SLR Portable Calibration Standard Mission Review

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Czech Technical University, Prague, Czech Republic
SLR Portable Calibration Standard Mission Review

Goals

• ground ranging machine diagnostics
• identification of error sources due to:
  - epoch and time interval timing
  - epoch and frequency reference
  - data acquisition, filtering and processing
  - calibration scheme and ground survey
  - operational procedures
  - radio frequency interference
  - other sources (?)
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Pico Event Timer
Portable Calibration Standard

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P-PET Main Parameters

- timing resolution: 1.2 ps
- timing jitter / channel: 2.5 ps
- non-linearity: < 2.5 ps
- drift, stability: < 0.7 ps/K, 0.5 ps/hour
- adjustment: NO
- input signals: Start, Stop, 1 pps, 10 MHz
- max. repetition rate: > 100 readings/sec
  > 2 MHz laser rate
- interface: RS232 (3 wires)
- mass (transport config.): 32 kg
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Portable Calibration Standard Missions

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graz</td>
<td>97/98/99</td>
<td>high precision SLR, stability comparison to counter cluster</td>
</tr>
<tr>
<td>WLRS Wettzell</td>
<td>97/99</td>
<td>t/r biases, low jitter, stability</td>
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<tr>
<td>TIGO Wettzell</td>
<td>1998</td>
<td>TW, t/r biases, low jitter, stability</td>
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<tr>
<td>Zimmerwald</td>
<td>1998</td>
<td>TW, t/r biases, low jitter, stability</td>
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<td>Herstmonceux</td>
<td>1998</td>
<td>counters linearity</td>
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<tr>
<td>Shanghai</td>
<td>2001</td>
<td>t/r biases, low jitter, survey, operation procedures</td>
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<td></td>
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<td>HP5370B counter linearity</td>
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<tr>
<td>Potsdam</td>
<td>2001</td>
<td>low jitter, SR620 counters linearity</td>
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</tbody>
</table>

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P-PET Mission, TIGO, 1998, TW SLR

4 x SR620

Infrared, 75 ps
1 phot

Blue, 45 ps
1 phot

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PET Mission, Graz, 1999
Comparison to Graz Counter Cluster

3 x SR620
2 x HP5370

PET4TIGO
Two wavelength ranging

Original station setup 150 psec

After system re-cabling and detectors tuning
  SLR system 120 psec
  P-PET timing
    76 psec @ red
    58 psec @ blue

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P-PET Mission, Herstmonceux, 1998
Counters linearity tests

Counters

=> Eurolas Workshop, Herstmonceux, March 2002

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P-PET Mission, Shanghai, August 2001

Personal Luggage Transportation

Shanghai Observatory SLR

Lufthansa Check-in

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Shanghai SLR, P-PET timing
Lageos, Aug. 19, 2001  7.0 mm rms

Range residuals 101 8 19 7603901. at 12:20 UT

Data file RANG036.DAT  totaly  1876 points

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mean</th>
<th>Sigma</th>
<th>PT #</th>
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<td>0.027430</td>
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<td>3 * SIGMA</td>
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## P-PET Results Summary, Shanghai 2001

<table>
<thead>
<tr>
<th>Satellite</th>
<th>P-PET rms (mm)</th>
<th>SLR rms (mm)</th>
<th>Time bias (us)</th>
<th>Rng. bias (ns)</th>
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<tr>
<td>Starlette</td>
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Conclusion

• Portable Calibration Standard based on a Pico Event Timer is a powerful tool to identify error sources in the SLR “ranging machine”

• the entire system is compact, easy to transport, fast to install and user friendly

• the calibration mission can be accomplished within one week time slot,