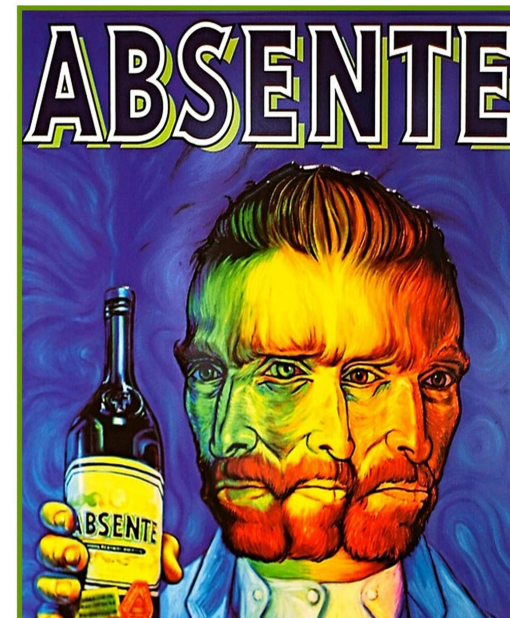
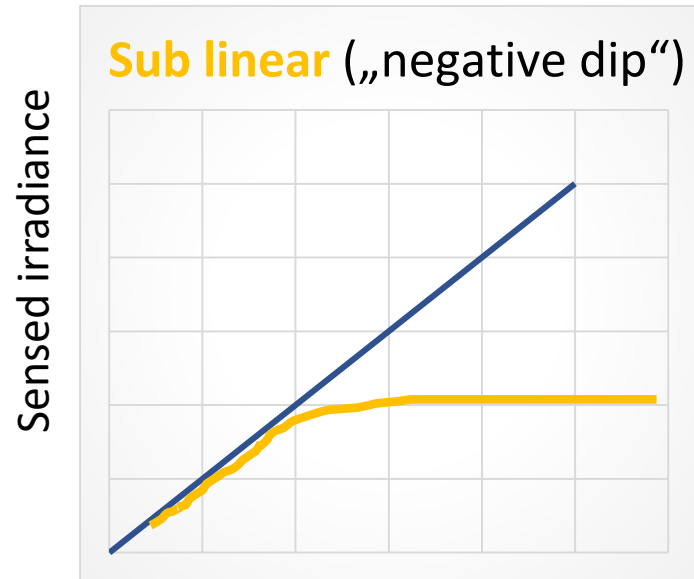
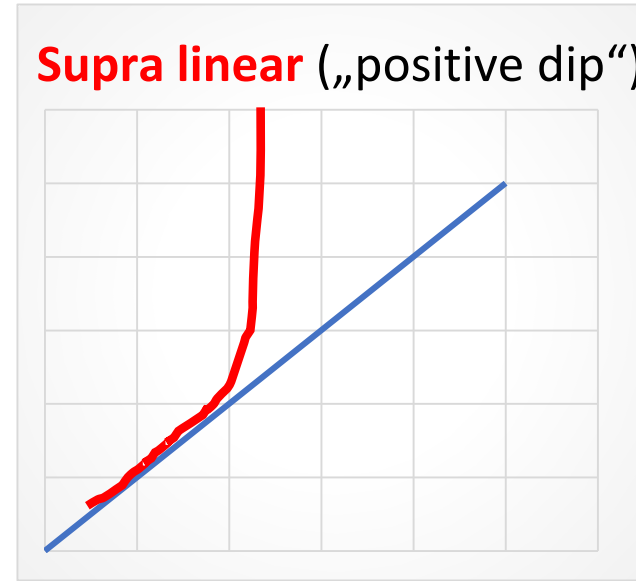
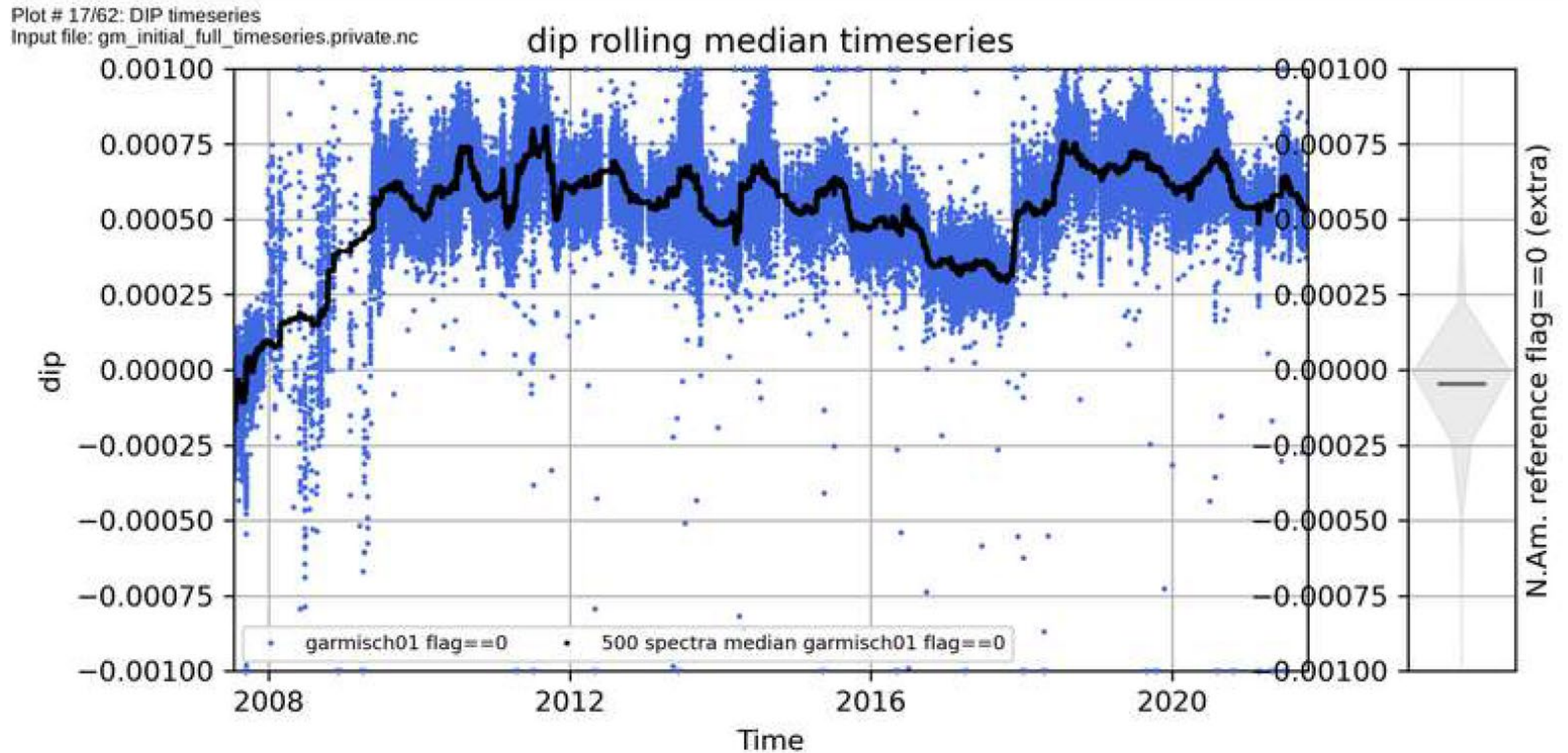


Garmisch positive dip update, Ralf Sussmann and Markus Rettinger



Garmisch dip levels [+0.0005; +0.00075] had been the highest positive ones in the network

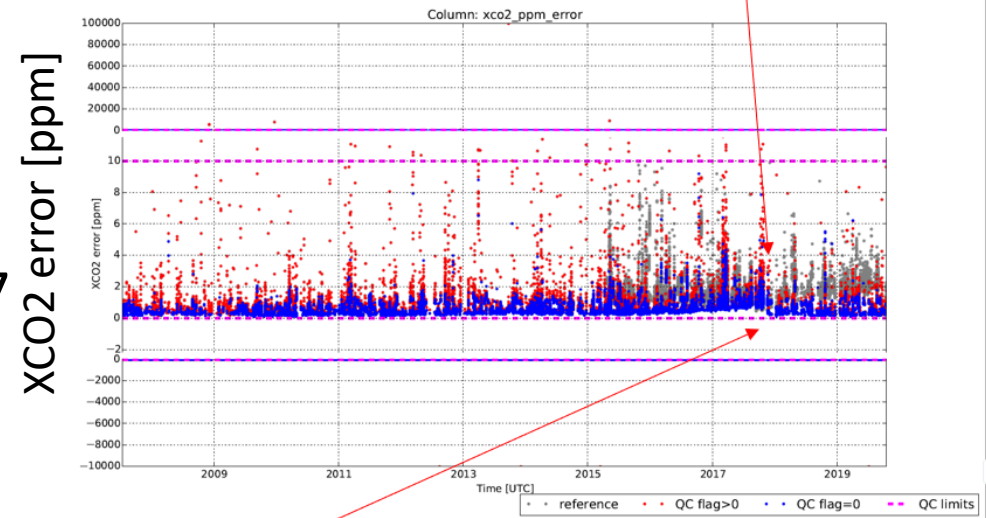
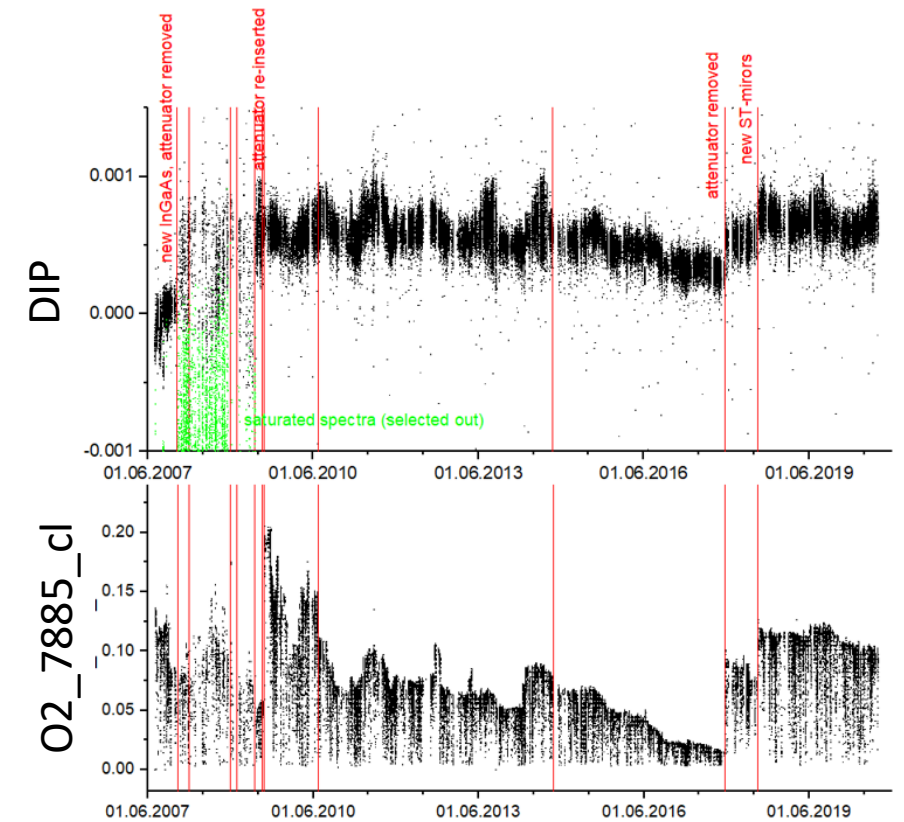


Cause for positive (Garmisch) dip?

- No dip before 13 Dec 2007
 - Changed detector on 13 Dec 2007
 - Dip since then between +0.0005 and +0.00075
 - Reduction of O2_cl in 2016 due to mirror degradation:
 - XCO2 errors became significant
 - dip decreased but still too large ($\approx +0.0003$)
- ⇒ no way for Garmisch to get rid of the dip by attenuating the solar beam

Hypothesis: The (bad?) detector inserted on 13 Dec 2007 caused the dip

Test: Perform detector swapping experiments

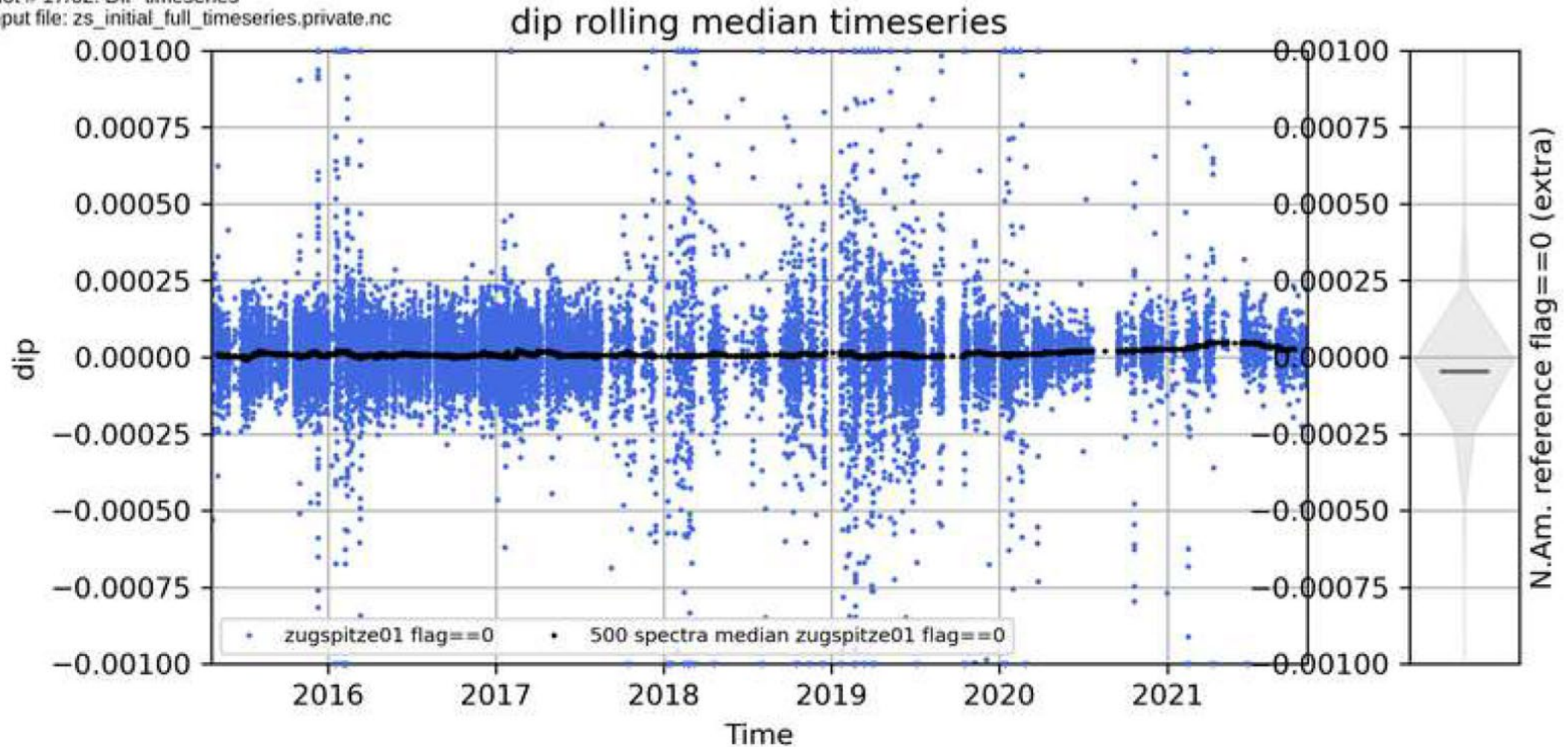


- The **down jump** in XCO2 error is coincident with increasing photon intensity by 3.6 (removing the attenuator).

Plan: Swap good Zugspitze InGaAs into Garmisch FTS

Zugspitze DIP timeseries: DIP [0; 0.00008]

Plot # 17/62: DIP timeseries
Input file: zs_initial_full_timeseries.private.nc



Problem: 1994 Zugspitze InGaAs didn't fit into Garmisch instrument

➤ ordered electronics/mechanics adapter from Bruker

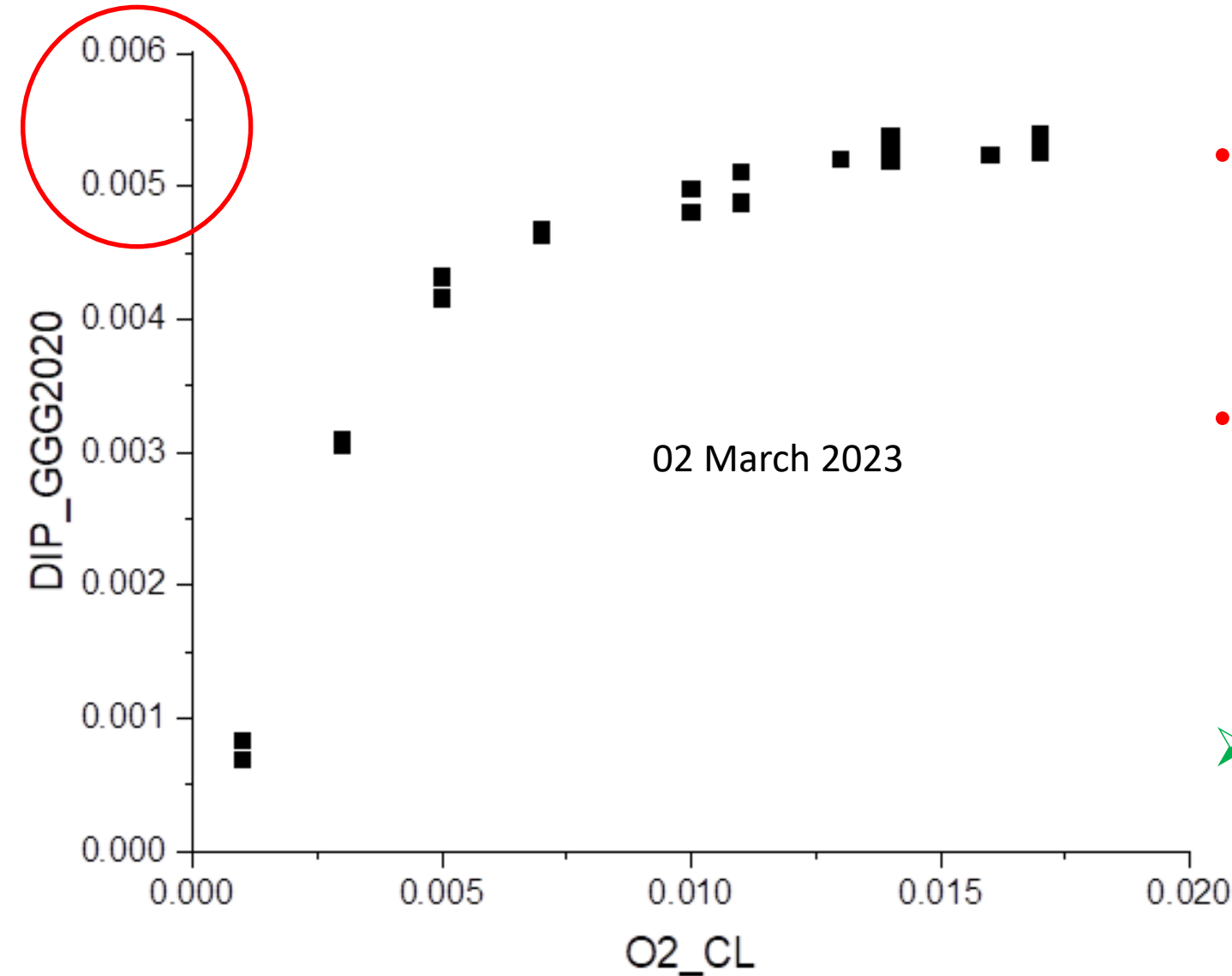
The (bad?) modern Garmisch InGaAs



The good 1994 Zugspitze InGaAs with adapter



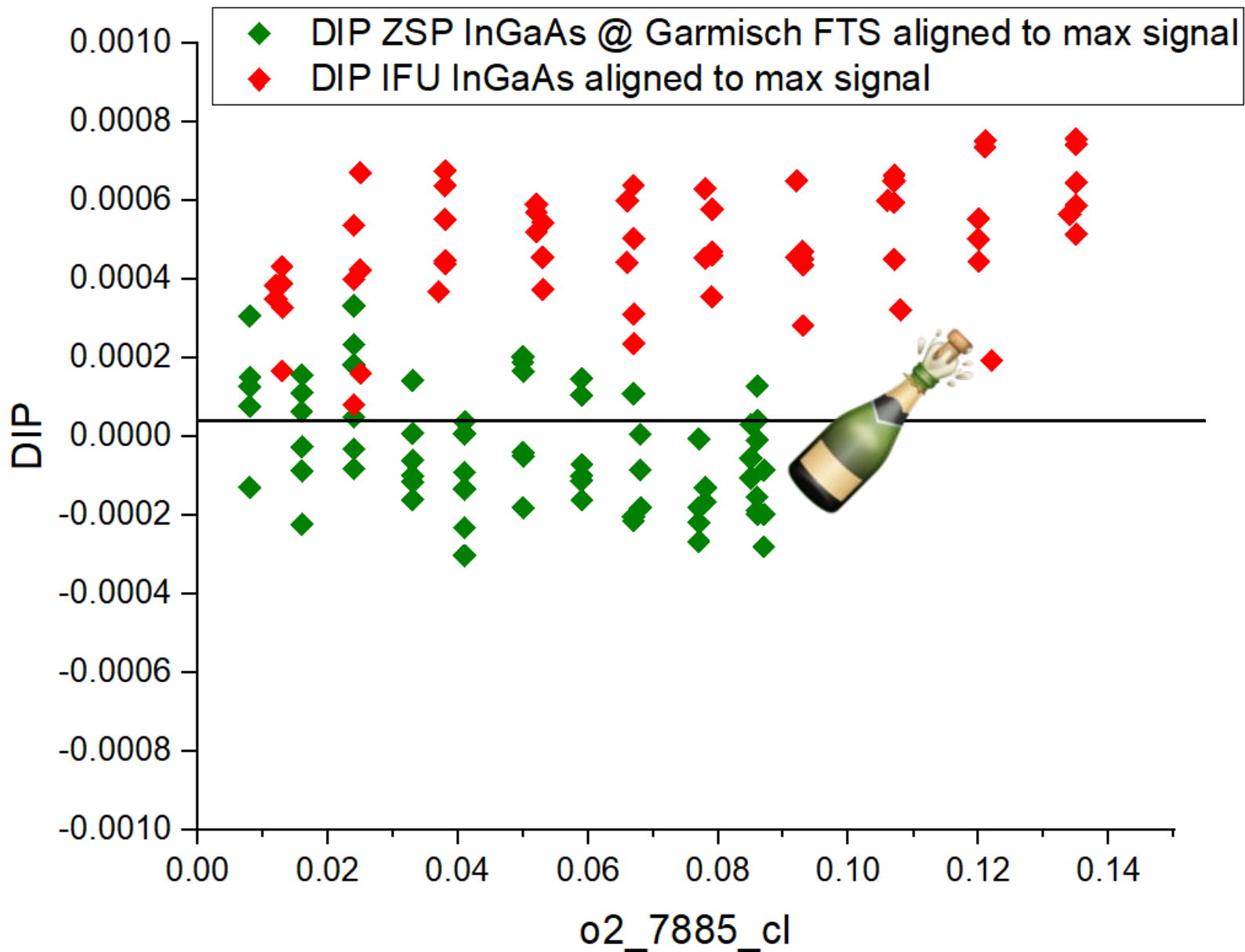
Solar measurements with Zugspitze InGaAs @ Garmisch FTS: **Unsuccessful 1st attempt**



- Dip not smaller with Zugspitze InGaAs as expected (0.00008), but indeed a factor 10 higher than with Garmisch InGaAs
- Possible cause: We had not realigned the focusing mirror before the detector after detector swapping
- Redo the experiment: realignment of focusing mirror allowed to increase peak amplitude 9000 -> 27000, with the following result:

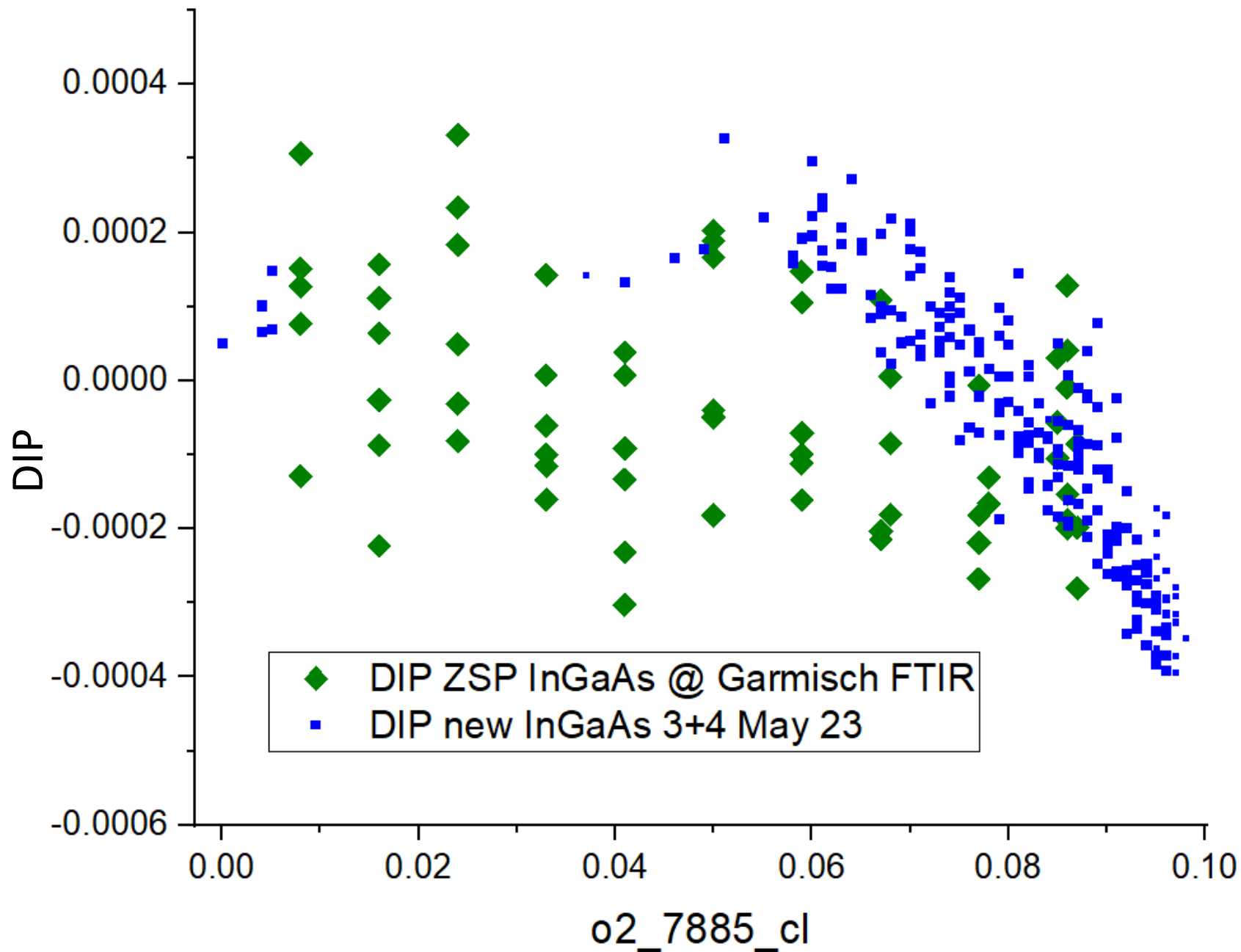
Solar measurements with Zugspitze InGaAs @ Garmisch FTS:

Success after realignment of focusing mirror

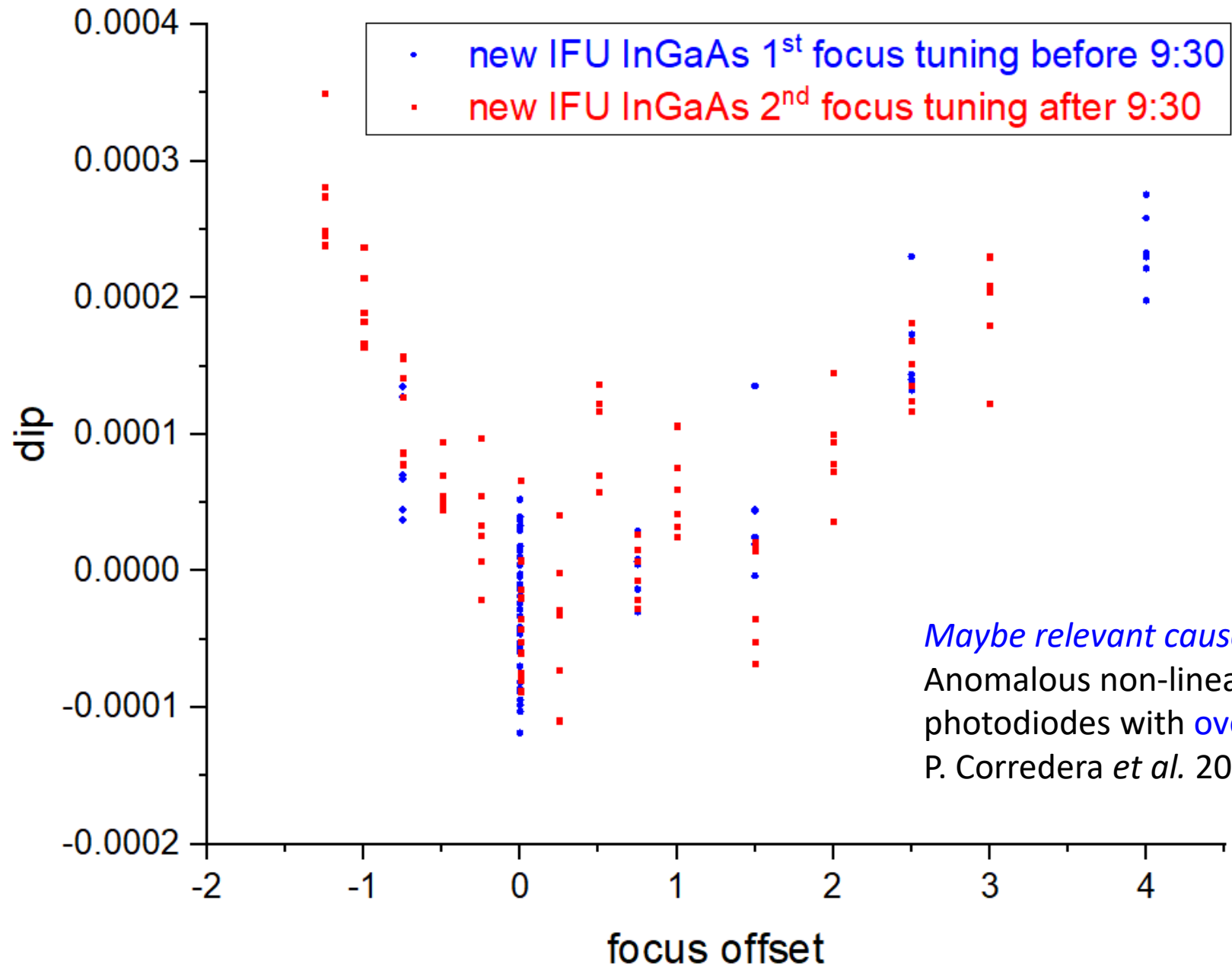


22 March 2023

Ordered a **new InGaAs** for the Garmisch FTS: **Also no positive dip but differing O2-cl sensitivity**



Focal distance tuning experiment with new InGaAs



Maybe relevant cause:

Anomalous non-linear behaviour of InGaAs photodiodes with **overfilled illumination**.

P. Corredera *et al.* 2003 *Metrologia* **40** S150

Conclusions to avoid positive dips

- attenuate solar irradiance until your XCO₂ errors start to rise
 - *if you still have a positive dip* ⇒
- try another detector
- carefully x-y-align the focusing mirror to the most sensitive position of the detector element
- carefully check correct focal distance to the detector
- **never drink such stuff ...**

