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HOUSTON CHAPTER
"The Industry forum for Drilling practices and technology"

Fluids Management Group
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"Rigsite PSD Confirmation & Functional Validation Techniques"

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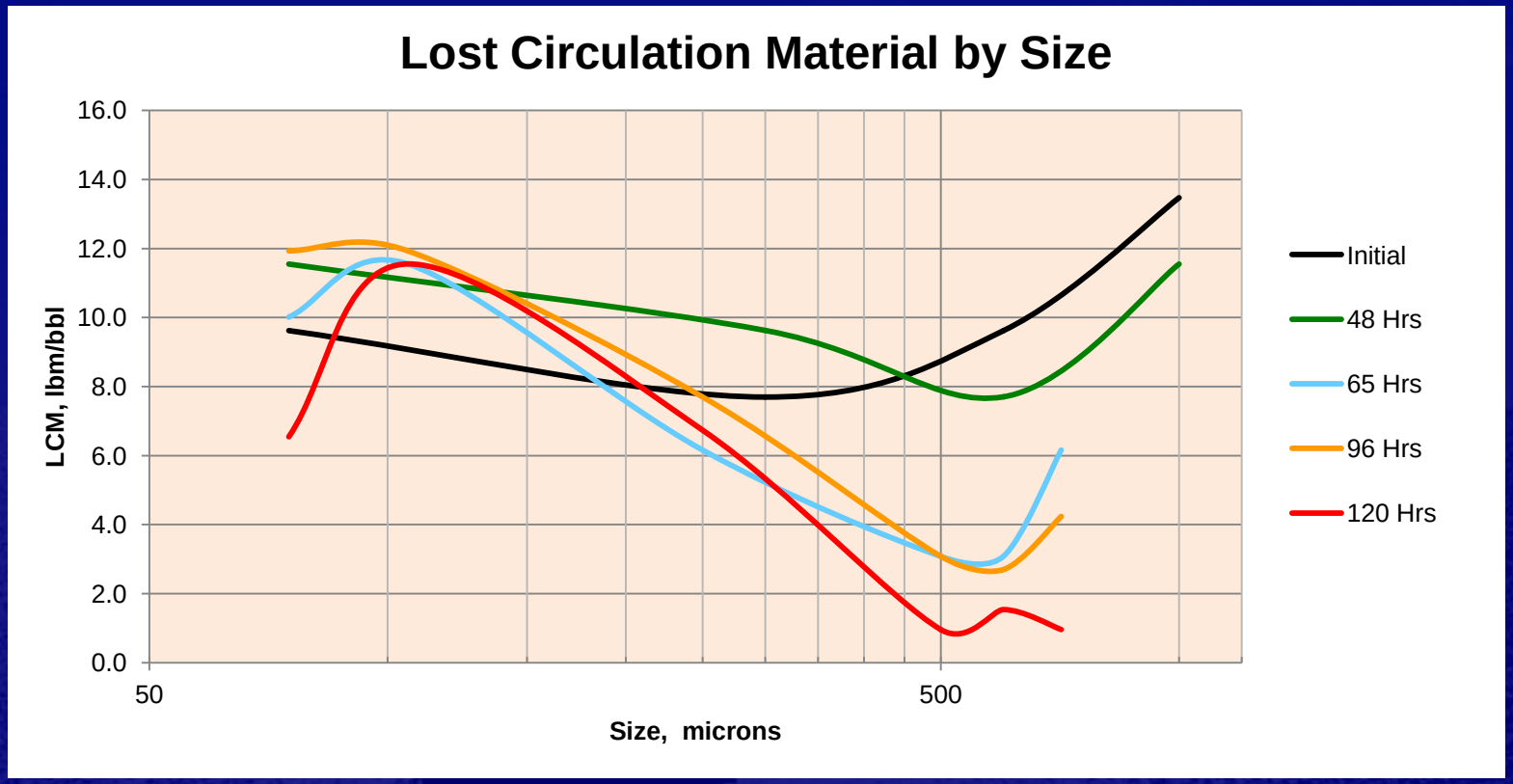
Rigsite PSD Confirmation & Functional Validation Techniques - *S. Mason, M-I SWACO*

1. *Successfully performing Wellbore Strengthening treatments depends upon the ability to keep: a.) the WSM concentration to above a critical threshold volume and b.) the PSD of the WSM within a critical size/volume profile.*
2. *The volume and size of WSM/LCM present in an active fluid system degrades over time based upon environmental factors and the intrinsic tendencies /properties of the material.*
3. *When using traditional rigsite methods (i.e. wet sieve), the ability to expeditiously measure the size & volume of the WSM solids in the system is poor. Discriminating by LCM type is difficult.*
4. *Wherever applicable, even modern rigsite PSD evaluation techniques (laser) do not functionally validate the bridging and sealing performance of the resultant fluid.*

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Particle Size Distribution (PSD) Shift over Time



Granular LCM blend: Graphite, CaCO3, Nut Shells

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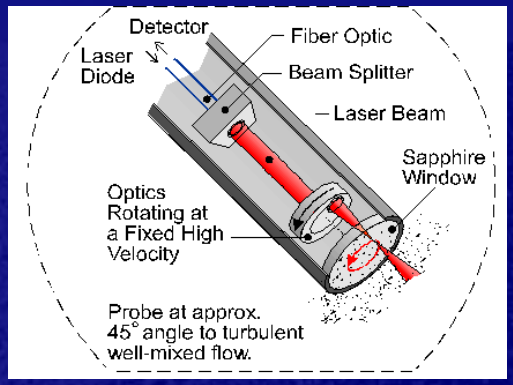
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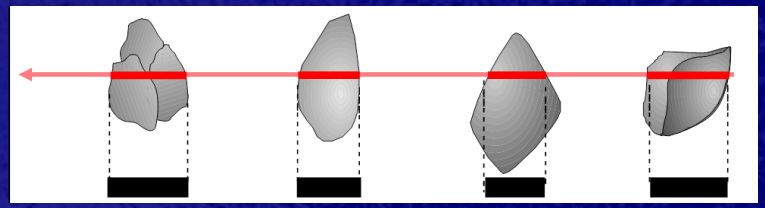
- Current Std. Technique: Wet Sieve Analysis
  - Messy
  - Time Consuming
  - Problematic
  - HSE Issues
  - Accuracy & Repeatability





- Emerging: In-Line Particle Size Analysis
  - Laser & Imaging Techniques
  - Clean & Fast (Real Time capability)
  - Minimal HSE Issues
  - Location Sensitive
  - Accurate & Repeatable (?)
  - Can Handle Aspect Ratio effects (?)





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Bridging and Sealing Performance - Evaluation

- The Key Factors proposed for Evaluation are:
  - ~ Effectiveness – Is a seal preventing fluid loss developed? How much differential pressure can the developed seal withstand? (injection direction)
  - ~ Efficiency – How quickly does an effective seal develop when the formation is exposed to the treatment fluid? (i.e. How much treatment fluid is lost prior to developing an Effective seal?)
  - ~ Robustness of the developed seal? Is the developed seal resilient with respect to likely operating conditions?

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- 350 ml (barrel equiv.)
- Customizable slots
- Variable Conditions
  - > Any Fluid
  - > Slot Size
  - > Total ΔP
  - > Flow Rate
  - > PSI hold intervals

Hydraulic drive unit eliminates the use of compressed gas (safety) and allows testing at variable loss rates.

* Patent Pending

M-I SWACO Advanced Slot Tester*







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Testing & Evaluation: M-I SWACO Advanced Slot Tester

Rate Set, ml/min	58.3	145.8	145.8	58.3	58.3
Slot Size, mm	*3*	*3*	*3*	*2*	*1*
Sec to 250 PSI	45	30	Go directly to 1000 psi	45	31
ml Lost to 250	97	95		17	60
Sec to 500 psi	75	70		95	43
ml Lost to 500	120	102		21	60
Sec to 750 psi	110	95		115	55
ml Lost to 750	142	131		43	60
Sec to 1000 psi				145	61
ml Lost to 1000	**240**	**240**	**240**	**240**	60
Sec to 1500 psi					66
ml Lost to 1500					**60**
Max Observed PSI:	**750**	**750**	**N/A**	**1000**	**1500**

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Conclusions:

1. An expeditious rigsite method to validate the specific functionality of a WSM blend for Wellbore Strengthening (bridging & sealing) has been developed and used offshore.
2. The device provides the ability to test both the sealing effectiveness (ΔP), and efficiency (volume lost prior to effective seal development) of WSM blends in real time.
3. LC & WS performance standards for treatment fluids can now be established and evaluated at the rigsite
4. The effectiveness of rigsite maintenance treatments to restore the performance of degraded fluid systems can be determined at the rigsite. Permitting targeted, more effective and lower cost, treatments.

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Thank You for your attention!

Questions / Comments?

The author wishes to express his appreciation to AADE Fluid Management Group for the opportunity to present this work, and to M-I SWACO Drilling Solutions for permission to prepare and present the information contained herein.

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