Scale contribution in adverse pressure-gradient turbulent boundary layers

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The present work is an experimental counterpart to the numerical study by Bobke et al. [1], which reinforced the importance of upstream conditions and pressure-gradient development effects in turbulent boundary layers (TBLs) with adverse pressure-gradients (PGs), while previous work mainly focussed at considering local Reynolds number (Re) and (Clauser) pressure-gradient (β) effects. Taking PG history effects into account, Vinuesa et al. [2] were able to predict integral quantities of equilibrium and non-equilibrium PG TBLs solely based on correlations from zero PG TBLs. The present work – utilising new wind-tunnel measurements over a wider Re–range and various PG conditions – extends these works towards Re and PG effects on turbulence statistics and spectral decomposition as anticipated in the figure.

REFERENCES

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[2] Vinuesa, R., Örlü, R., Sanmiguel Vila, C., Ianiro, A., Discetti, S., and Schlatter, P., (2017), Revisiting history effects in adverse-pressure-gradient turbulent boundary layers, *Flow, Turbul. Combust., 99:565–587*
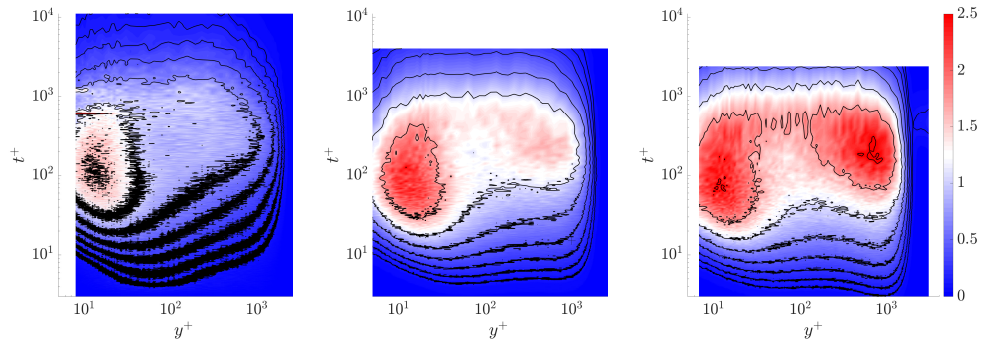
Figure 1: Inner-scaled spectral maps for (left) ZPG, i.e. $\beta = 0$, (middle) APG, $\beta = 0.7$, and (right) APG, $\beta = 2.4$ at friction Reynolds number $Re_\tau \approx 2000$.