
Camera Calibration for the IceCube Upgrade and Gen2

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on behalf of the IceCube Collaboration[†]

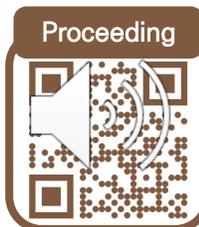
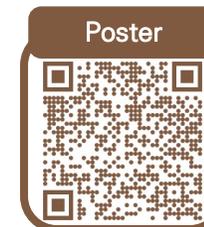
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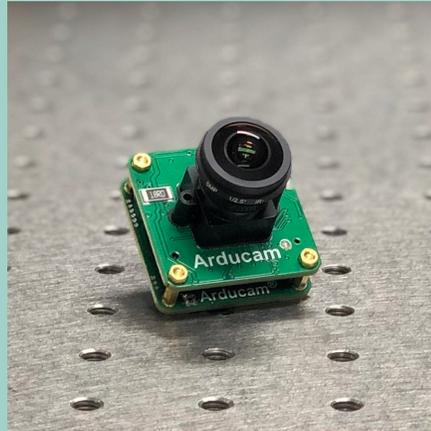
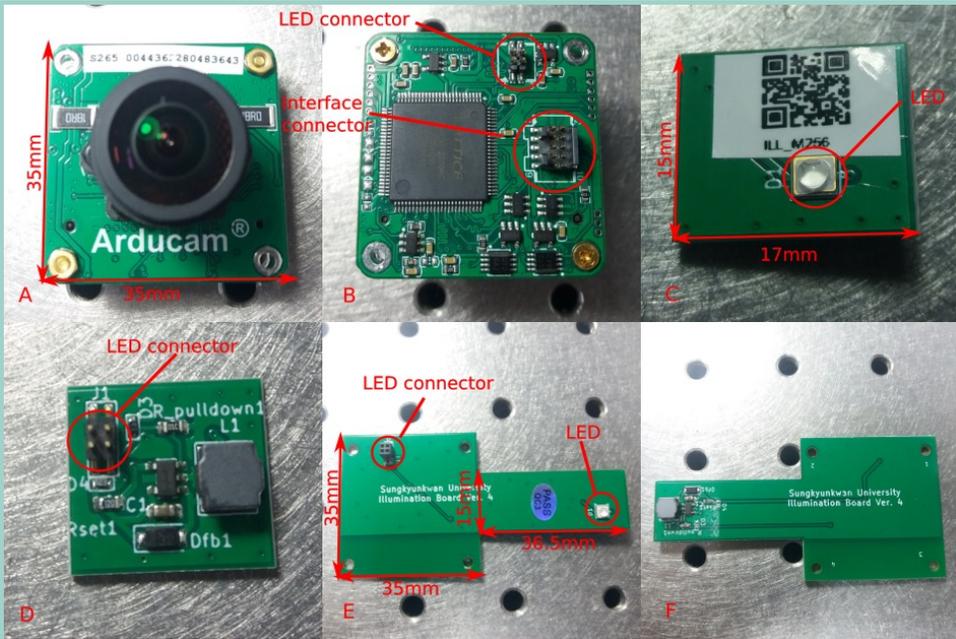
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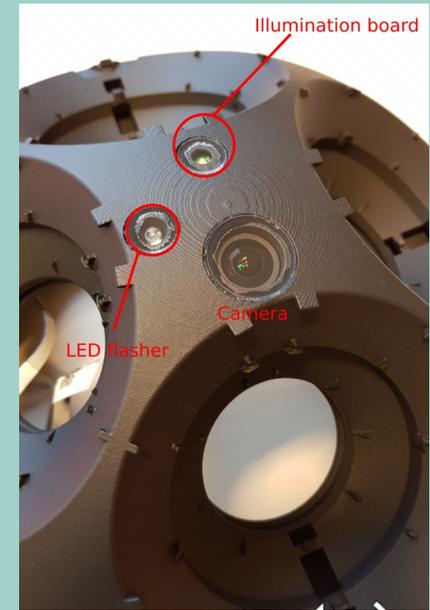
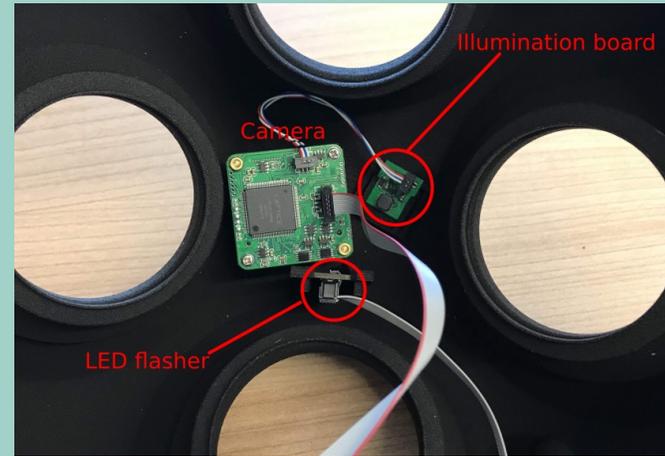
IceCube Upgrade Camera System



- The camera system developed for the IceCube Upgrade currently in the mass production stage.
- More than 2000 camera modules and the illumination modules to be produced for all new optical sensors.
- 3 Cameras to be installed in every upgrade DOM.
- Every camera installed with an illumination system.

Fig. 1: Images of the IceCube Upgrade Camera System.

- Upper two: detailed view of major components.
- Lower four: camera system integrated into the new optical sensor modules.



IceCube Upgrade Camera System

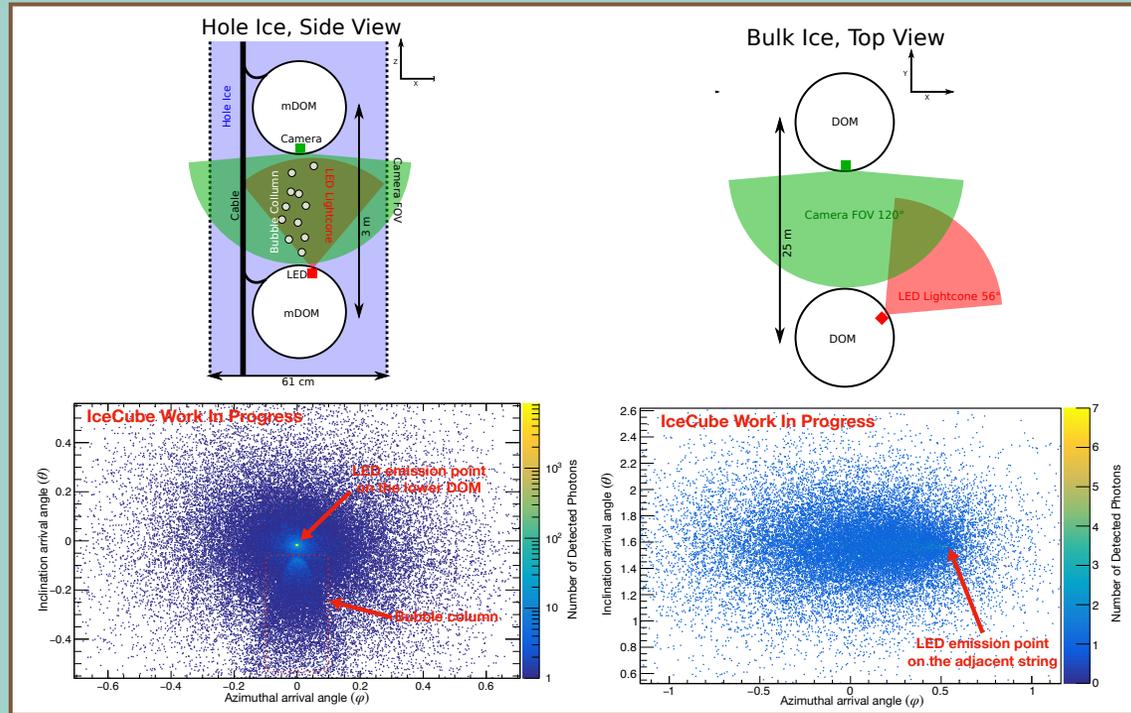


Fig. 2: schematic diagrams and simulated images for the major objectives

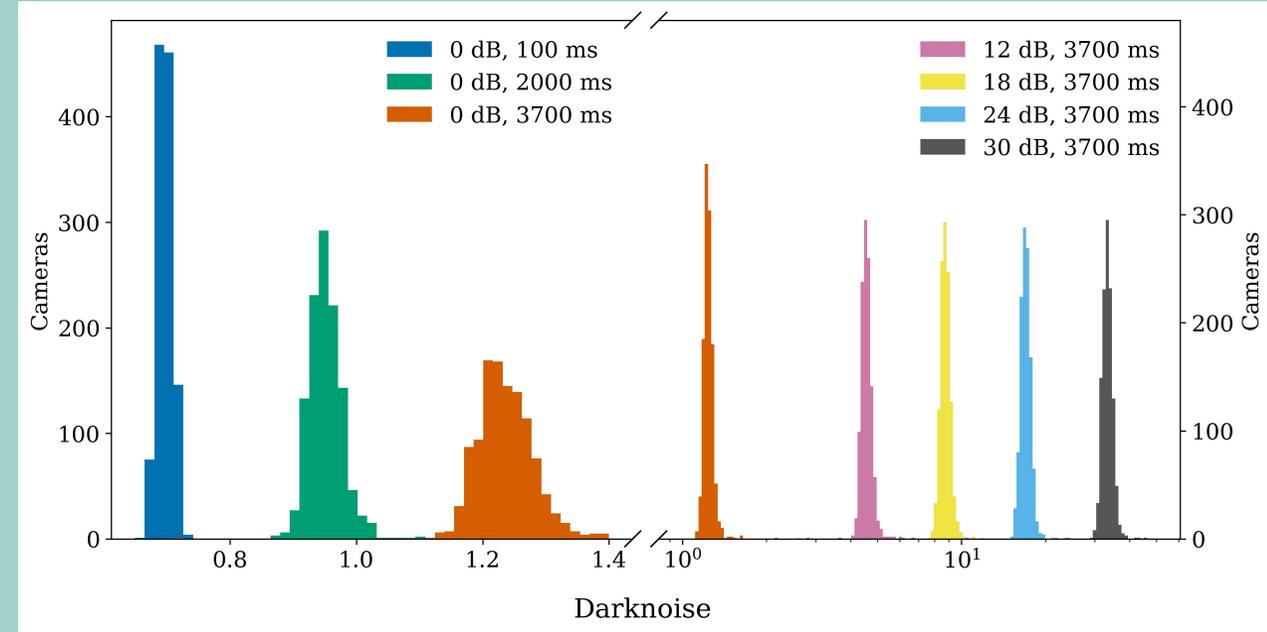


Fig. 3: Mean Pixel Darknoise distribution over 1,178 cameras for multiple settings in the in-lab system calibration tests under low temperature (-40°C)

- Optical properties of ice in the vicinity of optical modules measured by capturing the light signature and analysing its distribution in the image data.
- The local environment and the relative orientation & position of each optical modules surveyed from the examination of multiple images additionally.
- IceCube Upgrade Camera System is a key component for a comprehensive understanding of the IceCube detector medium; the Antarctic ice.
- Calibration measurements with the camera system will enhance the science capabilities of IceCube by a substantially improved ice model.
- A significant fraction of cameras have been tested and integrated into the new optical sensor modules for the IceCube Upgrade, and their evaluated test data demonstrate the quality of the system and its capabilities
- For IceCube-Gen2, a similar camera system will be employed to perform the hole ice surveys, which also has a potential for the bulk ice studies.



IceCube Upgrade Camera System

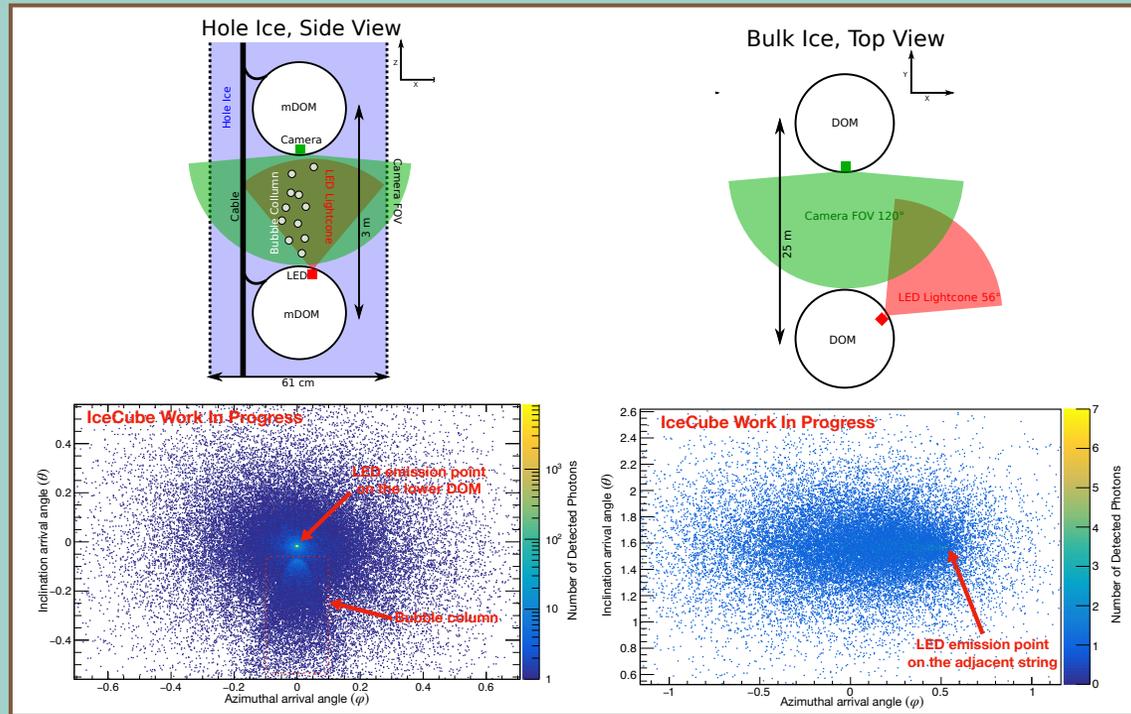


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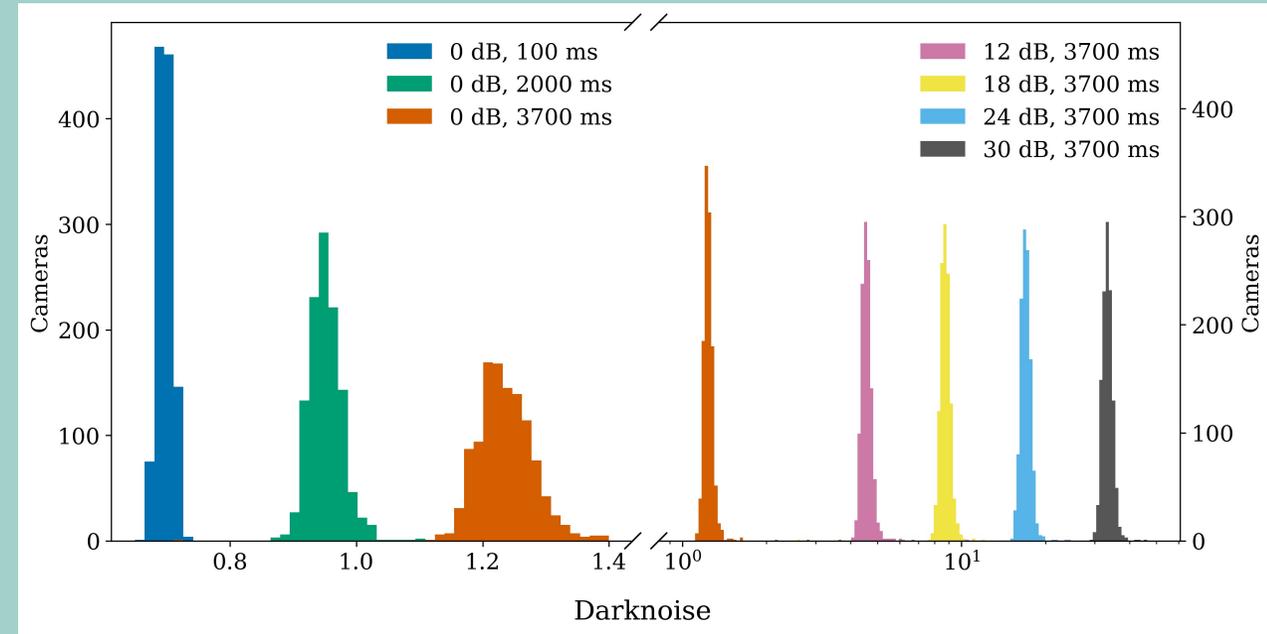


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