

# Radial Flow Model

Is an experimental device for studying radial flow of yield stress fluids with application to rock grouting.

The Radial Flow Model was developed at KTH Sweden in collaboration with Incipientus AB. It is a device for non-invasively measuring the radial flow field of model yield stress fluids (YSFs) such as Carbopol that mimic the flow of cement grouts used in rock grouting applications. Such a flow model that utilizes Incipientus ultrasound technology provides unseen 'pictures' of the YSF radial flow field. The results from radial flow experiments complement and verify theoretical radial flow solutions used during rock grouting design to estimate cement grout spread. Experiments of this nature have become even more important in recent years when environmental restrictions on water inflows into grouted tunnels have become stricter.

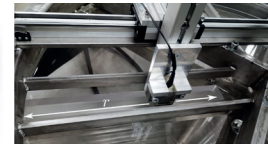
***“Ultrasound visualization provides a ‘picture’ of the radial velocity flow field”***

## Benefits

- Incipientus ultrasound system provides high resolution velocity profile measurements.
- Touch free sensors allow for non-invasive and non-intrusive testing.
- Incipientus system provides velocity profile visualizations.
- A ‘picture’ of the radial flow field including the plug-flow region was measured noninvasively.



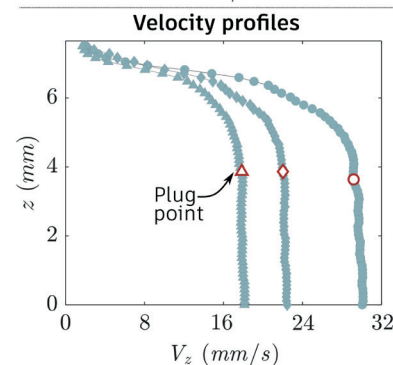
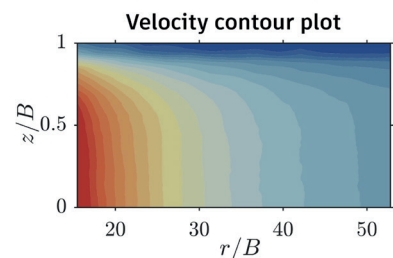
Incipientus Flow Visualizer



Incipientus Non-invasive Ultrasound sensor technology

## Incipientus IFV & touch-free sensors

The Incipientus Flow Visualizer (IFV) and touch-free sensors were used to measure the Carbopol-980 velocity profiles during different flow rate conditions.



## Visualization of radial flow field

The results from the radial flow experiments are sets of velocity profiles measured during different flow rate conditions. Each set of velocity profiles is then visualized as a contour color plot that shows essential features, including the plug-flow region's shape. Such measurements and graphs can directly be compared to theoretical ones for verification.