

SNS Linac Technical Memo

Wirescanner Outgassing Rate

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WBS 14.5.2.4 (Diagnostics – Wirescanner)

Vacuum Loads for SNS wirescanner

Summary : In order to do the initial design of the D-plate vacuum system a calculation was done to estimate the out-gassing load from the wirescanner. The wire scanner for the D-plate is being developed under WBS 1.4.5.2.4, since it will be used elsewhere in the accelerator. Also note that as the designs of these devices become more mature, the responsible person should update these values and pass the information on to the vacuum system designers, especially if the new values exceed these presented here.

The assumptions made were:

Device is mounted on a linear actuator.

Kapton insulated wires are used to bring the signals out from the vacuum.

Conclusion

The estimated out-gassing rate for the wirescanner is 1.774×10^{-7} torr*L/s

Inner surfaces exposed to vacuum:

$$\text{Fork}_{SA} := 20.8 \cdot \text{in}^2$$

$$\text{Fork}_{SA} = 134.193 \text{ cm}^2$$

$$\text{Guide_rail}_{SA} := 19.91 \text{ in}^2$$

$$\text{Guide_rail}_{SA} = 128.451 \text{ cm}^2$$

$$\text{Support}_{SA} := 84.1 \cdot \text{in}^2$$

$$\text{Support}_{SA} = 542.58 \text{ cm}^2$$

$$\text{Tube}_{SA} := \pi \cdot (.625 \cdot \text{in} + .375 \cdot \text{in}) \cdot 14.2 \text{ in}$$

$$\text{Tube}_{SA} = 287.81 \text{ cm}^2$$

$$\text{Bellows}_{SA} := \frac{\pi}{4} \cdot [(2.2 \text{ in})^2 - (1.04 \text{ in})^2] \cdot 12.2$$

$$\text{Bellows}_{SA} = 457.058 \text{ cm}^2$$

$$\text{Box}_{SA} := \pi \cdot 1.5 \text{ in} \cdot 3 \text{ in}$$

$$\text{Box}_{SA} = 9.121 \times 10^{-3} \text{ m}^2$$

Signal wires, assuming .024" diameter Kapton insulated wires.

$$\text{Wire}_{SA} := 6 \cdot 24 \cdot \text{in} \cdot \pi \cdot .024 \cdot \text{in}$$

$$\text{Wire}_{SA} = 70.047 \text{ cm}^2$$

$$\text{Wire}_{SA} = 10.857 \text{ in}^2$$

Outgassing rate of exposed surfaces

$$\text{LR}_{ss} := 1 \cdot 10^{-10} \cdot \frac{\text{torr} \cdot \text{L}}{\text{s} \cdot \text{cm}^2}$$

$$\text{OGR}_{ss} := \text{LR}_{ss} \cdot (\text{Fork}_{SA} + \text{Guide_rail}_{SA} + \text{Support}_{SA} + \text{Tube}_{SA} + \text{Bellows}_{SA} + \text{Box}_{SA})$$

$$\text{bar} := 760 \cdot \text{torr}$$

$$\text{mbar} := .001 \cdot \text{bar}$$

$$\text{OGR}_{ss} = 1.641 \times 10^{-7} \frac{\text{torr} \cdot \text{L}}{\text{s}}$$

$$\text{mbar} = 0.76 \text{ torr}$$

Outgassing rate as listed by "Virgo" vacpisa kapton cables

$$\text{LR}_{\text{kapton}} := 1.110^{-10} \cdot \frac{\text{mbar} \cdot \text{L}}{\text{s} \cdot \text{cm}^2}$$

$$\text{LR}_{\text{kapton}} = 8.36 \times 10^{-11} \frac{\text{torr} \cdot \text{L}}{\text{s} \cdot \text{cm}^2}$$

$$\text{OGR}_{\text{kapton}} := \text{Wire}_{SA} \cdot \text{LR}_{\text{kapton}}$$

$$\text{OGR}_{\text{kapton}} = 5.856 \times 10^{-9} \frac{\text{torr} \cdot \text{L}}{\text{s}}$$

Seals and their leak rates

$$\text{Bellows} := 2 \cdot 10^{-9} \cdot \frac{\text{torr} \cdot \text{L}}{\text{s}}$$

$$\text{conflat} := 1 \cdot 10^{-10} \cdot \text{torr} \cdot \frac{\text{L}}{\text{s}}$$

$$\text{viton} := 5 \cdot 10^{-9} \cdot \text{torr} \cdot \frac{\text{L}}{\text{s}}$$

Total out-gassing rate of the wire scanner is:

$$\text{OGR}_{\text{ws}} := \text{OGR}_{\text{ss}} + \text{OGR}_{\text{kapton}} + \text{Bellows} + 4 \cdot \text{conflat} + \text{viton}$$

$$\text{OGR}_{\text{ws}} = 1.774 \times 10^{-7} \frac{\text{torr} \cdot \text{L}}{\text{s}}$$