Document Title Flux correction factors as function of TOF selection

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Table of Contents

Scope

When a TOF selection is applied to EVP datasets, a fraction of the events of the forward TOF peak will be lost. The fraction depends on the D1 and D2 energy spectra and on the particular TOF selection applied.
This document contains flux correction factors as function of total energy range and TOF selection for both TOF corrected and uncorrected data, and discusses the uncertainties.

Document references

- COM-RP-ROL-DRG-55, ‘TOF correction using the subroutine TOFCOR’, B. Boer and R. van Dijk, 10-AUG-1993
- COM-RP-ROL-DRG-53, ‘TOF as a function of D1E and D2E’, B. Boer, 25-JUN-93
- COM-RP-ROL-DRG-45, ‘TOF selections’, B. Boer, 30-MAR-1993
- COM-RP-ROL-DRG-37, ‘TOF selections’, B. Boer and R. van Dijk, 26-NOV-92

1. Introduction

In a series of previous reports (COM-RP-ROL-DRG-37, 45, 53, 55) the forward TOF peak *for uncorrected events* has been studied extensively. The position P and variance $V = \sigma^2$ of the gaussian peak was found (and already known) to be a function of the D1 and D2 energy deposits:

$$\begin{aligned} P &= P(D1E, D2E) = P_1(D1E) + P_2(D2E) \\ V &= V(D1E, D2E) = V_1(D1E) + V_2(D2E) \end{aligned} \qquad (1)$$

The unknown function $P_1(D1E)$ was determined, apart from the constant $P_2(D2E_R)$, by fitting the forward TOF peak for events within a small range around the reference D2 energy deposit $D2E_R$. The function $P_2(D2E)$ was likewise determined (apart from the constant $P_1(D1E_R)$) using events within a small range around the reference D1 energy deposit $D1E_R$. Together with the reference position $P(D1E_R, D2E_R)$ these functions completely determine P. The variance function V was found in a similar way.

The function P that has been implemented in TOFCOR was determined using data from Obs. 2.0 and 20. The subroutine has as input variables the (uncorrected) TOF value and the D1 and D2 energy deposits *EINP1* and *EINP2*, and as output variable the corrected TOF value. TOFCOR firstly calculates, using P, what the position of the forward TOF peak would be for uncorrected events with D1 and D2 energy deposits *EINP1* and *EINP2*. It then corrects the TOF in such a way that the forward TOF peak for events with these energy deposits will be centered at 120.

TOFCOR is contained in DAL library DALAAA18, and has been implemented in the EVP dataset read and write subroutines. The implementation is such that when reading an EVP dataset the TOF correction is applied only for EVP datasets of version 2 and older. The events that are written (EVP datasets version 3) have already been TOF corrected. As a result, all EVP events that are read or written after the implementation dates have corrected TOF values. The implementation dates are site dependent:

ROL	17-DEC-93	TJD 9338
MPE	04-OCT-93	TJD 9264
UNH	04-OCT-93	TJD 9264
SSD	not yet impl.	

The forward TOF peak for corrected events is centered more close to 120 than the uncorrected peak and its width has decreased slightly. Because of these differences the fraction of events lost due to TOF selections, and therefore the flux correction factors, also differ.

This document contains the flux correction factors for both the corrected (section 2.1) as the uncorrected (section 2.2) forward TOF peak. In section 3 the uncertainties concerning these correction factors are discussed.

2. Results

The data mentioned in this section were subject to the following general selections:

70 < D1E < 20000
650 < D2E < 30000
0 < PSD < 110
no VETO flags
rejection flag >= 10
0 < GCEL< 50 (earth viewing)

2.1 Flux correction factors for TOF corrected data

To obtain the flux correction factors listed in this section, data from Obs. 10, 11 and 12 were used to create *corrected* TOF spectra. The spectra were then fitted with a parabolic background and a gaussian to obtain the width of the gaussian forward peak. The discarded fractions and the corresponding flux correction factors were calculated using these widths. assuming that the forward peak is nicely centered at 120. In section 3 the validity of this assumption is checked.

On this and the next two pages you'll find three tables:

- Table 1 shows the flux correction factors for a number of often used energy intervals and several TOF selections.
- Table 2 shows the flux correction factors for many energy intervals and TOF selection [110,130]
- Table 3 shows the flux correction factors for many energy intervals and TOF selection [115,130]

Table 1: Flux correction factors to be used with data for which the TOF has been corrected with TOFCOR. The TOF selection applied is [*L*,130] where the lower edge of the TOF selection *L* is varied from 110 to 119.

E_T start	E_T end	σ of gaussian	*L*: lower edge of TOF selection [channels]									
[MeV]	[MeV]	[channels]	110	111	112	113	114	115	116	117	118	119
0.75	1.00	6.52	1.14	1.17	1.21	1.26	1.32	1.40	1.50	1.63	1.79	2.01
0.75	30.00	5.09	1.05	1.07	1.09	1.12	1.17	1.23	1.32	1.43	1.59	1.81
1.00	2.00	5.71	1.09	1.11	1.14	1.18	1.23	1.30	1.39	1.51	1.68	1.89
1.00	3.00	5.41	1.07	1.09	1.11	1.15	1.20	1.27	1.36	1.47	1.63	1.85
1.00	30.00	4.80	1.04	1.05	1.07	1.10	1.14	1.20	1.28	1.40	1.56	1.77
3.00	10.00	4.44	1.02	1.03	1.05	1.07	1.11	1.17	1.24	1.35	1.51	1.73
10.00	30.00	3.77	1.01	1.01	1.02	1.04	1.06	1.11	1.17	1.28	1.43	1.67

Table 2: Flux correction factors to be used with data for which the TOF has been corrected with TOFCOR. The TOF selection applied is [110,130]. The correction factors are for energy intervals [E_L , E_H], with E_L [MeV} listed in the leftmost column and E_R [MeV] in the uppermost row.

E_L \ E_H	0.90	1.08	1.30	1.57	1.89	2.27	2.73	3.28	3.94	4.74	5.70	6.86	8.25	9.92	11.93	14.35	17.25	20.75	24.95	30.00
0.75	1.15	1.13	1.12	1.11	1.10	1.09	1.09	1.08	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.05	1.05	1.05	1.05
0.90		1.13	1.12	1.10	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04
1.08			1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04
1.30				1.09	1.08	1.07	1.06	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.03	1.03
1.57					1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03
1.89						1.06	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03
2.27							1.05	1.05	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.02	1.02
2.73								1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02
3.28									1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
3.94										1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
4.74											1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01
5.70												1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01
6.86													1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01
8.25														1.01	1.01	1.01	1.01	1.01	1.01	1.01
9.92															1.01	1.01	1.01	1.01	1.01	1.01
11.93																1.01	1.01	1.01	1.01	1.01
14.35																	1.01	1.01	1.01	1.01
17.25																		1.01	1.01	1.00
20.75																			1.00	1.00
24.95																				1.00

Table 3: Flux correction factors to be used with data for which the TOF has been corrected with TOFCOR. The TOF selection applied is [115,130]. The correction factors are for energy intervals [E_L , E_H], with E_L [MeV] listed in the leftmost column and E_R [MeV] in the uppermost row.

E_L \ E_H	0.90	1.08	1.30	1.57	1.89	2.27	2.73	3.28	3.94	4.74	5.70	6.86	8.25	9.92	11.93	14.35	17.25	20.75	24.95	30.00
0.75	1.41	1.38	1.36	1.34	1.33	1.31	1.30	1.29	1.28	1.27	1.26	1.26	1.25	1.25	1.24	1.24	1.24	1.23	1.23	1.23
0.90		1.37	1.35	1.33	1.31	1.29	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.22	1.21	1.21	1.21	1.21	1.20	1.20
1.08			1.34	1.32	1.30	1.28	1.27	1.26	1.25	1.24	1.23	1.22	1.22	1.21	1.21	1.21	1.20	1.20	1.20	1.20
1.30				1.30	1.29	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.21	1.21	1.20	1.20	1.20	1.19	1.19	1.19
1.57					1.27	1.25	1.24	1.24	1.23	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.19	1.19	1.18	1.18
1.89						1.24	1.23	1.23	1.22	1.21	1.20	1.20	1.19	1.19	1.18	1.18	1.18	1.18	1.18	1.17
2.27							1.23	1.22	1.21	1.20	1.19	1.19	1.18	1.18	1.18	1.17	1.17	1.17	1.17	1.16
2.73								1.21	1.20	1.19	1.18	1.18	1.17	1.17	1.17	1.16	1.16	1.16	1.16	1.16
3.28									1.19	1.18	1.17	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.15
3.94										1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.14	1.14	1.14	1.14
4.74											1.16	1.16	1.15	1.15	1.14	1.14	1.14	1.14	1.13	1.13
5.70												1.15	1.15	1.14	1.14	1.13	1.13	1.13	1.13	1.12
6.86													1.14	1.13	1.13	1.13	1.12	1.12	1.12	1.12
8.25														1.12	1.12	1.12	1.12	1.12	1.11	1.11
9.92															1.12	1.12	1.12	1.11	1.11	1.11
11.93																1.11	1.11	1.11	1.10	1.10
14.35																	1.11	1.11	1.10	1.09
17.25																		1.11	1.09	1.08
20.75																			1.07	1.06
24.95																				1.05

2.2 Flux correction factors for uncorrected data

To obtain the flux correction factors listed in this section, data from Obs. 10, 11 and 12 were used to create *uncorrected* TOF spectra. The spectra were then fitted with a parabolic background and a gaussian to obtain the position and the width of the gaussian forward peak. The discarded fractions and the corresponding flux correction factors were calculated using these positions and widths. There is a difference in the flux correction factors derived here and those of section 2.1 due to differences in the positions and widths.

On the next two pages you'll find two tables:

- Table 4 shows the flux correction factors for many energy intervals and TOF selection [110,130]
- Table 5 shows the flux correction factors for many energy intervals and TOF selection [115,130]

Table 4: Flux correction factors to be used with data for which the TOF has *not* been corrected. The TOF selection applied is [110,130]. The correction factors are for energy intervals [E_L , E_H], with E_L [MeV] listed in the leftmost column and E_R [MeV] in the uppermost row.

E_L \ E_H	0.90	1.08	1.30	1.57	1.89	2.27	2.73	3.28	3.94	4.74	5.70	6.86	8.25	9.92	11.93	14.35	17.25	20.75	24.95	30.00
0.75	1.16	1.14	1.13	1.11	1.10	1.09	1.09	1.08	1.08	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
0.90		1.13	1.12	1.10	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
1.08			1.11	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
1.30				1.08	1.08	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.05	1.05
1.57					1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
1.89						1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
2.27							1.05	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.04
2.73								1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04
3.28									1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04
3.94										1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04	1.04
4.74											1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.05	1.05	1.05
5.70												1.03	1.03	1.04	1.04	1.05	1.06	1.06	1.06	1.06
6.86													1.04	1.05	1.06	1.07	1.07	1.07	1.07	1.07
8.25														1.07	1.08	1.08	1.09	1.09	1.08	1.08
9.92															1.09	1.09	1.09	1.09	1.08	1.08
11.93																1.09	1.09	1.09	1.08	1.07
14.35																	1.09	1.09	1.07	1.07
17.25																		1.08	1.06	1.05
20.75																			1.03	1.03
24.95																				1.03

Table 5: Flux correction factors to be used with data for which the TOF has *not* been corrected. The TOF selection applied is [115,130]. The correction factors are for energy intervals [E_L , E_H], with E_L [MeV] listed in the leftmost column and E_R [MeV] in the uppermost row.

E_L \ E_H	0.90	1.08	1.30	1.57	1.89	2.27	2.73	3.28	3.94	4.74	5.70	6.86	8.25	9.92	11.93	14.35	17.25	20.75	24.95	30.00
0.75	1.50	1.46	1.42	1.38	1.35	1.33	1.31	1.30	1.29	1.28	1.28	1.27	1.26	1.26	1.26	1.25	1.25	1.24	1.24	1.24
0.90		1.45	1.40	1.34	1.32	1.29	1.28	1.27	1.26	1.25	1.25	1.24	1.23	1.23	1.22	1.22	1.22	1.22	1.21	1.21
1.08			1.36	1.32	1.29	1.27	1.26	1.26	1.25	1.24	1.24	1.23	1.22	1.22	1.21	1.21	1.21	1.21	1.20	1.20
1.30				1.28	1.27	1.25	1.25	1.24	1.24	1.23	1.23	1.22	1.21	1.21	1.20	1.20	1.20	1.20	1.19	1.19
1.57					1.26	1.24	1.24	1.24	1.23	1.22	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.19	1.19	1.19
1.89						1.23	1.23	1.23	1.23	1.22	1.21	1.21	1.20	1.19	1.19	1.18	1.18	1.18	1.18	1.18
2.27							1.23	1.23	1.23	1.22	1.21	1.20	1.19	1.19	1.18	1.18	1.17	1.17	1.17	1.17
2.73								1.24	1.22	1.21	1.20	1.19	1.19	1.18	1.17	1.17	1.16	1.16	1.16	1.16
3.28									1.21	1.20	1.19	1.18	1.17	1.16	1.16	1.15	1.15	1.15	1.15	1.15
3.94										1.19	1.18	1.17	1.16	1.15	1.15	1.15	1.14	1.14	1.14	1.14
4.74											1.17	1.16	1.15	1.15	1.14	1.14	1.14	1.14	1.14	1.14
5.70												1.15	1.15	1.14	1.14	1.14	1.14	1.14	1.14	1.14
6.86													1.14	1.14	1.14	1.15	1.15	1.14	1.14	1.13
8.25														1.15	1.15	1.15	1.15	1.14	1.14	1.13
9.92															1.16	1.15	1.15	1.14	1.13	1.12
11.93																1.15	1.14	1.13	1.12	1.11
14.35																	1.13	1.12	1.10	1.09
17.25																		1.11	1.08	1.08
20.75																			1.05	1.05
24.95																				1.04

3. Discussion

This section describes the uncertainties of the flux correction factors presented in this document. The sections 3.1 and 3.2 discuss the nature of the uncertainties and section 3.3 discusses the impact on the flux correction factors.

3.1 Differences in D1/D2 energy spectra

The flux correction factors from section 2 are given as function of total energy range. The position of the forward peak, however, depends on the specific D1 and D2 energy spectra. The flux correction factors may therefore depend on the input spectrum and the distance of the source to the Z-axis.
To get an idea about the influence of the D1 and D2 energy spectra, we used SIMGAM to simulate a source twice: once at a zenith angle of 0° and once at a zenith angle of 40°. As input spectrum we used an E^{-2} power law with an input range of 0.65-5.0 MeV and the number of events generated was 50000. Fig 1 shows the D1 and D2 energy spectra, the distribution of the widths of the D1/D2 energy dependent forward TOF peaks (using the function *V* from Eq. 1) and the resulting total TOF spectrum. The latter plot was produced by summing gaussians with width and amplitude according to the lower left plot and centered at 120. Only events for which *D1E* > 70 keV and *D2E* > 650 keV were selected to produce these plots.

Although the D1 and the D2 energy spectra and therefore also the distribution of the widths of the forward TOF peak are very different for sources at different zenith angles, the resulting TOF spectra are obviously quite similar. A gaussian fit to the forward peaks in the lower right picture of Fig. 1 gives widths of 5.60 (Z=0°) and σ=5.76 (Z=40°).
The analysis presented above was repeated for a Wien input spectrum (kT=150 keV, input range 0.65-3.0 MeV, 50000 events). The forward peaks in the resulting TOF spectra are again quite similar and have widths of 6.57 (Z=0°) and 6.35 (Z=40°).

3.2 Differences between observations

The flux correction factors from section 2.1 have been derived assuming that the centre of the forward TOF peak is at 120. This will only be the case if the function *P* (Eq. 1) is constant in time and does not vary from observation to observation. The important question to ask is thus:

is the function P really time independent?

If it is time independent, the forward TOF peak should (after correction by TOFCOR) always be centered at 120, no matter which observation and which energy selections. To check this, we determined the position μ of the corrected forward TOF peak in the four standard energy ranges for two sets of observations: Obs. 3+4 and Obs. 304-308. The event selections are the same as listed on page 4. The results are listed in Table 6 .

Table 6 shows clearly that the corrected forward TOF peak is not always consistent with a gaussian centered at 120, thus

P is not constant!

To study the change of *P* we determined the position of the forward peak for TOF corrected data as a function of D1 energy deposit for a small D2 energy range (0.7-0.9 MeV) and, vice versa, as a function of D2 energy deposit for a small D1 energy range (1.5-2.0 MeV). This was done for two sets of data

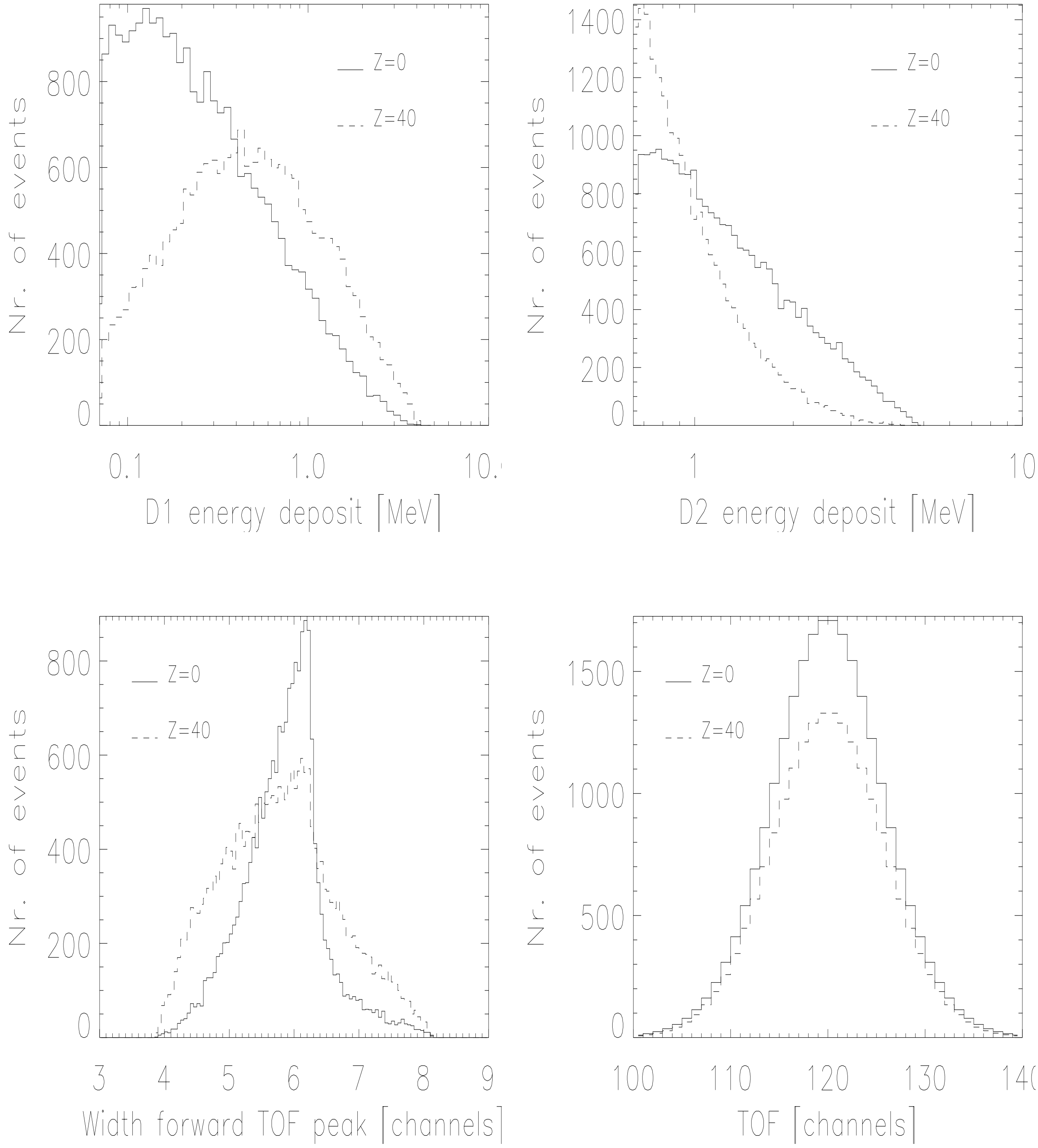

Fig. 1. Differences for sources at zenith angles of 0° (ROL-QEV-162) and 40° (ROL-QEV-163) for an E^{-2} power law input spectrum. *Upper left*: D1 energy spectra. *Upper right:* D2 energy spectra. *Lower left:* distribution of the widths of the forward TOF peaks. *Lower right:* resulting total TOF spectrum

Table 6: The position μ [channels] of the corrected forward TOF peak in the four standard energy ranges for two sets of observations (earth viewing).

Obs.	0.75-1 MeV	1-3 MeV	3-10 MeV	10-30 MeV
3+4	121.95 ± 0.06	120.62 ± 0.03	120.02 ± 0.03	120.07 ± 0.06
304-308	120.94 ± 0.07	119.55 ± 0.03	119.19 ± 0.05	119.47 ± 0.06

that had to be large in order to obtain good statistics:

set 1: Obs. 1, 2.0, 2.5, 3, 4, 5, 6, 7.0, 7.5 TJDs 8392 -> 8490
set 2: Obs. 230 -> half of 310 TJDs 9195 -> 9329

The forward TOF peak positions are plotted in Fig 2. From these plots we can conclude two things: 1) after correction of the TOF values, the peak position is still (but much less) a function of the D1 energy deposit and, less significantly, of the D2 energy deposit; 2) the functional shape of the D1 energy dependence (P_1) is similar for both sets of data, but for the D2 energy dependence (P_2) there is a difference of up to ~1.0 channels at low energies. The former effect reflects an inaccurate determination of the function P used in TOFCOR, caused by poor statistics. The latter effect denotes a time variable origin, possibly related to the gain changes of the D2 modules.

3.2.1 Difference between sky and earth viewing

The analysis leading to Table 6 was repeated for 130 < GCEL < 180 (sky viewing), the results are shown in Table 7.

Table 7: The position μ [channels] of the corrected forward TOF peak in the four standard energy ranges for two sets of observations (sky viewing).

Obs.	0.75-1 MeV	1-3 MeV	3-10 MeV	10-30 MeV
3+4	121.45 ± 0.13	119.89 ± 0.03	118.68 ± 0.07	120.40 ± 0.22
304-308	120.50 ± 0.23	118.76 ± 0.04	117.81 ± 0.06	119.73 ± 0.19

The difference in peak positions between the earth and sky viewing data varies between the energy ranges and is the worst for the 3-10 MeV range. Small differences are expected due to the effects mentioned in sections 3.1 and 3.2 (the D1 and D2 energy spectra differ between earth and sky viewing).

The difference observed for the 3-10 MeV range is not so easy to understand, however. A fit to the *uncorrected* forward TOF peak for the sky viewing data of Obs. 304-308 gives a position of 117.14. Why then is the *corrected* forward TOF peak centered at 117.81 (Table 7), instead of being centered nicely at 120? The answer can be found by considering the D1 energy deposits of the events in the forward peak. In Fig. 3 the TOF spectra for two *D1E* selections have been plotted. The figure shows that the forward TOF peak for the 3-10 MeV range consists mainly of events with a D1 energy deposit larger than 1 MeV. For such events the TOF correction is relatively small, as can be seen in Figs. 1 and 2 of COM-RP-ROL-DRG-55. It is therefore not surprising that the forward TOF peak for such events does not shift much when the TOF values are corrected. This is also true for the earth viewing data, for which the peak positions for uncorrected and corrected data are 119.44 and 119.19 respectively. There remains one question to be answered, however: why is the forward TOF peak for the uncorrected sky

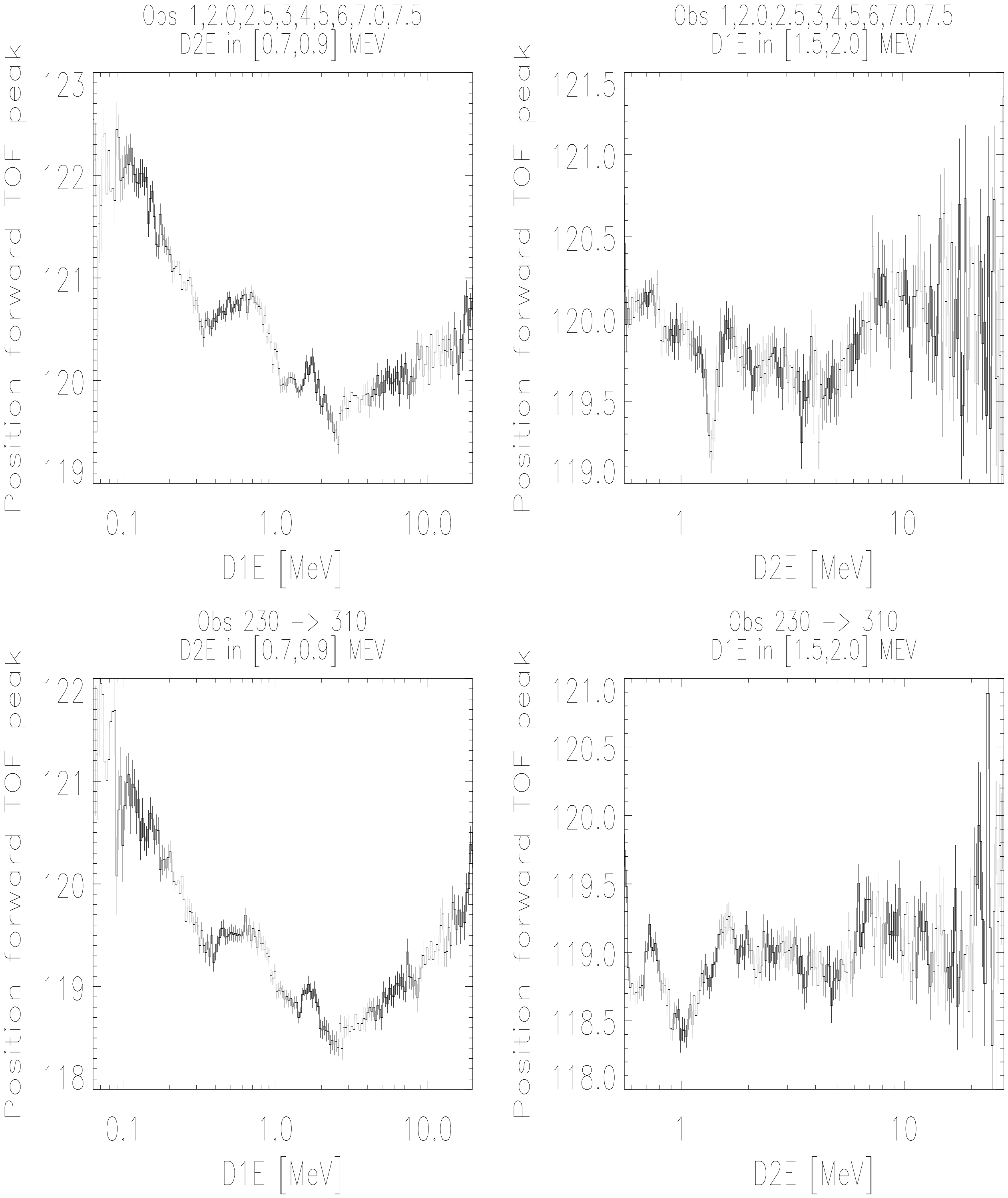

Fig. 2. Position of corrected forward TOF peak as function of D1 and D2 energy deposits for two sets of observations.

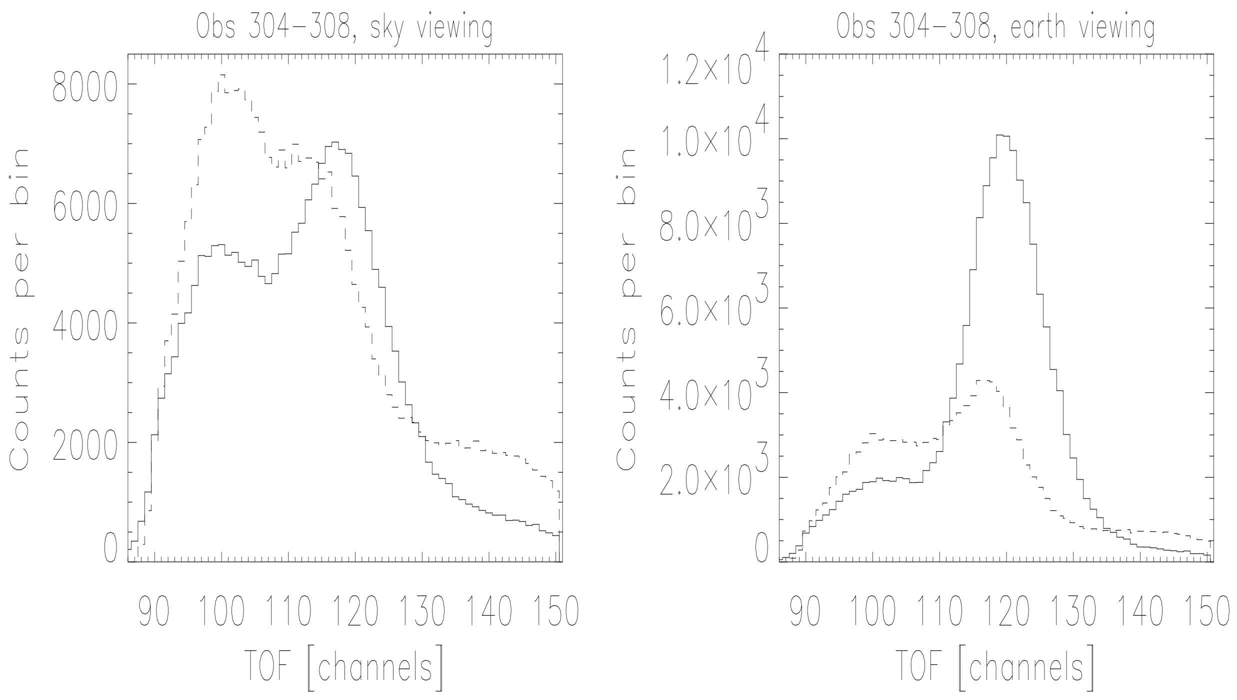

Fig. 3. Uncorrected TOF spectra for the 3-10 MeV range of Obs. 304-308. The left picture shows spectra for the sky viewing data (130 < GCEL < 180), the right picture for earth viewing data (0 < GCEL < 50). *Solid line*: *D1E* > 1 MeV. *Dashed line*: *D1E* < 1 MeV.

viewing data centered at such a low TOF value? A possible cause might be that a large fraction of the forward TOF peak for sky viewing consists of a collection of lines that are somewhat shifted in TOF. For earth viewing this fraction would be negligible due to the large amount of normal photons.

3.3 Summary

The effect of the uncertainties mentioned in sections 3.1 and 3.2 is to displace and broaden the corrected forward TOF peak compared to the assumed position (120) and width (Table 1). Here we try to estimate the resulting uncertainty in the flux correction factors.
The uncertainty in the width is ~0.5 channels (section 3.1) and the uncertainty in the position is ~1.5 channels (section 3.2). The flux correction factors for the standard [115,130] TOF selection will be affected most for broad peaks. A 0.75-1 MeV TOF peak, which is assumed to be centered at 120 with a width of 6.52 channels (Table 1), might in the worst cases be centered at 118.5 with a width of 7 channels, or at 121.5 with a width of 6 channels. The corresponding flux correction factors for the [115,130] TOF selection in this energy range, 1.56 and 1.28 respectively, deviate 11.4 % and 8.6% from the value of 1.4 listed in Table 1. A rough estimate of the largest uncertainty to expect for the standard TOF selection [115,130] is thus ~12%.

4. Conclusions

The corrected forward TOF peak might in some cases be broadened and displaced from 120 due to two effects:

- small inaccuracies in the function *P* used in TOFCOR
- time variability, possibly related to the gain changes of the D2 modules

The result of the broadening and displacement of the forward TOF peak is an uncertainty of at most ~12% in the flux correction factors for a [115,130] TOF selection.