# The TMT approach to maximizing value from key performance parameters

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**Abstract**

The community has long used key performance parameters (KPPs) to model and track system performance from concept to design to operations. As designs change, parts are accepted, subsystems assembled, and systems built, we redetermine KPP values and ensure the designed/as-built system meets requirements. As systems become more and more complicated, it becomes harder to track KPPs and understand how they affect and are affected by other system requirements. The Thirty Meter Telescope (TMT) is one such complicated system, with the telescope, facilities, adaptive optics system, and instruments being simultaneously designed and built. To really make our identified KPPs useful, we needed a better set of tools to visualize the web of connections from the top level science cases to multiple levels of requirements and the key performance parameters.
The TMT system is ideally suited to benefit from careful KPP analysis. We are able to include the design of the instruments and adaptive optics systems with that of the telescope from day one. As a result, the TMT telescope, the first light adaptive optics system NFIRAOS - a laser guide star multi conjugate adaptive optics system - and its instruments IRIS and MODHIS are designed together to maximize performance. Knowing the relationships between KPPs and the requirements in each of these systems is an important key to successfully optimizing the design.

The industry standard DOORS requirements management tool has proven useful for requirements management, but lacked a way to easily determine the connections between them and our KPPs. We therefore developed a visualization tool called TraceTree to help analyze the relationships within the entire requirements flowdown including those between the project's science cases and KPPs. This ability allows us to answer questions like which science cases are most demanding on a particular KPP or which science cases are affected by a change in a KPP value. Being able to visualize this traceability provides insight to the potential impact a change in requirements or predicted performance can have across the observatory. This paper presents the definition and management of system level KPPs and performance budgets at TMT that allows teams to refine estimates as designs mature and proactively identify areas of concern that may need additional analysis or resources.

**Keywords:** KPP, Requirements, Wavefront error, Traceability, Science Cases, Performance Bugets

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