

Fumes filtration technology with suspended particles captured by liquids.

Spraytechs Technologies Ltd, UK - Document (28/12/2015)



www.spraytechs.com

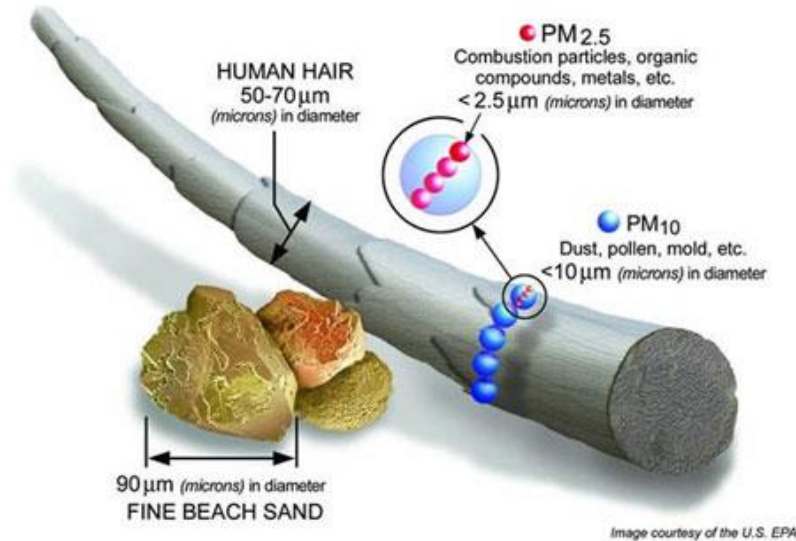


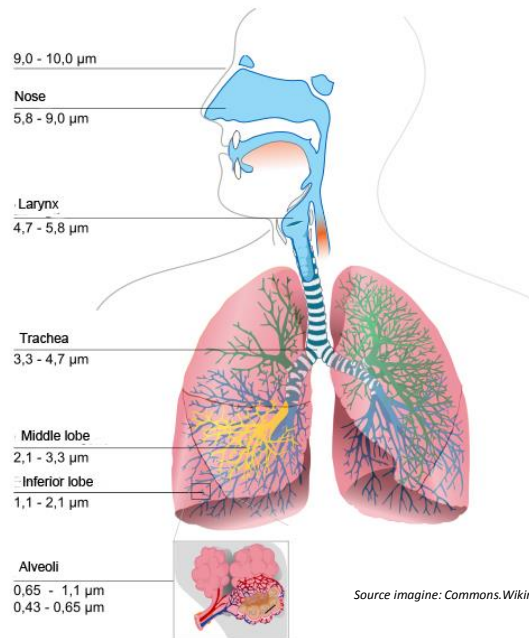
Image courtesy of the U.S. EPA

As general a smoke is composed of various substances, some very dangerous for human health, in the form of solid or liquid particles, suspended in a flow of air or gas.

All particles smaller than 10 microns (PM10, ie 0.01 mm) are inhalable by humans and therefore can affect the respiratory system.

Moreover, the larger part of them (90% as verified in air quality in cities like Milan) are generated by combustion residues from boilers, burners, internal combustion engines, and consist of micro-particles in sizes between 2.5 and 0.1 microns, which can penetrate bronchi and alveoli in humans.

Therefore an effective filtration can not be limited to the aggregation of the suspended particles of the visible dimension (the human eye is able to see objects of minimum size between 40 and 20 microns), but must consider the capture of particles 200 times smaller.



Source image: Commons.Wikimedia Xander89



The majority of industrial scrubbers (washing towers fumes) uses the fractionation of water jets obtained from spray nozzles, oriented directly inside the smoke that must be decontaminated, through appropriate ducts and suitable internal chambers. The drops of water are used to capture suspended dust particles in the gas, precipitating in the collection tanks of resulting liquid, and often filtered for reuse. In scrubbers are widely used nozzles with spiral shape, of simple manufacture and large internal passages to avoid occlusions, so to can reuse the water containing the residues of the fumes (also in coarse parts, of several millimeters in diameter). Even in the fumes suppressors for small size boilers is common the spiral nozzles installation.

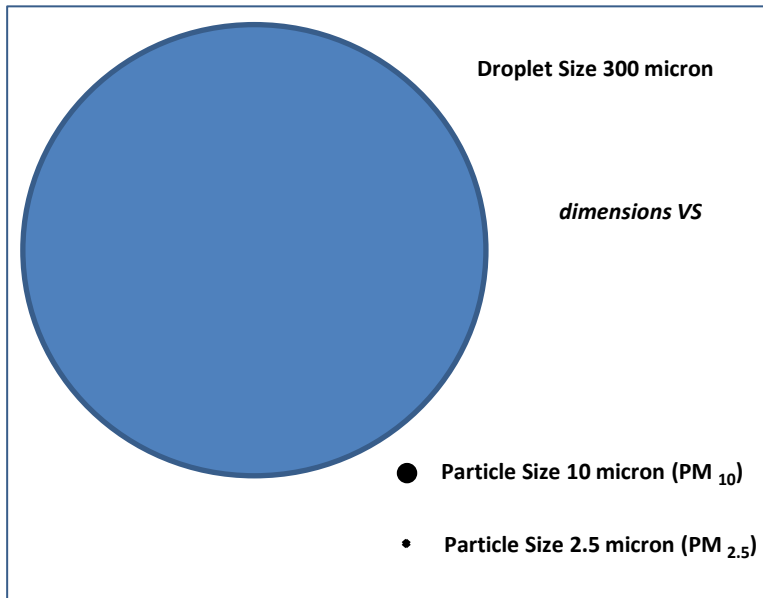
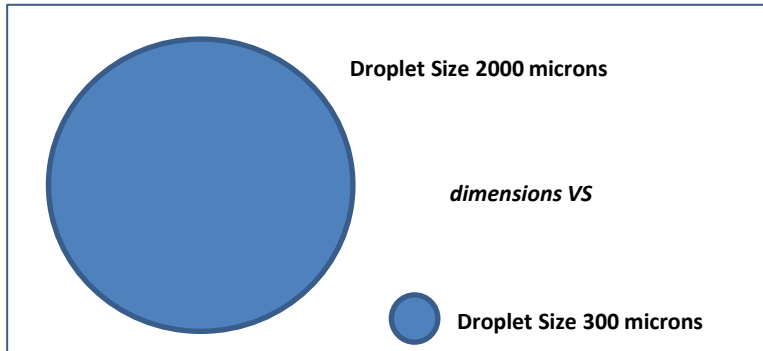
A nozzle spiral, even when of small size, generates a concentric laminar spray formed by droplets of average size of at least 2 mm (2000 microns), that travel in the gas relatively spaced between them, at distances of several millimeters.

Moreover, the relatively large mass of these drops creates air displacement during the movement, which tends to move away from the colliding trajectory the smaller mass particles, preventing contacts, and thus an higher probability of particle capture faults.

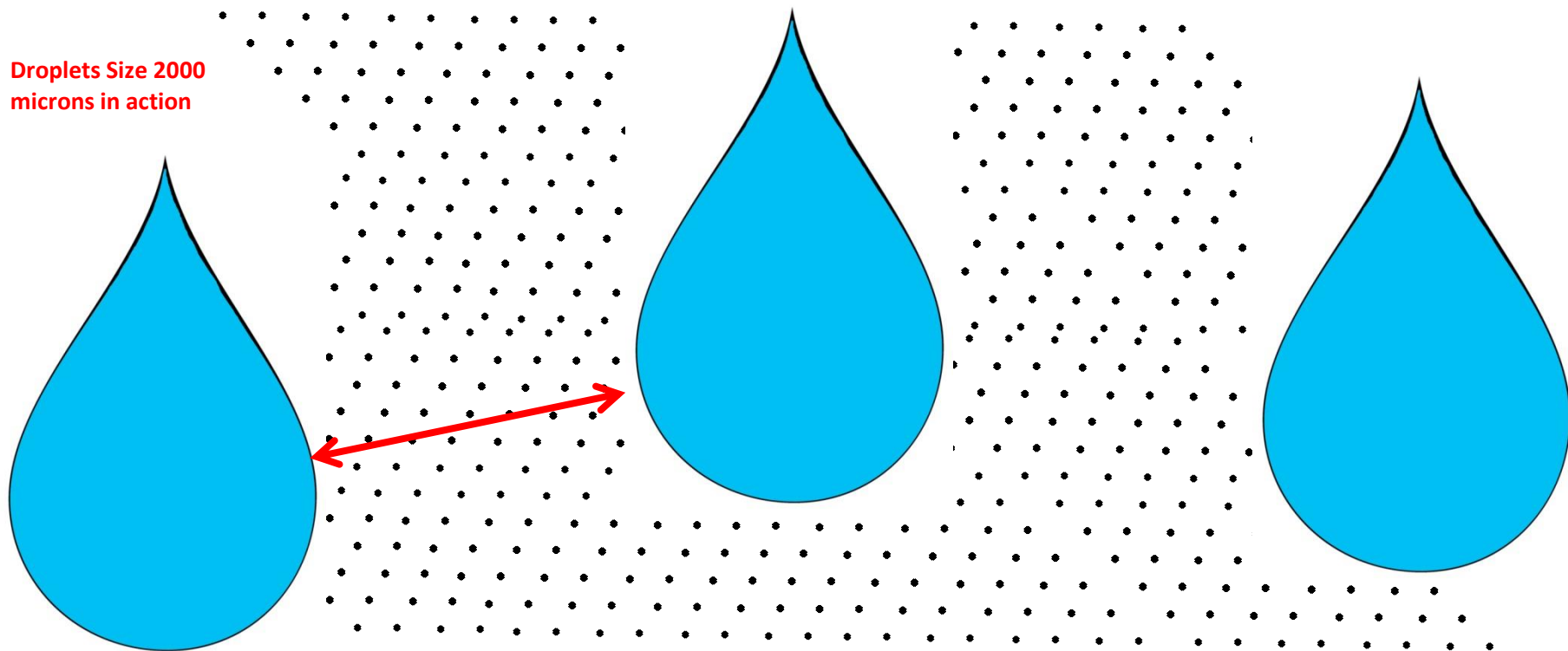
In consequence are filtered particles of greater size, allowing the passage of the smallest and most dangerous.

In general it is desirable, in the plants of small size, generate an average size of smaller drops, in the order of 300 microns, to get more concrete effects on the number and size of suspended particles captured.

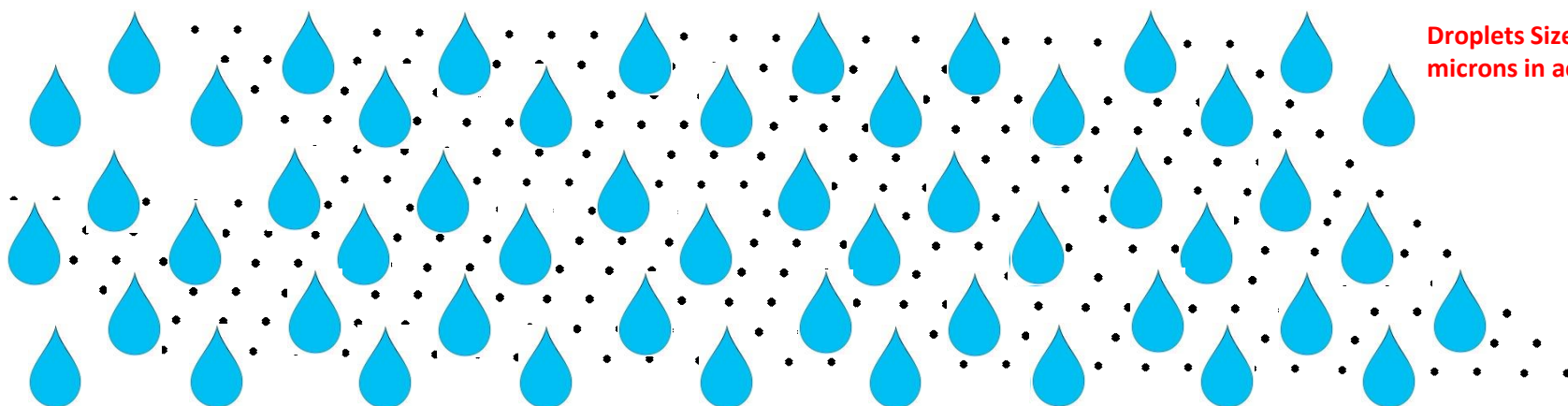
A further important decrease in droplets size is also possible through more complex solutions, which are not presented in this document for space reasons.



**Droplets Size 2000
microns in action**



**Droplets Size 300
microns in action**

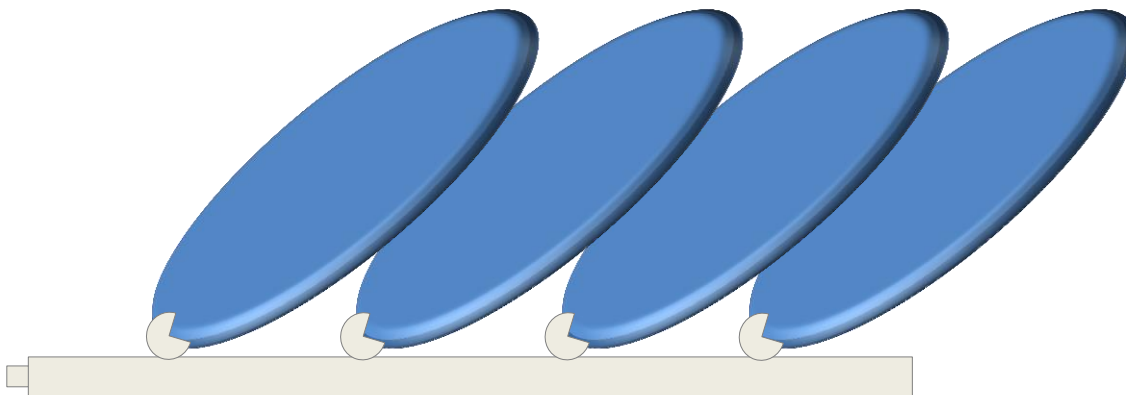


In the previous images, different actions of different sizes of drops are shown, when used to hit and capture equal sizes of floating particles (PM10).

In the drops dimension class of 2000 microns, it's evident that number of particles not affected is relatively high, due to the distances between the drops and the reduced number of drops, while in the same space droplets of 300 microns are much more numerous, thus with less free space and less particles free of floating.

As consequence Spraytechs has made available on the market a series of nozzles designed specifically for the treatment and reduction of suspended particles inside of fumes and gases containing various substances.

The name of the series of nozzles for the stream dust removal is STRATOS, since the action carried out is the emission of several superimposed layers of laminar flow, on a circular area (as a cilindric duct), so to create a layer of small droplets (200 microns on average), very close together.

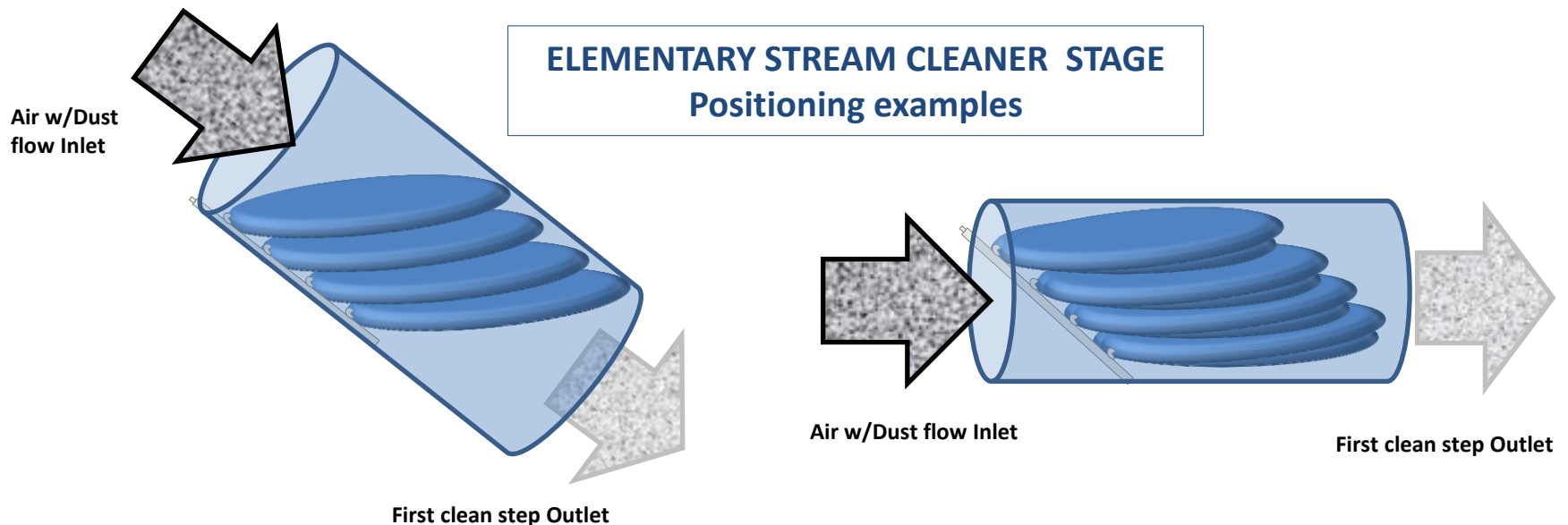


STRATOS

Nozzle spray shape



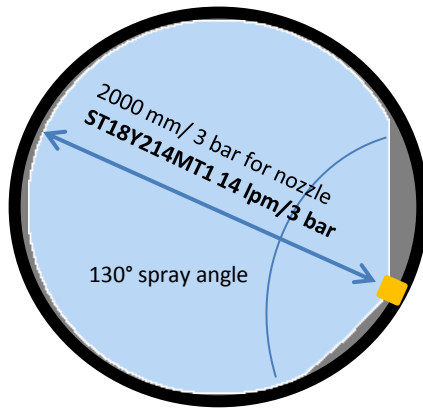
The STRATOS nozzles Spraytechs enable new project solutions for designers, because it is now possible capture a larger number of suspended particles of small size, with low consumption of water and reduced sizing of pumps in plant of treatment fumes smaller, saving money in initial investment and cost of plant or device exercise.



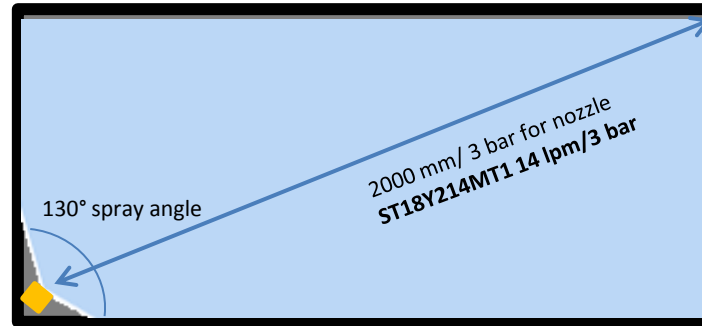
The Spraytechs STRATOS nozzle is available with different flow rates, size of drops and construction materials, so as to allow different design configurations, and allow the micro-particles suspended capture performances as per desired goals with different kinds of contaminants to be treated.

In many applications designers can consider water mist flow control through an accurately dimensioned demister stage.

Flat jet layers shape of Stratos nozzle in a Circular Duct



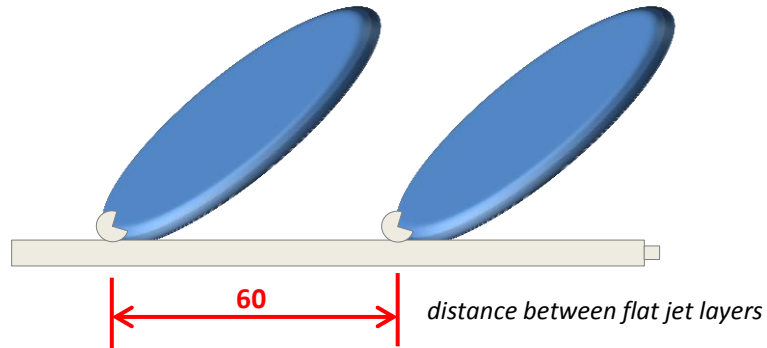
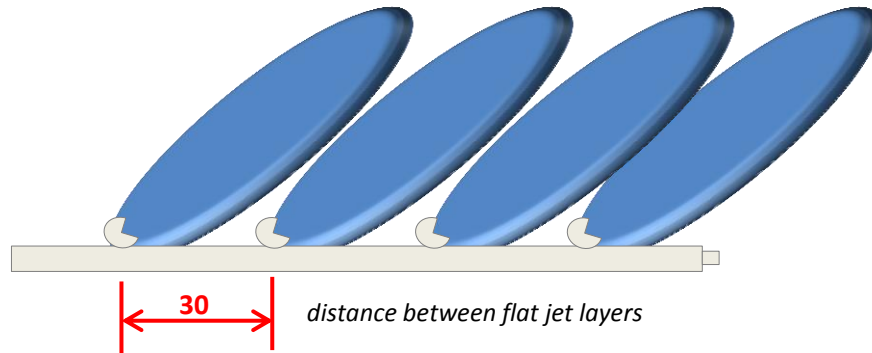
Flat jet layers shape of Stratos nozzle in a Squared Duct



ST18Y214MT1 14 lpm/3 bar
(other flow rates available)

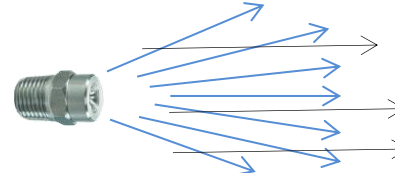
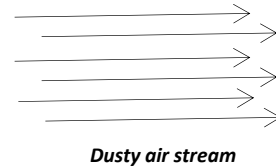
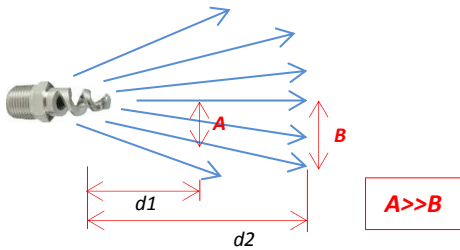


ST18Y170MT1 7.0 lpm/3 bar
(other flow rates available)



The fluidics Basic Principle of Spraytechs STRATOS multi-layers nozzles

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Only affected fume particles are collected, and direct collect % DECREASE with distance

Standard spray nozzles droplets have directions that raise their tangential distances between droplets distribution in the space, and distances are proportional to the distance from the nozzle orifice, that is the point of origin .

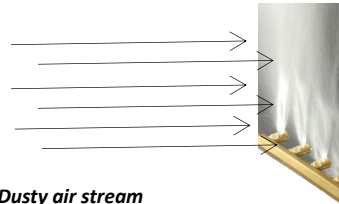
This can be a problem when spray droplets must collect small size floating particles, because the percentage of collect performance varies with the distance from the nozzle orifice, and smaller particles are almost difficult to collect. This fact is partially attenuated by droplets sizes that decrease with throw distance, and raise in number.



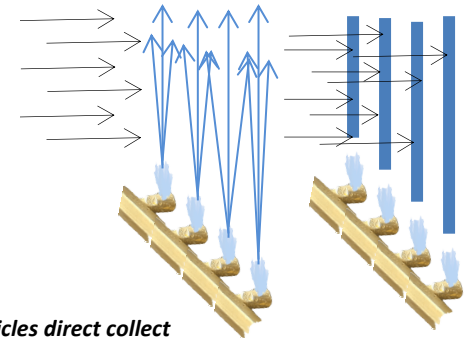
STRATOS nozzles give you two basic ways to collect particles inside dust flows:

- Tangential Flow
- Crossflow

Tangential Flow positioning



Dusty air stream

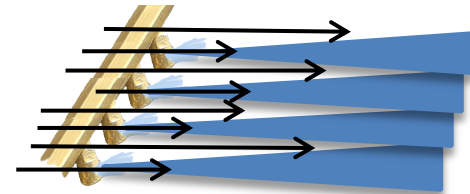
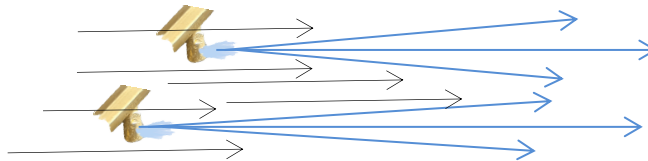


Only affected fume particles are collected, and PMx particles direct collect percentage INCREASE with distance and raising the number of laminar water layers to overpass

Crossflow positioning



Dusty air stream



Fume particles are compressed between uniform flat jet layers (that are moderately diverging from orifice) and then collected, thus PMx particles direct collect percentage INCREASE with distance, raising the number of droplets and decreasing their sizes and mass. Therefore new horizons are now available in PMx collect precision, and in design, economics, dimensions, performances of Wet Scrubbers