

# Status of HV power supply and HV feedthrough for the 6x6x6

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# High voltage power supplies

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**February 10th, 2017:** Joint Meeting with SP to discuss about PSUs for ProtoDUNE detectors organised by Eric James:

- **Assistants:** Eric James, Flavio Cavanna, Dario Autiero, Sarah Lockwitz, Andrew Renshaw, Franco Sergiampietri, Flor De Maria Blaszczyk, Sebastien Murphy, Laura Molina Bueno.
- **Summary:** Because of the large cost, it may not be possible to order a third 300kV Heinzinger HV supply for use as a joint ProtoDUNE-SP/ProtoDUNE-DP spare. Although the chance of a HV supply failure during detector operations is small, this still seems like a dangerous situation since loss of a supply could effectively end data taking during the short test beam operations period available in summer/fall 2018. Eric has talked to Hanguo Wang at UCLA who might be willing to let us keep his 200 kV at CERN during the data taking period in 2018. This supply could serve as the back-up for ProtoDUNE-SP and in the case of a failure of the ProtoDUNE-DP supply could be used to free up the nominal 300 kV ProtoDUNE-SP HV supply, which could then be used as a back-up for ProtoDUNE-DP. Sizes of the power output supply cables differ between modules:

PSU	Cable diameter [mm]	Detector
Heinzinger 300kV	22	3x1x1/ProtoDUNESP
New Heinzinger 300 kV	38	ProtoDUNEDP
200 kV PSU from UCLA	38?	Spare for ProtoDUNE-SP
100 kV	14	3x1x1

Flor reported on several options they would like to have for the PSU to ProtoDUNE SP as **Ethernet/RS232 16-bit**.

# High voltage power supplies

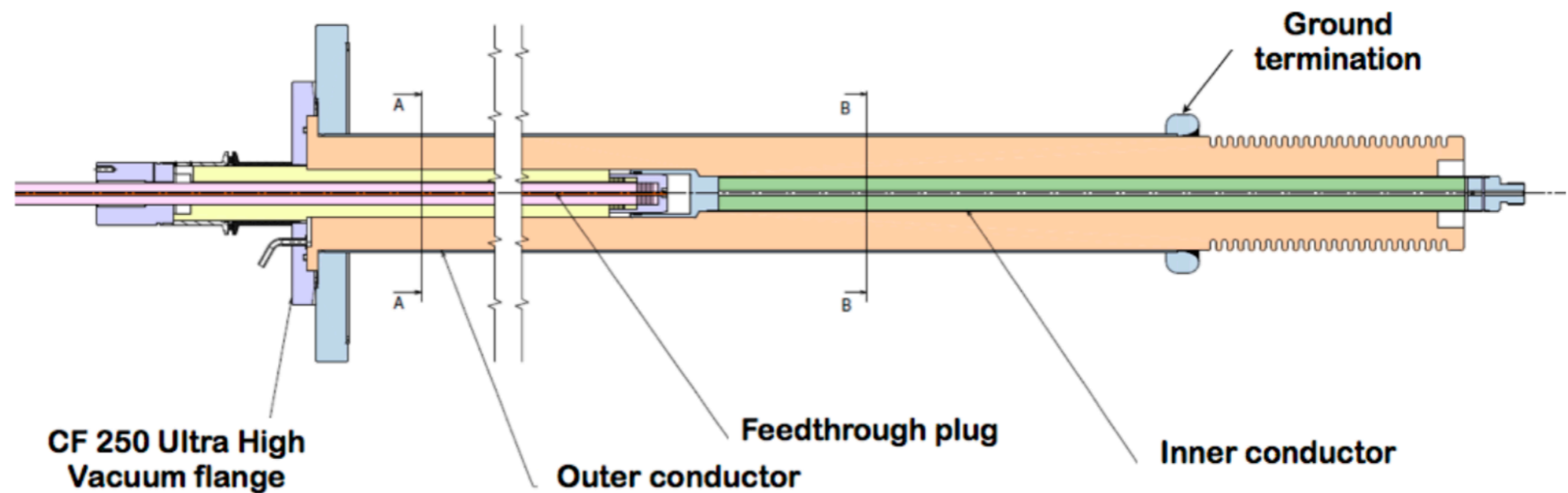
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- **Proposed plan of action:**

- \* Franco agreed that he would contact Heinzinger to see if the Ethernet/RS232 16-bit control option could be added to the recently-placed order for the second 300 kV supply. It was agreed that this supply (when it arrives at CERN) could be used by the people working on the slow controls interface – hopefully as early as this summer.
- \* We would work to understand when we would need to return the current 300 kV supply used by the 3x1x1 to the company to have the additional option added (probably early fall 2017). In the meantime, this supply would continue to be used for the 3x1x1, although a separate 100 kV supply has been ordered and will be available when the swap out needs to occur.
- \* Flor will continue to study whether there are additional options that SP would like to have added to the current 300 kV supply for use in ProtoDUNE-SP, and the topic will be re-visit before it is sent out to the company to have the Ethernet/RS232 16-bit control option added in the fall.
- \* I will work with Sarah to set up a regular, on-order-of monthly meeting, for this group in the context of the Joint Single-Phase/Dual-Phase HV Working Group to continue these Technical discussions moving forward. Eric mentioned that Francesco Pietropaolo and Bo Yu will join also these meetings as HV is included in ProtoDUNE-SP CPA/FC/HV working group. He asked me if we want to include people from DP and I propose to include Animesh, Cosimo and Yann.

# High voltage feedthrough

- Minor changes need to be done in the design respect to the one 300kV feedthrough already installed in the 3x1x1, to accept the new HV cable
- 3D drawings are work in progress.

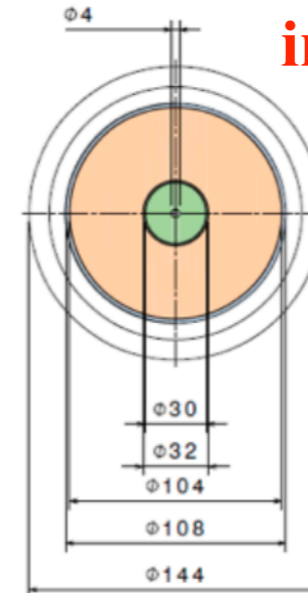
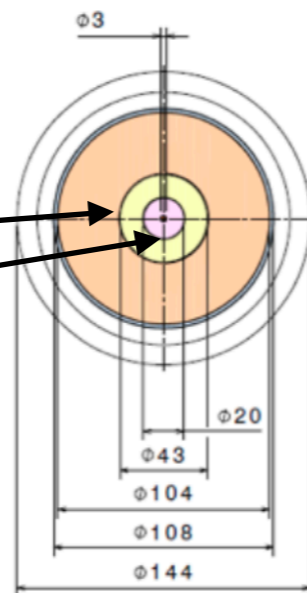


SECTION A-A

SECTION B-B

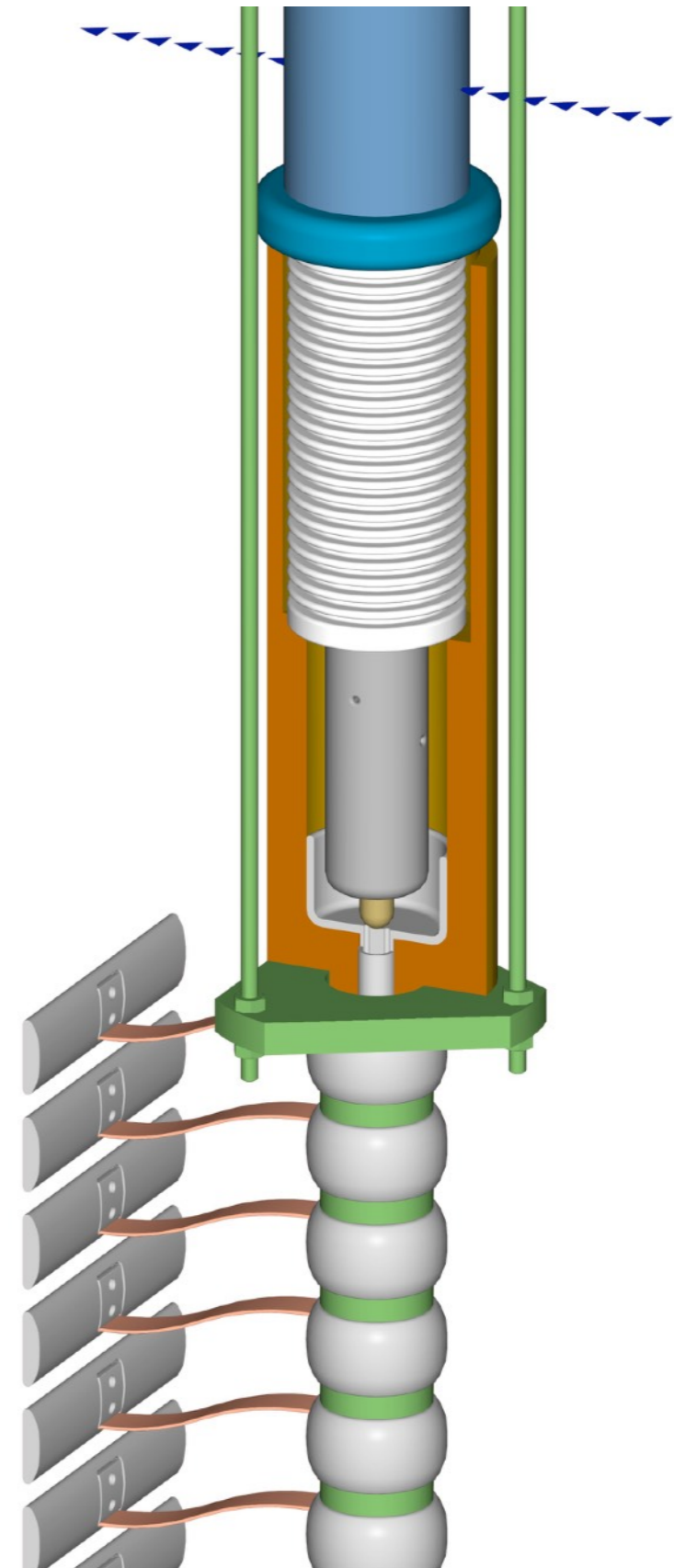
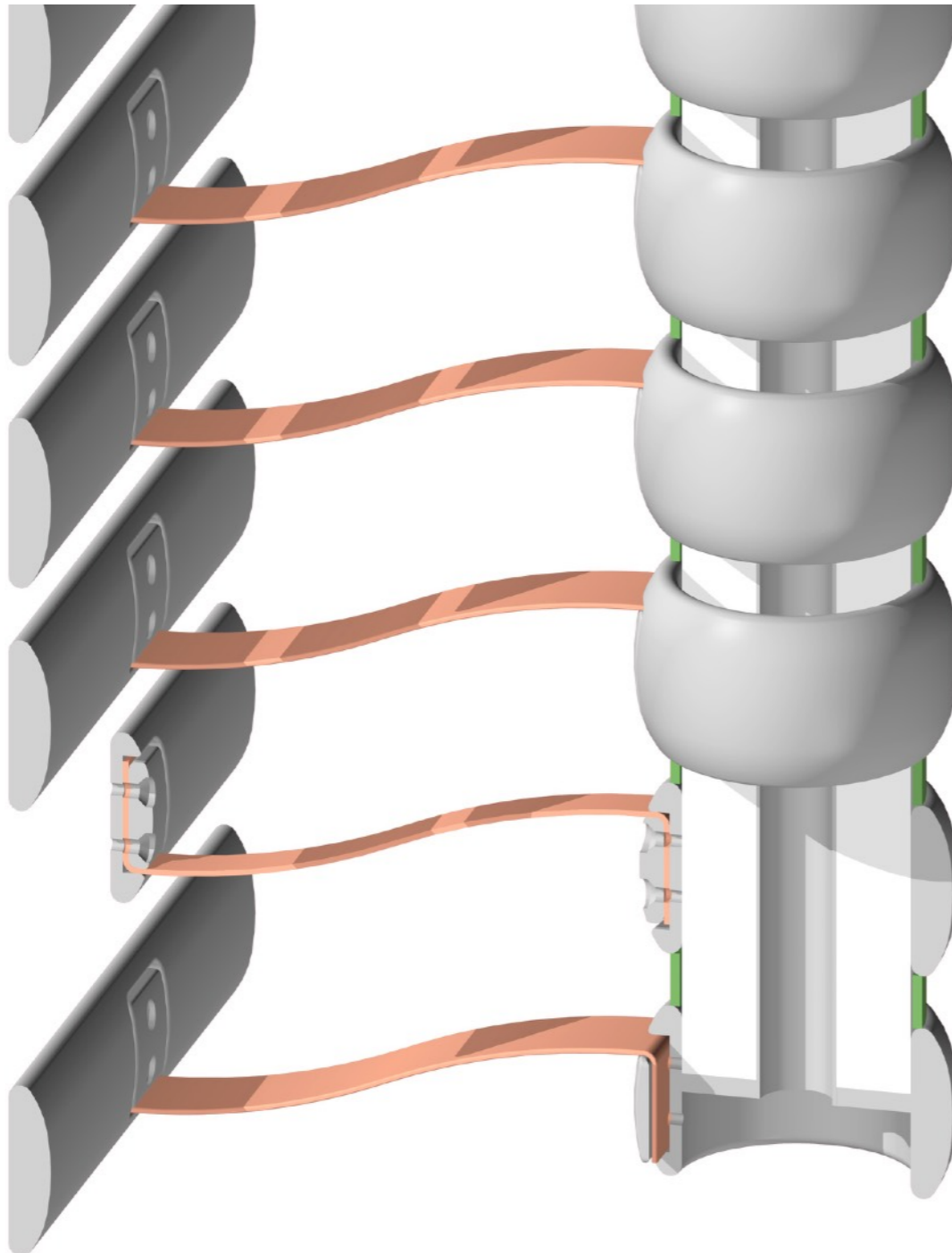
**Current 300kV feedthrough installed in the 3x1x1.**

**New cable diameter is 38 mm.**

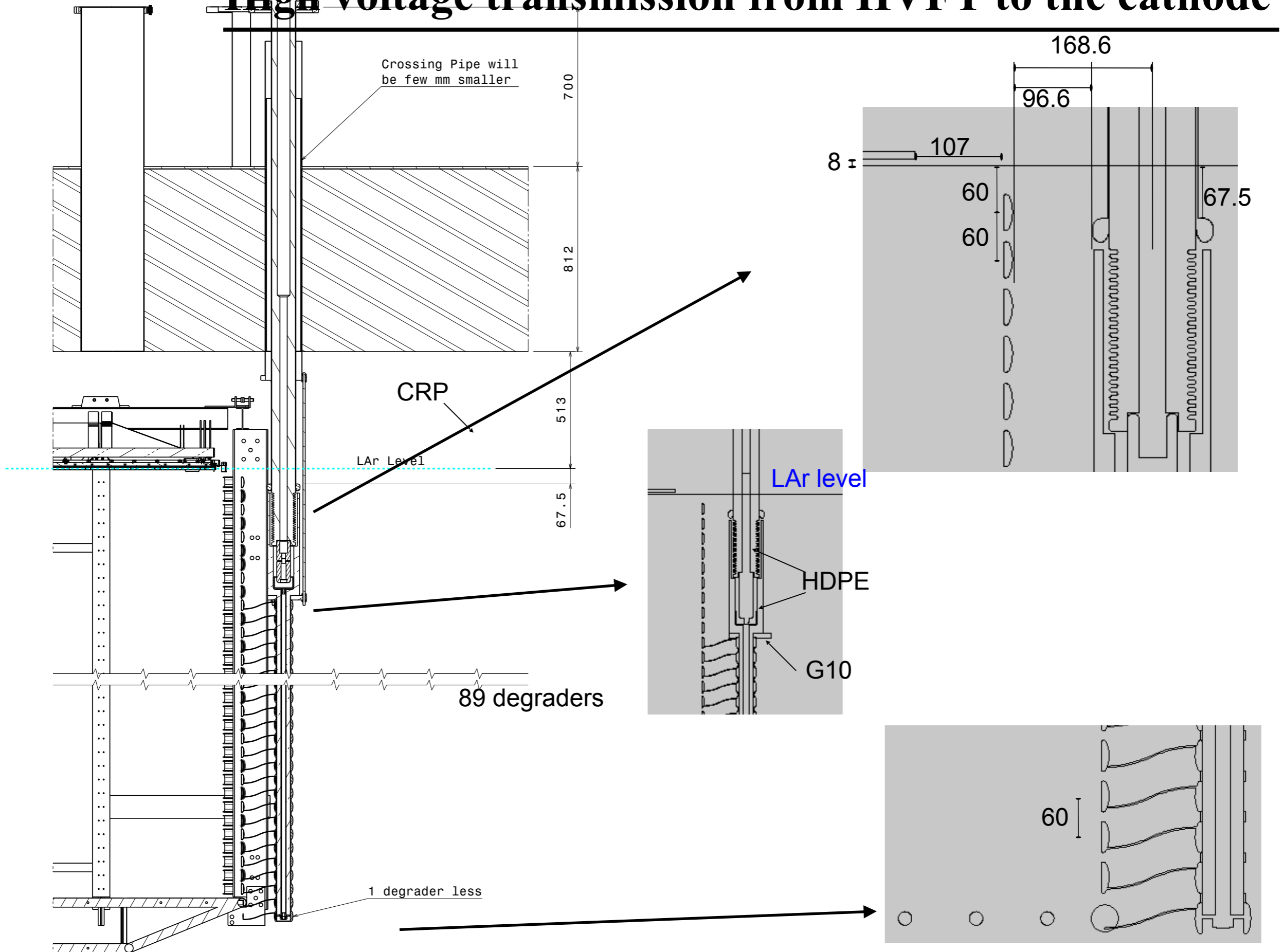


# High voltage transmission from HVFT to the cathode

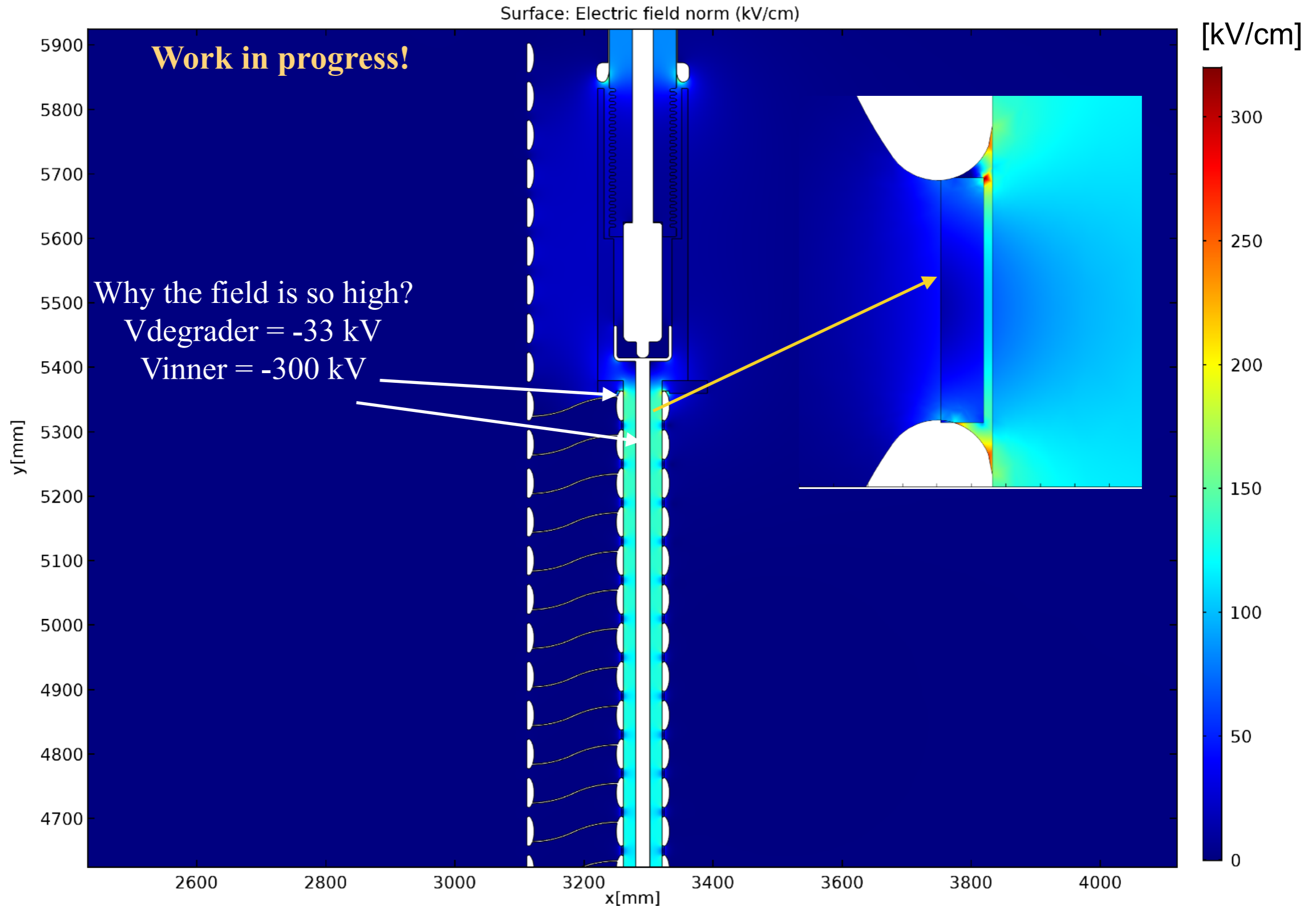
- Preliminary design done by **Franco**.
- Options to be decided: **with** or **without** degrader



# High voltage transmission from HVFT to the cathode



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Electric field locally higher than our guideline, electric field in LAr below 40 kV/cm

# High voltage transmission from HVFT to the cathode

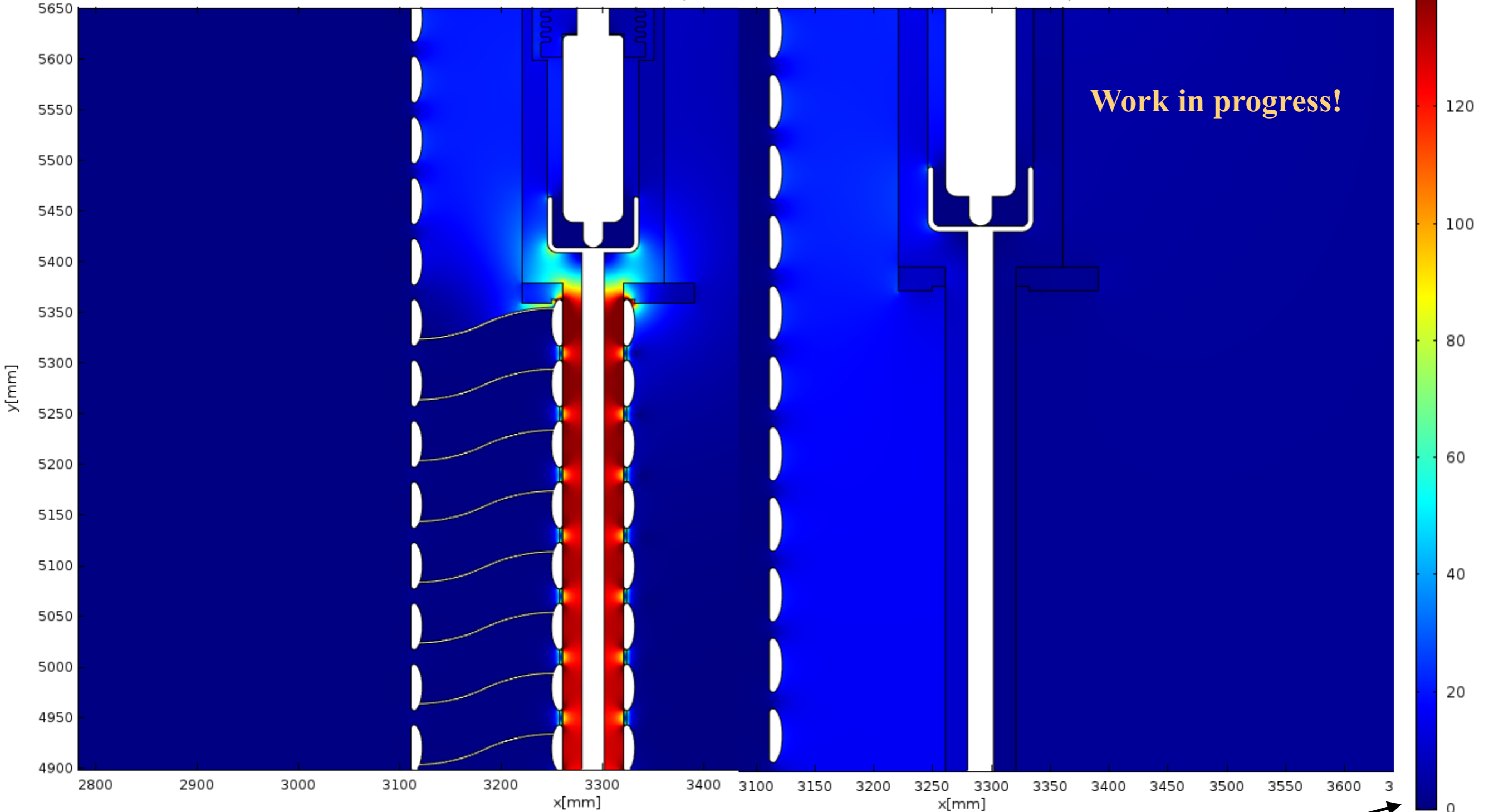
With Degraders

Without Degraders

[kV/cm]

Surface: Electric field norm (kV/cm)

Surface: Electric field norm (kV/cm)



\*scale adjusted to be able to compare both cases



# High voltage transmission from HVFT to the cathode

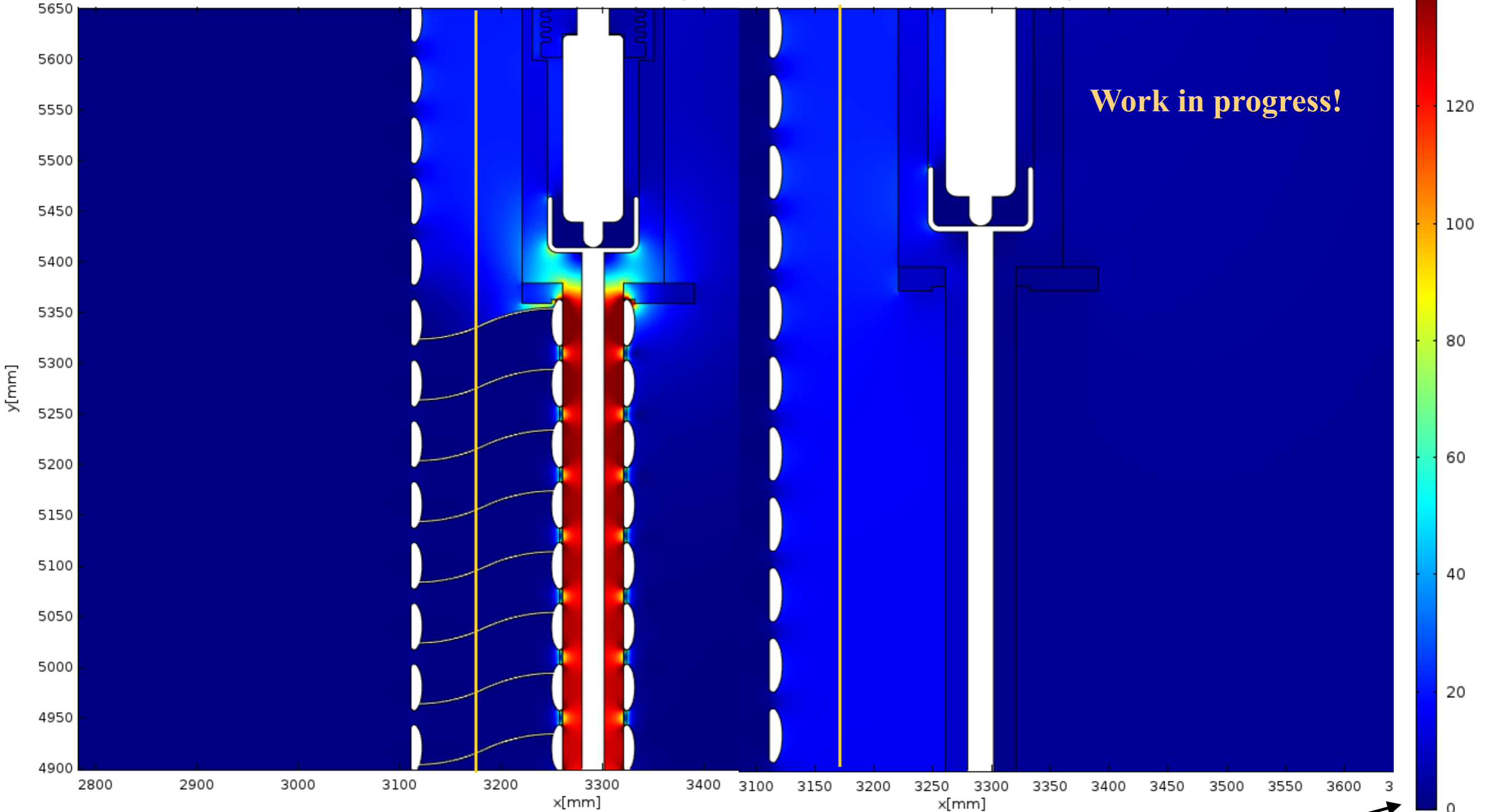
With Degraders

Without Degraders

[kV/cm]

Surface: Electric field norm (kV/cm)

Surface: Electric field norm (kV/cm)



\*scale adjusted to be able to compare both cases

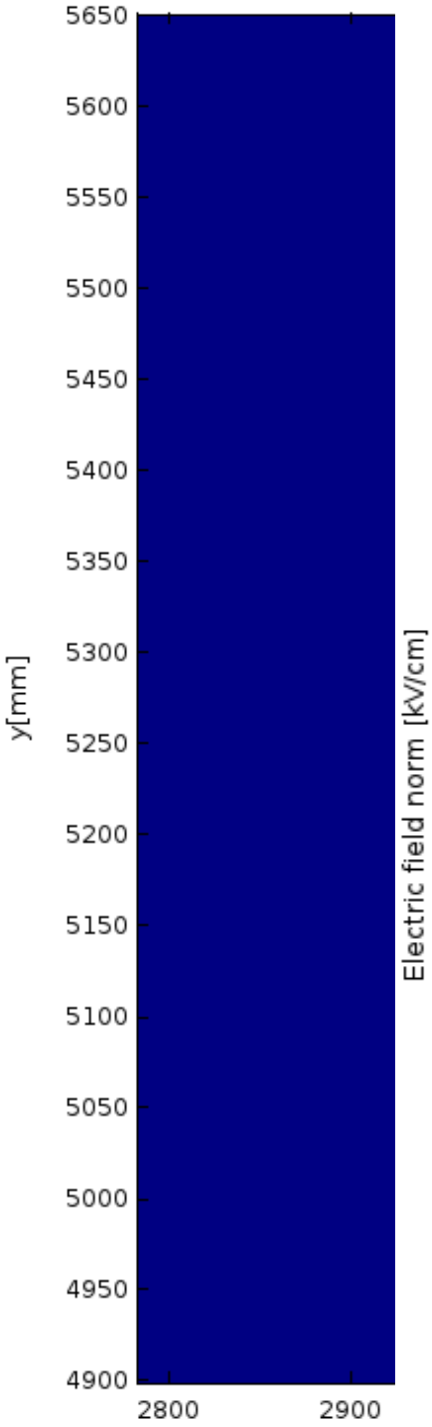
# High voltage transmission from HVFT to the cathode

With Degraders

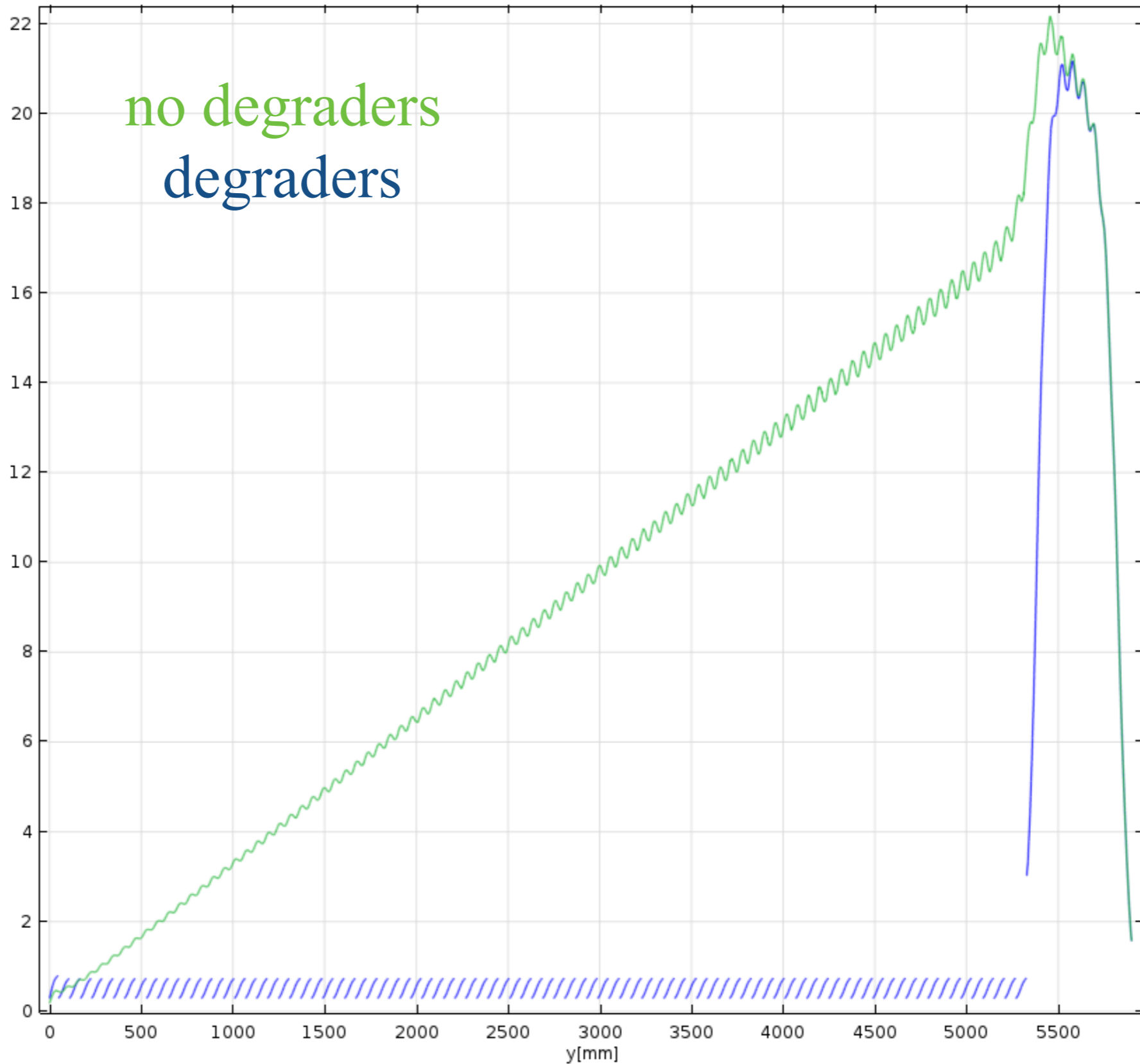
Without Degraders

[kV/cm]

Line Graph: Electric field norm (kV/cm) Line Graph: Electric field norm (kV/cm)

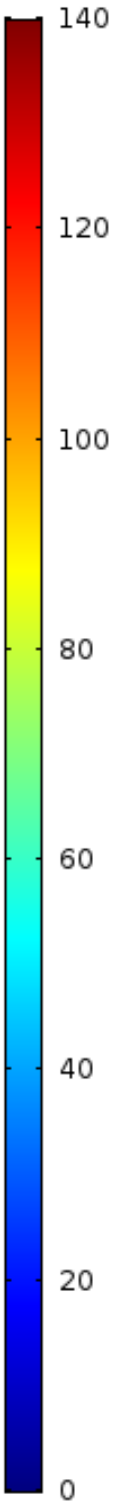


Electric field norm [kV/cm]



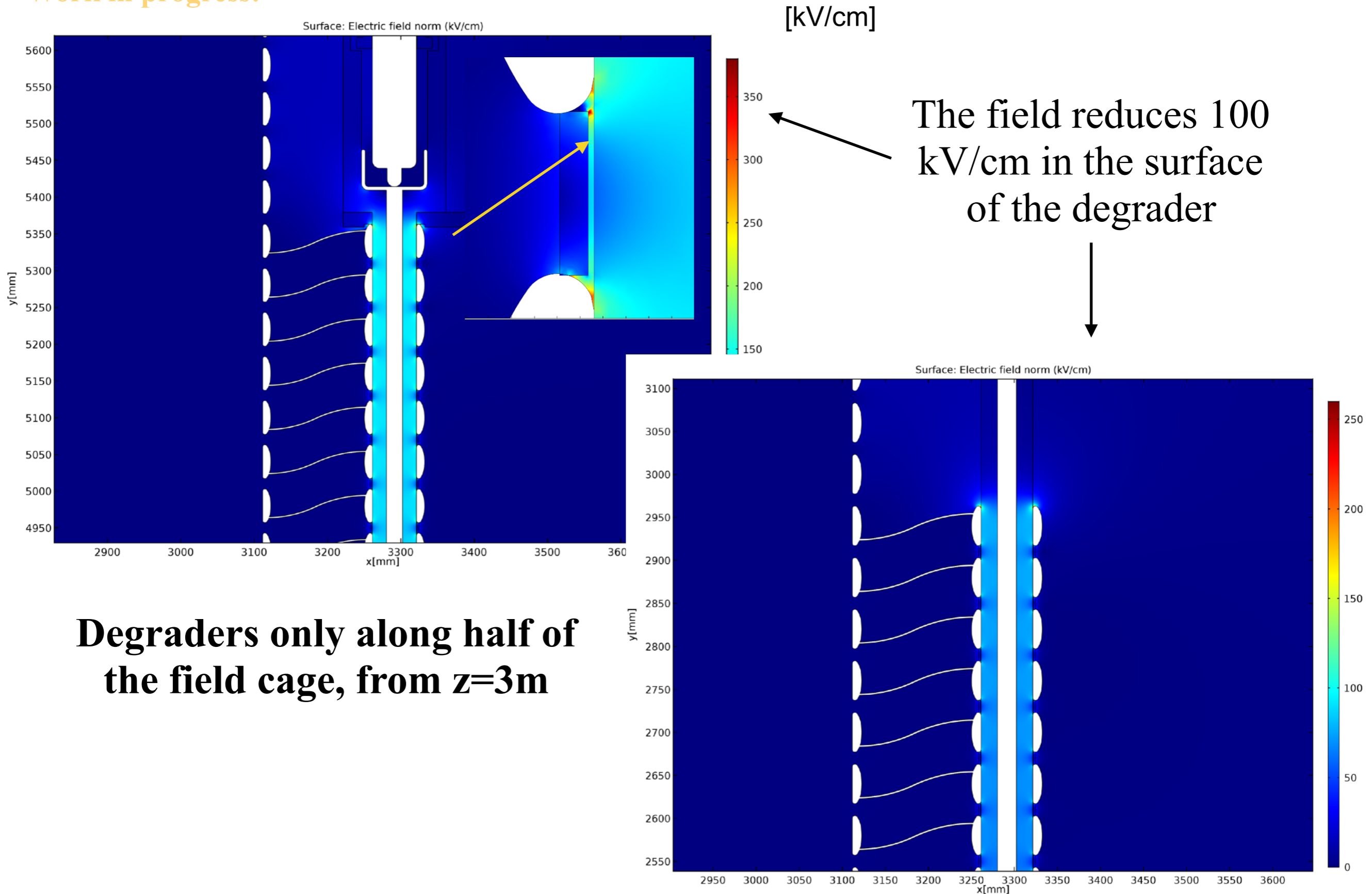
no degraders  
degraders

gress!



# High voltage transmission from HVFT to the cathode

Work in progress!



**Degraders only along half of the field cage, from  $z=3\text{m}$**