Westfälische
Wilhelms-Universität
Münster

PANDA Collaboration Meeting
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Update on Targets

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Status of the PANDA Cluster Source

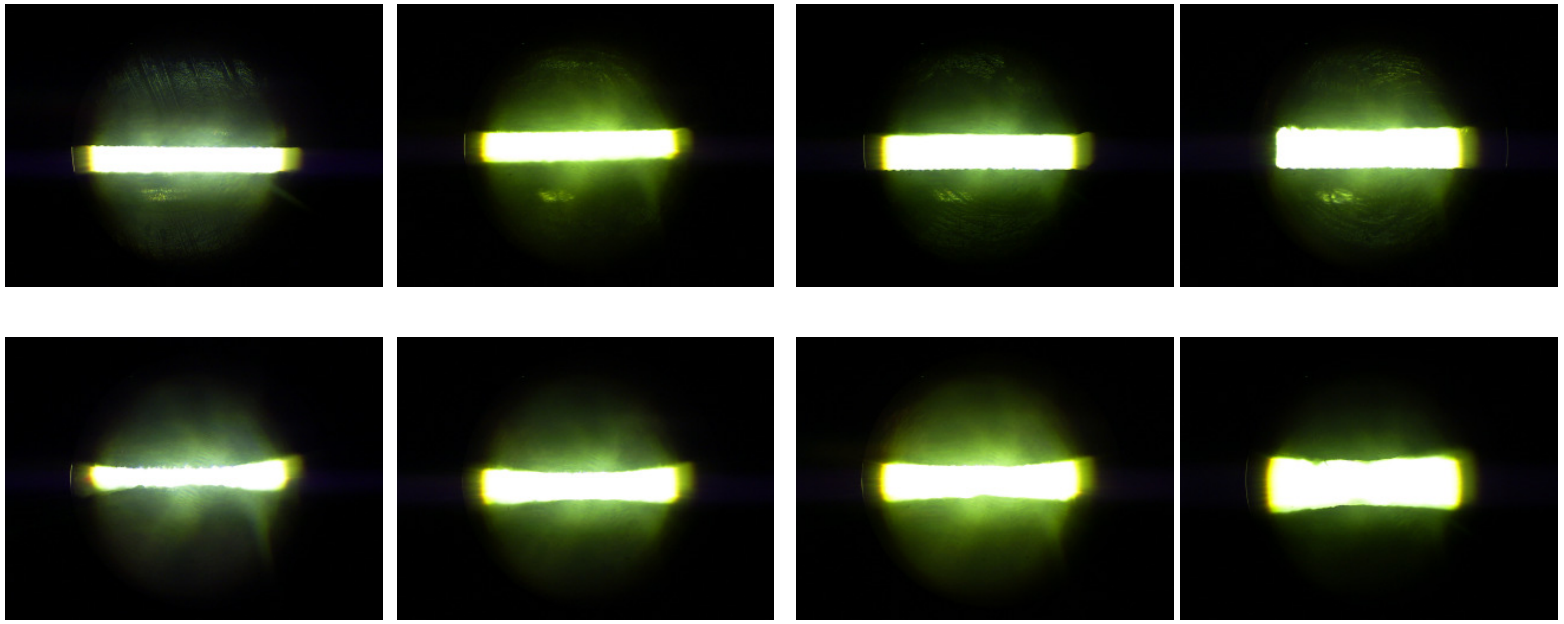
- All vacuum pumps for the PANDA cluster source are ordered
- PANDA cluster source is currently under construction
- Safety aspects: Hydrogen

  For the design and operation of the cluster source including pumps etc. a safety document has been created by INBUREX, Hamm

  → Target can be operated as planned

Reduction of the Gas Load

- Systematic measurements with different skimmer sizes
- Measurements are performed with new skimmers (xx µm x 800 µm)



60 µm 100 µm 120 µm 140 µm

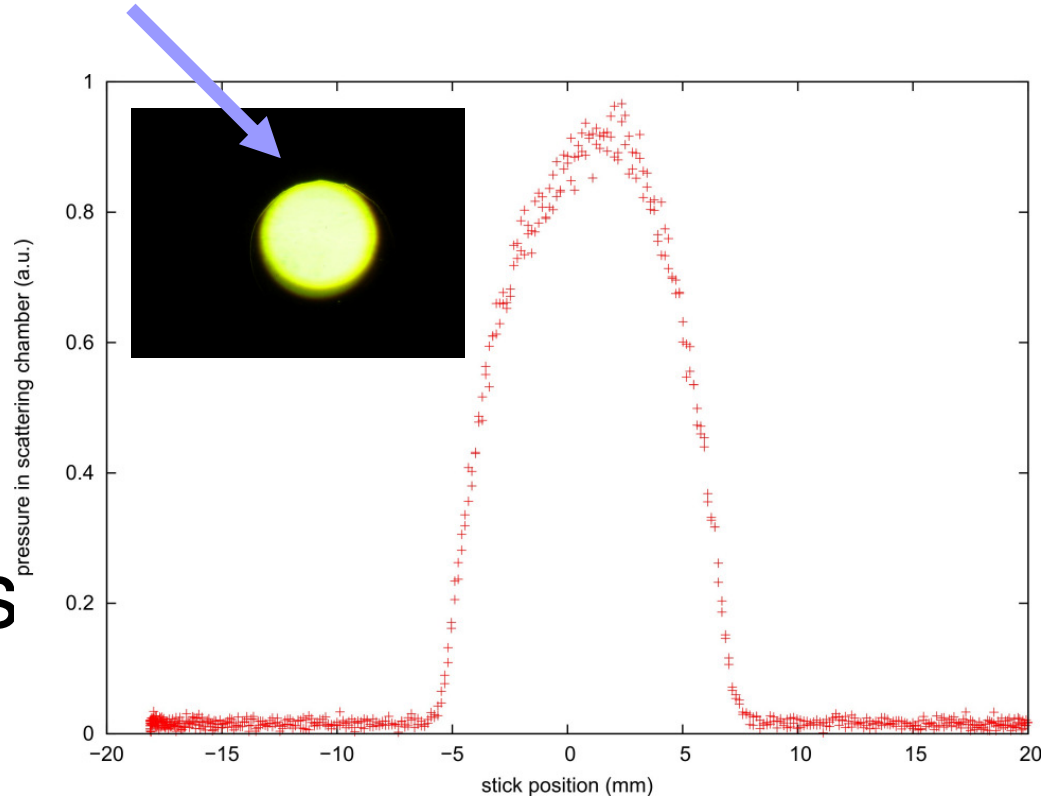
flat skimmer tip

vs.

conical skimmer tip

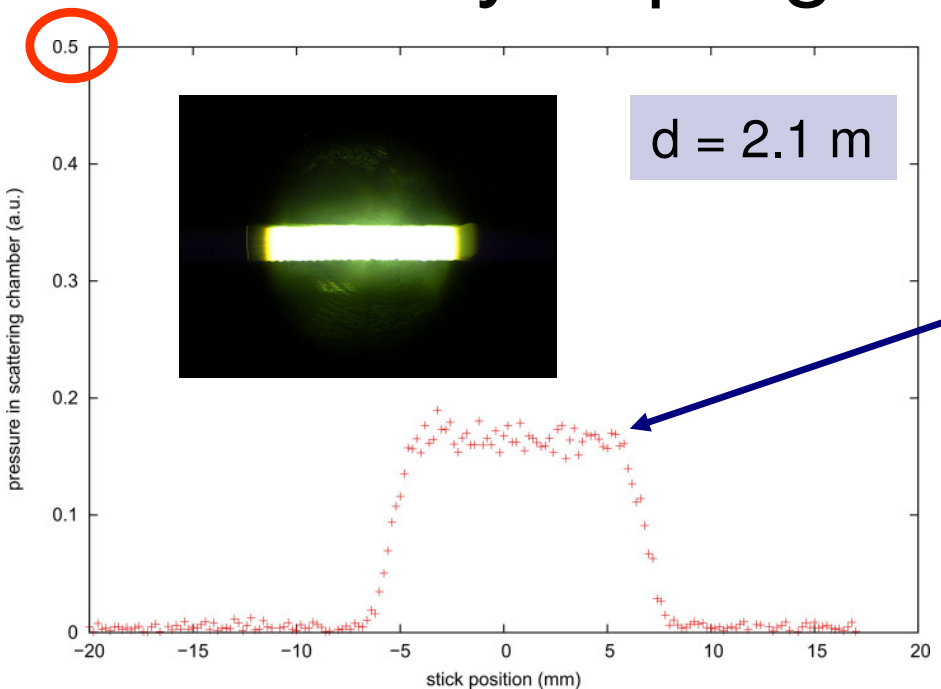
Areal Density: Circular Collimator

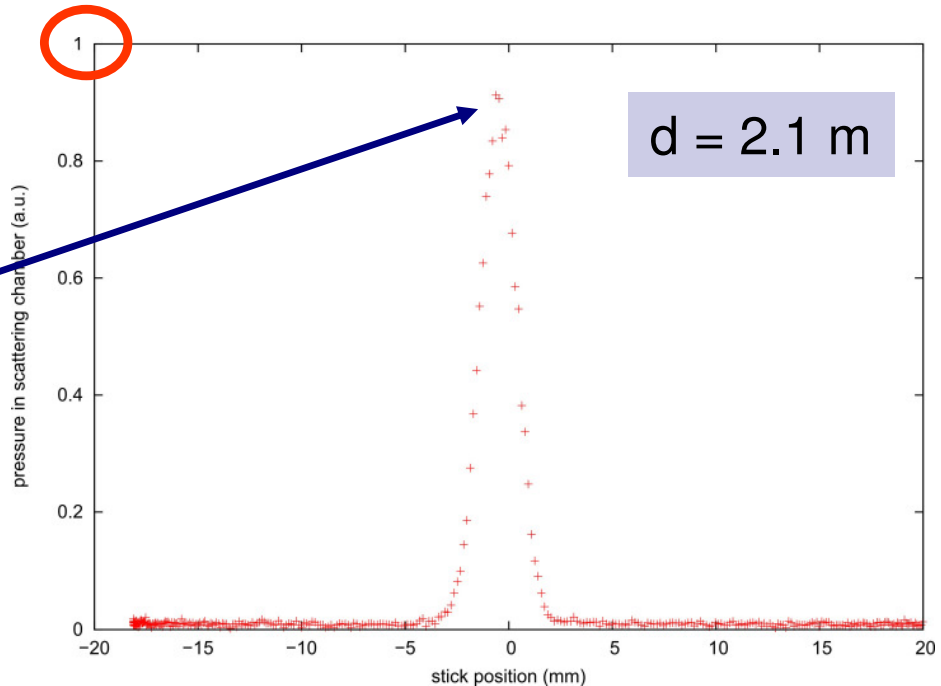
- Density obtained with a circular collimator with a diameter of 700 μm is used as reference
- Compare this number with densities obtained using slit collimators of different sizes



Areal Density: Slit Collimator

- Slit collimators of 140 µm and 120 µm (times 800 µm) result in same longitudinal densities (antiproton direction)
- Measurements with smaller collimators currently in progress





Recent Developments at GSI

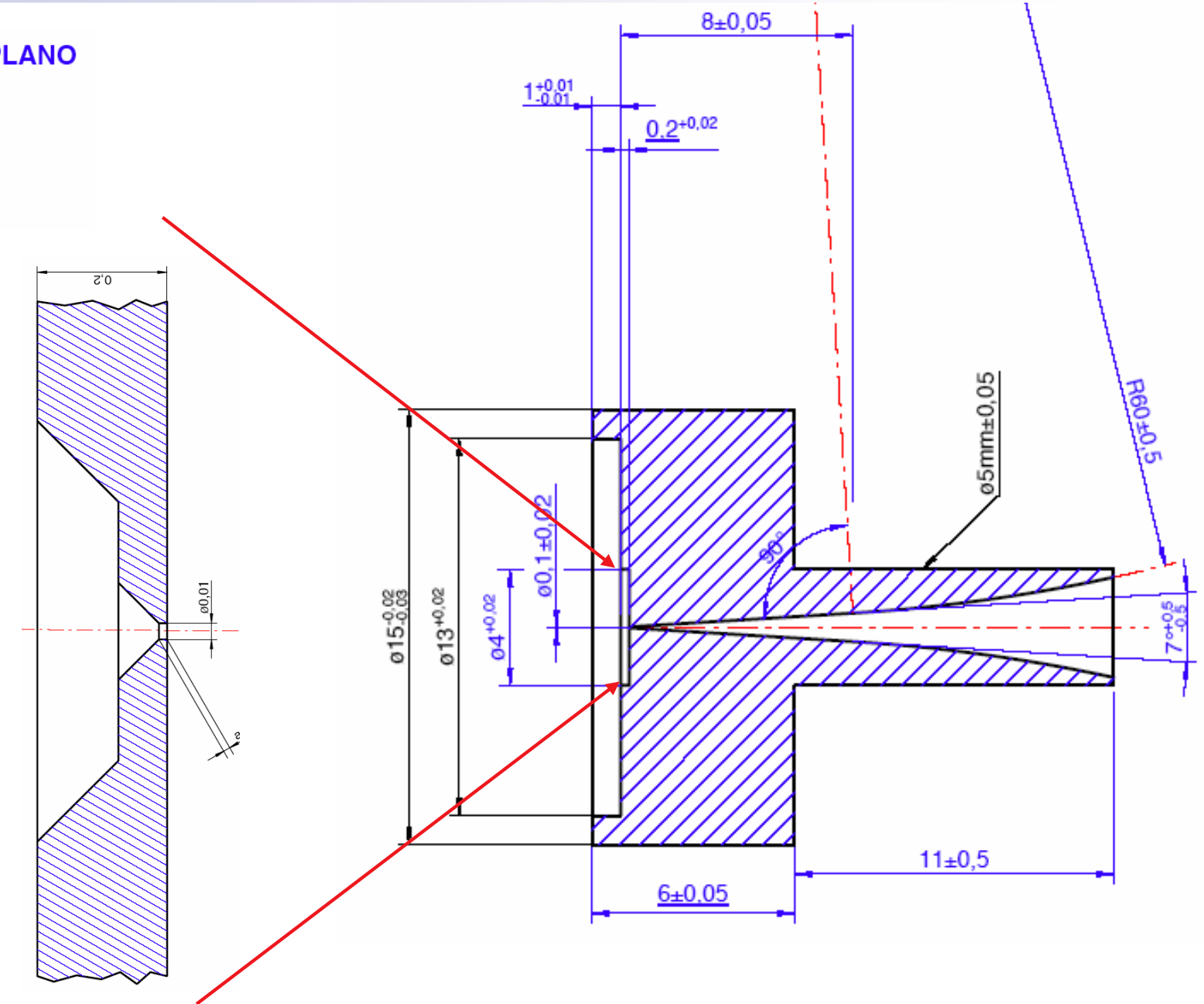
- Production of new µm-sized nozzles is of high relevance for the cluster targets
- Groups from GSI and Genova investigate different approaches for new nozzles, e.g.
  - galvanic growing
  - electro erosion
  - composite design

Recent Developments at GSI

FREY-Blenden der Firma PLANO

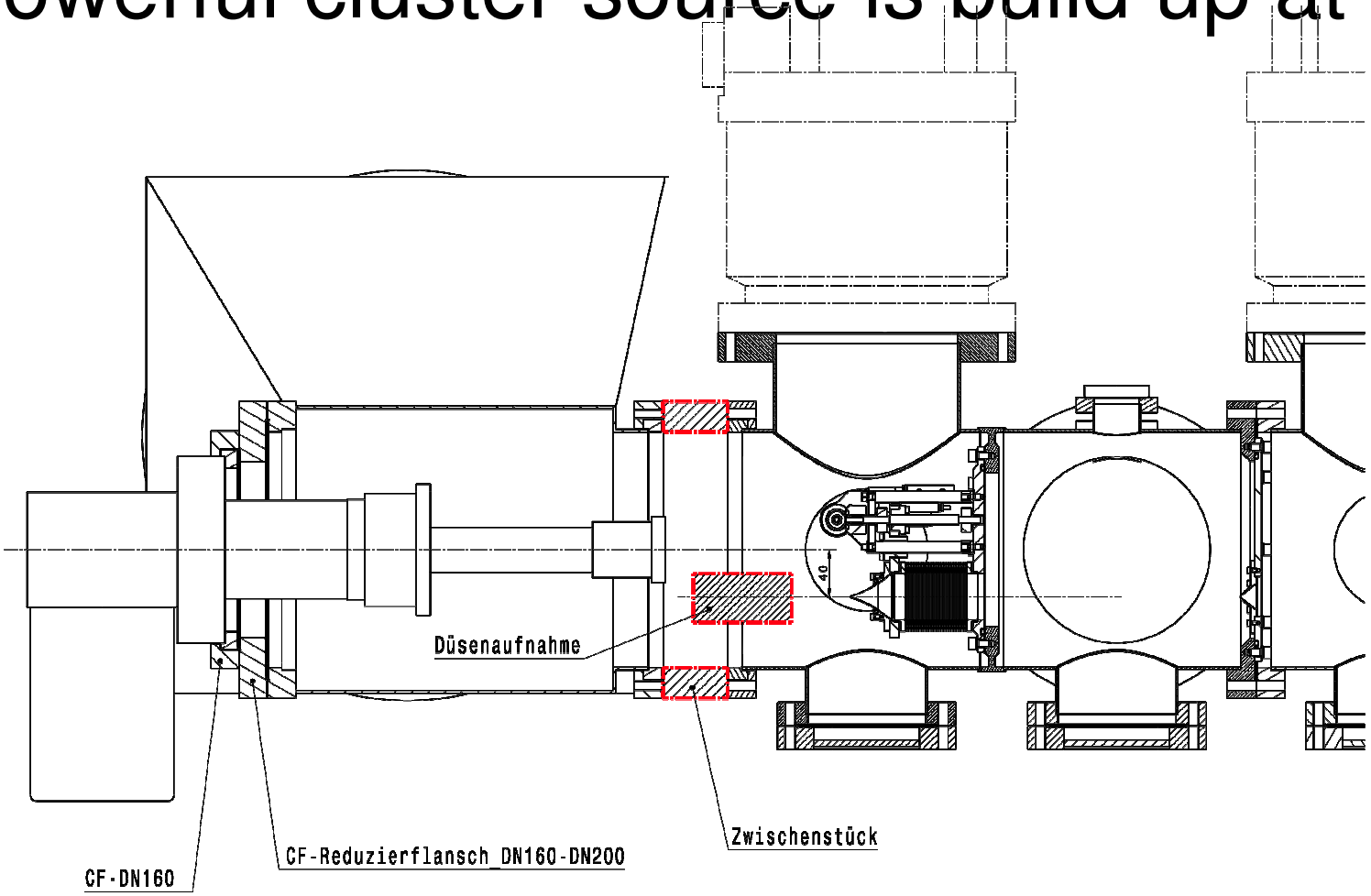
Material: Molybdän, 0,2mm dick
Aussen ø 4mm
Innen ab ø 0,01mm
in Abstufungen 0,001mm möglich
a= Lochdurchmesser x 0,5

Modified
CERN Nozzle



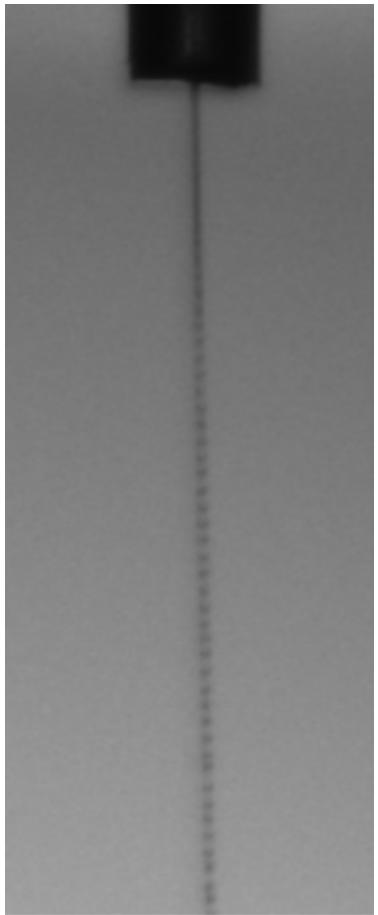
Recent Developments at GSI

- For performance tests of new nozzles a powerful cluster source is build up at GSI



Pellet Target Activities at FZJ

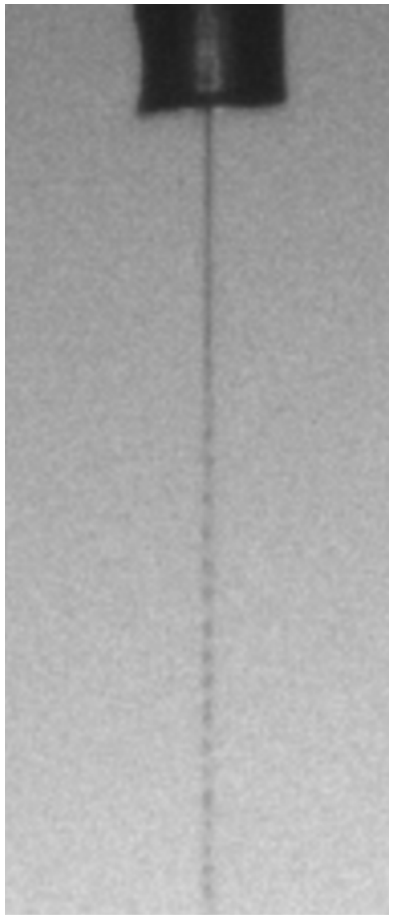
- Investigations on the production of mono-disperse droplets from thin jets (d ≤ 10 µm) and high frequency was started



Hydrogen droplets directly behind the nozzle and before the vacuum injection:

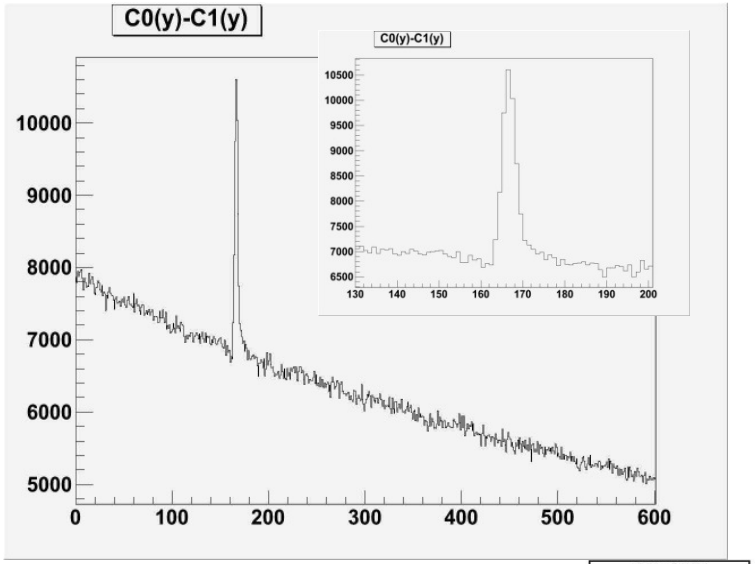
Left: Droplet diameter ≤ 10 µm
f = 144 kHz

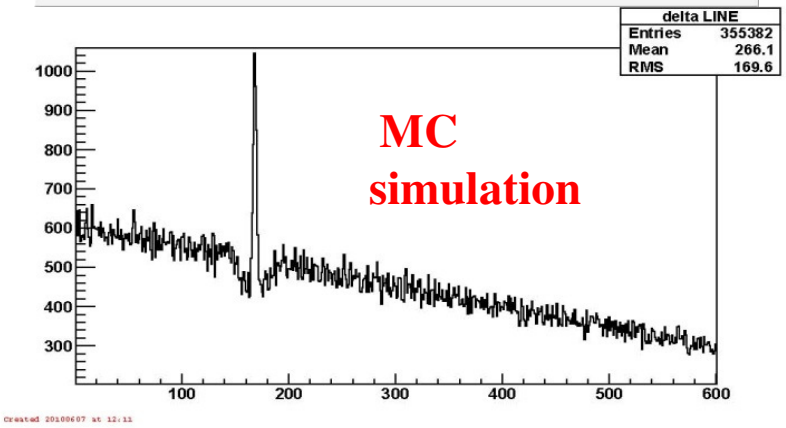
Right: Jet diameter ≤ 7 µm
f= 150 kHz



Pellet Tracking Developments

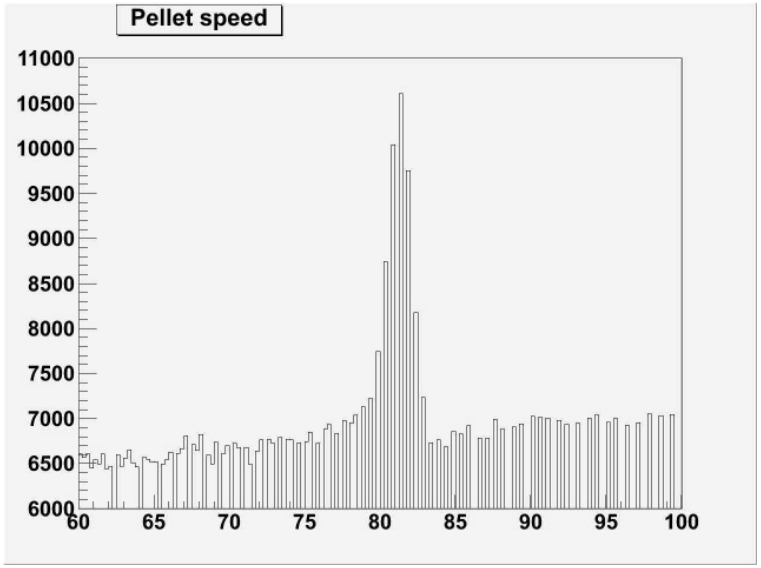
Pellet velocity estimate at UPTS May 2010





Time difference

Pellet generation conditions
$f_{droplet} \approx 50$kHz
$p(H_2) \approx 400$mbar, p(droplet.ch.) ≈ 25mbar
droplet velocity 25 m/s
pellet diameter 20-30 micron (guess)

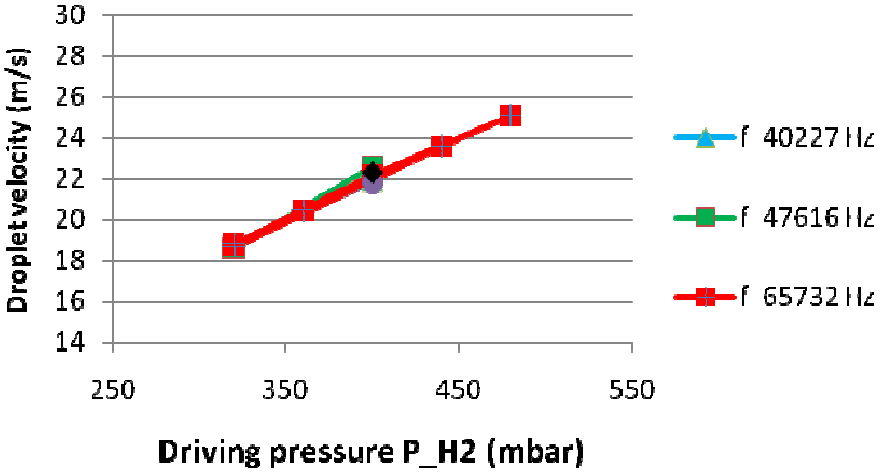


60m/s **Velocity** **100m/s**

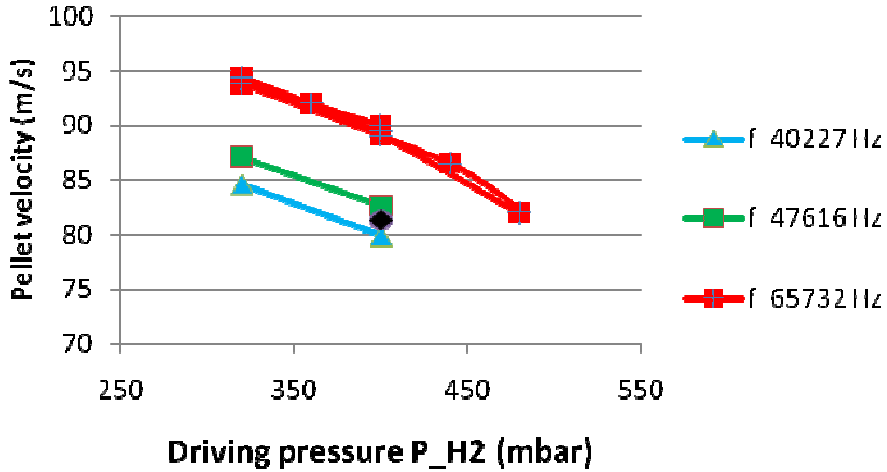
The good agreement with MC indicates that a "big" fraction of the pellets have a velocity $v \approx 80$ m/s …with a small spread $\sigma_v/v \approx 1\%$

Droplet and Pellet Velocities

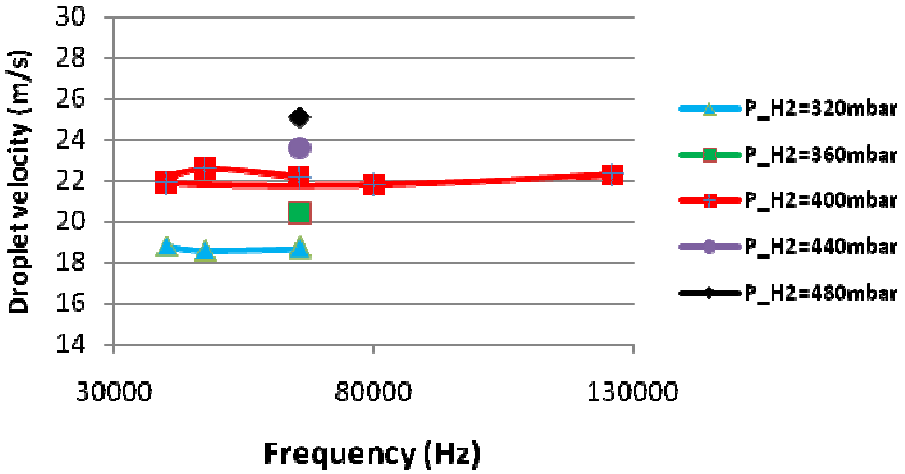
Droplet velocity vs driving pressure and generation frequency



Pellet velocity from LS-camera measurement



Pellet generation conditions
p(droplet.ch.) ≈ 25mbar
pellet diameter 25-35 micron (guess)

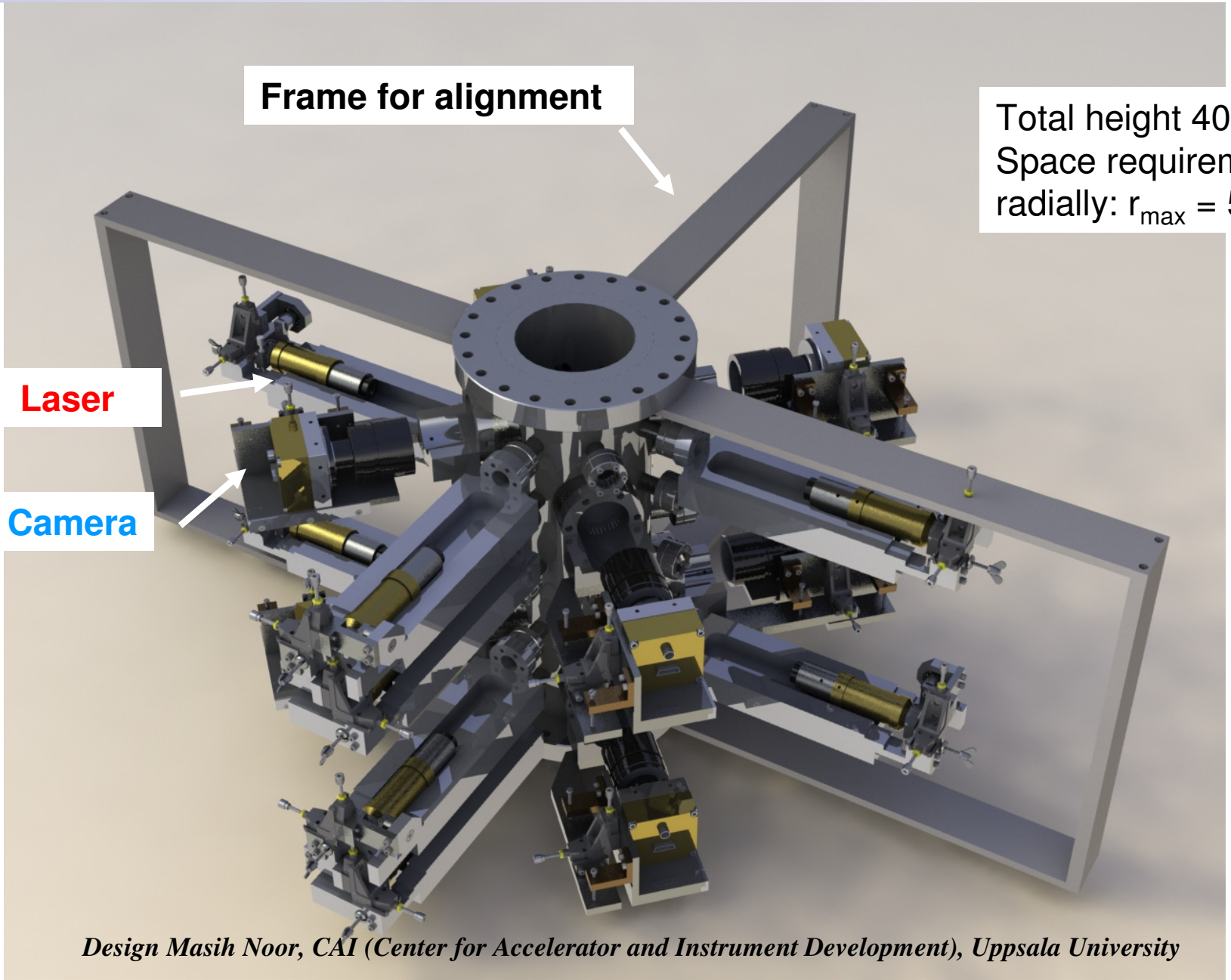


Higher driving pressure
⇒ faster (and bigger droplets)
⇒ slower pellets

$$\Delta\phi/\phi \approx 1\% \Leftrightarrow \sigma_v/v \approx 1.5\%$$

(at these conditions)

Design idea: Pellet Tracking Section



Total height 400 mm.
Space requirement radially: r_{max} = 500 mm.

Design Masih Noor, CAI (Center for Accelerator and Instrument Development), Uppsala University

Status of the Target TDR

1.) Cluster-Jet Target

- a cluster target setup in PANDA geometry is available
- prototype cluster source built up and set into operation

  → data for the TDR
- target density: $\rho = 8 \cdot 10^{14}$ atoms/cm^2

  with potential of further improvement

Status of the Target TDR

- based on obtained results the cluster target design for PANDA is fixed for
  - the vacuum system
  - the gas supply system
  - the mechanical setup
  - the beam dump (also for the pellet target!)

→ ready for a TDR

- in parallel: further studies/improvements which can be considered for PANDA

Status of the Target TDR

2.) Pellet Target

- for technical developments pellet beam set-ups are available at Uppsala, FZJ and Moscow
- the Uppsala PTS has PANDA geometry
- with WASA-at-COSY a running pellet target similar to PANDA geometry is available
- target density: $\rho = 4 \cdot 10^{15}$ atoms/cm^2 (average) at interaction zone

Status of the Target TDR

some WASA-at-COSY parameters

- pellet diameters: Ø = 25…30 µm routinely available
- ~ 3 mm pellet beam width at interaction zone
- pellet rate ~ 10.000/s
- vertical pellet distance ~ 5 mm (average)

→ a WASA-type pellet target can safely be build in PANDA geometry

Status of the Target TDR

Important topics, which are currently studied:

- smaller pellet diameters: Ø ~ 10 µm
  - promising results on small droplets, but no pellet stream data yet in PANDA geometry
  - small pellets needed for high-luminosity measurements (no tracking) $\rho \geq 4 \cdot 10^{15}$ at./cm^2
- pellet tracking system
  - pellet tracking possible for pellet velocity spread of $\Delta v/v \leq 1\%$ (already achieved)
  - tracking possible for large pellets (≥ 20 µm)

Status of the Target TDR

- pellet tracking system
  - identification of individual pellets achieved
    (2d hit distribution, velocity measurements)
  - design concept for a 3d pellet tracking system available

At present no measured results can be given on

- small pellets
- 3d pellet tracking system (it should work)

Possibilities for the Target TDR

Solution A): joint TDR (cluster+pellet) now

- cluster target similar to the Münster prototype
- description of a WASA-type pellet generator for PANDA
- design of a 3d pellet tracking system compatible with a WASA-type pellet generator
- description of the current studies on small pellets

Possibilities for the Target TDR

Solution B): two separate TDRs

- description of a cluster target similar to the Münster prototype (existing already)
- finalization of the pellet TDR as soon as data on pellet tracking and small pellets in PANDA geometry are available (≥ 1 year)

Proposal: Decision by the Collaboration Board latest on next PANDA meeting (spring 2011)