

# BARRACUDA VIRTUAL REACTOR®


## USERS' CONFERENCE 2024

June 19 - 21, 2024 | W Chicago - Lakeshore



# Welcome

Thank you for attending the Barracuda Virtual Reactor Users' Conference 2024! Over the three days of the conference, you'll have opportunities to learn how others are using Virtual Reactor, network with Barracuda users and partners from around the globe, and meet with CPF D staff in-person. Our program includes presentations from industry, academia, technology providers, and CPF D's development team. Thank you for joining us in Chicago!

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## Agenda

### Wednesday, June 19

- 3:15 PM Registration
- 3:45 PM **Welcome**  
Sam Clark, CPF D Software
- 4:00 PM **Chevron Pascagoula FCC Regenerator Optimization via Modeling**  
Robert Montgomery, Chevron and Peter Blaser, CPF D Software
- 4:30 PM **Computational Particle Fluid Dynamics 3D Simulation of the Sorption-Enhanced Steam Methane Reforming Process in a Dual Fluidized Bed**  
Federico Monterosso, OMIQ on behalf of ENEA, NextChem, and SNAM
- 5:00 PM **CPF D Team Introduction**  
Rajat Barua, CPF D Software
- 5:15 PM **Adjourn**
- 5:30 PM **Reception**

## Thursday, June 20

- 8:00 AM      **Breakfast and Registration**
- 9:00 AM      **Enhancing Fluidization Design Using Computational Methods**  
John Zhizhong Ding, Shell Global Solutions
- 9:30 AM      **Modeling FCCU: Success and Challenges**  
Raj Singh and Scott Golczynski , Technip Energies
- 10:00 AM     **Improving the Hydrodynamics and Heat Transfer in Crude Oil Catalytic Cracking via a Novel Catalyst Formulation**  
Isa Al Aslani, King Abdullah University of Science and Technology
- 10:30 AM     **Break**
- 10:55 AM     **Successful Process Decarbonization in Cement Industry with Barracuda Virtual Reactor Computational Engineering**  
Martin Weng, aixprocess
- 11:25 AM     **CEMEX Rudniki Digital Design Twins Modeler (RDDT)**  
Jorge Pablo Garcia, CEMEX
- 11:55 AM     **Altair's Complementary Solutions for Modeling Particle-Fluid Systems**  
Jerrin Job Sibychan, Altair
- 12:10 PM     **Lunch**
- 1:10 PM      **Accelerating Advanced CFD Simulation through High-Performance Computing on Rescale**  
Madhu Vellakal, Rescale
- 1:25 PM      **CFD Analysis of Sand and Gravel Filling in Seabed Socket for Wind Turbine Tower**  
Frederik Zafiryadis, Aerotak
- 1:55 PM      **Fluidization's Role in the Scale-Up and Commercialization of Sustainability and Decarbonization Technologies**  
S. B. Reddy Karri, PSRI
- 2:25 PM      **Modeling CFP Catalyst Regeneration in BFCC Units**  
Bruce Adkins, Oak Ridge National Laboratory in collaboration with NETL

- 2:55 PM **Break**
- 3:20 PM **Simulation of a Novel Clean Hydrogen Process Using Virtual Reactor's New Vapor-Liquid-Solid Capabilities**  
Ahmed Mahmoud, Ally Power and Shashank Karra, CPF D Software
- 3:50 PM **CPF D Software Updates: Product, Support, R&D and Q&A**  
Sam Clark, Andrew Larson, and James Parker, CPF D Software
- 5:00 PM **Adjourn**
- 7:00 PM **Chicago River Dinner Cruise**

## Friday, June 21

- 8:00 AM **Breakfast**
- 9:00 AM **Breakout A: Introductory Training Workshop in Focus 2**  
Rosemary Clark and Tanner Stelmach, CPF D Software
- Breakout B: Advanced Training Workshop in Altitude**  
Sam Clark and Pramod Bangalore, CPF D Software  
Scott Fowler, Tecplot, Inc.
- Breakout C: In-Person Meetings with CPF D by Appointment**
- 10:20 AM **Break**
- 10:40 AM **Breakout A: Introductory Training Workshop in Focus 2**  
Rosemary Clark and Tanner Stelmach, CPF D Software
- Breakout B: Advanced Training Workshop in Altitude**  
Sam Clark and Pramod Bangalore, CPF D Software  
Scott Fowler, Tecplot, Inc.
- Breakout C: In-Person Meetings with CPF D by Appointment**
- 12:00 PM **Lunch and Adjourn**

# Presentations

## Robert Montgomery Chevron Products Company

### Chevron Pascagoula FCC Regenerator Optimization via Modeling

As part of Chevron's Pascagoula 2022 Turnaround planning, CPFDP Software was contracted to model several parameters of interest for the refinery. While the regen performance had been reliable and satisfactory since the 2006 revamp, the refinery decided to conduct a study to evaluate sensitivity and propose changes aimed at improving catalyst retention and combustion kinetics. In the spirit of "don't fix it if it's not broken," the rigorous modeling provided by CPFDP was used to reduce potential risk while delivering the desired results: reduced regen catalyst losses and improved afterburn.



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#### About the Speaker

Rob Montgomery is a senior FCC process engineer who supports the fluid catalytic cracking units in the Chevron refining system. He has over 25 years of experience in refining operations, troubleshooting, optimization, and technology development. He holds a BS degree in Chemical Engineering from Mississippi State University. Rob is a frequent presenter and author on topics related to FCC process safety, performance and reliability.

## Federico Monterosso OMIQ on behalf of ENEA, NextChem, and SNAM

### Computational Particle Fluid Dynamics 3D Simulation of the Sorption-Enhanced Steam Methane Reforming Process in a Dual Fluidized Bed

Aim of this work is the 3D simulation of the sorption enhanced steam methane reforming process in a dual fluidized bed reactor, by means of the Computational Particle Fluid Dynamics (CPFDP) method of the Barracuda Virtual Reactor® software. The simulation results in terms of solid flow, pressure balance and particle segregation are reported. A post-processing routine has been written to characterize bubbles in the two fluidized beds. The effects of bed inventory, superficial velocity and steam to methane ratio on hydrogen purity and methane conversion are discussed in the paper.



#### About the Speaker

Federico Monterosso graduated in Aerospace Engineering from the University of Rome many, many years ago. He spent some time as research fellow at the Imperial College of London (UK) and eventually joined the engineering simulation industry. He dedicated all of his career to Computational Fluid Dynamics, initially in a technical role and subsequently as a sales professional. In 2007, he cofounded OMIQ Srl in Milan, which is now the main reseller of Barracuda Virtual Reactor in Italy.

## John Zhizhong Ding Shell Global Solutions

### Enhancing Fluidization Design Using Computational Methods

To ensure that production requirements of the refinery are met and value is generated, it is essential to fully utilize the Fluidized Catalytic Cracking (FCC) capacity and maintain its reliability. To address reliability issues, Shell's fluidization group has been leveraging Computational Fluid Dynamics (CFD) technology in troubleshooting asset reliability issues and testing countermeasures to improve reliability. This paper showcases a collection of case studies that highlight the diverse applications of CFD in the oil and gas industry.



#### About the Speaker

Dr. John Zhizhong Ding is a Research and Development Engineer of the fluidization tech support and design group at Shell Catalysts & Technologies. He is a fluid dynamics specialist with extensive background in multiphase computational methods. He conducts CFD simulations and hydraulic modeling to model industrial units or equipment for process development and troubleshooting. He has a BS and PhD in Chemical Engineering with a focus on multiphase computational fluid dynamics along with 5 years of experience in equipment design, technology development and asset support.

## Raj Singh Technip Energies

### Modeling FCCU: Success and Challenges

Technip Energies actively uses computational fluid dynamics (CFD) tools for Fluid Catalytic Cracking (FCC) design optimization and for troubleshooting FCC operation. This paper will cover several case studies showing an effective use of CFD in FCC hardware design development, such as improved distributor for regenerators to reduce afterburn, optimized feed injector design parameters for increased conversion and yield enhancements, and validating the effectiveness of new riser termination devices for commercial applications. The challenges of modeling complex structures/internals, such as tube bundles in catalyst coolers, will be discussed as well.



#### About the Speaker

Raj oversees the High Olefins FCC Program at Technip Energies, which includes technology, project development and licensing activities. He has over 15 years of experience in FCC equipment design, technology development and troubleshooting. He has contributed to a wide range of projects including revamps, grassroots designs, process studies and proposals, CFD studies and FCC start-ups. Raj holds an MS in Chemical Engineering, with specialization in the field of multiphase flow and fluidization from the Illinois Institute of Technology, Chicago.

**Isa Al Aslani** King Abdullah University of Science and Technology

### Improving the Hydrodynamics and Heat Transfer in Crude Oil Catalytic Cracking via a Novel Catalyst Formulation

Our work investigated a method to improve the hydrodynamics and heat transfer in a multizone fluidized bed reactor for directly transforming crude oil into chemicals. We fabricated a novel catalyst by spray-drying and incorporating silicon carbide into the formulation, which has good microstructure, fluidization, and thermal conductivity properties. We evaluated this catalyst with a commercial benchmark for catalyst circulation and heat transfer by non-reactive CFPD simulations. Optimal operating conditions and catalyst loading values were suggested for the desired intermediate product of direct catalytic cracking in crude oil-to-chemicals.



#### About the Speaker

Isa Al Aslani is an Aramco-sponsored PhD candidate at the King Abdullah University of Science and Technology (KAUST), where he works on developing kinetic models for crude oil cracking. Before that, he was working on the crude oil-to-chemicals project at Aramco Research Center at KAUST with a one-year internship as a process engineer in the Fluid Catalytic Cracking (FCC) unit at Saudi Aramco Total Refining and Petrochemicals complex (SATORP).

**Martin Weng** aixprocess

### Successful Process Decarbonization in Cement Industry with Barracuda Virtual Reactor Computational Engineering

The cement industry contributes ~8% to global CO<sub>2</sub> emission, with ~50% from fuel emissions. Whilst substitution of fossil fuels by waste material plays a major role in CO<sub>2</sub> emission reduction, it significantly affects the pyro-process with changes in retention time requirements for burnout, fuel-air ratios, and increased levels of minor components. This presentation provides an example of Alternative Fuel process engineering in an existing South-American cement plant. Barracuda Virtual Reactor was applied to predict the reacting gas-solid flow behavior in the calciner part and engineer feeding points and necessary geometry adaptations.



#### About the Speaker

Martin combines engineering skills and entrepreneurship: while working as an assistant scientist in process engineering at Aachen University of Technology, he founded aixprocess company for technical consulting and simulation services in 2001. In the following years, he established aixprocess as one of the leading simulation providers in Germany, building up a team of more than 20 highly qualified experts for modeling and simulation. In 2015, Martin initiated the development of aixProM software platform for real-time Big Data Analytics and online process digitalisation.

## Jorge Pablo Garcia CEMEX

### CEMEX Rudniki Digital Design Twins Modeler (RDDT)

CEMEX's strategy of digitalization includes the use of Barracuda Virtual Reactor and other tools based on digital design twins to deploy novel technologies in the market, bringing the cement sector into the next digitalization level. This capability allows us to assess and deploy technologies in a digital frame connected to the operation in real time. At the same time, it enables us to learn state of the art digital parametrization of processes/technologies before building them in real life. Our digital design twin development has the objective to reduce our CO2 footprint through the improvement of combustion performance and maximizing alternative fuels usage. Our digital design twin will be installed in Mexico and connected to a facility in Poland to display their performance.



#### About the Speaker

Jorge Pablo has a MS in Chemical Engineering, and has been working in the cement industry since 2005. He is responsible for the evaluation, design, and definition of the Pyroprocess & Energy technology required for cement operational plants worldwide and for the CFD area at CEMEX.

## Jerrin Job Sibychan Altair

### Altair's Complementary Solutions for Modeling Particle-Fluid Systems

Granular materials and fluids are everywhere and present challenges to engineers looking to optimize their equipment design and processes. In this talk, we present a synergistic approach leveraging Altair's DEM and CFD solutions in partnership with CPM. Examples are shown for systems dominated by particle interactions, pure fluid dynamics, and coupled multiphase systems.



#### About the Speaker

Jerrin Job Sibychan is an Application Engineer at Altair focusing on DEM related applications. His main focus is on multiphase systems where coupling CFD technology with existing DEM models can give greater insight into the system behavior.



## Madhu Vellakal Rescale

### Accelerating Advanced CFD Simulation through High-Performance Computing on Rescale

The study investigates the advantages of employing Barracuda Virtual Reactor on Rescale, offering instant access to cutting-edge high-performance computing (HPC) resources. This presentation elucidates the remarkable performance enhancements achieved through Virtual Reactor's utilization of multi-GPU processing on Rescale, showcasing an extraordinary 500x acceleration compared to CPU performance.

Attendees of this conference will gain invaluable insights into leveraging advanced CFD simulations and HPC technologies for optimizing foundation designs, thereby advancing the efficiency and reliability of design performance.



#### About the Speaker

Madhu Vellakal is a Solutions Engineering Manager at Rescale. Madhu brings several years of experience in computational science, high-performance computing, analytics, and machine learning to Rescale. He is part of the AI Physics team at Rescale chartered with accelerating the adoption of AI technologies in CAE workflows. He received his Master's of Engineering from The University of Illinois Urbana-Champaign and has authored 10+ publications throughout his career.

## Frederik Zafiryadis Aerotak

### CFD Analysis of Sand and Gravel Filling in Seabed Socket for Wind Turbine Tower

This work employs CFD to simulate sand and gravel filling within a seabed socket, aiming to assess filling quality in terms of particle distribution uniformity, settled particle surface contour, and particle loss to surrounding water. Findings suggest the cost-effective top-filling method can replace complex and costly retraction approaches, with minimal particle escape. Integration of Virtual Reactor with Rescale expands the simulation capacity, enhancing business propositions, and delivering more valuable insights, while exceptional support from CPFD Software and Rescale improves project workflow, leading to significant time and cost efficiencies.



#### About the Speaker

Frederik Zafiryadis holds a Master's degree in Mechanical Engineering and a PhD in Chemical Engineering from the Technical University of Denmark (DTU), specializing in industrial fluid mechanics and computational fluid dynamics simulations of dilute particle-laden flow systems as well as fluidized beds. Since the completion of his PhD in 2022, on the topic of simulation of hydrodynamics of circulating fluidized beds using Virtual Reactor, he has been working as partner in the Danish engineering consultancy, Aerotak.

## S.B. Reddy Karri PSRI

### Fluidization's Role in the Scale-Up and Commercialization of Sustainability and Decarbonization Technologies

This presentation reviews current decarbonization technologies and emerging new processes. The role of particle technology, and fluidization specifically, is explored. Knowledge from experienced practitioners in particle technology will be critical to minimize scale-up risk and achieve successful designs. Strategic partnership with experts, targeted large-scale testing, and use of simulation, in conjunction with each other, are recommended to improve the likelihood of profitable commercialization.



#### About the Speaker

Reddy has 35 years' experience at PSRI and is a world-renowned expert in particle technology and fluid-particle systems. Reddy has written hundreds of internal reports in the area of fluid-particle systems and developed most of the tools available to the PSRI membership. He has been teaching PSRI's technical seminars to over 8000 industrial engineers from all over the world for the last 33 years. He has over 70 external publications and was awarded the prestigious AIChE Particle Technology Forum (Dow) Fluidization Processing Award.

## Bruce Adkins Oak Ridge National Laboratory in collaboration with NETL

### Modeling CFP Catalyst Regeneration in BFCC Units

Catalytic Fast Pyrolysis (CFP) is a promising technology for producing fungible transportation fuels from biomass in BFCC units. The biogenic coke that deposits on the catalyst is chemically different from petroleum derived coke, and unit designers must take the differences into account. The Consortium for Computational Physics and Chemistry (CCPC) has been investigating the combustion of biogenic coke on ZSM-5 based catalysts and has developed kinetics to model industrial scale regenerators. This presentation covers kinetics model development using COMSOL and lab scale experiments, and reactor scale modeling in Barracuda Virtual Reactor.



#### About the Speaker

Dr. Adkins has broad experience in the fuels and chemicals industry spanning four decades. He has worked for two refining catalyst companies in roles ranging from R&D to Commercial Technical Service. He has also worked in coal conversion and biofuels companies on catalyst development, process research and reactor design. He has extensive experience in testing, modeling and scaleup. Dr. Adkins has been part of ORNL and the Consortium for Computational Physics and Chemistry since November 2018.

## Ahmed Mahmoud Ally Power

### Simulation of a Novel Clean Hydrogen Process Using Virtual Reactor's New Vapor-Liquid-Solid Capabilities

Ally Power is revolutionizing clean hydrogen production, becoming one of the only hydrogen production processes that is a net producer of electricity. Ally Power's Hydrogen and Electric Refueling Station (HERS) utilizes a chemical reaction process between a solid and liquid material feed to generate clean hydrogen, heat (electricity) and a byproduct that's used in several different industries such as cement and wastewater treatment. This presentation showcases how Barracuda Virtual Reactor plays an instrumental role in simulating the liquid, gas and solid phases of Ally Power's chemical reaction process.



#### About the Speaker

Ahmed is a board member and COO at Ally Power where he oversees commercialization and operations of Ally Power's novel clean hydrogen production technology. Ahmed plays a vital role at Ally Power, orchestrating and managing technical teams for the development of the Hydrogen and Electric Refueling Station (HERS) MVP, pilot and commercial PoC. Over the past 10 years, Ahmed has engaged in business development, operations, and manufacturing in a wide range of industries such as healthcare & life sciences, advanced technologies, energy, and industrial manufacturing.

## Scott Fowler Tecplot

### Advanced Training Workshop

This workshop will delve into recent additions to Barracuda Virtual Reactor and updates in Tecplot for Barracuda. Advanced post-processing using PyTecplot will be demonstrated.

#### About the Speaker

As Tecplot Product Manager, Scott is a natural problem solver and sees things from a customer perspective. He strives to understand where the CFD and aerospace markets are going, gathers customer feedback, and makes sure Tecplot develops products to meet those needs. Scott naturally stepped into the Product Management role after his tenure as the lead product architect for both products he now manages (Tecplot 360 and Tecplot Focus). Scott joined Tecplot in 2005 after receiving his Bachelor of Science in Electrical Engineering from the University of Washington.



# Events

## Wednesday Night Reception

Join us for drinks and appetizers on Wednesday night! The reception will be from 5:30 to 7:00 pm on the 6<sup>th</sup> floor of the W Chicago – Lakeshore.

Navy Pier sets off fireworks at 9:00 pm. Enjoy them from the hotel or at the pier.



## Thursday Night Dinner Cruise

CPFD invites you to join us for a dinner cruise on Thursday 7 to 10 pm for an evening of networking, wonderful Chicago views, and great food! Board near NBC Tower at 455 N Cityfront Plaza Dr, about half a mile from the W Chicago - Lakeshore. Dress attire is casual. Scan the QR code for a brochure with information about all of the great architecture we will see as well as detailed directions/map to the boarding location and nearby parking options if needed.



# Breakout Sessions

Friday morning is your opportunity to actively participate, learn more about Barracuda Virtual Reactor, and connect with CPF D Software team members in-person. We encourage all attendees to take advantage of the breakout session options.

If you wish to attend one of the training workshops, bring a laptop to participate in the hands-on exercises. We recommend using a 3-button mouse for ease of interacting with the Virtual Reactor and Tecplot for Barracuda GUIs.

Thanks to our training workshop sponsors for their contributions!

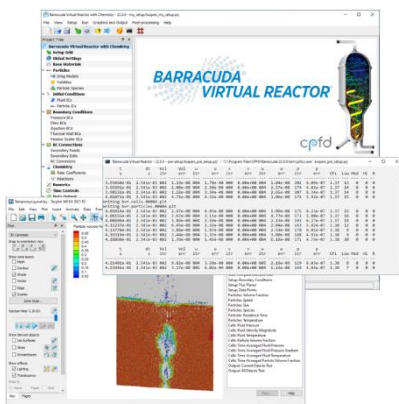


CPF D is grateful to Rescale for providing cloud-based Linux Workstations for attendees to use during the workshop. The Rescale Workstations are GPU-accelerated and allow for high-performance computing resources to be accessed directly from your web browser.

We are pleased to welcome Scott Fowler from Tecplot, Inc., who is co-leading the Advanced Training Workshop to present several post-processing topics that Virtual Reactor users are sure to find valuable for increasing their efficiency and effectiveness.

CPF D also thanks PSRI for providing A/V support and other information technology assistance to help make these training workshops a success.

## Breakout A: Introductory Training Workshop



**Location:** Focus 2 meeting room on the 7<sup>th</sup> Floor

**Instructors:** Rosemary Clark and Tanner Stelmach, CPF D Software

If you are new to Barracuda Virtual Reactor and have never attended our New User Training Class, we encourage you to attend this Introductory Training Workshop. The workshop will include an Introduction to Barracuda Virtual Reactor presentation and a hands-on training example where you will set up a basic Virtual Reactor simulation from start to finish.

## Breakout B: Advanced Training Workshop

**Location:** Altitude meeting room on the 33<sup>rd</sup> Floor

**Instructors:** Sam Clark and Pramod Bangalore, CPF D, and Scott Fowler, Tecplot, Inc.

For current users of Barracuda Virtual Reactor who have previously attended our New User Training Class, we invite you to join us for this Advanced Training Workshop. We will highlight important new features from the past several releases of Virtual Reactor, and provide opportunities for hands-on exploration of Barracuda's latest developments.

Additional post-processing training will be led by Scott Fowler from Tecplot, Inc. Topics covered will include advanced features in Tecplot for Barracuda, using PyTecplot for custom post-processing, and automation of analysis tasks.



## Breakout C: In-Person Meetings with CPF D by Appointment

**Location:** Arranged on a case-by-case basis

CPF D Software team members are available to meet in person on Friday morning by appointment. We want to hear from you! Tell us about your successes using Virtual Reactor, let us know how we can help, and share any feature requests you have to make Barracuda even more useful and valuable for your work.

To schedule a private meeting, sign up at the registration desk in the Altitude meeting room (33<sup>rd</sup> floor). Meeting times and locations will be determined based on availability on a first come, first served basis.



# Partners & Sponsors



## Applying the Fundamentals: The PSRI Advantage

### Solving Granular and Granular-Fluid Problems for 54 Years

PSRI, a CPF D Strategic Partner, is a research consortium for companies seeking solutions to their granular-fluid problems. Our members come from varying industrial sectors and from all over the world, but all have a common interest in understanding why particles do what they do and how to engineer around that understanding to meet business needs. In short, PSRI understands what the challenges are because they know the fundamentals and how to apply those fundamental to commercially relevant solutions and we have been doing it for over 54 years. CPF D has been a member of PSRI since 2006.



Since 1971, PSRI has amassed a prolific amount of design data, technology, know-how, design criteria and models on all aspects of slurries, liquid injection, fluidization, entrainment, pneumatic conveying, attrition, erosion, distributor design, standpipes, solids transfer, and circulating fluidized beds. From the data produced, PSRI has developed design correlations, models, procedures, methods and techniques which are among the best and most useful in the field. PSRI is the place to get the solutions for particle technology problems.



*CPF D Software is grateful to PSRI for being a long-time valued partner and our A/V sponsor for the 2024 Barracuda Virtual Reactor Users' Conference!*



Rescale enables Barracuda Virtual Reactor users to leverage AI-powered cloud high performance computing (HPC) when accelerating innovation for engineering and scientific research teams. Rescale's turnkey cloud HPC platform offers robust data security, intelligent controls, and a seamless AI-driven experience. CPFD users across the globe are pushing boundaries on Rescale by integrating compute-intensive simulations and physics-based AI tools. Their groundbreaking work spans testing product performance across various dimensions, accelerating time-to-market, and achieving uncanny precision in computational science and engineering for energy, manufacturing, and other industries.



Tecplot, Inc. is the leading post-processing software developer in CFD data visualization. We believe visual analysis is the key to unlocking information hidden in complex data, leading to world-changing discoveries and innovation. Not only do we empower engineers and scientists to visualize, analyze, and understand information in simulation and test data results, but through our high-resolution images and animations, we help them clearly communicate their results to stakeholders. Barracuda Virtual Reactor is enhanced with visualization software from Tecplot, Inc.



Mark III Systems, an NVIDIA NPN Elite and CPFD Partner, has partnered with NVIDIA and CPFD to build a Barracuda Virtual Reactor appliance (powered by NVIDIA GPUs) to accelerate the time-to-value and simplify the onboarding and ongoing user experience for organizations leveraging Barracuda Virtual Reactor and simulation to transform their work. Regardless of if you need to run Barracuda Virtual Reactor quietly under your desk on an RTX-based workstation or with maximum multi-GPU parallelization in the datacenter with NVIDIA DGX server, Mark III can customize a bundled package for you with Barracuda Virtual Reactor and NVIDIA GPUs, complete with white glove services for installation onsite at your office or datacenter, or custom pre-staging and pre-integration at Mark III's Global Integration Center in Houston, TX, based on your unique requirements.



GTI Energy is a leading technology development organization. Our trusted team works to scale impactful solutions that shape energy transitions by leveraging gases, liquids, infrastructure, and efficiency. We embrace systems thinking, innovation, and collaboration to develop, scale, and deploy the technologies needed for low-carbon, low-cost energy systems.





Altair is a global leader in computational science and artificial intelligence (AI) that provides software and cloud solutions in simulation, high-performance computing (HPC), data analytics, and AI. Altair enables organizations across all industries to compete more effectively and drive smarter decisions in an increasingly connected world – all while creating a greener, more sustainable future. Altair customers using Altair Partner Alliance solutions can now enjoy instant-access to Barracuda Virtual Reactor, expanding Altair’s modeling capabilities and directly complementing their EDEM discrete element method software.



As an NVIDIA Elite Partner and recognized as 2024 NPN Solution Integration Partner of the Year, Exxact is committed to providing end-to-end NVIDIA AI and high-performance computing solutions that accelerate innovation and address intricate challenges. Exxact solutions are meticulously benchmarked using a variety of GPUs and configurations so you can accurately predict the performance of our systems based on your specific requirements. Whether you’re working with small-scale models or tackling large, complex simulations, Exxact delivers the right solution that balances power and cost, ensuring optimal efficiency for your CPFD projects.



NVIDIA’s invention of the GPU sparked the PC gaming market. The company’s pioneering work in accelerated computing—a supercharged form of computing at the intersection of computer graphics, high performance computing and AI—is reshaping trillion-dollar industries, such as transportation, healthcare and manufacturing, and fueling the growth of many others. Barracuda Virtual Reactor leverages NVIDIA’s hardware and CUDA® parallel computing platform for GPU and multi-GPU parallelization.

# The Team in Attendance



**Pramod Bangalore** Senior CFD Engineer

Pramod joined CPFD in 2023 and has worked as a CFD engineer in various industries, including modeling cement plant units, solid oxide fuel cell systems, consumer power tools, and consumer goods. He received an MS in Mechanical Engineering from the Missouri University of Science and Technology.



**Rajat Barua** President and CEO

Rajat Barua is President and CEO of CPFD Software. He has 26 years of industry experience in roles that span engineering, operations, finance, sales and marketing. Prior to his current role, he served as CEO of Senscient, Inc., Vice President at Lime Rock Partners, and field engineer at Schlumberger. Rajat is a Chemical Engineering graduate of McGill University and holds an MBA degree from Harvard University.



**Peter Blaser** Vice President of Operations

Peter is Vice President of Operations at CPFD Software with 25 years' experience developing and applying specialized CFD technologies. Peter is passionate about removing the guesswork surrounding the design and operations of fluid-particle processes via intelligent use of digitalization technology. Peter holds a Master's of Applied Science degree from the University of Toronto, and joined CPFD in 2003.



**Suraj Chowdhury** IT Infrastructure and Operations Director

Suraj is CPFD Software's IT Infrastructure and Operations Director with direct responsibility for operations, finance, and IT functions. Suraj holds an MBA Degree in Finance, a Master of Science in Computer Engineering, and Salesforce CRM certifications. Suraj is currently pursuing his Chief Technological Officer Program Certification from Massachusetts Institute of Technology (MIT), Cambridge.



## **Rosemary Clark** Senior Support Engineer

Rosemary is a Senior Support Engineer and has been at CPF D since 2015. She has experience supporting Barracuda Virtual Reactor users, creating training materials and documentation, leading training classes, utilizing Barracuda for engineering projects, and creating CAD models. Rosemary has a BS in Chemical Engineering from New Mexico Institute of Mining and Technology.



## **Sam Clark** Barracuda Virtual Reactor Product Manager

Sam has been with CPF D since 2008, and is an expert at simulating thermal, reacting, multiphase gas-particle systems with Barracuda Virtual Reactor. As Product Manager, he works closely with CPF D's development team to make Virtual Reactor the best tool possible for our users. Sam holds an MS in Chemical Engineering from the University of New Mexico.



## **Paul Earhart** Senior Software Engineer

Paul is a Senior Software Engineer and Scrum Master for CPF D Software's development team. He is a software professional with decades of experience and a passion for quality, process and design. Joining CPF D in 2020, he focuses on delivering high-quality features and a stream-lined user experience for Virtual Reactor. Paul has a BS in Computer Science from Michigan State University.



## **Shashank Karra** Applications Development Manager

Shashank is an applications development manager at CPF D software responsible for broadening application areas for Barracuda Virtual Reactor. He has over 18 years' experience in thermal-fluid and CFD applications, solving complex thermal-fluid problems in pipes, wellbores, porous structures, and other oil & gas applications. Shashank has a PhD in Mechanical Engineering from Oregon State University.



## **Andrew Larson** Principal Software Engineer, GPU Specialist

Andrew began work on GPU acceleration of Barracuda Virtual Reactor version 16 in 2012, and since then has implemented multi-GPU calculations. Andrew's work impacts the full product stack and product quality as the Principal Software Engineer. Andrew earned two Master's from the University of Minnesota Duluth, one in Applied and Computational Mathematics and another in Computer Science.



## **Hoan Larson** Software Testing and Automation

Hoan started to work with CPF D in 2022; her role at CPF D is Software Testing and Automation after recently earning an MBA from Drake University in Data Analysis. Prior to CPF D, she worked in education, where she spearheaded the setup of a collaborative university program between Vietnam's first private company FPT and Greenwich University.



## **Peter Loezos** Vice President of Engineering

Peter is CPF D's Vice President of Engineering, with 20 years of experience in the development and commercialization of new processes for the refining and petrochemical industries. His previous experience includes technology development roles in ExxonMobil, SABIC and Lummus Technology. Peter has a PhD in Chemical Engineering from Princeton University.



## **Niraj Mehta** Solutions Engineer

Niraj joined CPF D Software as a Software Engineer in 2019. Originally working on the Virtual Reactor development team, Niraj now works in account management and business development. Niraj holds a BA in Applied and Computational Mathematics from the University of Southern California and is currently pursuing an MS in Computer Science from the Georgia Institute of Technology.



## **James Parker** Chief Technology Officer

James oversees the software development of Barracuda Virtual Reactor and CPF D's computational research of multiphase modeling techniques. Prior to his appointment as CTO, James used Barracuda Virtual Reactor on a wide range of projects for refining, polyolefin, biomass, coal, and polysilicon applications. James has a PhD in Chemical Engineering from Oregon State University.



## **Tanner Stelmach** CFD Engineer

Since joining the team in 2023, Tanner has worked as a CFD Engineer on commercial projects, contributed to the CPF D support and training teams, and supported the development of Virtual Reactor through testing and validation. Tanner received his Bachelor's degree in Chemical Engineering from the University of Colorado.



## **Bryan Tomsula** Technology Manager

Bryan serves as Technology Manager for CPF D Software with 15 years of experience in the refining and petrochemical industries. His focus to date has been in various technology development, scale-up and licensing roles in the fields of fluid catalytic cracking, hydroprocessing and gasification. Bryan holds a BS degree from the University of Colorado in Chemical and Biological Engineering.



## **Pinghua (Paul) Zhao** Senior R&D Engineer

Paul is a senior research and development engineer at CPF D Software for over eighteen years. He participates in the solver development of new physics and features and maintenance for Barracuda Virtual Reactor. Paul received his Bachelor and Master degrees in Engineering from Tsinghua University, China and his PhD in Mechanical Engineering from the University of Arizona, USA.

# Attendees

## Attendee

Benjamin Jacobs  
Frederik Zafiryadis  
Martin Weng  
Andrew Loebel  
Walt Alfred  
Zaryab Choudhry  
Ahmed Mahmoud  
Karthik Datta  
Jerrin Job Sibychan  
Kory Soukup  
Michael Allegro  
Yorklin Yang  
Raj Venuturumilli  
Steve Forry  
Jorge Pablo Garcia  
Carlos Marquez  
Rob Montgomery  
Navraj Hanspal  
Michael Molnar  
Song Wang  
Tony Eastland  
Dexin Wang  
Alexandre Kokourine  
Sid Kulprathipanja  
Reza Mostofi  
Ling Zhou  
Pramod Kumar  
Lucas Massaro Sousa  
Isa Al Aslani

## Company

ACT-ion Battery Technologies  
Aerotak  
aixprocess GmbH  
Albemarle Corporation  
Ally Power  
Ally Power  
Ally Power  
Altair  
Altair  
Altair  
BASF  
BASF  
BP  
CECO Emtrol-Buell  
CEMEX  
CEMEX  
Chevron  
Corteva Agriscience  
Dow Silicones Corporation  
Encina  
GTI Energy  
GTI Energy  
Hatch  
Honeywell  
Honeywell  
Honeywell  
HPCL  
IFPEN  
KAUST



## Attendee

Matthew Black  
Mark Jackson  
Matt Nierman  
Madhu Vellakal  
Phillip Niccum  
Chen Demin  
Yan Hongming  
Chen Meili  
Guo Shuping  
Wang Xiaowei  
Robert Culp  
John Ding  
Jennifer Chinen  
Zachary Wadas  
Gocha Chochua  
Scott Golczynski  
Raj Singh  
Scott Fowler  
Keshav Ramchandran  
Quan Yuan  
Abdulrahman Alzailaie  
Embark Alshaafi

## Company

Purdue University  
Rescale  
Rescale  
Rescale  
Self-employed  
Shaanxi Xinli Injector  
Shaanxi Xinli Injector  
Shaanxi Xinli Injector  
Shaanxi Xinli Injector  
Shaanxi Xinli Injector  
Shell  
Shell  
Simonpietri Enterprises  
Simonpietri Enterprises  
SLB  
Technip Energies  
Technip Energies  
Tecplot, Inc.  
Texas A&M University / CPFD Intern  
The Dow Chemical Company  
University of Wisconsin - Madison  
Western University



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