
Tracerco
Insight through innovation
A new perspective on improving process and operational efficiencies
Eric Graham
Commercial Manager
JM Johnson Matthey
Inspiring science, enhancing life

Topics

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- Trayed towers
- Packed towers
- ThruVision™
- Pipe scans
- Neutron backscatter
- Tracer studies


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Scanning services
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Inside view

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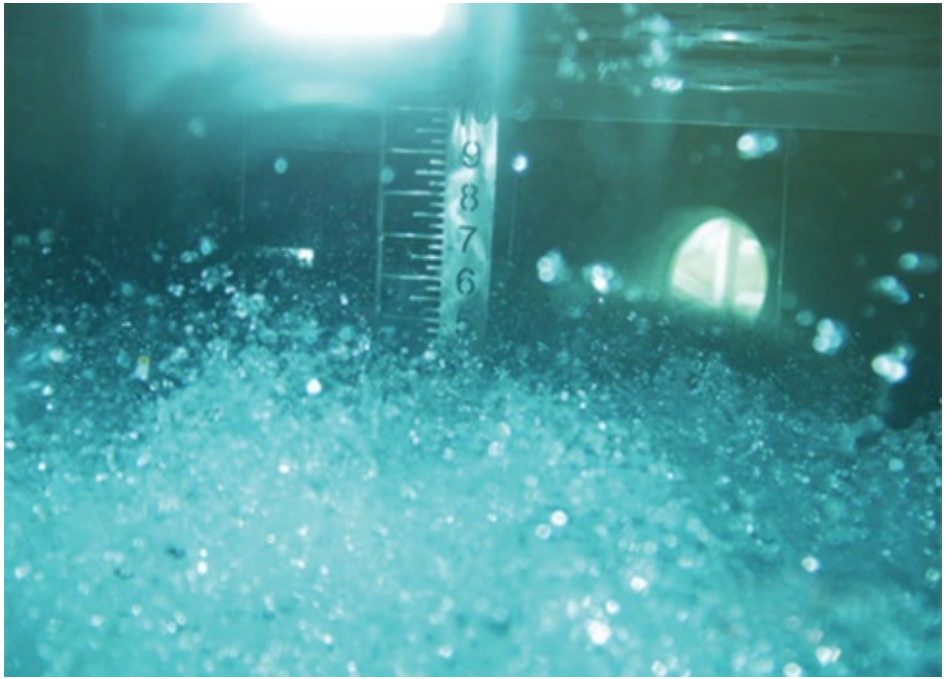

What is going on inside your vessel?

Unfortunately, we are all not lucky, like FRI. We do not have windows on every tray to see what is happening.

Quantitative results

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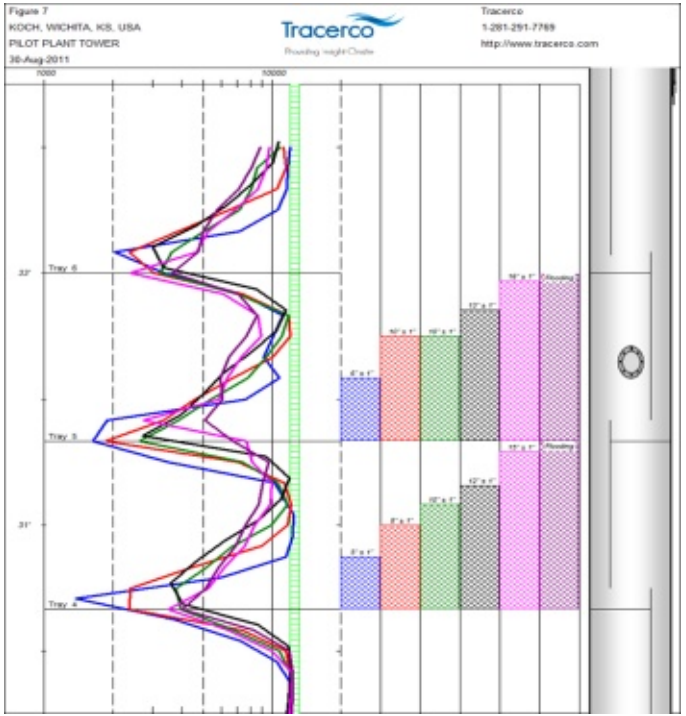
% Jet Flood	K-G Model Predicted Froth Height	% Tray Space	Measured Froth Heights, in.	
			Tray 5	Tray 4
38	6.4	31 - 38	6 ± 1	5 ± 1
62	9.6	50 - 63	10 ± 1	8 ± 1
71	10.8	63	10 ± 1	10 ± 1
79	11.7	75 - 81	13 ± 1	12 ± 1
94	16+	94-100	16 ± 1	15 ± 1
100	16+	100+	16+	16+



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Why scan?

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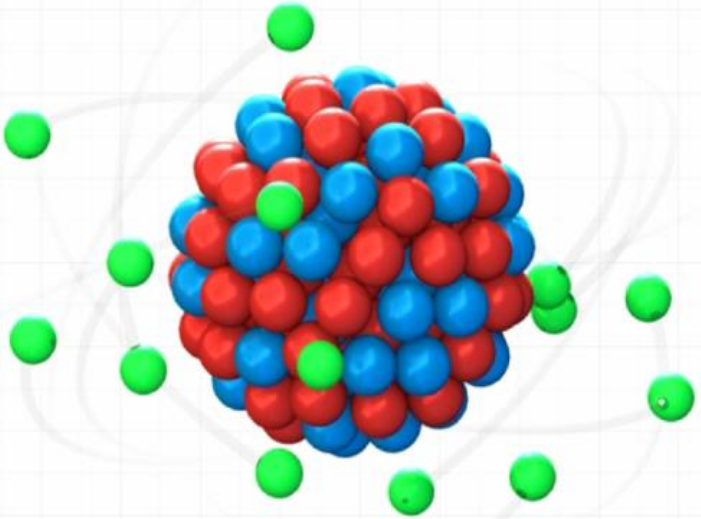
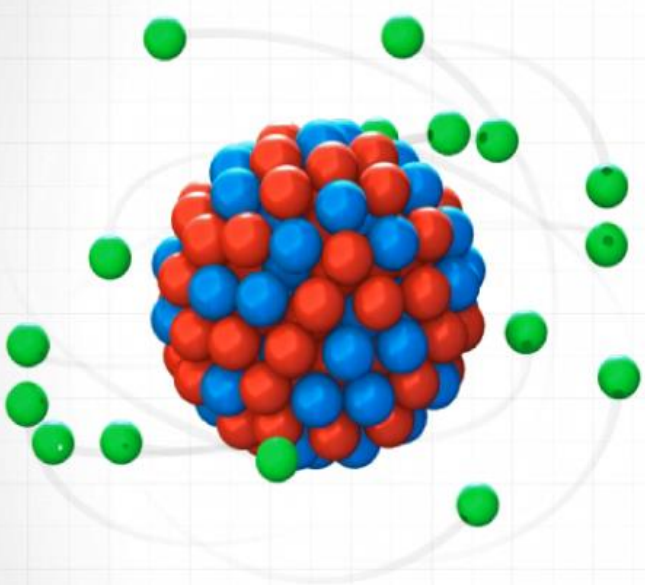
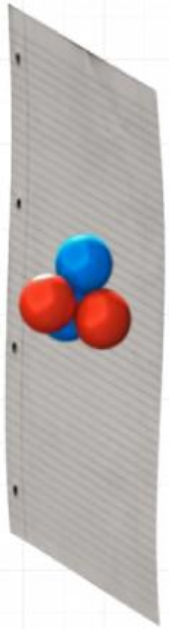
- Bottoms level
- Tray froth heights
  - Entrainment
  - Flooding
  - Weeping
  - Foaming
- Downcomer levels
  - Flooding
  - Vapor bypassing
- Shutdown or turnaround planning
  - Which vessels do you need to enter?
  - What internals do you need to order?

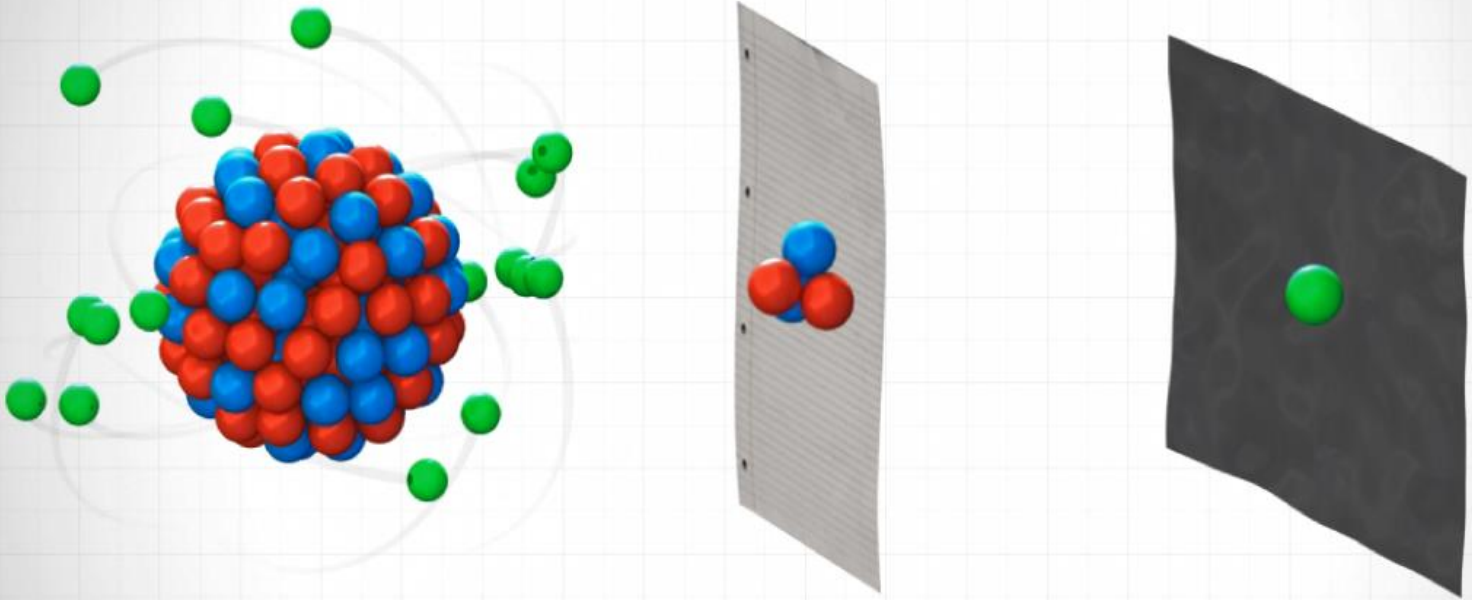


Alpha

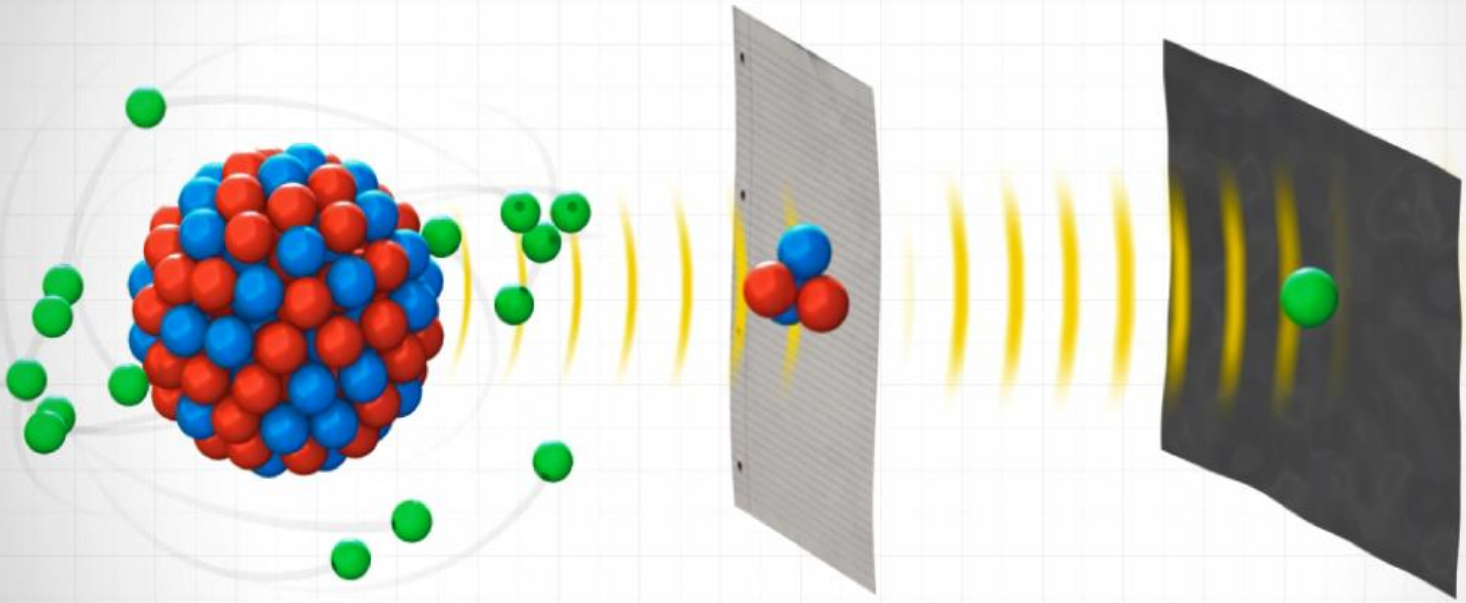




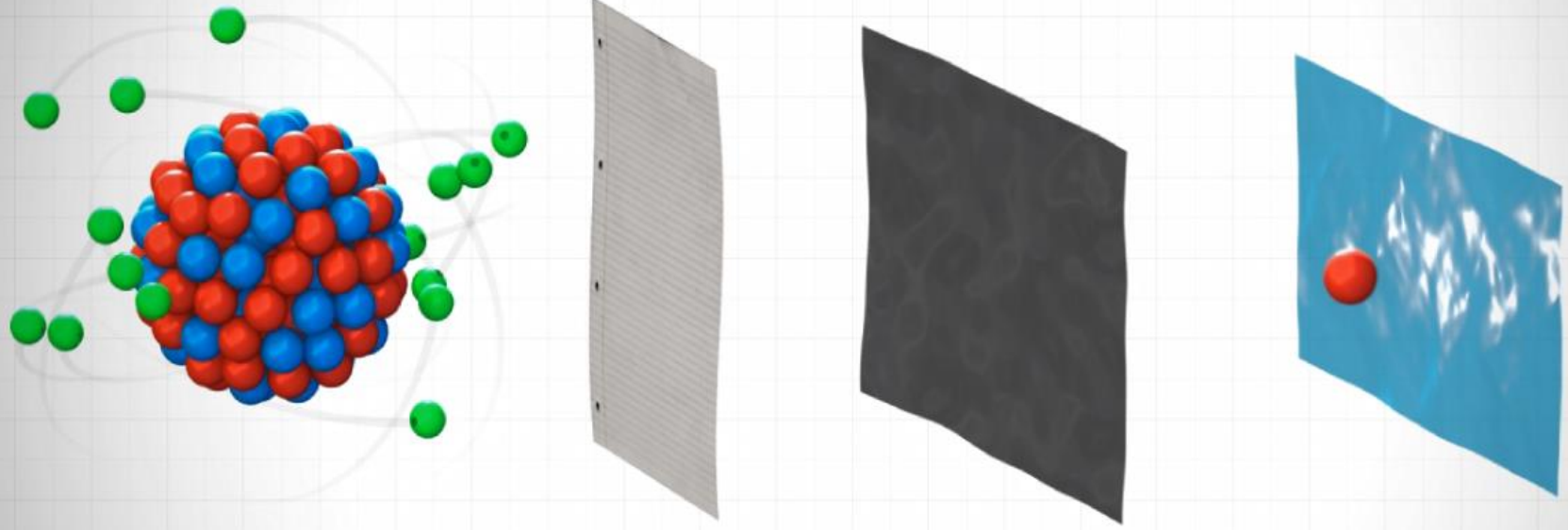
Beta



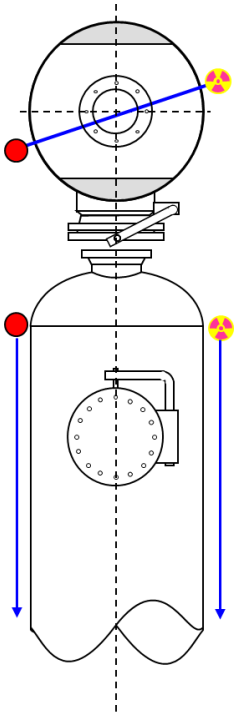
Gamma



Neutron



What is a scan?



- Use of small radioactive sources to **directly measure** certain process conditions and mechanical integrity
- Source and detector are external to the process, **no interaction or interference with the operation**
- Results are NOT theoretical nor calculated results but **actual, real-time measurements** while **process equipment is operating**

$$I = I_o \, e^{-\rho\mu\chi}$$

How to interpret a Tru-Scan™

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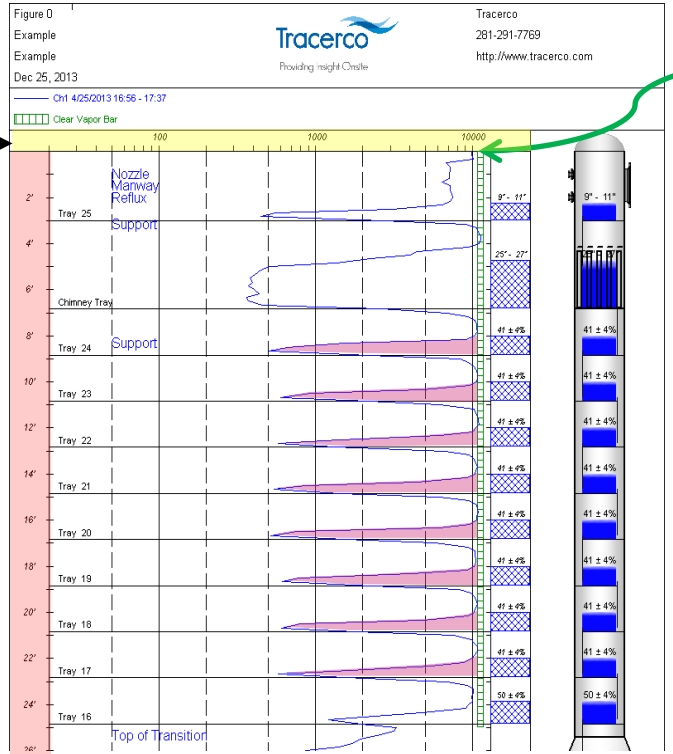
Radiation intensity on logarithmic scale



Clear vapor bar

The froth height is measured from the tray line to the intersection of the scan-line and clear vapor bar.

The distance is then divided by the tray space. It is presented as % tray space, which is an approximate measure of % flood.

Distance from top tangent line

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Baseline scans

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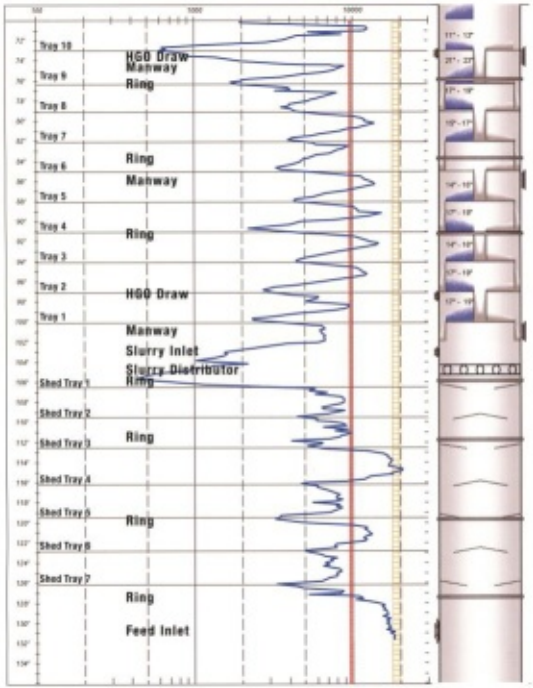
Why are they so important?

- This example baseline scan of a main fractionator displays none of the characteristics of a vessel operating with good disengagement or a consistent profile



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Baseline scans

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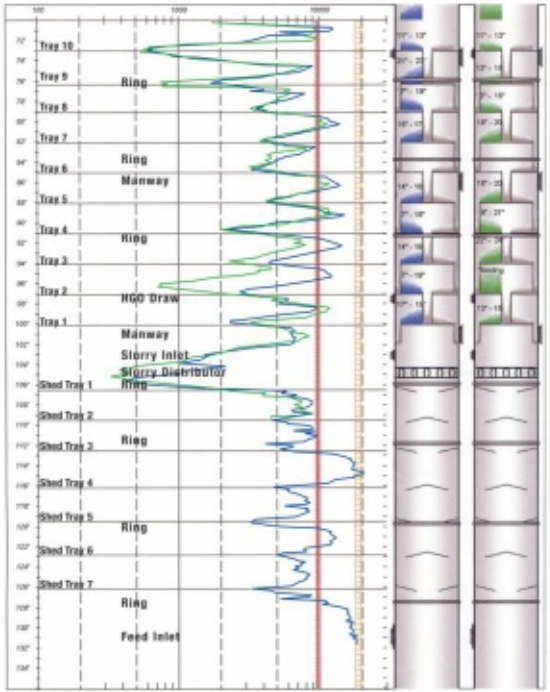
- Six months later, we were able to recognize exactly where the issue is, due to the baseline comparison. Tray 2 is flooding while Tray 3 is heavily loaded



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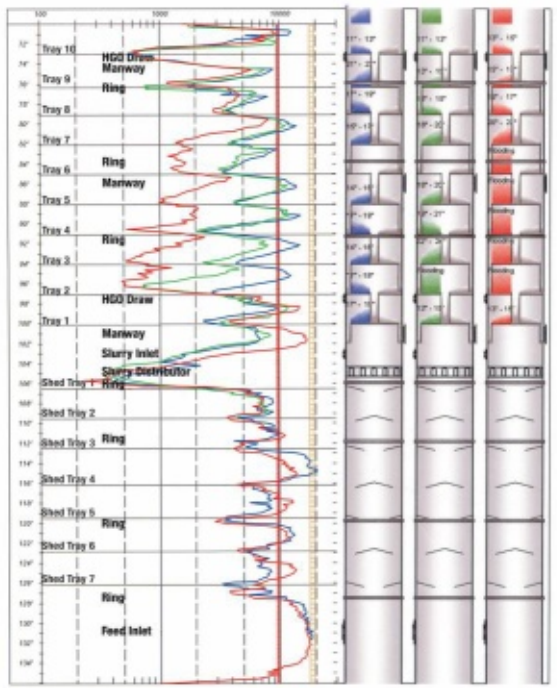
- After another seven months, the coke build-up has led to extensive flooding from Trays 2 through 7



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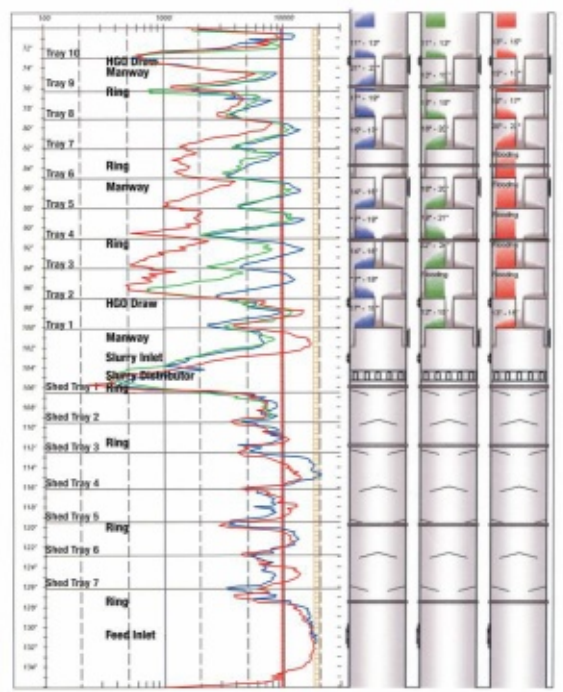
Baseline scans allow us to see what the tower looks like under your normal operating conditions, so we can identify any issues that may be of concern.



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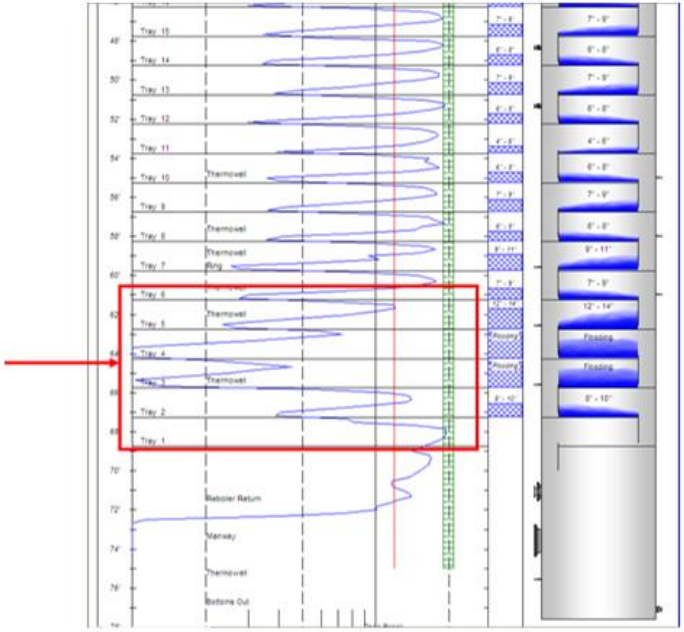
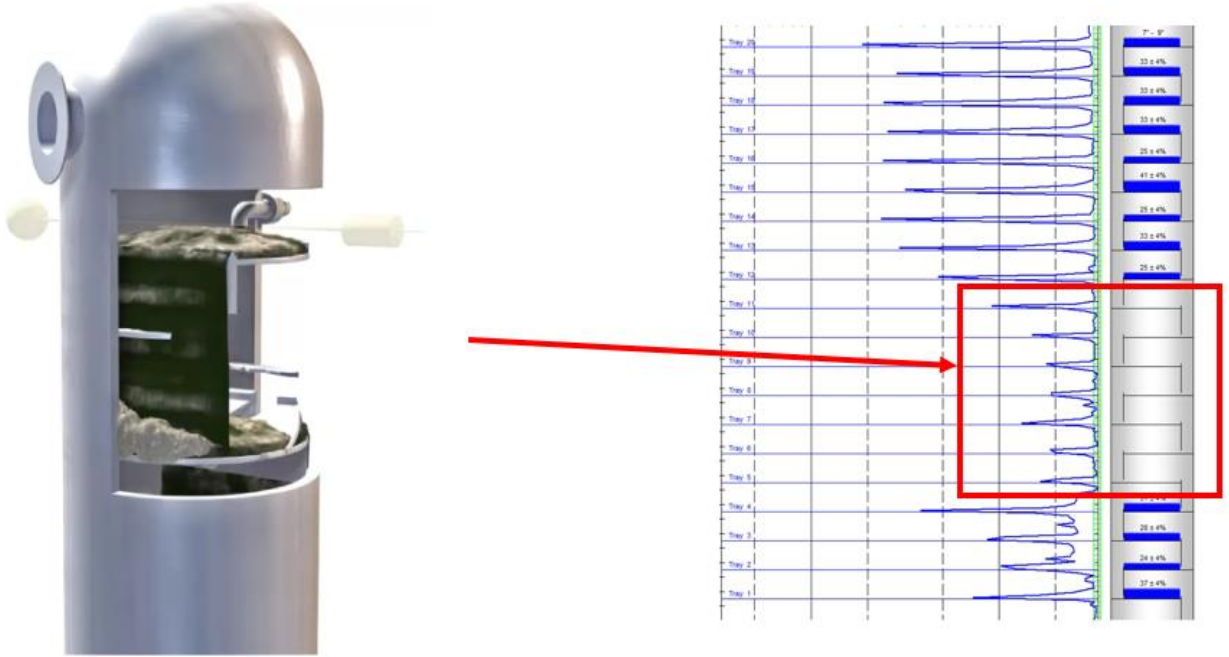
Flooding

Tru-Scan™ indicates where flooding occurs



Tray damage

Tru-Scan™ technology used to detect missing or damaged trays



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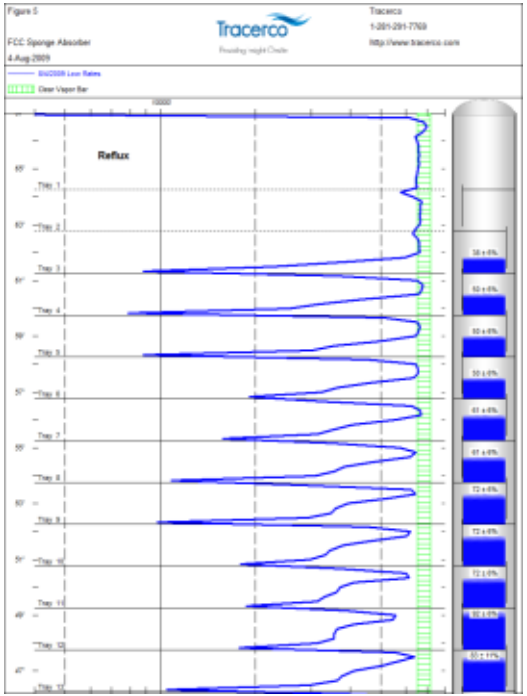
Examples

Foaming



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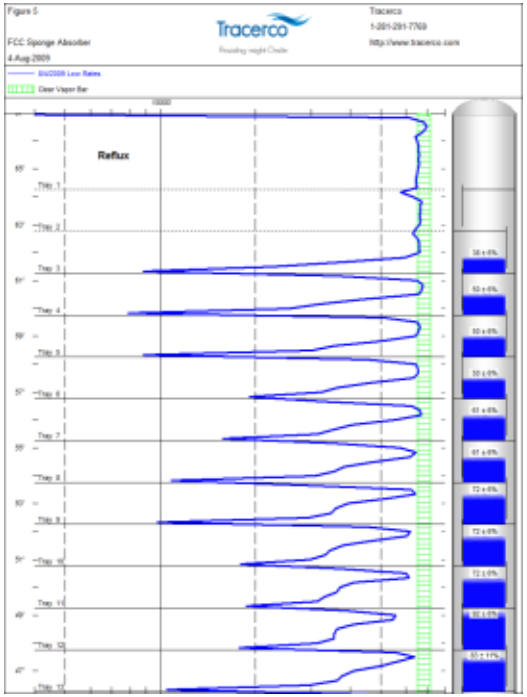
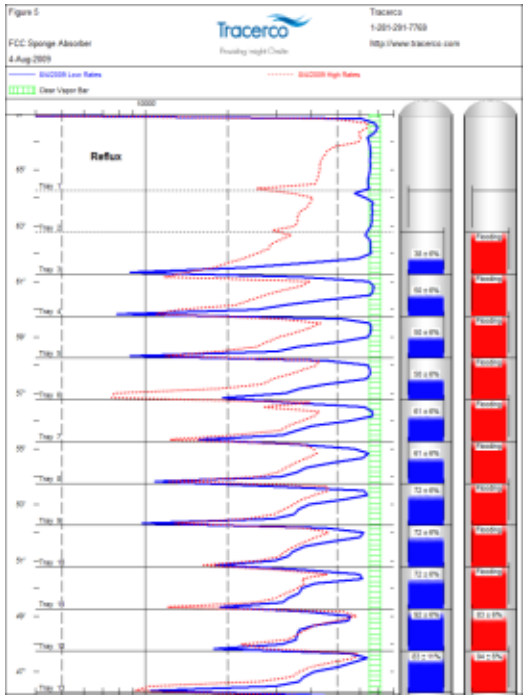
Examples

Foaming





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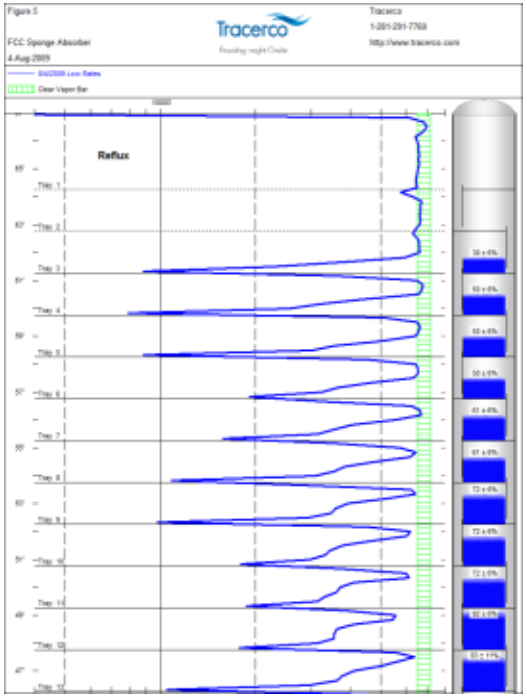
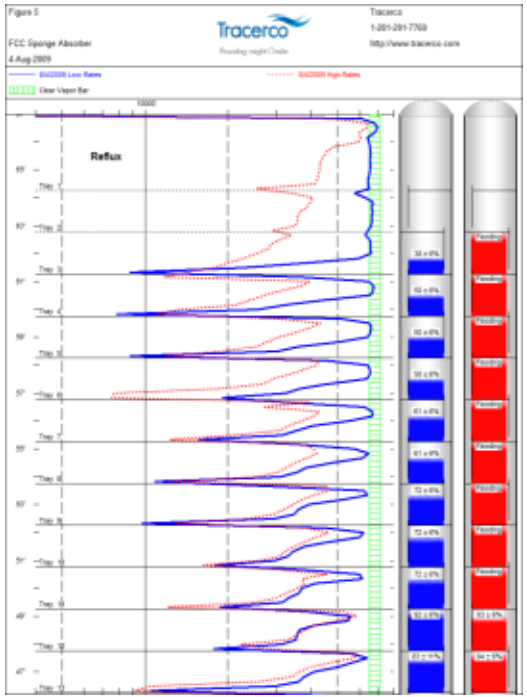
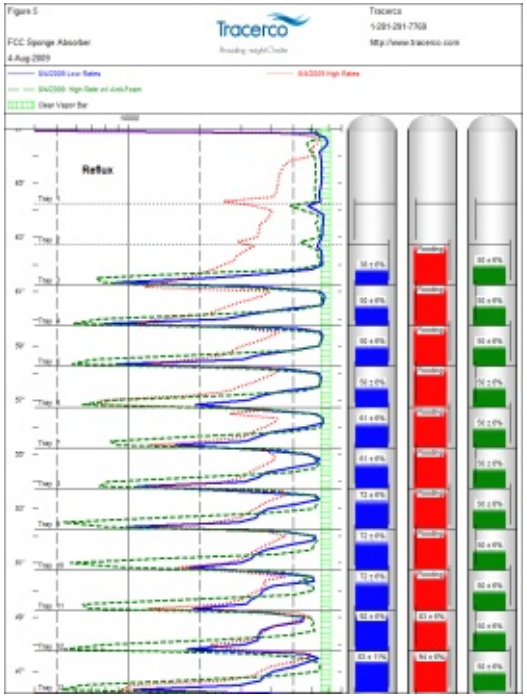
Examples

Foaming







Tru-Grid™ Scan on packed beds

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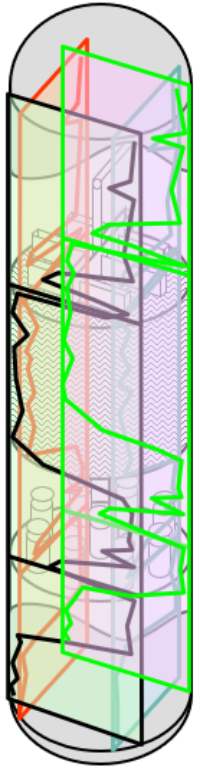

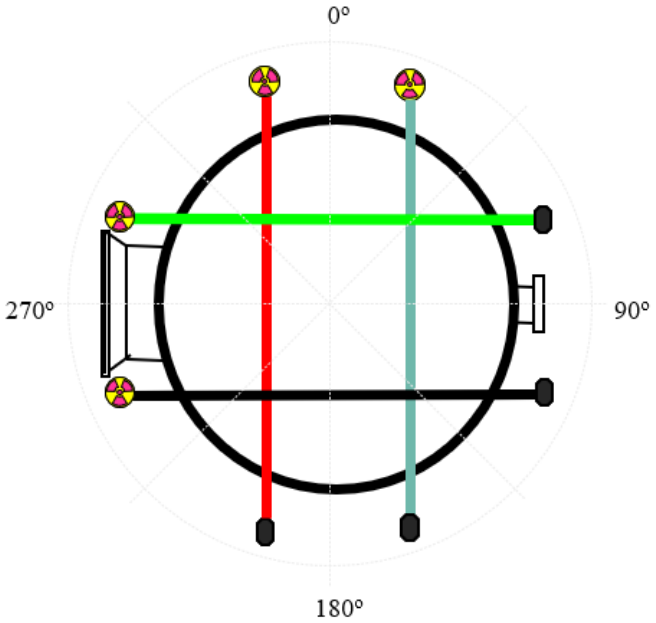

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Why scan?

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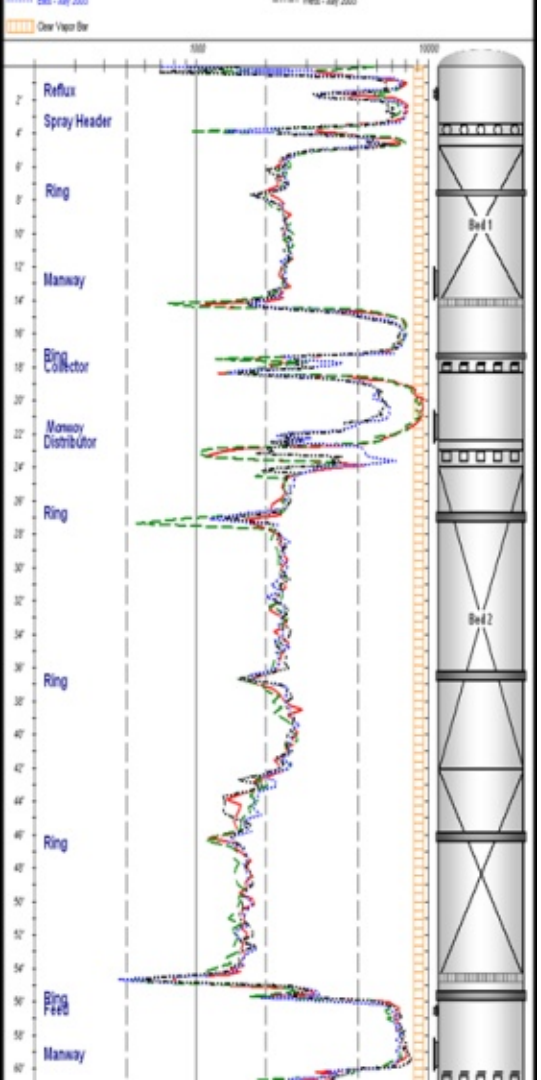
- Bottoms Level
- Bed placement
- Chimney tray and distributor levels
  - Damage?
  - Overflowing?
- Distribution
- Fouling or material hold-up
- Shutdown or turnaround planning



What should a packed tower look like?

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Example of a baseline scan

- Consistent density through each bed
- Overlaying scan lines indicate good distribution
- Distributors and chimney trays in place and operating as expected

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Example

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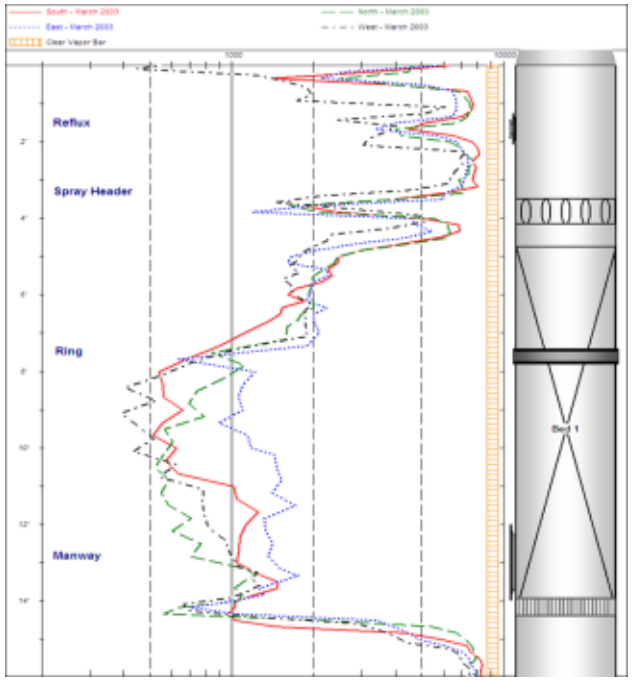

Poor distribution and material hold-up

- Scan lines do not overlay
- Deviation from bed density

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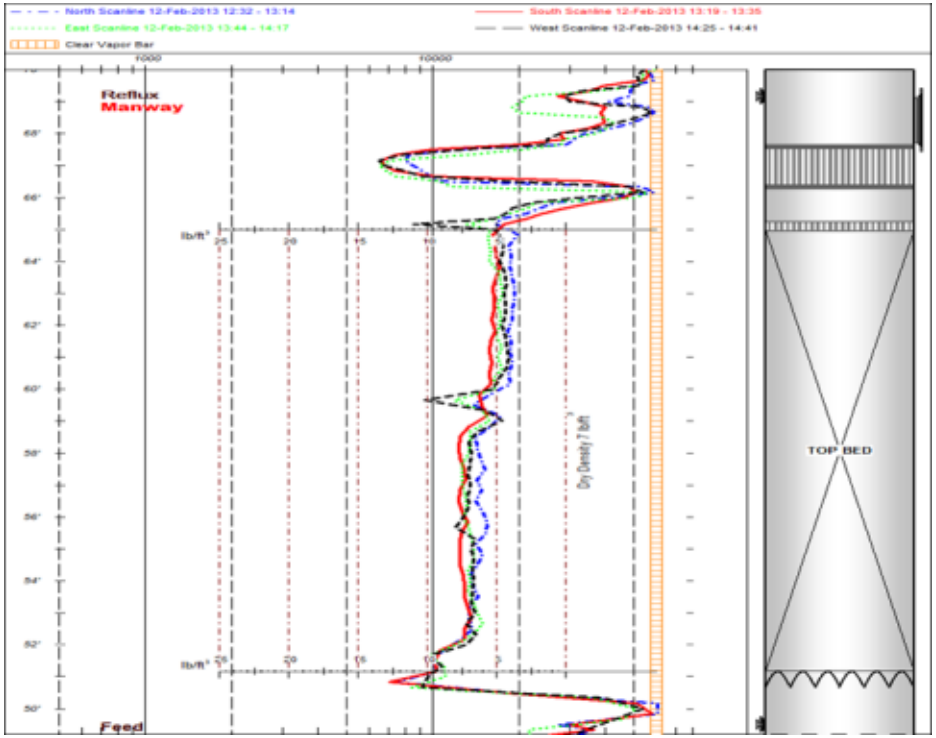
Tru-Grid™

Quantitative Results



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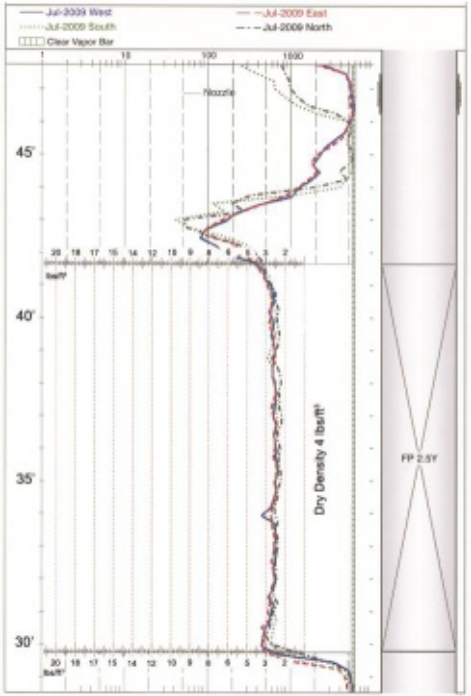
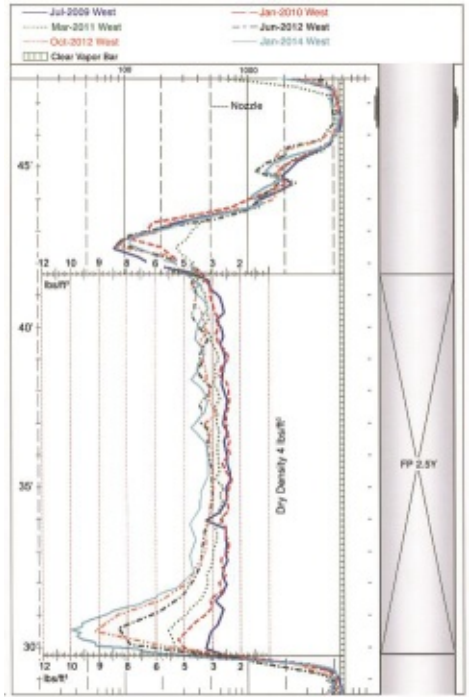
Identifying packed bed fouling build-up

Tru-Grid™ Scan results showing gradual progression of fouling build up over time





Example

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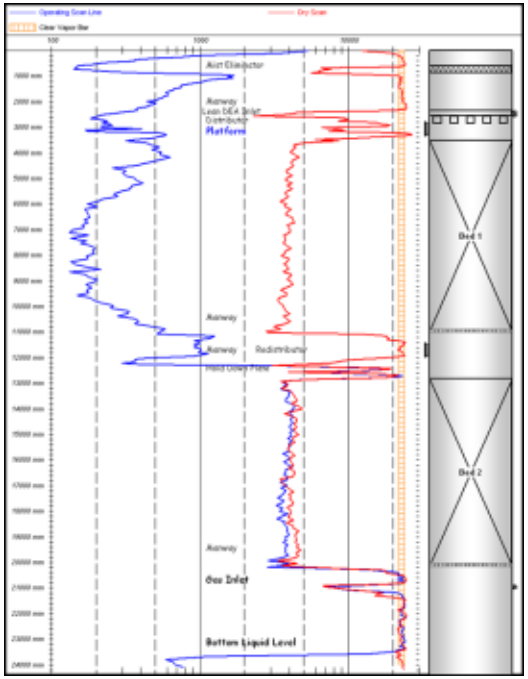
Plugged or damaged redistributor

- High density recognized from the distributor



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Why ThruVision™

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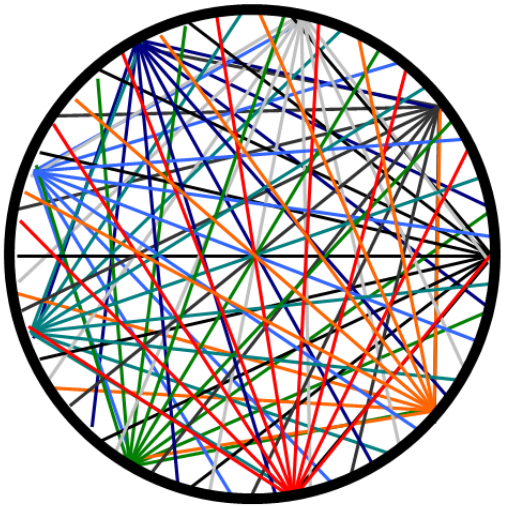
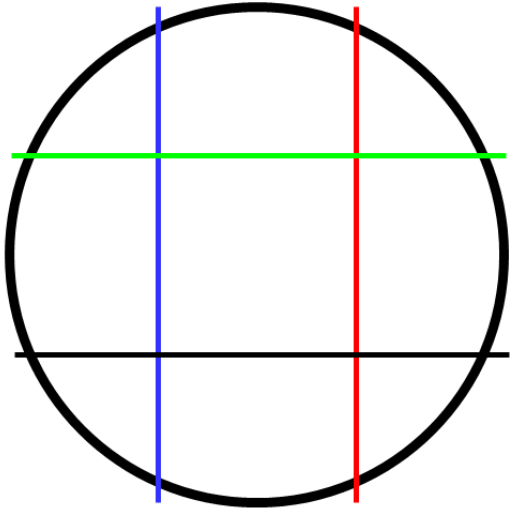


>40% of the cross-sectional area involved in the measurements

>1100 intersections



< 2% of the cross sectional area represented

4 intersections

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Why ThruVision™

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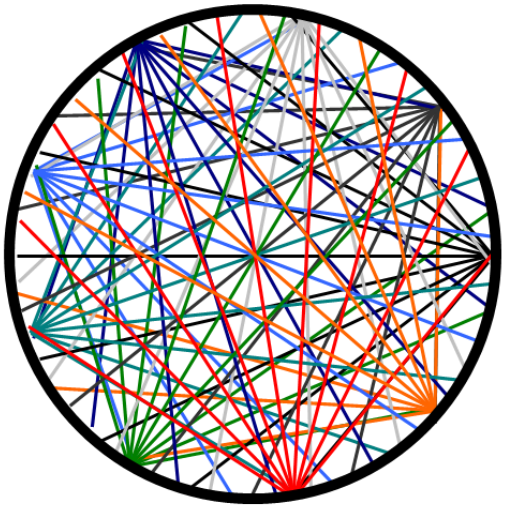

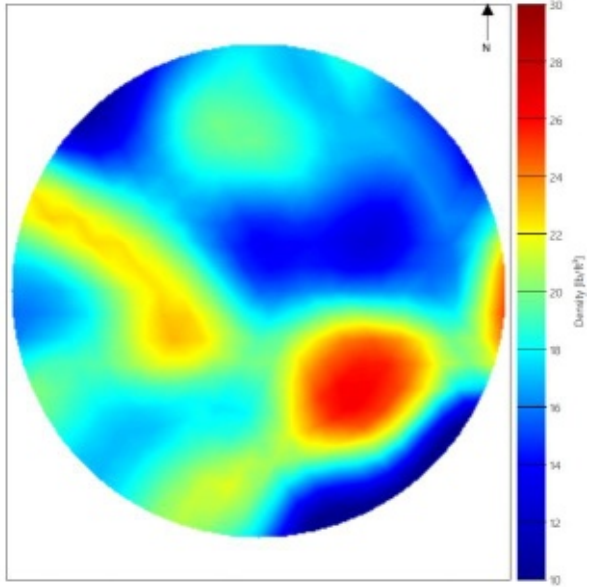

>40% of the cross-sectional area involved in the measurements

>1100 intersections

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ThruVision™ example

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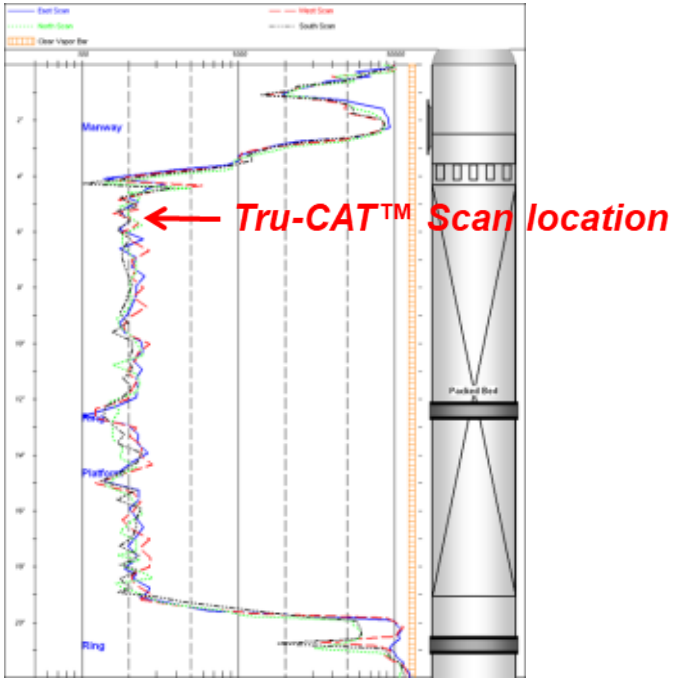
Tru-Grid™ Results

- Good liquid distribution
- Internals appeared to be in place
- No process degrading conditions were observed



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ThruVision™ example

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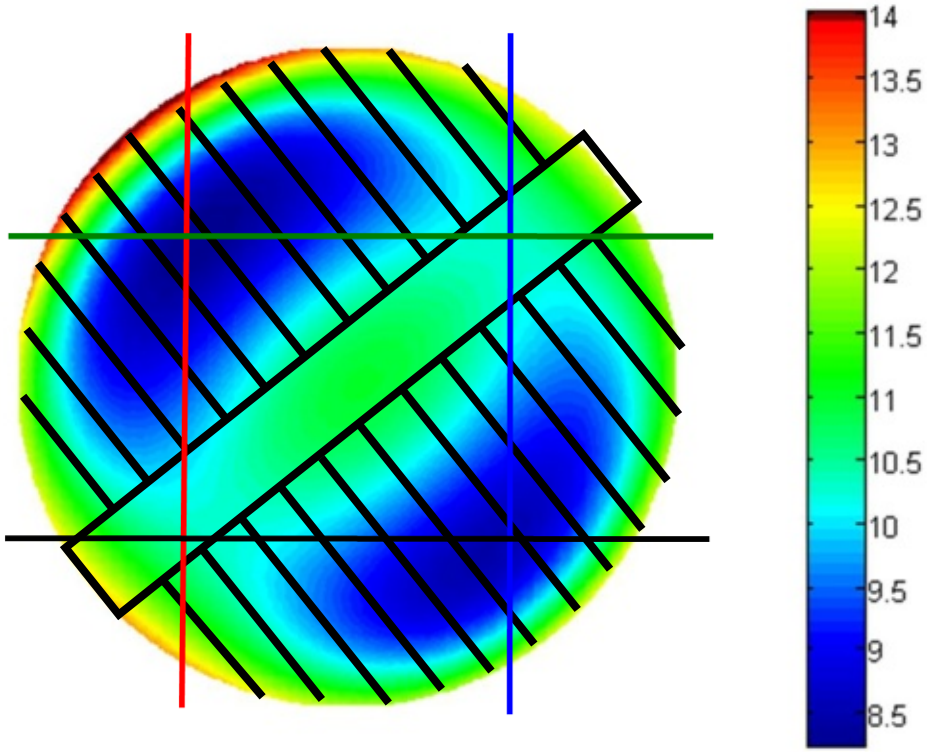

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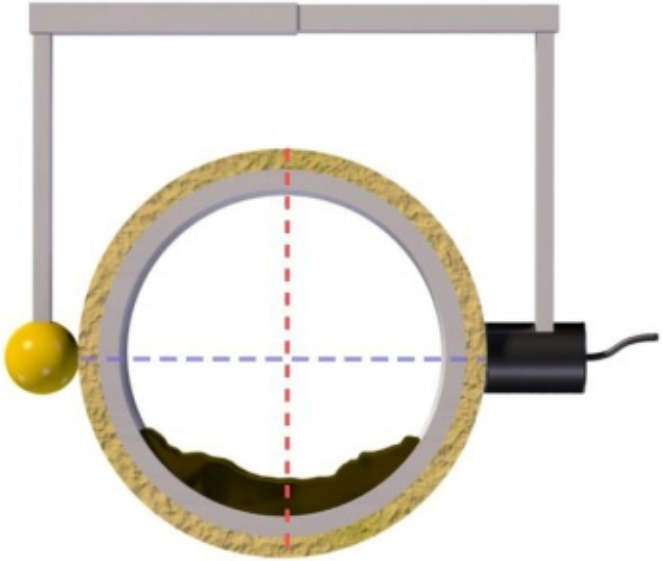
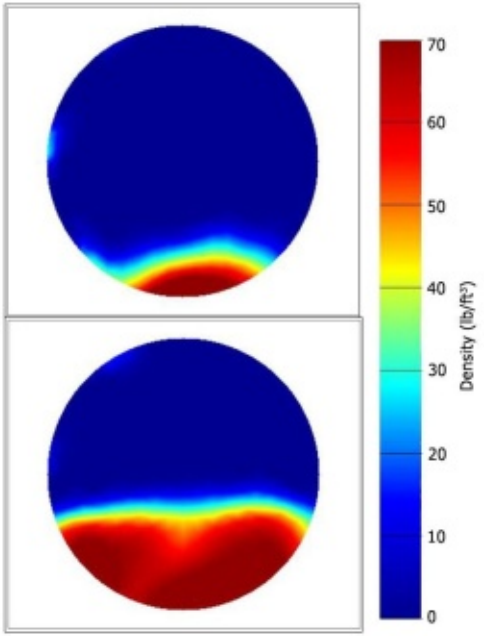
Measuring pipeline content

ThruPipe™ scans provides quantitative data on pipe build up



Measuring pipeline content

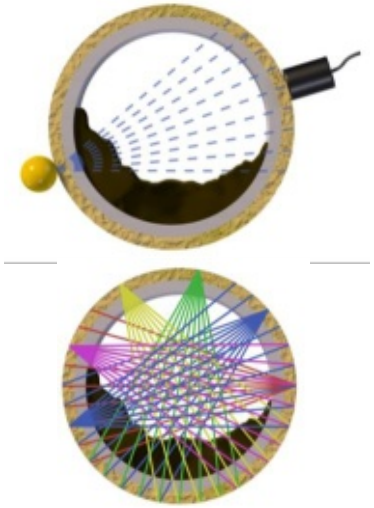
ThruVision™ scans provide a detailed density profile of build up



Density Range	% Distribution	Key
< 0.0 lb/ft³	0	
0.0 - 8.8 lb/ft³	74	
8.8 - 17.5 lb/ft³	6	
17.5 - 26.3 lb/ft³	4	
26.3 - 35.0 lb/ft³	3	
35.0 - 43.8 lb/ft³	3	
43.8 - 52.5 lb/ft³	3	
52.5 - 61.3 lb/ft³	2	
61.3 - 70.0 lb/ft³	2	
> 70.0 lb/ft³	2	

Density Range	% Distribution	Key
< 0.0 lb/ft³	0	
0.0 - 8.8 lb/ft³	52	
8.8 - 17.5 lb/ft³	6	
17.5 - 26.3 lb/ft³	4	
26.3 - 35.0 lb/ft³	4	
35.0 - 43.8 lb/ft³	4	
43.8 - 52.5 lb/ft³	8	
52.5 - 61.3 lb/ft³	12	
61.3 - 70.0 lb/ft³	8	
> 70.0 lb/ft³	1	

Illustration of ThruVision™ scan orientation.

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Tracerco™ Insights Platform

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The Tracerco™ Insights Platform provides fast, secure and convenient access to your process insights, allowing you to rapidly and confidently optimize your process and increase efficiencies.

With its cloud-based reporting, you can track the status of scanning projects, explore interactive reports and access a library of your historic scan data from wherever you are in the world. Being able to visualize and understand changes, you can identify potential issues quickly, saving valuable time and money associated with remediation costs.

Neutron backscatter

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Measuring pipeline content

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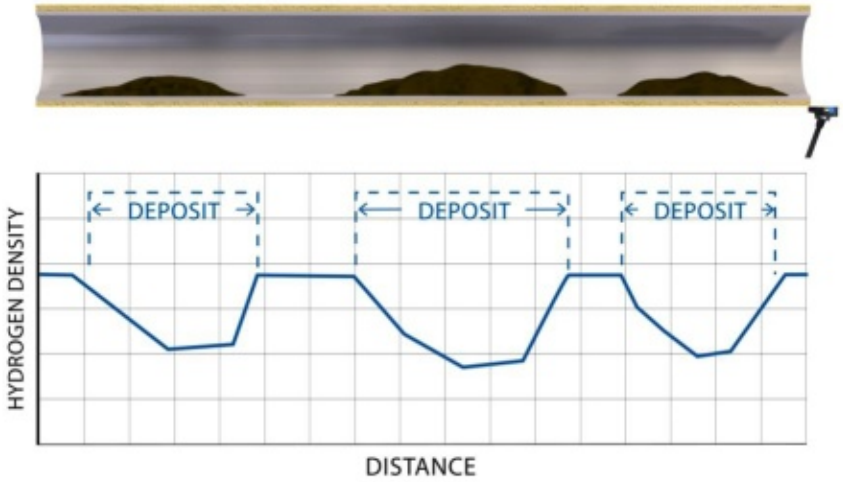
A rapid and portable system to locate and monitor the progress of build-up



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Manage your tank inventory efficiently

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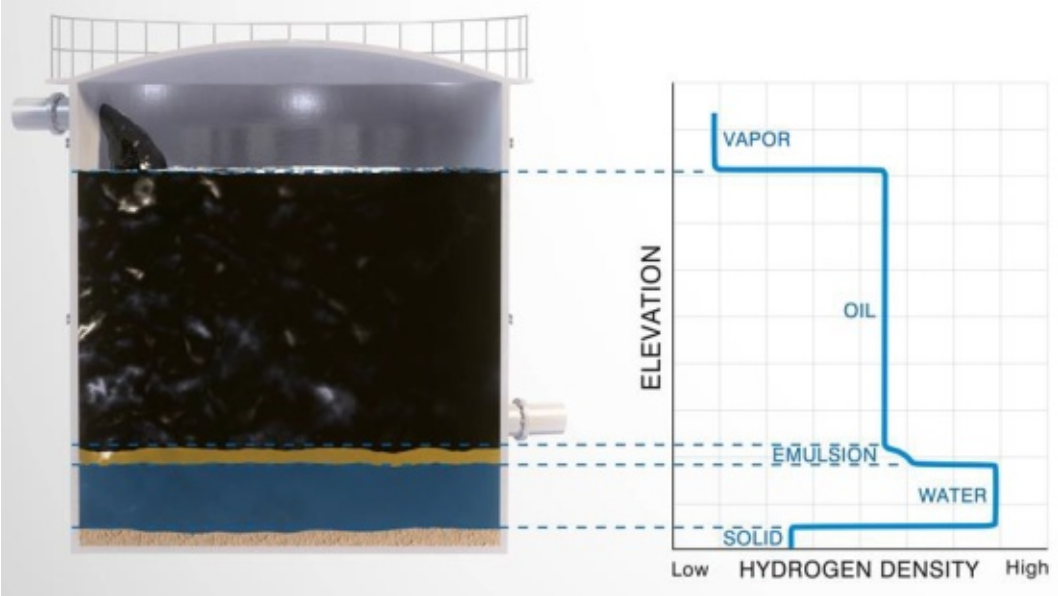

Bottom liquid level

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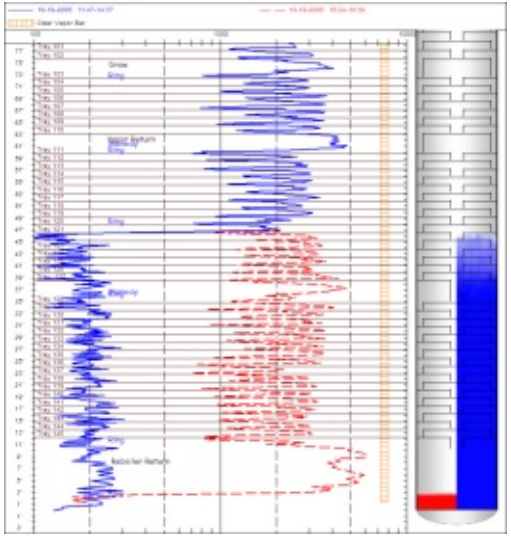

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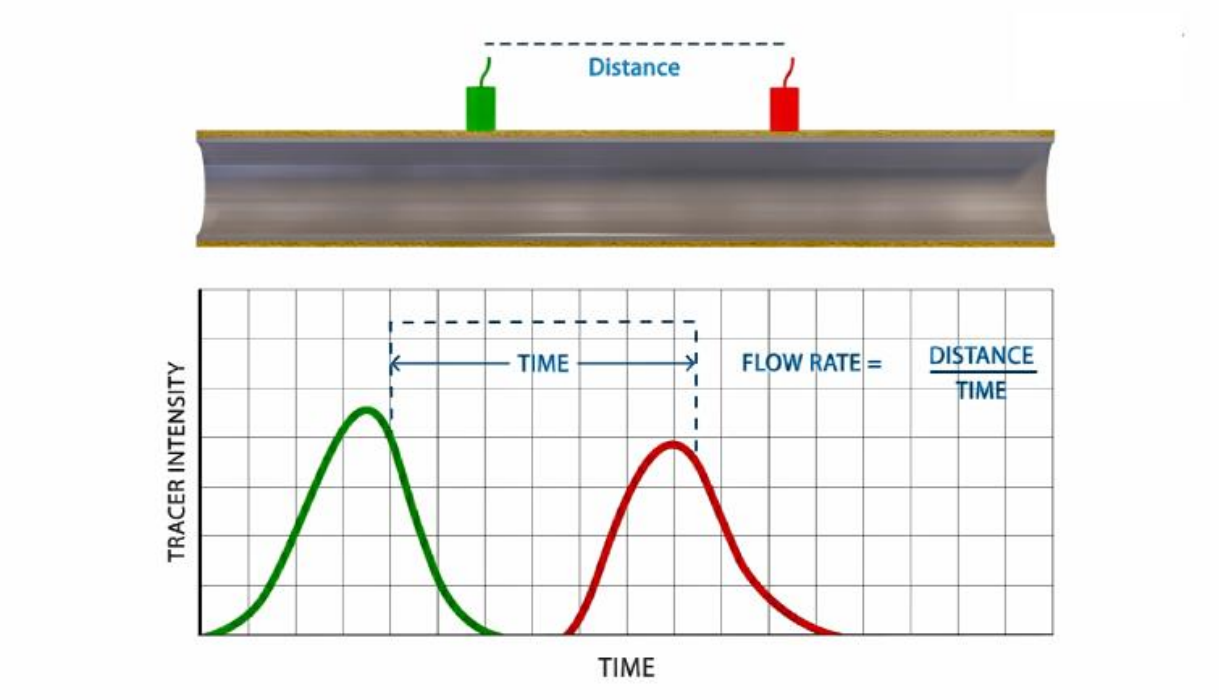
Accurate method for measuring flowrates

Tracerco Diagnostics™ Flare Study



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Tracerco Diagnostics™ Flare Study

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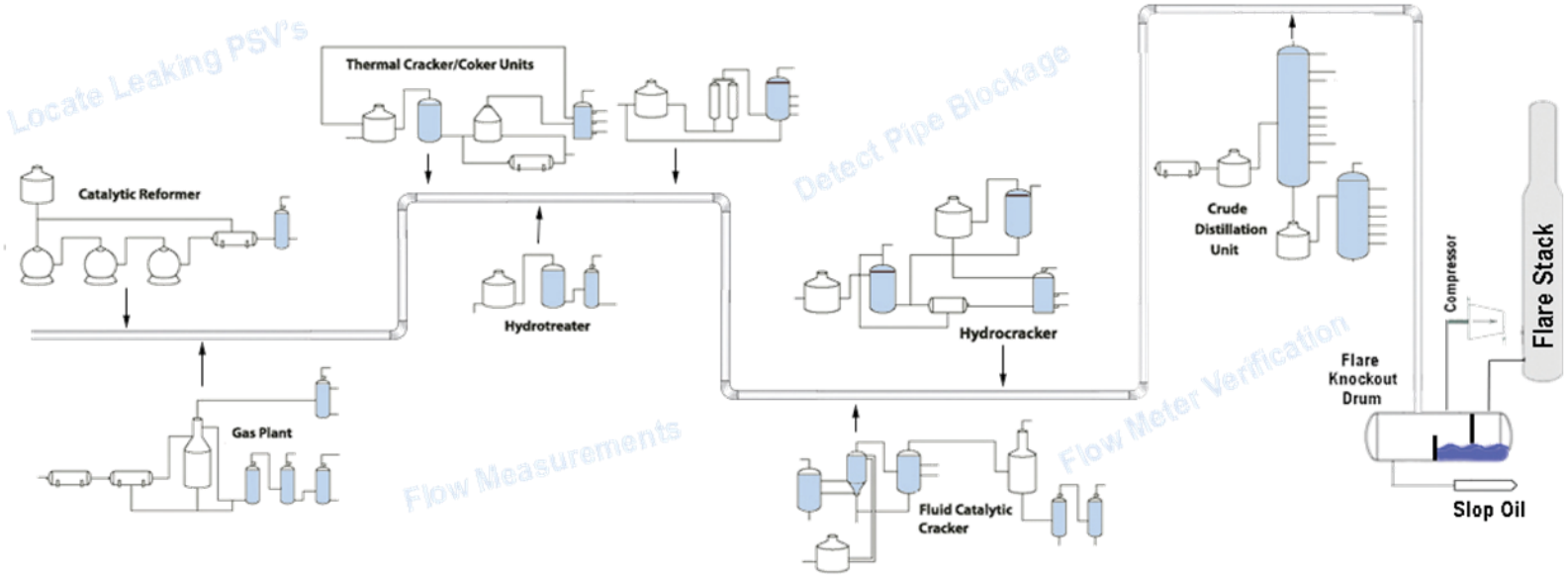

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Detect and confirm the presence of leak using a radioisotope

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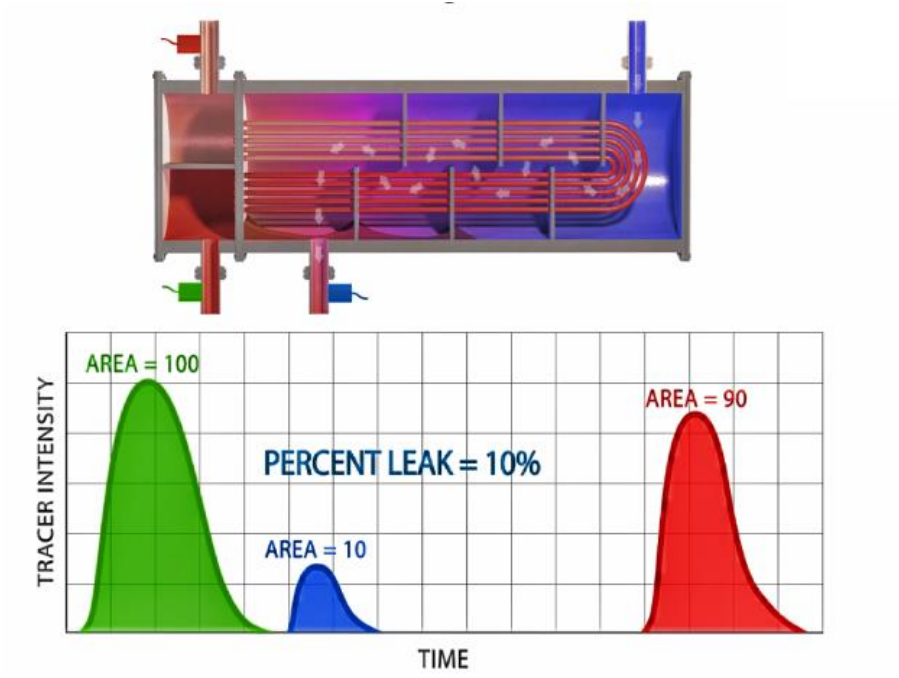

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Offline helium tracer technique

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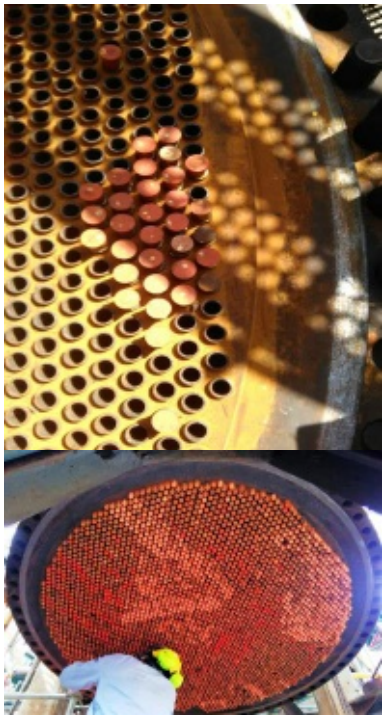
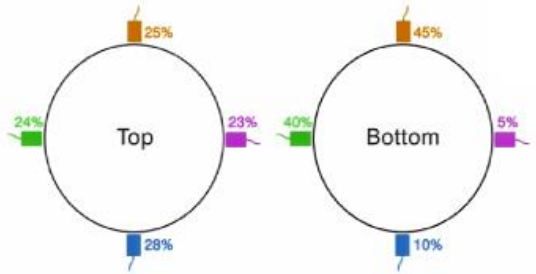
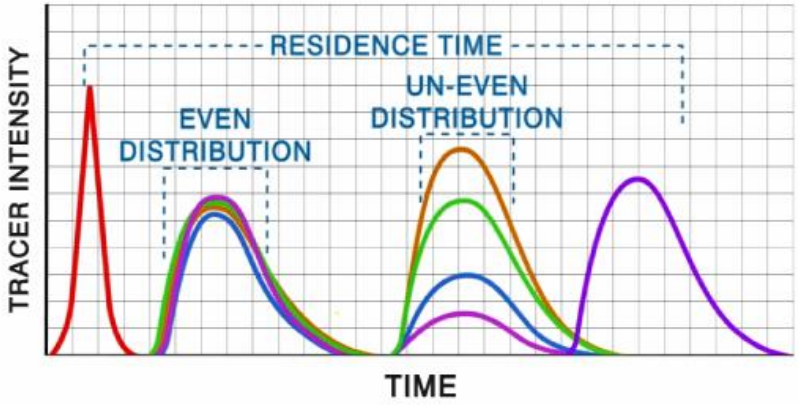


- Offline detection of leaking tubes using helium tracer
- All leaking tubes are identified and given a comparative leak size in ppm
- Enables operator to make necessary repairs and reduces equipment downtime

Identify maldistribution

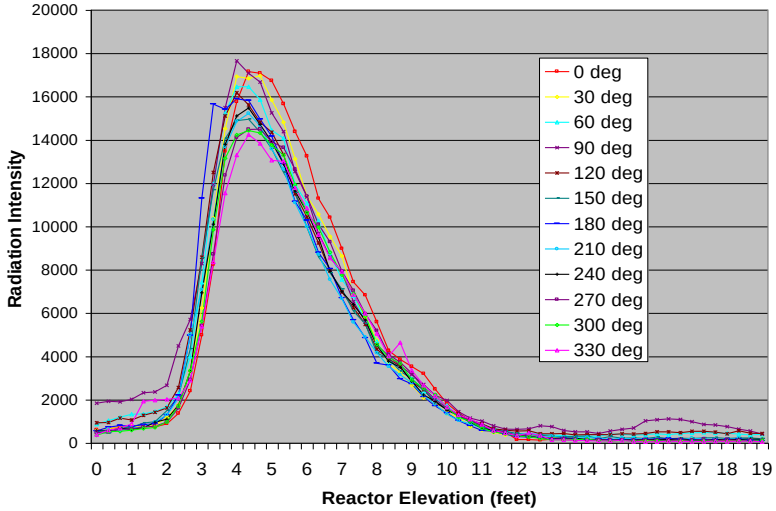
Tracerco™ Residence Time and Distribution Studies

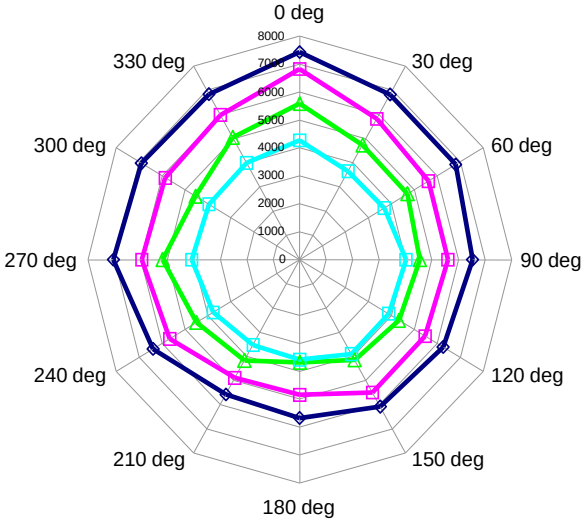




Identify maldistribution

Tracerco™ Distribution Studies

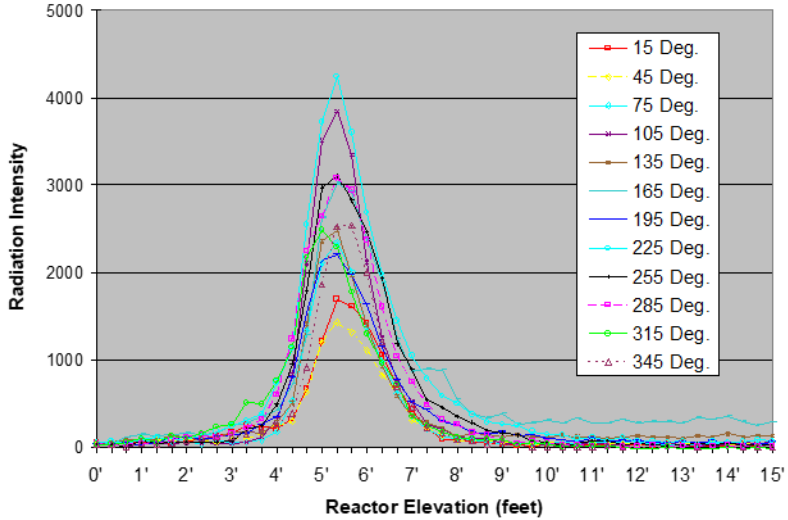


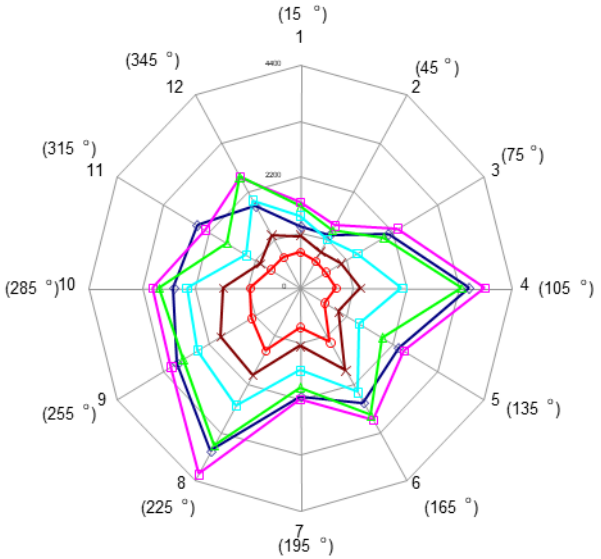


Normal distribution

Identify maldistribution

Tracerco™ Distribution Studies





Poor distribution

FCCU

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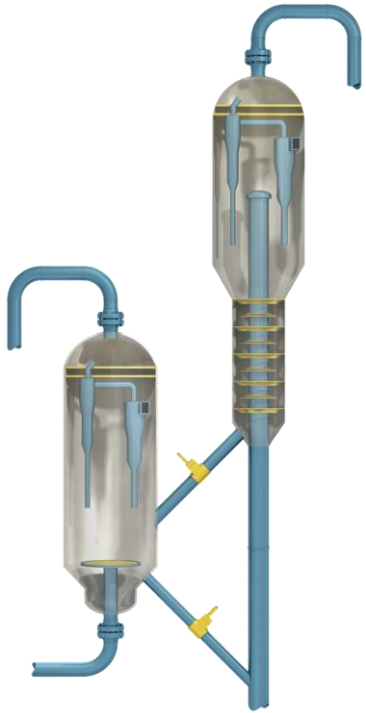
Valuable insights into FCCU's

Tracerco Diagnostics™ FCCU Study

- **Reactor riser**
  - Location of expansion zone
  - Velocity - slip ratios
  - Distribution of feed, steam and catalyst
- **FCC reactor**
  - Residence times
  - Distribution
  - Cyclone performance
  - Coke deposits in overhead line
- **Reactor stripper**
  - Residence times
  - Distribution
  - Damaged internals
- **Regenerator**
  - Air distribution
  - Cyclone performance
  - Catalyst distribution
  - Flue gas velocity
- **Spent and regen CAT standpipes**
  - Stratification of material
  - Slugging
  - Catalyst density



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Thank you so much for your time!
Any questions?
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