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**UNIVERSITÄT
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Module 0

Top flange replacement and refurbishments

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General Plan

- Top flange (TF) of Module 0 has to be replaced
 - New design with improved reinforcement of vacuum pocket
 - Add Johnstons coupling
- General steps:
 0. Get new TF
 1. Mount J-coupling on new TF
 2. Take Mod 0 out of sleeve
 3. Remove all feedthroughs
 4. Remove old TF
 5. Module refurbishments
 6. Mount new TF
 7. Test all SC, LRS and CRS
 8. Sleeve insertion
 9. Test all SC, LRS and CRS (QA/QC checkout)



0. Get new TF

- Where is the last TF?
- Still in the 2x2 cryostat?
- Has to be mounted on a support to be able to work underneath

Tools/Installations needed:

- Crane?
- Support structure (e.g. Mod 0 support frame)

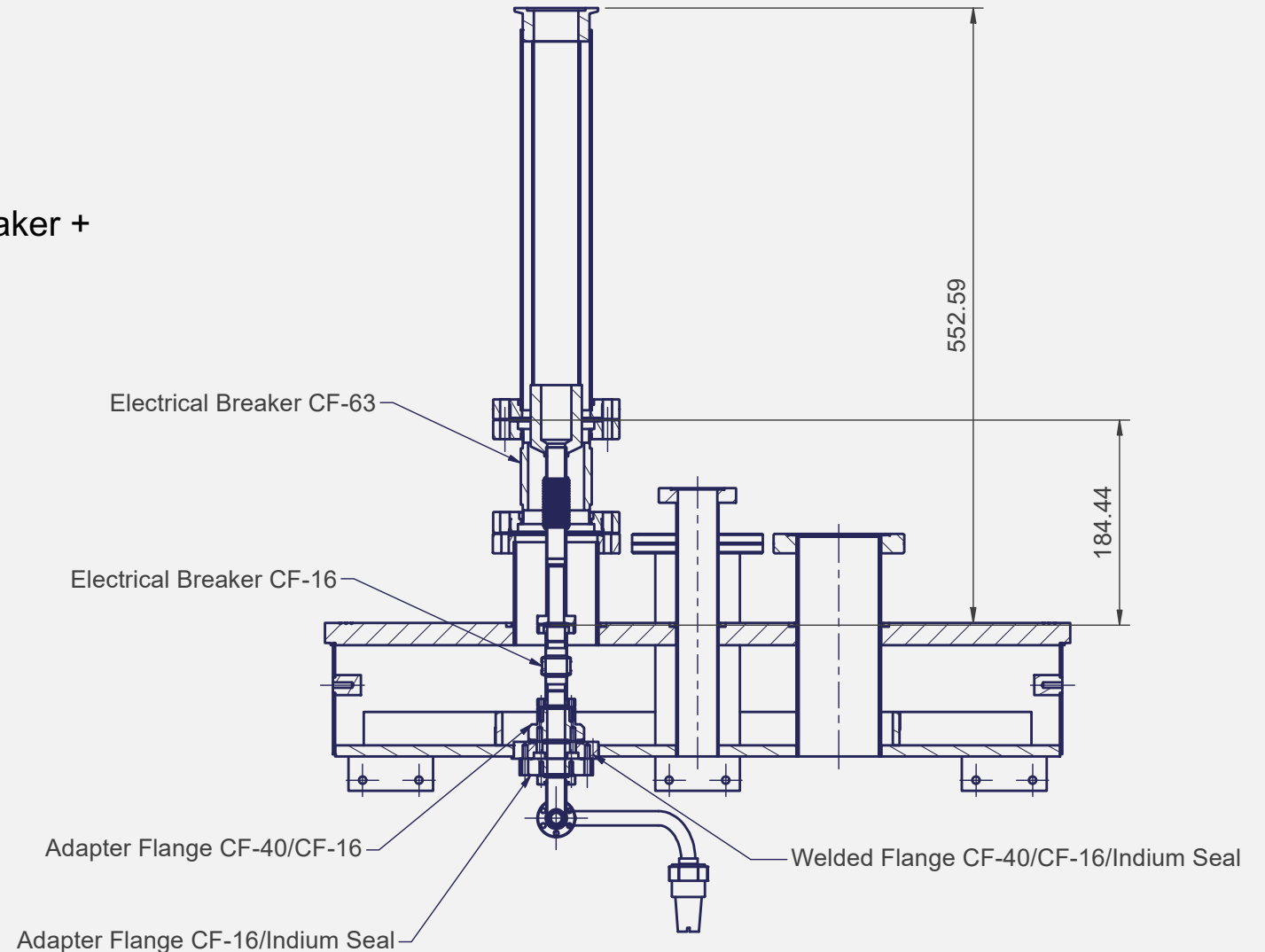
Time estimate: ???

1. Mount new J-coupling

- a) Release vacuum from pocket
- b) Take off blind flanges
- c) Mount big electrical breaker
- d) Assemble J-coupling + small electrical breaker + adapter CF16/40 (all CF)
- e) Mount j-coupling
- f) Pump out + Leak test
- g) Mount adapter indium seal/CF16

Tools/Installations needed:

- Helium leak tester
- Metric wrench set
- Metric allen keys (on hand)
- Indium (on hand)
- High vacuum grease ([Apiezon M](#))



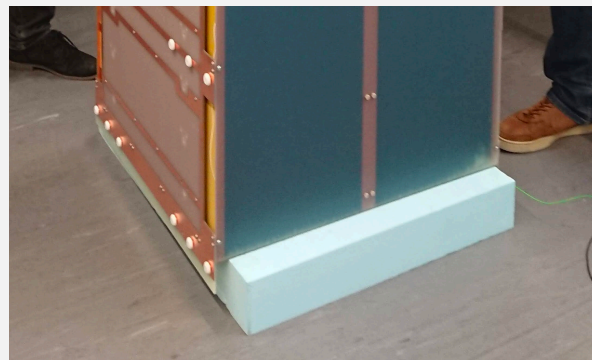
Time estimate: ~ 1/2 day

2. Take Mod-0 out of sleeve

- a) Ground TF
- b) Attach crane
- c) Put Mod0 on protection layer on the floor
 - **Module (also without sleeve) is self supporting!**
- d) Lift TF until “hovering” -> no stress on screws
- e) Remove screws (maybe adjust TF height)
- f) Lift module out
- g) Set down Mod0 on protection layer on the floor
 - **Module (also without sleeve) is self supporting!**
- h) Detach crane

Tools/Installations needed:

- Crane + operator
- Metric allen keys (on hands)
- Lab gloves
- **ESD protection!**



Time estimate: ~ 1h

3. Disconnect all feedthroughs (FT)

- a) Remove SC cylinder and Pacmans
- b) Maybe release tension on any cables going to FT
- c) Open SC FT flanges and disconnect D-Sub25 on cold side
- d) Remove T-piece and CF adapter
- e) Open Pacman FT and detach cables on cold side (very fragile!!)
- f) Disconnect LRS cables on cold side (through Pacman FT opening)
- g) Remove LRS FT
- h) Remove all adapters and T-Pieces
- i) Release vacuum on pocket
- j) Remove old LAr inlet

Tools/Installations needed:

- Metric allen keys (on hands)
- Metric wrenches
- Lab gloves
- **ESD protection!**



Time estimate: ~1 day

4. Remove old TF

- a) Ground Module and TF
- b) Make sure all cables are safely arranged
- c) Maybe remove support wires used for cable routing
- d) Remove HV isolator tube
- e) Attach crane
- f) Lift TF until “hovering” -> no stress on screws
- g) Remove screws (maybe adjust TF height)
- h) Lift off TF

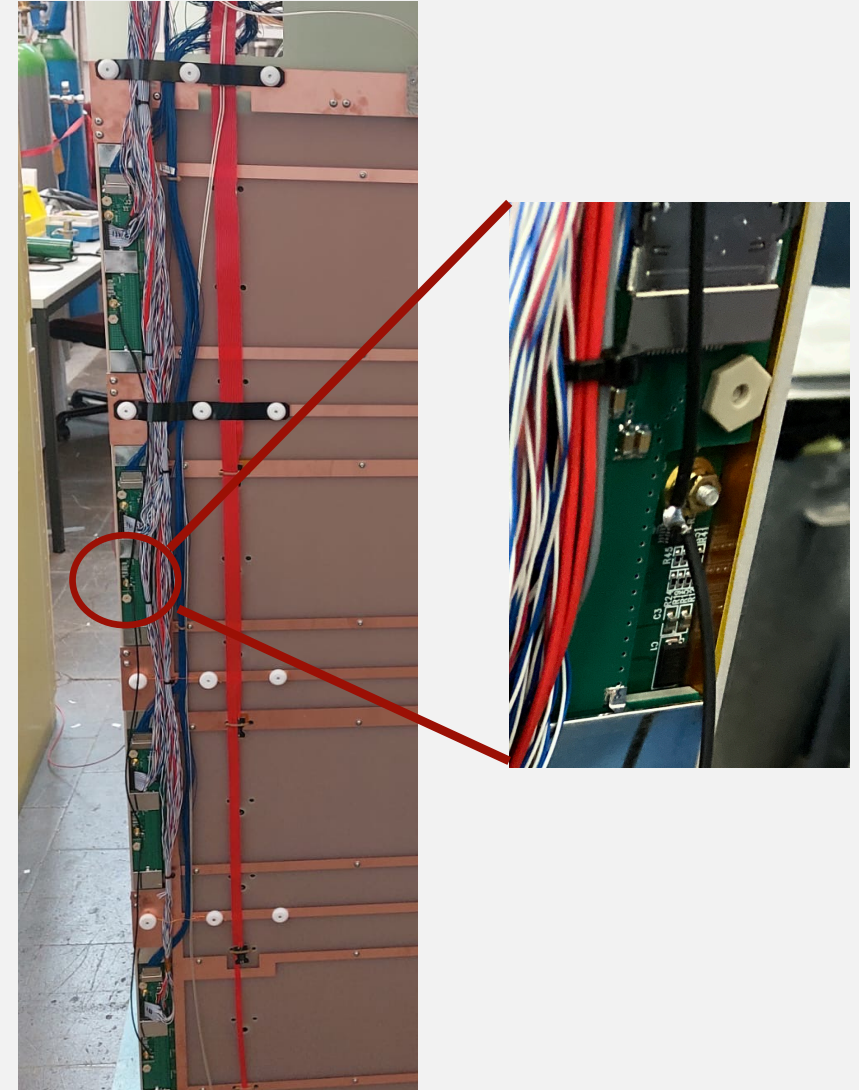
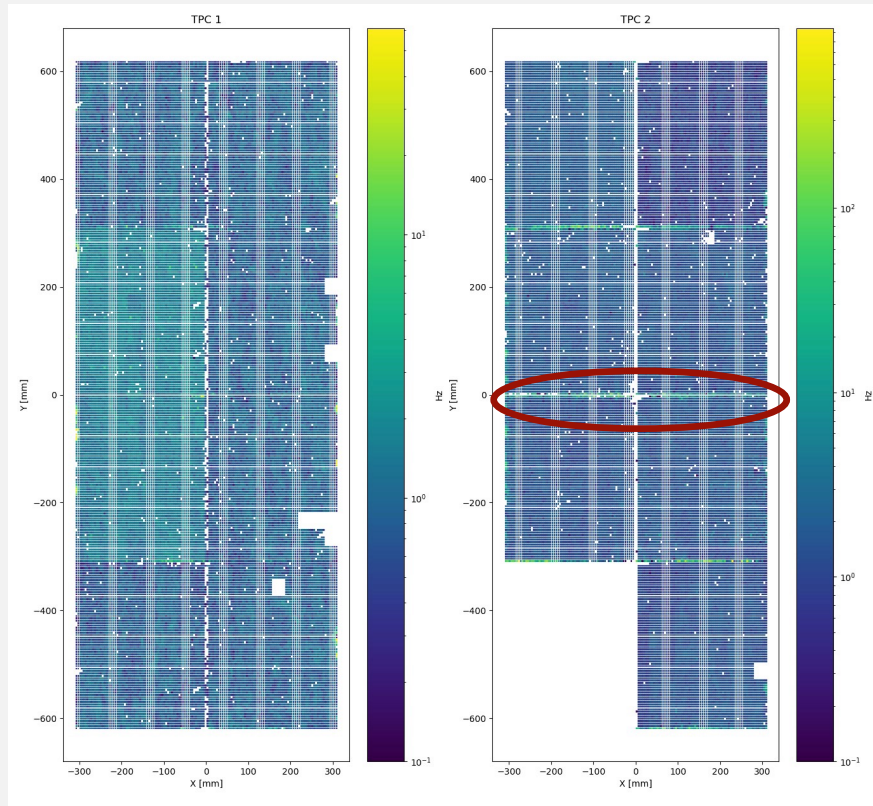
Tools/Installations needed:

- Crane + operator
- Metric wrenches
- Wire cutter
- Lab gloves
- **ESD protection!**

Time estimate: ~1 h

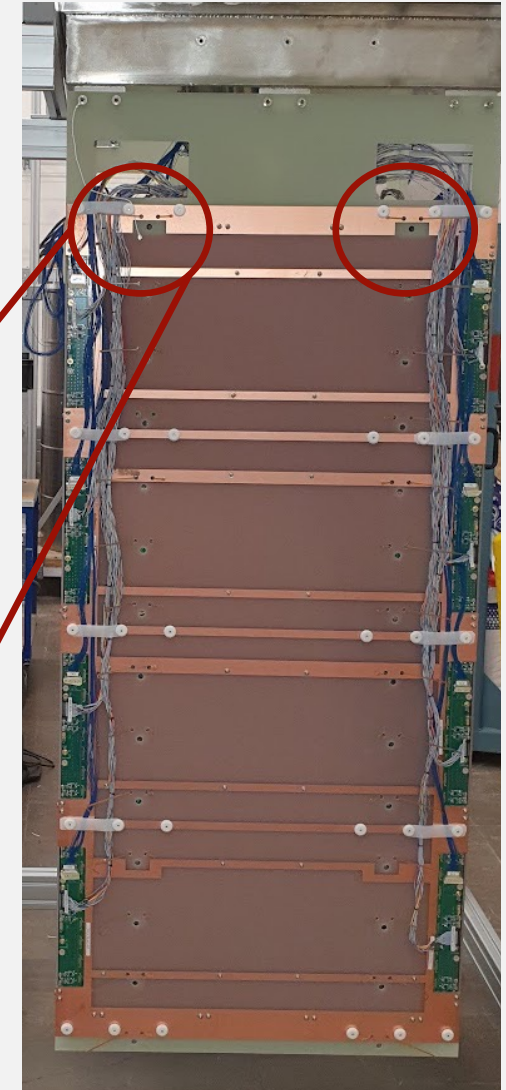
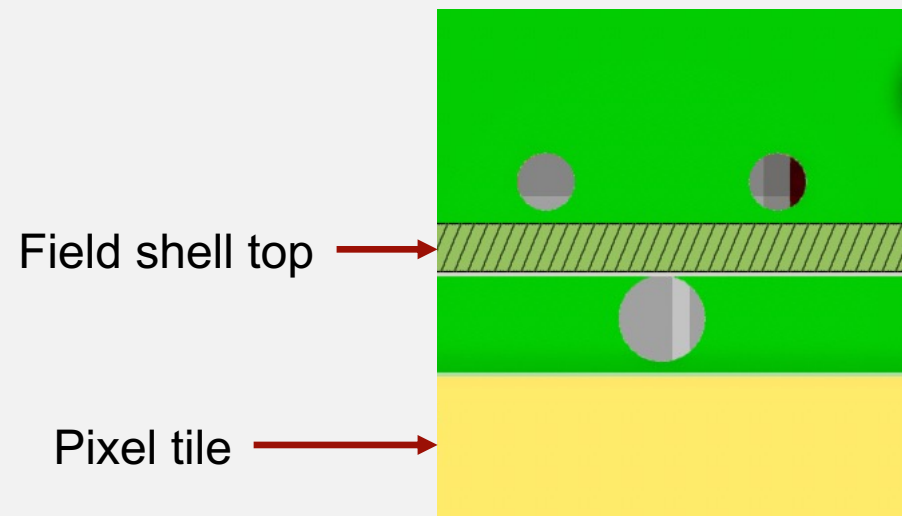
5. Refurbishments I: Grounding

- Add grounding lines as in Mod 1
- Reduces noise on edge pixels significantly
- “Low risk – high outcome”



5. Refurbishments II: LED

- Mod 0 does not have any calibration LEDs
 - Used pre-installed ones in Bern cryostat
- Either: Install LED in cryostat or in Mod0
- SC feedthrough can be used as in Mod1+
 - Needs modification of D-Sub connector on cold side
 - Soldering on/next to Module
 - Sacrifice 2-3 T-sensors (Mod0 has enough)
- But: No slot/hole as in Mod1 to put LED
 - Best option: use T-Sensor hole on very top



5. Refurbishments II: CRS

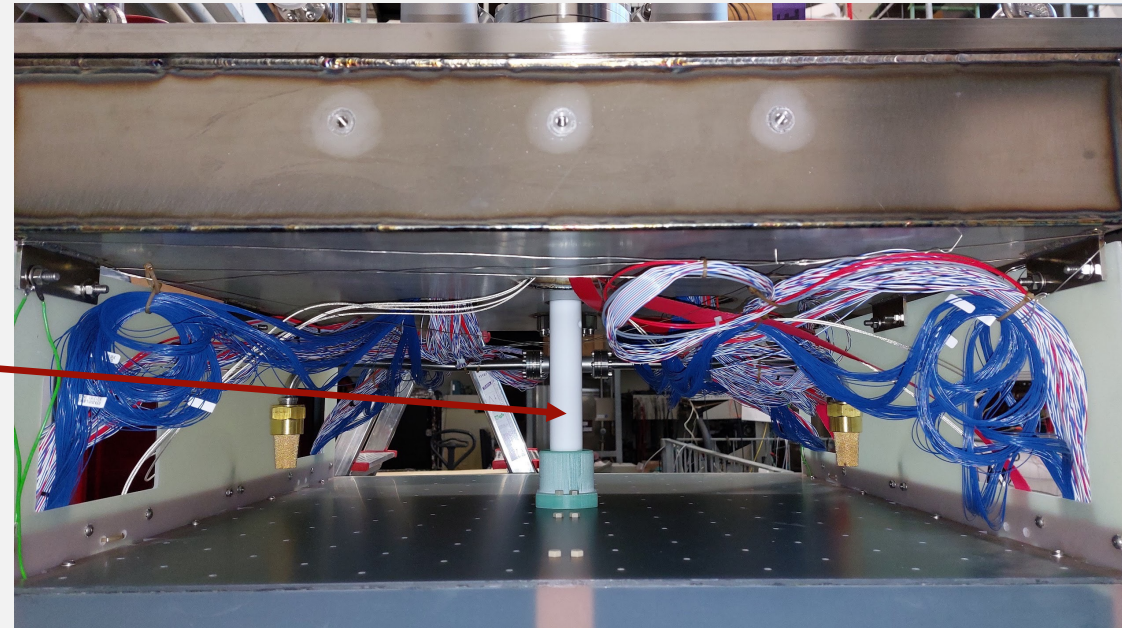
- Modify capacitor?
- TBD!

6. Mount new TF

- a) Mount T-Pieces and CF adapters on new TF
- b) Ground TF + module
- c) Lift new TF on Mod0
- d) Put 12 screws (maybe adjust TF height)
- e) Route cables to designated feedthrough places
- f) Mount SC, LRS, CRS FTs
- g) Place HV insulator tube
- h) Reinstall cable routing wires between TF and module

Tools/Installations needed:

- Crane + operator
- Metric wrenches + allen keys
- Wire cutter
- Lab gloves
- PEEK cable ties ([PLT1.5M-C71](#))
- ESD protection!



Time estimate: ~1 day

7. Test all LRS, CRS, RTD-SC

- a) Turn on RTD-SC (Livio)
 - i. Start Grafana and InfluxDB
 - ii. Turn on RTD-SC PS and check current drawn
 - iii. Test all T-sensors
 - iv. (Test calibration LEDs)
- b) Insert module to light tight (and noise shielded) enclosure (see slide below)
- c) Test CRS (experts needed)
 - i. Cooling needed ??
 - ii. Turn on fan PS
 - iii. Turn on PACMAN PS and check current drawn
 - iv. Run tests (see QA/QC procedure)
- d) Test LRS (Alexandr, Livio)
 - i. Turn on E-board PS and check current drawn

Tools/Installations needed:

- Lab gloves
- **ESD protection!**

Time estimate: ~1-2 days

8. Insert into sleeve

- a) Attach crane
- b) Lift module until hovering
- c) Adjust leveling
- d) Lift module over sleeve
- e) Attach plastic foils to sleeve to protect cables from edge
- f) Lower module into sleeve
- g) Insert screws one by one (Maybe adjust height)

Tools/Installations needed:

- Crane + operator
- Metric allen keys (I have)
- Plastic sheets (TBD)
- Lab gloves
- **ESD protection!**

Time estimate: ~1 h

9. Test all LRS, CRS, SC

- a) Turn on SlowControl (Livio)
 - i. Start Grafana and InfluxDB
 - ii. Turn on SC PS and check current drawn
 - iii. Test all T-sensors
 - iv. (Test calibration LEDs)
- b) Insert module to light tight (and noise shielded) enclosure (see slide below)
- c) Test CRS (experts needed)
 - i. **Cooling needed ??**
 - ii. Turn on fan PS
 - iii. Turn on PACMAN PS and check current drawn
 - iv. Run tests (see QA/QC procedure)
- d) **Mount Mod-0 in light tight enclosure**
- e) Test LRS (Alexandr, Livio)
 - i. Turn on E-board PS and check current drawn
 - ii. Check all channels individually with calibration LED
 - iii. **Full QA/QC procedure in progress**

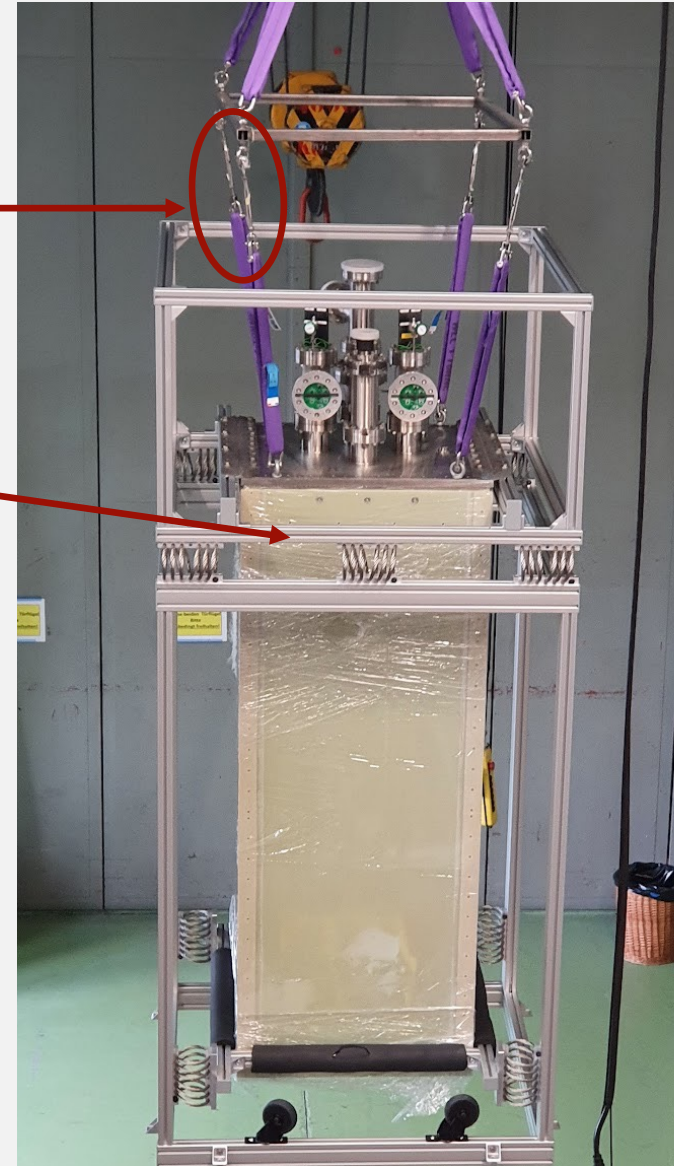
Tools/Installations needed:

- Crane + operator
- Lab gloves
- **ESD protection!**

Time estimate: ~1 day

Requirements Lifting

- Module weight 270kg
- Independent height adjustment on each corner
- Minimum lifting height (TF above ground):
 - Sleeve insertion: 3434mm (sleeve + module height)
 - Support structure extraction Mod-0: 3590 mm (Low frame + module)
 - Support structure extraction Mod-1+: 3381 mm (Low frame + module)
- Highest structure above module: 553 (J-coupling)



ESD protection

- Module grounding at TF
 - Make sure ground cable long enough for crane operation
 - If TF detached ground at anode plane
- Hand wrists

Light tight enclosure

- SiPM bias can NOT be turned on with ambient light
- LRS sensitive to single photons
- Idea: Use wooden shipping box and make it light tight
 - “Dummy” feedthrough with black styrofoam
 - Light tight tape to close edges

- Add faraday cage to test CRS?