

Comparative Study of Airflow Around a CFD Thermal Manikin

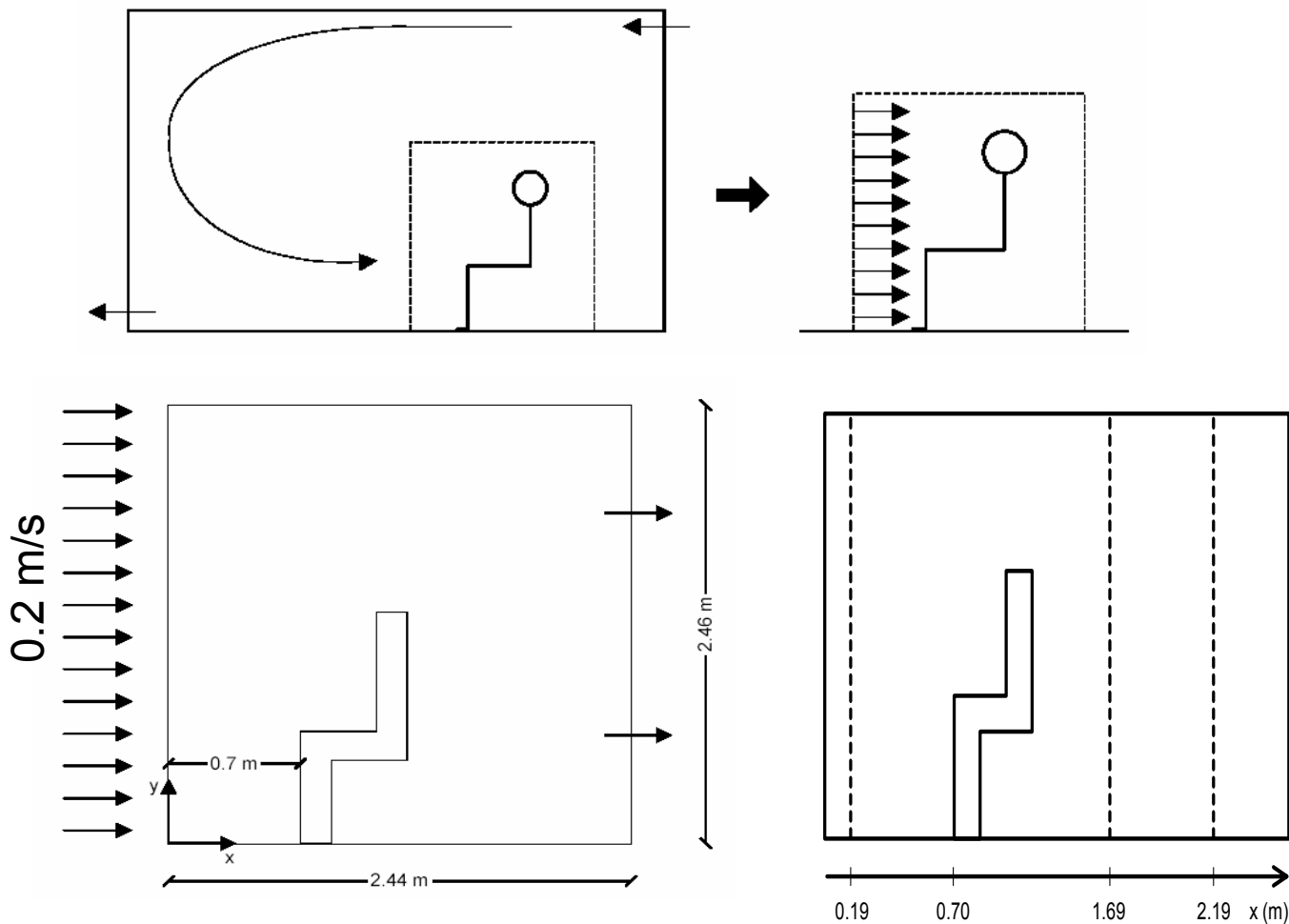
Prof. John Zhai, PhD

University of Colorado at Boulder

USA

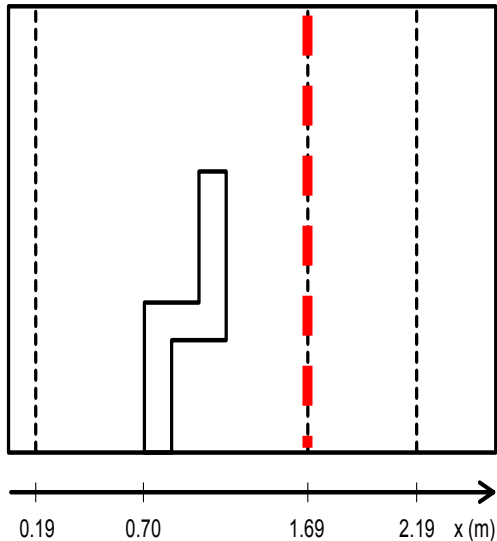
Case Descriptions:

Mixing Ventilation by Nielsen et al. (2003)

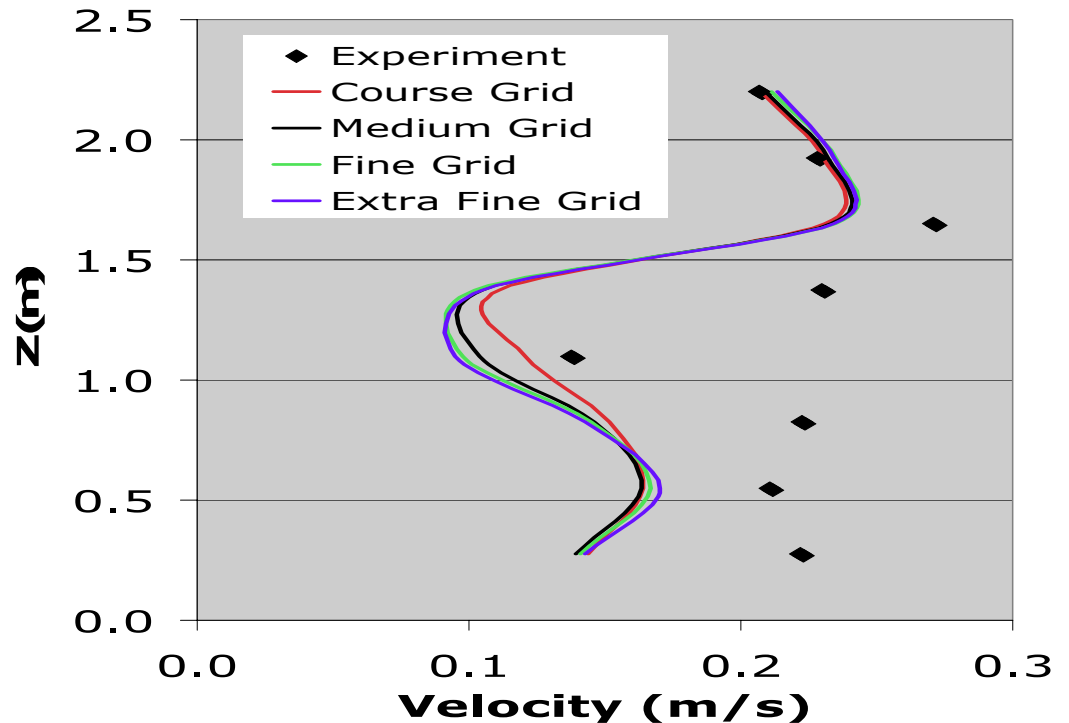


Grid Comparison: RANS+KERNNG

Structure Grid	Grid Size	Cell Number	Run Time (h:m)
Coarse	30x15x30	13,500	0:09
Medium	45x23x45	46,575	0:30
Fine	70x35x70	171,500	2:45
Extra Fine	90x44x90	356,400	4:00

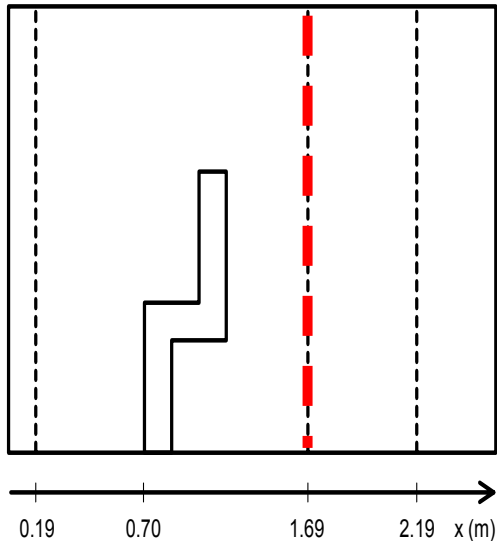


Phoenixes Grid Independent Solution

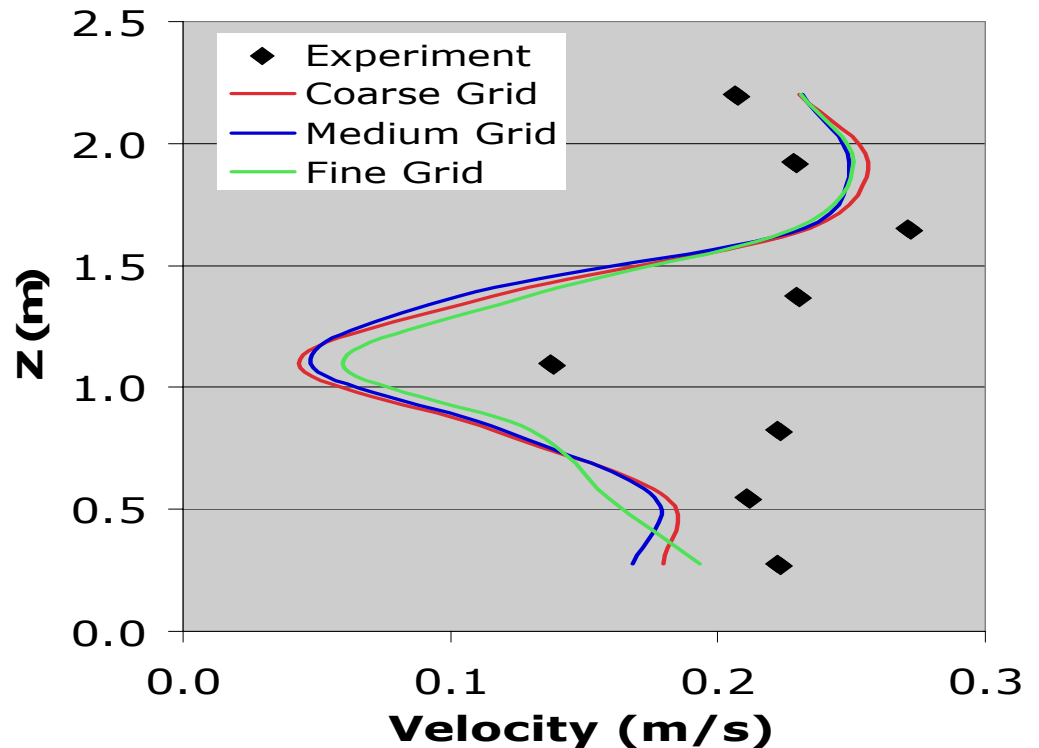


Grid Comparison: RANS+KERNG

Unstructure Grid	Cell Number	Run Time (h:m)
Coarse	21,964	0:30
Medium	83,559	2:00
Fine	216,534	6:00

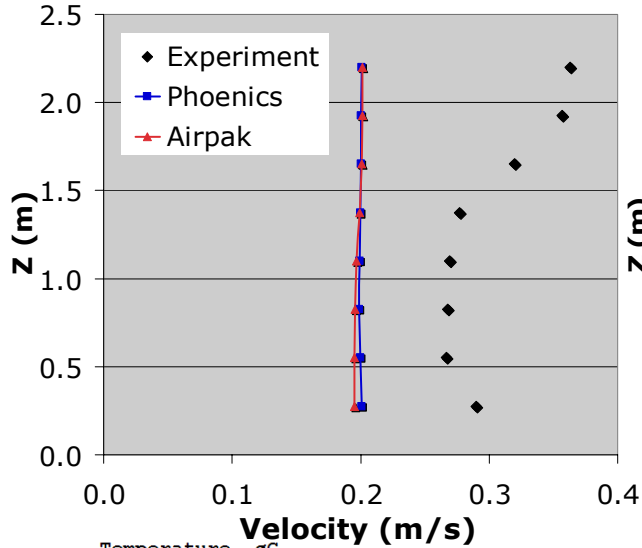


AirPak Grid Independent Solution

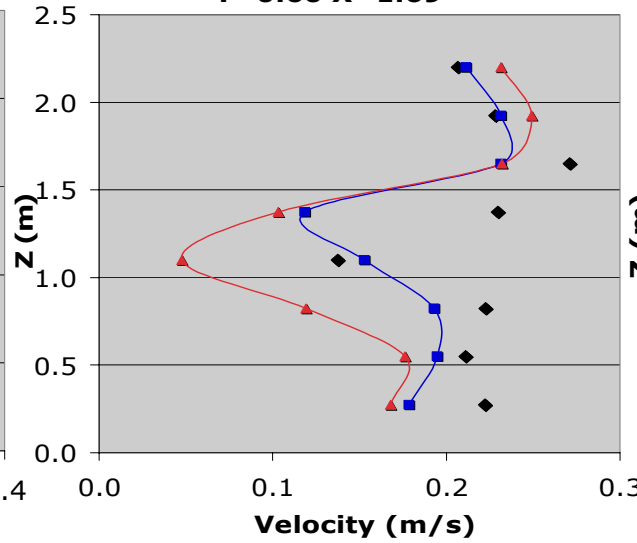


CFD Program Comparison: Pheonics vs Airpak (KERNG)

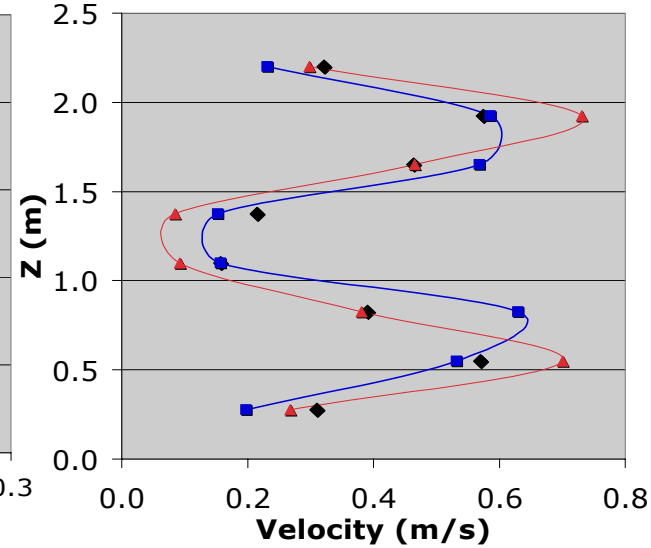
Y=0.60 X=0.19



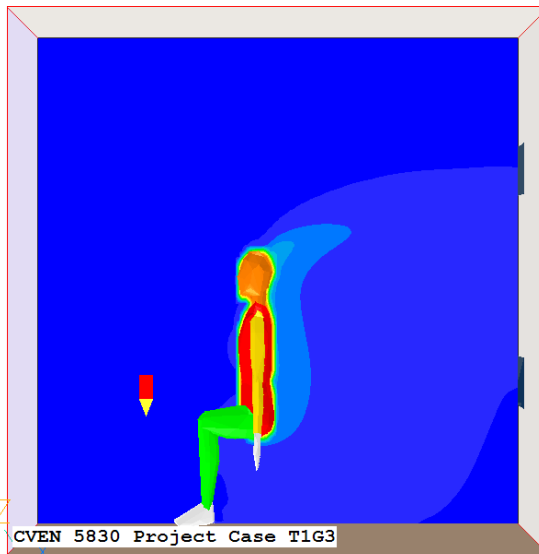
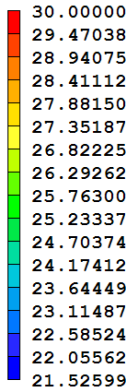
Y=0.60 X=1.69



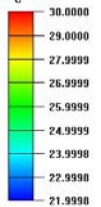
Y=0.60 X=2.19



Temperature, °C

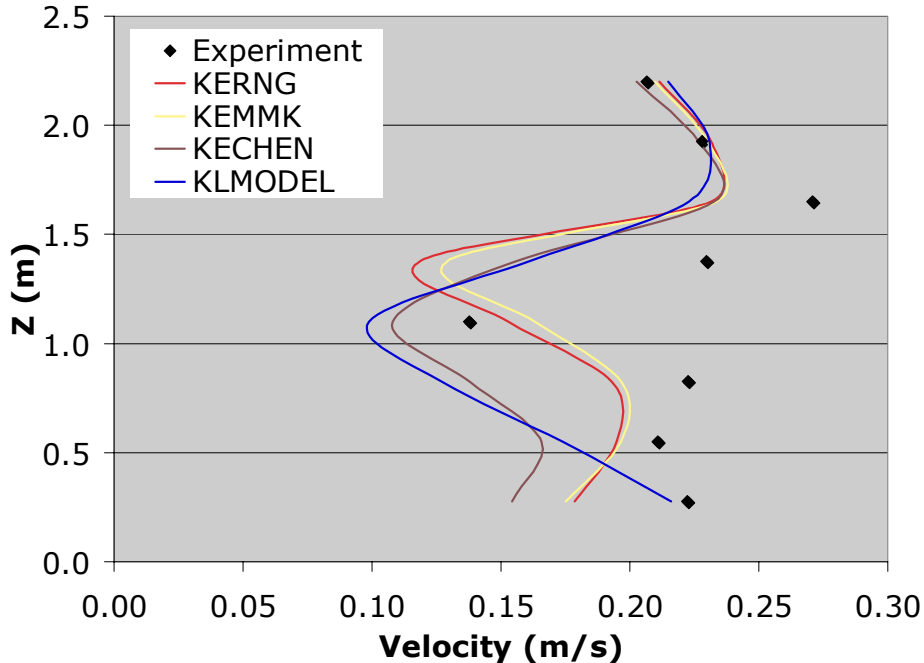


Temperature

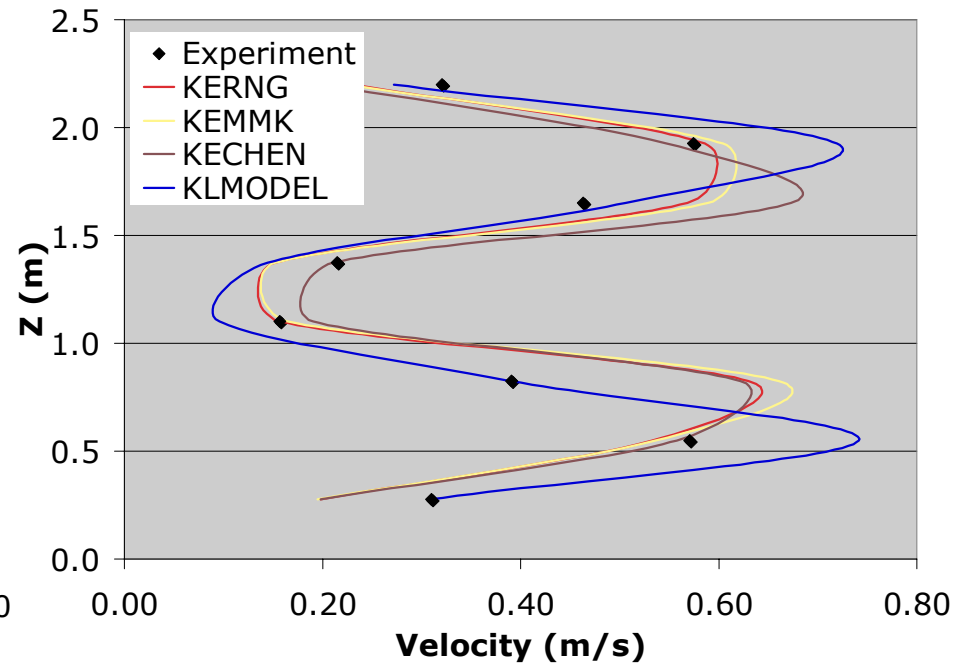


Turbulence Model Comparison: Phoenics+MediumGrid

Vertical Velocity Profile at Y=0.6 & X=1.69

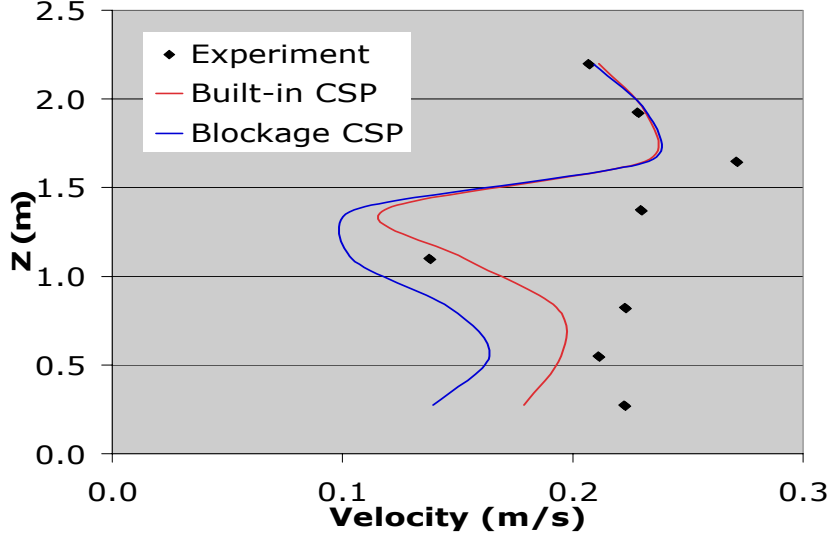


Vertical Velocity Profile at Y=0.6 & X=2.19

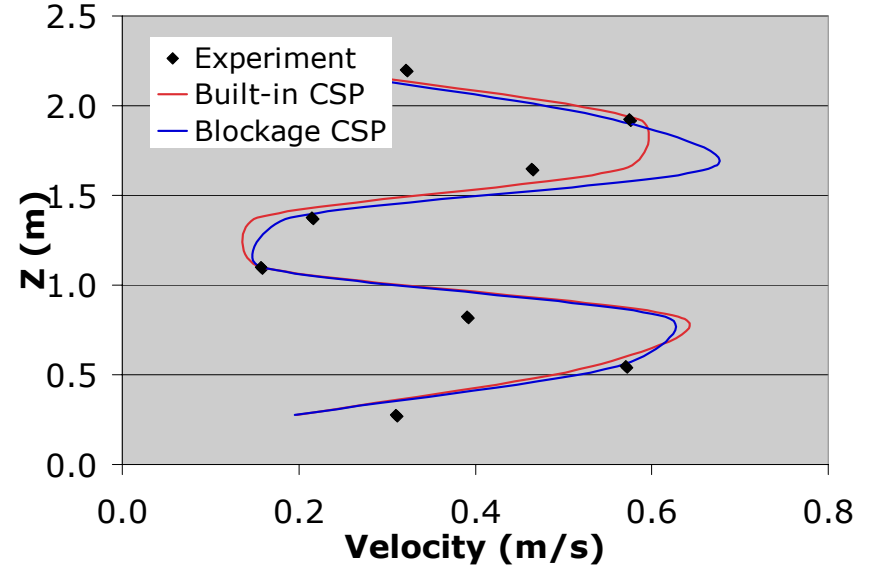


Manikin Model Comparison: Phoenics+KERNING+MediumGrid

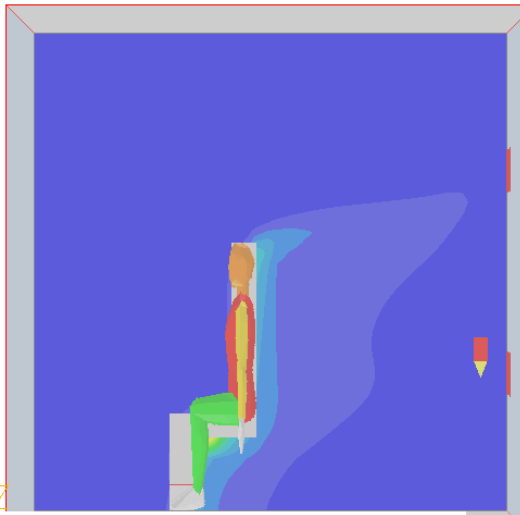
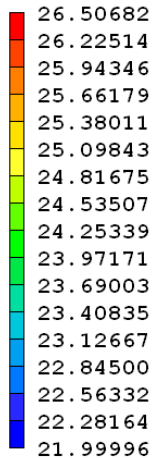
Velocity Profile at Y=0.6 and X=1.69



Velocity Profile at Y=0.6 and X=2.19

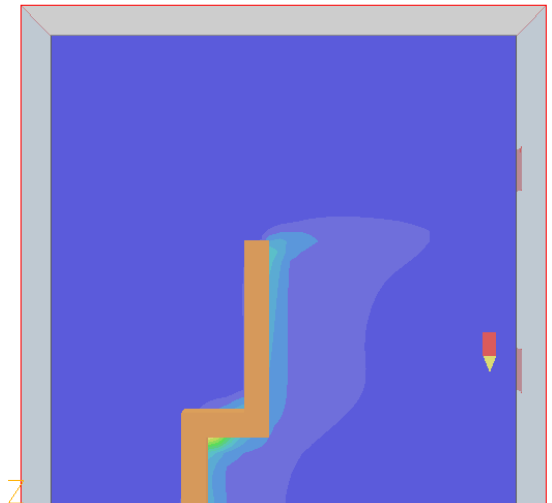
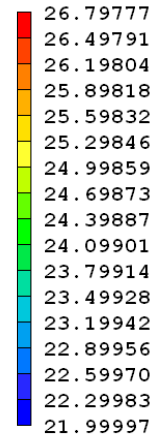


Temperature, °C



No title has been set for this run.

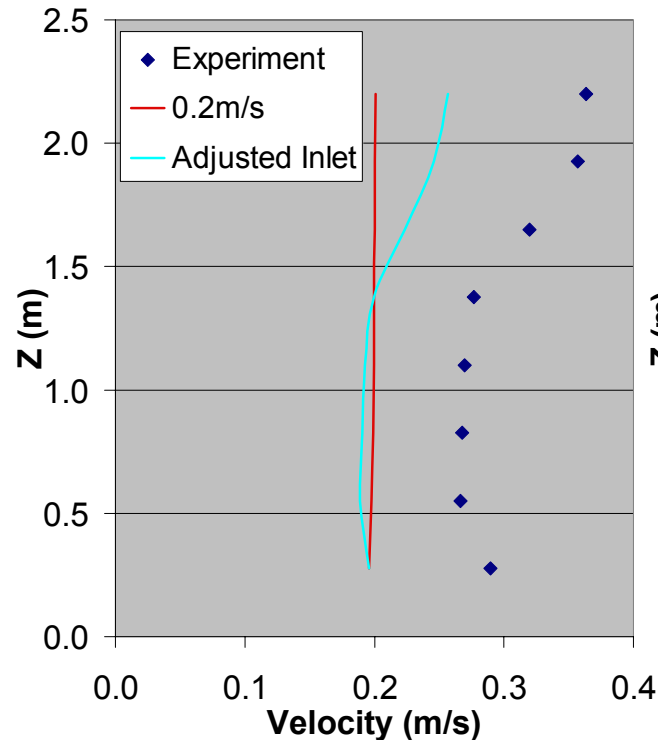
Temperature, °C



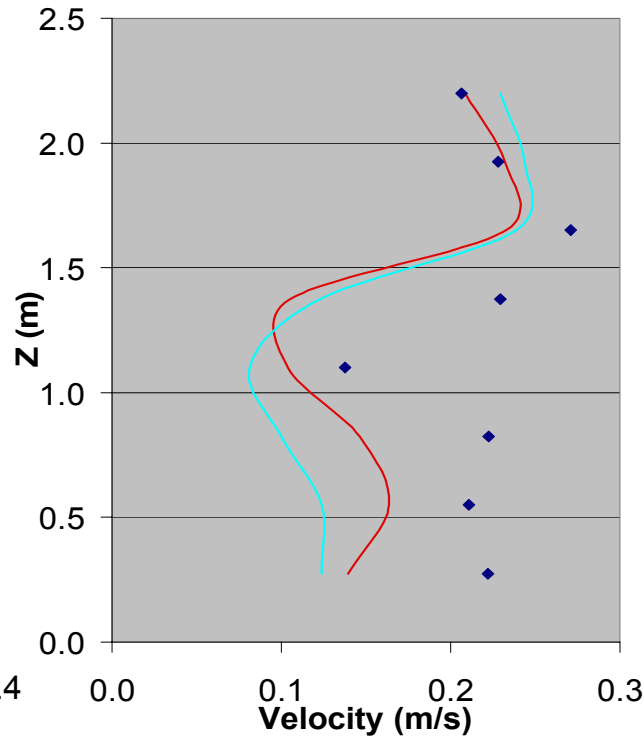
No title has been set for this run.

Inlet Condition Comparison: Phoenics+KERNING+MediumGrid

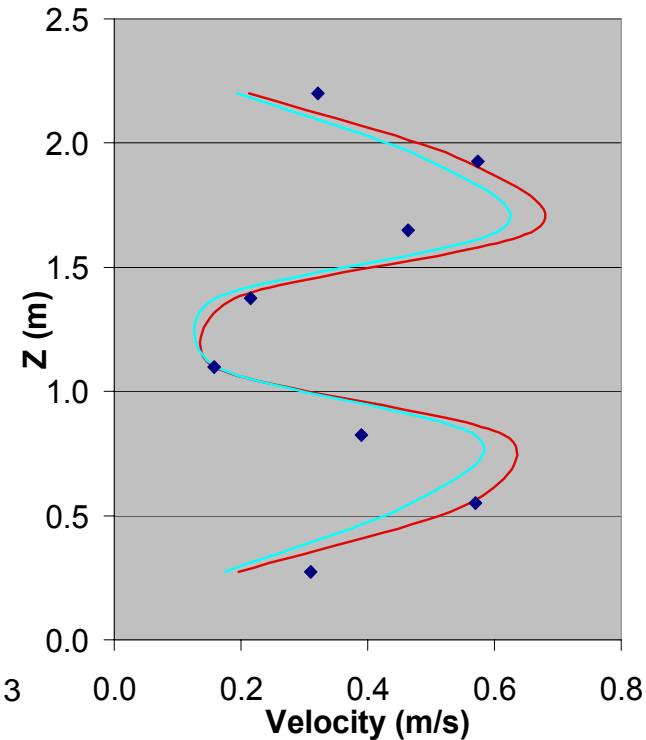
Adjusted Wind Profile x=0.19



Adjusted Wind Profile x=1.69

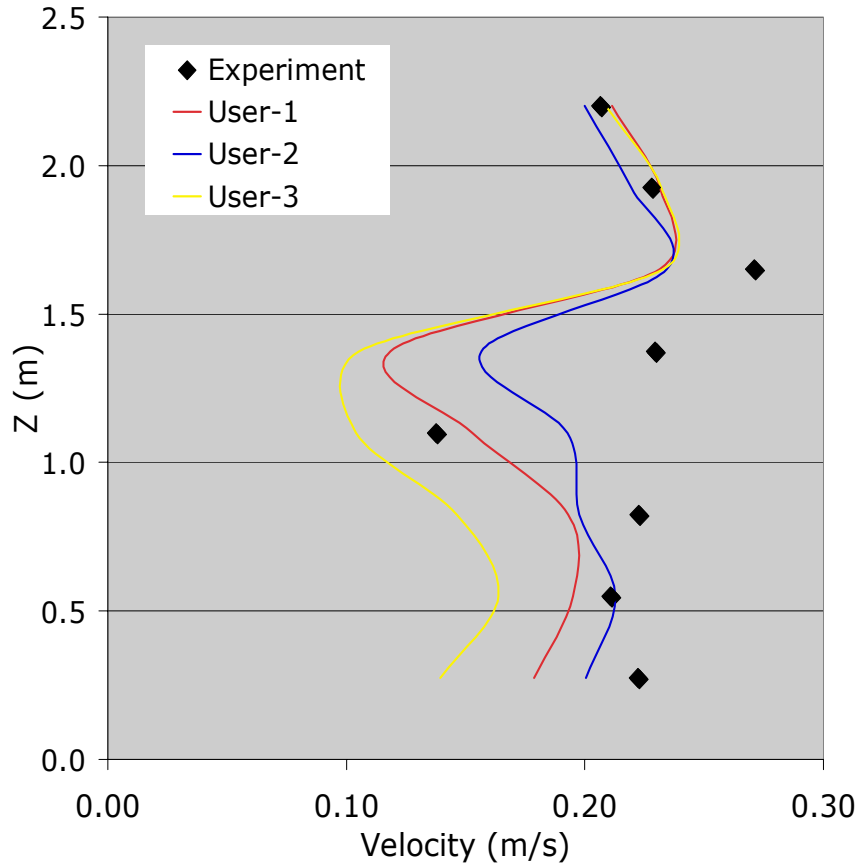


Adjusted Wind Profile x=2.19

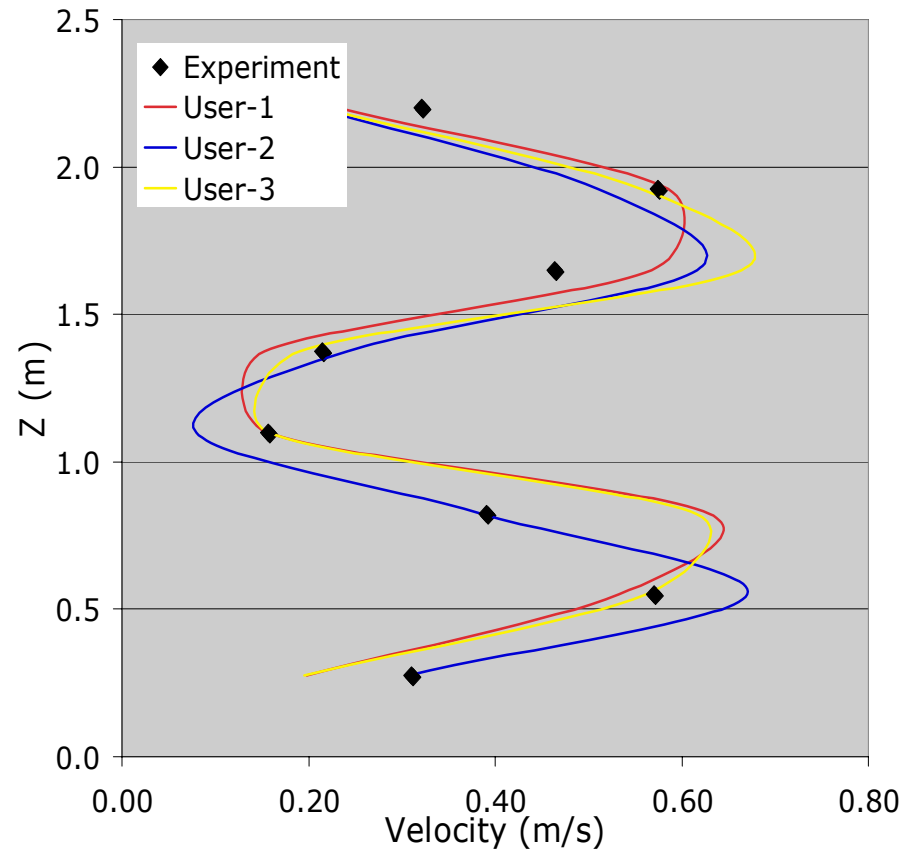


CFD User Comparison: Phoenics+KERNG+MediumGrid

KERNG Comparison at Y=0.6 and X=1.69

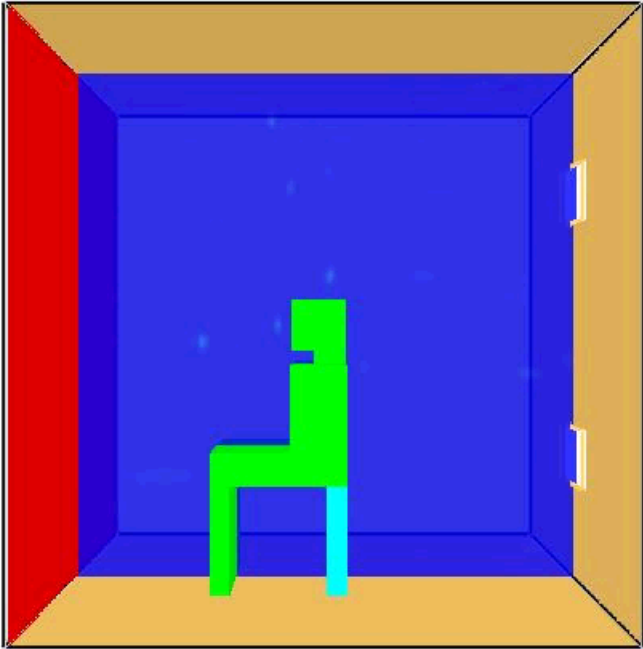


KERNG Comparison at Y=0.6 and X=2.19



Large Eddy Simulation:

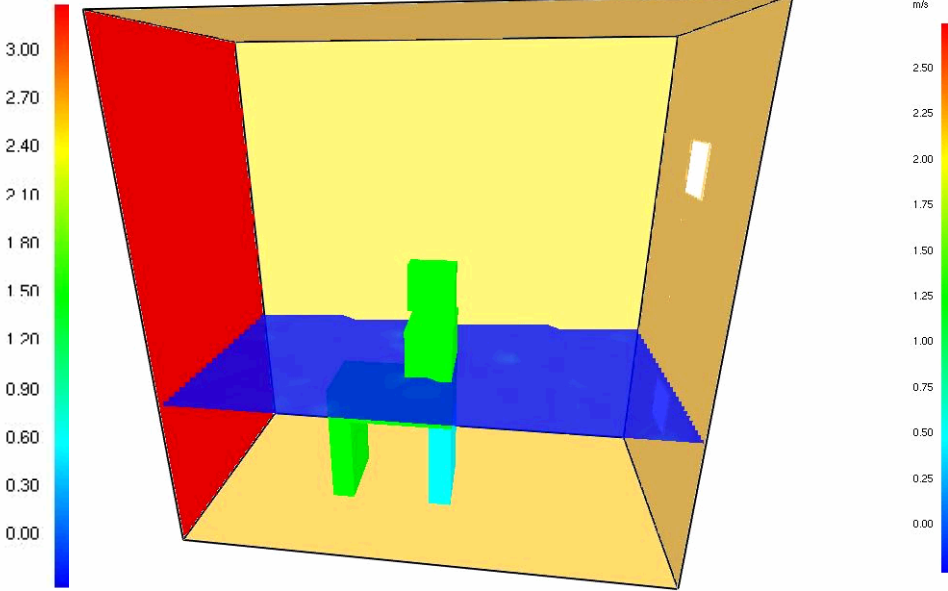
Smokeview 4.01 Aug 24 2004



Frame: 0
Time: 0.0

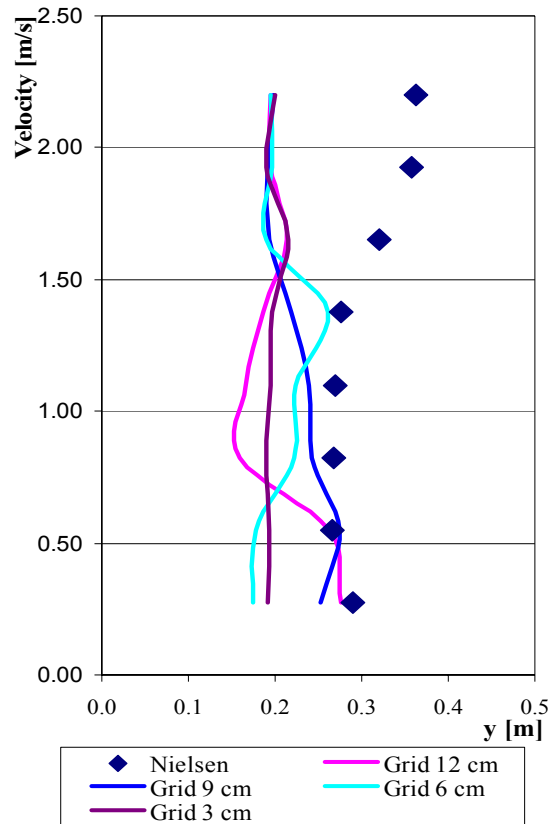


Slice
vel
m/s
Smokeview 4.01 - Aug 24 2004

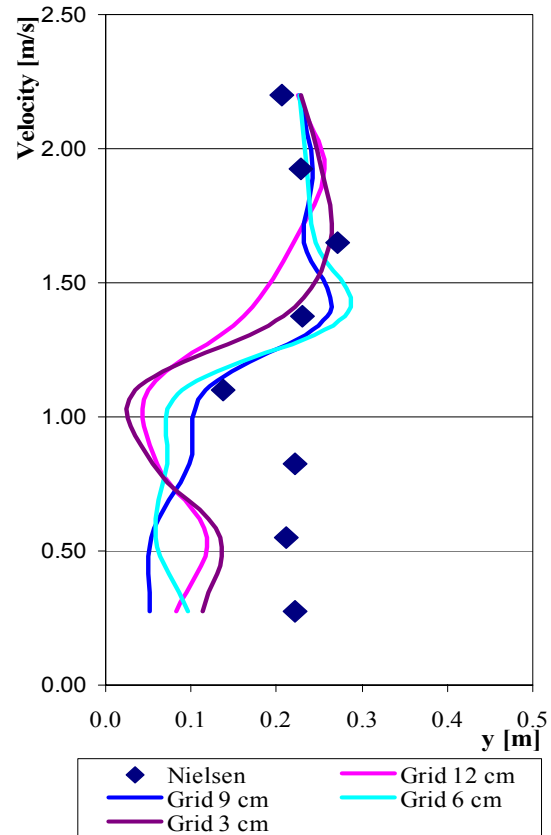


Large Eddy Simulation: No Significant Improvement

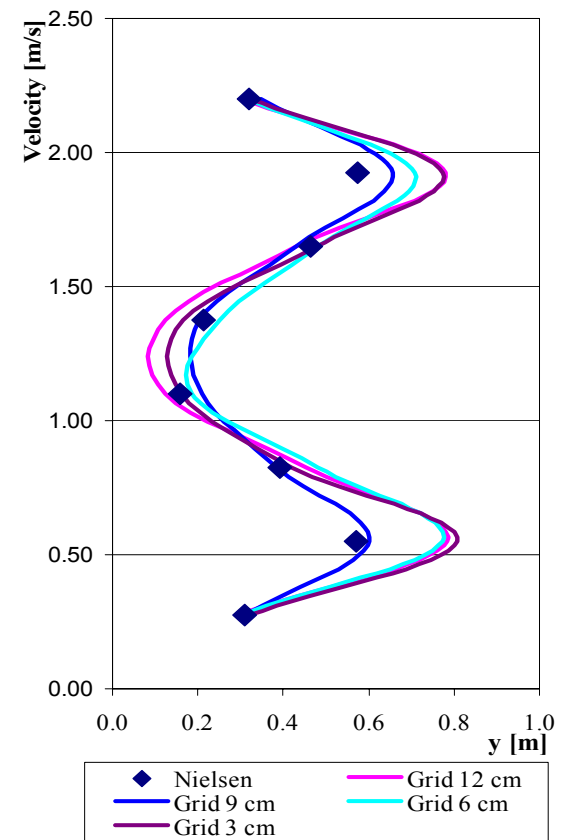
Vertical Velocity Values ($x = 0.19$ m); ($z = 0.0$ m)



Vertical Velocity Values ($x = 1.69$ m); ($z = 0.0$ m)



Vertical Velocity Values ($x = 2.19$ m); ($z = 0.0$ m)



What is the CFD modeling accuracy that

We can achieve ?

We can believe ?

and

We need for practice ?