The structure and origin of confined Holmboe waves

Adrien Lefauve J. L. Partridge Q. Zhou

C. P. Caulfield S. B. Dalziel P. F. Linden

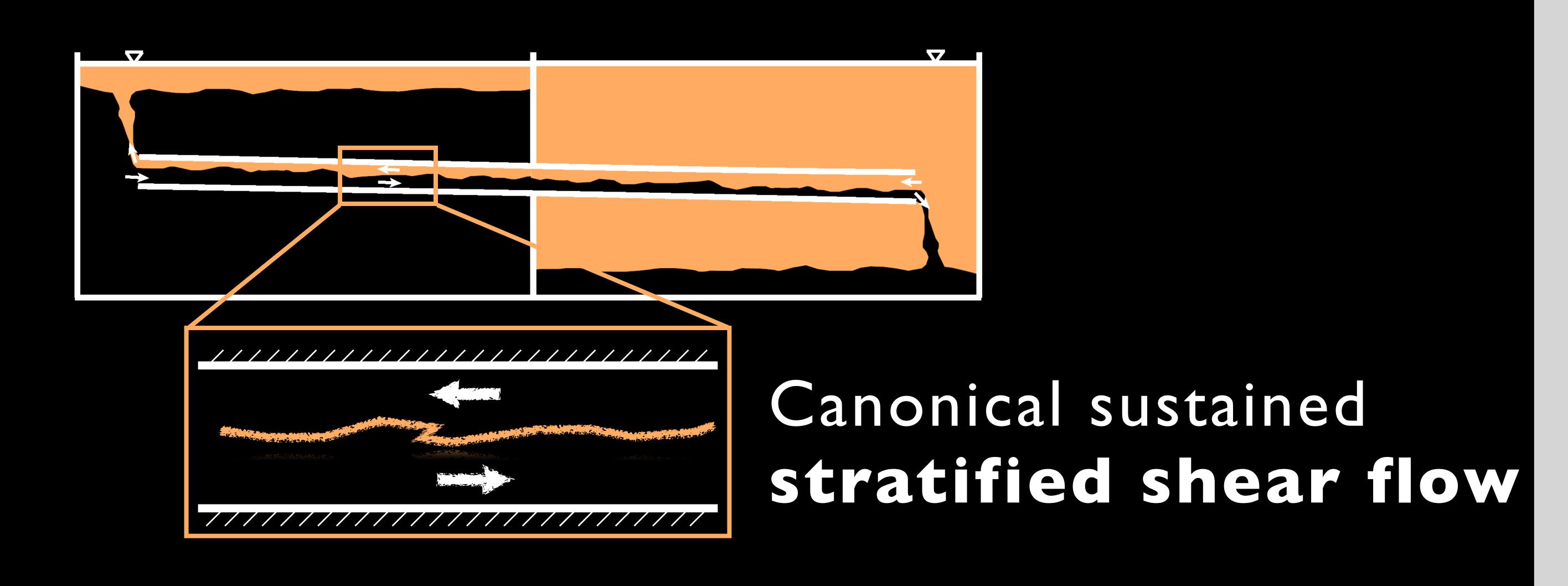
Department of Applied Mathematics and Theoretical Physics University of Cambridge, UK

1. Fluid Mech. 848, 508-544 (2018)

Email, article and movies available at:

damtp.cam.ac.uk/people/aspl2/

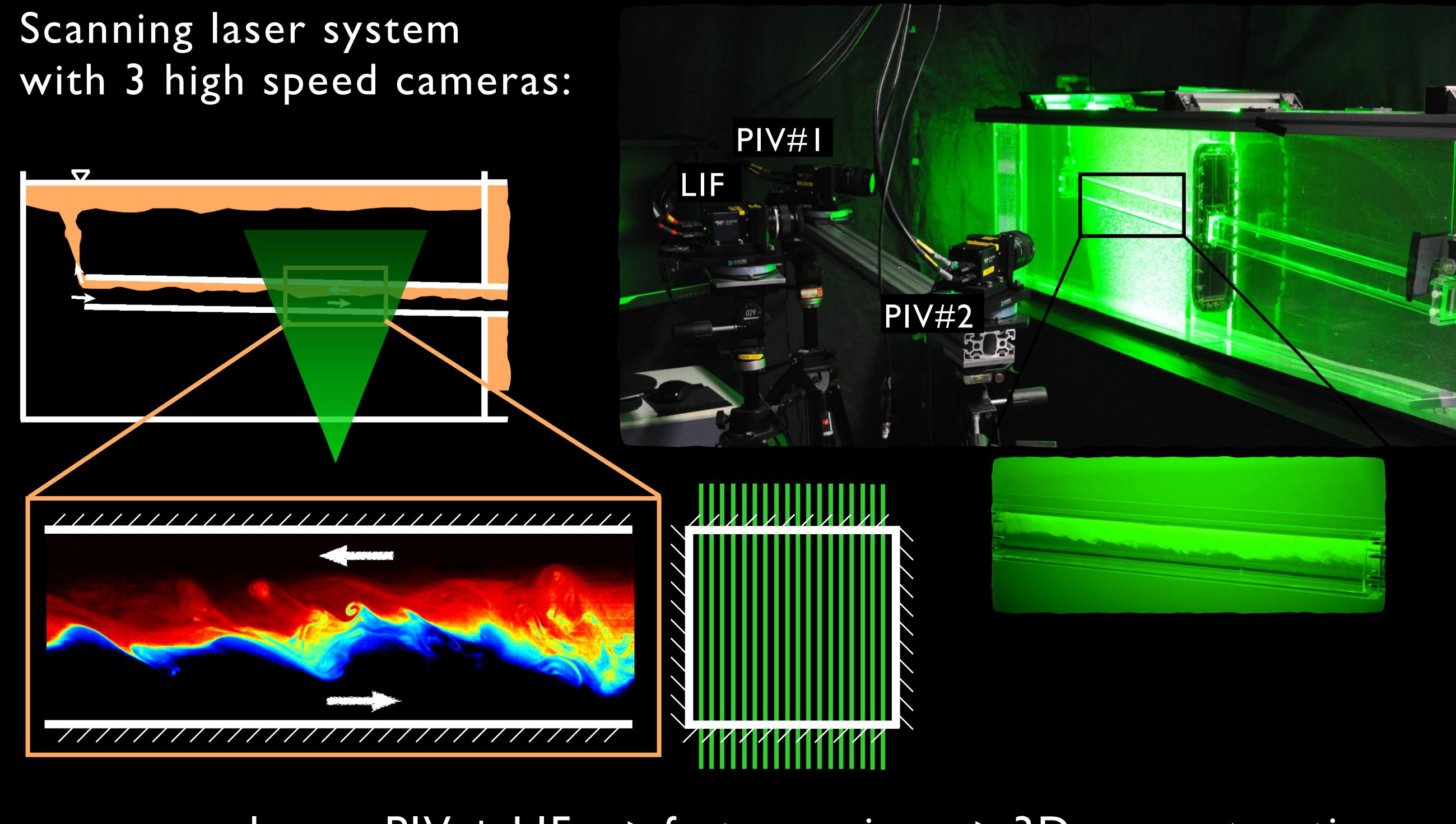
The Stratified Inclined Duct



Objective:

Study the coherent structures in this flow

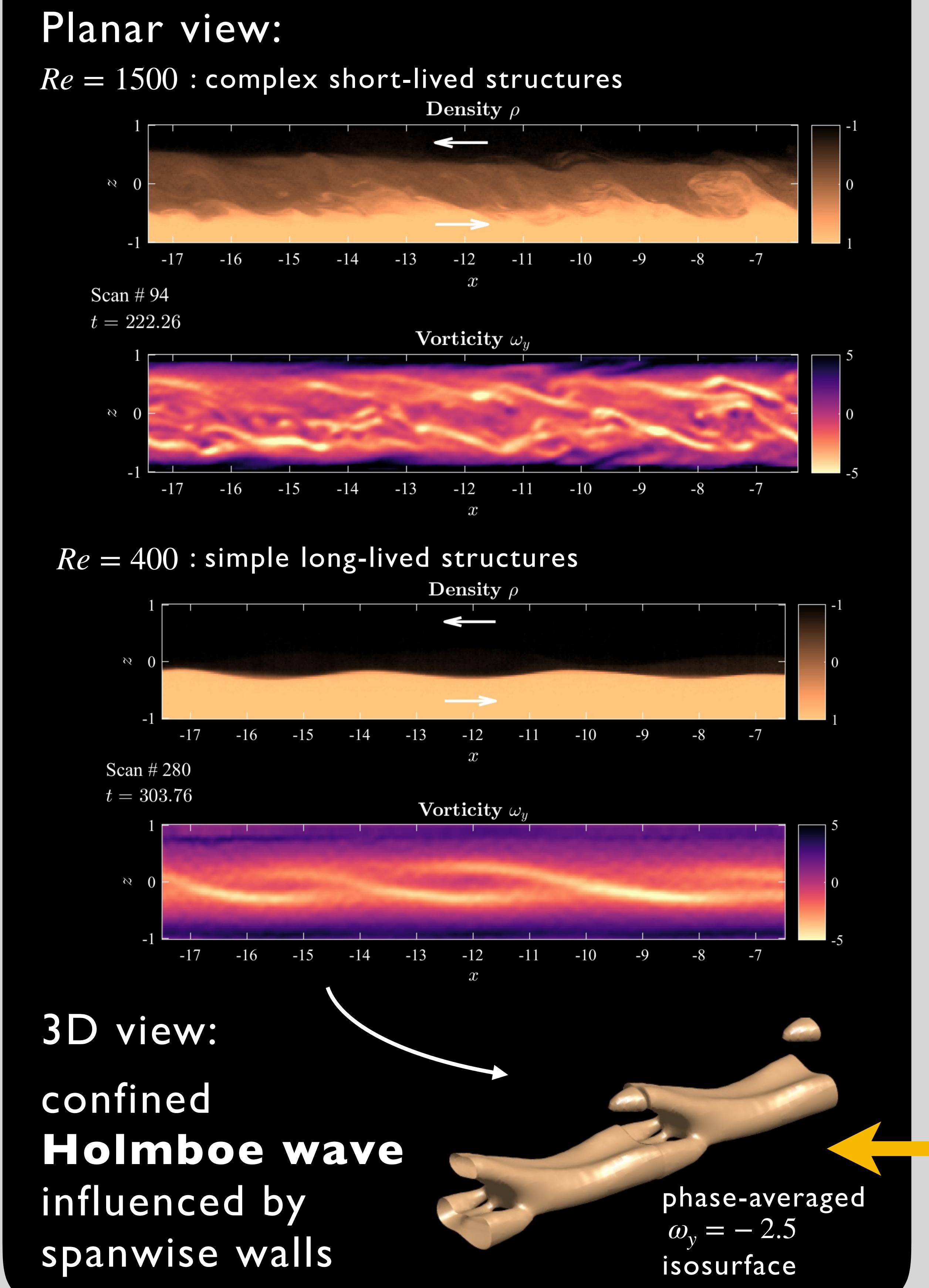
Volumetric measurements



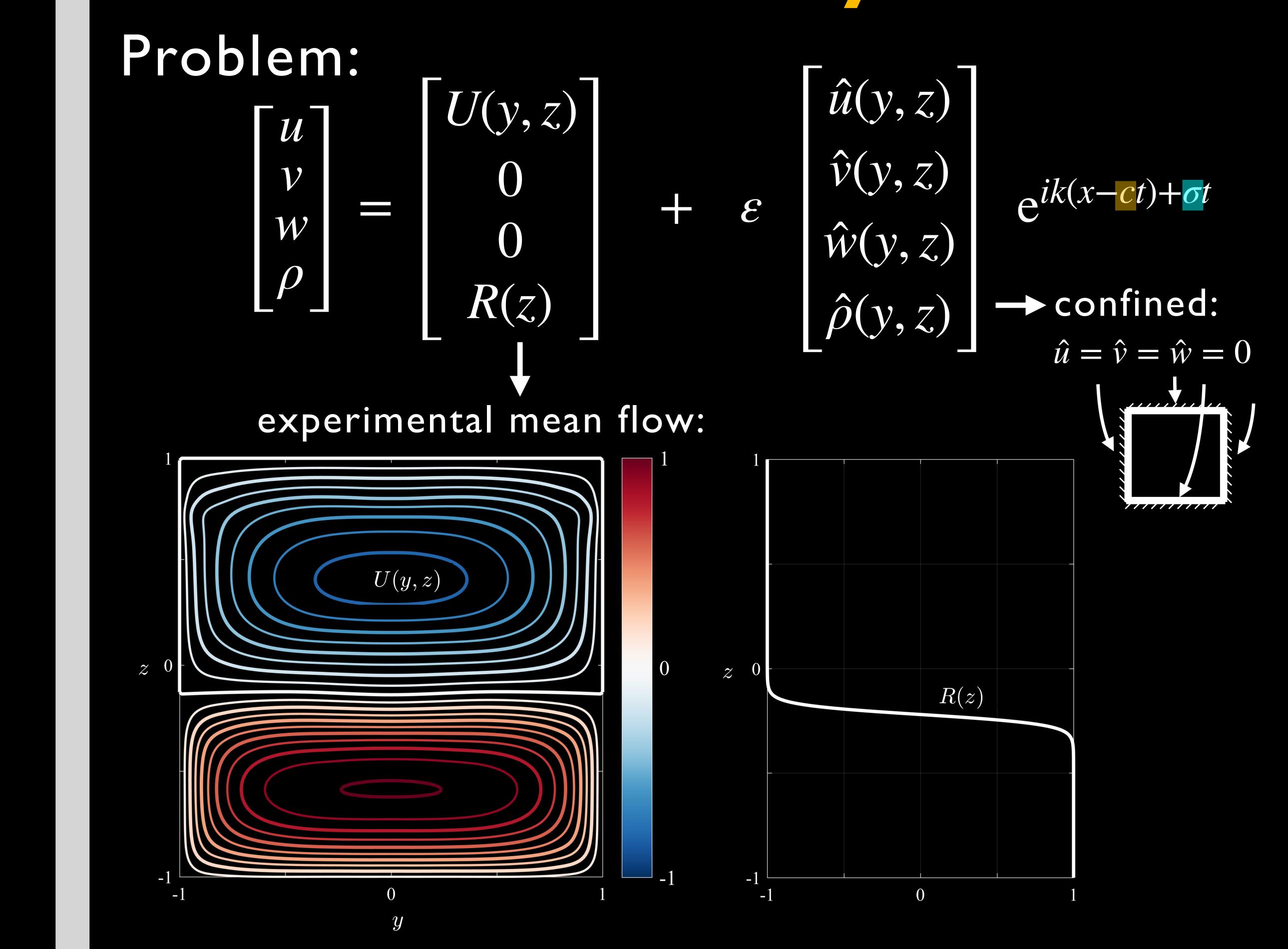
planar sPIV + LIF → fast scanning → 3D reconstruction

We measure velocity and density in a 3D volume: $u, v, w, \rho(x, y, z, t)$, at high resolution 500 x 30 x 100 x 300

Experimental results



Linear stability results



Solution: confined Holmboe instability

Dispersion relation agrees with experimental range of k and c Holmboe mechanism: //gravity waves interaction



The nonlinear structure has a linear origin!

Open

I. How to extract coherent structures from the turbulent data?

questions 2. Link between Holmboe and turbulent structures as $Re \nearrow ?$