

# Observation of noise in production VPTs at 1.8T

## VPTs with bar-codes 1501-7900

### Draft

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#### 1. Introduction

This note gives details of noise observations in recent batches of VPTs, covering devices with bar-codes from 1501 to 7900. The observations are preliminary, because some of these VPTs have only been measured once in the RAL 1.8T test rig. A final assessment of these devices will be made when they have all been remeasured to confirm the initial observation of noise. When this set of measurements has been carried out, a more detailed report will be presented.

#### 2. VPTs displaying discharges

A list of VPTs showing spikes is given in Table 1. This list covers all tubes with bar-codes in the range 1501-7900. The data on VPTs in the range 5001-6900 is preliminary, because these tubes have been measured only once in the RAL test rig; they will be remeasured as soon as possible to confirm the observation of discharges.

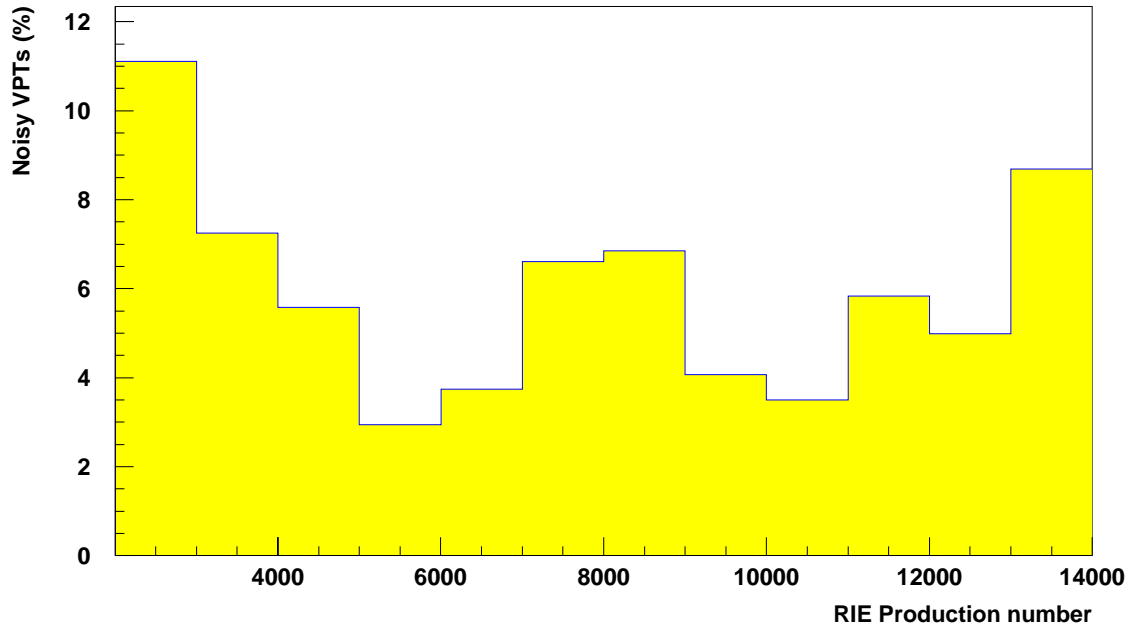
Bar-code range	Noisy	Bar-codes of noisy VPTs
1501-1600	8	1503 1508 1529 1546 1550 1553 1559 1571
1601-1700	8	1613 1615 1616 1619 1638 1639 1641 1672
1701-1800	8	1700 1708 1742 1745 1752 1758 1765 1794
1801-1900	8	1808 1829 1837 1846 1852 1853 1855 1875
1901-2000	6	1905 1937 1944 1950 1996 1999
2001-2100	10	2020 2036 2042 2058 2062 2064 2085 2089 2090 2096
2101-2200	4	2134 2156 2174 2179
2201-2300	6	2212 2220 2228 2256 2283 2299
2301-2400	4	2310 2319 2382 2395
2401-2500	5	2400 2413 2448 2456 2461
2501-2600	2	2564 2579
2601-2700	6	2635 2647 2669 2697 2698 2699
2701-2800	2	2712 2719
2801-2900	3	2804 2830 2896
2901-3000	2	2902 2947
3001-3100	3	3065 3070 3086
3101-3200	2	3117 3174
3201-3300	3	3215 3227 3249
3301-3400	4	3322 3339 3368 3373

3401-3500	1	3422
3501-3600	3	3511 3592 3594
3601-3700	3	3610 3647 3663
3701-3800	10	3704 3705 3714 3744 3756 3760 3762 3782 3786 3798
3801-3900	4	3822 3826 3833 3836
3901-4000	12	3903 3904 3907 3909 3911 3928 3930 3932 3946 3951 3956 3985
4001-4100	8	4000 4010 4013 4017 4046 4059 4082 4090
4101-4200	5	4107 4124 4150 4151 4157
4201-4300	5	4205 4210 4212 4221 4281
4301-4400	11	4303 4314 4326 4328 4336 4353 4374 4377 4385 4393 4399
4401-4500	3	4409 4465 4490
4501-4600	8	4508 4509 4517 4519 4550 4563 4565 4568
4601-4700	7	4623 4626 4642 4644 4649 4650 4661
4701-4800	12	4701 4705 4710 4718 4731 4754 4756 4758 4765 4775 4784 4786
4801-4900	5	4833 4844 4848 4867 4899
4901-5000	5	4900 4908 4945 4980 4983
5001-5100	3	5015 5038 5047
5101-5200	3	5143 5145 5186
5201-5300	7	5206 5231 5234 5235 5264 5270 5295
5301-5400	4	5333 5351 5381 5398
5401-5500	1	5432
5501-5600	5	5507 5509 5548 5570 5575
5601-5700	2	5605 5658
5701-5800	7	5715 5737 5747 5749 5768 5769 5791
5801-5900	1	5827
5901-6000	3	5921 5925 5937
6001-6100	4	6002 6022 6029 6030
6101-6200	1	6106
6201-6300	8	6209 6234 6247 6252 6258 6263 6290 6292
6301-6400	4	6320 6353 6362 6398
6401-6500	7	6429 6444 6466 6474 6475 6481 6488
6501-6600	4	6519 6533 6537 6586
6601-6700	5	6613 6623 6640 6663 6696
6701-6800	2	6701 6711
6801-6900	3	6812 6813 6871
6901-7000	3	6915 6923 6968
7001-7100	9	7002 7004 7031 7039 7051 7067 7086 7091 7099
7101-7200	6	7104 7112 7120 7121 7160 7182
7201-7300	3	7205 7249 7260
7301-7400	6	7310 7333 7345 7350 7352 7386
7401-7500	6	7402 7423 7464 7471 7480 7496
7501-7600	10	7510 7521 7542 7551 7554 7566 7568 7580 7586 7594
7601-7700	5	7613 7621 7629 7637 7647
7701-7800	8	7702 7717 7741 7742 7756 7780 7788 7798
7801-7900	11	7805 7807 7824 7841 7842 7845 7847 7848 7862 7863 7868

Table 1. Bar codes of VPTs displaying discharges in a 1.8T magnetic field. VPTs shown in *italic type* have only been measured once in the RAL test rig.

A total of 338 noisy VPTs are listed here, or 5.3% of the devices with bar-codes in the range 1501-7900.

Figure 1 shows the distribution of noisy VPTs as a function of the RIE production number. Each bin in this plot covers a range of 1000 in production number; typically 500-600 VPTs in each bin are delivered to RAL.



**Figure 1.** Fraction of noisy tubes as a function of RIE production number. Only VPTs with bar-codes in the range 1501-7900 are included.

Table 2 gives more detailed information on these VPTs, including the angle at which the discharges were first observed. In this table the VPTs are ordered by the RIE production number rather than the bar code. The angle can be positive or negative, according to the alignment of the VPT in the 1.8T test rig.

RIE Production number	Bar code	Angle to 1.8T field (deg)
2770	1905	13
2791	1550	-35
2884	3956	11
2982	1508	-35
3042	1503	11
3109	1529	13
3121	1559	15
3130	1553	17
3132	1546	-35
3144	1571	-35
3176	1619	-35
3215	1613	-35
3221	1615	-35
3222	1616	-35
3269	1638	11
3270	1639	15

RIE Production number	Bar code	Angle to 1.8T field (deg)
3272	1641	-35
3292	2179	-10
3313	1672	-35
3371	7091	17
3388	1700	-25
3397	1708	-35
3406	4157	-27
3468	1742	13
3473	1745	15
3492	1765	25
3536	1758	-35
3555	1752	13
3567	1808	17
3571	1794	19
3598	1837	-35
3621	1846	13
3676	1829	-19
3697	1852	11
3708	1853	15
3719	1855	-27
3752	1875	-35
3819	1944	19
3835	1950	19
3842	1937	15
3914	1996	27
3924	1999	17
3950	2042	23
3979	2020	19
3985	2036	9
4013	2058	-35
4019	2085	11
4066	2062	11
4074	2064	23
4087	2096	27
4132	2089	19
4133	2090	13
4186	2134	-19
4235	2156	13
4245	2174	17
4247	3117	-35
4254	3798	-30
4284	2212	20
4294	2228	13
4320	2220	-35
4375	2256	15
4395	2283	17
4443	2299	17
4453	2319	-30
4562	2310	25
4568	2395	-35
4733	2413	17

RIE Production number	Bar code	Angle to 1.8T field (deg)
4799	2461	-35
4808	2456	11
4918	2382	-35
4922	2400	-35
4927	2448	-23
4967	2564	-35
5086	2579	-35
5143	2635	-35
5207	2647	-35
5251	2669	-35
5288	2697	-19
5307	2698	-35
5310	2699	11
5315	2719	-35
5335	2712	-35
5467	2896	21
5570	2804	-35
5671	2830	17
5704	2902	11
5747	2947	23
5794	3907	-35
6046	3086	13
6056	3065	11
6093	3070	15
6161	3174	19
6259	3322	-35
6287	4303	17
6293	3786	-35
6312	3249	-35
6413	3215	21
6442	7031	-23
6451	3227	-30
6511	3368	-35
6636	3714	25
6684	3782	-35
6691	3339	-35
6739	3373	-35
6811	5145	-30 to -15
6815	3511	-35
6834	3422	-35
6887	3909	13
6923	3911	-35
6993	3592	-35
7005	3594	-35
7012	3610	-35
7019	3663	-35
7053	4833	-35
7075	3647	-35
7087	3903	-35
7099	3985	21
7134	3705	-30

RIE Production number	Bar code	Angle to 1.8T field (deg)
7241	3833	21
7252	3704	-35
7262	4046	-35
7274	3762	-25
7276	5381	-35
7279	3760	23
7281	4212	-15
7292	3822	21
7295	3756	13
7298	3744	30
7329	3826	-35
7332	4124	-27
7360	3836	-25
7371	3904	11
7468	4059	-35
7539	3928	-1
7556	3930	-35
7561	3932	-35
7576	3946	21
7590	3951	11
7619	4000	-35
7627	4010	-35
7632	4013	-35
7648	4017	-35
7673	4082	-35
7739	4090	5
7802	4107	-23
7843	4150	13
7853	4899	-30
7854	4151	17
7911	7260	-25
7940	4900	23
7959	7182	-35
7983	4210	15
7989	4393	-35
8021	4221	-35
8106	4205	-30
8160	4385	-35
8165	4281	-35
8194	4326	-35
8196	4314	-35
8215	4328	19
8220	4353	-30
8232	5038	-35 to -11
8247	4336	-35
8248	4399	27
8301	4374	-21
8311	4409	-35
8319	4377	17
8325	4983	19
8331	4508	23

RIE Production number	Bar code	Angle to 1.8T field (deg)
8353	4908	19
8376	4465	-35
8381	4509	-25
8396	4490	-30
8426	4517	-27
8438	4519	-35
8443	4550	-30
8453	4786	-35
8454	4642	-35
8483	4563	17
8514	4565	-35
8581	4710	-35
8623	4718	-30
8707	4568	27
8744	4644	13
8746	4623	15
8773	4626	-35
8784	4649	-35
8785	4650	-30
8798	4661	-27
8820	4701	-35
8850	4775	17
8855	4754	13
8871	4705	-35
8891	4731	-35
8901	4756	21
8904	4758	23
8928	4765	-35
8931	4848	-27
8945	4784	-35
9232	5047	-35
9248	4844	9
9259	4867	23
9303	4945	19
9355	5015	-35
9364	4980	-35
9372	5398	<i>15 to 30</i>
9404	5231	<i>-35 to -13</i>
9434	7067	-35
9455	5143	<i>17 to 21</i>
9487	5234	15
9500	5235	27
9502	5186	27
9507	7099	-35
9531	5791	<i>-35 to -9</i>
9551	5206	<i>21 to 30</i>
9561	6258	<i>-35 to -11</i>
9575	5295	<i>-35 to -27</i>
9578	5264	<i>19 to 30</i>
9605	5270	<i>-30 to -19</i>
9626	5351	<i>-35 to -9</i>

RIE Production number	Bar code	Angle to 1.8T field (deg)
9658	5333	-35 to 0
9822	5432	17 to 27
9842	5507	-30 to -21
9866	5509	-21 to -11
9872	5548	-35 to -23
9886	5570	-35 to -27
9923	5575	25 to 30
9999	5658	19 to 25
10003	5605	-35 to -13
10097	5737	-35
10233	5715	-35 to 0
10298	5747	-35
10300	5749	-35 to -11
10316	5768	-13
10338	5769	9 to 30
10349	5827	-35 to 0
10459	6022	-35 to -9
10708	5921	25 to 30
10722	5925	11 to 27
10739	5937	-30
10772	6029	13 to 30
10795	6002	-35
10818	6030	-35
10910	7471	-35
10920	7039	-35
10933	7551	15
10952	6362	-35 to -23
10956	6106	11 to 21
11019	6209	13 to 27
11071	6701	23
11168	6586	-35 to -25
11302	6234	-35 to -15
11323	6247	-35 to -15
11324	6320	13 to 30
11357	7717	-35
11367	7554	-35
11387	6252	-35 to -25
11396	7121	-35
11398	6915	-35
11414	7120	-35
11426	6290	-35 to -21
11428	6292	-35 to -27
11433	6533	-35
11461	6263	13 to 30
11501	6353	-35 to -17
11510	6398	-35 to -15
11609	6429	-35 to -9
11618	7104	-35
11619	6466	-35 to -20
11621	6444	-35 to -27
11638	6474	-35 to -17



RIE Production number	Bar code	Angle to 1.8T field (deg)
11642	6475	19 to +30
11644	6488	17 to 23
11661	6537	9 to 30
11674	6481	9 to 30
11702	6519	-30 to -21
11711	6812	-35
11770	6613	-35 to -5
11771	6623	15 to 25
11786	6813	-27
11816	6640	-25 to -15
11872	6663	-25 to -7
11887	6696	15
11916	6711	-35
12229	6923	17
12325	7112	-35
12345	6871	9
12359	6968	-35
12457	7002	-35
12496	7004	-30
12536	7051	-30
12681	7249	-35
12698	7310	-35
12712	7205	-35
12735	7086	-27
12755	7160	-35
12823	7333	-35
12848	7386	17
12953	7345	11
12976	7350	-30
12993	7352	-35
13054	7521	11
13062	7402	11
13063	7480	21
13094	7423	25
13206	7629	17
13348	7566	21
13354	7430	-35
13359	7464	9
13371	7496	-35
13373	7510	7
13375	7568	9
13396	7580	30
13441	7542	19
13459	7594	-27
13470	7586	-35
13492	7613	-35
13519	7637	-35
13546	7647	-30
13548	7621	-9
13608	7702	-35
13611	7756	19

RIE Production number	Bar code	Angle to 1.8T field (deg)
13613	7741	-35
13655	7780	-27
13662	7742	-35
13695	7788	-30
13702	7798	-27
13712	7805	-35
13715	7862	-35
13718	7863	-35
13728	7807	27
13767	7841	-35
13768	7868	-35
13772	7842	-35
13780	7845	9
13782	7824	15
13791	7847	30
13792	7848	-35

**Table 2. Details of VPTs displaying discharges, ordered by RIE production number. VPTs shown *in italic type* have only been measured once in the RAL test rig.**

### 3. Summary and conclusions

This note has presented data on all VPTs with bar-codes in the range 1501-7900 which have displayed discharges when measured in the RAL 1.8T test rig. 5.3% of these VPTs appear to be noisy. Devices with bar codes in the range 5001-6900 have only been tested once in the test rig, and will be remeasured at RAL to confirm the observation of discharges.

The fraction of noisy VPTs shows significant variations as a function of the RIE production number. This information may be useful in understanding how the manufacturing conditions affect the behaviour of the VPTs.