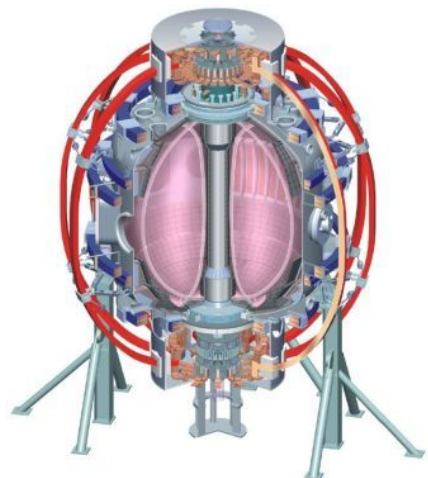


Developing the Core Physics Scenarios For Next Step STs

Stefan Gerhardt

Friday AM Talk at 2011 APS DPP

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ASIPP
ENEA, Frascati
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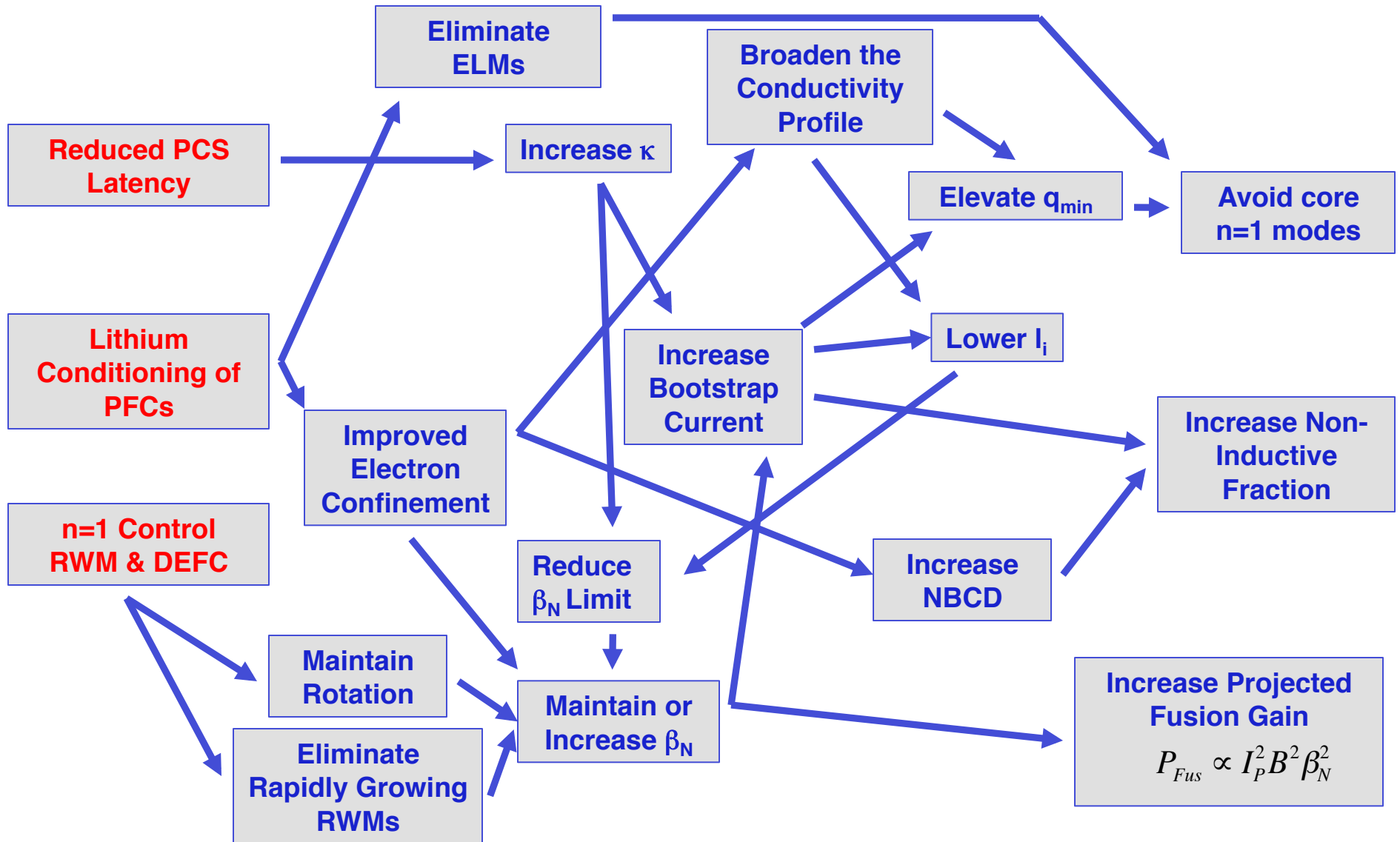
Outline of Talk (20 slides)

- Intro (4 slides)
 - Describe why STs are (potentially) useful. (1 slide)
 - The NSTX facility. (1 slide)
 - Emphasize upgrades in the past 3-4 years that contribute to “advanced” plasmas (routine RMW control, Lithium, improved control).
 - What is the present “best” performance in NSTX. (2 slides)
 - Database analysis of operating space, example discharges.
- Describe results in three interacting areas (10 slides):
 - Transport (2 slides)
 - Lowest order scanlings....effect of Li?
 - Current drive (4 slides)
 - Cases that are approximately classical without *AE activity.
 - Phenomenological modeling of current redistribution with TAE Avalanches.
 - Achieved non-inductive fractions in NSTX
 - Stability (4 slides)
 - Importance of elevated $q_{\min} > 1$ to avoid core kink/tearing
 - Strong shaping, broad profiles.
 - RWM control
- NSTX-Upgrade Simulations (4 slides)
 - Describe the methods (1 slide)
 - Example profiles for 100% non-inductive cases w/ $P_{\text{inj}}=12.6$ MW, $B_T=1.0$ T, including thermal profile and confinement scaling sensitivity. (1 slide)
 - Compare a broad range of upgrade scenarios to existing NSTX parameters (2 slides)
 - Separate 100% non-inductive and high-current partial inductive.
 - Emphasize what is similar (β_N , H), and what is better (lower collisionality, elevated q_{\min})

2 Themes:

- *How facility improvements help with scenarios*
- *How physics results support the modeling.*

How Recent Facility Improvements Interact to Improve Performance



What is needed.

- Most of the data is well analyzed.
- Could use:
 - Finish upgrade modeling (SPG work).
 - Conclusion on the Li vs. no-Li confinement trends. Does collisionality explain everything? Pedestal vs. Core?
 - NSTX-U modeling assumes that ion transport remains neoclassical. Do we expect this to be true? GTS calculations started?
 - Elongation scaling of the no-wall limit in NSTX/NSTX-U relevant plasmas.
 - Conditions for TAE Avalanche onset in H-mode plasmas.
 - Is it necessary to say anything about disruptions...their frequency or predictability?