1. Introduction

This memo continues the investigation of switching effects in the O.C.E.M. power supply which first was described in a memo of March 29, 2006 (at http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/ILC/OCEM-PS/2006-03/ocem-ps.pdf or .odt or .doc or .html) and another memo (dated May 31, 2006, but with data of April 26) http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/ILC/OCEM-PS/2006-04/ocem-ps2.pdf or .odt or .doc).

In the latter memo it was shown that voltage, current and field of the attached dipole magnet return to a value undistinguishable from their pre-switching value within after switching occurs within about 200 milliseconds.

However, when we demonstrated this on April 27, 2006, the oscilloscope traces showed to our surprise, that the magnetic field does return only to an obviously lower value than that before switching. After much gnashing of teeth, this was shown due to an effect of the power supply on the Hall probe: When the cart with the Hall probe power supply and amplifier was close to the power supply, apparently the Hall probe's unshielded leads or connectors picked some EMF depressing its (small ~ 2mV) signal; this effect disappeared when the cart was moved to the side, of the rack with the power supply, as shown in Figure 1 below.

Nevertheless, we decided to repeat these measurements with a additional probe, namely a F.W. Bell/Sypris 7010 Gauss/Teslameter.[1], and this note shows data taken by both the Hall probe previously used, and the additional one.

2. Results

As in the previous note, data were recorded with a Tektronics TDS 3014B 'eScope'. The Hall Voltage from the previously used probe (Channel 2), a voltage from the additional Gauss/Teslameter (Ch.3), both proportional to the magnetic field, the current (Ch. 1), and the voltage (Ch.4) were measured, in a 1000 ms time window, with ~100 ms before, and ~900 ms after the trigger for the switching. The oscilloscope records 10,000 data points in this 1000ms time window.

As before, the data were averaged in 100ms segments; the average over the first segment preceding the switching trigger provides a nominal value for the measured quantity. Dividing these averages by the nominal value, multiplying by 100 and subtracting 100, one obtains then a percent deviation from the nominal value, which is shown in the tables below.

For an error estimate on this percent deviation, I take the standard deviation for each segment average, and scale it by 100/(nominal value).

Appendix A shows tables for these averages and percent average deviations from the nominal values.

All data were taken using the 25Hz version of the board.
Data were taken with switching the power supply at currents of 150 A, 75 A, and 25A; we also recorded 1000 ms at 150 A in which no switching occurred. All four data sets are shown as figures and tables in Appendix A.

The previously-used Hall probe and the new Gauss/Teslameter were not aligned perpendicular to the magnetic field of the dipole; hence the absolute values of the fields shown in 'Data as measured' in the table are offset by a scale factor.

From looking at the tables and figures in the appendix, we notice the following:

- Within 300ms after switching, the magnetic field, measured by either probe, has returned to a value undistinguishable from the pre-trigger value.
- Considering the percentage-deviation values, both magnetic field probes follow each other closely, indicating consistency, even if the absolute values might differ, due to relative position and rotation.
- We note the following anomaly: For the 150A and 75A data, the voltage after switching, returns to a value \(\sim(3.3 \pm 1.6)\%\) and \(\sim(6\pm4)\%\) above the pre-trigger voltage, the currents correspondingly to \(\sim(0.17\pm 0.08)\%\) and \(\sim(0.4\pm 0.13)\%\) above the pre-trigger value. While bigger than previously observed, this current increase is within the (averaging) error previously observed (Data Files 7-10 of ‘Switching Effects .. II’ of May 31, 2006 had 0.2% and 0.4% current averaging error).
The corresponding increase in B, if linear, ~5Gauss in both cases, is of the order of the measurement error.

Thus we conclude that this study confirms that of the memo ('Switching Effects .. II') of May 31, 2006, namely that the field, current and voltage return to the pre-switching values, without need for re-standardization of the magnet.

References

Appendix A:
For each of the 4 data sets,
- the figure on the left shows the original data,
- the figure on the right the percentage deviation from the nominal value.
- Top row: magnetic field (blue trace: Hall probe, green or upper trace: Sypris 7010 Gauss/Teslameter);
- middle row: current;
- bottom row: voltage.

The columns in the tables 'Data as measured' are:
- Time Interval [ms]: The time interval of ~100ms over which the data were averaged,
- Ch1 [A]: The current,
- Ch2 [kG]: The magnetic field, in kiloGauss, as measured by the Hall probe,
- Ch3 [kG]: The magnetic field, in kiloGauss, as measured by the Gauss/Teslameter.
- Ch4 [V]: The Voltage output by the power supply.

The 'Percent difference from 100' shows the differences to 100% of the corresponding quantities rescaled to 100% = average to pre-trigger (-100 to -0.2 ms) average.
Data File 1: 150 A

Graphs showing changes in B/A, current (A), and voltage (V) over time for 150 A-25 Hz Data and 150 A-25 Hz Scaled and Averaged.
Data File 1: 150A continued:

Results for C:\achim\MM\OCEM-PS\2006-04-28-Data\150A.CSV.
9 segments.

--- Data as measured: -----------------------------------------------

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1 [A]</th>
<th>ch2 [kG]</th>
<th>ch3 [kG]</th>
<th>ch4 [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 - -0.20</td>
<td>149.304 +/- 1.007</td>
<td>3.006 +/- 0.010</td>
<td>3.017 +/- 0.009</td>
<td>15.502 +/- 2.102</td>
</tr>
<tr>
<td>0.10 - 99.90</td>
<td>146.121 +/- 1.964</td>
<td>2.943 +/- 0.028</td>
<td>2.952 +/- 0.027</td>
<td>15.998 +/- 1.130</td>
</tr>
<tr>
<td>100.00 - 199.80</td>
<td>149.281 +/- 0.234</td>
<td>3.006 +/- 0.008</td>
<td>3.006 +/- 0.006</td>
<td>16.123 +/- 0.259</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>149.526 +/- 0.109</td>
<td>3.006 +/- 0.005</td>
<td>3.013 +/- 0.002</td>
<td>16.109 +/- 0.253</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>149.564 +/- 0.115</td>
<td>3.008 +/- 0.005</td>
<td>3.015 +/- 0.002</td>
<td>16.081 +/- 0.251</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>149.571 +/- 0.117</td>
<td>3.008 +/- 0.005</td>
<td>3.016 +/- 0.002</td>
<td>16.062 +/- 0.260</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>149.565 +/- 0.100</td>
<td>3.009 +/- 0.005</td>
<td>3.016 +/- 0.002</td>
<td>16.026 +/- 0.246</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>149.551 +/- 0.118</td>
<td>3.010 +/- 0.005</td>
<td>3.017 +/- 0.002</td>
<td>16.001 +/- 0.269</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>149.549 +/- 0.120</td>
<td>3.010 +/- 0.005</td>
<td>3.017 +/- 0.002</td>
<td>16.010 +/- 0.249</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>149.522 +/- 0.110</td>
<td>3.011 +/- 0.005</td>
<td>3.017 +/- 0.002</td>
<td>16.035 +/- 0.256</td>
</tr>
</tbody>
</table>

--- Percent difference from 100:

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1</th>
<th>ch2</th>
<th>ch3</th>
<th>ch4</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 - -0.20</td>
<td>0.000 +/- 0.675</td>
<td>0.000 +/- 0.329</td>
<td>0.000 +/- 0.291</td>
<td>0.000 +/- 13.560</td>
</tr>
<tr>
<td>0.10 - 99.90</td>
<td>-2.132 +/- 1.315</td>
<td>-2.113 +/- 0.925</td>
<td>-2.132 +/- 0.879</td>
<td>3.199 +/-  7.291</td>
</tr>
<tr>
<td>100.00 - 199.80</td>
<td>-0.015 +/- 0.157</td>
<td>-0.286 +/- 0.259</td>
<td>-0.363 +/- 0.194</td>
<td>4.005 +/-  1.671</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>0.149 +/- 0.073</td>
<td>-0.012 +/- 0.167</td>
<td>-0.112 +/- 0.064</td>
<td>3.918 +/-  1.631</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>0.174 +/- 0.077</td>
<td>0.044 +/- 0.174</td>
<td>-0.063 +/- 0.058</td>
<td>3.735 +/-  1.618</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>0.179 +/- 0.078</td>
<td>0.059 +/- 0.174</td>
<td>-0.037 +/- 0.063</td>
<td>3.612 +/-  1.674</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>0.175 +/- 0.067</td>
<td>0.080 +/- 0.163</td>
<td>-0.015 +/- 0.062</td>
<td>3.382 +/-  1.588</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>0.165 +/- 0.079</td>
<td>0.105 +/- 0.166</td>
<td>-0.003 +/- 0.064</td>
<td>3.220 +/-  1.734</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>0.164 +/- 0.080</td>
<td>0.125 +/- 0.169</td>
<td>-0.002 +/- 0.063</td>
<td>3.280 +/-  1.603</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>0.146 +/- 0.073</td>
<td>0.138 +/- 0.156</td>
<td>-0.003 +/- 0.061</td>
<td>3.437 +/-  1.652</td>
</tr>
</tbody>
</table>

--- Done with file no. 1 ------------------------------------------
Data File 2: 75 A

75A-25Hz- Data

75A-25Hz- Scaled and Averaged

B, Kg

1.5

1.5

1.45

1.4

1.35

1.3

1.25

1.2

1.15

1.1

1.05

1.0

0.95

0.9

0.85

0.8

0.75

0.7

0.65

0.6

0.55

0.5

0.45

0.4

0.35

0.3

0.25

0.2

0.15

0.1

0.05

0.0

-100

0

100

200

300

400

500

600

700

800

900

Timelns

-100

0

100

200

300

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700

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900

Timelns

-100

0

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200

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400

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Timelns

-100

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800

900

Timelns

-100

0

100

200

300

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500

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700

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900

Timelns

-100

0

100

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700

800

900

Timelns
Data File 2: 75A continued:
Results for C:\achim\MM\OCEM-PS\2006-04-28-Data\75A.CSV .
9 segments.

<table>
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<tr>
<th>Time interval [ms]</th>
<th>ch1 [A]</th>
<th>ch2 [kG]</th>
<th>ch3 [kG]</th>
<th>ch4 [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 -  -0.20</td>
<td>74.510 +/- 0.862</td>
<td>1.458 +/- 0.012</td>
<td>1.517 +/- 0.010</td>
<td>7.439 +/- 1.170</td>
</tr>
<tr>
<td>0.10 -  99.90</td>
<td>73.292 +/- 0.930</td>
<td>1.428 +/- 0.015</td>
<td>1.487 +/- 0.014</td>
<td>8.020 +/- 0.419</td>
</tr>
<tr>
<td>100.00 - 199.80</td>
<td>74.717 +/- 0.129</td>
<td>1.455 +/- 0.006</td>
<td>1.513 +/- 0.003</td>
<td>7.986 +/- 0.301</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>74.804 +/- 0.088</td>
<td>1.459 +/- 0.005</td>
<td>1.517 +/- 0.002</td>
<td>7.905 +/- 0.294</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>74.806 +/- 0.091</td>
<td>1.459 +/- 0.005</td>
<td>1.518 +/- 0.001</td>
<td>7.883 +/- 0.299</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>74.813 +/- 0.098</td>
<td>1.460 +/- 0.005</td>
<td>1.518 +/- 0.002</td>
<td>7.898 +/- 0.291</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>74.803 +/- 0.084</td>
<td>1.461 +/- 0.005</td>
<td>1.518 +/- 0.002</td>
<td>7.891 +/- 0.297</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>74.812 +/- 0.089</td>
<td>1.461 +/- 0.005</td>
<td>1.518 +/- 0.002</td>
<td>7.896 +/- 0.300</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>74.809 +/- 0.098</td>
<td>1.460 +/- 0.005</td>
<td>1.518 +/- 0.002</td>
<td>7.895 +/- 0.288</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>74.802 +/- 0.087</td>
<td>1.460 +/- 0.005</td>
<td>1.518 +/- 0.002</td>
<td>7.890 +/- 0.301</td>
</tr>
</tbody>
</table>

Percent difference from 100:

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1</th>
<th>ch2</th>
<th>ch3</th>
<th>ch4</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 -  -0.20</td>
<td>0.000 +/- 1.157</td>
<td>0.000 +/- 0.790</td>
<td>0.000 +/- 0.664</td>
<td>0.000 +/- 15.734</td>
</tr>
<tr>
<td>0.10 -  99.90</td>
<td>-1.636 +/- 1.249</td>
<td>-2.070 +/- 1.026</td>
<td>-1.985 +/- 0.901</td>
<td>7.802 +/- 5.639</td>
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<tr>
<td>100.00 - 199.80</td>
<td>0.277 +/- 0.173</td>
<td>-0.248 +/- 0.380</td>
<td>-0.251 +/- 0.191</td>
<td>7.355 +/- 4.052</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>0.394 +/- 0.118</td>
<td>0.015 +/- 0.323</td>
<td>0.021 +/- 0.101</td>
<td>6.260 +/- 3.957</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>0.397 +/- 0.123</td>
<td>0.042 +/- 0.332</td>
<td>0.079 +/- 0.097</td>
<td>5.969 +/- 4.019</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>0.407 +/- 0.131</td>
<td>0.090 +/- 0.327</td>
<td>0.082 +/- 0.103</td>
<td>6.163 +/- 3.914</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>0.393 +/- 0.113</td>
<td>0.175 +/- 0.316</td>
<td>0.086 +/- 0.106</td>
<td>6.402 +/- 3.986</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>0.404 +/- 0.119</td>
<td>0.159 +/- 0.319</td>
<td>0.089 +/- 0.104</td>
<td>6.136 +/- 4.034</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>0.400 +/- 0.132</td>
<td>0.107 +/- 0.331</td>
<td>0.098 +/- 0.100</td>
<td>6.128 +/- 3.868</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>0.391 +/- 0.117</td>
<td>0.131 +/- 0.311</td>
<td>0.095 +/- 0.103</td>
<td>6.190 +/- 4.047</td>
</tr>
</tbody>
</table>

Done with file no. 2
Data File 3: 25 A

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25A-25Hz Data

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25A-25Hz: Scaled and Averaged

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Timels

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Timels
Data File 3: 25A continued:
Results for C:\achim\MM\OCEM-PS\2006-04-28-Data\25A.CSV.

9 segments.

---- Data as measured: __________________________________________________

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1 [A]</th>
<th>ch2 [kG]</th>
<th>ch3 [kG]</th>
<th>ch4 [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 - -0.20</td>
<td>24.960 +/- 0.106</td>
<td>0.407 +/- 0.004</td>
<td>0.511 +/- 0.002</td>
<td>2.679 +/- 0.224</td>
</tr>
<tr>
<td>0.10 - 99.90</td>
<td>24.370 +/- 0.313</td>
<td>0.396 +/- 0.005</td>
<td>0.501 +/- 0.004</td>
<td>2.584 +/- 0.360</td>
</tr>
<tr>
<td>100.00 - 199.80</td>
<td>24.903 +/- 0.104</td>
<td>0.404 +/- 0.004</td>
<td>0.508 +/- 0.002</td>
<td>2.704 +/- 0.117</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>24.966 +/- 0.104</td>
<td>0.405 +/- 0.004</td>
<td>0.510 +/- 0.002</td>
<td>2.673 +/- 0.111</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>24.973 +/- 0.109</td>
<td>0.406 +/- 0.004</td>
<td>0.510 +/- 0.002</td>
<td>2.674 +/- 0.126</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>24.969 +/- 0.103</td>
<td>0.406 +/- 0.004</td>
<td>0.510 +/- 0.002</td>
<td>2.717 +/- 0.116</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>24.966 +/- 0.104</td>
<td>0.406 +/- 0.004</td>
<td>0.510 +/- 0.002</td>
<td>2.701 +/- 0.114</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>24.959 +/- 0.101</td>
<td>0.406 +/- 0.004</td>
<td>0.511 +/- 0.002</td>
<td>2.684 +/- 0.118</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>24.947 +/- 0.104</td>
<td>0.406 +/- 0.004</td>
<td>0.511 +/- 0.001</td>
<td>2.677 +/- 0.116</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>24.952 +/- 0.106</td>
<td>0.406 +/- 0.004</td>
<td>0.510 +/- 0.002</td>
<td>2.692 +/- 0.117</td>
</tr>
</tbody>
</table>

Percent difference from 100:

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1</th>
<th>ch2</th>
<th>ch3</th>
<th>ch4</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00 - -0.20</td>
<td>0.000 +/- 0.426</td>
<td>0.000 +/- 0.881</td>
<td>0.000 +/- 0.299</td>
<td>0.000 +/- 8.375</td>
</tr>
<tr>
<td>0.10 - 99.90</td>
<td>-2.362 +/- 1.253</td>
<td>-2.660 +/- 1.266</td>
<td>-1.958 +/- 0.810</td>
<td>-3.535 +/- 13.453</td>
</tr>
<tr>
<td>100.00 - 199.80</td>
<td>-0.225 +/- 0.415</td>
<td>-0.757 +/- 0.867</td>
<td>-0.550 +/- 0.329</td>
<td>0.953 +/- 4.379</td>
</tr>
<tr>
<td>199.90 - 299.70</td>
<td>0.025 +/- 0.416</td>
<td>0.367 +/- 0.885</td>
<td>-0.232 +/- 0.294</td>
<td>-0.206 +/- 4.142</td>
</tr>
<tr>
<td>299.80 - 399.60</td>
<td>0.054 +/- 0.438</td>
<td>-0.294 +/- 0.894</td>
<td>-0.200 +/- 0.299</td>
<td>-0.176 +/- 4.705</td>
</tr>
<tr>
<td>399.70 - 499.50</td>
<td>0.038 +/- 0.412</td>
<td>-0.209 +/- 0.907</td>
<td>-0.157 +/- 0.305</td>
<td>1.439 +/- 4.348</td>
</tr>
<tr>
<td>499.60 - 599.40</td>
<td>0.025 +/- 0.417</td>
<td>-0.251 +/- 0.919</td>
<td>-0.150 +/- 0.297</td>
<td>0.833 +/- 4.266</td>
</tr>
<tr>
<td>599.50 - 699.30</td>
<td>-0.002 +/- 0.405</td>
<td>-0.193 +/- 0.876</td>
<td>-0.112 +/- 0.300</td>
<td>0.209 +/- 4.411</td>
</tr>
<tr>
<td>699.40 - 799.20</td>
<td>-0.052 +/- 0.416</td>
<td>-0.169 +/- 0.870</td>
<td>-0.101 +/- 0.290</td>
<td>-0.052 +/- 4.316</td>
</tr>
<tr>
<td>799.30 - 899.10</td>
<td>-0.030 +/- 0.424</td>
<td>-0.131 +/- 0.916</td>
<td>-0.159 +/- 0.303</td>
<td>0.505 +/- 4.379</td>
</tr>
</tbody>
</table>

--- Done with file no. 3 ---
Data File 4: 150A No switching -Flat Line
Data File 4: 150A - No Switching - Flat Line continued:
Results for C:\achim\MM\OCEM-PS\2006-04-28-Data\FlatLine.CSV.

--- Data as measured : -------------------------------------------------------------

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1 [A]</th>
<th>ch2 [kG]</th>
<th>ch3 [kG]</th>
<th>ch4 [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-500.00 - -0.20</td>
<td>149.553 +/- 0.112</td>
<td>3.018 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.945 +/- 0.263</td>
</tr>
<tr>
<td>0.10 - 55.40</td>
<td>149.540 +/- 0.100</td>
<td>3.019 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.956 +/- 0.262</td>
</tr>
<tr>
<td>55.50 - 110.80</td>
<td>149.549 +/- 0.111</td>
<td>3.019 +/- 0.005</td>
<td>3.027 +/- 0.002</td>
<td>15.975 +/- 0.261</td>
</tr>
<tr>
<td>110.90 - 166.20</td>
<td>149.558 +/- 0.128</td>
<td>3.018 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.960 +/- 0.273</td>
</tr>
<tr>
<td>166.30 - 221.60</td>
<td>149.539 +/- 0.107</td>
<td>3.018 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.943 +/- 0.258</td>
</tr>
<tr>
<td>221.70 - 277.00</td>
<td>149.557 +/- 0.122</td>
<td>3.019 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.885 +/- 0.269</td>
</tr>
<tr>
<td>277.10 - 332.40</td>
<td>149.560 +/- 0.120</td>
<td>3.019 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.964 +/- 0.251</td>
</tr>
<tr>
<td>332.50 - 387.80</td>
<td>149.561 +/- 0.123</td>
<td>3.019 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.943 +/- 0.256</td>
</tr>
<tr>
<td>387.90 - 443.20</td>
<td>149.558 +/- 0.110</td>
<td>3.018 +/- 0.005</td>
<td>3.026 +/- 0.002</td>
<td>15.927 +/- 0.265</td>
</tr>
<tr>
<td>443.30 - 498.60</td>
<td>149.566 +/- 0.112</td>
<td>3.019 +/- 0.005</td>
<td>3.025 +/- 0.002</td>
<td>15.963 +/- 0.262</td>
</tr>
</tbody>
</table>

--- Percent difference from 100:

--- ((chxave(i)/chxave(first seg)*100 - 100) with scaled errors): ---------------

<table>
<thead>
<tr>
<th>Time interval [ms]</th>
<th>ch1</th>
<th>ch2</th>
<th>ch3</th>
<th>ch4</th>
</tr>
</thead>
<tbody>
<tr>
<td>-500.00 - -0.20</td>
<td>0.000 +/- 0.075</td>
<td>0.000 +/- 0.160</td>
<td>0.000 +/- 0.068</td>
<td>0.000 +/- 1.651</td>
</tr>
<tr>
<td>0.10 - 55.40</td>
<td>-0.009 +/- 0.067</td>
<td>0.005 +/- 0.150</td>
<td>0.013 +/- 0.063</td>
<td>0.066 +/- 1.640</td>
</tr>
<tr>
<td>55.50 - 110.80</td>
<td>-0.003 +/- 0.074</td>
<td>0.014 +/- 0.152</td>
<td>0.022 +/- 0.065</td>
<td>0.184 +/- 1.638</td>
</tr>
<tr>
<td>110.90 - 166.20</td>
<td>0.003 +/- 0.085</td>
<td>-0.008 +/- 0.161</td>
<td>0.005 +/- 0.066</td>
<td>0.008 +/- 1.715</td>
</tr>
<tr>
<td>166.30 - 221.60</td>
<td>-0.009 +/- 0.071</td>
<td>-0.018 +/- 0.159</td>
<td>-0.012 +/- 0.066</td>
<td>-0.013 +/- 1.620</td>
</tr>
<tr>
<td>221.70 - 277.00</td>
<td>0.003 +/- 0.082</td>
<td>0.006 +/- 0.164</td>
<td>-0.001 +/- 0.069</td>
<td>-0.380 +/- 1.686</td>
</tr>
<tr>
<td>277.10 - 332.40</td>
<td>0.004 +/- 0.080</td>
<td>0.005 +/- 0.160</td>
<td>0.010 +/- 0.064</td>
<td>0.116 +/- 1.577</td>
</tr>
<tr>
<td>332.50 - 387.80</td>
<td>0.006 +/- 0.083</td>
<td>0.012 +/- 0.159</td>
<td>-0.012 +/- 0.065</td>
<td>-0.017 +/- 1.608</td>
</tr>
<tr>
<td>387.90 - 443.20</td>
<td>0.003 +/- 0.073</td>
<td>-0.005 +/- 0.155</td>
<td>-0.009 +/- 0.071</td>
<td>-0.115 +/- 1.664</td>
</tr>
<tr>
<td>443.30 - 498.60</td>
<td>0.008 +/- 0.075</td>
<td>0.008 +/- 0.157</td>
<td>-0.015 +/- 0.065</td>
<td>0.112 +/- 1.640</td>
</tr>
</tbody>
</table>

--- Done with file no. 4 ----------------------------------------------------------