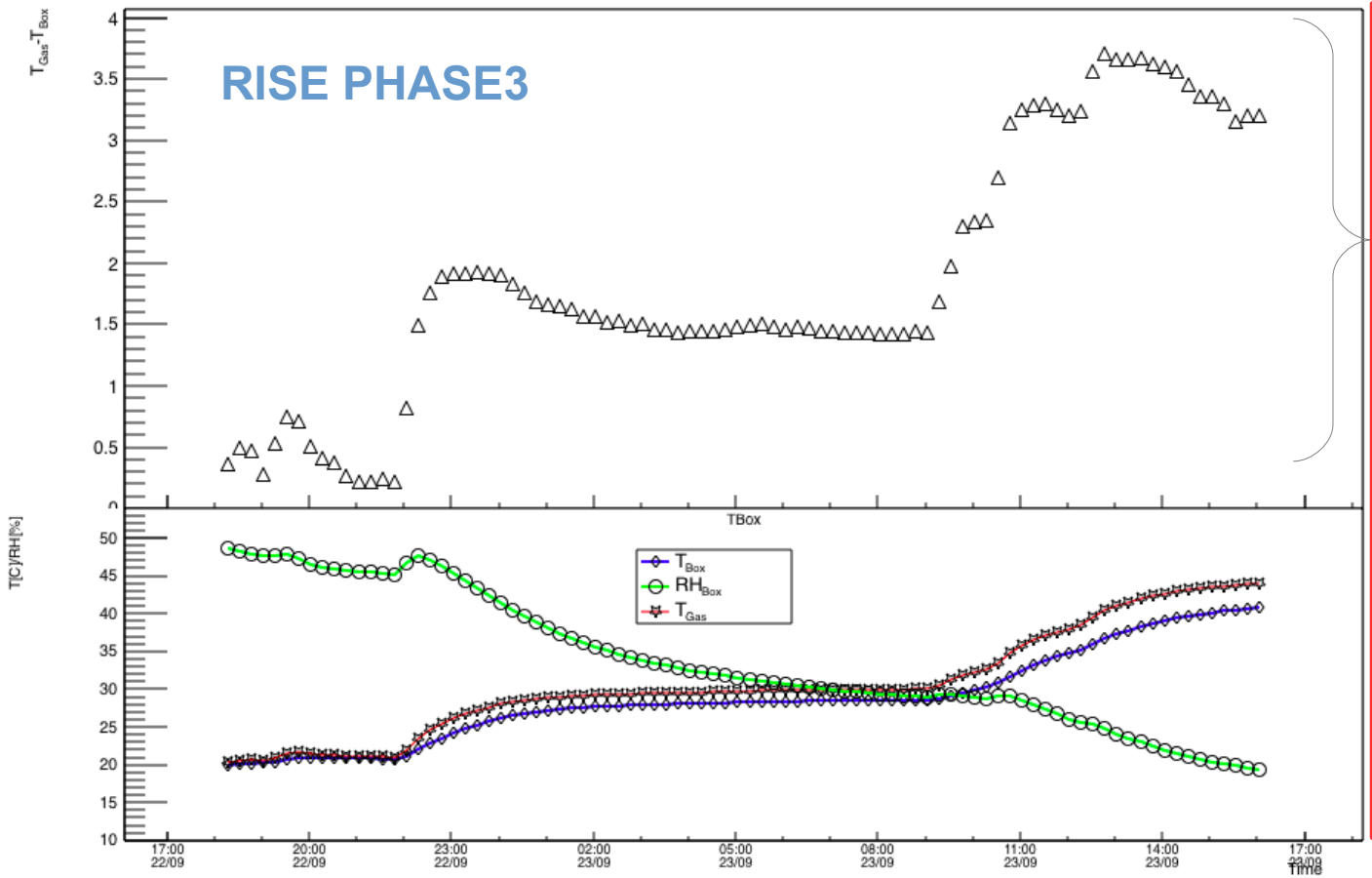


!!! For the DROP and RISE phase the gain increases in a quite linear way
BUT
THE 2 CURVES ARE NOT OVERLAPPED → HYSTERESIS EFFECT??

Temperature Test: 3st cycle

Remarks:

- T1 on top of T5
- Iron55 spectrum measured from T1



- T_{Box} measured near T5 (bottom part of the box)
- T_{Gas} assumed to be the same for both chambers

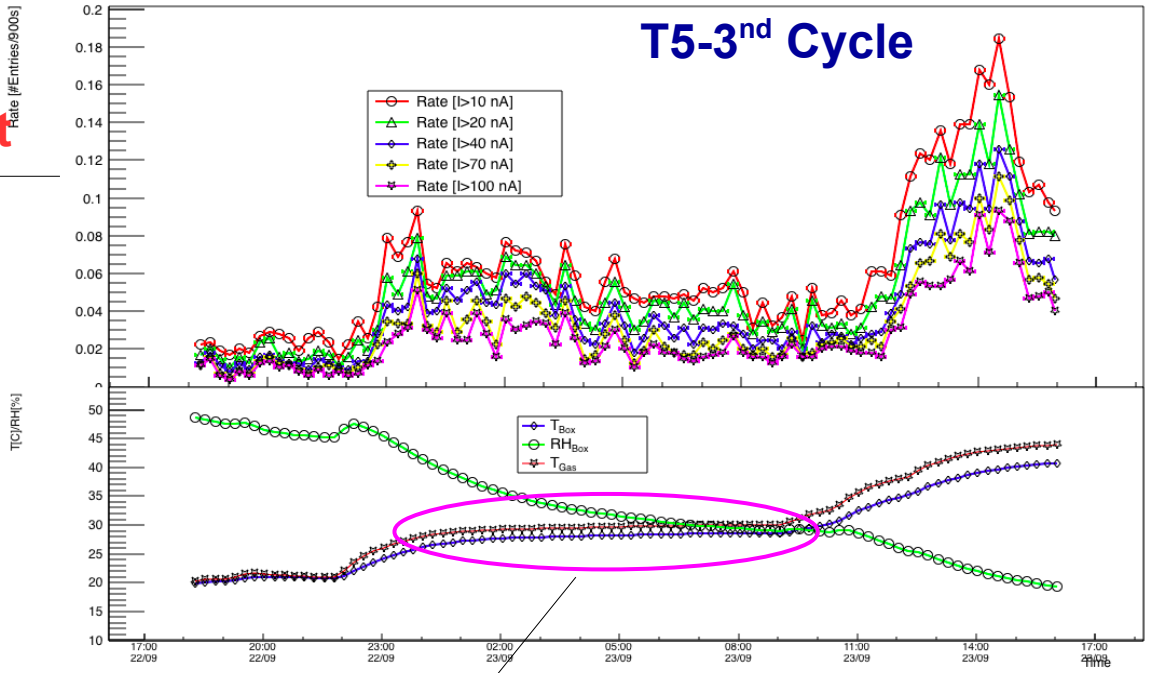
The effect could be due to a temperature gradient inside the box

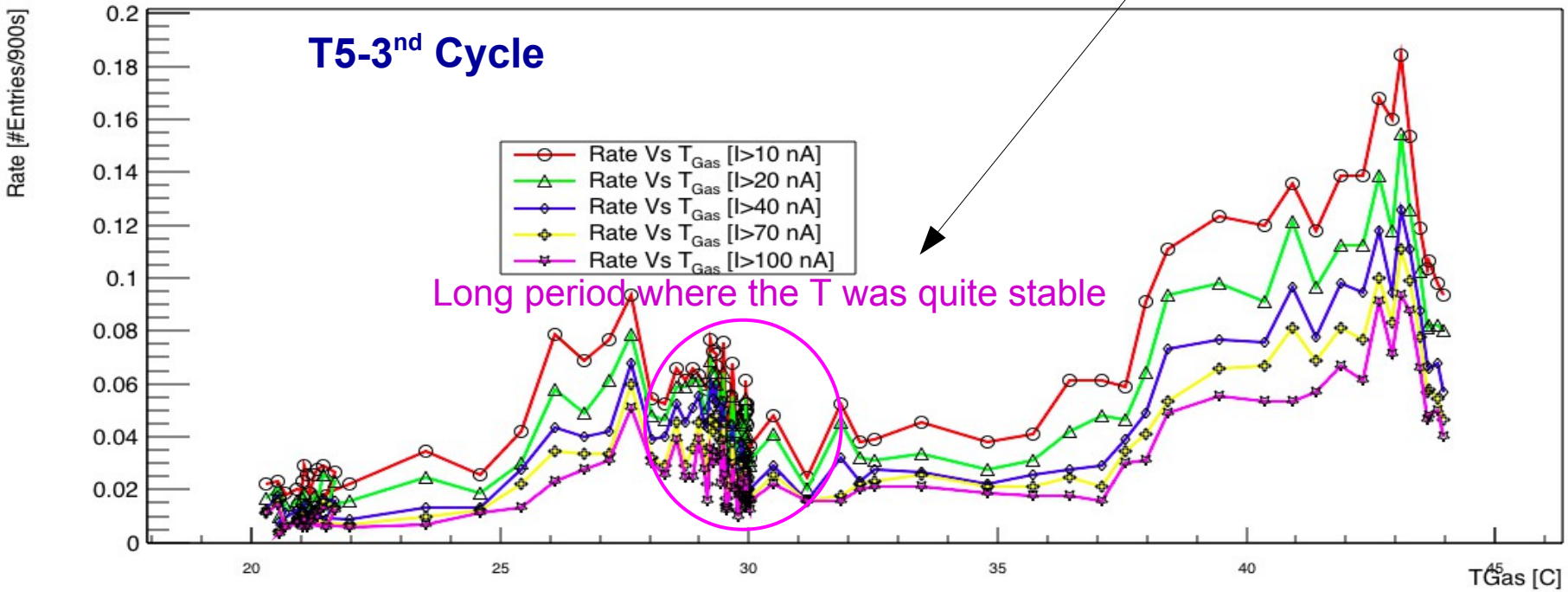
!!! One should assume that in the previous cycles T1 was at lower temperature wrt T5

Temperature Test:3nd cycle – RISE PHASE3

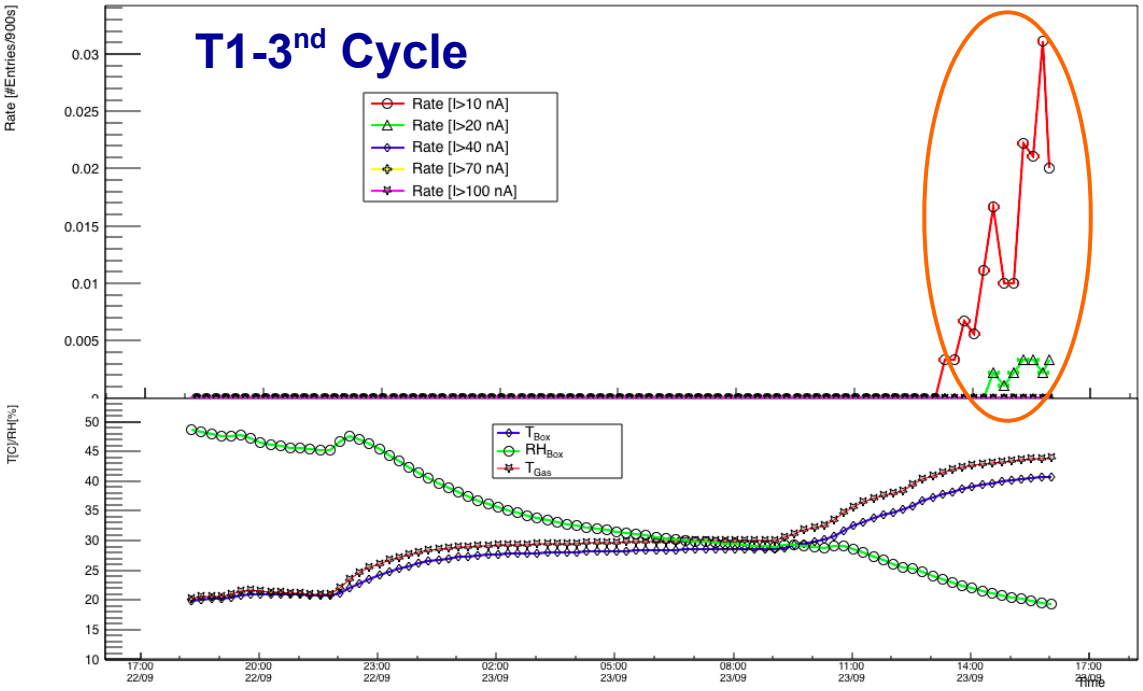
T5 sparks rate is again different wrt the previous cycle

AN HYSTERESIS EFFECT IS PRESENT FOR T5

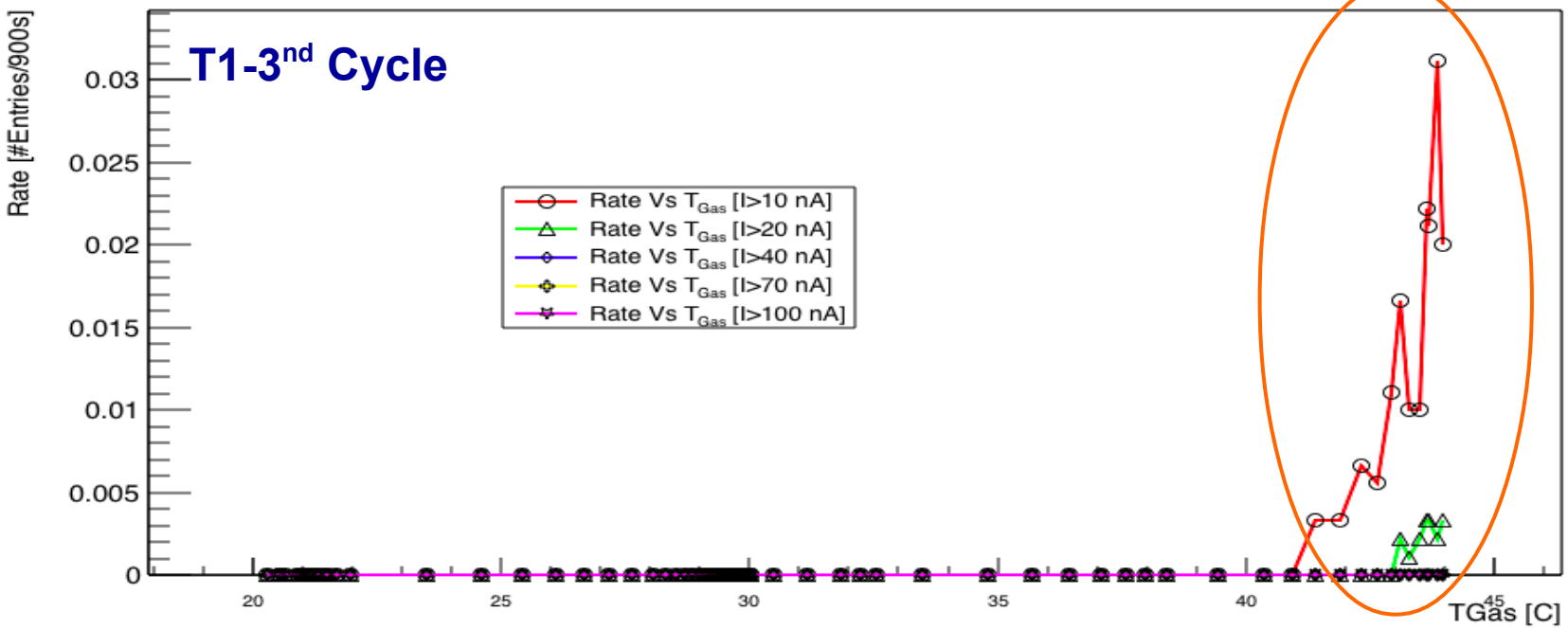




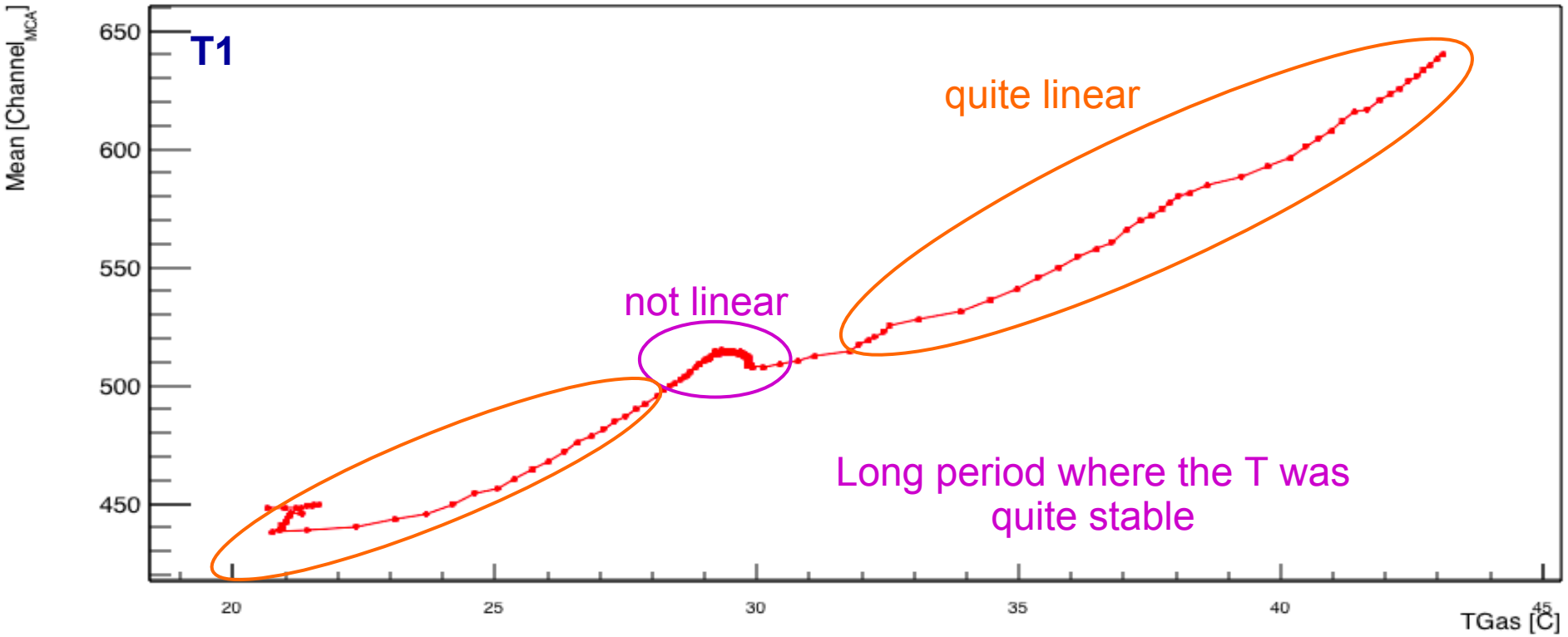
Temperature Test: 3st cycle - RISE PHASE3

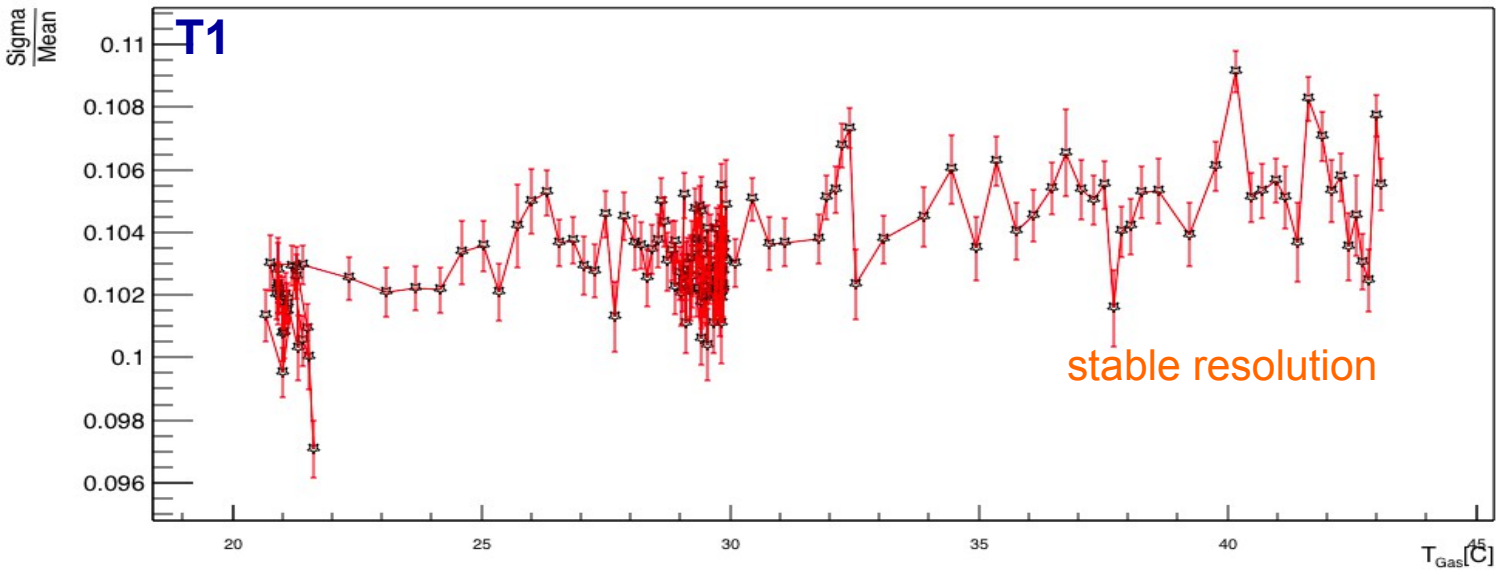


High sparks rate starts to be present after 40°C also for T1

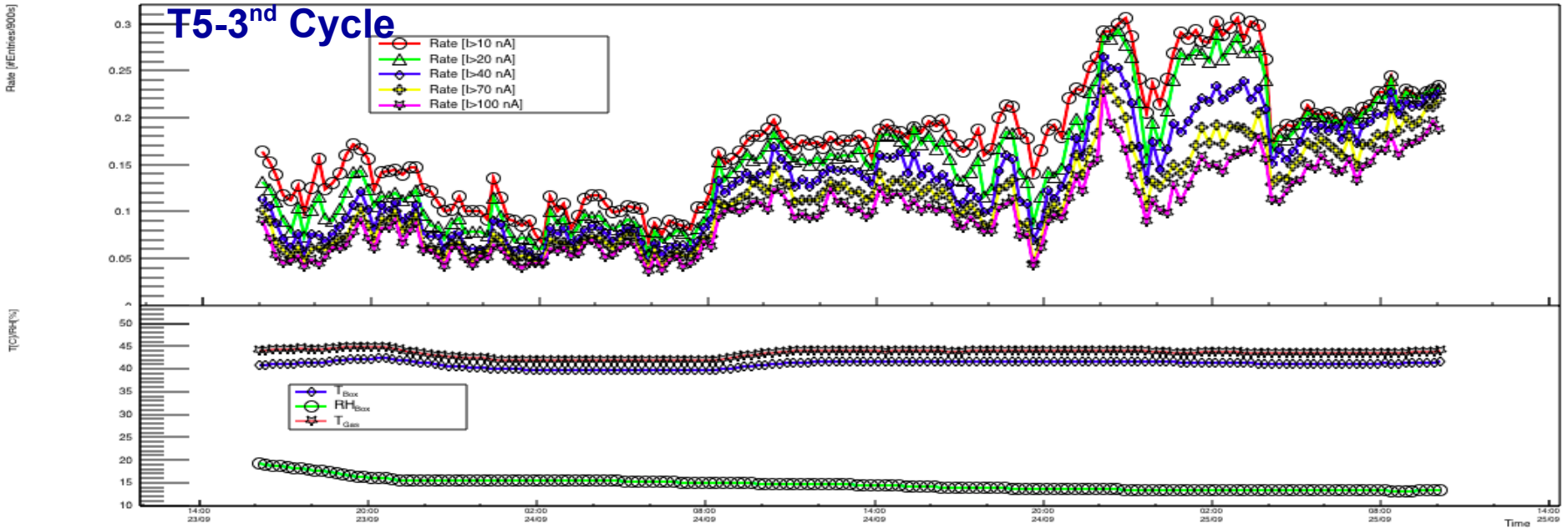


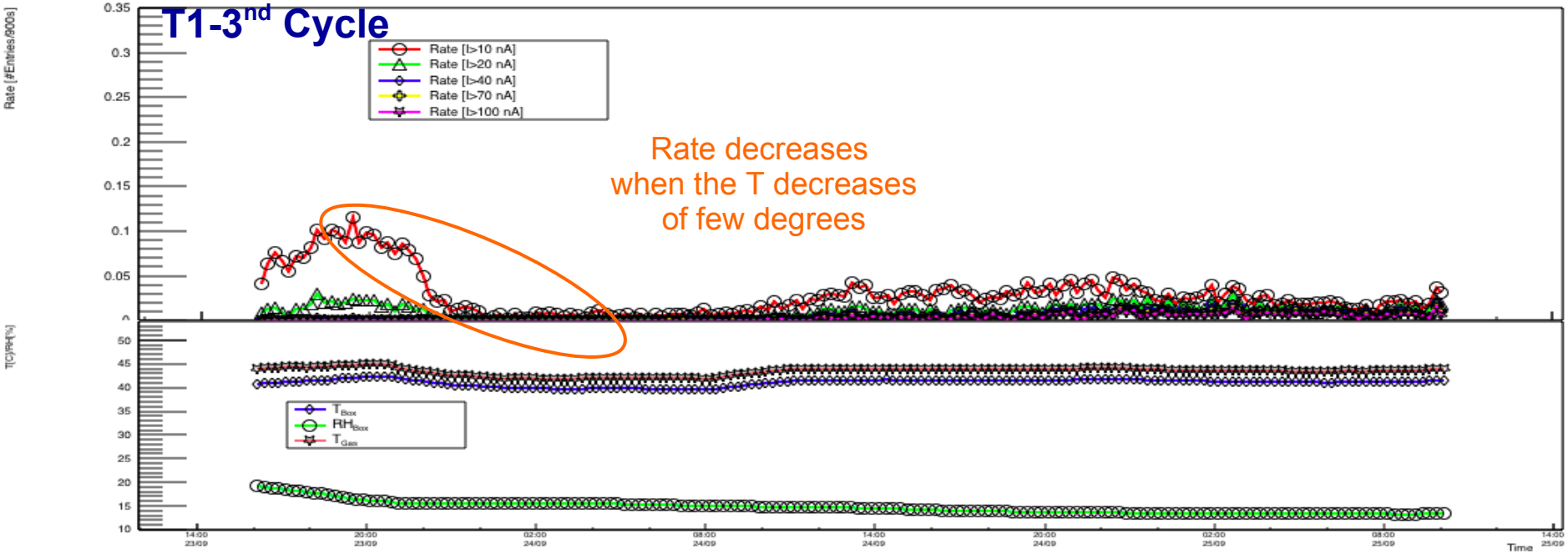
Temperature Test: 3st cycle - RISE PHASE3 Gain Vs Temp





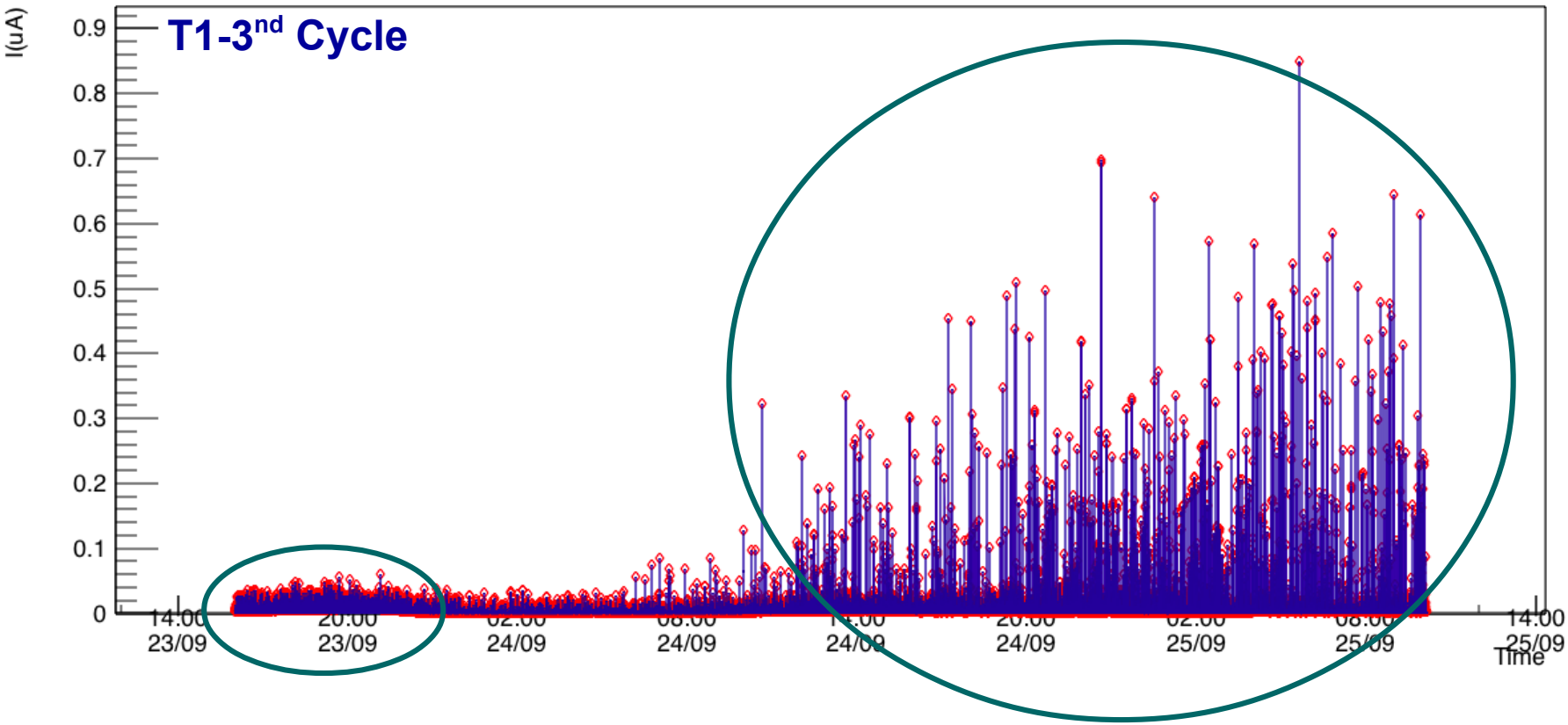
Temperature Test: 3st cycle - PLATEAU PHASE3





Pressure was not monitored

Temperature Test: 3st cycle - PLATEAU PHASE3

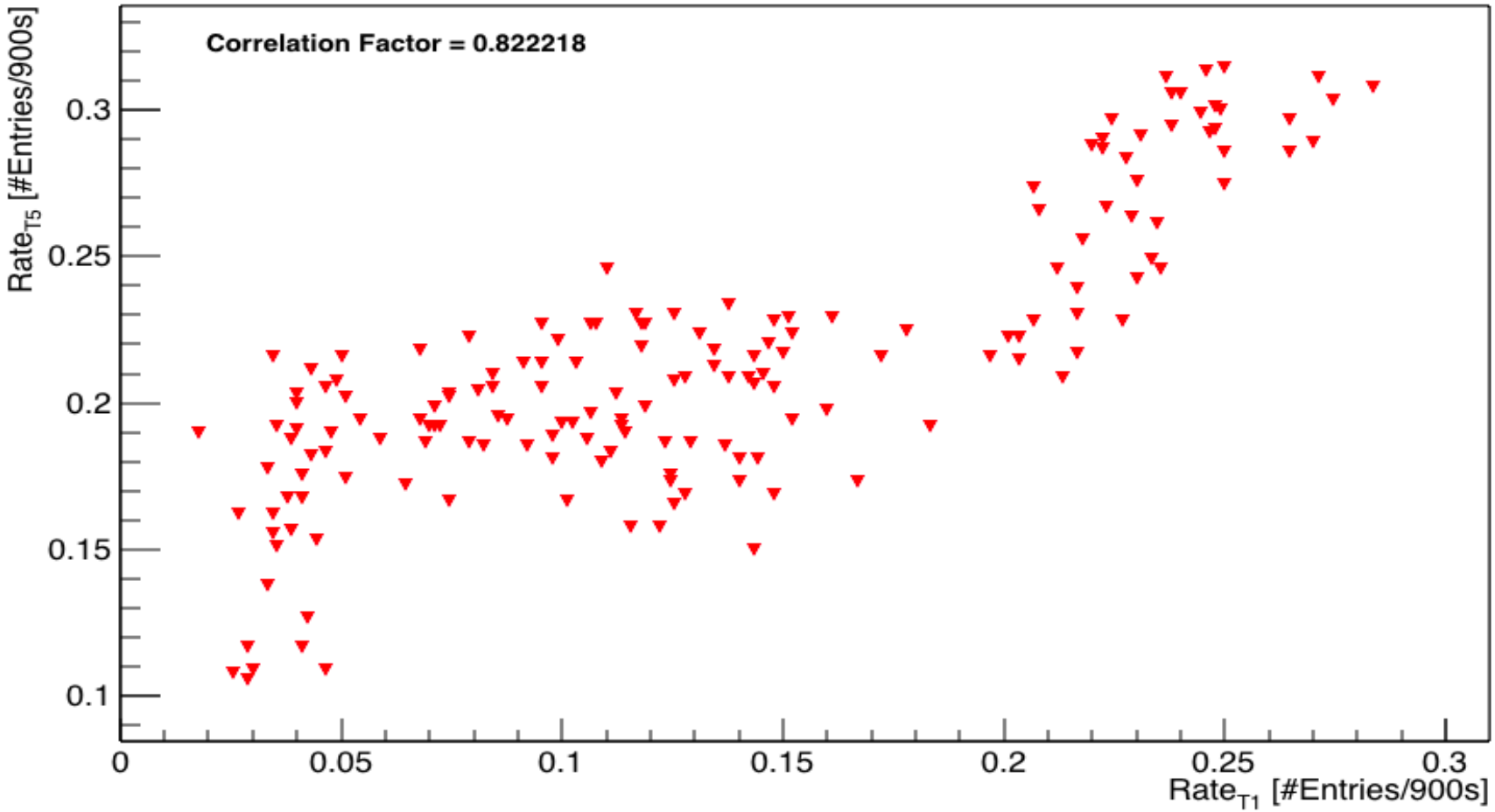


Same T in these regions but the spark amplitude is higher in the second period wrt the previous one

Temperature Test: 3st cycle - PLATEAU PHASE3

Remarks:

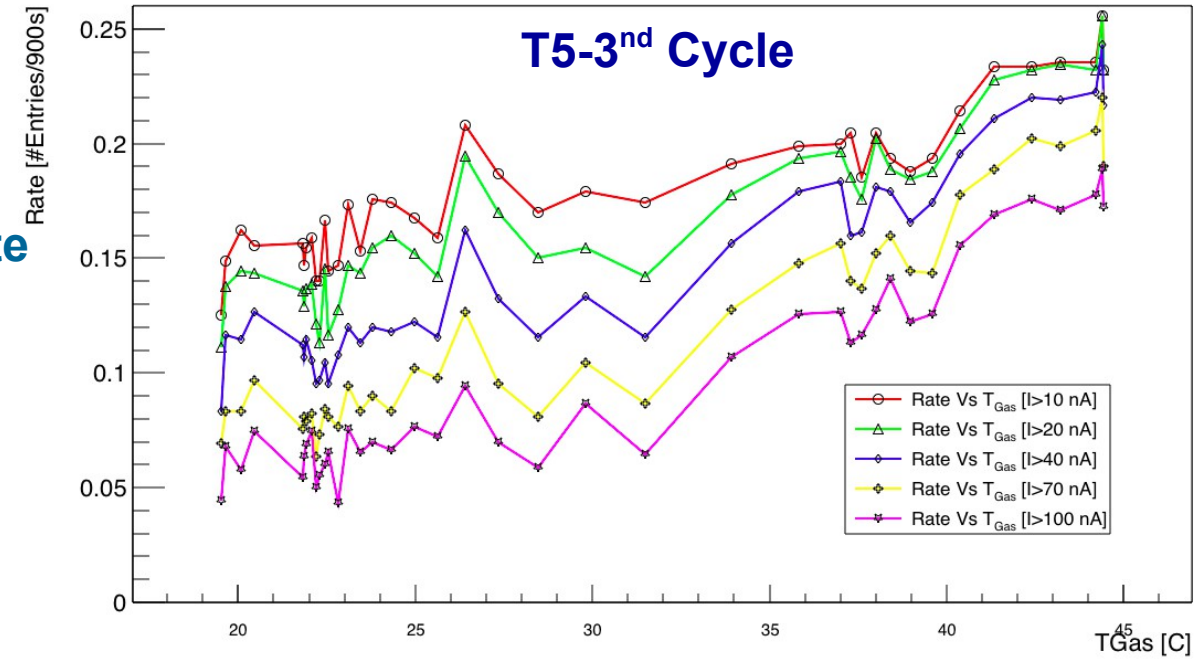
- Resolution of 1 s

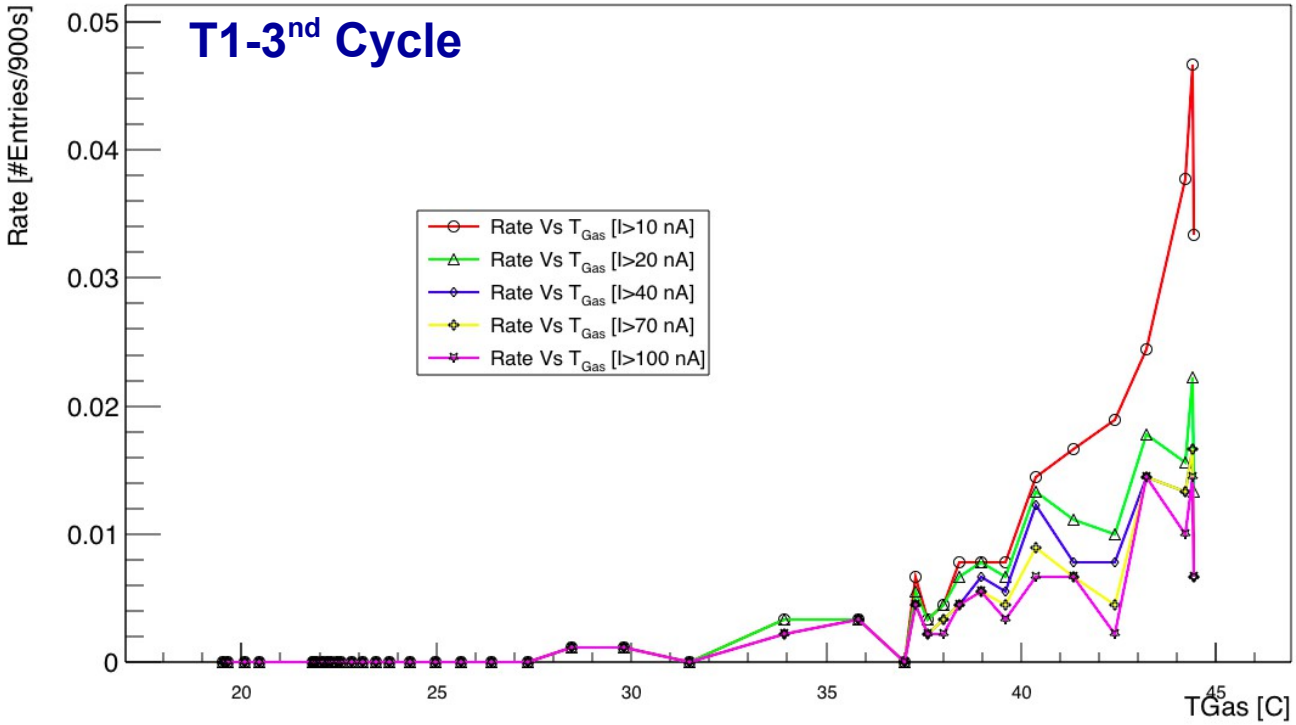


It seems to there be a CORRELATION BETWEEN T1 AND T5 RATE BUT it could be related to the fact that there is a BAD RESOLUTION

Temperature Test:3nd cycle – DROP PHASE3

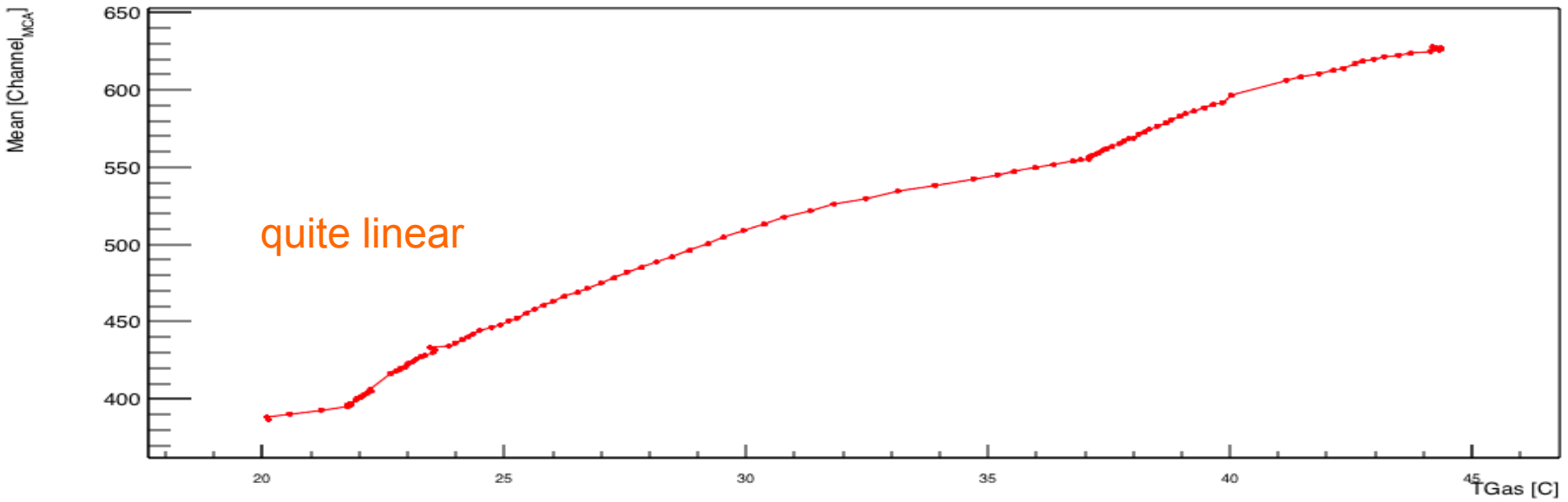
T5 continues to have an high-rate even if the T decreases

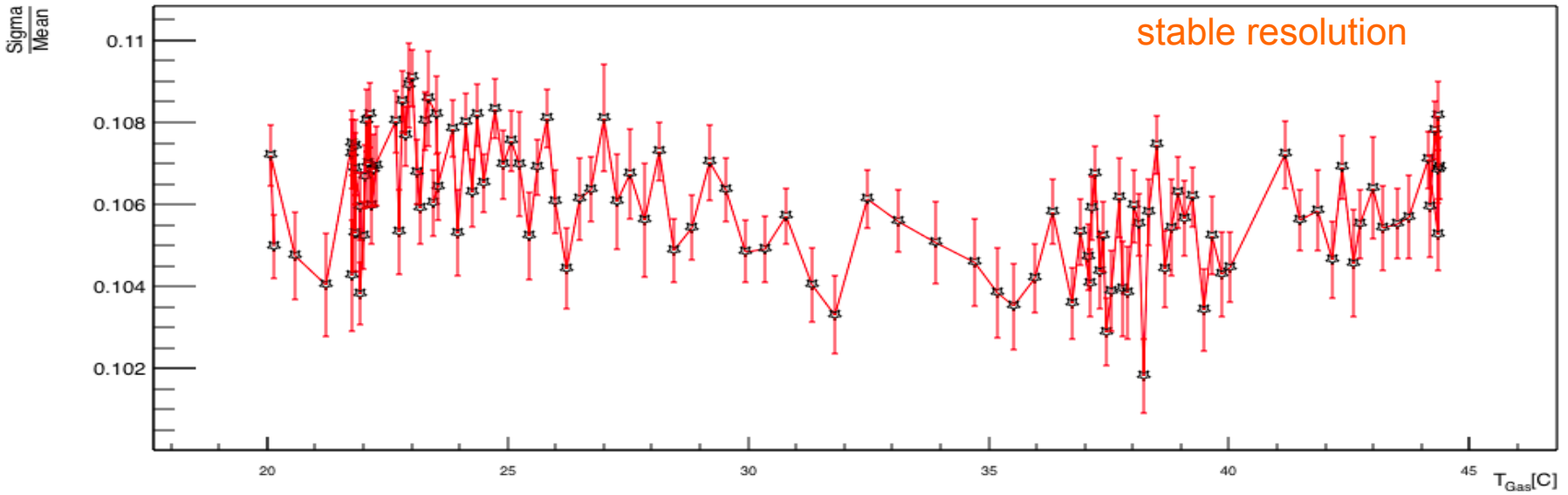




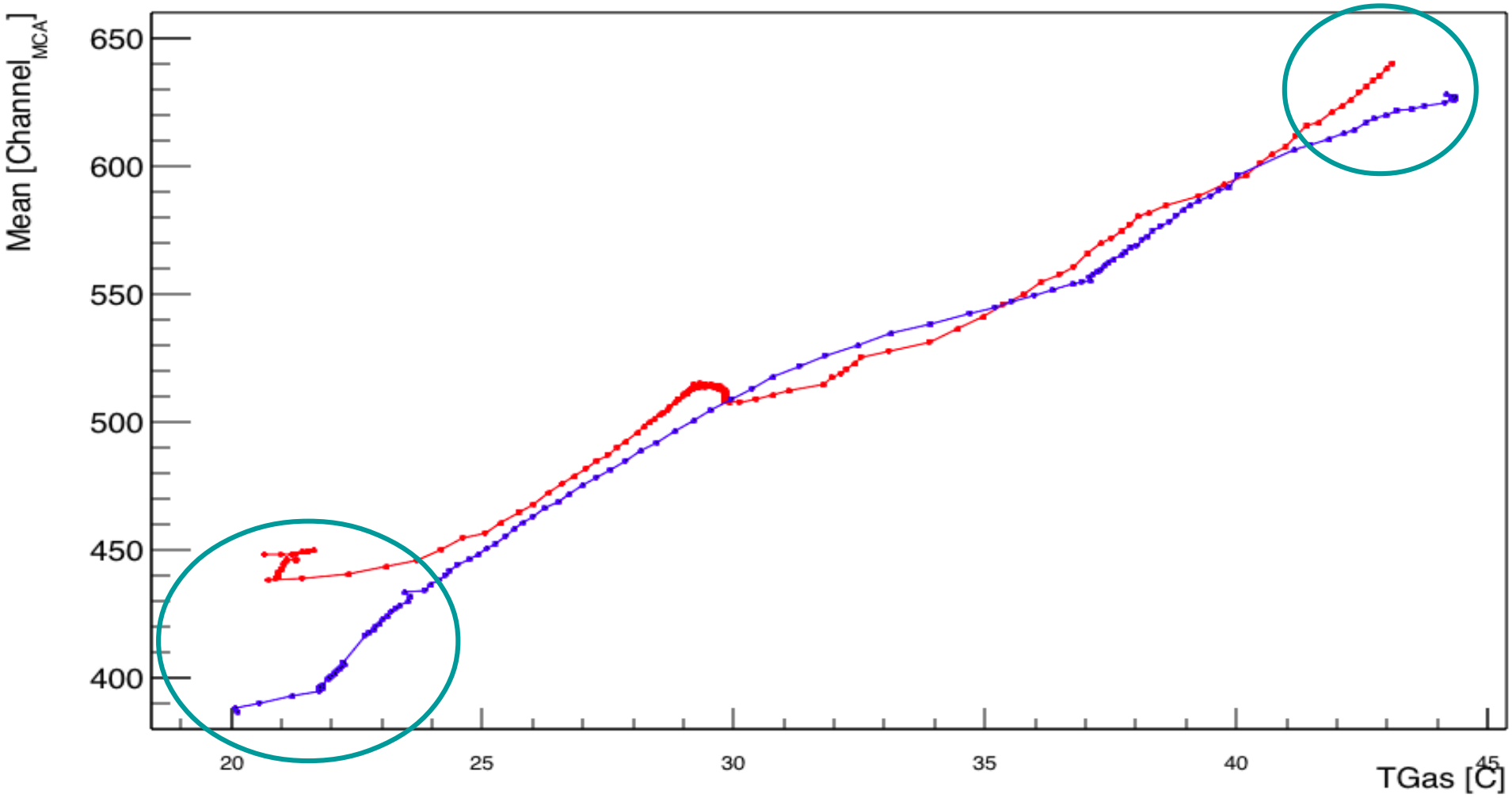
T1 rate decreases to zero decreasing the T

Temperature Test: 3nd cycle – DROP PHASE3 Gain Vs Temp





Temperature Test: 3st cycle - Gain Vs Temp



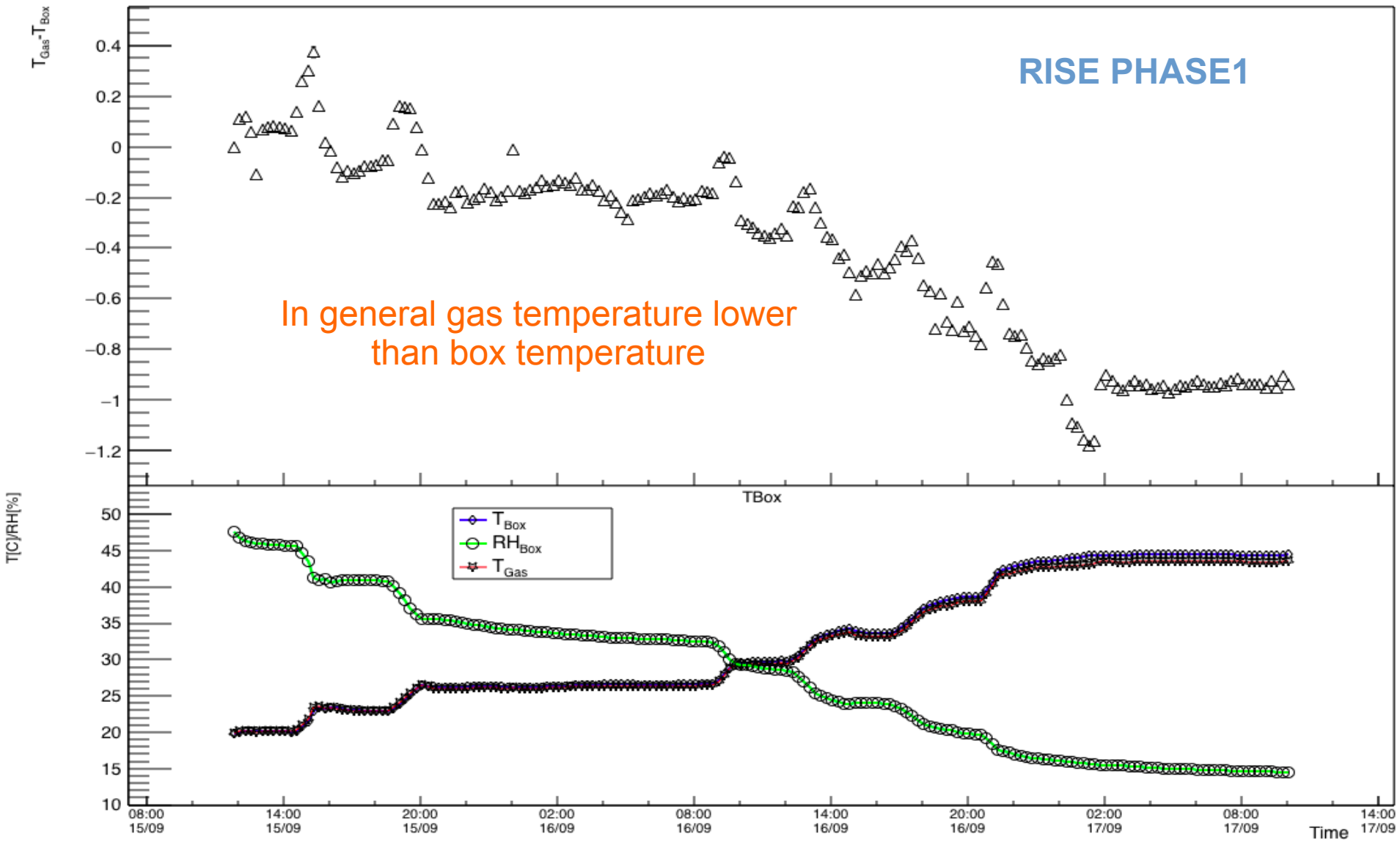
!!! For the DROP and RISE phase the gain increases in a quite linear way
BUT
THE 2 CURVES ARE NOT OVERLAPPED AT HIGH & LOW T

Temperature Test: Conclusion

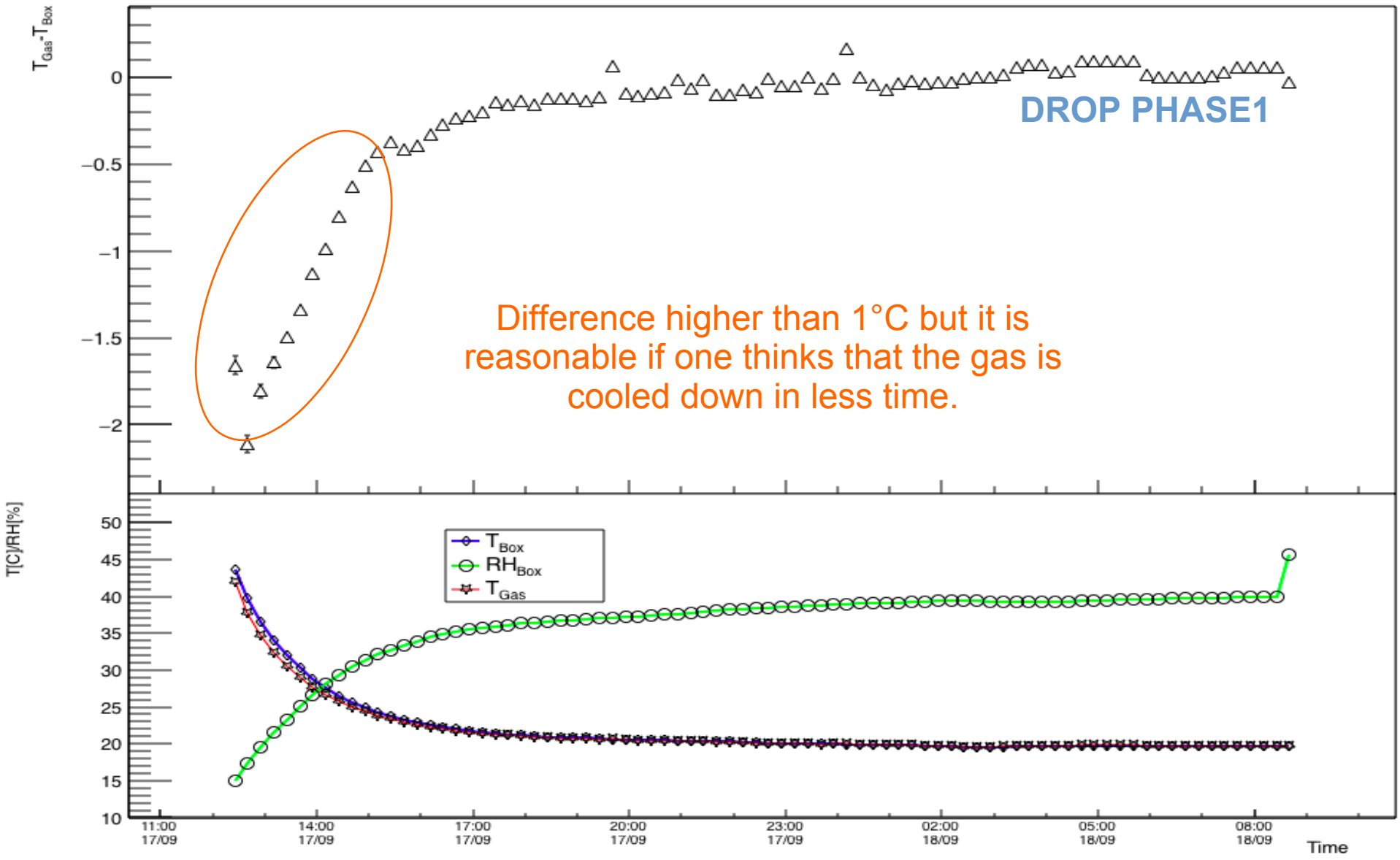
- **Sparks** increase with temperature
- Some **hysteresis effects** are present
- A safe operation under 30°C
- Next step:
  - Repeat the measurements increasing only gas or chamber temperature
  - Since the measurement takes a lot of time, next time the atmospheric pressure will be taken into account.

Backup

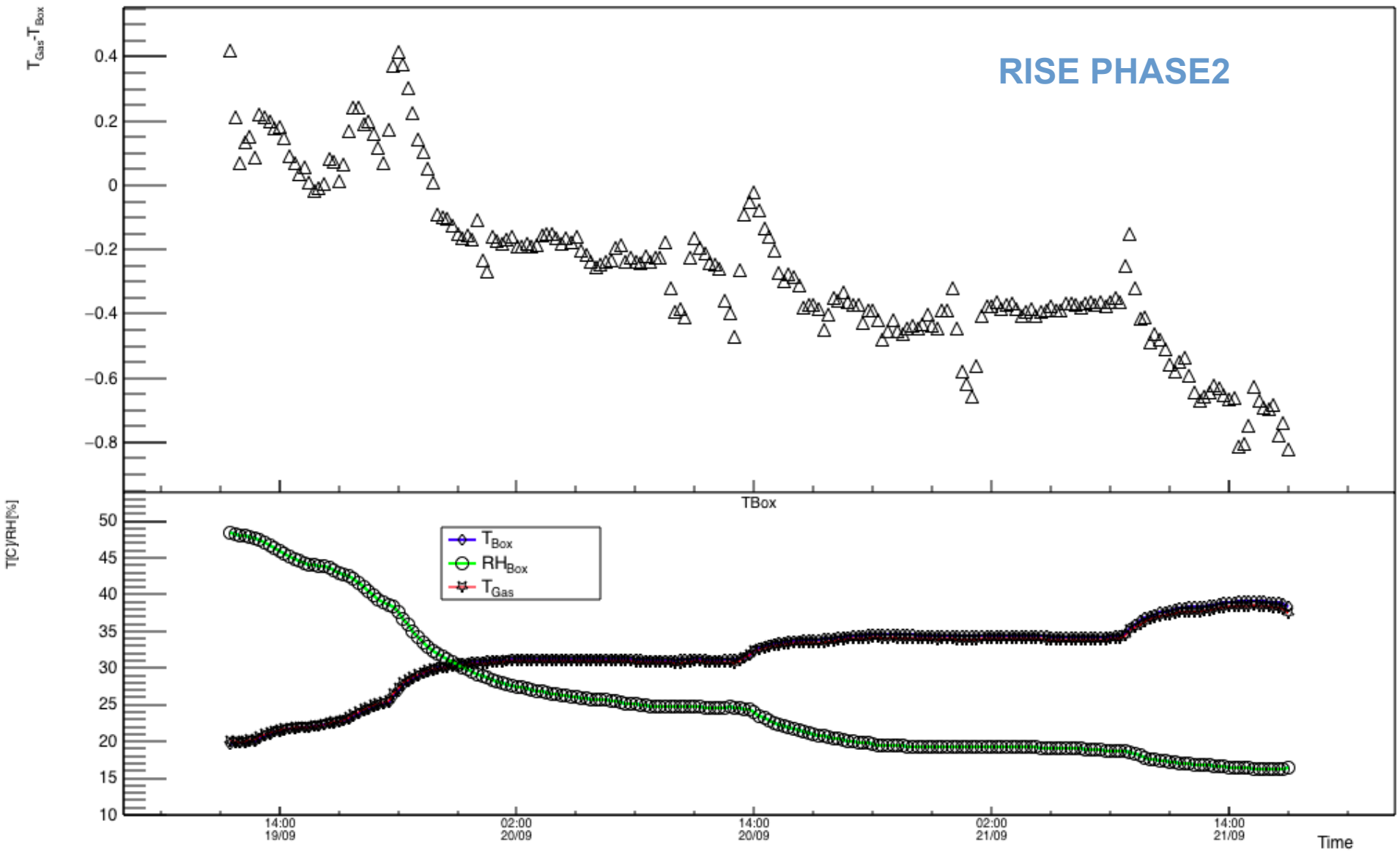
Temperature Test: Tgas-TBox 1st Cycle



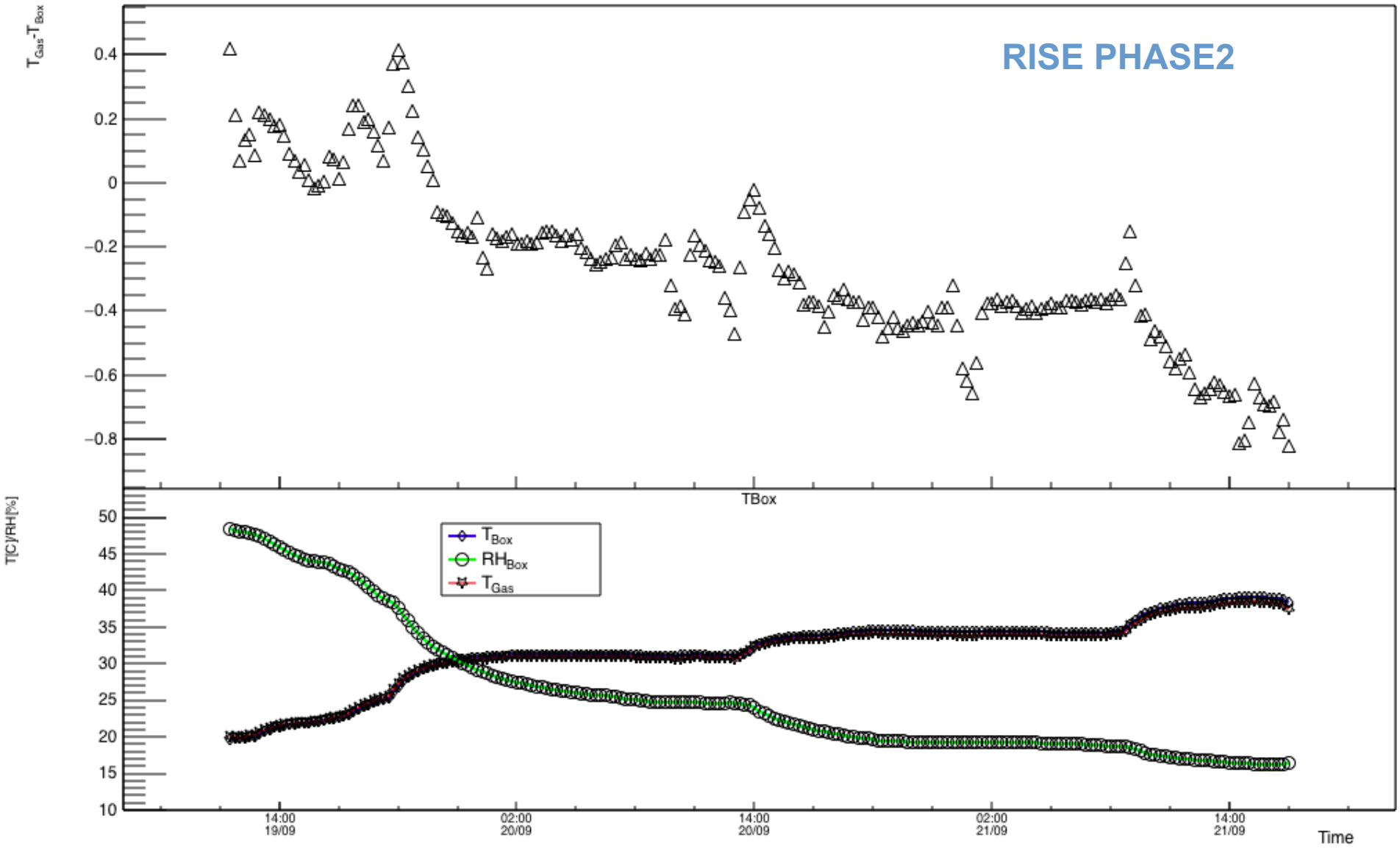
Temperature Test: Tgas-TBox 1st Cycle



Temperature Test: Tgas-TBox 2st Cycle



Temperature Test: Tgas-TBox 2st Cycle



Temperature Test: Tgas-TBox 2st Cycle