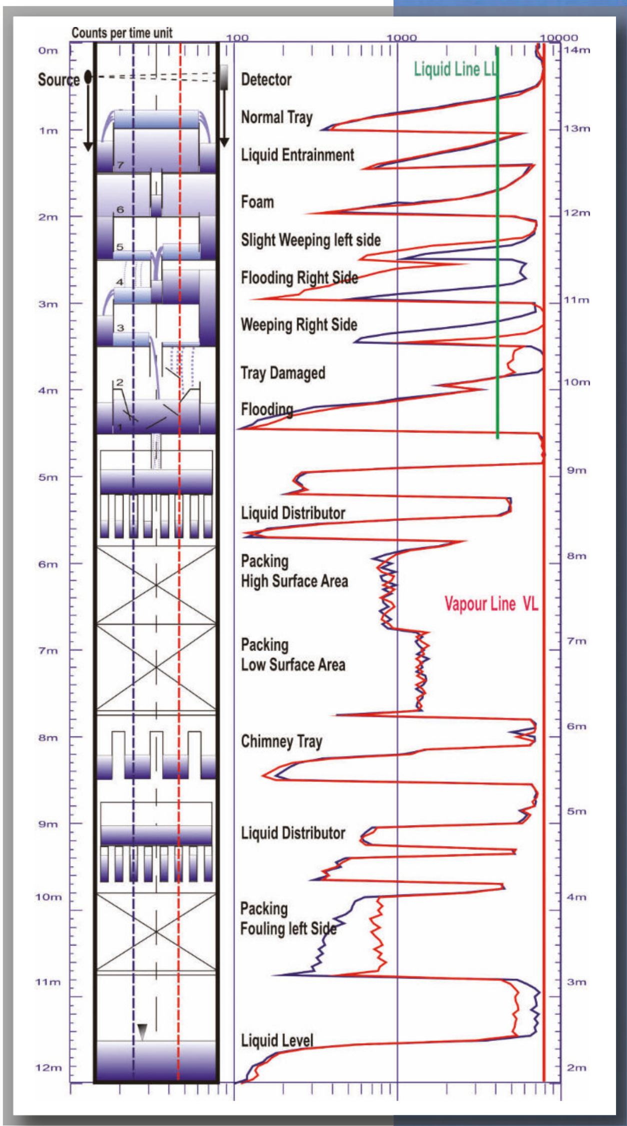
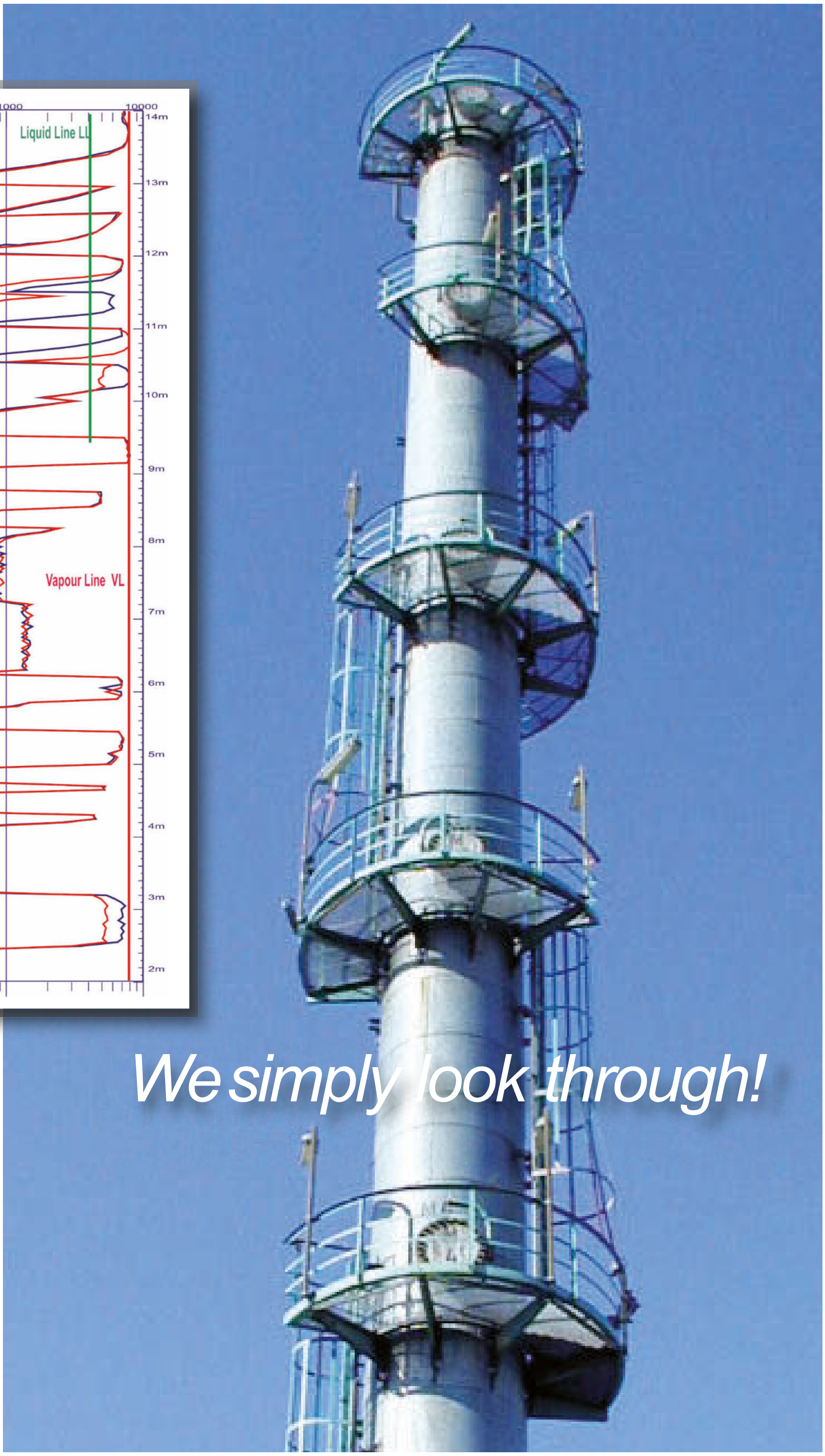
I B E Ingenieurbüro Esper GmbH
Verfahrenstechnik, Kolonnen- & Prozessdiagnostik

Your supplier in the thermal separation technology





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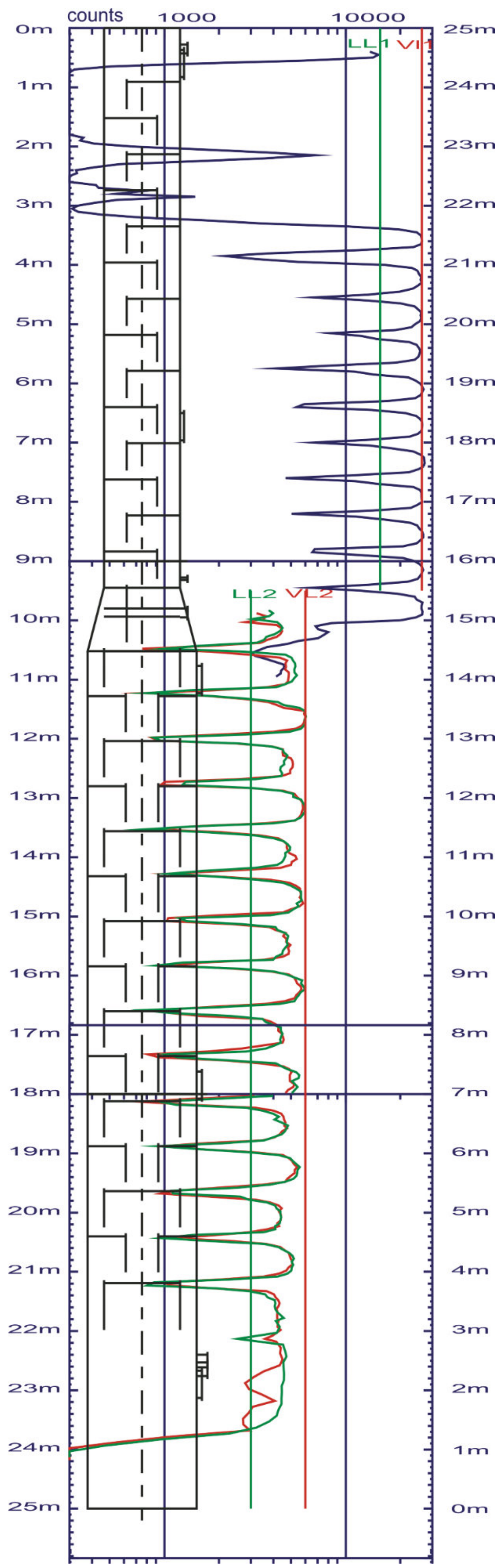


Case study: Scan of a distillation tower in a Refinery

Problem definition:
The trayed column with one-pass trays and 90° turned two-pass trays showed significant pressure drop increase and a reduced separation efficiency.

Possible causes:
Damage of one or more trays
Fouling on the trays

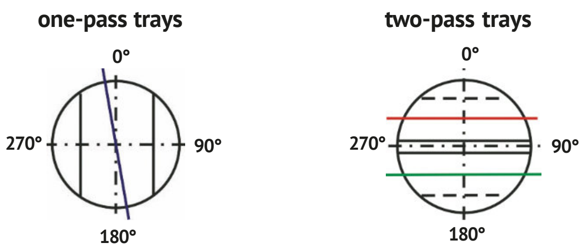
Scan program:
A scan was accomplished starting from the top tangent line over the active area of the one-pass trays. Two other scans were performed over the active areas of the two-pass trays down to the bottom liquid level.

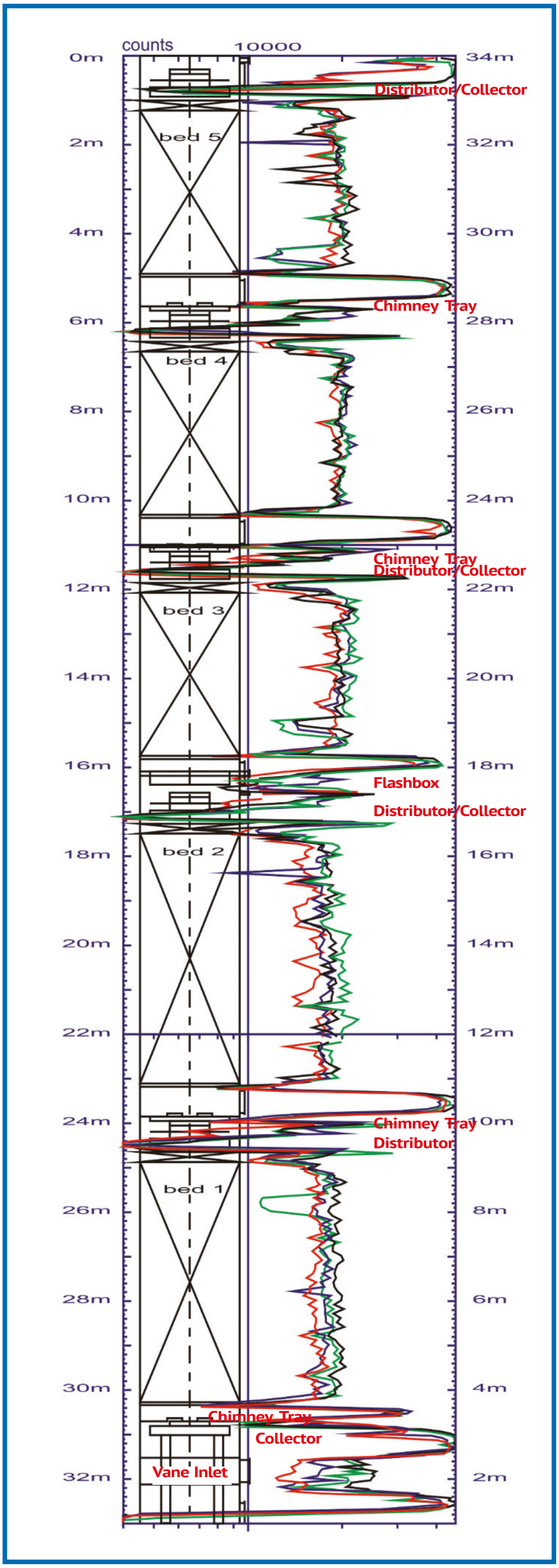
Results:
The upper five one-pass trays were flooded. Liquid was carried over through the vapour overhead line. The probable reason is fouling or debris in the downcomers and/or the active areas of the trays. No tray damage was detected. All other trays showed no mechanical or fluid dynamic malfunction.

Recommendations:
Decrease of the reflux rate to lower the internal liquid rate into the column. Further a water wash procedure to remove the debris in the column.

Feedback of the customer:
The customer turned the plant down and examined the area of the flooded trays inside. There glass fiber seals material was found which came from the old downcomer bolting bars. The column was revamped from two- to one-pass and two- to four-pass trays and the glass fiber seals were not removed properly.

Scanline orientation





Case study:
Scan of a distillation column for Toluene in an aromatic plant

Problem definition:
After modification by using the packing material of an other manufacturer the separation capacity was not reached.

Possible causes:
Maldistribution of the liquid and vapour phase in the packings.

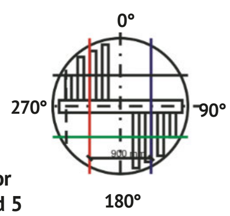
Scan program:
Four scans oriented in a fourway grid pattern according to the center line of the column were carried out from the top tangent line down to the bottom liquid level. In the column five beds with structured packings with each two different packing material sizes are installed. Above each bed a trough type distributor and below a collector is installed.

Result:
The scanlines show vapour liquid maldistribution in bed 2, there the subcooled feed enters the column. The distribution quality for bed 1 is adequate and good for bed 3, 4 und 5. The distributors and collectors show no malfunctions and even liquid levels.

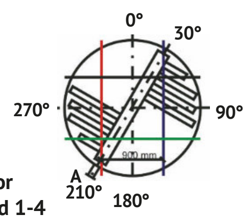
Recommendations:
The distribution quality could be improved by preheating the subcooled feed to bed 2 and therefore improve the separation efficiency.

Feedback of the customer:
At present the feed preheating system is not realised because of the high investment costs.

Scanline orientation

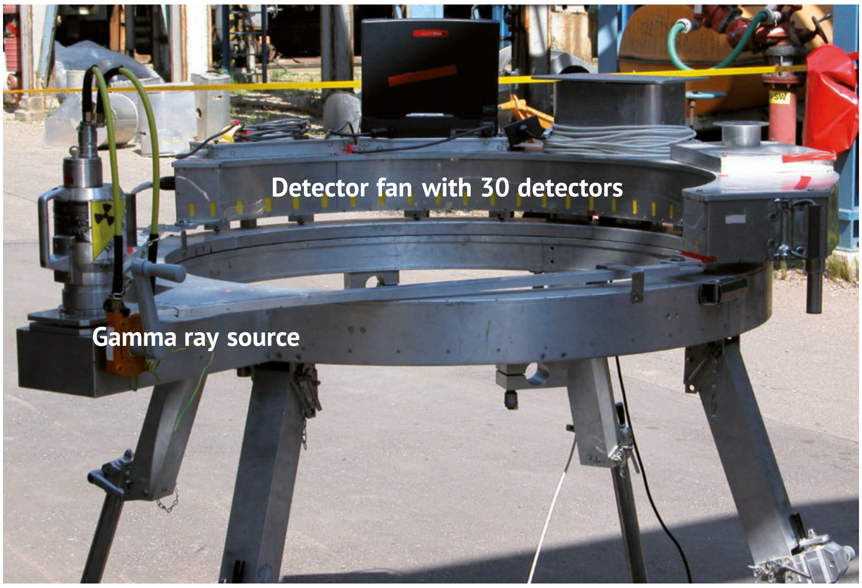


Distributor above bed 5



Distributor above bed 1-4

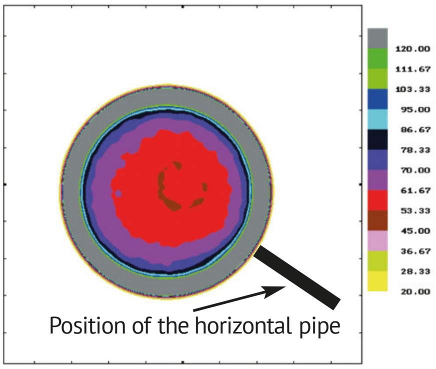
Tomography in process engineering:

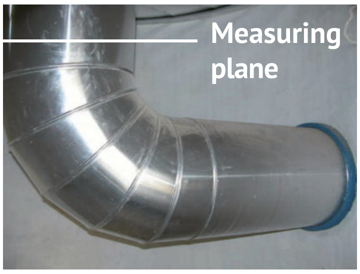


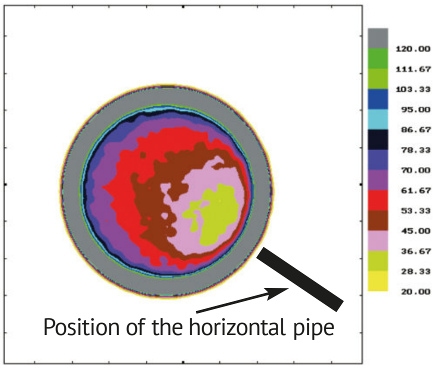
Computertomography at a 10“ feed pipe of an upflow hydrogenating reactor for hydrocarbons

Mode of operation:
The gamma ray source and the detector fan with 30 detectors are coupled to each other and carry out a rotation of 360° around the measurement object. The maximal object diameter is 1000 mm. The spatial resolution is 6 mm. The measuring data are represented as absorptions coefficients μ and are proportional to the density of the through-radiated device.

Result: Density allocation of the hydrocarbons (HC) and the hydrogen (H_2) in the vertical pipe:







Ratio of the mixture:
HC : $Nm^3 H_2$ = 1 :2,5
Result: **No maldistribution** of H_2 at the inside elbow-side of the feed pipe

Ratio of the mixture:
HC : $Nm^3 H_2$ = 1 :5
Result: **Maldistribution** of H_2 at the inside elbow-side of the feed pipe

Service package

- Diagnostic at columns, reactors, heatexchangers and pipes
- Computertomography at pipes and reactors
- Detection of fouling and bottlenecks in columns, reactors and pipes
- Evaluation of the distribution of the phases in packings and catalyst beds
- Detection of liquid heights on distributors and collectors
- Verification of the fluid dynamic process conditions of distillation trays: downcomer flooding, entrainment, weeping and foaming
- Thermodynamic process simulation of columns and their auxiliaries
- Hydraulic calculation of distillation trays, packings and related internals
- Studies to eliminate breakdowns or bottlenecks
- Design, delivery and installation of column internals
- Execution of turnkey revamps
- Inspection of columns
- Execution of column scans in Europe within four days