

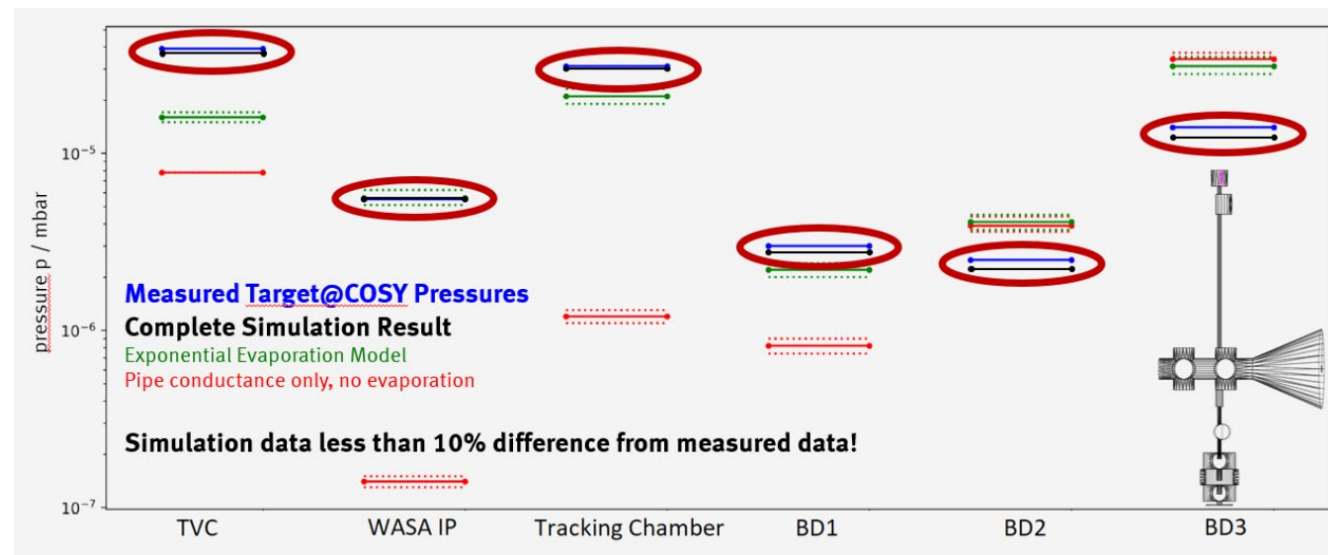
# Advanced gas entry models in PANDA vacuum studies

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31.05.2022



## Reminder of last meeting:

- B. Hetz demonstrated how cluster evaporation models can be used to accurately predict the COSY vacuum in combination with the PANDA cluster-jet target:



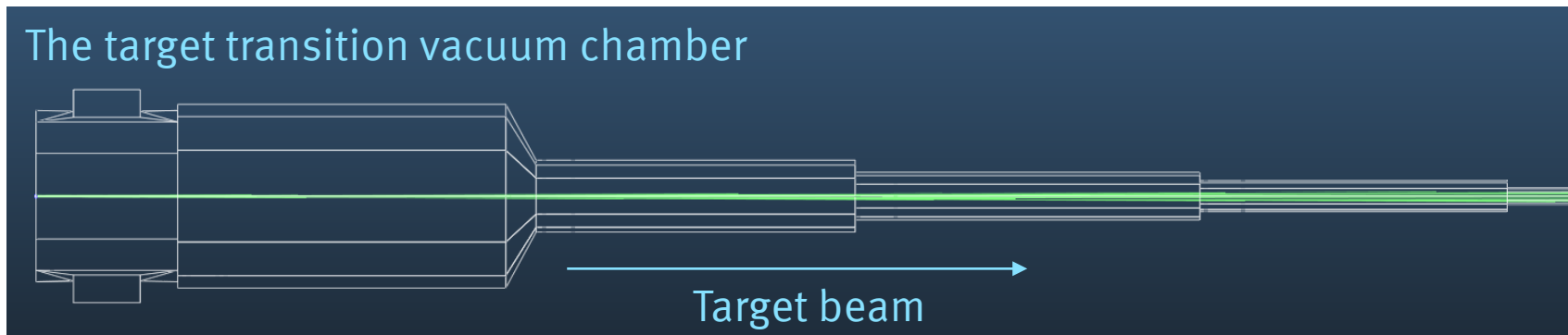
- Now: Apply these models to the PANDA vacuum system at HESR

## Advanced outgassing model:

- Before:
  - We assumed a point like outgassing at the interaction point of 0.01 mbarl/s.
- Now:
  - We consider two contributions:
    - The backflow of the target beam out of the beam dump.
    - The target beam evaporation.

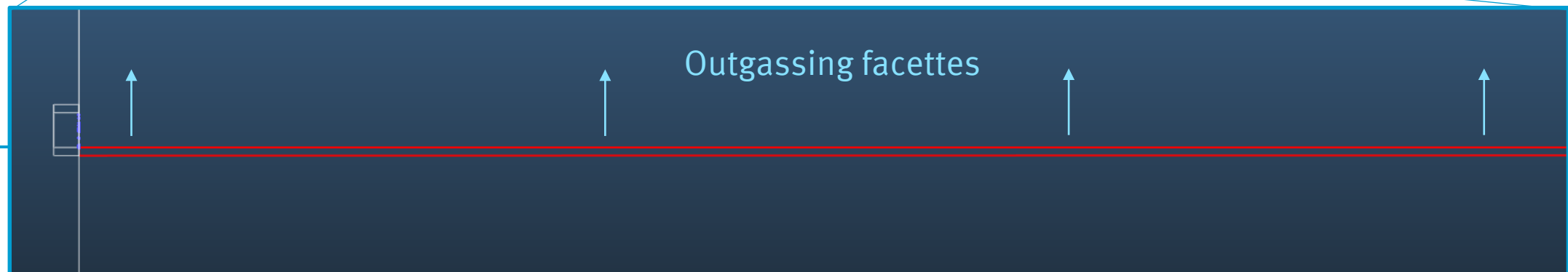
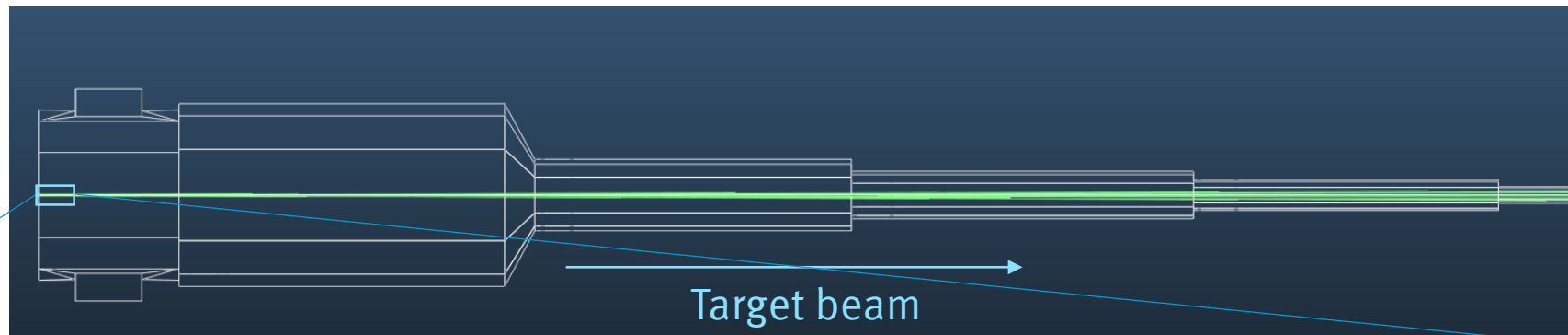
# The target beam

- The amount of gas which is introduced into the vacuum can be calculated from the desired target thickness.
- A target thickness of  $2e15$  atoms/cm<sup>2</sup> yields a gas entry of 0.57 mbar l/s.
- This gas is introduced into the vacuum as a collimated beam with the same shape as the real cluster beam:

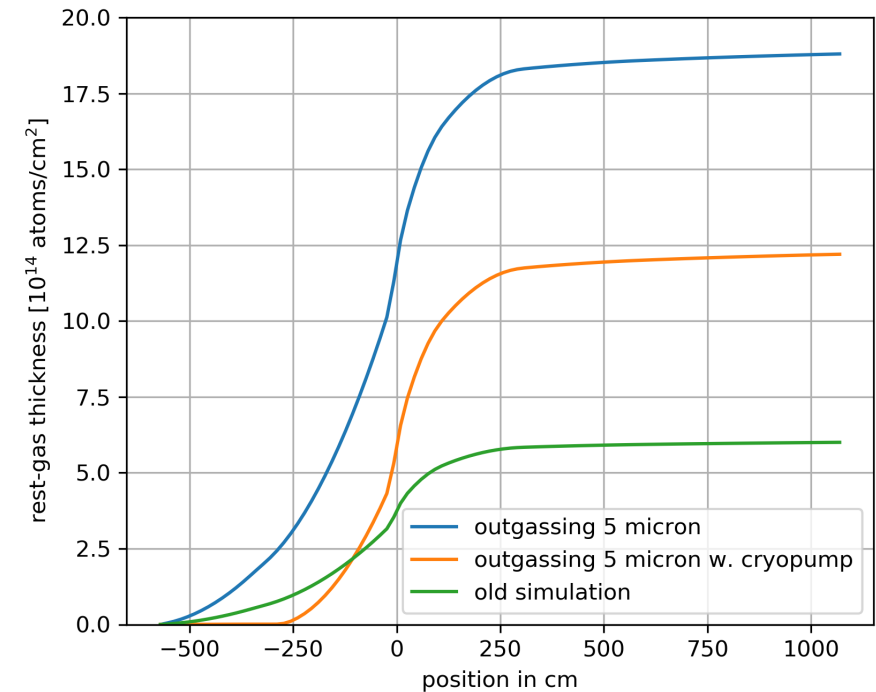
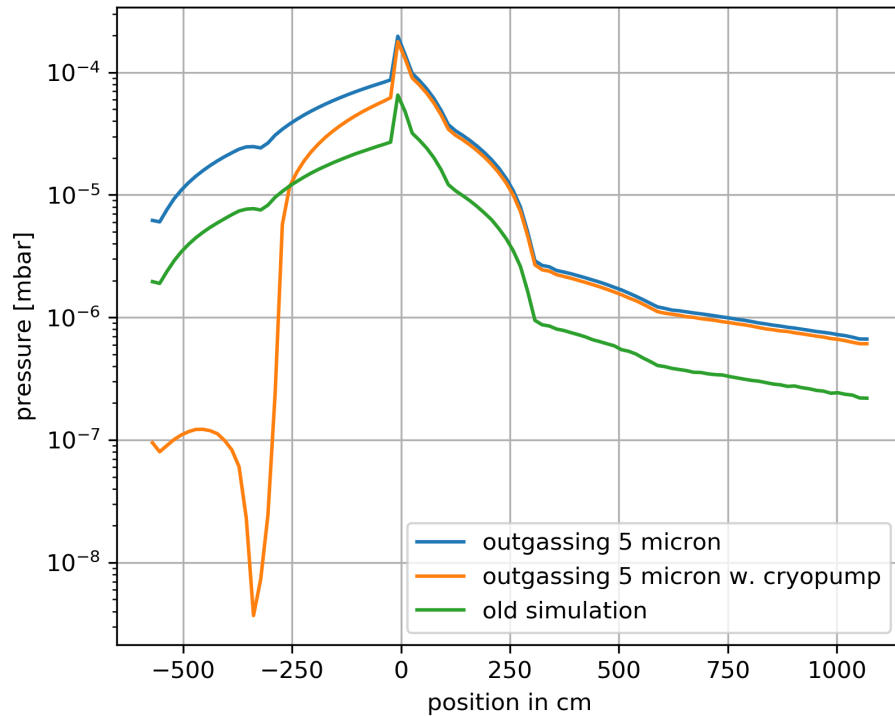


# The target beam evaporation

- While traversing the PANDA vacuum, the clusters emit gas at a constant rate depending on their size.
- The cluster size used for the COSY simulations was  $5\ \mu\text{m}$ , a realistic size estimate (c.f. Hanna Eick's talk)



# Simulation results

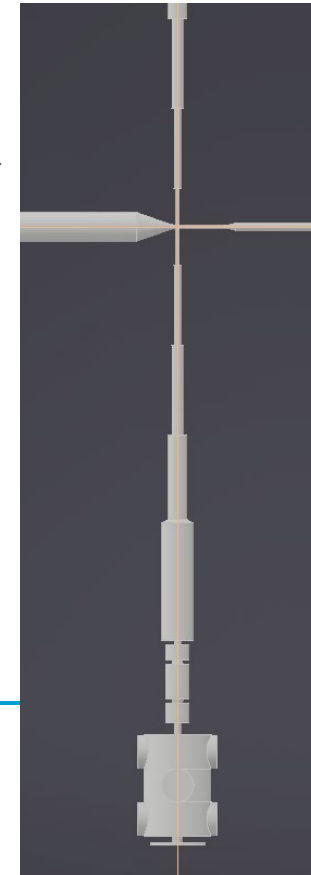


- Considerably higher rest-gas thickness than in earlier simulations, thus further measures become necessary

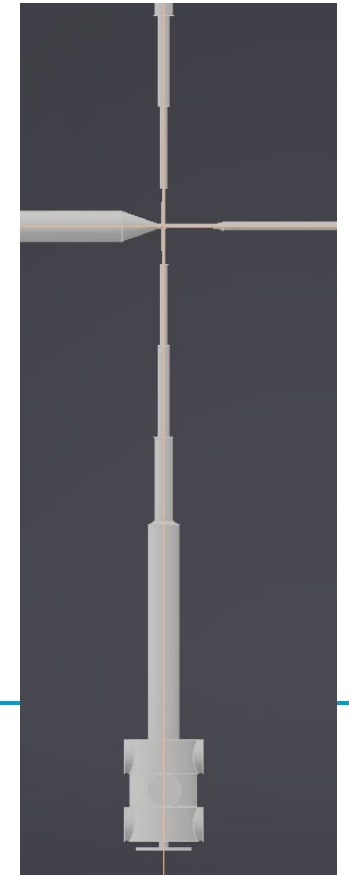
# Removing the pellet tracking chamber, when the cluster-jet target is in use

- Idea: A large contribution to the rest-gas is the constant evaporation from target particles (i.e. clusters, pellets) along the target beam.
- By improving the conductivity to the beam dump, less gas enters the anti-proton beam pipe

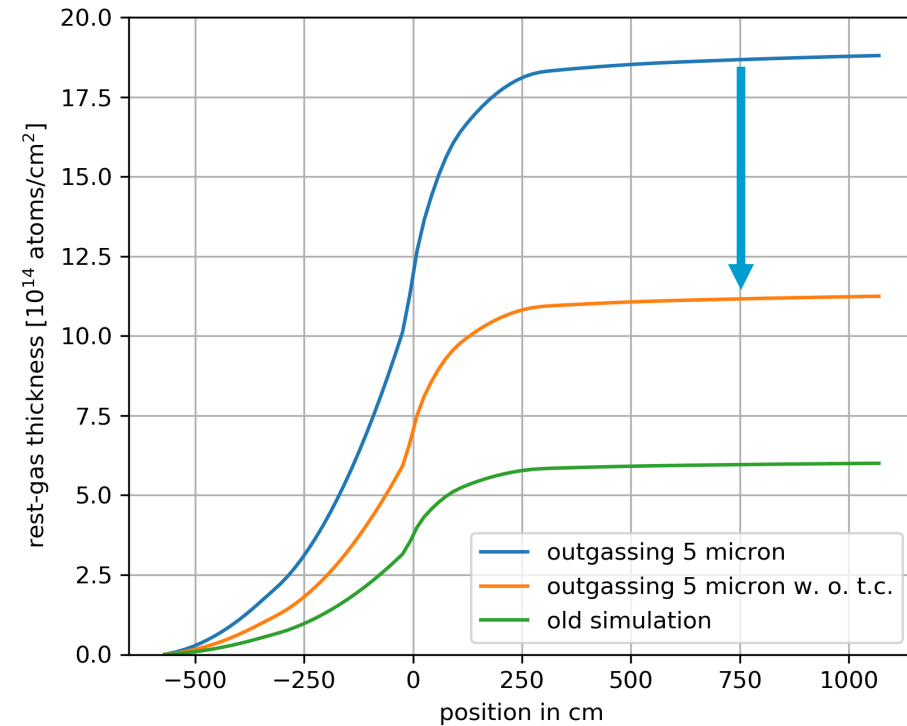
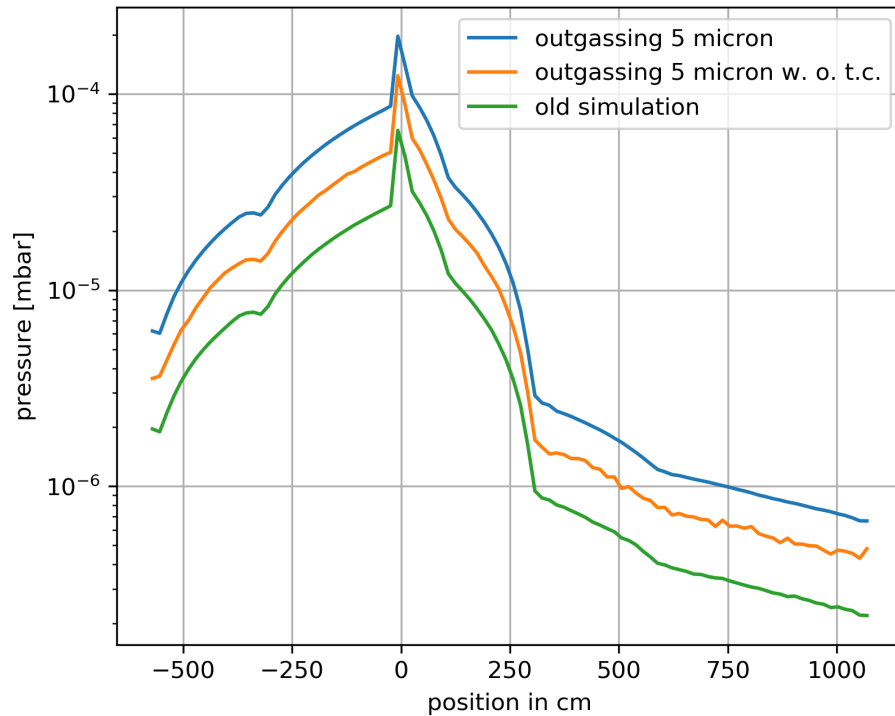
With pellet tracking chamber



Without pellet tracking chamber



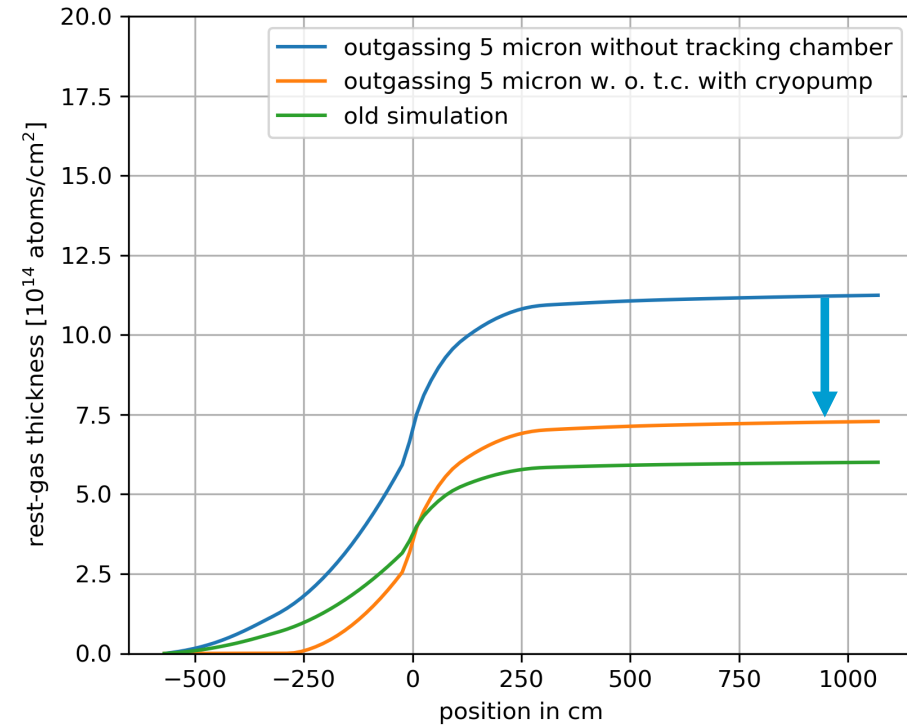
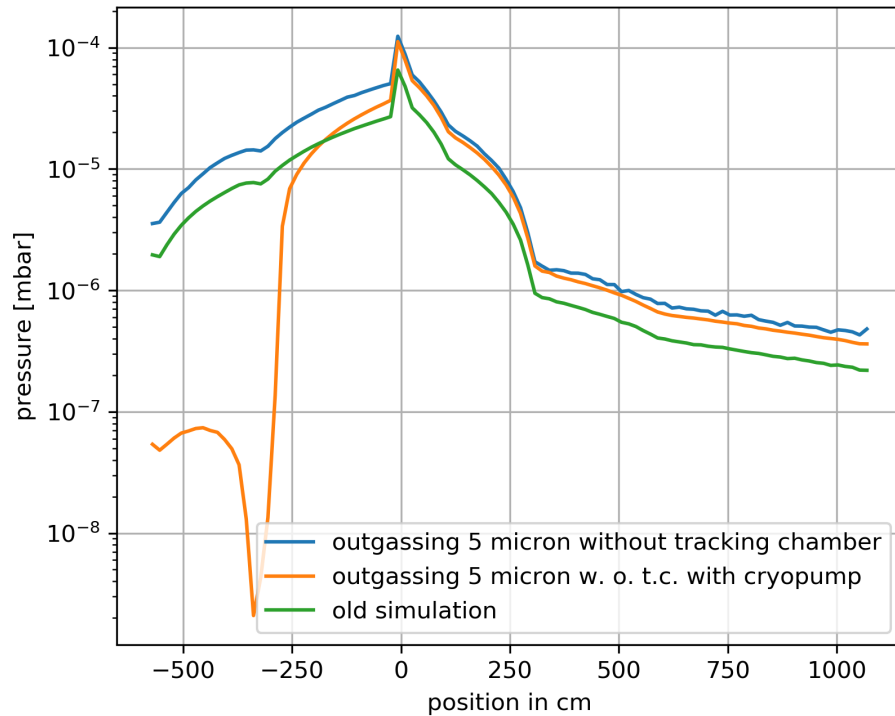
# Simulation results



- Improvement of over 30% concerning the rest-gas thickness



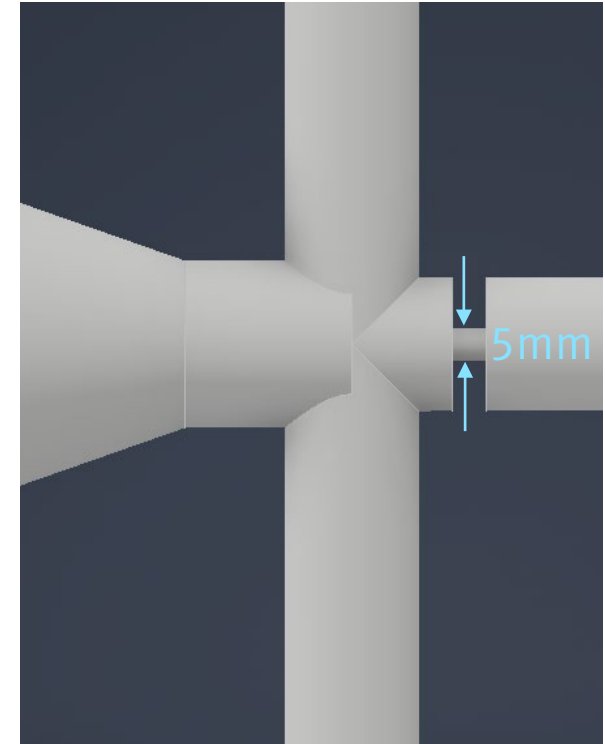
# Simulation results with cryopump



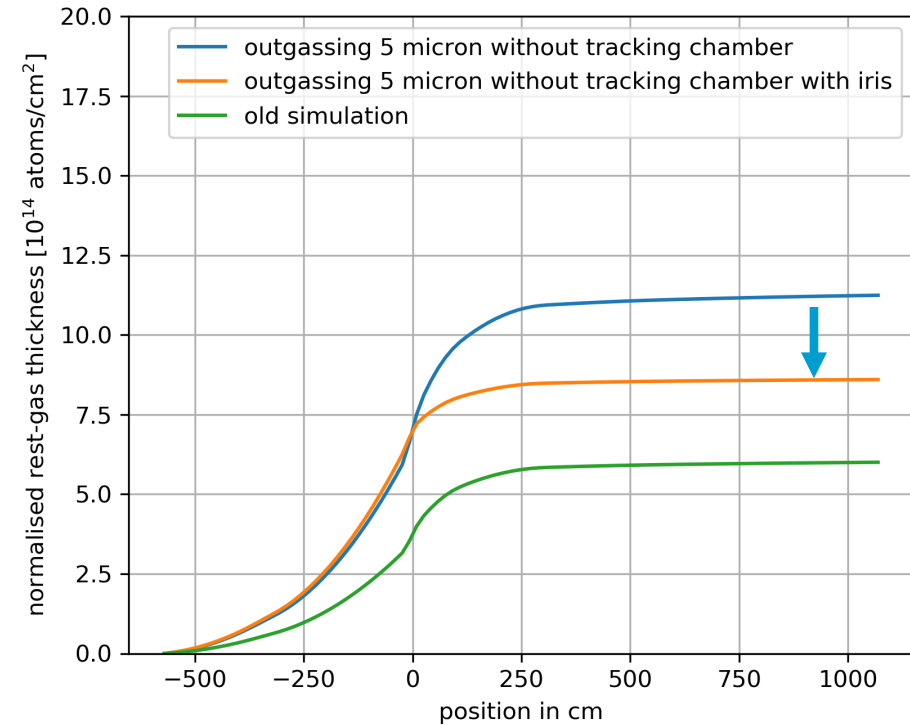
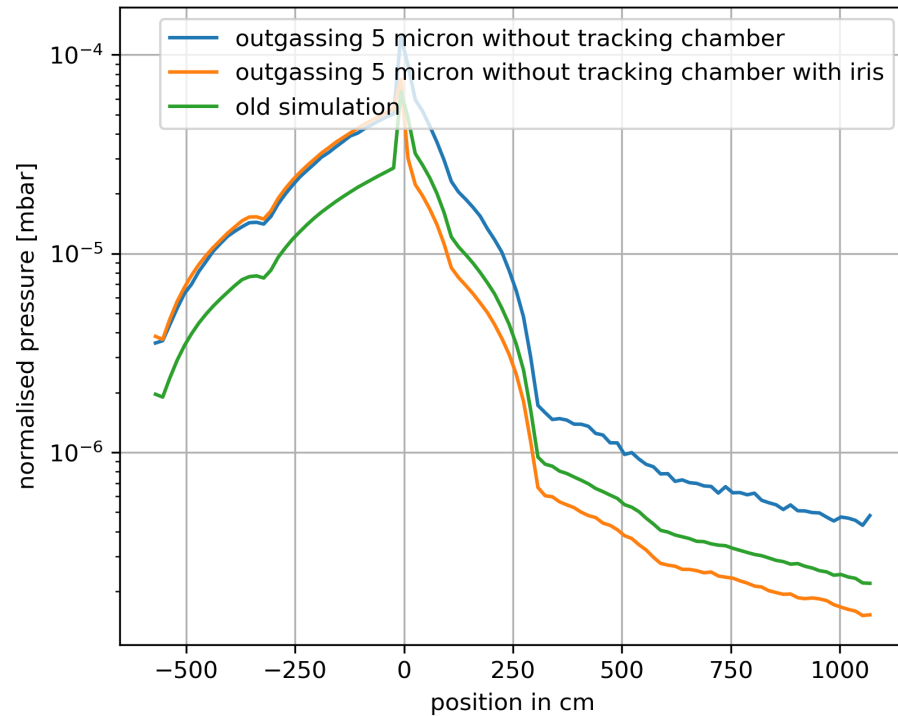
- Getting close to the earlier simulations...

## Adding an aperture downstream

- The cryopump only has an effect on the upstream region of the beam pipe.
- Idea: Force more gas into the upstream region by installing an aperture near the IP.

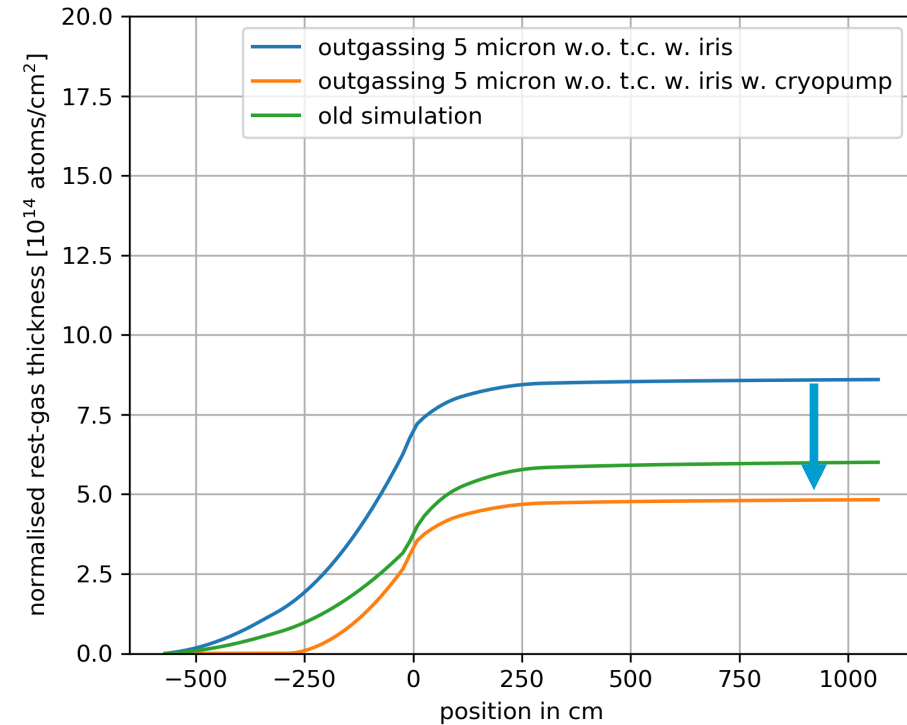
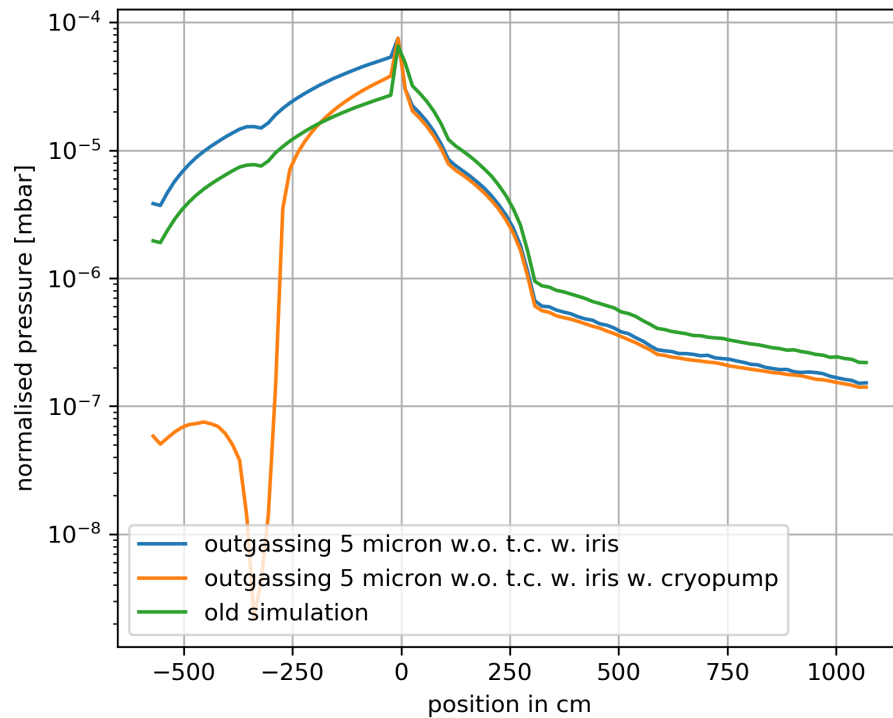


# Simulation Results



- Further improvement of around 20%.

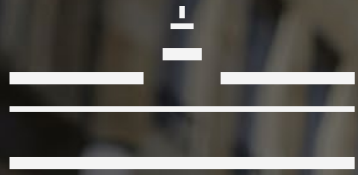
# Simulation results with cryopump



- With cryopump, aperture and without tracking chamber, the vacuum can be improved tremendously.

## Summary

- Integrating the simulation insights gained with simulations on the COSY vacuum into PANDA vacuum simulations reveal that the rest gas is considerably higher than originally anticipated.
- Apart from a cryopump, further measures appear necessary.
- Careful proposals are the deinstallation of the pellet tracking chamber when the Cluster-jet target is in use, the installation of a cryopump and the integration of an aperture into the downstream beam pipe.
- Additional ideas are welcome.



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**Thank you for your attention!**

**Are there any questions?**

