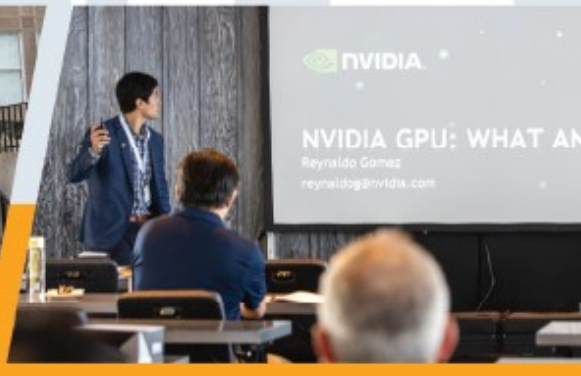
BARRACUDA VIRTUAL REACTOR®

USERS' CONFERENCE 2022

June 29 - July 1, 2022 | W Chicago - Lakeshore



cpfd

Welcome

Thank you for attending the Barracuda Virtual Reactor Users' Conference 2022! 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 CPFD staff in-person. Our program includes presentations from industry, academia, technology providers, and CPFD's development team. Thank you for joining us in Chicago!

WiFi

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Agenda

Wednesday, June 29

3:00 PM **Registration**

3:45 PM **Welcome**
Peter Blaser, CPFD Software

4:00 PM **Entrainment Reduction: Modeling and Plant Results**
Sibashis Banerjee, Tronox

4:25 PM **Making Multi-GPU Simulation Accessible to All with NVIDIA DGX A100**
Andy Lin, Mark III Systems

4:50 PM **NVIDIA DGX Station A100 Benchmarks and Customer Experience**
Sibashis Banerjee, Tronox

5:00 PM **NVIDIA DGX Station A100 Demonstration**
Sam Clark and Peter Blaser, CPFD Software

5:20 PM **Adjourn**

5:30 PM **Reception Sponsored by Mark III Systems and NVIDIA**

Thursday, June 30

7:30 AM **Breakfast and Registration**

8:30 AM **Welcome**
Peter Blaser, CPFD Software

8:35 AM **CPFD Simulation of Pilot-Scale CFB Riser for Cracking of Sugar to Glycolaldehyde and Other Oxygenates: Coupling Hydrodynamics and Reaction Kinetics**
Frederik Zafiryadis, Technical University of Denmark, Haldor Topsøe

9:00 AM **Optimizing FCC Riser Termination Device Design and Performance Using Barracuda**
Raj Singh, Technip Energies

9:25 AM **Pressurized Gas-Solid Feeder for Biomass Injection into Gas-Solid Fixed and Fluidized Beds**
Sina Tebianian, IFP Energies nouvelles

9:50 AM **Break**

10:20 AM **Combining Barracuda Modelling and Cutting-Edge Positron Imaging of Gas-Fluidised Beds: Toward the Design Optimization of Novel Plastic Recycling Technologies**
Kit Windows-Yule, University of Birmingham, Recycling Technologies

10:45 AM **Fluidized Bed Reactor Application for Catalytic Pyrolysis of Waste Plastic**
Song Wang, Encina

11:10 AM **Realistic Models Require Realistic Boundary Conditions**
Ray Cocco, PSRI

11:35 AM **Strategies to Improve 3D Simulation Accuracy Using 1D Simulation for CFB Boilers**
Uendo Lee, Korea Institute of Industrial Technology

12:00 PM **Lunch**

1:20 PM **A First-Ever Innovative Brown-Field Modification in Conservative Cement Industry - De-Risked by Smart Simulation**
Martin Weng, aixprocess

1:45 PM **CPFD Software R&D Update**
James Parker, CPFD Software

2:10 PM **The Benefits of NVIDIA for Barracuda Virtual Reactor**
Reynaldo Gomez, NVIDIA

2:35 PM **Scaling Performance of Barracuda Virtual Reactor on Azure**
Ahmed Taha, Microsoft Azure

3:00 PM **Break**

3:30 PM **Advanced Analysis with Tecplot 360**
Scott Fowler, Tecplot

3:55 PM **Barracuda Virtual Reactor: Product, Training, and Support Updates**
Sam Clark, CPFD Software

4:20 PM **Q&A and Open Discussion**

4:45 PM **Adjourn**

6:00 PM **Dinner at Pinstripes**

Friday, July 1

8:00 AM **Meetings with CPFD Software by Appointment**

12:00 PM **Adjourn**

Presentations

Sibashis Banerjee Tronox

Entrainment Reduction: Modeling and Plant Results

This talk will cover the use of modeling to reduce entrainment at Tronox unit operations. In particular, the talk will focus on using modeling with CPFD software to diagnose the cause of high entrainment in the aluminum chloride generator and subsequent rapid iteration on various designs to reduce entrainment by over 75%. This reduction in entrainment increased the availability of the downstream equipment and reduced maintenance costs. The talk will also cover the recent experience at Tronox with the NVIDIA DGX workstation.

About the Speaker

Sibashis is currently a Principal Process Improvement Engineer at Tronox with over twenty years of experience in the TiO_2 industry with focus on design and troubleshooting of multiphase unit operations. Sibashis led a DOE project to incorporate heat transfer and chemistry into Barracuda. He holds a PhD and master's in Nuclear Engineering as well as a bachelor's in Mechanical Engineering.

Andy Lin Mark III Systems

Making Multi-GPU Simulation Accessible to All with NVIDIA DGX A100

Barracuda Virtual Reactor is the industry-standard tool for simulating fluidized bed reactors (FBRs) for many applications in refining, petrochemicals, cement manufacture, power generation, and other energy-intensive industries. The complexity of FBR simulation lends itself well to acceleration via GPU computing. Virtual Reactor utilizes NVIDIA's multi-GPU computing technology to achieve 50-400x speedups over serial processing. This session demonstrates how the NVIDIA DGX A100 provides multi-GPU compute capabilities to everyday software users, in a form factor that fits under a desk or compactly in the data center. Week-long simulations can now be completed in an hour, and previously intractable problems are now solved in industrially relevant time scales.

About the Speaker

Andy Lin is VP of Strategy & Innovation at Mark III Systems, an NVIDIA NPN Elite and CPFD partner, with a strong focus and unique team partnering around accelerated computing strategies for the enterprise, including AI/ML, HPC, simulation, visualization, and virtualization workloads. Mark III's unique "full stack" team comprises of systems engineers, data scientists, devs, and DevOps/MLOps engineers that work

together to ensure the success of organizations, including those deploying and operating Barracuda Virtual Reactor on NVIDIA platforms.

Frederik Zafiryadis Technical University of Denmark

CPFD Simulation of Pilot-Scale CFB Riser for Cracking of Sugar to Glycolaldehyde and Other Oxygenates: Coupling Hydrodynamics and Reaction Kinetics

The success of the circulating fluidized bed (CFB) and reactor riser within the fluid catalytic cracking process has spurred additional use of these designs in emerging research fields such as processes for cracking of sugars. Here, an aqueous solution of sugars is sprayed into the reactor undergoing a fast pyrolysis type process in order to yield glycolaldehyde and other oxygenate products such as pyruvaldehyde, acetol, and formaldehyde. The technology has the potential to enable economically and environmentally sustainable production of bio-based chemicals.

The current study presents a computational particle fluid dynamics (CPFD) model for simulating the sugar cracking reaction in a pilot-scale riser. The model comprises of a previously validated hydrodynamic model coupled with a liquid injection, dispersion, and evaporation model and a homogeneous reaction kinetics model for handling the sugar cracking process. From optical measurements of droplet size distribution in ambient, quiescent conditions, a modified Rosin-Rammler droplet size distribution is proposed to accurately represent the gas-liquid jet in the simulations and obtain a sufficient level of agreement with pilot-plant data of pressure and temperature.

The ability of the gas-phase sugar cracking model within the framework of the CPFD model to predict the yields of glycolaldehyde and other oxygenates is evaluated by comparing simulated and experimental yields of the pilot-scale riser. Coupling the detailed hydrodynamics of the gas-liquid jet-dominated feed injection zone with the riser hydrodynamics and the homogeneous kinetics model is found to yield sound predictions for the overall hydrodynamic and thermal behavior of the system. Accurate yield predictions of oxygenates will require further work and improvements to the kinetic model.

About the Speaker

Frederik Zafiryadis holds a master's degree in mechanical engineering from the Technical University of Denmark (DTU), specializing in industrial fluid mechanics and computational fluid dynamics simulations of dilute particle-laden flow systems.

Since March 2019 he has been enrolled as a PhD student at the Chemical Engineering Department at DTU in collaboration with Haldor Topsøe, investigating and modeling the hydrodynamics of circulating fluidized beds, specifically looking at modeling of circulating fluidized beds for cracking of sugar into glycolaldehyde-rich oxygenates.

Raj Singh Technip Energies

Optimizing FCC Riser Termination Device Design and Performance Using Barracuda

Computational modeling plays an increasingly important role in understanding gas and particle flow dynamics in the Fluid Catalytic Cracking (FCC) process, enabling refiners to consider low-risk and high value improvements to their FCCUs. Technip Energies actively uses computational fluid dynamics (CFD) tools for FCC design optimization and for troubleshooting FCC operation. CFD provides adequate information required to understand and determine how hardware modifications and operational changes will impact gas-particle flow behavior and hence the overall performance of the unit. The paper provides various case studies on FCC riser / riser termination device (RTD) section, discussing the significance of modeling tools to effectively screen and evaluate design changes. This paper describes how modeling tools were used to confirm the adequacy of the proposed hardware changes, fine tune the design and evaluate the performance to minimize the potential risks on startup.

About the Speaker

Raj has 18 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, PDP/FEED packages, CFD studies, FCC proposals and unit startups. He has developed several mathematical / CFD models with applications towards coke combustion, cyclone operation, riser termination device performance, catalyst flow in strippers and standpipe behavior. He has been with Technip Energies (formerly Stone & Webster) for the last 15 years and is currently responsible for the High-Olefin FCC Program, including technology, business development and licensing. Raj has an MS in chemical engineering, with specialization in the field of multiphase flow and fluidization from the Illinois Institute of Technology, Chicago. He is a recipient of several patents and has published / presented several papers.

Sina Tebianian IFP Energies nouvelles

Pressurized Gas-Solid Feeder for Biomass Injection into Gas-Solid Fixed and Fluidized Beds

Efficient feed injection into multiphase reactors for waste biomass conversion is crucial for assuring the process performance. In this work, a pressurized gas-solid feeder is utilized to inject a batch of sawdust powders into a fixed and fluidized bed cold-flow unit. The hydrodynamic features associated with biomass transportation by pressurized gas are characterized at different operating conditions through experimentation with a high-speed camera and CFD modelling. The operation map for this pulsed feeder was built by combining physical parameters that result in a certain transport flow regime in the injection

line. The experimental results were compared with model predictions and the effect of different model parameters was investigated.

About the Speaker

Dr. Sina Tebianian obtained his PhD in fluidization at University of British Columbia under supervision of Prof. John Grace. Currently he works as research engineer at IFPEN on design and scale-up of several processes such as High-Severity FCC, biomass pyrolysis, chemical looping combustion and plastic recycling. He also performs fundamental research activities in the field of fluidization, supervising Master students, PhD candidates and Postdoc fellows.

Kit Windows-Yule University of Birmingham

Combining Barracuda Modelling and Cutting-Edge Positron Imaging of Gas-Fluidised Beds: Toward the Design Optimization of Novel Plastic Recycling Technologies

The plastic waste crisis is one of the great global challenges facing contemporary society. This talk concerns a novel, fluidised-bed-based plastic recycling system, detailing the synergistic use of MP-PIC modelling and positron emission particle tracking (PEPT) experimentation as a means to gain insight into the hydrodynamics of these complex systems, and thus develop their capabilities and optimise their performance.

In the talk, we will provide an overview of the most recent results of an ongoing, long-term funded collaboration between the University of Birmingham and industrial partners Recycling Technologies Ltd., discussing: the acquisition of PEPT data from both laboratory experiments and unique on-site campaigns at Recycling Technologies' HQ; the use of the detailed, three-dimensional flow fields acquired to rigorously calibrate and validate Barracuda models of these systems; the use of these, alongside real process data, to create models of full, industrial-scale systems; and the use of Barracuda models at all scales to gain detailed, novel insight into the dynamics of the systems' hydrodynamics, and how this new knowledge is being used to develop, improve and optimise the plastic recycling process

About the Speaker

Dr. Kit Windows-Yule is a lecturer in the University of Birmingham's School of Chemical Engineering, working jointly in the School of Physics and Astronomy's Positron Imaging Centre, a Turing Fellow, and a two-time Royal Academy of Engineering Industrial Fellow. His research interests concern the imaging and numerical modelling of particulate and multiphase systems, employing a diverse range of techniques including X-Ray Tomography, Particle Tracking Velocimetry (PTV), Multi-Phase Particle-in-Cell (MP-PIC) and Discrete Element Method (DEM) modelling, Computational Fluid Dynamics (CFD), and most notably Positron Emission Particle Tracking (PEPT). His research aims to address significant contemporary challenges in science, medicine, and industry by exploiting the synergy of experimental techniques, numerical simulation, and machine-learning methodologies.

The ubiquity of particulate media and the versatility of the techniques used by Dr. Windows-Yule mean that his research spans multiple disciplinary boundaries, facilitating a highly diverse research portfolio. Current projects include work, funded by EPSRC, the Royal Academy of Engineering and the Royal Society, developing novel plastic recycling methods, work funded by the British Heart Foundation aiming to develop novel methods of blood-flow imaging for the diagnosis of cardiovascular disease, and diverse industry-funded projects in the pharmaceutical, food, agriculture, chemical, personal care and green energy sectors with companies including AstraZeneca, GlaxoSmithKline, Mondelez, Johnson Matthey, Unilever and the French Petroleum Institute's Energies nouvelles arm.

Song Wang Encina

Fluidized Bed Reactor Application for Catalytic Pyrolysis of Waste Plastic

Plastics are found in almost all products today, and more than 300 million metric tons of plastic waste are produced each year. Due to its characteristic biodegradation properties, post-consumer plastic management is a great challenge in today's world. Encina has developed a novel fluidized bed catalytic pyrolysis reaction system to convert post-consumer plastic to valuable products, such as light olefins and BTX aromatics. Determining reactor design and fluidization regime is essential to providing a sustainable and efficient plastic treatment. Proprietary internals are investigated at Particulate Solid Research Inc. (PSRI) to ensure high heat transfer rates and uniform bed temperatures. The optimal fluidization regime determines which geometry provides sufficient mass transfer and exhibits desired reaction parameters. Barracuda Virtual Reactor is used for CFD simulation of particle fluidization and chemical reaction. Computational particle fluid dynamics (CPFD) enables a fast simulation method and stable multiphase flow coupling solution. The simulation results are used to guide reactor design and operation regime selection.

ENCINA

About the Speaker

Song Wang is the Technology Team Lead for the Encina Development Group. He holds a PhD in Chemical Engineering from New Jersey Institute of Technology. His experience includes development and characterization of multi-functional particles as well as extensive research experience of powder particles in combustion dynamics and ignition kinetics. During his PhD career, he has built a 3D-CFD modeling of a complex flow system and developed a theoretical model to describe the performance of new reactive materials quantitatively. He has authored 12 publications related to biocidal, metal combustion and material synthesis.

Ray Cocco PSRI

Realistic Models Require Realistic Boundary Conditions

Part of any CFD model is defining the boundary and initial conditions. For the initial conditions, setup is usually straightforward, especially for transient simulations. For boundary conditions, setup is much more complicated, or at least it should be more complicated. To start, your boundary condition for a granular-fluid problem is unlikely to be uniform. Yet, we often define our boundary conditions as such. This talk focuses on the challenges of defining boundary conditions that are either (i) as accurate as possible or (ii) located in a region of the computational domain that has the least impact with a uniform flow and concentration assumption.

About the Speaker

Ray Cocco has been with PSRI for 15 years, where he currently has the role of President and CEO. PSRI is a consortium-based company with 30 member companies headquartered in Canada, France, Finland, Germany, India, Japan, Saudi Arabia, UAE, UK, and the United States. Before PSRI, Ray spent 17 years with The Dow Chemical Company, where he led research and development efforts in numerous particle technology platforms, including the production of WoodStalk™ (a particleboard made of straw) for Dow BioProducts, the production of vinyl chloride monomer, and RCI oxidation using fluidized beds, the production of hydrocarbon using circulating fluidized beds, the development of polyolefin catalyst for fluidized beds, and in the production of aluminum nitride and silicon carbide ceramic powders using moving bed reactors. Today, he is an advisory board member of the University of Florida Chemical Engineering Advisory Board, Auburn University Chemical Engineering Alumni Committee, University College at London's CNIE, and on the editorial boards for Powder and Bulk Engineering and Powder Technology. Ray was the past chair of the AIChE Particle Technology Forum (Group 3), a past member of the AIChE Chemical Technology Operating Council (CTOC), and is currently an AIChE Fellow. Ray was also the past chairman of the World Congress in Particle Technology VIII in April 2018. He has over 80 publications, three book chapters, several patents, numerous invited presentations, and consults for industry, national labs, and universities regularly.

Uendo Lee Korea Institute of Industrial Technology

Strategies to Improve 3D Simulation Accuracy Using 1D Simulation for CFB Boilers

Eulerian-Lagrangian methods such as the MP-PIC model and CFD-DEM can effectively simulate the fluidized bed phenomenon, enabling 3D calculations of fluidized bed boilers at reasonable computational costs. However, the development of numerical analysis technology through excellent models and the precise determination of a fluidized bed boiler's operation and boundary conditions dealing with solid combustion are different issues. It is often difficult to accurately define the flow rate of solid fuel and oxidizer, heat transfer conditions inside the boiler, the amount and properties of various solids in the boiler, and the results of 3D simulation based on such inaccurate information are unreliable. Therefore, to increase the reliability of numerical simulation, an 'accurate problem definition' that reflects the actual situation as much as possible is essential. Most calculation conditions issues can be solved through rigorous measurement of the experimental conditions. However, the difficulty in securing clear information on particles starts from the limitation that it is not easy to sample representative particles and encounters the inherent limitation of not being able to measure the properties of particles that change during the reaction. This problem can be solved by checking the operation and boundary conditions required for 3D simulation in advance by using 1D simulation to examine the effects of various variables with a short calculation time. In particular, 1D simulation equipped with a model that can closely evaluate attrition and fragmentation that can affect particle properties can significantly reduce errors in calculating important hydrodynamics in a fluidized bed reactor. In this study, we present a strategy for improving the accuracy of 3D simulation using 1D simulation for CFB boilers.

About the Speaker

Uendo Lee received a PhD in Mechanical Engineering from Korea Advanced Institute of Science and Technology (KAIST) in 2005 and has been working at Korea Institute of Industrial Technology (KITECH) since 2008. Uendo is involved in numerous projects spread across both the experimental and computational domains, with the reacting flow as a commonality. His current interests are multiphase flows, thermochemical conversion of biomass, CO_2-free hydrogen production, simulation of a large CFB boiler, and liquid metal system.

Martin Weng aixprocess

A First-Ever Innovative Brown-Field Modification in Conservative Cement Industry - De-Risked by Smart Simulation

A German cement plant was planning to optimize their production in terms of increasing the thermal substitution rate to 100% in the calciner, aiming at entirely coal-free operation. At the same time, some CO limit exception issues should be overcome. After analyzing fuel kinematics and combustion behavior, a modification

concept was developed resulting in an innovative design of a specific combustion chamber without any reference or experience from other installations. The plant decided to use advanced simulation as an engineering base in order to de-risk the modification for the next revision. In a few weeks' time, the design was analyzed and optimized in a series of multi-physics Barracuda Virtual Reactor simulations with simultaneous computation of dense particle flow, multi-fuel combustion and calcination reactions.

After installation, the process showed the expected optimized operation with 70-80% CO reduction and 100% calciner TSR. In addition, some refractory hot spots could be eliminated resulting in savings of maintenance costs. Fuel cost could be reduced by 2.4 € / t clinker (without consideration of CO2 costs), return on invest for full modification was less than 6 months.

About the Speaker

Martin combines engineering skills and entrepreneurship: while working as an assistant scientist in process engineering at the RWTH Aachen (Aachen University of Technology) from 1996 - 2002, 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. Comprehensive engineering with a focus on cyclone, fluidized bed and high temperature process technology complement the portfolio as a process optimisation company with international customers throughout the process industry.

In 2015, Martin initiated the development of aixProM software platform for real-time Big Data Analytics and online process digitalisation – joining well-established engineering models with Big Data statistics and AI.

Reynaldo Gomez NVIDIA

The Benefits of NVIDIA for Barracuda Virtual Reactor

Barracuda Virtual Reactor has seen huge speedups from GPU acceleration in the last five years thanks to innovation in both NVIDIA hardware and software. In this talk, Reynaldo Gomez discusses how GPUs are used for much more than gaming and how the NVIDIA accelerated computing platform is powering workloads from CFD to physics-informed neural networks (PINNs). He will also discuss various options for consuming GPUs from cloud to workstation deployments.

About the Speaker

Reynaldo Gomez earned his BS in Nuclear Physics from the University of Texas in 2013 and is now earning an MS in Management Science and Engineering from Stanford. He spent three years at Schlumberger WesternGeco as a geophysicist before moving to IBM and eventually landing on the Energy team at NVIDIA. Reynaldo manages the partner ecosystem for the energy vertical with a focus on machine learning, deep learning, and high-performance computing.

Ahmed Taha Microsoft Azure

Scaling Performance of Barracuda Virtual Reactor on Azure

Barracuda Virtual Reactor was recently tested on Azure's state-of-the-art "ND96asr_v4" virtual machines (VMs) using 8 different models with sizes ranging from 25M to 55M computational particles. The study is a showcase for Barracuda's scalability performance across the models. Smaller simulations which in our tests had less than 25M computational particles, achieved maximum speed-up when running in multi-GPU mode using two NVIDIA A100 Tensor Core GPUs. Larger simulations achieved maximum speed-up when using four GPUs. The presentation will share details on the Azure GPU computational resources used in addition to highlighting the recent results and the scaling capabilities of Barracuda Virtual Reactor code on Azure.

About the Speaker

Ahmed Taha is a senior specialist in the Americas HPC Global Black Belt "GBB" team in Microsoft Azure. He has a PhD in Mechanical Engineering from Old Dominion University, Norfolk, VA, in High Speed Reacting Flow & Thermal Management with over 20 years of experience in the academic and industrial field of modeling and simulation in high performance computing.

Scott Fowler Tecplot

Advanced Analysis with Tecplot 360

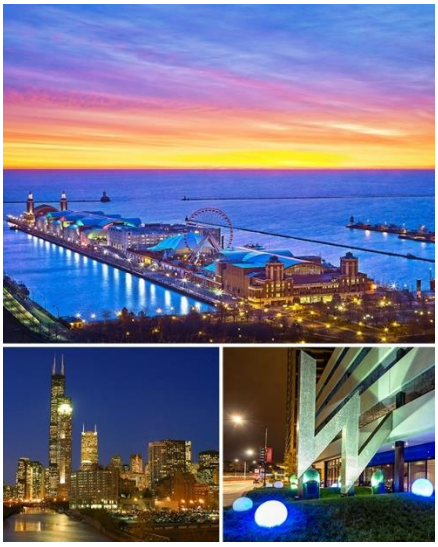
This talk will demonstrate the use of Tecplot 360, PyTecplot, and Tecplot's Add-on Developer Kit to perform advanced analysis of results from Barracuda. You'll learn techniques and what's possible with Tecplot products beyond simple plot and movie creation.

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



Thanks to Mark III Systems and NVIDIA for sponsoring drinks and appetizers on Wednesday night! The reception will be from **5:30 to 7:30 pm** in the Industry Room on the 6th floor of the W Chicago – Lakeshore.

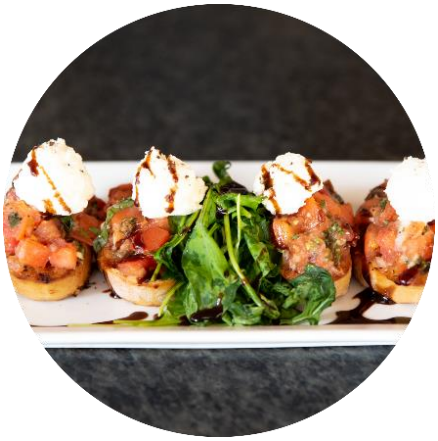
Mark III Systems

NVIDIA PREFERRED PARTNER

Thursday Night Dinner

cpfd

CPFD invites you to join us for dinner on Thursday at Pinstripes from **6 to 9 pm** for an evening of networking, bocce, other games, and Italian cuisine! Pinstripes is located at 435 East Illinois St., about half a mile from the W Chicago - Lakeshore. Dress attire is casual.



Partners & Sponsors

PSRI, a CPFD Strategic Partner, is an international consortium of companies focused on the advancement of multiphase flows technology with granular and granular-fluid systems. 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. CPFD has been a member of PSRI since 2006.

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 DGX A100 Station and Server) 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 a DGX A100 Station or with maximum multi-GPU parallelization in the datacenter with DGX A100 Server, Mark III can customize a bundled package of Barracuda Virtual Reactor and DGX A100, complete with white glove services for DGX 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.

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.

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.

The cpfd Team in Attendance

Rajat Barua President and CEO

Rajat Barua is President and CEO of CPFD Software. He has 24 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., a technology company at the forefront of innovation in the field of lasers and sensor research, development and commercialization. Prior to Senscient, Rajat was Vice President at Lime Rock Partners, a private equity firm. He began his career with Schlumberger, where he served as a field engineer in North Africa and offshore, in the Gulf of Mexico. Rajat is a chemical engineering graduate of McGill University and holds an MBA degree from Harvard University.

Matt Black Support Engineer

Matt is a Support Engineer for CPFD Software. Since joining the team in 2021, Matt has provided assistance to Barracuda users from a wide range of industries and applications. He has also done work relating to the development of the software, including quality assurance testing and creation of scripts packaged with Barracuda. Additionally, Matt has been involved with troubleshooting and developing simulations of FCC equipment including standpipes, risers, and regenerators. Matt holds a Bachelor's Degree in Chemical Engineering from Auburn University.

Peter Blaser Vice President of Operations

Peter is Vice President of Operations at CPFD Software with 20+ years' experience developing and applying specialized computational fluid dynamics (CFD) technologies. Peter is passionate about removing the guesswork surrounding the design and operations of fluid-particle processes through intelligent use of digitalization technology.

Peter began working with CFD at the University of Toronto, where he earned a Master's of Applied Science degree. Before joining CPFD in 2003, Peter worked for the CD-adapco group (now part of Siemens) deploying general purpose CFD technology across diverse industries.

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 is an IT professional with more than 20 years of experience as an IT Director, Program Manager, Scrum Master, and Corporate Banker. Prior to IT, Suraj had a successful career in the banking industry. Suraj holds an MBA Degree in Finance, a Master of Science in Computer Engineering, and Salesforce CRM certifications.

Rosemary Clark Senior Support Engineer

Rosemary is a Senior Support Engineer and has been at CPFD 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 Product Manager

Sam is the Barracuda Virtual Reactor Product Manager, and has been with CPFD since 2008. He is an expert at simulating thermal, reacting, multiphase gas-particle systems with Barracuda Virtual Reactor. As Product Manager, Sam works closely with CPFD's development team to make Virtual Reactor the best tool possible for our users. He also provides high-quality engineering support to Barracuda Virtual Reactor users worldwide, leads and contributes content to documentation of the software, and is an instructor for Barracuda Virtual Reactor training classes. Sam holds a master's in Chemical Engineering from the University of New Mexico.

Paul Earhart Senior Software Engineer

Paul is a Senior Software Engineer and Scrum Master for CPFD Software's development team. He is a software professional with decades of experience and a passion for quality, process and design. Joining CPFD 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.

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

Andrew began working on Barracuda Virtual Reactor version 16 in 2012, applying GPU acceleration to reduce simulation times. Most recently, his work has enabled multi-GPU calculations, which allows users to run bigger models than ever before. Andrew's work impacts the full product stack and product quality as the Principal Software Developer.

As an undergraduate, Andrew double majored in Mathematics and Computer Science at Central College in Pella, IA. He then attended the University of Minnesota Duluth, where he earned a Masters in Applied and Computational Mathematics and also a Masters in Computer Science.

Peter Loezos **Vice President of Engineering**

Peter is CPFD's Vice President of Engineering, with 18 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 where he had a specific emphasis on fluidization engineering. Peter has a PhD in Chemical Engineering from Princeton University where his research included the development of CFD sub-grid models for gas-particle flow applications.

Niraj Mehta **Software Engineer**

Niraj joined CPFD in 2019 as a Software Engineer. Originally working in full-stack development of Barracuda Virtual Reactor, Niraj has recently transitioned to a client-facing role that interfaces between the user community and the product development team. Niraj holds a BA in Applied and Computational Mathematics from the University of Southern California.

James Parker **Chief Technology Officer**

James oversees the software development of Barracuda Virtual Reactor and CPFD's computational research of multiphase modeling techniques. Prior to his appointment as CTO, James was Principal Chemical Engineer for CPFD Software and used Barracuda Virtual Reactor on a wide range of fluidization modeling projects for refining, polyolefin, biomass, coal, and polysilicon applications. James has a PhD in Chemical Engineering from Oregon State University where his research included the development of numerical methods for multiphase flow.

Attendees

Attendee	Company
Martin Weng	aixprocess
Zachary Wadas	Aloha Carbon
Zhengcai Ye	Aramco Americas
Betul Aslanli	Dal Engineering
Carlo Badiola	Encina
Song Wang	Encina
Alexandre Kokourine	Hatch
Chris McIntyre	Hatch
Reza Mostofi	Honeywell
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