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Pre-production and quality assurance of the Mu2e Silicon Photomultipliers

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The Mu2e calorimeter is composed by two disks of 1348 un-doped parallelepiped CsI crystals of $34 \times 34 \times 200 \text{ mm}^3$ dimension, each one readout by two large area SiPM arrays. We translated the calorimeter requirements in a series of technical specifications for the SiPMs that are summarized by the following list:

- high gain, above 10^6 , for each monolithic $(6 \times 6) \text{ mm}^2$ SiPM cell;
- good photon detection efficiency, PDE, of above 20% at 310 nm to well match the light emitted by the un-doped CsI crystals;
- large active area that, in combination with the PDE, could provide a light yield of above 20 p.e./MeV;
- fast rise time and a narrow signal width to improve time resolution and pileup rejection;
- Mean to Time Failure (MTTF) of $O(10^6)$ hours;
- good resilience to neutrons for a total fluency up to $10^{12} \text{ n(1 MeV-eq)/cm}^2$.

A modular and custom SiPM layout has been chosen to satisfy these requirements. A pre-production of 150 Mu2e SiPMs has been procured by three international firms (Hamamatsu, Sensl and Advansid). A detailed quality assurance, QA, has been carried out on each SiPM. A summary of the techniques used and of the QA characterization of the sensors will be shown.

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