

Flow field investigation of a generic truck model

Michael Thimm¹, Daniel Reidt¹, Jan Roblin², Johannes Bosbach¹, Sigfried Loose¹, Hugues Richard¹, M. Raffel¹

¹German Aerospace Center (DLR), Institute for Aerodynamics and Flow Technology,
Bunsenstr. 10, 37073 Göttingen, Germany
e-mail: michael.thimm@dlr.de

²Hermann Föttinger Institut TU Berlin

***Summary:** The flow field around a generic truck model has been investigated for different angles of attack and different end pieces by Particle Image Velocimetry. The main interests of these measurements were the development of the lee side vortex and the wake. Furthermore oil paint images have been prepared and particularly force measurements have been carried out to correlate the drag with the characteristics of velocity field near the model. The results will be discussed in the article and compared with numerical simulation.*

Ecologic Aspects play an increasing role in commercial transportation. The geometry of commercial vehicles is nevertheless mainly determined by other aspects like maximisation of the payload. On the other hand, the drag of current trucks is mainly determined by the wake and the base pressure behind the trailer. For that and other technical reasons any improvement of the geometry must leave the amount of the payload untouched.

SETUP

For the measurements a 1:25 model featuring adaptors for the end pieces of the trailer and a connector for the six component piezo balance were designed. The body and the end pieces were manufactured out of artificial wood and high rigidity aluminium, respectively. The end pieces are fixed by screws on the main body of the trailer in order to exchange it easily.

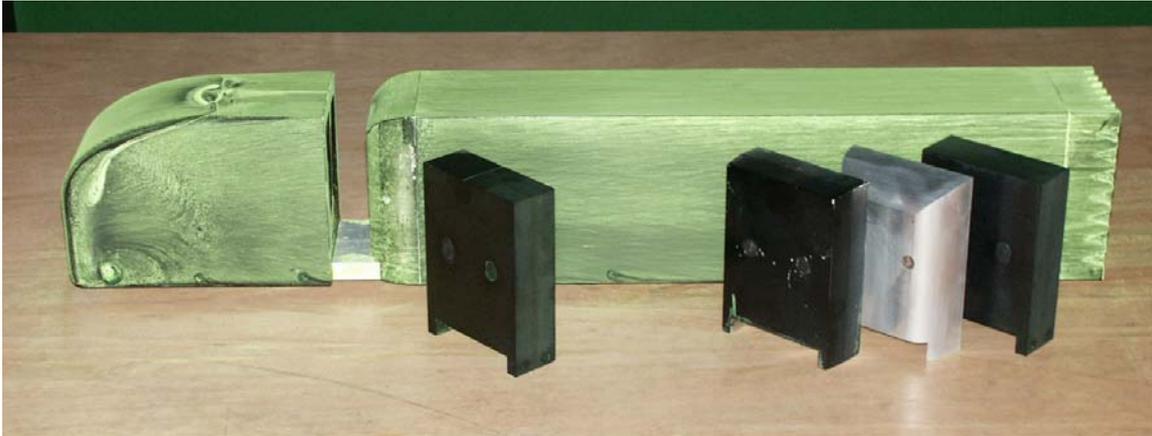


Fig 1: Model with several end pieces

As a light source for PIV a pulsed Nd:Yag Laser with a maximum energy of 70 mJ per pulse has been used. The seeding particles have been imaged by a CCD with an area resolution of 1376 by 1040 pixels and a grey-scale resolution of 12 bits. Peltier cooling of the sensor reduced the black current noise, thus increasing the usable grey-scale dynamic range. The camera was equipped with 85mm lens and connected to the computer by fibre optics.

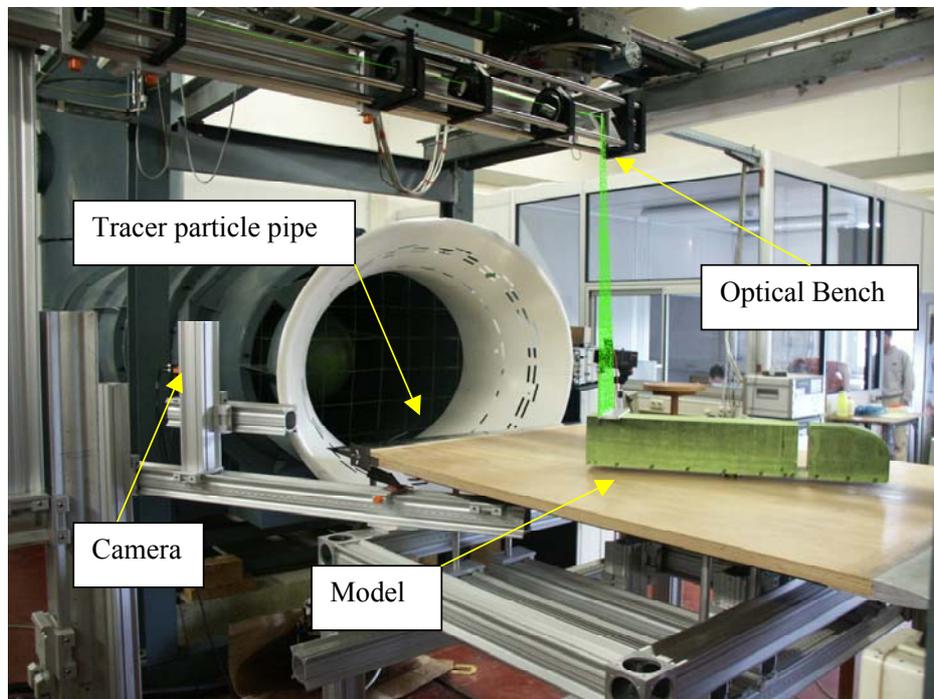


Fig 2: The PIV Setup

A Laskin nozzle particle generator was used in order to seed the flow with atomized Di-Ethyl-Hexyl-Sebacat. The particles were brought into the tunnel through a pipe attached to the end of the test section.

PRELIMINARY RESULTS

The PIV measurements were performed with a light sheet oriented in flow direction and in cross flow direction as well at different locations and angles for a free stream velocity of 45 m/s. Figure 3 shows a cross flow section magnitude field with the so called inlet end piece, which intends to reduce the base pressure in the wake. In figure 4 the location of two vortices at an yawing angle of 30 degrees can be seen.

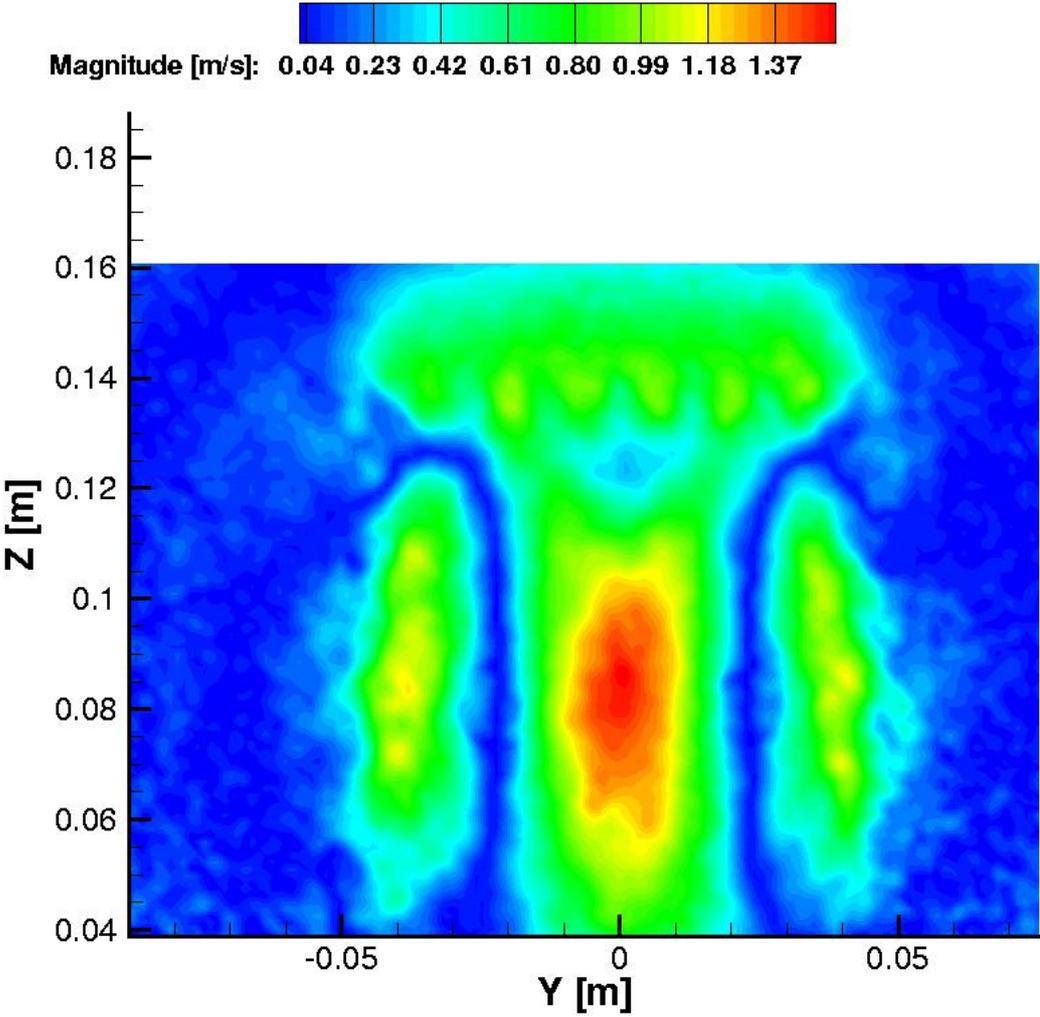


Fig 3: Cross flow section of the wake

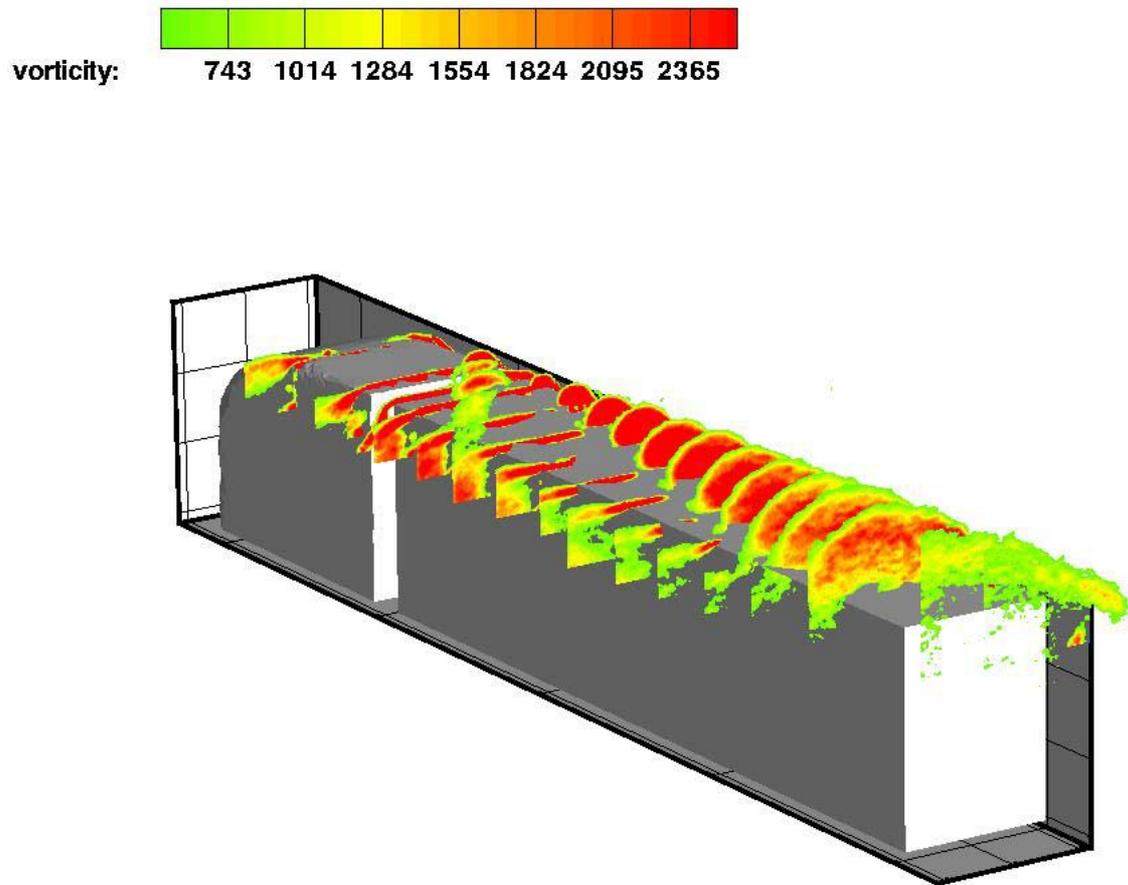


Fig 4:PIV result of lee side vortices at a yawing angle of 30 degrees

Additionally oil paint images were made as can be seen in Fig. 1 using a paraffin-paint suspension.

The experimental results shall be compared with numerical simulation.