Retrieval Errors due to Spectral Errors
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1 Introduction

This report analyses the effects of different types of spectral errors on a MIPAS water vapour retrieval.

Three types of error are considered:

1. Residual spectral calibration error
2. Line position error
3. Error due to neglecting pressure shift

The effects are considered separately and in worst-case combinations, evaluated for the 'old', 'h3' and 'fad' water vapour microwindow databases[1], and expressed in terms of an equivalent H_2O VMR retrieval error.

2 Spectral Errors

2.1 Calibration Error

It is assumed that the MIPAS spectral calibration will be accurate to ± 0.001 cm^{-1}(worst case).

2.2 Position Error

The HITRAN database format has a flag indicating uncertainty in line position (definitions listed in Table 1). For this study, a geometric mid-point of the uncertainty range was assumed. However, for most H_2O lines, this flag is set to '0' indicating that no information is available. Where uncertainties are reported, a flag value '3' (uncertainty 0.01 – 0.001 cm^{-1}) appears to be the worst-case so this value was also assumed for those lines flagged '0'.

Table 1: Definitions and Interpretations of HITRAN flags for line position uncertainty $\delta\nu$ (cm^{-1})

Flag	Definition	Interpretation
0	$\delta\nu \geq 1.0$ or unknown	$\delta\nu = 0.003$
1	$1.0 > \delta\nu \geq 0.1$	$\delta\nu = 0.3$
2	$0.1 > \delta\nu \geq 0.01$	$\delta\nu = 0.03$
3	$0.01 > \delta\nu \geq 10^{-3}$	$\delta\nu = 0.003$
4	$10^{-3} > \delta\nu \geq 10^{-4}$	$\delta\nu = 0.0003$
etc.		

2.3 Pressure Shift

Pressure shift parameters for H_2O lines are not reported in the HITRAN 1996 database, but a 'typical' value of ± 0.01cm^{-1}/atm is assumed (Flaud, pers. comm.), corresponding to a shift 0.001 cm^{-1}at 100 mb ($\sim$16 km) and negligible compared with the other error sources above 20 km. In practice, pressure shifts are usually negative but for this study it was also assumed (pessimistically) that these could also be positive when combined with a positive position/calibration error.

3 Spectral→Retrieval Errors

To relate a spectral error (difference between modelled and measured spectra) to an error in retrieved H_2O profile, a single-layer retrieval model was used with two variables: H_2O & Continuum ($z \leq 29$ km) or H_2O & Offset ($z \geq 32$ km).[1].

This 2-element state vector $\mathbf{x} = (v, c)$ (where v is the VMR and c is either the continuum or offset) is related to the m-point microwindow radiance spec-

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[1]The same model is used in the generation of the 'h3' and 'fad' microwindow databases[1]

trum $\mathbf{y} = (y_1, y_2, \ldots, y_m)$, by the Jacobian matrix $\mathbf{K}$ $(m \times 2)$:

$$\mathbf{y} = \mathbf{K}\mathbf{x} \tag{1}$$

Assuming the same, uncorrelated random noise for each spectral point, The 'Global Fit' retrieval of the state vector is given by:

$$\mathbf{x} = \left(\mathbf{K}^T\mathbf{K}\right)^{-1}\mathbf{K}^T\mathbf{y} \tag{2}$$

A spectrum of radiance errors $\epsilon = (\epsilon_1, \epsilon_2, \ldots, \epsilon_m)$ will map into a retrieval error $\boldsymbol{\delta}$ using a similar relationship:

$$\boldsymbol{\delta} = \left(\mathbf{K}^T\mathbf{K}\right)^{-1}\mathbf{K}^T\boldsymbol{\epsilon} \tag{3}$$

For comparison, it is useful to know the retrieval accuracy that could be obtained from the same spectrum if limited purely by the random noise variance, σ_y^2. The covariance $\mathbf{S}_x$ of the random noise-induced retrieval error is given by:

$$\mathbf{S}_x = \sigma_y^2\left(\mathbf{K}^T\mathbf{K}\right)^{-1} \tag{4}$$

Taking just the H_2O VMR components of $\boldsymbol{\delta}$ and $\mathbf{S}_x$ (δ_v and σ_v^2 respectively) the 'significance' of the spectral error in each microwindow can be expressed in terms of a dimensionless *error ratio* E:

$$E = \frac{\delta_v}{\sqrt{\sigma_v^2}} \tag{5}$$

To compute the combined effect of the spectral errors on a multi-microwindow retrieval, each microwindow error δ_v would be weighted by the inverse of the noise-induced error variance σ_v^2.

4 Procedure

The procedure was to adapt the MIPAS Reference Forward Model (RFM)[2] to apply the appropriate line shifts on reading the HITRAN database, and then create the perturbed spectra for each MIPAS band at each tangent height, from which the microwindow spectra were extracted ($\mathbf{y}+\epsilon$). The unperturbed spectra $\mathbf{y}$ have been generated as part of an earlier study[1], which includes a detailed description of the computation. The Jacobians ($\mathbf{K}$), derived from the spectral sensitivities to perturbations in tangent point mixing ratio and continuum, were also computed as part of the same study.

The nominal values of NESR were assumed (e.g., 50 nW/(cm^2 st cm^{-1}) for Band A microwindows, 685–970 cm^{-1}).

Nine separate experiments have been performed, detailed in Table 2. The first six consider each of the three effects ($\pm$) in isolation, the last three in combination: all errors positive, calibration and position positive with negative pressure shift, and all errors negative.

Table 2: List of the different experiments performed to investigate the effect of Spectral Errors

	Spectral Error Type		
Code	Position	Calibration	Pressure
pw	+ve	0	0
mw	−ve	0	0
pc	0	+ve	0
mc	0	−ve	0
ps	0	0	+ve
ms	0	0	−ve
mm	−ve	−ve	−ve
pm	+ve	+ve	−ve
pp	+ve	+ve	+ve

The microwindow-by-microwindow results for the 'old' database (100 microwindows), the 'h3' database (91 microwindows) and the 'fad' database (191 microwindows) are listed in the Appendix, and summarised in the Conclusions.

5 Discussion

The results show a wide variety of spectral error sensitivities for all microwindow databases. To understand this it is necessary to consider the various mechanisms by which a spectral error can contribute to the retrieval error.

To simplify things further, the continuum/offset retrieval will be ignored in this section, so that the retrieval error is simply proportional to the (scalar) product of the Jacobian with the error spectrum.

5.1 Isolated line, within MW edge

The idealised case of a shift of a single, isolated line well within the MW edges is shown in Fig. 1. In this example, the convolved spectral error (dashed line in (d)) is anti-symmetric about the centre of the (symmetric) Jacobian (dotted line in (d)) so significant cancellation occurs resulting in a small error contribution. Neglecting the continuum retrieval, this spectral error would result in a retrieval error of δ_v=−2.6%, compared with a noise error of σ_v=39%, giving a ratio of E=−0.065%. Note that the retrieval error is negative (corresponding to an over-estimated mixing ratio): this is expected if the modelled line does not coincide with the actual line.

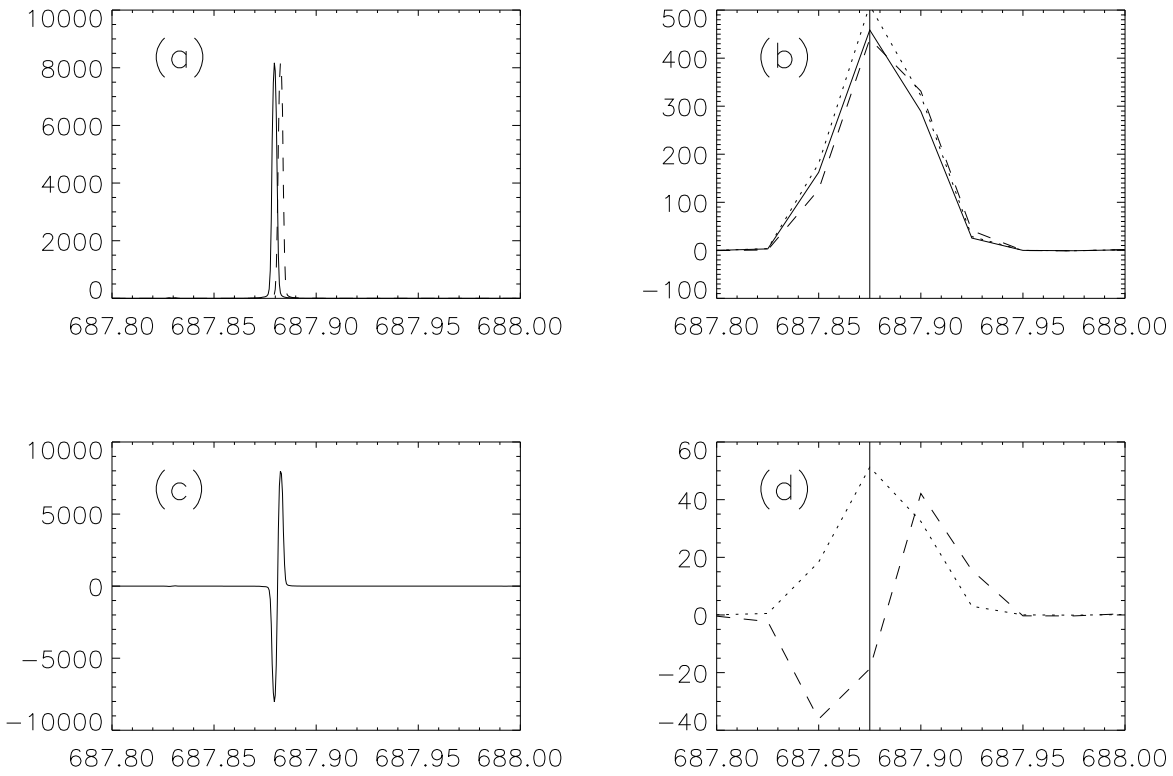

Figure 1: Radiance spectra showing the effect of a 0.003 cm^{-1}displacement of a single, isolated H_2O line at 44 km tangent height within a microwindow 687.8–688.0 cm^{-1}. Radiance units are $nW/(cm^2\ sr\ cm^{-1})$. (a) shows the modelled line (solid) and actual line (dashed) at high resolution, (b) shows the same lines convolved with the ILS, with a dotted showing the radiance expected if the tangent point H_2O mixing ratio is increased by 50%. The solid vertical line indicates the position of an edge at 687.875 cm^{-1}discussed in the text. (c) shows the difference between the two spectra in (a), and (d) shows the convolved difference (dashed) (either the convolution of (c) with the ILS, or the difference between the solid and dashed lines in (b)), with the Jacobian superimposed (dotted line) (proportional to the difference between the solid and dotted lines in (b)).

5.2 Isolated line, across MW edge

If the upper edge of the microwindow in Fig. 1 is reduced to 687.875 cm^{-1}, i.e. so only part of the convolved lineshape is included in the retrieval, the noise error is only slightly increased to σ_v=46% (this is because the peak is still included), but the retrieval error due to the spectral shift increases significantly to δ_v=−27%, giving a ratio of E=−0.6 — almost an order of magnitude increase. This is easily explained since the positive half of the error spectrum is no longer included, hence there is no longer any cancellation when multiplied by the (truncated) Jacobian. A similar situation occurs if part of the convolved lineshape is excluded by a spectral mask instead of the MW edge.

5.3 Interfering lines

A different situation is illustrated in Fig. 2. In this case the presence of an adjacent CO_2 line leads to an asymmetric high-resolution residual error spectrum (c), which convolves with the ILS to give an entirely negative error spectrum (d). In this case the error spectrum is highly anti-correlated with the Jacobian (resembling the sort of error expected if the actual line is much weaker than modelled, or missing altogether) and therefore has a large error contribution: $\delta_v = -208\%$ while the noise-induced error $\sigma_v = 54\%$ remains similar to the previous cases, giving a ratio of $E = -4.5$ — yet another order of magnitude increase. This is, in fact, the explanation why MW#1 of the 'h3' and 'fad' databases has such a large error associated with the line position uncertainty (Tables 6 and 8).

6 Summary & Conclusions

The 'old' database consists of subjectively-selected microwindows which would avoid including only parts of lines in order to allow for some spectral errors. This selection would also exclude microwindows with significantly overlapping foreign lines due to the difficulty in quantifying the foreign line contribution.

The 'h3' (3 height mask) database was created using an objective-selection algorithm which did not allow for spectral uncertainties, therefore there was no restriction on truncating lines by microwindow edges or masks. On the other hand, the uncertainty due to overlapping foreign lines *was* quantified: overlaps were permitted provided that the foreign line absorption was well characterised (in practice, this probably just allows significant overlaps from CO_2 lines).

The 'fad' ('fully altitude dependent', i.e., separate logical masks for each altitude) database included a single direction 0.001 cm^{-1}calibration uncertainty as part of the objective-selection algorithm. Therefore it can be assumed that where the calibration error is large for microwindows in this database, the errors from other error sources (such as uncertainties in contaminant species) are even larger.

Table 3 summarises the results for the three microwindow databases.

1. The uncertainty in line position appears to be the major source of spectral error, followed by calibration errors and then effects due to neglecting pressure shifts.

2. Spectral errors are most significant (compared to the noise error) at mid-altitudes. At lower altitudes, the impact is reduced by pressure broadening of the lines, and at higher altitudes the increase in noise dominates.

3. The objectively-selected databases contain a higher proportion of microwindows which are highly sensitive to spectral errors, (defined as contributing more to the retrieval error than the measurement noise from the same microwindow). The 'fad' database is more sensitive than the 'h3' database, presumably due to the larger number of mask edges within the spectrum.

4. Although the errors are small for many individual microwindows, most errors are negative, so their effect on the retrieved profile will be cumulative (generally leading to an *overestimate* of the retrieved water vapour).

5. Due to the assumptions made here (spectral shifts by fixed amounts) these results can only be interpreted as indicative of spectral sensitivities of each database as a whole, and should not be interpreted as a sensitivity analysis for each individual microwindow.

6. The calibration error is an operational variable, changing from one spectrum to the next, and should therefore be included as part of the microwindow selection process. On the other hand, the position and pressure shift errors are constant and can, in principle, be assessed from a single atmospheric spectrum prior to launch. Affected microwindows can then be removed, or corrections made to the spectral database.

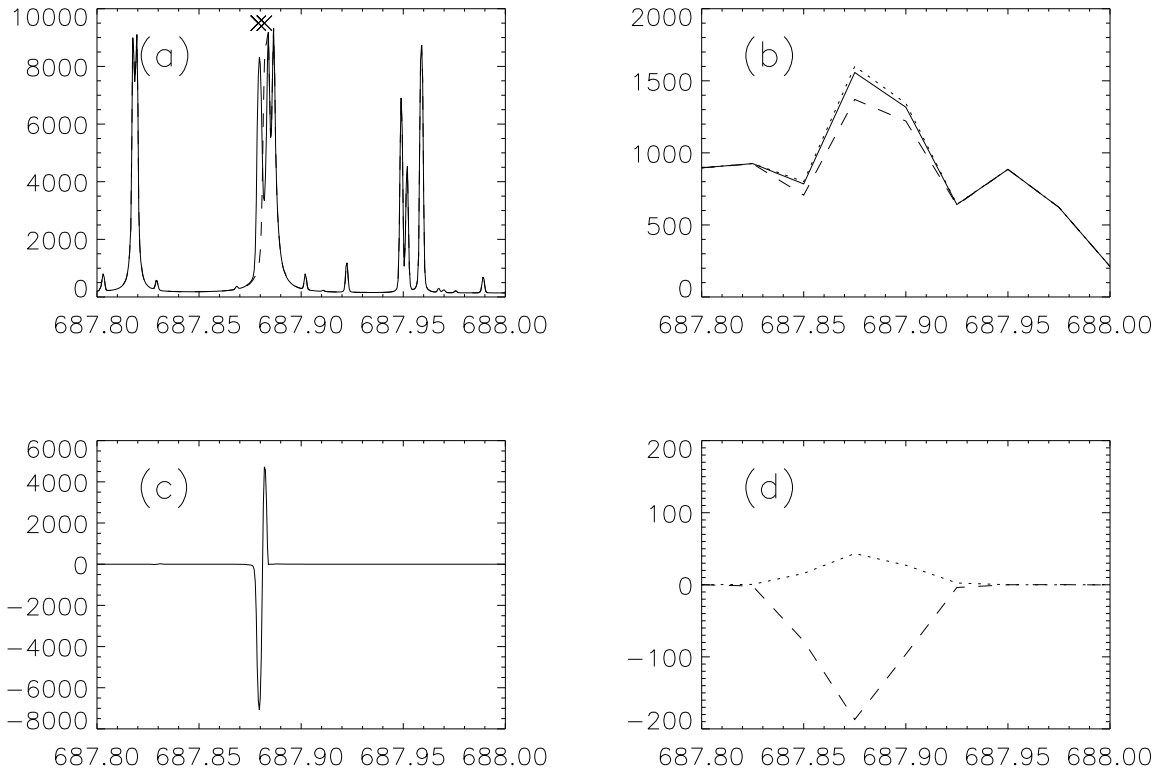

Figure 2: Effect of a displacement of a single H_2O line in the presence of (unshifted) interfering lines (in this case CO_2) using the same microwindow as in Fig. 1, and showing the equivalent diagnostics. (a) shows the modelled lines (solid) and displaced H_2O line (dashed) at high resolution, the $\times$ symbols above indicating the positions of the H_2O line before and after displacement. (b) shows the two spectra convolved with the ILS, with the radiance expected for a 50% increase in tangent point VMR shown as a dotted line. (c) shows the difference between the two spectra in (a), and (d) shows the convolved difference (solid) with the Jacobian superimposed (dotted line).

Table 3: Summary of MW Database Sensitivity to Spectral Errors, expressed as the percentage of microwindows with maximum ratios δ_v/σ_v in certain ranges

	> 1.0	> 0.3	> 0.1	< 0.1
Spectral calibration errors				
'old'	0	0	6%	94%
'h3'	2%	12%	34%	66%
'fad'	7%	42%	77%	23%
Line position errors				
'old'	0	13%	58%	32%
'h3'	8%	18%	35%	65%
'fad'	25%	53%	76%	24%
Pressure shift				
'old'	0	0	5%	95%
'h3'	1%	3%	8%	92%
'fad'	3%	9%	21%	79%
Combined errors				
'old'	1%	23%	77%	23%
'h3'	12%	30%	54%	46%
'fad'	37%	76%	95%	5%

A Appendix: Results by Microwindow

The maximum error ratios for each microwindow are listed in Tables 4 and 5 for the 'old' microwindow database, separated and combined errors respectively; Tables 6 and 7 for the 'h3' microwindows; and Tables 8 and 9 for the 'fad' microwindows.

The tests have been performed over the full altitude of each microwindow, although only the altitude with the largest magnitude (=worst case) error ratio E (`RATIO`) is reported, along with the noise-induced retrieval error σ_v (`ENOIS`) as a guide to the overall significance of the microwindow (large values = low weight in retrieval). In the case of the separated errors, the only the larger error from the two directions of spectral shift ($\pm$) is reported. Note that the 'h3' and 'fad' analyses included the application of spectral masks to exclude certain spectral grid points from the retrieval.

The sign convention used is that the error spectrum $\boldsymbol{\epsilon}$ represents (measured $-$ modelled) radiance, therefore the retrieval error δ_v represents (true $-$ retrieved) VMR. A negative value of the error ratio E (sign taken from δ_v) therefore represents a retrieval which *over-estimates* the true profile.

References

[1] Clarmann, T.v. *et. al.* Final Report: Study on the simulation of Atmospheric Infrared Spectra *ESA Contract 12054/96/NL/CN*, ESTEC, 1998.

[2] Dudhia, A. MIPAS RFM Software User's Manual (SUM) *ESA Document PO-MA-OXF-GS-0003*, ESTEC, 1996.

Table 4: Results for the 'old' microwindow database — separated errors

	Microwindow			Calib.Error			Posn. Error			Press.Shift		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	1224.800	1225.300	14 65	20	-0.02	39.3	17	-0.15	29.0	14	0.03	18.7
2	1354.700	1355.100	35 65	35	-0.06	77.5	35	-0.13	77.5	35	0.00	77.5
3	1362.200	1362.850	8 65	8	0.04	999.9	41	-0.11	62.5	8	-0.05	999.9
4	1369.750	1369.950	8 65	8	-0.04	999.9	8	-0.01	999.9	11	-0.04	78.2
5	1371.850	1372.400	8 65	8	-0.04	999.9	14	-0.06	35.5	8	-0.08	999.9
6	1374.800	1375.300	11 65	14	-0.02	43.6	38	-0.12	33.5	14	-0.03	43.6
7	1379.400	1379.900	8 65	8	0.04	999.9	11	-0.16	43.6	8	0.11	999.9
8	1386.800	1387.900	26 65	41	-0.09	27.2	41	-0.38	27.2	26	0.01	24.7
9	1388.300	1388.900	8 65	11	0.02	29.3	14	-0.05	41.2	11	0.03	29.3
10	1389.800	1391.200	8 65	20	-0.02	56.5	26	-0.37	87.9	17	0.04	41.9
11	1393.600	1395.000	8 65	47	-0.10	20.1	47	-0.38	20.1	14	-0.03	15.5
12	1395.200	1396.500	8 65	8	0.07	999.9	20	0.21	24.4	8	-0.10	999.9
13	1397.450	1398.250	8 65	14	-0.06	25.7	14	-0.13	25.7	14	0.07	25.7
14	1398.250	1401.250	8 65	26	0.01	18.2	41	-0.10	23.3	11	0.03	17.6
15	1402.600	1405.600	8 65	8	0.03	999.9	23	0.16	21.1	11	-0.05	16.4
16	1409.850	1410.150	8 65	11	0.02	81.3	23	-0.10	76.2	11	-0.05	81.3
17	1411.200	1412.100	8 65	8	0.05	999.9	8	0.15	999.9	8	0.10	999.9
18	1413.900	1416.400	8 65	8	-0.07	999.9	8	-0.21	999.9	8	-0.13	999.9
19	1417.300	1418.100	8 65	14	0.08	25.0	17	0.28	29.5	14	0.08	25.0
20	1418.450	1420.500	8 65	8	-0.03	999.9	41	-0.17	16.7	8	-0.06	999.9
21	1423.600	1424.100	11 65	23	0.18	30.4	23	0.57	30.4	20	0.03	33.3
22	1424.500	1425.200	8 65	11	0.01	39.2	11	0.04	39.2	11	0.03	39.2
23	1427.700	1428.700	8 65	44	-0.01	78.3	44	-0.06	78.3	8	0.01	999.9
24	1429.200	1431.300	8 65	8	-0.03	999.9	41	-0.09	30.6	8	0.05	999.9
25	1431.450	1432.450	8 65	38	-0.05	86.2	38	-0.20	86.2	8	0.04	999.9
26	1433.500	1433.800	8 65	8	-0.07	999.9	8	-0.21	999.9	8	0.14	999.9
27	1434.000	1434.600	8 65	11	-0.01	107.2	20	-0.03	107.7	11	0.00	107.2
28	1436.000	1437.100	8 65	17	0.05	33.5	44	-0.17	20.4	14	-0.04	55.9
29	1441.250	1441.600	8 60	8	-0.01	999.9	8	-0.04	999.9	8	-0.02	999.9
30	1441.900	1443.100	8 65	8	0.00	999.9	17	-0.02	90.0	8	0.01	999.9
31	1444.600	1446.000	8 65	14	-0.01	63.5	14	-0.03	63.5	14	0.01	63.5
32	1446.200	1448.300	8 65	38	-0.02	27.5	41	-0.12	29.3	14	0.02	15.9
33	1449.300	1450.700	8 65	8	-0.01	999.9	17	-0.03	74.3	8	-0.01	999.9
34	1451.800	1452.500	8 65	8	-0.04	999.9	8	-0.13	999.9	8	-0.08	999.9
35	1454.000	1457.000	8 65	23	0.09	14.8	23	0.29	14.8	8	-0.05	999.9
36	1457.600	1459.500	8 65	38	-0.08	19.6	38	-0.31	19.6	17	0.00	26.1
37	1463.600	1465.300	8 65	14	-0.04	26.0	14	-0.10	26.0	14	-0.04	26.0
38	1466.100	1469.600	8 65	8	-0.01	999.9	26	-0.04	80.5	11	0.01	54.2
39	1469.700	1471.100	8 65	14	-0.01	31.6	14	-0.04	31.6	14	0.01	31.6
40	1471.300	1472.300	11 65	14	0.02	108.5	44	-0.10	22.1	14	-0.01	108.5
41	1473.200	1474.400	8 65	8	0.02	999.9	44	-0.09	25.9	8	0.08	999.9
42	1474.900	1476.650	8 65	14	-0.02	25.4	41	-0.11	33.9	8	0.02	999.9
43	1479.450	1482.450	8 65	44	-0.01	59.7	44	-0.09	59.7	8	-0.02	999.9
44	1483.900	1485.500	8 65	8	-0.02	999.9	8	0.09	999.9	8	0.06	999.9
45	1485.500	1488.500	8 65	8	0.02	999.9	47	-0.10	36.2	8	0.03	999.9
46	1488.500	1490.300	8 65	8	0.02	999.9	44	-0.12	37.8	8	-0.03	999.9
47	1490.300	1491.800	8 65	41	-0.01	30.4	41	-0.09	30.4	8	0.01	999.9
48	1492.800	1493.100	8 65	8	0.02	999.9	8	0.05	999.9	8	0.03	999.9
49	1494.700	1497.500	8 65	44	-0.01	21.3	44	-0.07	21.3	14	-0.01	21.3
50	1497.500	1500.000	17 17	17	0.00	21.4	17	0.00	21.4	17	0.00	21.4

Table 4: (ctd) Results for the 'old' microwindow database — separated errors

	Microwindow			- Calib.Error -			- Posn. Error -			- Press.Shift -		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1601.050	1601.550	8 65	8	0.05	999.9	41	-0.18	48.1	8	0.08	999.9
52	1606.500	1606.900	14 65	17	0.02	33.2	41	-0.12	58.4	14	0.02	25.5
53	1616.000	1617.600	38 65	47	-0.02	7.8	44	-0.17	7.0	41	0.00	7.3
54	1625.000	1625.250	17 65	17	-0.01	127.0	17	-0.05	127.0	17	0.01	127.0
55	1635.000	1635.900	41 65	41	-0.26	9.7	41	-0.98	9.7	41	0.01	9.7
56	1640.450	1640.750	14 65	14	-0.04	47.7	14	-0.12	47.7	14	-0.03	47.7
57	1641.750	1642.550	11 65	29	-0.13	52.7	26	-0.83	44.7	23	0.04	38.0
58	1645.600	1648.500	8 65	50	-0.05	13.0	47	-0.27	8.9	20	0.01	12.6
59	1649.150	1649.600	14 65	14	-0.01	80.7	17	-0.07	60.1	14	-0.01	80.7
60	1651.400	1654.000	11 65	38	0.16	6.4	41	-0.53	5.9	32	0.01	9.3
61	1654.000	1655.450	8 65	11	0.02	999.9	44	-0.15	14.2	14	0.01	49.5
62	1656.600	1657.850	8 65	14	0.02	27.1	41	-0.11	49.6	14	0.02	27.1
63	1658.000	1659.500	14 65	14	0.00	56.2	23	-0.02	127.4	14	0.00	56.2
64	1660.600	1663.100	8 65	17	0.05	13.8	17	0.17	13.8	14	0.04	14.2
65	1663.300	1664.400	14 65	14	-0.03	19.5	14	-0.10	19.5	14	0.04	19.5
66	1667.800	1670.300	8 65	44	-0.04	11.4	44	-0.24	11.4	14	0.02	22.4
67	1670.900	1671.800	8 65	41	-0.08	17.3	41	-0.31	17.3	14	-0.02	65.6
68	1672.000	1672.900	8 65	8	0.01	999.9	44	-0.10	47.8	8	0.03	999.9
69	1674.800	1675.900	11 65	32	0.04	18.2	44	-0.20	13.0	17	0.02	48.6
70	1679.600	1680.150	8 65	8	-0.04	999.9	44	-0.14	48.5	8	-0.07	999.9
71	1682.500	1685.200	8 65	47	-0.02	8.6	44	-0.27	7.7	14	-0.02	86.3
72	1700.350	1701.100	17 65	32	0.08	29.1	32	0.42	29.1	32	0.01	29.1
73	1709.550	1709.750	8 65	14	-0.02	106.7	14	-0.08	106.7	14	0.02	106.7
74	1824.900	1825.600	8 65	23	0.09	33.8	23	0.34	33.8	8	-0.03	999.9
75	1828.900	1830.300	23 65	38	-0.03	21.0	44	-0.15	23.1	26	0.00	23.1
76	1835.650	1836.150	11 65	11	0.01	63.0	38	-0.03	141.4	11	-0.01	63.0
77	1841.850	1842.300	11 65	41	-0.13	66.9	41	-0.46	66.9	14	0.04	71.9
78	1843.250	1844.600	8 65	8	-0.02	999.9	41	-0.16	21.6	14	0.02	44.8
79	1847.450	1848.250	11 65	26	-0.07	61.2	26	-0.26	61.2	17	0.01	46.5
80	1848.600	1849.050	11 65	26	-0.01	667.6	41	-0.04	107.7	14	0.02	212.2
81	1861.300	1861.900	8 65	11	0.02	62.1	44	-0.05	66.7	17	0.01	185.9
82	1867.750	1868.200	8 65	44	-0.05	53.3	44	-0.21	53.3	14	-0.02	285.8
83	1868.400	1869.050	14 65	65	0.03	999.9	14	-0.10	56.2	14	0.04	56.2
84	1894.900	1895.800	11 65	44	-0.04	81.1	44	-0.11	81.1	11	-0.02	99.6
85	1904.000	1904.650	11 65	11	-0.01	75.1	44	-0.06	69.3	11	-0.02	75.1
86	1906.900	1909.000	8 65	20	0.17	96.7	20	0.49	96.7	17	0.05	79.1
87	1909.900	1910.500	11 65	17	0.06	70.5	17	0.17	70.5	14	0.06	63.2
88	1921.900	1922.900	11 65	47	-0.01	65.6	44	-0.08	92.2	11	0.00	84.8
89	1941.200	1942.100	11 65	11	0.01	44.3	41	-0.04	127.4	11	0.02	44.3
90	1942.200	1943.300	8 65	8	0.08	999.9	47	-0.11	57.8	8	-0.05	999.9
91	1944.800	1945.700	11 65	44	-0.01	89.9	44	-0.07	89.9	11	-0.01	63.3
92	1946.000	1947.100	11 65	44	-0.01	92.2	44	-0.07	92.2	14	0.00	57.9
93	1954.500	1955.400	11 65	44	-0.01	83.2	44	-0.05	83.2	11	0.00	55.7
94	1960.500	1961.900	11 65	14	0.05	86.1	41	-0.04	126.4	11	0.02	48.5
95	1965.900	1966.800	11 65	44	-0.01	101.8	44	-0.06	101.8	11	0.00	76.3
96	1967.000	1968.200	11 65	44	-0.01	116.9	41	-0.09	155.2	11	-0.01	52.5
97	1975.700	1976.700	11 65	11	0.00	63.9	35	-0.01	329.4	11	0.00	63.9
98	1988.100	1988.700	11 65	26	-0.02	209.5	26	-0.12	209.5	11	-0.01	116.4
99	1991.200	1993.400	11 65	44	-0.01	54.6	44	-0.10	54.6	11	0.01	50.9
100	1998.700	1999.100	11 65	17	-0.01	172.6	41	-0.03	150.9	11	-0.01	153.8

Table 5: Results for the 'old' microwindow database — combined errors

------ Microwindow -------				--- mm shift --			-- pm shift ---			-- pp shift ---		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	1224.800	1225.300	14 65	26	-0.11	64.9	17	-0.21	29.0	17	-0.21	29.0
2	1354.700	1355.100	35 65	47	-0.15	60.1	35	-0.25	77.5	35	-0.25	77.5
3	1362.200	1362.850	8 65	41	-0.19	62.5	38	-0.19	54.6	38	-0.19	54.6
4	1369.750	1369.950	8 65	11	-0.02	78.2	11	-0.03	78.2	11	-0.03	78.2
5	1371.850	1372.400	8 65	8	0.11	999.9	8	-0.10	999.9	8	-0.10	999.9
6	1374.800	1375.300	11 65	38	-0.20	33.5	38	-0.20	33.5	38	-0.20	33.5
7	1379.400	1379.900	8 65	11	-0.18	43.6	11	0.17	43.6	11	0.17	43.6
8	1386.800	1387.900	26 65	59	-0.23	71.0	41	-0.56	27.2	41	-0.56	27.2
9	1388.300	1388.900	8 65	11	-0.05	29.3	14	-0.07	41.2	14	-0.07	41.2
10	1389.800	1391.200	8 65	26	-0.42	87.9	23	0.19	69.5	23	0.19	69.5
11	1393.600	1395.000	8 65	50	0.21	22.7	47	-0.54	20.1	47	-0.54	20.1
12	1395.200	1396.500	8 65	20	0.27	24.4	8	0.23	999.9	8	0.23	999.9
13	1397.450	1398.250	8 65	14	-0.19	25.7	14	0.16	25.7	14	0.16	25.7
14	1398.250	1401.250	8 65	41	-0.18	23.3	41	-0.18	23.3	41	-0.18	23.3
15	1402.600	1405.600	8 65	41	-0.18	32.2	23	0.21	21.1	23	0.21	21.1
16	1409.850	1410.150	8 65	23	-0.15	76.2	44	-0.13	87.7	44	-0.13	87.7
17	1411.200	1412.100	8 65	38	-0.23	95.1	8	0.20	999.9	8	0.20	999.9
18	1413.900	1416.400	8 65	8	0.26	999.9	8	-0.29	999.9	8	-0.29	999.9
19	1417.300	1418.100	8 65	14	-0.29	25.0	17	0.40	29.5	17	0.40	29.5
20	1418.450	1420.500	8 65	44	-0.27	18.8	41	-0.29	16.7	41	-0.29	16.7
21	1423.600	1424.100	11 65	23	0.77	30.4	23	-0.62	30.4	23	-0.62	30.4
22	1424.500	1425.200	8 65	11	-0.05	39.2	11	0.05	39.2	11	0.05	39.2
23	1427.700	1428.700	8 65	44	-0.11	78.3	44	-0.11	78.3	44	-0.11	78.3
24	1429.200	1431.300	8 65	41	-0.16	30.6	41	-0.16	30.6	41	-0.16	30.6
25	1431.450	1432.450	8 65	38	-0.30	86.2	8	0.08	999.9	8	0.08	999.9
26	1433.500	1433.800	8 65	8	-0.27	999.9	8	0.27	999.9	8	0.27	999.9
27	1434.000	1434.600	8 65	20	-0.05	107.7	14	-0.03	57.9	14	-0.03	57.9
28	1436.000	1437.100	8 65	44	-0.29	20.4	47	-0.27	24.4	47	-0.27	24.4
29	1441.250	1441.600	8 60	8	-0.05	999.9	8	0.04	999.9	8	0.04	999.9
30	1441.900	1443.100	8 65	17	-0.04	90.0	17	-0.04	90.0	17	-0.04	90.0
31	1444.600	1446.000	8 65	14	-0.05	63.5	41	-0.04	138.7	41	-0.04	138.7
32	1446.200	1448.300	8 65	44	-0.20	32.2	44	-0.14	32.2	44	-0.14	32.2
33	1449.300	1450.700	8 65	20	-0.05	103.9	17	-0.05	74.3	17	-0.05	74.3
34	1451.800	1452.500	8 65	38	-0.17	82.2	8	-0.17	999.9	8	-0.17	999.9
35	1454.000	1457.000	8 65	26	0.40	13.7	23	-0.33	14.8	23	-0.33	14.8
36	1457.600	1459.500	8 65	50	-0.29	30.3	38	-0.46	19.6	38	-0.46	19.6
37	1463.600	1465.300	8 65	44	-0.15	21.5	44	-0.16	21.5	44	-0.16	21.5
38	1466.100	1469.600	8 65	23	-0.07	63.3	26	-0.07	80.5	26	-0.07	80.5
39	1469.700	1471.100	8 65	14	0.02	31.6	14	-0.06	31.6	14	-0.06	31.6
40	1471.300	1472.300	11 65	44	-0.18	22.1	44	-0.17	22.1	44	-0.17	22.1
41	1473.200	1474.400	8 65	44	-0.17	25.9	44	-0.16	25.9	44	-0.16	25.9
42	1474.900	1476.650	8 65	41	-0.19	33.9	41	-0.19	33.9	41	-0.19	33.9
43	1479.450	1482.450	8 65	38	-0.12	53.7	41	-0.15	58.4	41	-0.15	58.4
44	1483.900	1485.500	8 65	8	-0.10	999.9	8	0.10	999.9	8	0.10	999.9
45	1485.500	1488.500	8 65	44	-0.17	30.3	44	-0.14	30.3	44	-0.14	30.3
46	1488.500	1490.300	8 65	44	-0.22	37.8	44	-0.22	37.8	44	-0.22	37.8
47	1490.300	1491.800	8 65	44	-0.16	33.8	44	-0.11	33.8	44	-0.11	33.8
48	1492.800	1493.100	8 65	8	0.07	999.9	8	-0.07	999.9	8	-0.07	999.9
49	1494.700	1497.500	8 65	44	-0.13	21.3	44	-0.13	21.3	44	-0.13	21.3
50	1497.500	1500.000	17 17	17	0.00	21.4	17	0.00	21.4	17	0.00	21.4

Table 5: (ctd) Results for the 'old' microwindow database — combined errors

	Microwindow			mm shift			pm shift			pp shift		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1601.050	1601.550	8 65	38	-0.31	46.8	44	-0.31	42.5	44	-0.31	42.5
52	1606.500	1606.900	14 65	41	-0.21	58.4	44	-0.21	39.5	44	-0.21	39.5
53	1616.000	1617.600	38 65	47	-0.26	7.8	47	-0.29	7.8	47	-0.29	7.8
54	1625.000	1625.250	17 65	23	-0.04	186.8	17	-0.07	127.0	17	-0.07	127.0
55	1635.000	1635.900	41 65	41	-1.29	9.7	41	1.06	9.7	41	1.06	9.7
56	1640.450	1640.750	14 65	14	-0.18	47.7	14	0.09	47.7	14	0.09	47.7
57	1641.750	1642.550	11 65	29	-1.00	52.7	26	0.71	44.7	26	0.71	44.7
58	1645.600	1648.500	8 65	47	-0.44	8.9	41	-0.40	7.5	41	-0.40	7.5
59	1649.150	1649.600	14 65	23	-0.11	73.7	17	-0.11	60.1	17	-0.11	60.1
60	1651.400	1654.000	11 65	35	0.71	7.4	44	-0.79	5.7	44	-0.79	5.7
61	1654.000	1655.450	8 65	44	-0.25	14.2	44	-0.26	14.2	44	-0.26	14.2
62	1656.600	1657.850	8 65	41	-0.18	49.6	44	-0.17	36.4	44	-0.17	36.4
63	1658.000	1659.500	14 65	20	-0.03	106.7	20	-0.04	106.7	20	-0.04	106.7
64	1660.600	1663.100	8 65	47	-0.29	15.6	47	-0.29	15.6	47	-0.29	15.6
65	1663.300	1664.400	14 65	14	-0.13	19.5	14	0.12	19.5	14	0.12	19.5
66	1667.800	1670.300	8 65	44	-0.41	11.4	44	-0.29	11.4	44	-0.29	11.4
67	1670.900	1671.800	8 65	41	-0.45	17.3	41	0.14	17.3	41	0.14	17.3
68	1672.000	1672.900	8 65	44	-0.18	47.8	44	-0.18	47.8	44	-0.18	47.8
69	1674.800	1675.900	11 65	44	-0.34	13.0	44	-0.36	13.0	44	-0.36	13.0
70	1679.600	1680.150	8 65	44	-0.25	48.5	44	-0.25	48.5	44	-0.25	48.5
71	1682.500	1685.200	8 65	44	-0.42	7.7	47	-0.32	8.6	47	-0.32	8.6
72	1700.350	1701.100	17 65	44	-0.39	14.8	32	0.59	29.1	32	0.59	29.1
73	1709.550	1709.750	8 65	14	-0.10	106.7	38	-0.06	152.4	38	-0.06	152.4
74	1824.900	1825.600	8 65	23	0.45	33.8	35	-0.35	35.0	35	-0.35	35.0
75	1828.900	1830.300	23 65	44	-0.26	23.1	44	-0.26	23.1	44	-0.26	23.1
76	1835.650	1836.150	11 65	38	-0.05	141.4	38	-0.05	141.4	38	-0.05	141.4
77	1841.850	1842.300	11 65	41	-0.63	66.9	41	0.38	66.9	41	0.38	66.9
78	1843.250	1844.600	8 65	44	-0.25	22.7	44	-0.27	22.7	44	-0.27	22.7
79	1847.450	1848.250	11 65	26	-0.33	61.2	23	0.32	56.5	23	0.32	56.5
80	1848.600	1849.050	11 65	41	-0.06	107.7	41	-0.06	107.7	41	-0.06	107.7
81	1861.300	1861.900	8 65	44	-0.09	66.7	44	-0.09	66.7	44	-0.09	66.7
82	1867.750	1868.200	8 65	44	-0.35	53.3	35	-0.22	61.4	35	-0.22	61.4
83	1868.400	1869.050	14 65	14	0.11	56.2	14	-0.12	56.2	14	-0.12	56.2
84	1894.900	1895.800	11 65	44	-0.20	81.1	50	-0.12	66.5	50	-0.12	66.5
85	1904.000	1904.650	11 65	44	-0.11	69.3	44	-0.11	69.3	44	-0.11	69.3
86	1906.900	1909.000	8 65	20	0.66	96.7	20	-0.65	96.7	20	-0.65	96.7
87	1909.900	1910.500	11 65	14	-0.22	63.2	17	0.24	70.5	17	0.24	70.5
88	1921.900	1922.900	11 65	44	-0.15	92.2	47	-0.14	65.6	47	-0.14	65.6
89	1941.200	1942.100	11 65	41	-0.07	127.4	44	-0.06	87.0	44	-0.06	87.0
90	1942.200	1943.300	8 65	47	-0.16	57.8	44	-0.24	74.3	44	-0.24	74.3
91	1944.800	1945.700	11 65	44	-0.11	89.9	44	-0.11	89.9	44	-0.11	89.9
92	1946.000	1947.100	11 65	44	-0.11	92.2	44	-0.11	92.2	44	-0.11	92.2
93	1954.500	1955.400	11 65	44	-0.09	83.2	44	-0.09	83.2	44	-0.09	83.2
94	1960.500	1961.900	11 65	14	0.07	86.1	41	-0.07	126.4	41	-0.07	126.4
95	1965.900	1966.800	11 65	44	-0.11	101.8	44	-0.10	101.8	44	-0.10	101.8
96	1967.000	1968.200	11 65	47	-0.12	85.5	44	-0.14	116.9	44	-0.14	116.9
97	1975.700	1976.700	11 65	35	-0.02	329.4	35	-0.02	329.4	35	-0.02	329.4
98	1988.100	1988.700	11 65	26	-0.15	209.5	44	-0.10	115.6	44	-0.10	115.6
99	1991.200	1993.400	11 65	44	-0.17	54.6	38	-0.14	126.9	38	-0.14	126.9
100	1998.700	1999.100	11 65	41	-0.06	150.9	41	-0.06	150.9	41	-0.06	150.9

Table 6: Results for the 'h3' microwindow database — separated errors

	Microwindow			- Calib.Error -			- Posn. Error -			- Press.Shift -		
	Wavenumber	Range	Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	687.525	688.175	38 74	38	-0.45	155.7	41	-5.00	95.4	38	0.03	155.7
2	688.875	689.125	44 83	44	-0.49	75.0	44	-0.09	75.0	44	0.00	75.0
3	690.100	690.300	41 71	44	1.39	103.0	41	-0.08	136.5	41	0.00	136.5
4	693.950	694.125	32 50	38	-0.14	89.6	32	-0.15	122.8	32	0.00	122.8
5	696.150	696.325	41 83	41	1.62	96.7	41	-0.97	96.7	41	0.00	96.7
6	697.875	697.975	26 83	32	0.07	168.1	35	-1.36	147.6	29	0.03	178.6
7	703.525	703.800	44 83	44	0.77	116.4	44	-0.02	116.4	44	0.00	116.4
8	704.950	705.450	47 62	47	-0.93	43.8	47	-0.11	43.8	47	0.00	43.8
9	713.400	713.525	23 38	23	-0.09	131.8	26	-0.15	133.1	23	0.01	131.8
10	729.150	729.250	41 41	41	-0.26	194.5	41	-0.03	194.5	41	0.00	194.5
11	730.725	731.000	17 23	23	-0.34	61.3	23	-1.47	61.3	20	0.13	52.9
12	740.250	740.750	26 83	29	0.07	118.8	26	-0.38	98.6	26	0.01	98.6
13	769.050	769.175	8 26	8	0.21	17.6	8	0.73	17.6	8	0.79	17.6
14	776.925	777.050	14 29	17	-0.15	81.6	20	0.00	110.6	14	-0.01	44.7
15	784.350	784.650	14 23	14	-0.08	18.0	14	-0.01	18.0	14	0.02	18.0
16	795.700	796.075	17 83	20	-0.05	42.7	17	-0.13	32.6	17	0.03	32.6
17	798.275	798.650	17 29	23	-0.23	85.2	29	-2.13	121.0	17	0.22	41.0
18	808.200	808.350	11 11	11	-0.03	12.6	11	-0.16	12.6	11	-0.07	12.6
19	813.750	814.125	11 26	11	-0.07	19.2	11	-0.19	19.2	11	-0.03	19.2
20	824.925	825.525	11 23	11	-0.01	11.9	11	-0.08	11.9	11	-0.03	11.9
21	851.725	853.150	17 83	17	-0.01	82.0	17	-0.03	82.0	17	0.00	82.0
22	940.500	941.150	8 32	8	-0.11	20.9	8	0.00	20.9	8	-0.04	20.9
23	954.400	955.200	8 32	8	0.52	14.8	8	1.56	14.8	8	1.68	14.8
24	959.425	959.750	8 26	8	-0.20	20.1	8	-0.05	20.1	8	-0.05	20.1
25	1218.000	1218.675	14 26	14	-0.22	27.6	20	-0.25	53.7	17	0.03	44.5
26	1220.850	1221.100	11 17	11	-0.31	30.9	11	-0.18	30.9	11	-0.10	30.9
27	1224.025	1225.475	35 83	35	-0.02	87.5	35	-0.06	87.5	35	0.00	87.5
28	1244.225	1245.475	8 17	11	0.30	17.6	11	0.59	17.6	11	0.39	17.6
29	1259.925	1261.125	17 83	17	0.15	28.4	17	-0.15	28.4	17	0.03	28.4
30	1271.675	1271.925	32 83	32	-0.08	63.2	32	-0.15	63.2	32	0.00	63.2
31	1284.125	1284.400	17 29	17	-0.17	62.7	17	-0.16	62.7	17	0.02	62.7
32	1311.550	1314.525	32 83	32	-0.09	102.6	32	-0.27	102.6	32	0.00	102.6
33	1314.700	1314.800	35 38	35	-0.10	213.6	38	-0.15	140.7	38	0.00	140.7
34	1317.450	1320.425	62 83	62	0.00	114.7	62	0.00	114.7	62	0.00	114.7
35	1335.775	1336.925	62 83	62	0.00	139.9	62	-0.01	139.9	62	0.00	139.9
36	1337.625	1340.600	65 83	65	0.00	144.3	65	-0.01	144.3	65	0.00	144.3
37	1348.050	1350.900	14 83	14	0.03	62.5	56	-0.03	72.0	14	0.00	62.5
38	1359.525	1362.500	65 83	65	0.00	159.0	65	-0.01	159.0	65	0.00	159.0
39	1362.550	1362.650	65 83	65	0.00	350.7	65	-0.01	350.7	65	0.00	350.7
40	1368.075	1371.050	65 83	65	0.00	216.1	65	-0.01	216.1	68	0.00	445.8
41	1375.175	1375.625	14 17	14	-0.17	38.4	17	0.47	28.9	17	0.10	28.9
42	1375.650	1377.100	14 29	14	0.08	62.2	14	-0.04	62.2	14	0.02	62.2
43	1386.450	1389.425	68 83	68	-0.01	150.4	68	-0.03	150.4	68	0.00	150.4
44	1393.050	1396.025	68 83	68	0.00	171.4	68	-0.02	171.4	68	0.00	171.4
45	1414.775	1417.750	65 83	65	0.00	182.1	65	-0.01	182.1	65	0.00	182.1
46	1418.350	1419.475	68 83	68	0.00	212.0	68	-0.02	212.0	68	0.00	212.0
47	1456.725	1456.875	32 32	32	0.14	63.0	32	0.46	63.0	32	0.01	63.0
48	1458.325	1460.900	35 35	35	-0.13	30.0	35	-0.42	30.0	35	0.00	30.0
49	1466.050	1467.775	32 38	32	-0.01	137.3	35	-0.04	119.1	32	0.00	137.3
50	1570.000	1570.275	53 83	53	-0.01	58.8	53	-0.05	58.8	53	0.00	58.8

Table 6: (ctd) Results for the 'h3' microwindow database — separated errors

------ Microwindow -------				- Calib.Error -			- Posn. Error -			- Press.Shift -		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1570.300	1573.175	17 35	17	0.08	11.6	17	0.23	11.6	17	0.05	11.6
52	1574.075	1575.800	23 29	23	0.09	12.0	23	0.29	12.0	23	0.03	12.0
53	1576.225	1578.875	62 68	62	-0.02	113.1	62	-0.06	113.1	62	0.00	113.1
54	1589.375	1592.350	59 83	59	0.00	61.9	59	-0.03	61.9	59	0.00	61.9
55	1592.950	1594.425	17 83	17	-0.04	123.5	17	-0.04	123.5	17	0.00	123.5
56	1594.450	1597.450	56 83	56	-0.01	33.7	56	-0.05	33.7	56	0.00	33.7
57	1601.075	1603.425	59 83	59	0.00	73.9	59	-0.04	73.9	59	0.00	73.9
58	1606.875	1609.850	68 83	68	0.00	171.2	68	-0.01	171.2	68	0.00	171.2
59	1614.775	1615.825	20 20	20	-0.12	45.7	20	0.04	45.7	20	0.01	45.7
60	1616.700	1616.825	35 38	38	0.74	31.7	38	2.32	31.7	38	0.02	31.7
61	1622.525	1622.675	65 83	65	0.00	171.1	65	-0.02	171.1	68	0.00	312.4
62	1637.550	1640.525	35 83	35	-0.24	159.7	35	-0.04	159.7	35	0.00	159.7
63	1641.925	1644.900	59 83	59	0.00	81.5	59	-0.02	81.5	62	0.00	149.9
64	1648.300	1648.400	32 32	32	0.61	87.7	32	1.90	87.7	32	0.03	87.7
65	1652.450	1653.225	65 83	65	-0.01	192.8	65	-0.02	192.8	65	0.00	192.8
66	1657.425	1660.400	20 38	38	-0.02	208.9	38	-0.07	208.9	20	0.00	100.1
67	1661.325	1661.425	62 83	62	0.00	221.9	62	-0.02	221.9	62	0.00	221.9
68	1668.250	1669.350	68 83	68	0.00	183.5	68	-0.02	183.5	68	0.00	183.5
69	1669.400	1669.550	32 32	32	0.30	45.5	32	0.97	45.5	32	-0.02	45.5
70	1675.750	1675.850	35 83	35	-0.02	185.9	35	-0.08	185.9	35	0.00	185.9
71	1679.225	1682.225	32 83	32	-0.03	106.3	38	-0.09	71.9	32	0.00	106.3
72	1684.925	1685.925	41 41	41	0.11	53.4	41	0.33	53.4	41	0.00	53.4
73	1687.975	1690.950	68 83	68	0.00	196.8	68	-0.01	196.8	68	0.00	196.8
74	1692.075	1692.450	41 83	41	-0.07	69.5	41	-0.07	69.5	41	0.00	69.5
75	1699.200	1699.900	65 83	77	0.01	999.9	77	0.04	999.9	65	0.00	207.3
76	1732.250	1732.350	44 83	44	-0.02	128.2	44	-0.04	128.2	44	0.00	128.2
77	1746.850	1749.750	68 83	68	0.00	206.9	68	-0.01	206.9	68	0.00	206.9
78	1822.625	1824.175	56 83	83	-0.04	999.9	56	-0.02	90.0	56	0.00	90.0
79	1828.100	1829.425	65 83	83	-0.03	999.9	65	-0.01	202.4	65	0.00	202.4
80	1835.975	1837.975	62 83	83	-0.03	999.9	62	-0.01	155.2	62	0.00	155.2
81	1841.825	1842.900	56 83	56	-0.03	80.3	56	-0.02	80.3	56	0.00	80.3
82	1850.825	1852.850	50 83	50	-0.02	103.5	50	-0.03	103.5	50	0.00	103.5
83	1864.250	1867.150	62 83	83	0.02	999.9	62	-0.01	158.9	62	0.00	158.9
84	1884.350	1887.325	56 83	56	-0.01	92.4	56	-0.02	92.4	56	0.00	92.4
85	1894.175	1895.225	59 83	83	-0.04	999.9	59	-0.03	117.1	59	0.00	117.1
86	1904.175	1906.100	53 83	53	-0.01	87.3	53	-0.02	87.3	53	0.00	87.3
87	1909.800	1912.000	59 83	59	-0.03	120.6	59	-0.02	120.6	59	0.00	120.6
88	1917.900	1918.650	62 83	62	-0.10	119.9	62	-0.08	119.9	62	0.00	119.9
89	1933.100	1933.225	26 65	26	-0.21	453.6	26	-0.09	453.6	26	0.00	453.6
90	1936.250	1937.025	8 8	8	0.10	94.3	8	0.13	94.3	8	0.15	94.3
91	1945.925	1947.100	56 83	83	-0.02	999.9	56	-0.02	118.9	59	0.00	215.4

Table 7: Results for the 'h3' microwindow database — combined errors

	Microwindow				mm shift			pm shift			pp shift		
	Wavenumber	Range	Alts.		ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	687.525	688.175	38	74	38	2.14	155.7	41	-4.63	95.4	41	-4.63	95.4
2	688.875	689.125	44	83	53	0.41	109.5	44	-0.62	75.0	44	-0.62	75.0
3	690.100	690.300	41	71	44	-1.40	103.0	44	1.32	103.0	44	1.32	103.0
4	693.950	694.125	32	50	50	-0.19	85.9	38	-0.19	89.6	38	-0.19	89.6
5	696.150	696.325	41	83	41	-2.59	96.7	41	1.49	96.7	41	1.49	96.7
6	697.875	697.975	26	83	29	0.51	178.6	35	-1.45	147.6	35	-1.45	147.6
7	703.525	703.800	44	83	44	0.73	116.4	44	-0.79	116.4	44	-0.79	116.4
8	704.950	705.450	47	62	47	0.76	43.8	47	-1.05	43.8	47	-1.05	43.8
9	713.400	713.525	23	38	23	0.08	131.8	26	-0.25	133.1	26	-0.25	133.1
10	729.150	729.250	41	41	41	-0.31	194.5	41	0.21	194.5	41	0.21	194.5
11	730.725	731.000	17	23	23	0.82	61.3	23	-1.85	61.3	23	-1.85	61.3
12	740.250	740.750	26	83	32	-0.15	132.6	26	-0.35	98.6	26	-0.35	98.6
13	769.050	769.175	8	26	8	-0.90	17.6	8	0.94	17.6	8	0.94	17.6
14	776.925	777.050	14	29	17	-0.15	81.6	17	0.14	81.6	17	0.14	81.6
15	784.350	784.650	14	23	14	-0.10	18.0	14	0.07	18.0	14	0.07	18.0
16	795.700	796.075	17	83	17	-0.09	32.6	17	-0.22	32.6	17	-0.22	32.6
17	798.275	798.650	17	29	23	1.25	85.2	26	-2.34	103.0	26	-2.34	103.0
18	808.200	808.350	11	11	11	-0.25	12.6	11	-0.20	12.6	11	-0.20	12.6
19	813.750	814.125	11	26	14	-0.04	116.4	11	-0.16	19.2	11	-0.16	19.2
20	824.925	825.525	11	23	11	-0.14	11.9	11	-0.13	11.9	11	-0.13	11.9
21	851.725	853.150	17	83	17	-0.05	82.0	17	-0.03	82.0	17	-0.03	82.0
22	940.500	941.150	8	32	8	0.11	20.9	8	-0.12	20.9	8	-0.12	20.9
23	954.400	955.200	8	32	8	2.13	14.8	8	-1.90	14.8	8	-1.90	14.8
24	959.425	959.750	8	26	8	0.13	20.1	8	-0.24	20.1	8	-0.24	20.1
25	1218.000	1218.675	14	26	20	0.09	53.7	14	-0.42	27.6	14	-0.42	27.6
26	1220.850	1221.100	11	17	11	-0.35	30.9	11	-0.29	30.9	11	-0.29	30.9
27	1224.025	1225.475	35	83	38	-0.10	72.9	35	-0.12	87.5	35	-0.12	87.5
28	1244.225	1245.475	8	17	11	-0.85	17.6	11	0.89	17.6	11	0.89	17.6
29	1259.925	1261.125	17	83	17	-0.30	28.4	17	0.29	28.4	17	0.29	28.4
30	1271.675	1271.925	32	83	32	-0.25	63.2	32	-0.19	63.2	32	-0.19	63.2
31	1284.125	1284.400	17	29	17	0.19	62.7	17	-0.35	62.7	17	-0.35	62.7
32	1311.550	1314.525	32	83	32	-0.42	102.6	44	-0.19	29.2	44	-0.19	29.2
33	1314.700	1314.800	35	38	35	-0.29	213.6	38	-0.18	140.7	38	-0.18	140.7
34	1317.450	1320.425	62	83	62	-0.01	114.7	62	-0.01	114.7	62	-0.01	114.7
35	1335.775	1336.925	62	83	62	-0.02	139.9	62	-0.01	139.9	62	-0.01	139.9
36	1337.625	1340.600	65	83	65	-0.01	144.3	65	-0.01	144.3	65	-0.01	144.3
37	1348.050	1350.900	14	83	56	-0.06	72.0	56	-0.05	72.0	56	-0.05	72.0
38	1359.525	1362.500	65	83	65	-0.02	159.0	65	-0.02	159.0	65	-0.02	159.0
39	1362.550	1362.650	65	83	65	-0.02	350.7	65	-0.02	350.7	65	-0.02	350.7
40	1368.075	1371.050	65	83	65	-0.01	216.1	65	-0.01	216.1	65	-0.01	216.1
41	1375.175	1375.625	14	17	17	-0.57	28.9	17	0.54	28.9	17	0.54	28.9
42	1375.650	1377.100	14	29	14	-0.08	62.2	14	0.12	62.2	14	0.12	62.2
43	1386.450	1389.425	68	83	68	-0.04	150.4	71	0.00	247.2	71	0.00	247.2
44	1393.050	1396.025	68	83	68	-0.04	171.4	68	-0.01	171.4	68	-0.01	171.4
45	1414.775	1417.750	65	83	65	-0.02	182.1	65	-0.02	182.1	65	-0.02	182.1
46	1418.350	1419.475	68	83	68	-0.01	212.0	68	-0.03	212.0	68	-0.03	212.0
47	1456.725	1456.875	32	32	32	0.65	63.0	32	-0.39	63.0	32	-0.39	63.0
48	1458.325	1460.900	35	35	35	-0.57	30.0	35	0.45	30.0	35	0.45	30.0
49	1466.050	1467.775	32	38	38	-0.05	98.5	32	-0.07	137.3	32	-0.07	137.3
50	1570.000	1570.275	53	83	53	-0.05	58.8	53	-0.08	58.8	53	-0.08	58.8

Table 7: (ctd) Results for the 'h3' microwindow database - combined errors

------ Microwindow -------				--- mm shift --			-- pm shift ---			-- pp shift ---		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1570.300	1573.175	17 35	17	-0.30	11.6	35	-0.31	58.2	35	-0.31	58.2
52	1574.075	1575.800	23 29	23	0.39	12.0	23	-0.38	12.0	23	-0.38	12.0
53	1576.225	1578.875	62 68	62	-0.08	113.1	68	0.05	538.8	68	0.05	538.8
54	1589.375	1592.350	59 83	59	-0.05	61.9	59	-0.05	61.9	59	-0.05	61.9
55	1592.950	1594.425	17 83	65	0.01	999.9	17	-0.01	123.5	17	-0.01	123.5
56	1594.450	1597.450	56 83	56	-0.08	33.7	56	-0.03	33.7	56	-0.03	33.7
57	1601.075	1603.425	59 83	59	-0.06	73.9	59	-0.06	73.9	59	-0.06	73.9
58	1606.875	1609.850	68 83	68	-0.02	171.2	68	-0.02	171.2	68	-0.02	171.2
59	1614.775	1615.825	20 20	20	0.16	45.7	20	-0.16	45.7	20	-0.16	45.7
60	1616.700	1616.825	35 38	38	-2.58	31.7	38	3.16	31.7	38	3.16	31.7
61	1622.525	1622.675	65 83	65	-0.03	171.1	65	-0.03	171.1	65	-0.03	171.1
62	1637.550	1640.525	35 83	35	-0.30	159.7	35	0.17	159.7	35	0.17	159.7
63	1641.925	1644.900	59 83	59	-0.04	81.5	59	-0.04	81.5	59	-0.04	81.5
64	1648.300	1648.400	32 32	32	-2.18	87.7	32	2.58	87.7	32	2.58	87.7
65	1652.450	1653.225	65 83	65	-0.03	192.8	65	0.02	192.8	65	0.02	192.8
66	1657.425	1660.400	20 38	38	-0.10	208.9	38	0.08	208.9	38	0.08	208.9
67	1661.325	1661.425	62 83	62	-0.03	221.9	62	-0.03	221.9	62	-0.03	221.9
68	1668.250	1669.350	68 83	68	-0.03	183.5	68	-0.02	183.5	68	-0.02	183.5
69	1669.400	1669.550	32 32	32	-0.92	45.5	32	1.35	45.5	32	1.35	45.5
70	1675.750	1675.850	35 83	41	-0.04	141.5	35	-0.13	185.9	35	-0.13	185.9
71	1679.225	1682.225	32 83	38	-0.17	71.9	38	-0.12	71.9	38	-0.12	71.9
72	1684.925	1685.925	41 41	41	-0.41	53.4	41	0.45	53.4	41	0.45	53.4
73	1687.975	1690.950	68 83	68	-0.02	196.8	68	-0.02	196.8	68	-0.02	196.8
74	1692.075	1692.450	41 83	44	-0.07	57.1	41	-0.19	69.5	41	-0.19	69.5
75	1699.200	1699.900	65 83	77	0.05	999.9	77	-0.04	999.9	77	-0.04	999.9
76	1732.250	1732.350	44 83	44	-0.05	128.2	44	-0.09	128.2	44	-0.09	128.2
77	1746.850	1749.750	68 83	68	-0.02	206.9	68	-0.02	206.9	68	-0.02	206.9
78	1822.625	1824.175	56 83	83	0.03	999.9	56	-0.06	90.0	56	-0.06	90.0
79	1828.100	1829.425	65 83	83	0.03	999.9	65	-0.05	202.4	65	-0.05	202.4
80	1835.975	1837.975	62 83	62	-0.04	155.2	83	0.03	999.9	83	0.03	999.9
81	1841.825	1842.900	56 83	56	-0.06	80.3	83	0.02	999.9	83	0.02	999.9
82	1850.825	1852.850	50 83	50	-0.05	103.5	50	-0.01	103.5	50	-0.01	103.5
83	1864.250	1867.150	62 83	83	0.02	999.9	62	-0.04	158.9	62	-0.04	158.9
84	1884.350	1887.325	56 83	56	-0.03	92.4	56	-0.04	92.4	56	-0.04	92.4
85	1894.175	1895.225	59 83	83	0.04	999.9	59	-0.08	117.1	59	-0.08	117.1
86	1904.175	1906.100	53 83	53	-0.05	87.3	53	-0.03	87.3	53	-0.03	87.3
87	1909.800	1912.000	59 83	80	0.02	999.9	59	-0.06	120.6	59	-0.06	120.6
88	1917.900	1918.650	62 83	62	0.13	119.9	62	-0.19	119.9	62	-0.19	119.9
89	1933.100	1933.225	26 65	32	0.14	610.6	41	-0.28	156.5	41	-0.28	156.5
90	1936.250	1937.025	8 8	8	0.23	94.3	8	-0.22	94.3	8	-0.22	94.3
91	1945.925	1947.100	56 83	83	0.02	999.9	56	-0.05	118.9	56	-0.05	118.9

Table 8: Results for the 'fad' microwindow database — separated errors

	Microwindow				Calib.Error			Posn. Error			Press.Shift		
	Wavenumber	Range	Alts.		ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	687.550	687.925	20	83	29	-0.30	999.9	41	-4.81	99.5	35	0.04	285.2
2	688.525	689.050	26	83	41	0.39	99.4	38	-0.61	196.3	38	0.00	196.3
3	689.150	689.375	26	80	44	-1.66	999.9	47	-0.01	999.9	35	0.00	999.9
4	689.900	690.600	23	83	35	0.71	831.5	38	-0.10	237.5	35	0.00	831.5
5	693.850	694.125	23	83	38	-0.31	83.8	32	-0.13	114.8	32	0.00	114.8
6	696.200	696.350	20	83	35	1.43	122.4	35	-1.29	122.4	26	0.01	532.0
7	697.875	697.975	20	83	32	0.07	168.1	35	-1.36	147.6	29	0.03	178.6
8	703.350	703.750	17	83	29	-1.26	267.2	26	-0.27	411.1	26	0.01	411.1
9	704.875	705.425	17	83	32	-1.68	78.1	29	-1.70	90.1	26	0.03	139.9
10	705.450	706.250	8	59	29	0.79	999.9	41	-0.02	999.9	20	0.00	999.9
11	711.150	711.450	20	80	32	-1.11	999.9	29	0.00	999.9	23	0.00	999.9
12	713.425	713.500	14	83	23	0.11	140.1	38	-0.09	183.3	17	0.00	489.4
13	713.525	713.625	8	83	23	0.62	999.9	26	0.18	999.9	23	0.01	999.9
14	713.750	713.850	17	83	29	-1.24	852.5	32	-0.11	518.6	26	0.00	999.9
15	729.125	729.225	14	83	20	-0.19	99.5	20	-0.11	99.5	17	0.01	112.7
16	729.250	729.400	8	83	23	-0.79	638.7	20	-0.34	714.0	20	-0.03	714.0
17	730.725	730.925	8	80	32	-0.44	114.4	26	-1.55	68.3	20	0.13	52.9
18	740.525	740.625	14	83	41	-0.19	142.1	23	-0.22	162.9	23	0.01	162.9
19	740.650	741.125	8	83	26	-1.04	999.9	41	-0.01	999.9	17	0.00	999.9
20	744.725	745.725	8	83	20	1.02	97.6	11	0.06	103.6	11	0.33	103.6
21	752.225	752.525	8	83	23	-1.58	807.1	8	-0.72	52.6	8	-0.80	52.6
22	754.725	755.475	8	74	14	-0.73	999.9	8	0.04	16.1	8	0.39	16.1
23	755.875	755.975	8	83	23	-0.39	999.9	8	0.00	394.8	8	-0.04	394.8
24	760.350	760.450	8	80	17	-1.01	999.9	14	-0.02	999.9	8	-0.02	505.7
25	760.625	760.725	8	80	11	-0.19	211.6	8	-0.41	17.8	8	-0.44	17.8
26	776.925	777.050	8	83	14	-0.10	48.1	11	-0.02	14.1	11	-0.16	14.1
27	778.975	779.275	8	83	8	1.01	8.6	8	0.19	8.6	8	2.08	8.6
28	783.425	784.175	8	71	8	-0.41	8.4	8	0.05	8.4	8	0.53	8.4
29	784.400	784.850	8	83	11	-0.32	7.2	23	-0.06	88.6	8	0.63	11.9
30	787.600	787.725	8	74	17	0.06	999.9	8	-0.18	23.0	8	-0.19	23.0
31	795.700	795.925	8	83	11	-0.57	23.6	11	-1.45	23.6	11	-0.92	23.6
32	798.375	798.600	8	83	11	0.39	23.6	29	-2.23	114.3	11	-0.48	23.6
33	798.625	798.725	8	83	11	-0.26	162.1	8	0.14	369.0	8	-0.25	369.0
34	803.025	803.125	8	83	8	0.73	25.6	8	-1.42	25.6	8	-1.54	25.6
35	803.275	803.600	8	83	8	0.56	12.2	8	0.13	12.2	8	1.32	12.2
36	808.200	808.425	11	83	11	-0.03	12.6	11	-0.16	12.6	11	-0.07	12.6
37	813.775	814.075	8	83	8	0.77	12.4	8	1.98	12.4	8	2.28	12.4
38	851.725	853.150	8	83	8	0.51	6.8	8	1.46	6.8	8	1.58	6.8
39	1218.400	1218.675	8	83	11	-0.30	48.9	11	-0.62	48.9	11	-0.37	48.9
40	1224.050	1225.500	8	83	11	0.49	16.6	11	1.01	16.6	11	0.68	16.6
41	1225.525	1225.625	11	83	14	0.52	999.9	17	-0.01	999.9	11	0.06	378.2
42	1239.150	1239.275	11	80	11	-0.01	68.1	11	0.00	68.1	11	-0.02	68.1
43	1239.950	1240.050	11	80	11	0.27	100.2	11	-0.07	100.2	11	-0.03	100.2
44	1241.200	1241.350	8	74	11	-0.09	999.9	8	-0.02	64.0	8	-0.03	64.0
45	1243.800	1245.175	8	83	11	0.32	17.7	11	0.59	17.7	11	0.39	17.7
46	1260.275	1260.400	8	83	8	-0.10	999.9	8	-0.38	999.9	8	-0.26	999.9
47	1271.825	1271.925	8	83	26	0.64	129.1	26	1.14	129.1	20	0.07	141.1
48	1279.625	1280.075	8	83	20	-0.15	166.2	23	0.04	283.9	8	0.03	999.9
49	1284.250	1284.350	8	83	8	0.16	999.9	8	0.48	999.9	8	0.31	999.9
50	1287.925	1288.075	8	83	23	-0.11	288.6	20	-0.04	341.5	17	0.00	593.6

Table 8: (ctd) Results for the 'fad' microwindow database — separated errors

------ Microwindow -------				- Calib.Error -			- Posn. Error -			- Press.Shift -		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1288.850	1288.975	8 83	23	-0.29	435.2	26	-0.15	383.7	20	0.00	999.9
52	1296.750	1297.000	8 83	17	0.16	630.4	17	0.03	630.4	8	-0.05	999.9
53	1311.700	1314.675	8 83	26	-0.21	44.3	23	-0.55	46.3	11	-0.06	52.5
54	1316.825	1319.800	8 83	20	0.30	53.5	20	0.15	53.5	14	0.12	37.2
55	1332.675	1332.800	14 83	29	1.10	839.2	26	-0.06	999.9	26	0.00	999.9
56	1334.175	1334.275	8 83	14	0.08	501.4	20	-0.04	553.8	8	0.01	999.9
57	1336.075	1336.925	8 83	47	-0.13	30.6	47	-0.46	30.6	8	-0.03	999.9
58	1338.250	1338.350	8 83	17	-0.17	328.5	23	-0.04	241.1	8	0.07	999.9
59	1338.375	1340.800	8 83	20	-0.68	33.2	20	-1.46	33.2	20	0.17	33.2
60	1348.050	1349.975	8 83	14	-0.13	27.3	14	0.46	27.3	14	0.18	27.3
61	1350.000	1350.800	8 83	14	0.03	62.5	11	-0.05	28.5	11	-0.03	28.5
62	1358.050	1358.150	8 83	20	0.26	963.4	41	-0.06	104.3	26	0.01	356.4
63	1360.450	1360.700	8 83	20	0.27	579.0	14	-0.06	324.8	8	0.02	999.9
64	1360.725	1363.325	8 83	17	-0.23	37.2	17	0.82	37.2	14	0.17	25.9
65	1365.000	1365.375	8 83	11	0.11	60.6	8	-0.04	665.6	8	-0.02	665.6
66	1367.975	1370.950	8 83	11	0.07	37.2	20	-0.29	63.3	20	-0.03	63.3
67	1373.175	1373.575	8 74	20	-0.29	141.0	14	0.02	48.8	14	0.05	48.8
68	1373.600	1374.925	8 83	17	-0.08	34.1	14	0.30	25.3	14	0.12	25.3
69	1374.950	1377.100	8 83	14	-0.17	38.4	17	0.47	28.9	17	0.10	28.9
70	1377.125	1377.225	11 83	17	0.06	316.4	11	-0.11	137.1	11	-0.06	137.1
71	1378.450	1378.550	8 83	14	0.16	242.9	17	-0.47	176.0	17	-0.07	176.0
72	1384.650	1387.625	8 83	26	0.35	34.7	26	0.98	34.7	14	0.11	15.2
73	1389.075	1389.175	8 83	8	-0.02	999.9	8	-0.07	999.9	8	-0.04	999.9
74	1390.175	1390.300	11 83	11	-0.02	171.2	11	-0.07	171.2	11	-0.04	171.2
75	1391.275	1391.375	8 83	8	0.07	999.9	8	-0.25	999.9	8	-0.15	999.9
76	1394.250	1397.200	8 83	29	0.27	24.1	29	0.88	24.1	17	0.10	17.9
77	1397.400	1400.375	8 83	29	0.11	24.8	29	0.39	24.8	14	0.05	19.8
78	1404.950	1405.050	29 83	29	-0.11	68.0	29	-0.44	68.0	29	0.01	68.0
79	1416.850	1419.775	8 83	35	-0.41	21.2	35	-1.25	21.2	14	0.07	20.2
80	1422.950	1425.900	8 83	26	0.18	24.5	26	0.57	24.5	14	-0.05	30.7
81	1429.125	1432.100	8 83	29	0.15	27.9	29	0.51	27.9	11	-0.04	74.8
82	1433.700	1436.600	8 83	20	-0.09	24.2	17	0.27	23.8	17	0.06	23.8
83	1436.825	1436.950	17 83	38	-0.47	42.4	38	-1.45	42.4	29	0.03	55.9
84	1436.975	1438.450	8 83	23	0.33	32.8	23	1.00	32.8	23	0.05	32.8
85	1447.725	1450.675	8 83	26	0.09	24.6	26	0.30	24.6	17	0.05	29.4
86	1454.375	1457.325	8 83	29	0.25	15.1	29	0.76	15.1	17	0.07	23.4
87	1457.350	1460.325	8 83	26	0.15	18.0	41	-0.50	22.0	14	0.04	39.3
88	1463.675	1466.625	8 83	14	-0.06	34.4	17	0.13	31.9	8	-0.04	999.9
89	1469.825	1472.800	8 83	29	0.09	21.8	29	0.28	21.8	14	0.04	24.0
90	1473.425	1476.400	8 83	29	0.27	23.8	29	0.82	23.8	17	0.03	28.7
91	1478.675	1481.650	8 83	20	0.06	32.3	20	0.19	32.3	11	-0.04	92.0
92	1486.150	1489.125	8 83	29	0.09	25.9	29	0.29	25.9	8	0.06	999.9
93	1489.150	1492.125	8 83	29	0.19	25.6	29	0.60	25.6	14	0.02	21.7
94	1496.225	1496.325	32 83	32	0.26	86.1	32	0.84	86.1	32	0.01	86.1
95	1498.800	1498.925	32 83	38	-0.14	60.9	38	-0.46	60.9	35	0.00	81.3
96	1570.000	1571.025	8 83	26	0.40	25.8	26	1.25	25.8	26	0.05	25.8
97	1571.050	1573.525	8 83	47	-0.15	36.1	47	-0.49	36.1	8	-0.03	999.9
98	1574.075	1575.975	8 83	29	0.14	15.7	29	0.42	15.7	17	0.04	12.7
99	1576.250	1579.225	8 83	35	0.76	10.5	35	2.29	10.5	17	0.07	13.0
100	1589.050	1591.750	8 83	20	0.77	28.3	20	2.75	28.3	14	0.27	29.6

Table 8: (ctd) Results for the 'fad' microwindow database — separated errors

	Microwindow			Calib.Error			Posn. Error			Press.Shift		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
101	1591.775	1592.125	8 83	14	0.19	32.8	14	0.42	32.8	14	0.16	32.8
102	1594.450	1594.525	14 83	14	0.30	999.9	32	-1.02	94.3	14	-0.02	999.9
103	1594.550	1596.575	8 83	23	0.54	51.0	23	2.39	51.0	23	0.12	51.0
104	1601.100	1601.375	8 83	23	0.47	51.3	23	1.47	51.3	8	0.14	999.9
105	1602.675	1603.400	8 83	20	0.42	31.9	20	1.29	31.9	17	0.15	31.0
106	1606.875	1609.850	8 83	17	0.60	48.3	17	1.59	48.3	17	0.21	48.3
107	1609.950	1610.050	8 83	17	-0.41	269.7	8	0.13	999.9	8	0.08	999.9
108	1611.700	1612.250	8 83	14	-0.05	75.1	26	0.14	231.7	14	0.01	75.1
109	1612.550	1615.525	8 83	23	-0.15	86.0	29	0.55	121.1	8	0.04	999.9
110	1620.075	1622.950	8 83	23	0.29	31.5	38	-2.36	42.2	14	0.07	33.2
111	1623.075	1626.025	8 83	38	1.10	18.4	38	3.23	18.4	8	-0.11	999.9
112	1627.625	1630.450	8 83	32	0.73	34.1	32	1.93	34.1	17	0.16	72.4
113	1631.250	1631.375	14 83	26	0.30	216.7	14	-0.18	112.9	14	-0.05	112.9
114	1632.250	1633.125	8 83	20	-0.18	646.3	26	-0.17	990.1	8	0.02	999.9
115	1634.600	1637.525	8 83	32	0.42	44.5	32	1.53	44.5	26	0.04	30.2
116	1637.550	1640.525	8 83	35	0.70	32.4	35	2.23	32.4	14	0.09	34.7
117	1640.900	1643.875	8 83	23	0.67	50.4	23	2.02	50.4	17	0.14	33.7
118	1645.975	1646.075	32 83	35	0.36	49.7	35	1.13	49.7	35	0.02	49.7
119	1647.100	1649.775	8 83	35	0.32	19.1	35	1.01	19.1	17	-0.05	24.8
120	1649.800	1649.975	8 83	20	-0.09	365.1	23	-0.31	388.0	20	0.02	365.1
121	1652.400	1652.500	32 83	32	0.41	40.4	32	1.27	40.4	32	0.02	40.4
122	1653.375	1653.475	32 83	38	-0.40	51.0	38	-1.31	51.0	38	0.01	51.0
123	1653.500	1656.425	8 83	32	0.34	67.7	32	1.09	67.7	17	0.04	16.9
124	1662.750	1662.875	17 83	26	0.37	827.2	26	1.12	827.2	26	0.02	827.2
125	1667.225	1670.175	8 83	41	-0.30	17.6	41	-0.97	17.6	14	0.05	28.8
126	1670.350	1673.300	8 83	32	0.56	31.8	32	1.73	31.8	14	0.05	20.8
127	1675.100	1675.250	17 83	35	0.54	88.3	35	1.70	88.3	35	0.02	88.3
128	1675.275	1675.700	14 83	29	0.18	36.2	29	0.55	36.2	23	0.02	136.3
129	1675.725	1675.850	20 83	23	-0.07	100.0	23	-0.22	100.0	20	0.01	82.6
130	1679.725	1681.225	8 83	23	0.16	28.5	23	0.53	28.5	14	-0.07	35.5
131	1681.250	1684.225	8 83	44	0.55	23.6	44	1.66	23.6	17	0.04	20.8
132	1686.025	1687.275	8 83	20	-0.05	116.8	26	-0.06	140.4	8	-0.03	999.9
133	1687.475	1690.200	8 83	26	0.20	31.0	26	0.67	31.0	8	-0.04	999.9
134	1690.225	1693.200	8 83	20	-0.10	39.9	20	-0.36	39.9	14	0.07	28.6
135	1693.450	1696.425	8 83	38	-0.70	21.3	38	-2.10	21.3	8	0.03	999.9
136	1696.975	1697.075	11 83	23	-0.03	351.9	23	-0.10	351.9	20	0.01	365.2
137	1697.100	1699.250	8 83	26	0.31	47.0	26	0.74	47.0	17	0.03	35.0
138	1700.025	1702.950	8 83	35	0.36	25.4	35	1.07	25.4	23	0.02	26.2
139	1704.400	1704.500	17 83	32	0.15	140.4	32	0.58	140.4	20	0.01	999.9
140	1705.375	1708.325	8 83	23	-0.13	37.0	23	-0.33	37.0	8	-0.05	999.9
141	1708.525	1710.800	8 83	23	0.40	52.2	23	1.30	52.2	23	0.06	52.2
142	1710.825	1710.925	14 83	23	0.12	648.3	17	0.24	362.3	17	0.04	362.3
143	1712.900	1714.875	8 83	20	0.08	44.6	14	0.19	43.0	8	0.05	999.9
144	1714.900	1717.875	8 83	35	0.29	62.7	35	1.29	62.7	14	0.03	73.6
145	1717.900	1719.825	8 83	32	0.57	36.3	32	1.66	36.3	23	0.03	33.1
146	1719.850	1720.425	8 83	17	0.07	999.9	8	-0.01	999.9	8	-0.01	999.9
147	1721.250	1724.125	8 83	23	-0.36	65.8	23	-1.02	65.8	23	0.04	65.8
148	1726.650	1726.800	8 83	8	0.11	999.9	26	-0.34	240.1	8	0.26	999.9
149	1728.400	1731.375	8 83	26	0.16	27.9	26	0.48	27.9	14	0.03	46.5
150	1733.000	1735.950	8 83	35	0.30	72.9	35	0.92	72.9	8	0.02	999.9

Table 8: (ctd) Results for the 'fad' microwindow database — separated errors

------ Microwindow -------				- Calib.Error -			- Posn. Error -			- Press.Shift -		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
151	1739.775	1739.900	20 83	41	-0.32	45.4	41	-1.27	45.4	23	0.01	999.9
152	1739.925	1742.075	8 83	32	-0.21	130.3	29	0.41	46.6	14	0.04	39.2
153	1742.100	1744.525	8 83	23	0.28	35.8	23	0.89	35.8	23	0.04	35.8
154	1744.925	1747.800	8 83	35	-0.10	47.1	35	-0.50	47.1	17	0.02	31.2
155	1748.050	1749.950	8 83	32	0.53	54.7	32	1.66	54.7	8	-0.05	999.9
156	1821.550	1822.325	8 83	20	-0.04	114.0	14	-0.11	55.7	14	-0.03	55.7
157	1822.450	1822.550	8 68	26	0.19	999.9	11	0.02	351.2	11	0.01	351.2
158	1822.625	1824.175	8 83	14	0.08	98.0	14	0.21	98.0	14	0.08	98.0
159	1824.325	1825.225	8 83	29	-0.24	40.8	26	0.79	44.6	14	0.04	42.1
160	1825.250	1826.450	8 83	20	0.27	62.7	20	0.81	62.7	17	0.05	49.6
161	1828.150	1829.150	8 83	29	0.53	55.6	29	1.61	55.6	17	0.05	38.8
162	1829.300	1830.275	8 83	29	0.21	31.5	29	0.67	31.5	20	0.03	47.7
163	1835.650	1836.250	8 83	11	0.02	64.5	11	0.03	64.5	11	0.02	64.5
164	1839.225	1839.325	11 65	65	0.95	999.9	11	0.13	381.1	11	0.08	381.1
165	1843.225	1845.475	8 83	26	0.14	30.0	26	0.44	30.0	8	-0.04	999.9
166	1846.850	1849.175	8 83	26	-0.07	58.3	26	-0.25	58.3	11	-0.04	30.4
167	1860.700	1860.825	8 29	26	0.59	999.9	8	0.01	476.0	8	0.00	476.0
168	1864.125	1864.225	8 50	50	0.37	999.9	20	-0.01	999.9	8	0.00	999.9
169	1864.250	1867.125	8 83	14	0.04	26.8	44	-0.10	67.1	8	0.03	999.9
170	1867.725	1868.975	8 83	17	-0.06	66.9	17	-0.19	66.9	8	-0.05	999.9
171	1869.000	1870.150	8 83	26	0.05	37.5	26	0.20	37.5	14	0.03	57.4
172	1884.350	1887.325	8 83	11	0.03	34.3	11	0.09	34.3	11	0.06	34.3
173	1889.350	1890.050	8 83	14	-0.04	79.4	26	0.13	50.8	14	0.03	79.4
174	1894.175	1895.225	8 83	20	0.26	80.2	20	0.74	80.2	14	0.07	47.9
175	1897.325	1897.425	11 68	41	-1.00	999.9	11	-0.08	404.6	11	-0.05	404.6
176	1897.450	1897.725	11 77	14	-0.08	804.8	11	-0.02	262.5	11	0.00	262.5
177	1900.050	1900.400	8 59	38	0.94	999.9	8	0.00	515.3	8	0.00	515.3
178	1904.125	1906.100	8 83	8	0.02	347.6	11	-0.12	53.6	11	0.08	53.6
179	1906.125	1906.275	8 65	23	-0.98	999.9	11	0.01	999.9	11	0.01	999.9
180	1906.725	1908.025	8 83	20	-0.25	102.6	20	0.72	102.6	17	0.06	82.6
181	1909.800	1912.000	8 83	14	-0.06	49.7	14	0.18	49.7	14	0.07	49.7
182	1917.925	1918.225	17 83	20	0.13	142.2	20	0.38	142.2	20	0.03	142.2
183	1921.800	1923.475	8 83	32	-0.14	100.2	35	-0.75	95.8	11	-0.03	117.7
184	1929.050	1929.475	8 59	17	0.44	999.9	8	0.00	310.8	8	0.00	310.8
185	1933.075	1933.250	8 83	23	0.17	369.5	14	-0.10	999.9	8	0.03	999.9
186	1937.000	1937.100	14 65	41	-0.70	999.9	14	-0.26	999.9	14	-0.07	999.9
187	1942.250	1943.325	8 83	11	-0.10	137.0	47	-0.11	57.9	11	-0.02	137.0
188	1945.125	1945.875	8 83	11	-0.08	121.7	11	-0.07	121.7	11	-0.05	121.7
189	1945.925	1947.100	8 83	47	-0.03	60.9	44	-0.07	92.9	11	0.01	48.0
190	2040.750	2041.575	8 83	20	-0.06	430.7	35	0.16	489.6	11	0.04	189.5
191	2113.975	2115.125	8 77	20	-0.04	999.9	29	-0.05	999.9	8	-0.03	270.3

Table 9: Results for the 'fad' microwindow database — combined errors

	Microwindow				mm shift			pm shift			pp shift		
	Wavenumber	Range	Alts.		ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
1	687.550	687.925	20	83	38	2.37	165.2	41	-4.58	99.5	41	-4.58	99.5
2	688.525	689.050	26	83	44	0.64	97.8	44	-0.79	97.8	44	-0.79	97.8
3	689.150	689.375	26	80	44	-1.66	999.9	44	1.65	999.9	44	1.65	999.9
4	689.900	690.600	23	83	35	-0.65	831.5	35	0.63	831.5	35	0.63	831.5
5	693.850	694.125	23	83	38	0.19	83.8	38	-0.40	83.8	38	-0.40	83.8
6	696.200	696.350	20	83	35	-2.70	122.4	32	1.46	151.2	32	1.46	151.2
7	697.875	697.975	20	83	29	0.51	178.6	35	-1.45	147.6	35	-1.45	147.6
8	703.350	703.750	17	83	41	1.17	126.5	41	-1.22	126.5	41	-1.22	126.5
9	704.875	705.425	17	83	23	0.93	406.5	32	-1.66	78.1	32	-1.66	78.1
10	705.450	706.250	8	59	29	0.79	999.9	29	-0.75	999.9	29	-0.75	999.9
11	711.150	711.450	20	80	32	-1.11	999.9	32	1.10	999.9	32	1.10	999.9
12	713.425	713.500	14	83	41	-0.14	179.2	23	-0.15	140.1	23	-0.15	140.1
13	713.525	713.625	8	83	23	-0.73	999.9	26	0.80	999.9	26	0.80	999.9
14	713.750	713.850	17	83	29	-1.29	852.5	29	1.22	852.5	29	1.22	852.5
15	729.125	729.225	14	83	44	-0.21	232.2	20	-0.19	99.5	20	-0.19	99.5
16	729.250	729.400	8	83	23	0.76	638.7	23	-0.94	638.7	23	-0.94	638.7
17	730.725	730.925	8	80	23	0.57	57.4	26	-1.64	68.3	26	-1.64	68.3
18	740.525	740.625	14	83	41	-0.29	142.1	23	-0.44	162.9	23	-0.44	162.9
19	740.650	741.125	8	83	26	1.04	999.9	26	-1.04	999.9	26	-1.04	999.9
20	744.725	745.725	8	83	20	1.03	97.6	20	-1.02	97.6	20	-1.02	97.6
21	752.225	752.525	8	83	20	1.58	605.4	20	-1.61	605.4	20	-1.61	605.4
22	754.725	755.475	8	74	14	-0.73	999.9	14	0.72	999.9	14	0.72	999.9
23	755.875	755.975	8	83	23	-0.38	999.9	23	0.37	999.9	23	0.37	999.9
24	760.350	760.450	8	80	17	0.99	999.9	17	-1.00	999.9	17	-1.00	999.9
25	760.625	760.725	8	80	8	-0.41	17.8	11	-0.18	211.6	11	-0.18	211.6
26	776.925	777.050	8	83	14	-0.11	48.1	17	0.09	91.9	17	0.09	91.9
27	778.975	779.275	8	83	8	1.20	8.6	8	-1.19	8.6	8	-1.19	8.6
28	783.425	784.175	8	71	8	0.45	8.4	8	-0.46	8.4	8	-0.46	8.4
29	784.400	784.850	8	83	11	-0.37	7.2	11	0.36	7.2	11	0.36	7.2
30	787.600	787.725	8	74	8	-0.23	23.0	17	-0.06	999.9	17	-0.06	999.9
31	795.700	795.925	8	83	11	2.01	23.6	11	-2.02	23.6	11	-2.02	23.6
32	798.375	798.600	8	83	11	-1.14	23.6	29	-2.28	114.3	29	-2.28	114.3
33	798.625	798.725	8	83	11	-0.36	162.1	11	0.36	162.1	11	0.36	162.1
34	803.025	803.125	8	83	8	-2.14	25.6	8	2.12	25.6	8	2.12	25.6
35	803.275	803.600	8	83	8	0.68	12.2	8	-0.67	12.2	8	-0.67	12.2
36	808.200	808.425	11	83	11	-0.25	12.6	11	-0.20	12.6	11	-0.20	12.6
37	813.775	814.075	8	83	8	-2.65	12.4	8	2.76	12.4	8	2.76	12.4
38	851.725	853.150	8	83	8	1.98	6.8	8	-1.90	6.8	8	-1.90	6.8
39	1218.400	1218.675	8	83	11	-0.67	48.9	14	-0.42	27.6	14	-0.42	27.6
40	1224.050	1225.500	8	83	11	-1.40	16.6	11	1.50	16.6	11	1.50	16.6
41	1225.525	1225.625	11	83	14	-0.40	999.9	14	0.53	999.9	14	0.53	999.9
42	1239.150	1239.275	11	80	11	-0.02	68.1	11	0.01	68.1	11	0.01	68.1
43	1239.950	1240.050	11	80	11	-0.19	100.2	11	0.28	100.2	11	0.28	100.2
44	1241.200	1241.350	8	74	8	-0.10	64.0	14	0.07	999.9	14	0.07	999.9
45	1243.800	1245.175	8	83	11	-0.86	17.7	11	0.91	17.7	11	0.91	17.7
46	1260.275	1260.400	8	83	8	-0.50	999.9	8	0.43	999.9	8	0.43	999.9
47	1271.825	1271.925	8	83	26	-1.58	129.1	26	1.83	129.1	26	1.83	129.1
48	1279.625	1280.075	8	83	29	0.15	425.2	20	-0.15	166.2	20	-0.15	166.2
49	1284.250	1284.350	8	83	8	-0.59	999.9	8	0.64	999.9	8	0.64	999.9
50	1287.925	1288.075	8	83	23	0.07	288.6	23	-0.14	288.6	23	-0.14	288.6

Table 9: (ctd) Results for the 'fad' microwindow database - combined errors

------ Microwindow -------				--- mm shift --			-- pm shift ---			-- pp shift ---		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
51	1288.850	1288.975	8 83	38	-0.33	259.7	20	-0.28	999.9	20	-0.28	999.9
52	1296.750	1297.000	8 83	20	-0.11	465.6	17	0.14	630.4	17	0.14	630.4
53	1311.700	1314.675	8 83	23	-0.79	46.3	23	0.66	46.3	23	0.66	46.3
54	1316.825	1319.800	8 83	20	0.45	53.5	20	-0.43	53.5	20	-0.43	53.5
55	1332.675	1332.800	14 83	29	-1.10	839.2	29	1.09	839.2	29	1.09	839.2
56	1334.175	1334.275	8 83	17	-0.03	559.2	14	0.06	501.4	14	0.06	501.4
57	1336.075	1336.925	8 83	47	-0.66	30.6	35	-0.38	103.7	35	-0.38	103.7
58	1338.250	1338.350	8 83	17	0.12	328.5	17	-0.16	328.5	17	-0.16	328.5
59	1338.375	1340.800	8 83	20	2.03	33.2	20	-2.16	33.2	20	-2.16	33.2
60	1348.050	1349.975	8 83	14	-0.57	27.3	14	0.59	27.3	14	0.59	27.3
61	1350.000	1350.800	8 83	8	-0.04	720.9	8	0.05	720.9	8	0.05	720.9
62	1358.050	1358.150	8 83	41	-0.25	104.3	20	0.25	963.4	20	0.25	963.4
63	1360.450	1360.700	8 83	20	-0.27	579.0	20	0.27	579.0	20	0.27	579.0
64	1360.725	1363.325	8 83	17	-0.98	37.2	17	1.06	37.2	17	1.06	37.2
65	1365.000	1365.375	8 83	35	0.06	999.9	11	0.08	60.6	11	0.08	60.6
66	1367.975	1370.950	8 83	20	-0.31	63.3	20	0.30	63.3	20	0.30	63.3
67	1373.175	1373.575	8 74	20	0.27	141.0	17	-0.30	78.8	17	-0.30	78.8
68	1373.600	1374.925	8 83	14	0.38	25.3	14	-0.38	25.3	14	-0.38	25.3
69	1374.950	1377.100	8 83	17	-0.57	28.9	17	0.54	28.9	17	0.54	28.9
70	1377.125	1377.225	11 83	11	-0.12	137.1	20	-0.06	435.6	20	-0.06	435.6
71	1378.450	1378.550	8 83	11	-0.30	999.9	17	-0.48	176.0	17	-0.48	176.0
72	1384.650	1387.625	8 83	26	1.37	34.7	26	-1.20	34.7	26	-1.20	34.7
73	1389.075	1389.175	8 83	8	-0.09	999.9	11	-0.07	106.9	11	-0.07	106.9
74	1390.175	1390.300	11 83	11	-0.10	171.2	11	0.06	171.2	11	0.06	171.2
75	1391.275	1391.375	8 83	8	-0.32	999.9	8	0.32	999.9	8	0.32	999.9
76	1394.250	1397.200	8 83	29	1.23	24.1	35	0.98	30.9	35	0.98	30.9
77	1397.400	1400.375	8 83	26	0.39	20.4	29	0.55	24.8	29	0.55	24.8
78	1404.950	1405.050	29 83	44	-0.25	67.6	29	-0.63	68.0	29	-0.63	68.0
79	1416.850	1419.775	8 83	35	-1.70	21.2	35	1.48	21.2	35	1.48	21.2
80	1422.950	1425.900	8 83	26	0.78	24.5	26	-0.54	24.5	26	-0.54	24.5
81	1429.125	1432.100	8 83	29	-0.44	27.9	29	0.70	27.9	29	0.70	27.9
82	1433.700	1436.600	8 83	17	0.35	23.8	20	-0.35	24.2	20	-0.35	24.2
83	1436.825	1436.950	17 83	38	-1.97	42.4	38	1.69	42.4	38	1.69	42.4
84	1436.975	1438.450	8 83	23	-1.24	32.8	23	1.34	32.8	23	1.34	32.8
85	1447.725	1450.675	8 83	26	0.41	24.6	17	0.33	29.4	17	0.33	29.4
86	1454.375	1457.325	8 83	29	1.04	15.1	29	-0.89	15.1	29	-0.89	15.1
87	1457.350	1460.325	8 83	26	-0.52	18.0	41	-0.69	22.0	41	-0.69	22.0
88	1463.675	1466.625	8 83	44	-0.15	21.1	29	0.18	19.6	29	0.18	19.6
89	1469.825	1472.800	8 83	29	0.39	21.8	29	-0.28	21.8	29	-0.28	21.8
90	1473.425	1476.400	8 83	29	-1.01	23.8	29	1.11	23.8	29	1.11	23.8
91	1478.675	1481.650	8 83	20	0.27	32.3	20	-0.16	32.3	20	-0.16	32.3
92	1486.150	1489.125	8 83	29	-0.29	25.9	29	0.40	25.9	29	0.40	25.9
93	1489.150	1492.125	8 83	29	-0.65	25.6	29	0.82	25.6	29	0.82	25.6
94	1496.225	1496.325	32 83	32	-0.80	86.1	32	1.16	86.1	32	1.16	86.1
95	1498.800	1498.925	32 83	35	0.49	81.3	38	-0.65	60.9	38	-0.65	60.9
96	1570.000	1571.025	8 83	26	-1.52	25.8	26	1.68	25.8	26	1.68	25.8
97	1571.050	1573.525	8 83	47	0.53	36.1	47	-0.67	36.1	47	-0.67	36.1
98	1574.075	1575.975	8 83	29	0.56	15.7	29	-0.54	15.7	29	-0.54	15.7
99	1576.250	1579.225	8 83	35	-2.94	10.5	35	3.08	10.5	35	3.08	10.5

Table 9: (ctd) Results for the 'fad' microwindow database - combined errors

	Microwindow			mm shift			pm shift			pp shift		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
100	1589.050	1591.750	8 83	20	3.53	28.3	20	-3.43	28.3	20	-3.43	28.3
101	1591.775	1592.125	8 83	14	-0.58	32.8	14	0.62	32.8	14	0.62	32.8
102	1594.450	1594.525	14 83	32	-1.45	94.3	14	-0.83	999.9	14	-0.83	999.9
103	1594.550	1596.575	8 83	23	2.96	51.0	23	-2.71	51.0	23	-2.71	51.0
104	1601.100	1601.375	8 83	23	-1.68	51.3	23	2.00	51.3	23	2.00	51.3
105	1602.675	1603.400	8 83	20	1.75	31.9	20	-1.57	31.9	20	-1.57	31.9
106	1606.875	1609.850	8 83	17	2.21	48.3	17	-2.04	48.3	17	-2.04	48.3
107	1609.950	1610.050	8 83	17	-0.49	269.7	17	0.48	269.7	17	0.48	269.7
108	1611.700	1612.250	8 83	26	-0.12	231.7	26	0.09	231.7	26	0.09	231.7
109	1612.550	1615.525	8 83	32	0.34	133.3	29	0.43	121.1	29	0.43	121.1
110	1620.075	1622.950	8 83	38	1.61	42.2	38	-2.50	42.2	38	-2.50	42.2
111	1623.075	1626.025	8 83	38	4.38	18.4	38	-4.07	18.4	38	-4.07	18.4
112	1627.625	1630.450	8 83	32	-2.64	34.1	32	2.66	34.1	32	2.66	34.1
113	1631.250	1631.375	14 83	14	0.29	112.9	17	-0.40	142.8	17	-0.40	142.8
114	1632.250	1633.125	8 83	20	0.26	646.3	26	-0.29	990.1	26	-0.29	990.1
115	1634.600	1637.525	8 83	32	-1.52	44.5	32	2.06	44.5	32	2.06	44.5
116	1637.550	1640.525	8 83	35	-2.56	32.4	35	3.01	32.4	35	3.01	32.4
117	1640.900	1643.875	8 83	23	-2.67	50.4	23	2.69	50.4	23	2.69	50.4
118	1645.975	1646.075	32 83	41	-1.42	22.9	35	1.55	49.7	35	1.55	49.7
119	1647.100	1649.775	8 83	35	1.43	19.1	35	-0.89	19.1	35	-0.89	19.1
120	1649.800	1649.975	8 83	23	-0.40	388.0	20	0.36	365.1	20	0.36	365.1
121	1652.400	1652.500	32 83	32	-1.52	40.4	32	1.72	40.4	32	1.72	40.4
122	1653.375	1653.475	32 83	32	1.26	66.6	38	-1.84	51.0	38	-1.84	51.0
123	1653.500	1656.425	8 83	32	-1.12	67.7	32	1.50	67.7	32	1.50	67.7
124	1662.750	1662.875	17 83	26	1.50	827.2	26	-1.46	827.2	26	-1.46	827.2
125	1667.225	1670.175	8 83	41	1.05	17.6	41	-1.32	17.6	41	-1.32	17.6
126	1670.350	1673.300	8 83	32	2.33	31.8	32	-2.03	31.8	32	-2.03	31.8
127	1675.100	1675.250	17 83	35	-1.93	88.3	35	2.30	88.3	35	2.30	88.3
128	1675.275	1675.700	14 83	29	-0.66	36.2	29	0.75	36.2	29	0.75	36.2
129	1675.725	1675.850	20 83	23	0.21	100.0	23	-0.30	100.0	23	-0.30	100.0
130	1679.725	1681.225	8 83	41	-0.57	36.7	23	0.73	28.5	23	0.73	28.5
131	1681.250	1684.225	8 83	44	2.22	23.6	44	-2.15	23.6	44	-2.15	23.6
132	1686.025	1687.275	8 83	23	-0.12	118.8	23	0.06	118.8	23	0.06	118.8
133	1687.475	1690.200	8 83	26	0.90	31.0	44	-0.84	34.8	44	-0.84	34.8
134	1690.225	1693.200	8 83	20	-0.46	39.9	20	0.43	39.9	20	0.43	39.9
135	1693.450	1696.425	8 83	38	-2.81	21.3	38	2.74	21.3	38	2.74	21.3
136	1696.975	1697.075	11 83	23	-0.14	351.9	23	0.08	351.9	23	0.08	351.9
137	1697.100	1699.250	8 83	26	1.05	47.0	26	-0.99	47.0	26	-0.99	47.0
138	1700.025	1702.950	8 83	35	1.43	25.4	35	-1.40	25.4	35	-1.40	25.4
139	1704.400	1704.500	17 83	38	-0.52	65.9	32	0.87	140.4	32	0.87	140.4
140	1705.375	1708.325	8 83	23	-0.46	37.0	23	0.45	37.0	23	0.45	37.0
141	1708.525	1710.800	8 83	23	1.73	52.2	23	-1.59	52.2	23	-1.59	52.2
142	1710.825	1710.925	14 83	17	-0.31	362.3	23	0.36	648.3	23	0.36	648.3
143	1712.900	1714.875	8 83	44	-0.27	35.9	14	0.27	43.0	14	0.27	43.0
144	1714.900	1717.875	8 83	35	1.64	62.7	35	-1.33	62.7	35	-1.33	62.7
145	1717.900	1719.825	8 83	32	-2.15	36.3	32	2.25	36.3	32	2.25	36.3
146	1719.850	1720.425	8 83	17	-0.07	999.9	17	0.06	999.9	17	0.06	999.9
147	1721.250	1724.125	8 83	23	1.34	65.8	23	-1.39	65.8	23	-1.39	65.8
148	1726.650	1726.800	8 83	8	-0.44	999.9	8	0.45	999.9	8	0.45	999.9
149	1728.400	1731.375	8 83	26	0.68	27.9	26	-0.51	27.9	26	-0.51	27.9
150	1733.000	1735.950	8 83	35	-0.94	72.9	35	1.28	72.9	35	1.28	72.9

Table 9: (ctd) Results for the 'fad' microwindow database - combined errors

------ Microwindow -------				--- mm shift --			-- pm shift ---			-- pp shift ---		
	Wavenumber Range		Alts.	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS	ALT	RATIO	ENOIS
151	1739.775	1739.900	20 83	41	1.11	45.4	41	-1.68	45.4	41	-1.68	45.4
152	1739.925	1742.075	8 83	29	-0.47	46.6	29	0.52	46.6	29	0.52	46.6
153	1742.100	1744.525	8 83	23	-1.04	35.8	23	1.20	35.8	23	1.20	35.8
154	1744.925	1747.800	8 83	35	0.37	47.1	35	-0.65	47.1	35	-0.65	47.1
155	1748.050	1749.950	8 83	32	2.22	54.7	32	-2.01	54.7	32	-2.01	54.7
156	1821.550	1822.325	8 83	14	0.07	55.7	14	-0.14	55.7	14	-0.14	55.7
157	1822.450	1822.550	8 68	26	0.19	999.9	11	-0.17	351.2	11	-0.17	351.2
158	1822.625	1824.175	8 83	14	-0.26	98.0	14	0.30	98.0	14	0.30	98.0
159	1824.325	1825.225	8 83	26	1.06	44.6	29	-1.00	40.8	29	-1.00	40.8
160	1825.250	1826.450	8 83	20	-0.99	62.7	20	1.10	62.7	20	1.10	62.7
161	1828.150	1829.150	8 83	29	2.18	55.6	29	-1.96	55.6	29	-1.96	55.6
162	1829.300	1830.275	8 83	29	-0.73	31.5	29	0.91	31.5	29	0.91	31.5
163	1835.650	1836.250	8 83	35	-0.05	182.0	11	0.06	64.5	11	0.06	64.5
164	1839.225	1839.325	11 65	65	-0.91	999.9	65	0.95	999.9	65	0.95	999.9
165	1843.225	1845.475	8 83	26	-0.50	30.0	26	0.59	30.0	26	0.59	30.0
166	1846.850	1849.175	8 83	26	-0.32	58.3	23	0.31	52.2	23	0.31	52.2
167	1860.700	1860.825	8 29	26	0.59	999.9	26	-0.56	999.9	26	-0.56	999.9
168	1864.125	1864.225	8 50	50	-0.35	999.9	50	0.37	999.9	50	0.37	999.9
169	1864.250	1867.125	8 83	41	-0.16	73.4	44	-0.19	67.1	44	-0.19	67.1
170	1867.725	1868.975	8 83	44	-0.30	38.3	17	0.24	66.9	17	0.24	66.9
171	1869.000	1870.150	8 83	26	0.28	37.5	41	-0.26	35.7	41	-0.26	35.7
172	1884.350	1887.325	8 83	44	-0.14	62.9	44	-0.13	62.9	44	-0.13	62.9
173	1889.350	1890.050	8 83	26	0.19	50.8	44	-0.18	55.7	44	-0.18	55.7
174	1894.175	1895.225	8 83	20	1.02	80.2	20	-0.93	80.2	20	-0.93	80.2
175	1897.325	1897.425	11 68	41	-1.00	999.9	41	0.97	999.9	41	0.97	999.9
176	1897.450	1897.725	11 77	11	-0.09	262.5	14	0.06	804.8	14	0.06	804.8
177	1900.050	1900.400	8 59	38	-0.90	999.9	38	0.94	999.9	38	0.94	999.9
178	1904.125	1906.100	8 83	11	-0.14	53.6	11	0.14	53.6	11	0.14	53.6
179	1906.125	1906.275	8 65	23	0.97	999.9	23	-0.98	999.9	23	-0.98	999.9
180	1906.725	1908.025	8 83	20	0.98	102.6	20	-0.96	102.6	20	-0.96	102.6
181	1909.800	1912.000	8 83	14	-0.24	49.7	14	0.24	49.7	14	0.24	49.7
182	1917.925	1918.225	17 83	38	-0.49	65.3	20	0.52	142.2	20	0.52	142.2
183	1921.800	1923.475	8 83	32	0.60	100.2	35	-0.93	95.8	35	-0.93	95.8
184	1929.050	1929.475	8 59	17	-0.43	999.9	17	0.44	999.9	17	0.44	999.9
185	1933.075	1933.250	8 83	17	0.16	854.5	41	-0.23	141.5	41	-0.23	141.5
186	1937.000	1937.100	14 65	41	0.66	999.9	41	-0.73	999.9	41	-0.73	999.9
187	1942.250	1943.325	8 83	47	-0.22	57.9	44	-0.19	74.6	44	-0.19	74.6
188	1945.125	1945.875	8 83	11	-0.15	121.7	11	0.15	121.7	11	0.15	121.7
189	1945.925	1947.100	8 83	44	-0.12	92.9	47	-0.13	60.9	47	-0.13	60.9
190	2040.750	2041.575	8 83	35	-0.22	489.6	17	0.20	369.8	17	0.20	369.8
191	2113.975	2115.125	8 77	8	0.06	270.3	8	-0.06	270.3	8	-0.06	270.3