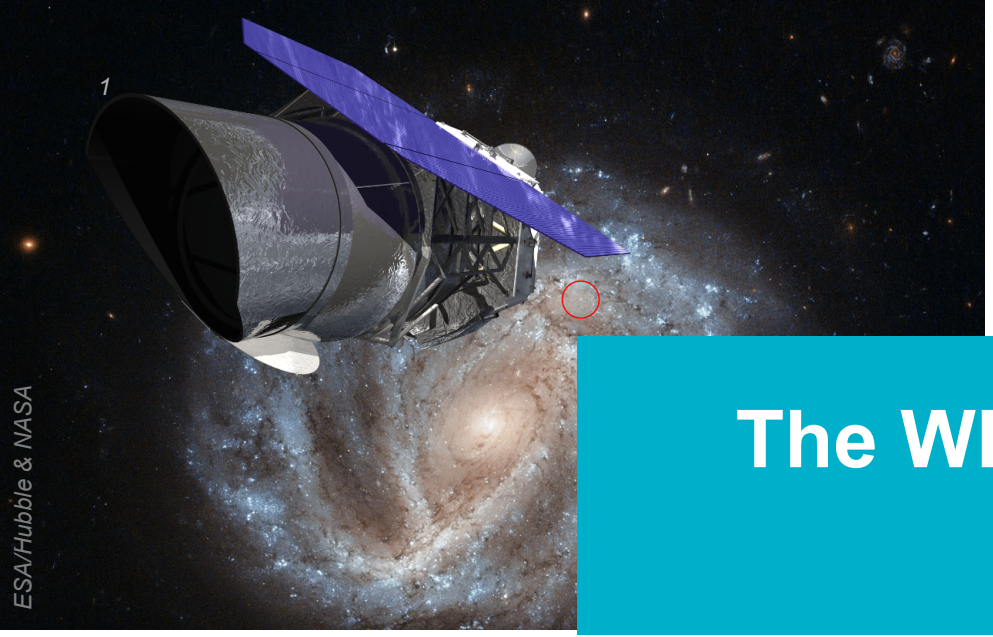


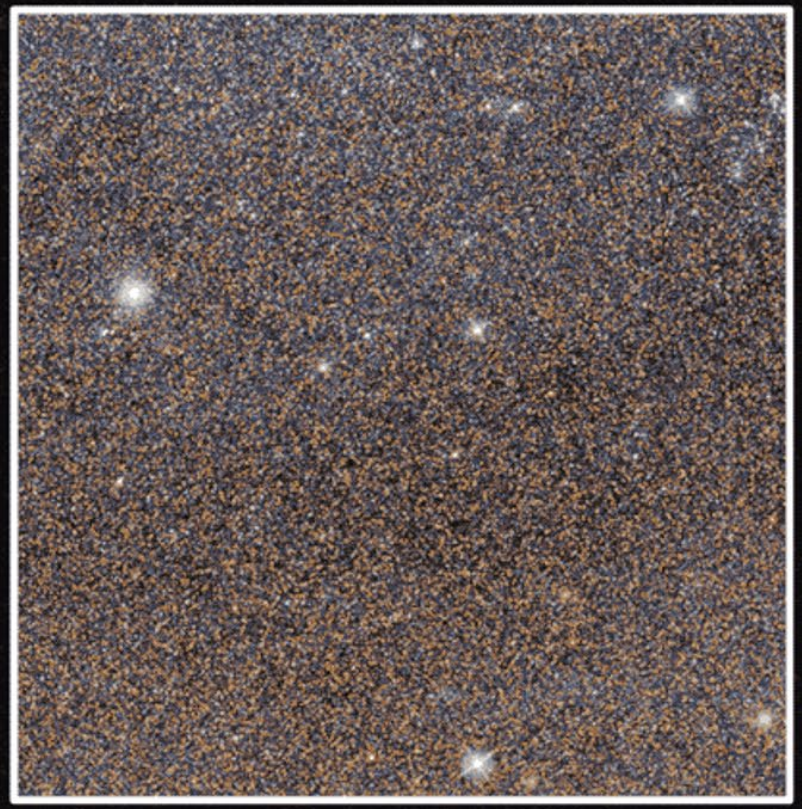
The WFI Relative Calibration System for WFIRST

Gregory D. Wirth and Sarah Lipscy
Ball Aerospace

Phil Scott and Alan Thurgood
Space Dynamics Laboratory
Utah State University

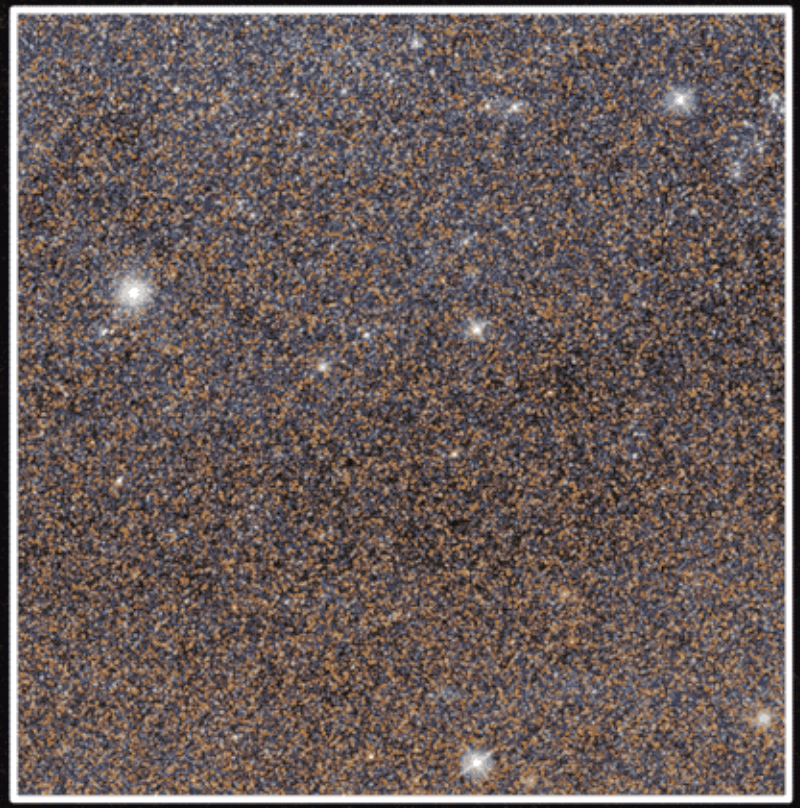
calcon
www.calcon.sdl.usu.edu

8/28/2019



Hubble

NASA

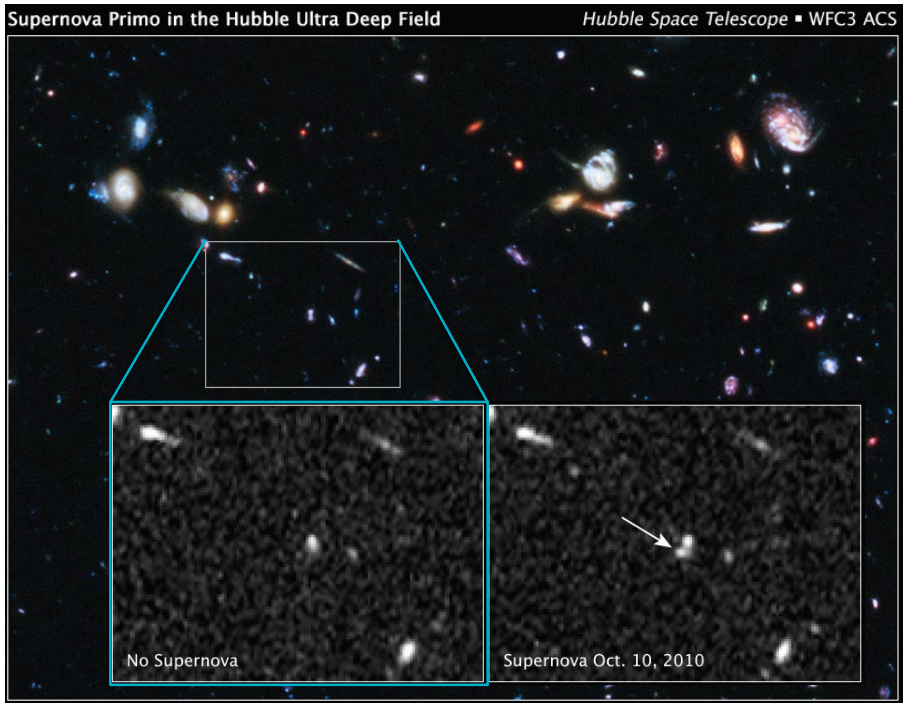


Hubble

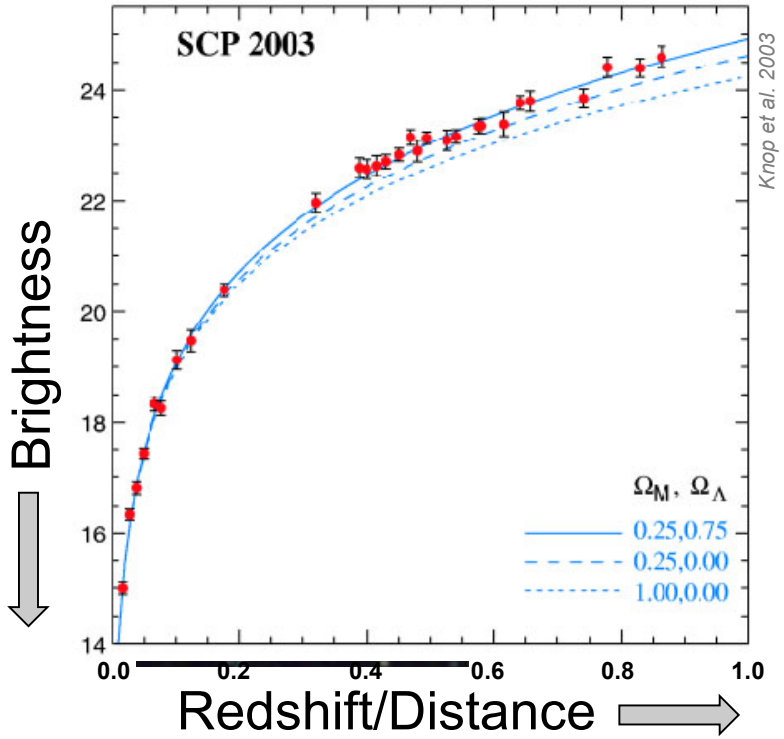
NASA

WFI's 18 detector mosaic images 100 times the sky area of HST and JWST

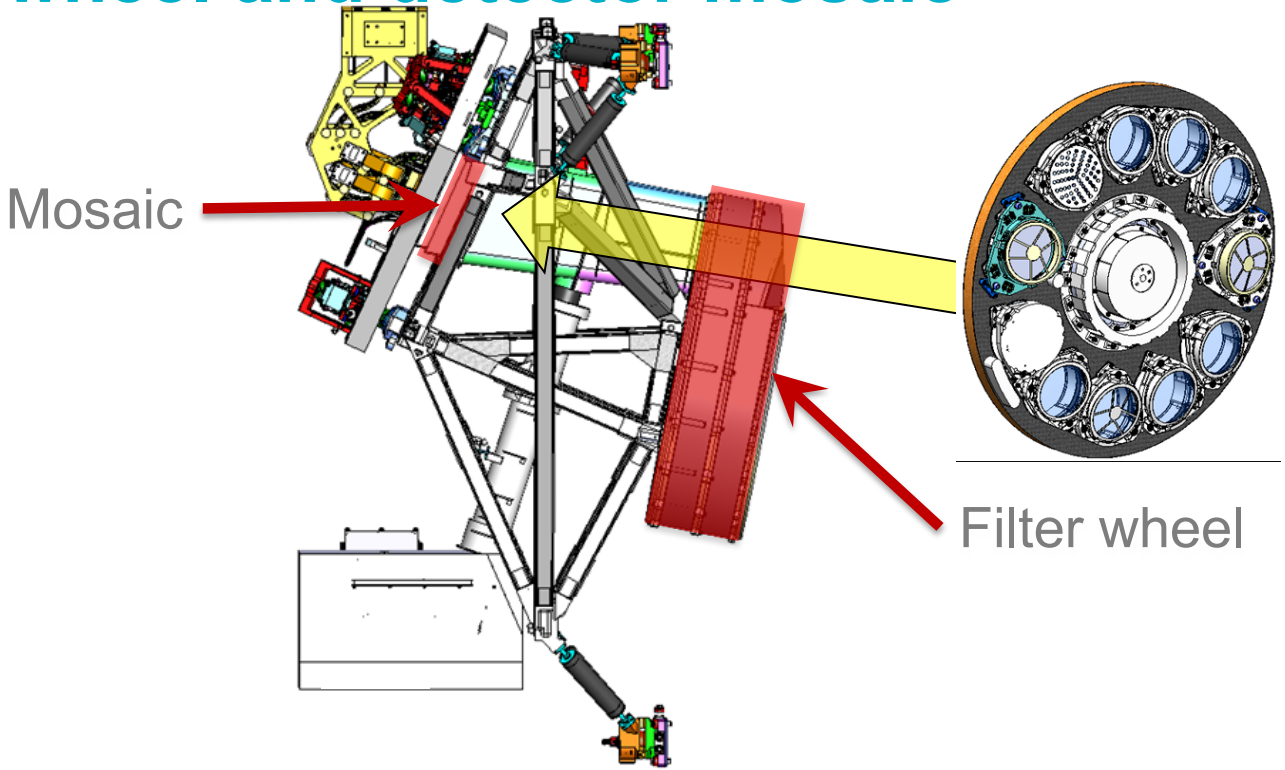
WFIRST science goals require highly accurate relative calibration



NASA, ESA, A. Riess (STScI and JNU) and S. Rodney (JHU)



WFI is a simple instrument with a filter wheel and detector mosaic



WFI needs a calibration system meeting stringent requirements

Broad range of illumination levels

Temporally stable illumination

Angle of incidence matches science light

Sufficiently bright light

Spatially smooth and uniform illumination

Simultaneous calibration and science light

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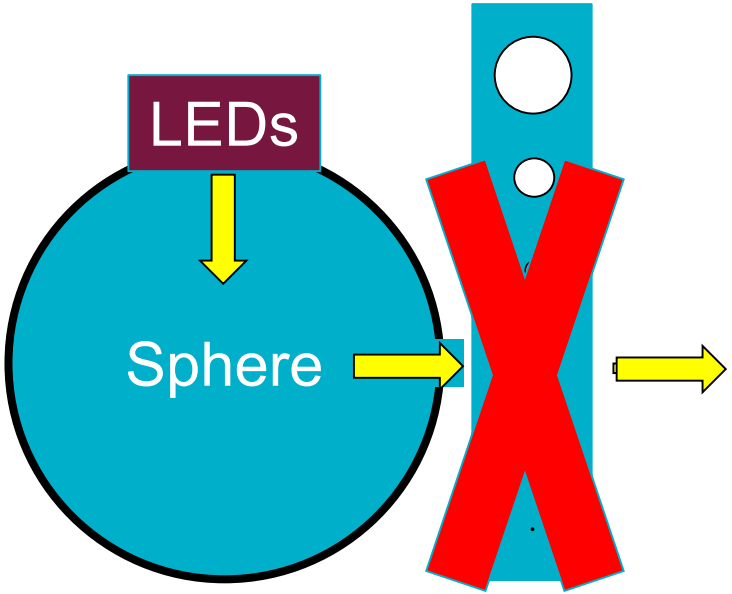
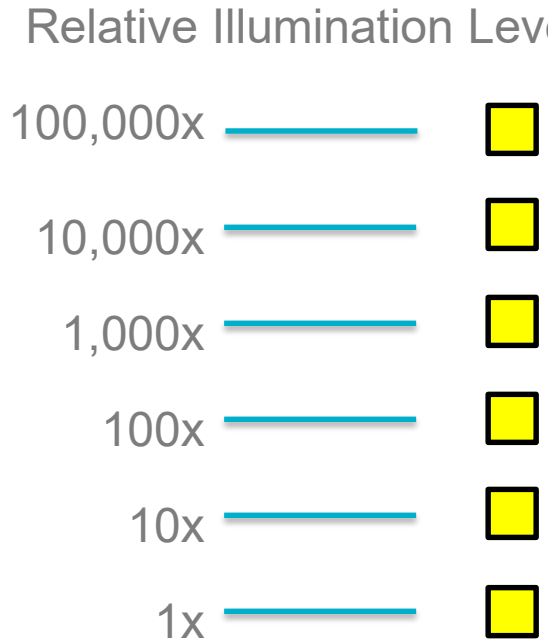
The RCS must provide illumination intensity over five orders of magnitude over the mission life





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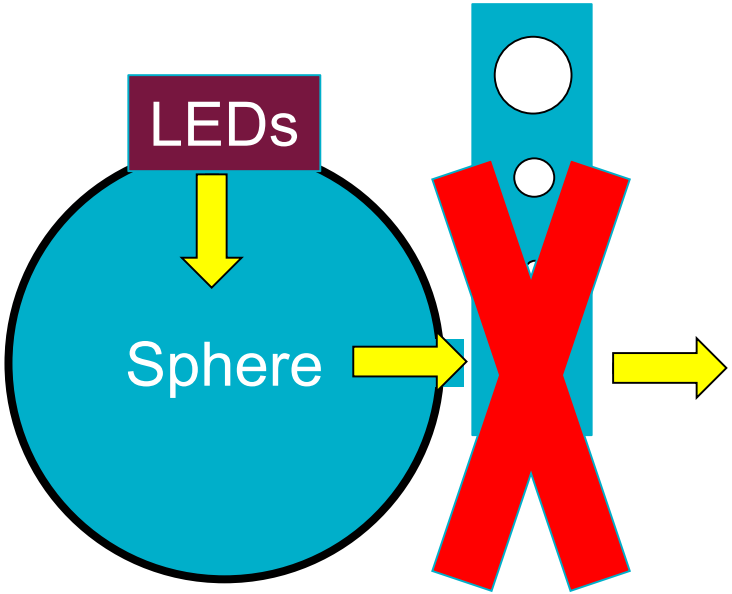

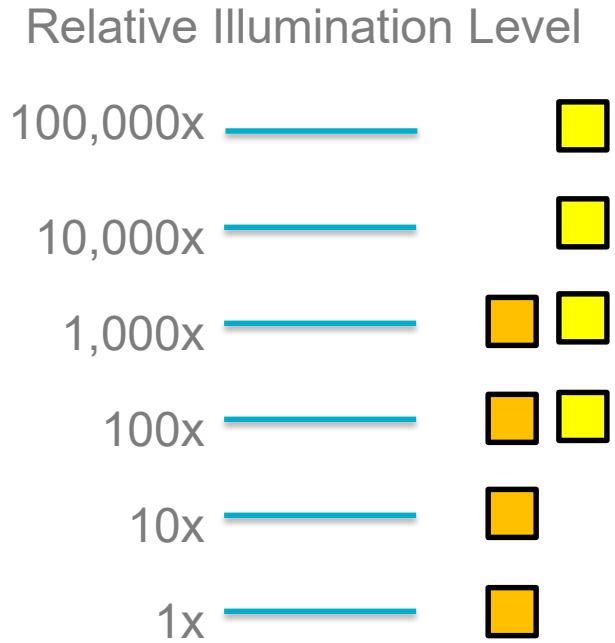

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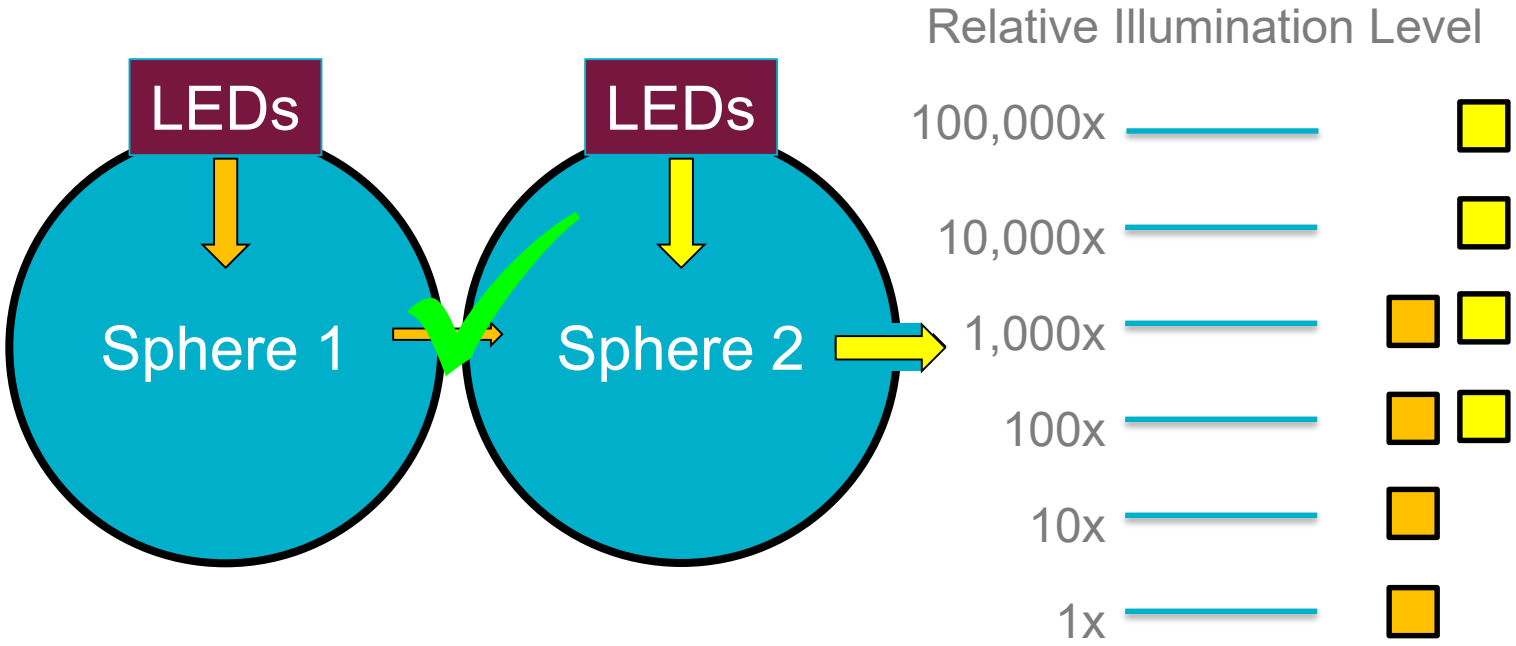

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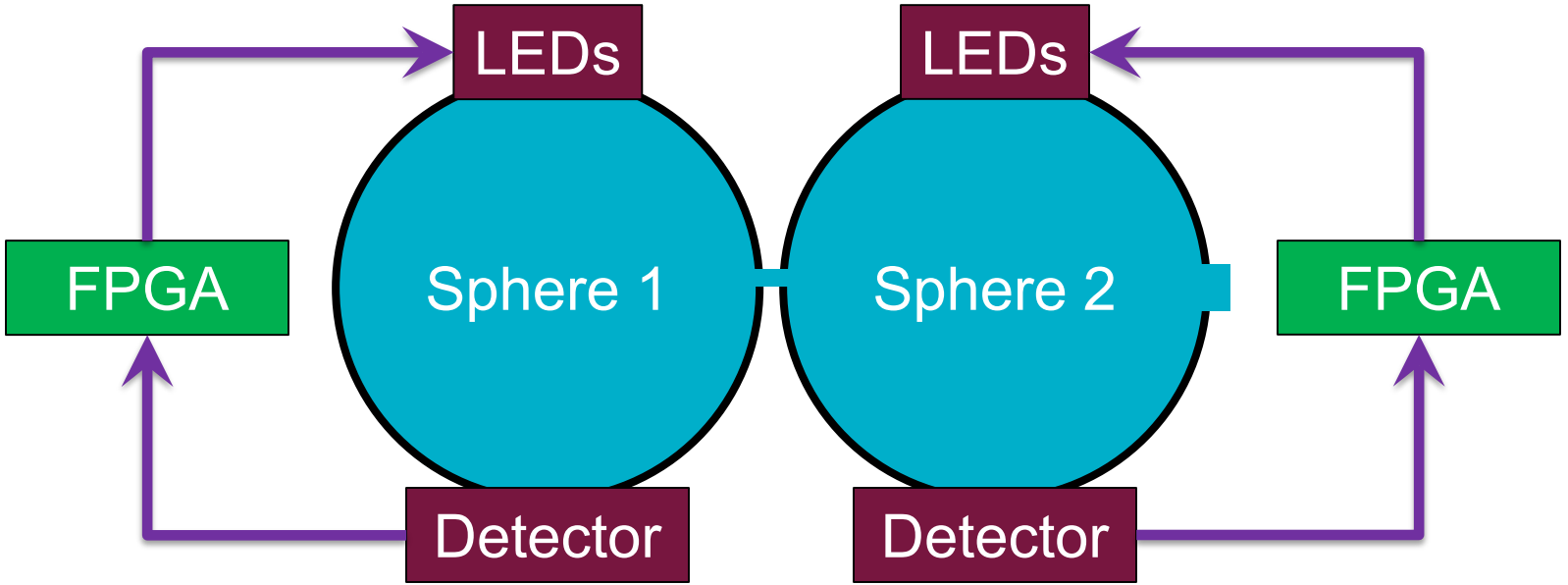
A closed-loop feedback system keeps illumination constant



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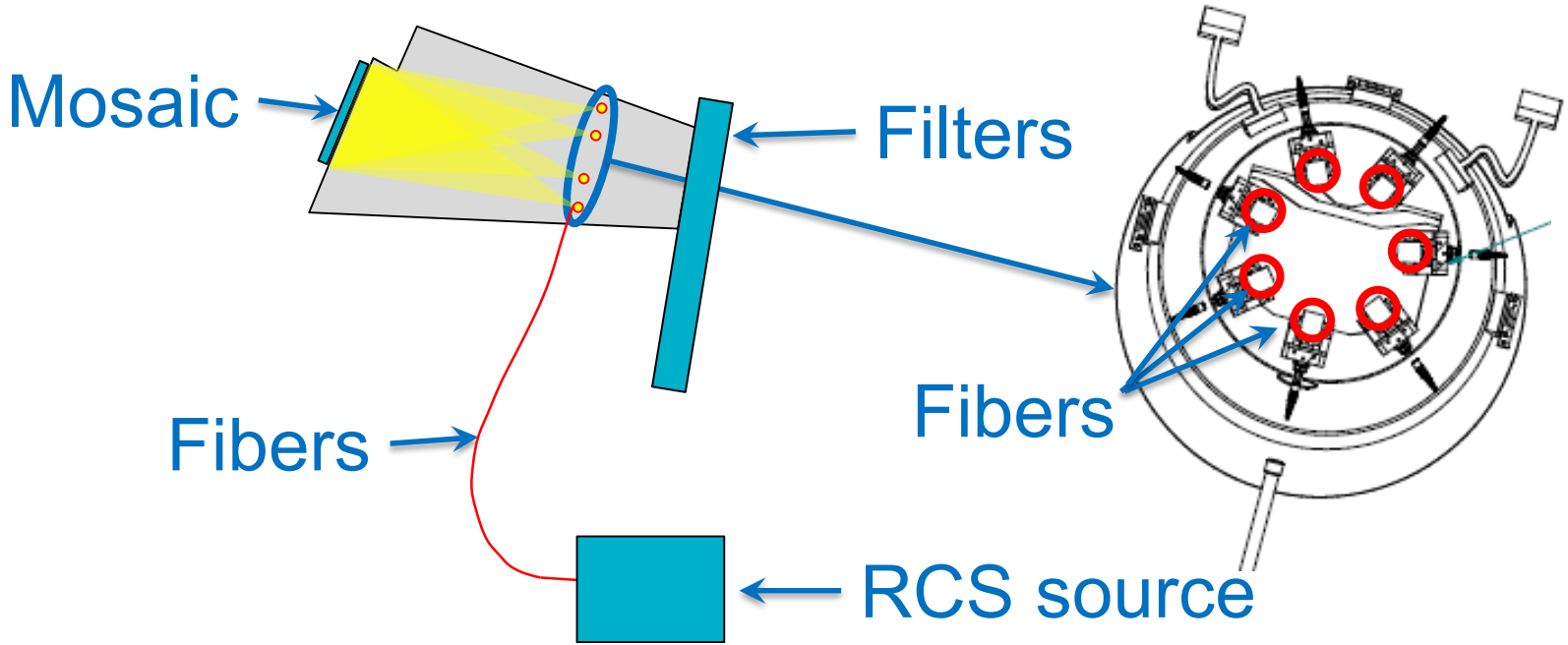
Direct fiber illumination provides light but does not match sky angle of incidence



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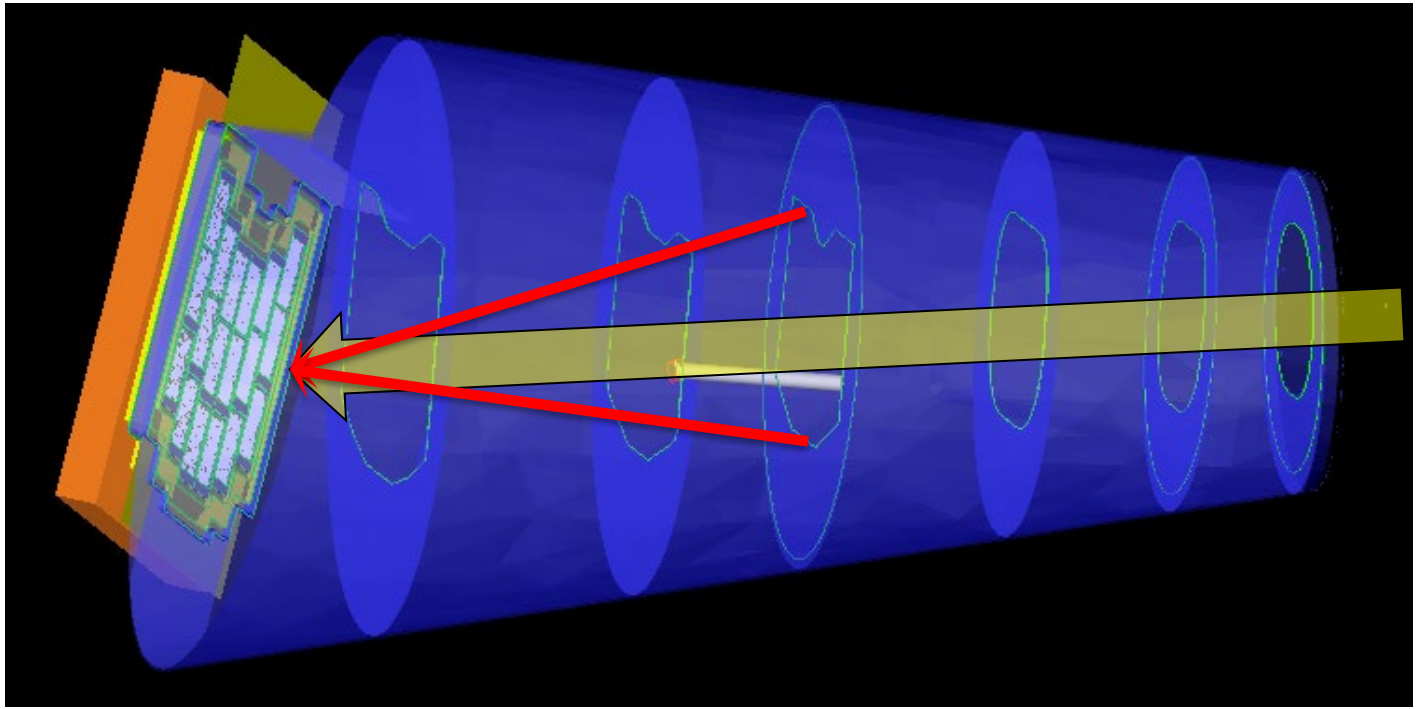
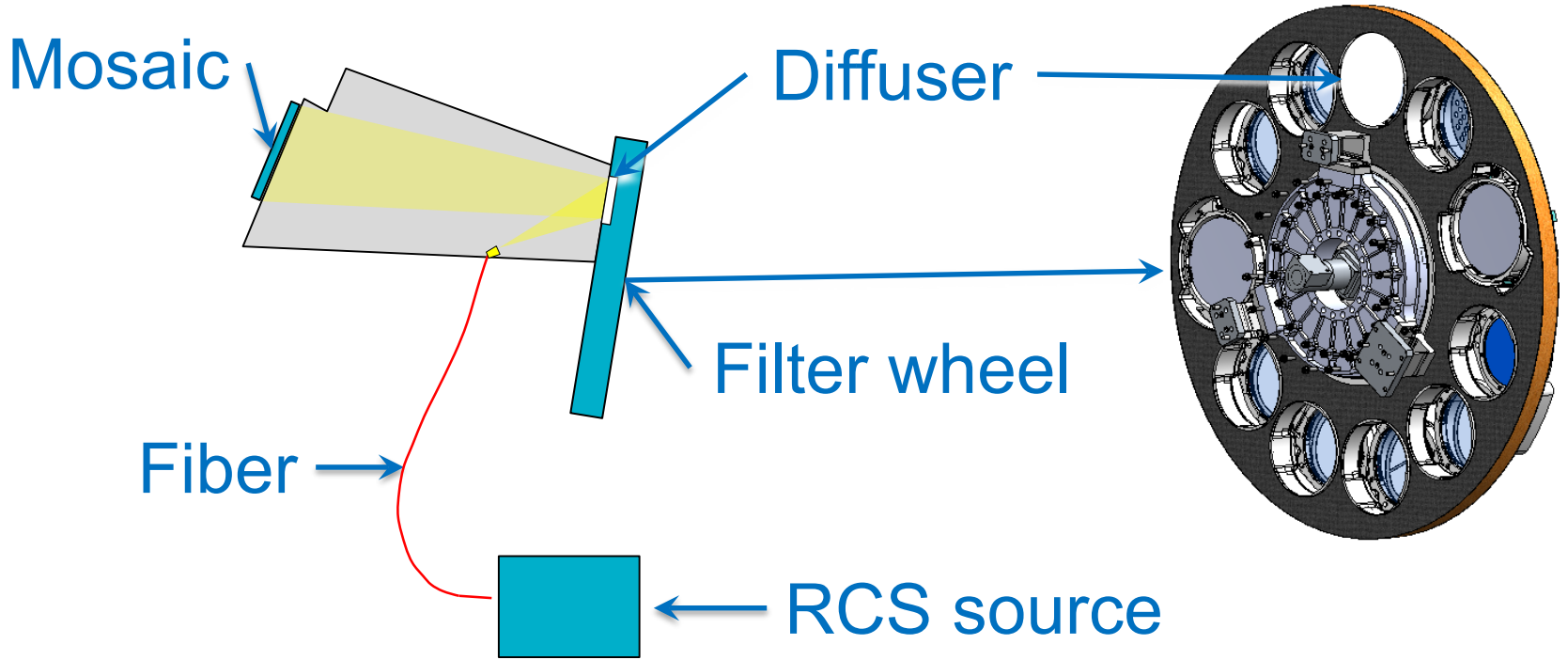
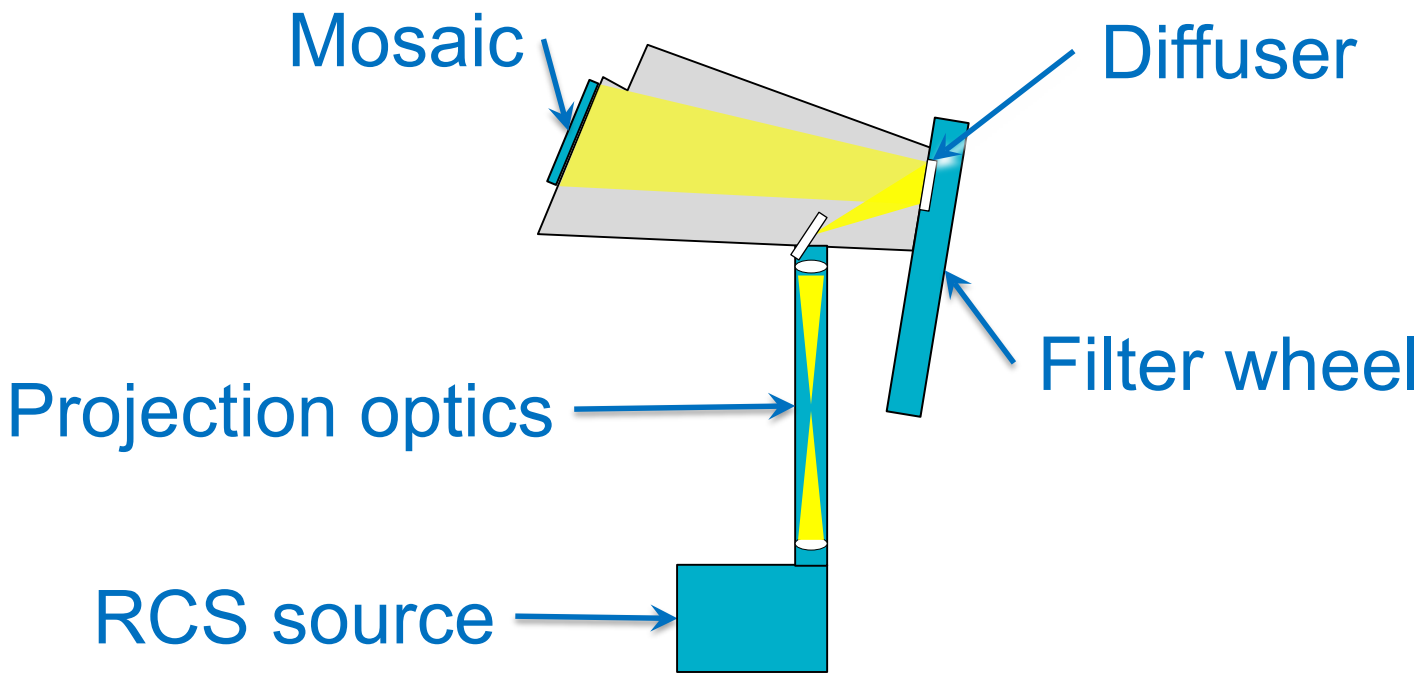


Indirect fiber illumination matches angle of incidence but provides too little light



Free-space projection optics yield greater illumination and match angle of incidence



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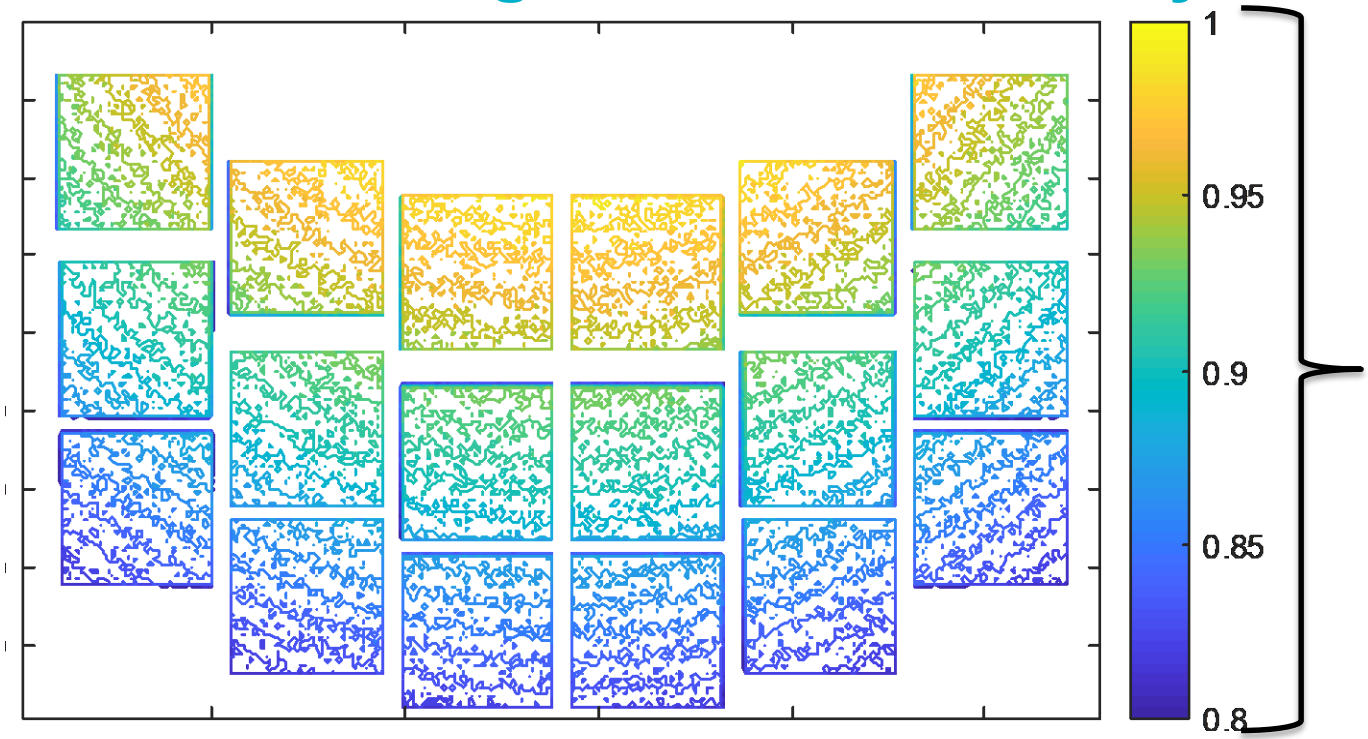
Element wheel diffuser provides smooth and uniform light on detector array



~20% peak-to-valley variation

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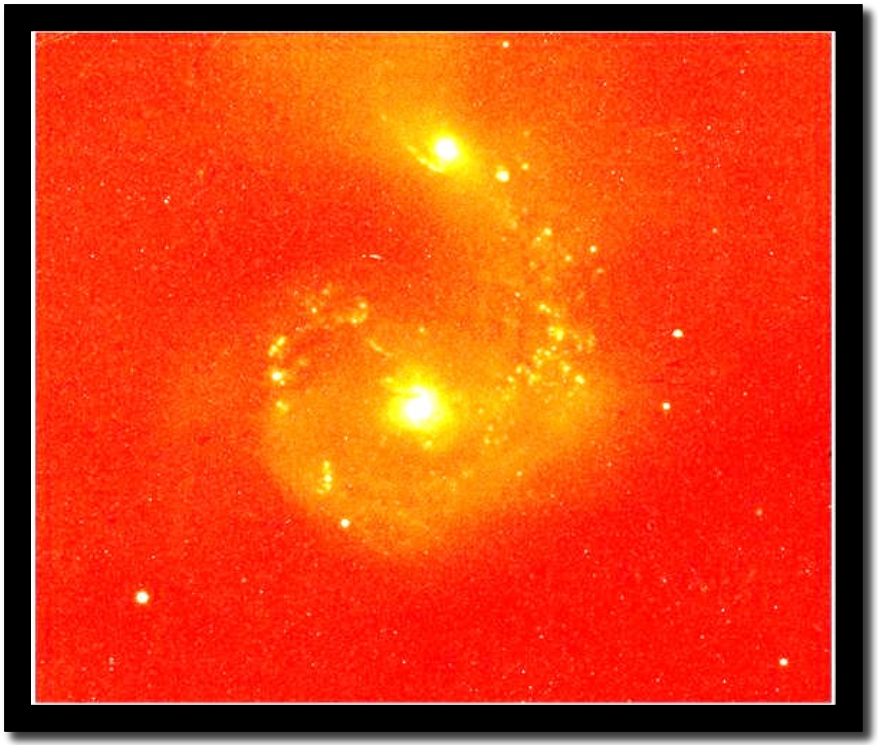
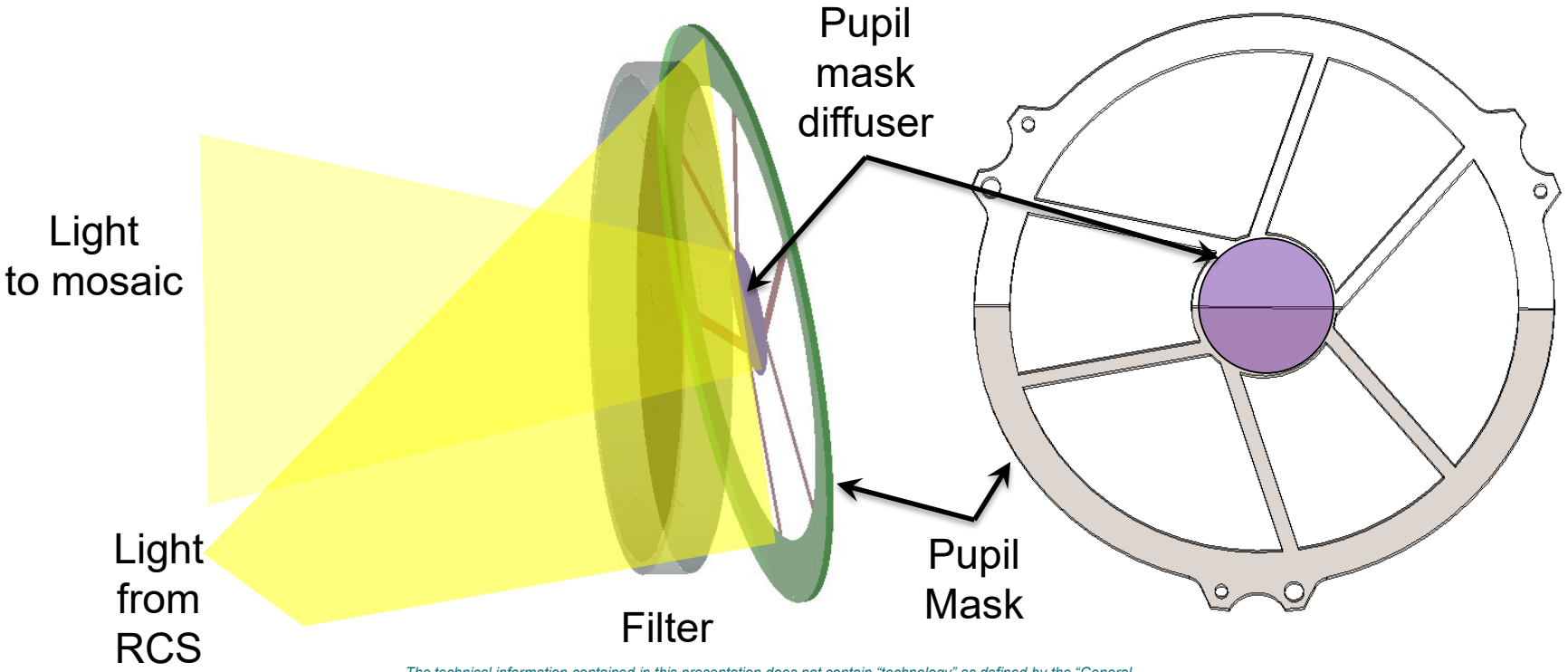
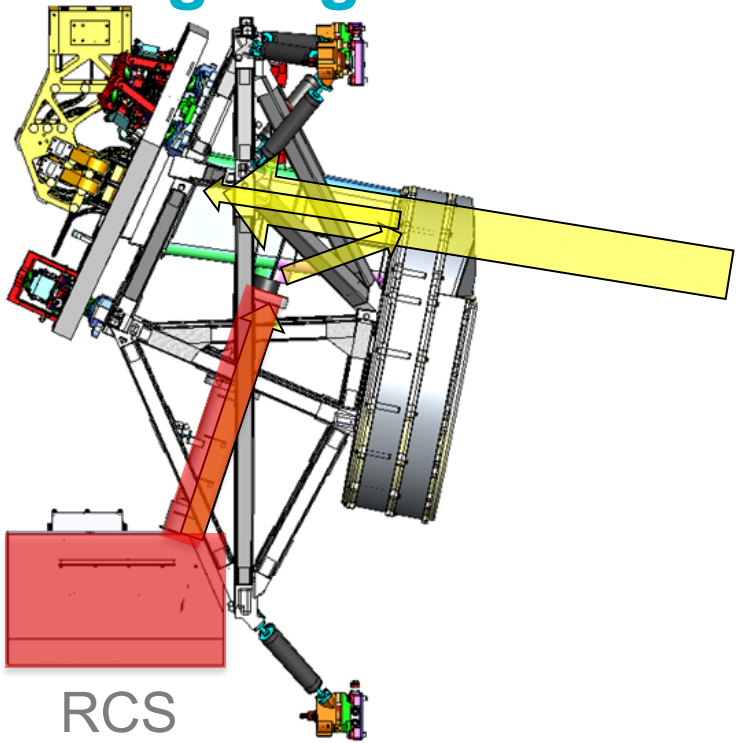
The RCS must provide “background” light in sky images to calibrate count-rate non-linearity



Pupil mask diffuser allows simultaneous illumination with calibration and science light



Ball, SDL, and GSFC have designed a cutting-edge calibration system for WFIRST



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