

# Production of Green Olefins by Steam Cracking of Hydrodeoxygenated Tall Oils

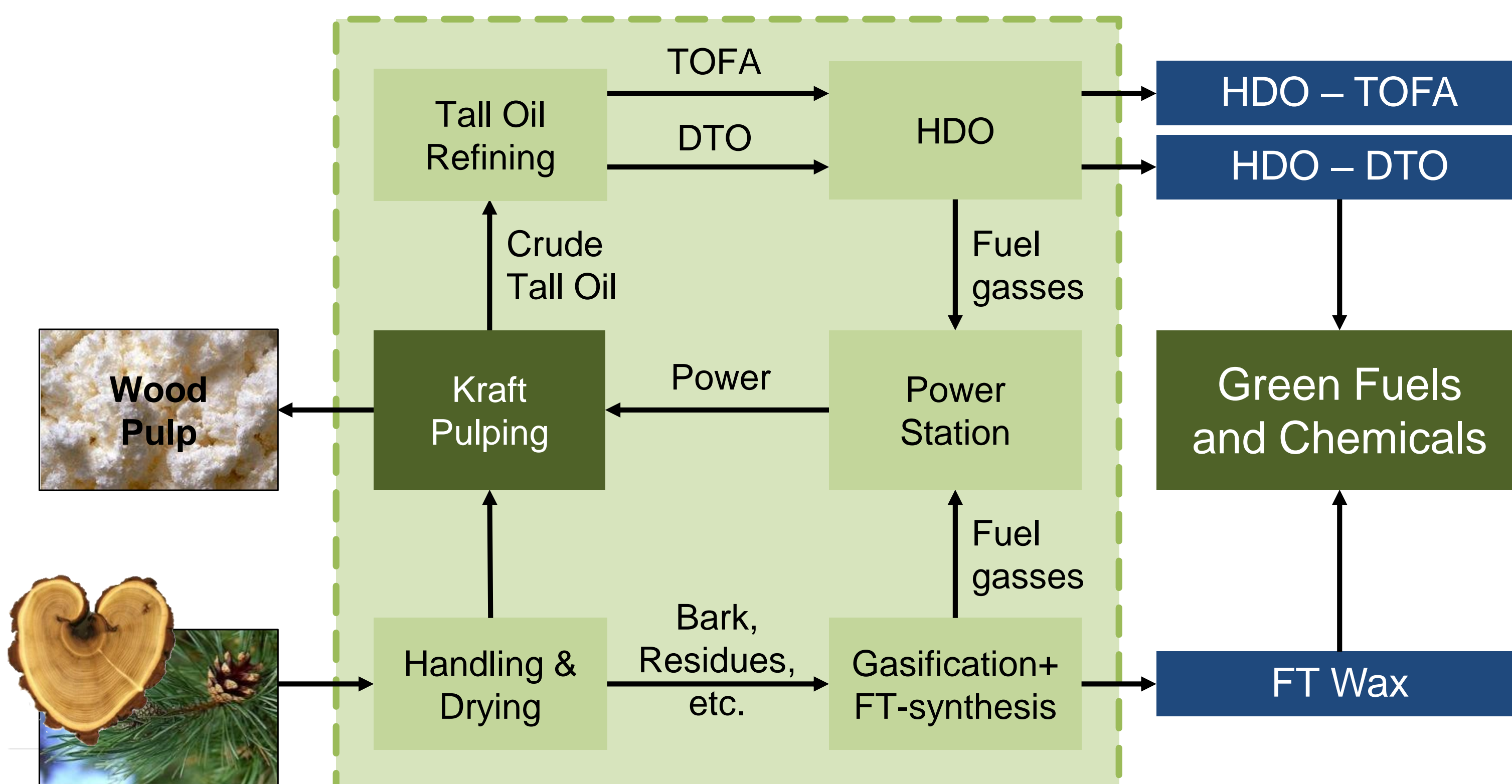
S.P. Pyl<sup>1</sup>, K.M. Van Geem<sup>1</sup>, T. Dijkmans<sup>1</sup>, J.M. Anthonykutti<sup>2</sup>, M.-F. Reyniers<sup>1</sup>, J. Räsänen<sup>2</sup>, T. Penttinen<sup>2</sup>, A. Harlin, G.B. Marin<sup>1</sup>

<sup>1</sup> Laboratory for Chemical Technology, Ghent University, Ghent, Belgium;

<sup>2</sup> VTT Technical Research Centre of Finland, Espoo, Finland; <sup>3</sup> Stora Enso Oyj, Finland

## Biorefinery

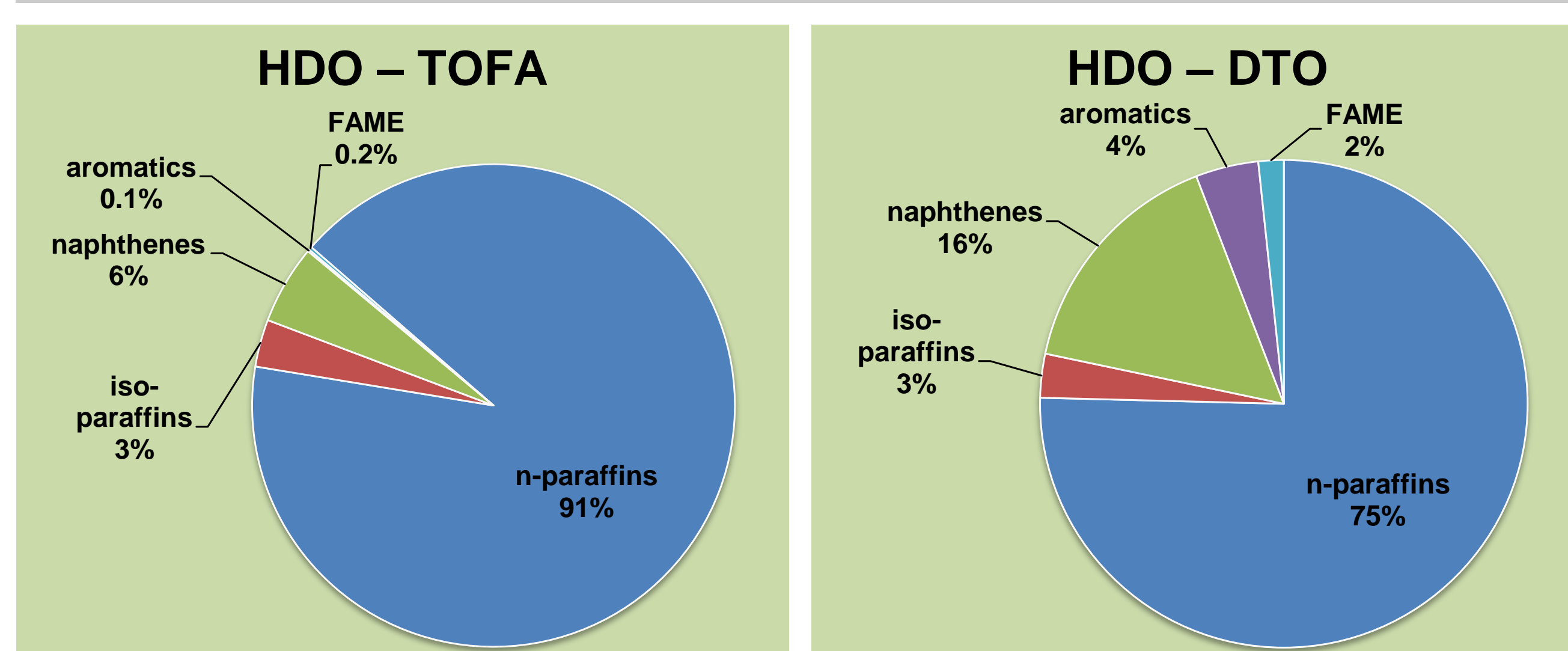
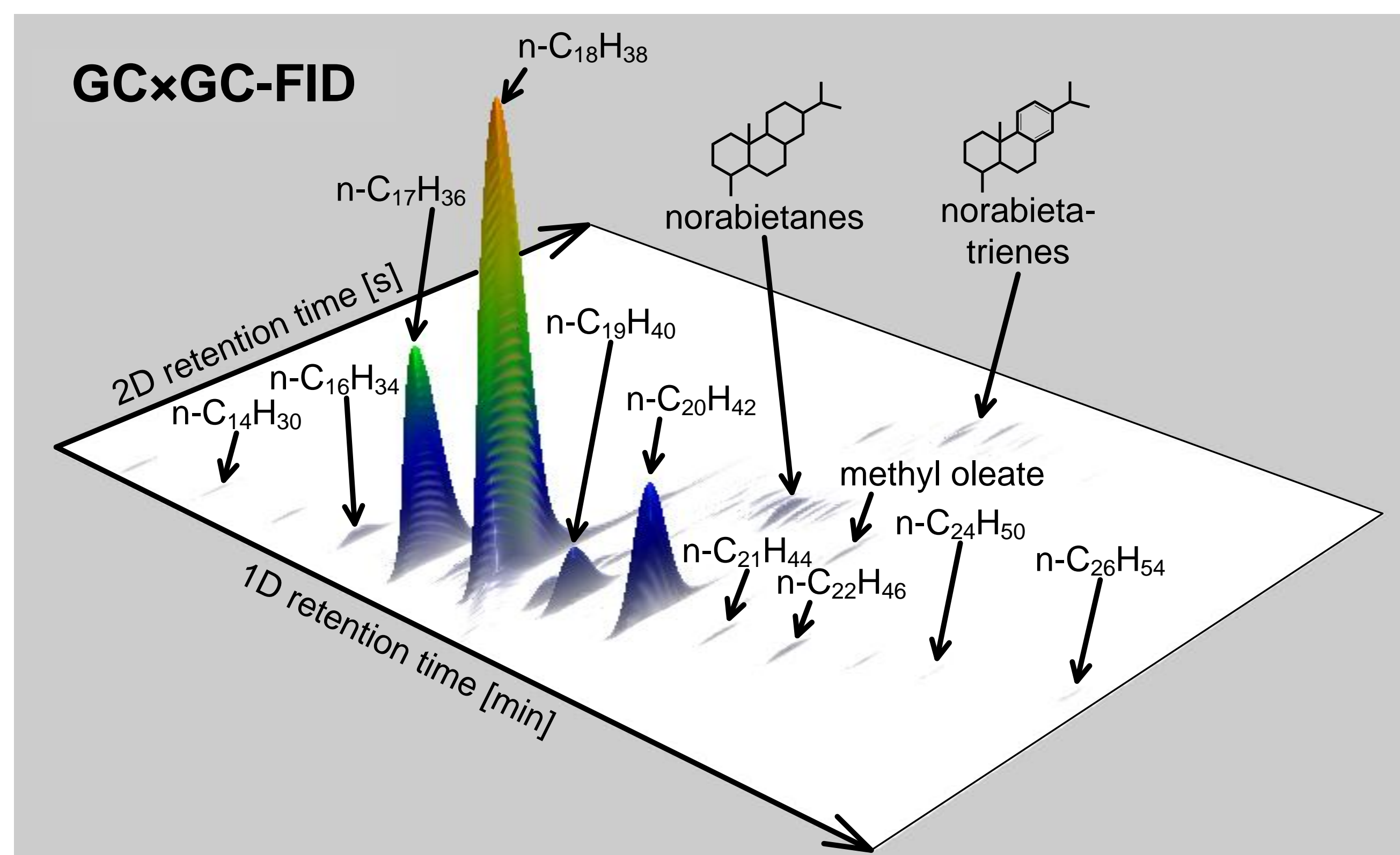
Integrated production of paper pulp and wood-based hydrocarbon liquids



A. Harlin, Green Polymer Chemistry, 2012

## Hydrodeoxygenated Tall Oils

Detailed analysis using comprehensive 2D gas chromatography (GC×GC)



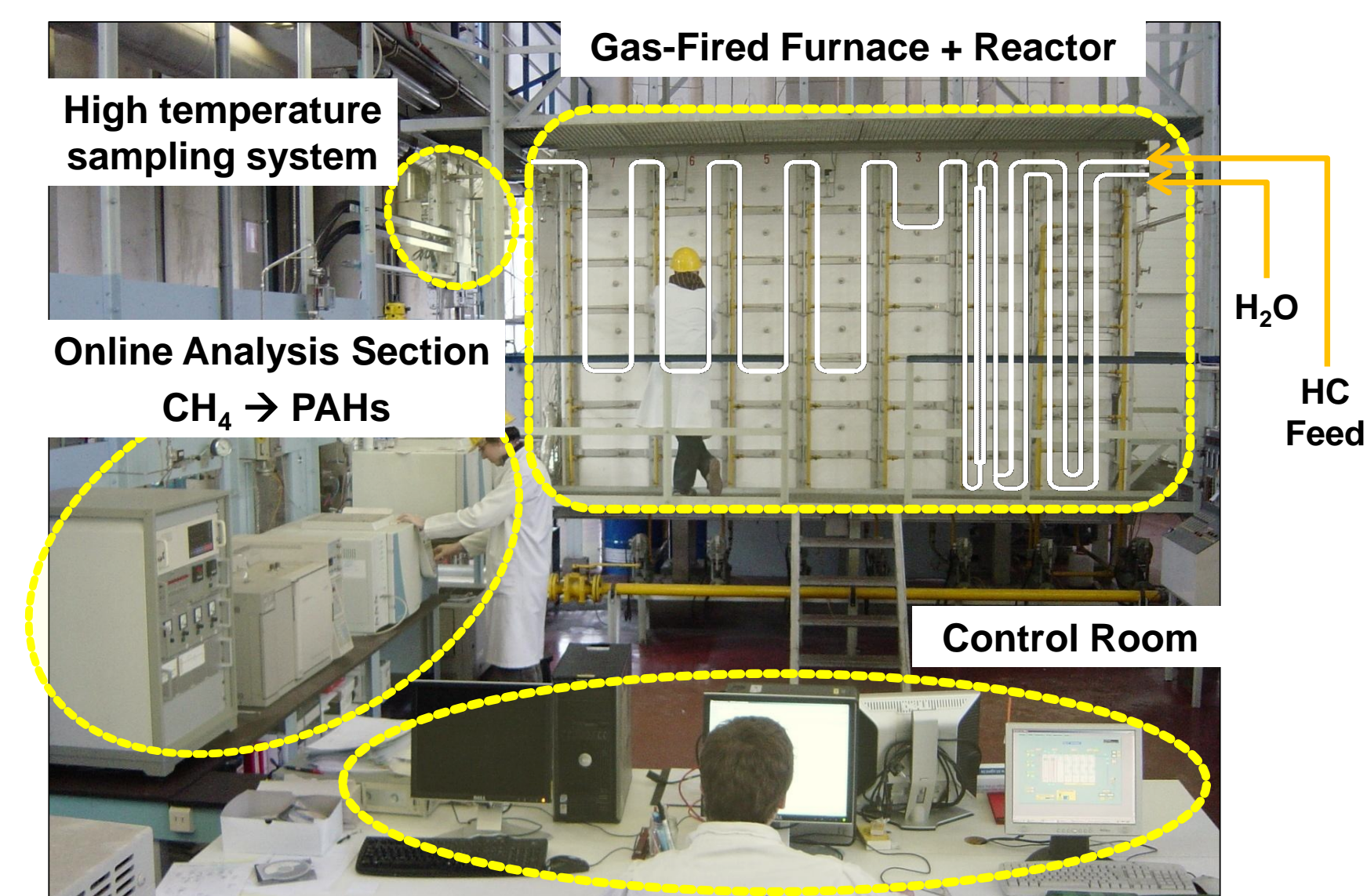
Pyl et al., Bioresource Technology, accepted for publication

## Conclusions

- Tall oils are cheap and promising starting materials for the production of green olefins
- Hydrodeoxygenation of these tall oils produces hydrocarbon liquids with a high amount of n-paraffins
- Steam cracking of these liquids results in high light olefin yields
- Lower heat requirement and reasonable run-lengths can be expected

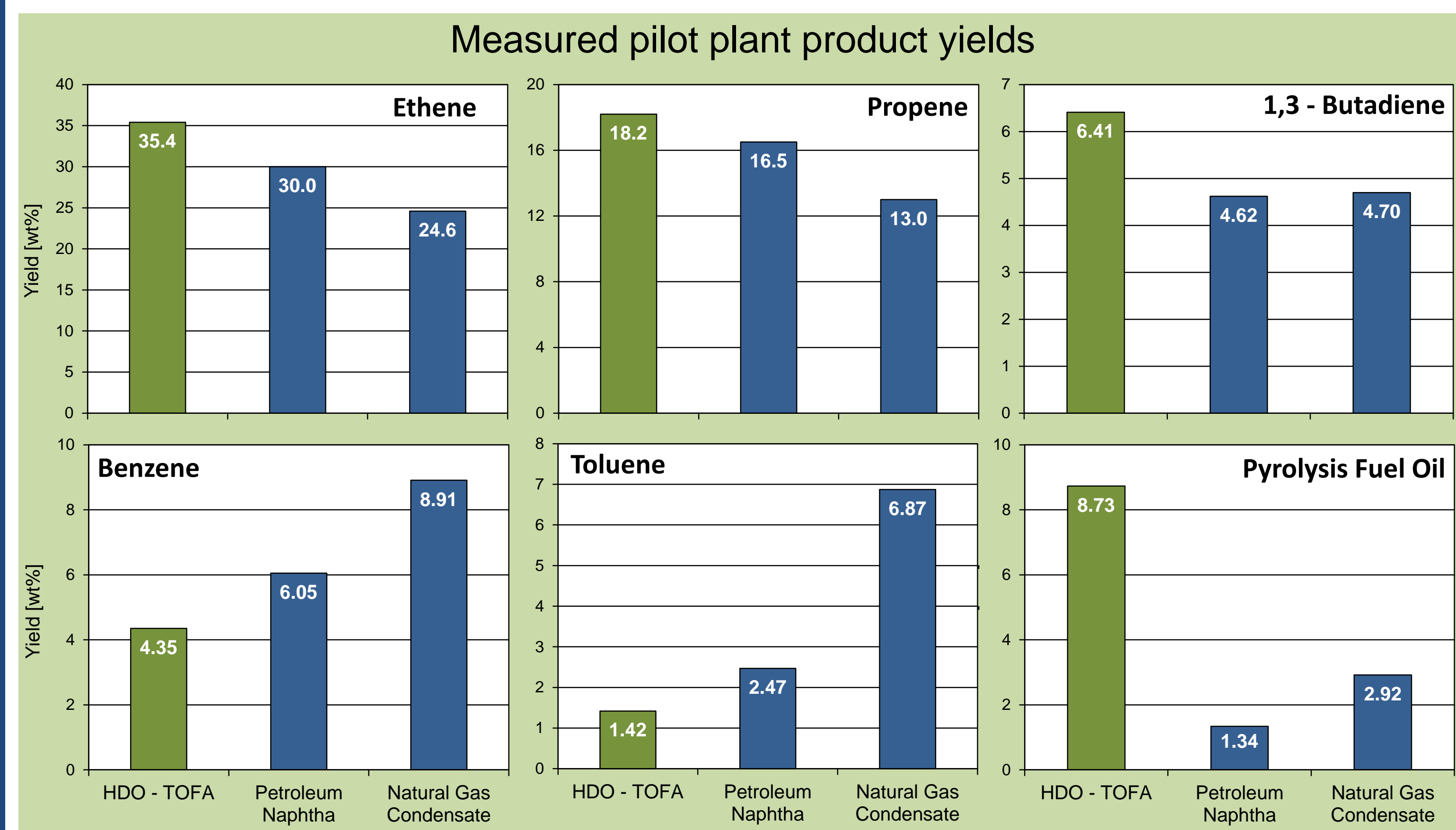
## Pilot Plant Steam Cracking

- 12m tubular reactor (9mm i.d.)
- Real-time measurement of process gas temperature and pressure profile
- High-temperature on-line effluent sampling
- Dedicated analysis section:
  - 2 Refinery Gas Analyzers
  - 2 GC×GC's
- Internal standard (N<sub>2</sub>) based products quantification

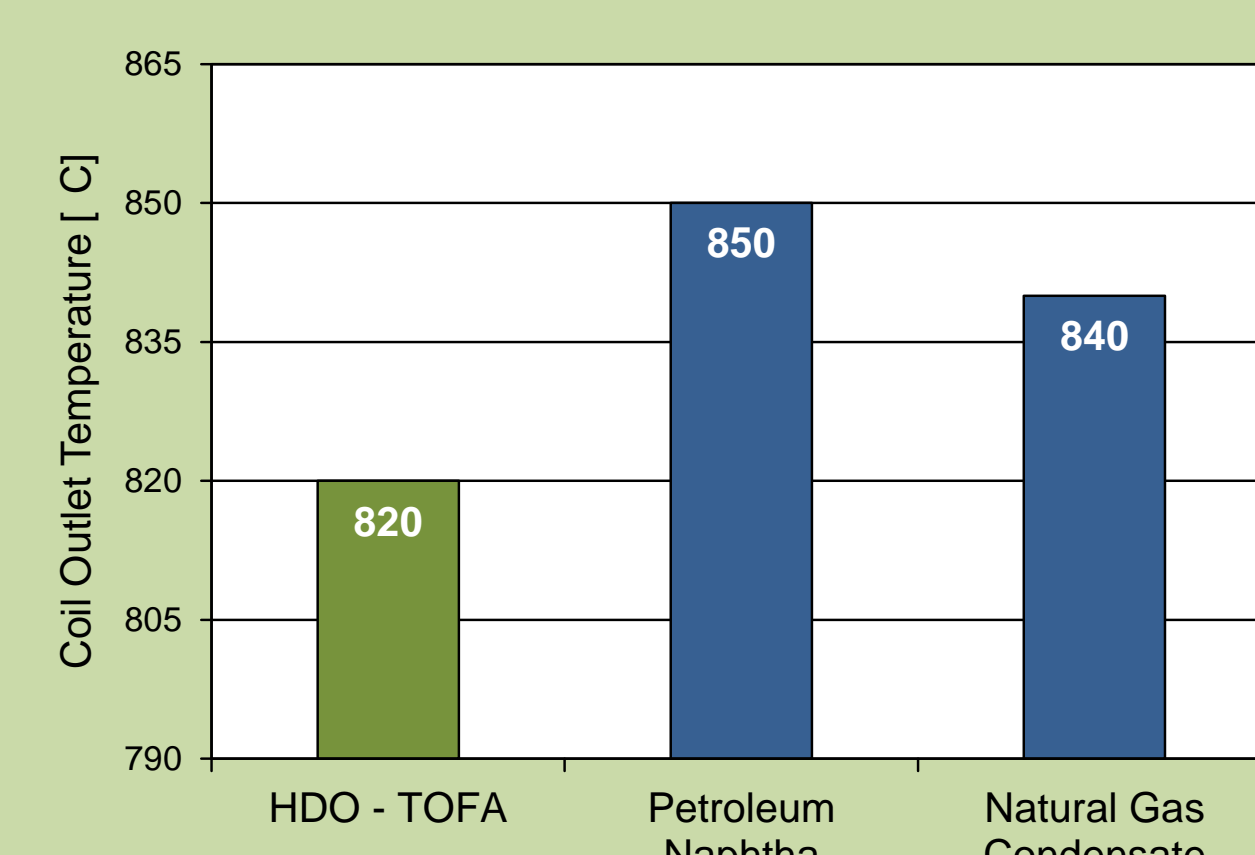


## HDO – TOFA Steam Cracking

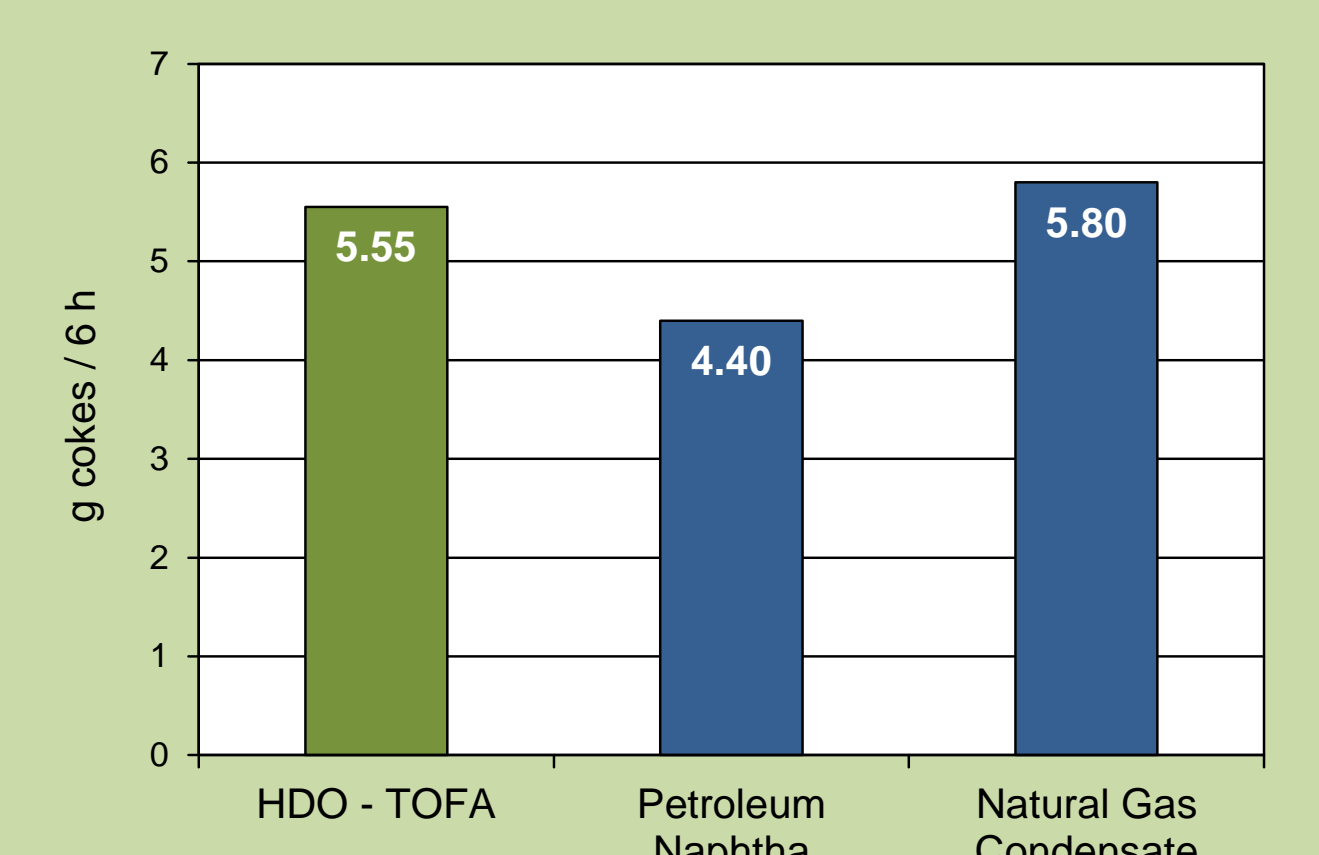
Compared to 2 fossil resource-based reference feedstocks at similar cracking severity → P/E ≈ 0.55 kg/kg



## Required Coil Outlet Temperature



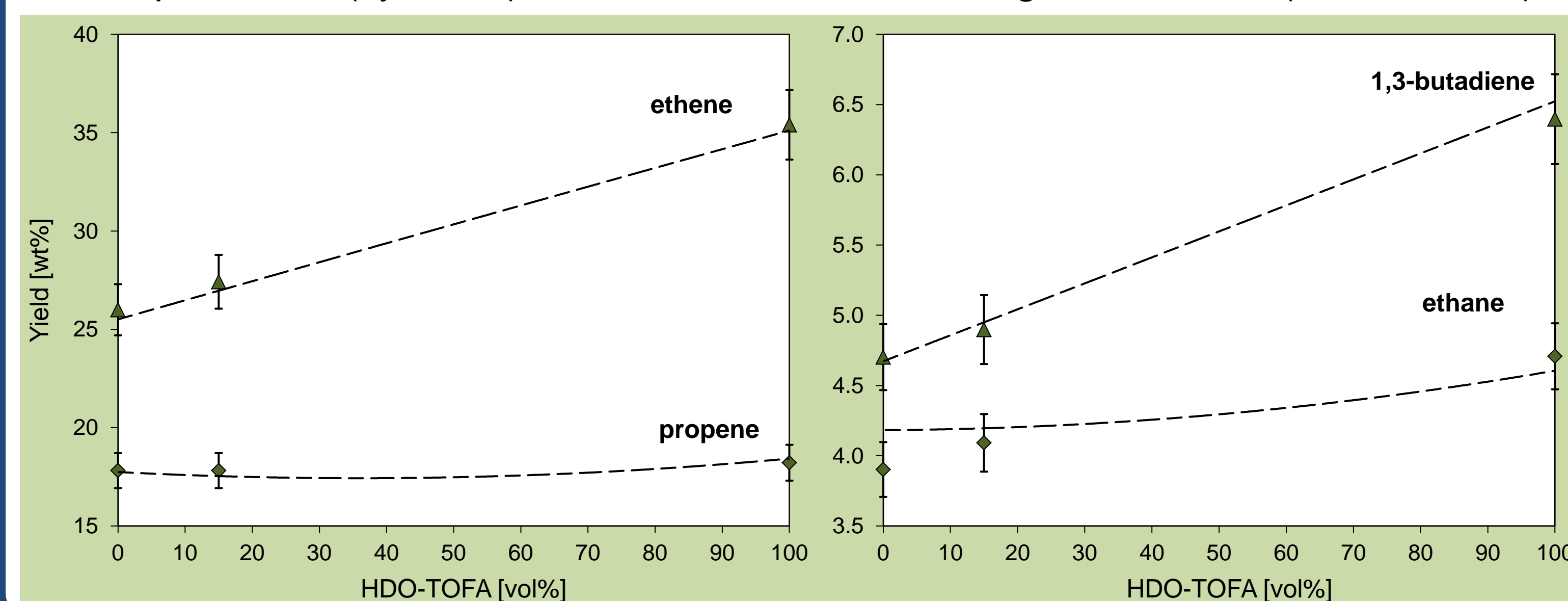
## Measured cokes formation during 6-h steady state operation



## Co-cracking with Naphtha

Effect of the amount of HDO-TOFA in the feed on product yields [COT=820°C; δ = 0.45 kg/kg; COP=1.7 bar]

Pilot plant data (symbols) versus data simulated using COILSIM1D (dashed lines)



## Acknowledgement

The Long Term Structural Methusalem Funding by the Flemish Government – grant number BOF09/01M00409

