The Shrouded Probe

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A short history of the Shrouded Probe.

The Shrouded Probe was designed, developed and patented by Texas A&M university in the USA.

In the past the ANSI committee had previously emphasised the importance of isokinetic sampling from multiple points, to overcome the limitations of mixing.

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A short history of the Shrouded Probe.

However, the Shrouded Probe developed by Dr McFarland at Texas A&M, when operated at a single location in a well-mixed stable location, will provide a more representative sample than a rake of numerous small probes.

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A short history of the Shrouded Probe.

The concept of taking a small sample of a flowing medium as a representative example of a whole, by use of a smaller shroud within the main flow conduit, has been used for many years.

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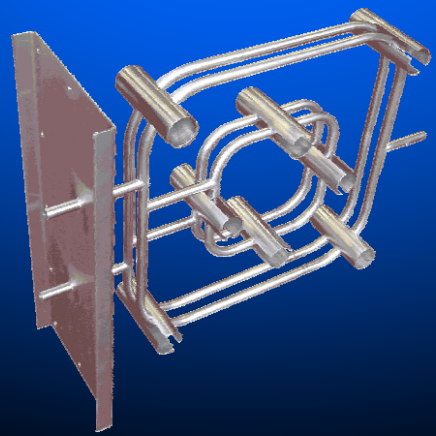
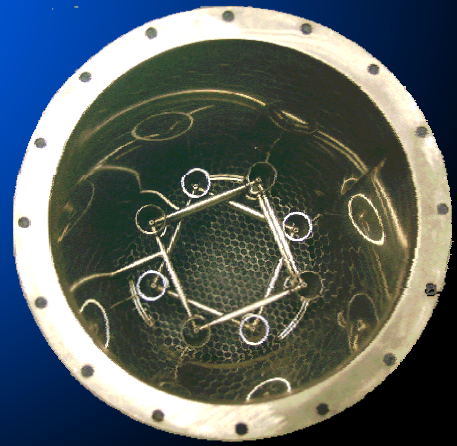
A short history of the Shrouded Probe.

For example, in Pitot type flow meters, where there is insufficient lengths of straight duct. Shrouds around the Pitot heads help to increase the accuracy.





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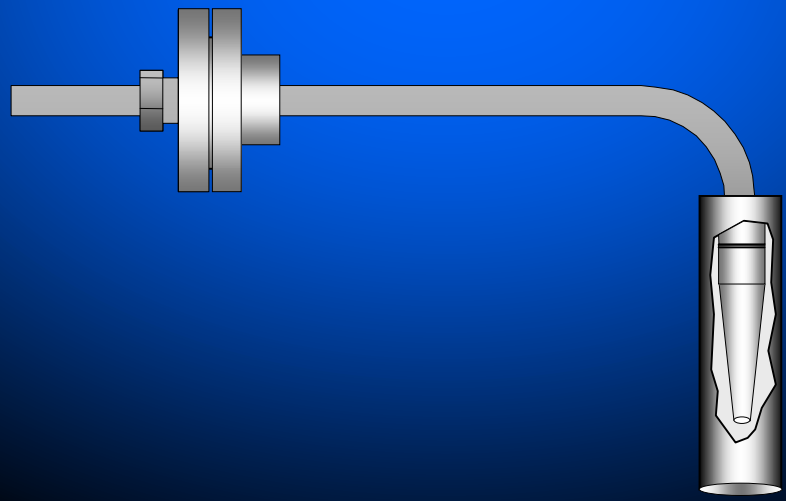
The requirement of any sampling collection system of particulate is to capture the sample by the most efficient method with the least amount of losses.

Historically Isokinetic sample probes have been employed for this task.



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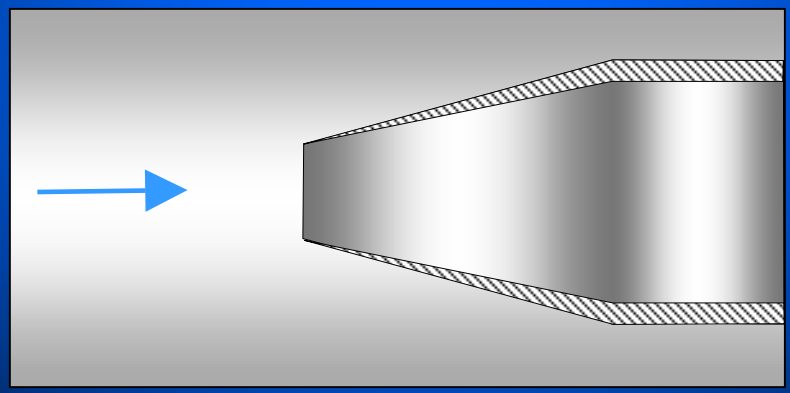
The main differences between an Isokinetic and a Shrouded Probe is that an Isokinetic probes is designed so that the sample flow enters the sample nozzle at the same velocity as that of the free air in the stack.



The velocity within the shroud is approx. 1/3 that of the free air in the duct.

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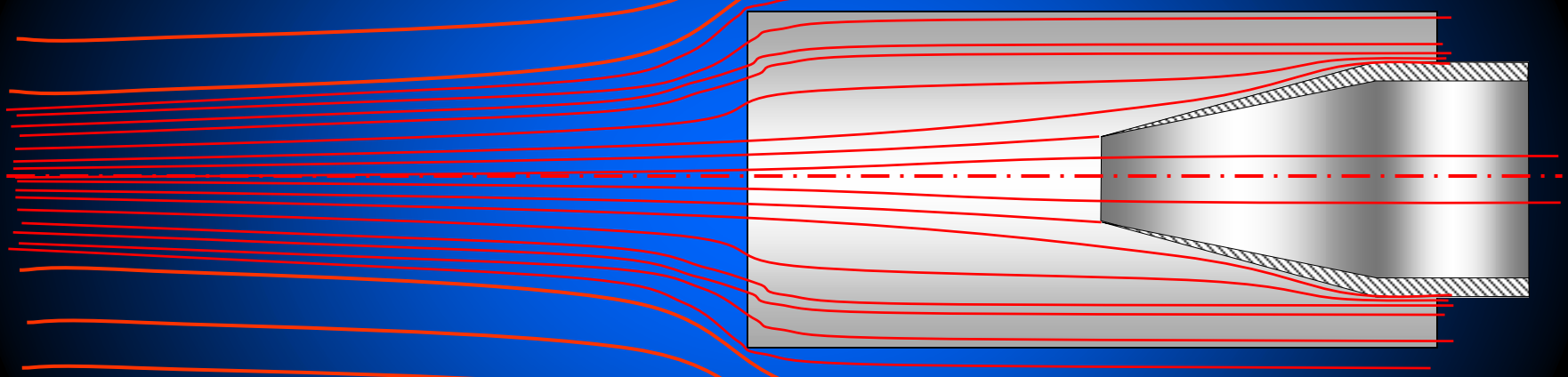
The deceleration at the shroud inlet causes aerosol enrichment in the region near the shroud wall, due to the curvature of the streamlines, however that aerosol is not sampled by the internal nozzle.



In contrast the streamlines in the core region of flow are quite straight and as a consequence, the aerosol in this region is not appreciably enriched.

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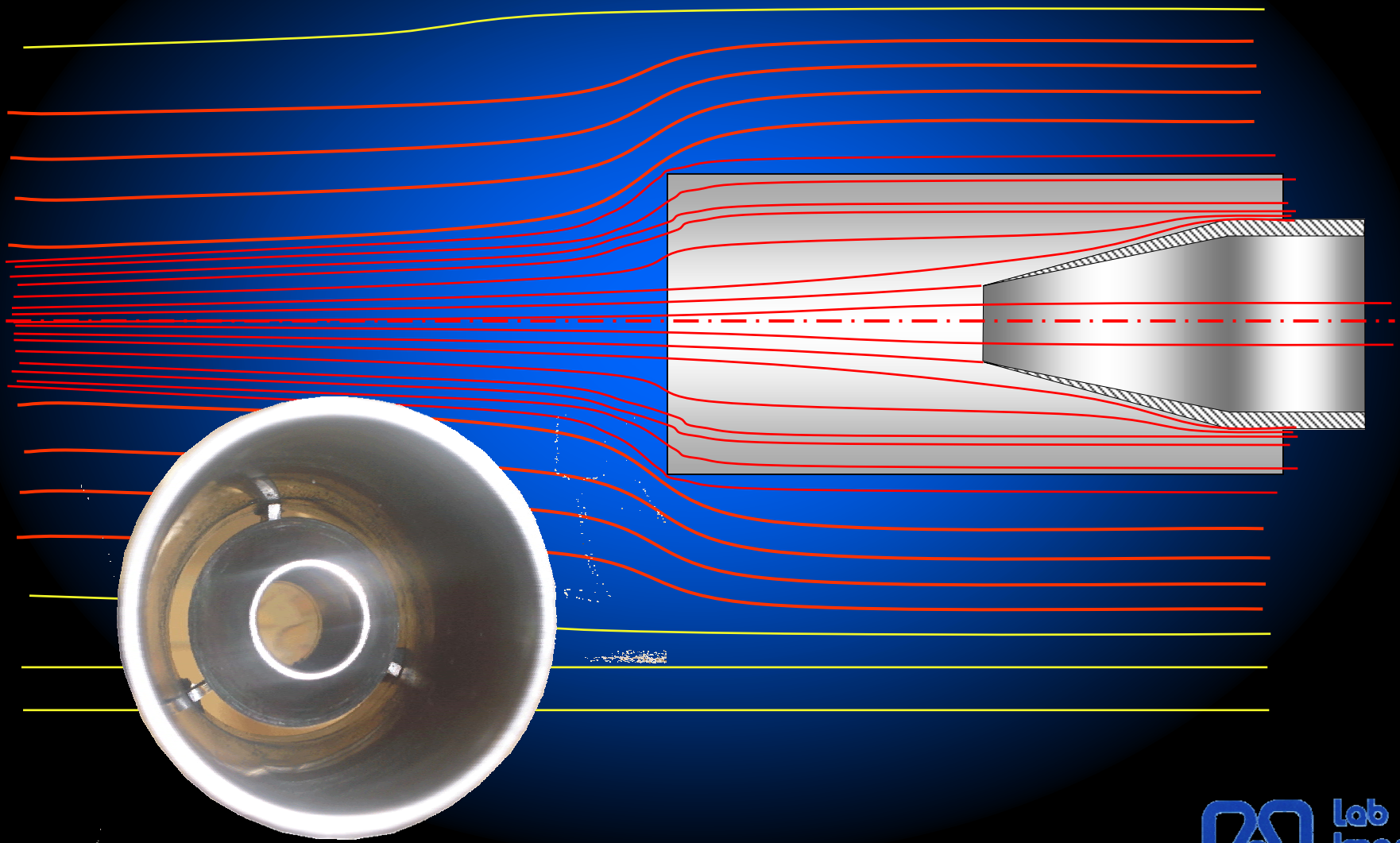
The inner nozzle samples the gas at nearly the same aerosol particle concentration as the undisturbed flow upstream of the stroud.



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Performance Characteristics:-

ANSI N13.1 provides guidance sampling in the nuclear industry. It states that over anticipated operating conditions (Sample flow rate and Stack velocity) an acceptable sampling probe must have a transmission ratio of between 80% and 130%.

The transmission ration is the concentration of aerosol at the exit plane of a probe, divided by the concentration in the stack at the probe location.

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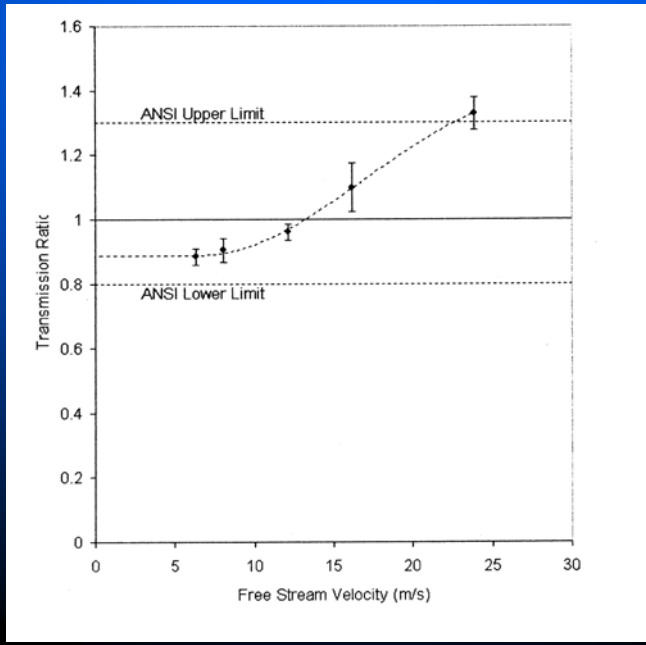
Performance Characteristics:-

The graph below shows the transmission ratio of a Shrouded Probe operated at a fixed sample rate of 57Lt/min (2cfm) over a stack flow rate which changes with time, between 1 – 24 m/sec.

The particle size = 10μm aerodynamic diameter (AD)



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Advantages of a Shrouded Probe over non-shrouded probes:-

- Lower internal wall losses.
- Better off-angle performance.
- Low sensitivity to flow stream turbulence.
- Can operate in either fixed or modulating flow rates.

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There have been many tests on Shrouded Probes to suit differing gas flow rates and sample rates.

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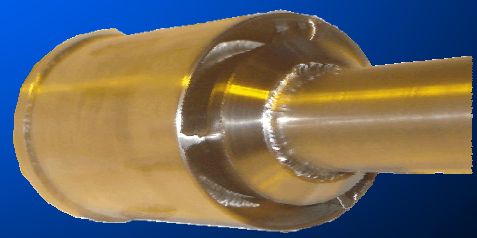
At this time tests are being performed on a new range of probe which will be suitable for lower sample rate, than those used in USA. The new range will be based on 37Lt/min with a sample transport line of 25mm OD as opposed to the US preferred size of 1 ½”.



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Thank you for your time.

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