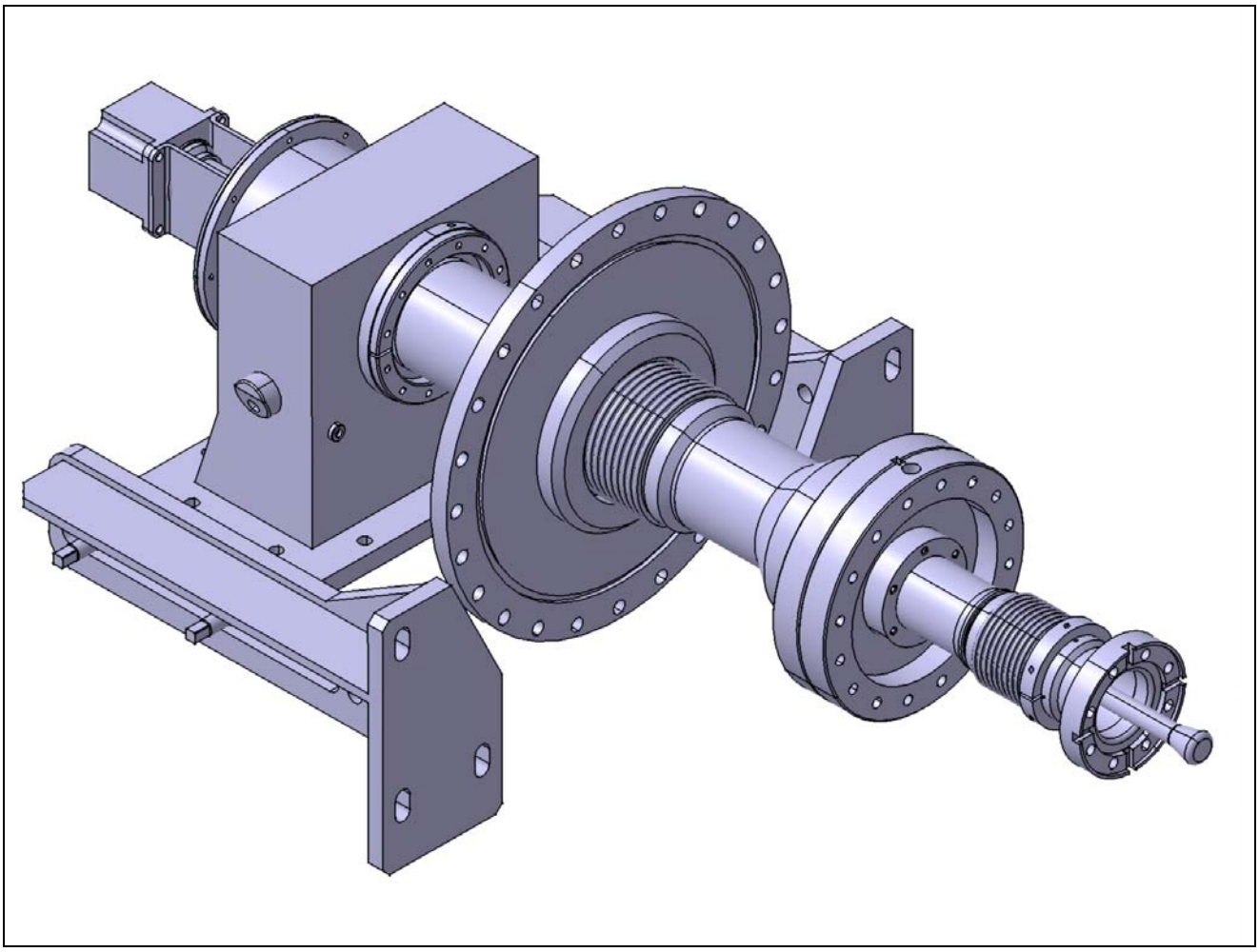
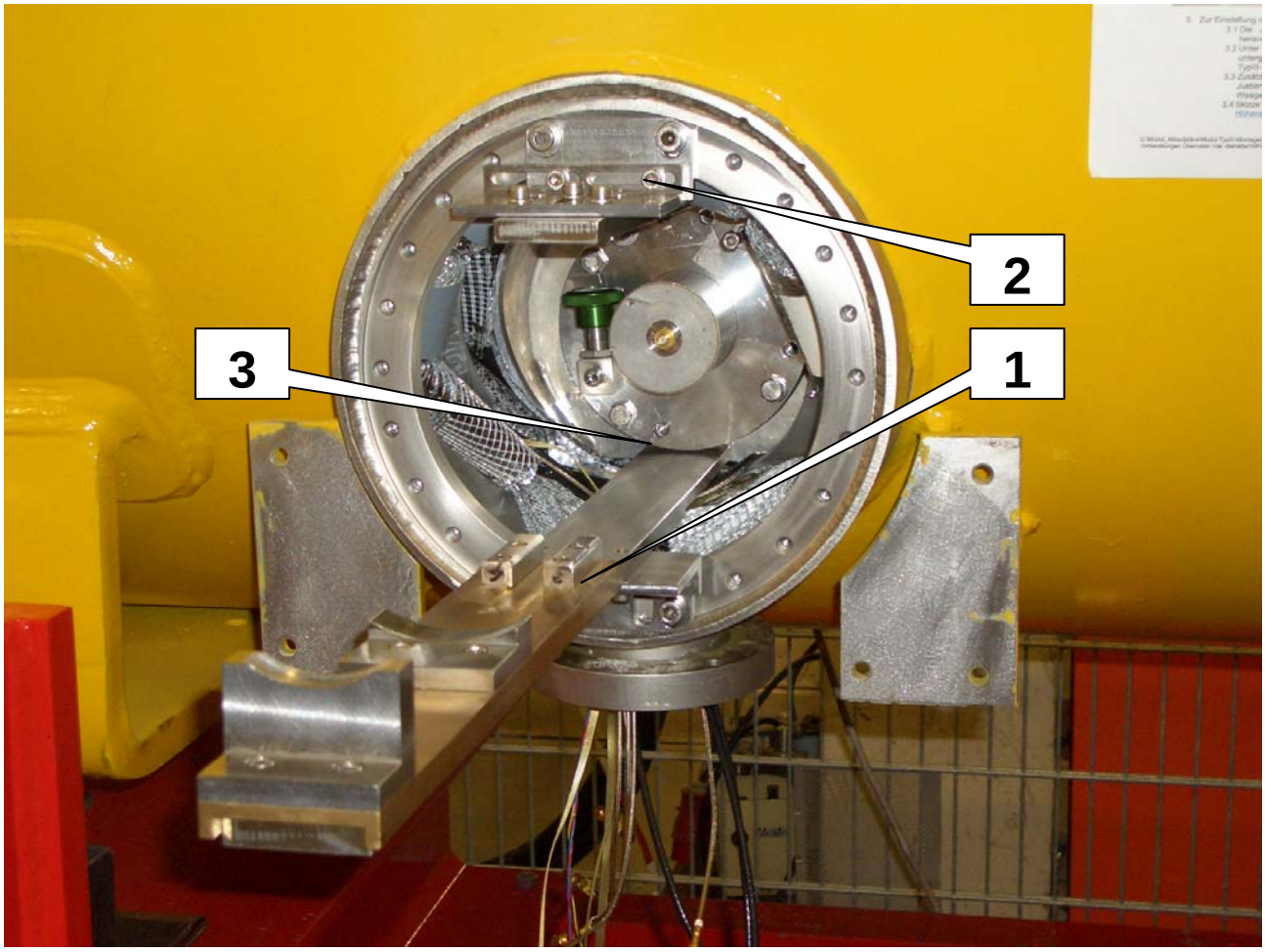
TTF III Coupler mounting on the XFEL Module

D. Kostin, 27.03.2008

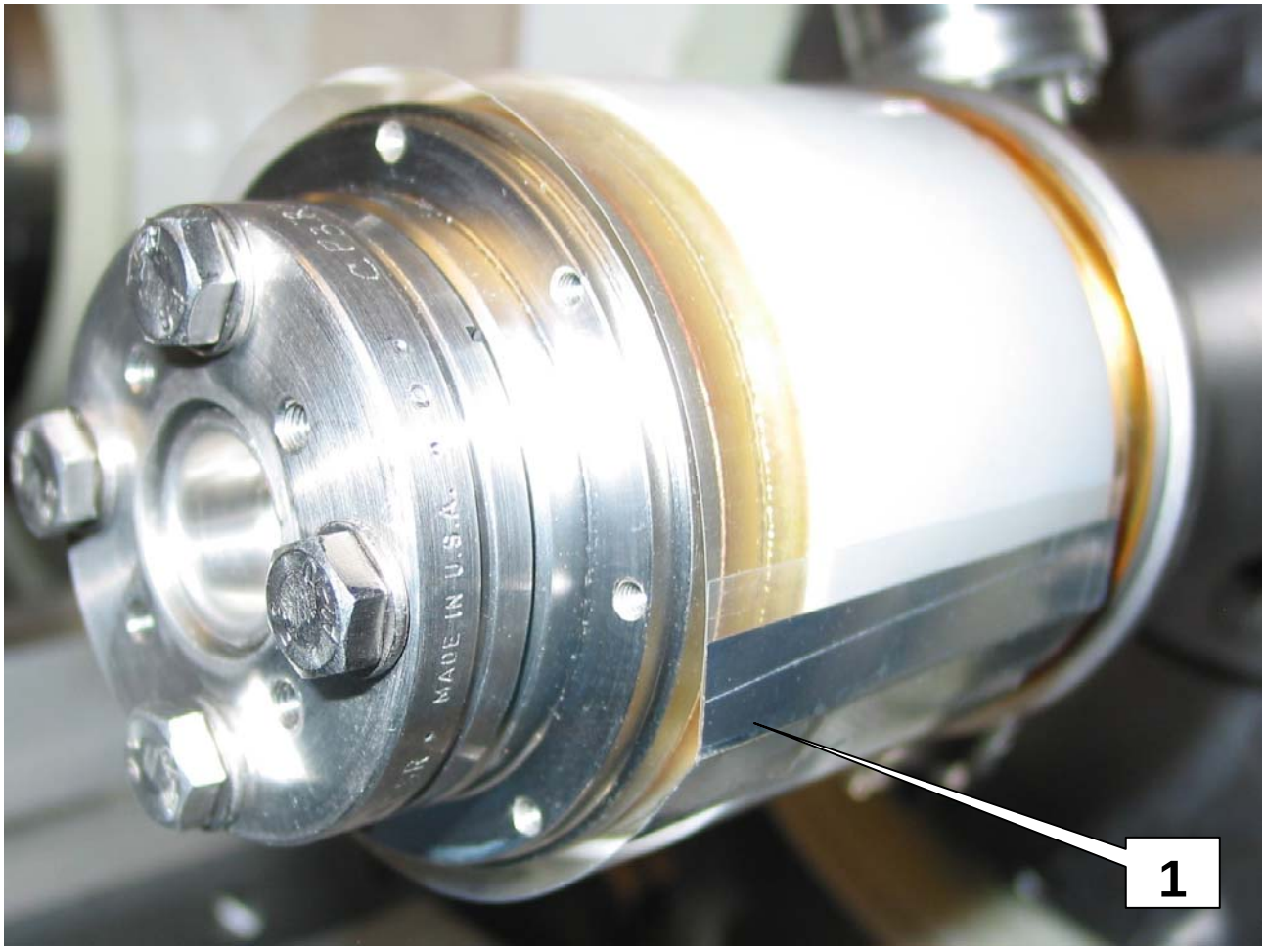


1. Equipment/Tool/Parts checklist:
    - Coupler drawings set.
    - Clean Room / clothing.
    - Tools → toolbox.
    - Special mounting setup:
        - Long Rail-slider for warm-coax assembly;
        - Hook-rod for warm-coax assembly;
        - Long M5-inner screwdriver;
        - Tuning mechanism flange screws tightening lever;
        - Warm window ceramic plastic cover.
        - Warm part assembly plastic cover.
    - Vacuum leak-searching setup and valves.
    - Dry nitrogen source and valve.
    - Car to move parts/tools + working table.
    - Coupler parts:
        - Cold part → already mounted
        - Warm coax part assembly
        - WG box assembly
        - Tuning mechanism
        - Tuning motor assembly
        - Cu seals:
            - CF100 rounded ×8 (70K flange)
            - CF35 ×8 (vac.valve+tube)
            - CF25 ×8 (tuning mechanism flange)
            - CF16 ×16 (pickup and PM window flange)
        - Rubber seals → EPDM O-rings (big+Al_ring, small)
        - Capacitors ×8 → preassembled
        - HV coils + sockets + cover plates ×8 → preassembled
        - Pick-ups ×8 (e-3, e-1,2 are already attached)
        - PM windows ×8
        - Cables e-2 (SMA connector) ×8
        - Coupler Support parts (brackets, bars, bolts, axles)
        - Screws: M8×35 CuNiSi (×16 pro coupler) + steel ones (other)
    - Superisolation foil;
    - T-tubes + feedthroughs.

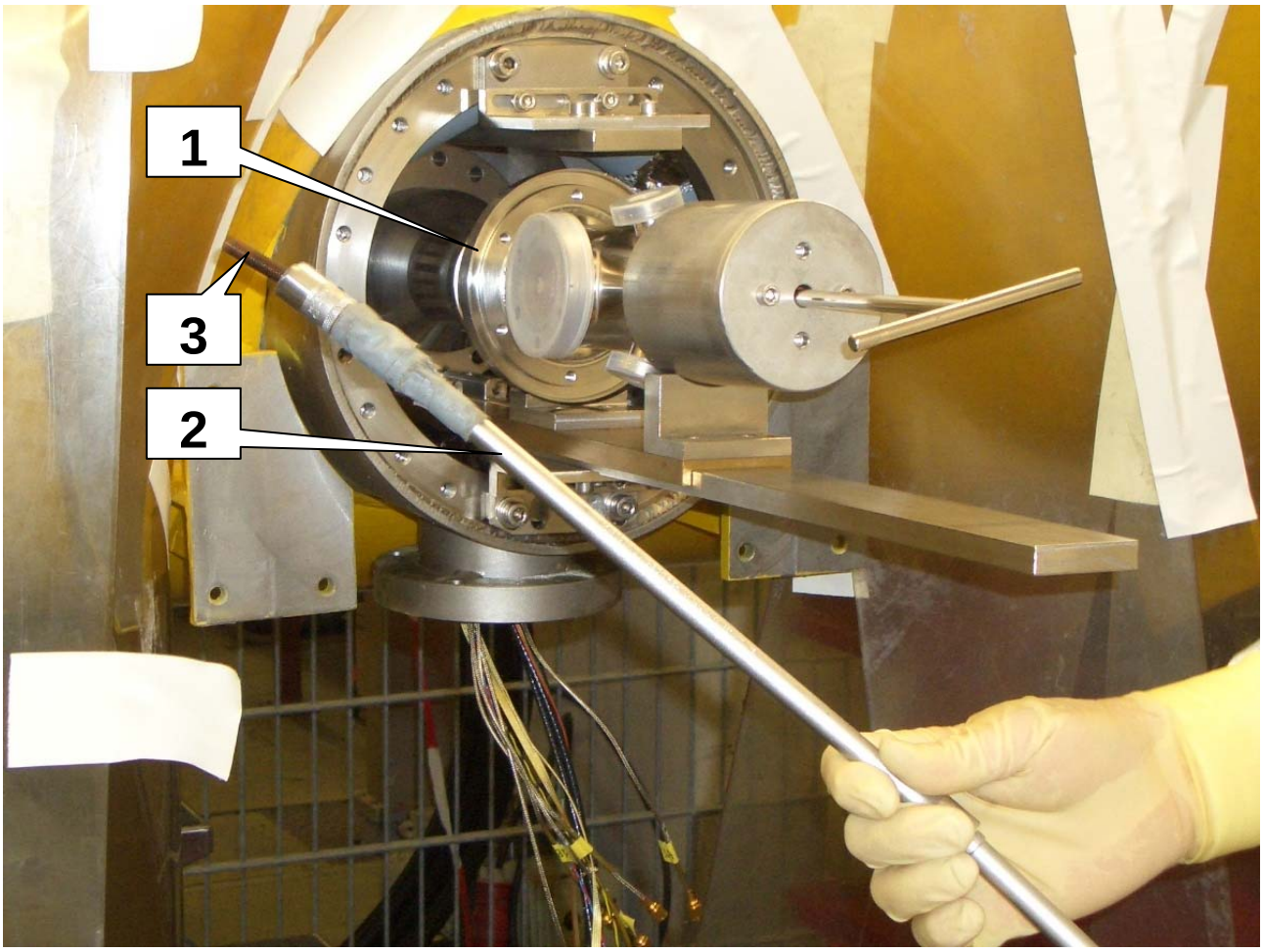
2. Install the Clean Room at coupler position.
3. Put the multilayer-super isolation cut flaps aside, fix them with adhesive tape.
4. Install the warm part mounting plastic cover (dust-free from super isolation).
5. Check the 70K-flange position [3] → it must be centered.
6. Check the distance between 70K and Iso. vac flanges (approx. 211 mm).
7. Measure coupler antenna and e- pickups impedance with DMM → must be ∞.
8. Install the rail-slide [1] and upper support [2] to fix 70K flange [3].



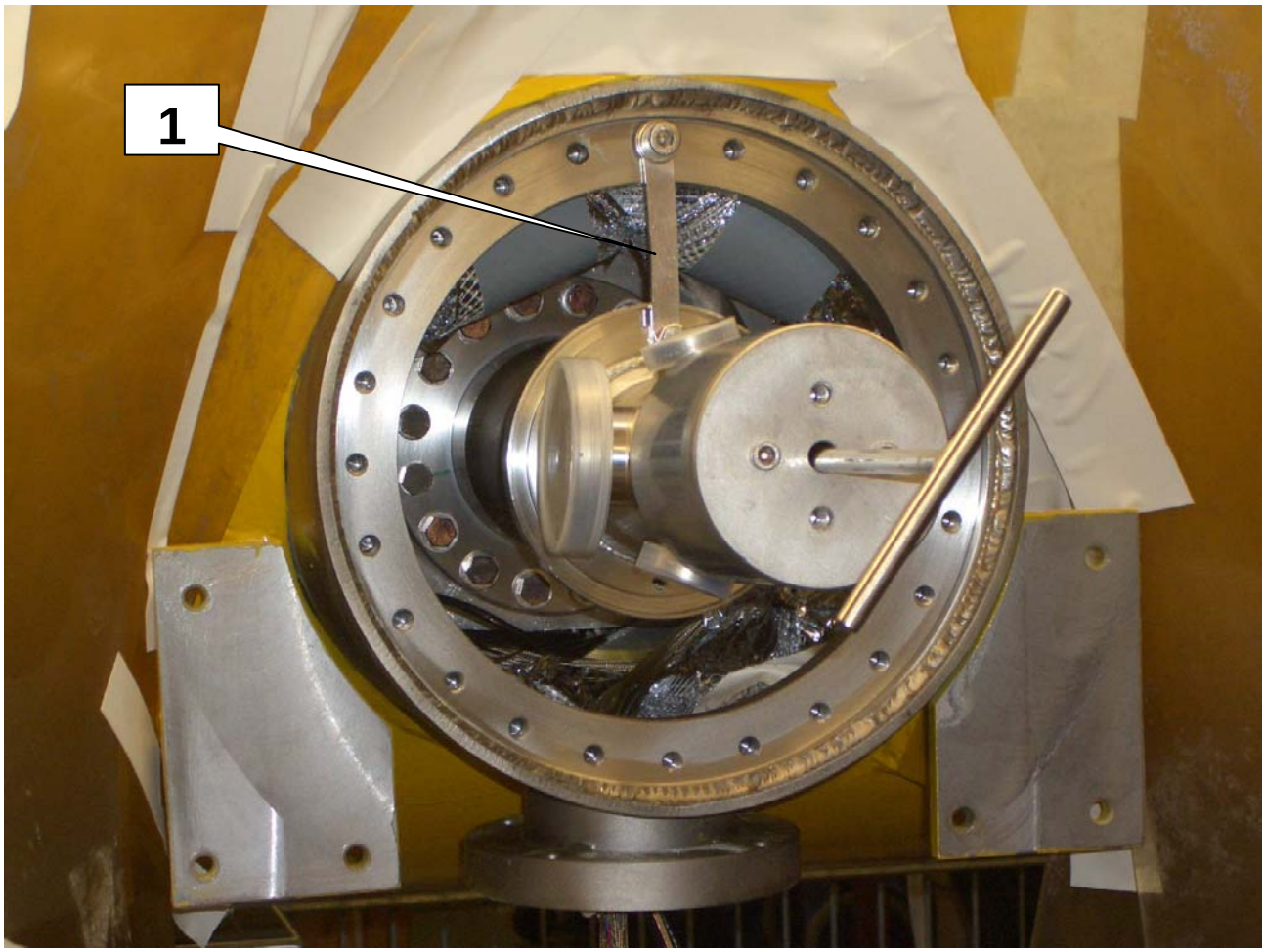
9. Remove the warm coupler part from the nitrogen storage cabinet and put it into the sealed transport box. Fill the transport box with the dry nitrogen. Deliver the warm part in the transport box to the module assembly place.
10. Remove warm window ceramic protecting cap and put on the warm window ceramic plastic cover [1]. Install the ceramic protecting cap again.
11. Remove threaded rods holding the cold part.
12. Prepare the CF100 rounded Cu seal → slightly tap it and set into place.
13. Check the warm-coax assembly, install e-2 pickup (if not installed and if it is present in current design), insert the long M5-inner screwdriver into the inner-coax in vertical position (ceramic protecting cap must be put on).
14. Install the dry nitrogen feed on the CF35 warm part vacuum flange. Start the nitrogen flow, the warm part must be under the nitrogen flow during the mounting.



15. Remove 70K flange ceramic window protecting cap.
16. Slide warm-coax assembly [1] in (holding long M5-inner screwdriver [2]), use the long M5-inner screwdriver to connect the inner conductor, do not tighten the screw yet.
17. Put 16 CuNiSi M8×35 screws [3], they must go easy into the threaded holes.
18. Tighten the inner M5-screw in the inner conductor of the warm part, remove the long M5-inner screwdriver.
19. Tighten the 16 CuNiSi M8×35 screws (use long-arm outer 13 screwdriver, do at least 4 rounds with 25 N*m max torque).



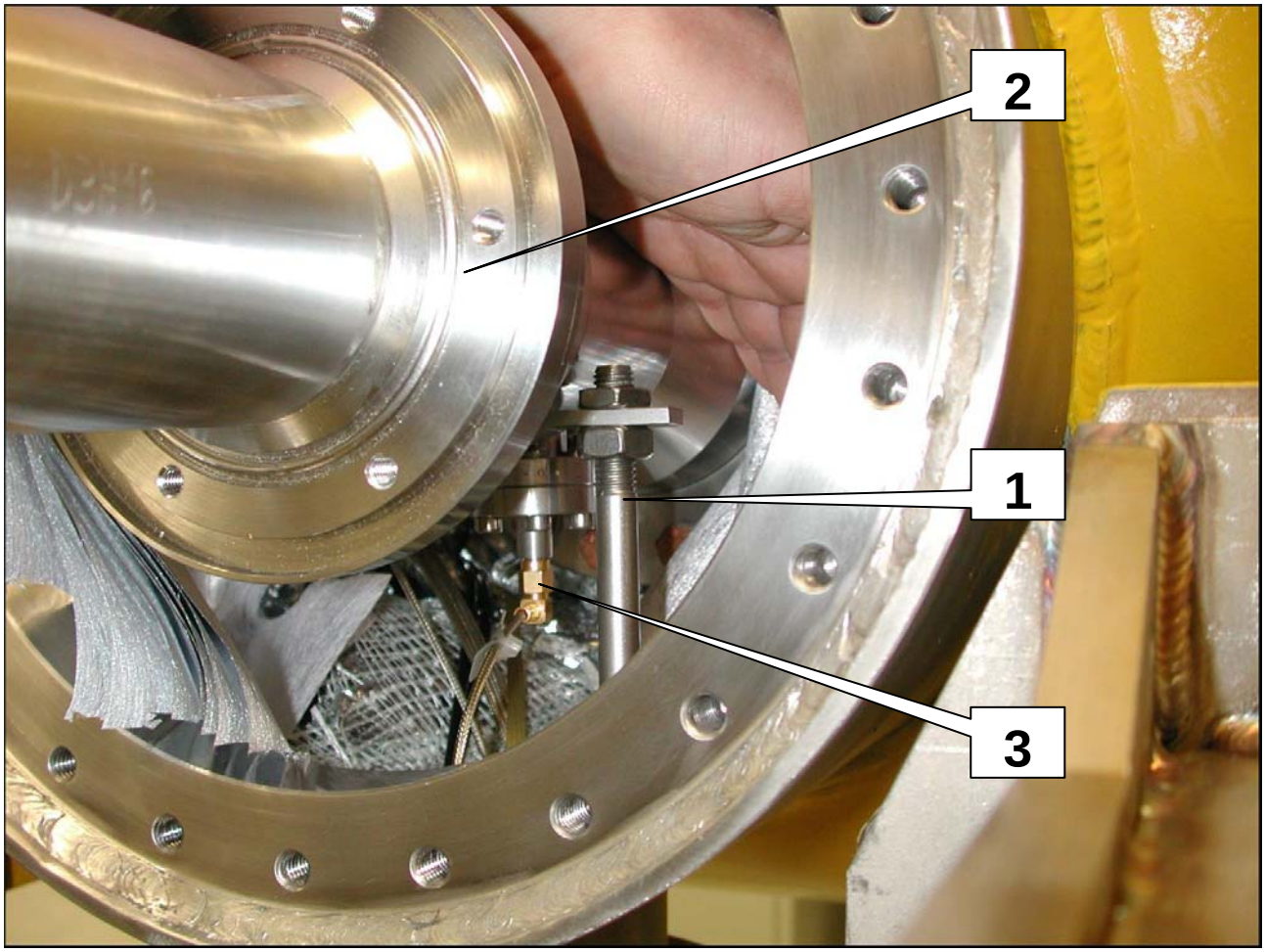
20. Install the warm part top-support [1].



21. Install supporting hook-rod [1] to hold out-coax part [2].

22. Remove rail-slider.

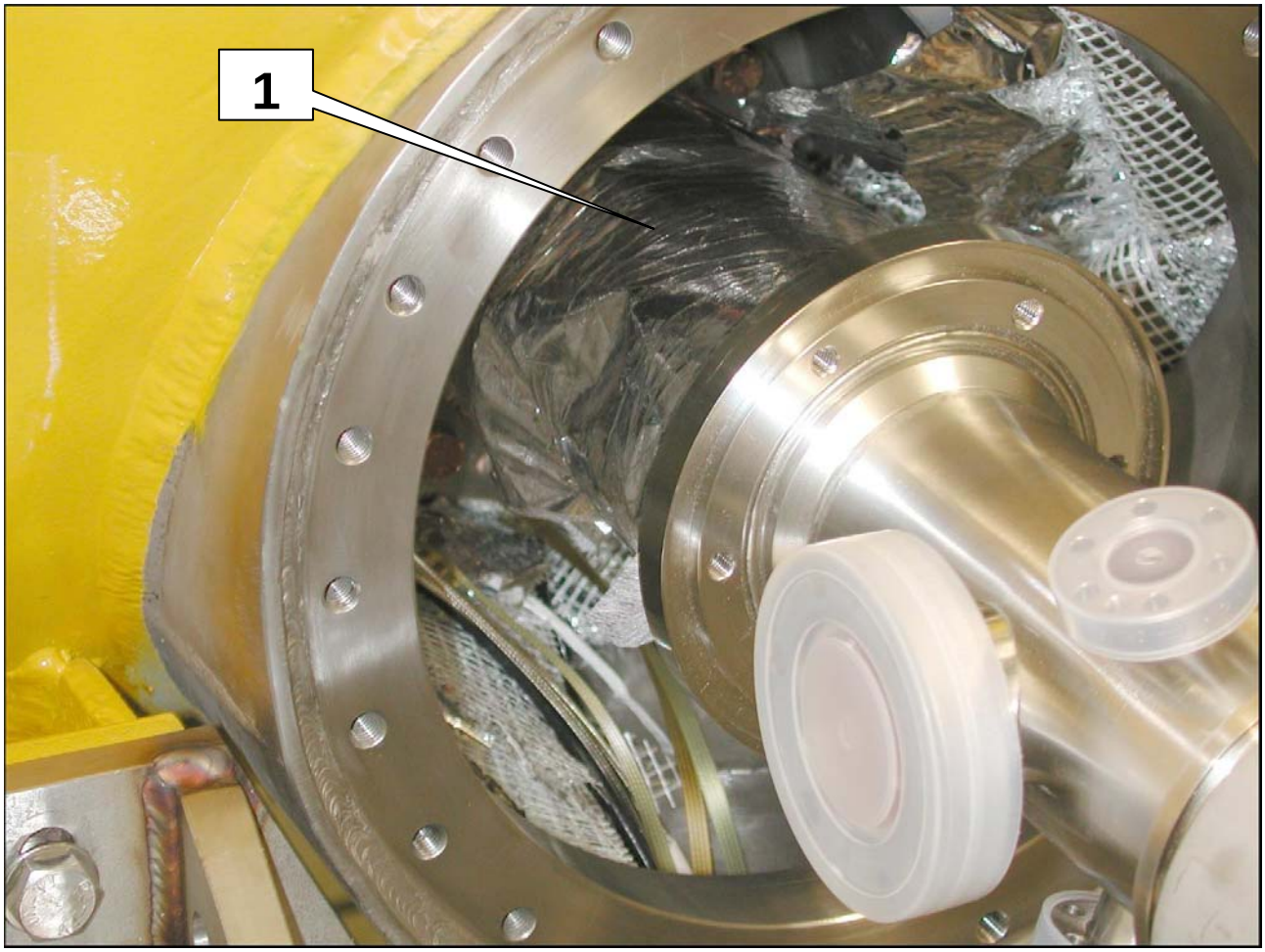
23. Attach e-2 cable [3], if e-2 pickup exists (use special SMA connector key).



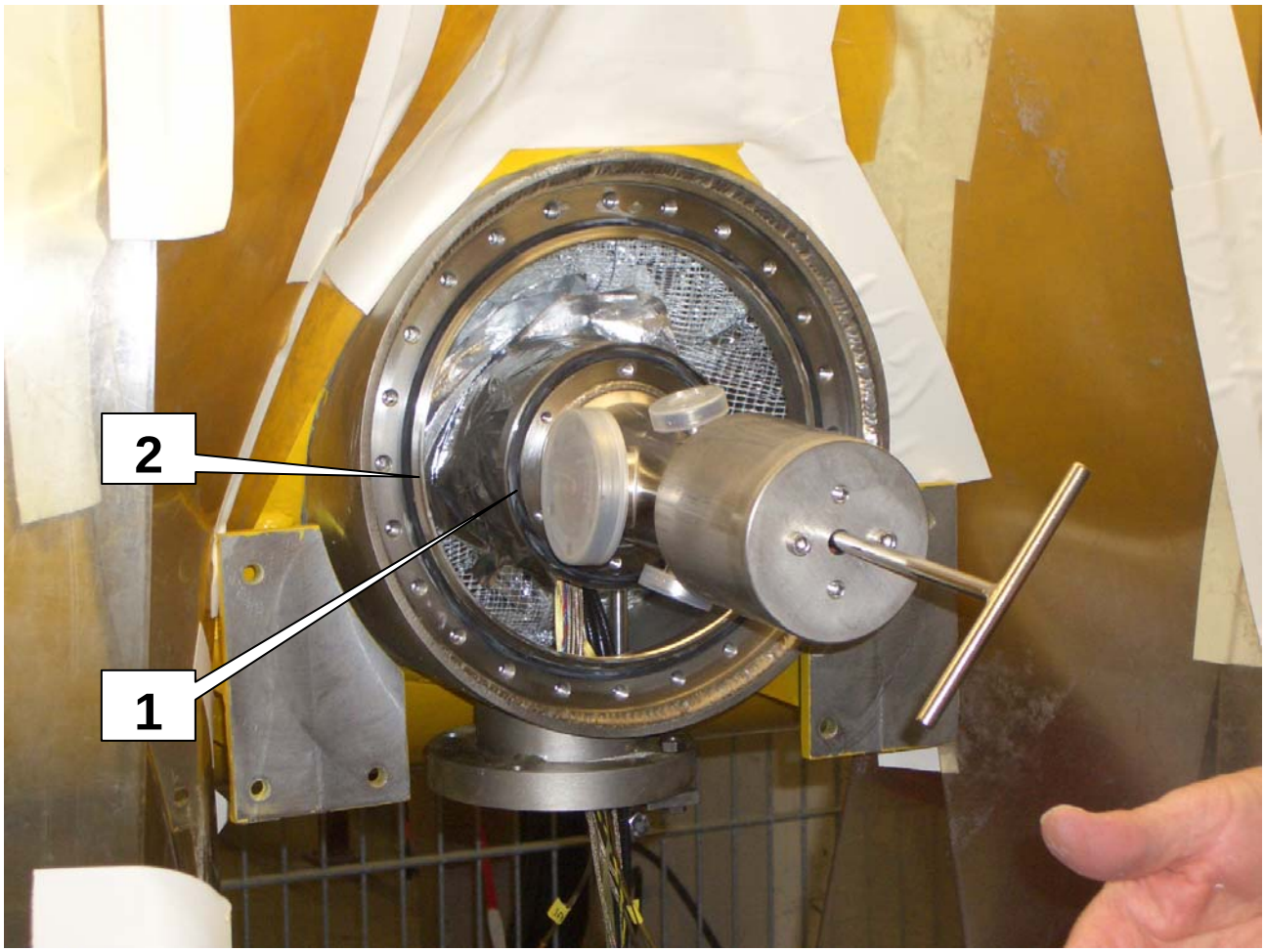
24. Remove the warm part dust-free mounting plastic cover.

25. Put super isolation foil [1] around the outer-coax part and fix it.

26. Remove the nitrogen feed.



27. Set small O-ring [1] on the iso. vac flange, set big O-ring with Al frame [2] into place on the module, use sealing lubricant (fat) on rubber seals.

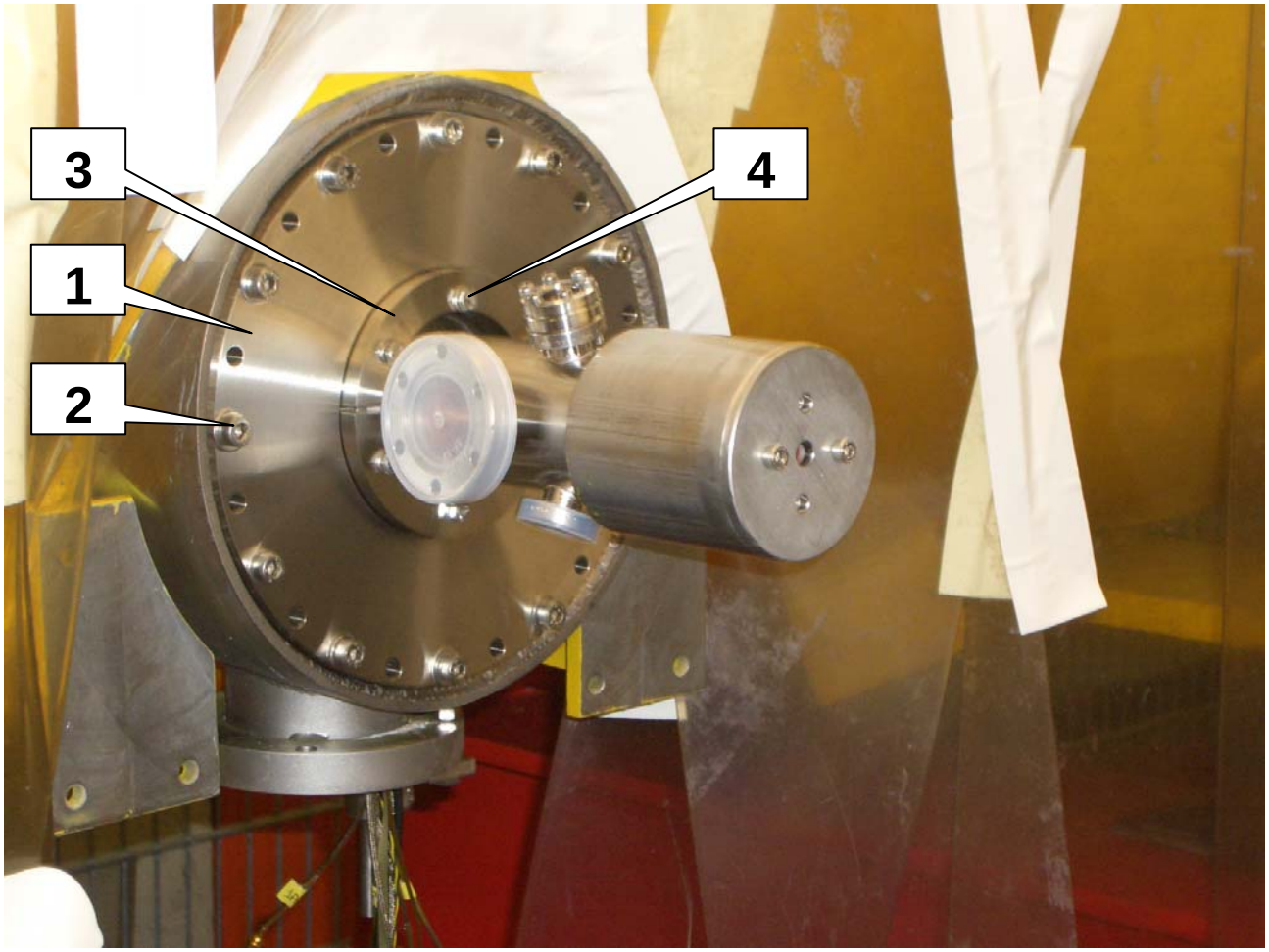


28. Install iso. vac flange [1] into place, put 12 M8 screws [2].

29. Attach two center steel half rings [3] by 6 M6 screws [4].

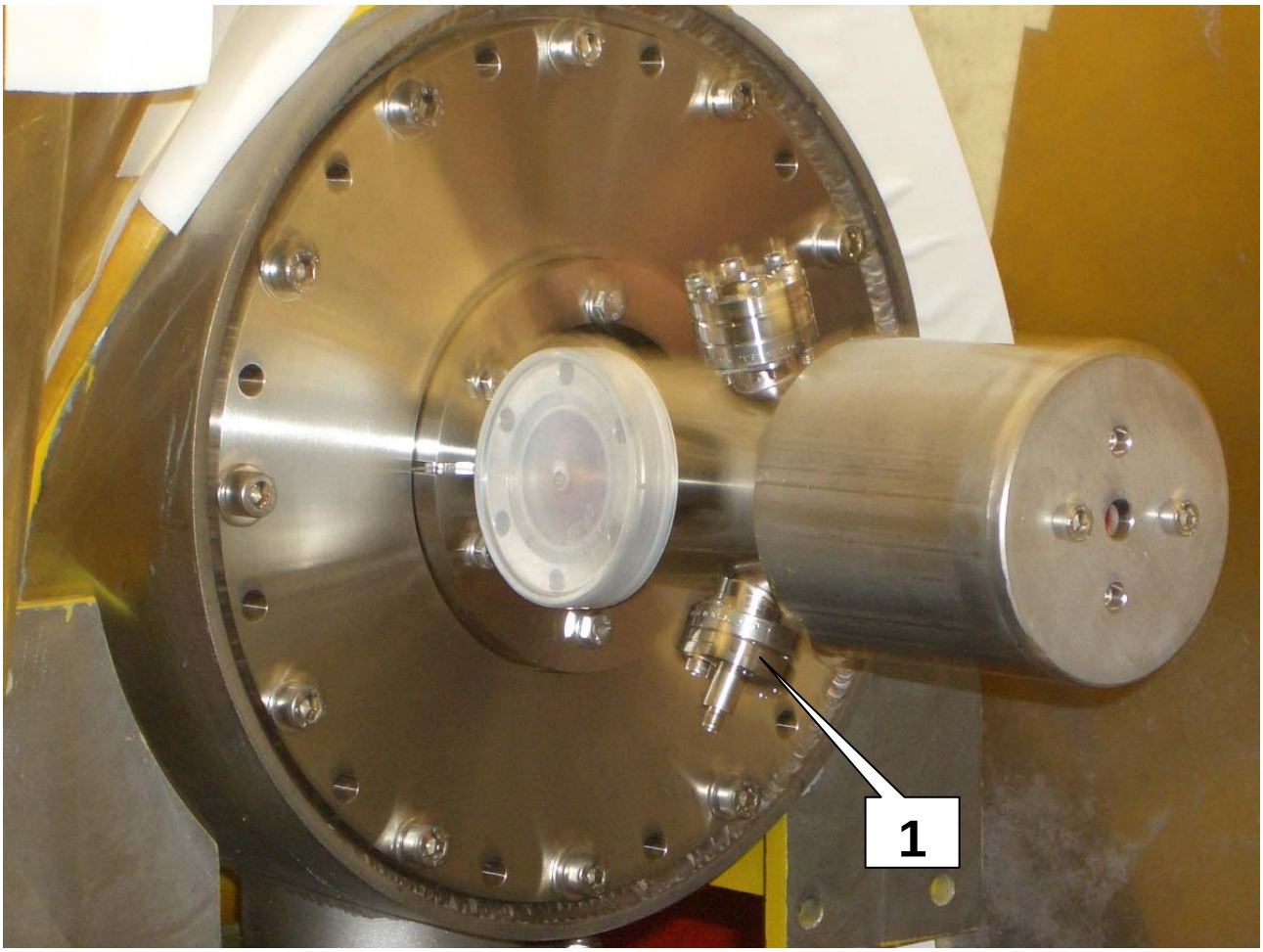
30. Tighten all screws.

31. Remove the supporting hook-rod.

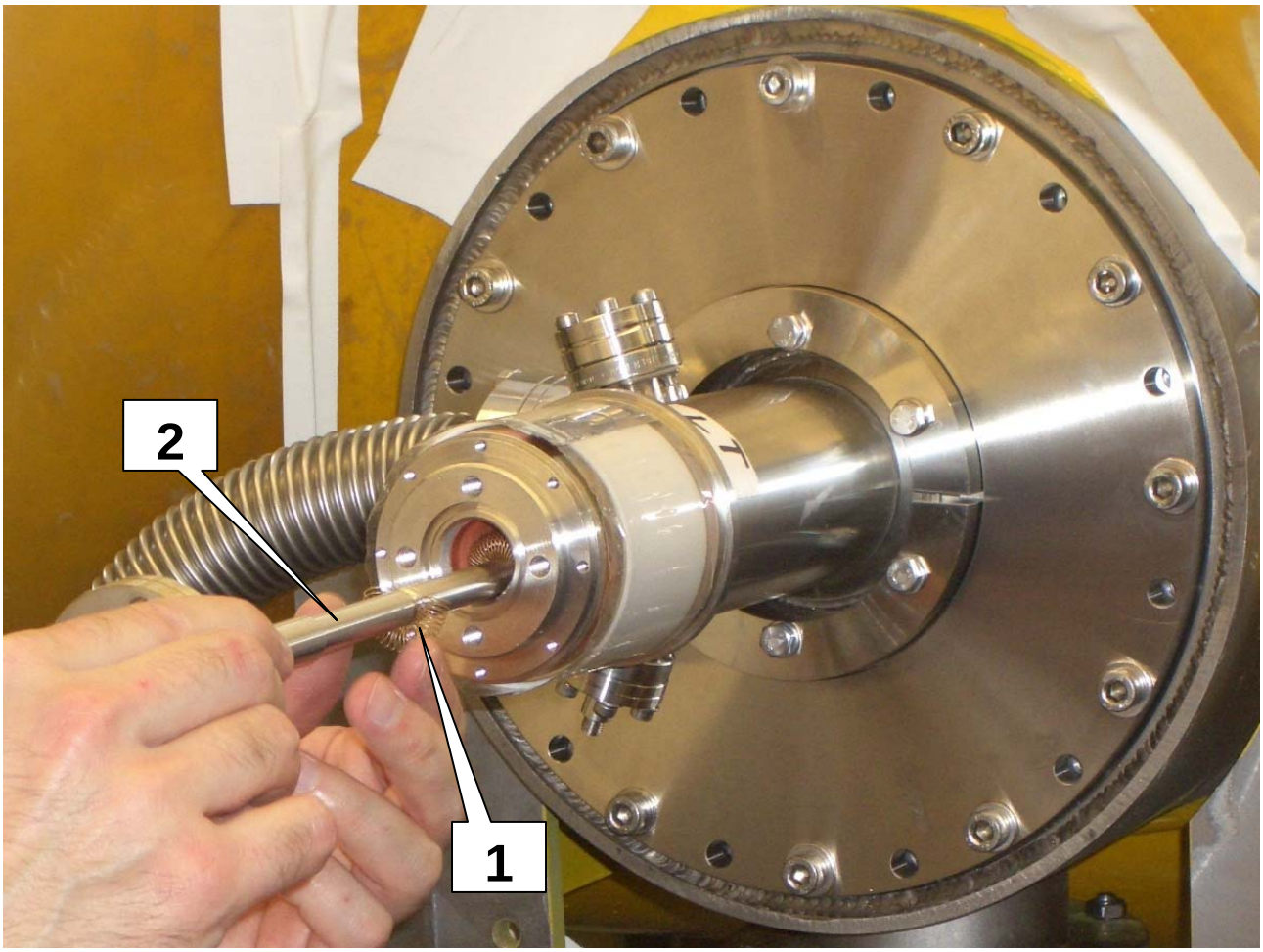


32. Install the nitrogen feed on CF35 coupler pumping flange, start the flow.

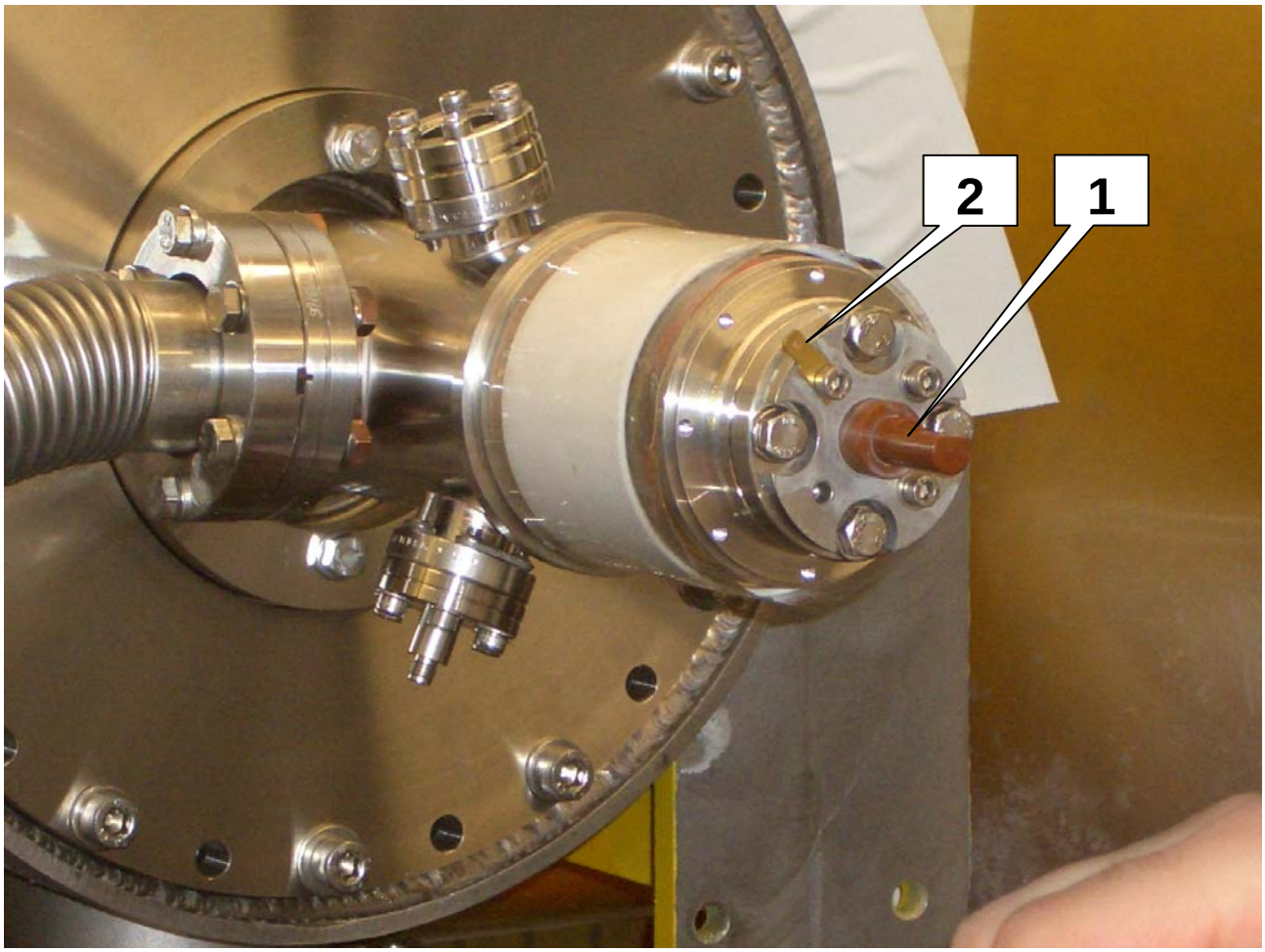
33. Install the e-3 pickup antenna [1] (if it is present in current design).



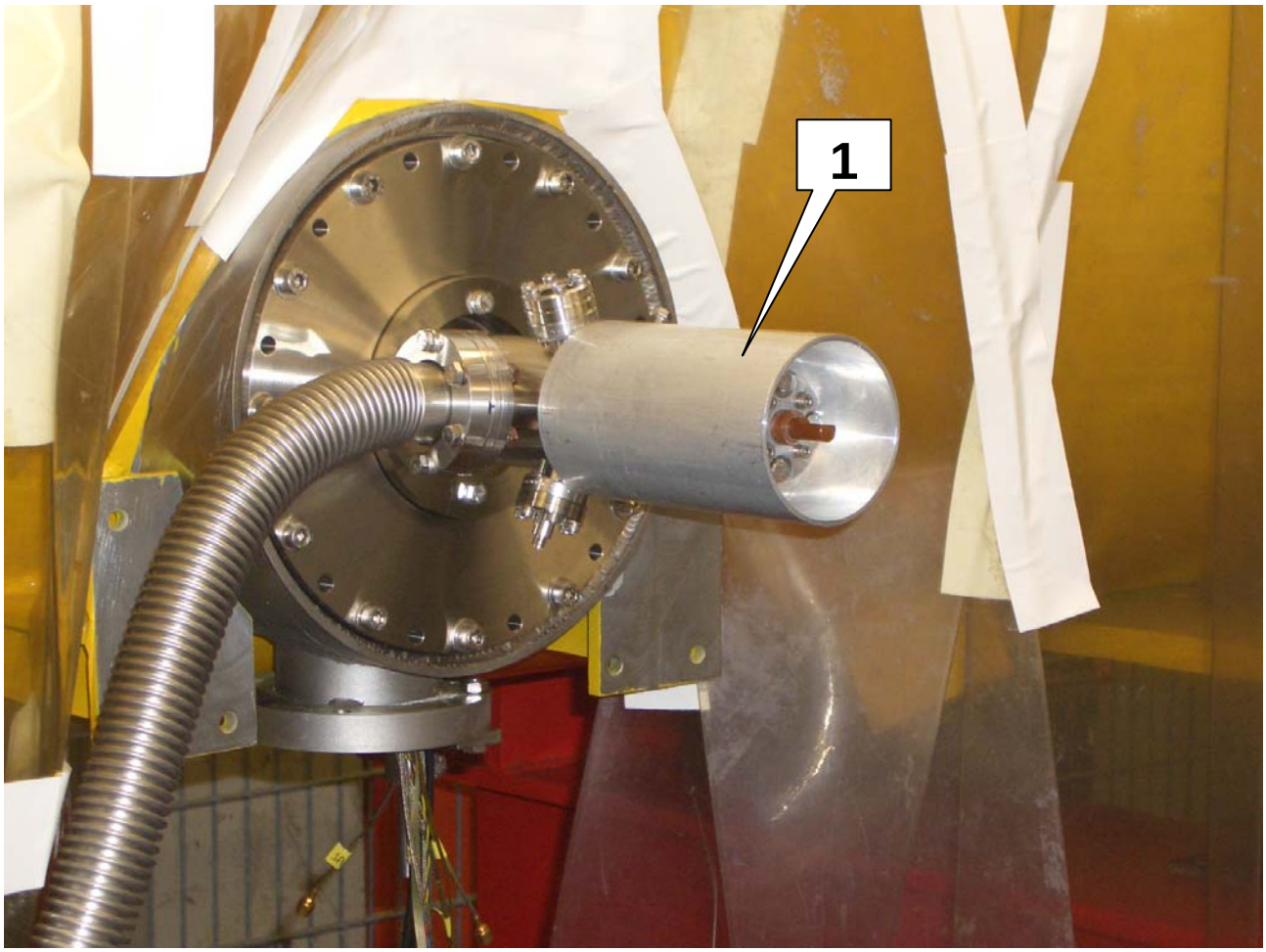
34. Install 2 Cu RF contact springs [1] on the tuning rod [2] (if not already done).
35. Remove the warm window ceramic protecting cap.
36. Put CF25 Cu seal and insert the tuning rod [2] inside the inner conductor rotated by 90° in respect to the final position, push the tuning mechanism and rotate the tuning mechanism assembly by 90°, check whether it is firmly attached, then put 4 M5 screws, attach the tuning mechanism flange screws tightening lever and tighten M5 screws, remove the lever afterwards.



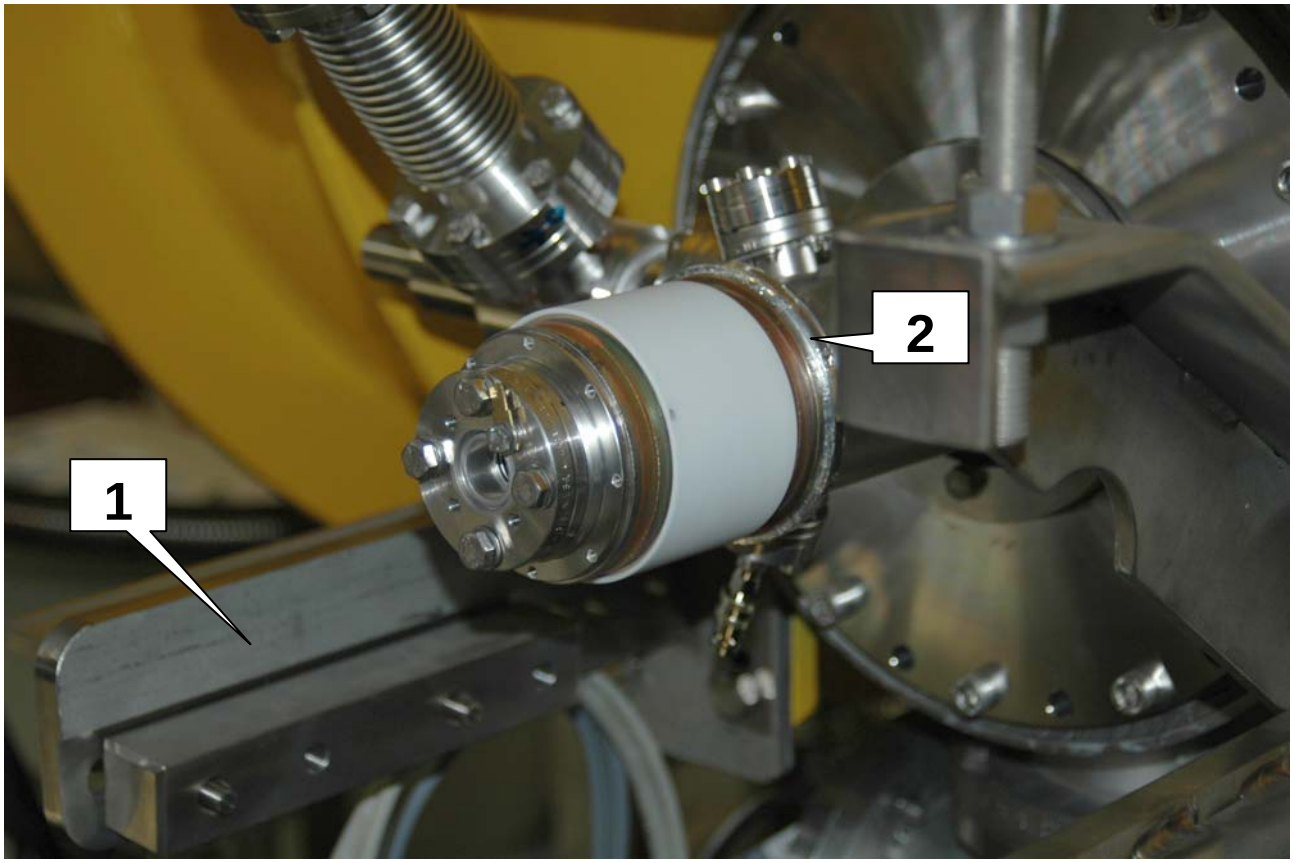
37. Install adjustment mechanism (tuning screw) [1] with HV connector [2].
(Subject to minor change in case of motor-tuning system)



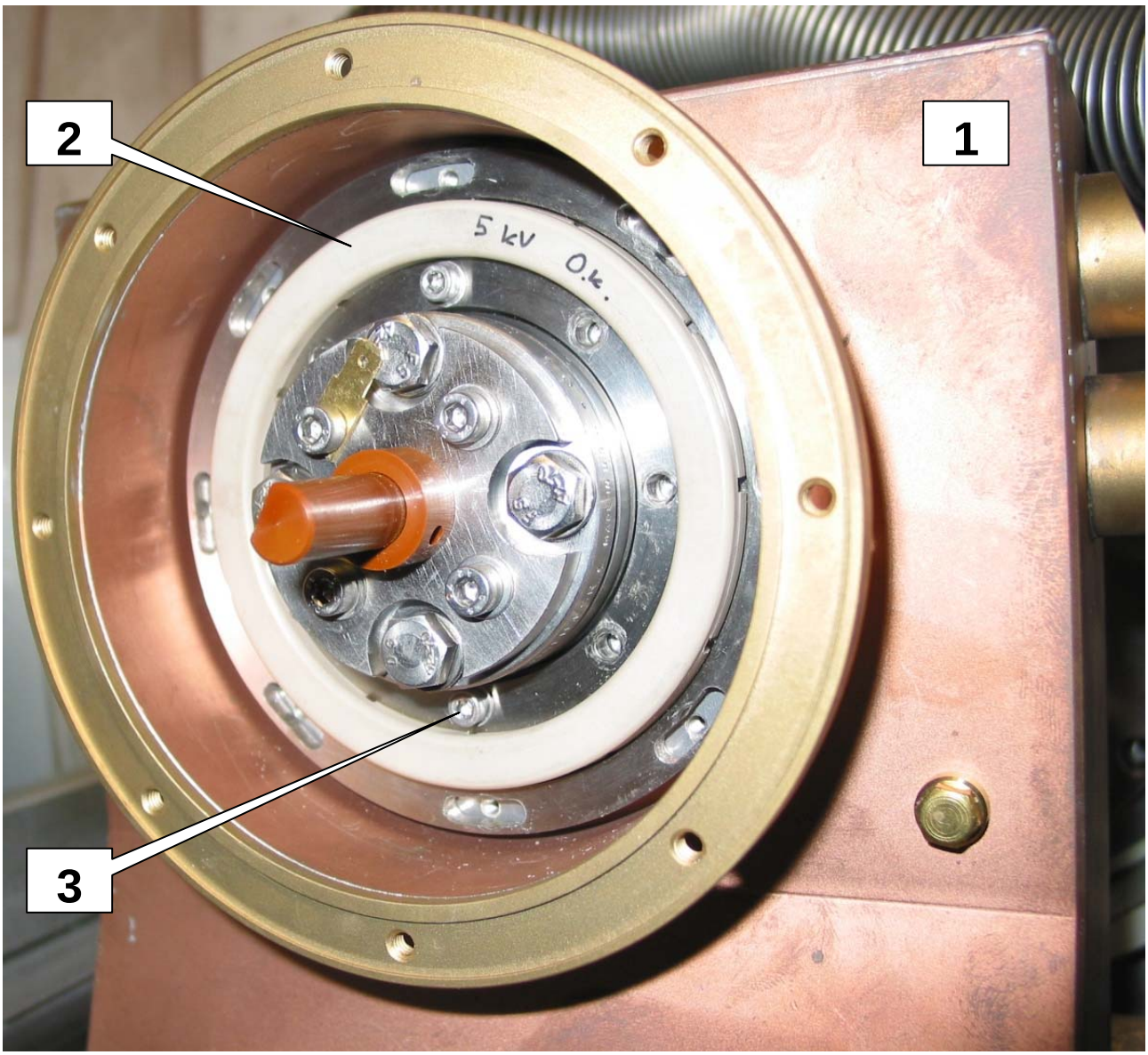
38. Put on the warm window protection [1] (Al cylinder, over the plastic cover).
39. Close the CF35 nitrogen flow and remove the feed.
40. Connect to the vacuum pump, pump down, do the leak search. After leak search is completed fill the coupler warm part with dry nitrogen and close the valve.



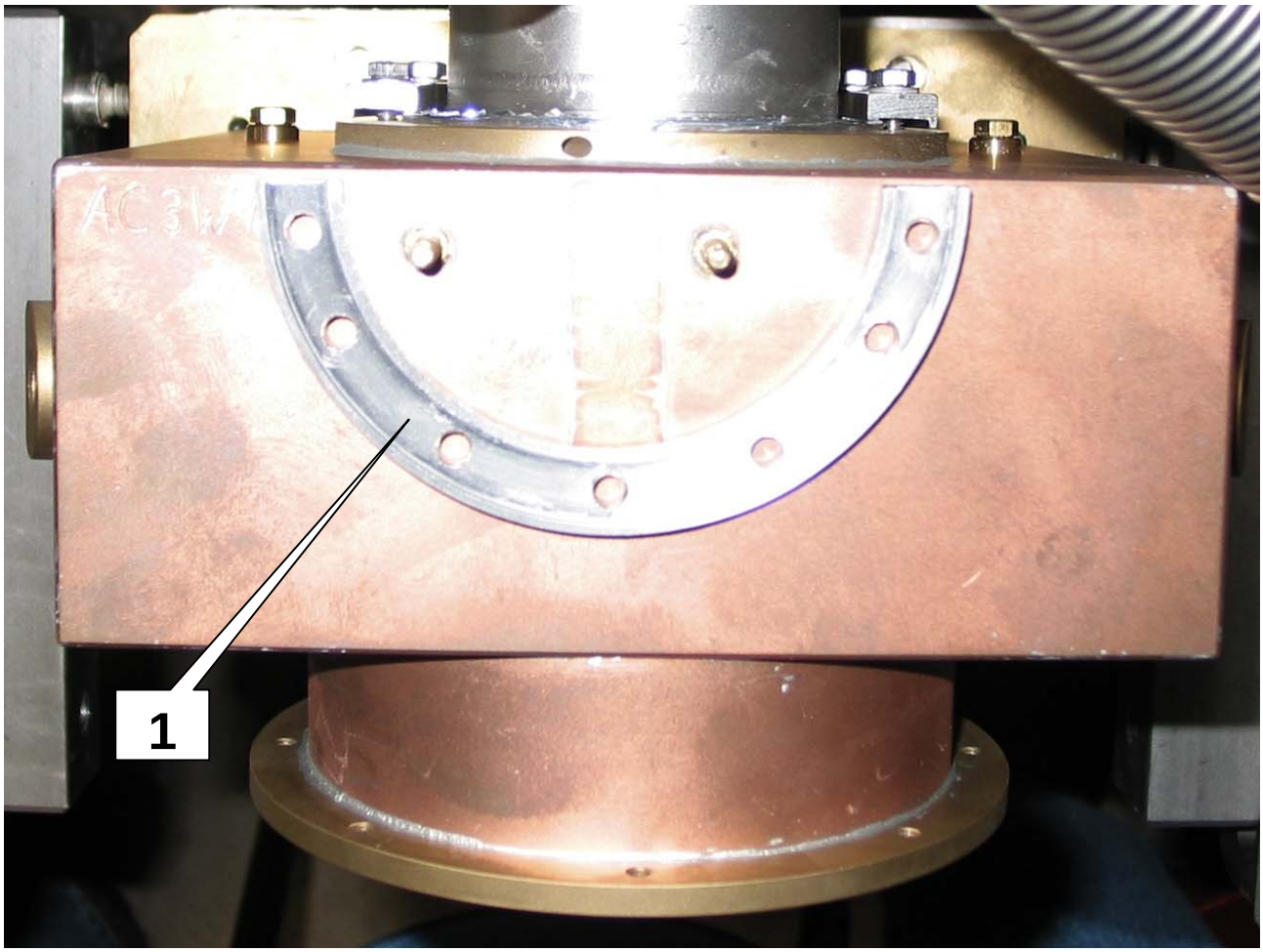
41. Mount the coupler support [1].
42. Remove the warm window protection (Al cylinder).
43. Wrap the warm part – WG box contact surface with 10 mm wide Al-foil stripe [2].



44. Install 14 threaded rods in the WG box [1] (coax part interface).
45. Slide the WG-box carefully into place – check Al-foil.
46. Hold the WG-part using the coupler support: install two connecting axles. Use small amount of a lubricant on the axles.
47. Remove the warm window ceramic plastic cover.
48. Install the capacitor [2]; fix it by only 2 inner screws [3], do not tighten yet.

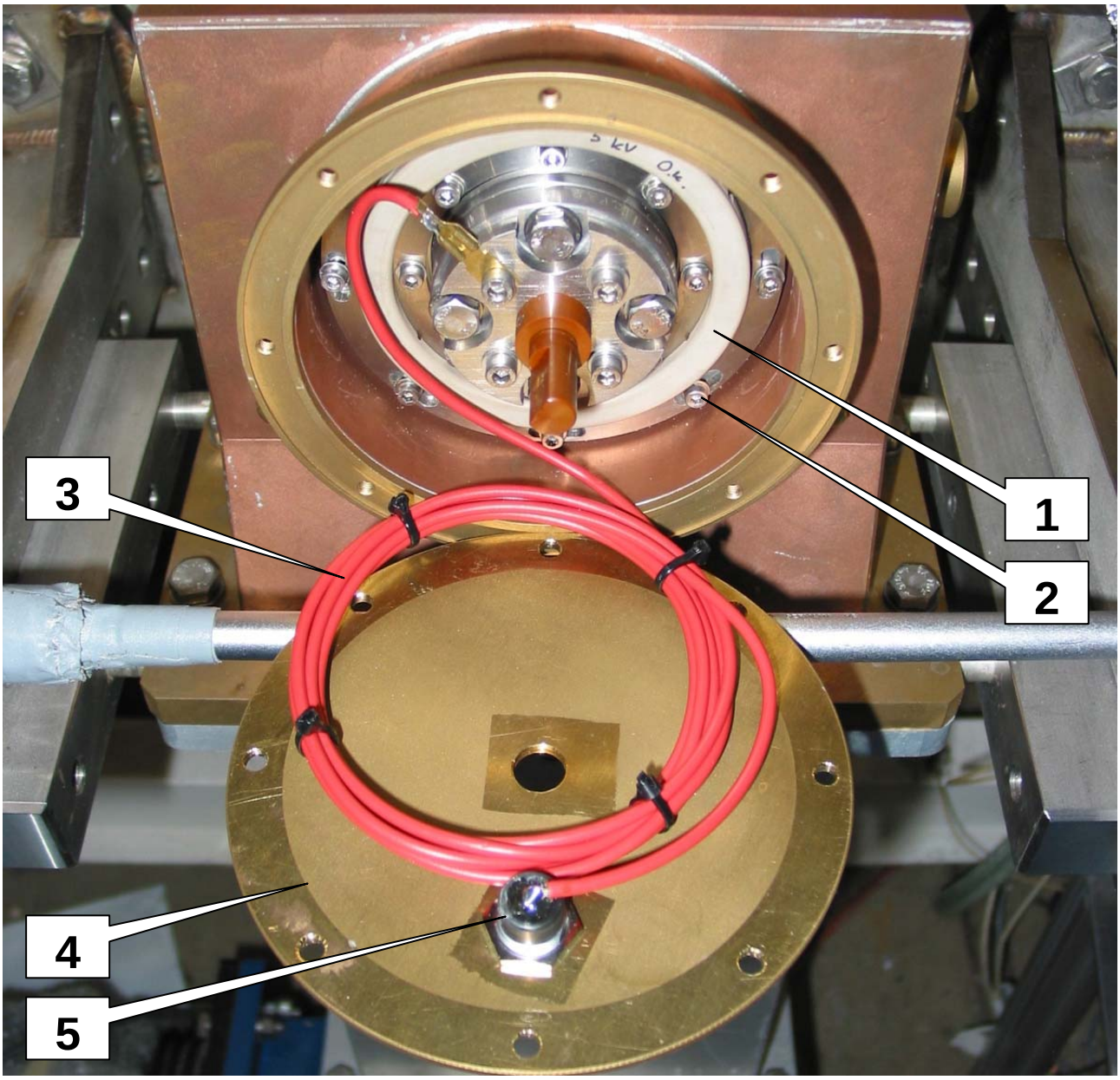


49. Install the stainless-steel half-rings [1] (use 14 M4 nuts with washers on the 14 threaded rods placed in the WG box), do not tighten yet.
50. Check the WG-part alignment with a level tool, correct if needed.
51. Install all the capacitor M3 screws: use the washers and lubricant.
52. Fasten the back half-rings nuts, do not over tighten.

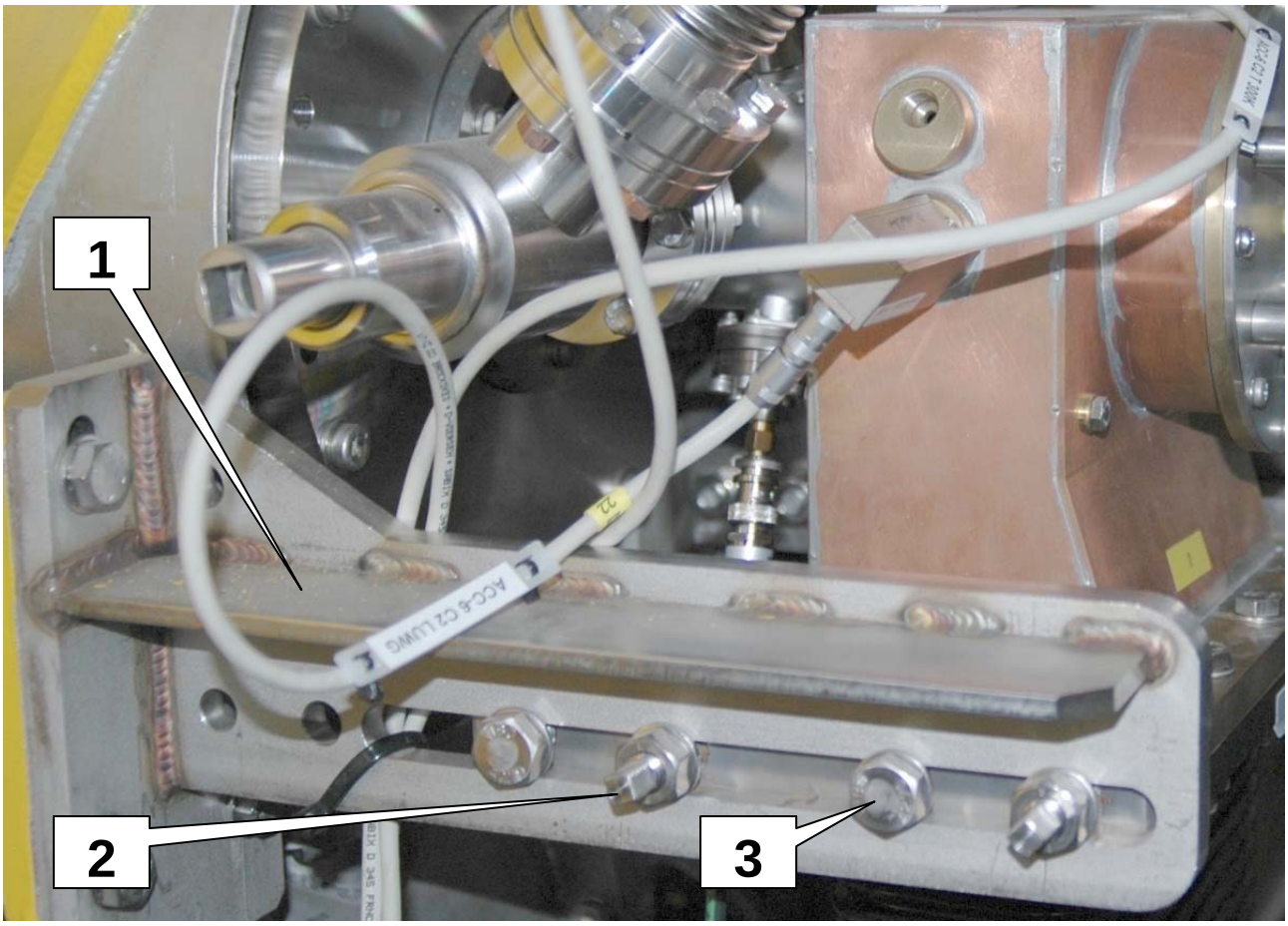


53. Tighten the capacitor [1] M3 screws [2] (use plane M2.5 inner screw driver).

54. Install and connect the HV coil [3] and WG-box cover plate [4] with HV feed [5].



55. Correct supporting brackets [1] position if needed.
56. Attach the WG-part to the coupler support: screw all 4 connecting axles [2]. Use small amount of a lubricant on the axles.
57. Tighten the coupler support M10 [3] screws. Tighten the coupler support axles nuts only with a hand, do not use the wrench.

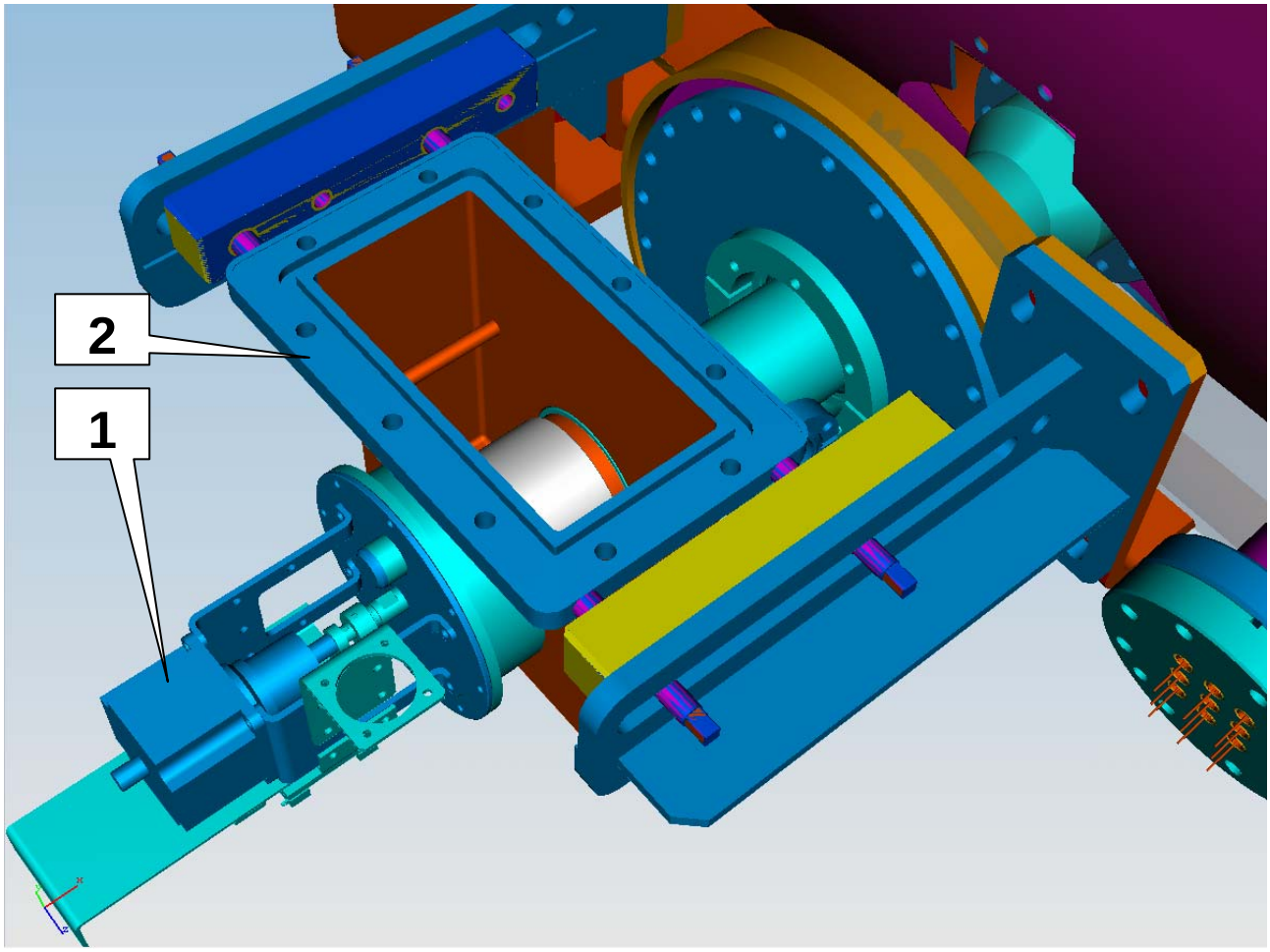


58. Attach the tuning motor assembly [1] and fix it.

59. Set protecting plate on the WG box rectangular flange [2].

60. Remove the Clean Room.

61. Check the HV input impedance with the DMM.



62. After all 8 couplers done warm coupler parts pumping system including the 100 mm pumping tube must be installed, leak search must be done. The pumping system must be filled with dry nitrogen afterwards.
63. Connect the coupler warm part to the pumping tube: remove the temporary valve on the CF35 coupler warm part pumping flange and install the bellow. It must be done in the local cleanroom. During the connection use dry nitrogen constant flow through the pumping system.
64. After all 8 couplers are connected to the pumping system do the vacuum leak search of the whole system.