Slide **1**: This presentation contains videos of schlieren patterns generated during flow past circular and square cylinders. The effect of heating and cylinder oscillation on the wake patterns is investigated. The experimental apparatus from which the images have been recorded is also described. The overall flow is in the vertically upward direction. Cylinder oscillations across the flow (transverse) and along (inline) are considered.

**2**: The schematic drawing of the experimental apparatus is shown here. The flow is created in a vertical test cell by using the suction side of a blower. The cylinder axis is horizontal. The cylinder is internally heated to create thermal gradients in the flow. These gradients are then imaged as schlieren patterns. The cylinder is held on electromagnetic actuators to provide the necessary oscillatory movement as a function of both frequency and amplitude. The schlieren imaging system has a laser and a camera. Optical glass windows are employed where the light beam enters the apparatus. Images are recorded in the computer in a time sequence.

**3**: These are photographs of the components of the experimental apparatus. The overall assembly is seen on the right.

**4**: Various modes of oscillation of cylinders with square and circular cross-sections are shown. The amplitude of oscillation is determined from images of the cylinder motion under unheated conditions. Sample videos can be seen by clicking on the respective images.

**6**: Schlieren patterns formed in the wake of a stationary circular cylinder are shown here for various temperature differences between the cylinder wall and the incoming fluid. Buoyancy effects become stronger at higher temperature differences, ultimately resulting in the suppression of vortex shedding. Click on each image to see the video.

**7**: These are individual videos of vortex shedding from a square cylinder that is heated with respect to the incoming flow. The main flow is in the vertically upward direction. As the temperature difference between the cylinder surface and the incoming fluid increases, buoyancy effects become significant. Ultimately, vortex shedding is suppressed and a steady plume is obtained.

**9**: Vortex patterns in the wakes of circular and square cylinders are shown for mild and strong heating conditions. For a stationary cylinder, buoyancy leads to suppression of vortex shedding. The second row shows images for cylinders *transversely* oscillated at the vortex shedding frequency of an unheated cylinder. Here, buoyancy is not adequate to suppress vortex shedding even at the highest heating level.

**10**: These videos show vortex shedding patterns from heated cylinders – circular and square. The cylinders are *transversely* oscillated at 0.5 times and 1.5 times the frequency of vortex shedding from an unheated cylinder.

**11**: These videos show vortex shedding patterns from heated cylinders – circular and square. The cylinders are *transversely* oscillated at twice and three times the frequency of vortex shedding from an unheated cylinder.

**13**: These are videos of wake patterns formed during flow past a heated circular cylinder with and without *inline* oscillations.

Click on the images to run the videos.