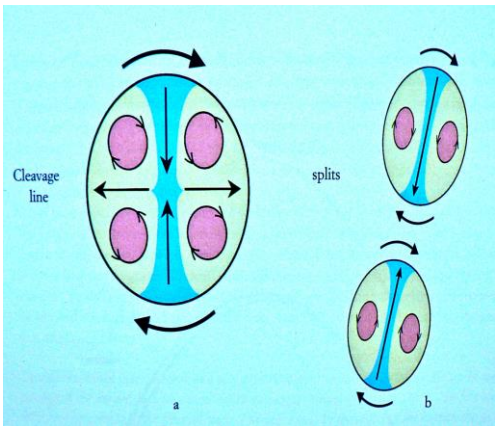
Similar Tyndall-Nikuradse-Hof transverse turbulent flow patterns in tubes

Key words: counter-rotating vortices, efflux jet, flat plate, geometric tubes, sound-sensitive, streaming, transition, transverse flows, turbulence

Tyndall (1867) showed that when cylinder water flow is in the "sound-sensitive" phase of transition, specific coherent sound frequencies cause immediate turbulence, with the efflux jet splitting into two, three or more, similar jets.

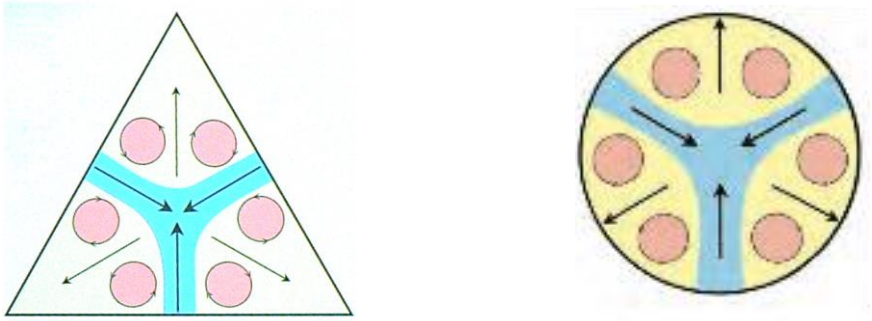
Hof (2004) found turbulent flow columns in cylinders (SPIV) are divided into 2, 3, or more, similar transverse flow divisions, each sector showing a pair of counter-rotating vortices, separated by a centripetal flow from the boundary, towards the mid-axial stream.

Logic suggests that the Hof flow divisions might define the number and character of Tyndall's efflux jet divisions.



2-division Hof turbulent cylinder column dividing into 2 Tyndall efflux jets

Nikuradse (1930) studied turbulent flow in tubes with geometric cross-sections, showing a specific pattern to the transverse flows associated with each wall – a pair of counter-rotating vortices, separated by a centripetal flow from the mid-wall boundary, towards the mid-stream. His equilateral tube displayed three such flow patterns, one for each wall.



Nikuradse 1930 **similar to** **Hof et al 2004**

Logically, one might predict that a tube with an equilateral triangular cross-section, with water flow in the sound-sensitive phase of transition, when subjected to a coherent sound to which it is sensitive, would have its efflux jet break up into three similar jets, each rounded off by surface tension and each with an SPIV image displaying a central streaming flow, flanked by a pair of similar, but counter-rotating, vortices.

Again, logic suggests that each efflux flow division (2, or more) caused by Tyndall's 1867 simple harmonic sound will show a similar pattern on SPIV – a central streaming flow, flanked by a pair of counter-rotating vortices.

A central streaming flow, flanked by a pair of similar, but counter-rotating vortices, is characteristic of flow created from a simple harmonic sound generator. Although this discussion is about transverse flows in tubes, one must consider that Nikuradse's geometric tubes are made up of conjoined flat plates, with one streaming flow arising from each mid-wall at the onset of turbulence.

A philosopher might draw an interesting conclusion to this convergence of similarities.