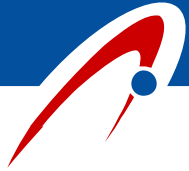


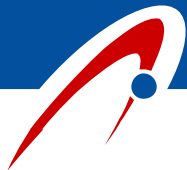
# Prime-G+ Update

Quentin Debuisschert

Axens

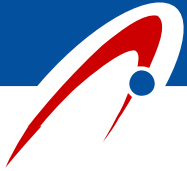


- **Gasoline Sulfur Control**
- **Prime-G+ Technology Update**
- **Prime-G+ Commercial Update**
- **The Industrial Experience**
- **Axens' Integrated Offer**



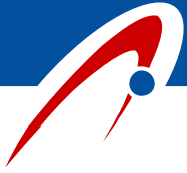
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- **Prime-G+ Commercial Update**
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- **Axens' Integrated Offer**

Axens



# European Gasoline Sulfur Regulations

- **EU 2000 spec.**                      **150 ppm sulfur**
- **EU 2005 spec.**                      **50 ppm sulfur**
- **U.K., October 2000**              **Tax incentive for 50 ppm S**
- **Germany, End 2001**              **Tax Incentive for 50 ppm S**
- **Germany 2003**                      **Tax Incentive for 10 ppm S**
- **EU 2009 spec.?**                    **100% of Mogas pool at 10 ppm S**
- **EU 2003 +**                            **10 ppm S driven by marketing**



# FCC Gasoline HDS Requirements

- **Maximize Octane Retention**
- **Minimize H<sub>2</sub> Consumption**
- **Reliability - Key Unit in the Refinery**
- **Cycle Length equivalent to FCC Turn-around**
- **Maximize Gasoline Yield without RVP Increase**
- **Possibility to Control Olefins Content**
- **Ability to Co-Process other S containing Streams**
- **Ability to Meet Potential Future Specs.**

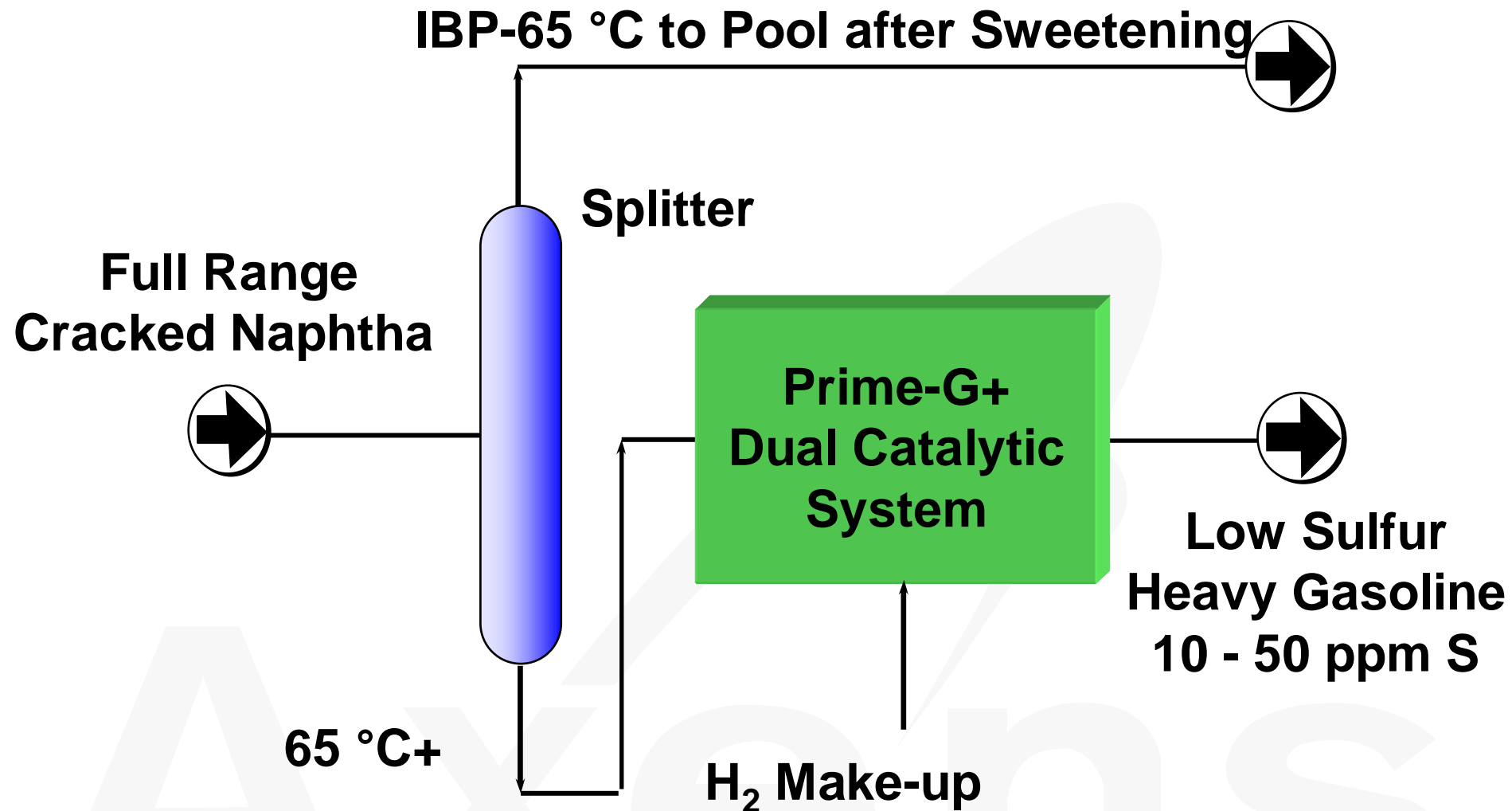


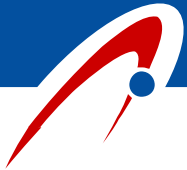
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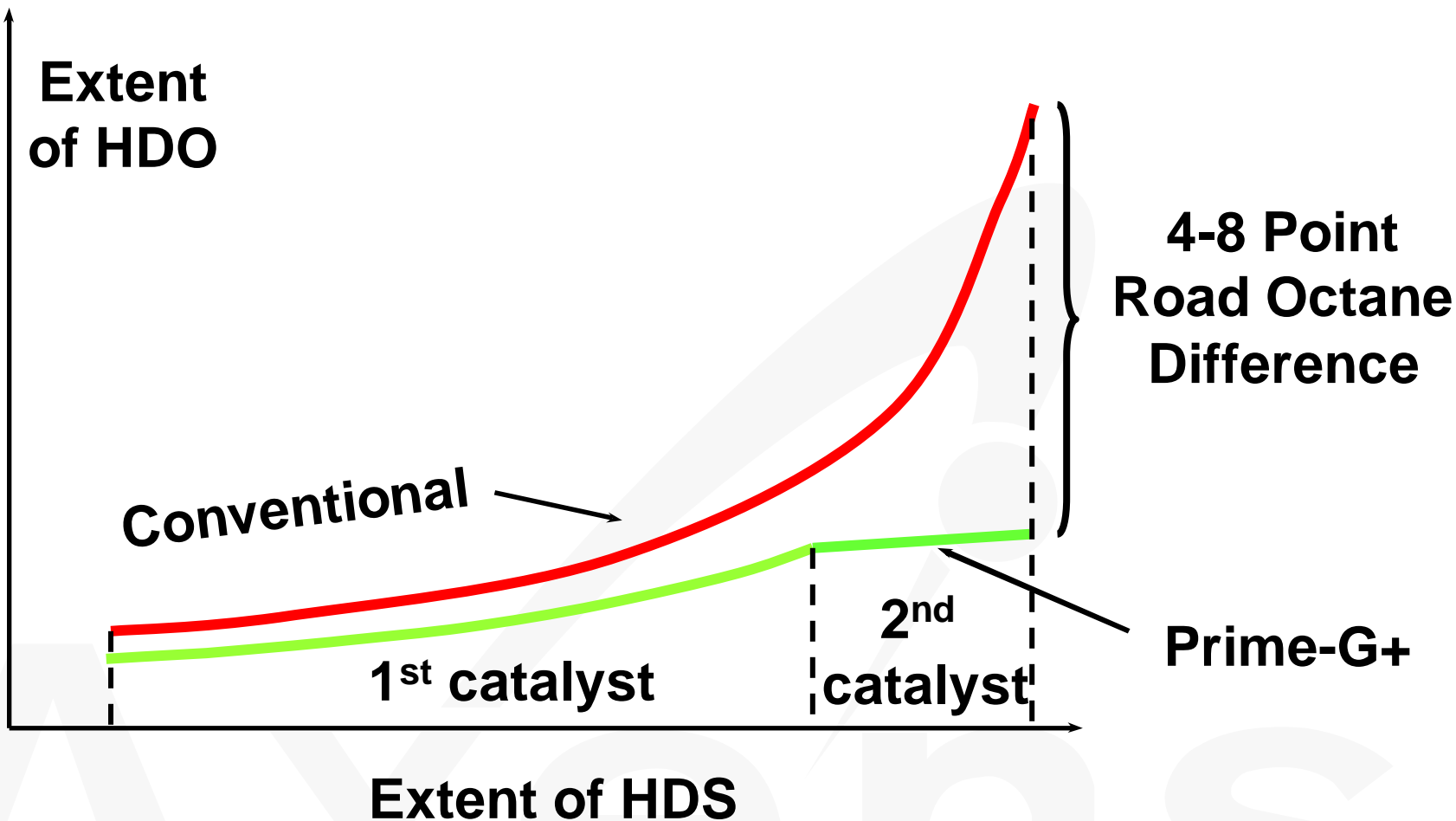


# Prime-G+ - 10-50 ppm Sulfur Selective HDS



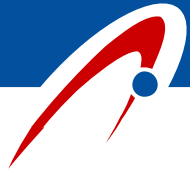


# HDO vs. HDS: Conventional and Prime-G+

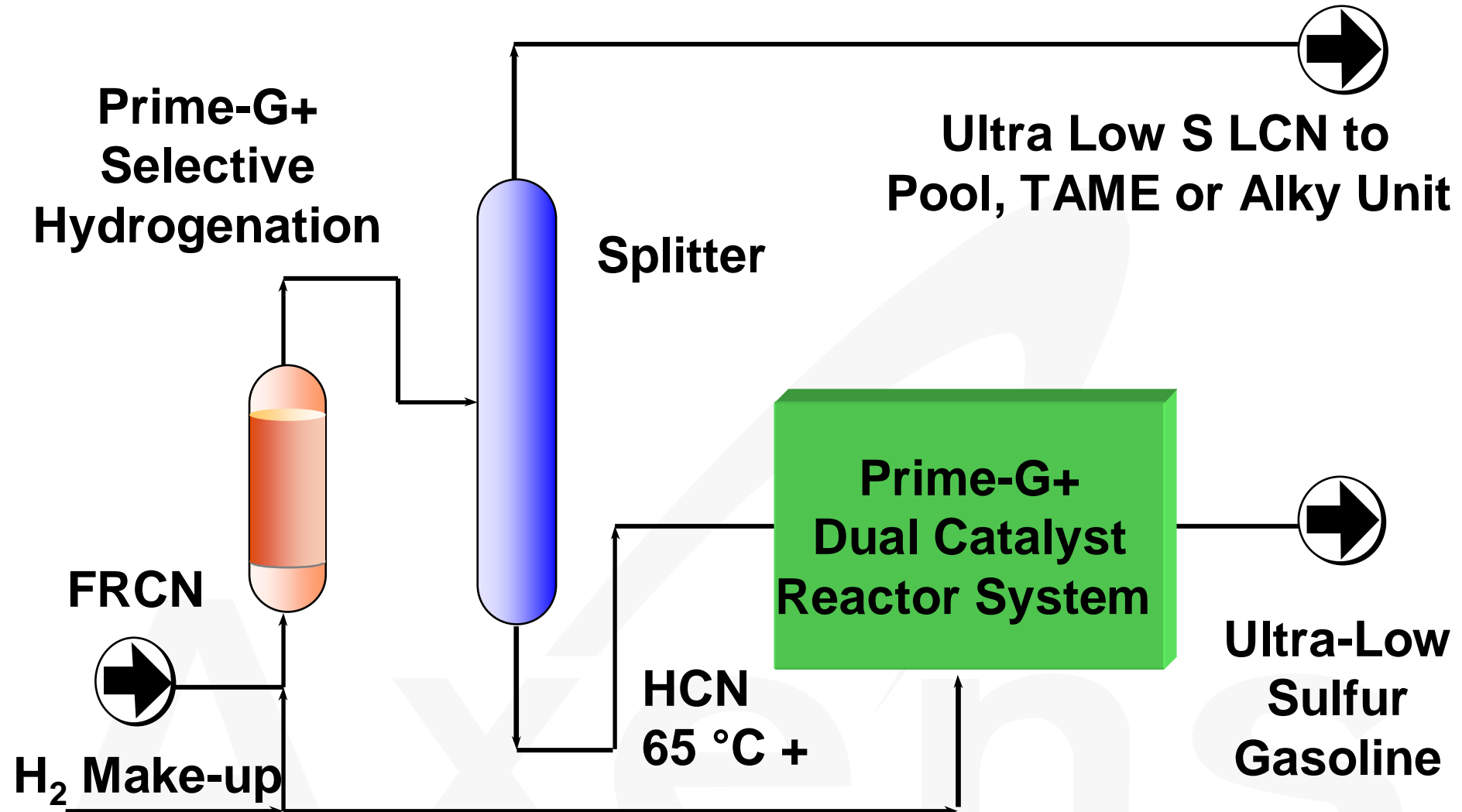


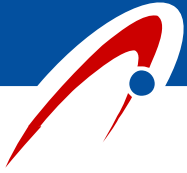


- **High performance**
  - Deep HDS (less than 10 wppm product S)
  - Low Octane Loss, Low product mercaptan
- **Low Cost and Utilities**
  - Well suited for idle units reutilization
- **Simple and Reliable Process**
  - Easy operation
  - Excellent stability
- **Industrially proven at Ultra Low Product Sulfur**
- **Ability to Co-process other Streams than FCC**



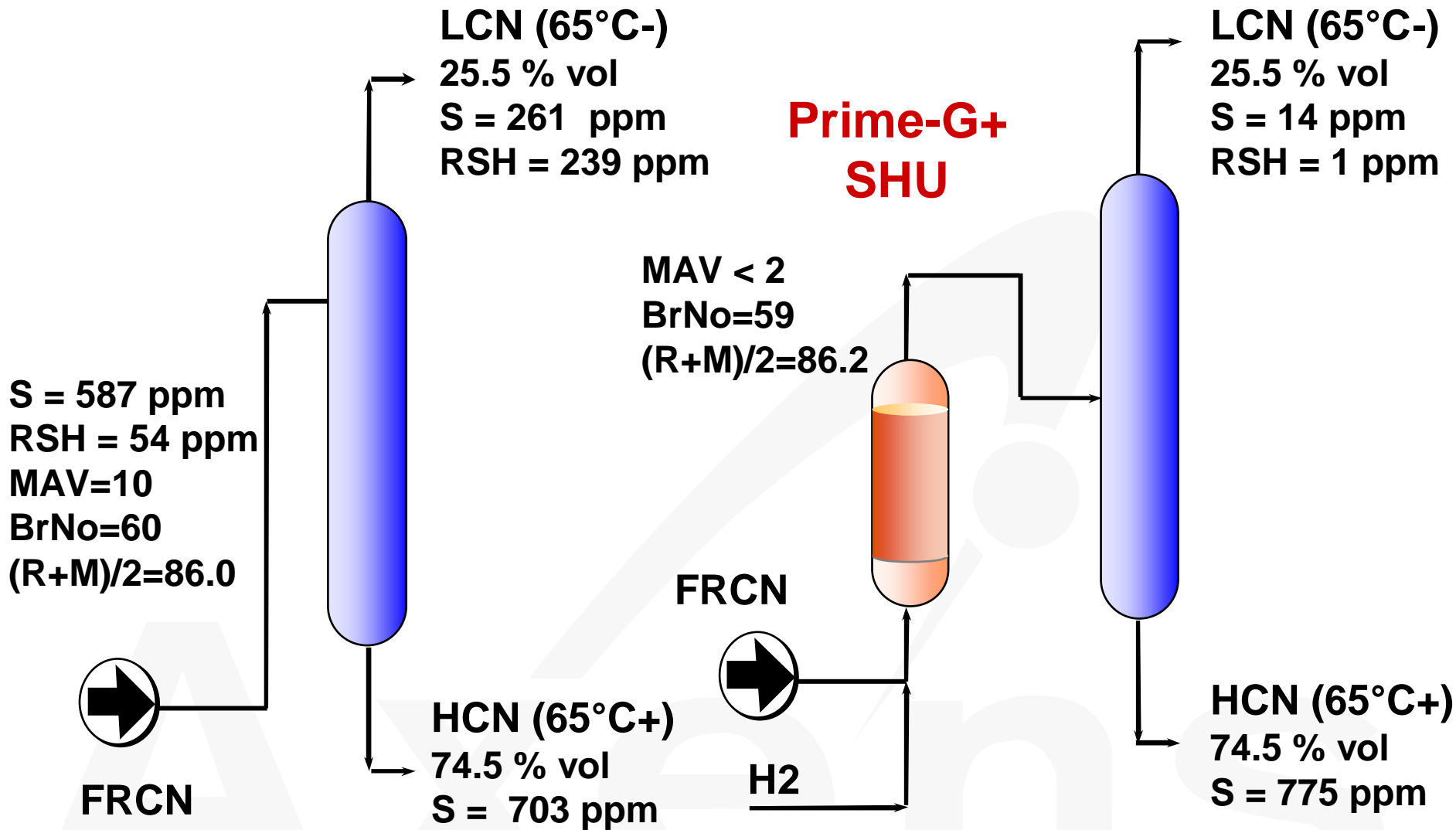
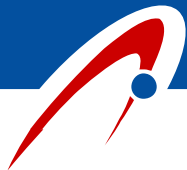
# Prime-G+ Process 10-50 ppm Sulfur Spec

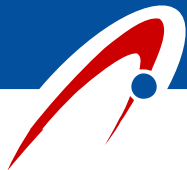




- **Removes Diolefins from HCN**
  - Minimizes pressure drop in selective HDS
  - Allows to achieve long cycles on selective HDS
- **Removes Diolefins from LCN**
  - Feed preparation for alkylation or etherification
- **Converts Lt. Mercaptans/Sulfides to Heavy Sulfur**
  - Very low sulfur LCN product
  - No need for extractive sweetening
- **Isomerizes External Olefins into Internal Olefins**
  - Moderate octane gain on LCN

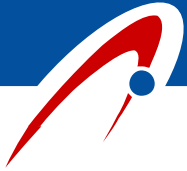
# SHU Performance & Mercaptans Conversion





- Gasoline Sulfur Control
- Prime-G+ Technology Update
- **Prime-G+ Commercial Update**
- The Industrial Experience
- Axens' Integrated Offer

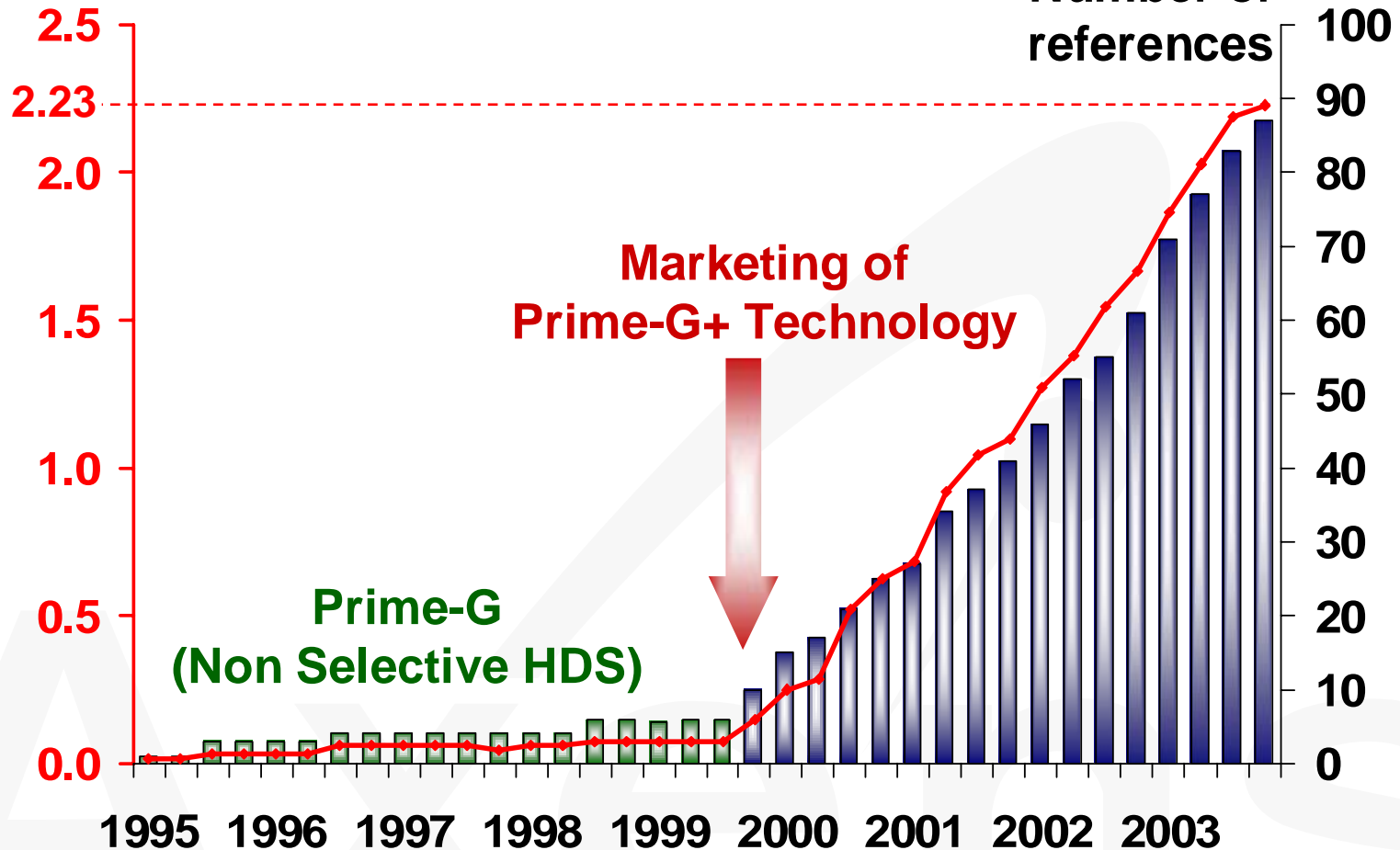
Axens



## Cumulative Capacity, MBPSD

## Prime-G / Prime-G+

Number of references



As of January 2004



## Licensed Units - Design Range

- **Unit Capacity**      **2,500 - 115,000 BPD**
- **Feed Sulfur**      **30 - 4,100 ppm**
- **Olefins Content**    **15 - 55 vol. %**
- **Feeds**    **FCC Naphtha, light Coker Naphtha, LSR, Steam-Cracking Naphtha**
- **Product S** < **10 ppm**

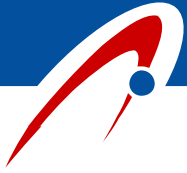


- **30 Prime-G+ units in operation at ULS**
- **Technology Selection after Pilot Testing**
- **Fast Track Projects**
  - **Less than 2 years between BEDP and Oil In**
- **Full Set of Axens services**
  - **Basic Engineering**
  - **Catalyst Supply**
  - **Assistance for Start-up**
  - **Follow-up of the unit**
  - **Advanced Control**
- **All Axens Guarantees met**



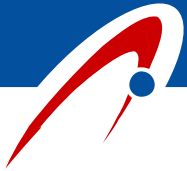
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Axens



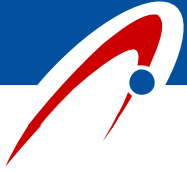
***Prime-G+***  
***First Unit***  
***Germany***





# Prime-G+ Commercial Achievements

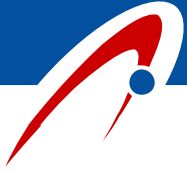
- **SHU performance**
- **HDS Octane Retention**
- **Permanent On-spec Sulfur Production**
- **SHU/HDS Mercaptan Control**
- **Prime-G+ Unit Reliability**
  - **Unit response to feed upsets**
  - **Catalysts stability**
  - **Pressure Drop management**



# Prime-G+ SHU Performance Mercaptans Removal

	SHU Feed	LCN Product
<i>RSH</i>	100	< 2
<i>Sulfur</i>	2100	< 10

- 
- ***Almost complete mercaptans removal***
  - ***Doctor Test negative LCN***

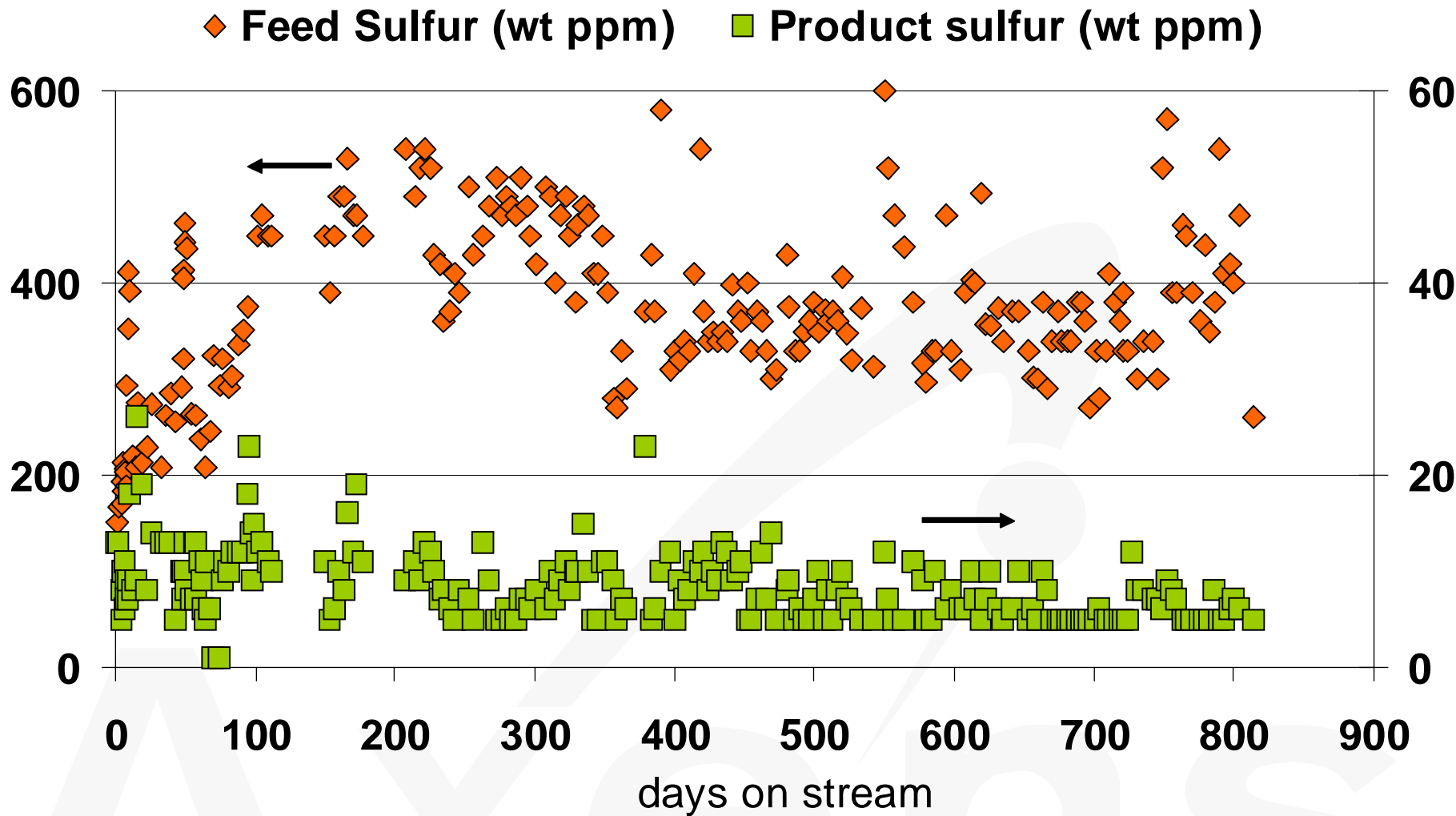
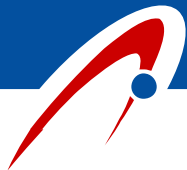


## *Performance Test Results*

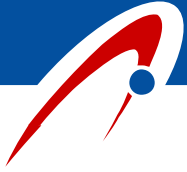
	SHU Feed	SHU Product
RON	94.0	94.3
MON	82.0	82.2

- 
- *Slight Octane Boost on SHU*
  - *Octane boost mostly concentrated on LCN*

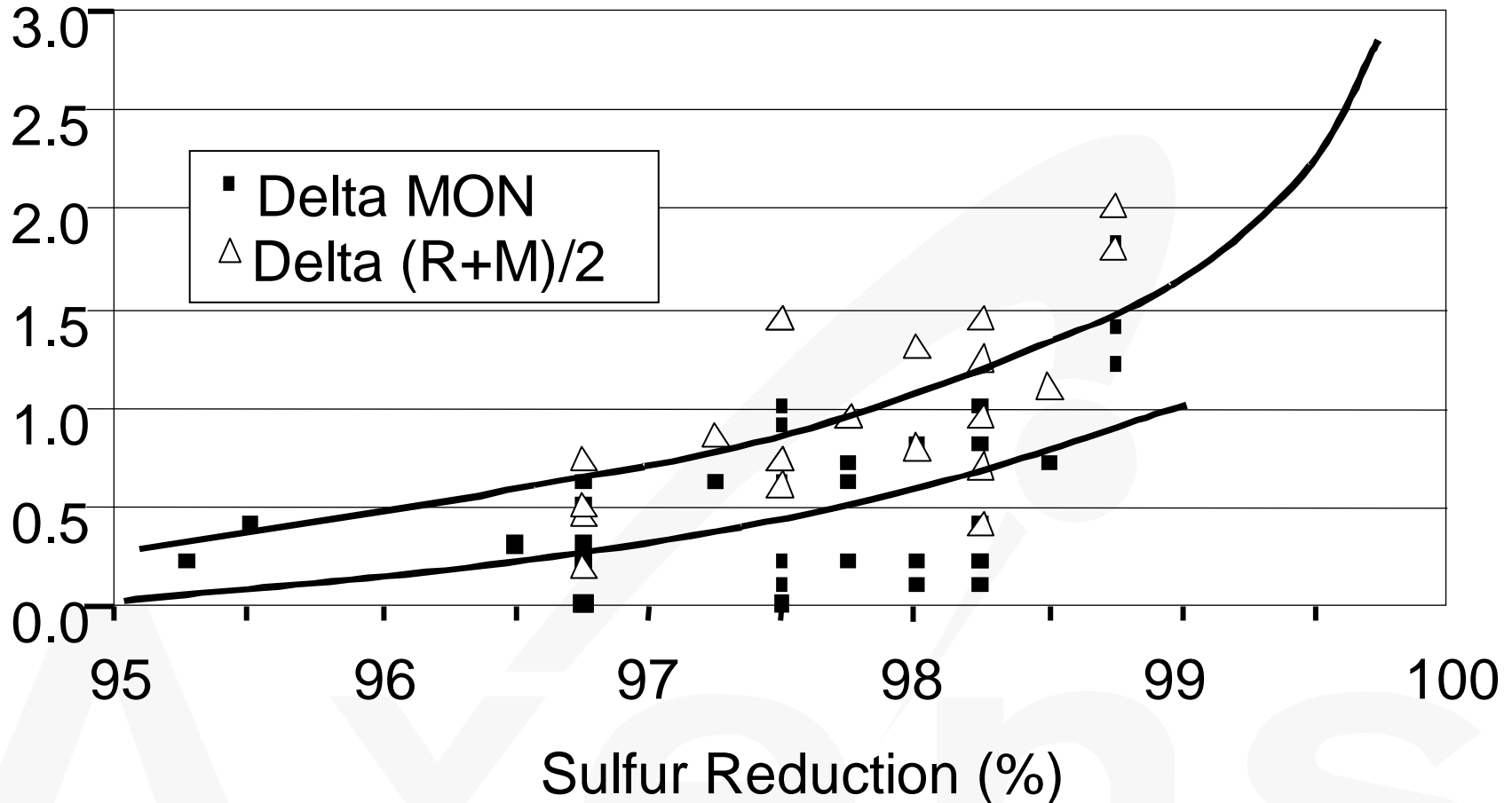
# On-Spec All the Time



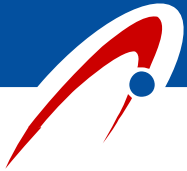
# Prime-G+ HDS Octane Retention Typical European Unit



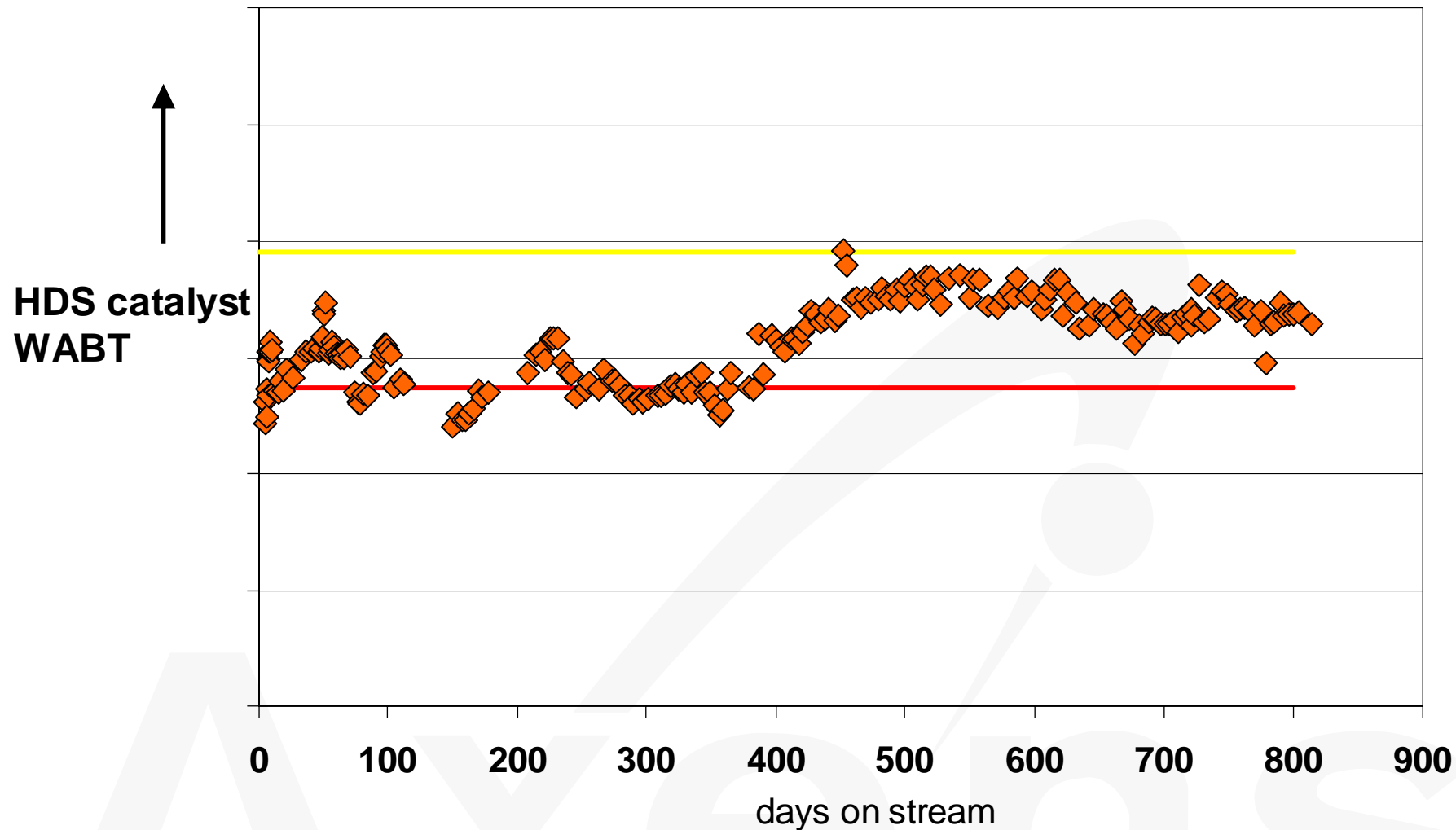
## Octane Loss

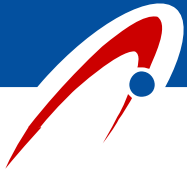






# Reliability - HDS catalysts stability

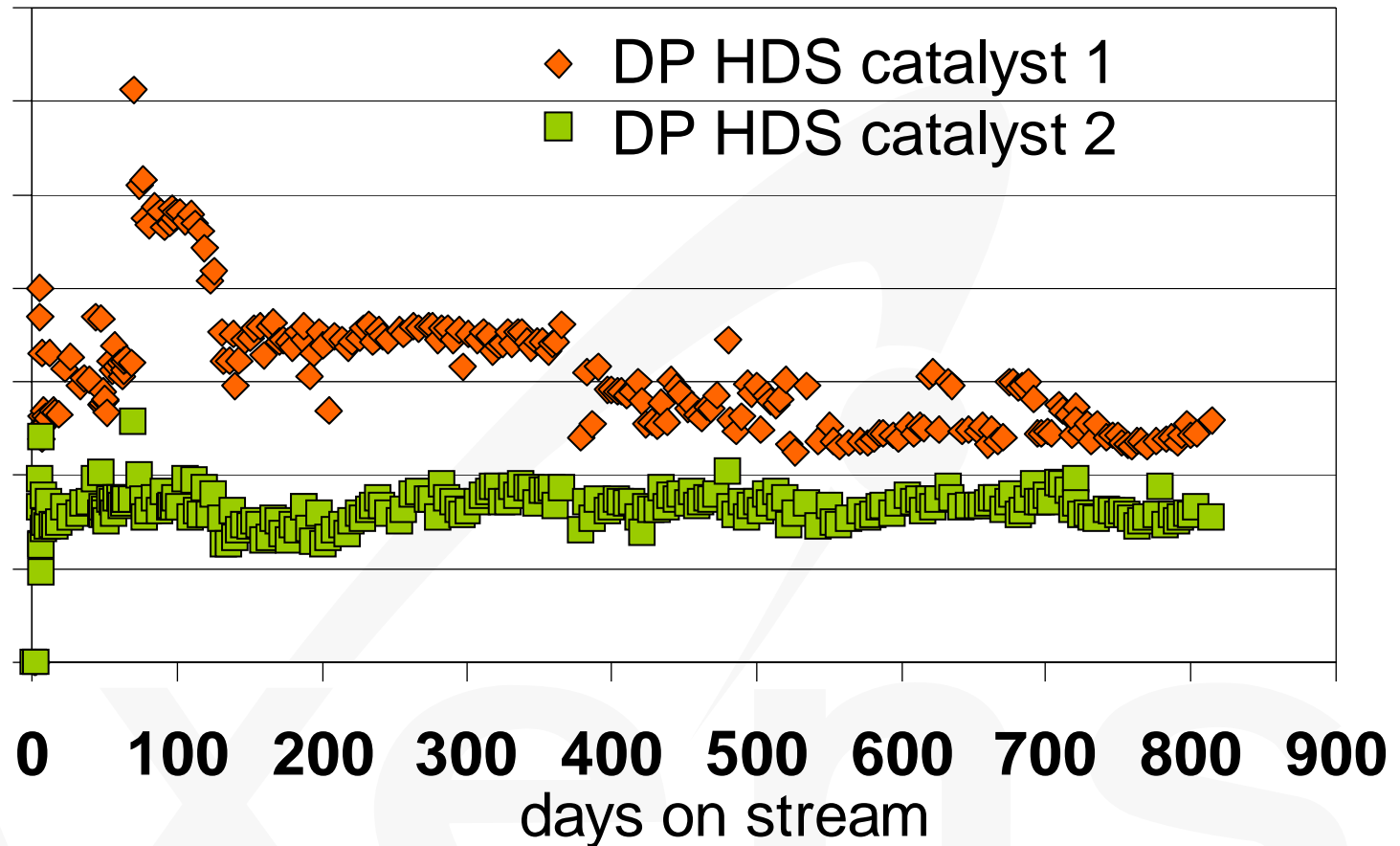




# Reliability – Pressure Drop Management

Normalized Pressure Drop,

$$\frac{\Delta P}{(\text{Flow Rate})^2}$$





- **Worldwide Trend towards ULS Fuels**
  - 10 ppm S today effective in Europe
- **Prime-G+ Leading Technology**
  - 90 References worldwide
  - 30 units in operation (+ 7 Prime-G)
  - Industrially Proven at ULS (10 ppm S)
- **Technology Highly Flexible**
  - Schemes with or without splitter
  - Flexible HDS Section
  - SHU upstream splitter

# Prime-G+ Update

*For more information, please visit our website*

*[www.axens.net](http://www.axens.net)*

Axens