

Observation of misaligned anode grids in production Vacuum Phototriodes

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B W Kennedy
Rutherford Appleton Laboratory

Introduction

Visual inspection of the production VPTs delivered to RAL has shown that a substantial fraction of the devices have their anode grids significantly misaligned with respect to the VPT axis. The fraction of VPTs affected has fluctuated during the delivery period. This feature of the VPTs has been reported previously [1]; this note presents a more detailed analysis of the observations.

Observation of misaligned anode grids

The percentage of tubes with grids significantly off-centre for VPTs with bar-codes from 6001 onwards is shown in Figure 1,. Each bin in the figure represents 100 VPTs. 27.2% of these VPTs have off-centre grids, but large fluctuations are seen over time. For example, the fraction was much lower for VPTs 6601-7600, but higher for devices in the ranges 6001-6500 and 8001-8400.

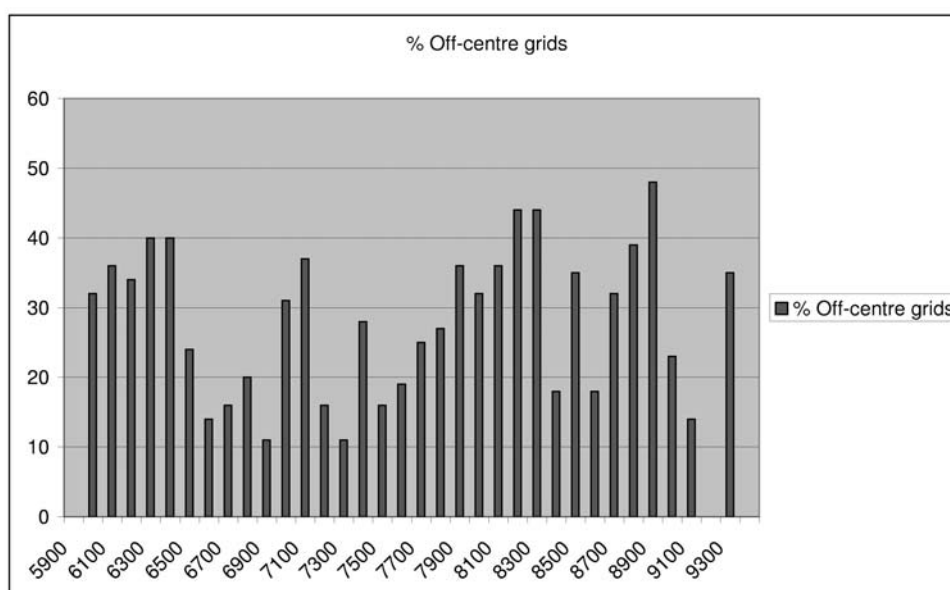


Figure 1. Fraction (%) of VPTs with significantly off-centre anode grids

Recently-delivered VPTs with bar-codes above 9000 appeared to show an improvement in the grid location. However, a preliminary examination of the most recent batch (only devices in the range 9301-9400 have been inspected so far) suggests that the misalignment rate in this batch is again above 20%.

Discussion

The gain and quantum efficiency of the misaligned VPTs are 9.93–0.06 and 0.219–0.001, according to the RIE measurements, compared with 10.14 and 0.221 for the complete sample of production VPTs. There is therefore no indication that these properties are affected by the grid misalignment. In magnetic field measurements carried out at in the RAL and Brunel University test rigs, the VPTs with misaligned grids behave in the same way as the well-aligned devices.

However, since a misalignment of the grid will inevitably reduce the minimum clearance between components inside the tube, there may be an increased chance of electrical breakdown in the future. For this reason, we have concerns about the long-term behaviour of these VPTs, and would encourage RIE to take steps to improve the grid alignment. We will continue to monitor the affected VPTs, to obtain a better understanding of their long-term behaviour.

References

[1] 'Behaviour of production VPTs for the CMS Endcap Electromagnetic Calorimeter: VPTs 501-8600', 14 October 2004.