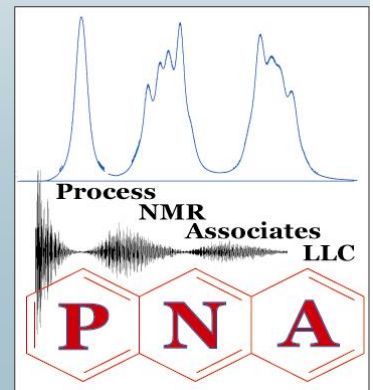


NMR Process Systems – Integrated Solutions[©]

On-Line NMR

NMR Process Systems, LLC
87A Sand Pit Road
Danbury, Connecticut 06810
+203-744-5905 (ph)
+203-743-9297 (fax)
www.nmr-automation.com



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On-Line NMR

System Advantages

- Complete, integrated application solution
- Calibration model and application software included with system (models available for many applications)
- Standard Ethernet communication with external data and control systems
- Field-proven reliable operation, running continuously in refinery applications since 1995
- Multi-variable analysis from a single instrument and a single sample
- High measurement resolution
- Stable, homogeneous magnetic field, no fringe field
- No moving parts in the core NMR analyzer
- Variety of sample probes
- Built-in reference for measuring chemical shifts of all process components
- Automatic shim control ensures uniformity of magnetic field during measurement
- Availability of continuing service and support Contracts
- Built-in manifold valves provide convenient purge, drain, and vent connections for cleaning sample line
- All system display, operation, and supervision performed from a remote computer



Qualion Process NMR Analyzer

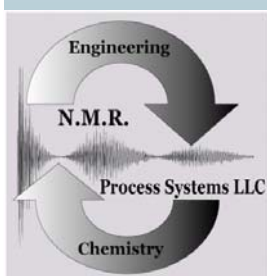
BENEFITS

Continuous, timely measurement of process fluid component qualities and ratios permits you to:

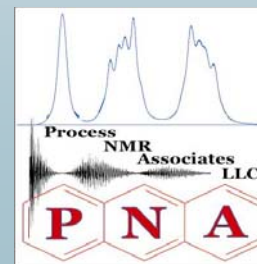
- Reduce consumption of costly catalysts and reagents
- Enable the use of a wider range of feedstocks
- Improve product quality
- Maximize process throughput rates even with varying feed compositions
- Operate nearer design limits
- Obtain reliable results even with optically dense process samples

INTEGRATED APPLICATION SOLUTION

- The Qualion NMR analyzer, combined with advanced control tools, provides a turnkey, engineered solution for a specific process control improvement task.
- NMR chemometric models are available for specific process applications. All are designed and field tested to meet the operating goals of the particular process, such as to maintain product quality, maximize yield, and enhance feedstock flexibility.



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FUNCTIONAL SPECIFICATIONS

Nuclei Observed

H+ (primary), F19, P31 (optional)

Operating Frequency

57±1.0 MHz for H+ (Approx. 53 MHz for F19, 23 MHz for P31)

Probe (Type C - 1/4 Inch OD)

Type C Dewar Probe designed to handle liquids at 5 to 90°C (41 to 194°F) and at maximum pressure of 24.0 bars (350 psi).

Probe (Type D - 3/8 Inch OD)

Type D Dewar Probe designed to handle liquids at 5 to 120°C (41 to 248°F) and at maximum pressure of 24.0 bars (350 psi).

Magnet System (Types C and D)

Temperature stabilized, self-condensed field, permanent (neodymium) magnet with integral field gradient (shim) coils and automatic shim control

Field strength

1.35 tesla at 45°C

Fringe field

Less than 1 gauss on external enclosure of magnet

Clear Bore Size Options

Type C Dewar Probe — 4 mm (0.157 in) inside diameter

Type D Dewar Probe — 7 mm (0.276 in) inside diameter



APPLICATIONS

- Gasoline Blending
- Diesel Fuel Blending
- Fuel Oil Blending
- Naphtha Cracking
- FCCU Feed
- FCCU Distillates
- Sulfuric Acid Alkylation
- Crude Switching/Blending
- Catalytic Reforming
- CDU Distillate

PHYSICAL SPECIFICATIONS

Enclosure

NEMA 4, 12 gauge stainless steel, air purged

Size

151.1 cm H x 179.6 cm W x 113.4 cm D
(59.5 in H x 70.9 in W x 44.7 in D)

Add 15 cm (6 in) to height for shipping pallet.

Weight

635 kg (1400 lb) net weight,
750 kg (1650 lb) gross shipping weight

Clearance

119 cm (26 in) recommended on all sides.
198 cm (78 in) recommended headroom.

Lifting Facilities

Four lifting lugs (eyes), 38 mm (1.5 in) diameter

Anchor Bolts four 11.9 mm (0.47 in) holes for 3/8 in anchor bolts.

Utilities

POWER REQUIREMENTS

27 A, 230 ±10 V single phase 50/60 Hz ac line, typical.

ELECTRIC SERVICE REQUIREMENTS

230/240 V: One 40 A, single phase 50/60 Hz circuit
(USA: L1, L2, N, G; Europe: L1, N, G)

Remote Computer Requirements

Pentium™ processor with 128 MB RAM and
WIndows NT™ 4.0 operating system

Purging Gas Requirements

2.89 m³/h (1.7 cfm) dry instrument air during operation. 17 m³/h (10.0 cfm) of 7 kg/cm² (100 psi) Instrument air (dry, oil-free) required during startup. A high purge time of approximately 30 minutes is required on startup.

Ambient Temperature

0 to +45°C (32 to 113°F) ventilated to atmosphere and sheltered from direct sunlight, 5 to 95%RH noncondensing

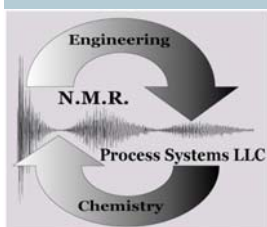
Electrical Classification

ATEX Certified for Zone 1 hazardous area
EE x p II T4 Epsilon 06ATEX2001

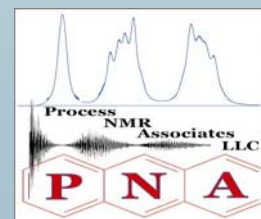
NMR Process Systems, LLC.

NMR Process Systems, Inc. is a joint venture company between Process NMR Associates, LLC (Danbury CT), and TTC Labs Inc. (Fond du Lac WI). NPS markets, installs and supports process NMR and other technology solutions for control and optimization in the refining, petrochemical, pharmaceutical and food industries.

NPS is now advancing new concepts in process analysis by offering integrated analytical solutions into its product slate. Integrated NMR, FTIR, NIR and other analyzer solutions offer strategic reliability, sampling, and control benefits to the end user.

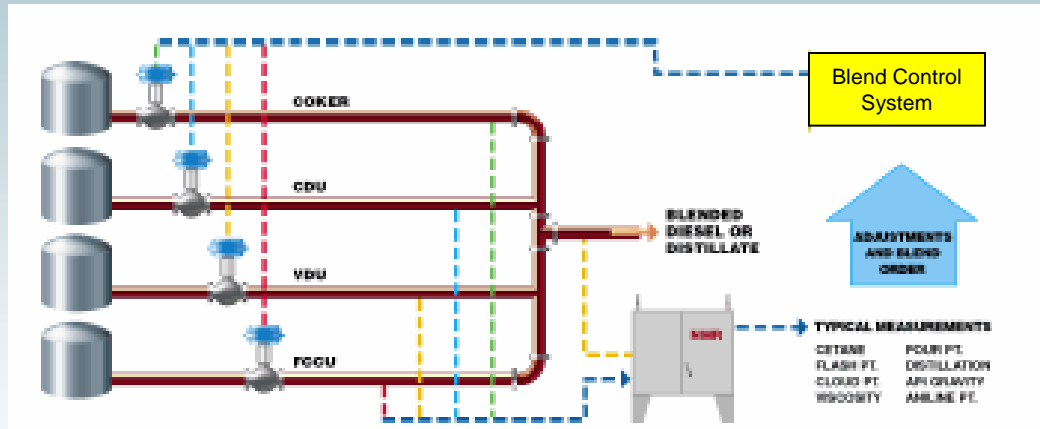


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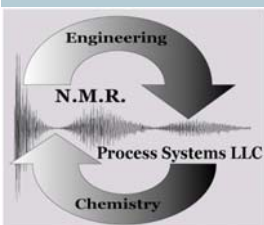
Refinery Product Blending Systems

Advanced process control generally requires near real time stream quality information. The exceptional availability of the NMR analyzer enables this information to be supplied reliably for process control, while the technology ensures robust accuracy and repeatability. Because this analyzer can be applied to numerous component quality measurements, a single analyzer can often alleviate the need for multiple analyzers to satisfy an APC or optimization application.

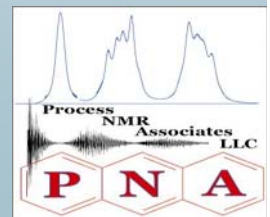
Blending Control Systems (BCS), whether by recipe or property control, provide management of the component and product tanks, blend header, on-line and laboratory analytical systems, and planning/scheduling activities. Integration of an NPS-IS[®] NMR and BCS produce blended products with a high degree of precision to meet specifications while minimizing quality giveaway. This maximizes the use of the lowest cost components in the blend, increasing the flexibility of the tank farm operation, and minimizing the frequency of re-blends.

The NMR analyzer provides BCS with near real time component stream and blended product chemical quality information. This information enables multivariable analyzer-directed control including:

- Feed forward control for component quality variations
- Feedback control for product quality variations
- Quality integration of product and component tanks
- Projected product qualities at the blend header
- Applicable to gasoline, jet fuel and distillate blending operations.

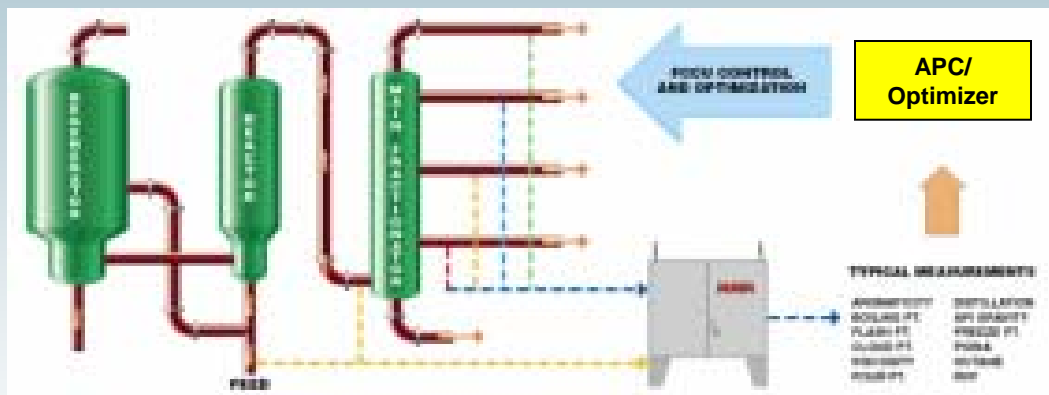


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Fluid Catalytic Cracking

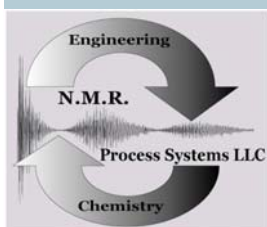
The fluid catalytic cracking unit (FCCU) is one of the most important units in the refinery. Few FCCUs have real-time process optimization implemented, since feeds typically have been measurable only in the laboratory. These measurements take many hours, with reports available only once or twice a day. Even the measurement of PIONA (paraffins, isoparaffins, olefins, naphthenes, and aromatics) and the distillation properties of the rundowns are difficult to achieve on-line.

The NPS-IS[®] NMR now provides a means of obtaining these measurements near real-time, thus enabling significant economic benefit to the refiner through APC and process optimization. FCCU controls and optimization include feed preparation, the reactor/regenerator, the main fractionator, the wet gas compressor, and the downstream gas plant. Typical operating objectives are:

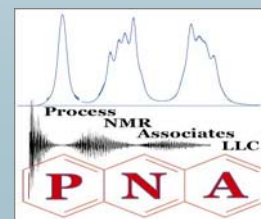
- Maximizing unit capacity
- Maintaining product quality while maximizing yields of most valuable products
- Optimizing energy utilization
- Controlling conversion
- Improving safety and reliability via operational stability

Typical parameters requested for the NMR are:

- Density
- Micro Conradson Residue
- Refractive Index
- Total Aromatics
- Aromatic Breakdown (Mono, di, tri, tetra+ rings)
- Distillation (D1160)
- Viscosity
- Hydrogen Content
- Asphaltenes

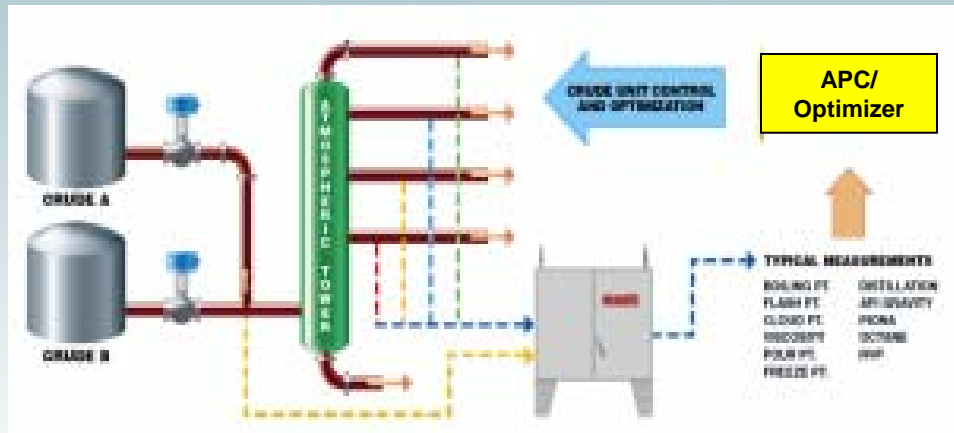


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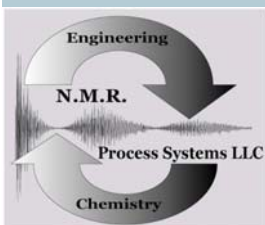
Atmospheric Crude Oil Distillation

In the past, refiners would manage the transition from one crude to another by manual adjustment of various controlled variables for a given time, thus relying upon prior crude transition experience in order to minimize process upset.

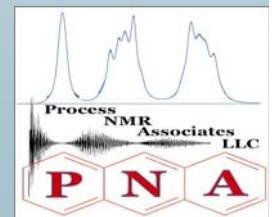
By using NMR-enhanced control and process optimization, however, the refiner can follow the transition from one crude to another in real-time and proactively adjust parameters as needed to maintain maximized profit. The result can be dramatic savings per crude transition, since the typical 4-to-8 hour upset due to a transition is essentially eliminated.

Advanced Process Controllers and Optimizers can maintain unit operation at optimum between crude transitions. Atmospheric tower overhead and side cut product draw stream quality measurements provided by the NPS-IS[®] NMR can be used in the APC model to monitor process operation performance and supply control feedback information. Common advanced control targets include:

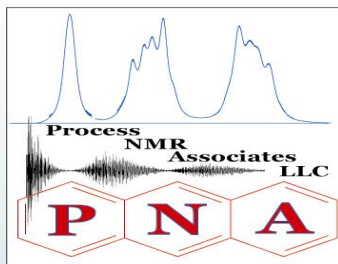
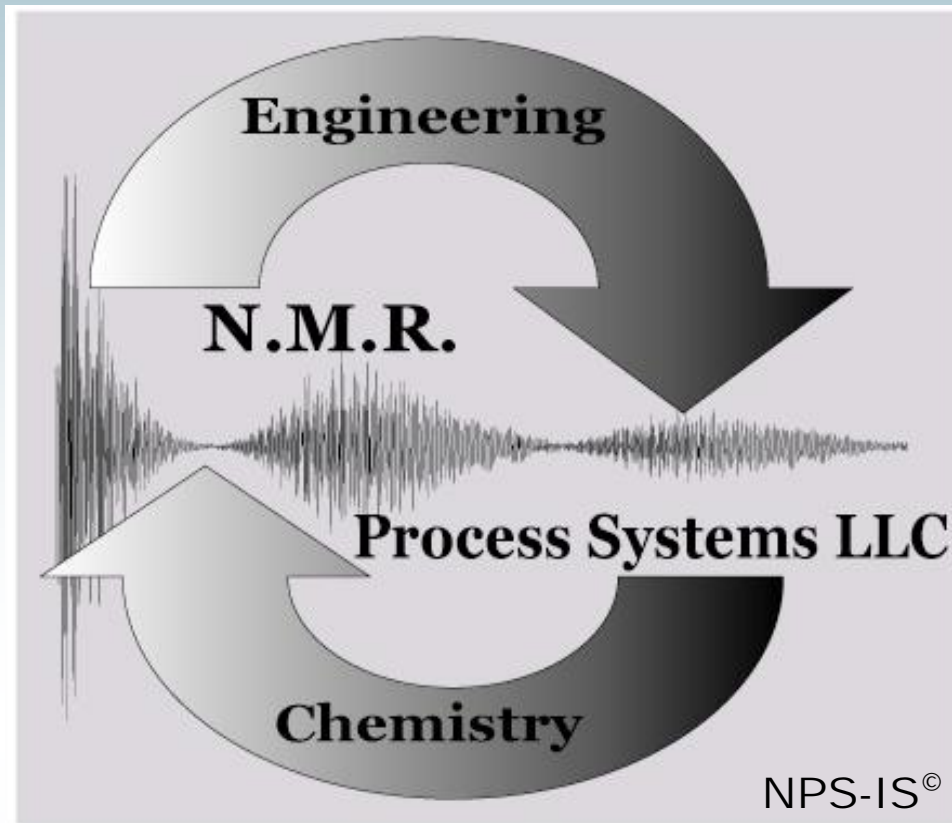
- Maximizing unit throughput up to equipment constraints
- Maintaining product quality while maximizing yield of most valuable products
- Optimized preheat train, pumparound, and fired heater operation



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NMR Process Systems – Integrating Solutions for Optimal Performance



Spin Track
NMR Spectrometer



RefinIR™
The New Refinery Products Analyzer

