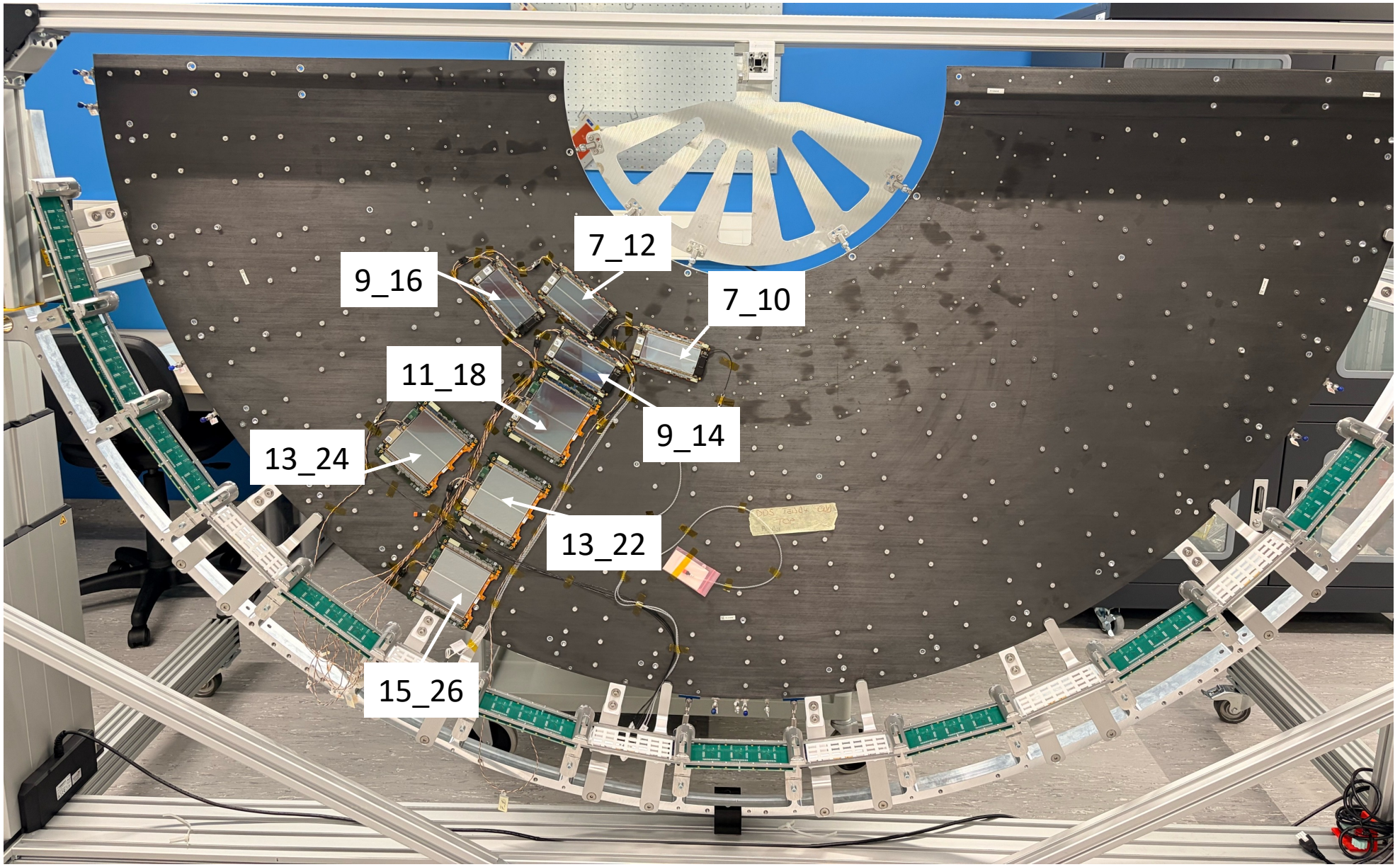
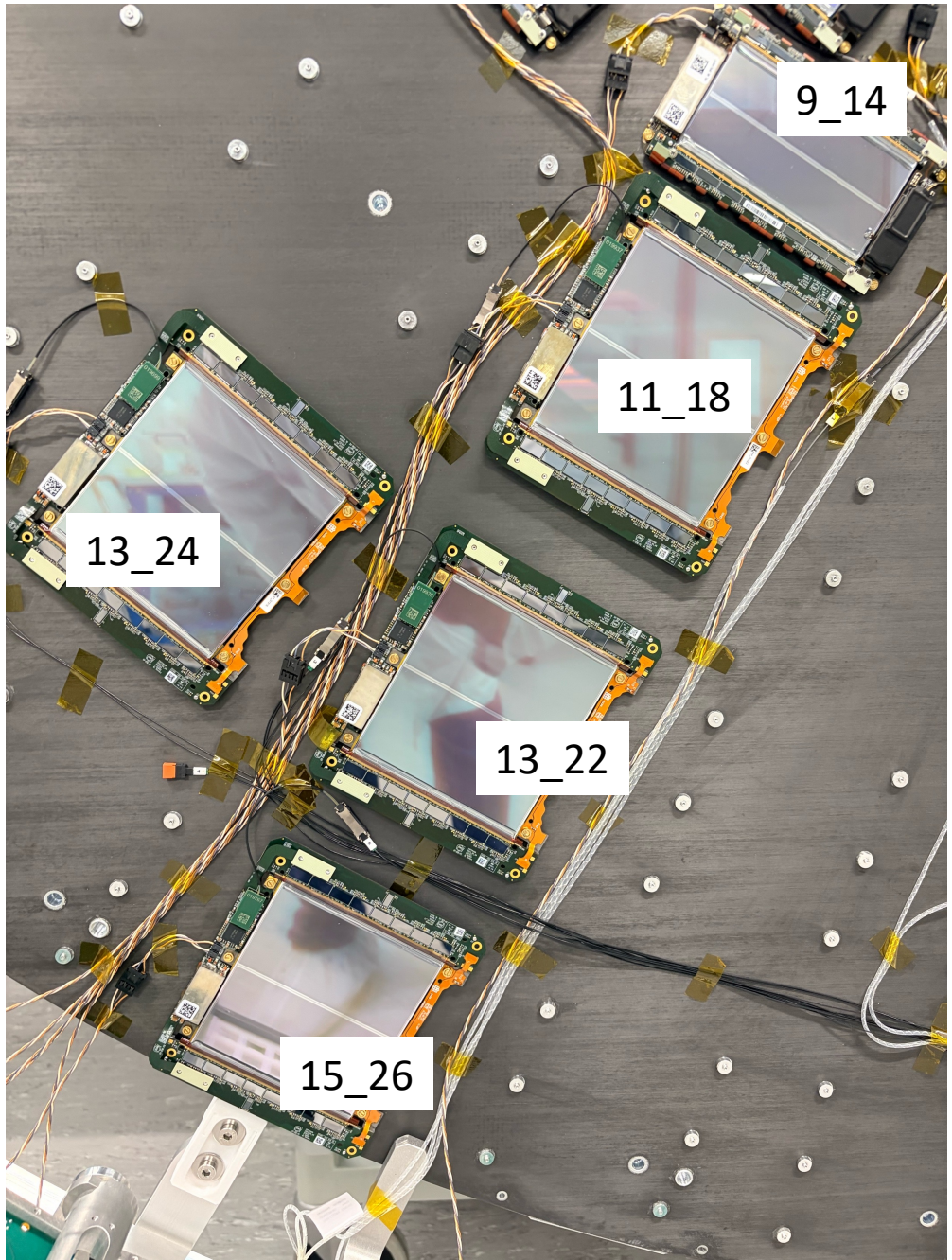

7_12
9_16
7_10
11_18
9_14
13_24
13_22
15_26

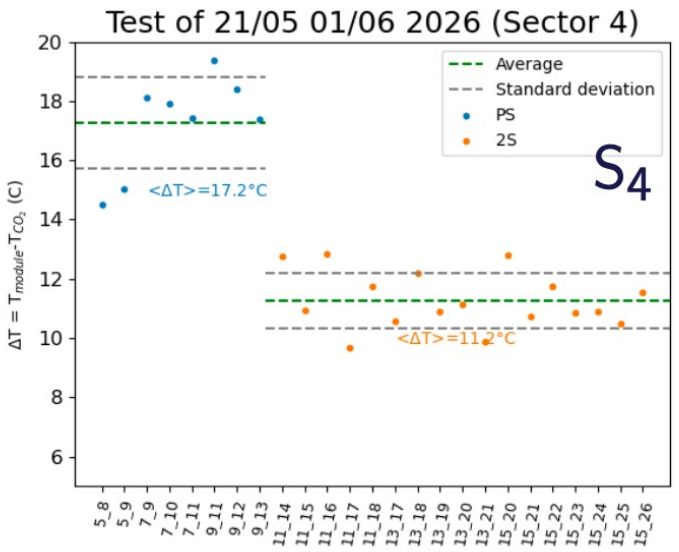
Module Name	Module Position
2S_40_6_KIT-10024	13-24
PS_40_IPG-10017	9-14
PS_40_IPG-10015	7-10
PS_40_IPG_10014	9-16
PS_40_IPG-10008	7-12
2S_40_6_KIT-10021	11-18
2S_40_6_KIT-10022	13-22
2S_40_6_KIT-10023	15-26

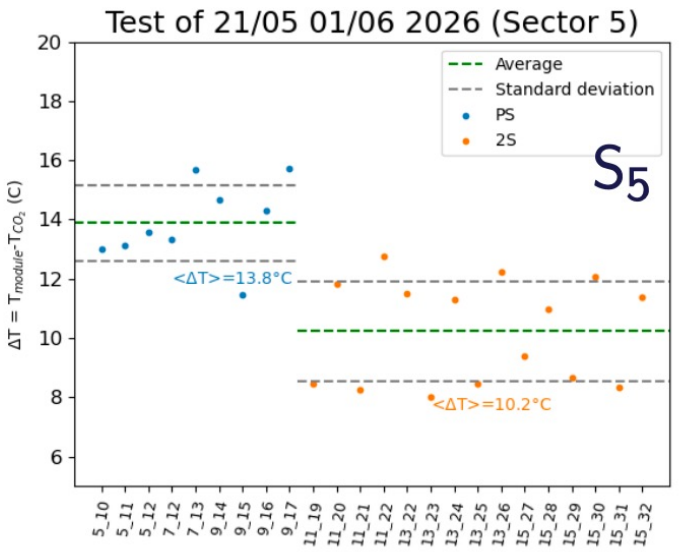


LPGBT ID tests for optical communication check

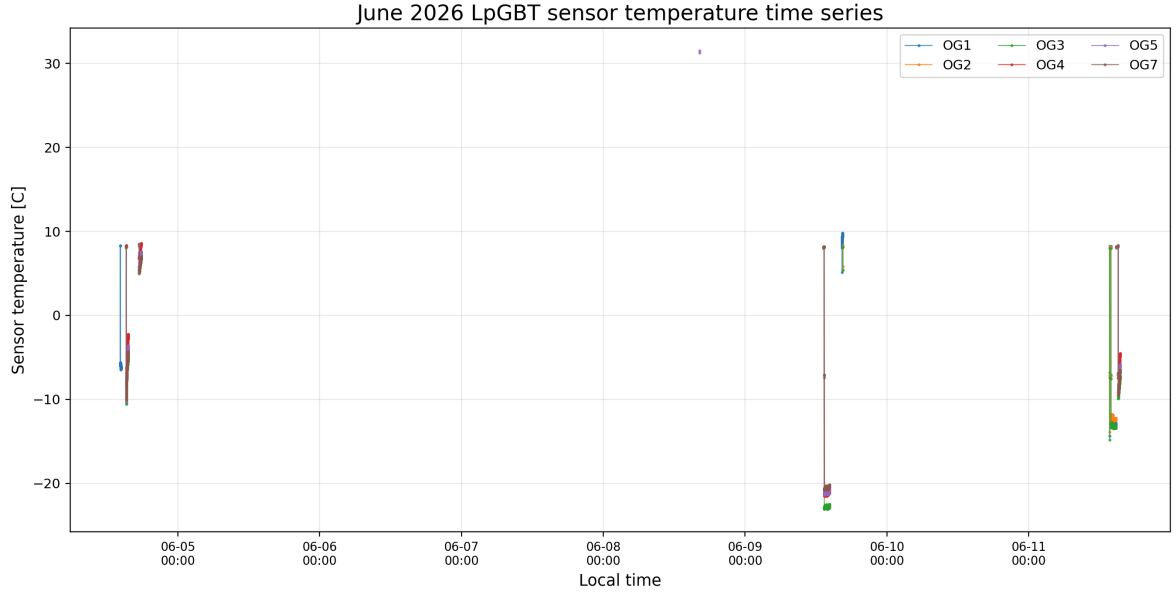
A	B	I	
Module Name	**Module Position**	**LPGBTID**	
2S_40_6_KIT-10024	13-24	2896800874	Yes
PS_40_IPG-10017	9-14	2057841160	Yes
PS_40_IPG-10015	7-10	850279691	Yes
PS_40_IPG_10014	9-16	1512803219	Yes
PS_40_IPG-10008	7-12	2058161484	Yes
2S_40_6_KIT-10021	11-18	2351704812	Yes
2S_40_6_KIT-10022	13-22	606628870	Yes
2S_40_6_KIT-10023	15-26	2360199962	Yes

Thermal Tests



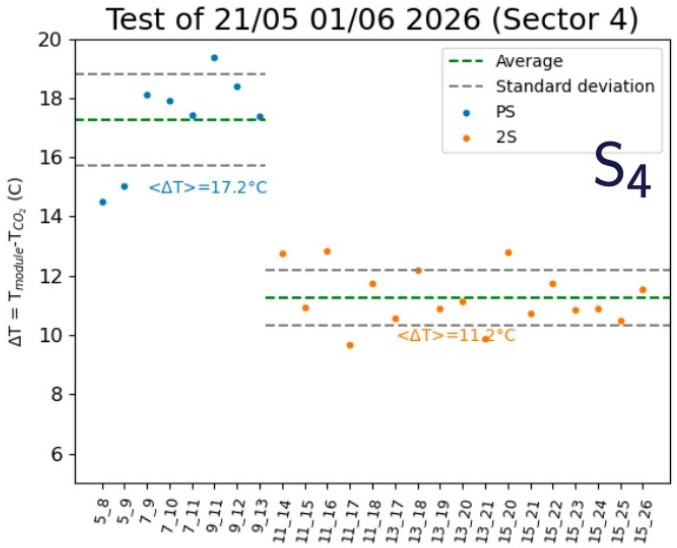


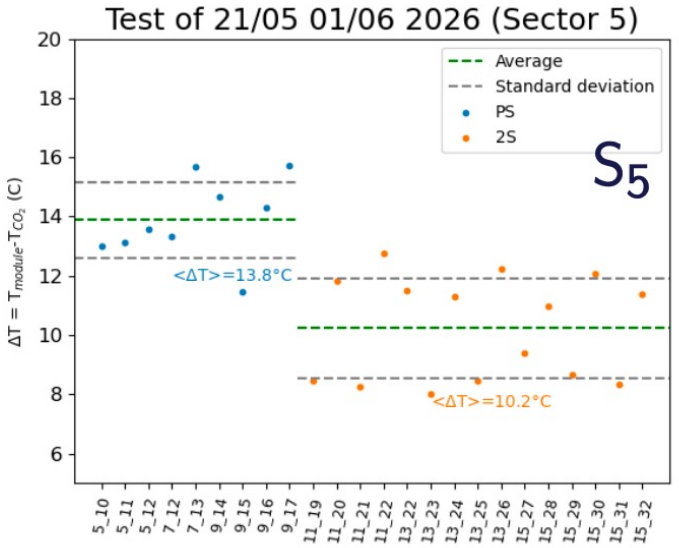
Plots from Muriel



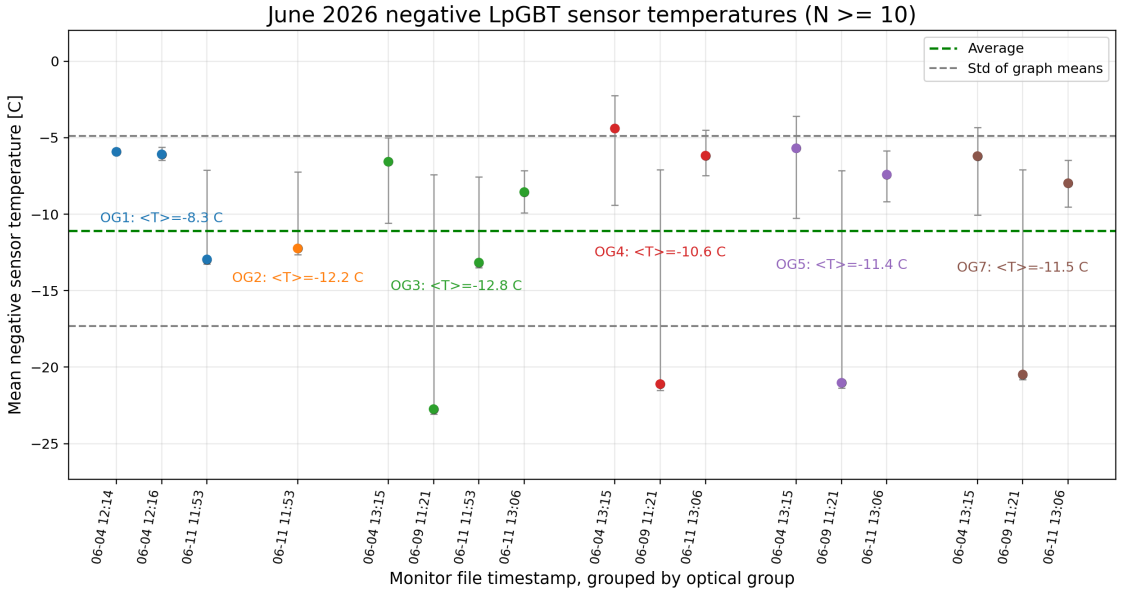
From Real Module tests at -30 C

Thermal Tests



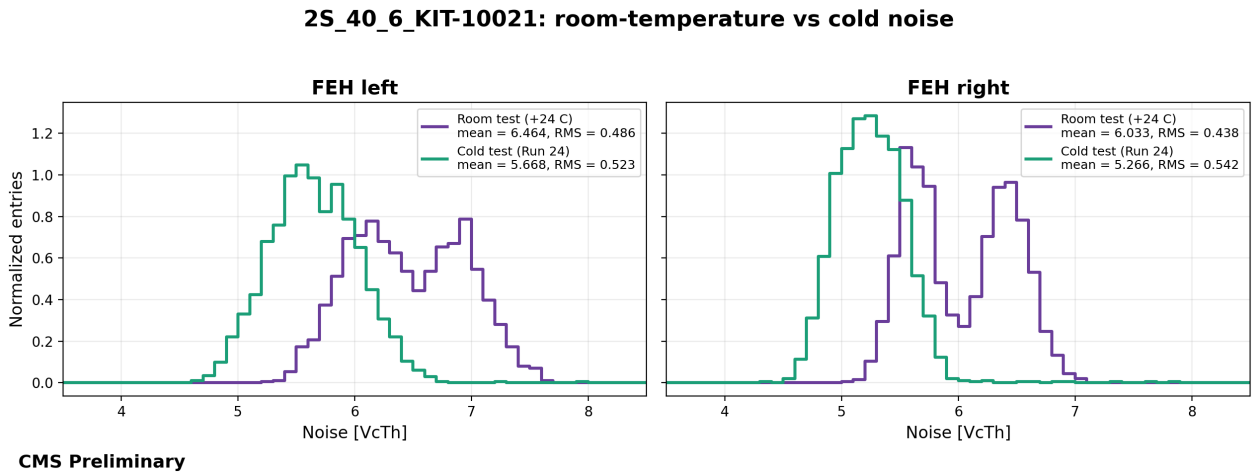


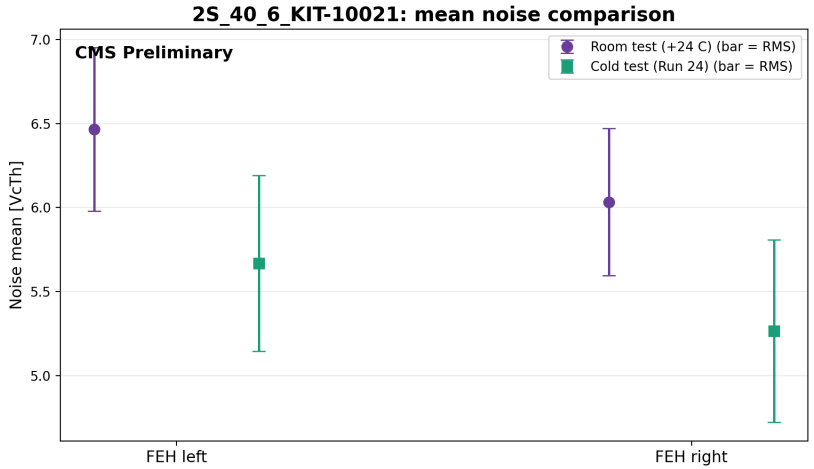
Plots from Muriel



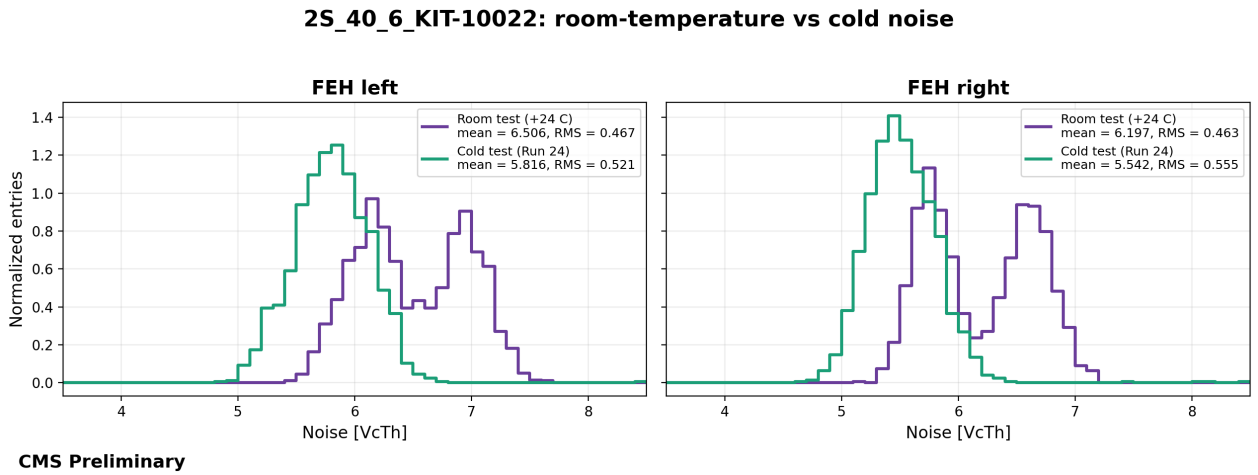
From Real Module tests at -30 C

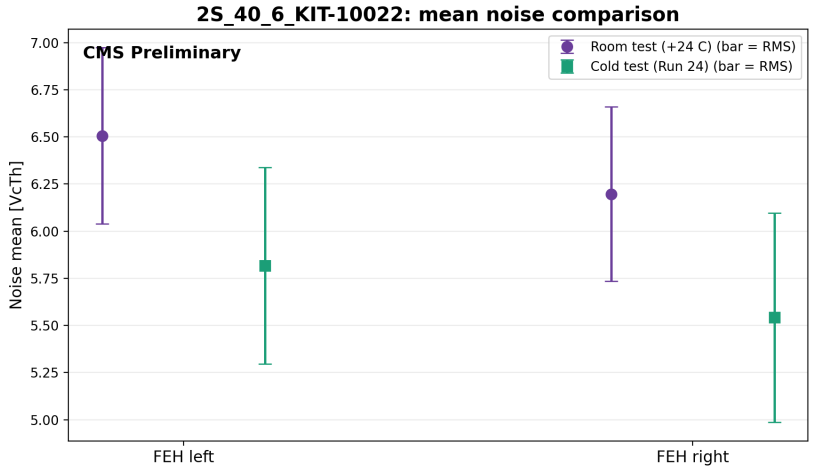
Noise comparison between Room temperature and Cold test



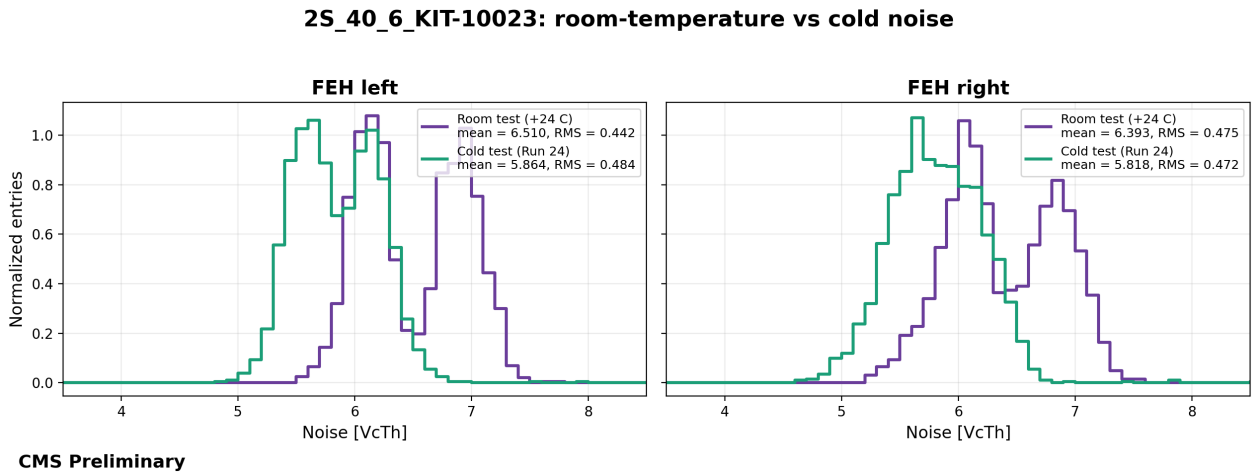


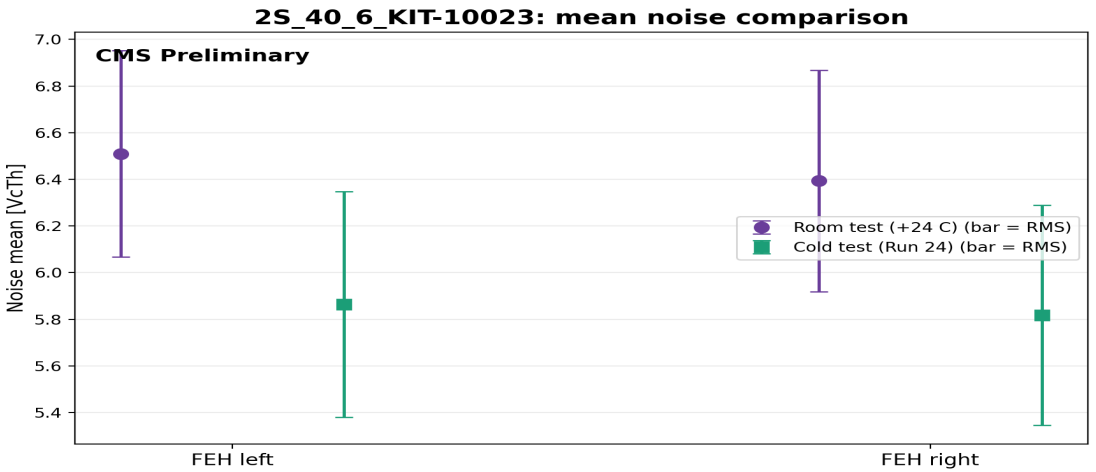
Noise comparison between Room temperature and Cold test



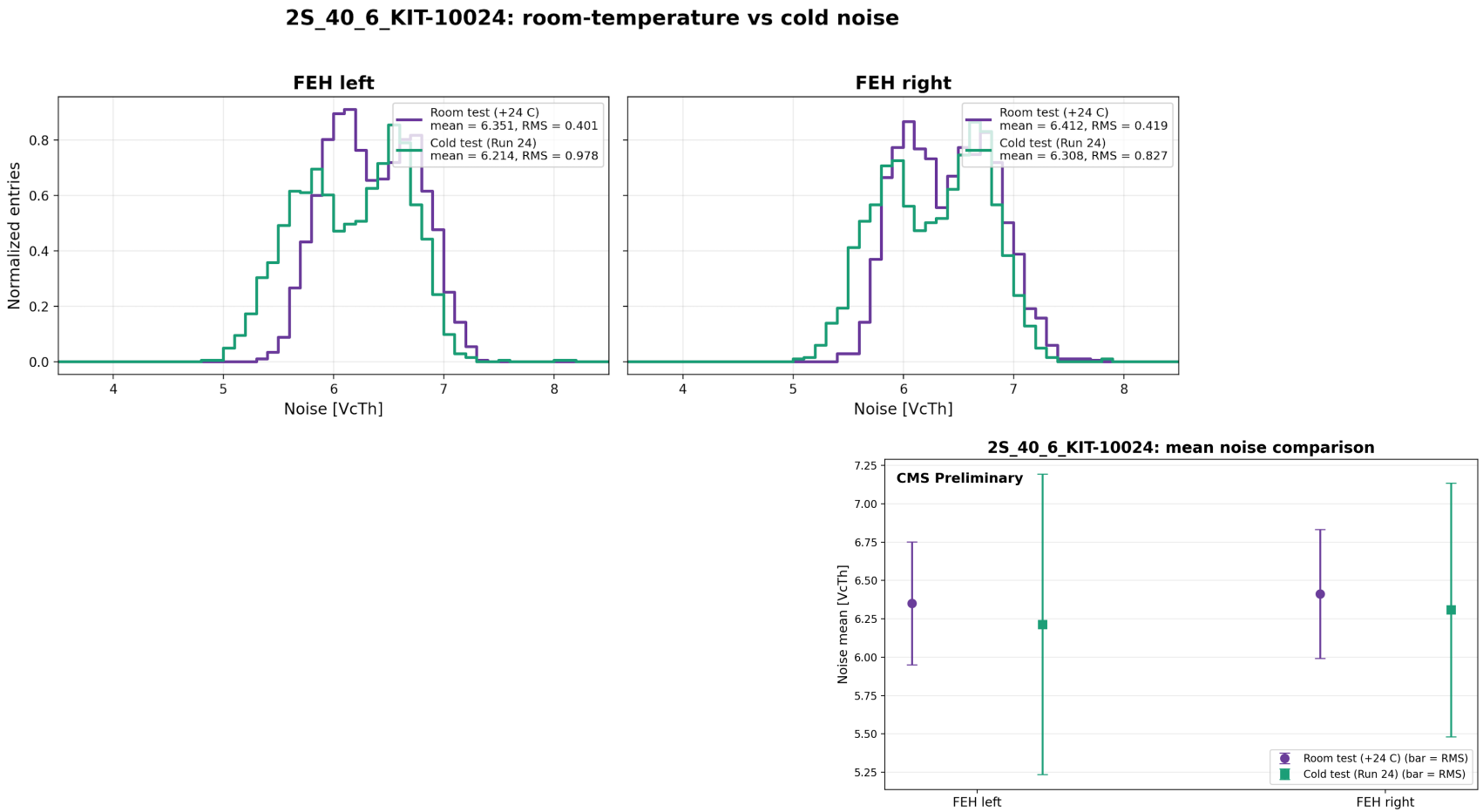


Noise comparison between Room temperature and Cold test





Noise comparison between Room temperature and Cold test



Observable used for common-mode noise

Feld et al. Eq. 19

$$\text{Gamma}^2 = \sin(\text{alpha}) / [1 - \sin(\text{alpha})]$$

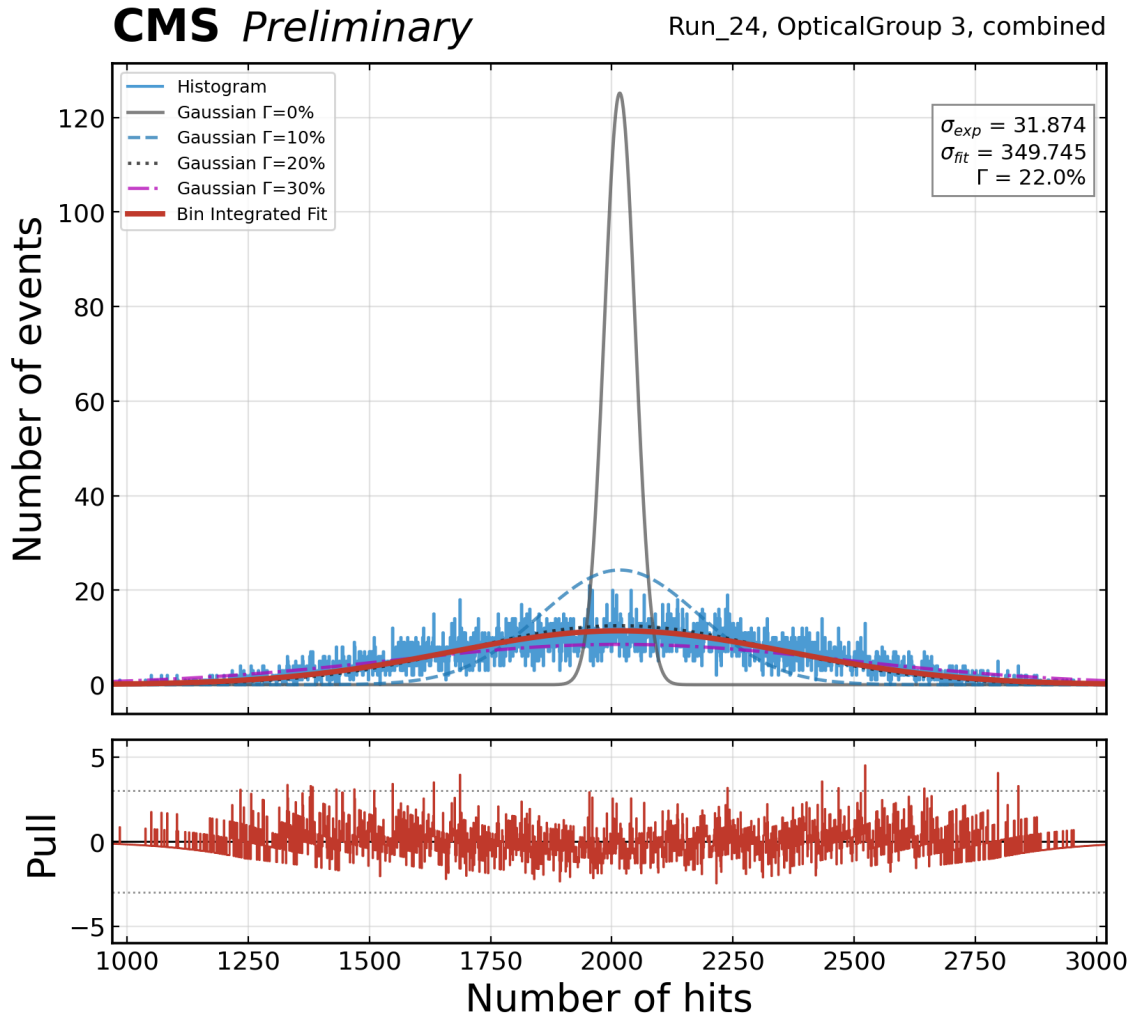
$$\text{alpha} = 2\pi [\text{Var}(Ne) - Ne\_bar(1 - Ne\_bar/n)] / [n(n - 1)]$$

Here Ne is the number of hit channels per event and n is the number of channels in the group.

- The binomial term is the expected variance without coherent noise.
- The excess variance is normalized as a pairwise channel-correlation effect.
- The plots show 100 x Gamma, so 0.220 appears as 22.0%.
- The same formula is used for observed histograms and fitted model widths.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

Representative bin-integrated fit: OG 3 combined

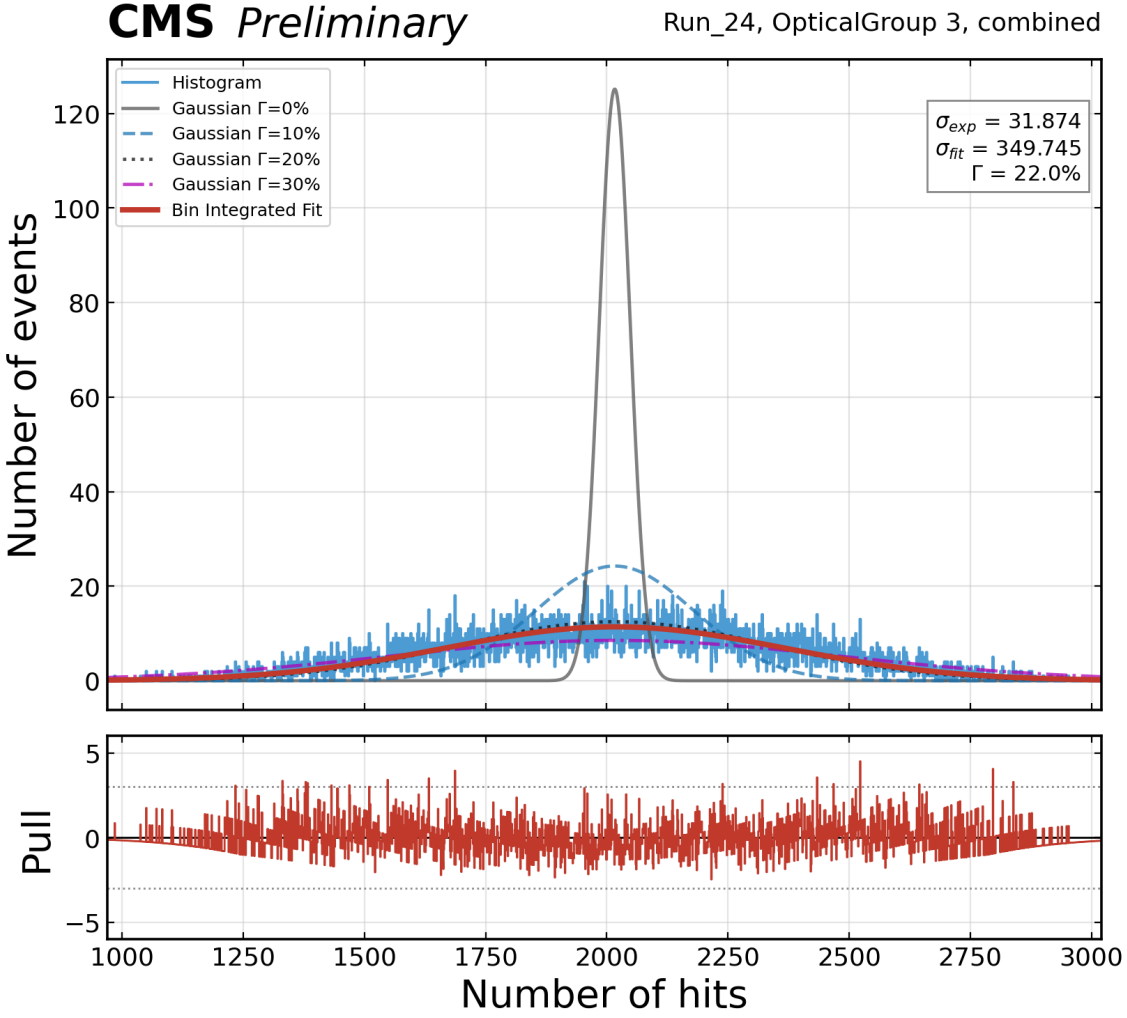


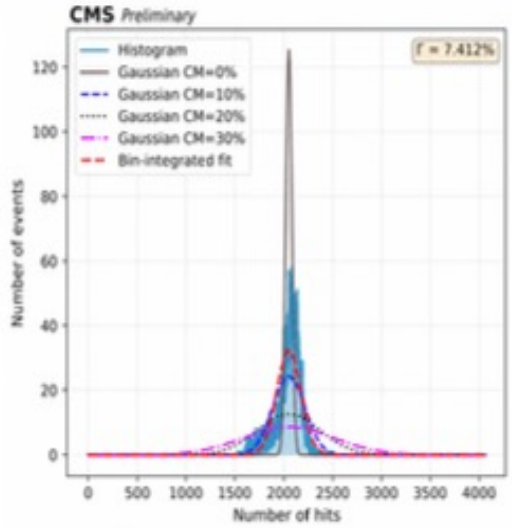
Interpretation

- Observed distribution is much wider than the binomial-only expectation.
- The bin-integrated mixture captures the broad multi-population shape.
- The plotted Gamma is the Feld value in percent.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

Representative bin-integrated fit: OG 3 combined



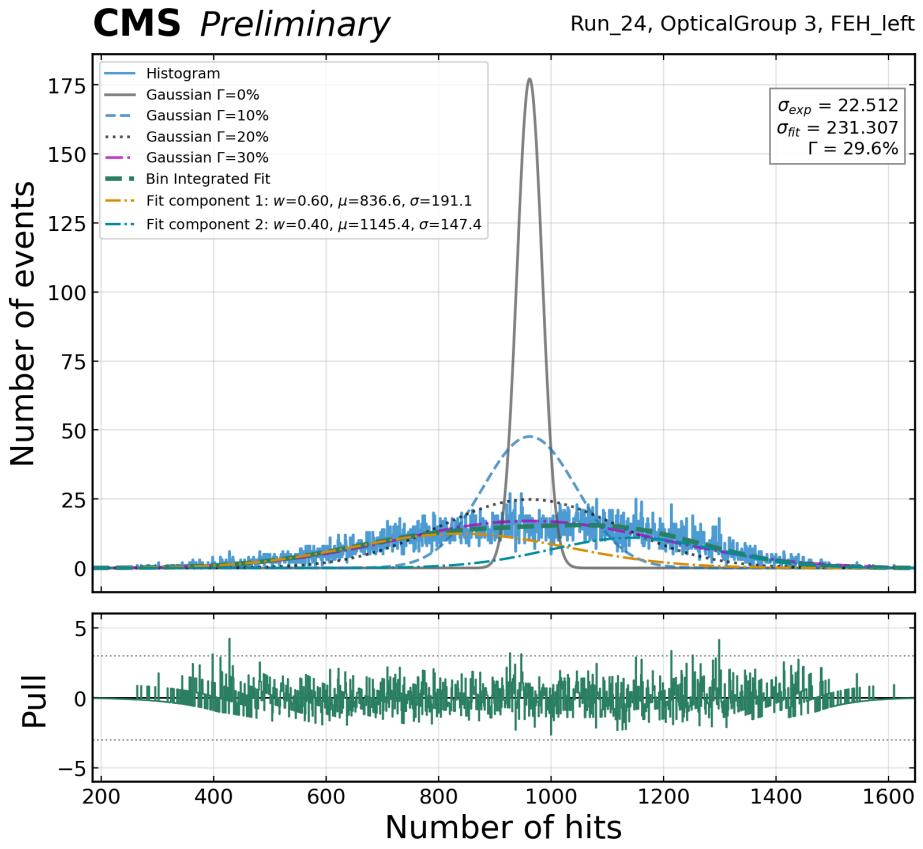


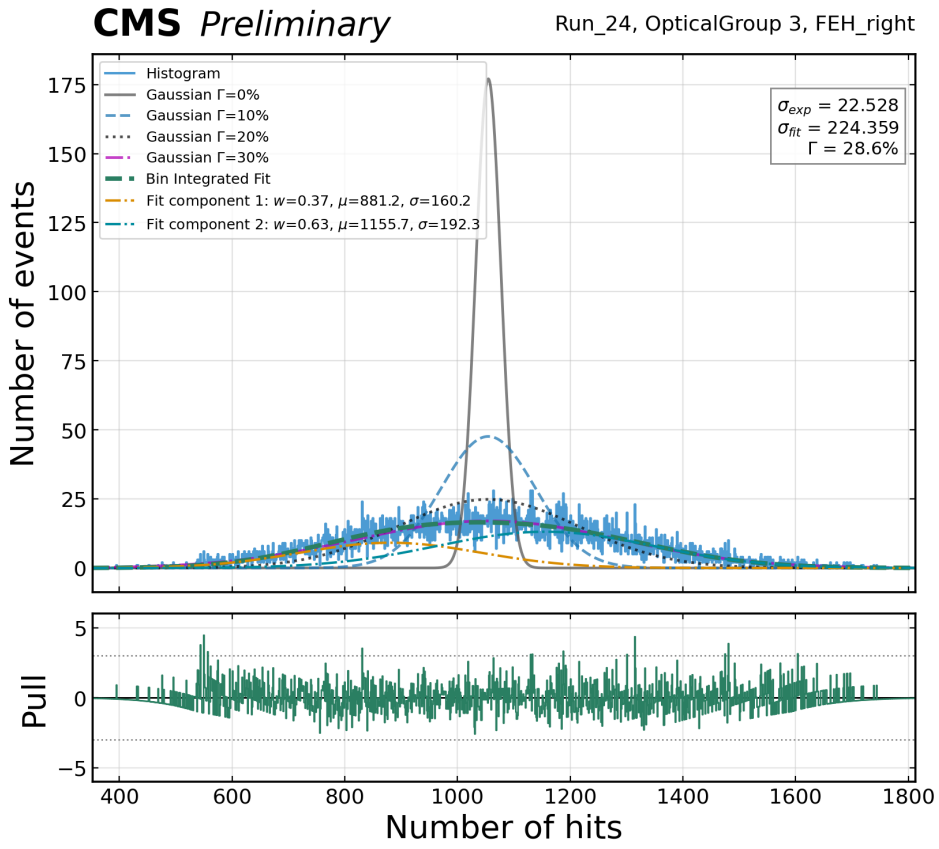
Louvain

Figure: **Fit Distribution for a typical module**. The plot shows the hit distribution and noise characterization for module. It compares the measured hit occupancy distribution with several Gaussian models corresponding to different levels of common-mode (CM) noise. **Blue histogram** represents the measured distribution of hits for the module. **Gray Solid Curve – Gaussian CM=0%** represents an idealized case with no common-mode noise. **Blue Dashed Curve – Gaussian CM=10%** includes a small common-mode noise. **Black Dotted Curve – Gaussian CM=20%** is broader distribution. **Magenta Dash-Dot Curve – Gaussian CM=30%** widest gaussian reprensenting large common-mode noise. **Red Dashed Curve – Bin-integrated fit** is the fitted model (a likelihood fit with Poisson bin statistics) to the measured histogram and the fit width is much larger than ideal CM=0% case, indicating subtantial spread in ocuupancy. Γ **(gamma)** represents the fraction value of common-mode noise. σ_{exp} **(ecpected width)** is 31.873. σ_{fit} **(measured width from fit)** is 123.994.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

FEH split: stronger common-mode broadening



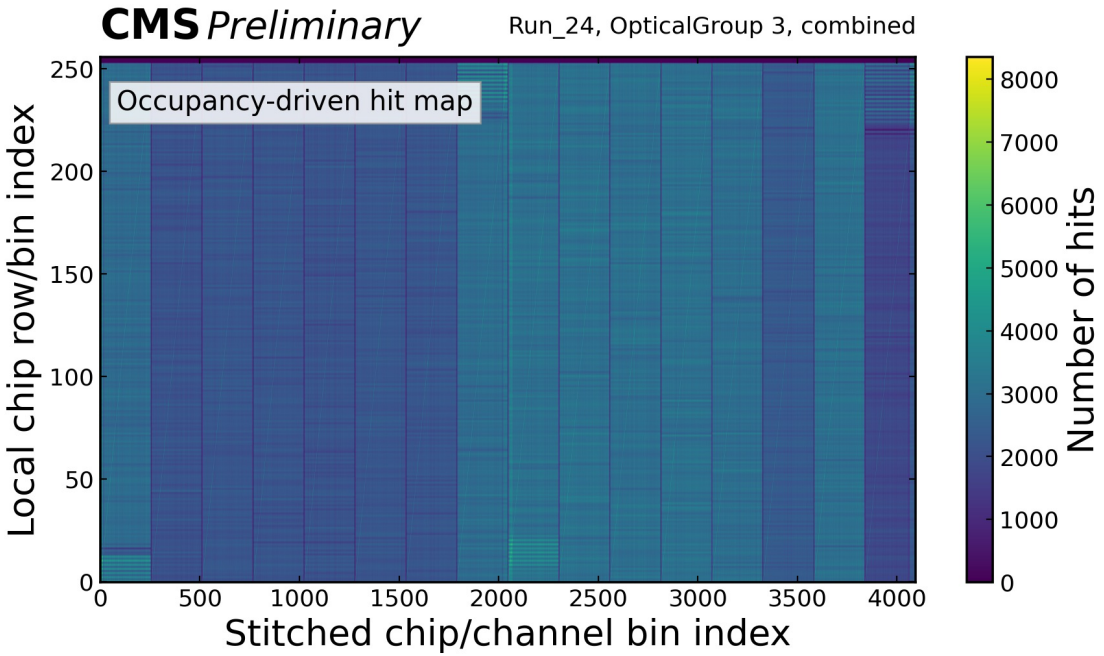


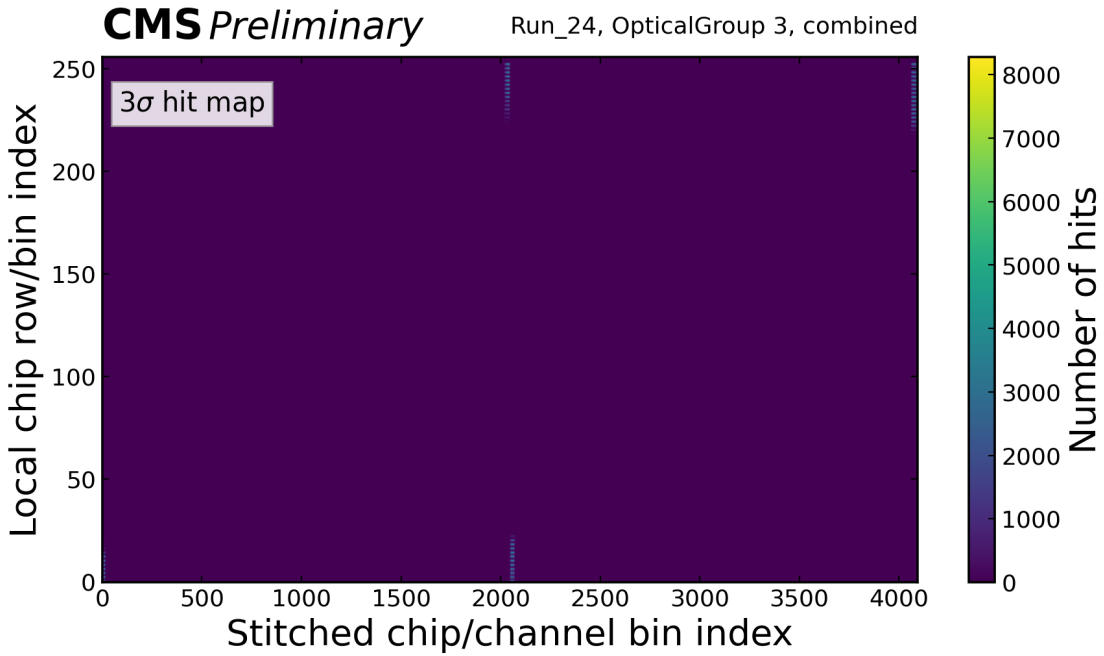
OG 3 FEH0: 29.6%

OG 3 FEH1: 28.6%

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

Hit-map diagnostics

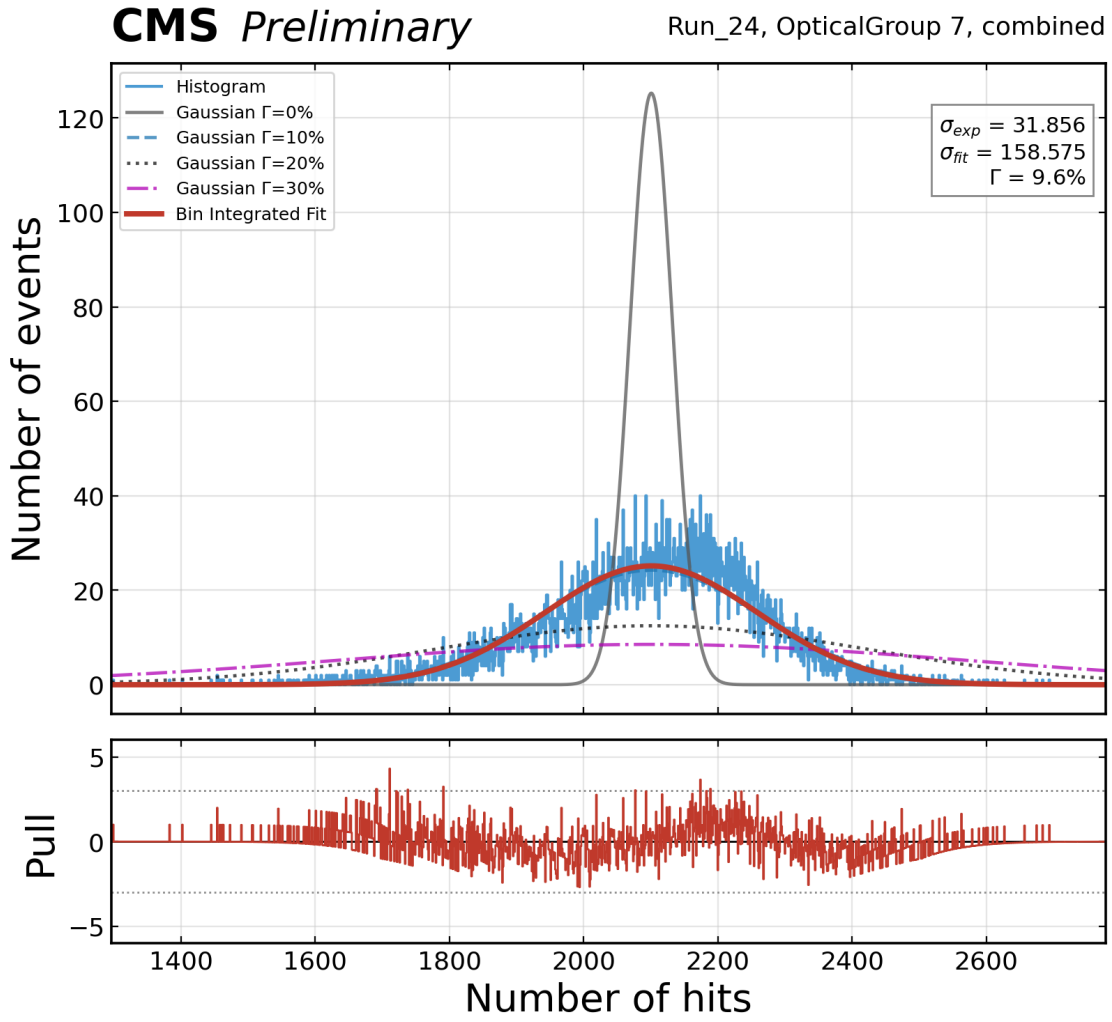


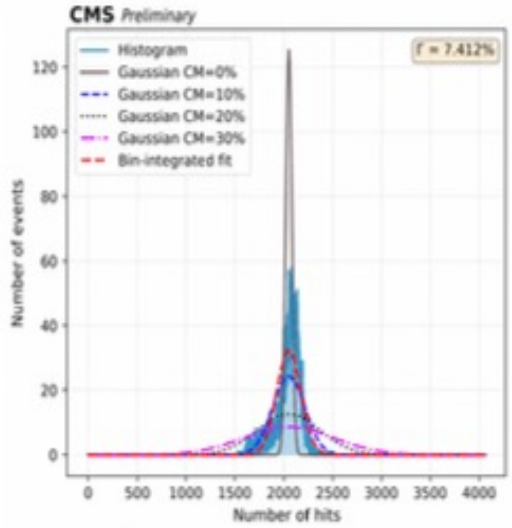


- Fit plots quantify the broadening through Gamma.
- Hit maps check whether the effect has coherent structure across stitched chip bins.
- The full output directory contains all optical groups, regions, models, PNGs, and PDFs.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

Representative bin-integrated fit: OG 7 combined





Louvain

Figure: **Fit Distribution for a typical module**. The plot shows the hit distribution and noise characterization for module. It compares the measured hit occupancy distribution with several Gaussian models corresponding to different levels of common-mode (CM) noise. **Blue histogram** represents the measured distribution of hits for the module. **Gray Solid Curve – Gaussian CM=0%** represents an idealized case with no common-mode noise. **Blue Dashed Curve – Gaussian CM=10%** includes a small common-mode noise. **Black Dotted Curve – Gaussian CM=20%** is broader distribution. **Magenta Dash-Dot Curve – Gaussian CM=30%** widest gaussian reprensenting large common-mode noise. **Red Dashed Curve – Bin-integrated fit** is the fitted model (a likelihood fit with Poisson bin statistics) to the measured histogram and the fit width is much larger than ideal CM=0% case, indicating subtantial spread in ocuupancy. Γ **(gamma)** represents the fraction value of common-mode noise. σ_{exp} **(ecpected width)** is 31.873. σ_{fit} **(measured width from fit)** is 123.994.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.

Gamma summary from observed hit-count distributions

Optical group	Combined	FEH0	FEH1
OG 3	22.0%	29.6%	28.6%
OG 4	13.4%	23.3%	23.5%
OG 5	8.9%	20.7%	21.8%
OG 7	9.6%	29.7%	30.1%

Values are shown as percent. FEH regions are consistently higher than the combined optical-group value.

Feld et al. NIM A 487 (2002) 557-564, Eq. 19; values shown as 100 x Gamma.