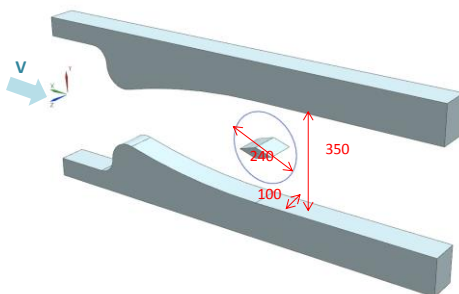


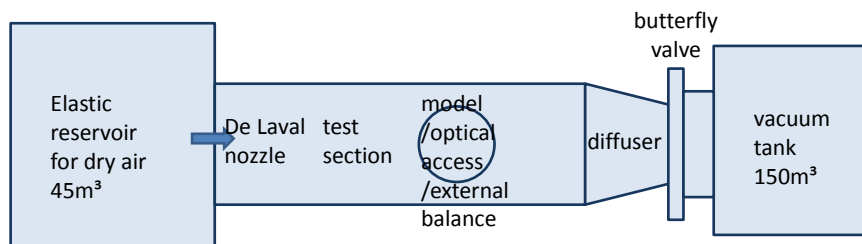
Supersonic wind tunnel testing

Idalia Jagodzińska, Bartosz Olszański, Zbigniew Nosal

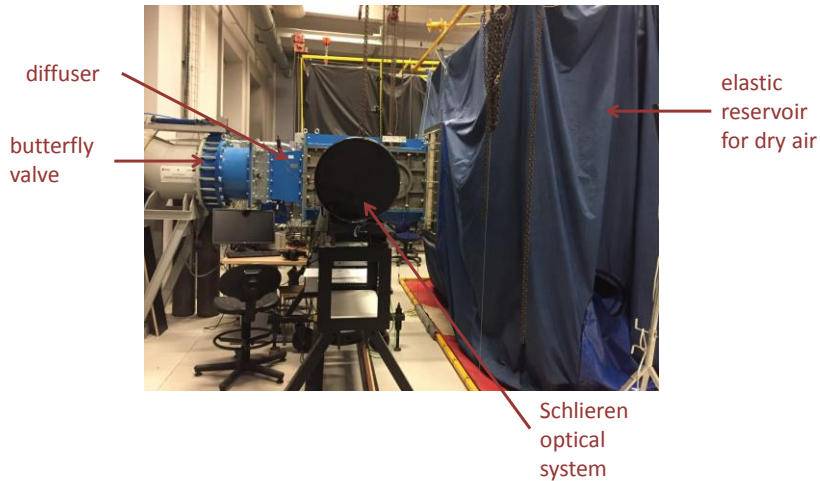
Supersonic wind tunnel



- IAAM supersonic wind tunnel
- open circuit, in-draft (suction) type
- intermittent (steady flow maintained usually for 1.5s)
- width 100mm, height 350mm
- M=2 de Laval nozzle

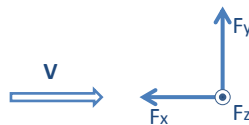
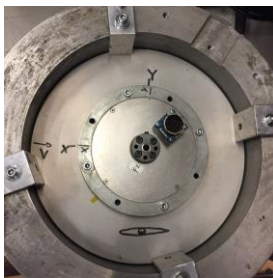


Supersonic wind tunnel

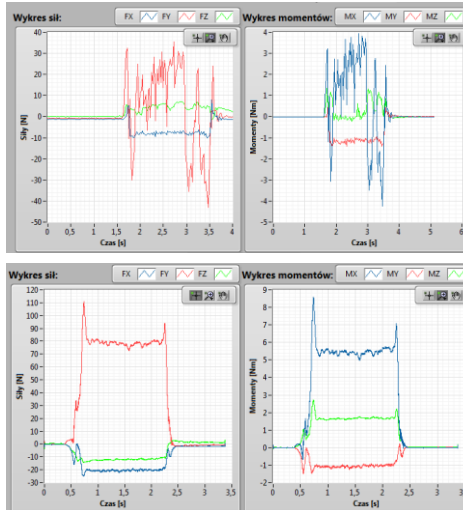


Forces and moments measurements by the 6-component external balance

- Measurement range: 2kN, 1.5kN, 200Nm, 50Nm
- External balance fixed in a disk-shaped housing mounted in a cavity in a side wall of the tunnel
- Model with a fixed pin mounted to the balance
- Angle of attack change provided by disk rotation
- Time series of 6-components (forces and moments) available



Wind tunnel choking



NACA 0012 airfoil

- Large oscillations of forces and moments
- Reversal of normal (lift) and axial forces
- Resonance frequency depending on the type and weight of the model

Diamond profile

- Good directions of forces
- Very limited range of angles of attack

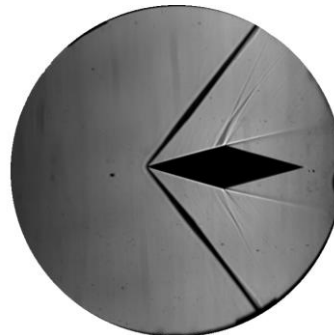
Visualisations by Schlieren optical technique

- Schlieren optical system
- 270 mm diameter mirrors
- continuous light source
- high speed camera acquisition (3000fps)

NACA 0012 airfoil

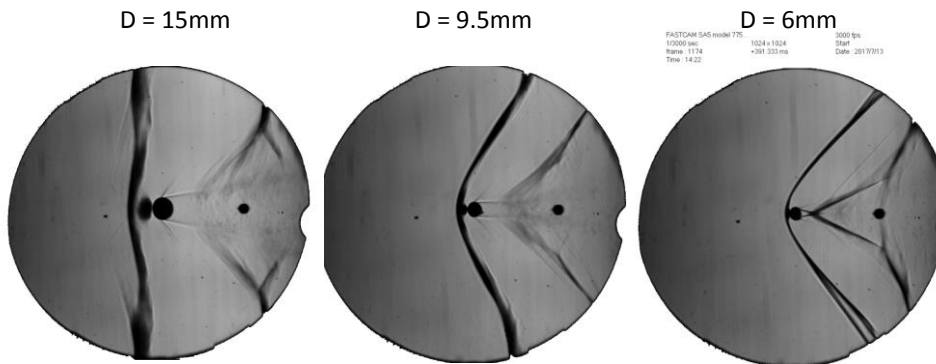


Diamond profile



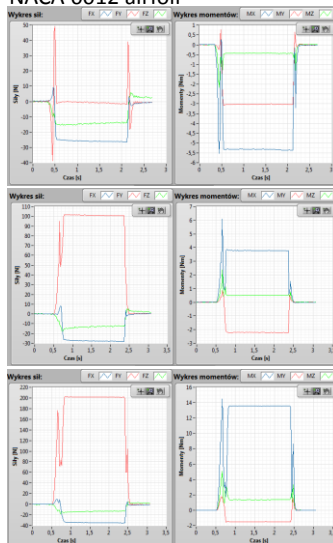
Wind tunnel choking

Cylindrical model- influence of diameter size



Regulated diffuser throat height

NACA 0012 airfoil



$\alpha = 0^\circ$

- improved characteristics, low noise
 - wind tunnel opening/close peaks
 - high angle of attack range
- allows for full $c_l(\alpha)$ characteristics

$\alpha = 5^\circ$

$\alpha = 10^\circ$

Conclusions and perspectives

- preliminary tests of supersonic wind tunnel have been performed on NACA 0012 airfoil, diamond profile and other models
- forces and moments measurements has been done with use of an external balance as well as visualisation by Schlieren optical technique
- choking problem has been solved by regulating the diffuser opening height

- quantitative results of forces and moments has already been obtained for different models
- use of internal balance would allow for simultaneous visualisation and comparison of visible phenomena with acquired data