Preprocessing of ESTEC photon counts simulations, Run No 9

by L Lindegren

The 9th run of IDT photon counts simulations by ESTEC (letter by S Vaghi, 1985 Nov 29) has been reduced with the IDT Preprocessing software at Lund Observatory (see NDAC/LO/061 for a description). Two reductions were made: the first one using the binning algorithm with 45 bins, the second one without binning. The results of the first reduction should be virtually identical to those obtained at RGO, while the second reduction should be similar to the one at CSS. The assumed scan velocity is 168.75 as/s.

The contents and format of the output are the same as described in NDAC/LO/061, except that a new statistic, t0, has been added in the fifth line (before t1). t0 indicates the presence of any modulation in the signal. It is the chi-square calculated on the hypothesis that the signal is not modulated (a homogeneous Poisson process), but transformed to a quasi-normal variable similarly to t1 [equation (6) in NDAC/LO/061]. Thus, if there is no modulation, t0 is expected to be unit normal. Conversely, if t0 > 3, some kind of modulation is clearly indicated. It should be noted that this test (of any kind of modulation) is much less sensitive than a test for a particular kind of modulation, such as a sinusoidal modulation with given period. Therefore, t0 may be less than 3 even though the sinusoidal modulation is quite significant.

The tables below give some statistics of the two reductions and of the difference between them. Some tendencies seen already in previous runs are confirmed: The binned solution degrades the result a little bit for the bright stars, but not at all for the faint stars; the Cramér-Rao limit is practically reached for the bright stars but not quite for the faint, especially in the second harmonic (Table 2b). It can also be remarked that on the basis of a t0 < 3 criterion, practically all the observations of the faint stars would be considered to have no modulation. Clearly, this is not a very useful rejection criterion.
Table 1a. Extreme and rms values of the actual phase errors ($\Delta p_1$, $\Delta p_2$) in the two reductions, and of the differences between the solutions. Bright stars only (2375 observations). Unit: mas.

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<th>Binned - Not Binned</th>
</tr>
</thead>
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<td>$\Delta p_2$</td>
<td>$\Delta p_1$</td>
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<tr>
<td>Minimum</td>
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<td>-174.6</td>
<td>-32.4</td>
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<td>235.8</td>
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Correlation between binned and not binned solutions: 0.9904 0.9700

Table 1b. Same as Table 1a but for the faint stars (894 observations)

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<td>$\Delta p_2$</td>
<td>$\Delta p_1$</td>
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Correlation between binned and not binned solutions: 0.9989 0.9781

Table 2a. Mean and rms values of $t_0$, $t_1$, and normalised phase errors, bright stars, binned solution

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Table 2b. Same as Table 2a but for faint stars

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<tr>
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file 2 = utnon

Number of observations = 874
(faint stars)

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STATISTICS OF DIFFERENCE, FILE 1 — FILE 2

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Correlation coefficients:

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file 2 = utnon

Number of observations = 2375
(bright stars)

STATISTICS; FILE = 1

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STATISTICS; FILE = 2

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### Statistics of difference: File 1 - File 2

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