

Status Report for the $\bar{\text{P}}\text{ANDA}$ Cluster-Jet Target

$\bar{\text{P}}\text{ANDA}$ Collaboration Meeting 20/3
Target Session
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Current Measurements and Developments

- Redesign of Prototype Gas System
- Glass nozzles
- Beam Visualization with MCP or Laser at Beam Dump
- Time of Flight measurements with MCP
- Maintenance Work at \bar{P} ANDA Target at COSY

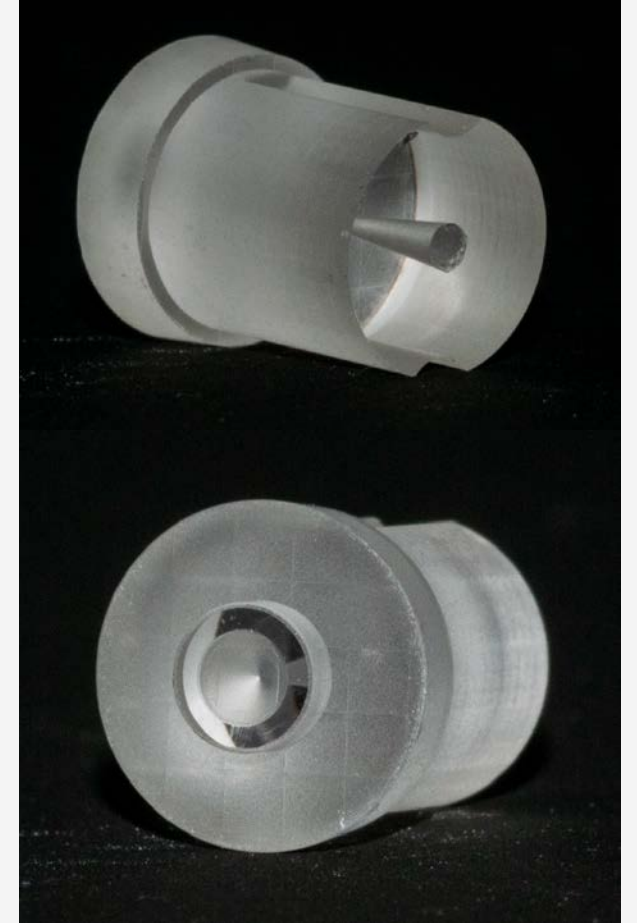
Redesign of Prototype Gas System

- Cluster Beam of prototype target showed instabilities which were probably caused by impurities in the gas (leakage in purifier)
- Solved by insertion of Purification Cartridge (temporary solution), prototype is back at work
- New Gas System is designed and first distribution modules are built
- New Purifier (same as for PANDA target) will be set into operation

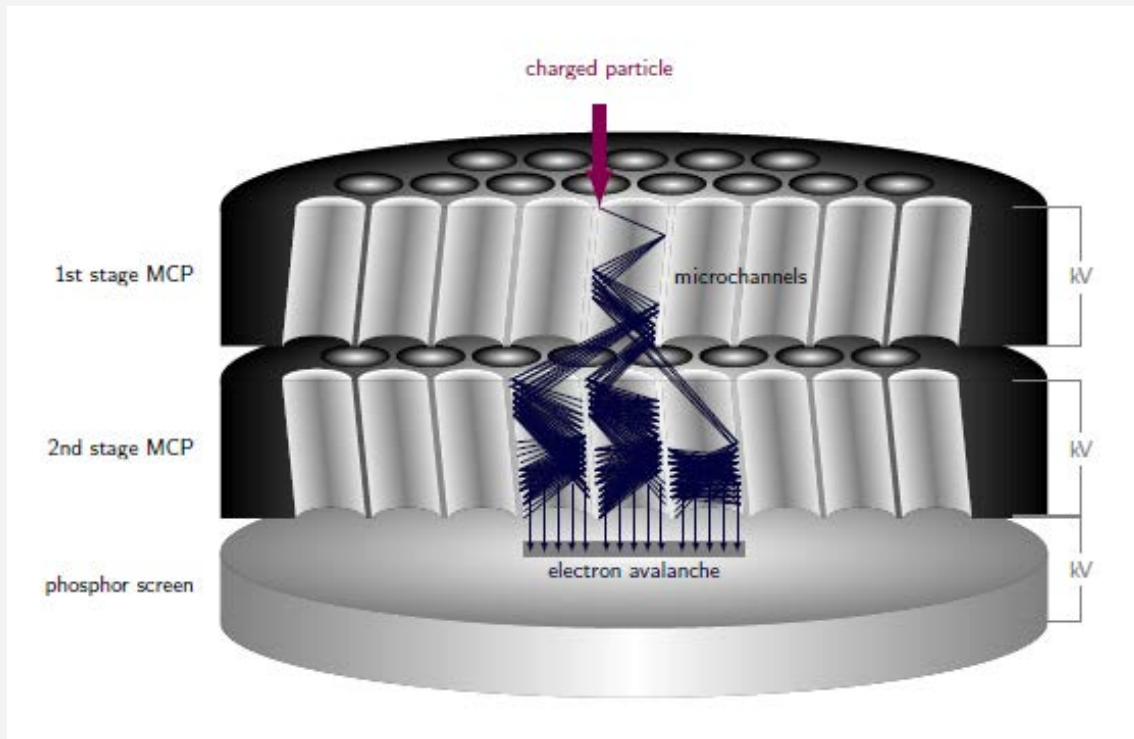


Measurements with Glass Nozzle

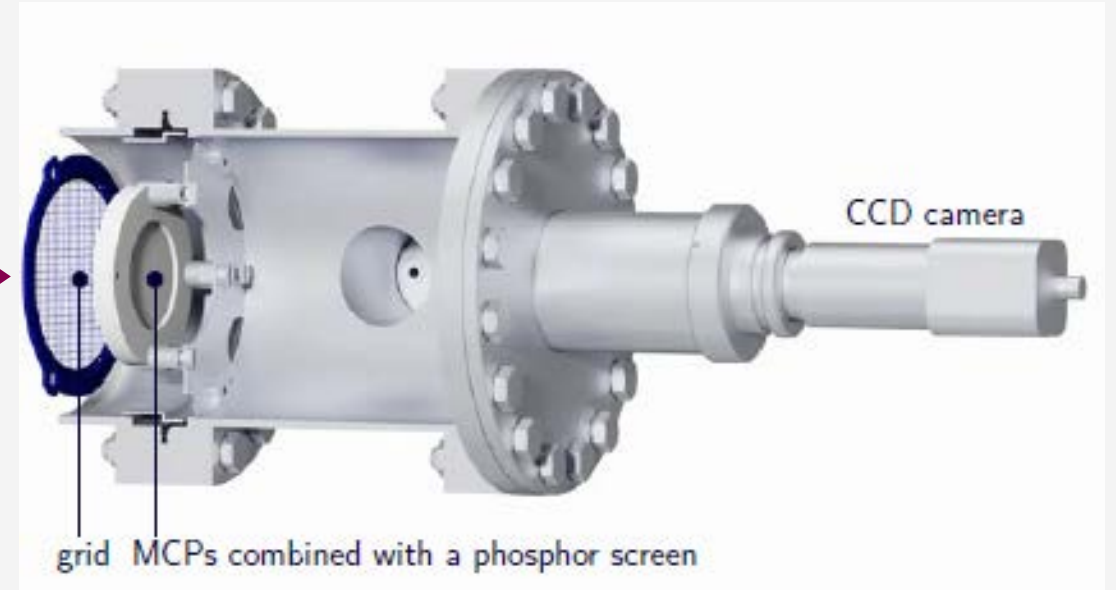
- Fabrication of Glass Nozzles by LightFab with total length of 10 mm according to our specifications and CAD drawings
- Usual beam properties in gaseous and supercritical regime
- No stable beam in liquid regime, even with nozzle extension
- Further investigations ongoing at prototype target in Münster



Microchannel Plate



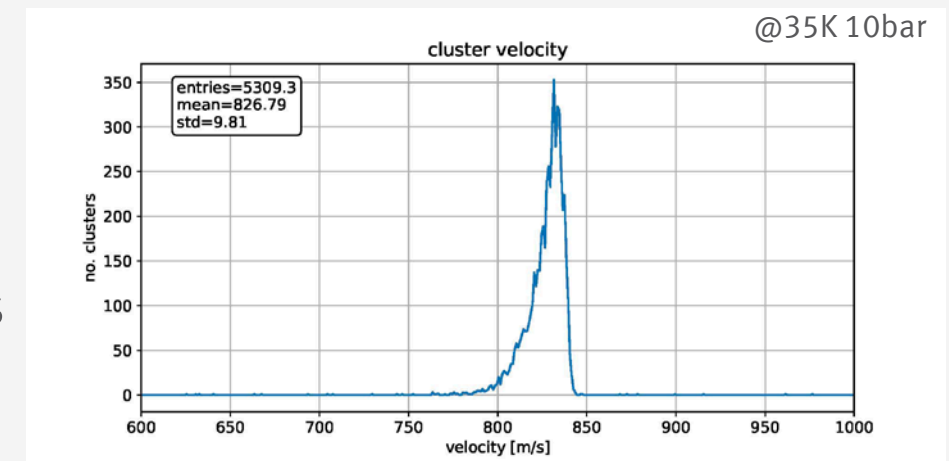
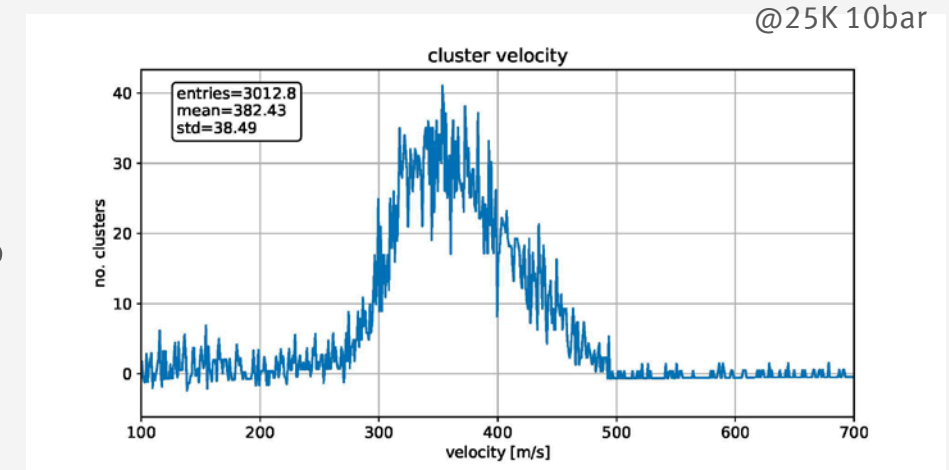
Cluster beam



- Ionized Clusters hit MCP
- Electron avalanche forms
- At phosphor screen either beam visualization or detection of voltage pulse for TOF measurement

Velocity Measurement with MCP

- Pulsed electron gun as start signal in 4.73 m distance to MCP
- Voltage drop at phosphor screen as stop signal
- Randomly distributed and therefore removable background due to spontaneous discharges at phosphor screen
- Determination of velocity distributions and thus of mean cluster velocity possible
- Broader velocity distribution in liquid regime than in gaseous regime → different cluster production processes (further studies at prototype target planned)

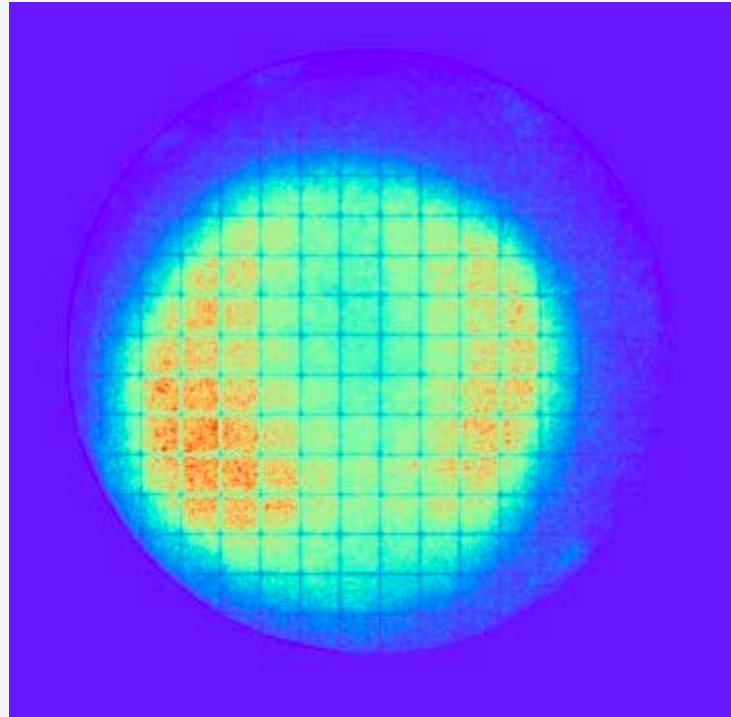


Beam Visualization with MCP

Beam analysis with determination of

- Intensity at phosphor screen, i.e. comparison of target thickness
- Shape of Cluster Beam, e.g. radius, position

possible

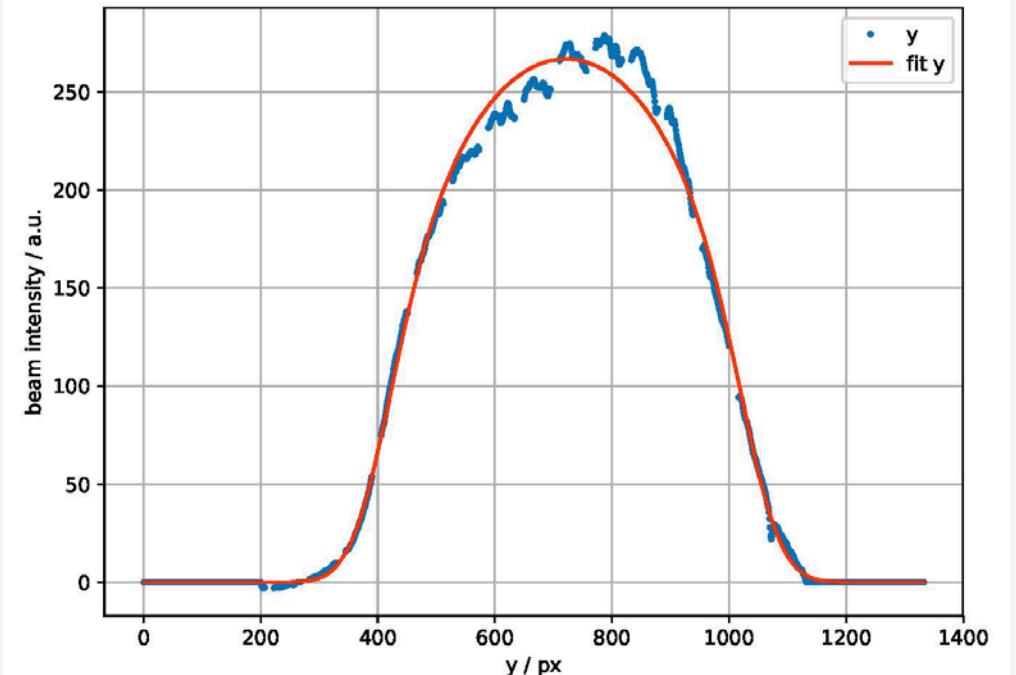


Centre of beam $y_0 = (721.05 \pm 0.44) \text{ px}$

Intensity $a = 0.412 \pm 0.002$

Radius of beam $R_c = (323.97 \pm 0.89) \text{ px} = (14.34 \pm 0.04) \text{ mm}$

Smearing parameter $s = (68.6 \pm 1.08) \text{ px} = (3.04 \pm 0.05) \text{ mm}$

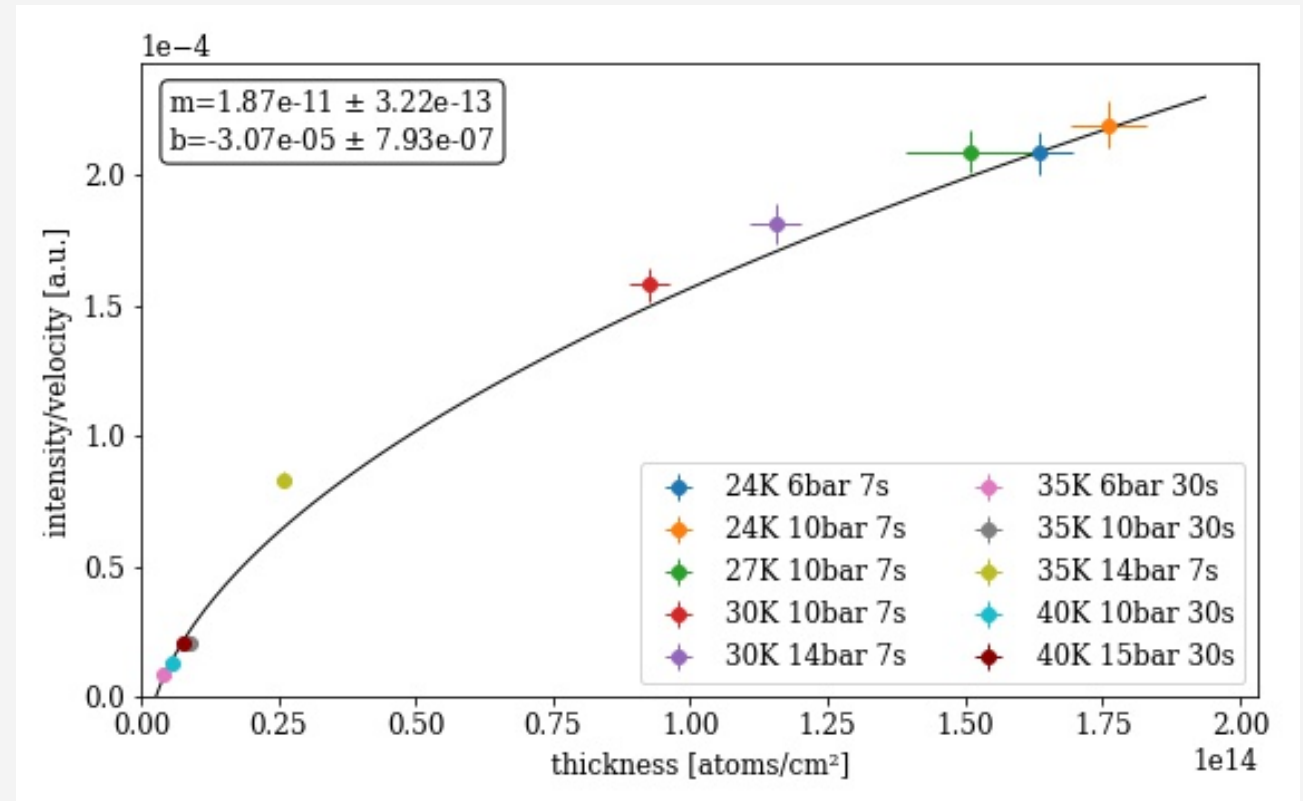


Thickness determination with MCP

- Thickness determination with absolute thickness monitor system
- Intensity determination of phosphor screen
- Measured intensity scales linearly with exposure time

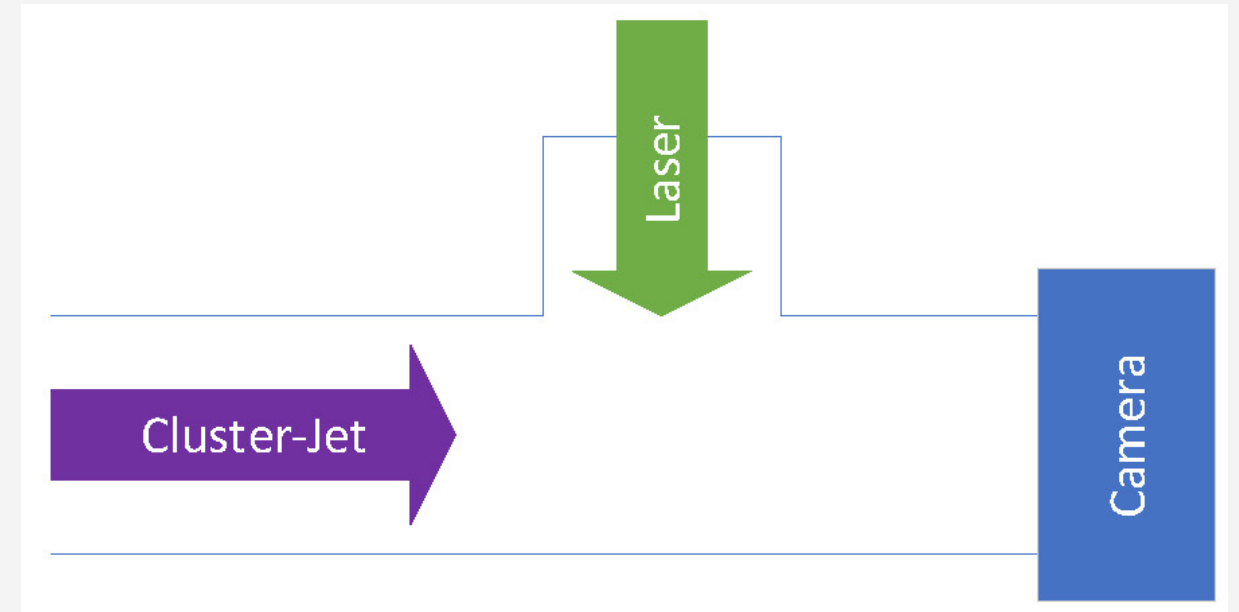
- Correlation: $\frac{I}{v} = m * \sqrt{\rho} + b$

⇒ Absolute thickness determination in liquid, supercritical, and gaseous regime with MCP

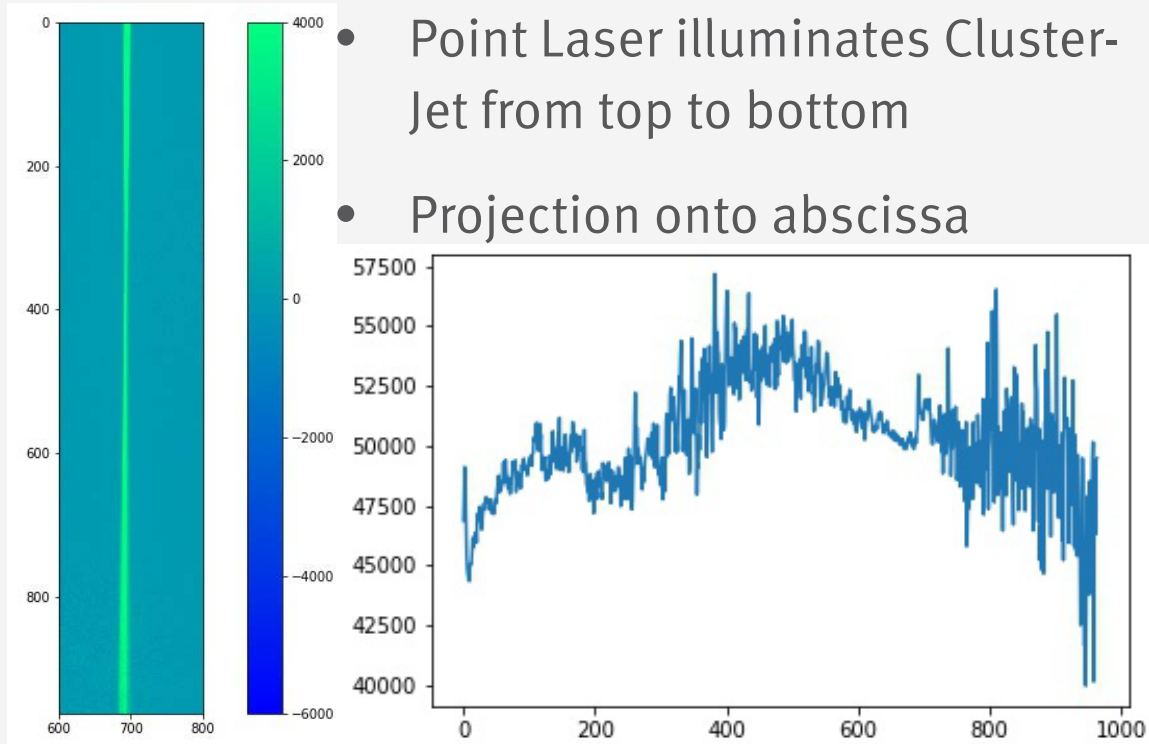


Beam Visualization with Laser

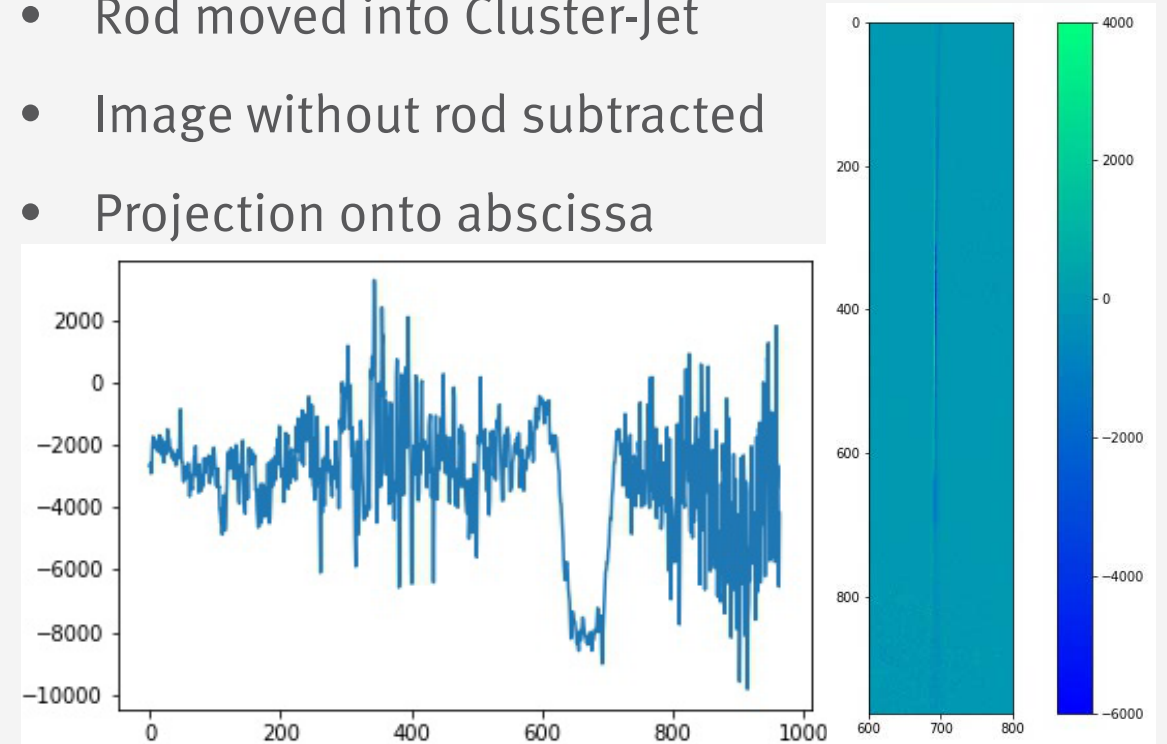
- Illumination of Cluster-Jet with point Laser and line Laser, i.e. only a line or slice is illuminated, respectively
- Scattered light is detected with camera



Beam Visualization with Point Laser



- Rod moved into Cluster-Jet
- Image without rod subtracted
- Projection onto abscissa

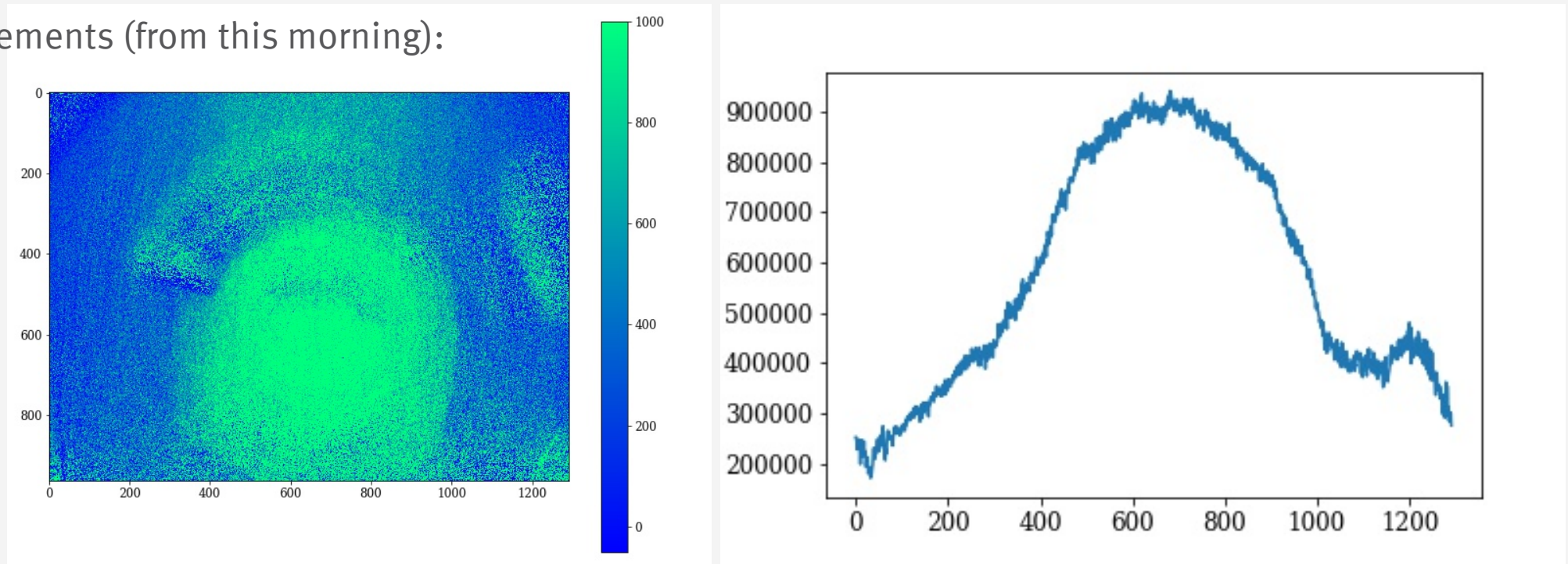




Beam Visualization with Line Laser

Brand new measurements (from this morning):

background
subtracted picture
of cluster-jet

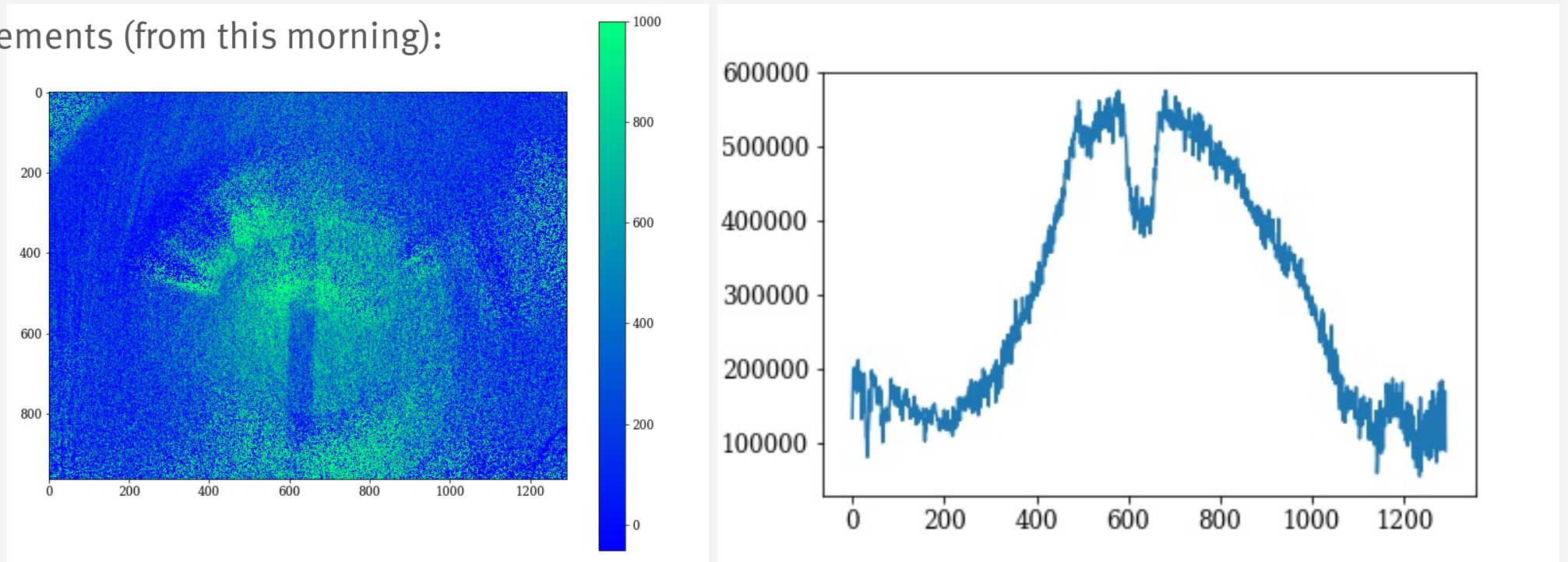




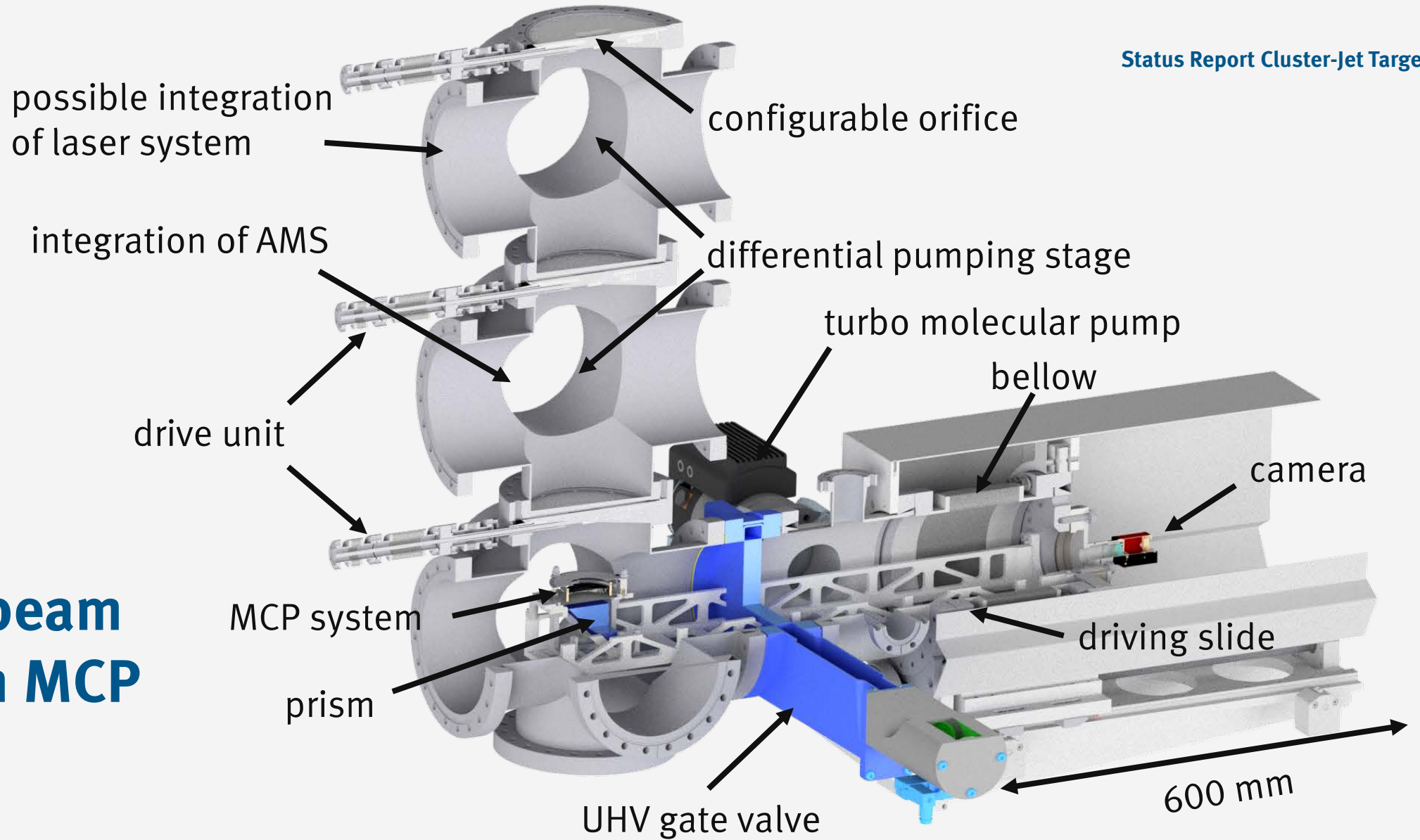
Beam Visualization with Line Laser

Brand new measurements (from this morning):

background
subtracted picture
of cluster-jet with
rod inside

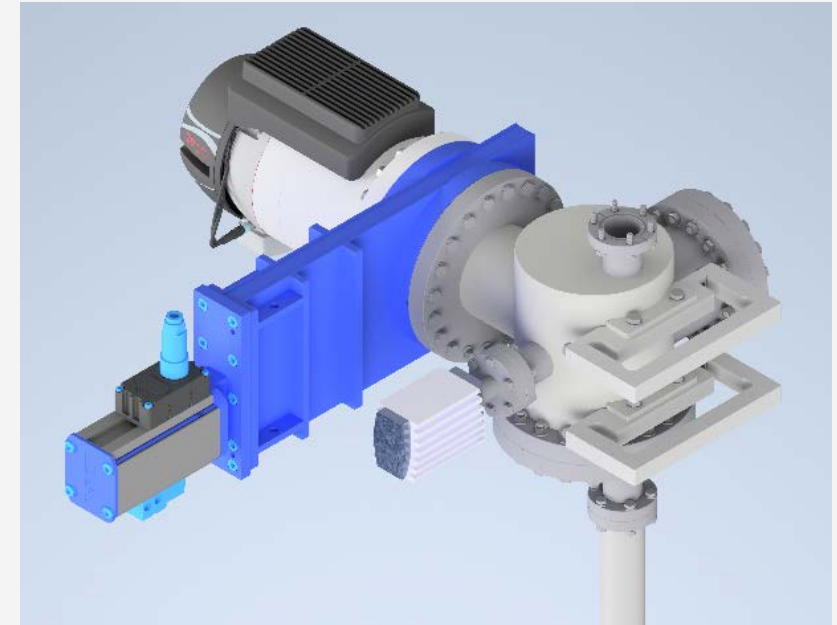


Modified beam dump with MCP system



Maintenance Work at \bar{P} ANDA Target at COSY

- Installation of a second transition vacuum chamber (TVC2) between source and IP
 - Equipped with turbo pump, which can be separated by a valve to measure with and without additional pumping speed
 - Measurements to understand the origin of residual gas at IP
- Adjustment of the target to prepare for next beam time
 - CBAC approved 1 week of beam time within first half of 2021 (not yet scheduled)



Summary / Outlook

- Installation of new gas system in the near future
- Glass nozzles are not working yet, but further studies ongoing
- Developments on copper nozzles and their production process
- MCP is foreseen as 2D imaging device and velocity measuring device at the modified beam dump
- Commissioning of new MCP
- Studies on beam visualization with line laser ongoing
- Preparation of beam time at COSY within the first half of 2021