Update on IR7 Layout for a Crystal Collimation System with 8 Crystals

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Motivation

• An ideal, **complete crystal collimation** system requires a total of **8 crystals**: 4 per beam, 2 per plane, 1 for each side of the beam

• Present horizontal crystals are installed on the **external side** of the beam pipe, while vertical crystals are **on top**: the other side does not have enough room for the goniometer devices

• The ideal solution would be to have 2 crystals installed on the **same goniometer** device: this however would require a **complete redesign** of the goniometer → perhaps possible in an **optimised design** without replacement chamber?

• Another option would be to have 2 crystals installed on **separate goniometer devices**: this would still require a redesign, although in principle less extreme

• The **ideal longitudinal location** of the crystals would be the **same** as the currently installed ones

• In case this is prevented by any constraints, **nearby suitable alternative locations** have been identified
# Alternative crystal positions

The positions on the currently installed **horizontal crystals** are different between the two beams due to constraints on the available slots.

The additional crystals can be installed on **symmetrical positions on the other side of the beam pipe**.

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1H</td>
<td>TCSM.D4L7.B1</td>
</tr>
</tbody>
</table>

**20 m upstream**

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1H</td>
<td>TCSM.A5L7.B1</td>
</tr>
</tbody>
</table>

**TCSPM prototype would need to be removed**

The **vertical crystals** are installed on the same position on the two beams.

The additional crystals can be installed in the closest available slot.

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1V</td>
<td>TCPCV.A6L7.B1</td>
</tr>
</tbody>
</table>

**8 m upstream**

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1V</td>
<td>TCSM.A6L7.B1</td>
</tr>
</tbody>
</table>
Trajectory of deflected halo: B1H injection
Trajectory of deflected halo: B1H flat top
Trajectory of deflected halo: B1V injection
Trajectory of deflected halo: B1V flat top
Trajectory of deflected halo: B2H injection
Trajectory of deflected halo: B2H flat top
Trajectory of deflected halo: B2V injection
Trajectory of deflected halo: B2V flat top
Conclusions

- The integration of an **8-crystal collimation layout in IR7** was studied.

- The additional crystals need to be installed on the **internal/bottom side** of the beam pipes, requiring a **redesign of the goniometer devices**.

- The ideal **longitudinal location** of the additional crystals would be the same as the already installed ones, but **suitable nearby alternative locations** have been identified.

- **Question**: do we need detailed tracking simulations?
Backup
Trajectory of deflected halo: B1H injection

Both crystals at the same location
Trajectory of deflected halo: B1H flat top

Both crystals at the same location
Trajectory of deflected halo: B1V injection

Both crystals at the same location
Trajectory of deflected halo: B1V flat top

Both crystals at the same location
Trajectory of deflected halo: B2H injection

Both crystals at the same location
Trajectory of deflected halo: B2H flat top

Both crystals at the same location
Trajectory of deflected halo: B2V injection

Both crystals at the same location

- beam envelope
- deflected beam
- deflected beam ±10 μrad
- aperture
- crystal
- secondary
- absorber

- s [m]
- y [mm]
Trajectory of deflected halo: B2V flat top

Both crystals at the same location