THE CONSIDERATION OF RF REFERENCE PHASE STABILIZATION FOR THE SUPERKEKB INJECTOR LINAC

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Introduction

- RF reference signal: 2856 MHz
- Delivered by coaxial cables and optical links (Furukawa optical fiber, 5 ps/km°C +E/O+O/E) without feedback
- The RF and optical devices are inside the temperature controlled chamber (no humidity control), but the long optical fiber is distributed in the gallery from sector 2 to 5.

Requirement for the SuperKEKB LINAC end (Phase III)

- Beam Energy: GeV
- Bunch charge: nC
- Energy spread (rms): %
- Bunch length (rms): mm
- Pulse repetition: pps
- RF width: μs
- RF reference phase (rms): deg.

2856 MHz Reference Phase Monitor System based on µTCA

- Temperature: 0.1°C pk-pk (no humidity control)
- ADC1: the long optical link (two pairs of E/O→400m optical fiber +E/O)
- ADC2: Reference signal directly from the MO
- ADC3: Reference signal directly from the MO (different down-converter with ADC2)
- ADC4: the short optical link (one pair of E/O→1m optical fiber +E/O)

Short-term phase stability without Filter

- There is no spurious spectrum from the FFT result.

Long-term phase drift for 72 hours

- The ADC noise is rejected by averaging.

<table>
<thead>
<tr>
<th>Term</th>
<th>Type</th>
<th>ADC Diff. [°]</th>
<th>MO [°]</th>
<th>SOFT [°]</th>
<th>LOFT [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term (3.5s)</td>
<td>RMS</td>
<td>0.018</td>
<td>0.023</td>
<td>0.026</td>
<td>0.603</td>
</tr>
<tr>
<td>Long-term (72h)</td>
<td>PK-PK</td>
<td>0.0386</td>
<td>0.3414</td>
<td>--</td>
<td>2.1899</td>
</tr>
</tbody>
</table>

- The noise is rejected by averaging.