Pellet Target Development for PANDA

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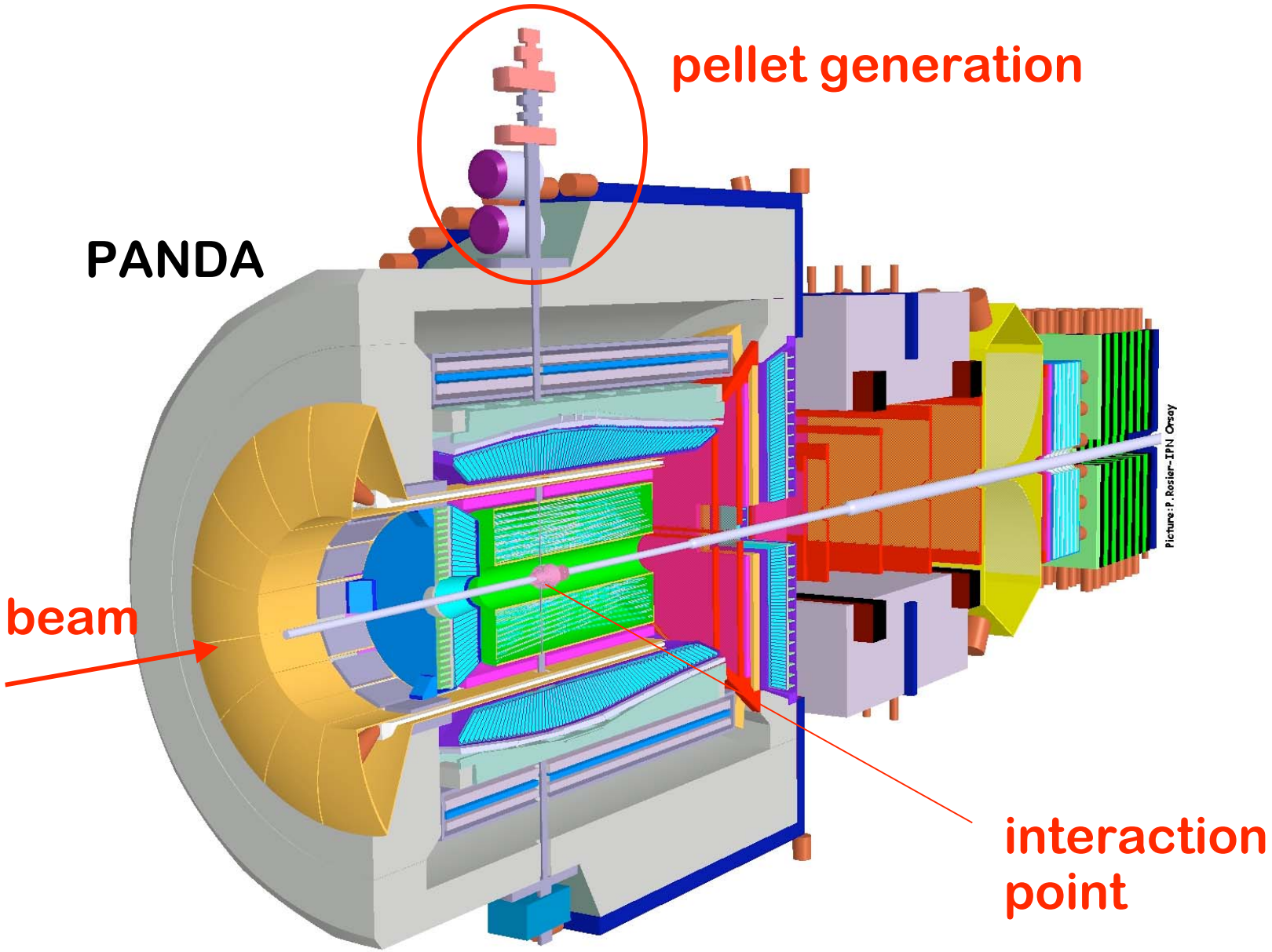
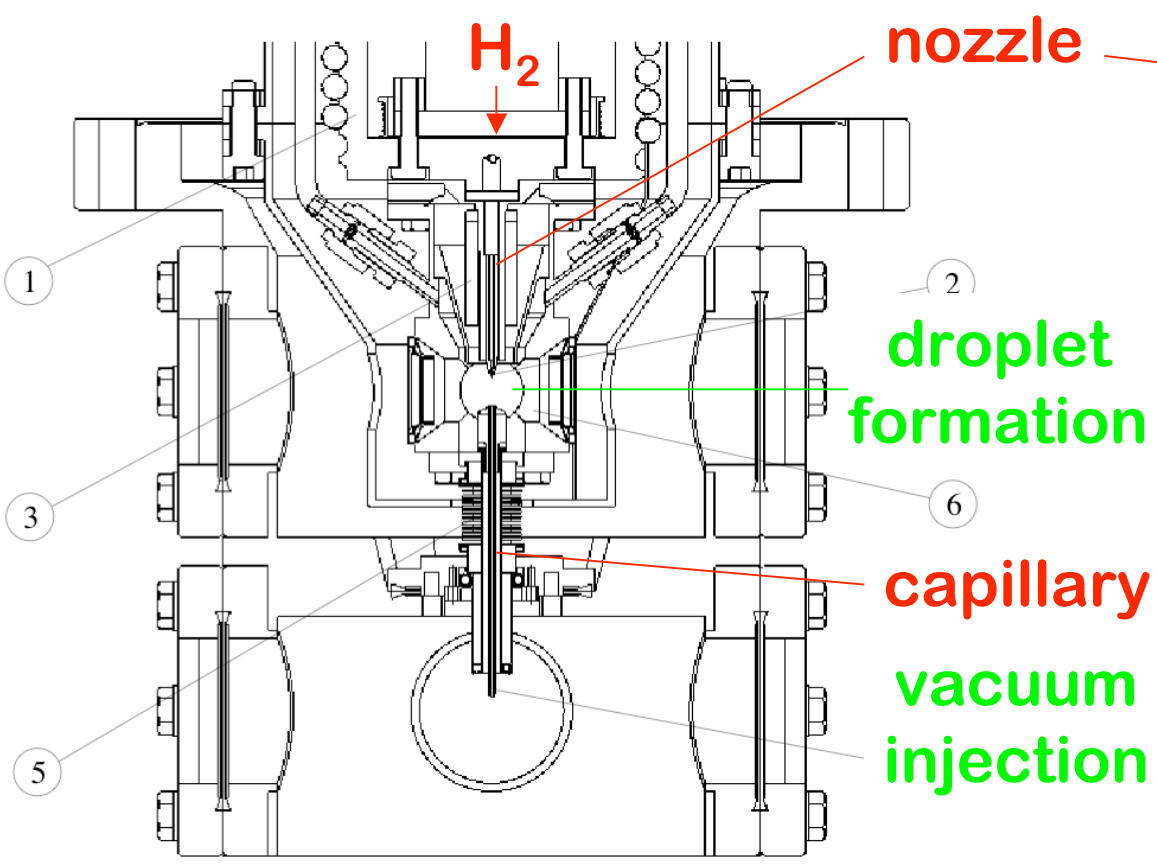
Where to use it?



Requirements on a Target for PANDA

- design luminosity: 2×10^{32} /cm^{2}s
  - average density: 3.8×10^{15} atoms/cm^2
- reconstruction of short lived reaction products
  - define primary vertex
- leave space for detectors
  - few mm pipe diameter for a length of 3.7 m
- good vacuum in the ring
  - low out-gassing (pumping is restricted)
- small beam size (few mm)
  - special requirements on inhomogeneous targets

Pellet Generation Principle

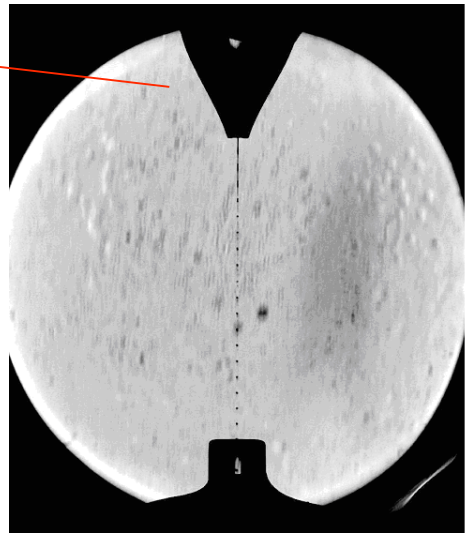


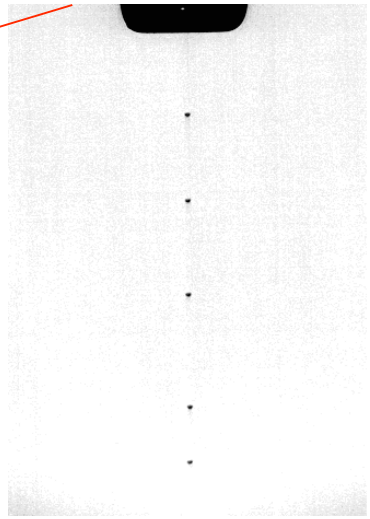
nozzle

droplet formation

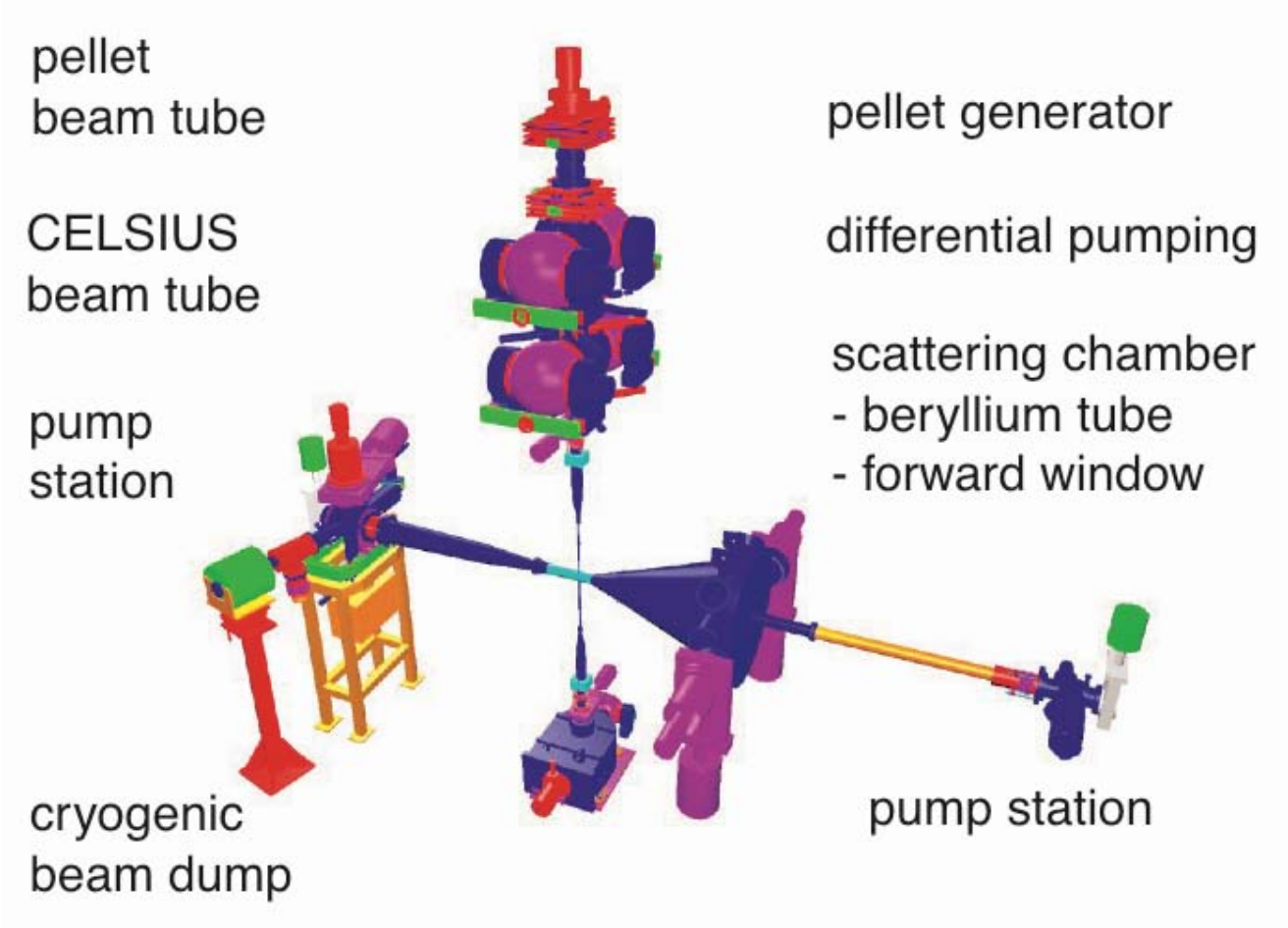
capillary

vacuum injection





WASA Pellet Target



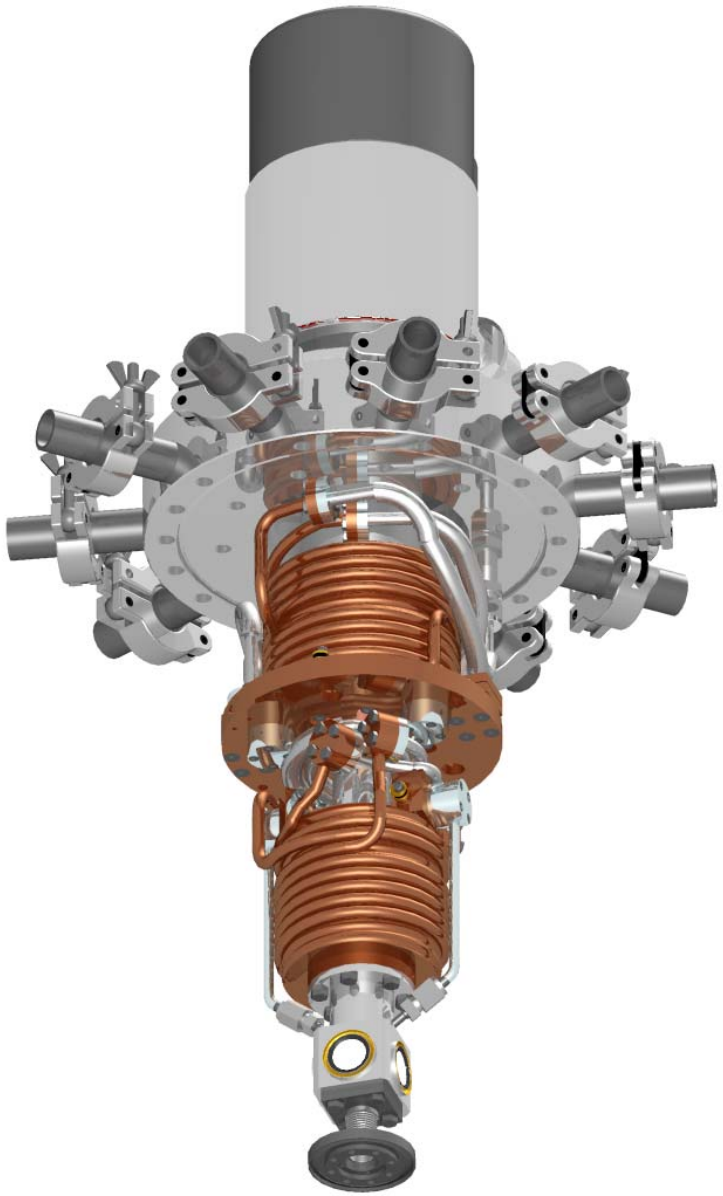
- **in regular operation for production experiments with hydrogen and deuterium since 2000 !**

Currently achieved at CELSIUS/WASA

- design luminosity: 2×10^{32} /cm^{2}s
  - average density: 3.8×10^{15} atoms/cm^2
  - currently: 1.7×10^{15} atoms/cm^2 √
- reconstruction of short lived reaction products
  - define primary vertex
  - 25μm pellets can be tracked √
- leave space for detectors
  - few mm pipe for 3.7 m length
  - currently: 3.2 m √
- good vacuum in the ring
  - low out-gassing (pumping is restricted)
  - currently under study at Uppsala !
- small beam size (few mm)
  - special requirements on inhomogeneous targets
  - currently: $\sigma_h \times \sigma_v = 1 \times 3$ mm^2 !

A Pellet Test Station at Uppsala

- new and completely independent system
- full access for observation and modifications
- independent on CELSIUS beam times...
- improvement keeping compatibility with the WASA system

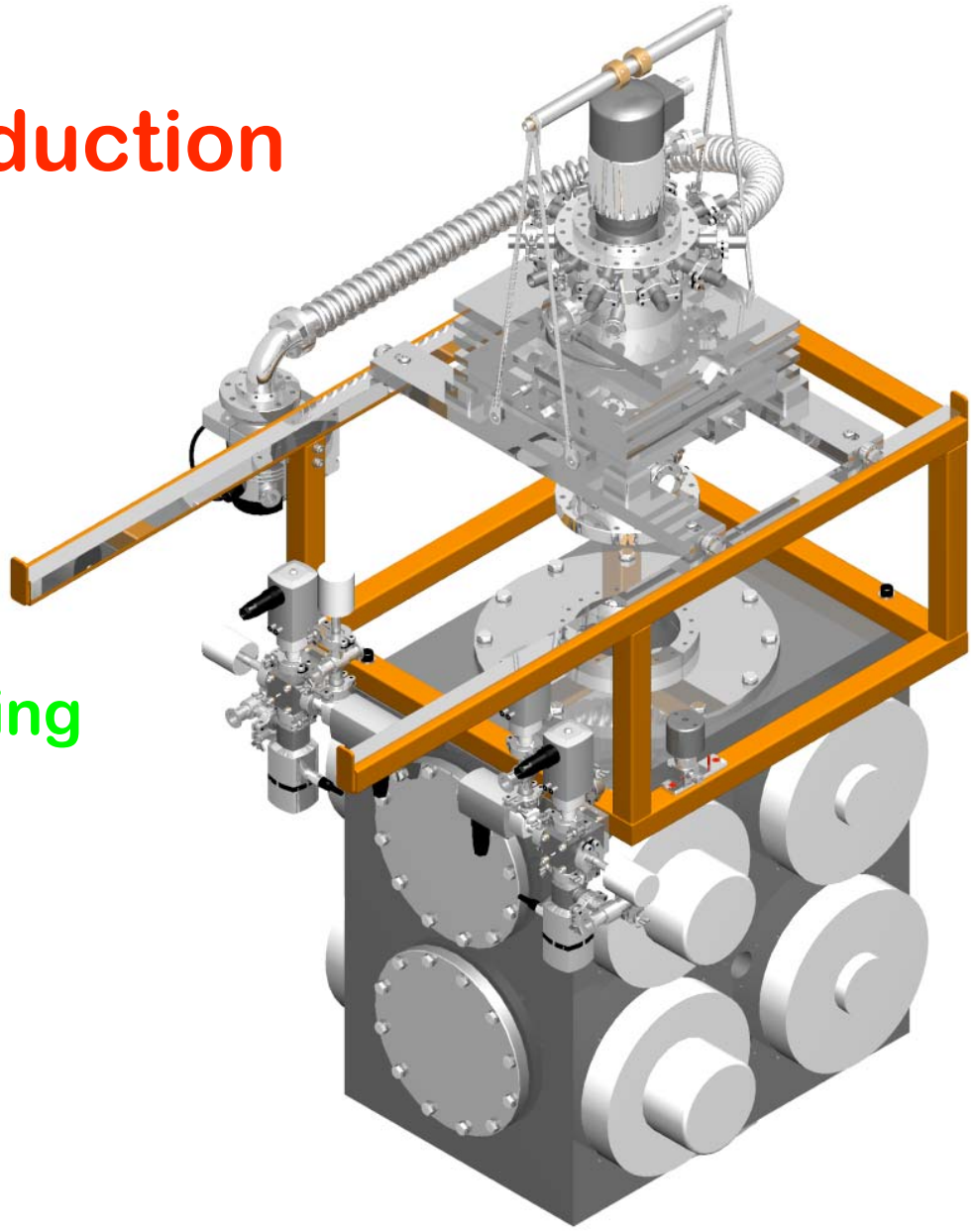


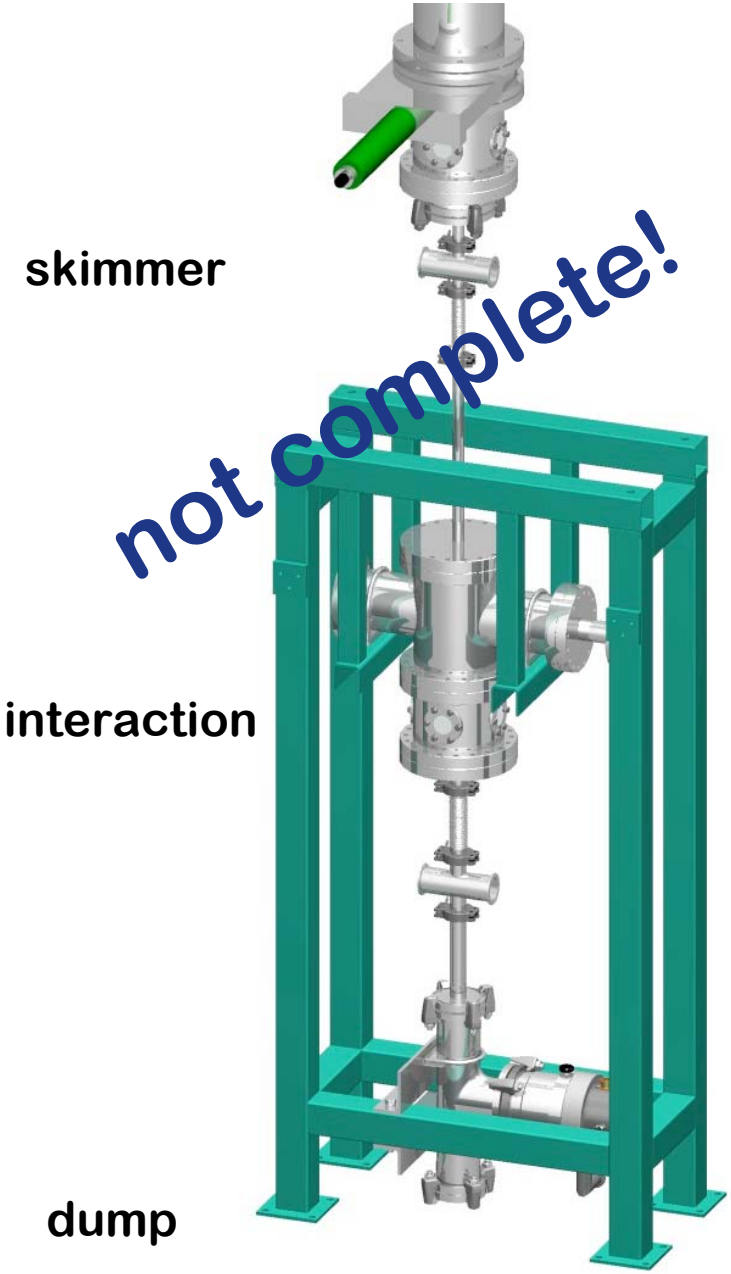
Improved Cold-Head

- lower vibrations
- faster pumping
- vacuum monitoring in all stages
- individual heating
- temperature measurements

Pellet Production

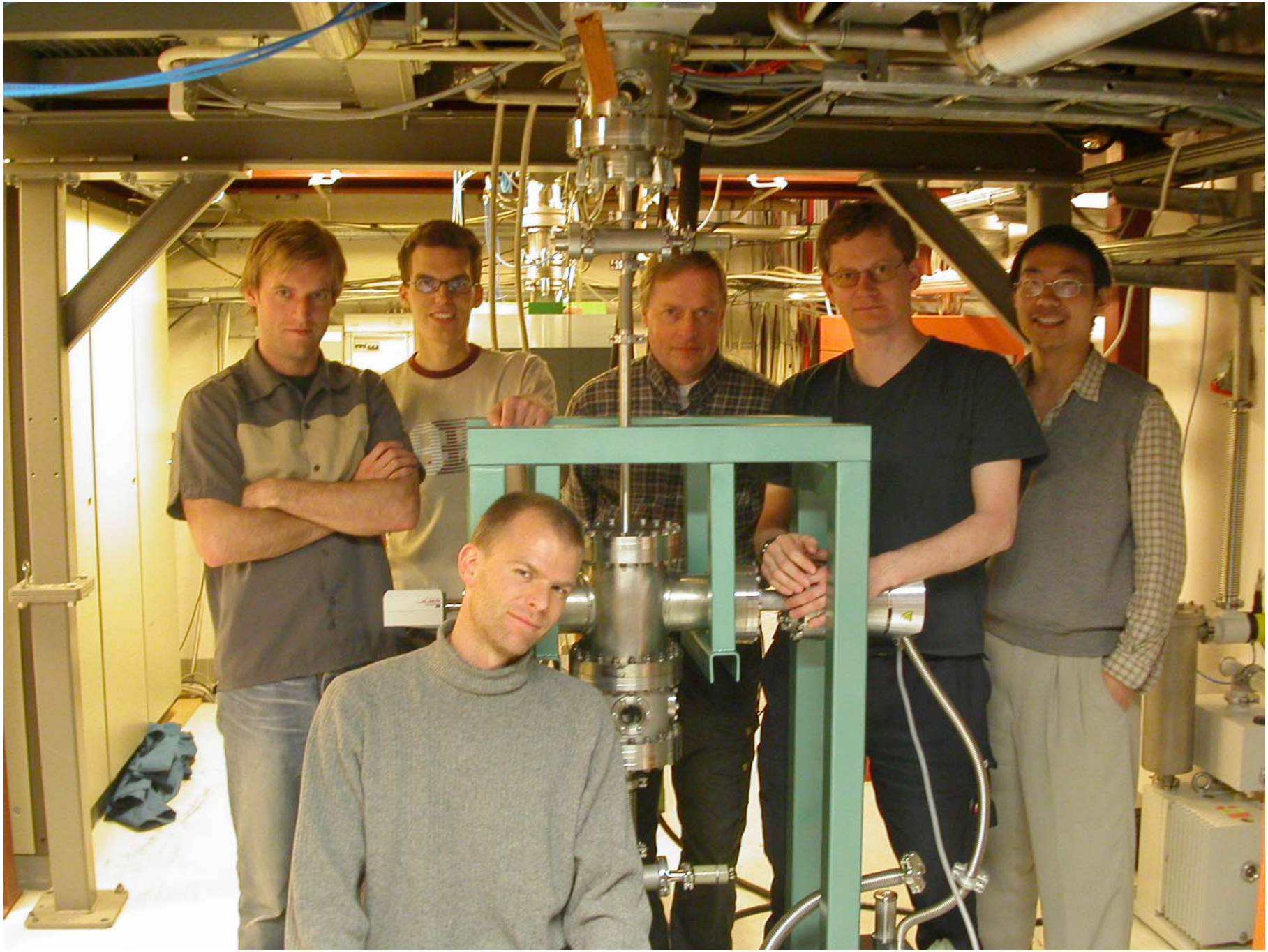
- nozzle + capillary interchangeable with WASA
- good access for mounting
- fast exchange of parts



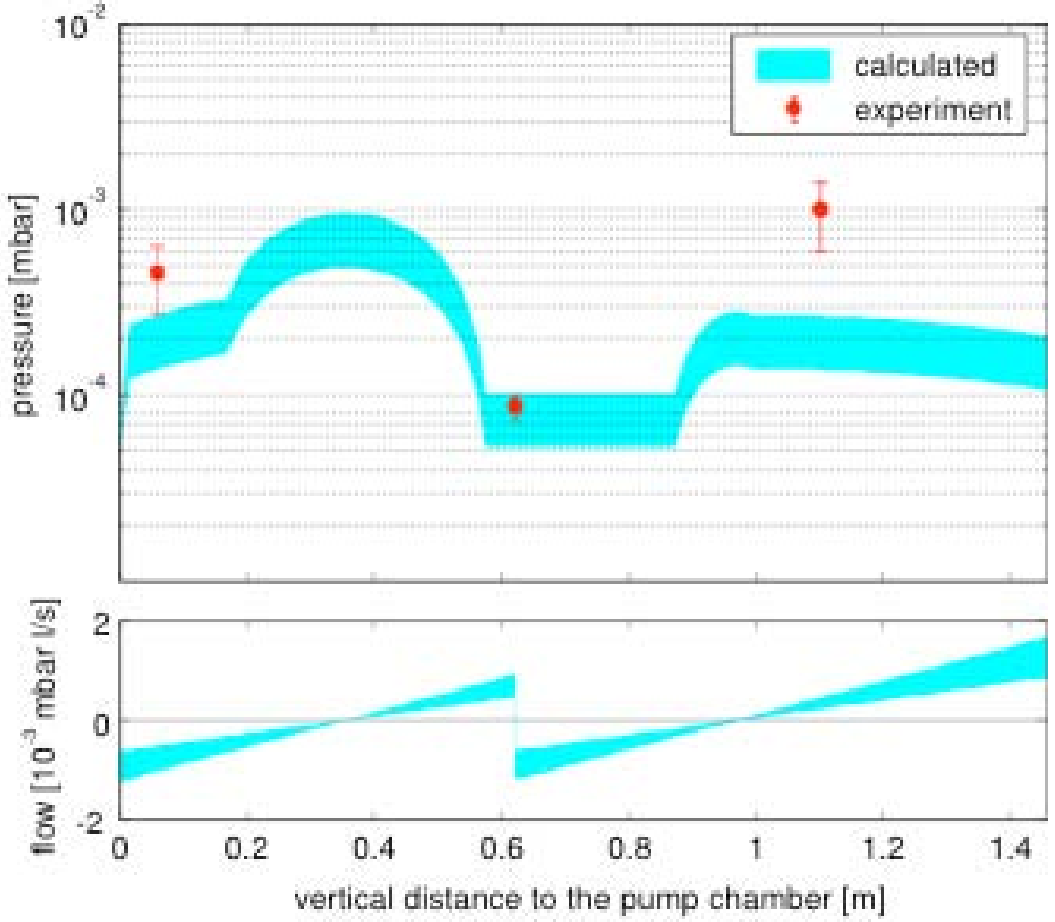


Lower Vacuum System

- simulating PANDA vacuum-wise
- vacuum monitoring at six points
- optical observation of the pellets
- flexible design
- ongoing developments:
  pellet tracking, ...



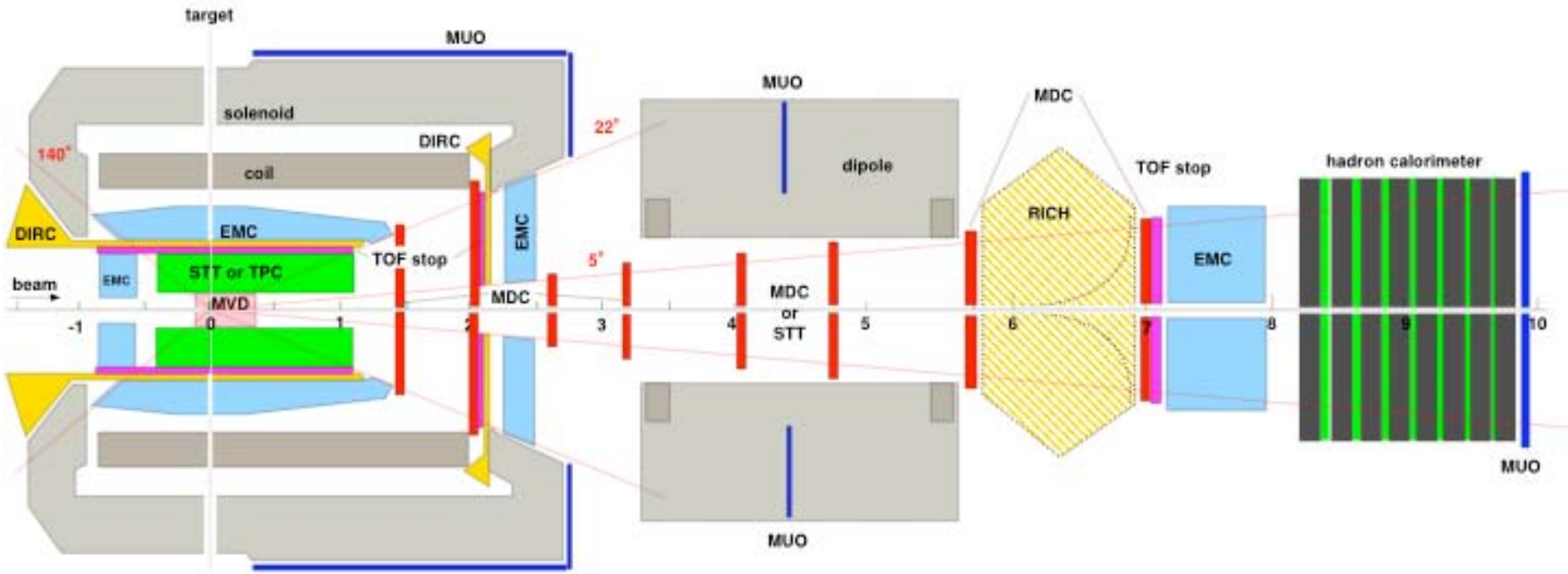
Results on the Vacuum in the Test Set-up



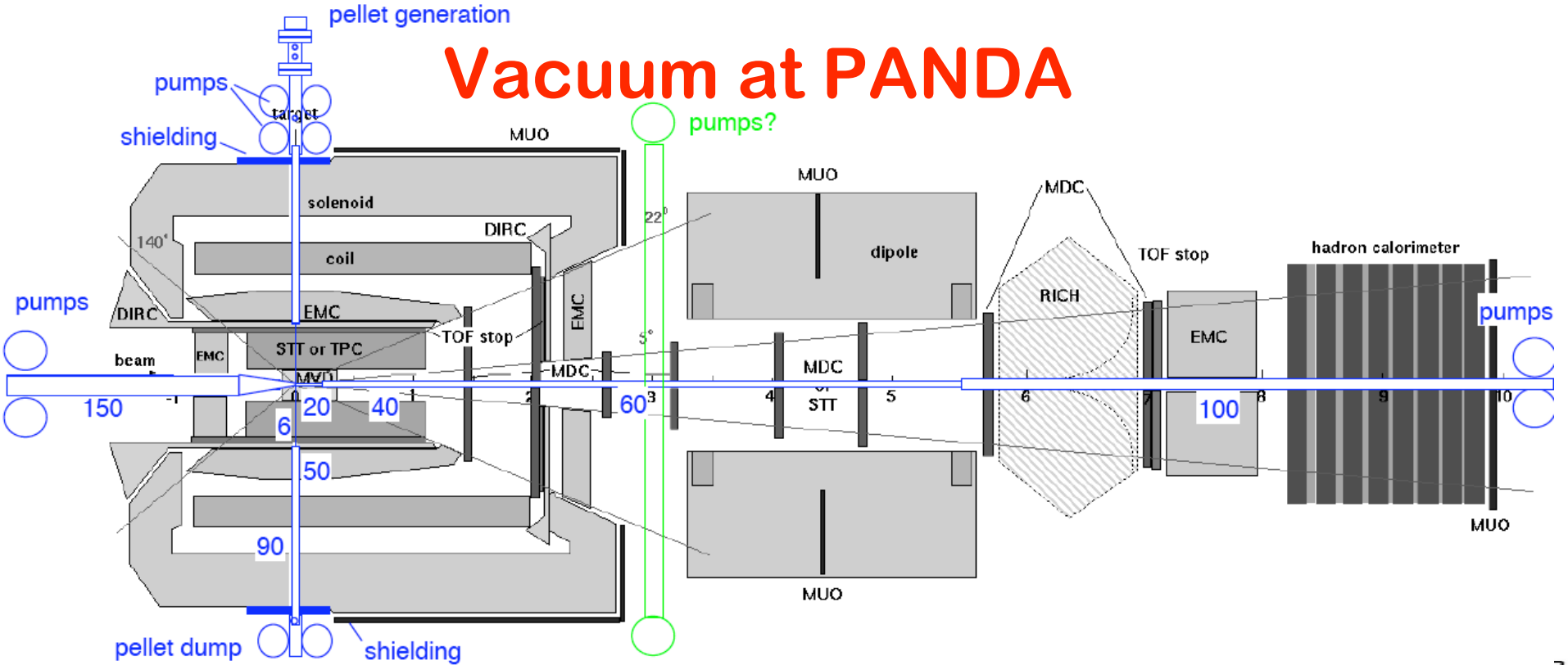
- measurements with a stable pellet train
- calculations using VACLOOP

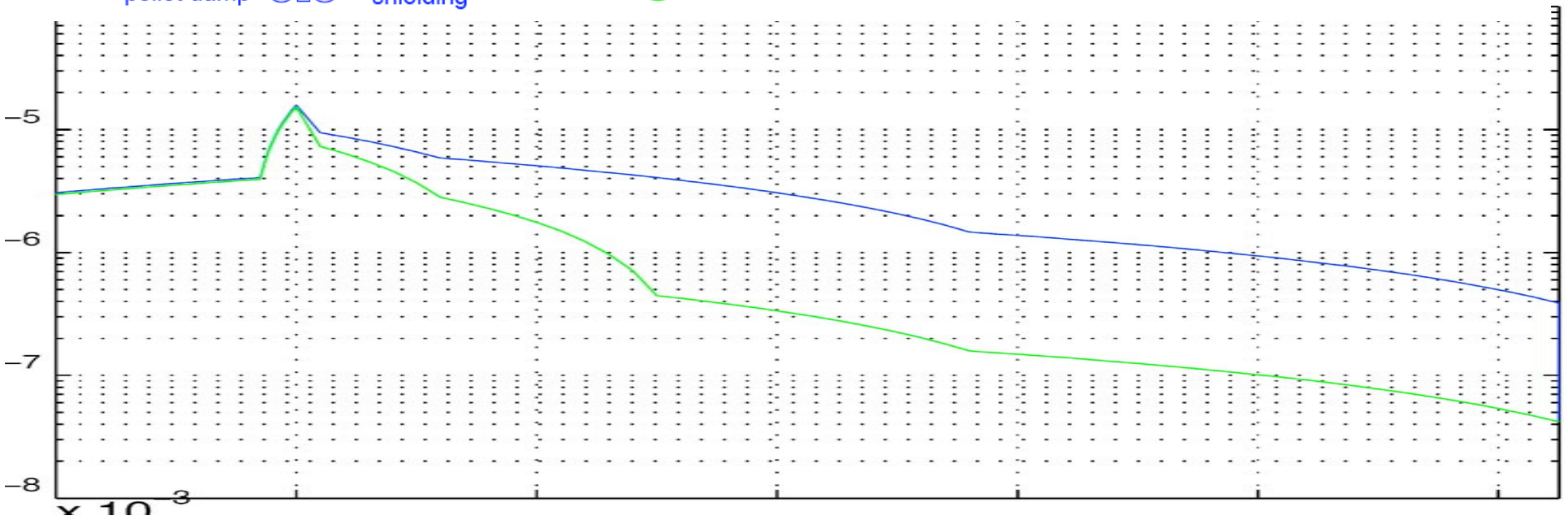
- agreement of experiment and calculations

Vacuum at PANDA

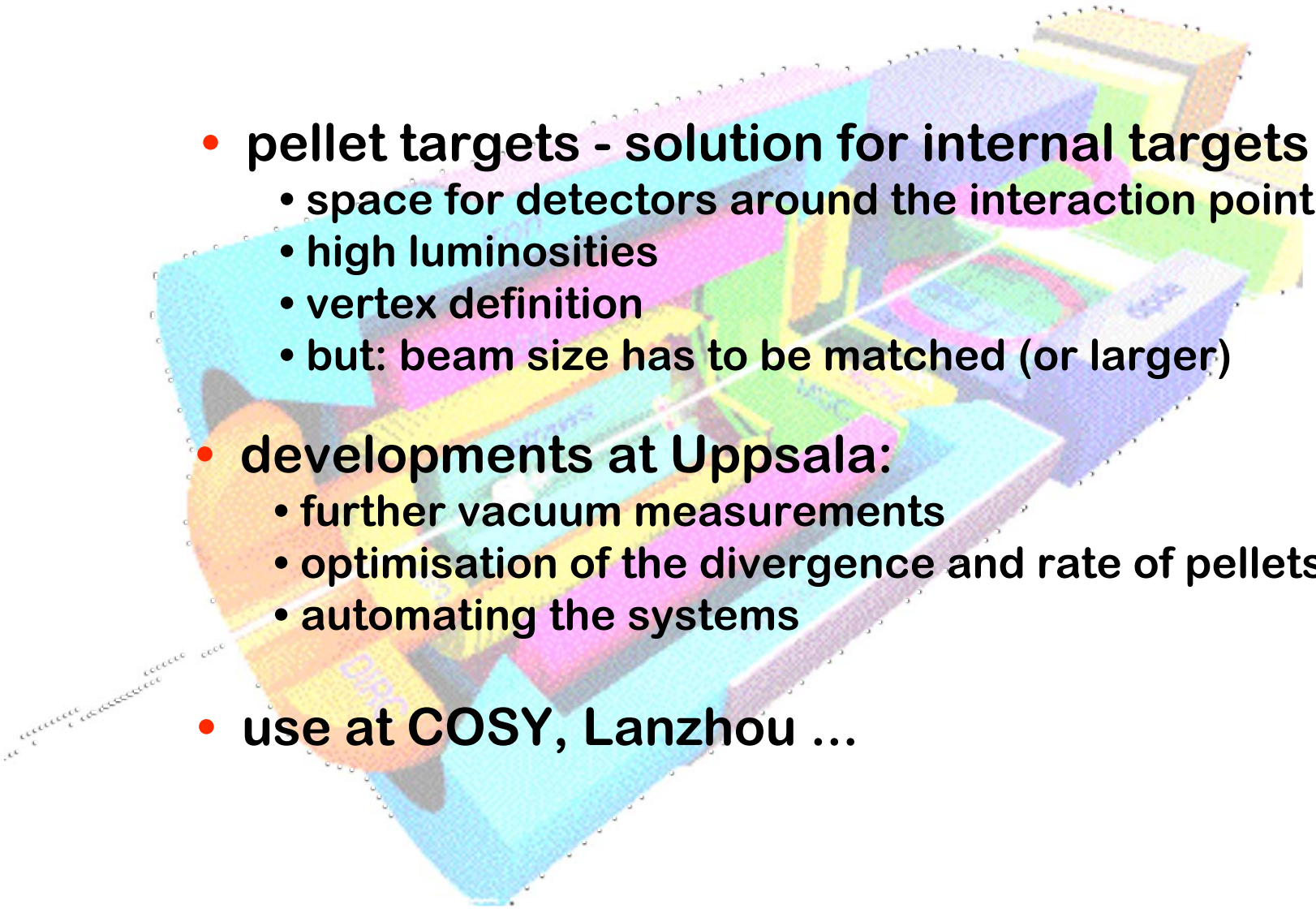


Vacuum at PANDA





Conclusions



- pellet targets - solution for internal targets with
  - space for detectors around the interaction point
  - high luminosities
  - vertex definition
  - but: beam size has to be matched (or larger)
- developments at Uppsala:
  - further vacuum measurements
  - optimisation of the divergence and rate of pellets
  - automating the systems
- use at COSY, Lanzhou ...