The proposal to expand investment in information systems to begin tracking demographics, leadership diversity, and research output should be funded at a higher level, so that these important statistics can be monitored.

On the individual level, the establishment of a process that tracks career development on a variety of metrics (not only scientific achievement) is suggested. Anonymized public disclosure of individual's information can be aggregated to identify the most needed areas of training, facilitate the matching of mentors/mentees, and lead to statistics on DEIA. Care must be taken, however, that this process does not interfere with similar processes in place at the users' home institutions.

Dedicated DIII-D schools or online training programs should be considered to assist with on-boarding, management proficiency, and diversity and inclusion awareness.

We welcome the plans to deploy a funded Mentoring program to a larger number of early career personnel. The idea of an apprenticeship program would widen the target group.

Personel support for communication should be strengthened to facilitate interfacing with technology development in preparation of the FPP program.

Charge 3: Negative Triangularity (NT)

The PAC congratulates the DIII-D team for the achievements made in the recent NT campaign. This campaign was a well-focused, targeted team effort, including international participants from institutions with relevant NT physics expertise. A wealth of interesting and novel experimental results was obtained, which is sure to have a significant international impact.

Charge 3a: Comment on the results of the recent campaign and how this would merit considering an NT FPP.

Findings:

- The NT campaign in 2023 provided a clear indication as a potential candidate for FPP meeting the required core performance metrics, i.e., high density of f_{GW}~1, high confinement of H_{98}>1 both at the steady-state like q_{95} >5 and at inductive low q_{95}<3 where it is not easy due to the typical MHD limit for the positive triangularity (PT) discharges.
- The advantage of the NT scenario (high confinement with L-mode like edge, i.e. without large ELMs) is clearly demonstrated in wide operational ranges in q_{95} and density, achieving H_{98}>1.0 and high beta (β_N ~3) at high normalised density f_{GW}~1 (1.5 at f_{GW}~ 0.75) even with an un-optimized divertor configuration.
- The NT plasmas were also shown to be compatible with divertor detachment that is approached in a gradual way demonstrating low divertor heat-load combined with core-edge integration, albeit detachment sets in at higher line-averaged density than in PT (see also below). Similarly, high core radiation fractions > 50%, a possible exhaust approach for FPP, was sustained with β_N > 2.
- Open issues include understanding the transport and MHD activity that may limit the performance in the core and at the plasma edge when extrapolating towards FPP conditions.

Recommendations:

- The PAC recommends the DIII-D team perform a design analysis study of engineering/physics requirements for an FPP based on NT to define possible show-stoppers and to define more quantitatively the precise targets of further NT studies in DIII-D. This study should also clearly make the case why an NT FPP is at least as attractive as a PT FPP, using clearly defined metrics.

- The PAC recommends analysing and clarifying the engineering issues in FPP with NT, i.e., for the design of vacuum vessel and shaping coils for which we may encounter additional difficulties to accommodate the NT shape.
- The PAC recommends analysis of edge plasma measurements and modelling (including grad-B effects) to understand the physics leading to the suppression of H-modes to determine if this would be at work in an FPP.

Charge 3b: What are key issues to follow up and how can that be one on DIII-D/other devices? Comment on the proposed further upgrades for DIII-D.

Finding: the NT results were compared to PT L- and H-modes in terms of scaling laws (confinement, density limit).
Recommendation: the PAC recommends that quantitative metrics for PT/NT comparison should be developed, e.g., in terms of figures of merit for an FPP (see also above) and that comparison experiments in PT shape are done along these lines.

Finding: vertical stability control as well as shaping capability of NT plasmas turned out to be difficult and it took quite some development time to establish the NT 'baseline' scenario.
Recommendation: the team is encouraged to implement the improvements proposed to improve plasma control, in addition to the other improvements previously identified as required. This will increase the confidence that a future campaign at higher current and higher elongation with more flexible shaping can be robustly conducted.

Finding: the detachment onset in terms of line averaged density was found to be more difficult than in PT discharges.
Recommendation: the PAC agrees that this is one of the key issues to follow up. The DIII-D team is encouraged to analyze the possible reasons for this behavior to strengthen the case for the proposed NT divertor upgrade.

Finding: many of the results were presented in terms of dimensionless parameters achieved, with little physics interpretation.
Recommendation: The PAC understand that the experiments concluded recently, and that more detailed data analysis is ongoing. The Team is encouraged to aim at a deeper physics understanding of the important trends that were observed, e.g., in the area of confinement, and also validate the new physics models on other devices doing NT studies. This will be needed for the extrapolation to an NT FPP, but also as input to the case for justifying an additional future NT campaign, including the proposed upgrades.

Finding: the Team proposed a hardware extension to widen the parameter space for future NT studies, both in terms of plasma performance as well as concerning divertor properties. Such an upgrade needs a preceding engineering design study, which has to be started now in order to potentially implement the hardware change in 2026.
Recommendation: the PAC recommends starting this engineering design study now, so that, together with the other measures recommended above, a definitive decision on the proposed NT modification can be taken. The PAC offers its advice for this process and recommends the following elements to be included in the decision process:

- The outcome of the NT FPP design study and its comparison to a PT FPP
- The improved physics understanding of the results obtained
- The results of the engineering design study

- The impact on the timely contributions to the national fusion strategy of the DIII-D physics and plasma-interfacing technology program

Based on these, the case for the upgrade should be made, clearly pointing out

- Cost and schedule for the proposed updates.
- What the different upgrades will bring in terms of advancing the physics understanding, and hence the resolution of open issues for the NT FPP.
- The impact on the wider DIII-D program (the 5-year plan that the PAC endorsed last year will be affected and the consequences for that part of the program must be weighed against the projected NT results).

The PAC recommends including a plan to verify the compatibility of a potential NT FPP plasma scenario with a reactor relevant wall.