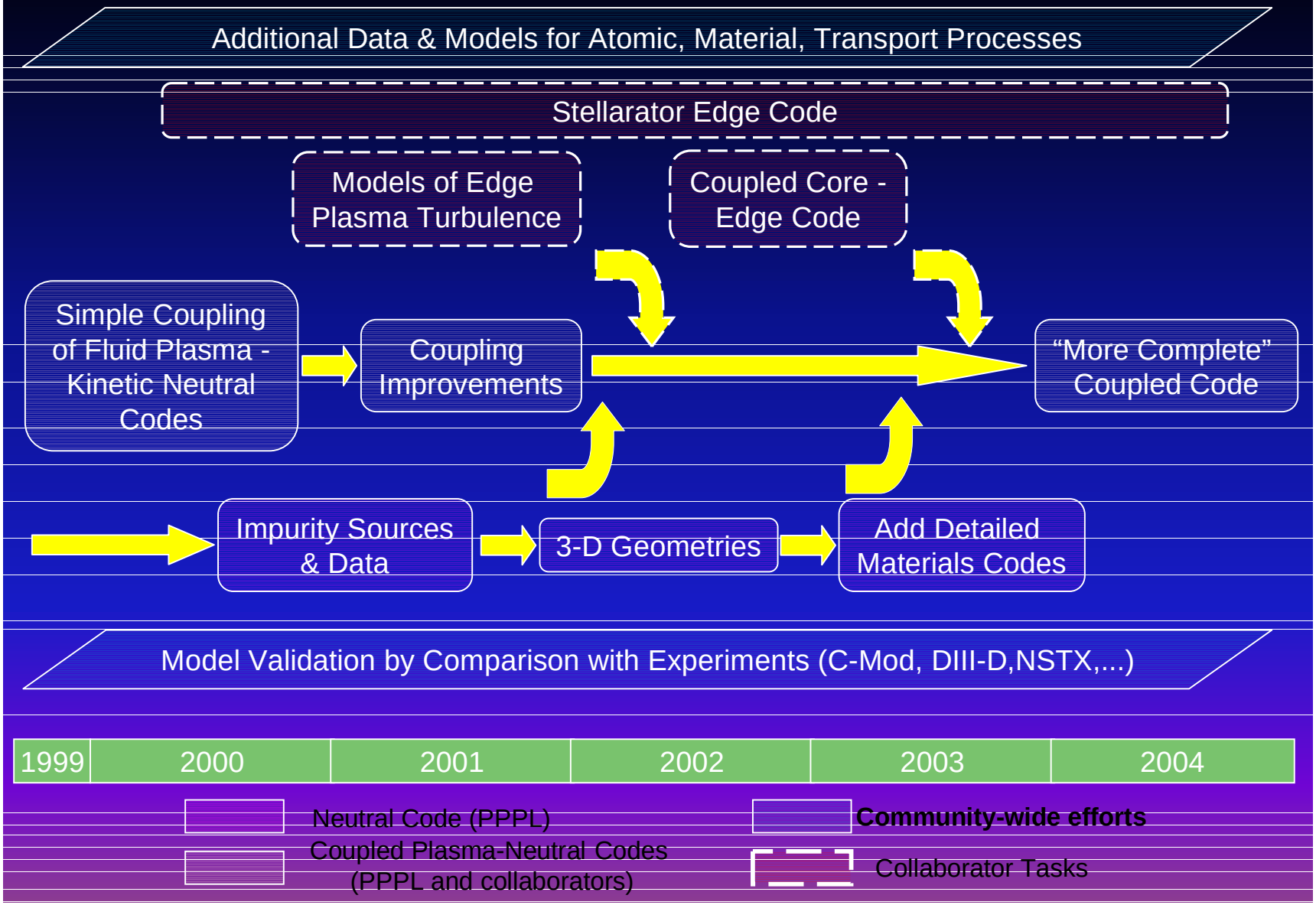
Advance Predictive Capabilities for Multi-Phase Interfaces



Multi-Phase Interfaces

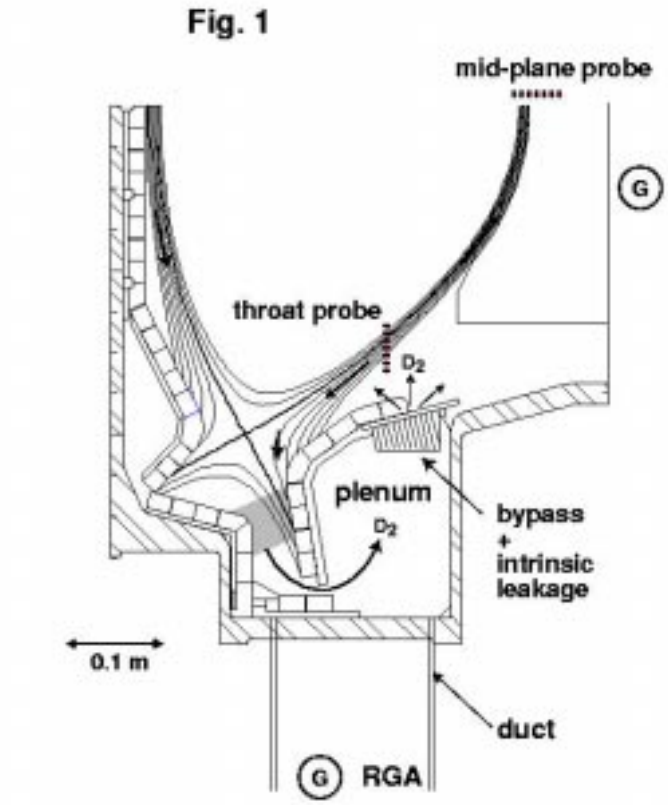
- Effort focused on DEGAS 2 neutral transport code.
- Current application: Alcator C-Mod
- Future development & applications:
- Sputtering & other impurity sources,
- Lithium experiments on CDX-U

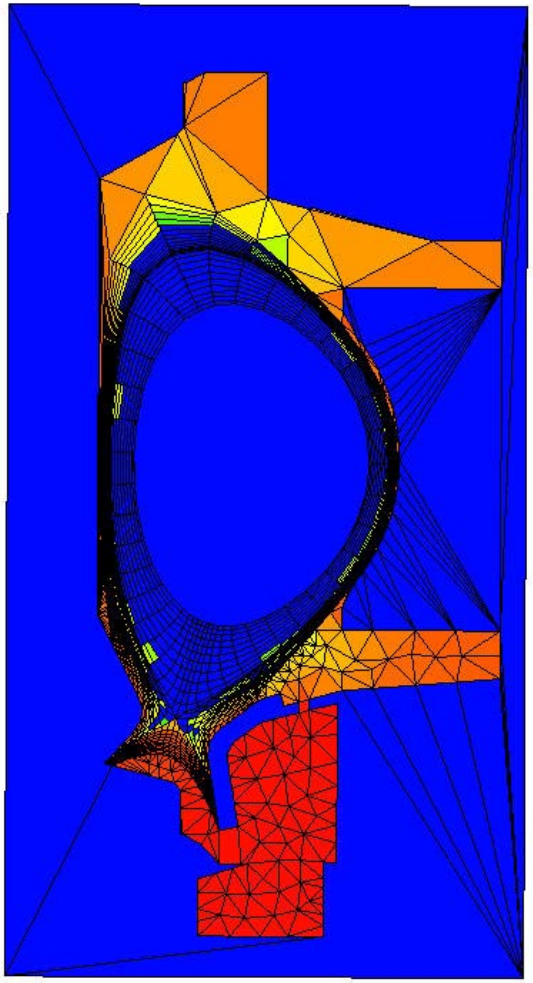
C-Mod Divertor Baffling Experiments

- C-Mod saw no effect on plasma of changing vacuum vessel gas conductance.
- DEGAS 2 is a perfect tool for modeling:
- Simulate complex geometry,
- Treat transition regime neutral gas flow (Knudsen number ~ 1),
- Parallelized

  $\Rightarrow$ run times ~ 10 minutes.

DEGAS 2 Modeling of C-Mod Bypass Experiments



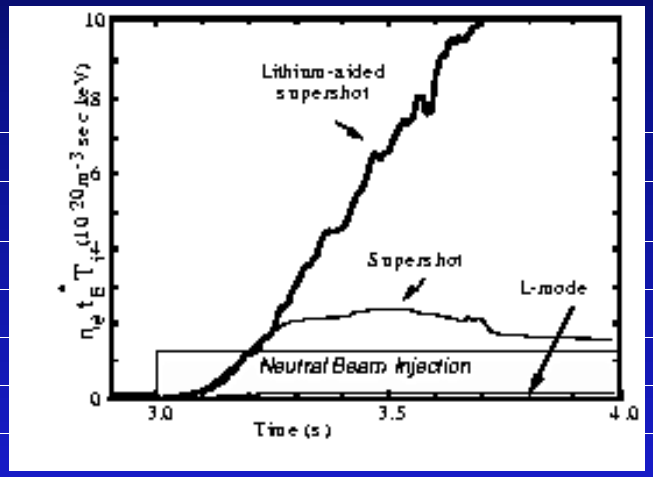


0 20

Log[D_2 density (m^{-3})]

Effect of Boundary Conditions

- Plasma performance improved strongly with lower D influx.
- What properties of Li are responsible?
- Can we predict this behavior?



Impurity Sources and Data

- Boundary plasma strongly impacted by impurities, particularly hydrocarbons.
- Add models for radiation enhanced sublimation, physical and chemical sputtering to DEGAS 2,
- E.g., hydrocarbon model from UIUC.
- Lithium data for CDX-U modeling.

Detailed Materials Code

- Boundary conditions can strongly impact plasma performance.
- Predictive models are needed.
- Proposed NSTX diagnostics will provide rapid and even real time data.
- Use data to develop new models of materials behavior.

Detailed Materials Code

- Couple to DEGAS 2
- Use to predict:
- Machine conditions,
- Erosion and redeposition,
- Also needed for tracking tritium retention.