

2nd May 2026

**Subject: Critical Review and Restructuring Recommendations for the Einstein Telescope Preliminary Technical Design Report (TDR) – ET-PP D6.4**

Dear ET-PP WP6 Coordinators,

Following a comprehensive review of the current draft of the Preliminary Technical Design Report (TDR) – ET-PP D6.4, the external review panel—comprising Stefan Ballmer, Albert Lazzarini, Yasunori Tanimoto, Callum Torrie, Stefano Vitale, Patrick Werneke (ETO), and Fiodor Sorrentino (ETO)—has concluded that the document is not yet ready for formal submission to the European Commission within the ET-PP project framework.

While individual sections contain high-quality information, the report currently functions as a collection of disconnected contributions rather than a coherent engineering blueprint. The panel found it exceptionally difficult to carry out a comprehensive, in-depth technical review of the various components due to the document's current structure; consequently, a structural revision is a prerequisite for a more meaningful evaluation by the panel.

The primary deficiency is a lack of "requirements flowdown," which results in no clear traceability linking top-level science goals to specific subsystem specifications. Without this logical bridge, technical requirements appear without context, posing a significant risk to the project's credibility during external evaluations. To improve focus and readability, the panel suggests that the document could be significantly shortened in areas that currently provide extended descriptions of existing second-generation (2G) technologies. Instead, the text should prioritize a detailed description of the proposed design for ET.

Crucially, the review panel considers that submitting the document in its current form to the European Commission might have undesirable funding consequences for the Einstein Telescope in the near future. A document perceived as lacking a well-defined technical roadmap or clear requirements could lead to a negative assessment of the project's maturity, potentially jeopardizing the support necessary for the next phase of development.

As a vital first step toward improving the document's accessibility, the panel recommends the inclusion of a formal Preamble. This section should clearly define the term "pre-TDR," the scope of the document, and, crucially, its current limitations. By explicitly stating what the document covers and what remains under development, you will provide readers with the necessary guidelines to interpret the data correctly. This transparency is essential for managing the expectations of EC officers and preventing the negative reaction that often follows when a document is perceived as claiming more completeness than it actually possesses.

To rectify broader structural issues, the panel suggests a reorganization that prioritizes a dedicated Requirements Section and a "product tree hierarchical plot." These tools are essential for visualizing how the system decomposes into subsystems and for ensuring that every design element is traceable to a specific functional need.

Most importantly, the document should count with an introduction indicating it covers both triangle and L configurations on equal footing. Fundamental design drivers—such as the Xylophone configuration and the given geometry—must be addressed "head-on" as primary mission choices rather than being presented as factual statements within sub-paragraphs.

Although an in-depth technical review was not completed, several "red flags" were identified that must be addressed to align the design with industry best practices. One concern, for example, is the proposed use of brass in Ultra-High Vacuum (UHV) environments for the ET-LF deformable mirrors; due to the high zinc content of brass and zinc's vapor pressure, this represents a significant contamination risk and should be reconsidered. Additionally, the panel suggests a candid application of the Technical Readiness Level (TRL) framework. Differentiating between proven 2G technologies and new, high-risk R&D will allow for a more realistic technology development path and provide a clearer justification for future funding.

The panel supports maintaining a few (but not too many) technical instances and their trade-offs, encouraging the team to retain these options as long as possible. The panel agrees that a diversified implementation may be necessary, allowing for specific solutions in certain areas and alternatives in others.

Finally, the document requires significant editorial attention. At present, the depth of detail varies inconsistently across chapters, and critical sections—most notably Chapter 3.4 on Integration—are entirely absent. We also noted that many figures and graphs are of low resolution and remain unreadable. We recommend appointing a single technical editor to harmonize the prose, ensure uniformity of style, and replace blurry graphics



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with high-resolution versions. Once these structural and content gaps are closed, the panel believes the existing material can be successfully integrated into a robust, submission-ready pre-TDR document for the ET-PP framework.

Sincerely,

Mario Martinez

ET-PP Coordinator