DArT mechanical design: pipes for DArT

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Summary

- We have three option for the pipes of the DArT chamber:

1. Top flange + pipes of stainless steel

2. Top flange + pipes of OFHC copper

3. Top flange of OFHC copper + pipes of standard copper

Option 1: stainless steel flange

- Assuming 2.5 kg for the top flange and the pipes. We obtain 1100 evt/week of background with a similar SS of the ArDM cryo.

detector	part	material	simulated mass (kg)	actual mass (kg)	RN	RNs in chain	activity (mBq/kg)	activity full chain
DART	vessel	SS	2.5	2.5	Co60	1	11.21	11.21
			2.5	2.5	K40	1	10.36	10.36
			2.5	2.5	Th232	10	6.37	63.7
			2.5	2.5	U238	14	3.42	47.88
DART	vessel	SS						

e / y	weight ev/w	events in ROI	events untagged ROI
1	8.47E-03	1803.0	125.0
8	5.64E-04	7.8	4.1
6	4.82E-02	1728.0	664.2
4	3.62E-02	1390.8	439.4
Events/week =		**3118.9**	**1103.6**

Option 2: OFHC copper

- Ideal case, background expected < 8 evt/week for DArT vessel.
- We can not obtain the copper pipes from the same provider as the DArT vessel. Two options:

- Electroform copper pipes in LSC. The diameter of the recirculation tube is small (6 mm external) → it is hard to electroform this piece. Additionally, 1 mm thickness wall maybe is not enough compact to withstand a good vacuum.

- On Monday, I spoke with an Avactec commercial. He said to me that maybe Testbourne Ltd could provide these pipes. Waiting for answer of the company.

Option 3: OFHC + standard copper

- The radiopurity level it is important, but we can survive with levels of tens of mBq for the internal pipe (most critical piece).

- Do we need a special treatment for the oxygen?

detector	part	material	simulated mass (kg)	actual mass (kg)	RN	RNs in chain	activity (mBq/kg)	activity full chain
DART	int pipe	SS	0.02	0.02	Co60	1	11.21	11.21
			0.02	0.02	K40	1	10.36	10.36
			0.02	0.02	Th232	10	6.37	63.7
			0.02	0.02	U238	14	3.42	47.88
DART	int pipe	SS						

weight ev/w	events in ROI	events untagged ROI
6.78E-03	23.8	1.8
6.27E-03	2.0	1.1
3.85E-02	34.8	15.6
2.90E-02	26.4	10.8
Events/week	**87.0**	**29.4**