



PROSPECTS AND CHALLENGES FOR OLEFINS PRODUCTION

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Panelists

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Richard Hughes



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Judson Wooters



3 October 2013

Overview of Discussion

- Brief Introduction on Panel Members
- Background on Olefins Production
- Pre-selected Questions
- Open Discussion Period
- Concluding Remarks



Mark Darby, Ph.D.

- Owner: CMiD Solutions
- Prior Work Experience:
 - AspenTech
 - Setpoint
- Ph.D. at the University of Houston
- Control / Optimization with 33 years application experience in refineries, ethylene, and gas plants
- Active researcher on methods that optimize signals to improve signal generation for model identification and control



Doug Nicholson



- Principal Engineer at APEX Optimisation
- Prior Work Experience:
 - Aptitude, Senior Consultant
 - AspenTech, Senior Advisor
 - ExxonMobil
- University of British Columbia
- Optimization / Control with 35 years experience
- Consulted for refineries and petrochemical plants throughout the world
- Ethylene units and other light hydrocarbon units



Judson Wooters



- Chevron Phillips, Senior Engineer
- B.S. Brigham Young University
- M.S. Oklahoma State University
- Optimization and Control
 - 2 years support of alpha olefins derivative unit APC, unit historian, and systems support
 - 3 years support of olefins unit optimization, furnace modeling, and APC



Richard Hughes

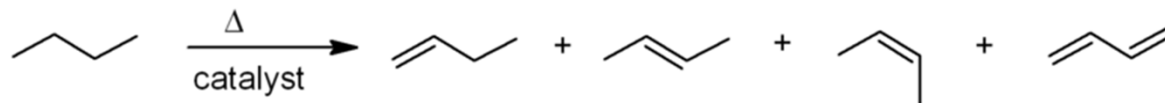
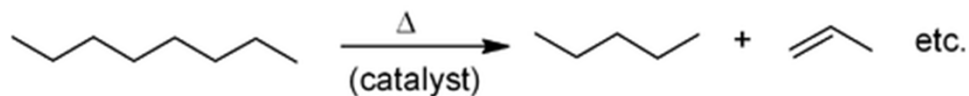


- SABIC UK Petrochemicals
 - Process control consultant
- B.S./M.S. University of Bath
- Prior Experience:
 - AspenTech, Senior Consultant
 - ICI, Engineer
 - GEC Avionics, Engineer
- Control consultant with 25 years experience



Olefins Production

- Alkenes ($C_2=$, $C_3=$, $C_{4+}=$) are produced by:
 - Hydrocarbon cracking (primary)
 - High temperatures, sometimes in presence of zeolite catalyst
- Raw materials:
 - U.S. and Middle East mostly natural gas condensate components (principally ethane and propane)
 - Europe and Asia feedstock is mostly naphtha



- Separated by fractional distillation

New U.S. Natural Gas Opportunities

- Ethylene capacity projected to increase by 33.4% by 2017 with an additional 8.9 million tonnes per year
- New crackers in the US include:
 - ExxonMobil
 - Chevron Phillips Chemical
 - Shell
 - Dow Chemical
 - Formosa Plastics
- Sasol feasibility study
 - 1.2 million tonne/year cracker at Lake Charles, Louisiana
- Other companies are also considering building or partnering on world-scale crackers in the US and include Saudi Arabia-based SABIC, Brazil's Braskem, Mexichem, US-based Occidental Petroleum, and others

Reference: ICIS, 2013



Overview of Panel Discussion

- Perspective on Existing Challenges and New Opportunities
- Current state of the art in multivariate control of olefins production
- Current state of the art in real time optimization of olefins production
- Recommendations for design modifications on new facilities for improved performance

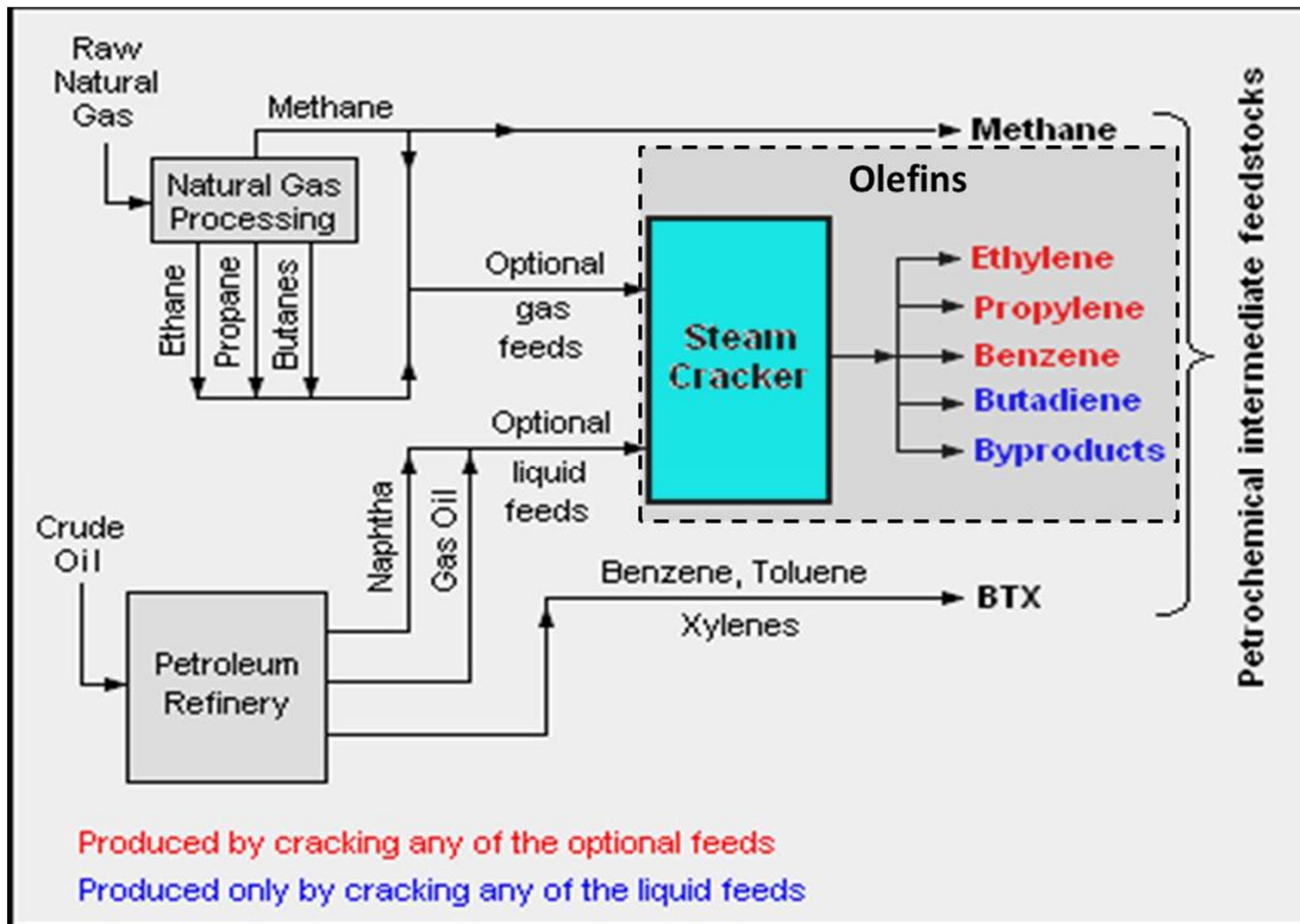


Discussion Topics: Overview

- Process Aspects
 - What is the difference between Naphtha and Ethane crackers?
- Getting to propylene and other products with shale gas
 - What are the challenges with Ethane cracking? (e.g. no propylene or butadiene products)
 - What is propane dehydrogenation?
 - What is metathesis (ethylene to propylene)?
 - What is the production route through syngas / Fisher Tropsch / GTL?



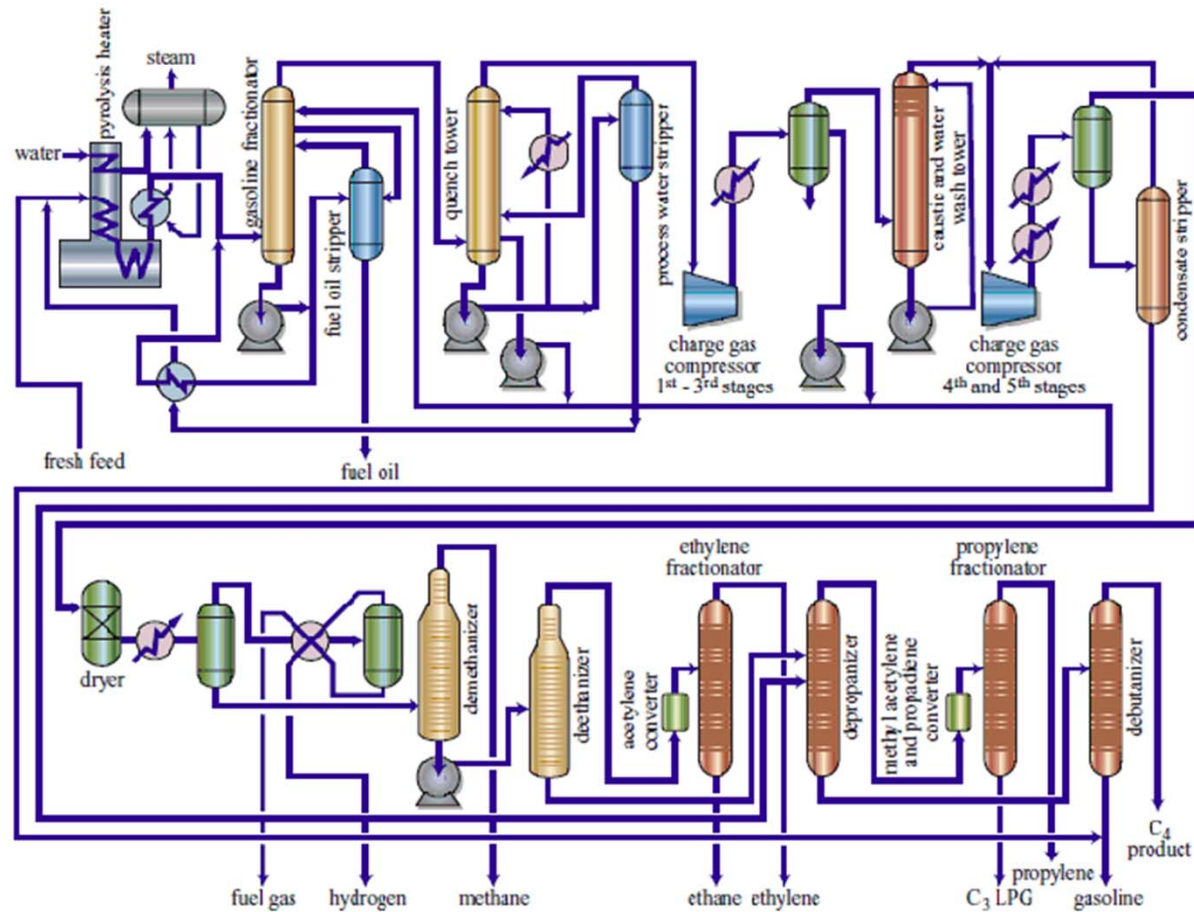
Process Overview



<http://www.2b1stconsulting.com/olefins/>

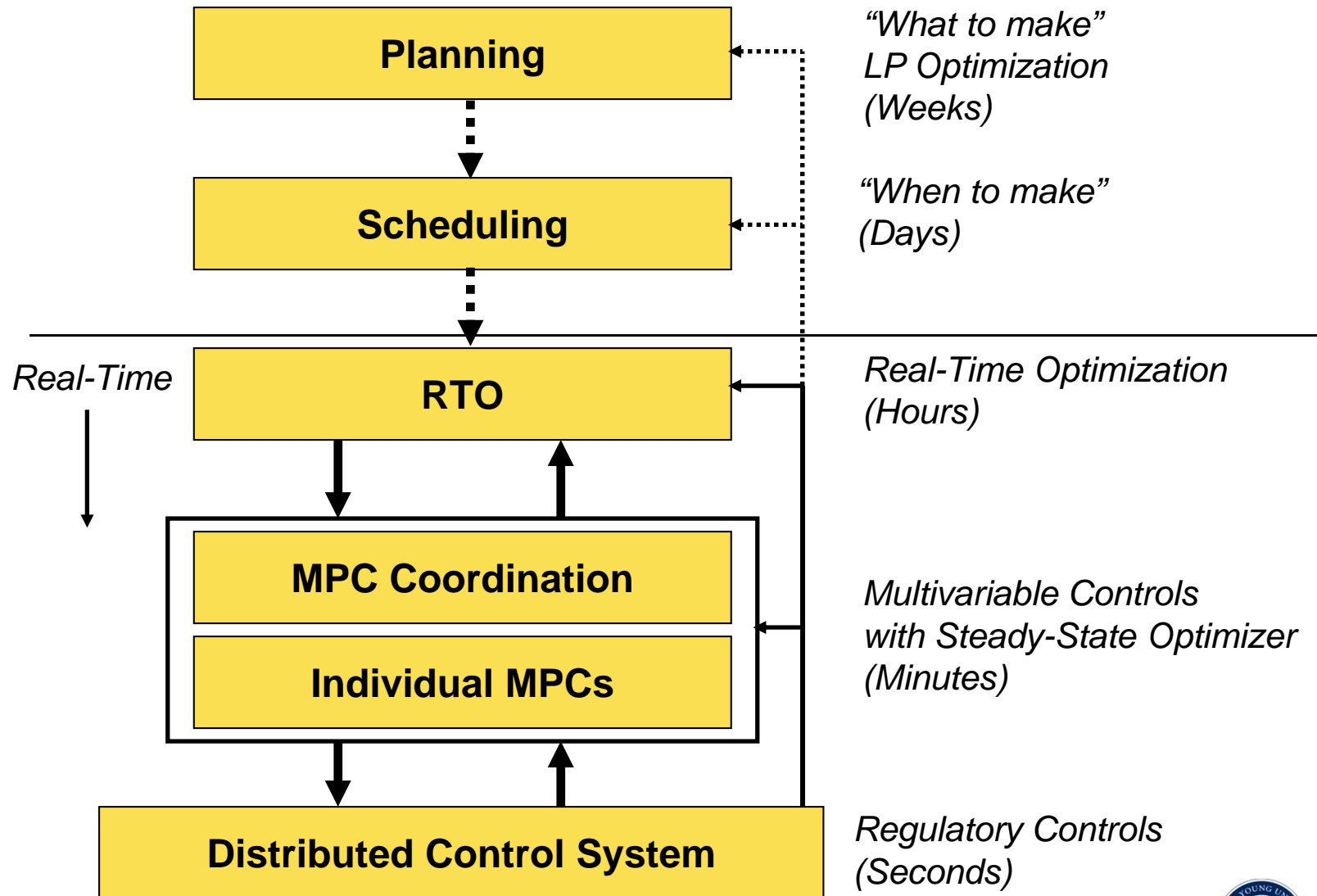


Naphtha Cracker Overview



<http://www.gasandoil.com/news/features/36151f19474f6d3484a7028b034c46c2>

Optimization & Controls Overview



Discussion Topics: Optimization

- Olefin plant opportunity for optimization (RTO)
 - True economics – envelope well defined
 - Trade-offs in Naphtha crackers for optimization – do these exist as well for Ethane crackers?
 - What are existing approaches to Naphtha and Ethane crackers?
 - What is the necessary amount of model rigor?
 - What has been the historical progress in model rigor? Why?
- What modeling packages and approaches are considered state-of-the-art?
- Do we expect feed maximization trends to continue?
- With surplus of natural gas feedstock, will the trend move to energy efficiency?



Discussion Topics: Control

- Control of Olefins
 - How are decisions split between RTO and MPC?
- Coordination approaches have been common in the past with distributed dynamic controllers under the direction of a common LP/QP. Is the trend to be more or less centralized?
- What is the current state-of-the-art for plant testing and model development? Where are the opportunities and beginnings of progress towards those opportunities?
- Are nonlinearities an issue? If so, how are they handled?
- What are the approaches/techniques that are considered state-of-the-art?

Discussion Topics: Projects and Careers

- What is involved in doing a “project”?
 - Base controls
 - Model predictive control
 - Decisions on envelopes and manipulated variables
 - Step testing
 - Dynamic Model development
 - Model validation
 - Commissioning of controls
 - Real-time Optimization
 - Steady State Model development
 - Model validation
 - Commissioning of RTO
- What are careers opportunities in these areas?



Open Question and Answer Session



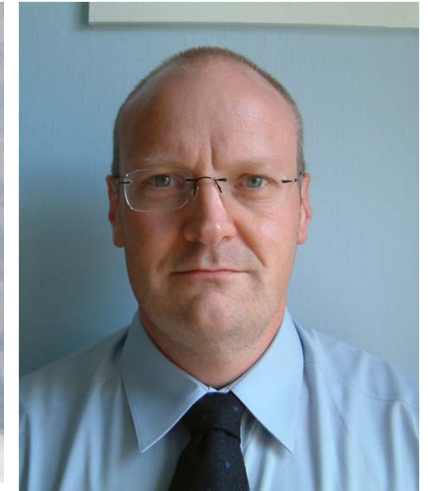
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Extra Slides



Naphtha Cracker Overview

