

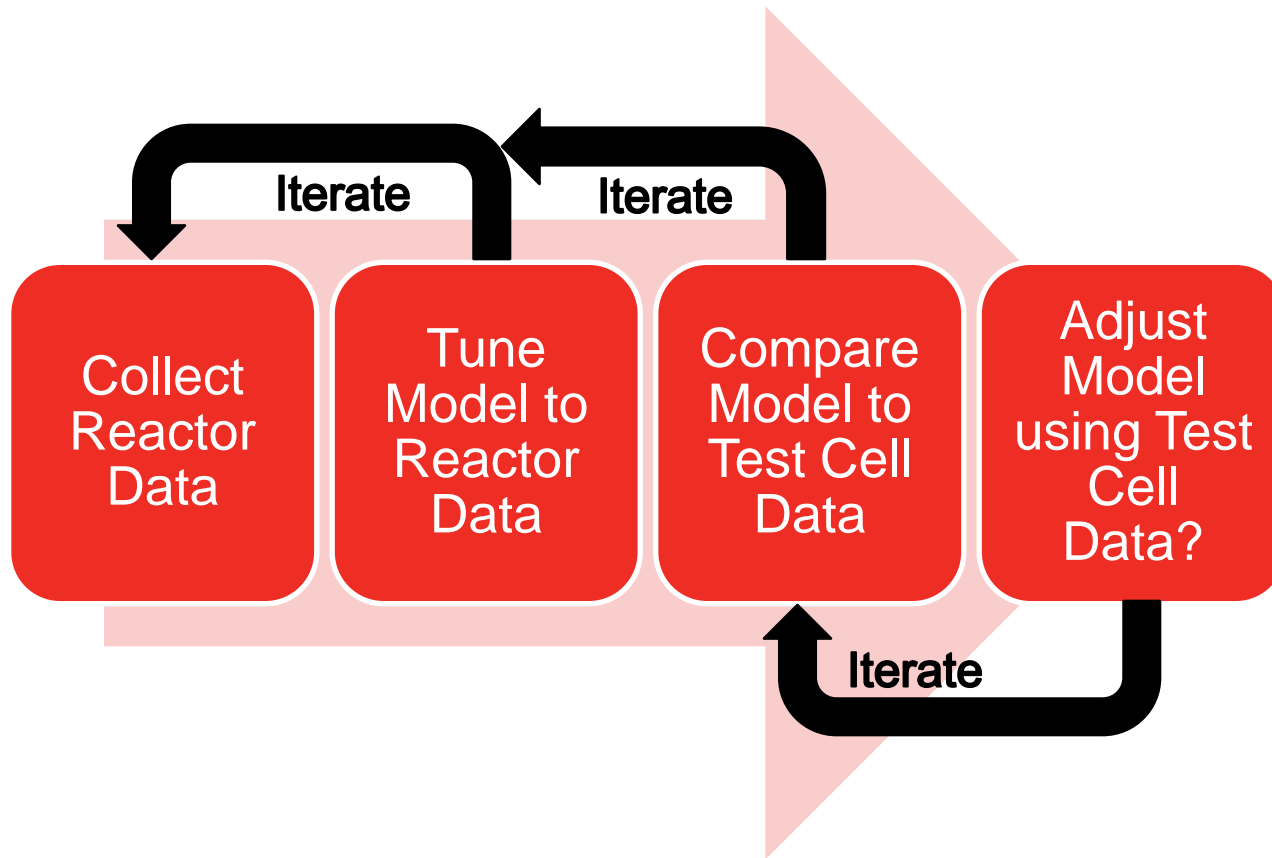


Aftertreatment Model Development: Reactor vs. Test Cell Data

April 20, 2011



Model Development Process

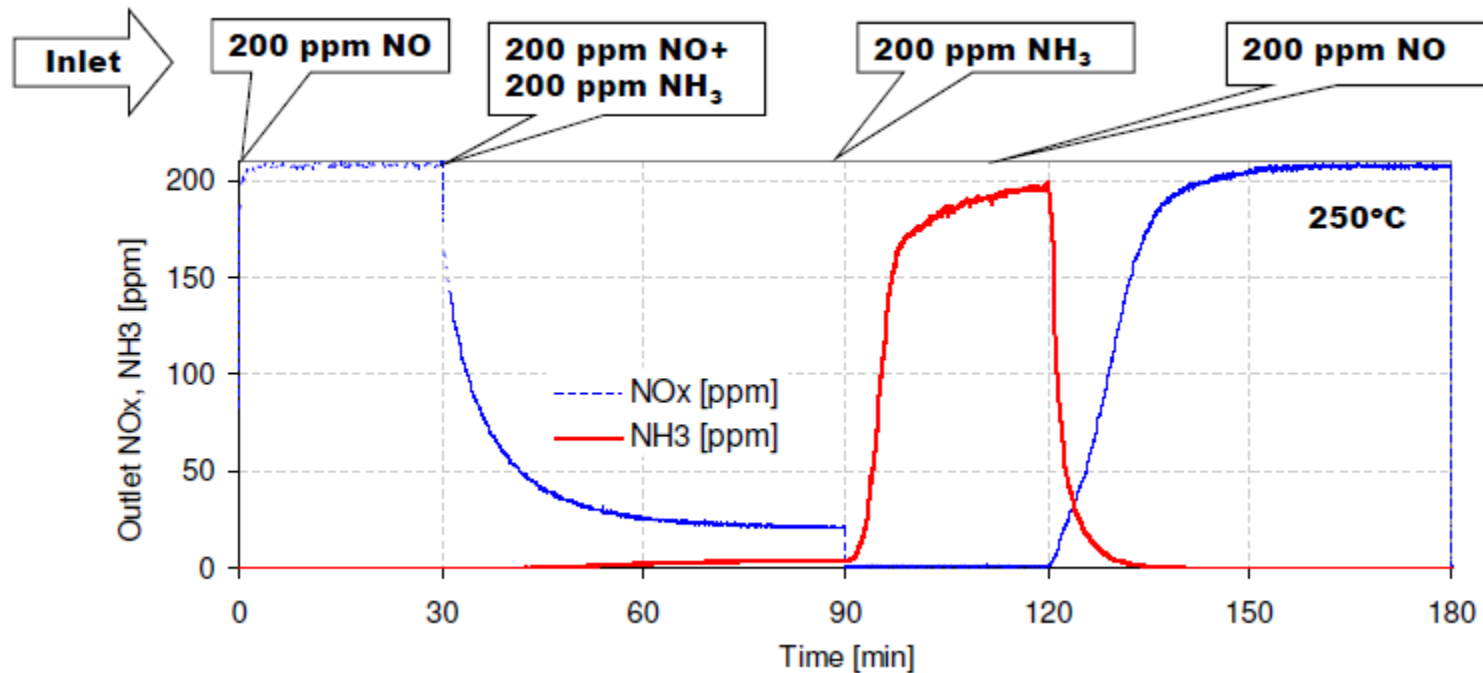


Reactor vs. Test Cell Data

Reactor	Test Cell
High level of control over input conditions and state	Cannot independently control key inputs
Good repeatability in data measurements	Variability in real system Measurement uncertainty
Easy to isolate specific components or functions	Difficult to isolate components Interaction of multiple phenomena
High uniformity (1D)	Non-uniform temperature, flow, concentration (3D)
Not intended for drive cycle inputs	Designed for running full drive cycles
Not reflective of the real system	Closer to the real system on an application

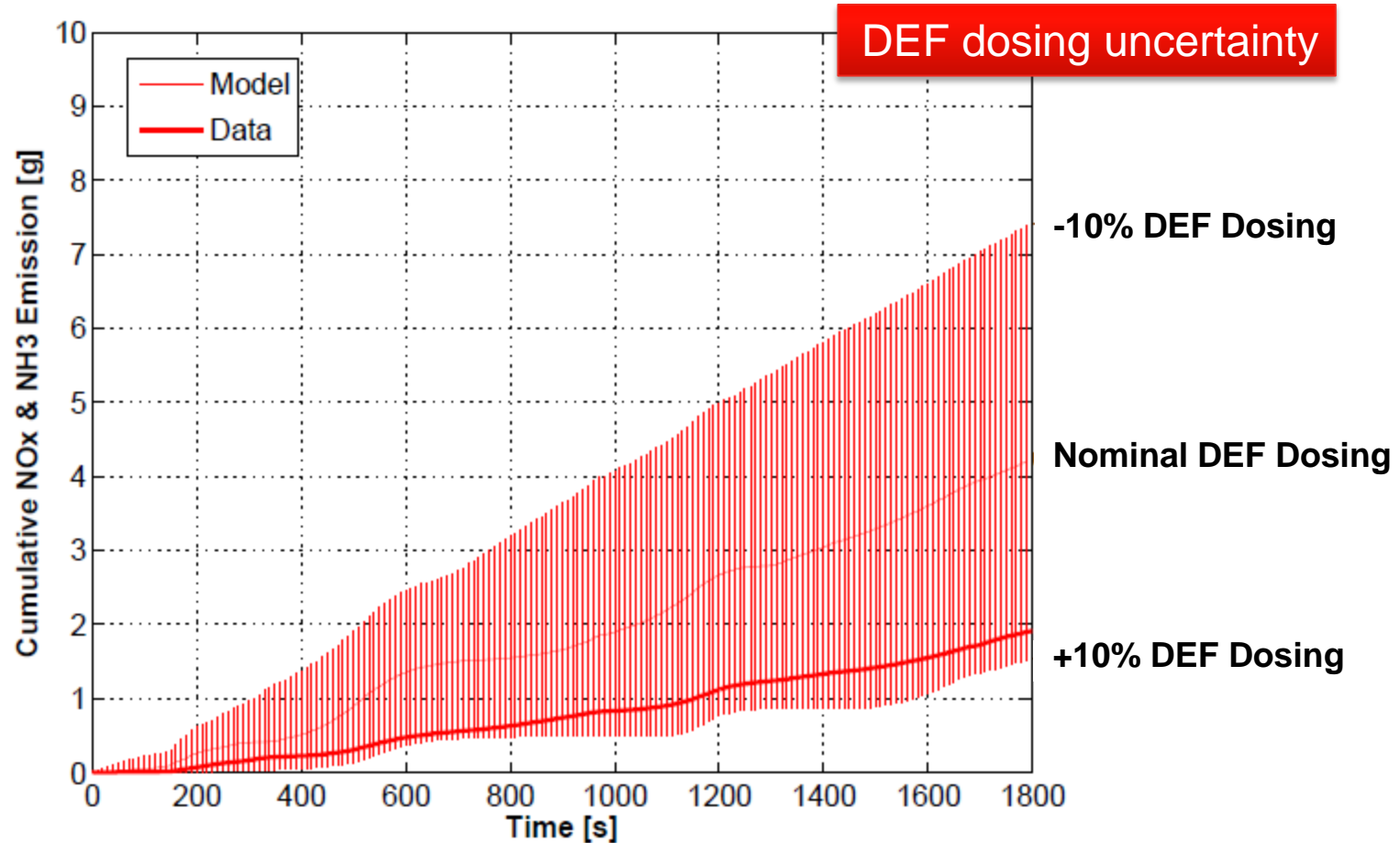
Reactor Data Example

4-step protocol



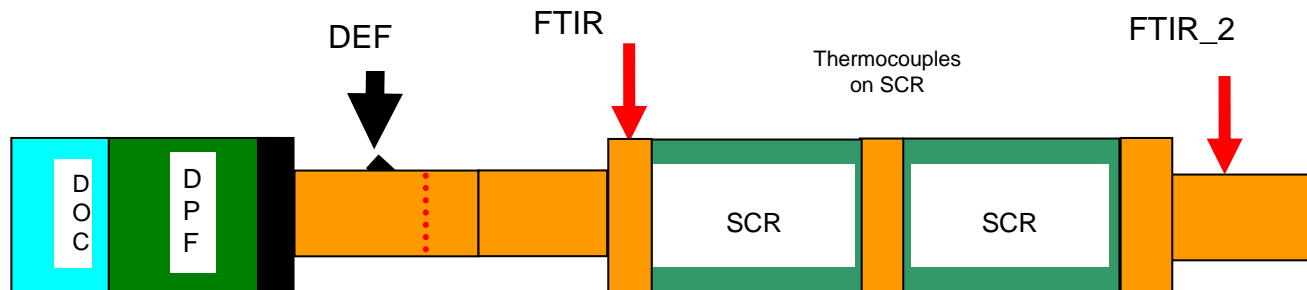
- Designed to isolate specific catalyst functions
- Repeats for multiple temperatures and NO₂/NO_x ratios

Test Cell Data Example

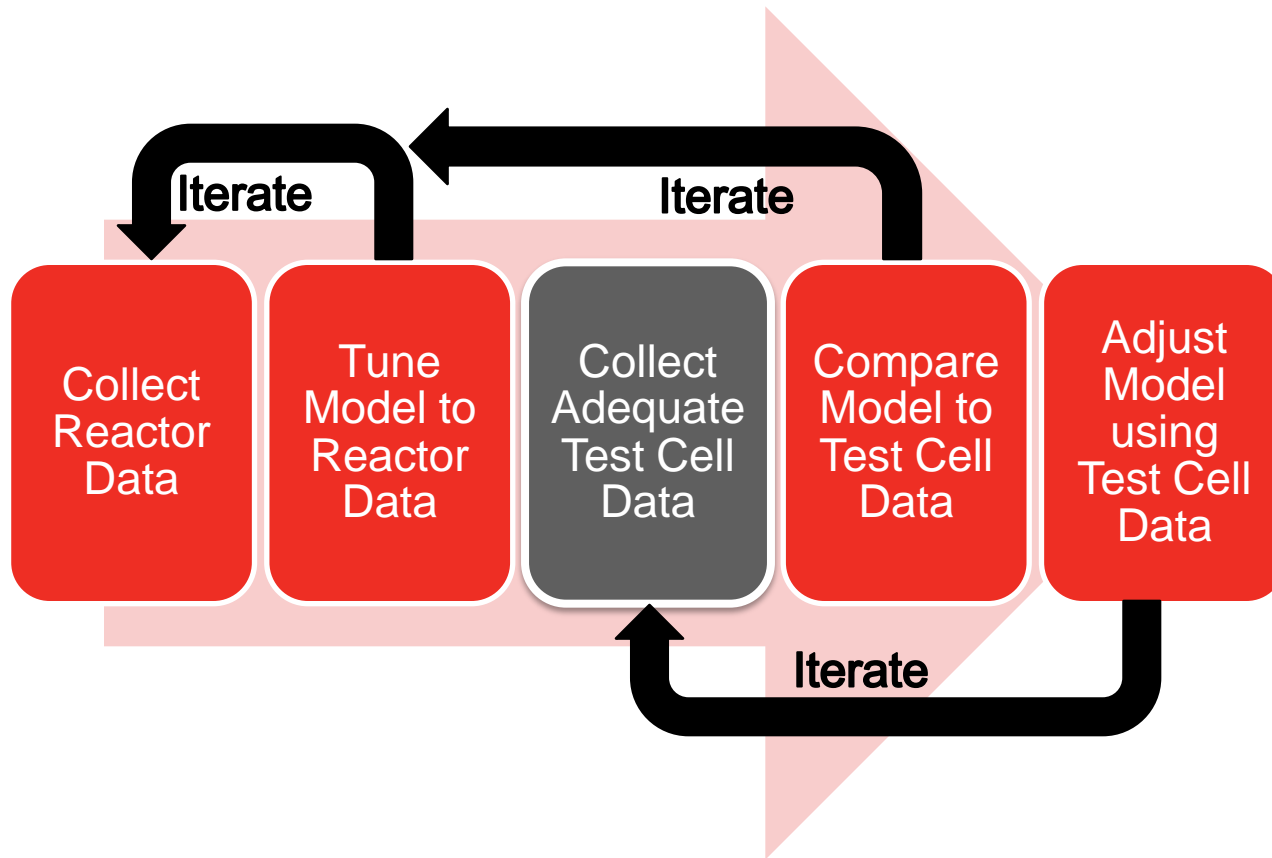


Collecting Adequate Test Cell Data

- Data collected with model development specifically in mind
 - Data collected at inlet and outlet to specific catalyst element
 - Temperatures, mass flow, and species composition
 - Also measure catalyst bed temperatures
 - Have repeats on tests to determine data uncertainty
 - Inclusion of errors bars



Model Development Process - Revisit



Reactor vs. Test Cell Data

Reactor	Test Cell
High level of control over input conditions and state	Cannot independently control key inputs
Good repeatability in data measurements	High variability in real system measurements, high uncertainty
Easy to isolate individual components	Difficult to isolate individual components, multiple interactions
High uniformity in flow, temperature, concentration (3D)	High variability in flow, temperature, concentration (3D)
Not intended for running full drive cycles	Designed for running full drive cycles
Not reflective of the real system	Closer to the real system on an application

Need both!!!

Questions

- How to best instrument a test cell for data collection?
- What measurement techniques to account for non-uniformity at the test cell?
- How to account for temperature measurements during transient events? Low flow?
- Use “golden” part to remove uncertainty?

