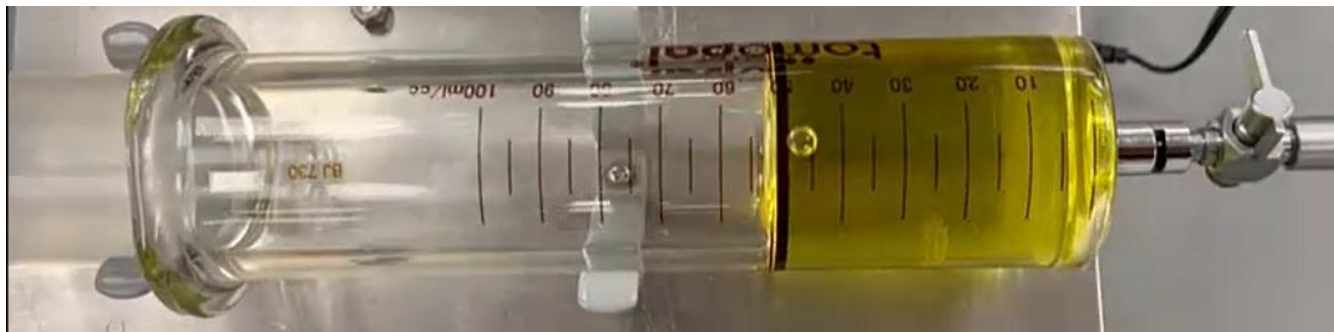


Improved Rapid Dissolved Gas Analysis

Ian Shaffer – Sr. Product Specialist – System GC
Shimadzu Scientific Instruments
NEMC 2022

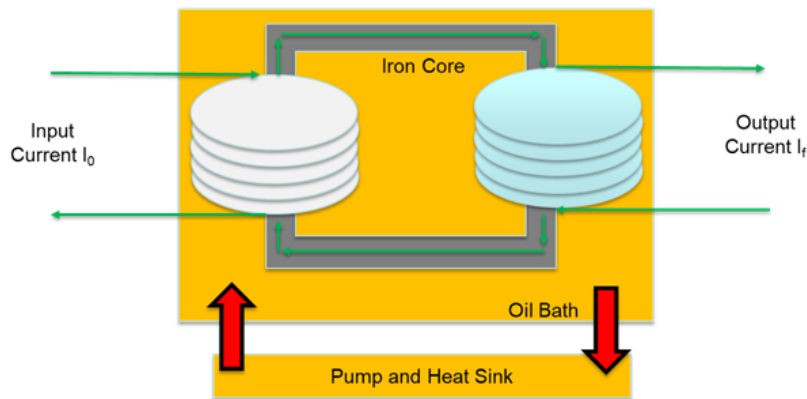
What is Dissolved Gas Analysis?

- **Analysis of gaseous contaminants in insulating oils**
 - Typically caused by break down or generated materials
 - Gases can include H₂, O₂, N₂, CH₄, CO, CO₂, and light hydrocarbons



Transformer Oil Gas Analysis

- Dissolved gas in transformers indicate the health of the transformer
 - Types and quantities of dissolved gases indicate potential error states of the transformer
- Throughput on the analysis is key
 - Increasing number of transformers with growing infrastructure



Analysis of Transformer Oils Comparison

- **EPA 3610/RSK 175**

- Manual headspace for volatiles
- Covers light hydrocarbons gases

- **ASTM D3612**

- Expanded analytes with carbon oxides and inorganic gases
- Three different variations
 - Method A: Manual gas extraction
 - Method B: Direct oil injection
 - Method C: Headspace

D3612 Methods

Method A: Gas

- Slow
- Labor intensive
- Less maintenance
- Requires Hg for degassing
- **Does not require change over for different oil types**

Method B: Oil Injection

- **Fast**
- **Less labor intensive**
- More maintenance
- No automation
- Requires change over for different oil types

Method C: Headspace

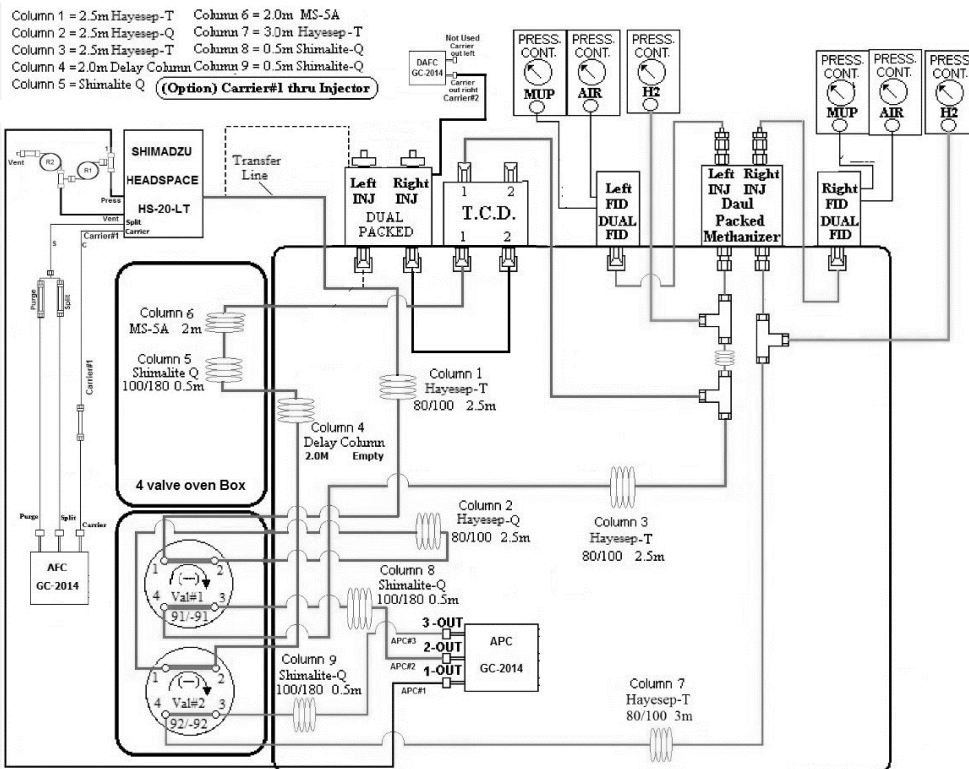
- **Fast**
- **Less labor intensive**
- **Less maintenance**
- **Fully automated**
- **Does not require change over for different oil types**

ASTM D3612 Method C

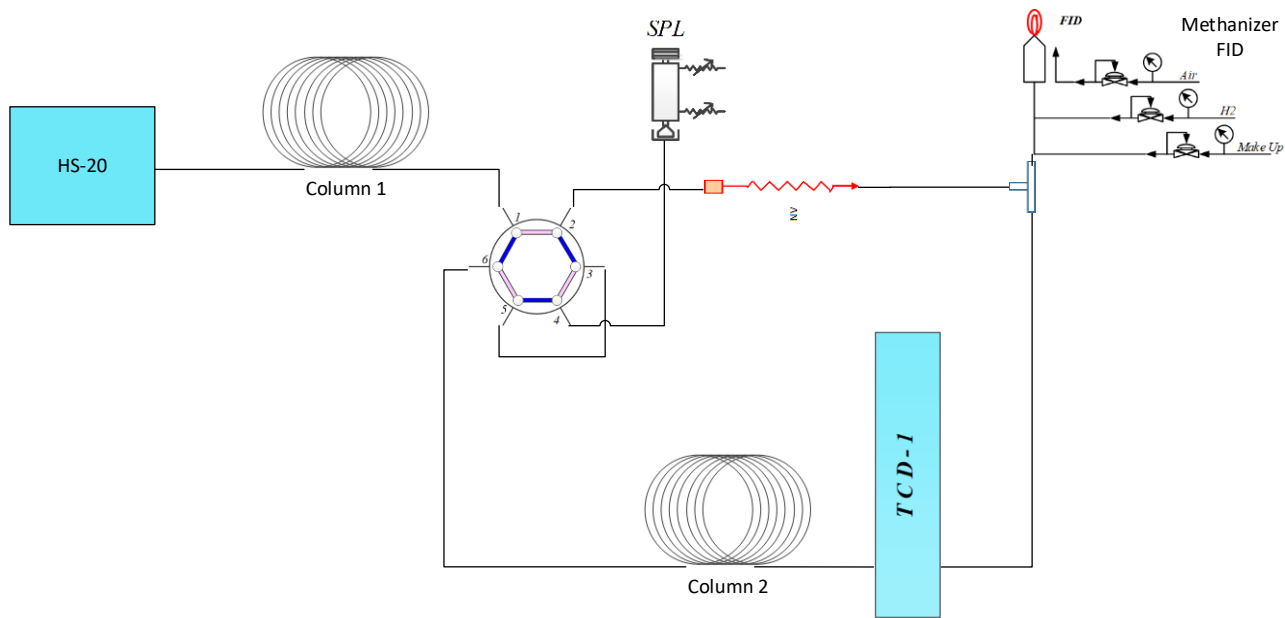
- **HS-20 sample introduction**
 - Large sample capacity
- **Capillary columns**
 - Fast Run Time
 - Improved resolution
- **Simplified Design**
 - Easy to maintain and troubleshoot
- **Compatible with new environmentally friendly oils**
- **Analysis out to C4 in under 15 minutes**
- **Argon Carrier Gas**



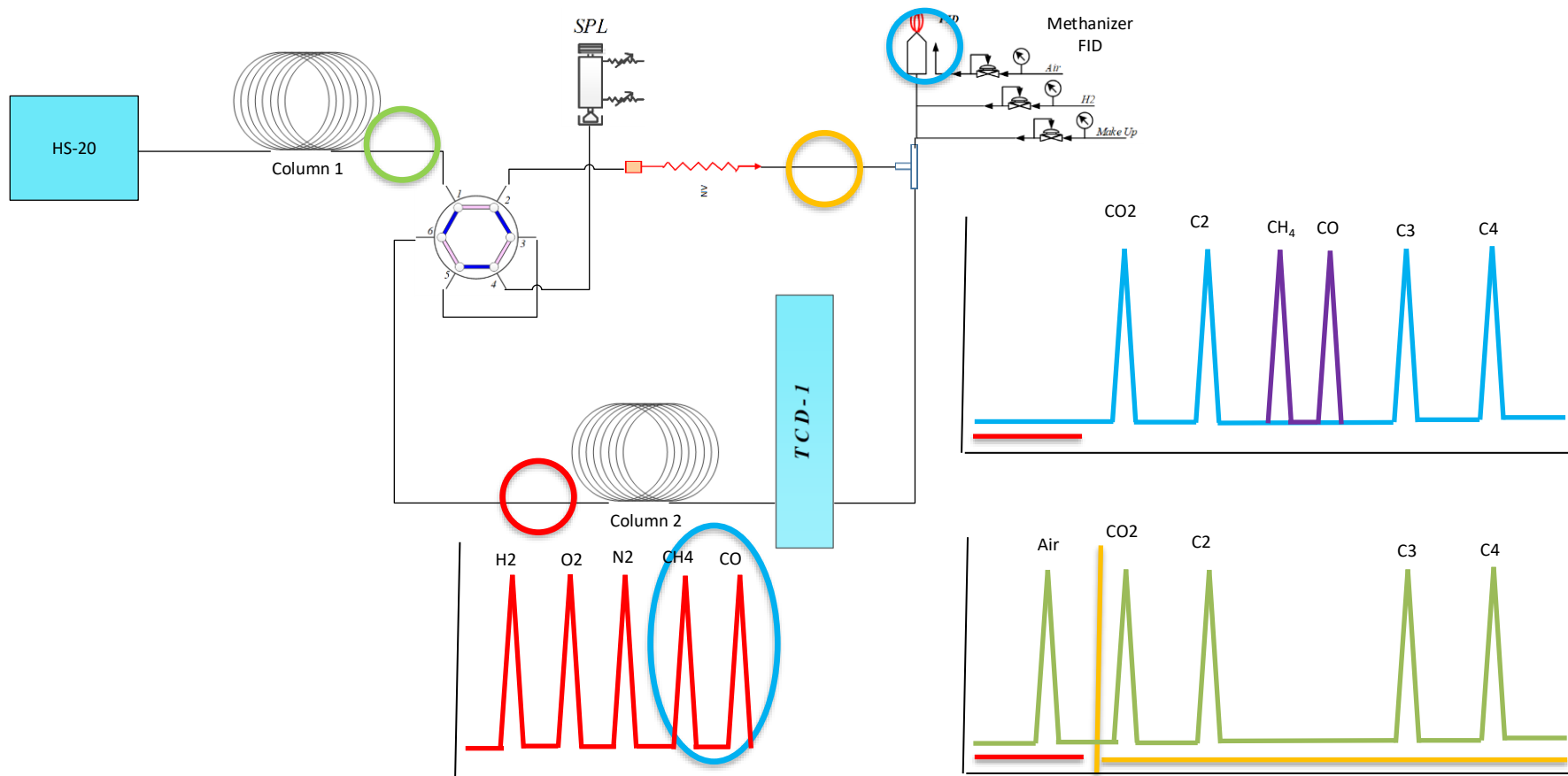
Previous D3612 Method C Flowpath



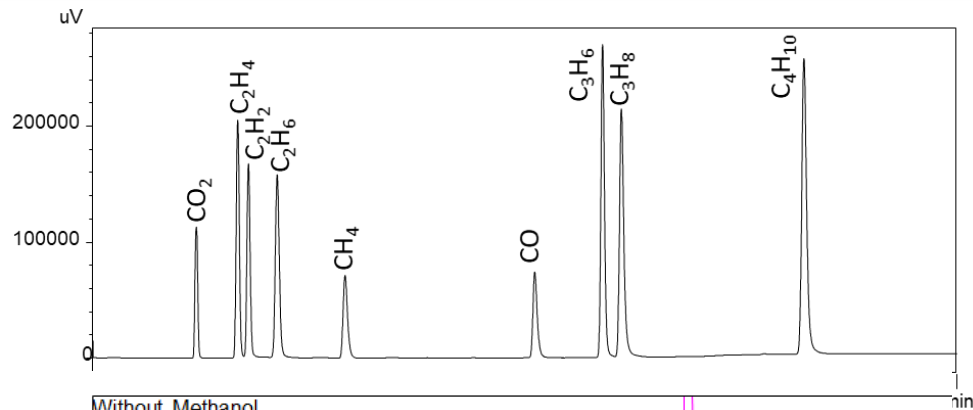
New GC-2030 Flowpath



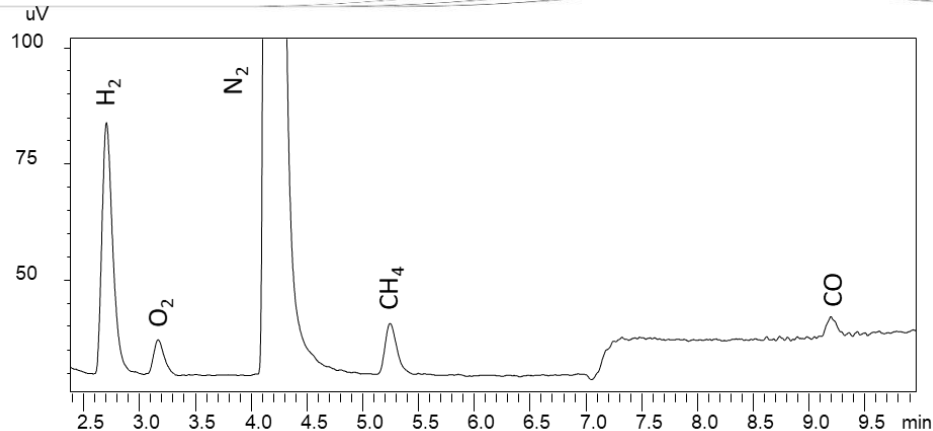
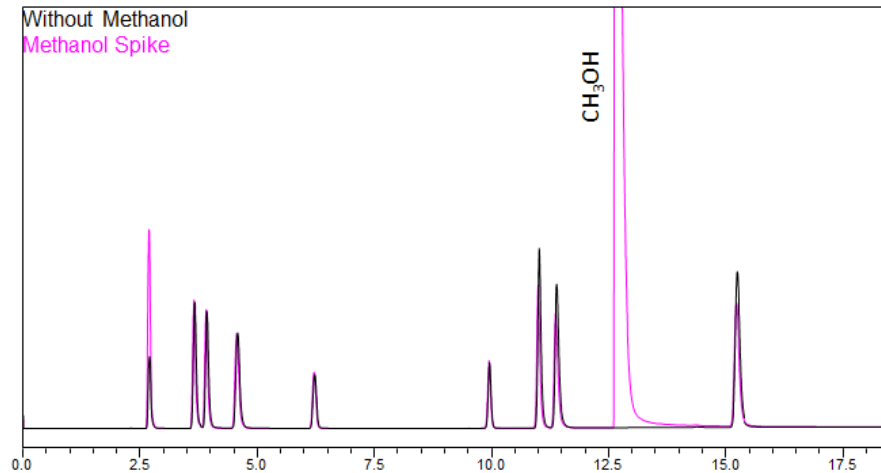
GC-2030 Flow path



Chromatograms



Without Methanol
Methanol Spike



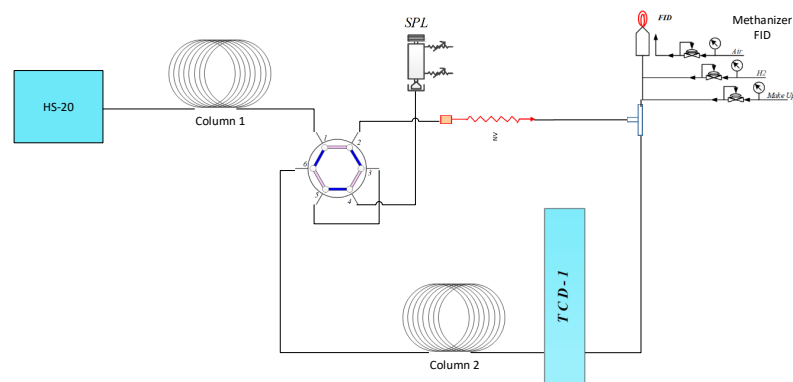
Methanol is a degradation product
of new environmentally friendly oils

Benefits of New Configuration

- **Throughput** → Rapid 15 minute runtime
- **Labor** → Less contact with oil/reduced prep time
- **Maintenance** → Simplified flow path/Rugged components
- **Automation** → Uses high capacity autosampler
- **Different oils** → Can use multiple oils types

Conclusions

- Simplified system with easier maintenance
- High throughput with automation
- No nickel catalyst
- Can switch between oil types
- Does not require helium carrier gas



Thank you for your attention

Questions?

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