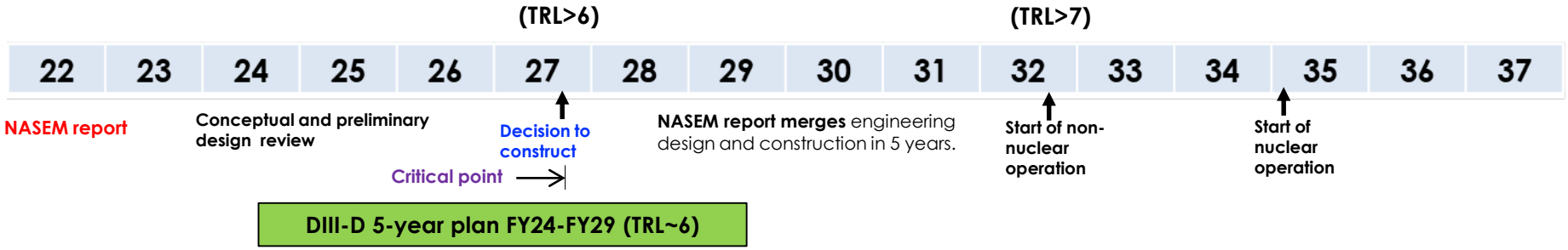
Introduction and motivation



- **Diagnostic design must be fixed before the FPP engineering design phase (critical point).**
- **A full set of "compact" diagnostics will be needed during the commissioning phase, while it will be replaced by a reduced set in the D-T operation phase, that measures "deviations" from the pre-designed and steady-state scenarios.**
- **Synthetic diagnostics based on the data measured during the commissioning phase combined with validated models predict plasma behavior for the plasma control and machine protection.**

Can synthetic diagnostic input control FPP plasmas?

Identification of synthetic diagnostic-driven FPP Plasma controllability, Suk-Ho Hong, et al…

- **Long range goal*:** Experimentally determine a "reduced set" of diagnostics for FPP plasma control
  - Key technology for FPP steady state operation
- **DIII-D need:**
  - Equipped with a set of real-time control diagnostics
  - Essential for FPP design/construction/operation
- **Priority for FY24-25 studies**
  - No experiment done before. Request 5 days/year
- **Risk and deliverable**
  - Risk of frequent disruption during the shots.
  - Modification of PCS codes to push stored/simulated data as "real-time" data
  - FPP plasma control technique combined with a "reduced set" of diagnostics

Some examples of experimental plan

- **Repeat 30 identical shots**
  - 1st shot: measure all parameters
  - 2nd shot: reroute measured n_e as the real-time data
  - 3rd shot: reroute measured T_e as the real-time data
  - 4th shot: reroute measured P_{rad} as the real-time data
  - …until the plasma disrupts
- **Repeat 30 identical shots**
  - 1st shot: measure all parameters
  - Sequentially, remove one magnetic probe from the control per shot until the plasma disrupts.
  - Find a set of magnetic sensors absolutely needed for PCS control.