## **Ray Tracing in Open Jet Wind Tunnel (RayTrO)**

Aircraft Noise & Climate Effects (ANCE) Prof. Dick G. Simons Supervisor: dr. Mirjam Snellen (m.snellen@tudelft.nl)

## **Project Overview**

Acoustic research on high-lift devices (flaps and slats) of aircraft wings is often carried out in open jet wind tunnels. A large wing model ( $7 \times 1.5 \text{ m}^2$ ) was recently measured in the Large Low-speed Facility (LLF) of DNW. A microphone array was used to locate and quantify the noise sources on the wing. The array was located outside the flow. To study noise radiation at several emission angles, the array was traversed between several locations upstream and downstream of the wing.

When placed under an angle of attack, the wing induced significant jet deflection. For downstream array positions this caused deterioration of the acoustic images (see rightmost image), since jet deflection was not included in the sound propagation model.

What these array data need is an appropriate description of sound propagation through the open jet flow. Within this project an acoustic ray-tracing approach will be implemented for this purpose. The aim is to significantly improve the acoustic images.

## **Project Goals**

The following topics will be addressed:

- A sufficiently accurate description of the deflected jet will be made, including the shear layer development.
- An assessment will be made of the errors due to the ray-tracing approximation.
- A Matlab script will be written for beamforming, using ray-tracing to model the sound propagation.
- The new beamforming algorithm will be applied to the DNW-LLF measurements.
- A comparison with a "quick and dirty" method of DNW will be made.

The student should have a clear interest in the maths of sound propagation.



MSc Research Thesis Assignment

