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Status report for the PANDA Cluster-Jet Target and the Prototype at Münster

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PANDA collaboration meeting, June 22-26, 2020

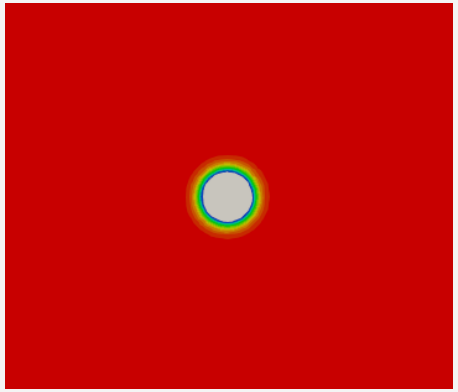
Corona consequences in Münster

- Labs and institute were accessible the whole time, but limited manpower at the beginning
- Strict travel restrictions for more than two months, currently only absolutely necessary trips allowed
  - Planned beam time at COSY in Jülich was postponed
- No work at the PANDA cluster-jet target in Jülich possible for the last three months, we will resume the work there soon. This includes:
  - Installation of new chamber between source and IP to study origin of residual gas at IP
  - Preparation for the next beam time

Influence of clusters/pellets on the vacuum

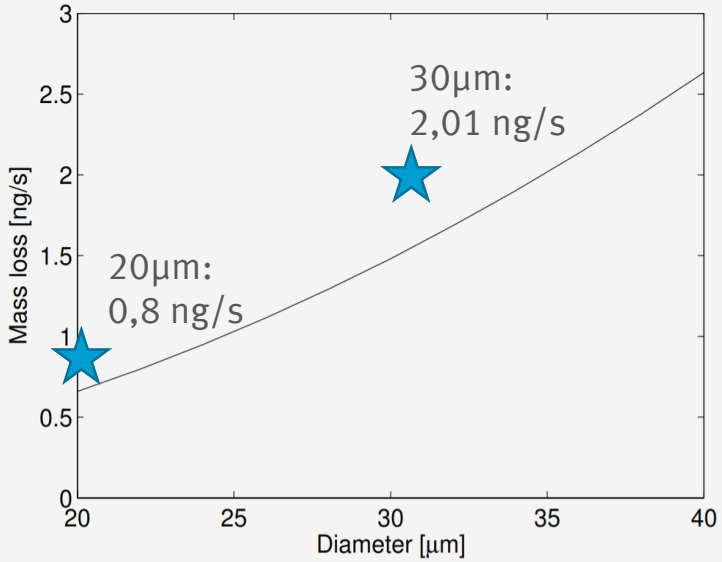
- Vacuum inside the PANDA beamline not only induced by dump backflow.
- Microspheres (clusters and pellets) start as liquid droplets injected into vacuum.
  - Freezing and evaporation processes happening.
  - Finally reaching an equilibrium state with a solid microsphere core.
- Calculations recently started in Münster based on former calculations of Örjan Nordhage (Uppsala) for the WASA pellet target.
  - Key aspect will be the understanding of microspheres in the cluster-size regime.

Influence of clusters/pellets on the vacuum



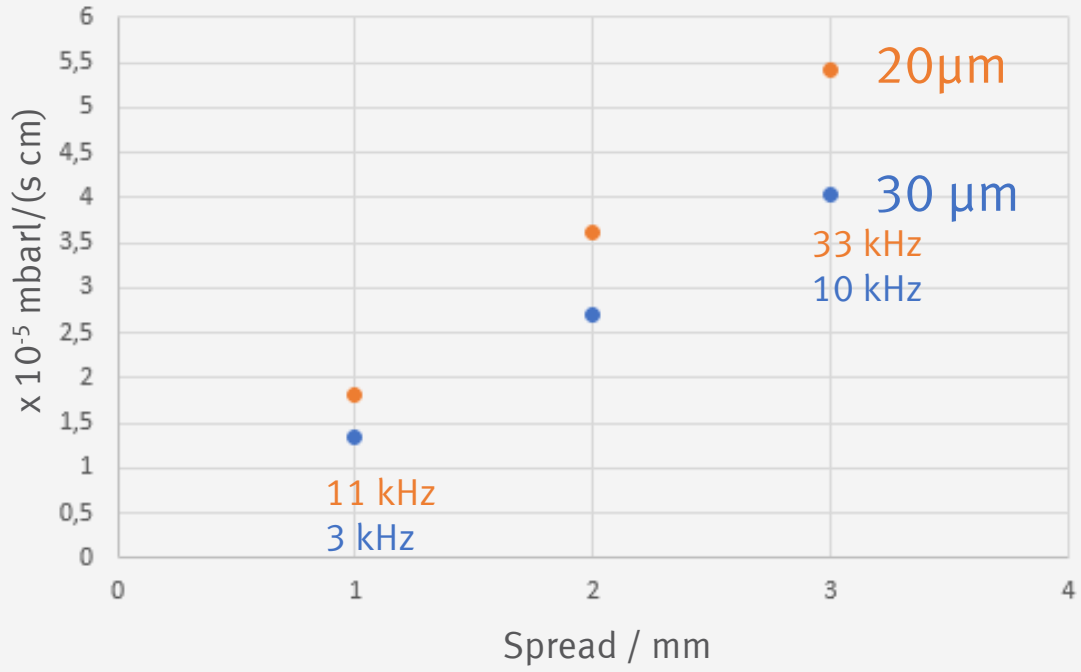
- Reproduction of ÖN‘s results successful using FEM simulations for two given microsphere sizes so far

- **Preliminary** results yield an effective gas load at IP using 30 µm pellets of
  - **≈ 2 x 10^{-3} mbar l/s (ÖN) to** *(using a simple PANDA Model 2006)*
  - **≈ 4 x 10^{-3} mbar l/s (BH).** (numbers calculated by using a realistic PANDA model in Molflow)



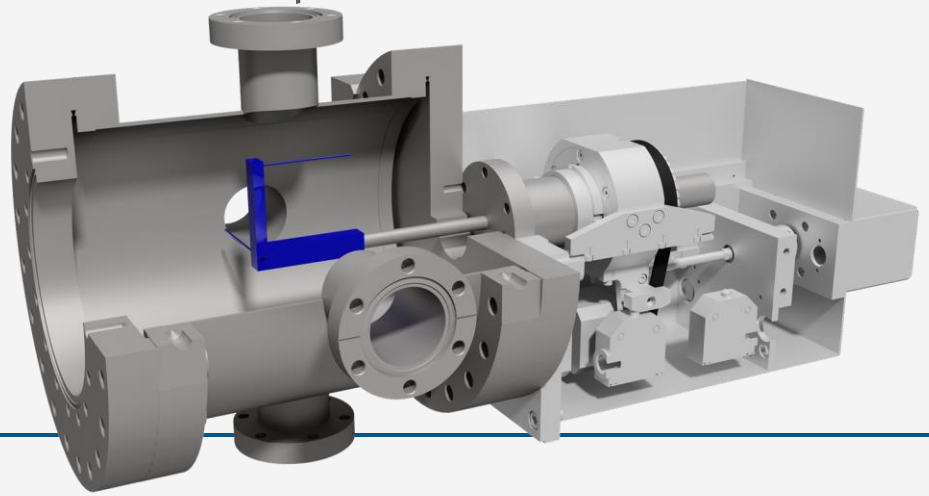
Influence of clusters/pellets on the vacuum

- Gas load induced by microspheres is depending on:
  - microsphere size and spread.
- Going down to cluster-size regime in next step.
- Things to consider in next steps:
  - Cluster size distribution inside jet beam,
  - jet beam size/spread different than pellet spread,
  - etc.

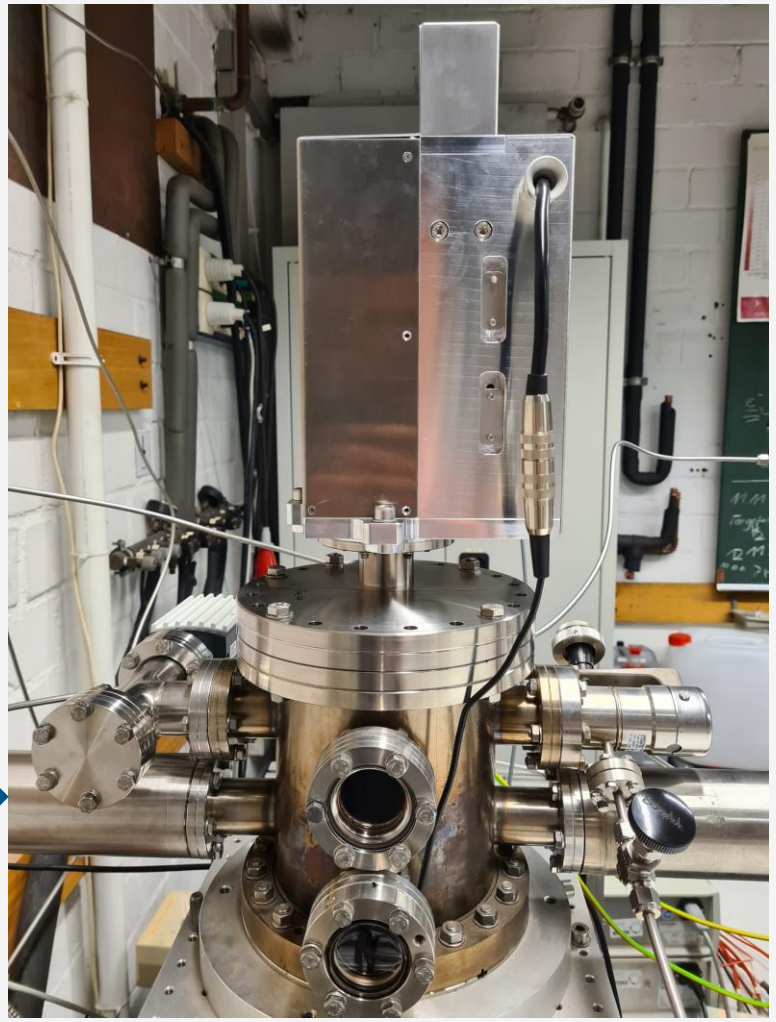


A new rod system for the prototype target

- New rod system at the scattering chamber of the prototype target
  - Exact copy of the system used at the final PANDA target at COSY
- Similar system is planned to use in a modified beam dump for the final PANDA setup

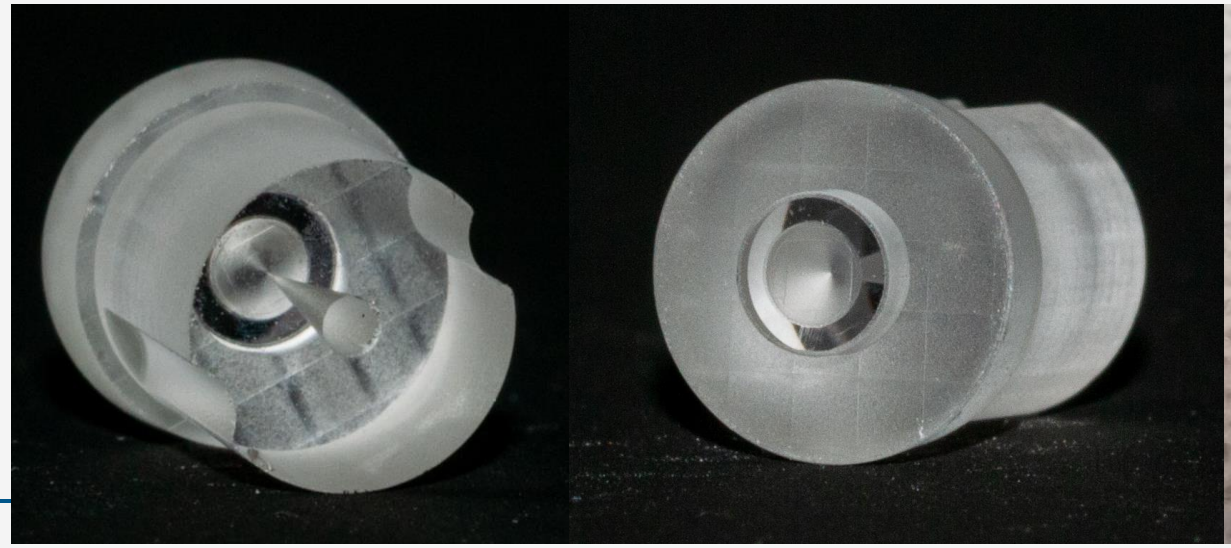
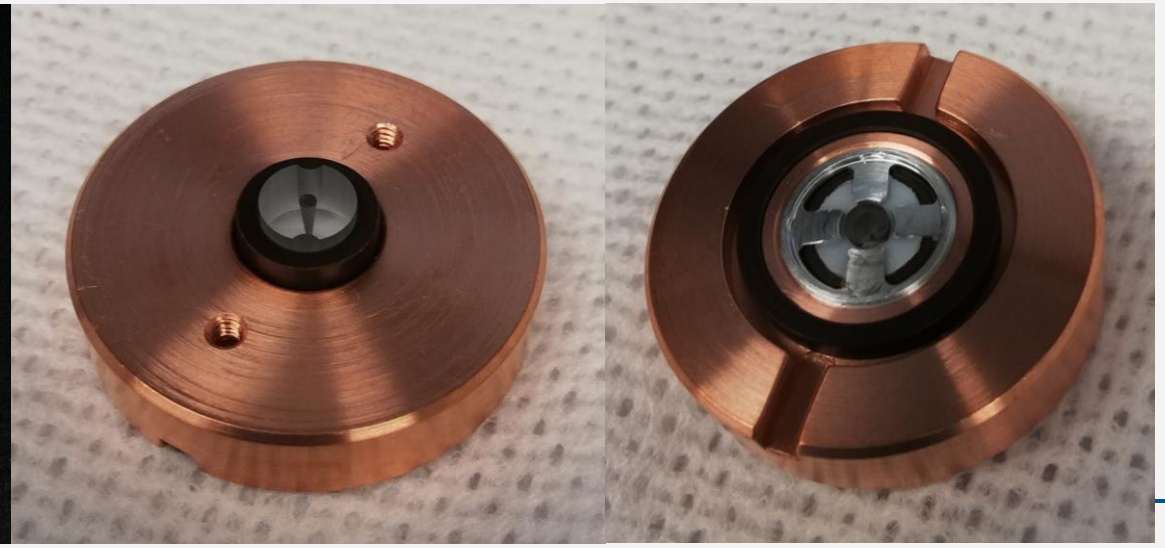


Cluster-Jet



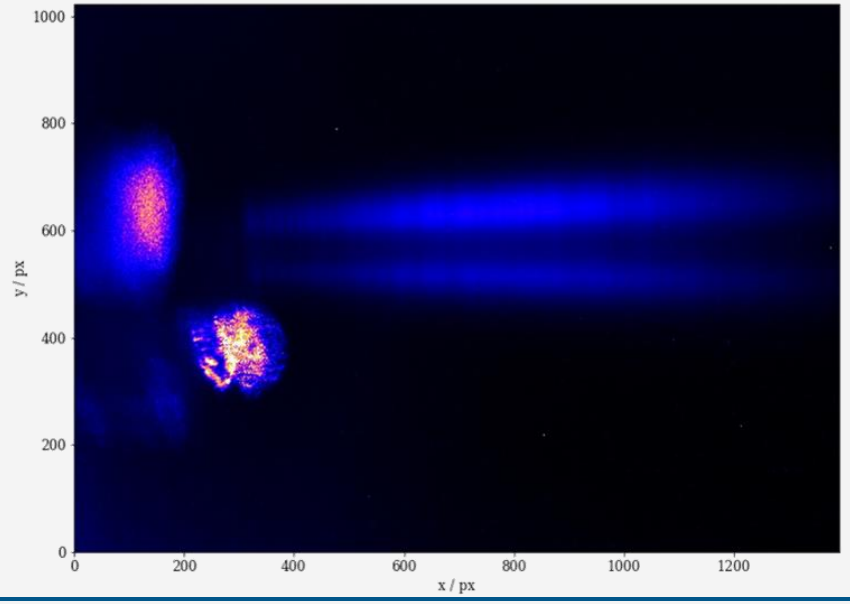
New glass nozzles

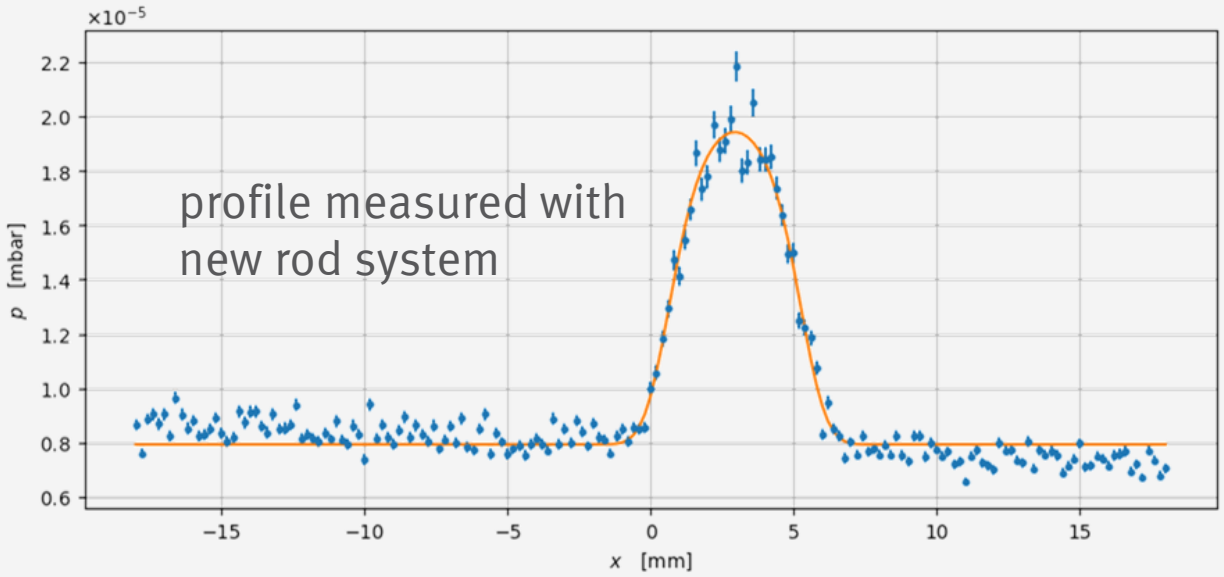
- Former glass nozzles had a maximum length of 3mm due to the production process
  - Standard copper nozzles have a length of 18mm
- Now nozzles up to 10mm can be produced by 3D laser etching (LightFab)

New glass nozzles

- First studies show a cluster-jet at least in the supercritical regime, more studies will follow
- Measurements in liquid regime are currently instable, probably caused by the gas system





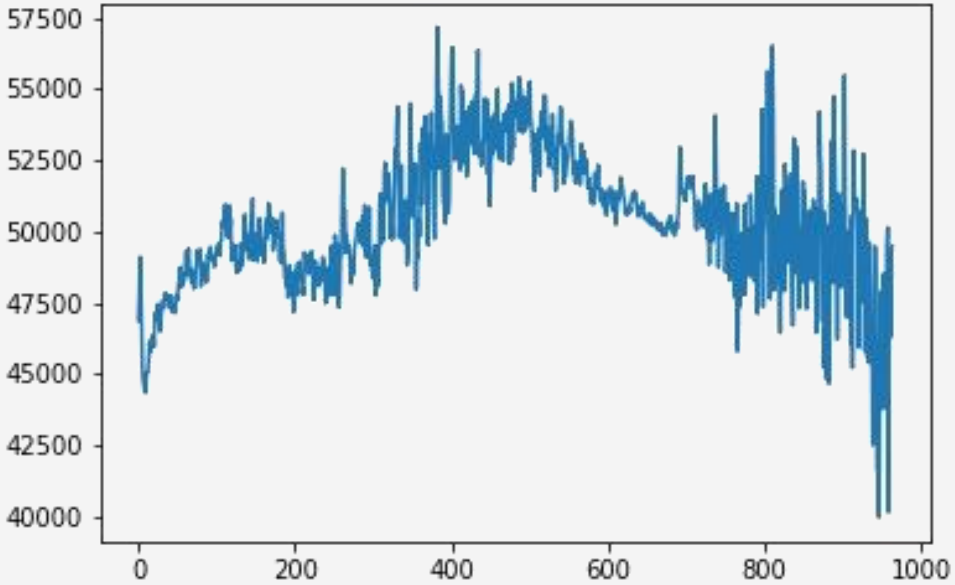
Exchange of the Hydrogen Purifier

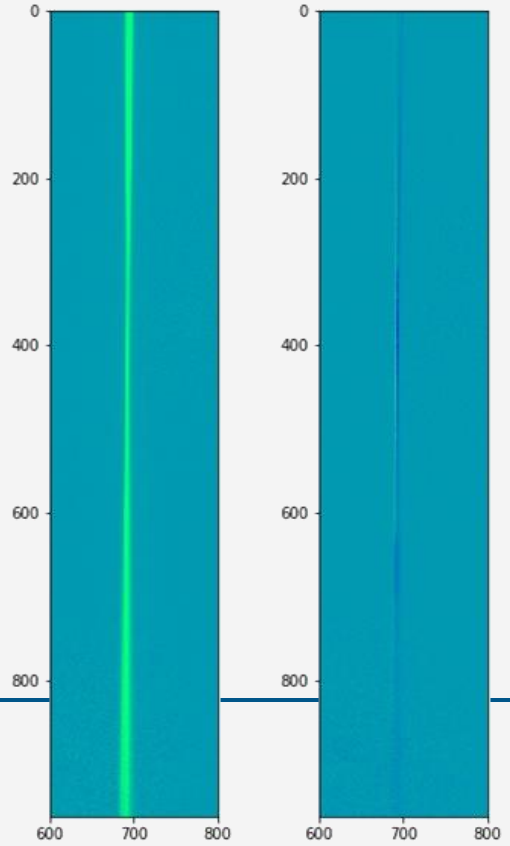
- New hydrogen purifier for the prototype target was delivered
- Same model is used for final PANDA target, we can gather experience for routine PANDA operation
- Will be installed soon with a completely renewed gas system, instabilities will be solved

Laser system within the beam dump of the prototype

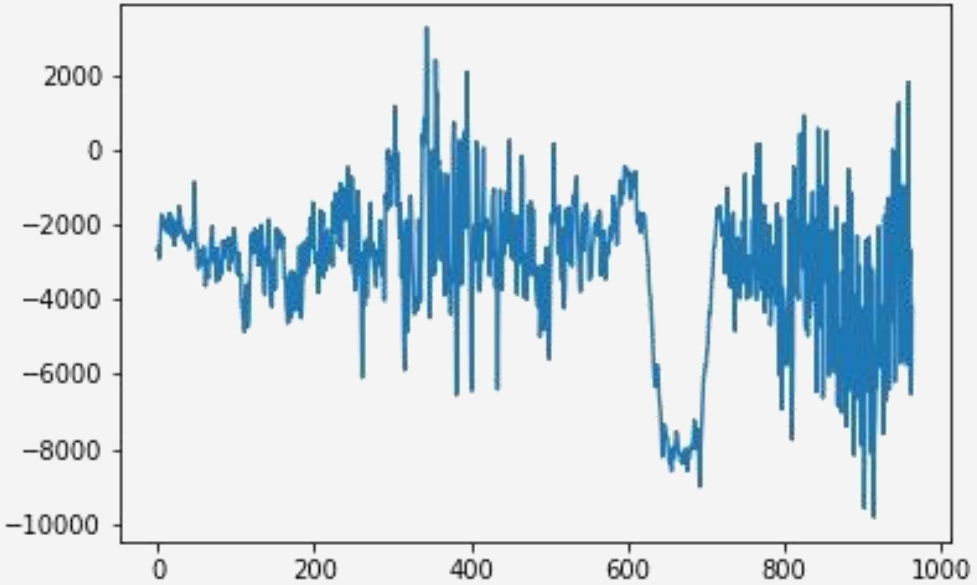
- Cluster-jet is illuminated by point laser, scattered light detected by CCD camera

Cluster-jet





Rod within Cluster-Jet



Laser system within the beam dump of the prototype

- Cluster-jet is illuminated by point laser, scattered light detected by CCD camera
- First simple setup shows huge background due to
  - The very simple laser dump
  - Dead end of prototype beam dump without pumping power
- Nevertheless a rod within the cluster-jet can be identified
- Upgrade will have a line laser to visualize a 2D cross section of the jet

Further ongoing work

- Data analysis of latest beam times
- Design of a modified beam dump, including new monitor systems
- Influence of the nozzle length on cluster production by shortening a copper nozzle
- Design and first tests of a cryopump (following talk by C. Mannweiler)

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Thank you for your attention!

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