

Titan-izing the Target Module

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Discussion

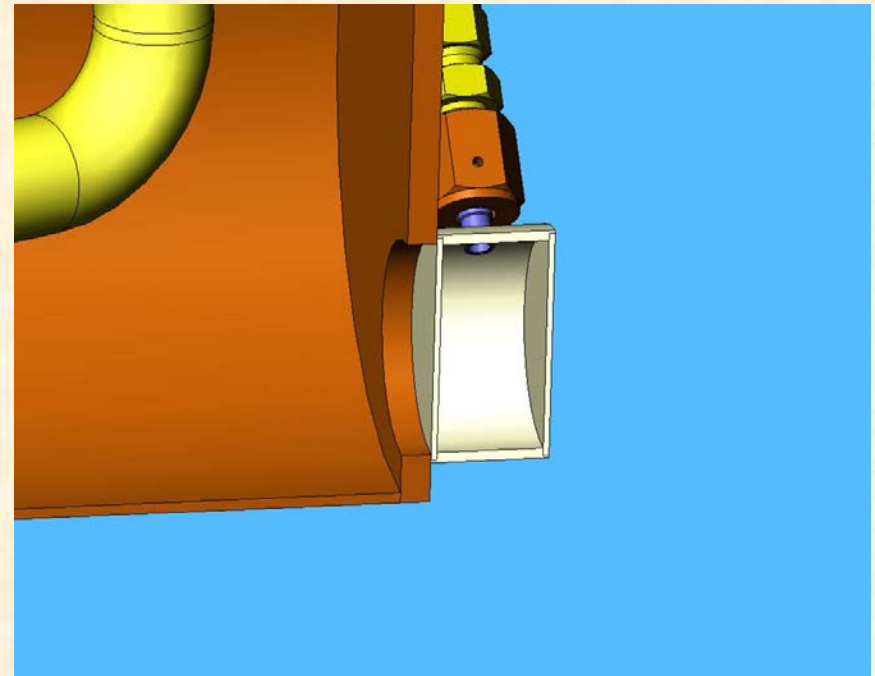


- **Issue: welding Ti6Al4V to SS316 is not a standard fabrication practice -> could increase Hg system fabrication cost**
- **Solution 1: add intermediate plate of Vanadium between all Ti/SS interfaces**
- **Solution 2: eliminate Ti/SS interfaces by using Ti alloy for most of the target module**
- **Let's look at each window separately**

Upstream Secondary Window

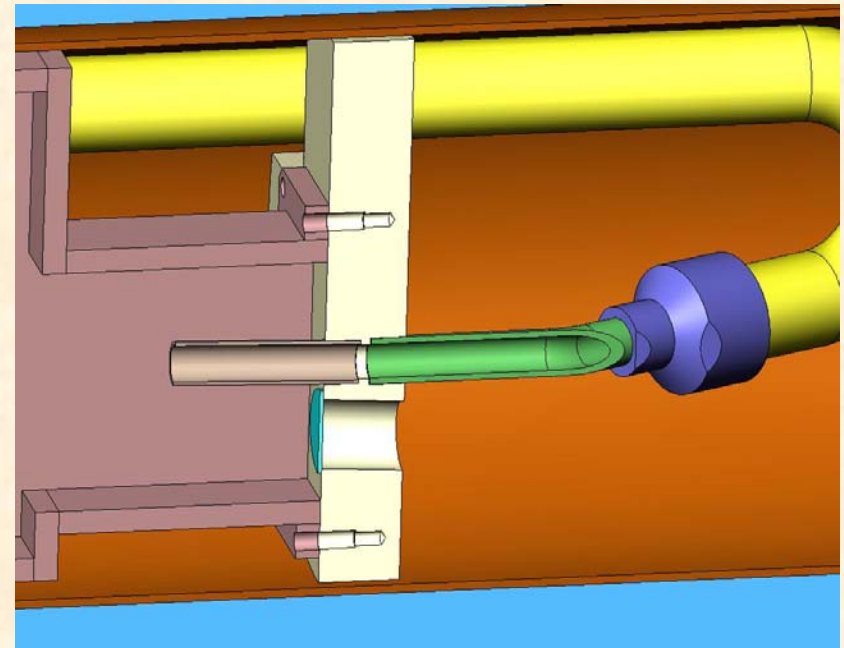


Action	Issue/Comment
Add vanadium flange	Uses small amt of window space
Make secondary containment out of titanium	Material & fabrication costs might increase



Upstream Primary Window

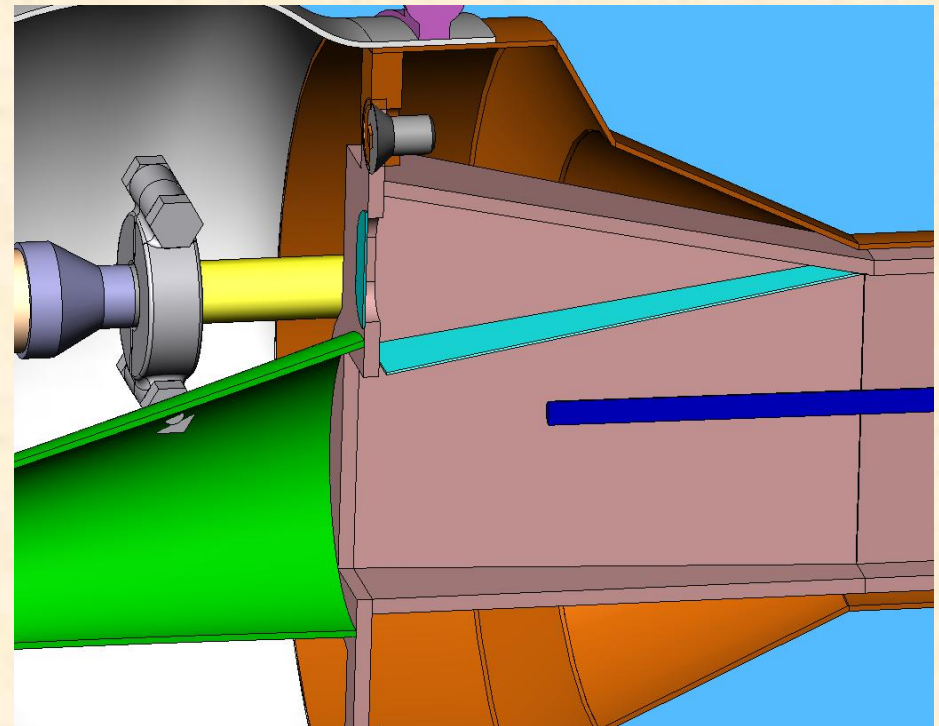
Action	Issue/Comment
Add vanadium flange to beam window	Space constraints between beam tube & nozzle
Make nozzle flange out of titanium	Beam window integrated into flange – no welding needed. Nozzle and Hg supply components must also be titanium.



Jet Deflector

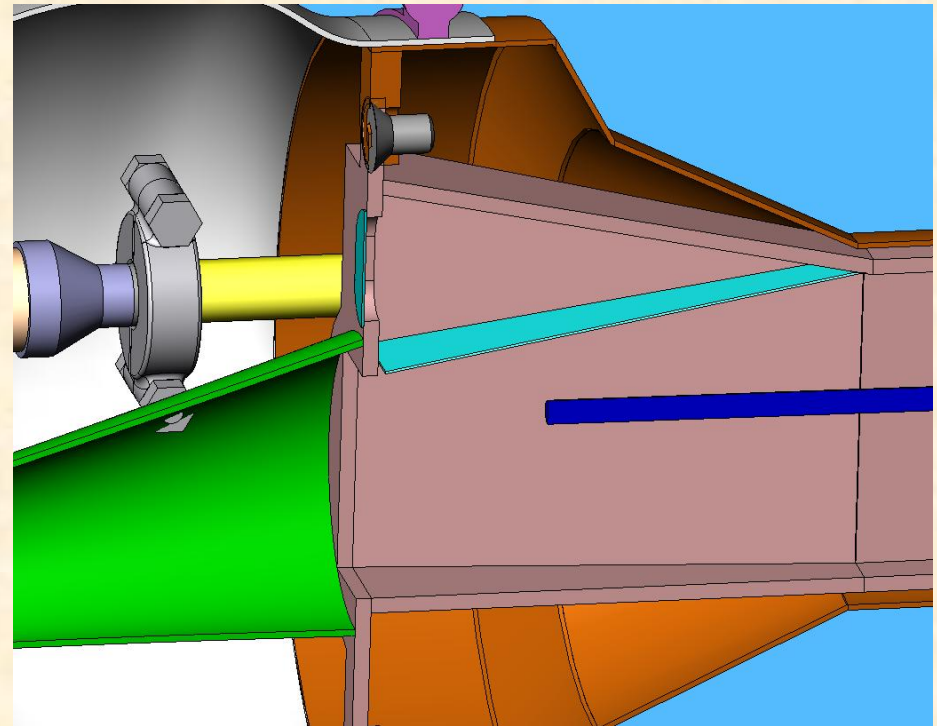


Action	Issue/Comment
Add vanadium flange to edges of deflector	None
Make primary containment out of titanium	Simplifies primary containment fabrication, but perhaps at increased cost
Exit funnel	Should be of same material as primary containment



Downstream Primary Window

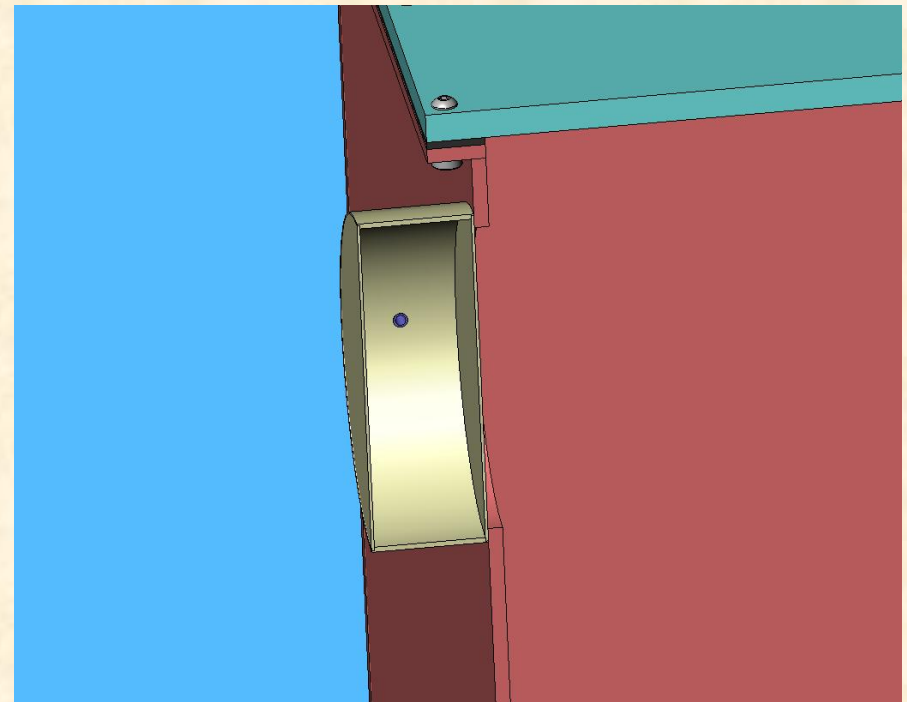
Action	Issue/Comment
Add vanadium flange to edges of window	Space constraint with funnel
Make primary containment out of titanium	Mill window into end flange rather than weld



Downstream Secondary Window



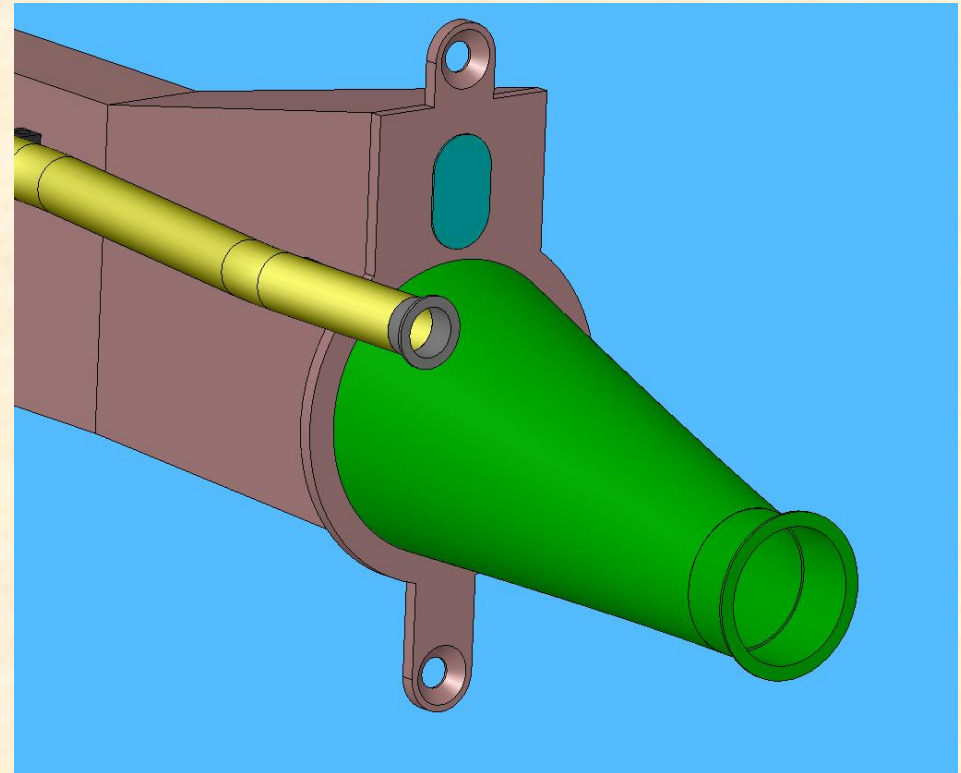
Action	Issue/Comment
Add vanadium flange to edges of window	None known
Mechanically attach window to secondary containment with gasket	Would increase contacting window flange diameter



Mechanical Attachment to Flex Hoses



Action	Issue/Comment
Titanium tubing requires titanium ferrule (grey end piece)	Unknown if titanium sanitary fittings are available and what their pressure ratings would be. Probably have to machine our own.
Exit funnel butt welded to flange	Must be same material or use compatible intermediate sheet. Funnel will have to be custom machined.



Other Considerations From Timet Design/Fab Handbook



- Link <http://www.timet.com/pdfs/ti-handbook.pdf>
- Titanium available in various "grades"
 - Ti6Al4V ASTM Grade 5, UNS R56400, Yield strength 950 MPa (138ksi)
 - Ti6Al4V may not be available in tubing
 - ASTM Ti Grade 2, Yield strength 430 MPa (62.4ksi)
- Internal working pressure for 1" OD tubing from Ti Grade 2
 - Wall=0.035, pressure=687psi
 - Wall=0.049, pressure=971psi
 - Wall=0.065, pressure=1304psi <- what we may need
 - Wall=0.083, pressure=1688psi
- 1" tubing has only 2" bend radius for 0.065" wall
 - May have to incorporate elbows into Hg supply tube

Conclusions



- **Desire that all components between the flex hoses be fabricated from Ti6Al4V or unalloyed Ti**
 - **Tubing pressure ratings may be an issue**
 - **What alloys/ratings are available?**
 - **1" OD is maximum we can easily fit into module**
 - **Some off-the-shelf tubing components may have to be custom machined**
- **Jet deflector fabrication simpler if the primary containment is titanium**
- **Titan-izing entire module simplifies beam window fabrication / attachment**
 - **Probably simpler than using intermediate vanadium sheet**
- **Cost may increase, but not by much**
- **Need to talk with actual supplier to get real answers**