

# Independent Catalyst Test Report 2015

Pushing the limits of FCC gasoline desulfurization



Hoekstra Trading LLC



# FCC gasoline desulfurization

- Goal: desulfurize FCC gasoline with minimum octane loss
- Uses conventional naphtha hydrotreating
- Uses selective catalysts to minimize olefin saturation



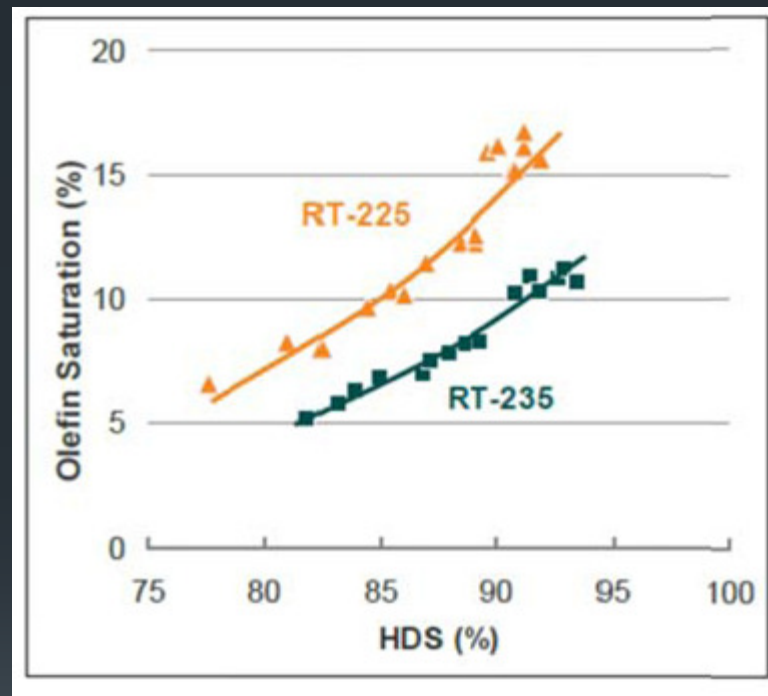
# Commercial status

- Got off the ground in 1999
- There are now 300 units in the world
- Most are Scanfining (ExxonMobil) or Prime G (Axens) units
- Revamps and new builds are ongoing



# FCC gasoline desulfurization catalysts are<sup>4</sup> designed for *olefin retention selectivity*

- Excerpt from ExxonMobil presentation
- Shows ExxonMobil pilot plant data - *olefin retention selectivity*



Excerpt from XOM presentation



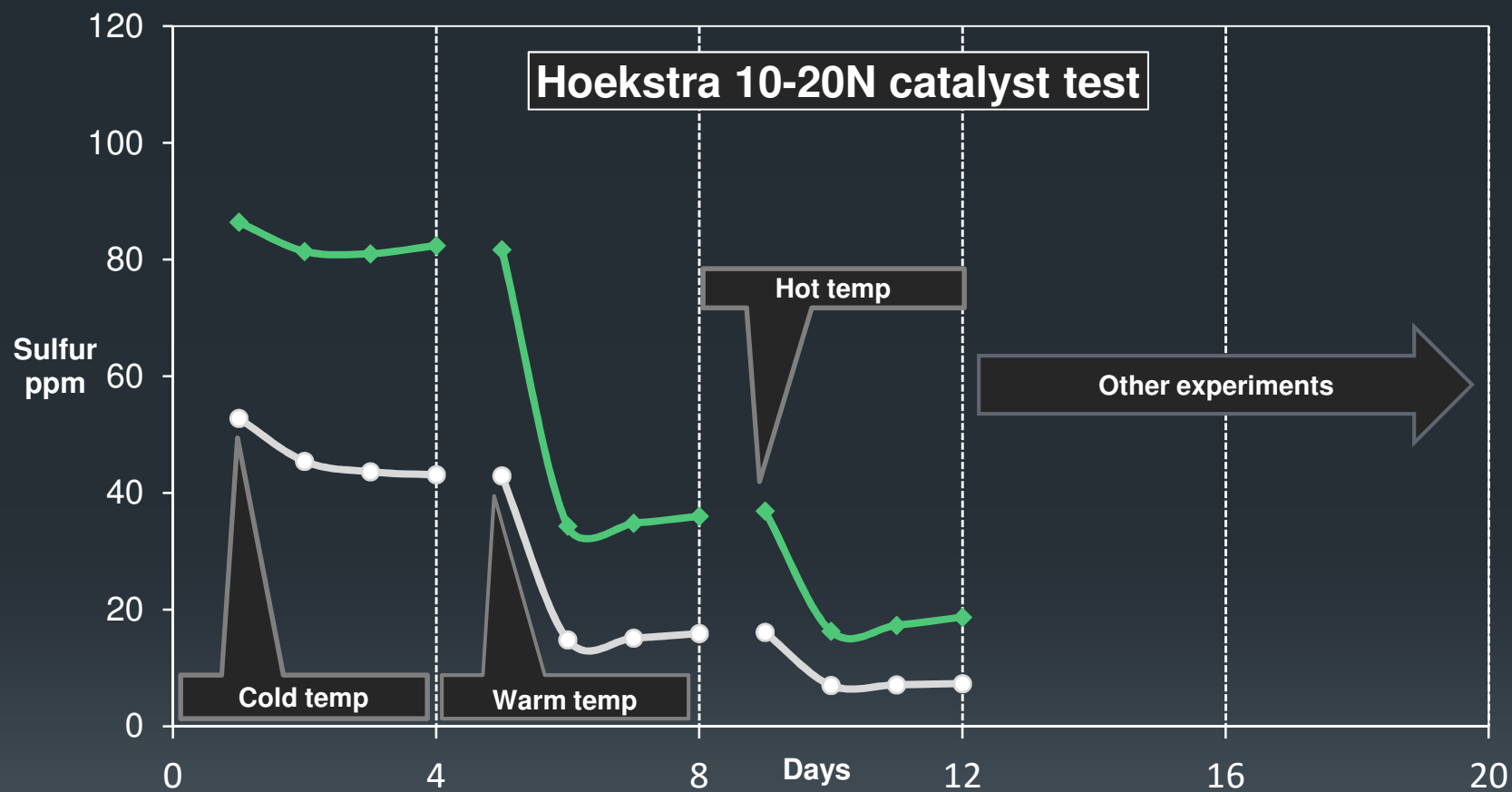
# Independent catalyst test report 2015 (ICT 2015)

- Side-by-side pilot plant tests of competitive catalysts
- Catalysts are ranked on activity and selectivity
- Includes competitive analysis
- Includes new insights on the process



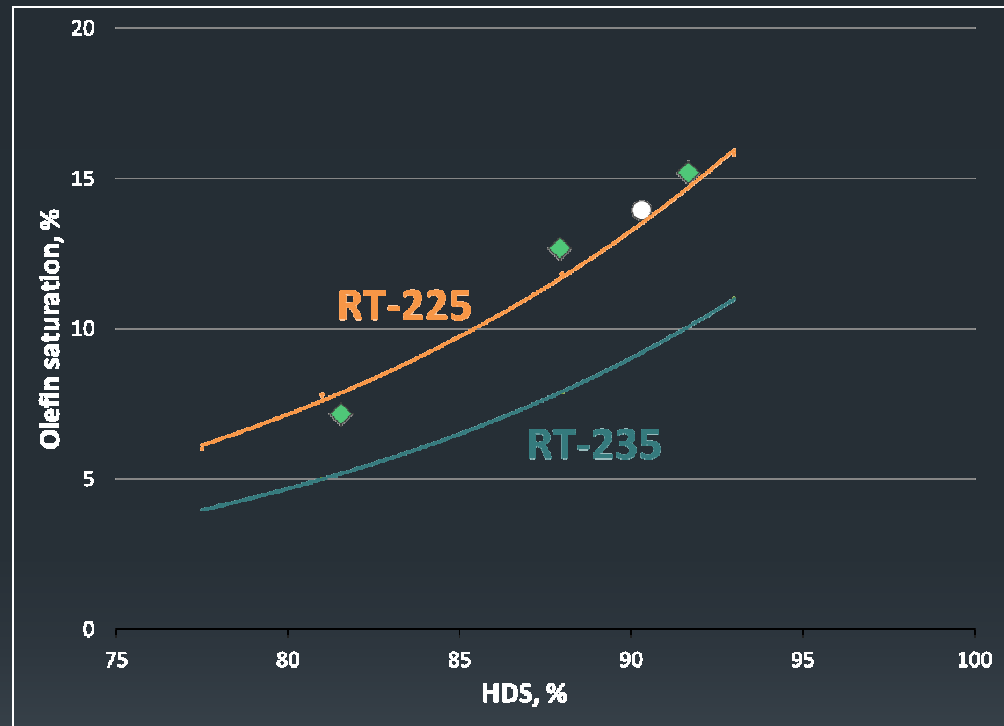
# ICT 2015 - desulfurization activity

6



# ICT 2015 - olefin retention selectivity<sup>7</sup>

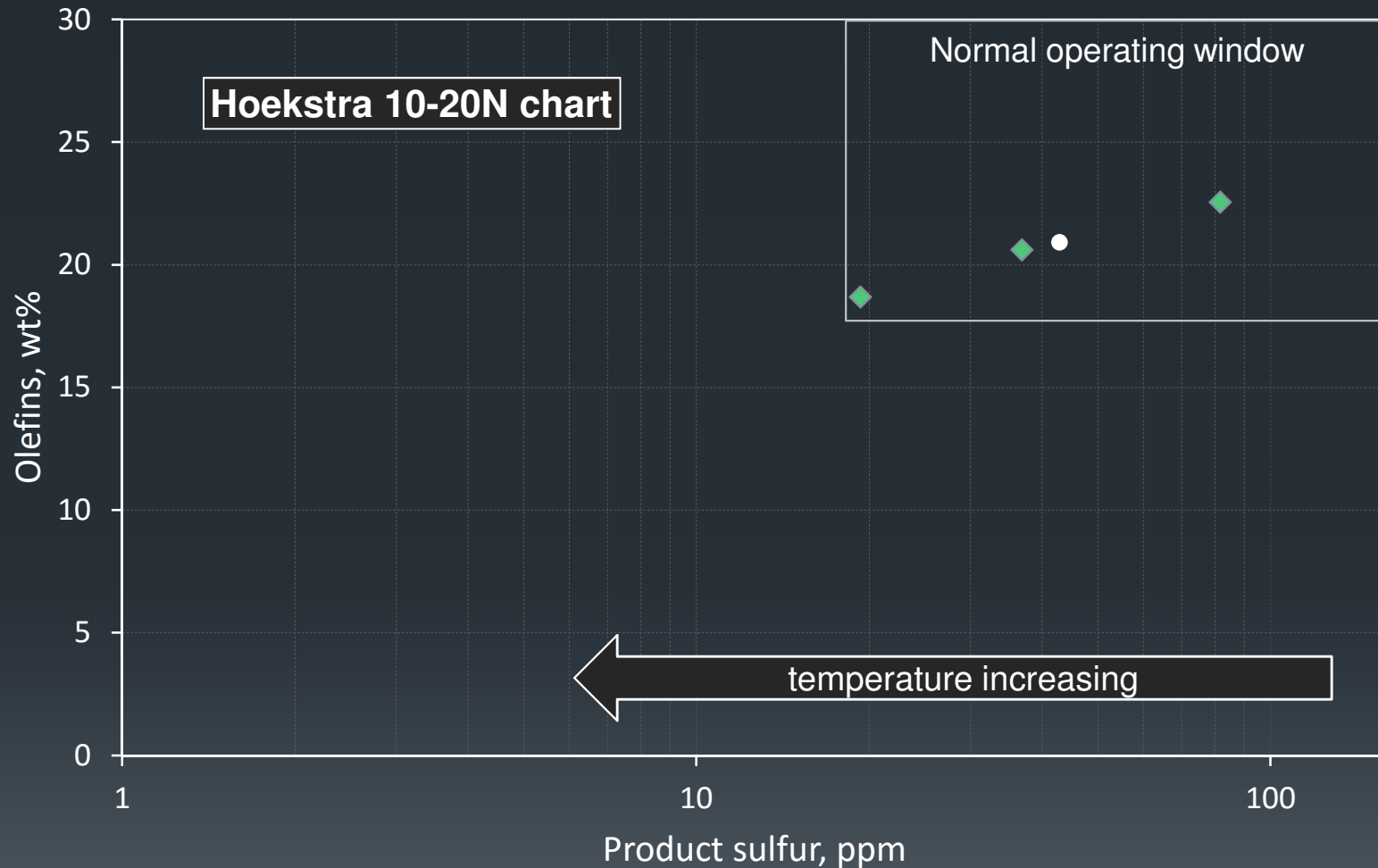
- Green and white data points are from ICT 2015 tests of competitive catalysts
- Trendlines are XOM pilot plant data for RT-225 and RT-235



Note: This chart shows 4 of 20 data points from ICT Report 2015



# ICT 2015 Technology landscape charts<sup>8</sup>





# ICT 2015 Catalyst ranking grid

Delta  
Activity

Delta Selectivity

	Base selectivity	-5 wt% olefin saturation
-20°F		
-10°F		
0°F		
+10°F		
+20°F		
+30°F		

Test catalysts are placed in this grid

# Pushing the limits

- Studying the detailed chemistry of the process
- Pushing severity to make ultra low sulfur gasoline

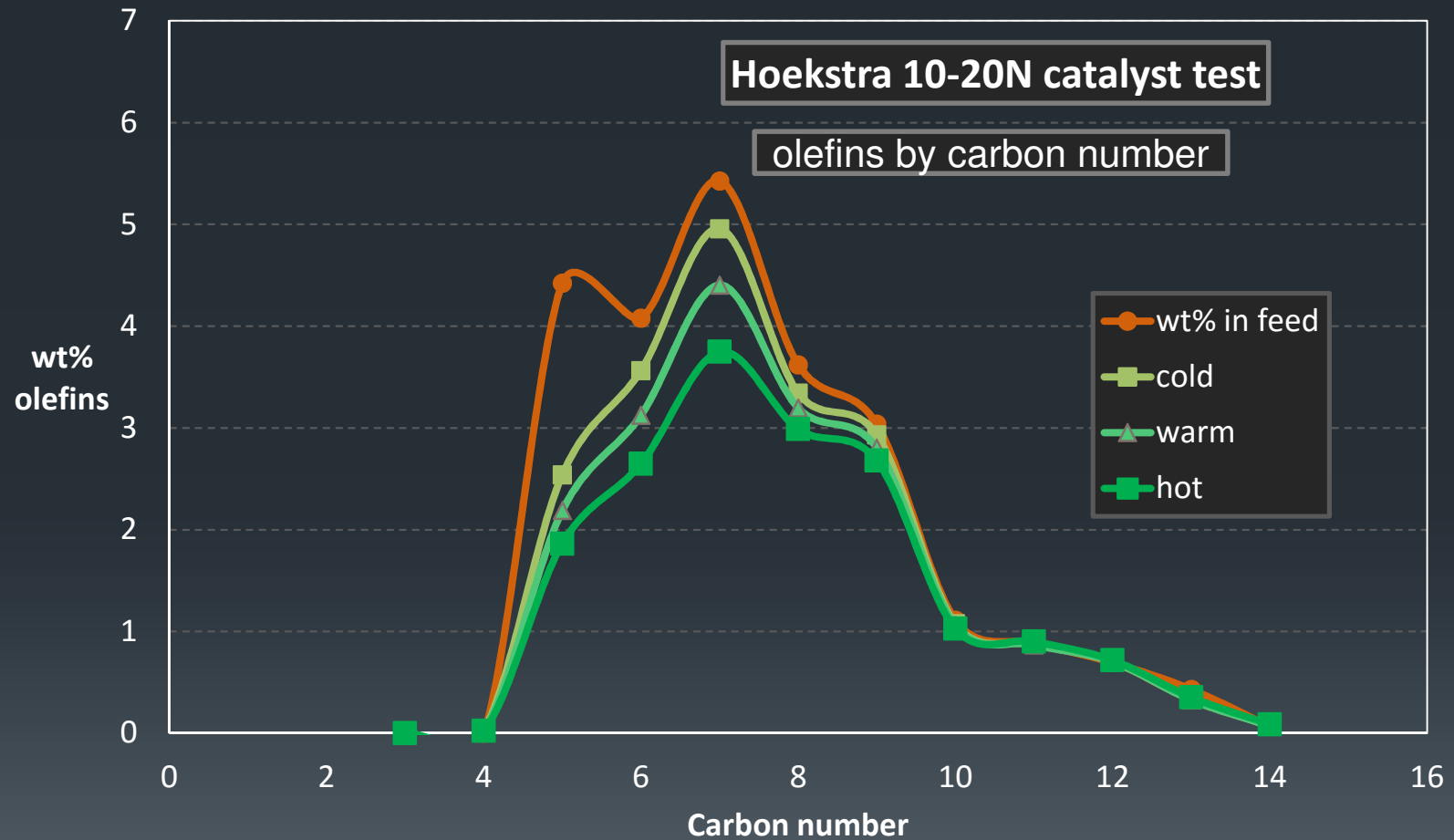


# Pushing the limits

Reactivity of compound groups

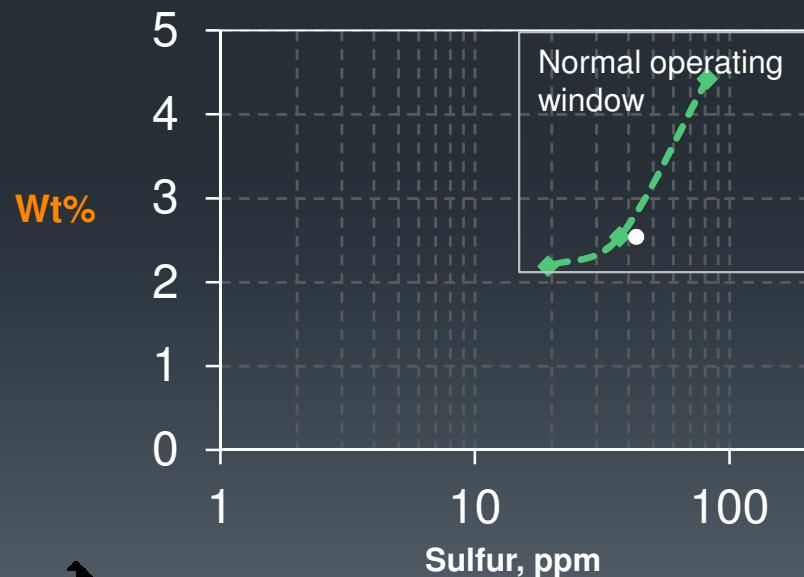


# ICT 2015 – olefins by carbon number<sup>12</sup>

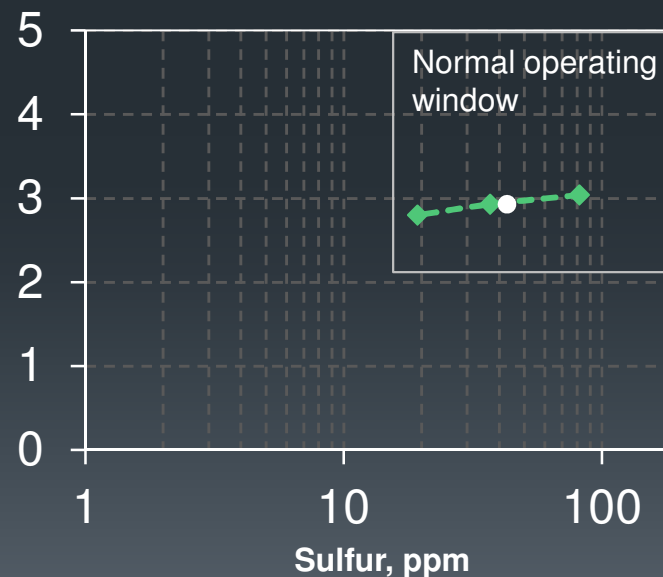


# ICT 2015 - olefin selectivity by compound group

## C5 olefins



## C9 olefins



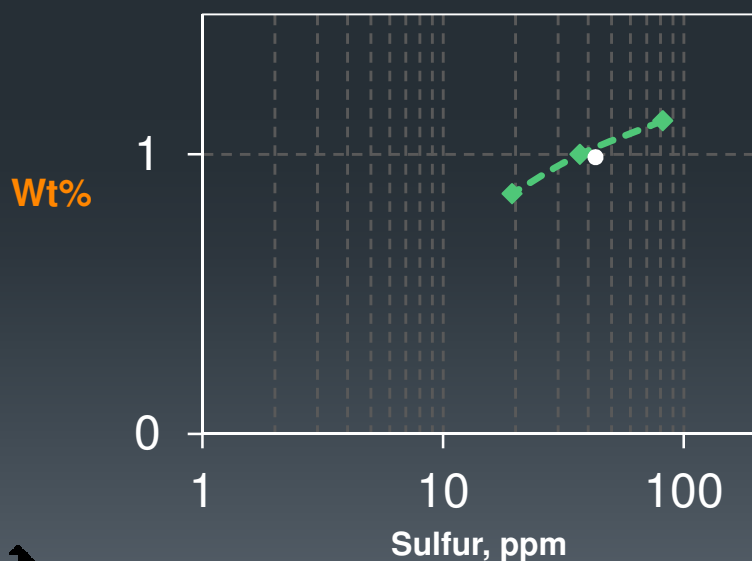
# Pushing the limits

Selectivity by individual compound

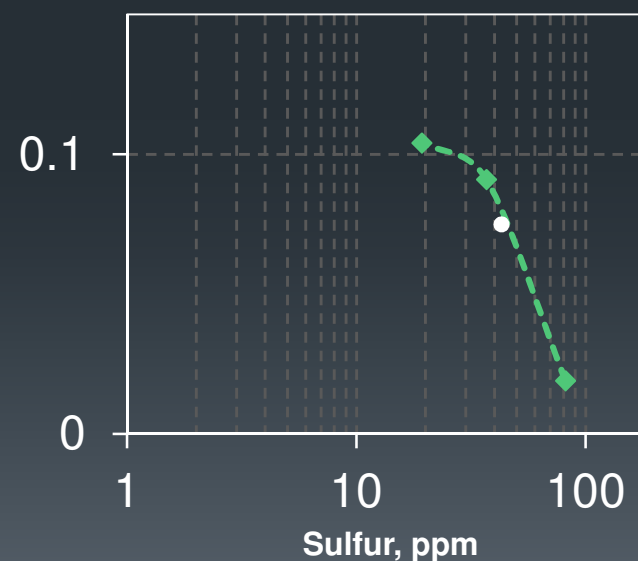


# ICT 2015 - olefin selectivity by individual compound

## 2-methyl-2-butene



## A C10 olefin



# Pushing the limits

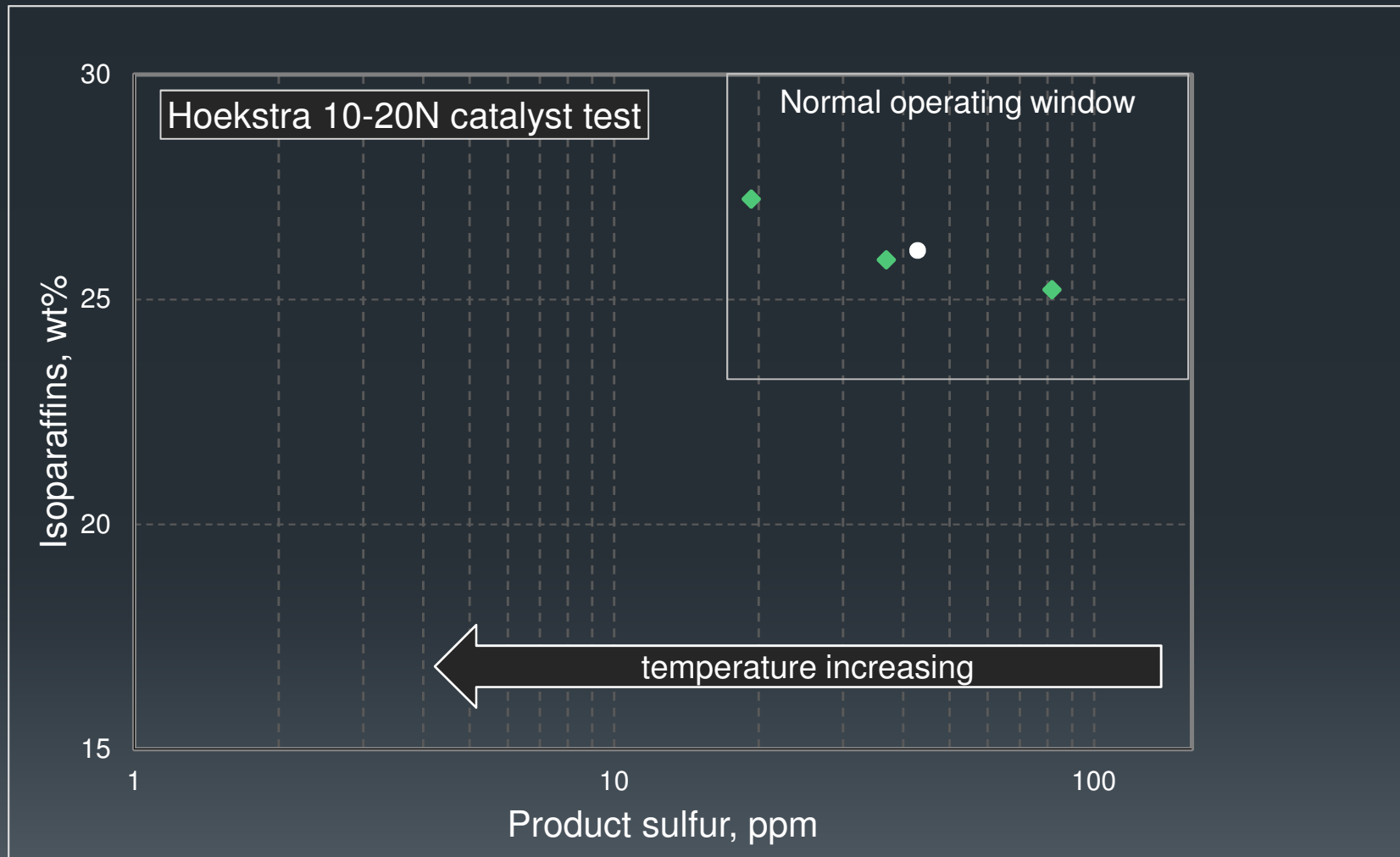
Selectivity for other hydrocarbon types





# ICT 2015 - isoparaffin selectivity

17

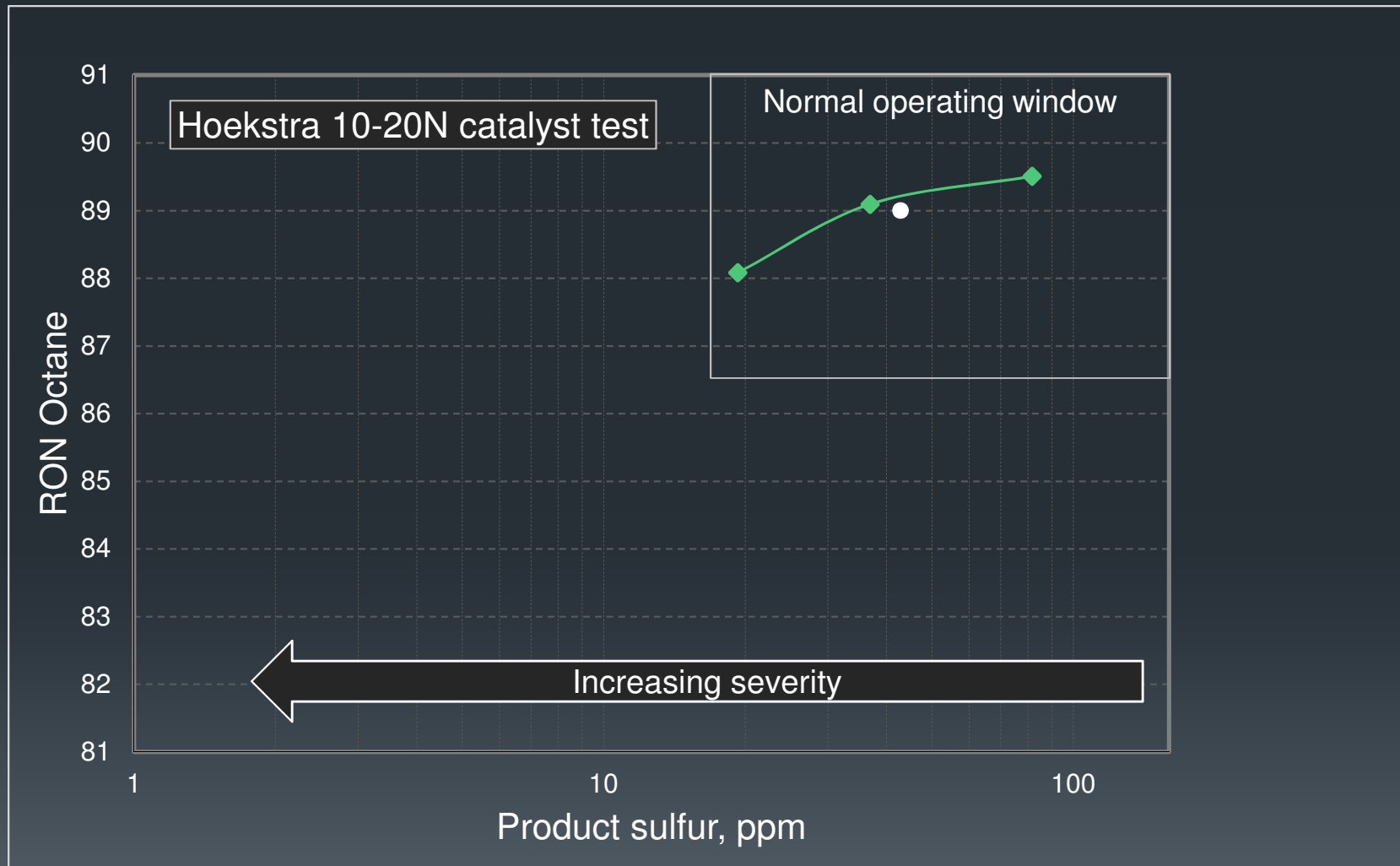


# Pushing the limits

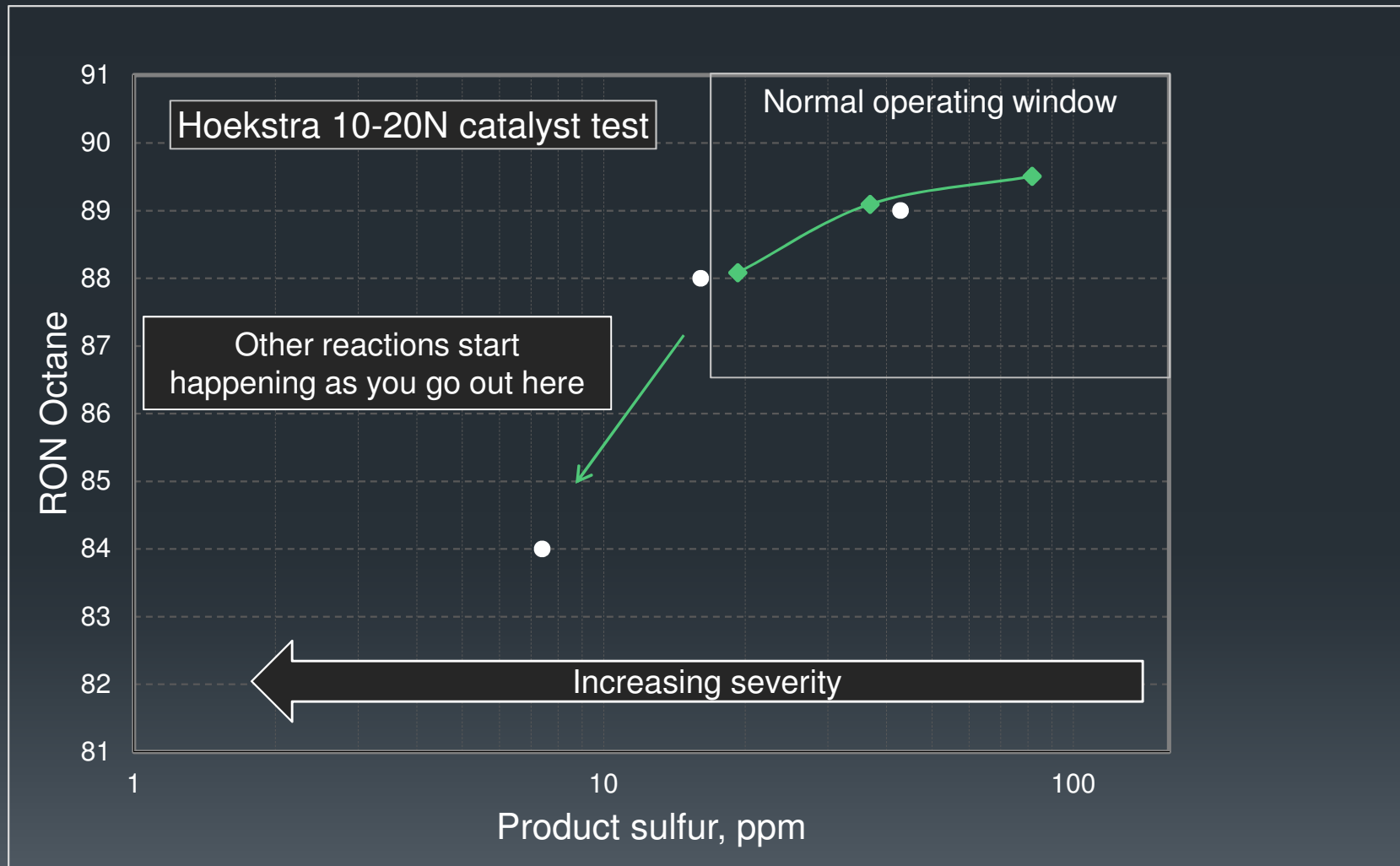
Increasing severity to make ultra-low-sulfur gasoline



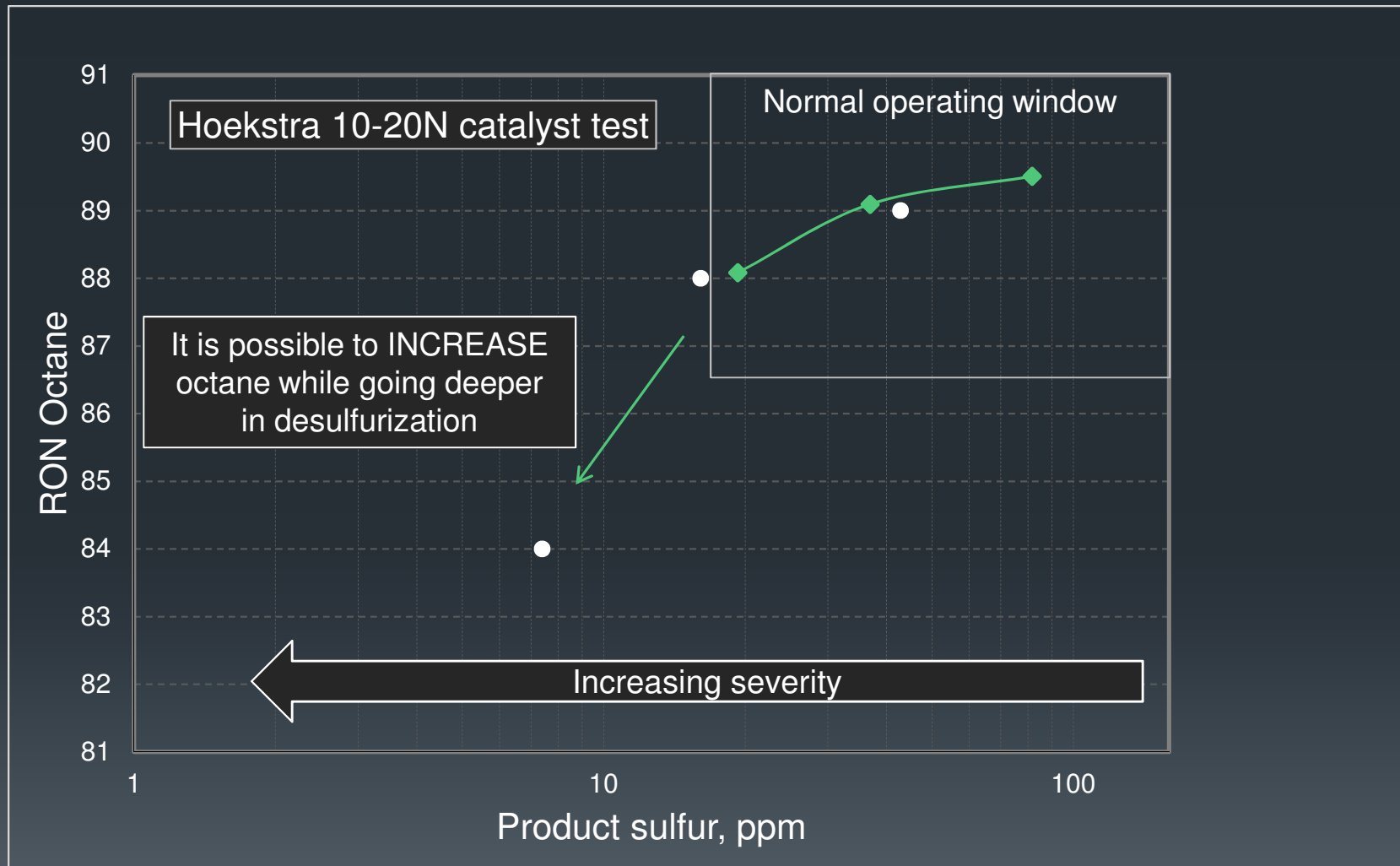
# ICT 2015 – octane retention selectivity <sup>19</sup>



# ICT 2015 – octane retention selectivity<sup>20</sup>



# ICT 2015 – octane retention selectivity <sup>21</sup>



# Independent catalyst test report 2015

- Competitive catalysts have been tested
- They are ranked on desulfurization activity
- They are ranked on olefin retention selectivity
- Large improvements in desulfurization/octane performance are possible at deep desulfurization
- The report is available to anyone from Hoekstra Trading



# Thanks for your attention!

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