NEXT-100 Energy plane

D. Shuman

Lawrence Berkeley National Laboratory

May 4, 2012

Table of Contents

with much valuable input from (among others):

- D. Nygren
- A. Goldschmidt
- T. Miller
- G. Pryzbilski
- I. Liubarsky
- S. Carcel
- V. Alvarez
- A. Martinez

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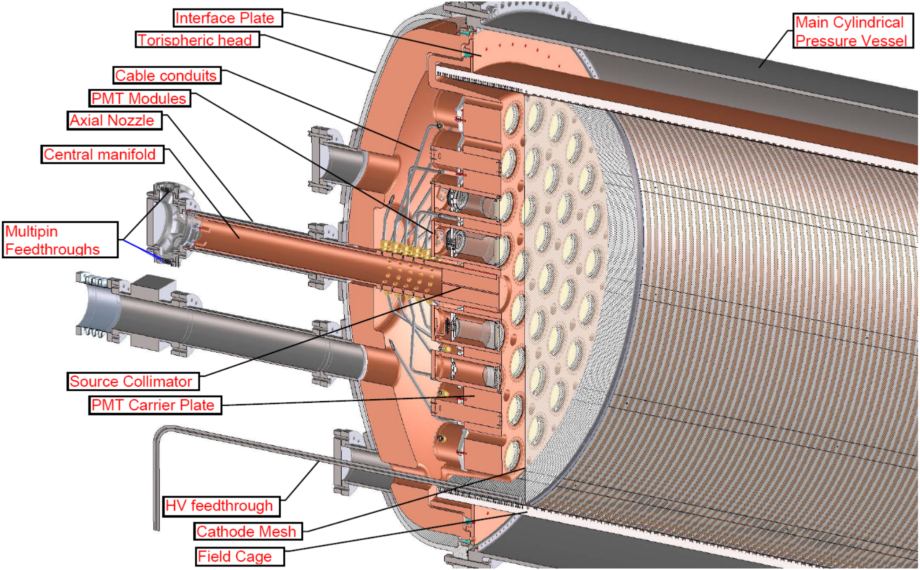
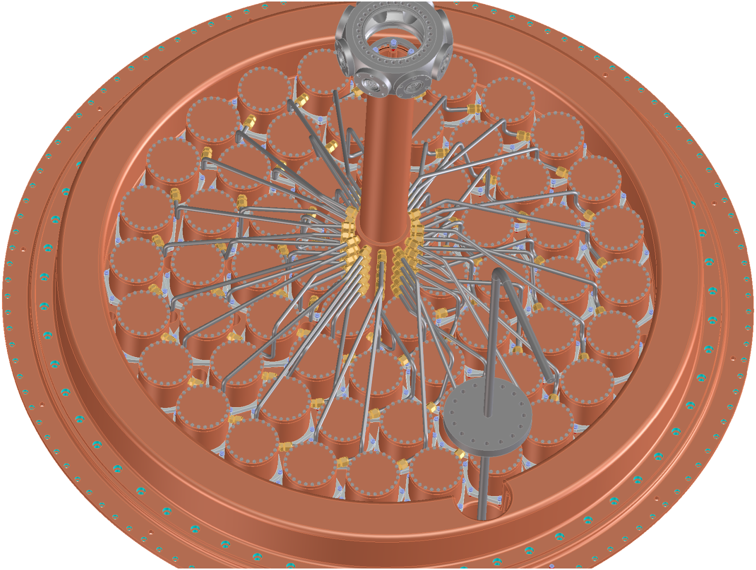
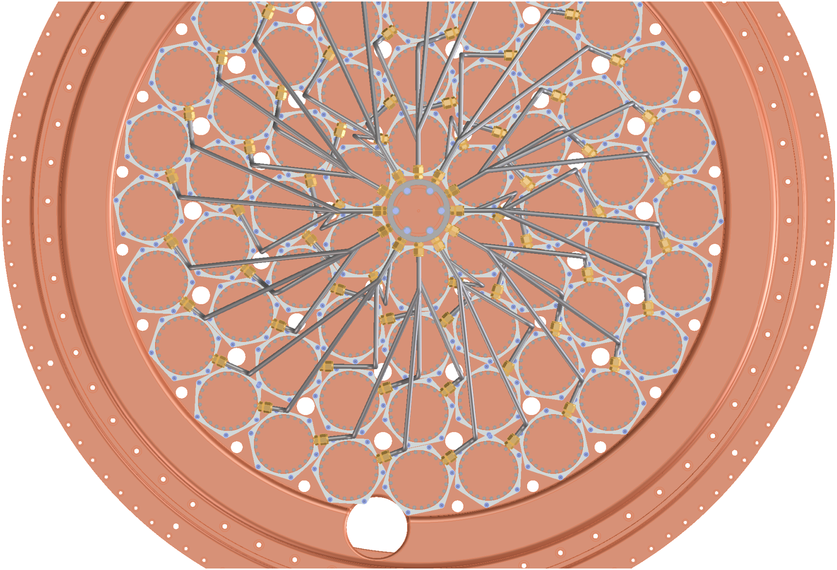
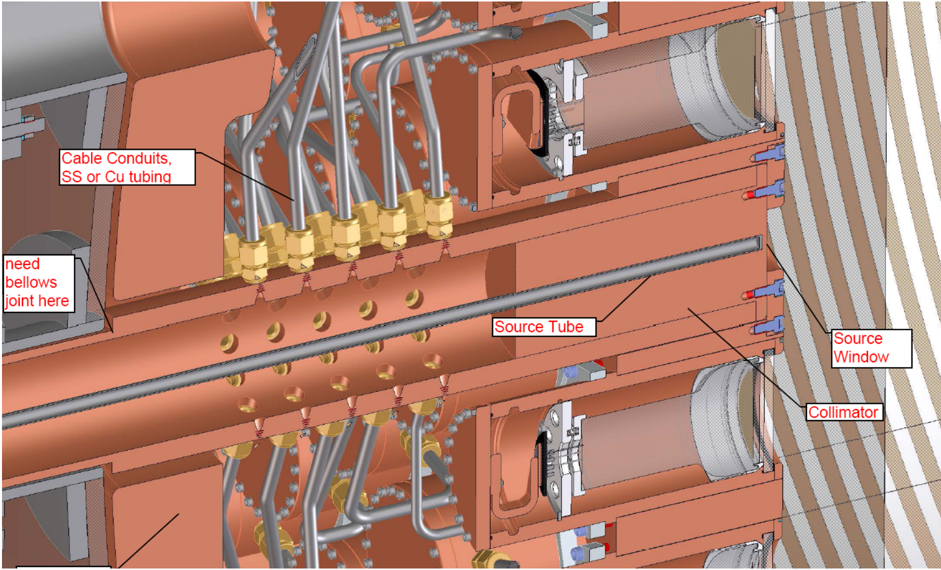
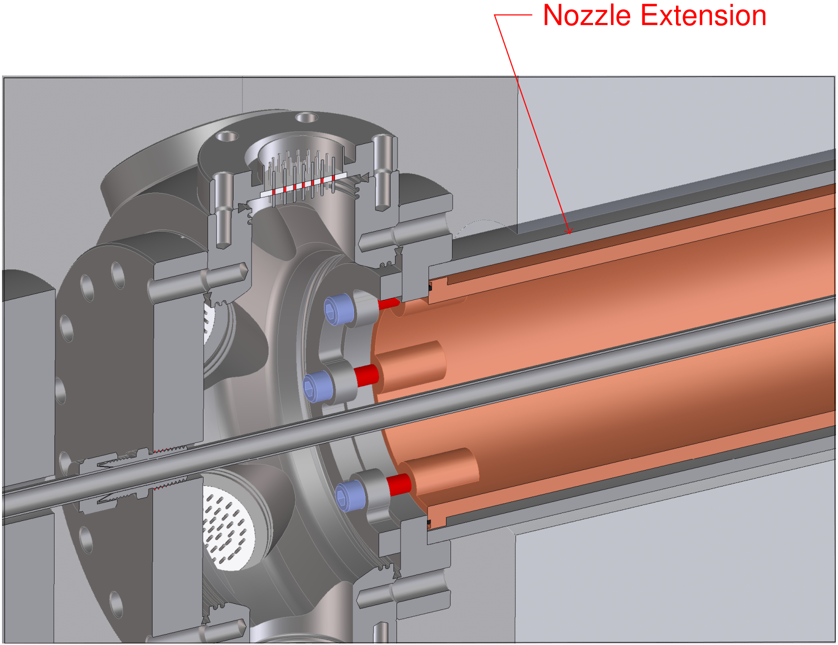
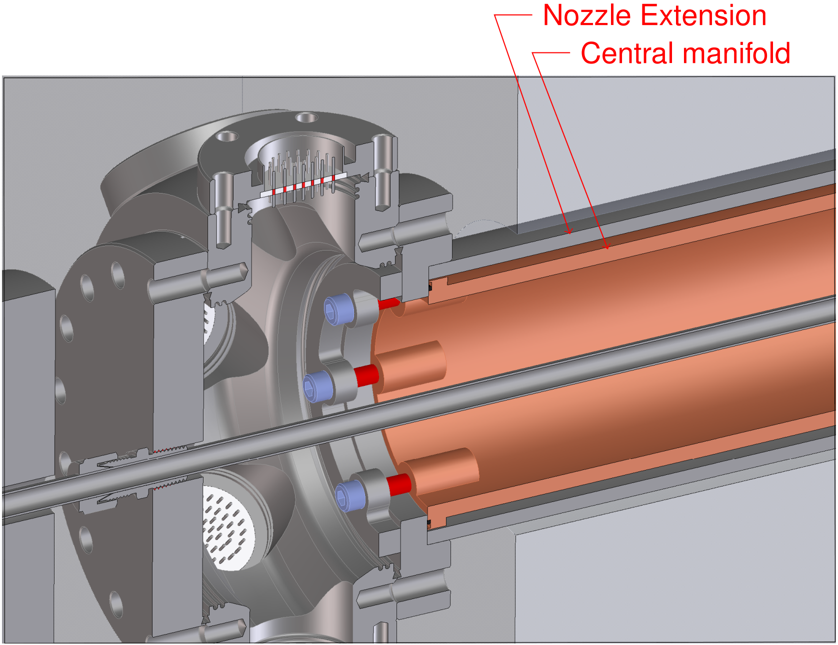

Interface Plate
Torispheric head
Cable conduits
PMT Modules
Axial Nozzle
Central manifold
Multipin Feedthroughs
Source Collimator
PMT Carrier Plate
HV feedthrough
Cathode Mesh
Field Cage
Main Cylindrical Pressure Vessel

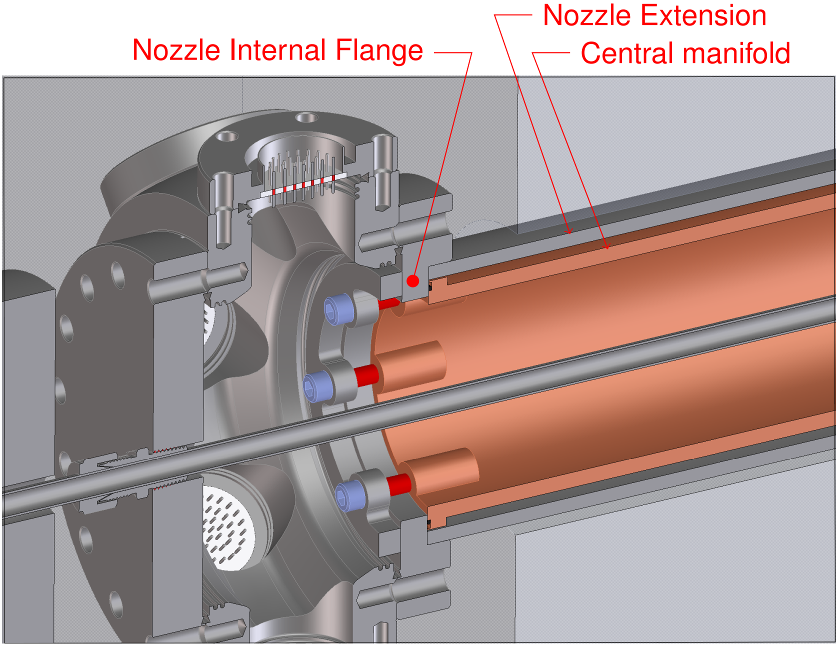


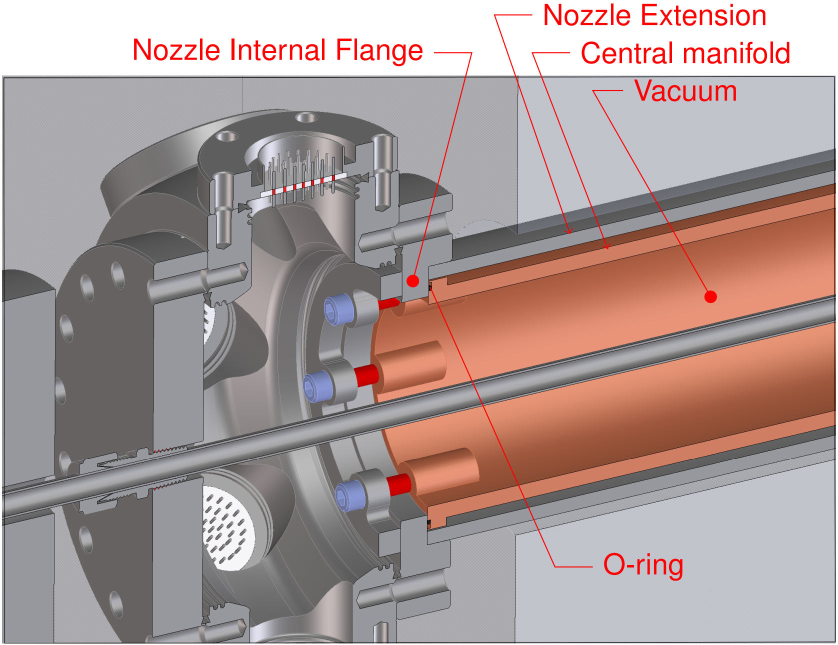


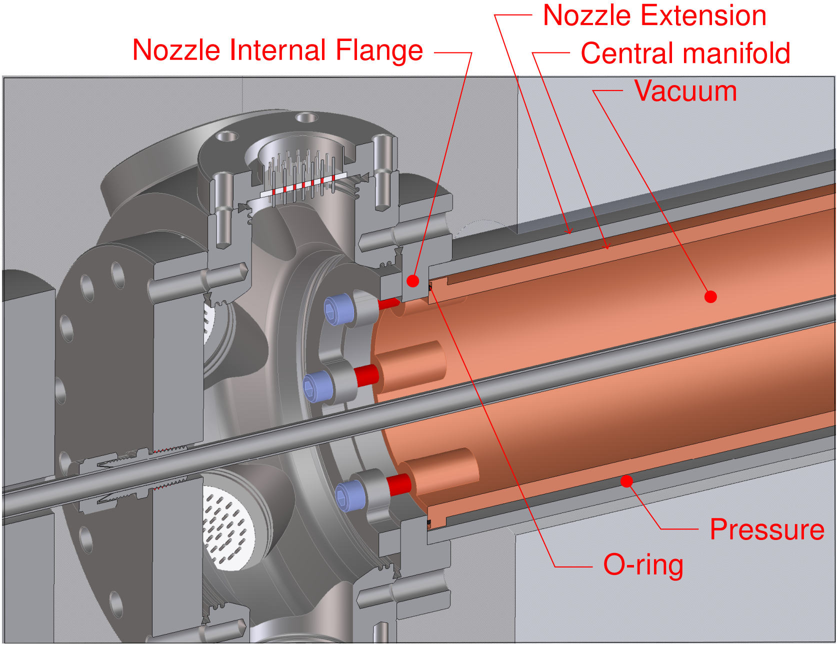

Cable Conduits,
SS or Cu tubing
need
bellows
joint here
Source Tube
Source
Window
Collimator

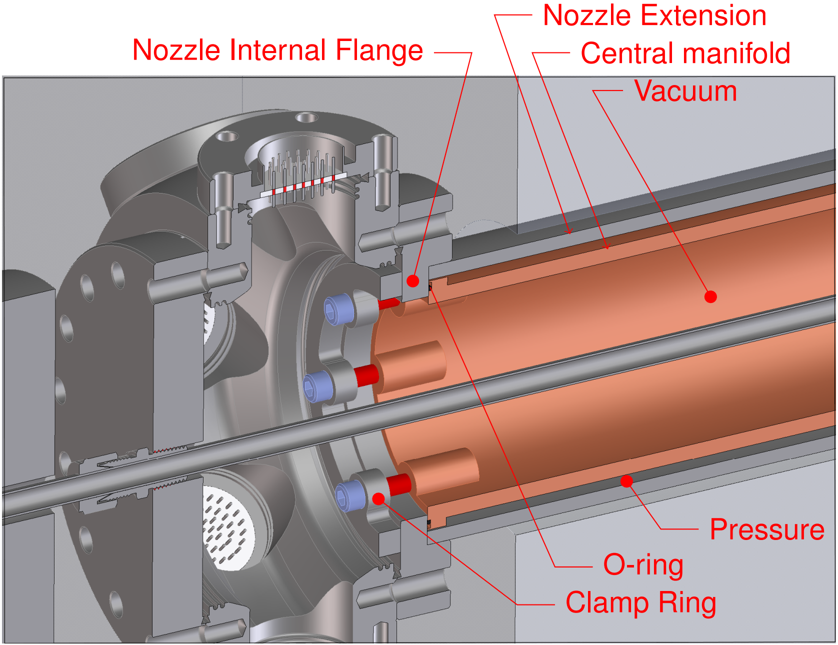

Nozzle Extension

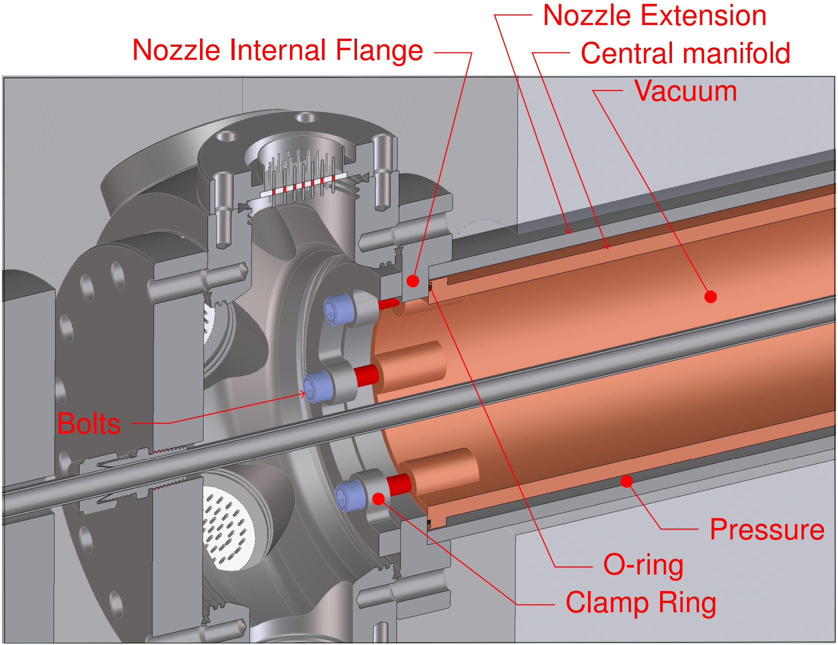

Nozzle Extension
Central manifold

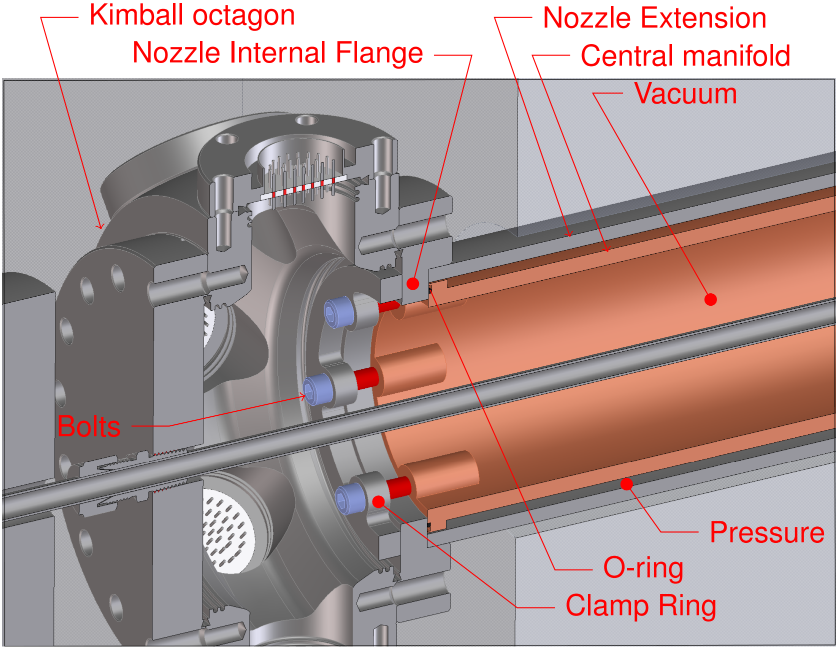

Nozzle Extension
Nozzle Internal Flange
Central manifold

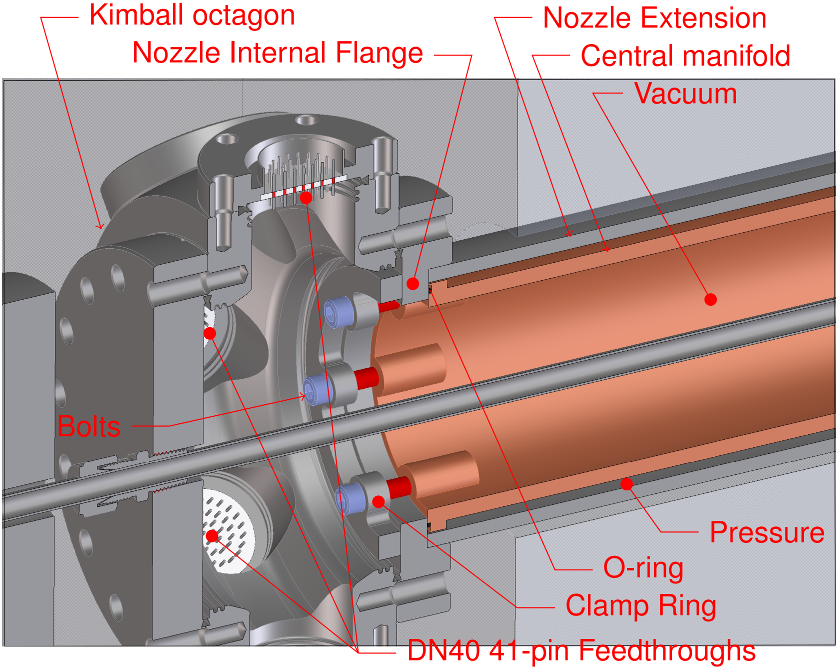

Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
O-ring

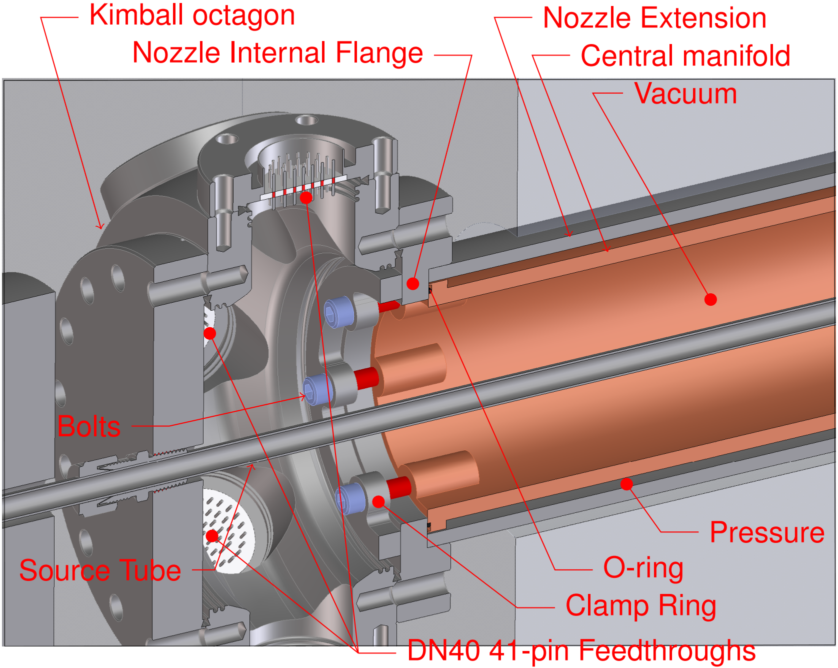

Nozzle Extension
Nozzle Internal Flange
Central manifold
Vacuum
Pressure
O-ring

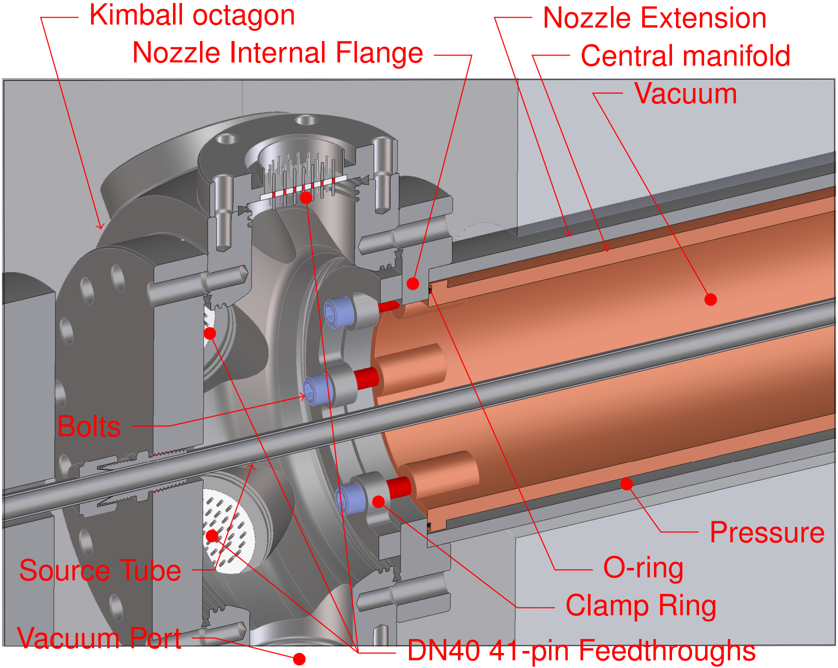

Nozzle Extension
Nozzle Internal Flange
Central manifold
Vacuum
Pressure
O-ring
Clamp Ring


Nozzle Extension
Nozzle Internal Flange
Central manifold
Vacuum
Bolts
Pressure
O-ring
Clamp Ring


Kimball octagon
Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
Bolts
Pressure
O-ring
Clamp Ring


Kimball octagon
Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
Bolts
Pressure
O-ring
Clamp Ring
DN40 41-pin Feedthroughs


Kimball octagon
Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
Bolts
Source Tube
Pressure
O-ring
Clamp Ring
DN40 41-pin Feedthroughs


Kimball octagon
Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
Bolts
Pressure
O-ring
Source Tube
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Vacuum Port
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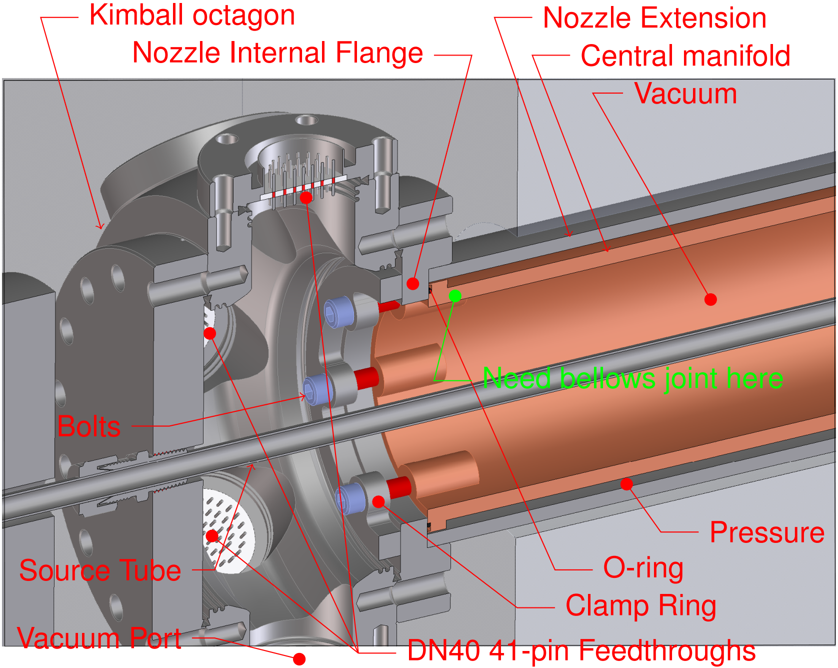
Kimball octagon
Nozzle Internal Flange
Nozzle Extension
Central manifold
Vacuum
Need bellows joint here
Bolts
Pressure
O-ring
Source Tube
Clamp Ring
Vacuum Port
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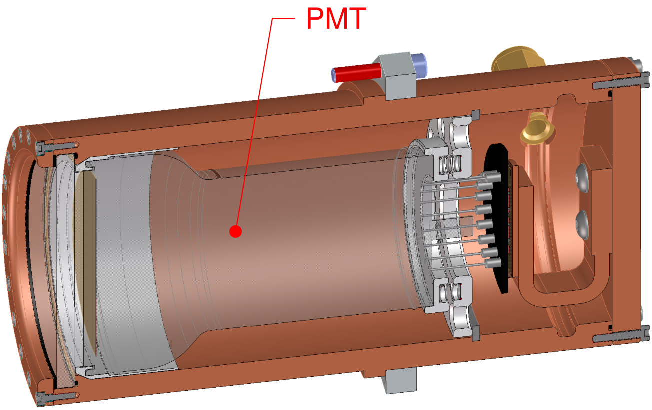
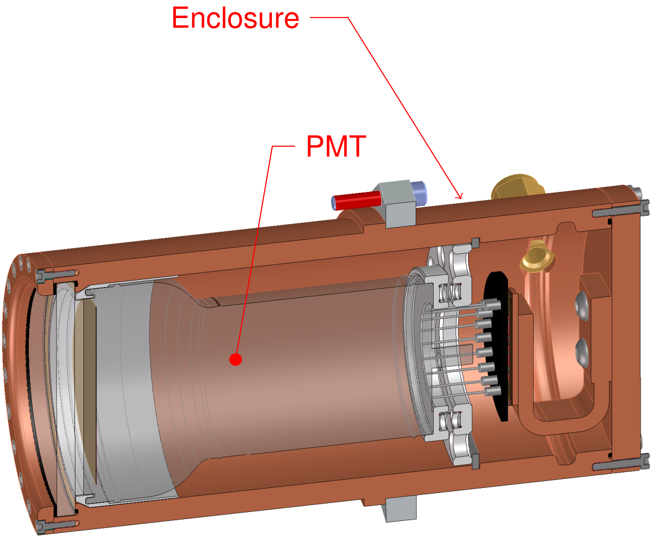
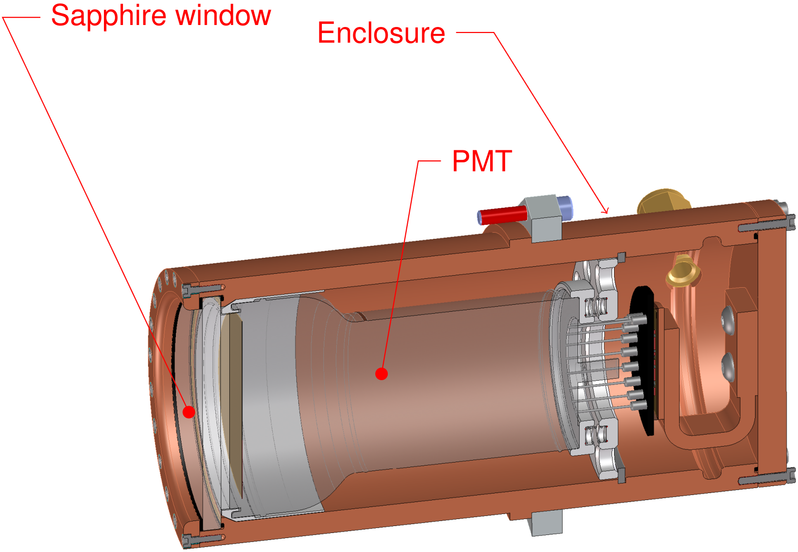
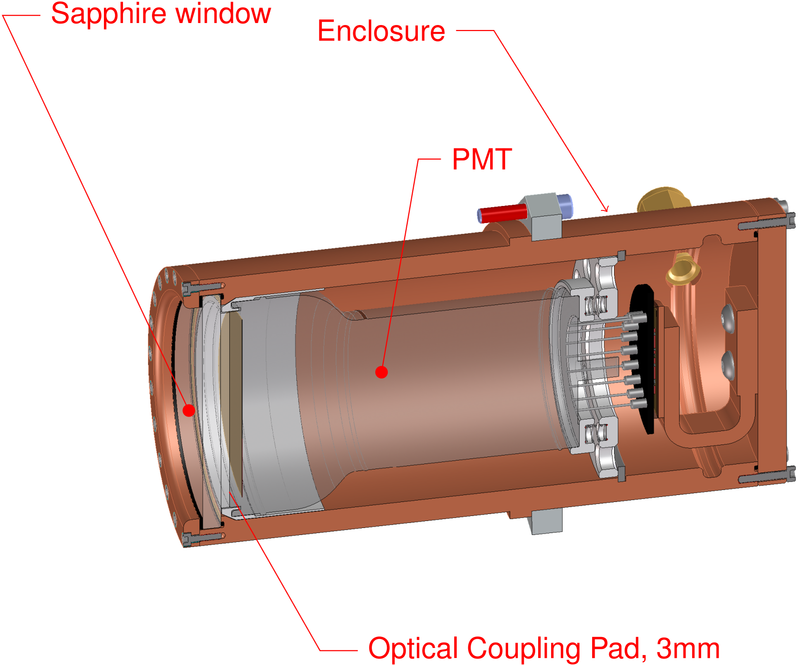
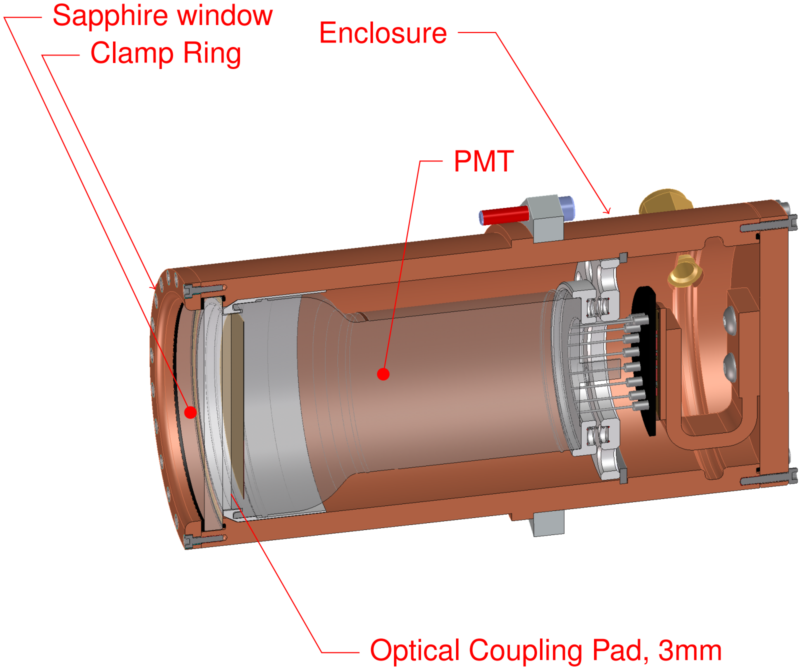
- Carrier plate will be redesigned for adjustable buffer distance

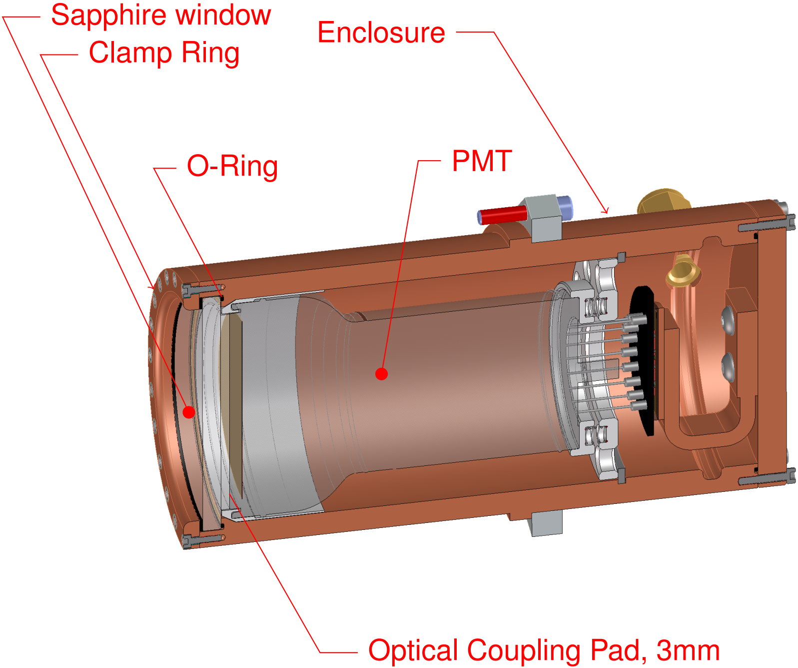

PMT

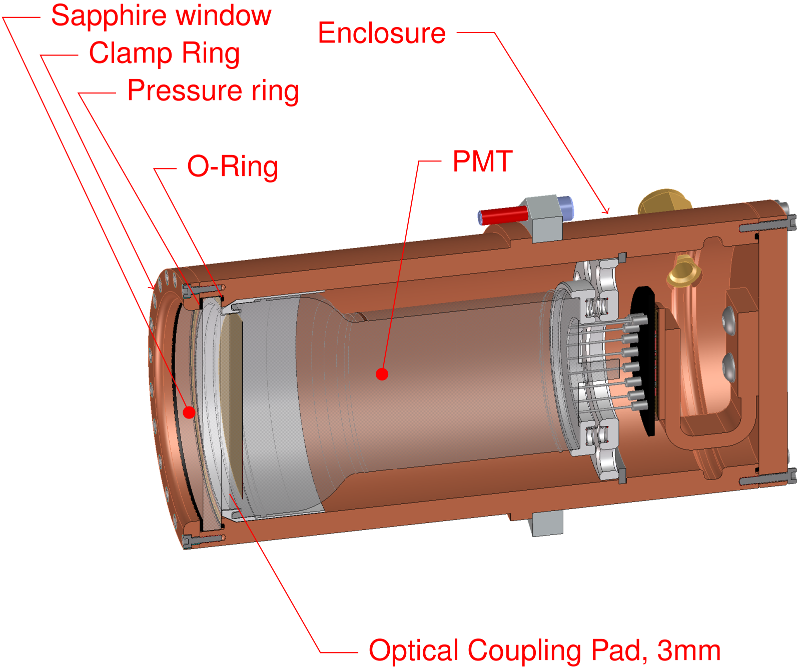

Enclosure
PMT

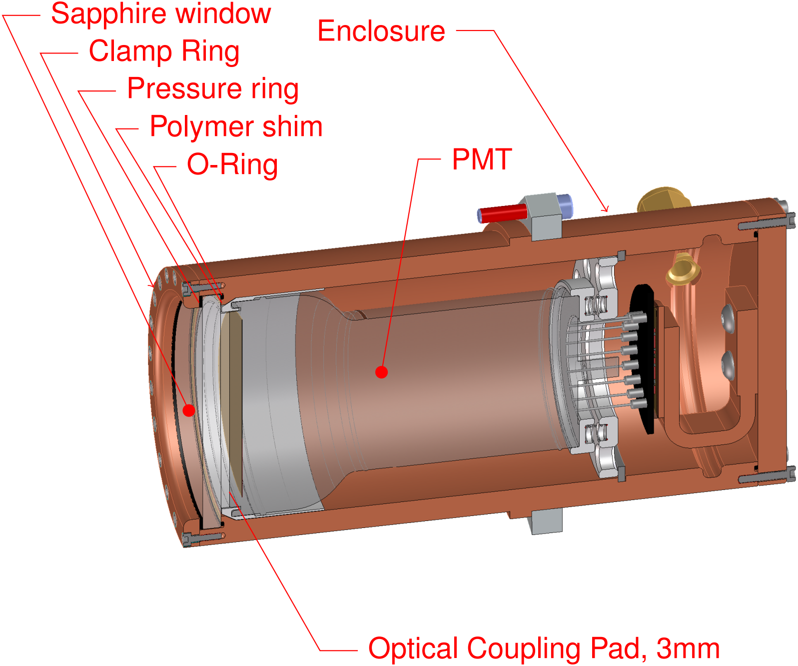

Sapphire window
Enclosure
PMT

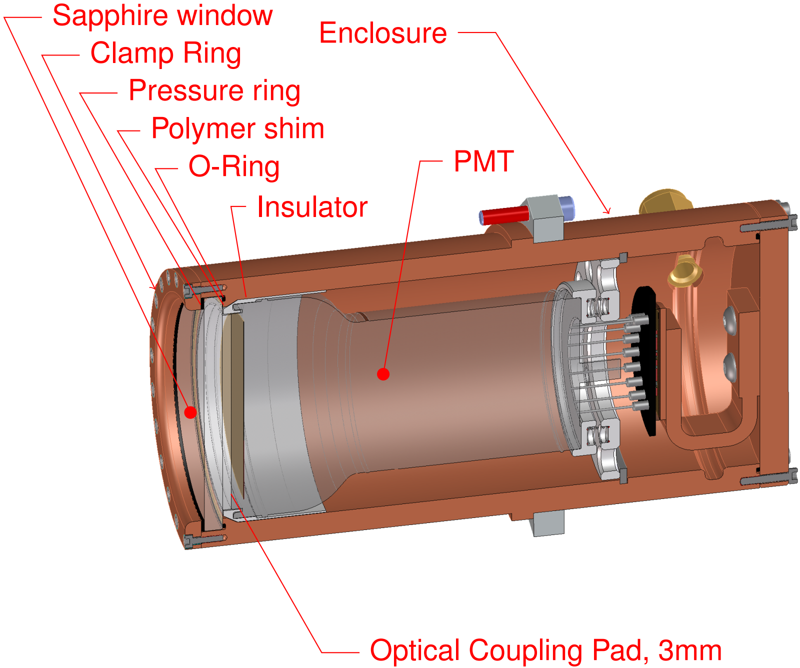

Sapphire window
Enclosure
PMT
Optical Coupling Pad, 3mm

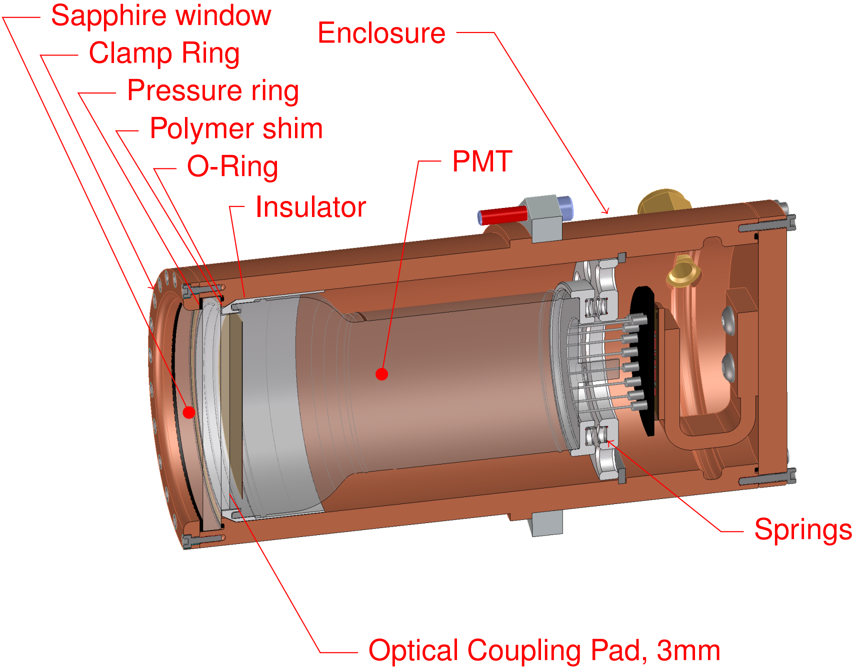

Sapphire window
Clamp Ring
Enclosure
PMT
Optical Coupling Pad, 3mm

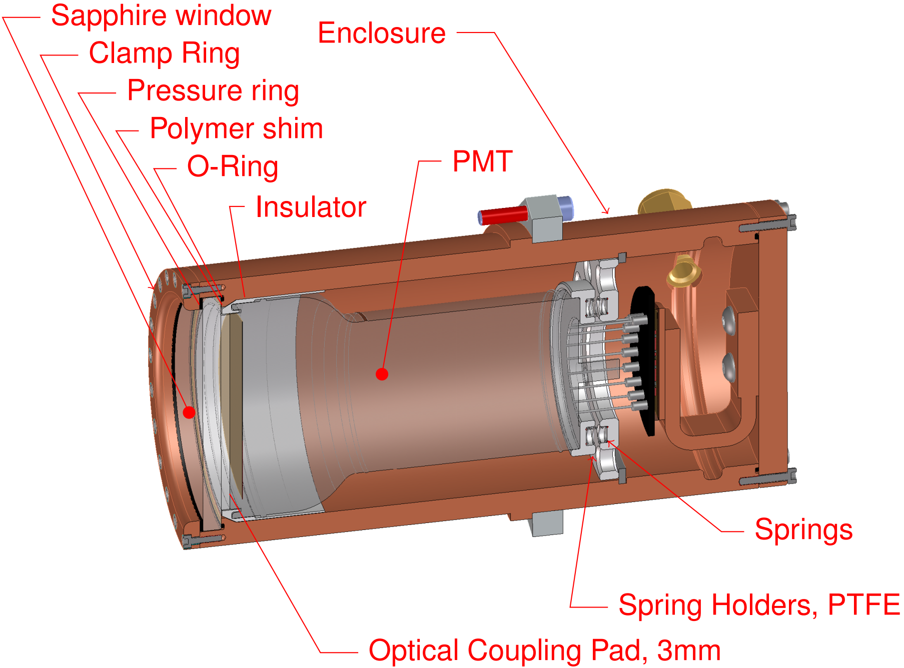

Sapphire window
Clamp Ring
Enclosure
O-Ring
PMT
Optical Coupling Pad, 3mm

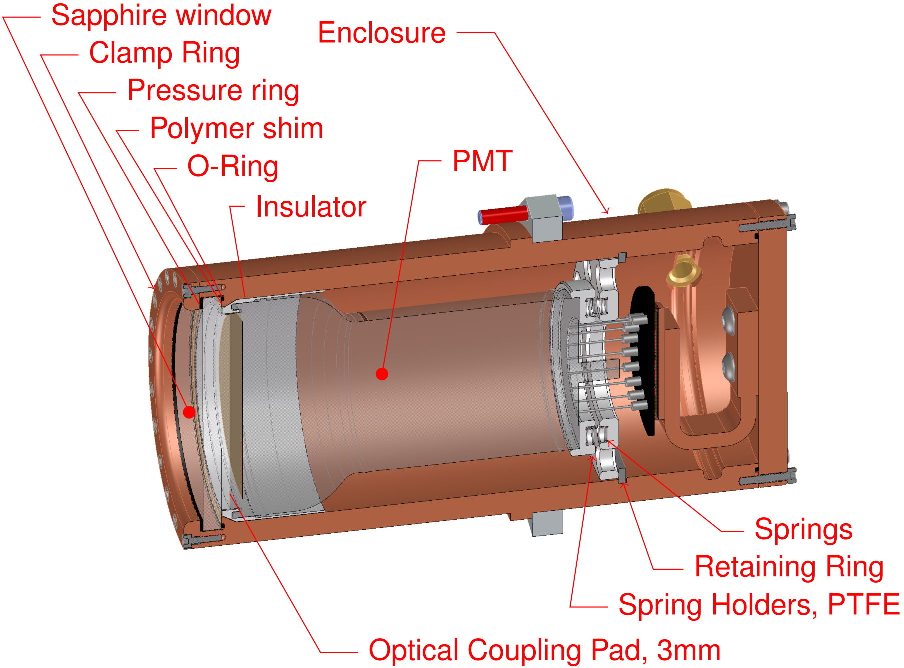

Sapphire window
Clamp Ring
Pressure ring
Enclosure
O-Ring
PMT
Optical Coupling Pad, 3mm

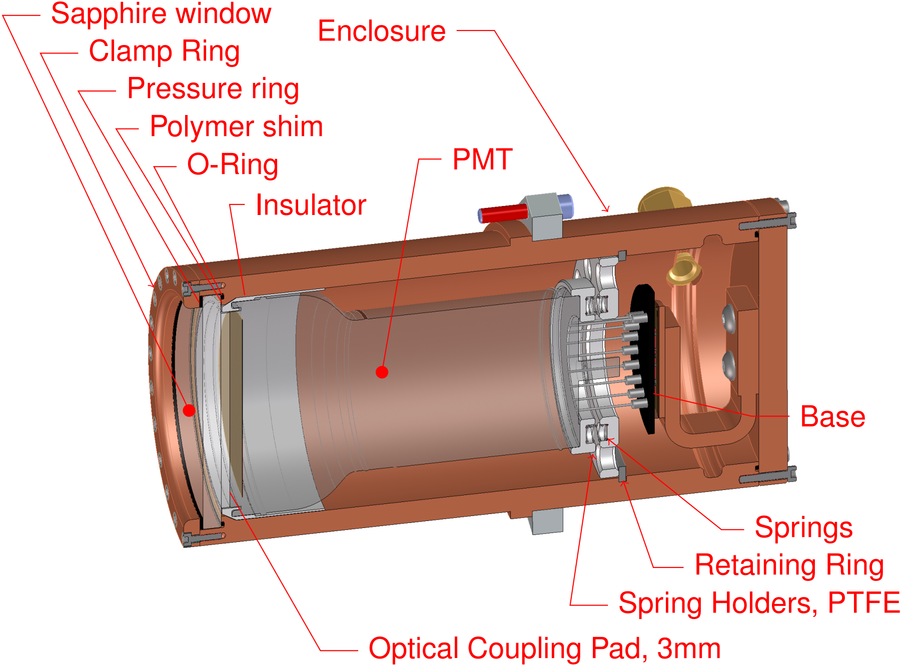

Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Enclosure
PMT
Optical Coupling Pad, 3mm

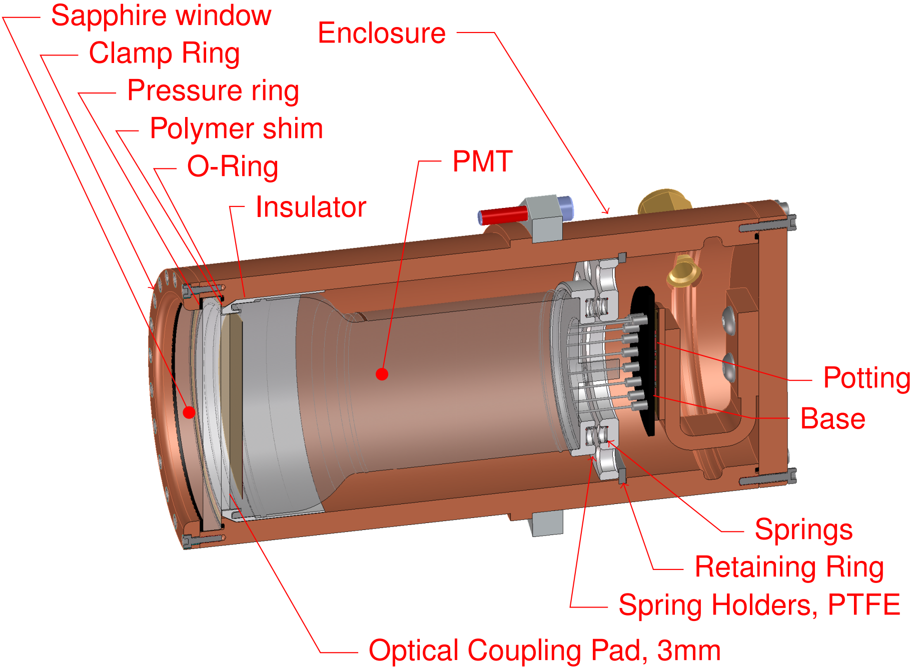

Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Springs
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Springs
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Springs
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Base
Springs
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
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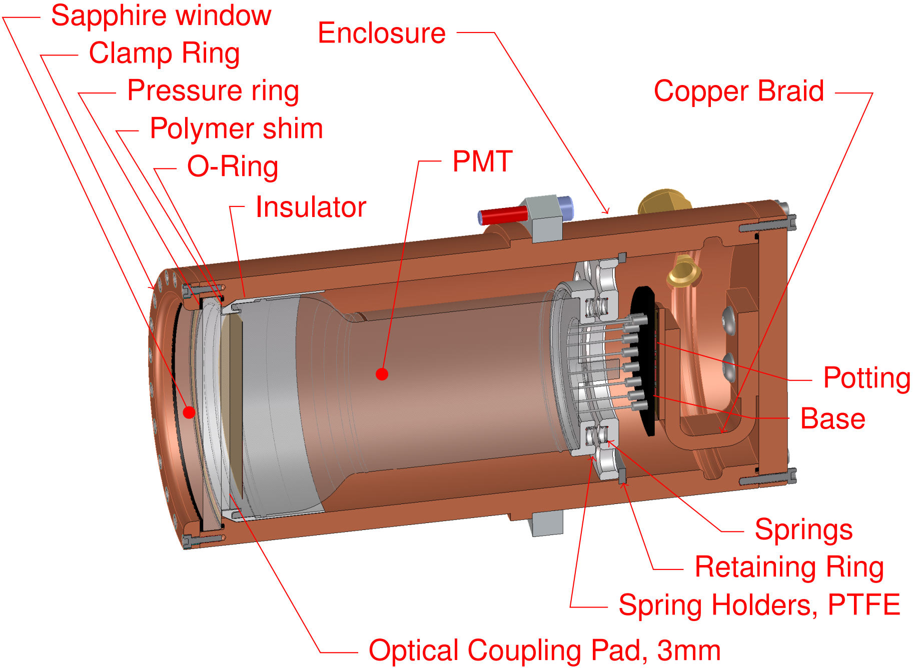
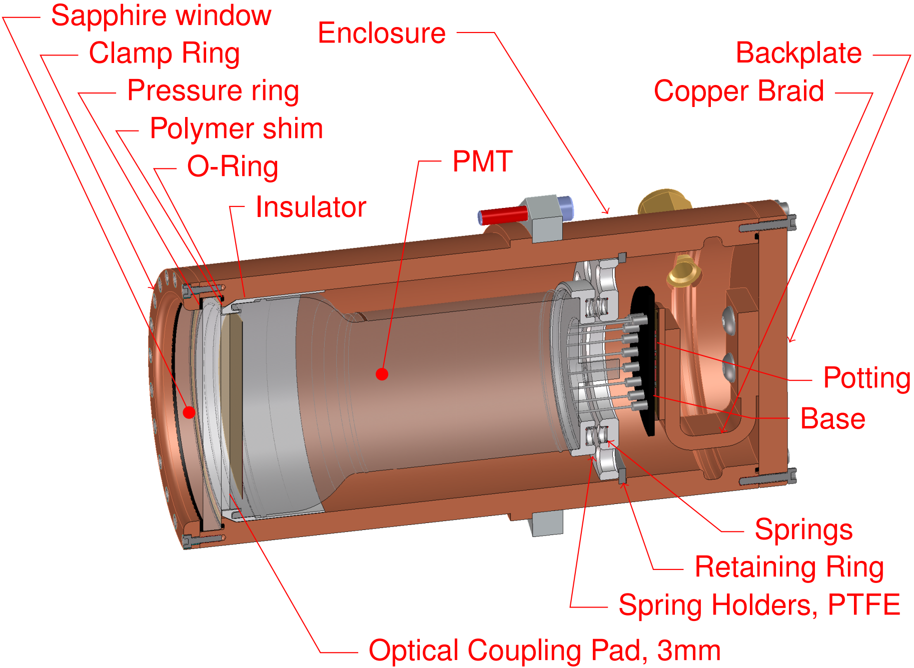
Enclosure
PMT
Potting
Base
Springs
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Copper Braid
Potting
Base
Springs
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm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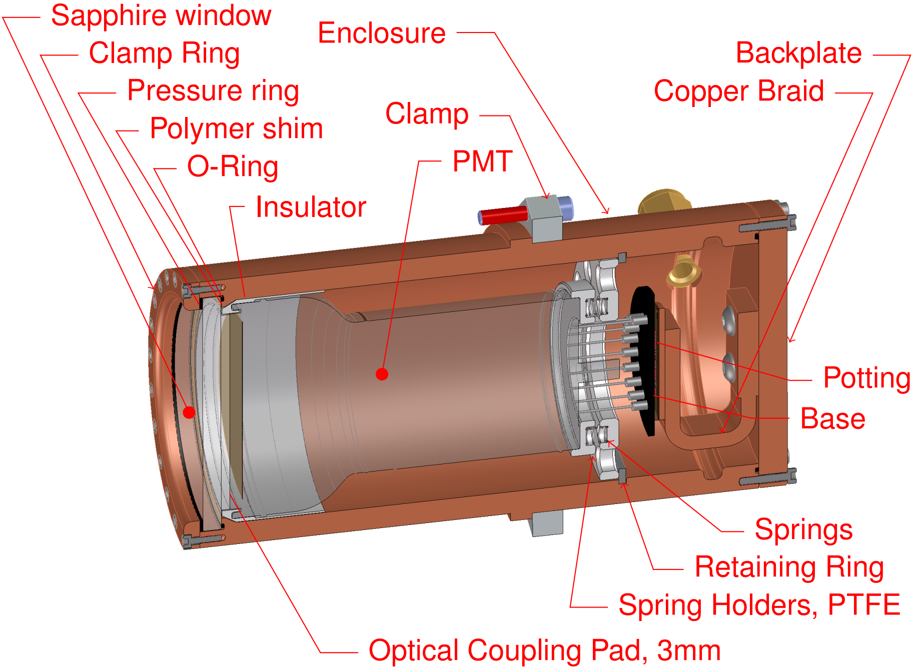
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
PMT
Backplate
Copper Braid
Potting
Base
Springs
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
Enclosure
Clamp
PMT
Backplate
Copper Braid
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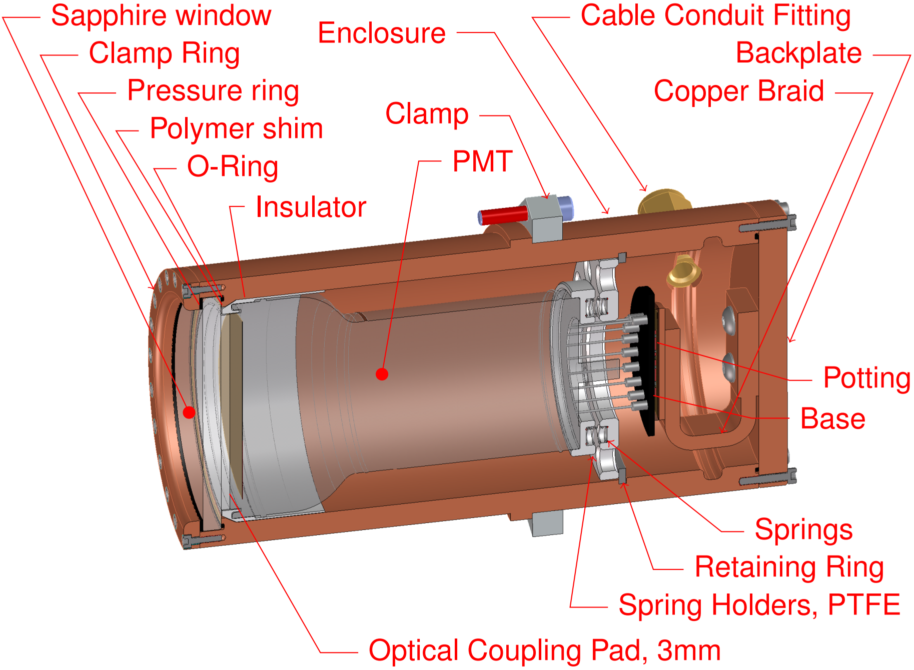
Sapphire window
Clamp Ring
Pressure ring
Polymer shim
O-Ring
Insulator
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Clamp
PMT
Cable Conduit Fitting
Backplate
Copper Braid
Potting
Base
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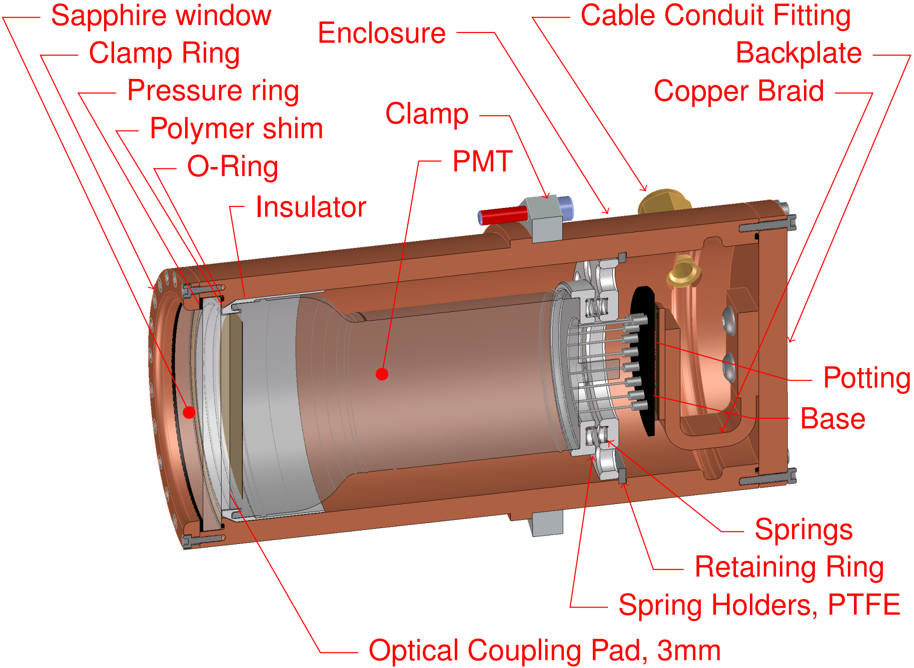
Retaining Ring
Spring Holders, PTFE
Optical Coupling Pad, 3mm


Sapphire window
Clamp Ring
Pressure ring
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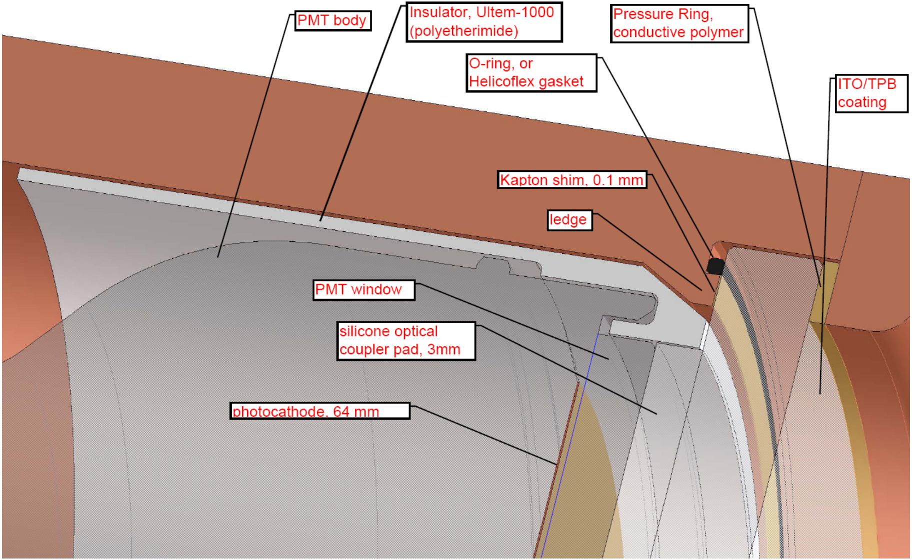
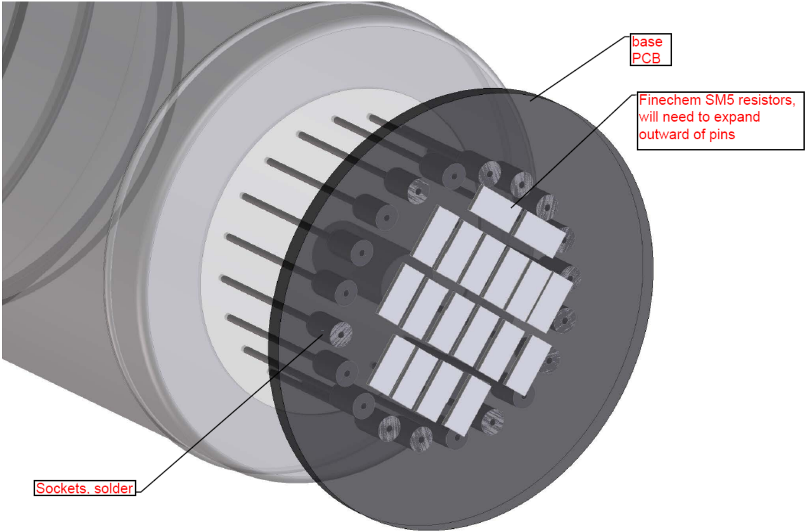
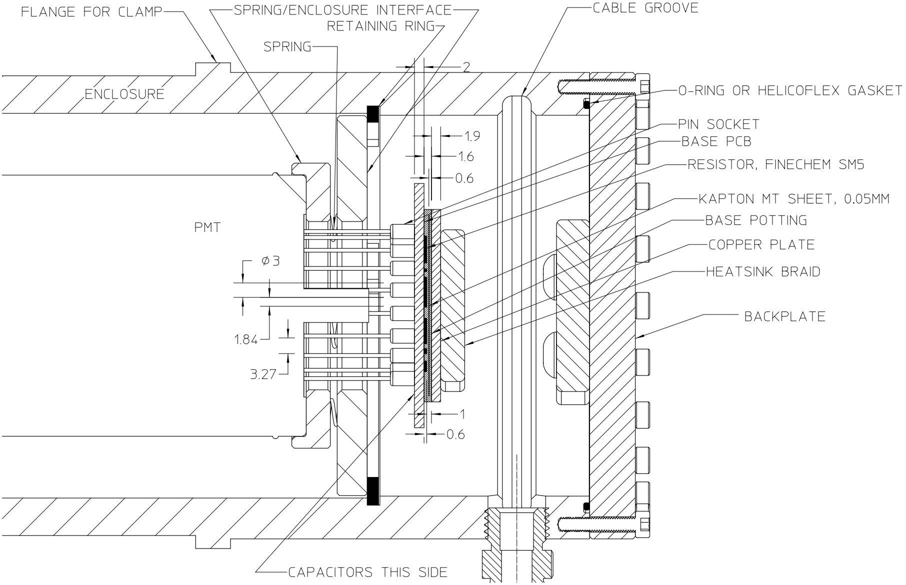
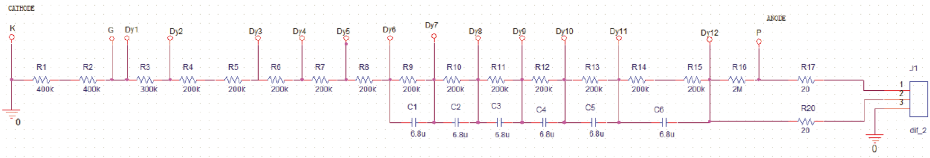
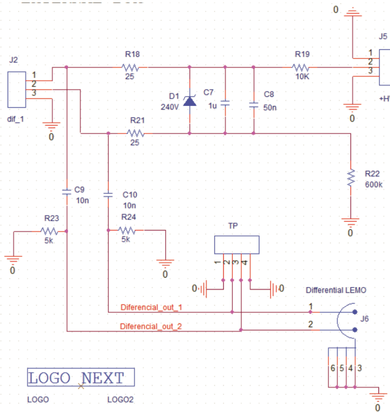

PMT body
Insulator, Ultem-1000 (polyetherimide)
Pressure Ring, conductive polymer
O-ring, or Helicoflex gasket
ITO/TPB coating
Kapton shim, 0.1 mm
ledge
PMT window
silicone optical coupler pad, 3mm
photocathode, 64 mm


base
PCB
Finechem SM5 resistors,
will need to expand
outward of pins
Sockets, solder


FLANGE FOR CLAMP
SPRING/ENCLOSURE INTERFACE
RETAINING RING
SPRING
CABLE GROOVE
2
ENCLOSURE
O-RING OR HELICOFLEX GASKET
PIN SOCKET
1.9
BASE PCB
1.6
RESISTOR, FINECHEM SM5
0.6
KAPTON MT SHEET, 0.05MM
PMT
BASE POTTING
ϕ3
COPPER PLATE
HEATSINK BRAID
BACKPLATE
1.84
3.27
1
0.6
CAPACITORS THIS SIDE


CATHODE
K
G
Dy1
Dy2
Dy3
Dy4
Dy5
Dy6
Dy7
Dy8
Dy9
Dy10
Dy11
Dy12
ANODE
P
R1 400k
R2 400k
R3 300k
R4 200k
R5 200k
R6 200k
R7 200k
R8 200k
R9 200k
R10 200k
R11 200k
R12 200k
R13 200k
R14 200k
R15 200k
R16 2M
R17 20
R20 20
C1 6.8u
C2 6.8u
C3 6.8u
C4 6.8u
C5 6.8u
C6 6.8u
J1
1
2
3
dif_2
0
0


J2
1
2
3
dif_1
0
R18 25
R19 10K
D1 240V
C7 1u
C8 50n
J5
1
2
3
+HV
0
R21 25
R22 600k
C9 10n
C10 10n
R23 5k
R24 5k
TP
1 2 3 4
Differential LEMO
Diferencial_out_1
Diferencial_out_2
J6
1
2
6 5 4 3
LOGO NEXT
LOGO
LOGO2
0

Prototyping progress

- 3 sapphire windows purchased and received, screened for gross radiopurity: Activity: <10 mBq/kg (U,late), <25mBq/kg (Th)
- prototype enclosure parts are designed, fabricated, assembled and undergoing first vacuum tests.
- pressure vessel for testing enclosure is designed, fabricated and pressure tested, ready for use
- sample 32 pin feedthrough has been tested (preliminarily) for flashover as a function of vacuum.

For U_z = E, in V/cm:

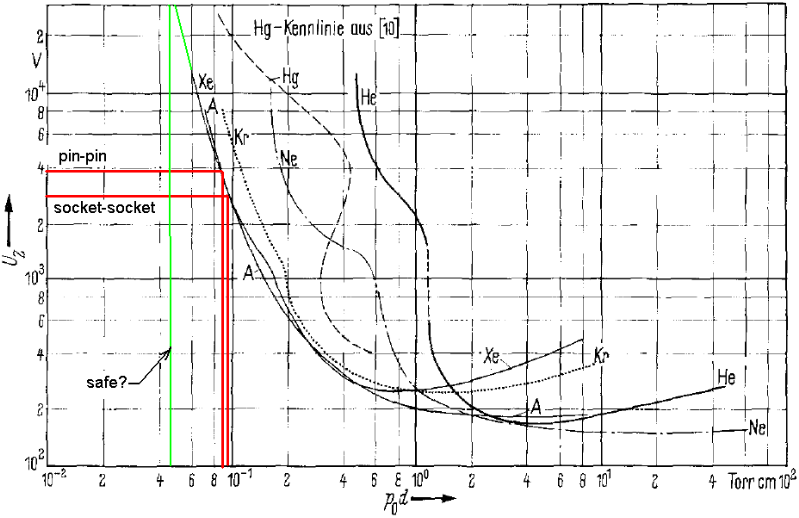
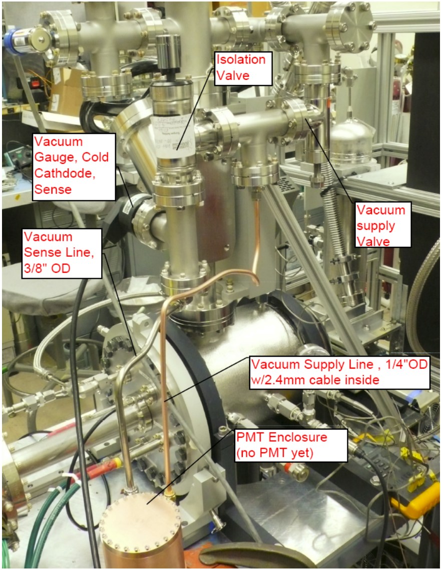
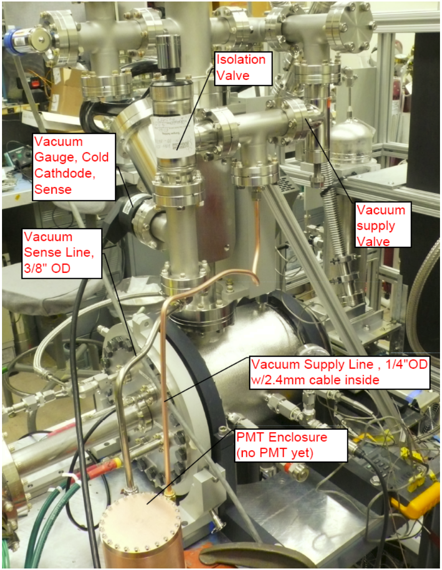


Bild 7. Zündkennlinien der Edelgase, Hg-Kennlinie aus [10].


Isolation Valve
Vacuum Gauge, Cold Cathdode, Sense
Vacuum supply Valve
Vacuum Sense Line, 3/8" OD
Vacuum Supply Line , 1/4"OD w/2.4mm cable inside
PMT Enclosure (no PMT yet)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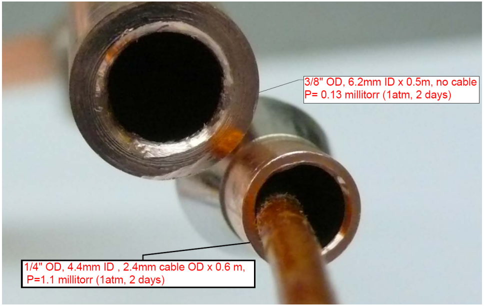
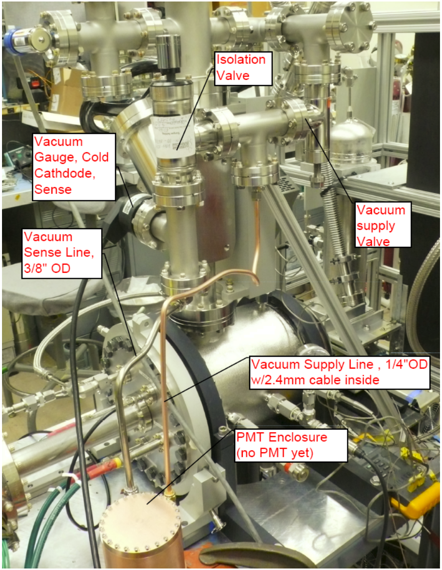
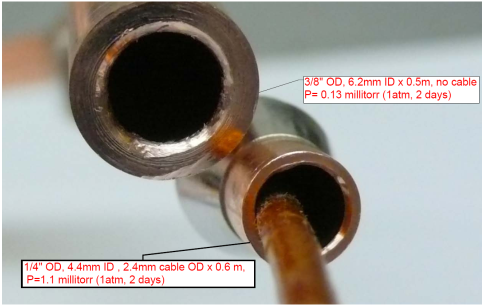
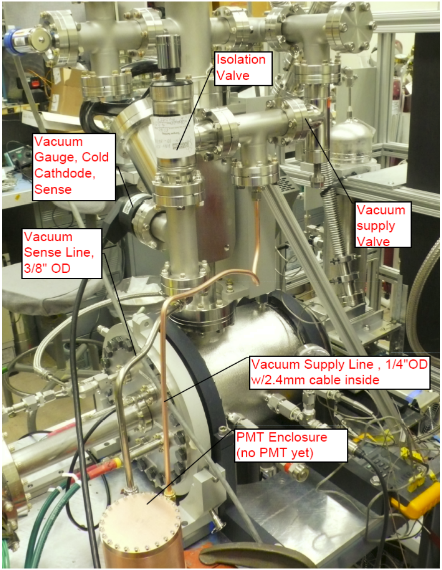
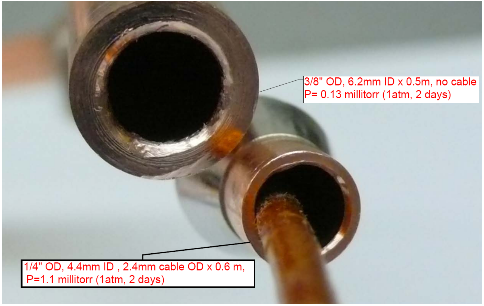

3/8" OD, 6.2mm ID x 0.5m, no cable
P= 0.13 millitorr (1atm, 2 days)
1/4" OD, 4.4mm ID , 2.4mm cable OD x 0.6 m,
P=1.1 millitorr (1atm, 2 days)





- not yet clear ratio outgassing to permeation - RGA He leak test negative





- not yet clear ratio outgassing to permeation - RGA He leak test negative
- Nitrile O-ring seals, window, backplate
- Expect 1 decade higher at high pressure

32 pin Ceramtec (similar to VACOM)

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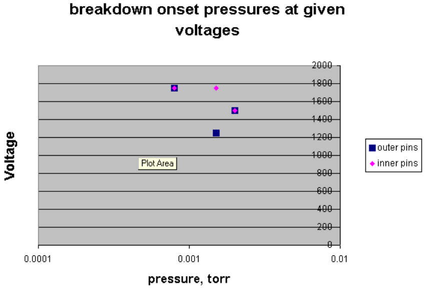
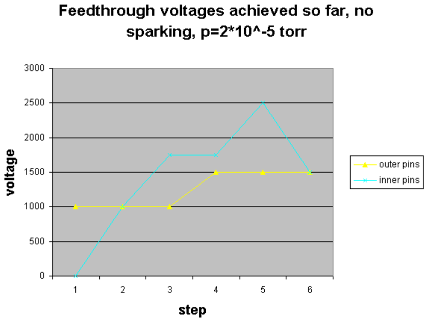
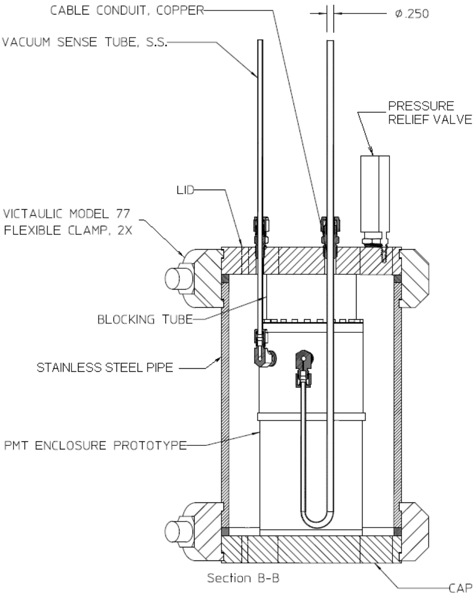




Pressure Testing Vessel for Permeation, HV? Studies



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