

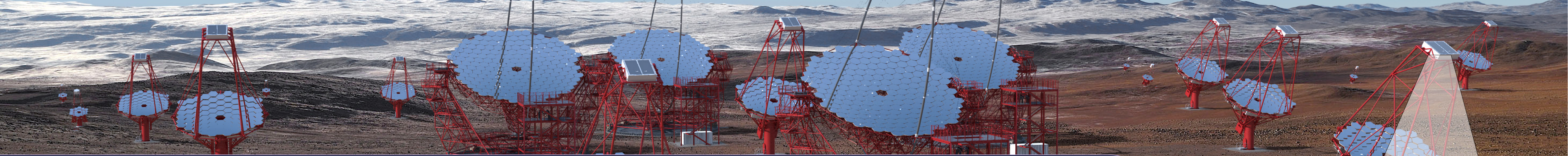
# Trigger Performance Verification of the FlashCam Prototype



cherenkov telescope array

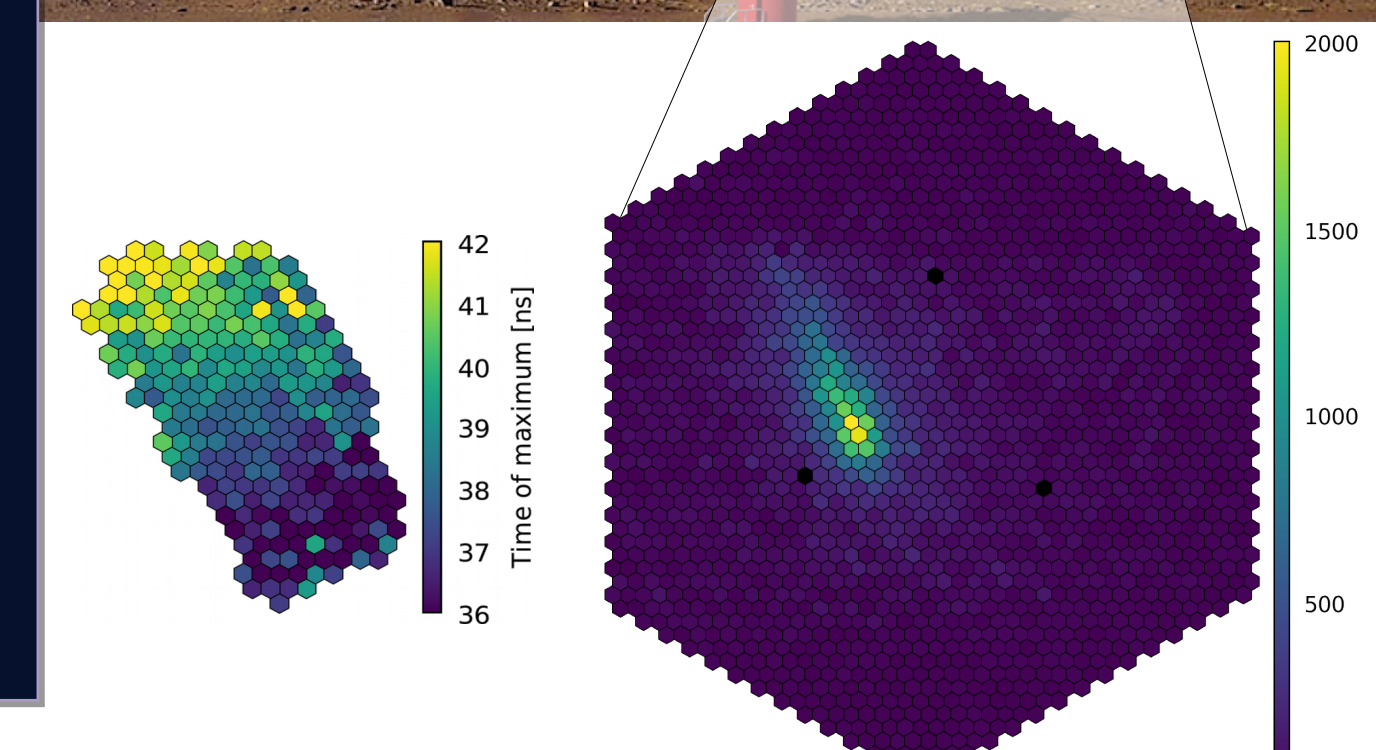
S.Sailer<sup>1</sup> for the CTA FlashCam Project

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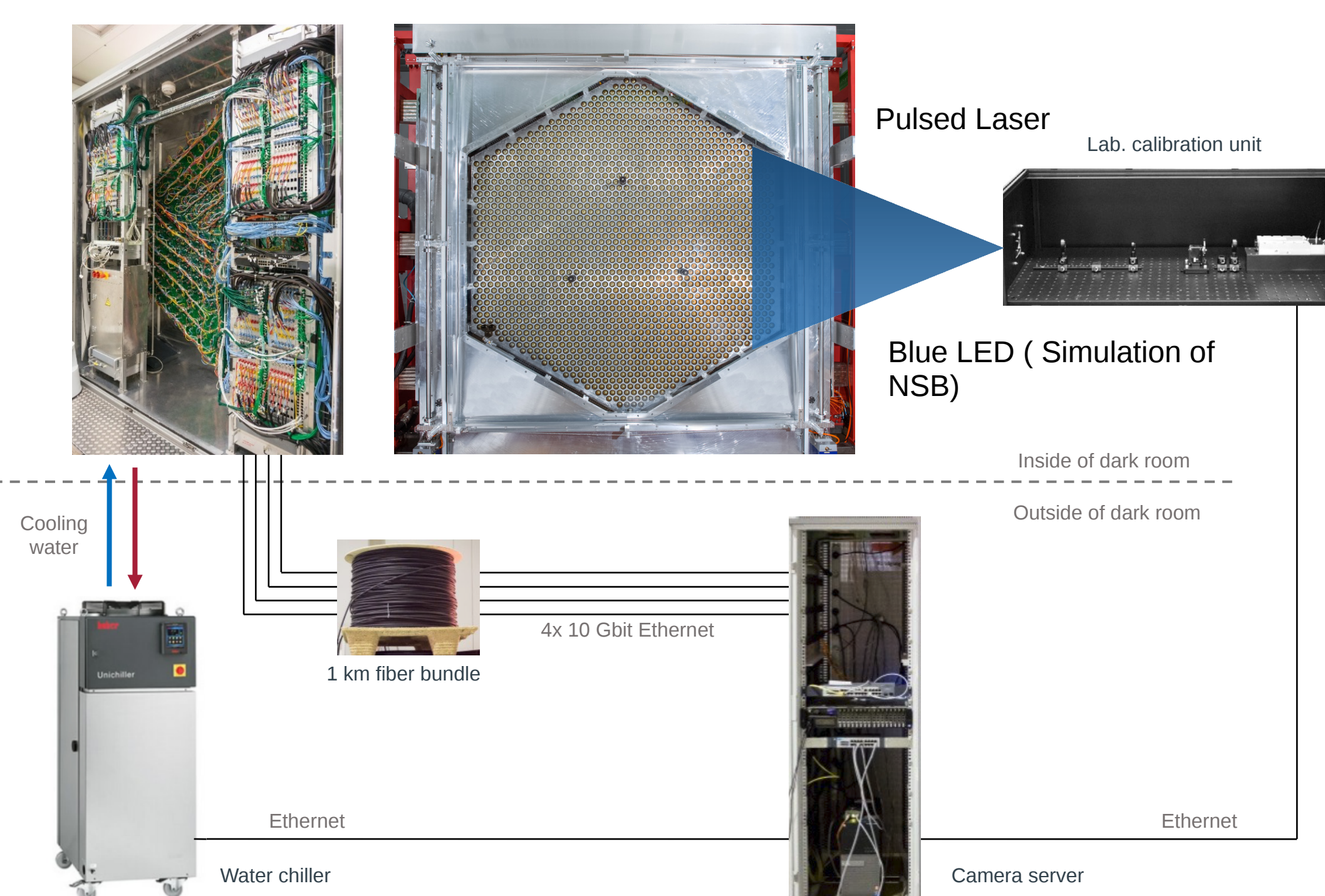


## ABSTRACT

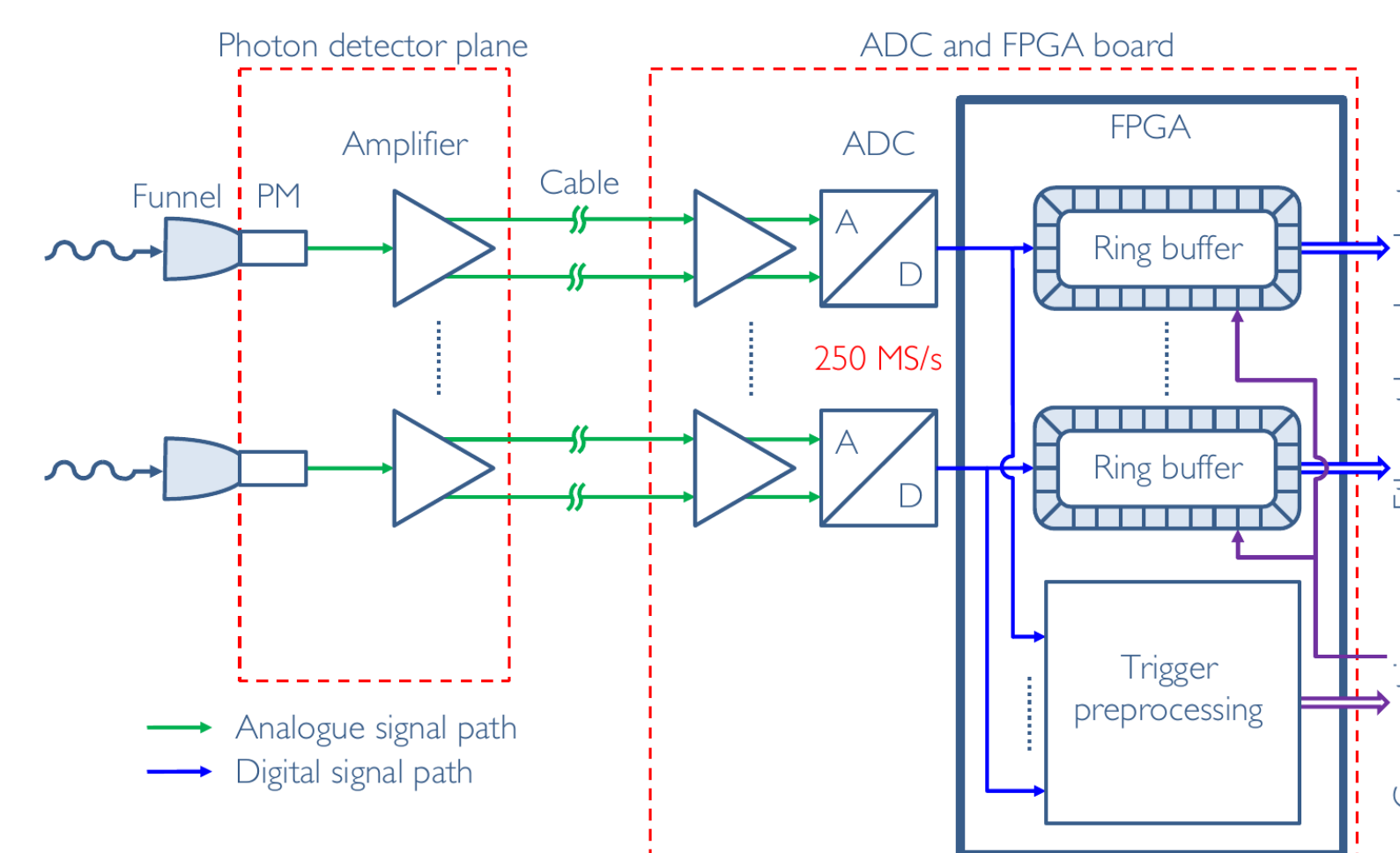
FlashCam is a camera proposed for the medium-sized telescopes of the Cherenkov Telescope Array which implements a **fully-digital trigger processing** and readout based on FADCs and FPGAs. The signals of the 1758 photomultiplier tubes are sampled continuously at a rate of 250 MS/s and upon a trigger decision the stored waveforms are read out via Ethernet. The fact that the trigger system is implemented digitally offers **unique opportunities for verification**, reconfiguration and detailed studies of systematic uncertainties. For verification, the trigger firmware logic has been reimplemented in software allowing a **bit-exact confirmation** of the digital processing chain and an **emulation of the trigger** over the full range of trigger parameters using measured or simulated data. The systematic influence of Poissonian fluctuations of the night sky background (NSB) illumination, PMT afterpulsing and pulse shaping on background trigger rates have been investigated using **Monte-Carlo simulations**. Comparative **measurements** have been taken with the fully equipped prototype in the laboratory by simulating the background light with an LED and overlaid short pulses mimicking the Cherenkov light signals.



## Full scale camera prototype in the laboratory

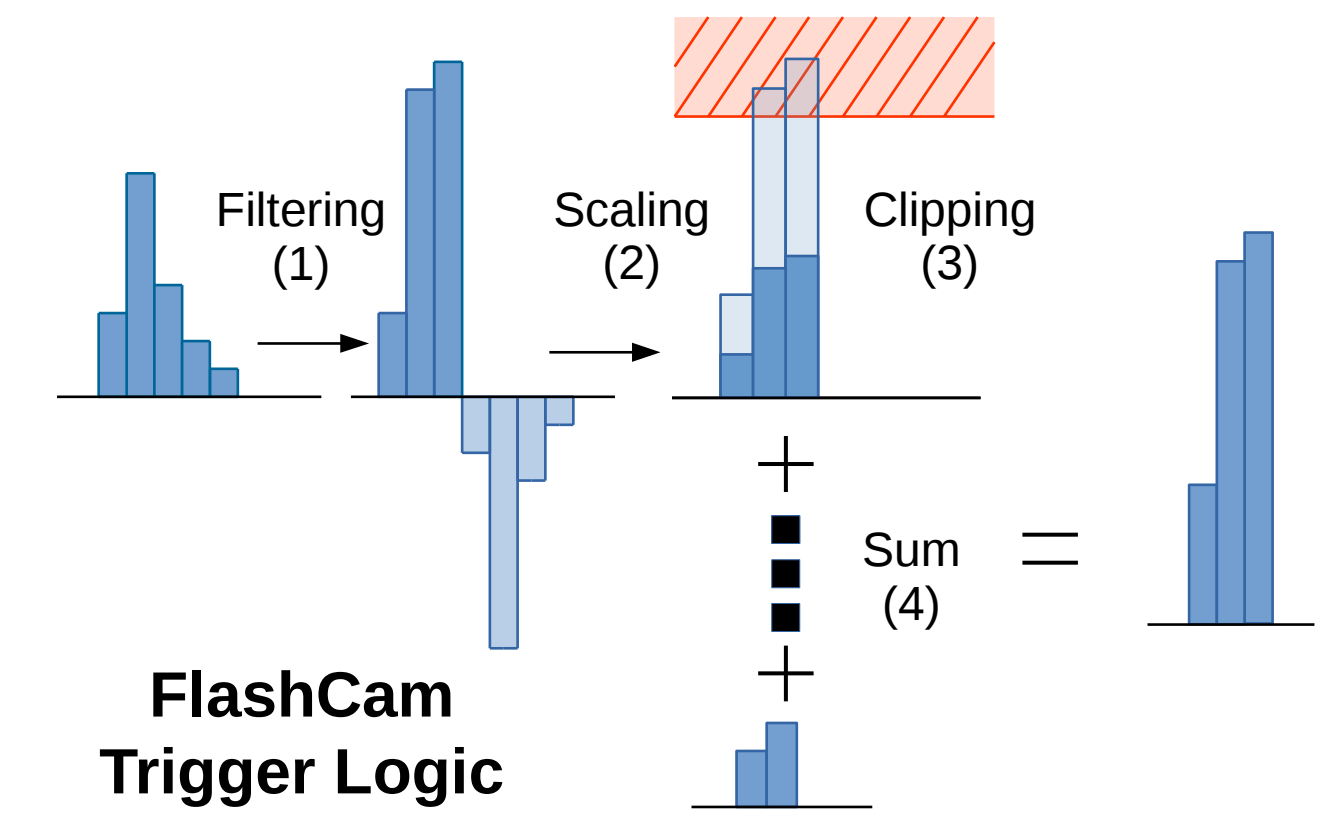


## FlashCam Architecture



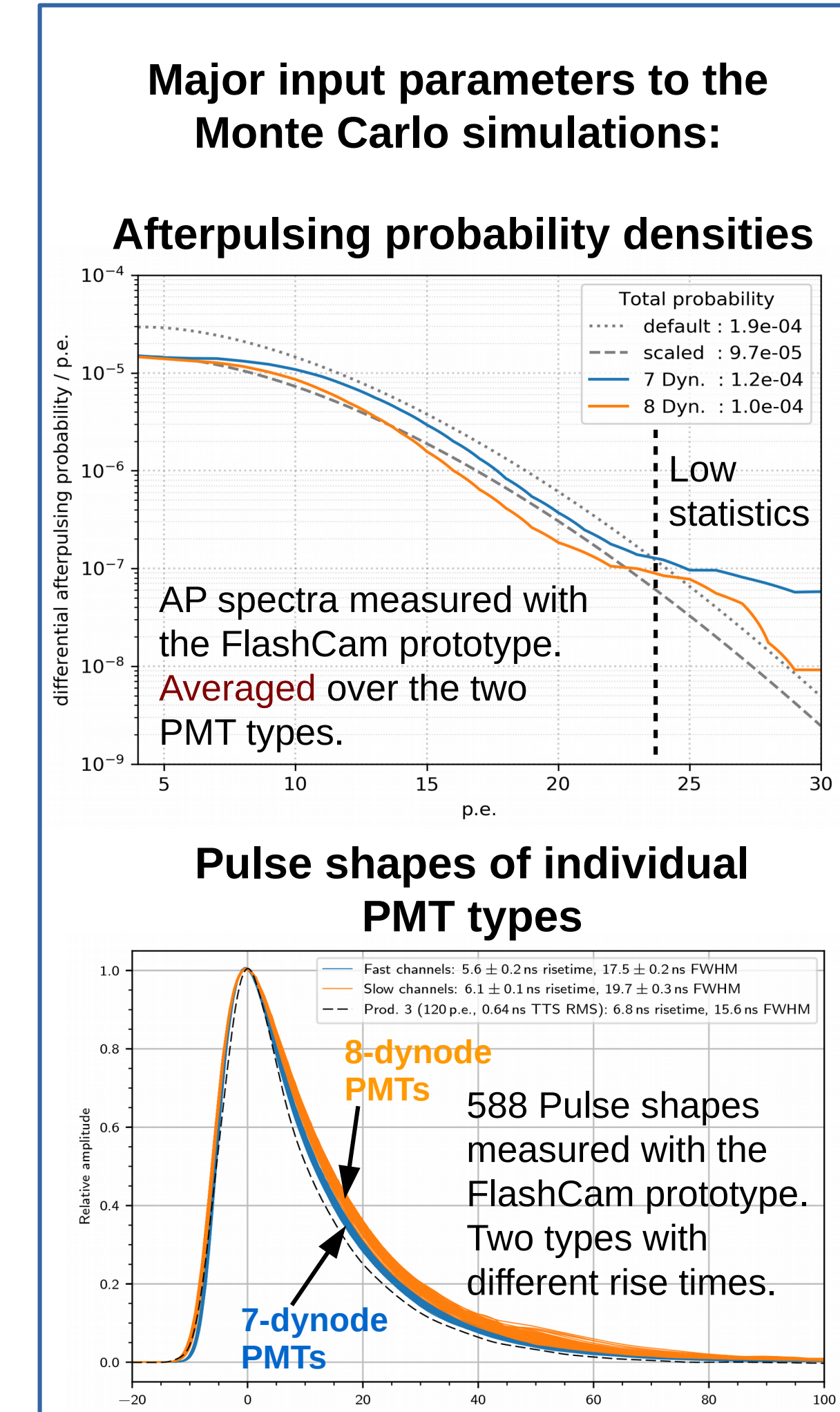
- Modular: separated photon detection modules and readout/trigger system
- Analogue signal transmission via CAT6 cables
- Continuous digitisation of pre-shaped PMT signals at 250MS/s with 12-bit ADCs
- Double-buffering of 4k samples per channel
- Deadtime-free Ethernet readout at >30kHz

## Fully-digital topological trigger forming

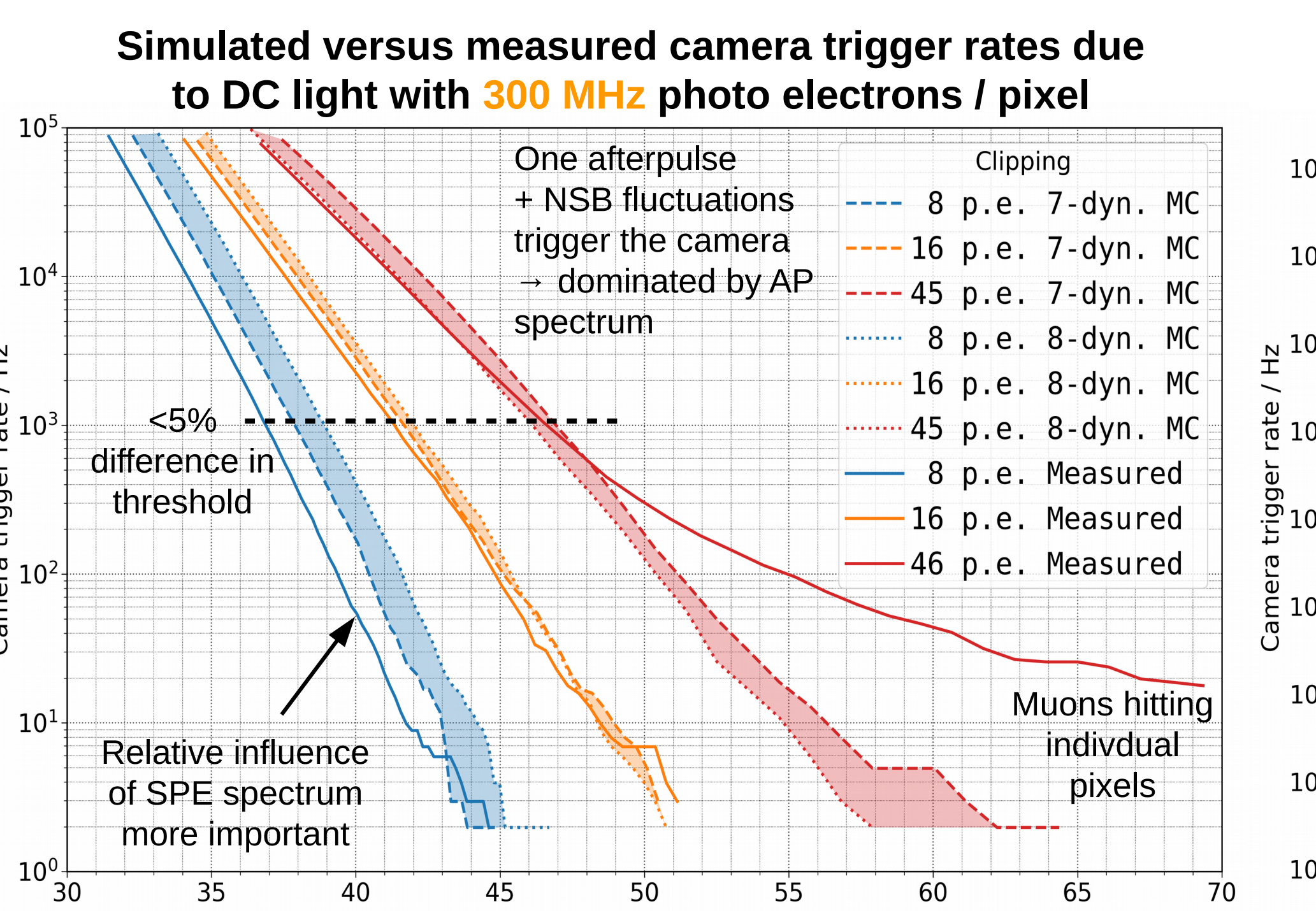


- channel-wise digital filtering (1), rescaling (2) and clipping (3) at 250 MS/s
- sum (4) of neighbouring pixel trigger signals
- homogeneous coverage of overlapping trigger sums over the photon detection plane

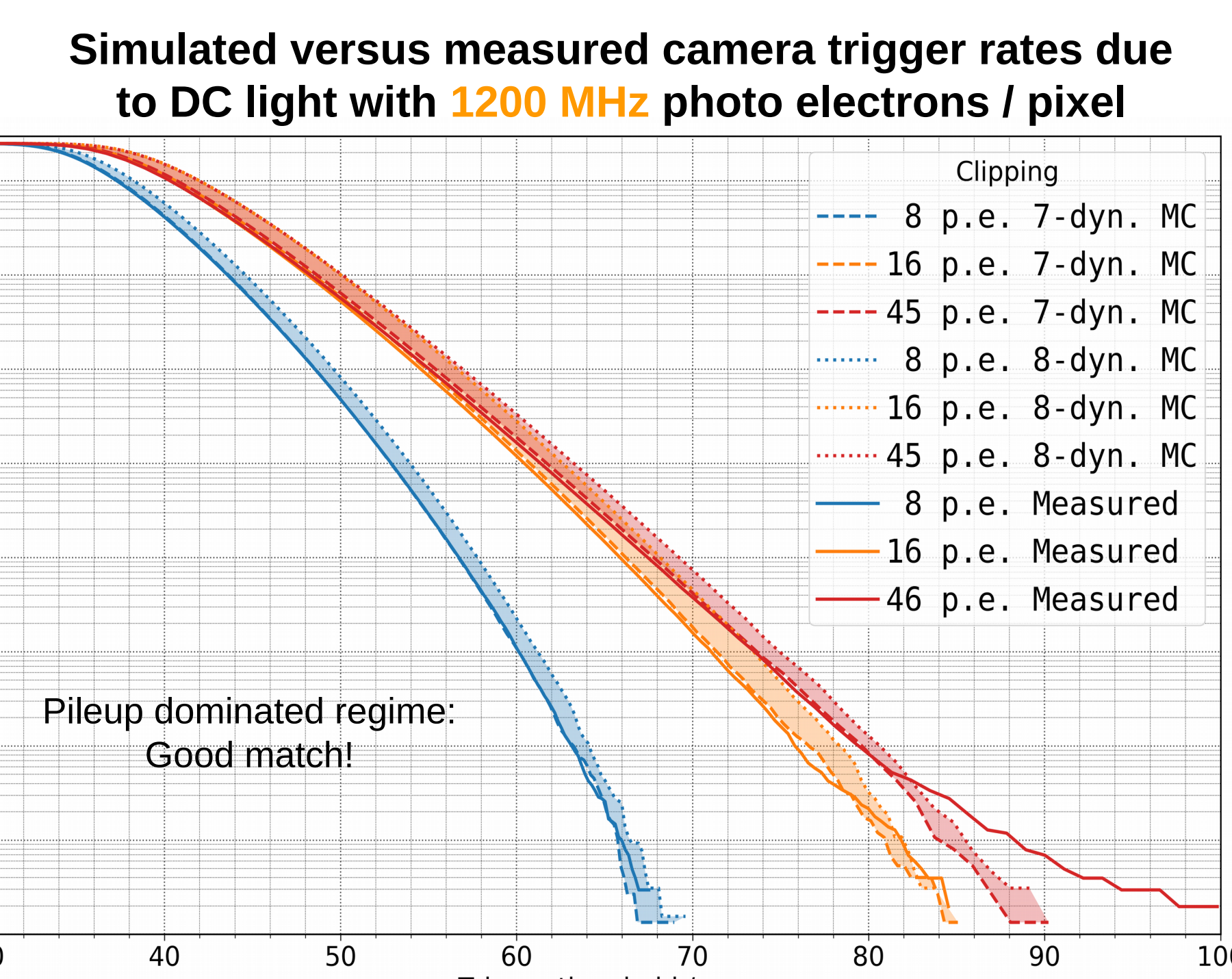
## Monte-Carlo simulations



- Full trace simulations of night sky background
- Simulations: Complete cameras with 7- and 8-dynode PMTs
- Measurements: Modules with one or the other PMT type installed in the prototype in equal numbers



- Application of bit-exact trigger emulation software to measured and simulated events
- Scan full range of trigger settings
- Comparisons for different levels of night sky background



## ACKNOWLEDGMENTS

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