ELENA Source Charging Up status and plans

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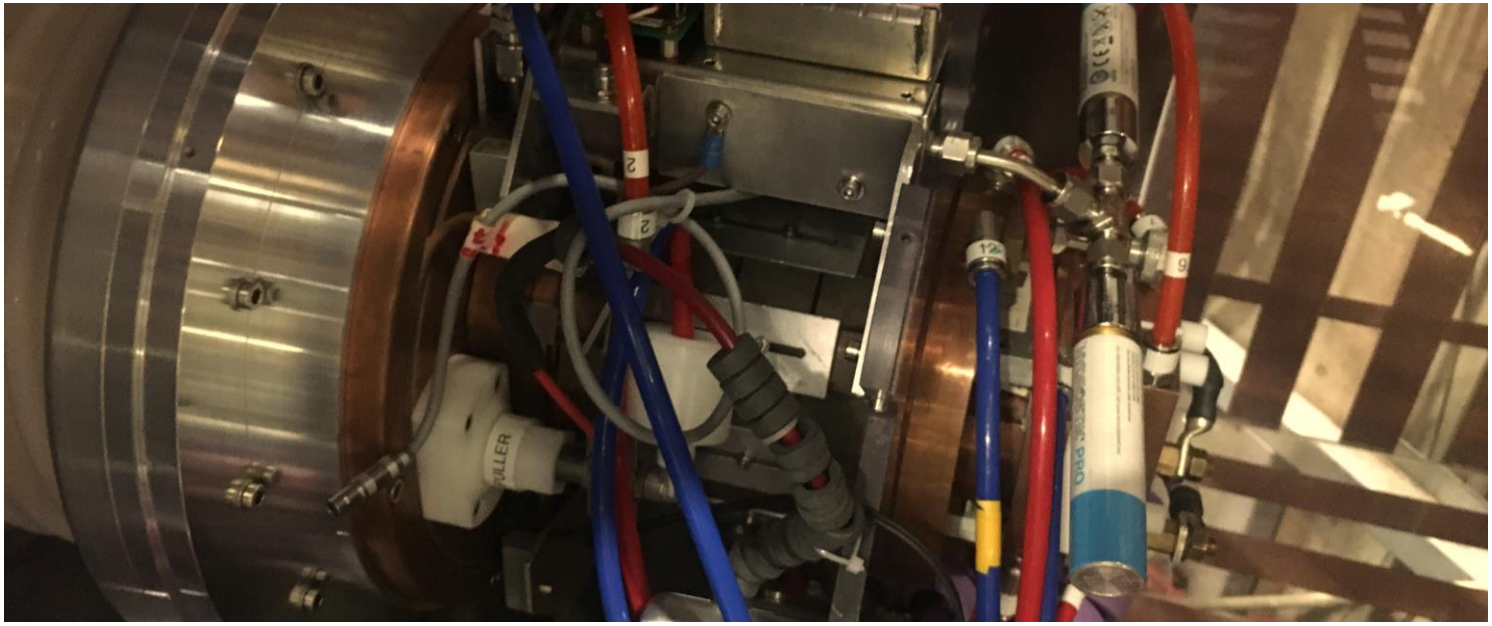
29th of Sep. 2020

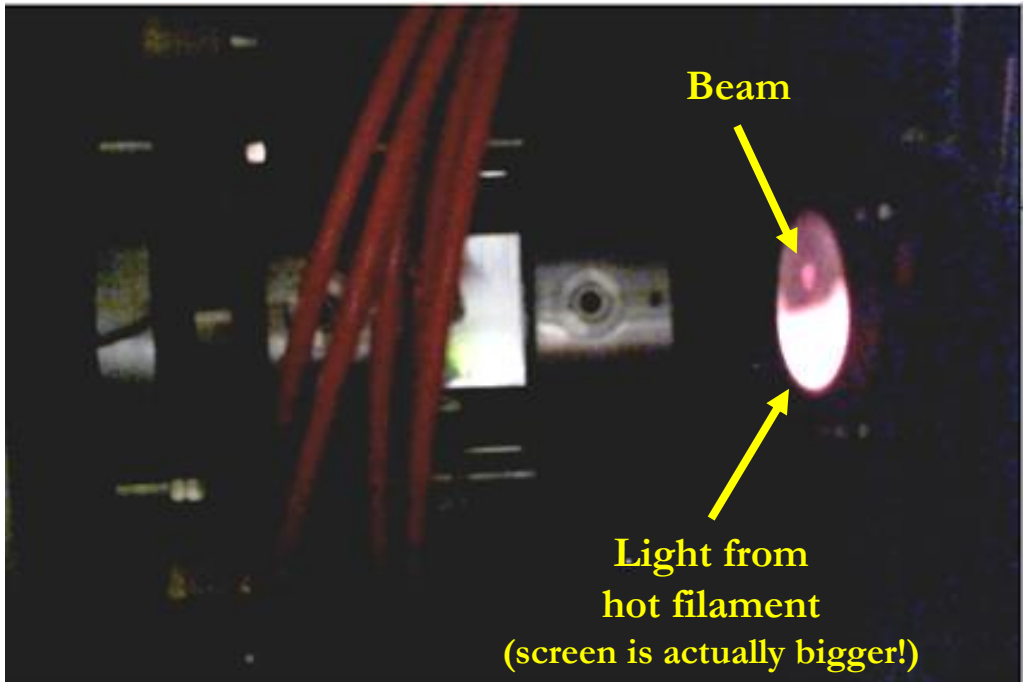


- Just a few slides with pictures and previous observations

General observations

- Charging up typically takes hours, then beam becomes unstable on "short" **time scales: from a few hours to a few minutes.**
- Beam movements on the ring (**BTV**) are visible on LNS quadrupoles **power supplies** and are **correlated** with movements on the **SEM** in front of the source.
- Having **strong (>1kV) steering in the source correctors** is **typically bad**: when in this condition, is very likely that **beam will move in a few minutes**.
- **After opening the source**, it might be that the source looks **more unstable** for a few weeks, than things becomes more quiet.
  - Is it because we find back a "sweet working point" or because something gets "conditioned"?

Some obs. with screen in – 19/10/20



First checks:

- **all quadrupole's electrode are well connected** and steer the beam as expected
  - They also do focus/defocus the beam as expected
- All the visible **metallic parts** (but "**triple junction**" **shielding** – **not checked**) are **grounded**

Additional observations:

- **"dark current" poorly visible**, but when enhanced (e.g. bad negative puller settings), several spots appear on the screen (no picture available)
- **Possible to measure beam current** (and probably dark current) on the screen plate uses as **Faraday cup.**

Some observations 18/09/20

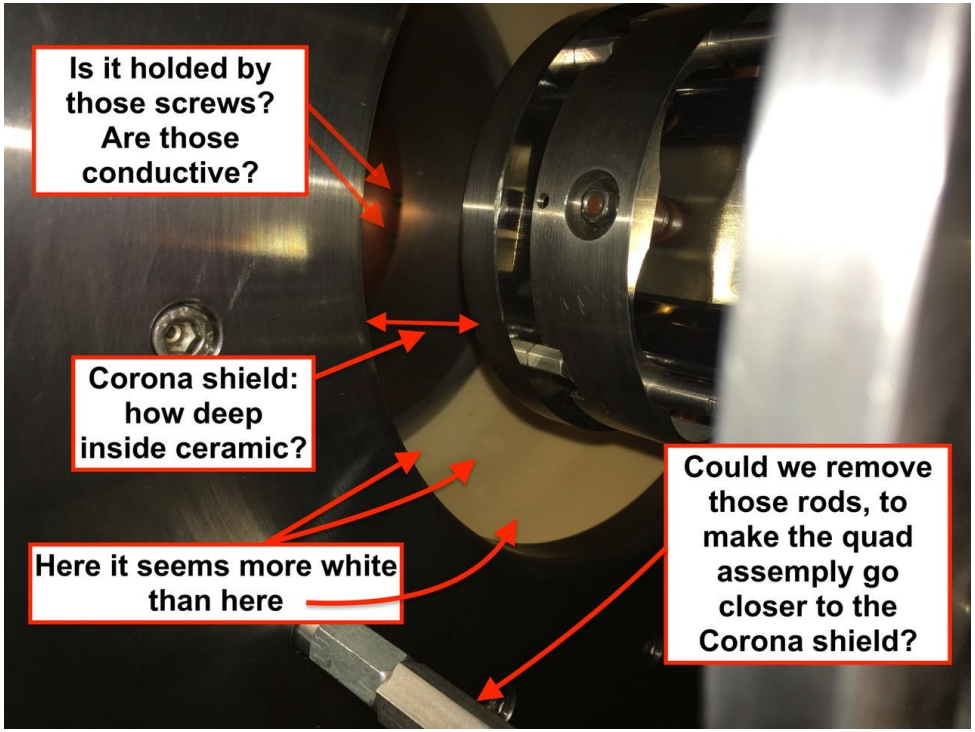
1. charging up is surely due to "negative" puller settings, i.e. not due to the short beam we produce.
   - It **can be reproduced**, for example, by "charging up" with negative puller at 400 V instead of 250 for a few seconds. with or without pulsing the actual beam (i.e. the positive puller).
2. the charging up seems to be faster for higher filament currents.
   - **still to be checked carefully**.
3. the charging up happens at least at 60 kV (maybe even at 100 kV).
   - It **can be reproduced** by stop pulsing the HV, setting the puller negative at 400 V, back to 250, HV on, beam, ... moved. then slowly recovering initial position (more or less)
4. charging up is certainly generated in the source
   - it **can be reproduced** by positive puller at 400 V for a few seconds without main beam with source valve closed. (in same condition, but with normal puller at 250 V, nothing happens)
5. using the steerers is very bad! with a few seconds on very high voltages, the beam then becomes much more unstable.
   - **Did not manage to reproduce**! To be checked.
   - Are we maybe looking at two kind of charging up: one that can be controlled (e.g. puller negative at 400 V) and one not ("fast") move of the beam spot.

Short term plans

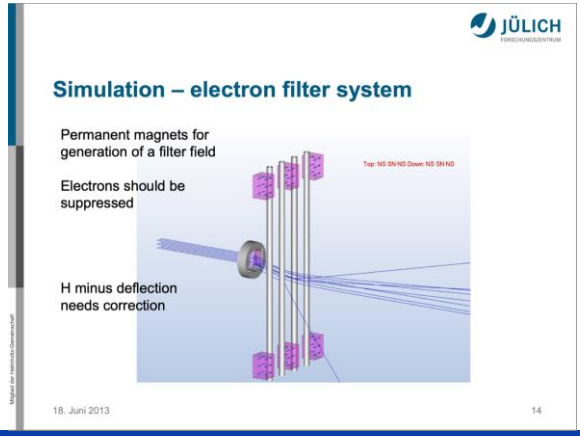
- Get a **digital camera** from Stephane B. and configure it on local windows computer
  - Ongoing
- See if we can have a **screen always in**:
  - Should we just produce the same size screen with a 10 mm diameter hole in the middle?
- Add **additional feedthrough and cabling** for "Faraday cup" measurement
  - We have everything. Just matter of doing it next time we open. **Suggestion** to use **isolated feedthrough for Pearson** signal and present **not-isolated one for Faraday cup**

Long term: brainstorming

- Is there **something in this region but the ceramic** that could charge up?
- Should we bring the **quad assembly closer** to the puller?
- Should we install a "**proper puller**" instead of the simple "ground electrode" presently used to shield the quads.



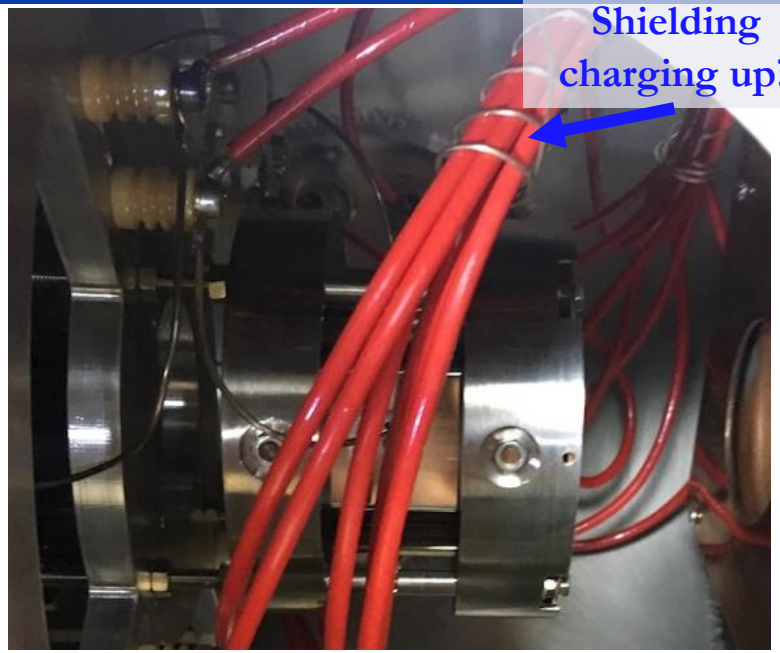
- In 2013 - link - Ralf mentioned that H- deflection needs correction. Can something "inside" the puller and/or magnetic filter region "charge up" and change the "angle" of the extracted beam?
  - Should we remove the source and check if there are spots/damages between puller and the source body or between the puller and ceramic?

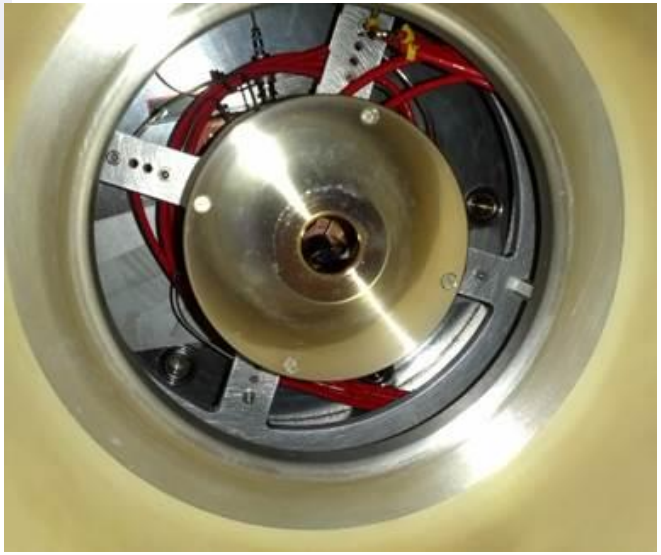


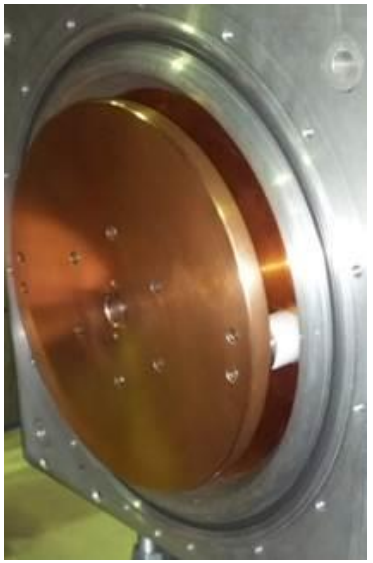
Some comments from the meeting:

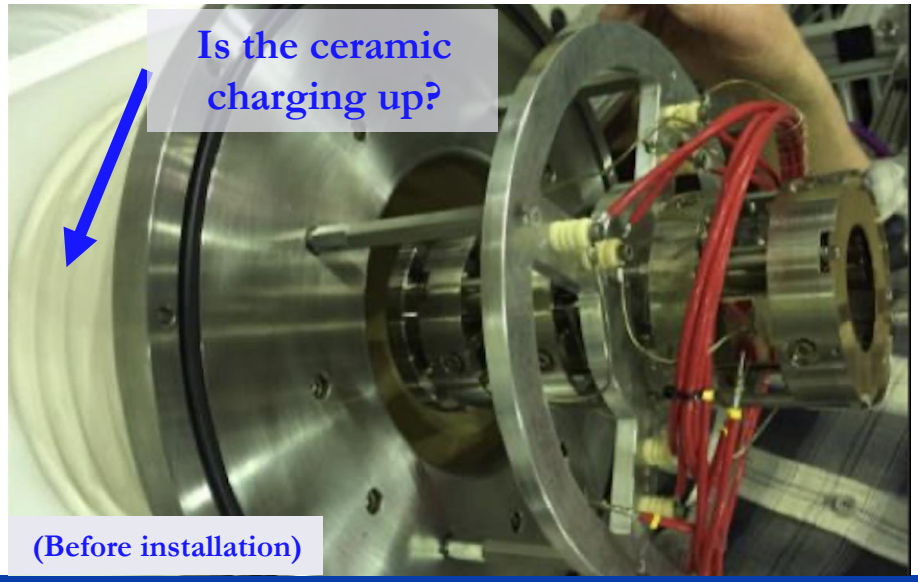
- Add tube to reduce aperture toward ring
  - To improve vacuum in the transfer line and be more comfortable on high gas pressure operation
- Don't try to clean insulator!!!
  - Will likely damage the insulator
- Add better insulation of quadrupole wires with simple metallic/grounded wire as already done, but extended.
- Change ground electrode:
  1. Fredrik will look if we can adapt some "proper puller"
  2. We can indeed think of moving in the quads a bit and see what happens
     - No real concern about alignment
- Puller material maybe important for secondary particle production and so dark current. In principle one could investigate different materials, but finally best from experience is polished stainless steel…
- Work with much higher positive puller settings, but looking at radiation level as a mean to optimize dark current emission

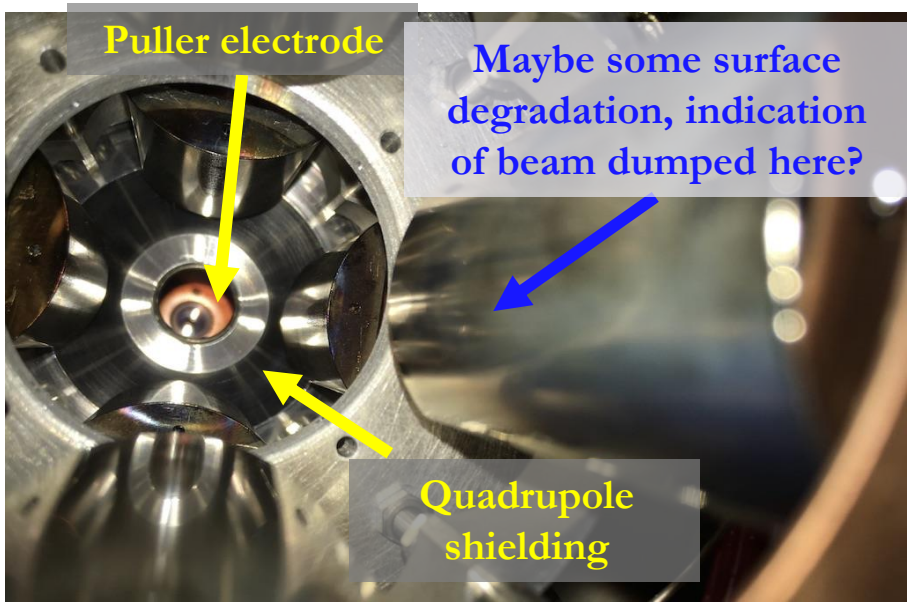
Some pictures



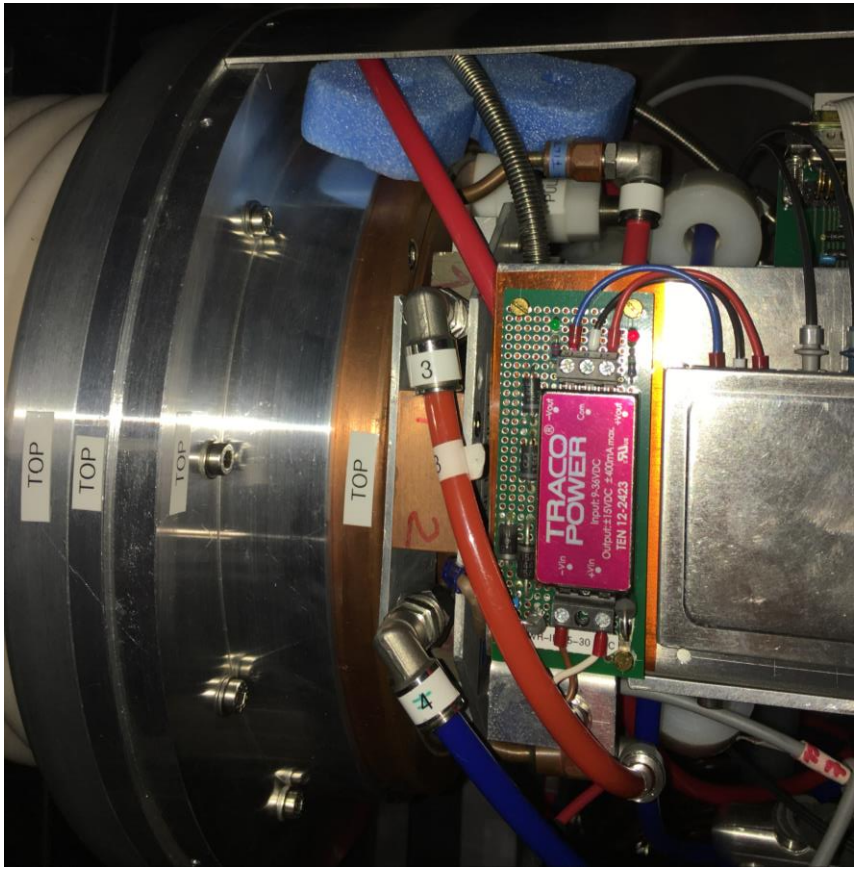


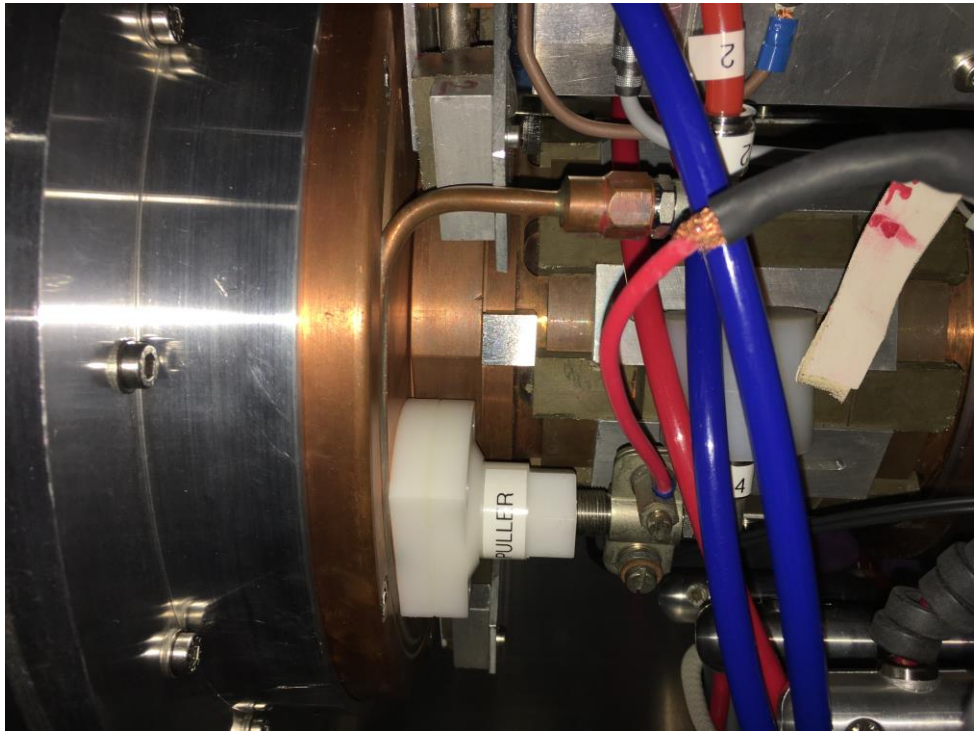






Some pictures





Source view