

Sample CrIS PFL Gas Cell Tests and Cross-Test Summary

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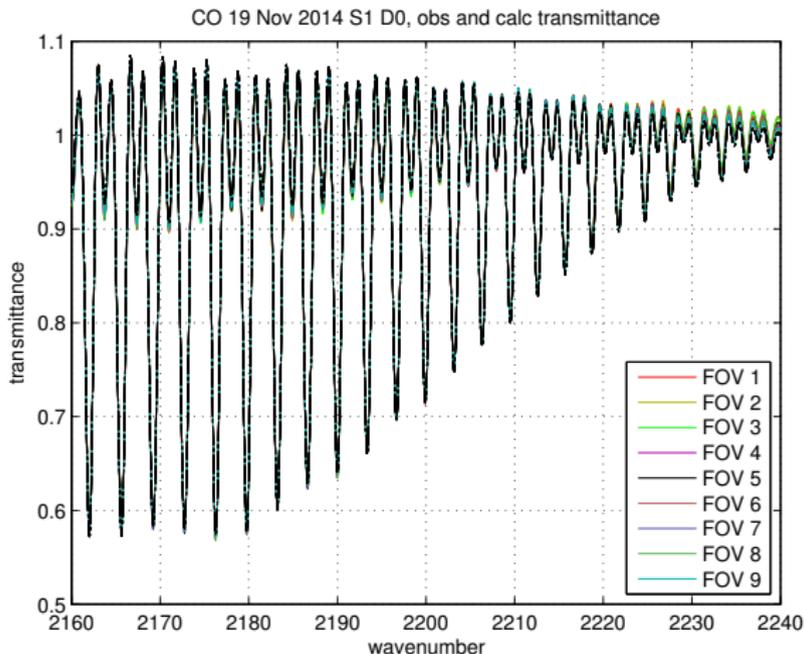
overview

- ▶ we look at three representative results from the PFL test sequence, and compare residuals for CO, CH₄, and CO₂ for the MN, PFH, and PFL tests
- ▶ the PFL tests show good agreement with calculated transmittances for the CO, CH₄ and CO₂ tests
- ▶ the CO and CH₄ side 1 residuals are very consistent across the MN, PFH, and PFL tests
- ▶ we continue to see a low-frequency component in residuals, in some tests
- ▶ we continue to see a significant difference between nominal and observed gas cell pressure in some tests

CO test parameters

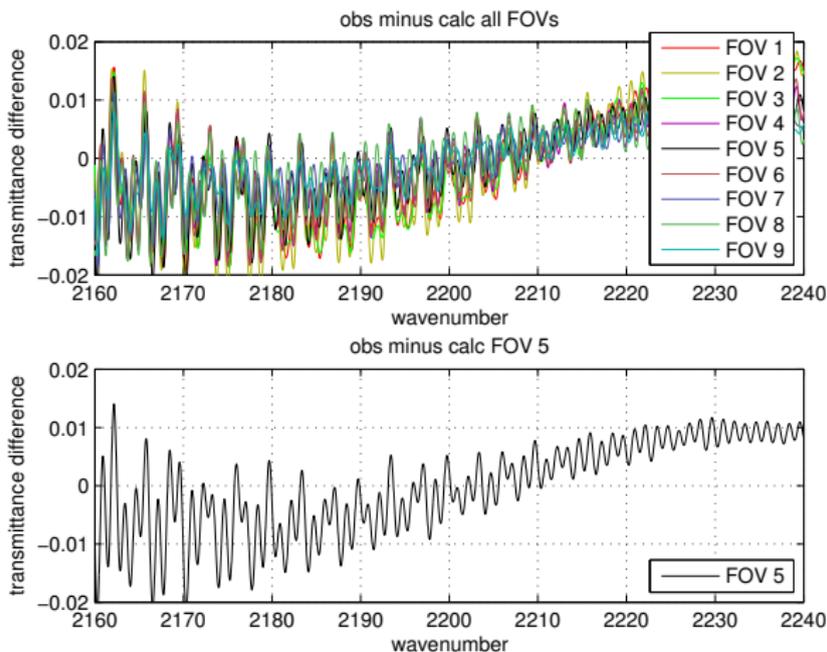
- ▶ SW PFL, 19-20 Nov 2014
- ▶ side 1, sweep direction 0
- ▶ fitting interval 2160 to 2240 cm^{-1}
- ▶ metrology laser 773.0763 nm from neon cal
- ▶ Oct 2013 Exelis side 1 focal plane values
- ▶ ILS with periodic sinc wrap at the sensor grid
- ▶ HTBB nominal T1 335 K, T2 320 K
- ▶ 330 observations in each test leg
- ▶ gas cell nominal pressure 45 torr
- ▶ gas cell observed pressure 45 torr
- ▶ gas cell temperature 16.6 C
- ▶ gas cell length 12.59 cm

CO obs and calc



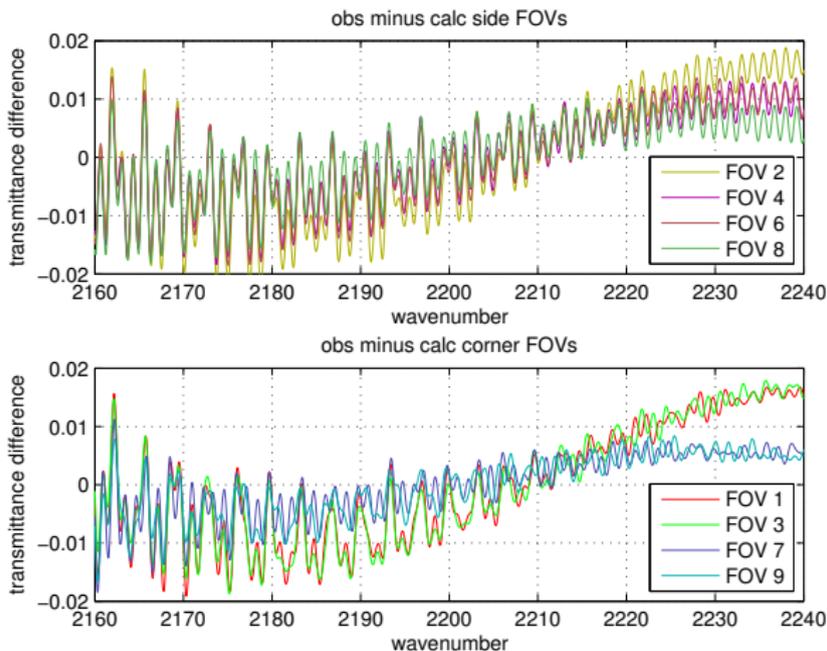
Observed and calculated transmittance for all FOVs, over the fitting interval. At this level of detail we see all values are very close.

CO obs minus calc



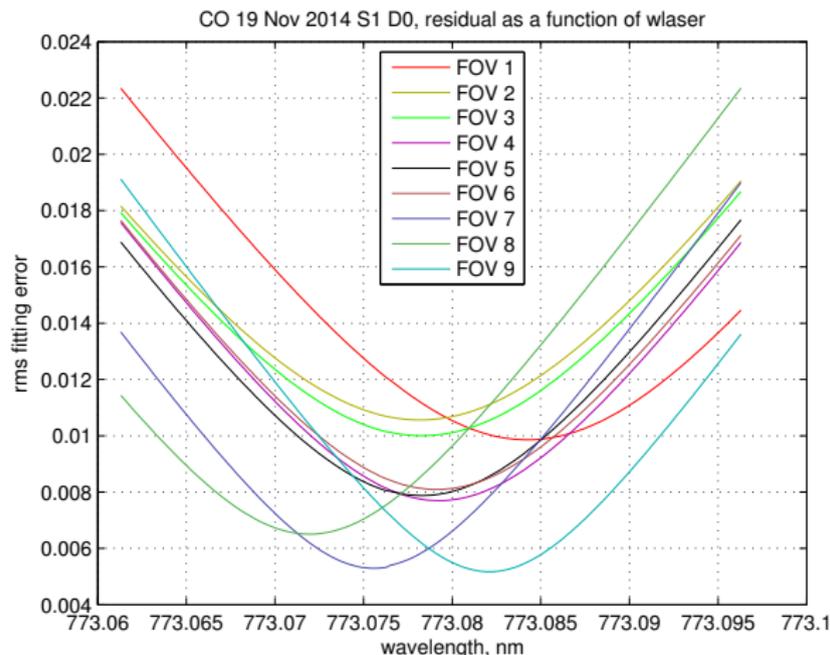
Observed minus calculated transmittance for all FOVs and for FOV 5 alone, over the fitting interval.

CO obs minus calc



Observed minus calculated transmittance for side and corner FOVs, over the fitting interval.

CO fitting residuals



residuals $\text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$ over the fitting interval as a function of metrology laser wavelength, for each FOV

CO tabulated residuals

metrology laser absolute residuals, ppm

-0.78	3.88	10.35	7	4	1
-5.69	2.59	2.33	8	5	2
7.50	3.62	2.59	9	6	3

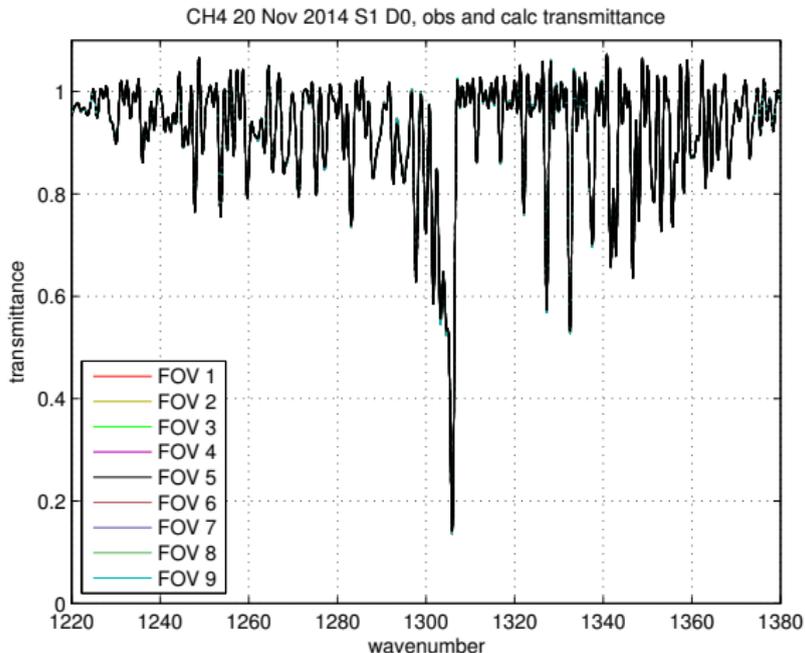
regression fitting weights and residuals

FOV	"a"	"b"	dmin	wmin	wfov
1	0.983	0.0196	0.0099	10.35	773.0843
2	0.988	0.0143	0.0106	2.33	773.0781
3	0.985	0.0181	0.0100	2.59	773.0783
4	0.998	0.0086	0.0077	3.88	773.0793
5	0.993	0.0144	0.0079	2.59	773.0783
6	0.997	0.0111	0.0081	3.62	773.0791
7	1.011	-0.0007	0.0053	-0.78	773.0757
8	1.010	0.0001	0.0065	-5.69	773.0719
9	0.997	0.0141	0.0052	7.50	773.0821

CH₄ test parameters

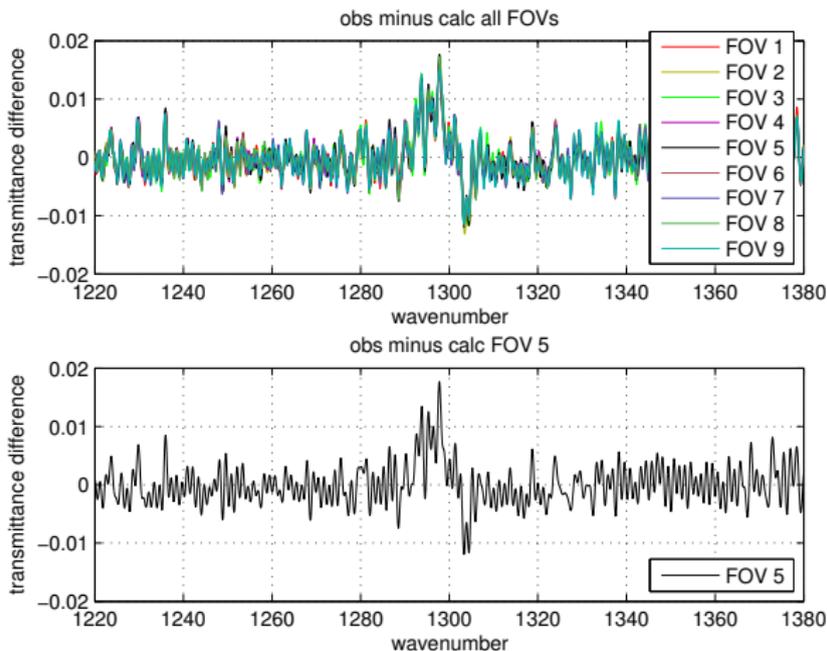
- ▶ MW PFL, 20 Nov 2014
- ▶ side 1, sweep direction 0
- ▶ fitting interval 1220 to 1380 cm⁻¹
- ▶ metrology laser 773.0764 nm from neon cal
- ▶ Oct 2013 Exelis side 1 focal plane values
- ▶ ILS with periodic sinc wrap at the sensor grid
- ▶ HTBB nominal T1 360 K, T2 320 K
- ▶ 330 observations in each test leg
- ▶ gas cell nominal pressure 41.3 torr
- ▶ gas cell observed pressure 29.5 torr
- ▶ gas cell temperature 16.6 C
- ▶ gas cell length 12.59 cm

CH₄ obs and calc



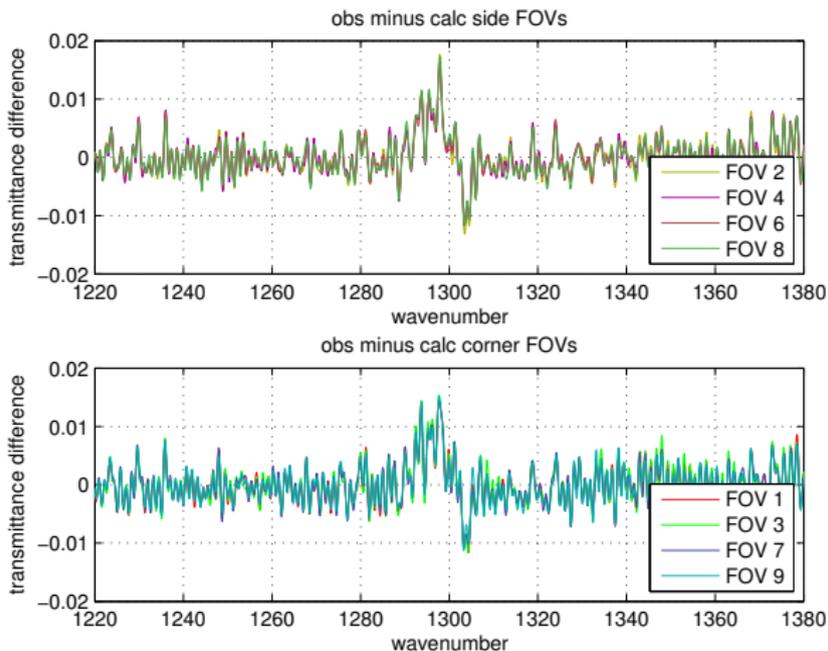
Observed and calculated transmittance for all FOVs, over the fitting interval. At this level of detail we see all values are very close.

CH₄ obs minus calc



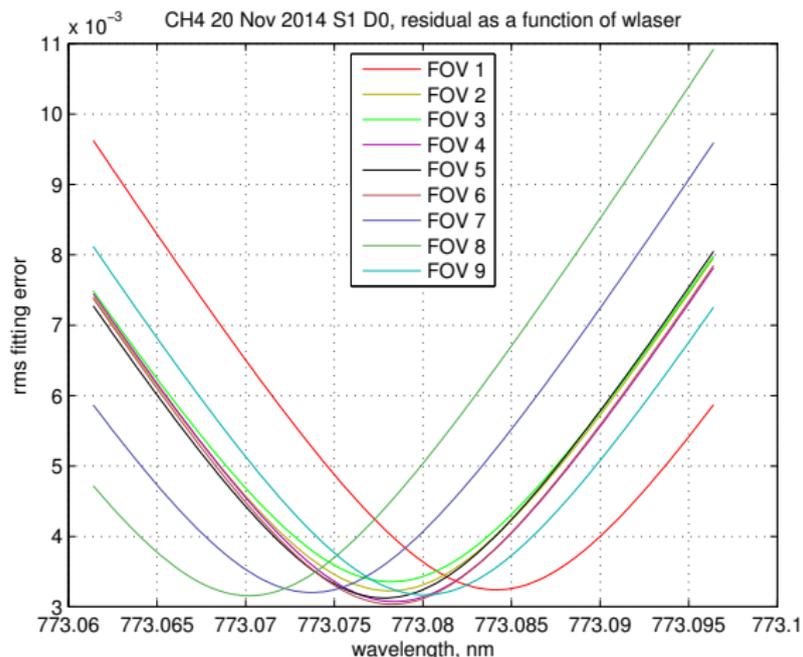
Observed minus calculated transmittance for all FOVs and for FOV 5 alone, over the fitting interval.

CH₄ obs minus calc



Observed minus calculated transmittance for side and corner FOVs, over the fitting interval.

CH₄ fitting residuals



residuals $\text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$ over the fitting interval as a function of metrology laser wavelength, for each FOV

CH₄ tabulated residuals

metrology laser absolute residuals, ppm

-3.62	2.59	9.83	7	4	1
-8.02	2.07	2.07	8	5	2
4.66	2.07	2.07	9	6	3

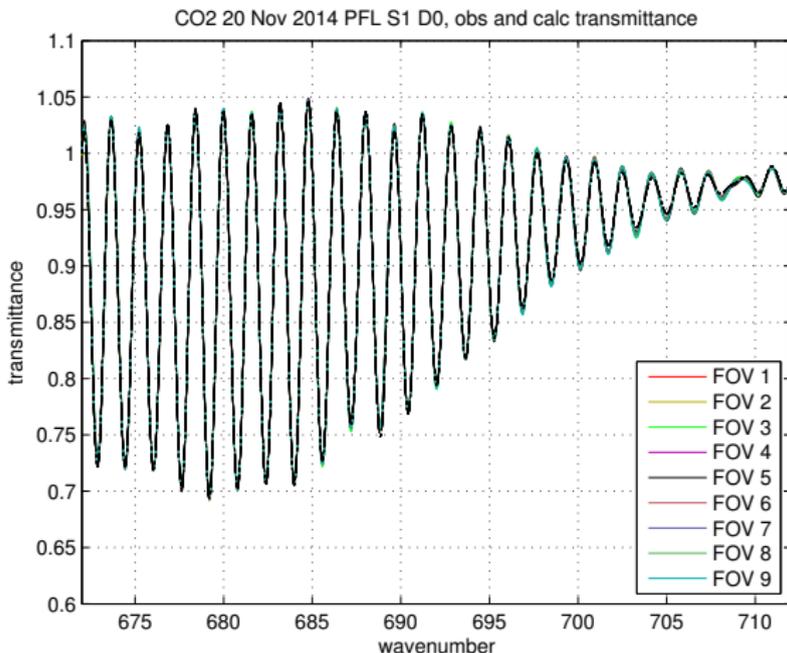
regression fitting weights and residuals

FOV	"a"	"b"	dmin	wmin	wfov
1	1.005	-0.0082	0.0032	9.83	773.0840
2	1.008	-0.0108	0.0032	2.07	773.0780
3	1.005	-0.0077	0.0034	2.07	773.0780
4	1.010	-0.0130	0.0031	2.59	773.0784
5	1.008	-0.0112	0.0031	2.07	773.0780
6	1.012	-0.0139	0.0030	2.07	773.0780
7	1.011	-0.0128	0.0032	-3.62	773.0736
8	1.010	-0.0116	0.0032	-8.02	773.0702
9	0.987	0.0090	0.0032	4.66	773.0800

CO₂ side 1 test parameters

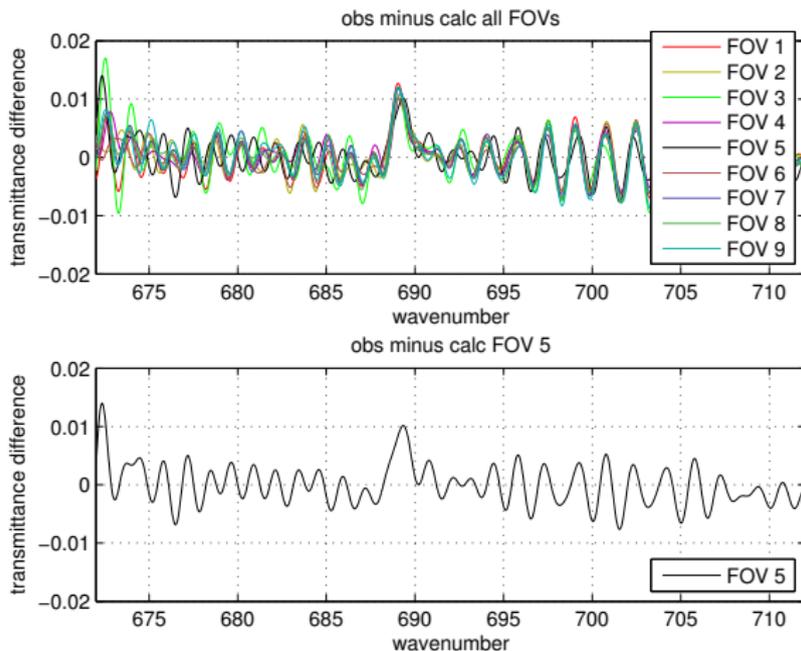
- ▶ LW PFL, 20 Nov 2014
- ▶ side 1, sweep direction 0
- ▶ fitting interval 672 to 712 cm⁻¹
- ▶ metrology laser 773.0765 nm from neon cal
- ▶ Oct 2013 Exelis side 1 focal plane values
- ▶ ILS with periodic sinc wrap at the sensor grid
- ▶ HTBB nominal T1 360 K, T2 320 K
- ▶ 330 observations in each test leg
- ▶ gas cell nominal pressure 40.7 torr
- ▶ gas cell observed pressure 22.0 torr
- ▶ gas cell temperature 16.7 C
- ▶ gas cell length 12.59 cm

CO₂ side 1 obs and calc



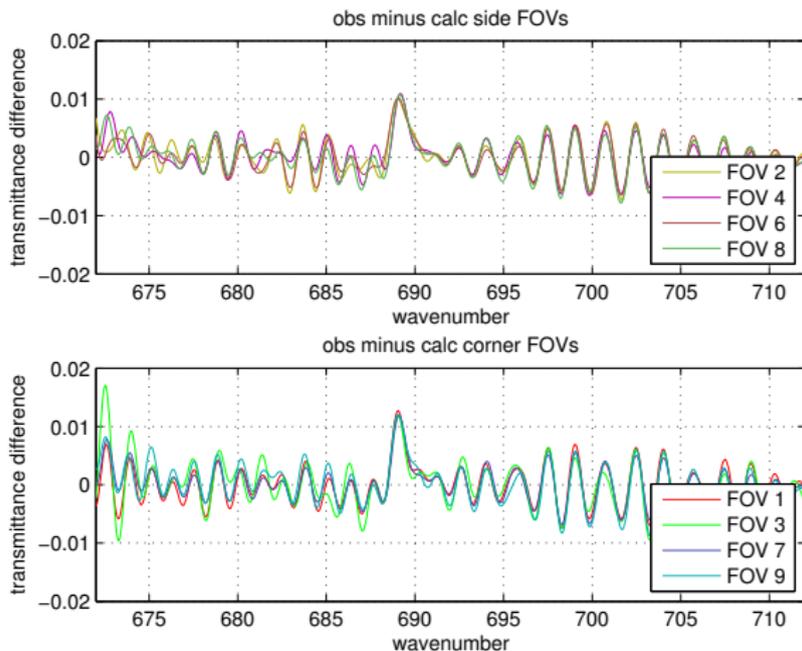
Observed and calculated transmittance for all FOVs, over the fitting interval. At this level of detail we see all values are close.

CO₂ side 1 obs minus calc



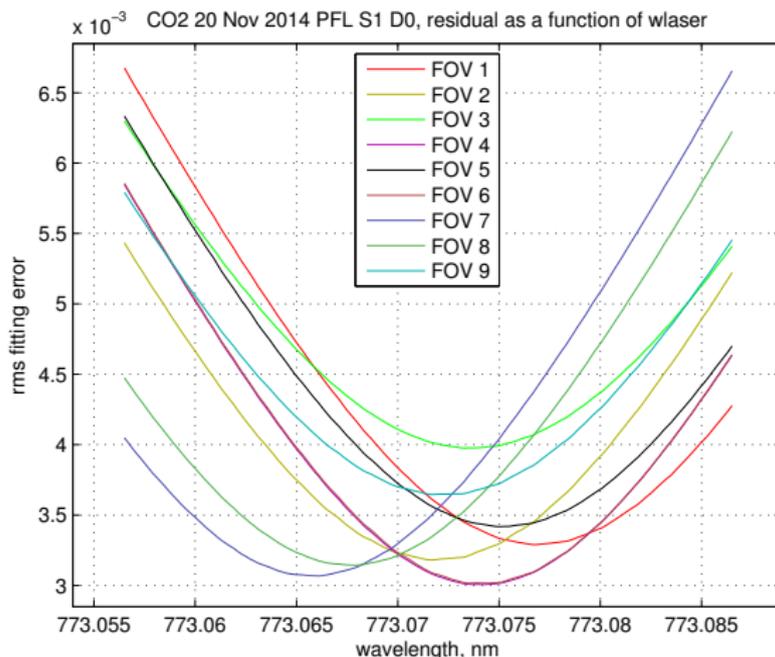
Observed minus calculated transmittance for all FOVs and for FOV 5 alone, over the fitting interval.

CO₂ side 1 obs minus calc



Observed minus calculated transmittance for side and corner FOVs, over the fitting interval.

CO₂ fitting residuals



residuals $\text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$ over the fitting interval as a function of metrology laser wavelength, for each FOV

CO₂ side 1 tabulated residuals

metrology laser absolute residuals, PPM

-13.45	-3.10	0.26	7	4	1
-11.12	-1.81	-6.21	8	5	2
-6.21	-3.88	-4.14	9	6	3

regression fitting weights and residuals

FOV	"a"	"b"	dmin	wmin	wfov
1	1.006	-0.0088	0.0033	0.26	773.0767
2	1.000	-0.0031	0.0032	-6.21	773.0717
3	1.000	-0.0034	0.0040	-4.14	773.0733
4	0.995	0.0002	0.0030	-3.10	773.0741
5	0.958	0.0368	0.0034	-1.81	773.0751
6	1.017	-0.0218	0.0030	-3.88	773.0735
7	1.013	-0.0182	0.0031	-13.45	773.0661
8	1.002	-0.0074	0.0031	-11.12	773.0679
9	1.006	-0.0130	0.0036	-6.21	773.0717

CO side 1 test comparison

“rms fit” is $1000 \cdot \text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$

“met laser” is the metrology laser residual

FOV	--- rms fit ----			--- met laser --		
	MN	PH	PL	MN	PH	PL
1	4.4	1.5	9.9	13.2	15.0	10.3
2	2.8	3.5	10.6	3.4	5.2	2.3
3	4.9	2.4	10.0	4.1	2.8	2.6
4	2.7	3.4	7.7	4.4	6.7	3.9
5	1.7	2.8	7.9	3.1	3.1	2.6
6	2.4	3.3	8.1	3.1	2.6	3.6
7	3.9	1.6	5.3	-0.5	-0.5	-0.8
8	2.4	3.3	6.5	-6.7	-6.7	-5.7
9	4.7	2.6	5.2	7.2	4.9	7.5

log torr: MN 40.5 PH 39.9 PL 45.0

obs torr: MN 41.0 PH 26.0 PL 45.0

CH₄ side 1 test comparison

“rms fit” is $1000 \cdot \text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$

“met laser” is the metrology laser residual

FOV	--- rms fit ----			--- met laser --		
	MN	PH	PL	MN	PH	PL
1	2.4	3.6	3.2	12.4	13.9	9.8
2	2.1	4.4	3.2	3.6	2.3	2.1
3	2.4	3.5	3.4	1.6	-0.3	2.1
4	1.9	4.2	3.1	5.2	5.9	2.6
5	1.8	3.8	3.1	2.8	2.8	2.1
6	2.1	4.1	3.0	2.3	-1.0	2.1
7	2.5	3.4	3.2	-1.6	0.3	-3.6
8	2.0	4.1	3.2	-7.2	-8.5	-8.0
9	2.1	3.3	3.2	3.9	1.8	4.7

log torr: MN 39.5 PH 40.6 PL 41.3

obs torr: MN 40.0 PH 40.6 PL 29.5

CO₂ side 1 test comparison

“rms fit” is $1000 \cdot \text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$

“met laser” is the metrology laser residual

FOV	--- rms fit ----			--- met laser --		
	MN	PH	PL	MN	PH	PL
1	1.6	1.4	3.3	8.3	11.3	0.3
2	1.6	1.2	3.2	2.1	2.6	-6.2
3	2.8	1.9	4.0	1.3	-0.3	-4.1
4	1.8	1.8	3.0	3.6	5.4	-3.1
5	2.5	2.1	3.4	3.6	4.9	-1.8
6	2.5	1.6	3.0	2.1	1.8	-3.9
7	1.7	1.2	3.1	-6.2	-3.9	-13.4
8	1.8	2.4	3.1	-6.5	-4.9	-11.1
9	1.7	1.9	3.6	0.8	0.8	-6.2

log torr: MN 40.2 PH 40.0 PL 40.7

obs torr: MN 40.2 PH 40.0 PL 22.0

CO₂ side 2 test comparison

“rms fit” is $1000 \cdot \text{RMS}(a \cdot \tau_{\text{obs}} + b - \tau_{\text{calc}})$

“met laser” is the metrology laser residual

FOV	--- rms fit ----			--- met laser --		
	MN	PH	PL	MN	PH	PL
1	1.5	1.5	3.1	9.0	9.0	4.4
2	2.0	1.7	3.2	2.1	0.8	-1.6
3	2.5	2.0	3.2	0.3	-2.3	-1.8
4	1.7	1.4	3.1	3.4	4.1	-2.3
5	2.0	1.5	2.9	3.9	2.6	0.8
6	2.0	1.7	3.3	2.6	-1.3	-1.0
7	1.7	1.6	2.9	-7.2	-6.5	-13.4
8	2.5	2.0	3.7	-6.7	-8.2	-11.9
9	1.6	1.8	3.0	-1.3	-1.8	-2.9

log torr: MN 40.5 PH 41.0 PL 40.4

obs torr: MN 40.5 PH 37.0 PL 27.0

notes and comments

- ▶ the CO and CH₄ side 1 residuals are very consistent across the MN, PFH, and PFL tests
- ▶ comparing CO₂ tests, the MN and PFH tests were in reasonable agreement in comparison with the PFL tests
- ▶ the CO₂ *a* and *b* weights for FOV 5 were constantly out of group, possibly due to the relatively greater nonlinearity for LW FOV 5.
- ▶ our NH₃ analysis is not complete, but residuals there were generally larger than for CO₂
- ▶ all tests shown here were done using UMBC LBL for calculated transmittances