Objectives and Agenda

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Multiphase Research Group

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Workshop on Multiphase Flow Research,
June 6-7, Morgantown, WV

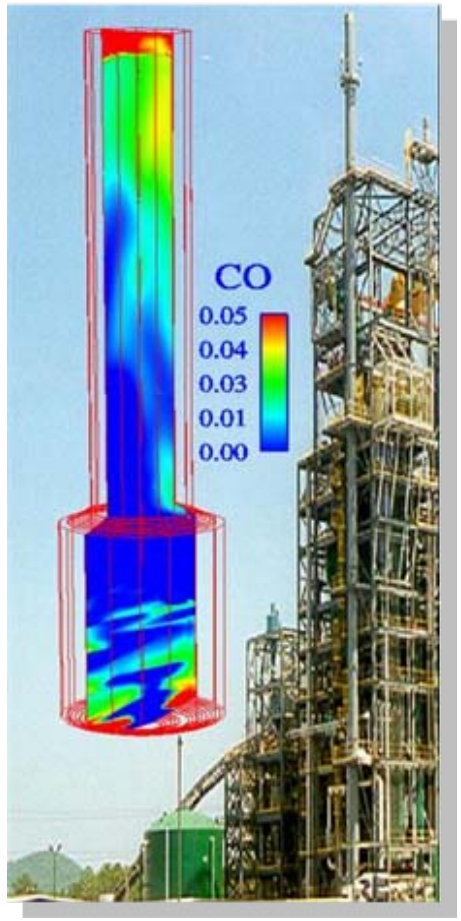
Vision

Ensure that by 2015 *multiphase* science based computer *simulations* play a significant role in the design, operation, and troubleshooting of multiphase flow devices in *fossil fuel processing plants*.

F*utureGen* graphics

Relevance of Multiphase Simulations

- Multiphase flow occurs in numerous fossil fuel processing devices
  - Gasifiers, chemical looping process, standpipe, coal storage, transport and feeding, CO_2 capture and sequestration, hot-gas cleanup, co-feeding coal with alternative feedstock, Shale oil extraction, Oxy-coal combustion, oxygen-free gasification, direct reduction of iron ore, Pulverized coal combustion, pneumatic conveying, transport and deposition of ash/slag, particle separation devices, biomass cofiring, transport desulfurizer, transport gasifier, Fischer-Tropsch reactor, coal-slurry feeder, slurry bubble column reactors, hydrocyclones, trickle bed reactors, absorbers, scrubber, fuel cell, bubble column reactor, air-lift reactors, FuturGen.
- Multiphase devices are difficult to scale-up; solids handling systems are unreliable
- "Computational Fluid Dynamics (CFD) … has much potential in predicting the effect of scale on hydrodynamics" [1]
  - Single phase CFD is a proven tool
  - Multiphase CFD on its way to becoming a reliable design tool
  - NETL already uses multiphase CFD for simulating commercial scale gasifiers



MFIX simulation of pilot scale KBR/Southern transport gasifier (Guenther 2005)

1. Knowlton, Karri, Issangya, Powder Technology, **150**, 72–77, 2005.

Challenges in Fossil Fuel Industry

- In next 20 years, 87 GW of *new* coal-based power generation is needed in US[1]
  - 174 new 500 MW plants[2]
  - Over $100 Billion investment[2]
  - Over $250 Billion of power generated[3]
- Aggressive targets for efficiency, availability, capital cost, and cost of electricity
- Near-zero emissions including CO_2
- Enormous R&D opportunities!

	Reference Plant	**2020 Plant**
Efficiency (HHV)	40%	**50-60%**
Availability	>80%	**≥90%**
Capital Cost, $/kW	1000 – 1300	**800 – 900**
COE, $/MWh	35	**<30**

1. Energy Information Administration, Annual Energy Outlook 2005 (reference case)
2. Klara and Shuster, "Coal's Resurgence in Electric Power Generation," March 2006.
3. Assuming a linear increase in generation, Cost of Electricity (COE) = $35/MWh
4. Table from Clean coal Technology Road map, 2004. Ref. Plant is one that can be built using current state-of-the-art technology and meets New Source Performance Standards

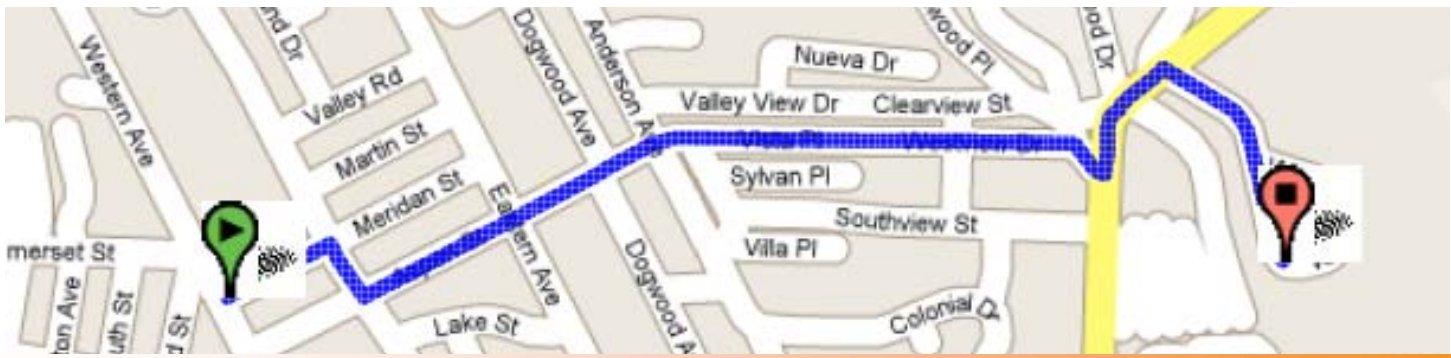
Vision

Ensure that by 2015 *multiphase* science based computer *simulations* play a significant role in the design, operation, and troubleshooting of multiphase flow devices in *fossil fuel processing plants*.

To achieve this vision we need integrated research in computations, theory, and experiments!

Workshop Objectives

- Discuss outstanding research problems in multiphase flow
- Develop an emerging technology roadmap
  - Establish the state-of-the-art *(starting point)*
  - Identify capabilities *needed* by 2015 *(destination)*
  - Describe technology development paths *(routes to get from the start to the destination)*
- Discuss collaborative research



Benefits

- **DOE**: Reduce the time and risk in developing advanced fossil fuel technologies by using multiphase CFD
- **Industry**: Multiphase CFD to satisfy a critical need in chemical, mineral, consumer products, petroleum, and pharmaceutical industries
- **University and National Labs**: Increased level of opportunities for collaborative research
- **CMFR**
  - Located at NETL, supported by the three local universities
  - Promotes collaboration among all US researchers
  - Leverages limited resources
  - Improves visibility and influences future R&D solicitations

Agenda – 1

Time	Title	Speaker/Leader
8:15-8:20	Welcome	C. Bauer (Director, NETL)
8:20-8:30	Workshop objectives and agenda	M. Syamlal (ORD-NETL)
8:30-9:15	NETL technology development direction and computational science needs	A. Cugini (Acting Associate Director, ORD-NETL)
9:15-9:45	Dense gas-solids flows and Granular flows	P. Mort (P&G) J. McCarthy (U. Pittsburgh)
9:45-10:15	Dilute Gas-Solids Flows	R. Patel (Exxon-Mobil), S. Subramaniam (Iowa State)
10:15-10:45	Break	
10:45-11:15	Liquid-solids/Gas-liquid flows	P. Ma (Air Products) R. Fox (Iowa State)
11:15-11:45	Computational Physics and Applications	R. Cocco (PSRI) C. Hrenya (U. Colorado)
11:45-12:00	Organization of tracks	Track chairs
12:00-1:00	Lunch	
1:00-2:30	Parallel technical track breakout sessions	Track chairs
2:30-3:00	5-minute track summaries to the whole group	Track chairs
3:00-3:30	Break	
3:30-4:30	Parallel technical track breakout sessions	Track chairs

Agenda – 2

Time	Title	Speaker/Leader
7:30-8:00	Breakfast	
8-8:15	Recap workshop objectives and day's agenda	
8:15-10:15	Presentations on the results of 4 breakout sessions by track chairs and moderated general discussion	T. O'Brien (NETL)
10:15-10:45	Break	
10:45-11:15	Integration of technical track presentations	D. Gidaspow (IIT) and S. Sundaresan (Princeton)
11:15-11:45	Vision for a Collaboratory on Multiphase Flow Research: presentation and discussion	W. Rogers (NETL)
11:45-12:00	Conference wrap up	
12:00-1:00	Lunch (on your own)	
1:00-2:30	Discuss follow up action items; attended only by the organizing committee.	Track chairs and discussion leaders
1:00-2:30	Optional NETL lab tour	

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Enjoy the Meeting!