

SMOG 2 WFS Discussion

24-Sept-2020

Motivation

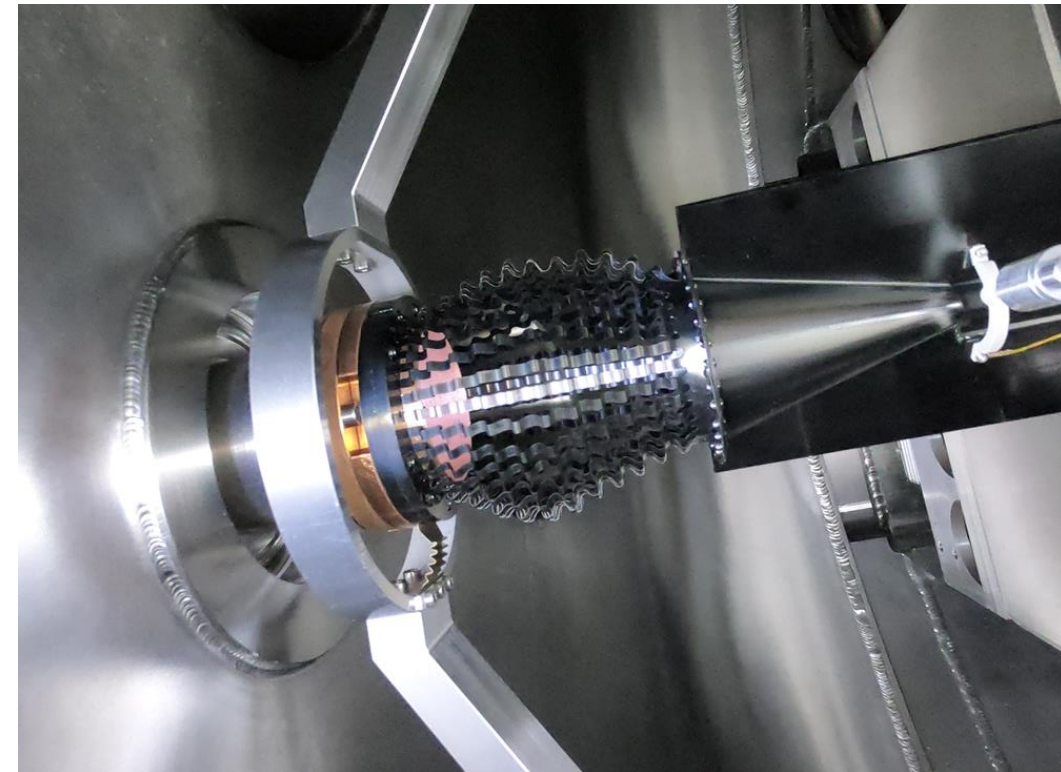


SMOG2 wake field suppressor (WFS) installation is not as expected (fingers buckling and twisting as observed on pictures). We recommend that the nominal situation with a cylindrically shaped WFS is restored to start Run 3 in good conditions.



Planned installation (from ECR 2331410)

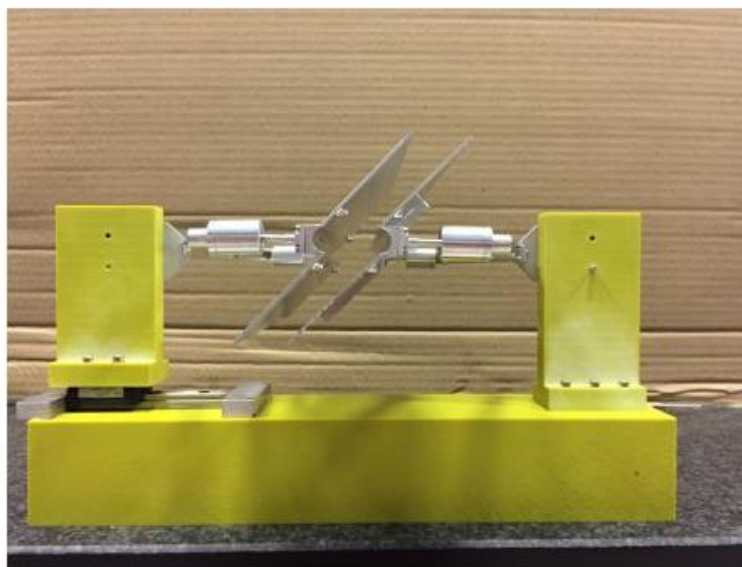
Buckling WFS (picture: P. Di Nezza)



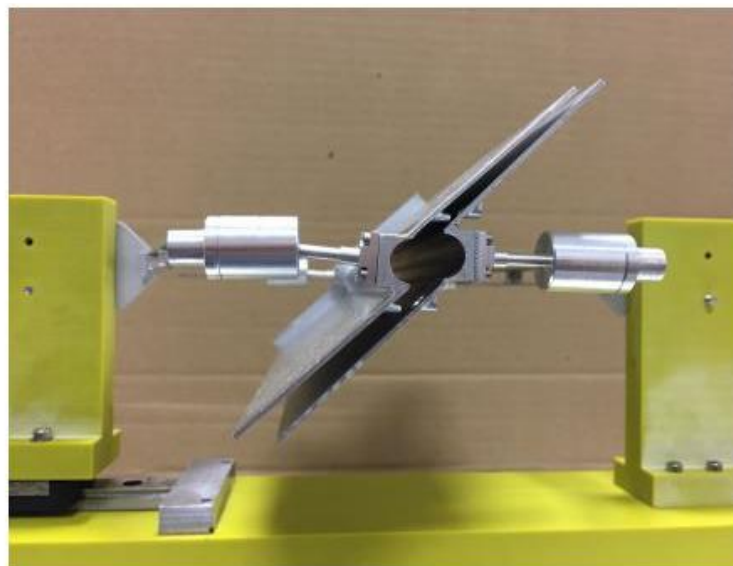
Closing mechanism of Smog 2 cell without WFS



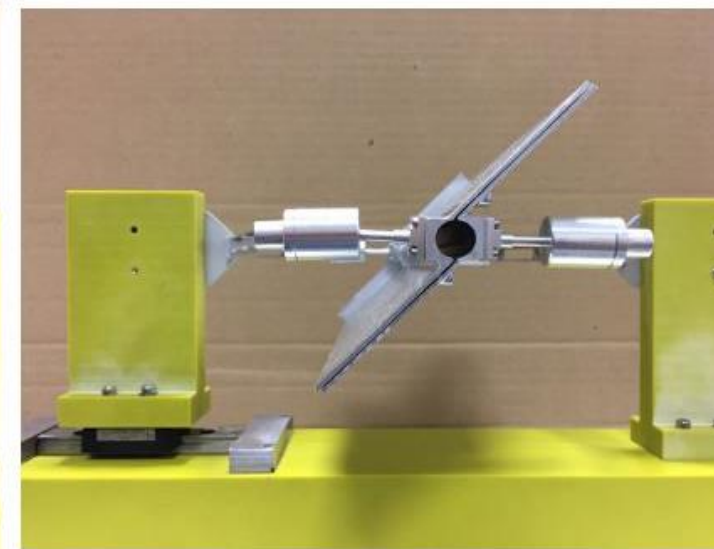
One half of the cell (right) is fixed and used as reference, the other has limited 3D degrees of freedom in order to find always the nominal closed position



open



before engaging



closed

old version prototype

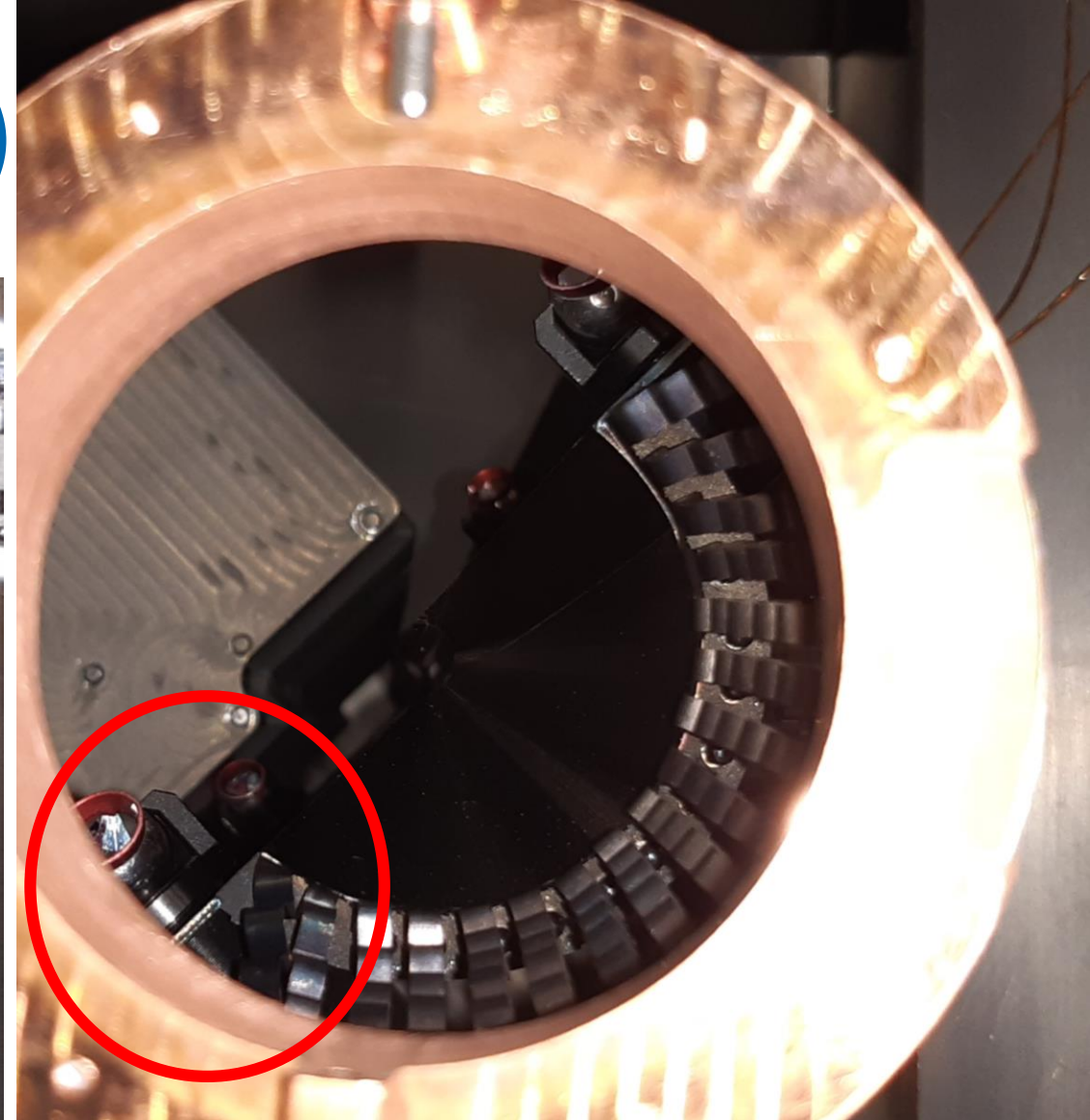
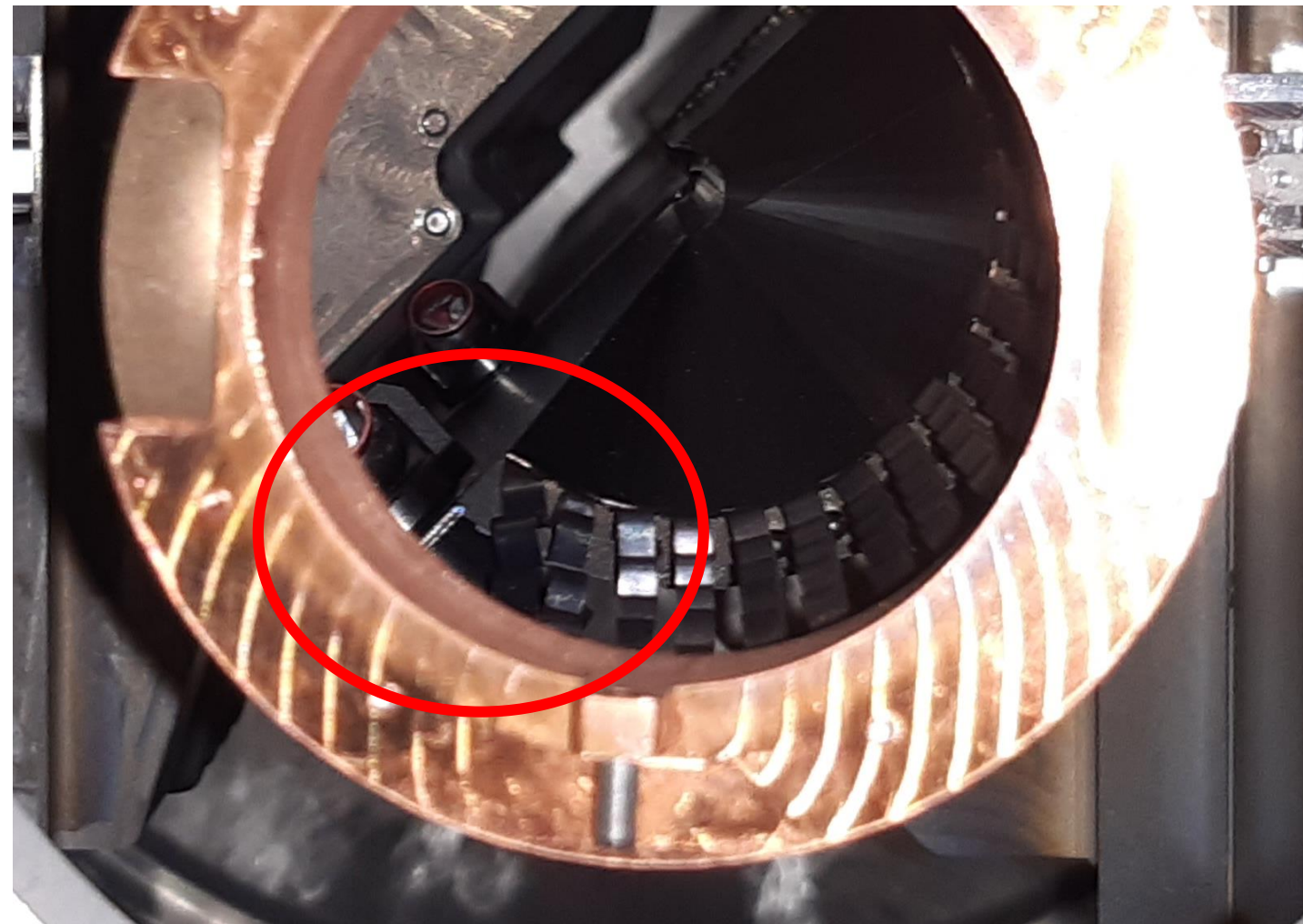
From presentation P Di Nezza, 173rd MPP meeting

Concerns w.r.t. beam impedance



- Current shape of the fingers increases the contribution to beam coupling impedance, but preliminary studies predict a small increase only which appears manageable for Run3. Even the removal of 3 fingers in the x-plane produce modes only above 1 GHz (simulation of A. Farricker).
- This contribution can be considered to remain small only if the shape of the WFS fingers does not degrade with mechanical cycles and operation with beam.
 - main concerns are beam induced heating and/or radiation damage combined with frequent mechanical movements (only the Velo is actively cooled but not the Smog 2 cell, neither the WFS).

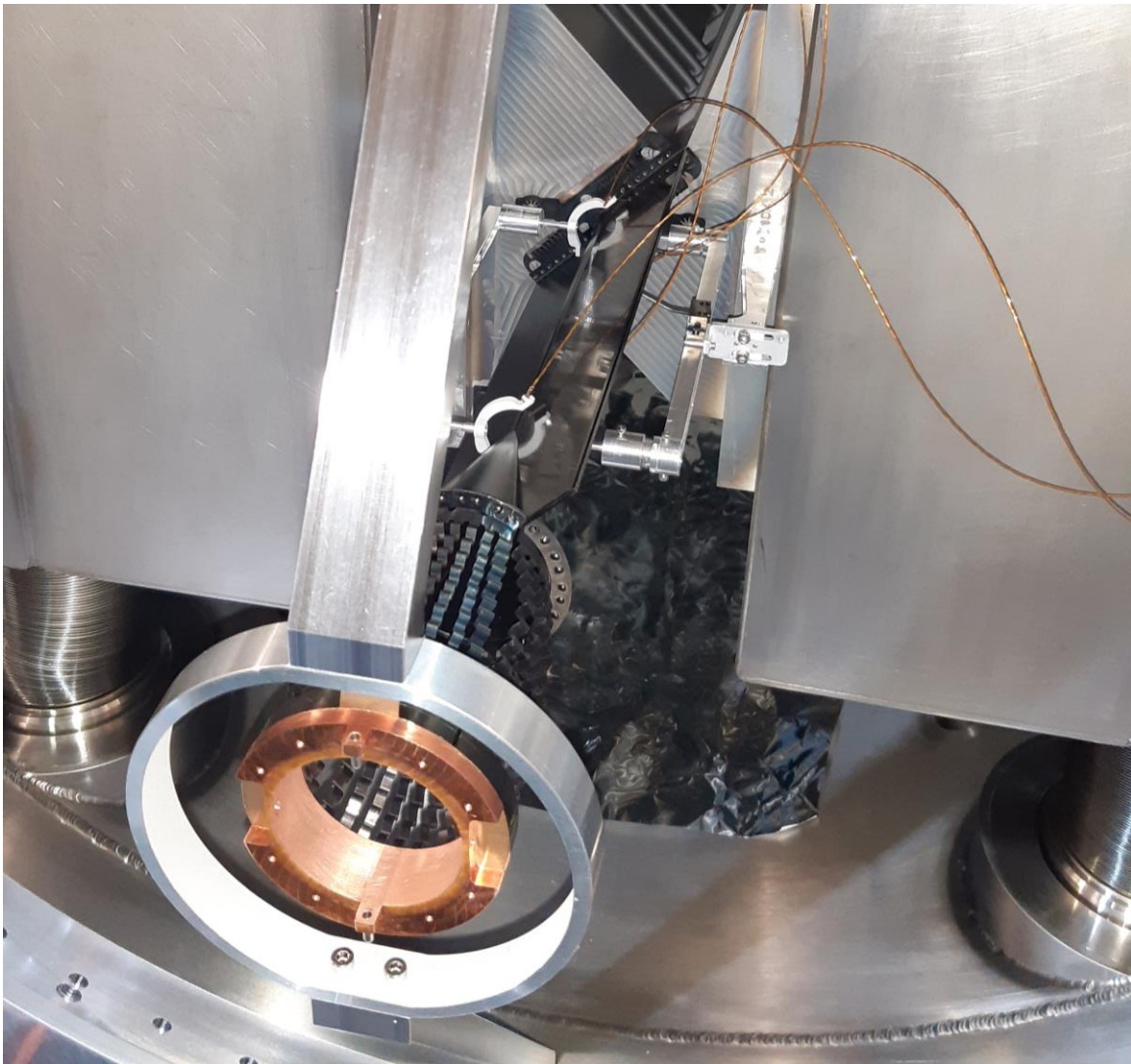
WFS – additional pictures (1/2)



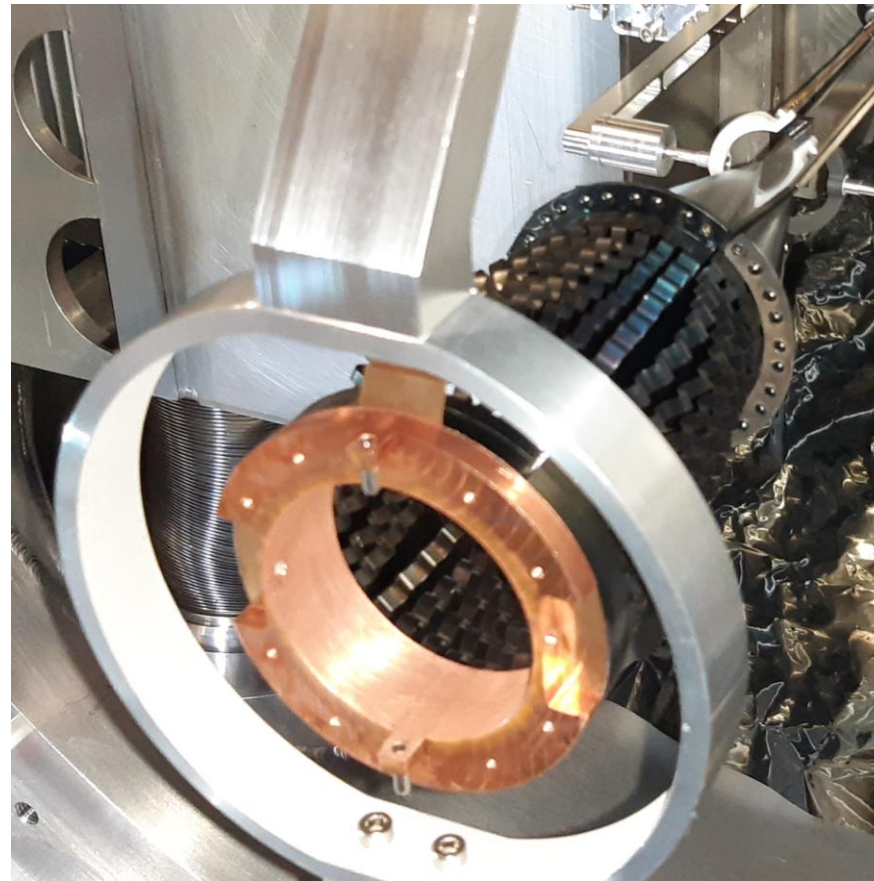
Pic 122052

Pic 114548

WFS – additional pictures (2/2)



Pic 095924



Pic 095918

Other concerns/ discussion



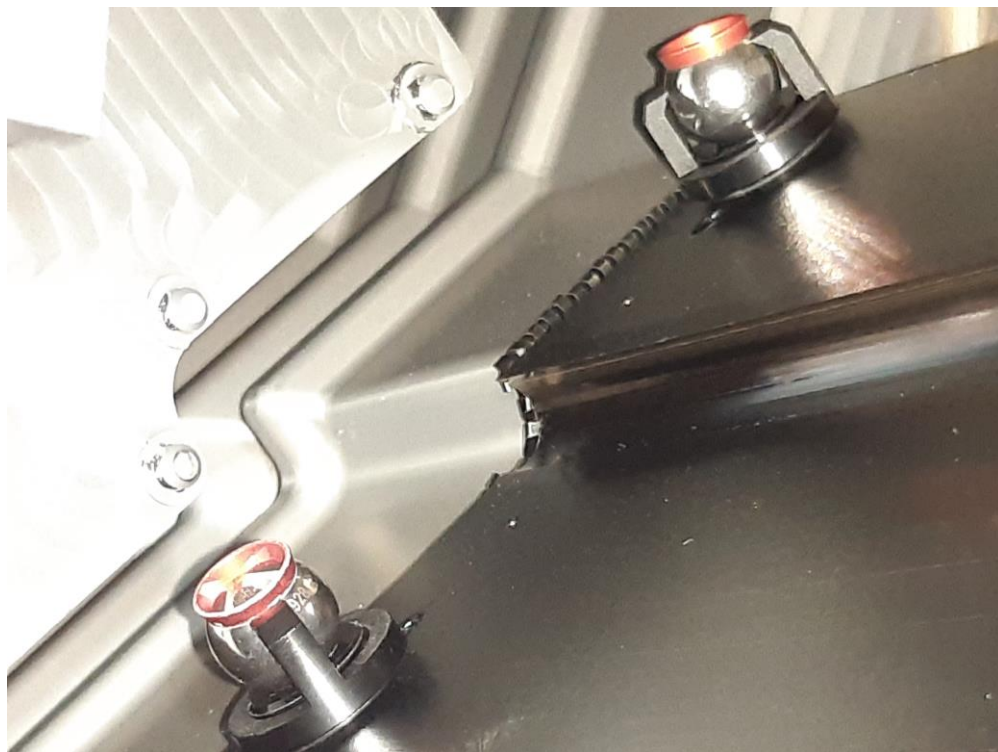
- What is the chance that the WFS keeps its shape and survives all movements during LHC run?
 - mechanical movement during each fill.
 - if fingers are ripped off, could they bend into the aperture?
- Is there a risk to LHCb or LHC run if the Smog 2 WFS fail?
 - Awareness of the problem to be given to LHCb (**inform Rolf or Massimiliano**).
- Was the twisting angle of the fingers observed during test installation already and has this been taken into account?
 - there was no full prototype which would have allowed us to identify these problems beforehand
 - but the cycling tests already included the sideways movement of the Smog 2 cell.
- It would be worth to see the calculated stress concentration in the WFS fingers. This in particular since no visual monitoring of the installation is possible, as far as we understand.
- The estimated longitudinal oversize of the WFS is about 2-3 mm.

Next steps/ Possible Mitigations

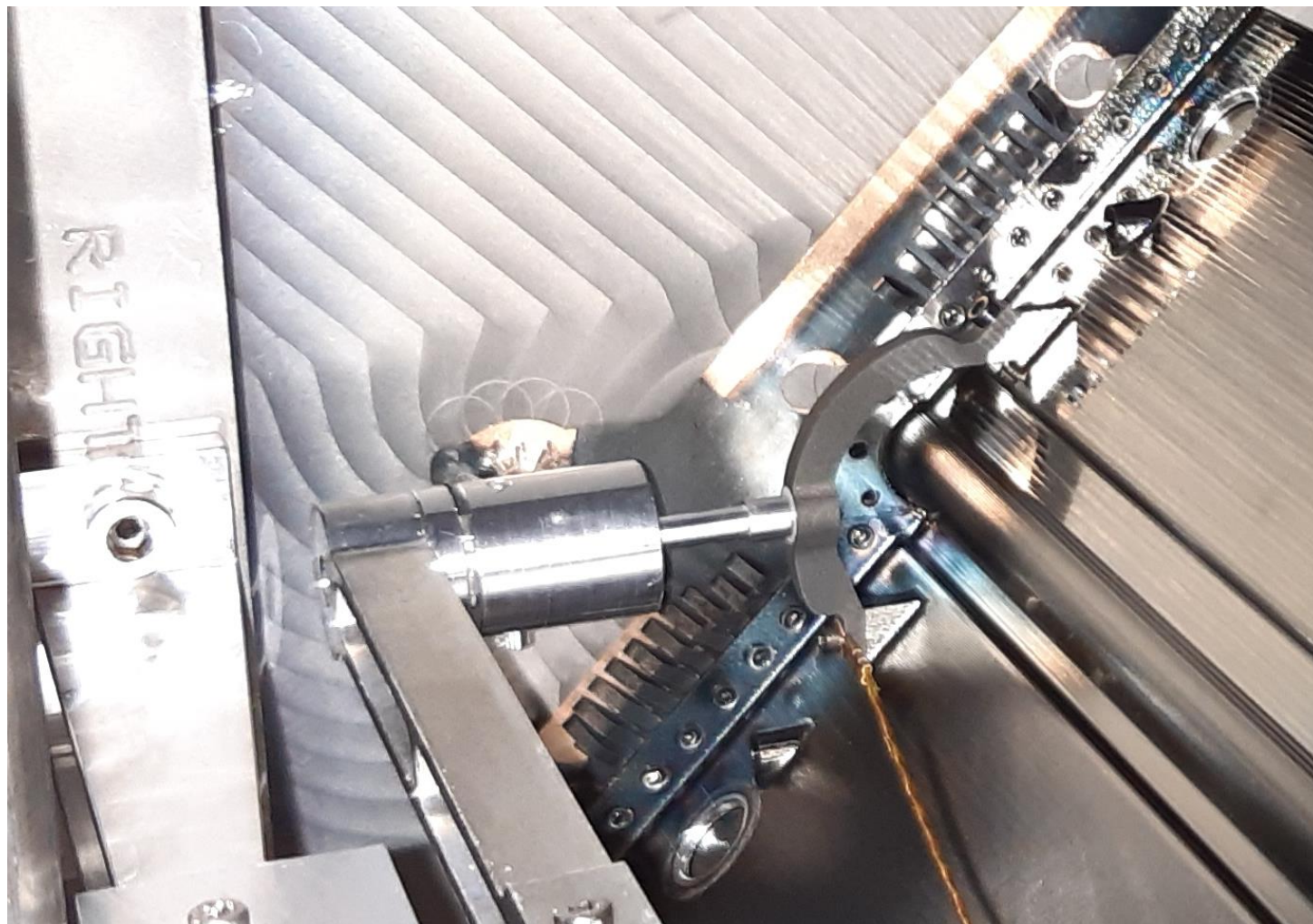


- If the 2-3 mm longitudinal oversize of the WFS is confirmed, this could be corrected by:
 - reducing of Cu flange would lead to recovery of the WFS length by about 1 mm (can be done without opening of the vessel).
 - “spacing flange” -> compensation flange installed additionally from outside, recovers up to 5-8 mm. Leads to a overcompression of the bellow on the upstream side (see picture).
 - re-doing the entire upstream transition chamber (est. costs ~15kCHF).
- Can the WFS status be checked while installed?
 - Endoscopy will be possible from the upstream side only before run and means venting the Velo (Josef).
- Could additional tests be done on a WFS outside the machine?
- Would an inspection of the WFS be possible by using the existing view ports, e.g. during TS. To be used for regular monitoring, if needed. View port needs to be modified to allow this method.

Other RF fingers

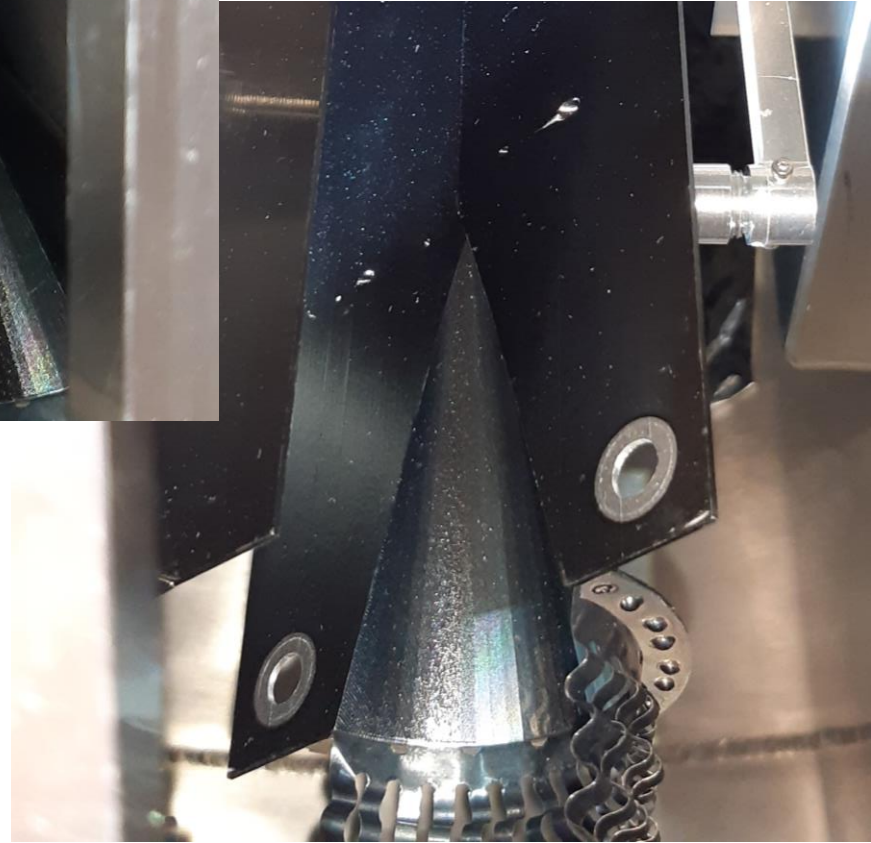
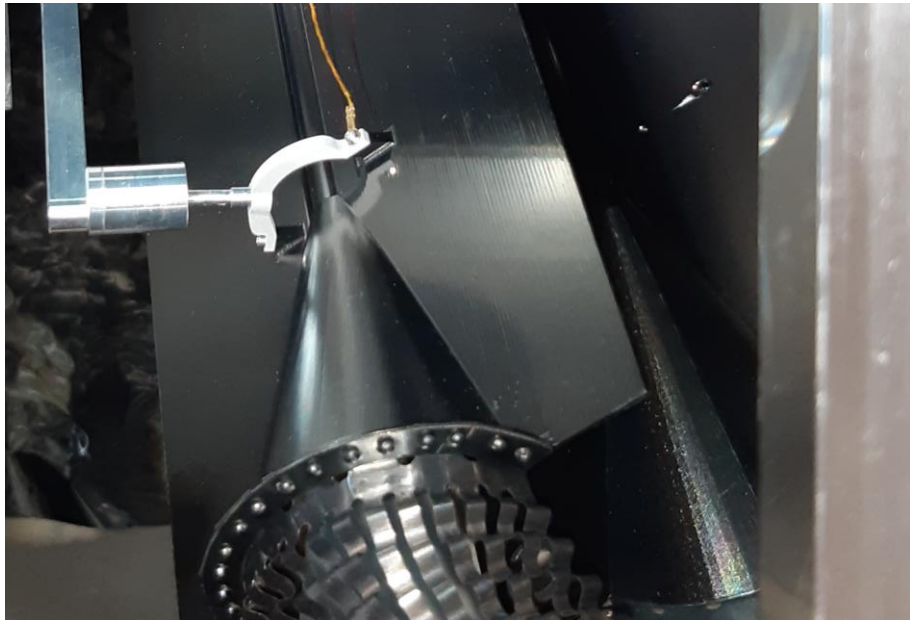


Pic 103527



Pic 165628

Other concerns: Scratches on the Smog 2 surface



Pics 164955, 165008, 165035