Summary of Jets

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BGC Collaboration Meeting

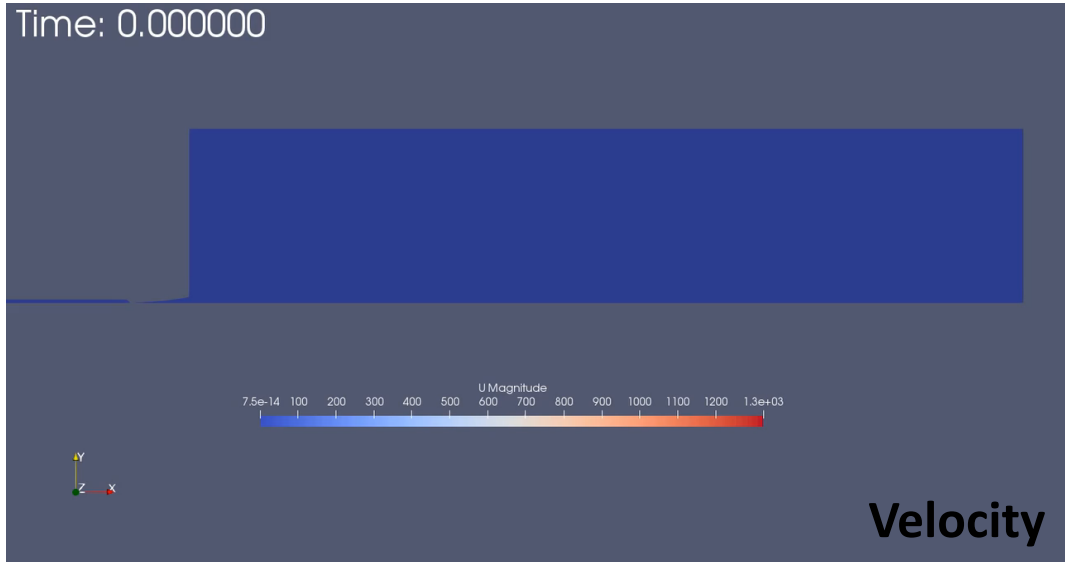
27/11/2018

PANDA Cluster Target - Nozzles

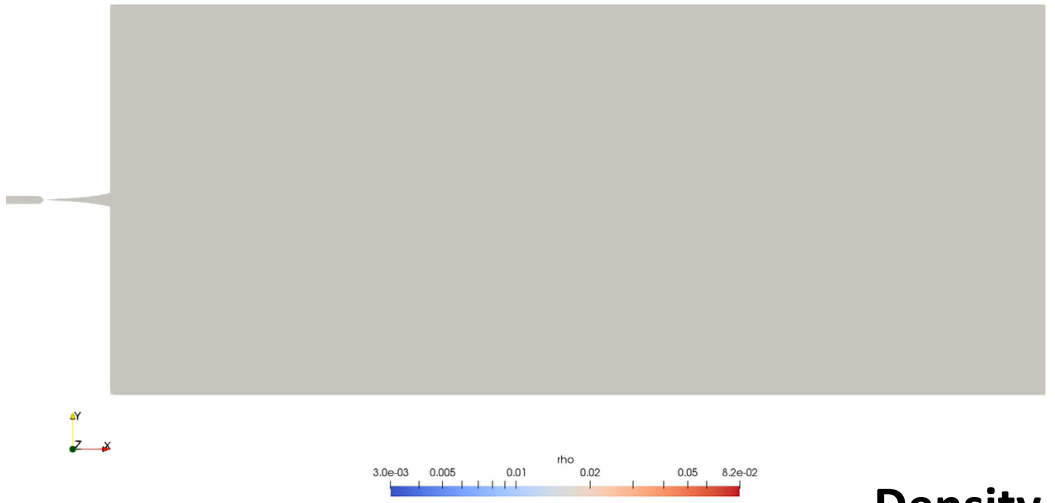
- Alfons Khoukaz & co. at Munster Uni.
- Nozzle simulations done using OpenFOAM. This can be used to simulate both gas-jet and cluster-jet beams.
- Variable nozzle temperature. This allows clustering, and the size of cluster can be selected by varying the temperature.
- Originally using CERN MME nozzles, now produced in-house.
- Measurements performed with gaseous, supercritical and fluid hydrogen

28um CERN Convergent-Divergent nozzle simulation
S. Vestrick and P. Brand (WWU)

p_nozzle = 10bar,
T_nozzle = 50K,
p_chamber = 10E-3mbar

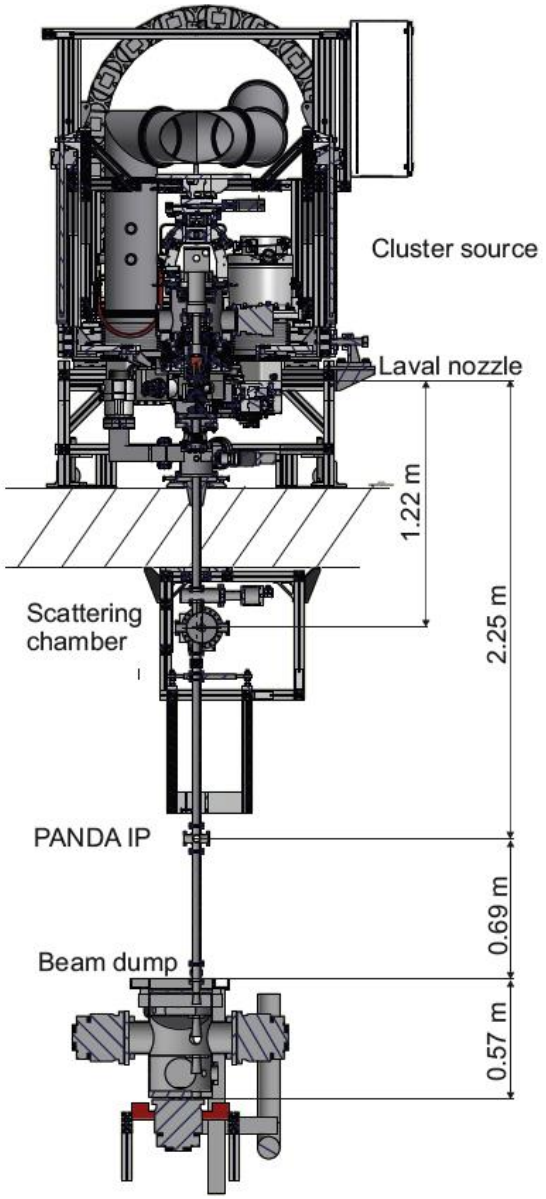


Velocity



Density

PANDA Cluster Target - Nozzles



“

- *Studies on vacuum situation*
- *Test of different collimator types*
- *Variation of orifices between pumping stages*
- *Minimization of beam dump back flow rates*

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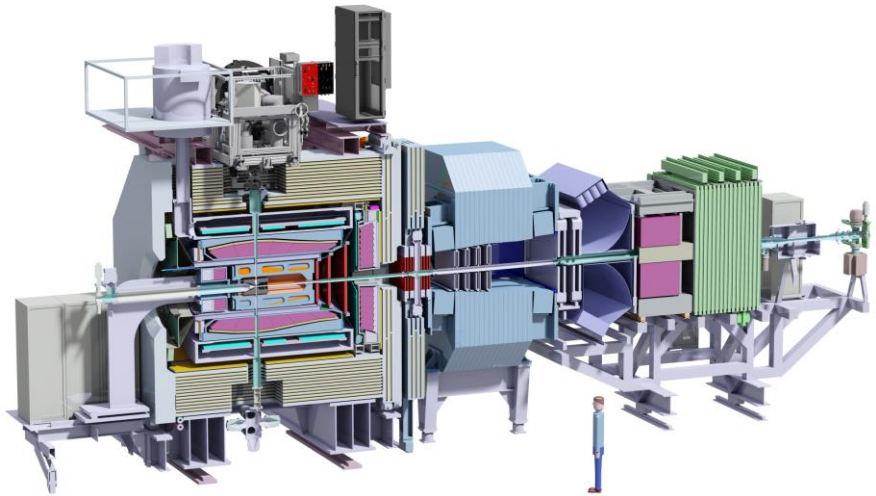


Münster cluster experiment
A. Khoukaz

Planned PANDA Setup with Cluster Target

- PANDA cluster target installed on the COSY ring at Jülich laboratory.
- Beam-Time approved
- Planned beam-target interactions

Other Cluster Experiments

- PANDA cluster jet was developed on concepts from E760 & E835 experiments at Fermilab.
- Hardware from these tests was shipped to GSI, has been offered to CERN BI as an in-kind contribution.
- These should be inspected by someone with vacuum experience.
- Working with M. Macri from CERN.

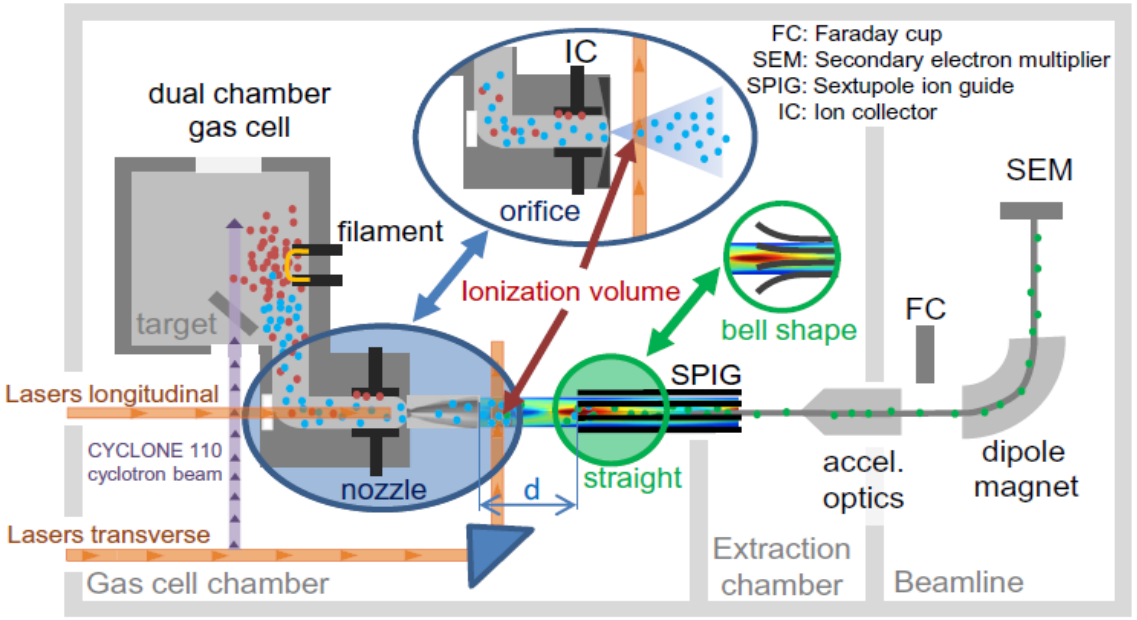
B	C
quantity found	device
1	rack mountable PC (Pentium IV)
1	PCI board for stepper motor control (PCI-7358)
1	Motion Interface board NI UMI-7774 (4 Axes) + cable SHC68-C68-S
1	GPIB board for PCI bus (NI-GPIB+)
2	cRIO DI board NI 9425 + connector NI 9933
2	cRIO DO board NI 9477 + connector NI 9933
1	cRIO Analog Input board NI 9205 with accessories
1	cRIO Analog Output board NI 9264
1	cRIO Serial Interface Module NI 9870
1	cRIO Serial Interface Module NI 9871
2	cRIO NI 9074
	_beam dump:
1	vacuum chamber
5	turbo-pump Varian Navigator 1001 + controller Turbo-V1000HT
2	turbo-pump Varian Navigator 551 + controller Turbo-V550
1	Pfeiffer calibrated leak valve
?	Varian vacuum gauge
	_E835 target:
1	vacuum chamber
2	Elettrorava 3500 turbo pump + electronic converter
10	Leybold 1000 turbo pumps + controller Turbotronik NT1000
1	gate valve VAT DN250
?	vacuum gauge
1	Cryocooler APD + Compressor HC-4
1	quadrupole mass spectrometer Stanford Research
1	Cryocooler Leybold "Coolpower 10MD" + accessories
	_forepumps:
1	roots pump LH Ruvac RA5001
1	roots pump LH Ruvac WAU1000
2	rotary vane pump LH Trivac D65B

LISOL In-Gas-Jet-Laser Spectroscopy

Info from Amir S

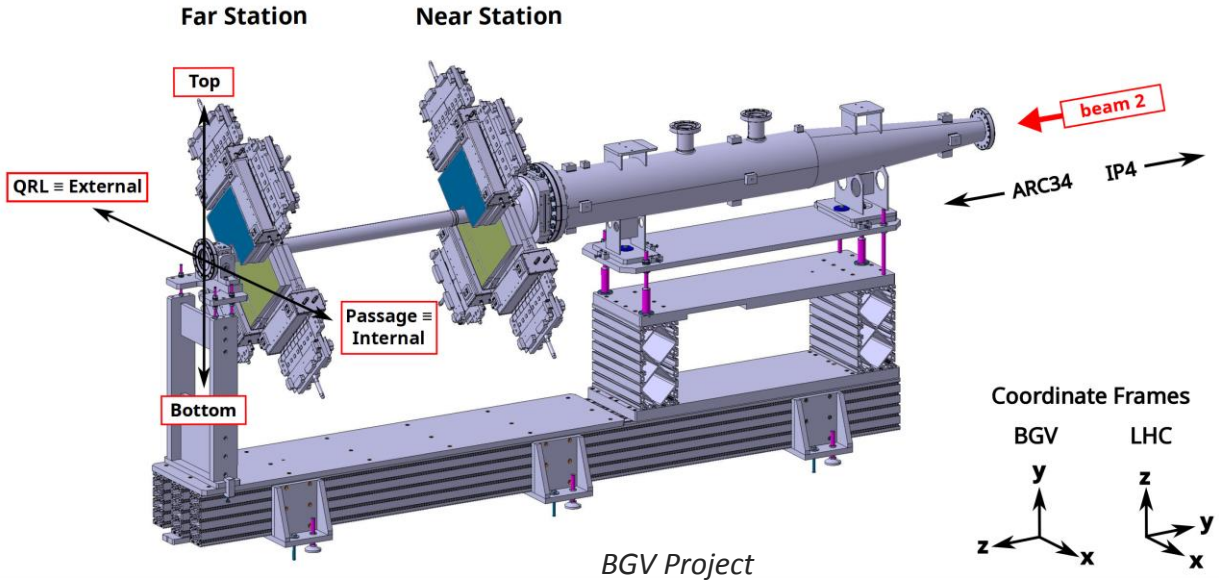
- De Laval nozzle with a throat diameter of 1 mm producing a gas jet with an effective Mach number ~ 5.5 and jet diameter of 3.5mm.

- The gas cell and extraction chamber are maintained at a working pressure of 350mbar and 1E-4mbar.

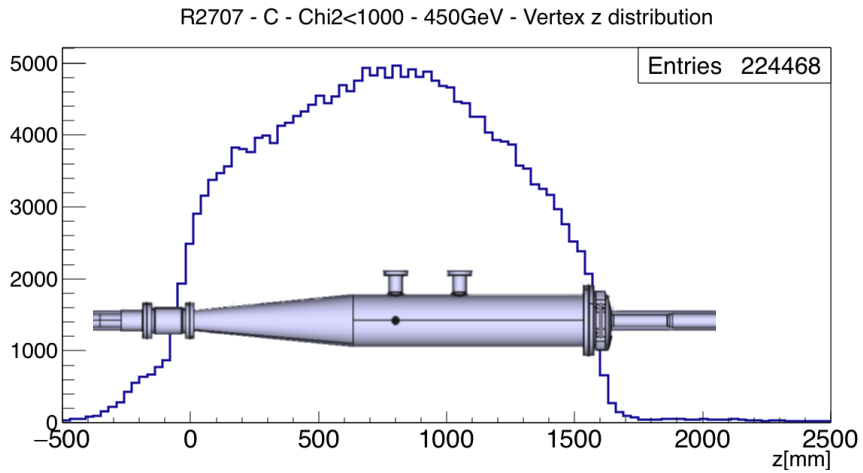


Can we use a gas jet for the BGV?

- Beam Gas Vertexing Monitor
- Recently developed and installed at LHC p4
- Uses background Neon gas target over 2m at 10^{-7} mbar.
- Secondary particles are detected by detector chips, and the beam *profile* can then be reconstructed.
- Can we replace this with a more dense gas jet over some cm, and a pressure of ~10^{-6} mbar? This should give a similar cross section.
- As fluorescence is not important, could this be effective with a clustered jet?



BGV Project

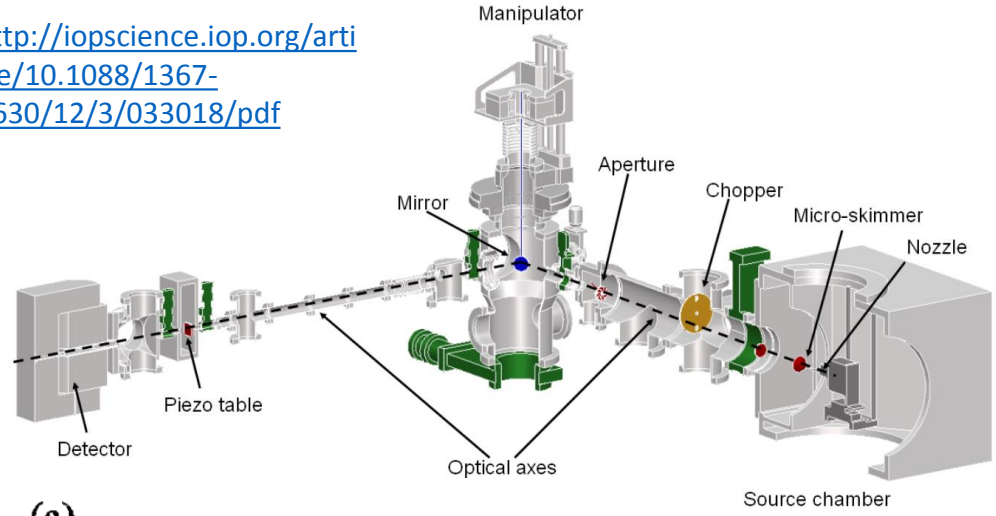


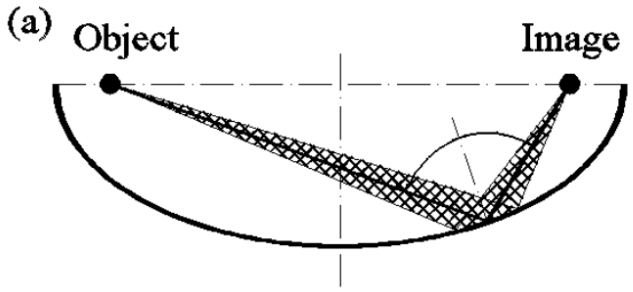
Other Jet focusing methods

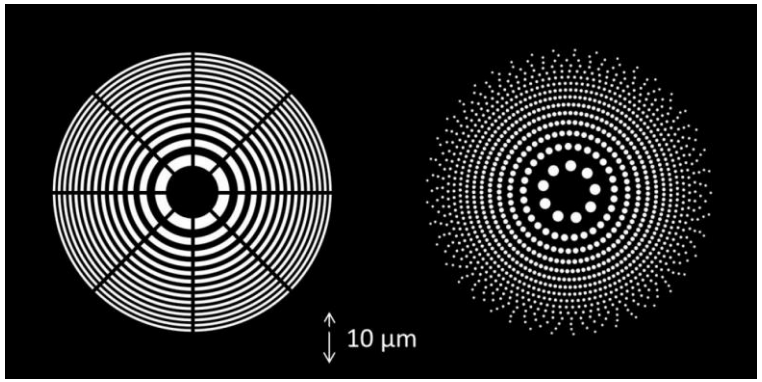
How can gas-jet beam instrumentation be applied to future high energy machines?

- **Mirror Focusing**
  - Demonstrated focusing of a He gas jet
- **Cluster Jets**
  - Jet stable over a longer distance
- **Zone Plates**
  - H and He jets have been focused using zone plates.
  - Using principles of wave-particle duality, works best with smaller particles (impact on de Broglie wavelength)

http://iopscience.iop.org/article/10.1088/1367-2630/12/3/033018/pdf







A. Jeff