

Activity on posts at INFN - Milano



INFN MILano - LASA
III Type IV Cryomodule Design Meeting
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Summary



- G11 tubes
 - specifications
 - measurement

- Aluminum and steel disks and rings
 - specifications
 - measurement

- Calculation of interference

- Preparation for the assembly at LASA
 - other needed parts
 - assembly kit
 - tests

G11 tubes - specifications



FNAL required specifications

Material:

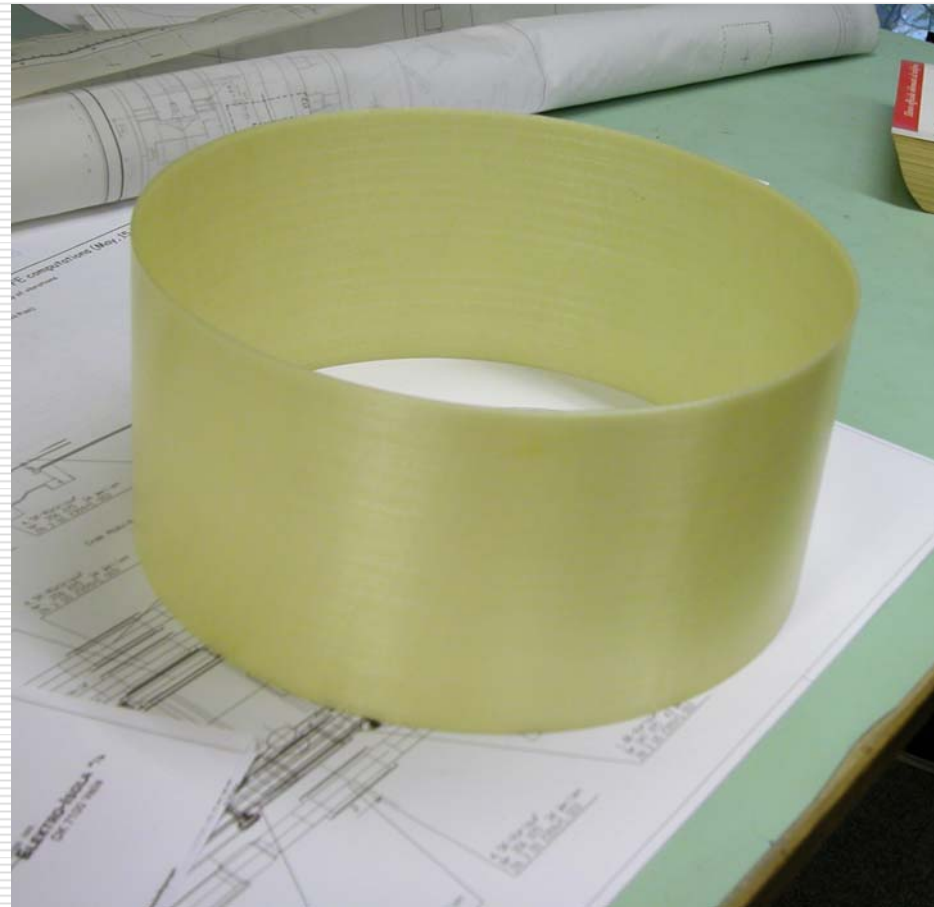
Filament wound in epoxy matrix

Geometry:

Int_diam = 295.58 ± 0.05

Ext_diam = 300.00 ± 0.05

Thickness = 2.21 ± 0.05



G11 tubes - specifications



Upper tube: American - Lower tube: Danish



G11 tubes - measurement



Tubes measurement

OMCM company performed a measurement of the 24 US tubes and the Danish one.

Measured dimensions: internal and external diameter

Temperature: 20°C

Procedure: the machine measures 8 points along the internal circumference, 8 points along the external circumference and calculate the mean internal diameter (D_i) and the mean external diameter (D_e)

G11 tubes - measurement



Measure of the top of the tube				
<i>tube n.</i>	<i>diam_ext</i>	<i>out of range</i>	<i>diam_int</i>	<i>out of range</i>
51	300.037		295.754	0.12
52	300.034		295.661	0.03
53	300.053	0.00	295.789	0.16
54	300.039		295.694	0.06
55	300.067	0.02	295.776	0.15
56	300.046		295.750	0.12
57	300.002		295.771	0.14
58	300.066	0.02	295.699	0.07
59	300.035		295.748	0.12
60	300.086	0.04	295.659	0.03
61	300.020		295.721	0.09
62	300.062	0.01	295.677	0.05
63	300.074	0.02	295.653	0.02
64	300.036		295.750	0.12
65	300.041		295.704	0.07
66	300.035		295.690	0.06
67	300.078	0.03	295.668	0.04
68	300.092	0.04	295.670	0.04
69	300.030		295.709	0.08
70	300.087	0.04	295.699	0.07
71	300.061	0.01	295.669	0.04
72	300.034		295.766	0.14
73	300.085	0.03	295.624	
74	300.073	0.02	295.661	0.03
75-danish	299.980		295.628	

Measure of the bottom of the tube				
<i>tube n.</i>	<i>diam_ext</i>	<i>out of range</i>	<i>diam_int</i>	<i>out of range</i>
51	300.038		295.775	0.14
52	300.063	0.01	295.648	0.02
53	300.033		295.794	0.16
54	300.043		295.696	0.07
55	300.037		295.754	0.12
56	300.056	0.01	295.750	0.12
57	299.991		295.766	0.14
58	300.040		295.688	0.06
59	300.021		295.745	0.12
60	300.113	0.06	295.669	0.04
61	300.005		295.720	0.09
62	300.041		295.675	0.04
63	300.071	0.02	295.650	0.02
64	300.026		295.749	0.12
65	300.047		295.715	0.08
66	300.030		295.678	0.05
67	300.084	0.03	295.645	0.02
68	300.047		295.663	0.03
69	299.993		295.704	0.07
70	299.989		295.691	0.06
71	300.090	0.04	295.655	0.03
72	300.050		295.764	0.13
73	300.085	0.04	295.643	0.01
74	300.077	0.03	295.648	0.02
75-danish	300.141	0.09	295.592	

G11 tubes - measurement



Thickness calculation: top and bottom				
<i>tube n.</i>	<i>T_top</i>	<i>out of range</i>	<i>T_bottom</i>	<i>out of range</i>
51	2.142	-0.018	2.131	-0.029
52	2.186		2.208	
53	2.132	-0.028	2.120	-0.040
54	2.173		2.174	
55	2.146	-0.014	2.142	-0.018
56	2.148	-0.012	2.153	-0.007
57	2.115	-0.045	2.112	-0.048
58	2.183		2.176	
59	2.144	-0.016	2.138	-0.022
60	2.214		2.222	
61	2.150	-0.010	2.143	-0.017
62	2.193		2.183	
63	2.211		2.210	
64	2.143	-0.017	2.138	-0.022
65	2.169		2.166	
66	2.172		2.176	
67	2.205		2.219	
68	2.211		2.192	
69	2.160		2.144	-0.016
70	2.194		2.149	-0.011
71	2.196		2.218	
72	2.134	-0.026	2.143	-0.017
73	2.230		2.221	
74	2.206		2.214	
75-danish	2.176		2.274	0.014

G11 tubes - measurement



o Results

- Internal diameter out of range: 47 / 50 measures
- External diameter out of range: 21 / 50 measures

- Thickness out of range: 21 / 50 measures

- Danish tube similar to US one

Al and steel parts - specification



FNAL required specifications

Materials:

Steel AISI 304

Aluminum 6061 T6

Geometry:

Rings Int_diam = 295.58 ± 0.05

Disks Ext_diam = 300.00 ± 0.05



Al and steel parts - measurement



Al and steel parts measurement

OMCM company performed a measurement of 6 sets of disks and rings.

Measured dimensions: internal rings diameter and external disks diameter

Temperature: 20°C

Procedure: the machine measures 16 points along the internal circumference of the ring, 16 points along the external circumference of the disk and calculate the mean internal diameter of the ring and the mean external diameter of the disk.

Al and steel parts - measurement



Results 1/2

<i>Position 1: steel disks 1.8K</i>		
disk n.	Mean_diam	out of tolerance
9	296.025	
10	296.015	
23	296.007	-0.003
36	296.021	
37	296.003	-0.007
38	296.000	-0.010

<i>Position 2: steel rings 1.8K</i>		
disk n.	Mean_diam	out of tolerance
13	299.947	-0.023
14	300.032	0.002
15	300.040	0.010
16	299.980	
17	299.960	-0.010
18	299.971	

<i>Position 7: steel disks 300K</i>		
disk n.	Mean_diam	out of tolerance
11	296.042	
12	296.020	
39	296.027	
40	296.002	-0.008
41	296.009	-0.001
42	296.003	-0.007

<i>Position 8: steel rings 300K</i>		
disk n.	Mean_diam	out of tolerance
5	299.986	
6	299.996	
19	299.988	
20	299.970	0.000
21	300.007	
22	299.956	-0.015

Al and steel parts - measurement



Results 2/2

<i>Position 3: aluminum disks 4-70 K</i>		
disk n.	Mean_diam	out of tolerance
8	296.077	0.017
7	296.076	0.016
32	296.029	
33	296.027	
34	296.086	0.026
35	296.008	-0.002
43	296.035	
44	296.028	
45	295.985	-0.025
46	296.020	
47	295.991	-0.019
48	296.053	

<i>Position 4: aluminum rings 4K</i>		
disk n.	Mean_diam	out of tolerance
3	299.958	-0.012
4	299.968	-0.002
28	299.949	-0.021
29	299.957	-0.013
30	299.952	-0.018
31	299.952	-0.018

<i>Position 6: aluminum rings 70K</i>		
disk n.	Mean_diam	out of tolerance
1	299.974	
2	299.998	
24	299.993	
25	299.981	
26	299.966	-0.004
27	299.993	

Interference



Calculation of interference between:

- empty space between disk and ring
- G11 tube thickness

		tubes											
pos1	pos2	empty	51	52	53	54	55	56	57	58	59	60	61
11	5	1.97	0.16	0.24	0.15	0.20	0.17	0.18	0.14	0.20	0.17	0.25	0.17
11	6	1.98	0.15	0.23	0.14	0.20	0.16	0.18	0.13	0.20	0.16	0.24	0.17
11	19	1.97	0.16	0.23	0.15	0.20	0.17	0.18	0.14	0.20	0.16	0.25	0.17
11	20	1.96	0.17	0.24	0.16	0.21	0.18	0.19	0.15	0.21	0.17	0.26	0.18
11	21	1.98	0.15	0.22	0.14	0.19	0.16	0.17	0.13	0.19	0.16	0.24	0.16
11	22	1.96	0.17	0.25	0.16	0.22	0.18	0.20	0.16	0.22	0.18	0.26	0.19
12	5	1.98	0.15	0.22	0.14	0.19	0.16	0.17	0.13	0.19	0.16	0.24	0.16
12	6	1.99	0.14	0.22	0.13	0.19	0.15	0.16	0.12	0.19	0.15	0.23	0.15
12	19	1.98	0.15	0.22	0.14	0.19	0.16	0.17	0.13	0.19	0.15	0.24	0.16
12	20	1.98	0.16	0.23	0.14	0.20	0.17	0.18	0.14	0.20	0.16	0.25	0.17
12	21	1.99	0.14	0.21	0.13	0.18	0.15	0.16	0.12	0.18	0.14	0.23	0.15
12	22	1.97	0.16	0.24	0.15	0.21	0.17	0.19	0.14	0.21	0.17	0.25	0.17
39	5	1.98	0.15	0.23	0.14	0.19	0.16	0.17	0.13	0.20	0.16	0.24	0.16

Post assembly



- The assembly of first 6 posts will be performed at LASA in next months;
- Superinsulation: 10 and 20 layers respectively between 5K to 70K disks and 70K to 300K disks;
- The assembly kit was produced by Zanon, it's now at LASA;
- Tests: every post will be tested at 5000 kg.

Post assembly

