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Studies of the Pitch-Moment CHUTE

GRIPEN 39 E/F

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Pitch-Moment CHUTE, NOT a Spin-chute!

1. New Fighter generation E/F
2. Care Free and MLL (Manoeuvre Load Limiter)
3. Flight tests with different weapons and sensors in all Envelope
4. Minimize RISKS and increase productivity -> safe net is needed
5. Design CHUTE (Size? Reiser length? Loads? Structure?...)
6. Use the previous CHUTE from C/D?
7. Skip the CHUTE? Enough authority to stop a spin and recover from HAoA?
8. New Engine -> flame out -> Hydraulic failure? ...

CMY (Pitch Moment Coefficient)

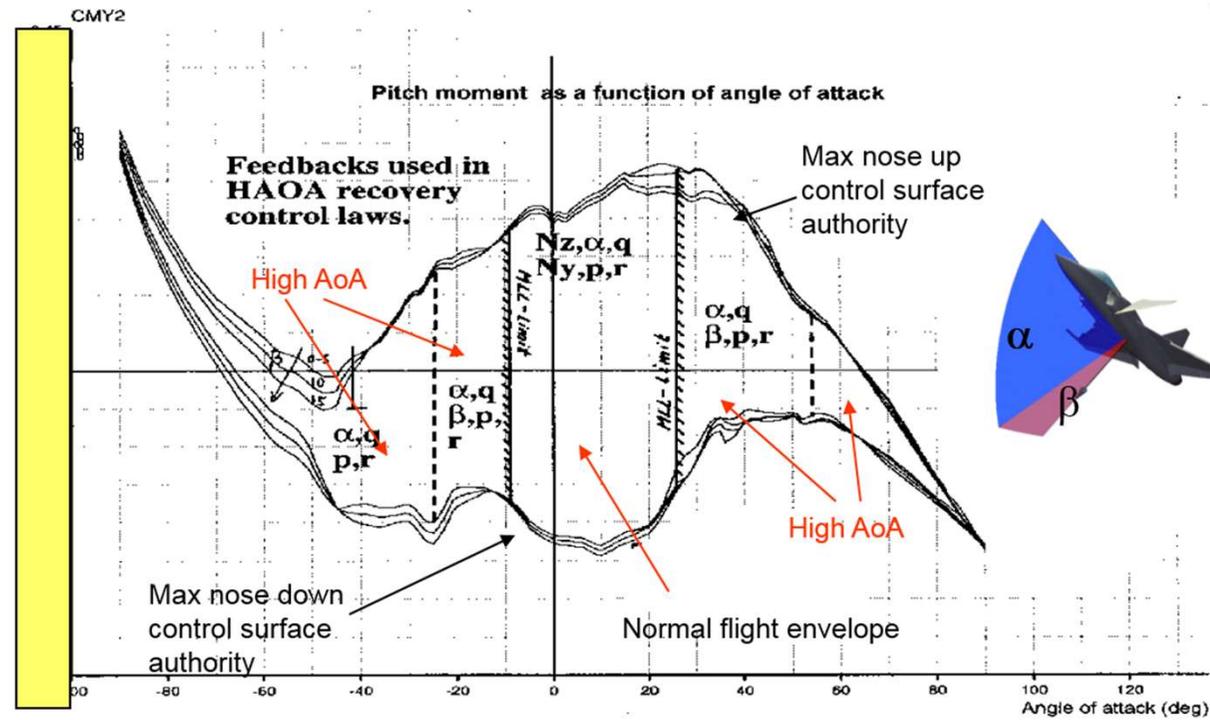


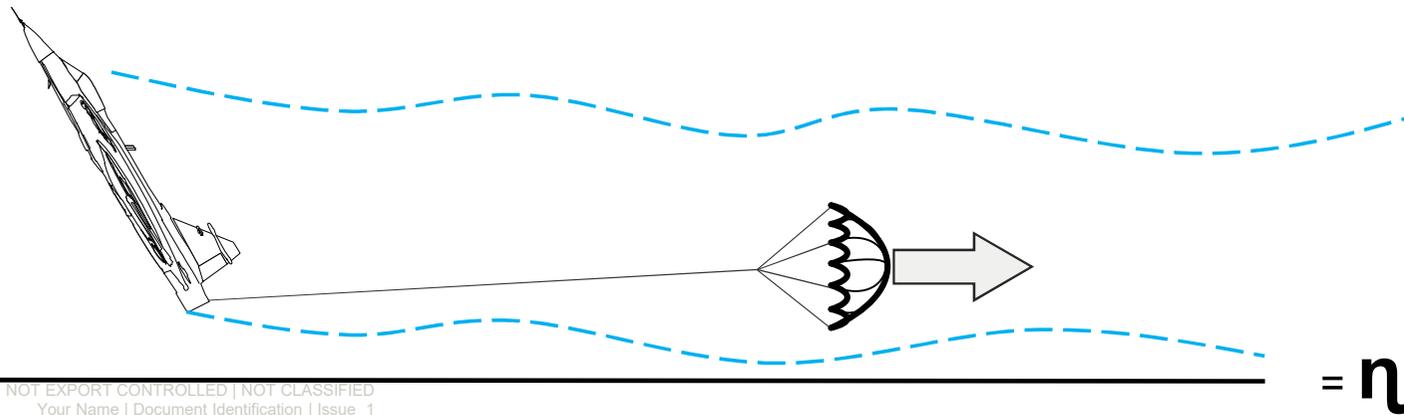
fig15.

Definition

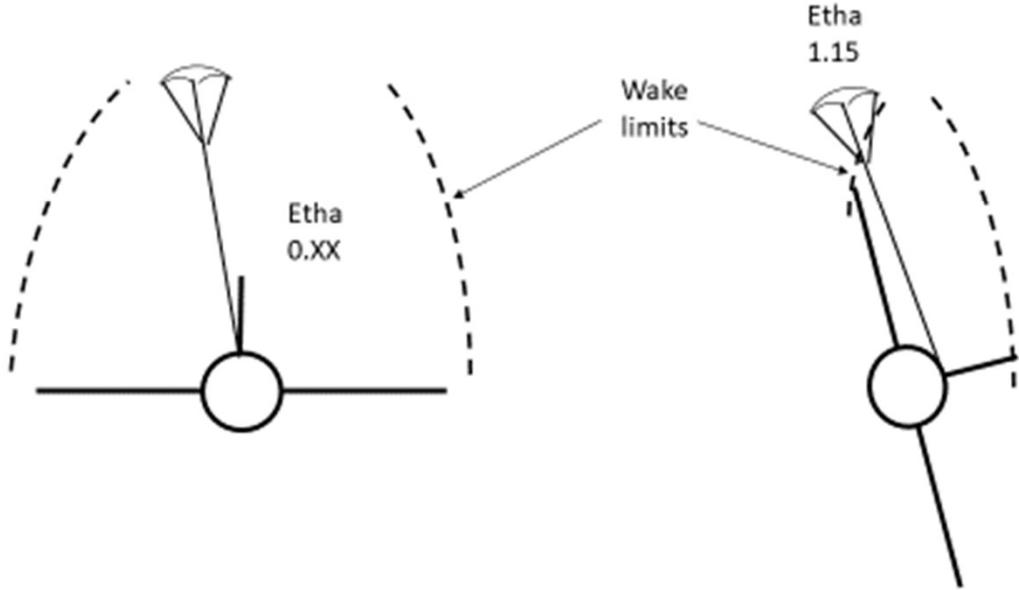
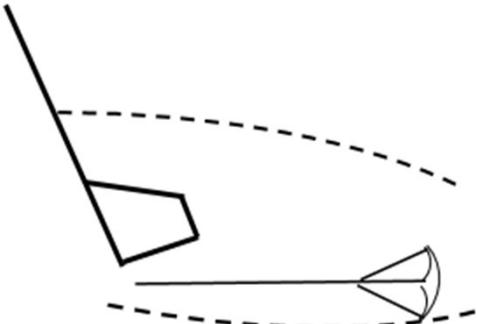
Moment-chute η (ETHA) is :

$$\eta = \frac{T}{T_{\infty}} = \frac{T}{\frac{1}{2}\rho V_{\infty}^2 C_D S}$$

$$\frac{\text{Air Drag of CHUTE in WAKE}}{\text{Air Drag of CHUTE in Freestream}} = \eta$$



Possible case when CHUTE is exposed to freestream



Structure weight

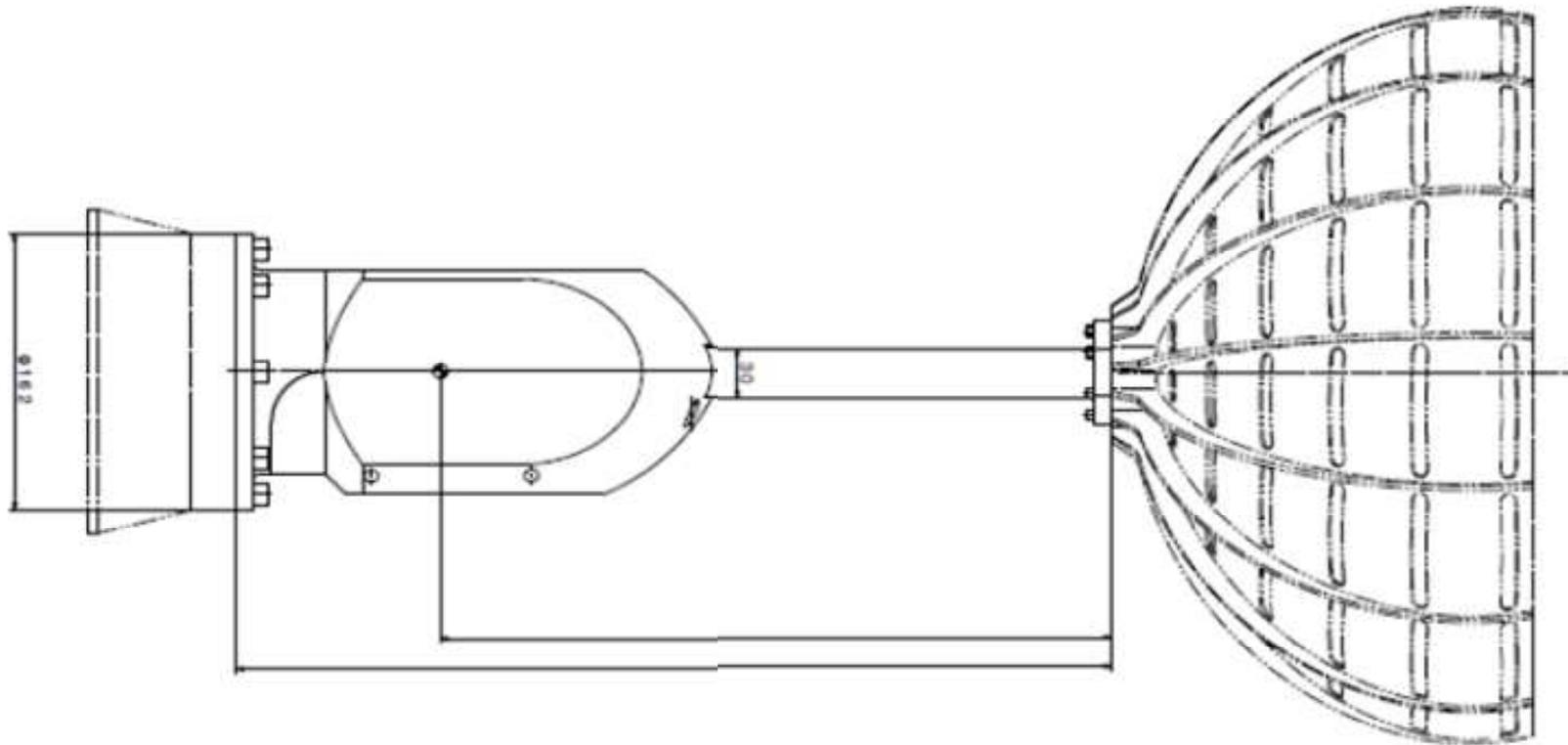


the big low
speed
Wind Tunnel
at
RUAG
in
Emmen

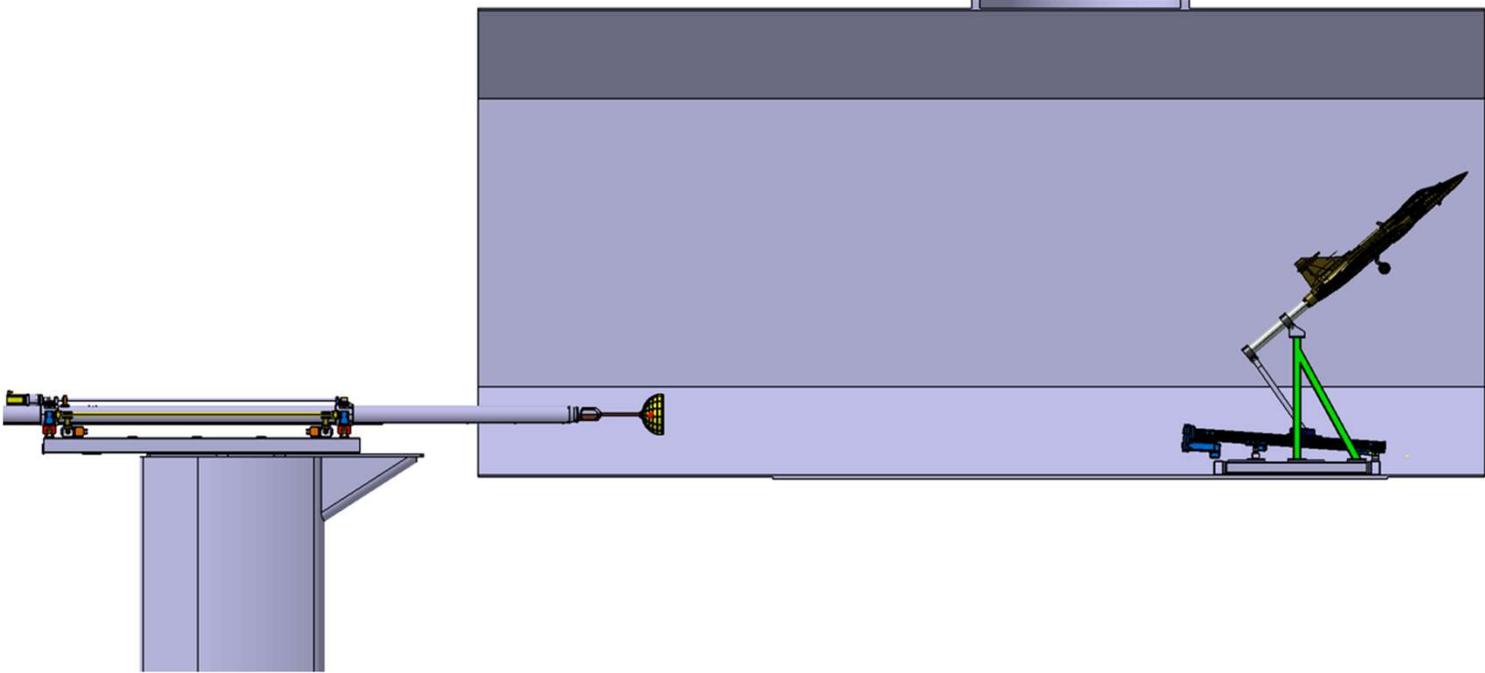


Figure 1: The test-setup used in the wind tunnel in Emmem.

CHUTE model used in tunnel

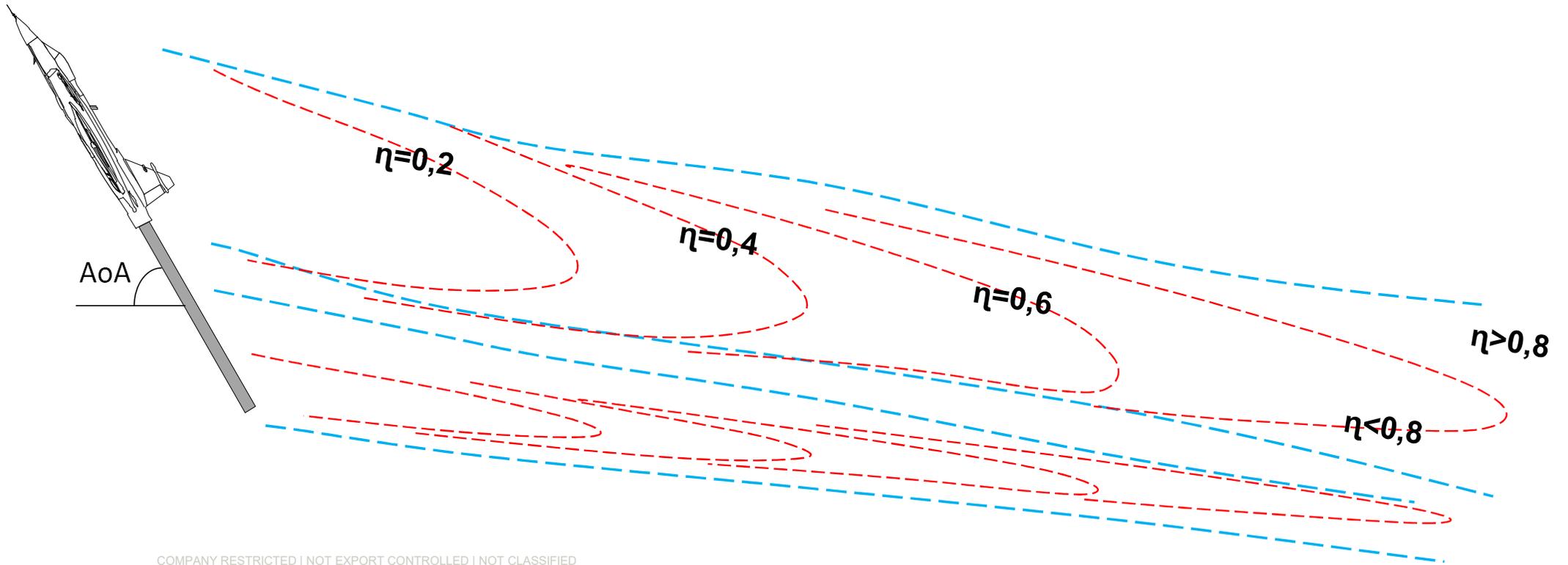


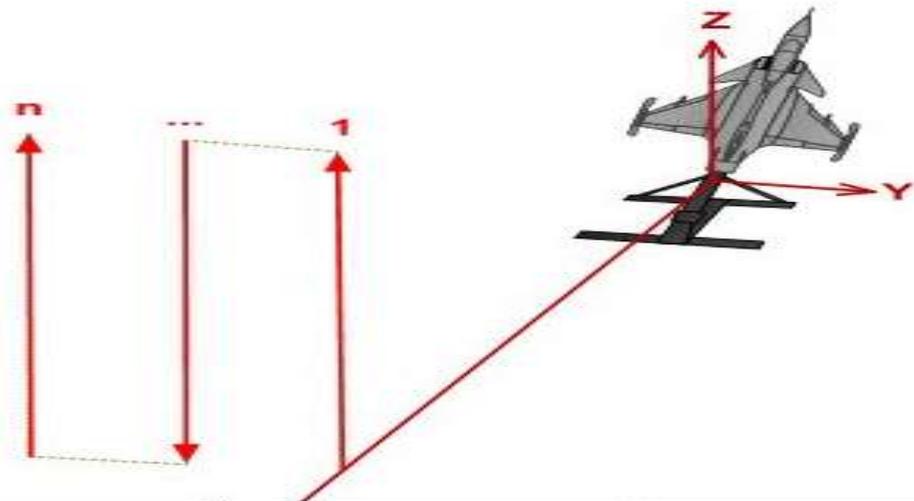
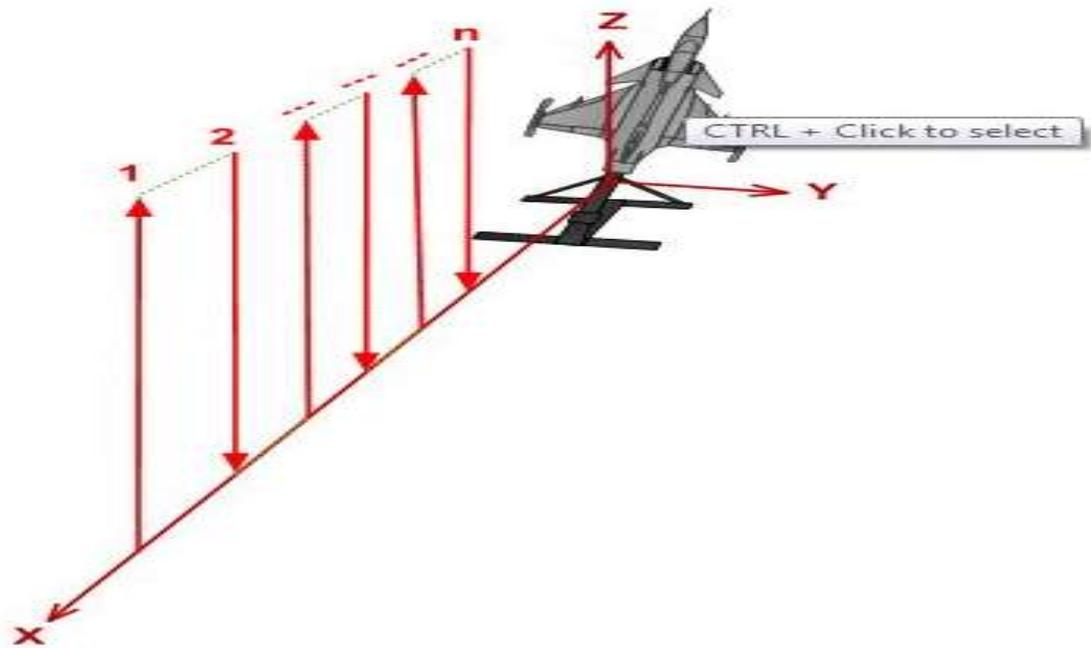
Interference between fixation and A/C in WAKE



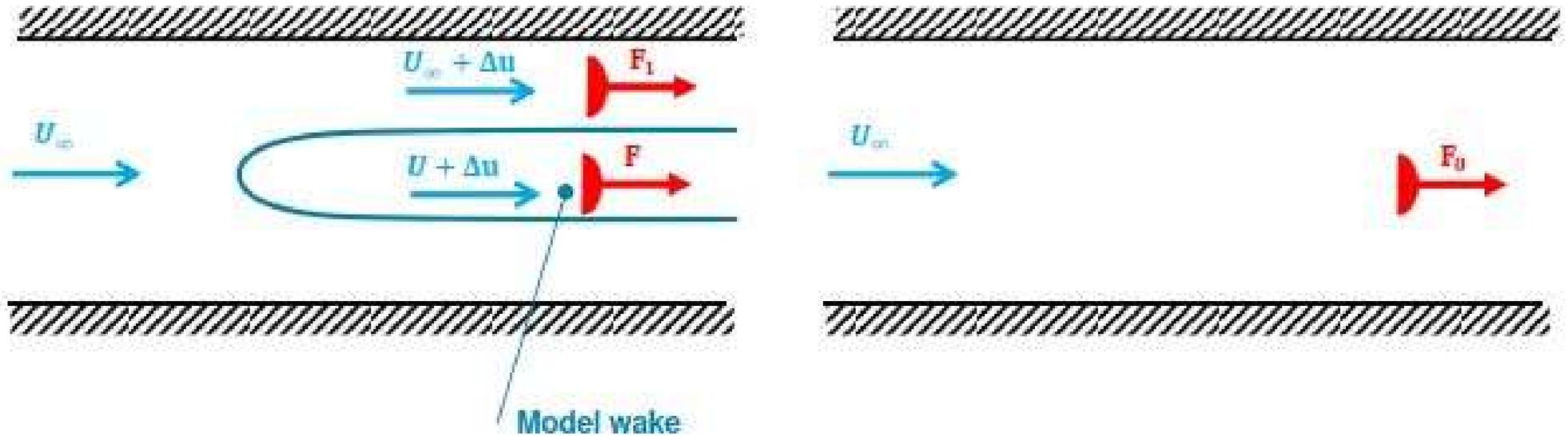
Downwash

Result of Downwash interference with STRUT Wake.



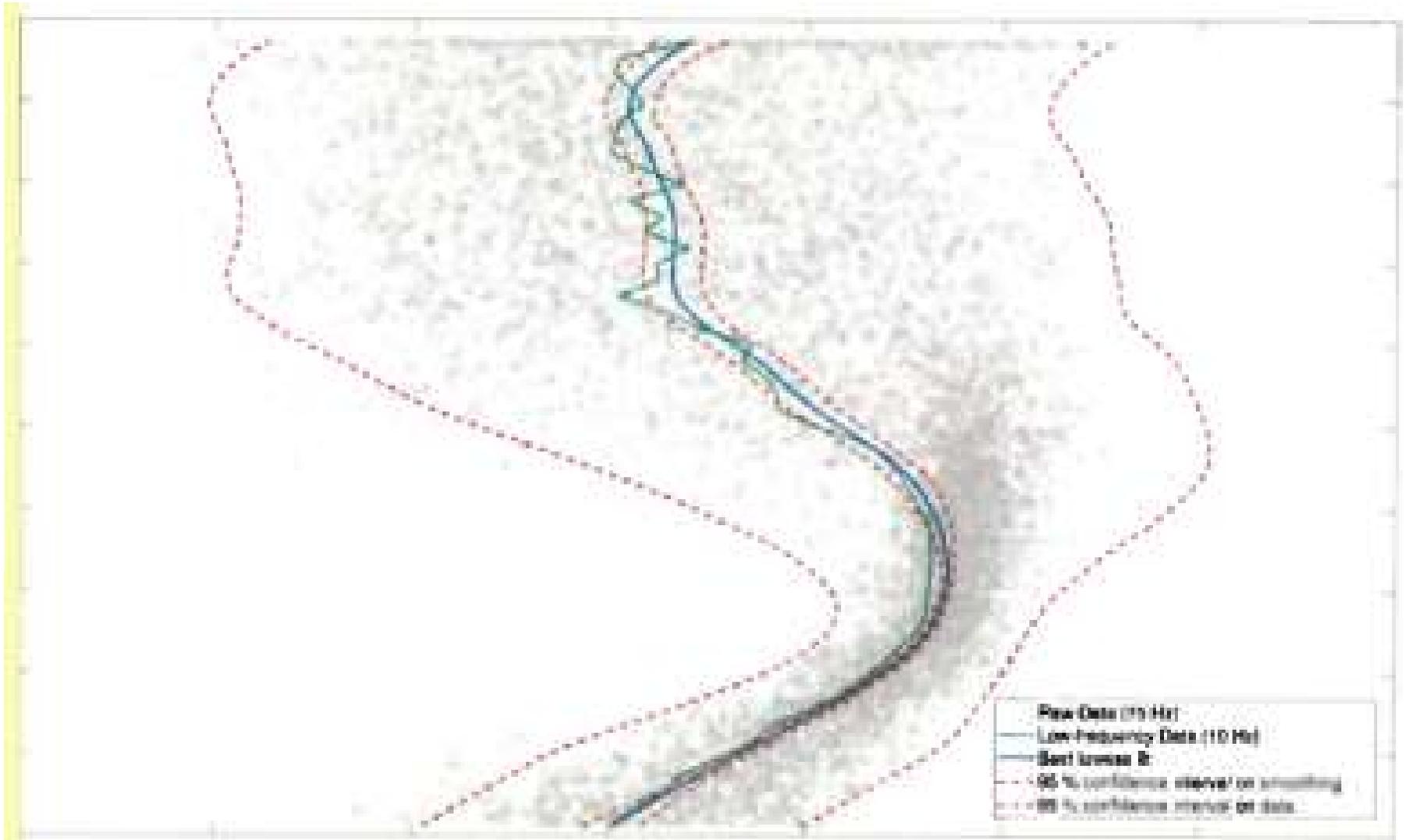


Blockage

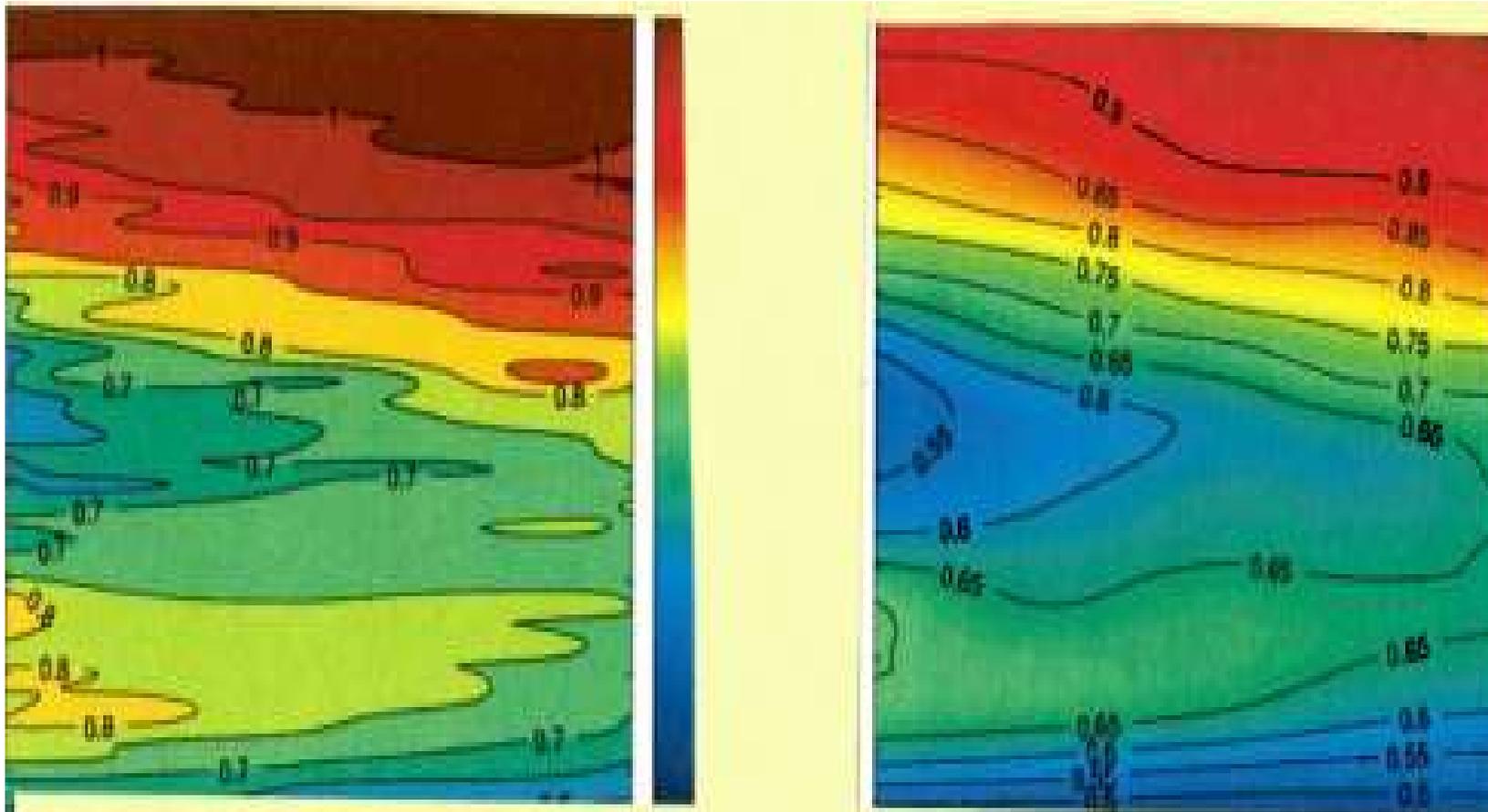


Sampled DATA from measurement

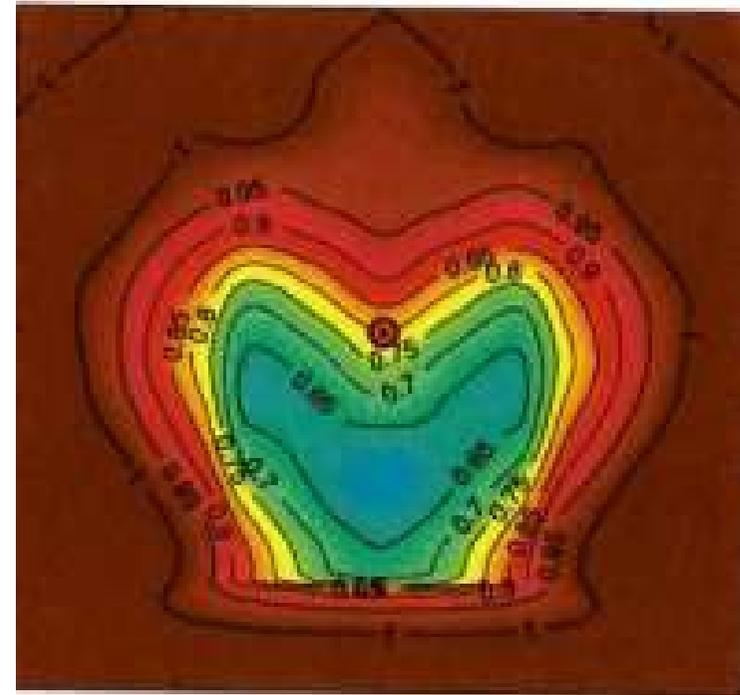
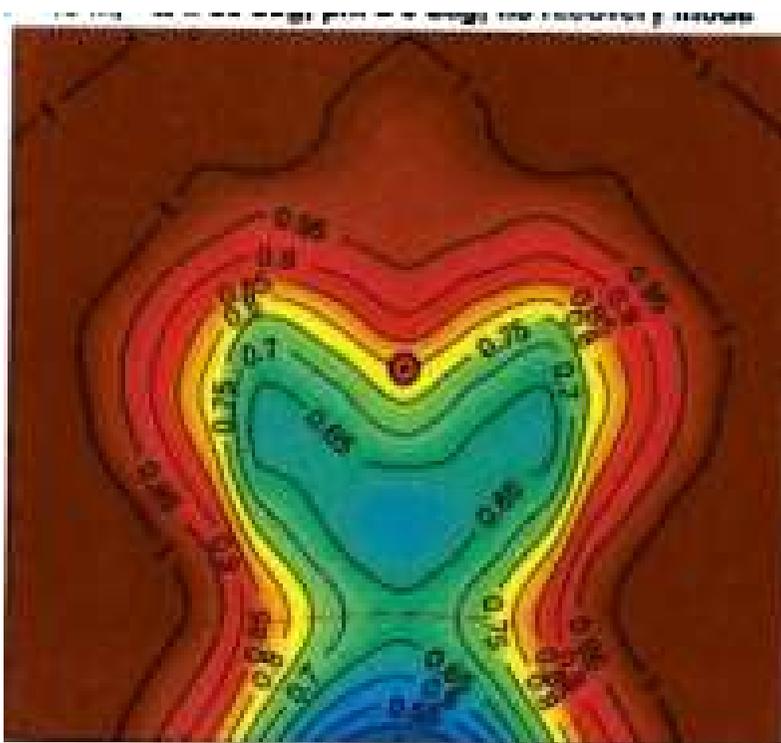
- Different translation speeds tested to know which is the highest to be used
- Original is a weighed 10 Hz data
- Choose to save the RAW 70 Hz Data -> Turned out to be a GOOD thing



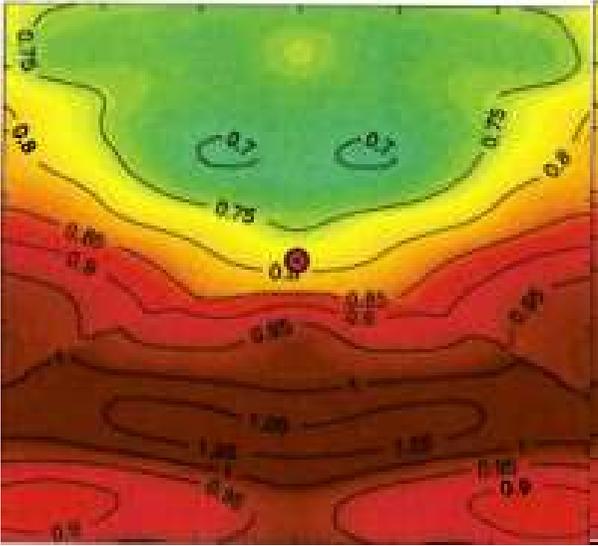
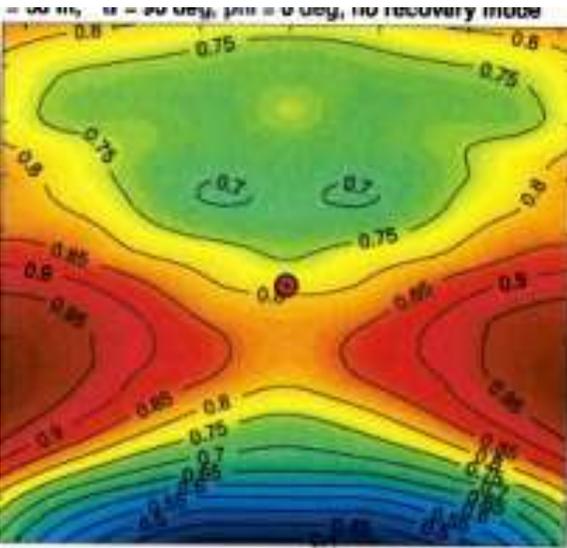
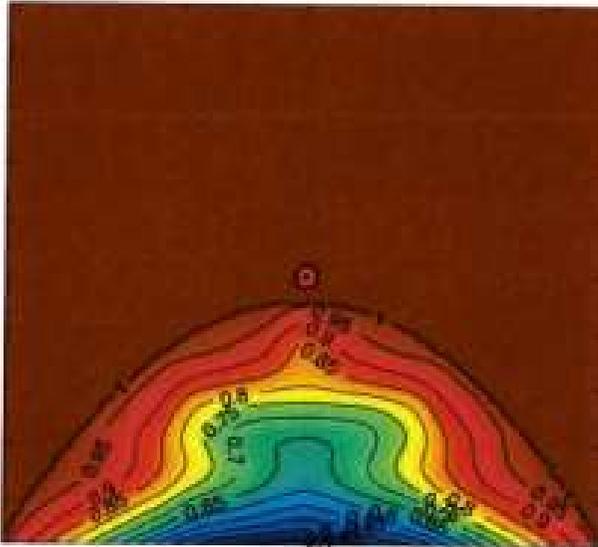
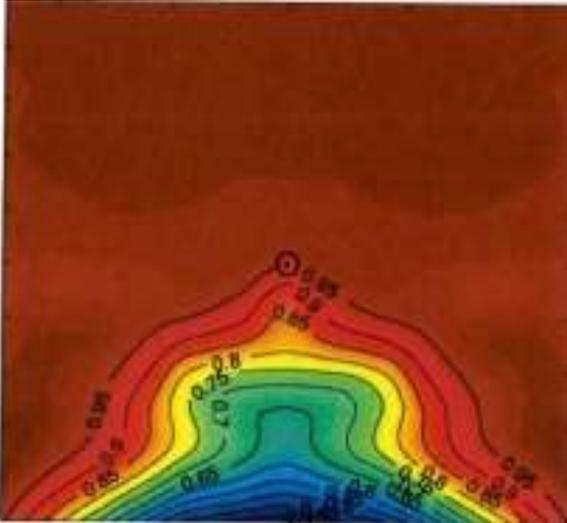
10 Hz vs smoothed 70 Hz



Lateral Ellipse method of STRUT correction

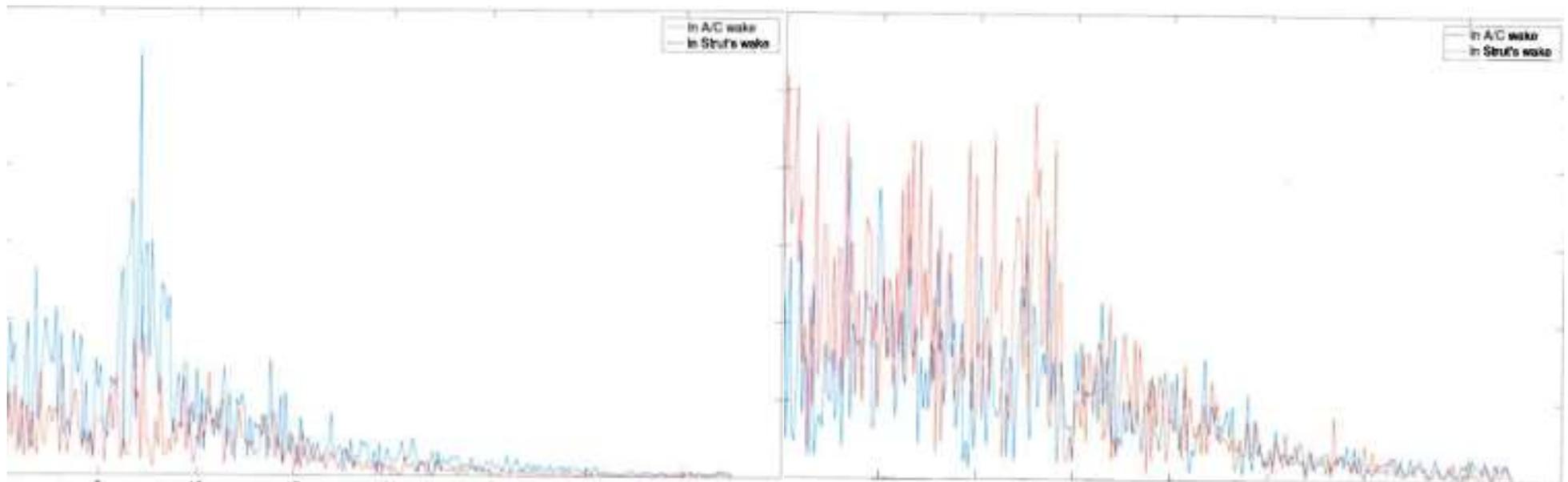


Alpha Zero method of STRUT correction

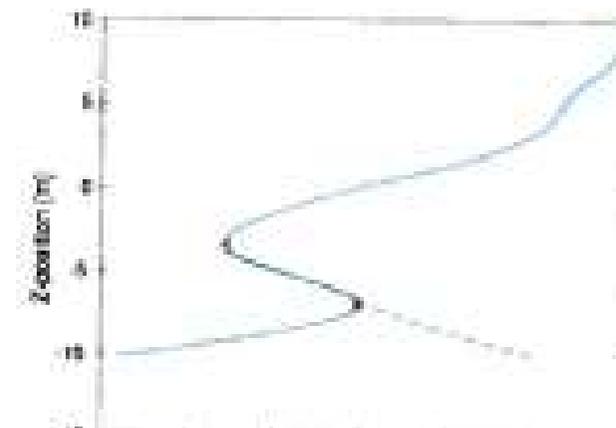
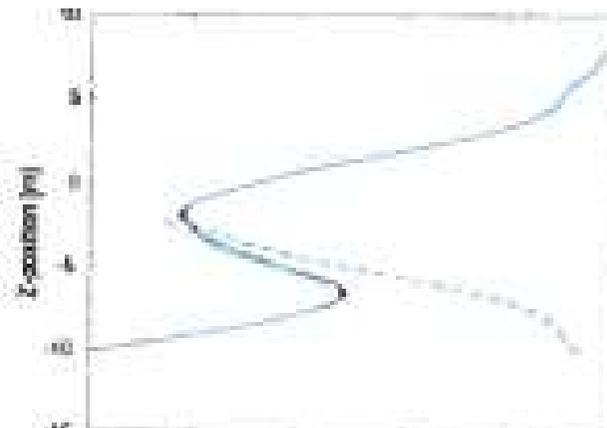
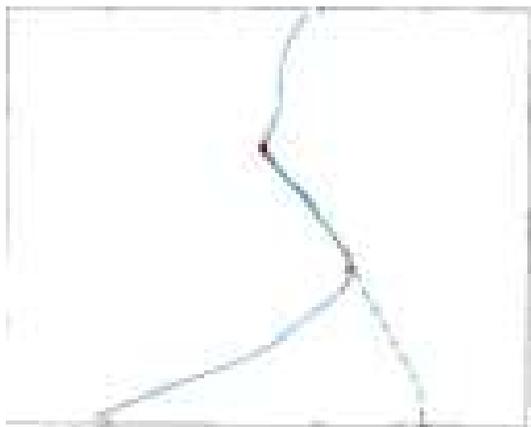
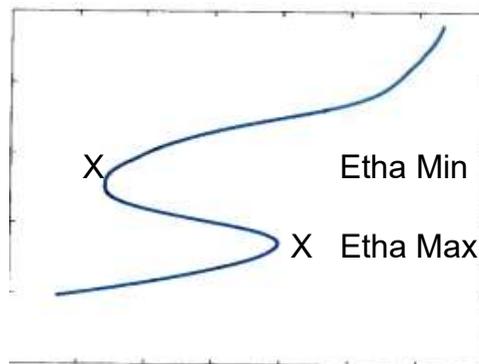
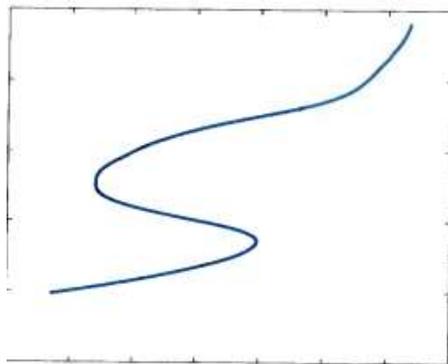


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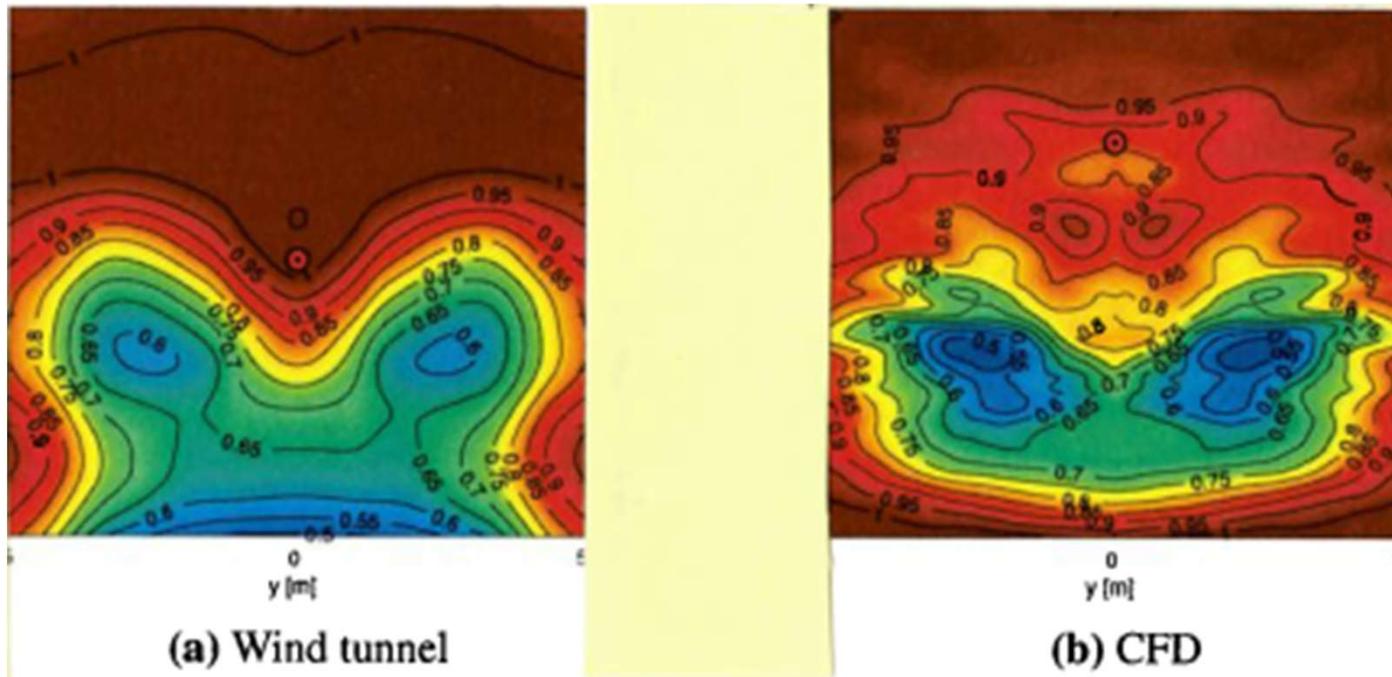
Spectral analysing method of STRUT correction



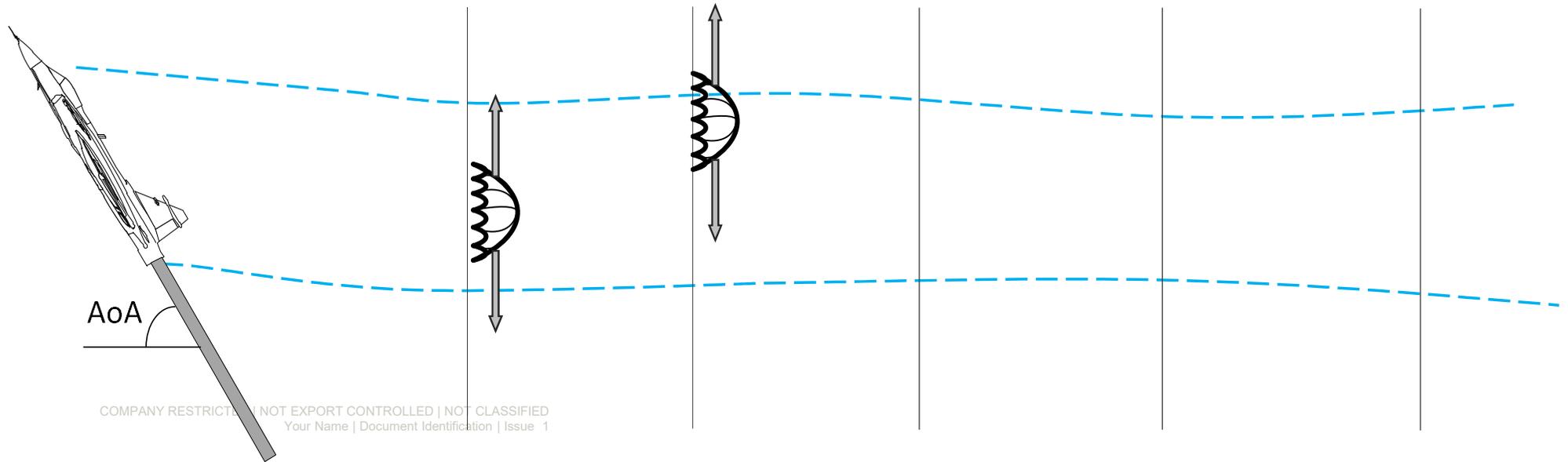
Vertical Interpolation & A/C wake mirroring method of STRUT correction



Comparison with CFD



Etha Min -> Conservative



Questions?
