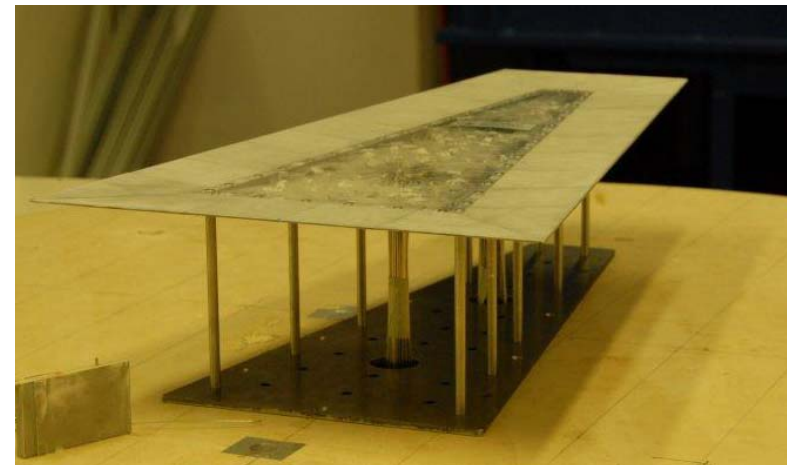


Tools for determining wind actions on bluff-bodies

- 1) Wind-Tunnel Tests**
- 2) CFD Models**
- 3) Full-Scale Measurements**
- 4) Electronic Data Bases**

WIND TUNNEL TESTS

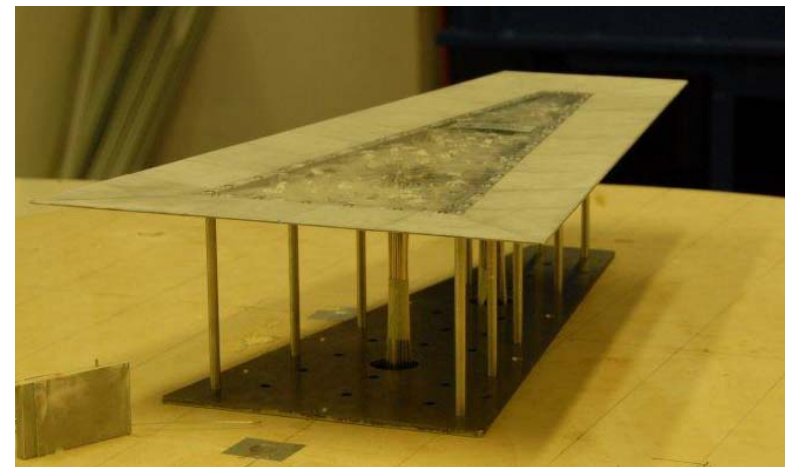
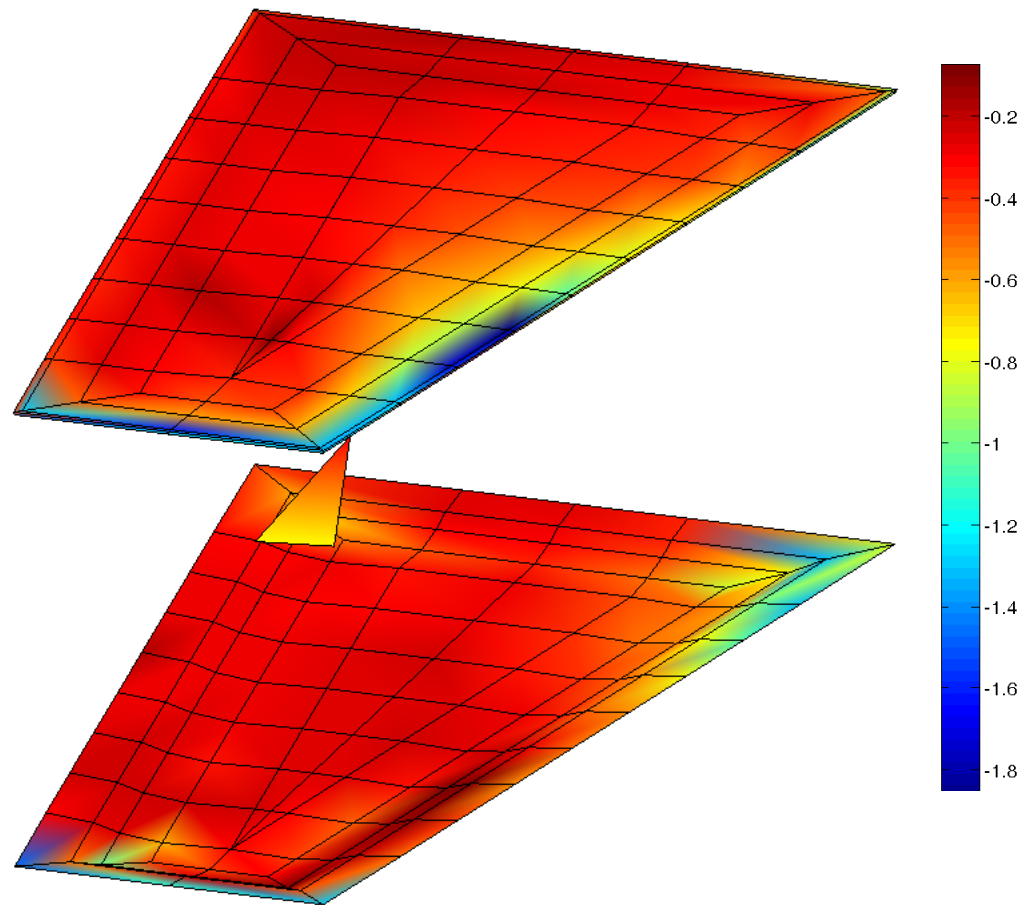
Pressure taps measurements



Portello Sail, Milano, Italy

WIND TUNNEL TESTS

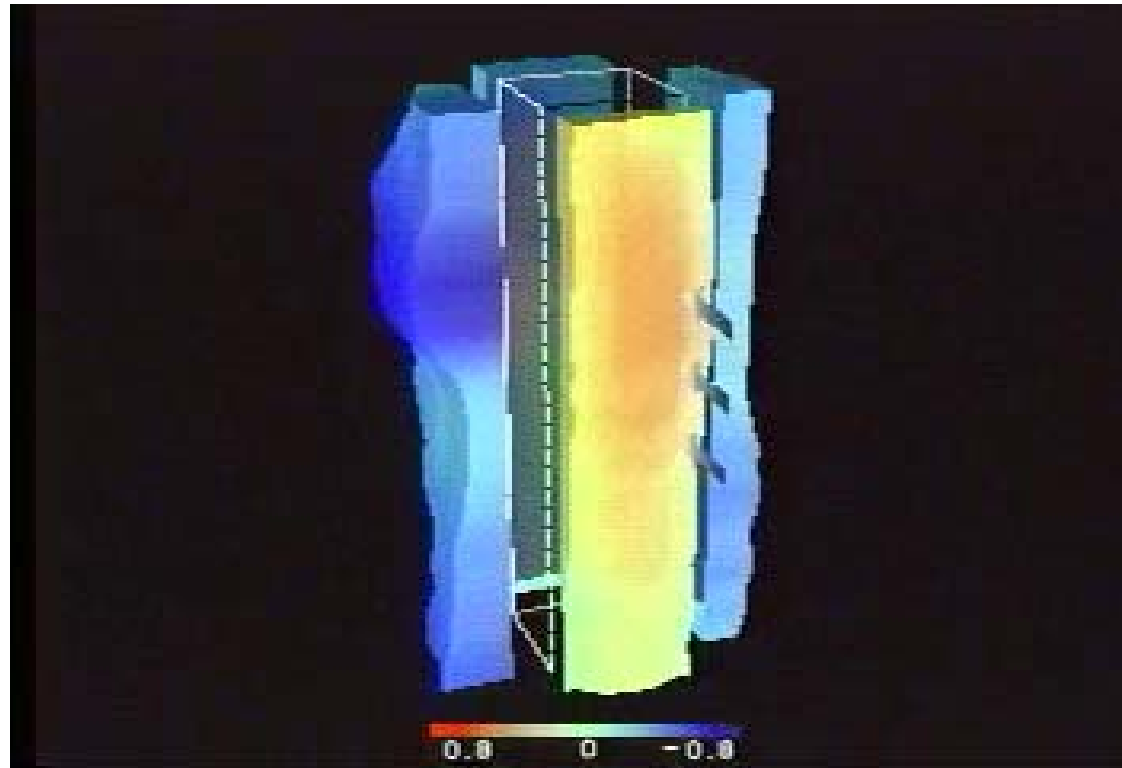
Pressure taps measurements



Portello Sail, Milano, Italy

WIND TUNNEL TESTS

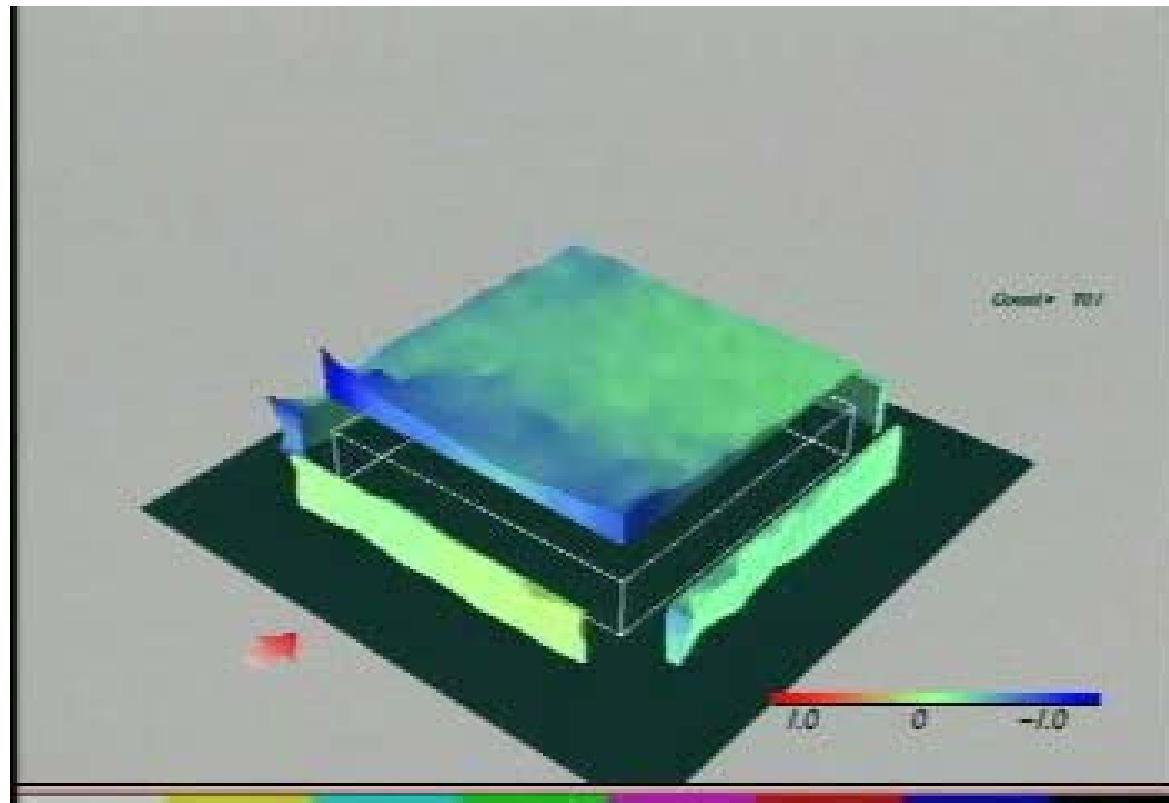
Pressure taps measurements



Courtesy Shimizu and Tokyo Politechnic University

WIND TUNNEL TESTS

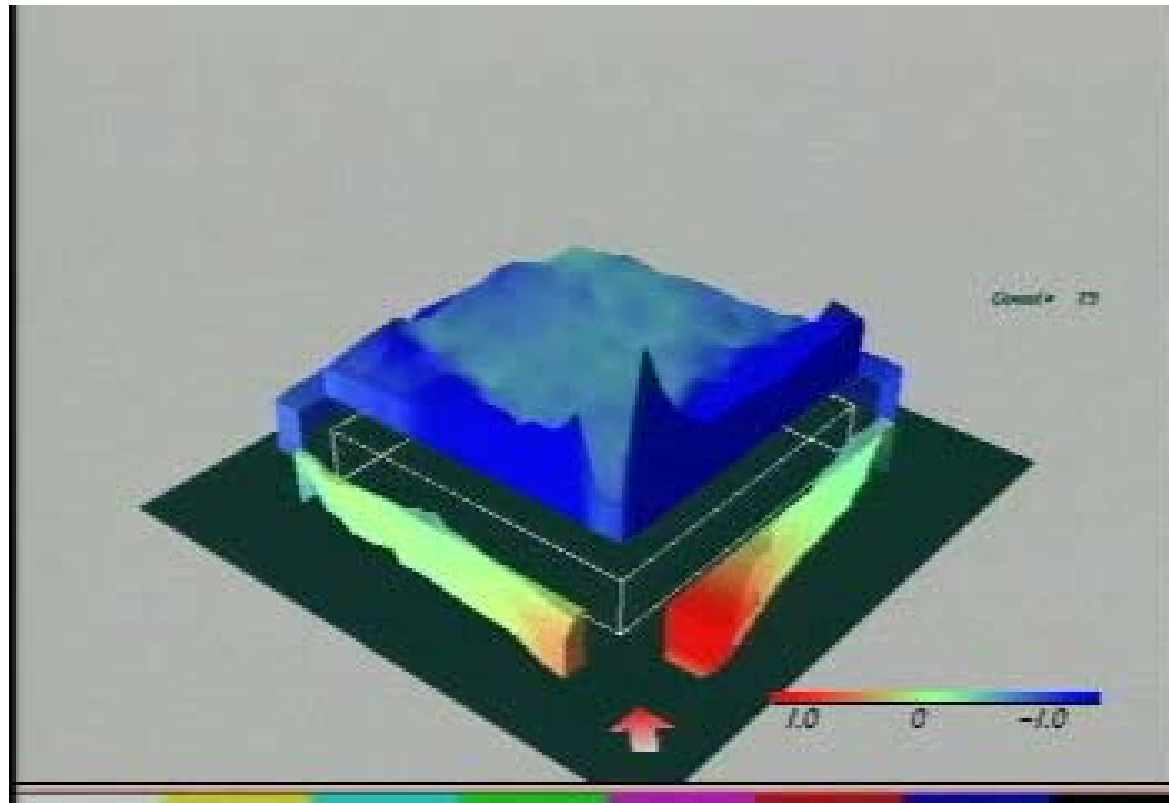
Pressure taps measurements



Courtesy Shimizu and Tokyo Politechnic University

WIND TUNNEL TESTS

Pressure taps measurements



Courtesy Shimizu and Tokyo Politechnic University

WIND TUNNEL TESTS

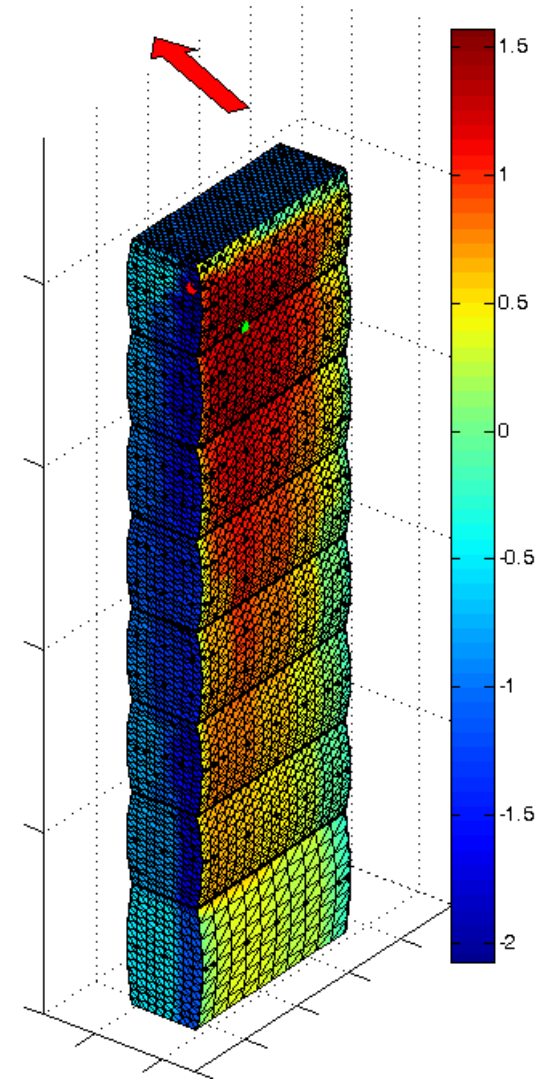
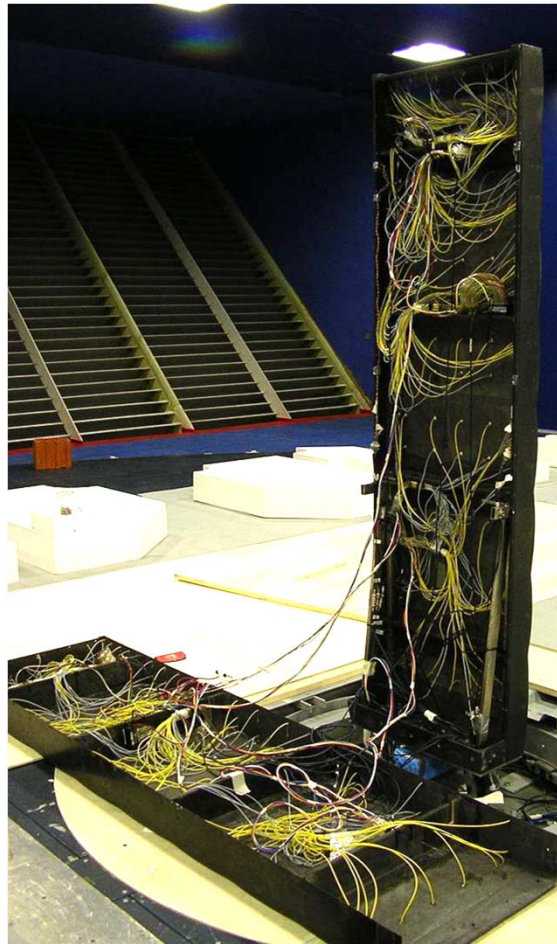
Pressure taps measurements



Historical Area, Milano Fair

WIND TUNNEL TESTS

Pressure taps measurements



Historical Area, Milano Fair

WIND TUNNEL TESTS

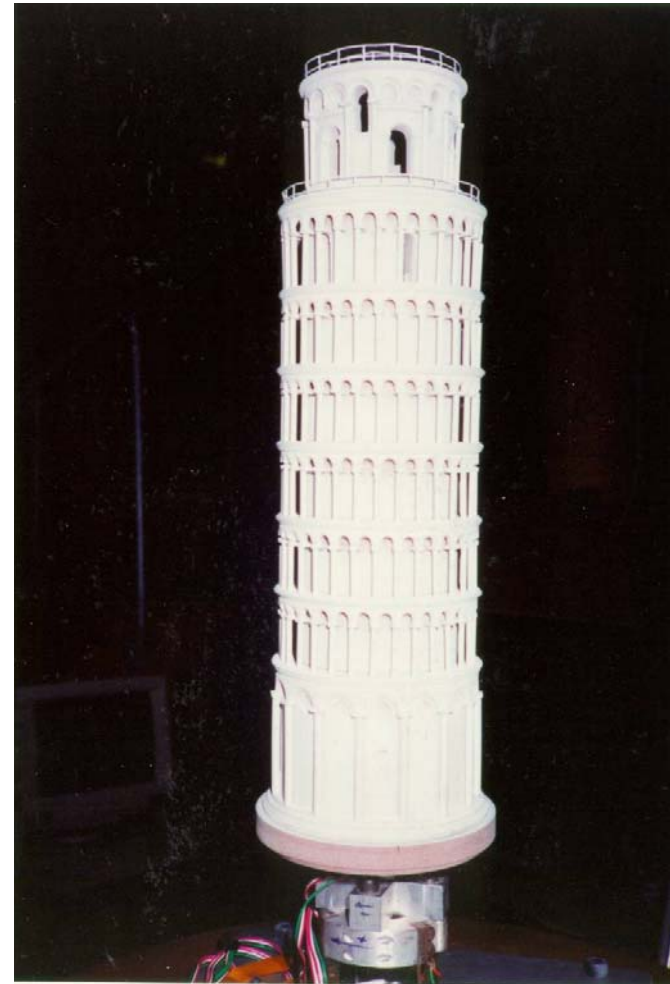
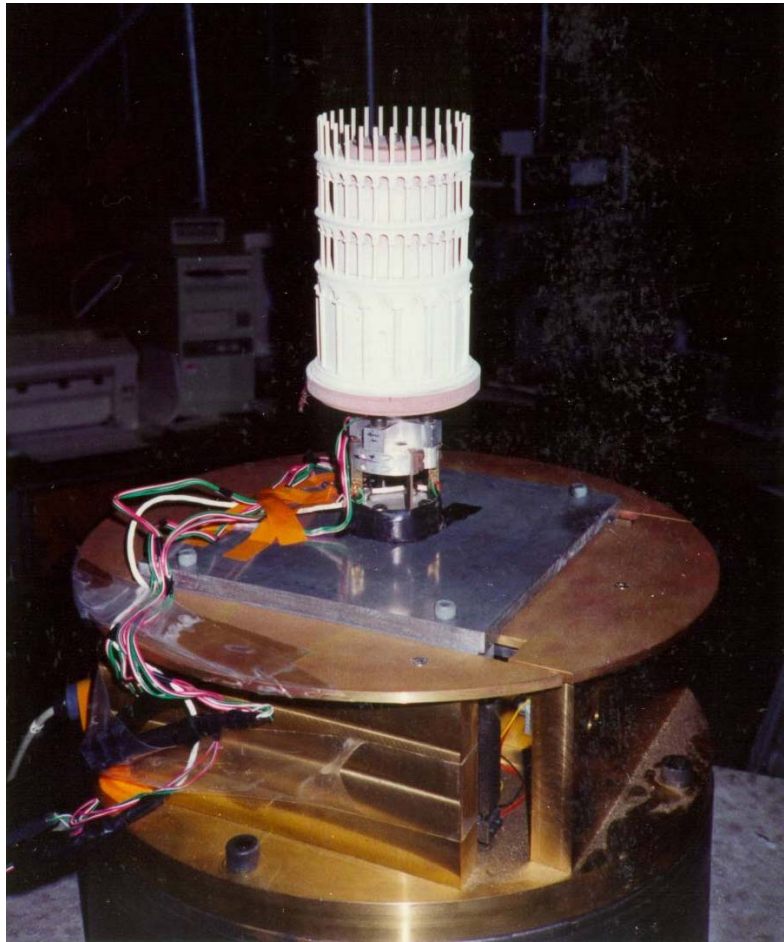
Force balance tests



Historical Area, Milano Fair

WIND TUNNEL TESTS

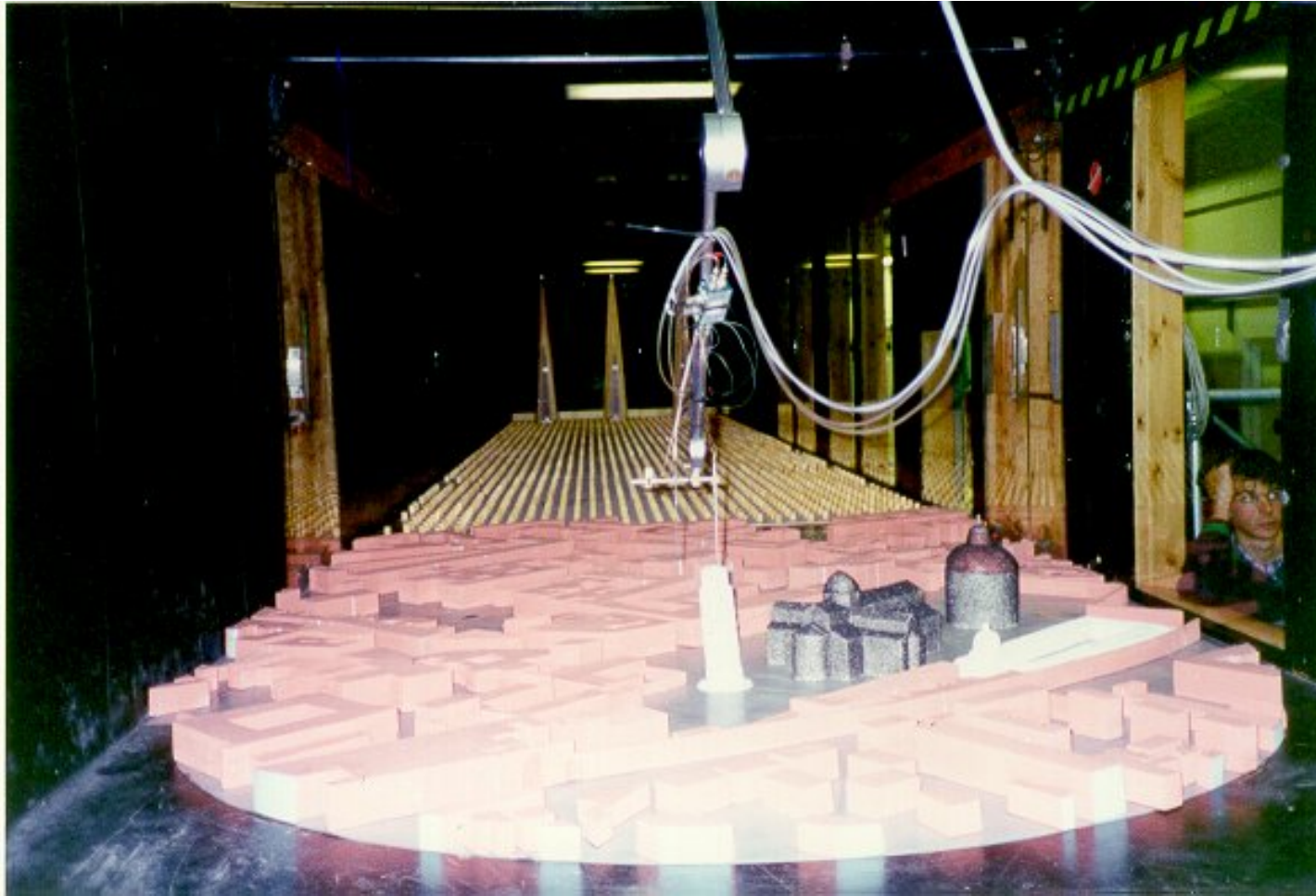
Force balance tests



Leaning Tower of Pisa

WIND TUNNEL TESTS

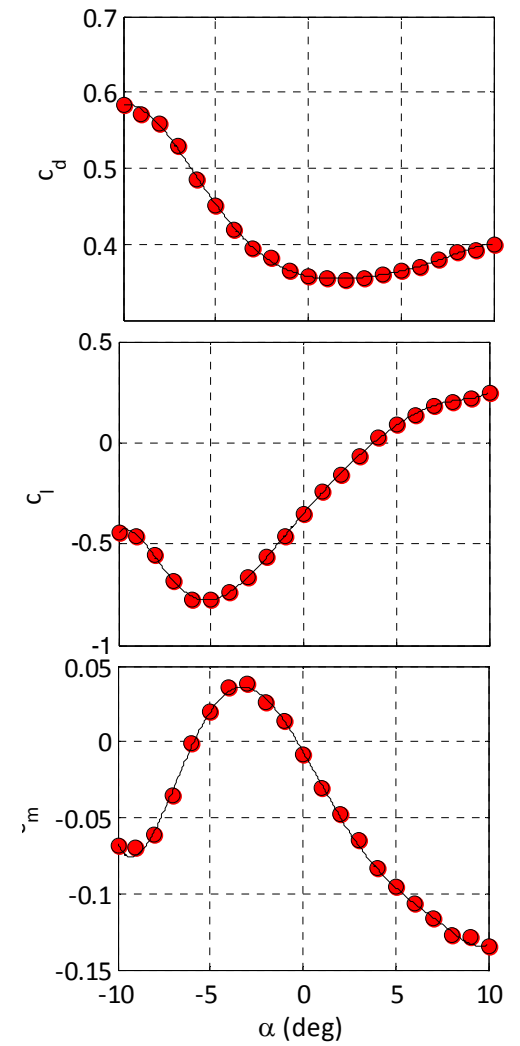
Force balance tests



Leaning Tower of Pisa

WIND TUNNEL TESTS

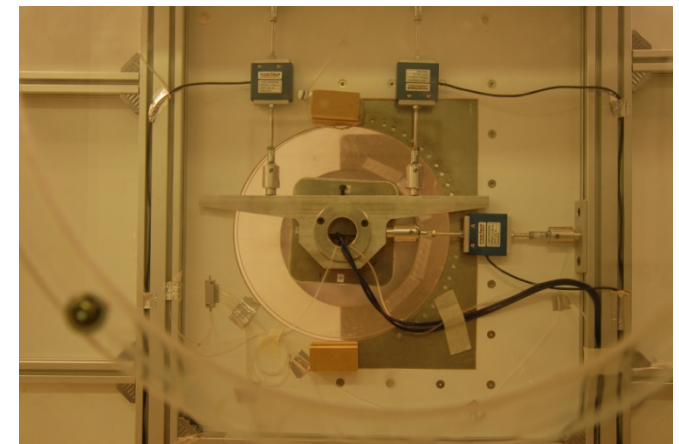
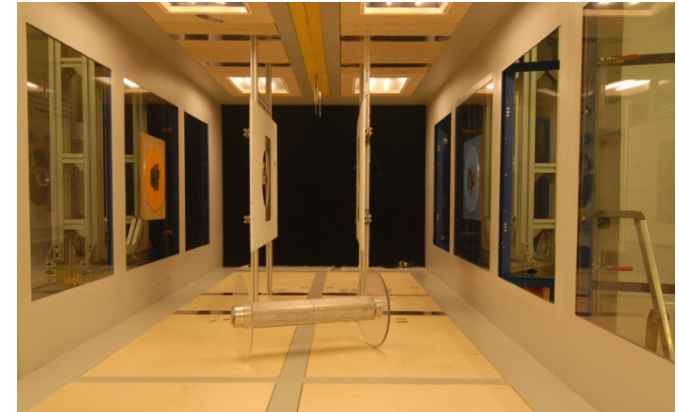
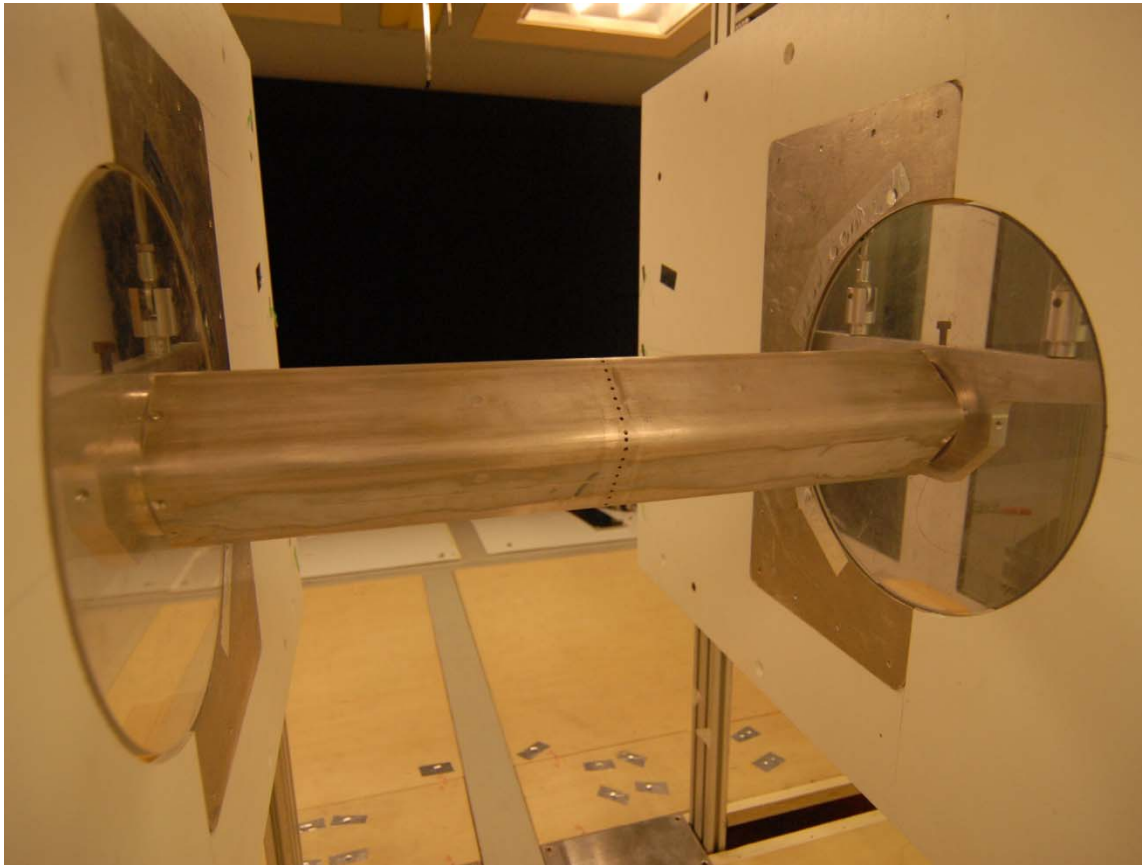
Force balance tests



Serra Footbridge, Milano, Italy

WIND TUNNEL TESTS

Force balance tests



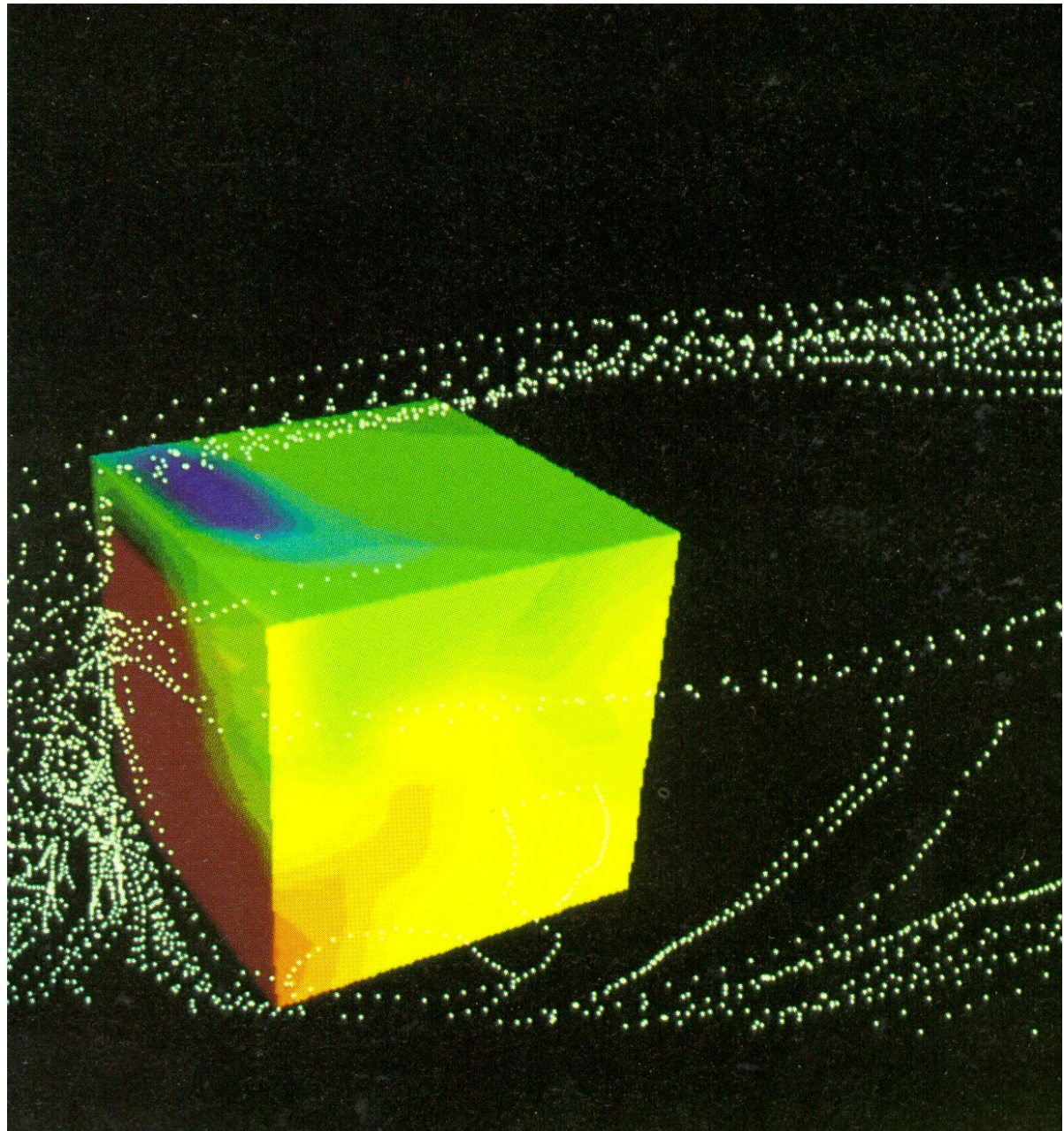
Varesine “Megaframe”, Milano, Italy

CFD MODELS

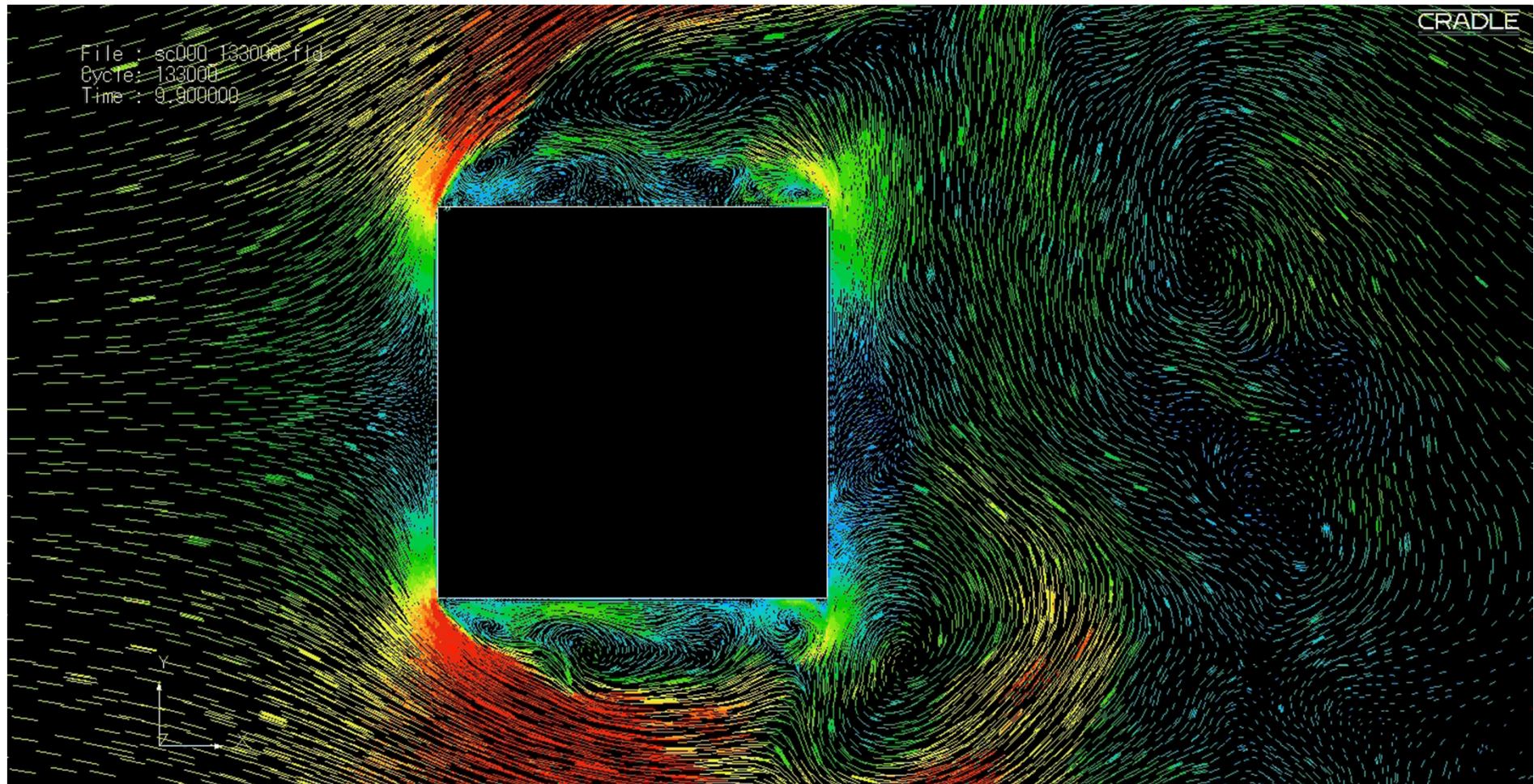
RANS

LES

.....

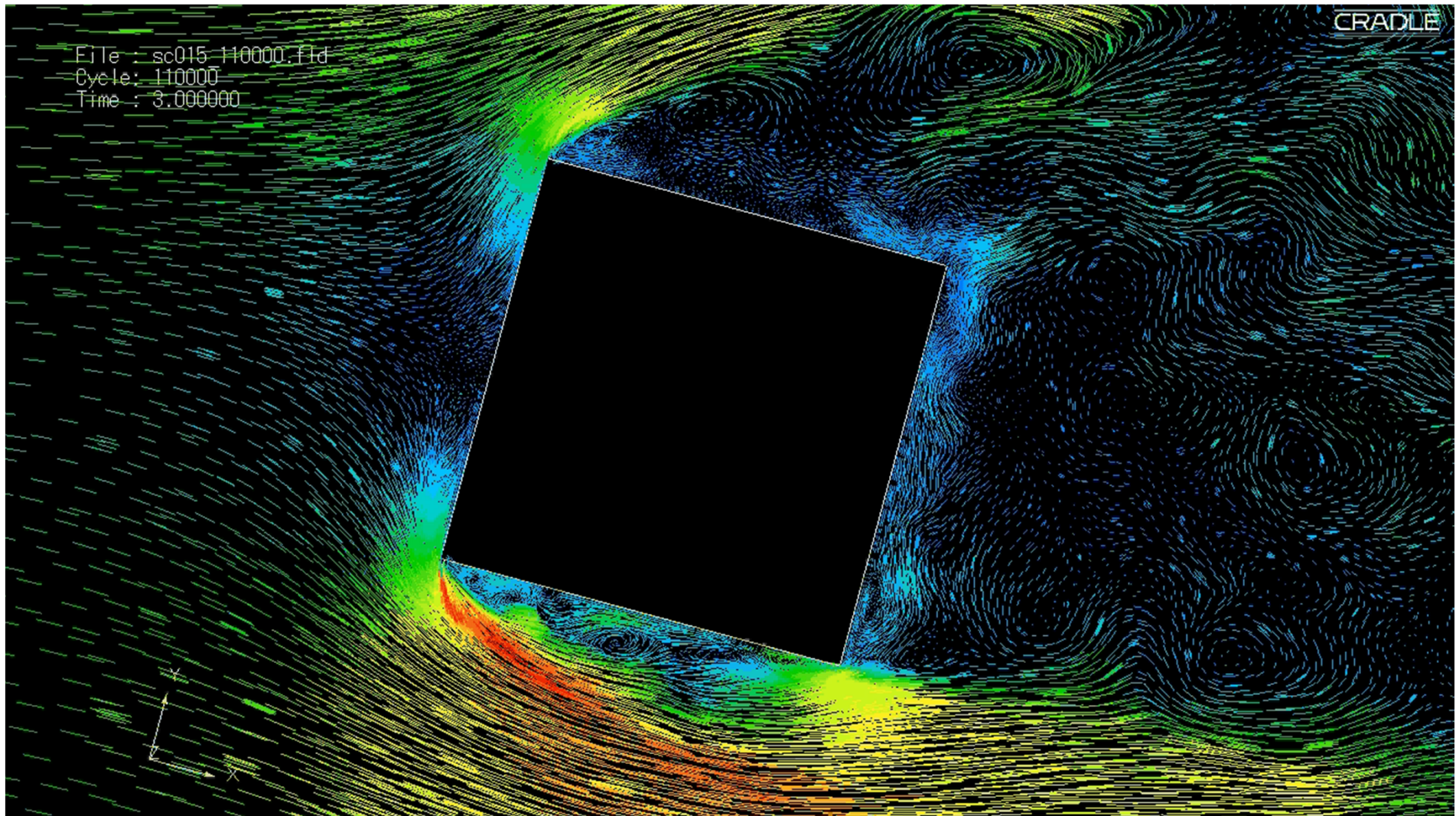


CFD MODELS



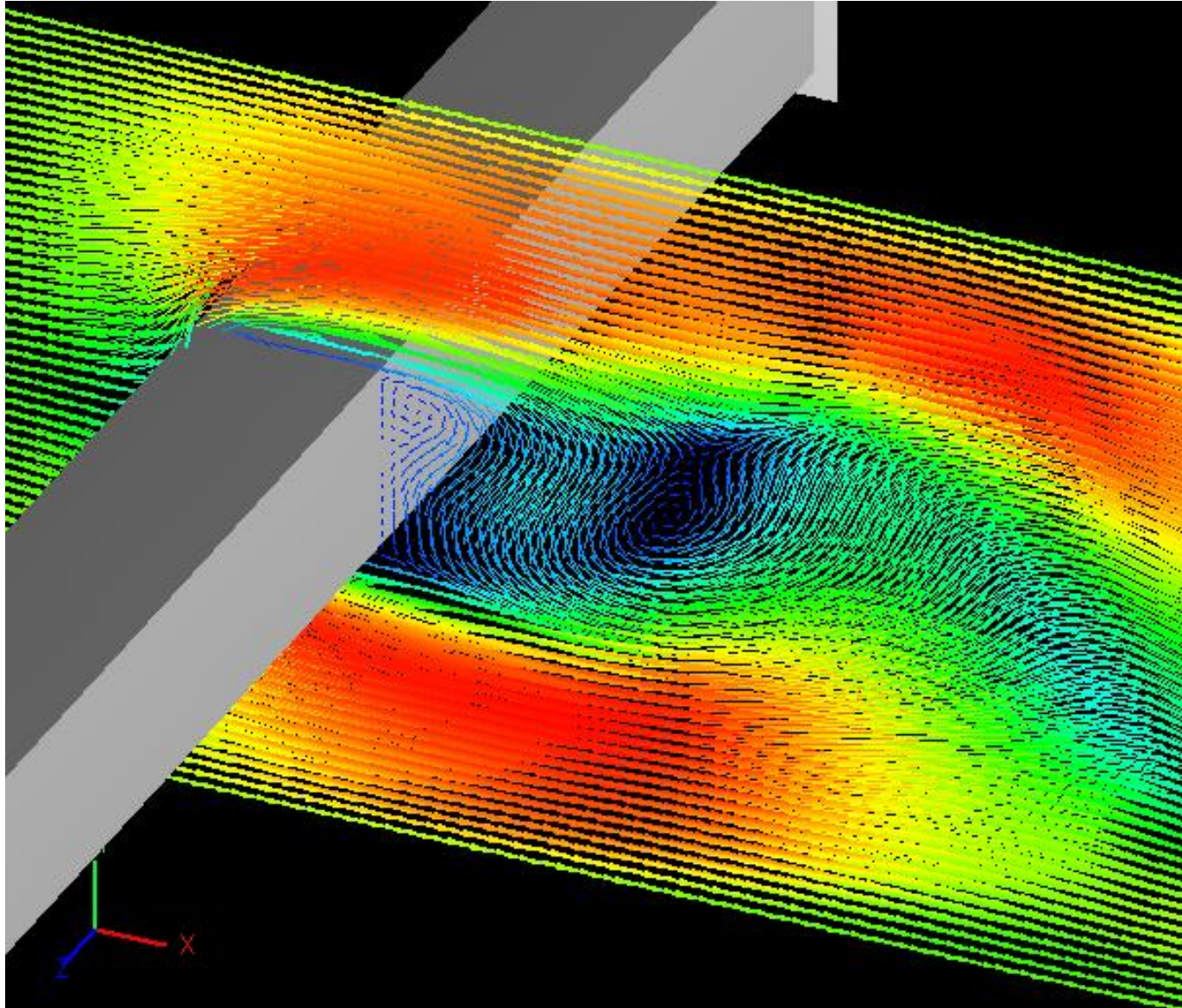
Square section building – wind direction 0 degrees

CFD MODELS

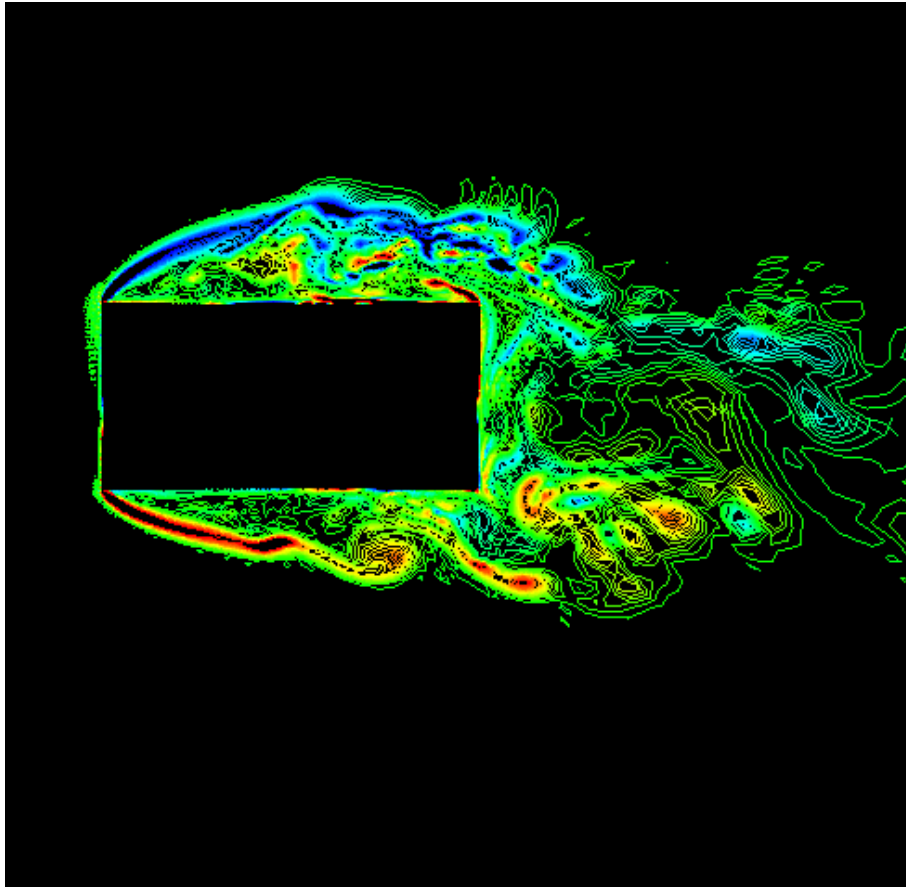


Square section building – wind direction 15 degrees

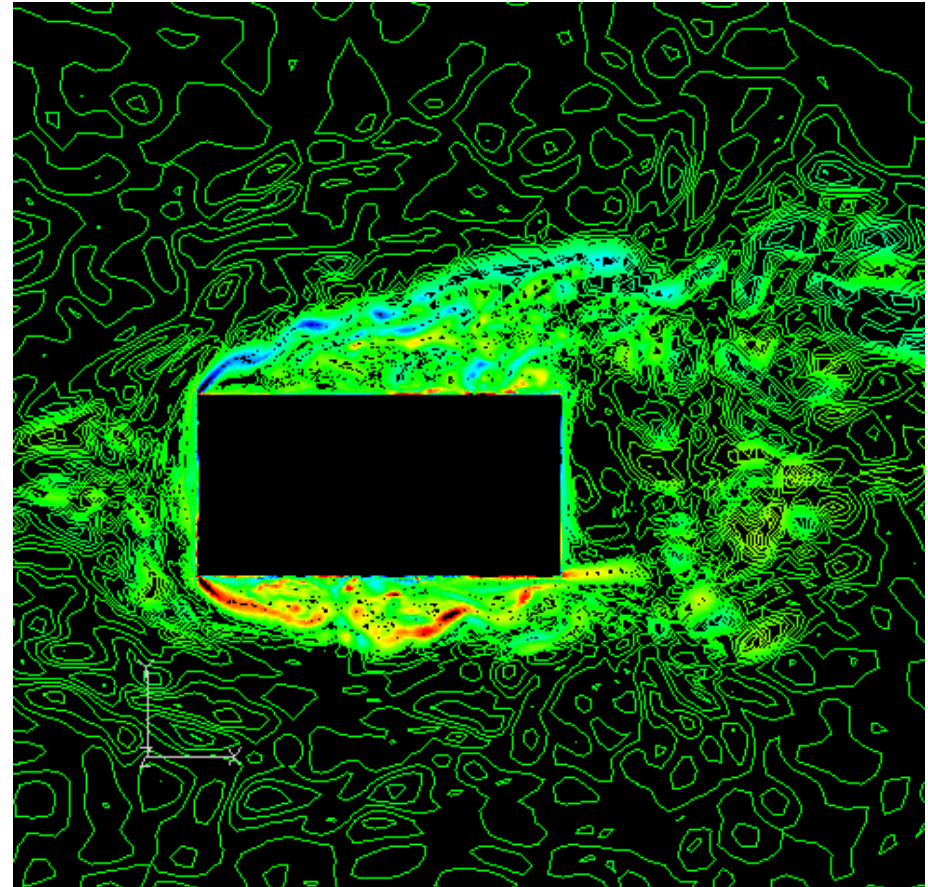
CFD MODELS



CFD MODELS



Uniform flow



Turbulent flow

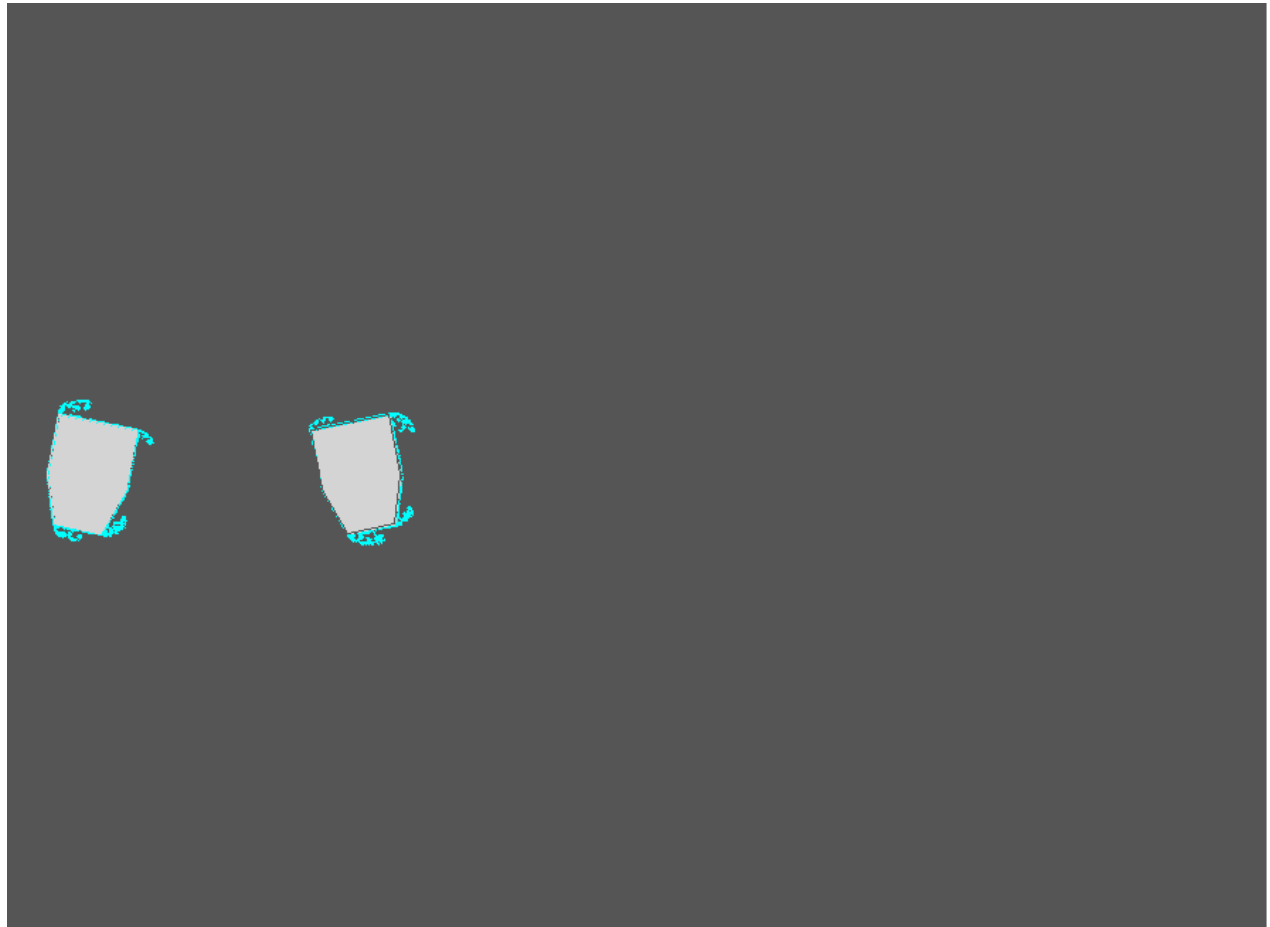
Vorticity contours

CFD MODELS

RANS

LES

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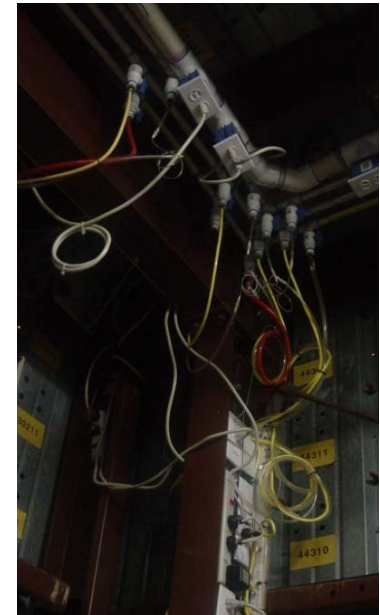
Lupu Bridge, Shanghai, China

FULL-SCALE MEASUREMENTS



Shionomisaki Wind Effect Laboratory of Kyoto University

FULL-SCALE MEASUREMENTS



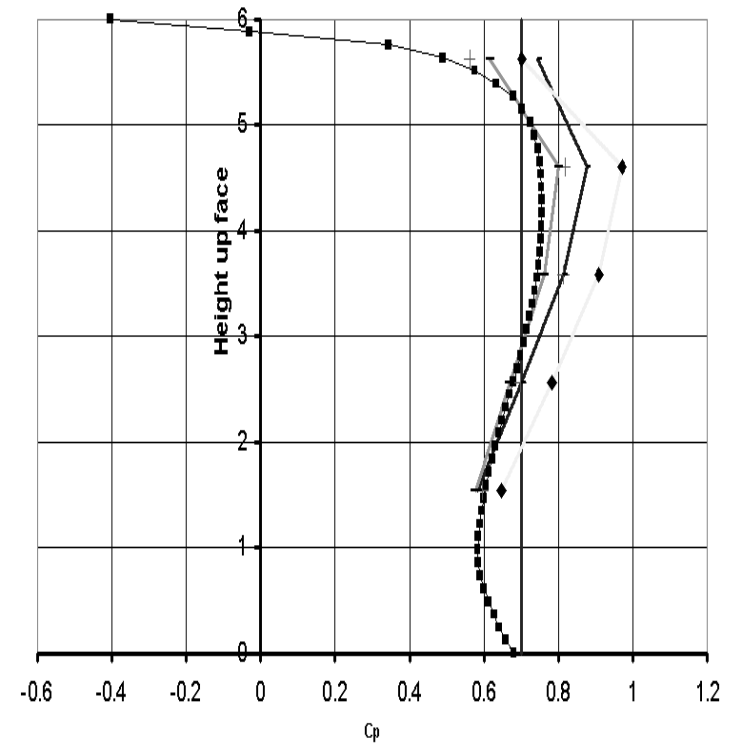
Wind Engineering Research Station, Lubbock, Texas

FULL-SCALE MEASUREMENTS



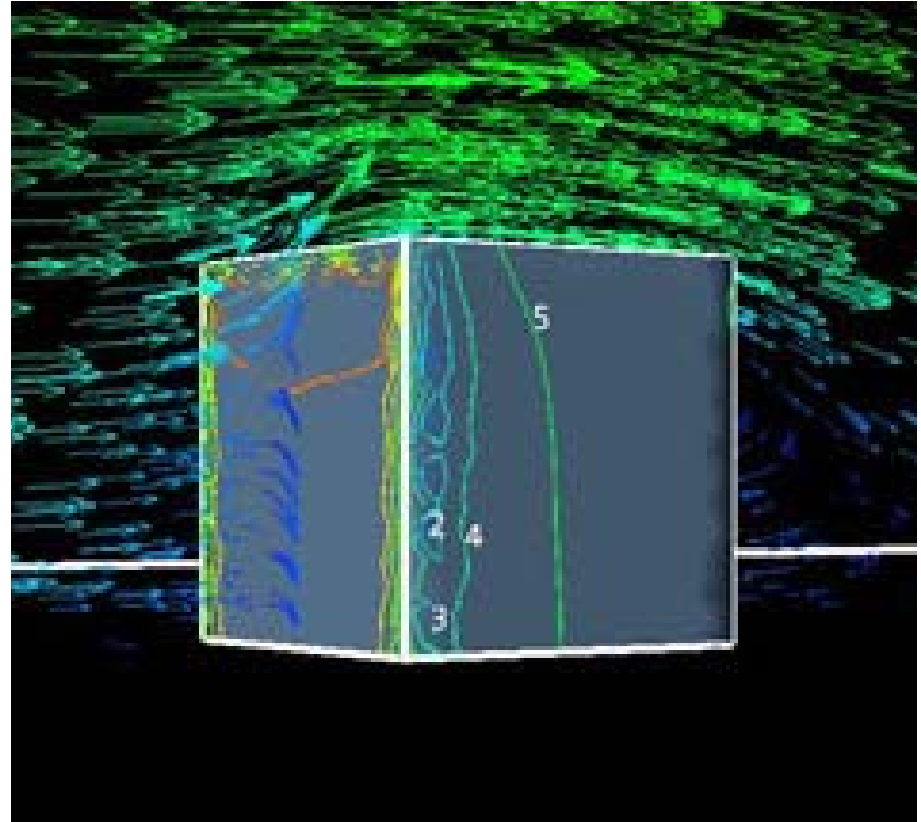
Silsoe Research Institute, U.K.

FULL-SCALE MEASUREMENTS



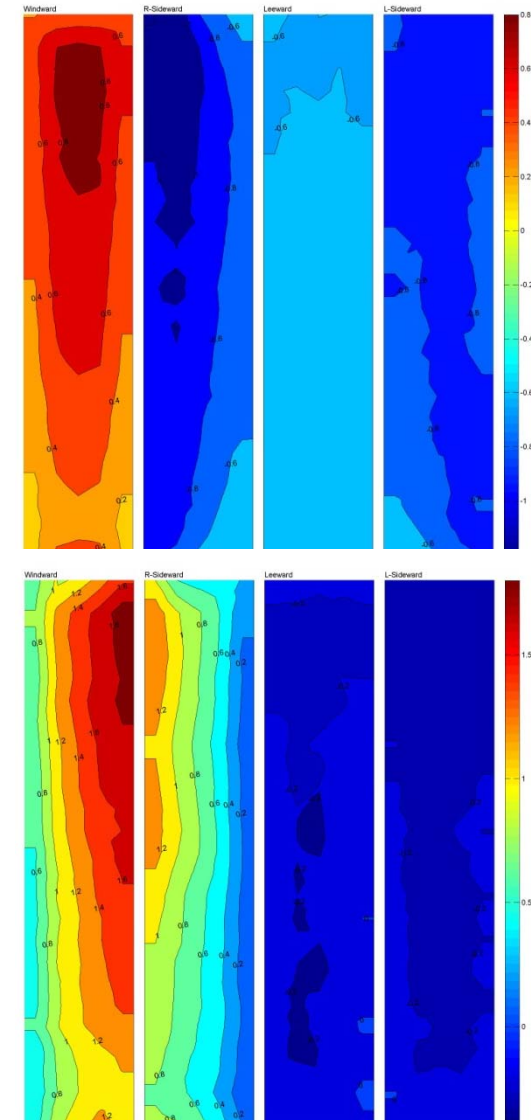
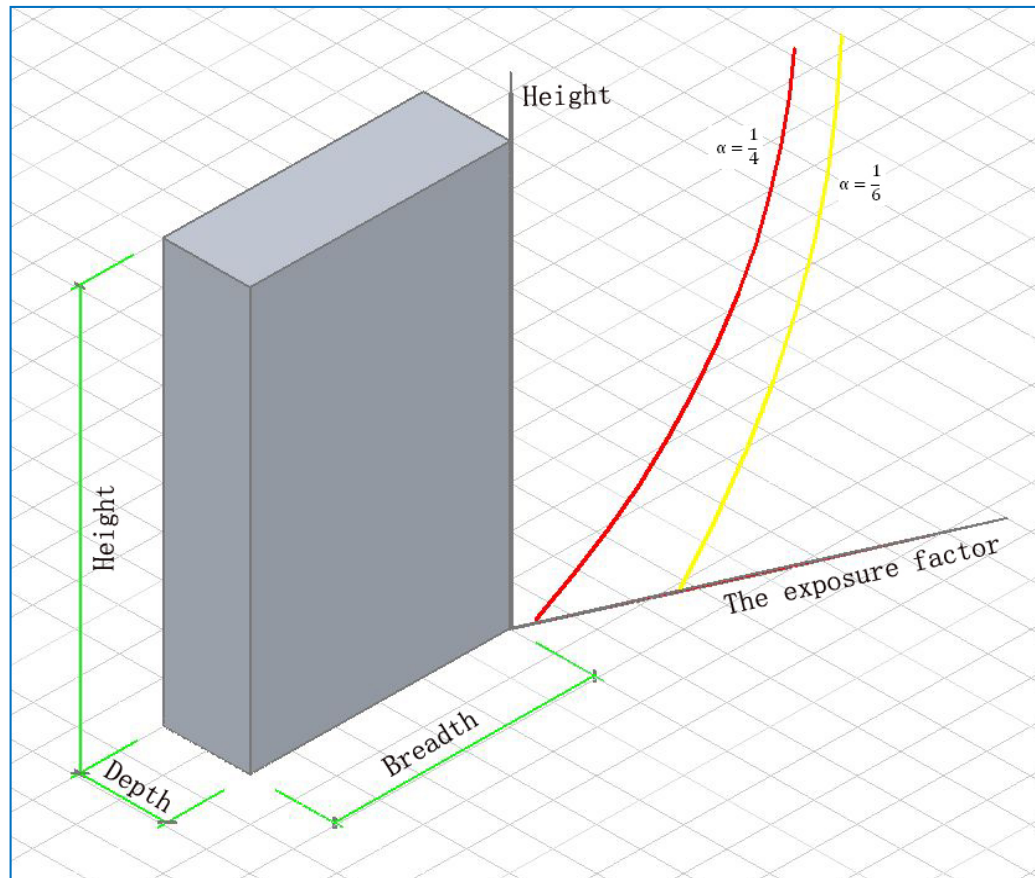
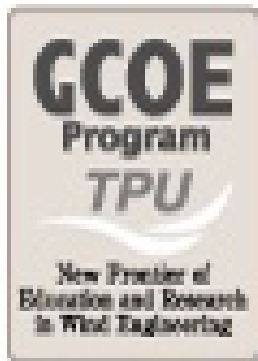
Silsoe Research Institute, U.K.

COMPARISON BETWEEN DIFFERENT TOOLS



Silsoe Research Institute, U.K.

ELECTRONIC DATA BASES



GCOE – TPU – Aerodynamic Data Base, Tokyo, Japan

ELECTRONIC DATA BASES

Step 1: Select Shape of Interest

01 D=2"
B=6"

02 D=3"
B=6"

03 D=4"
B=6"

04 D=4"
B=4"

05 D=6"
B=4"

06 D=6"
B=3"

07 D=6"
B=2"

08 4"
4"

D=4" 60°
B=6"

Step 2: Select Height of Interest

Step 3: Select BL condition of Interest

Open

Urban

Model #	1	2	3	4	5	6	7	8	9
Shape									
D:B [in.]	2:6	3:6	4:6	4:4	6:4	6:3	6:2	4:4	4:6 (60°)

NatHaz Aerodynamic Data Base, Notre Dame, Indiana, U.S.