The background features a central globe with the ANSYS logo overlaid. The globe is surrounded by a complex network of glowing blue and orange energy trails that radiate outwards, creating a sense of dynamic motion and high-tech energy.

APECS ROM Builder

**NETL 2009 Workshop on
Advanced Process
Engineering Co-Simulation
October 20-21, 2009**

- **Why ROMs?**
- **Purpose of the ROM Builder**
- **ROM Builder Features**
- **DEMO**

Why ROMs?

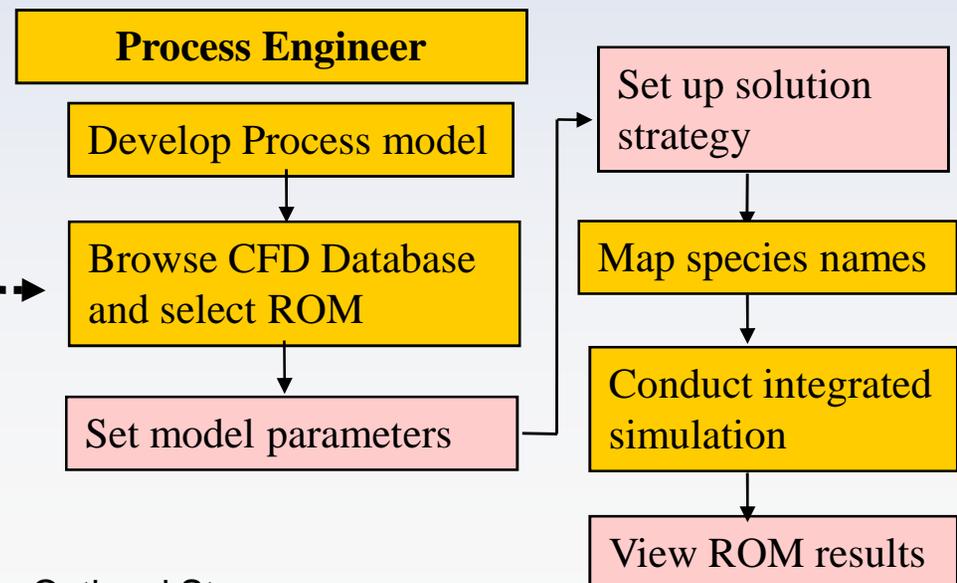
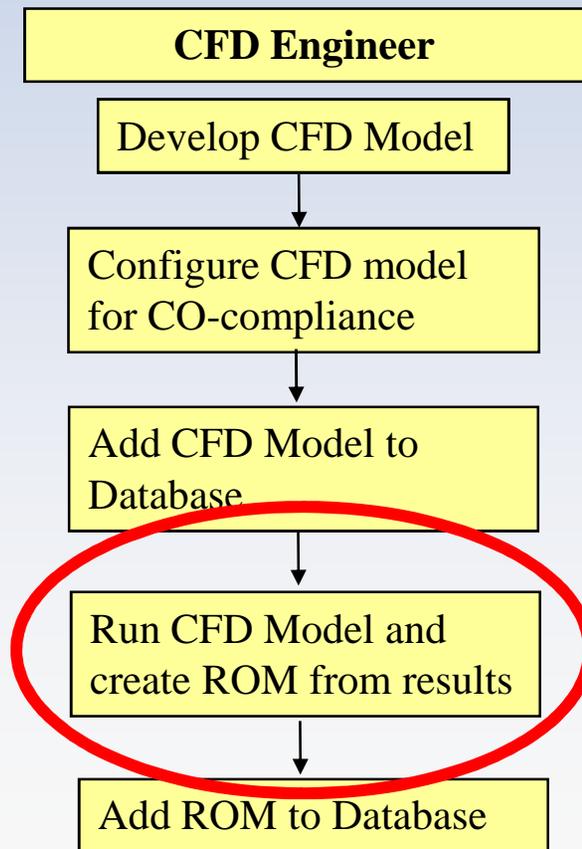


- **Large disparity in run times between 3D CFD models and native unit operation models**
- **ROMs run much faster than 3D CFD models**
- **ROMs can be**
 - Models with reduced dimensionality
 - Response surfaces that map inputs to outputs

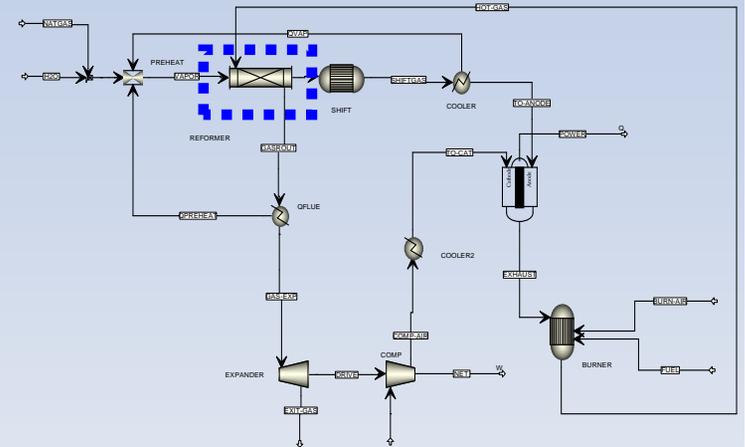
APECS Workflow using ROMs



- Replace FLUENT model with Reduced Order Model (ROM)



Indicates Optional Step

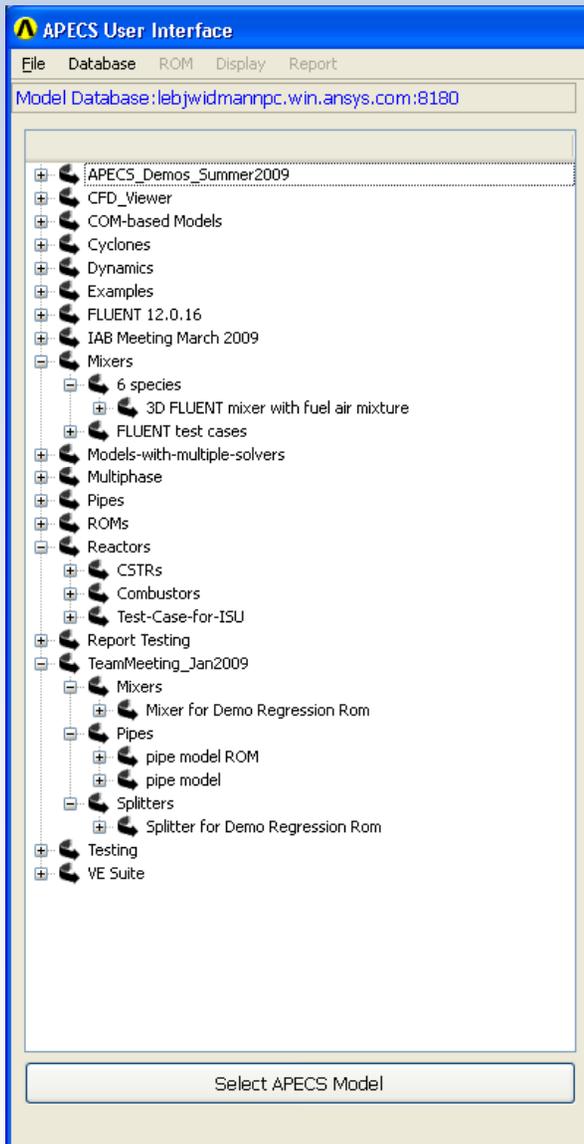


Purpose of the ROM Builder



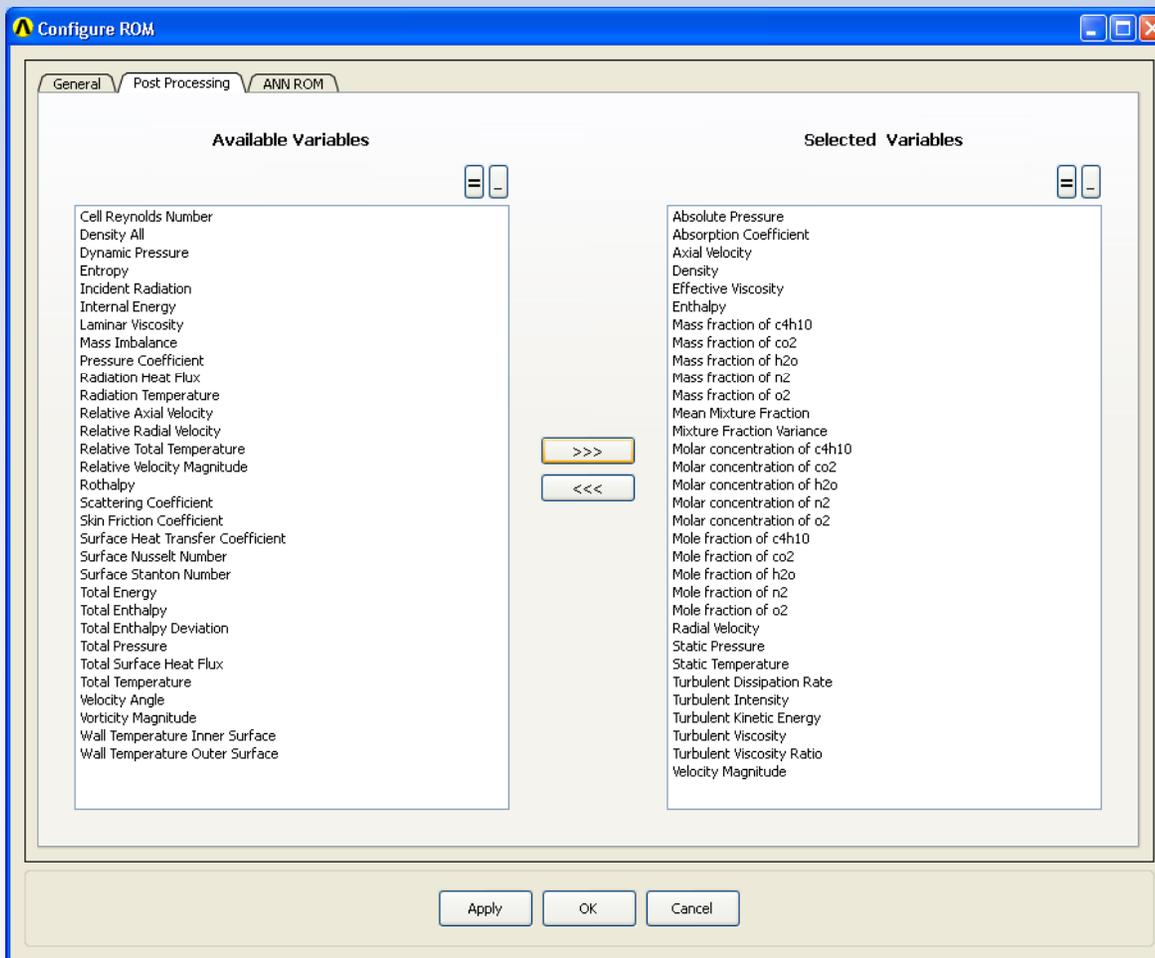
- **Provide a simple method for APECS users to create ROMs from CFD simulations**
- **Provide control over the input parameter space covered when “training” ROMs**
 - Building “on the fly” approach unsuccessful
 - Ability to specify Upper and Lower Bounds
- **Provide information to the user as to the “accuracy” of the ROM**

ROM Builder Functionality



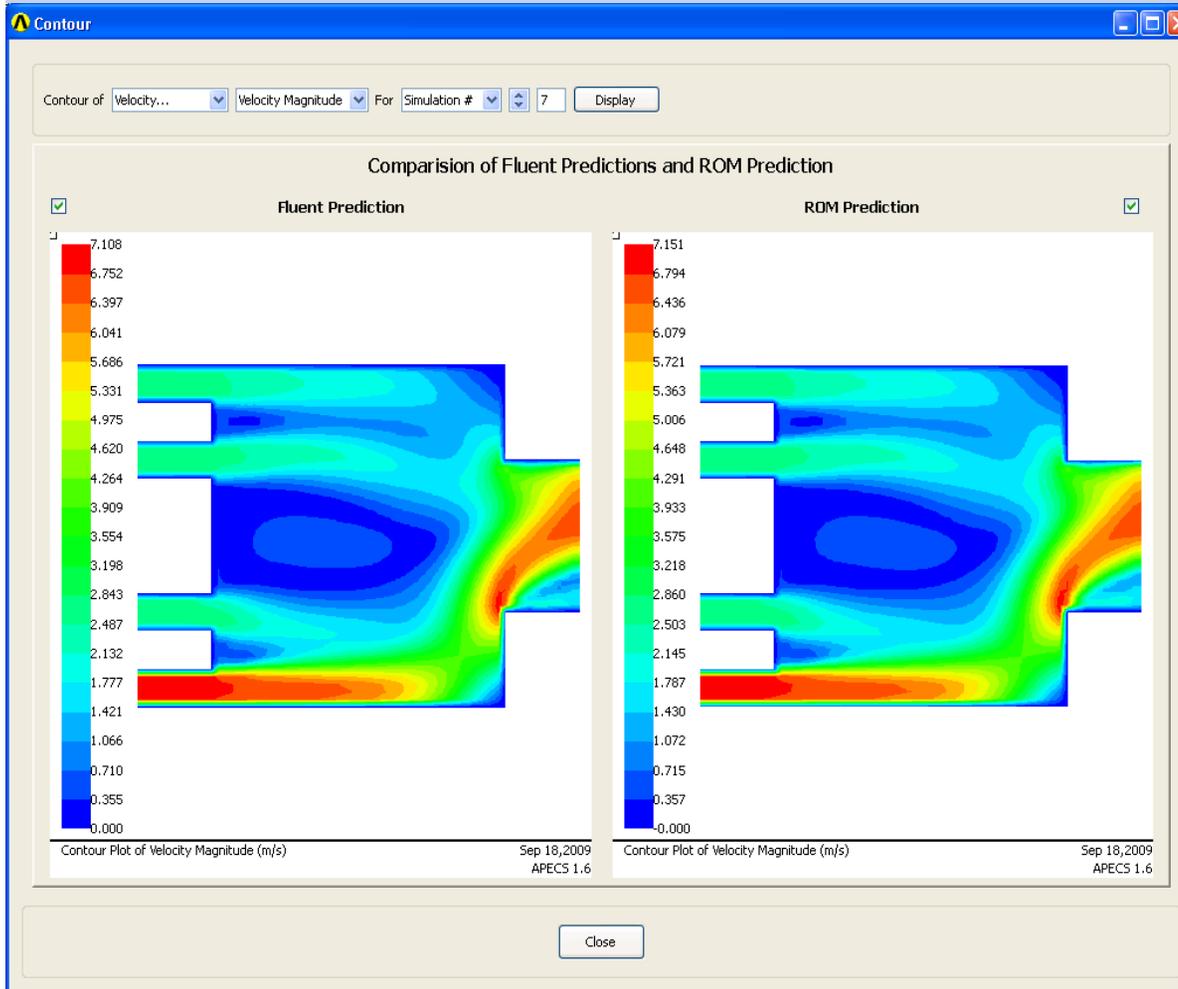
- **Unified user interface for selecting, configuring, and running CFD models**
- **Ability to specify (input) sample points manually or using DOE**
 - Latin Hypercube Sampling
- **Ability to rerun simulations that did not converge**
- **Ability to modify solution parameters (e.g., under-relaxation factors) and rerun simulations that did not converge**

ROM Builder Functionality (2)



- Ability to select solution variables for PCA ROMs
- Ability to specify computer(s) to run simulations
- Ability to use the parallel FLUENT solver
- Autosave functionality in case ROM Builder crashes

ROM Builder Functionality (3)



- Statistical tools for ROM accuracy evaluation
- Ability to compare ROM predictions and CFD predictions
- Comparison of contours generated by the CFD model and the PCA ROM

ROM Builder Functionality (4)



APECS Model

General | Ports | Parameters | Species | Solvers | Summary

Category: Reactors

Model Library: lebjwidmannpc.win.ansys.com:8180

Type: Combustors

Model Name: Berl combustor Regression ROM

Import from APECS DB | Import from COM/.Net Solver

Import from ASCII file | Import from Corba Solver

Model Description: non-premixed combustion with gas phase fuel stream; Linear Regression ROM

Save | Upload model to Database

Close

- Ability to upload ROMs to Model Database
- Can be combined with original FLUENT model for manual or automatic solution strategies

- **The APECS ROM Builder was developed to provide a user-friendly means of creating ROMs from CFD simulations**
- **Many features have been added to provide greater functionality and flexibility for the user**
- **DEMO**