The effect of ground motion on the SKIF beam orbit

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Introduction

The Resource Sharing Centre "The Siberian Circular Photon Sources" ("SKIF") is a fourth-generation synchrotron radiation (SR) source currently under construction in Novosibirsk. "SKIF" will require unprecedented orbit stability because the effect of seismic noise might become a relevant source of brightness loss, several studies have been conducted to characterize the actual ground motion in the area of the construction site of the "SKIF". This work summarizes the observations made on the "SKIF" area and uses this data to estimates of the impact of vibrations on the closed orbit at the radiation output points.

Objectives

For emittance coupling between vertical and horizontal:

\[ \varepsilon_x/\varepsilon_y = 10\% \]

Stability requirements: \( \Delta \sigma = 0.1 \times \sigma \rightarrow \Delta \sigma_x < 3.37 \mu \text{m} \) \( \Delta \sigma_y < 0.42 \mu \text{m} \)

Figure 1: Optical functions for one super-period of the SKIF storage ring lattice.

Ground vibration measurements

<table>
<thead>
<tr>
<th>Table 1. Classification of seismic events on the SKIF site.</th>
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<tbody>
<tr>
<td>per day</td>
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<tr>
<td>earthquakes</td>
</tr>
<tr>
<td>industrial explosions</td>
</tr>
<tr>
<td>railway</td>
</tr>
<tr>
<td>auto transport</td>
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<tr>
<td>industrial segment</td>
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<td>noise (day/night)</td>
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</tbody>
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Fast orbit feedback

All fast correctors horizontal and vertical. Correction for two BPM around insertion devices.

Table 3. Fast corrector requirements

| Number of correctors | 48 |
| Maximum field | ±10 T |
| Maximum winding current | 2.8 A |
| Effective length | 10 cm |
| Overall length with windings | 12 cm |
| Maximum frequency | 1000 Hz |

Figure 4: Results of distortion simulation orbits before correction (left row) and after correction (4000 events)

Acknowledgments

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