

The 4 meter New Robotic Telescope

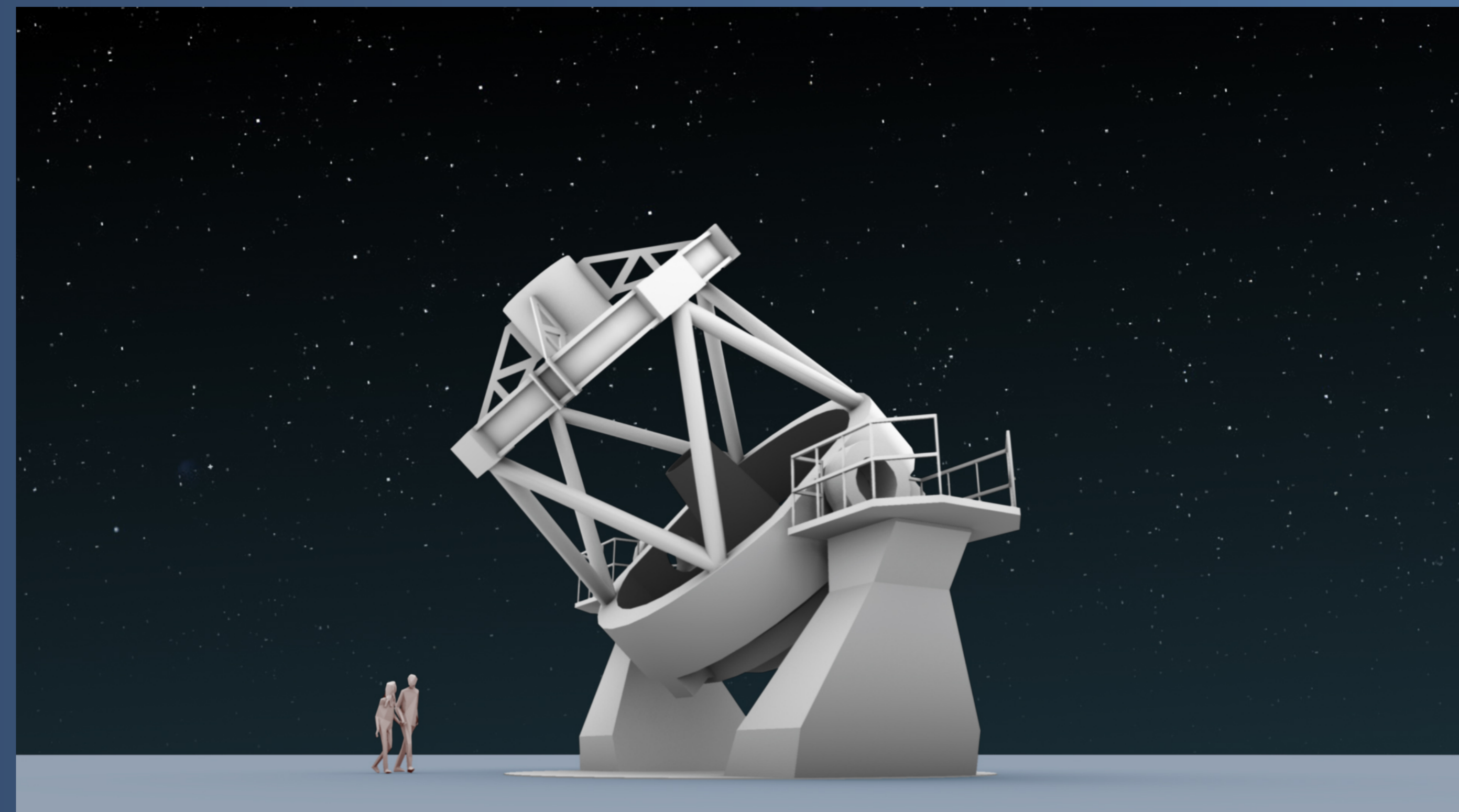
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(on behalf of the NRT collaboration)



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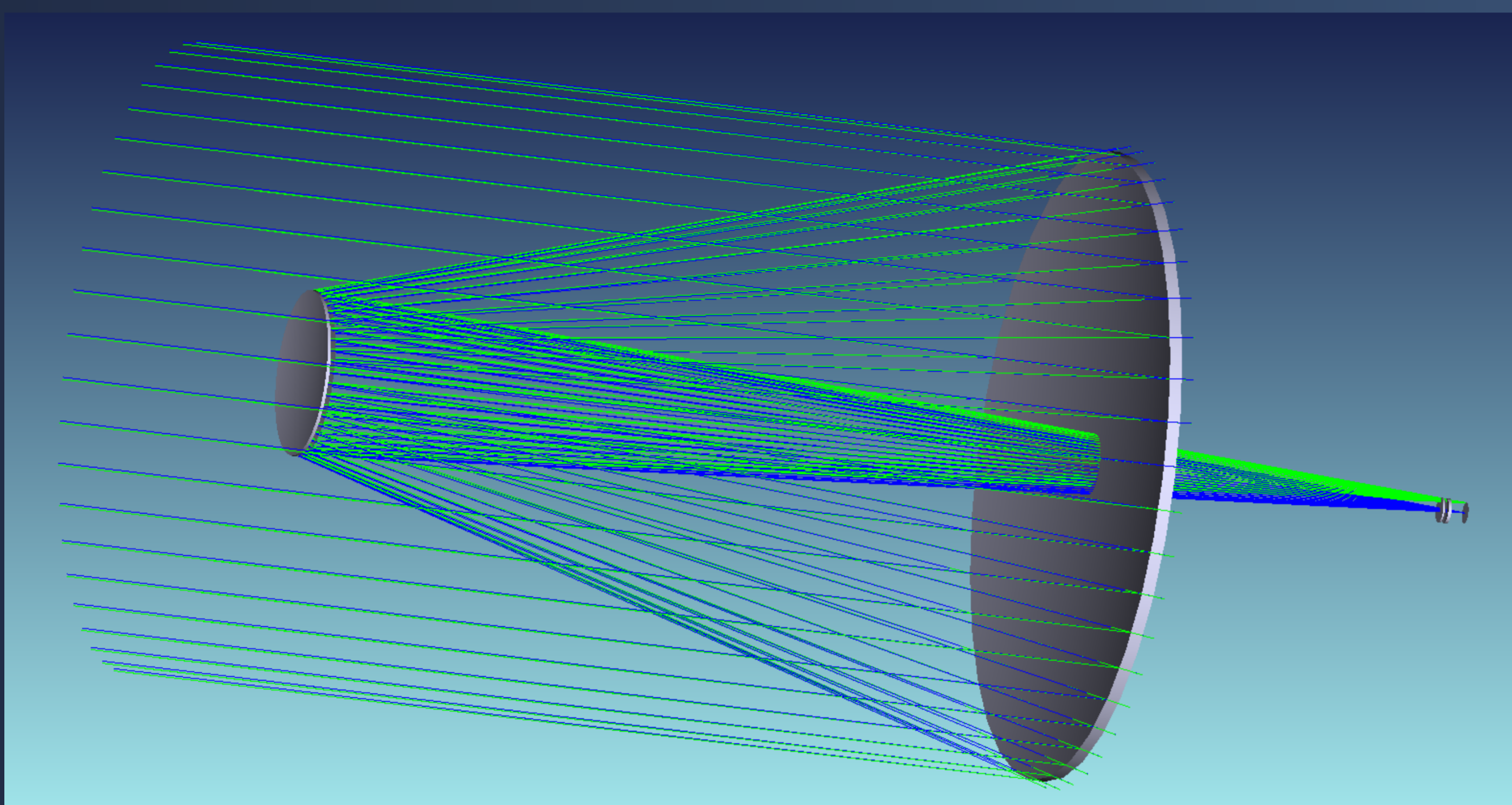


We present an overview of a project to build a 4 meter equivalent aperture telescope (New Robotic Telescope: NRT) with fully robotic operation and capable of an extremely fast response time (< 30 s on target). The telescope is currently under conceptual phase design, will be sited on the Observatory of Roque de los Muchachos (ORM) in La Palma (Canary Islands), and will be the largest robotic telescope in the world when it enters into operation in a five years time. These features coupled with a versatile and flexible instrumentation suite in the optical and near infrared will make the telescope a world leading facility in the area of time domain astrophysics. In this contribution, we present the status of the project focusing on some of the preliminar optical trade-offs that have been performed.



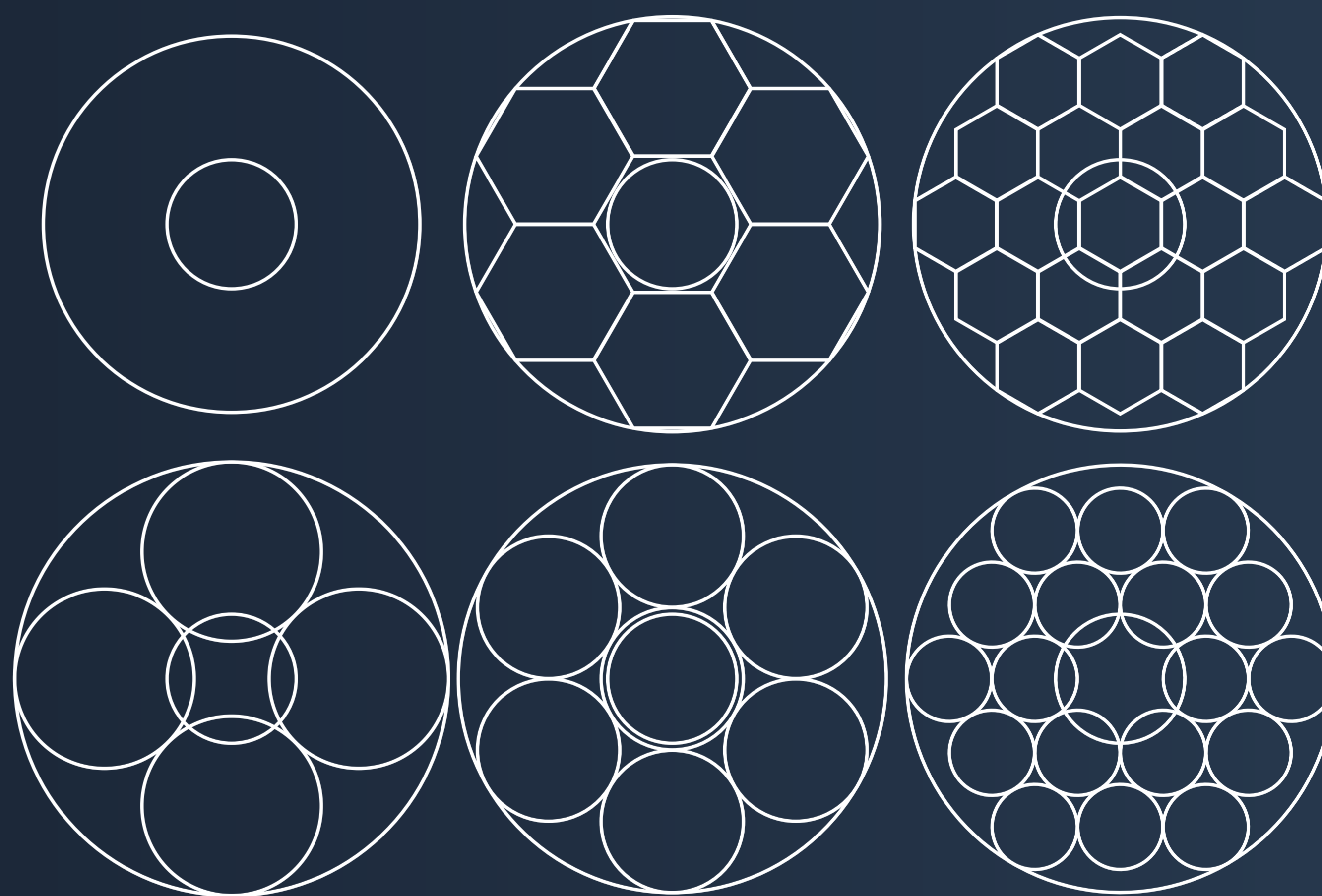
NRT Concept

The NRT will be the largest fully robotic telescope in the world, with a collecting area four times larger than the current Liverpool Telescope. The larger aperture and extremely quick response will allow the detection and characterization of fast fade transients, playing a key role in many areas of time domain astrophysics (gravitational waves, gamma ray bursts, supernovae, etc). The robotic operation of NRT will be ideal also for regular follow up programmes.



Baseline optical design

The NRT optical and mechanical design incorporate a concept of a compact telescope in order to minimize the telescope inertia and to allow fast pointing movements. The NRT baseline is a Ritchey-Chrétien configuration: 4 meter clear aperture, with a monolithic or segmented topology for the primary, a total collecting area of 4π square meters and a field of view of 15 arcmin. The telescope will operate in the optical (from 350 nm) and in the near infrared (up to 2 μ m) with several Cassegrain and Nasmyth foci.



Primary mirror topologies

Although a monolithic primary mirror is the common choice for 4 meter class telescopes, other topologies based on different configurations of segmented and multiple mirrors have been studied: from top to bottom and from left to right: Monolithic, HEX6, HEX18, CIRC4, CIRC6, and CIRC18. These multimirror configurations allow for a lighter primary mirror which could have a relevant impact in the final telescope moving mass. Additional advantages are the reduction in time maintenance associated to mirror coating, easier mirror handling operations, the possibility to scale the design to larger apertures and the existence of a broader choice of manufacturers.

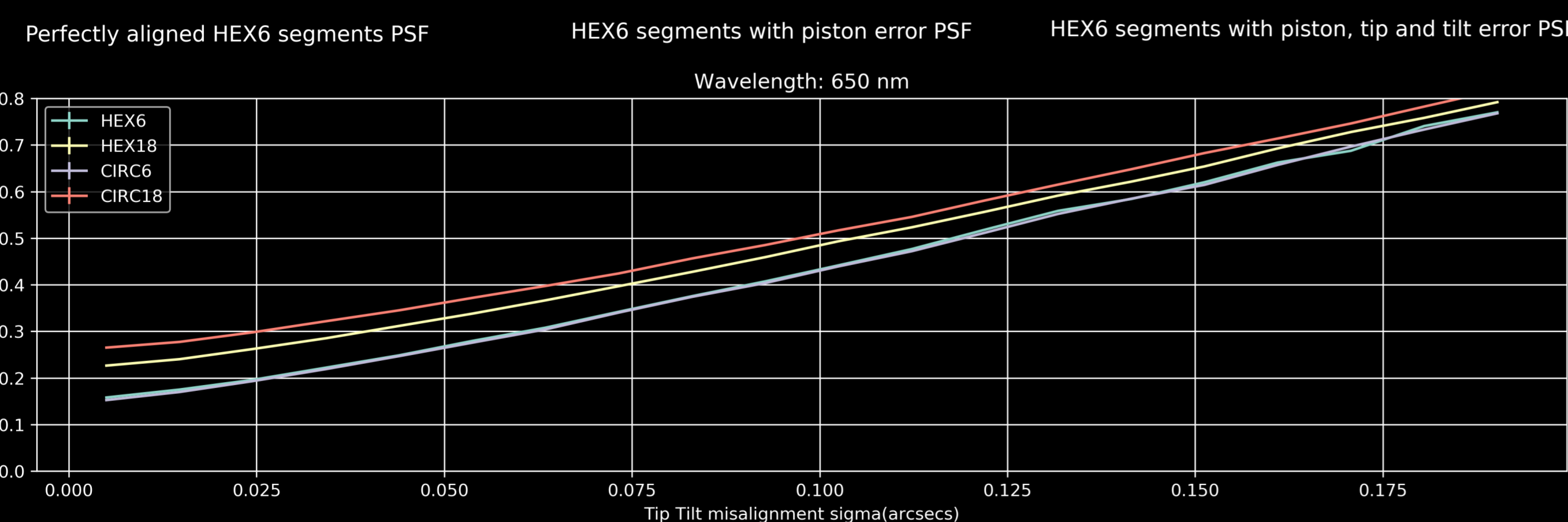
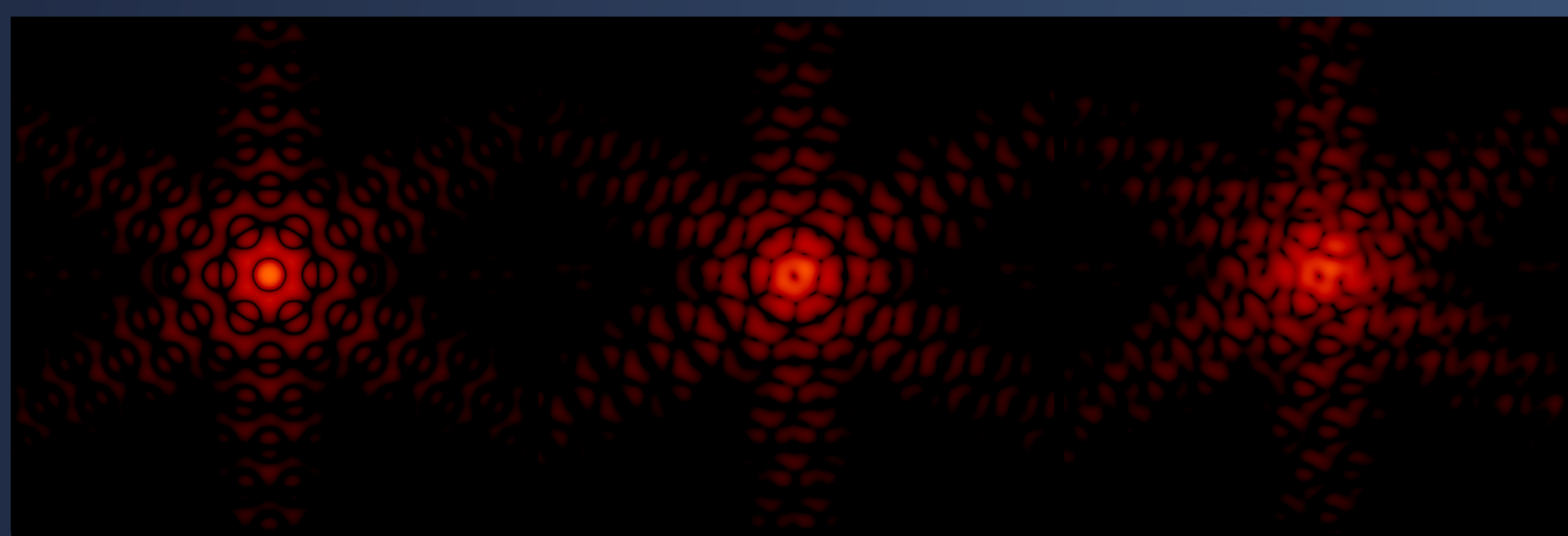


Image quality simulations for segmented apertures.

The Point Spread Function of the optical system has been simulated for different segmented primary mirror topologies. These Monte Carlo simulations estimate the contribution of diffraction and segment alignment to the final image quality. Other effects, like manufacturing, assembly or thermal contributions have not been taken into account.

References:

Copperwheat, C. M. et al. Liverpool Telescope 2: a new robotic facility for rapid transient follow-up. *Experimental Astronomy* 2015, 39,119.

Gutiérrez, C. M. et al. The 4 m New Robotic Telescope. *Astronomische Nachrichten* 2019 (in press).