NCSX Injected Neutral Beam Power Versus Transition Duct Width

H. W. Kugel

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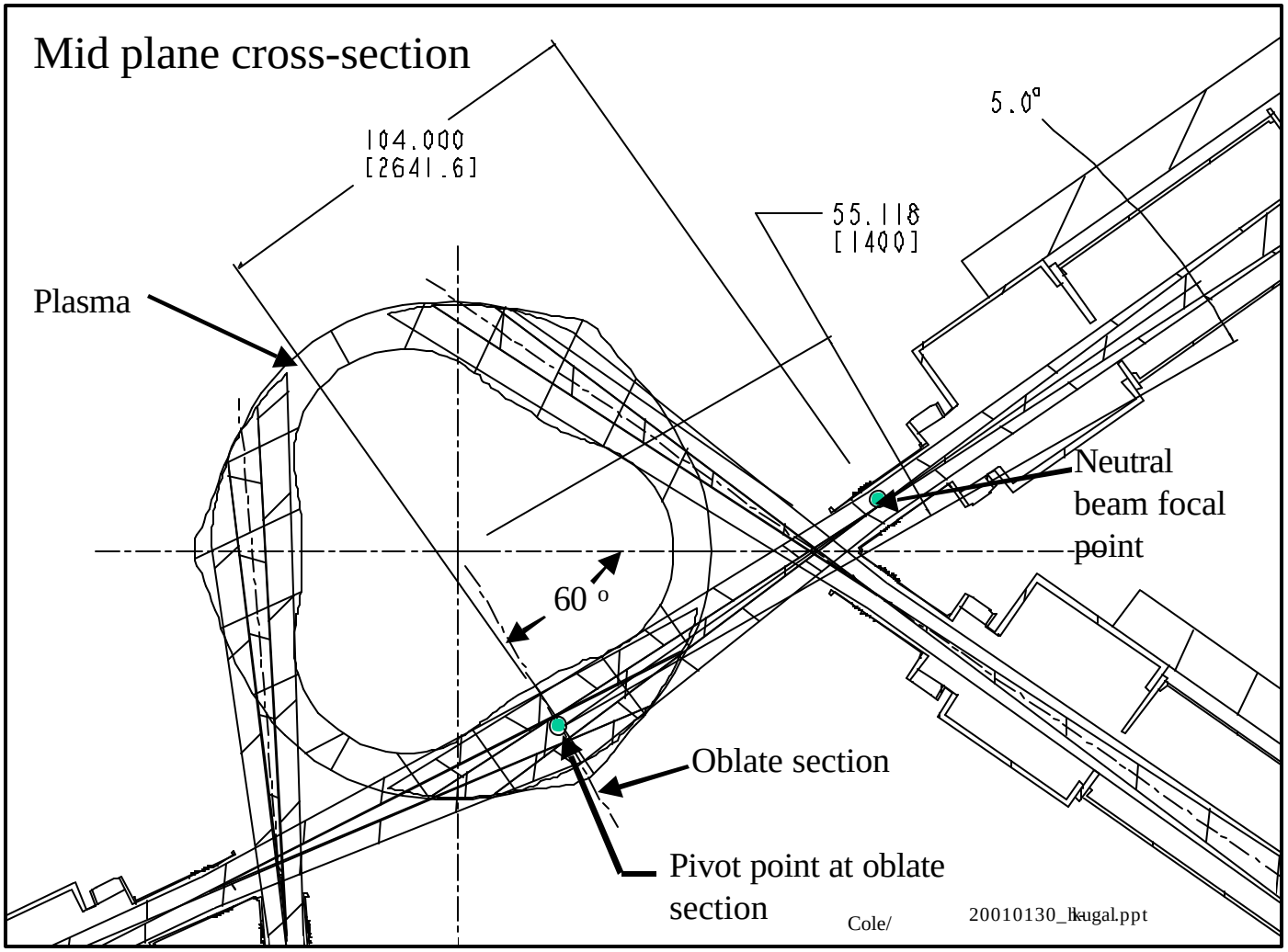
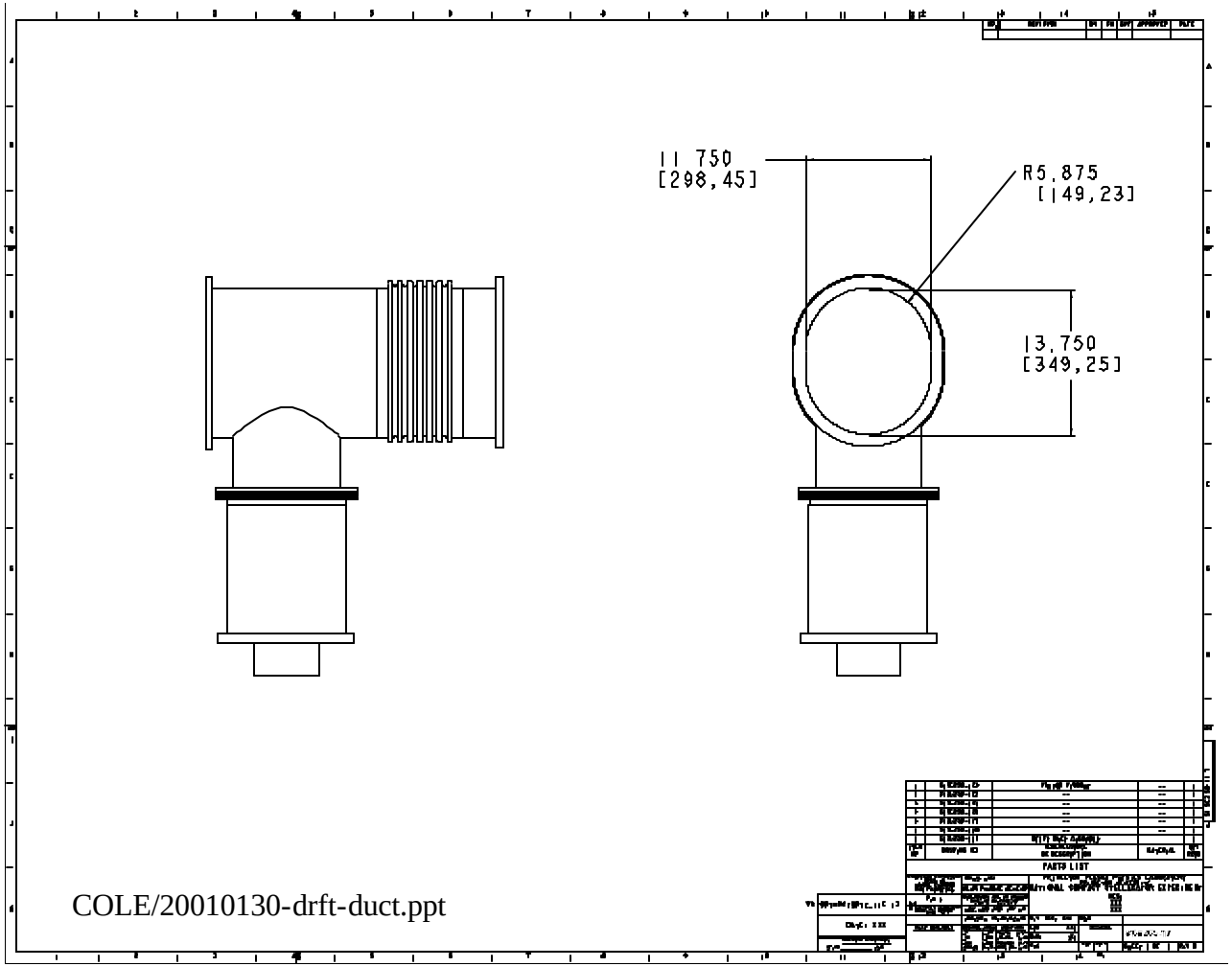
Transition Duct Region Requires Low Neutral Pressure (High Conductance & Fast Pumping) to Avoid Damage from Reionized NB Power

- Reionized Power damage has occurred on DIII-D & CMOD (DNB)



The Width of the Candidate NB Transition Duct is Comparable to the PBX-M Tangential Duct Diameter

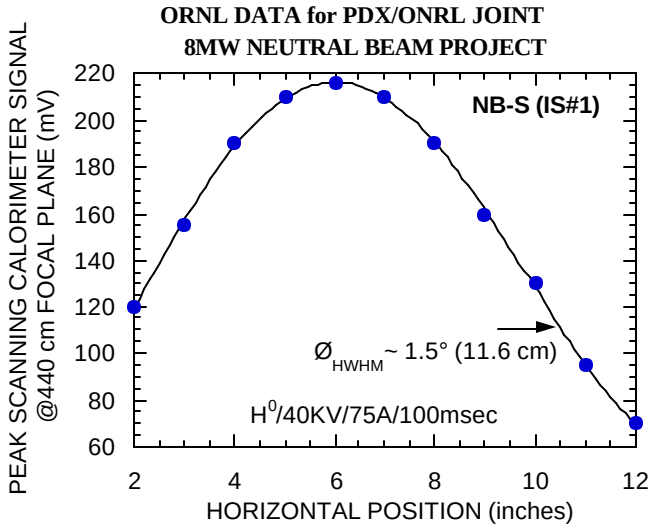
- A Wider Duct Will Reduce Reionization Power Loss & Possible Damage

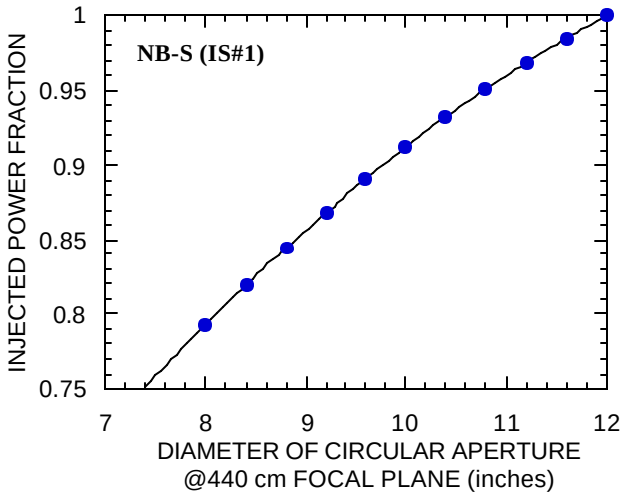


NCSX Vessel Size Reduction Might Require Smaller Neutral Beam Transition Duct Widths Resulting in Injected Power Loss

- The 2 Initial Neutral Beams should be selected for maximum power injection.
- The 4 Available Neutral Beam Power Density Profiles Vary.
- The spherically shaped, 30 cm diameter grids contain ~2000 small apertures and are shaped for a 440 cm focal point.
- After initial machine forming, the grids were manually corrected toward the desired shape.
- This process improved focusing of the central region more than at the beam edge.

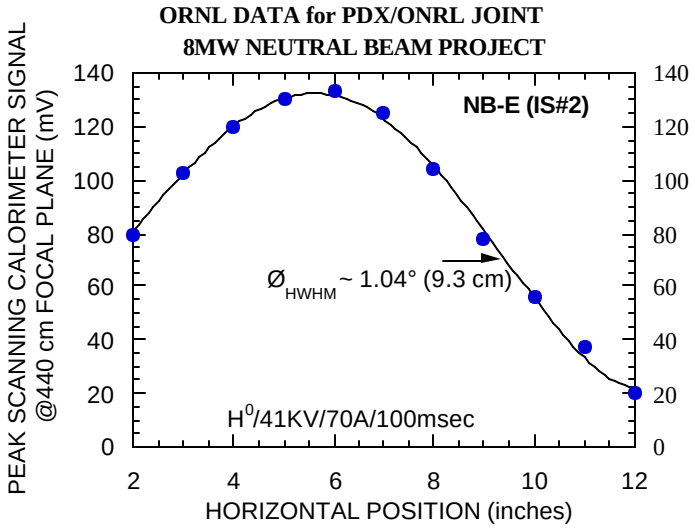
ORNL Data for PDX NB-S (IS#1) Neutral Power Density Horizontal Profile in 440 cm F.P. was LSF and integrated to determine effect of a restrictive circular aperture at the focal plane on injected power

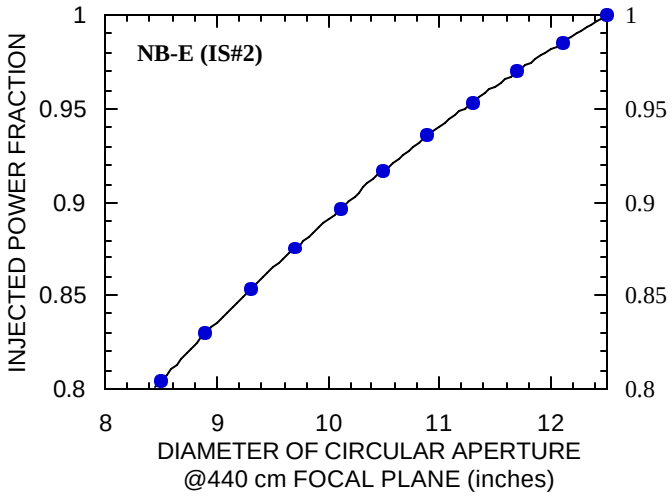




- The Candidate Transition Duct width is 11.75 in.
- An narrow elongated duct provides much less power interception than a circular duct of similar width but can still cause *possible damage from Reionized Power*

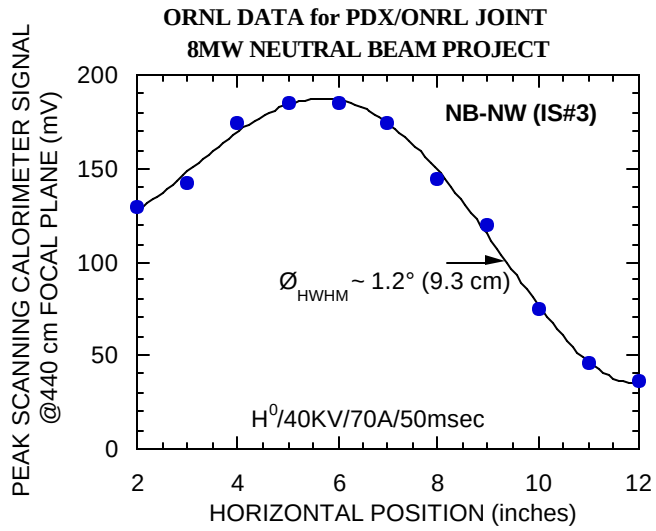
ORNL Data for PDX NB-E (IS#2) Neutral Power Density Horizontal Profile in 440 cm F.P. was LSF and integrated to determine effect of a restrictive circular aperture at the focal plane on injected power

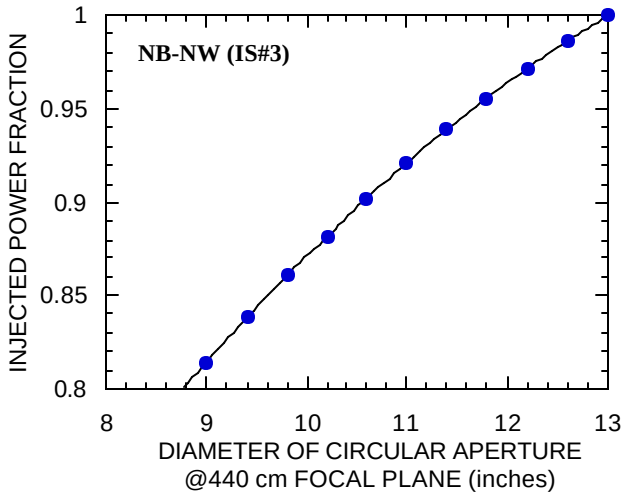




- The Candidate Transition Duct width is 11.75 in.
- An narrow elongated duct provides much less power interception than a circular duct of similar width but can still cause *possible damage from Reionized Power*

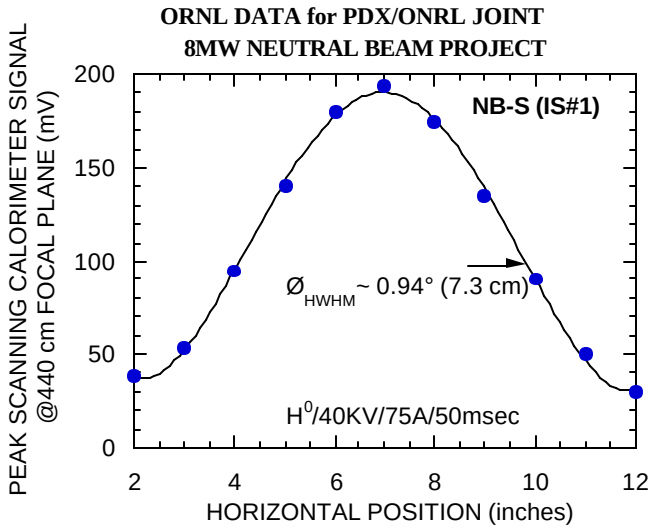
ORNL Data for PDX NB-NW (IS#3) Neutral Power Density Horizontal Profile in 440 cm F.P. was LSF and integrated to determine effect of a restrictive circular aperture at the focal plane on injected power

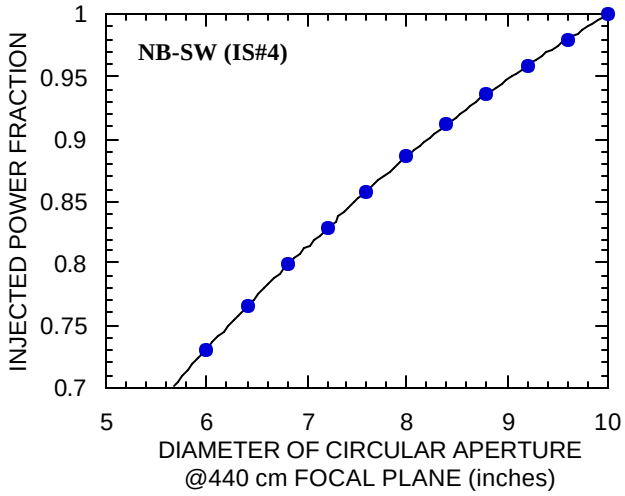




- The Candidate Transition Duct width is 11.75 in.
- An narrow elongated duct provides much less power interception than a circular duct of similar width but can still cause *possible damage from Reionized Power*

ORNL Data for PDX NB-SW (IS#4) Neutral Power Density Horizontal Profile in 440 cm F.P. was LSF and integrated to determine effect of a restrictive circular aperture at the focal plane on injected power



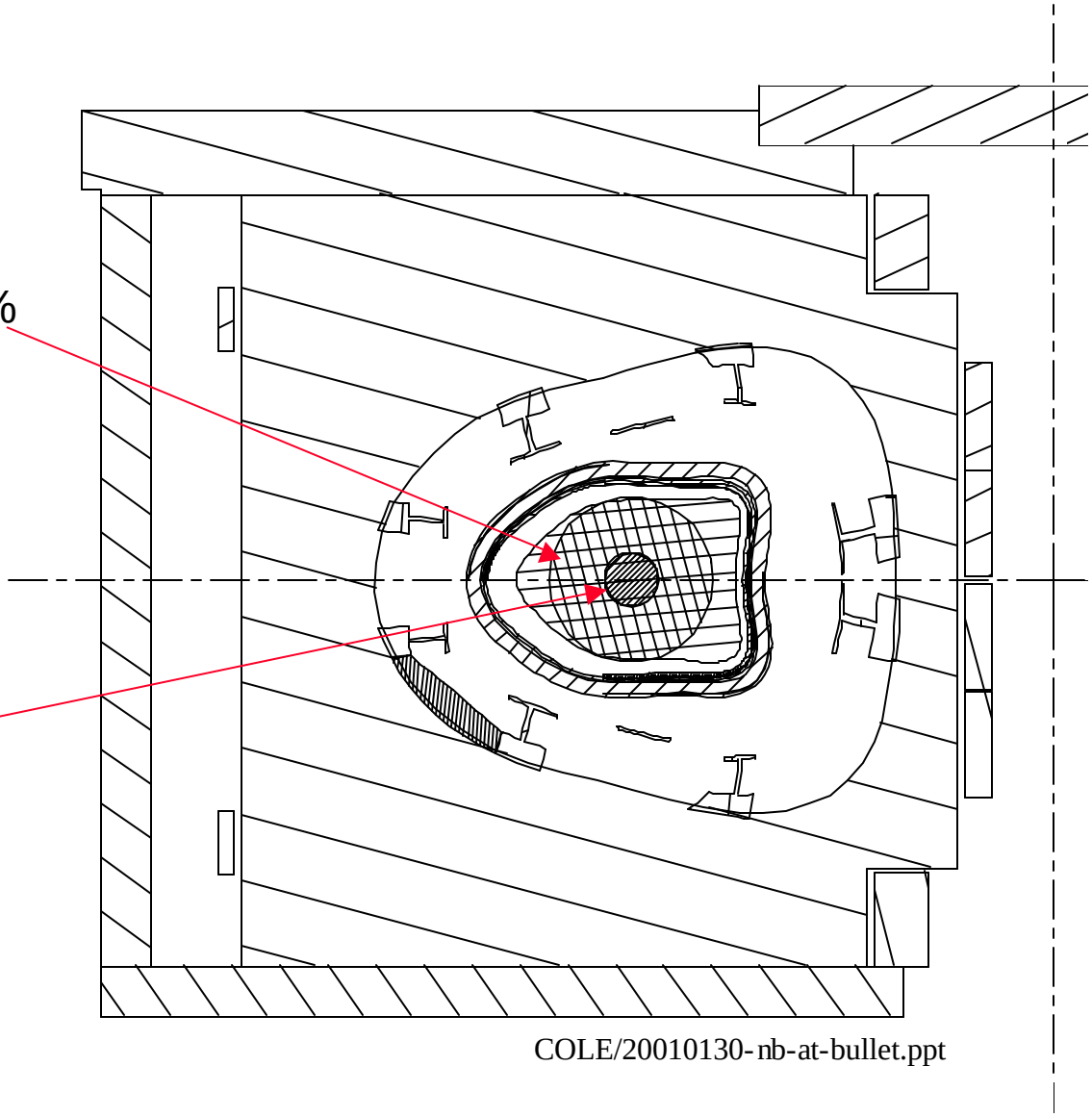


- The Candidate Transition Duct width is 11.75 in.
- An narrow elongated duct provides much less power interception than a circular duct of similar width but can still cause *possible damage from Reionized Power*

The Envelope of the Oblate Target Plasma Encloses More than 90% of Injected Power from Most Poorly Focused NB

- Circle Enclosing ~93% of the Injected Power from NB-S (IS#1) (HWHM =1.5°) Superimposed on the Oblate Target Plasma

- Angular Projection of Grid



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Summary and Conclusions

- The size reduction of the vessel has not changed the dimensions of the candidate NB transition duct.
- The envelope of the oblate target plasma encloses more than 90% of the power injected through the candidate duct from the most poorly focused NB.
- Transition Duct region requires low pressure (high conductance & fast pumping) to avoid damage from reionized NB power.
- The candidate NB transition duct horizontal is width comparable to PBX-M tangential ducts. A wider duct region will reduce reionization power loss & damage.
- The front box of the beamlines should have cryopumps (reduces duct pressure) and water cooled aperture (reduces NB on duct wall).