

ADVANCED SOLUTIONS FOR PARAFFIN ISOMERIZATION

Introducing ATIS-2L

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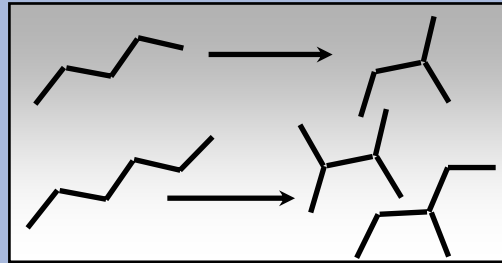
2004 Annual Meeting

Introduction

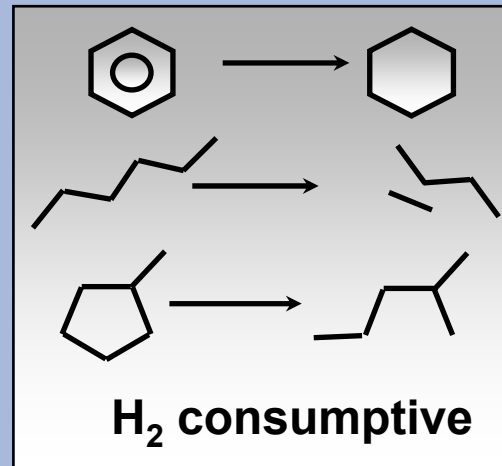
- **Octane shortage & restricted components**
- **Isomerate is becoming more important**
 - **Upgrades low octane stream**
 - **Reduces benzene in pool**
- **ATIS-2L is a new catalyst by Akzo & Axens for maximum octane**
- **Flow schemes from Axens address octane and capacity needs & retrofit opportunities**

Chemistry

C_5 / C_6
isomerization



skeletal isomerization

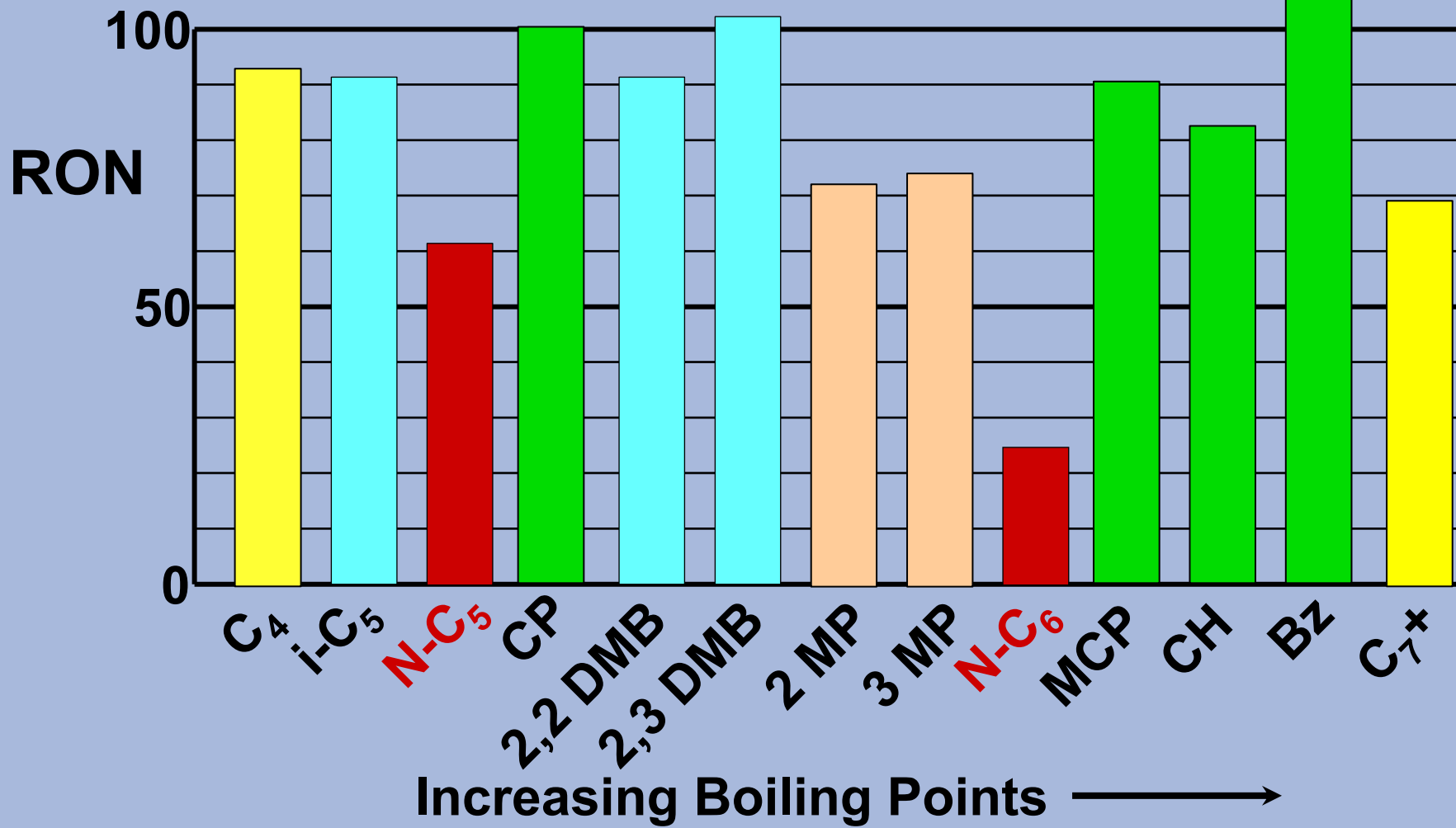


benzene saturation

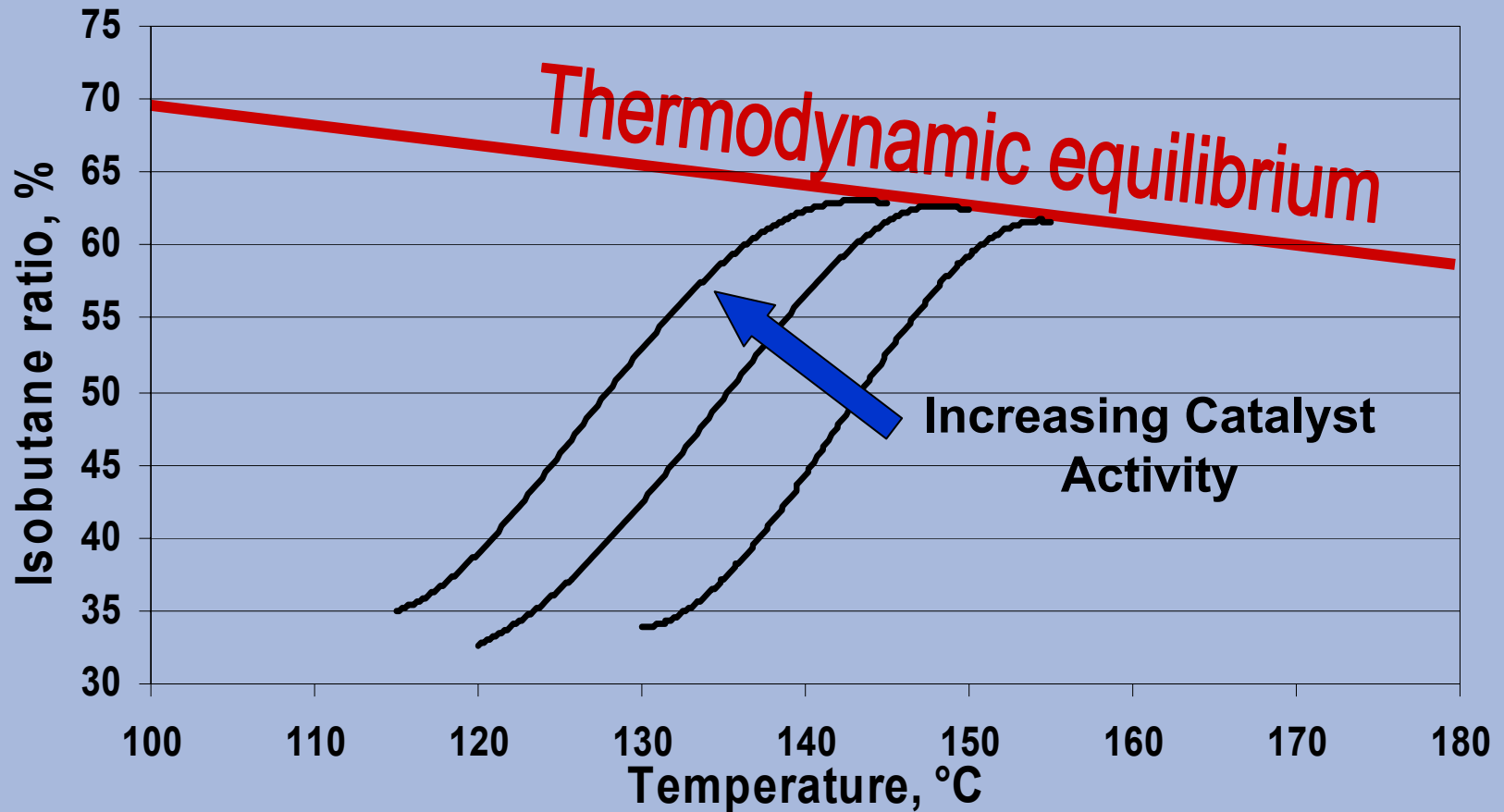
hydrocracking

(naphthene) ring opening

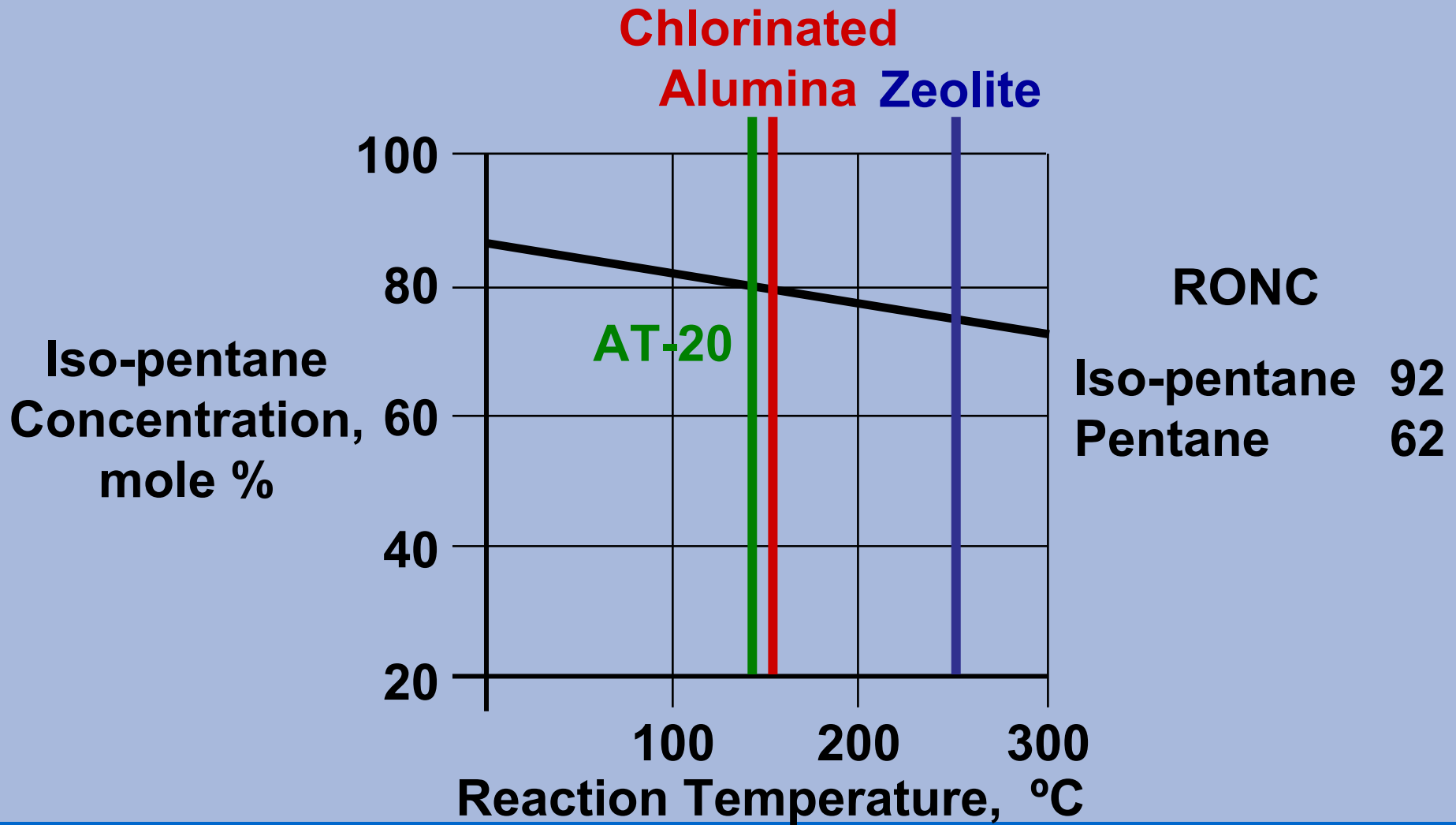
Component Octanes



Catalyst Activity



Catalyst Types



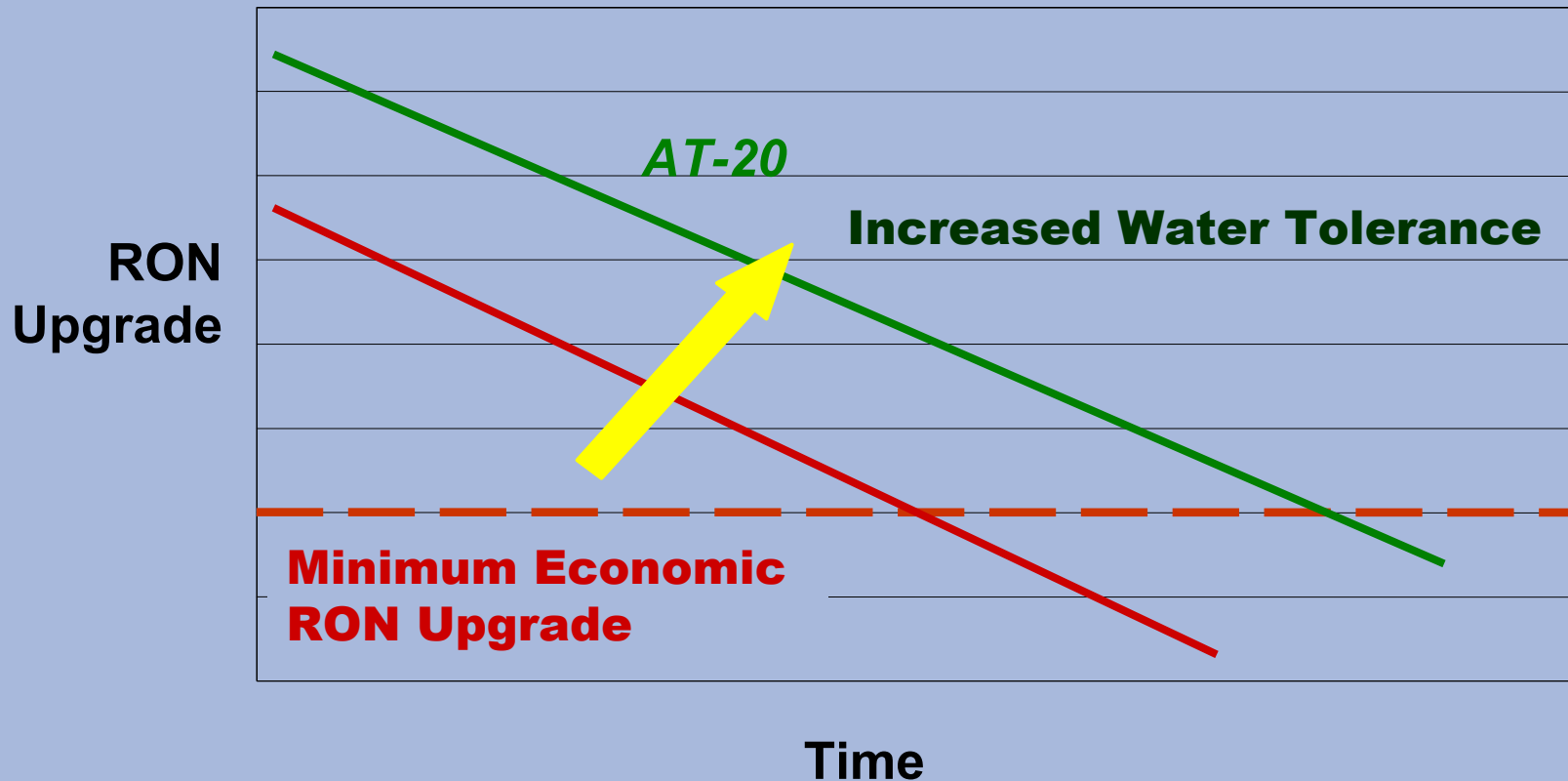
Two Main Types of Catalysts: Zeolite & Chlorinated Alumina

- **Zeolite-Pt type Catalyst**
 - Moderate Activity (higher T = heater, recycle H comp.)
 - Good RON – limited by higher T req'd
 - Relatively Insensitive to Impurities: S, N, O, water, C7+ (no feed HDT or dryers)
 - No chlorides (no scrubbers / guard beds)
- **Chlorinated Alumina - Pt Catalyst**
 - High Activity (lower T, no heater)
 - Excellent RON – operation at low T
 - Sensitive to Impurities (feed HDT, dryers on feed & H₂)

Tolerance for Contaminants

	Cl-Al	Zeolite
		ppm wt
Feed		
Water and oxygenates	0.1	50
Basic nitrogen	0.1	1.0
Sulfur	0.5	20
Hydrogen make-up gas		
Water	0.5	50
CO + CO₂	10	50
Sulfur	1.0	10

Oxygenate (water) Poisoning



A New Low Density Catalyst

- Build on proven performance of AT20
- High activity (lower T, more iso-P)
- Improved water tolerance
- Lower density
 - Retain or improve activity at constant volume
 - Reduce catalyst load cost (wt & Pt)



ATIS-2L

Pilot Testing AT-20 & ATIS-2L

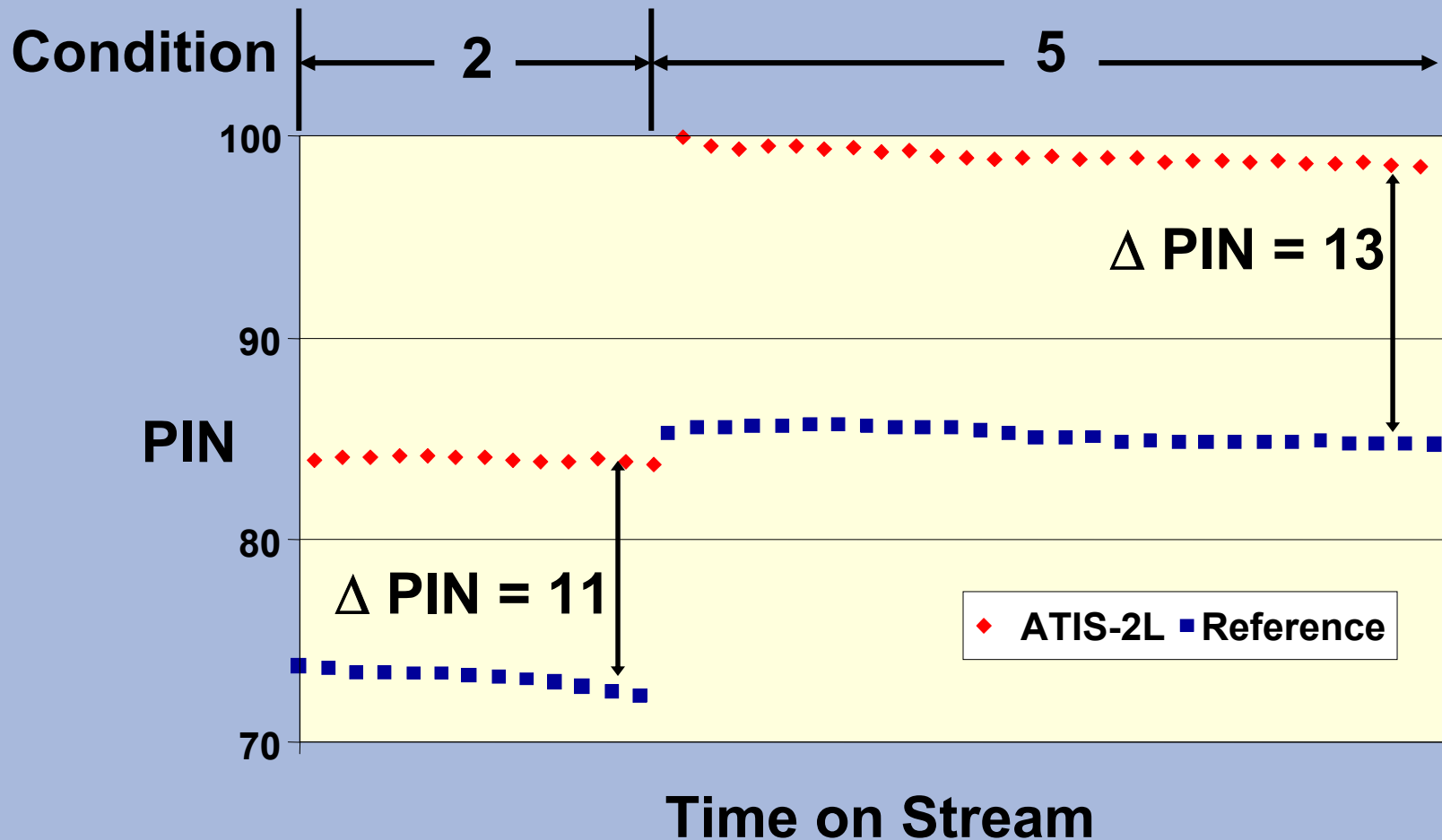
Definitions

- **X factor = sum of MCP, benzene, CH and C7+**
- **PIN = sum of i-C₅, 2,2 DMB and 2,3 DMB ratios**
- **TIN = sum of i-C₅ and 2,2 DMB ratios**
- **i-C₅ ratio = i-C₅/(sum of C₅ paraffin)**
- **2,2 DMB ratio = 2,2 DMB/(sum of C₆ paraffin)**
- **2,3 DMB ratio = 2,3 DMB/(sum of C₆ paraffin)**
- **WHSV = combined feed (t/hr)/cat. weight (t)**

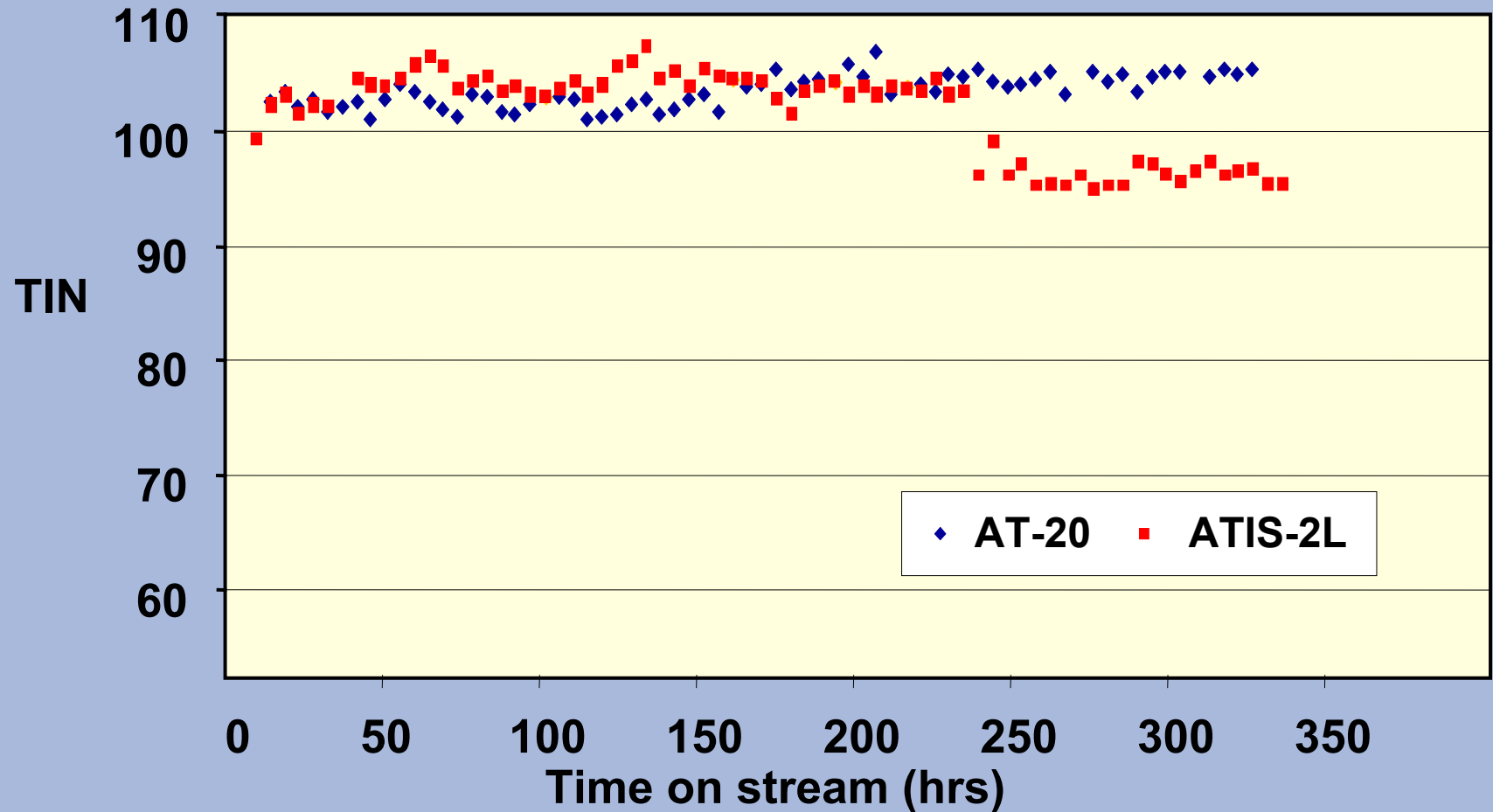
Test Conditions

Condition	WHSV (hr ⁻¹)	H ₂ /HC Lag Reactor Outlet (mol/mol)	Pressure (psig)	Catalyst		Temperature	
				Lead	Lag	Lead (°F)	Lag (°F)
1	1.9	0.05	435	AT-20	ATIS-2L	330	285
2	1.9	0.05	435	ATIS-2L	AT-20	330	285
3	1.9	0.05	435	AT-20	ATIS-2L	330	285
4	1.8	0.20	435	AT-20	ATIS-2L	330	285
5	1.8	0.20	435	ATIS-2L	AT-20	330	285

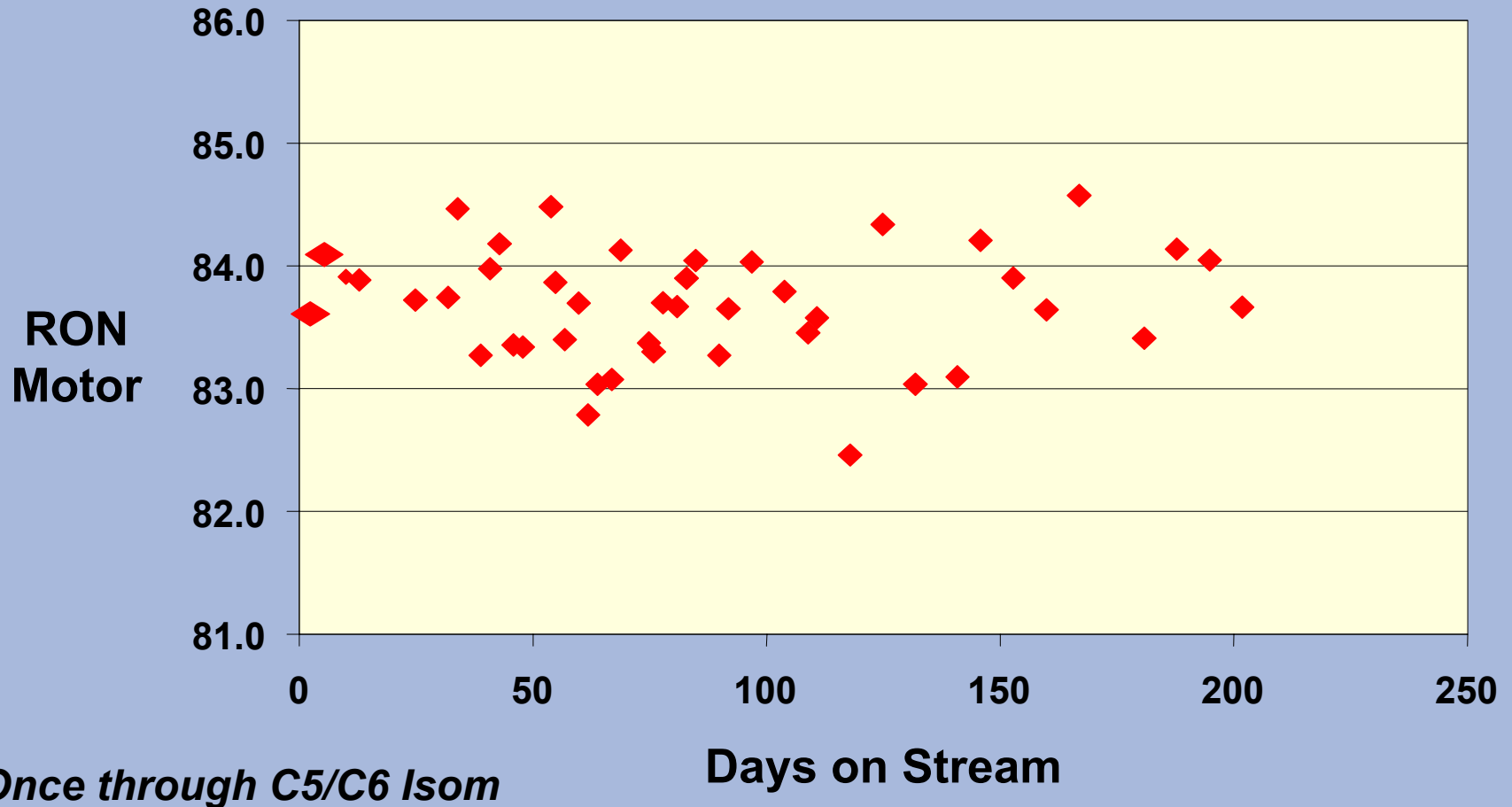
Comparison ATIS-2L & Reference



3rd Party Tests



ATIS-2L Commercial Data



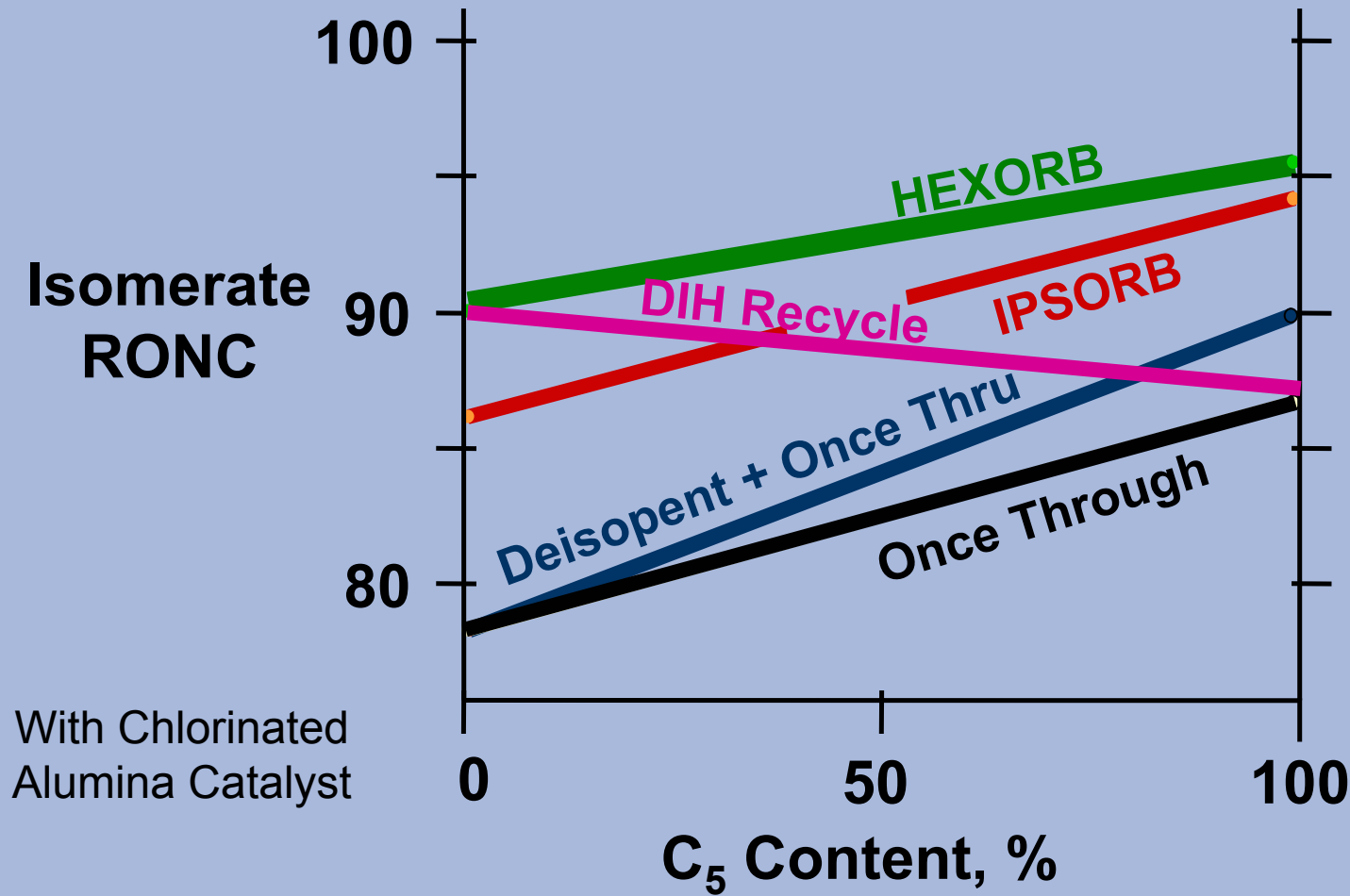
Once through C5/C6 Isom

Days on Stream

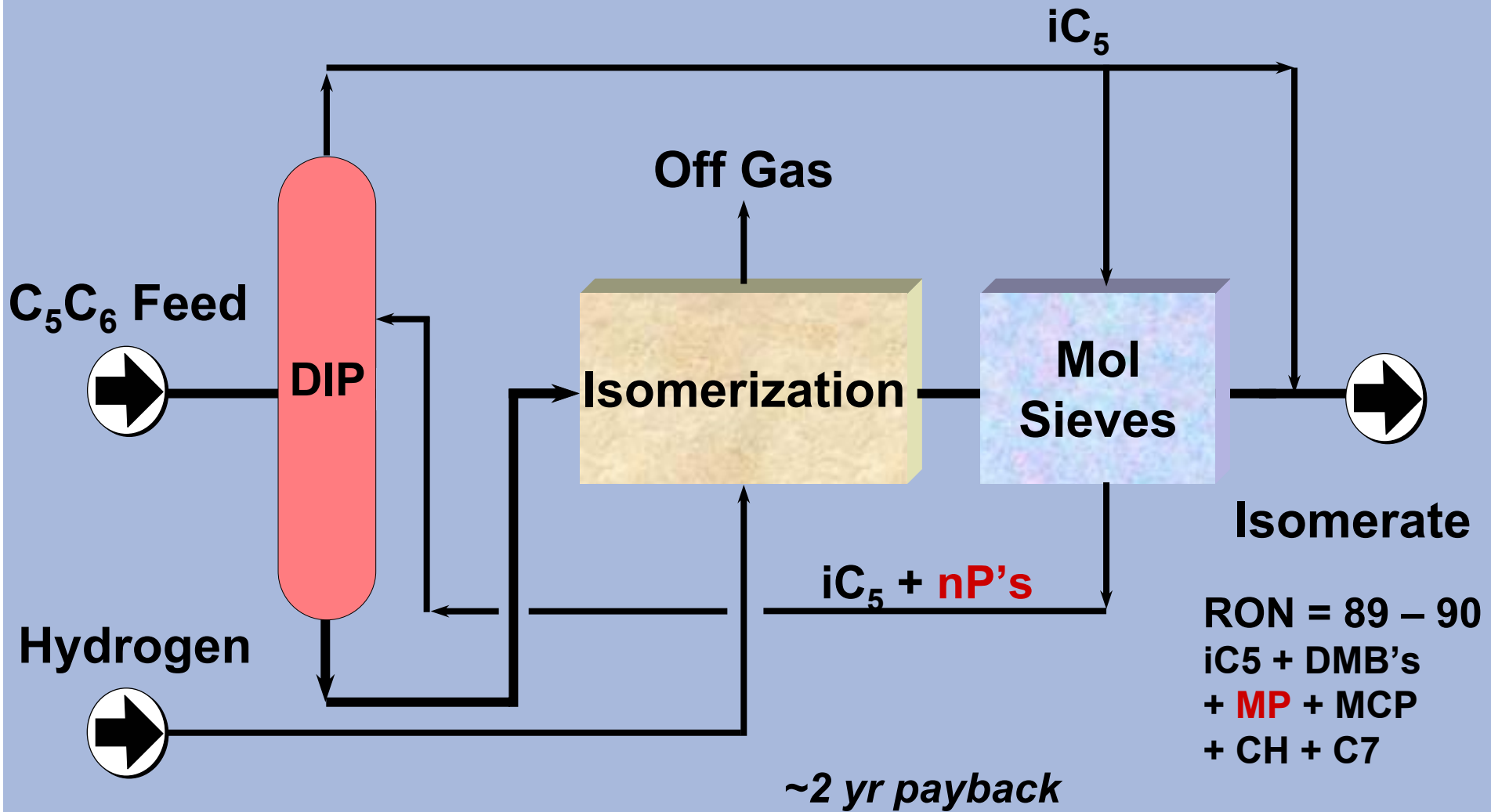
Isomerization Technologies

- **Conventional technologies**
 - **Once-through**
 - **Deisohexanizer recycle**
- **Advanced Recycle**
 - **Ipsorb**
 - **Hexorb**
- **Opportunities for revamps to enhance throughput and octane**

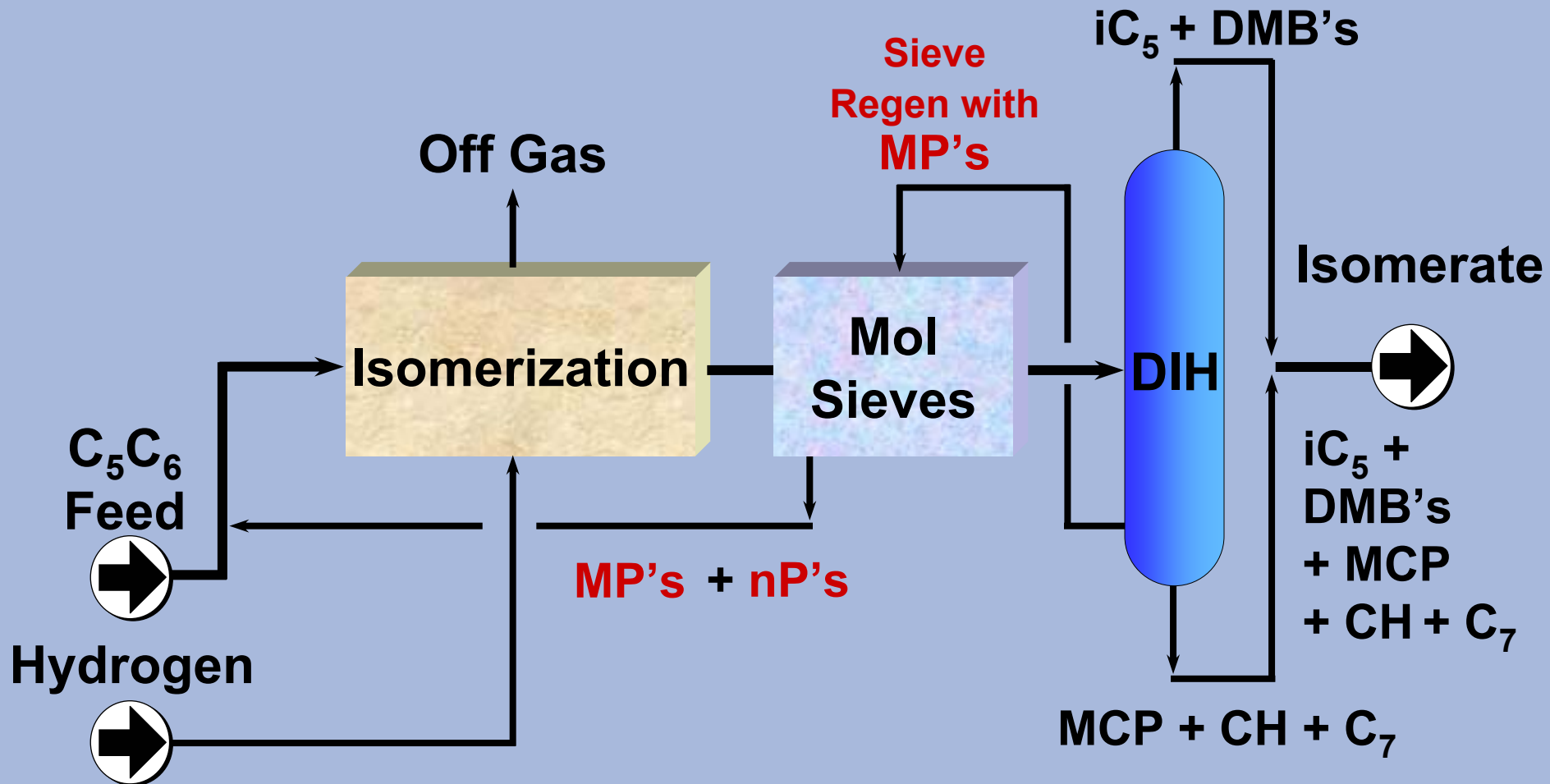
Selecting an Isom Scheme: Recycle Options Overcome Equilib. Limits



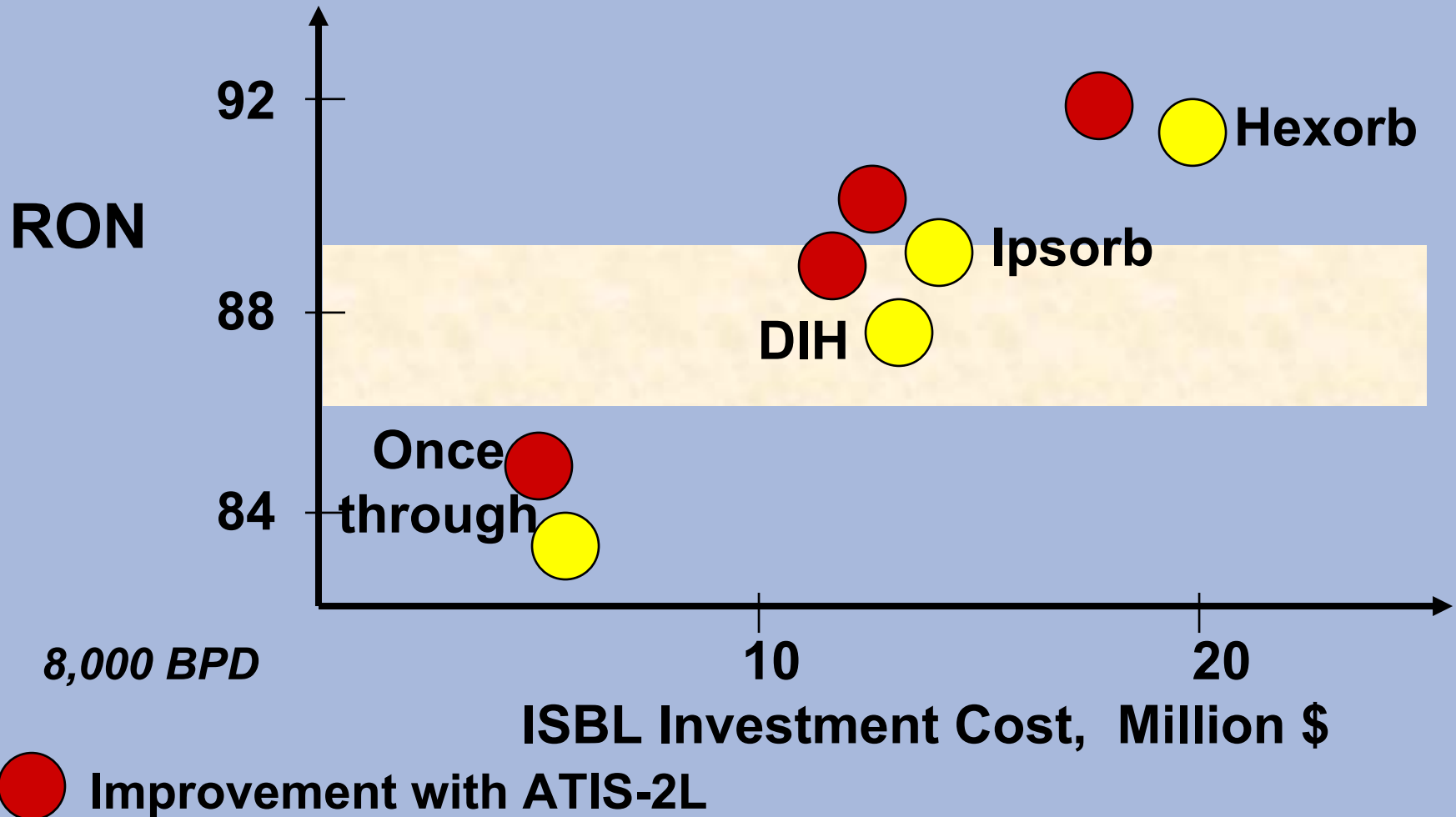
Revamping a Once-thru to Ipsorb



DIH to Hexorb: Complete Recycle



ATIS-2L Improves All Schemes



Conclusion: New High Activity Isom Catalyst by Akzo & Axens

	Base	ATIS-2L
Activity	base	- 10°F
Once-through RON	base	+ 0.5 - 1
Catalyst cost, Pt included	base	~0.85 x base

* constant-volume comparison

Commercially Proven: 84 RON Once Through

Conclusion

- **Conventional & advanced recycle technologies**
 - **30+ licensed units**
 - **Once-through**
 - **DIH recycle**
 - **Ipsorb Mol Sieve recycle**
 - **Experience from 100+ loads of isomerization catalyst (Axens units & Others)**
- **All isomerization process technologies benefit from ATIS-2L's higher activity**
- **Very attractive step-wise revamp opportunities**

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ATIS – 2L

