Research and Development Progress of CEPC RF Shield Bellows
RF shield bellows is a key component to ensure good vacuum conditions and reach the best possible machine performance.

The primary function of RF shield bellows is to allow for thermal expansion of the chambers and for lateral, longitudinal and angular offsets due to tolerances and alignment, while providing a uniform chamber cross section to reduce the impedance seen by beam.

The usual RF-shield is done with many narrow Be-Cu fingers that slide along the inside of the beam passage as the bellows is being compressed.

There are many other types of RF shielding structures in the world, such as comb type, pls type, etc.
The RF shielding structure of cepc bellows consists of three parts: spring finger, contact finger and inner tube.

- The spring finger provides contact force to ensure good electrical contact between the inner tube and beryllium copper finger.

### Design Features and Performance Specifications

<table>
<thead>
<tr>
<th>Total length</th>
<th>Expansion</th>
<th>Contraction</th>
<th>Ellipse cross section</th>
<th>Contact force</th>
<th>Maximum radial offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>140mm</td>
<td>5mm</td>
<td>12mm</td>
<td>75mm × 56mm</td>
<td>125g</td>
<td>2mm</td>
</tr>
</tbody>
</table>
Contact force between the spring fingers and the contact fingers is a key parameter. In order to reduce the human factors in the test, a test device is designed. The control precision of test tension can reach 0.01 N.

Schematic diagram of the test device

Actual picture of the device
In order to achieve the required contact force, the mold and welding tooling of the spring finger are constantly optimized, and the pre-bending angle is also constantly adjusted.
Forming of Spring Finger

- Contact force is determined by pre-bending angle of the spring fingers. Different pre-bending angles of $25^\circ, 26^\circ, 27^\circ, 31^\circ$ have been tested which shows that $27^\circ$ is best.
- $27^\circ$ is chosen and which forces between the spring fingers and the contact fingers is uniformly from different fingers and is about $125 \pm 5g$, which meets $125 \pm 25g$. 

![Image of Before and After weld](image-url)
Prototype of RF Shielding Bellows

prototype I:

prototype II: