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A Cockcroft-Walton High-Voltage Power Supply for the EUSO Instruments

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The future JEM-EUSO instrument is a UV telescope to be installed on the International Space Station (ISS) with the goal of observing Extensive Air Showers (EAS) created by Ultra-High Energy Cosmic Rays (UHECRs). EUSO-balloon is a pathfinder mission for JEM-EUSO which flew in a stratospheric balloon from Timmins, Canada in August 2014. Due to its placement on the ISS, two major specifications of the JEM-EUSO instrument are that: i) the power allocated for the entire instrument should be no more than 1000 W; requiring that the power allocated to polarize the Photomultiplier Tubes (PMTs) should be less than ~50 W (using normal resistive voltage dividers requires nearly 2 kW), and ii) the light intensity reaching JEM-EUSO has a dynamic range larger than $1E6$, going from the background illumination (about one photoelectron per pixel per $2.5 \mu\text{s}$) up to Transient Luminous Events (TLE). Our solution for i) is to use a Cockcroft Walton circuit to effectively create a separate power supply for each dynode, regrouping identical dynodes at the same power supply. These groups will be at the level of the Elementary Cell (EC) (4 PMTs). The required dynamic range, ii), will be provided by a switching circuit, giving an overall dynamic range of $1E6$ in steps of 100 and in a time of several microseconds. Here we present the Cockcroft-Walton high voltage power supply design used in EUSO-Balloon. This design resulted in a power consumption of 630 mW to polarize the entire EUSO-Balloon focal surface (36 PMT), and the switching circuit was capable of reducing the focal surface collection efficiency within $2.5 \mu\text{s}$.

Collaboration

JEM-EUSO

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