Prof. Emilio Cafaro GRF-DENER-C
Dipartimento di Energetica Politecnico di Torino

Quantificare la Sicurezza:

La modellazione degli eventi pericolosi

tra

Fire Engineering & Fire Investigation

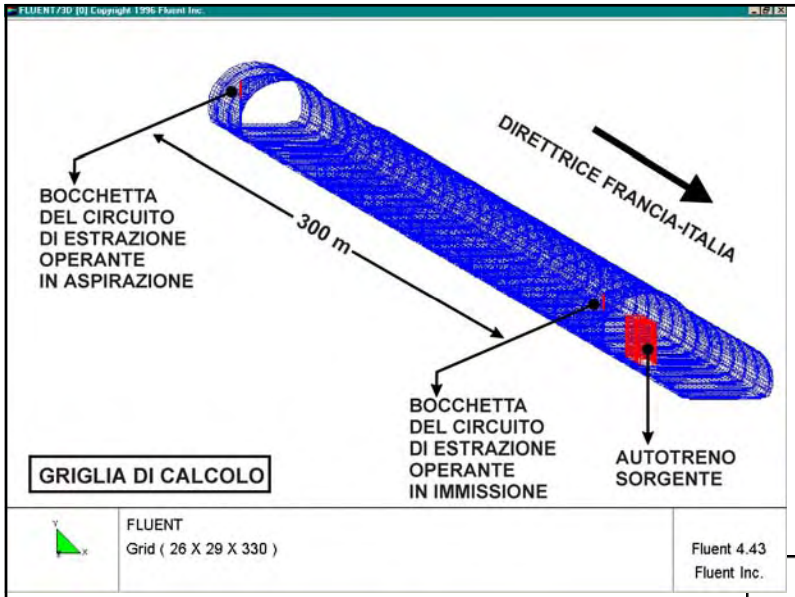
Parte V –
Diapositive dal n. 136 al n. 157

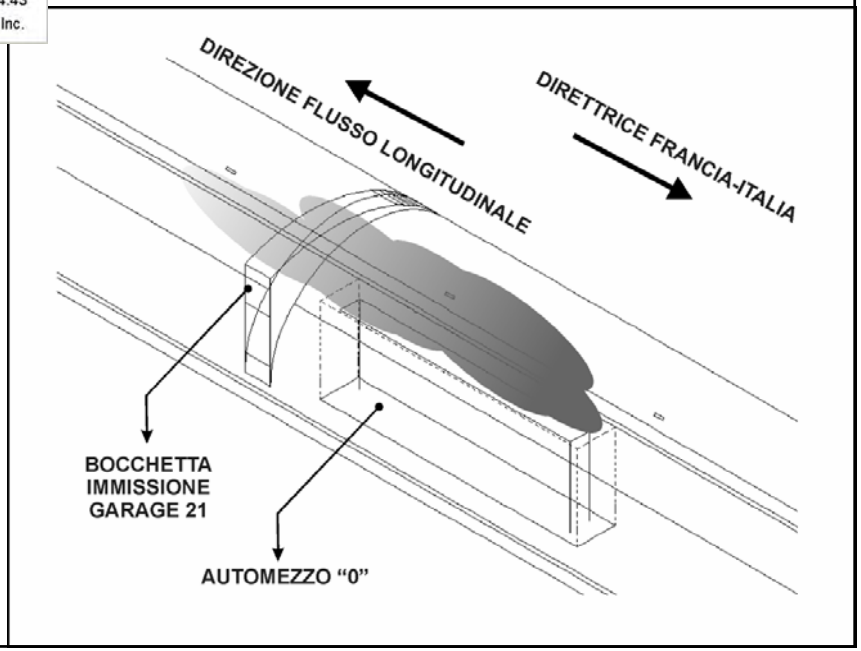
Galleria Stradale

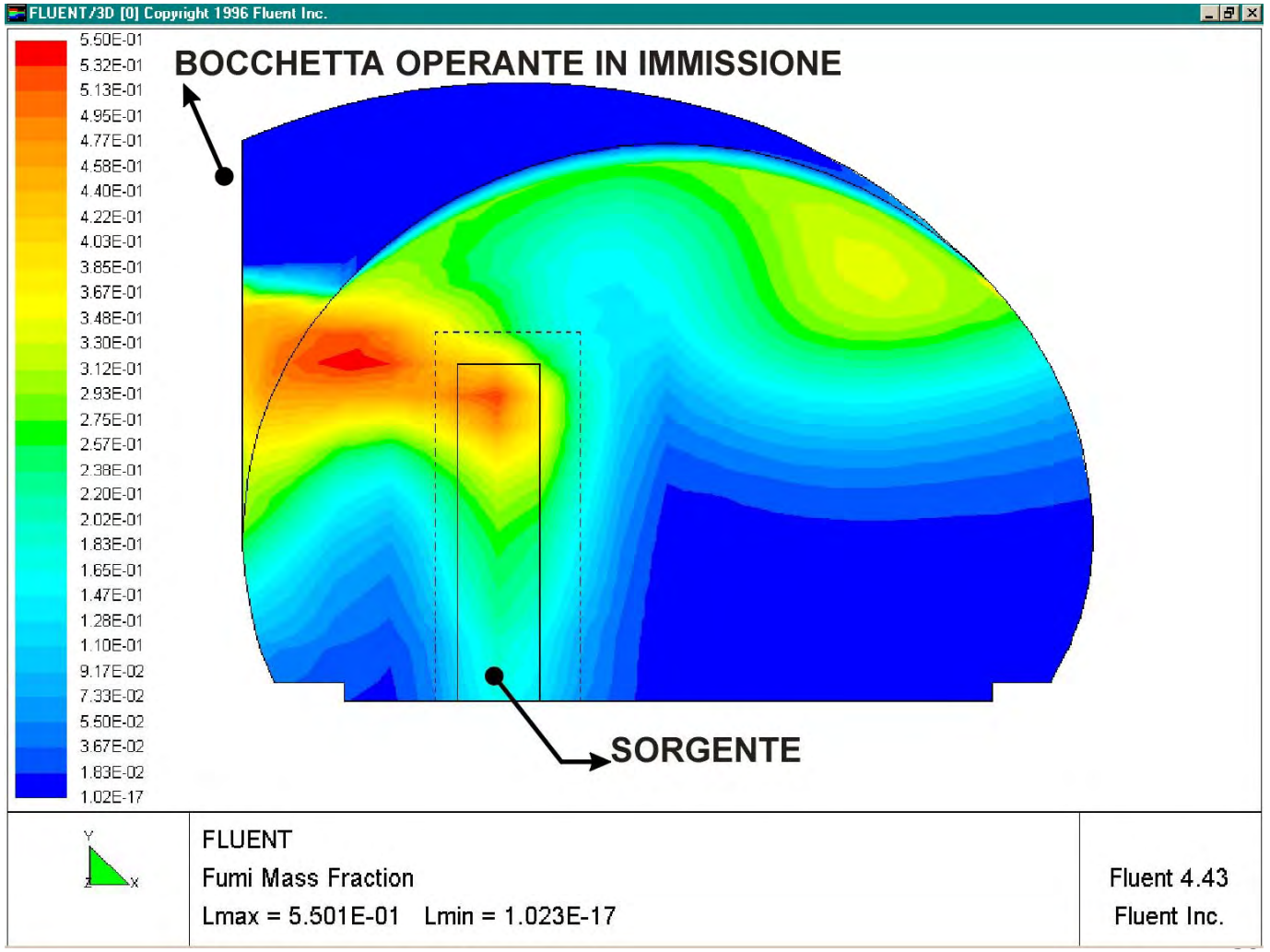
Condizioni di simulazione:

- **sistema di ventilazione trasversale**
- porzione galleria simulata: 500 m
- potenza termica generata: 100 MW
- portata di fumi generati: 250 m^3/s

Evento di incendio Monte Bianco


DIRETTRICE FRANCIA-ITALIA
BOCCHETTA DEL CIRCUITO DI ESTRAZIONE OPERANTE IN ASPIRAZIONE
300 m
BOCCHETTA DEL CIRCUITO DI ESTRAZIONE OPERANTE IN IMMISSIONE
AUTOTRENO SORGENTE
GRIGLIA DI CALCOLO
FLUENT
Grid (26 X 29 X 330)
Fluent 4.43
Fluent Inc.


DIREZIONE FLUSSO LONGITUDINALE
DIRETTRICE FRANCIA-ITALIA
BOCCHETTA IMMISSIONE GARAGE 21
AUTOMEZZO "0"


FLUENT/3D [0] Copyright 1996 Fluent Inc.
5.50E-01
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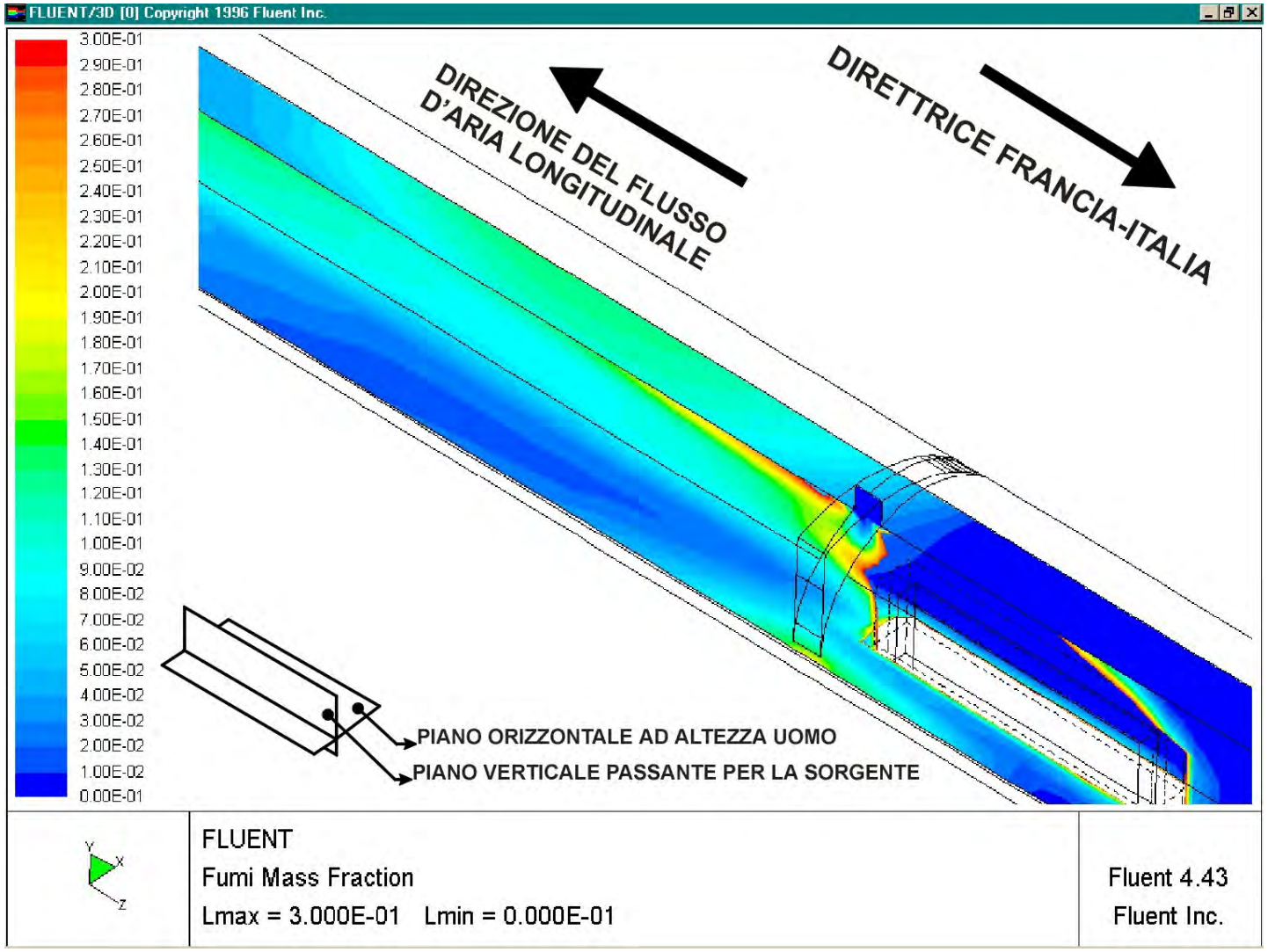
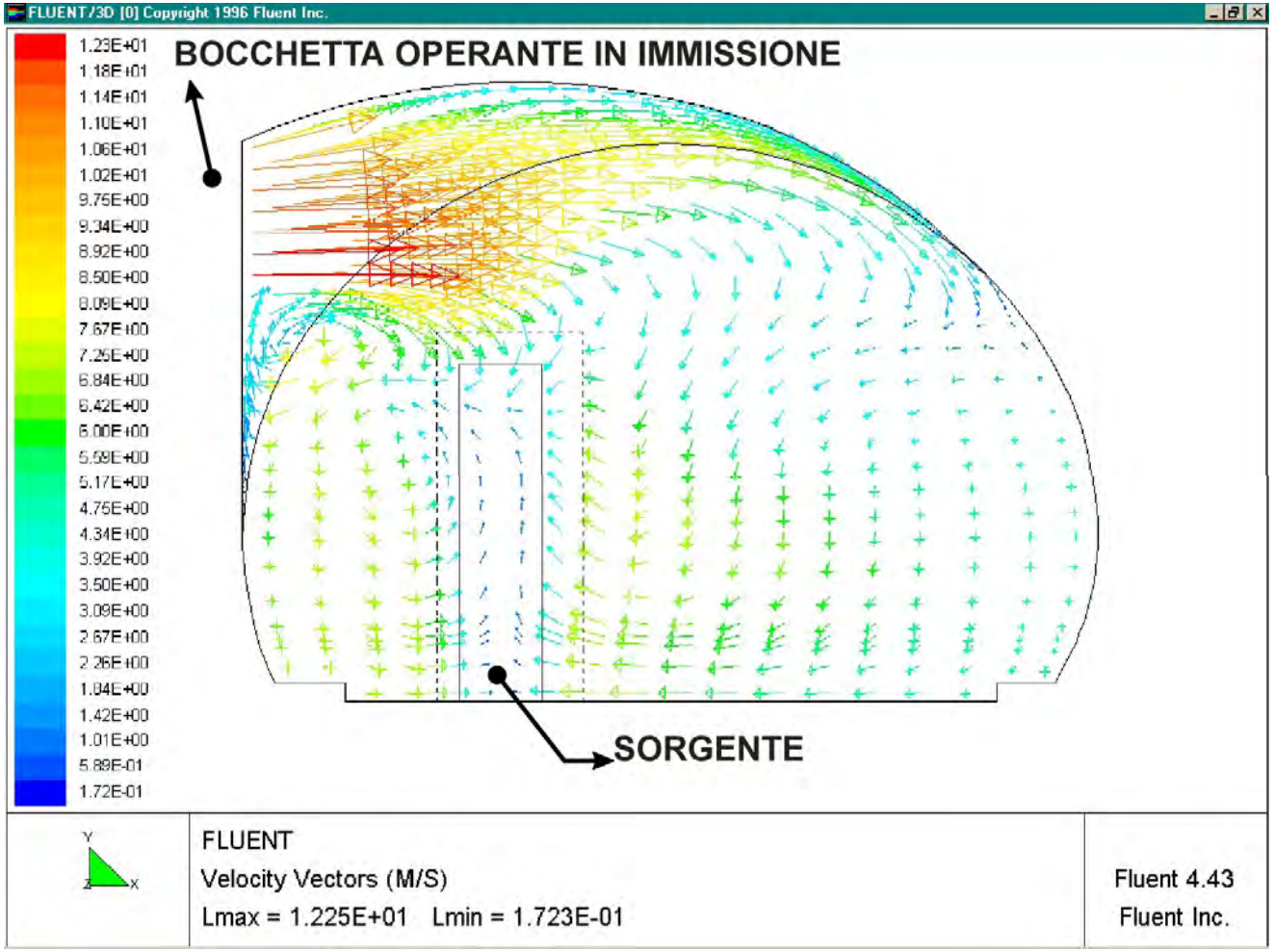
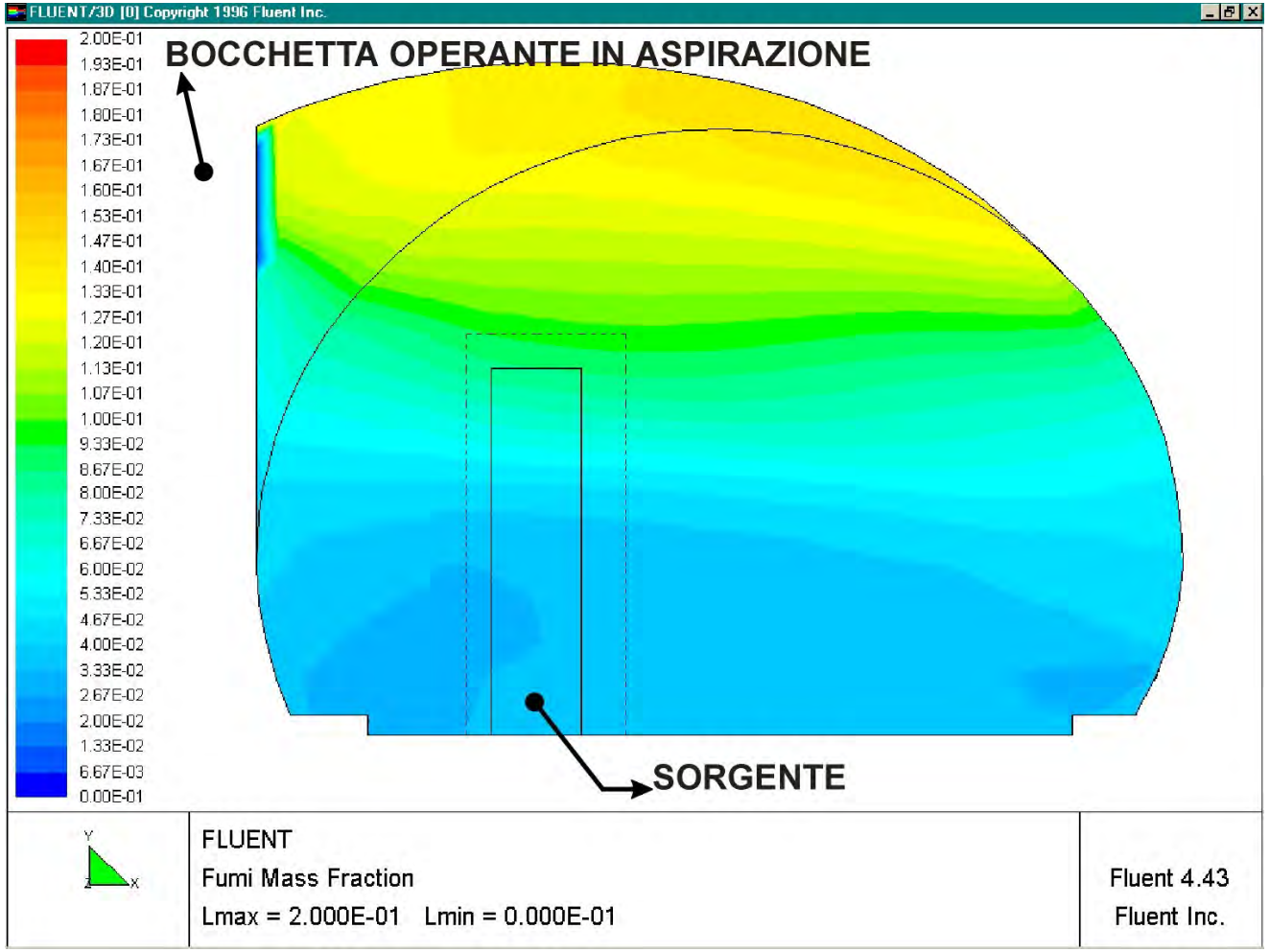
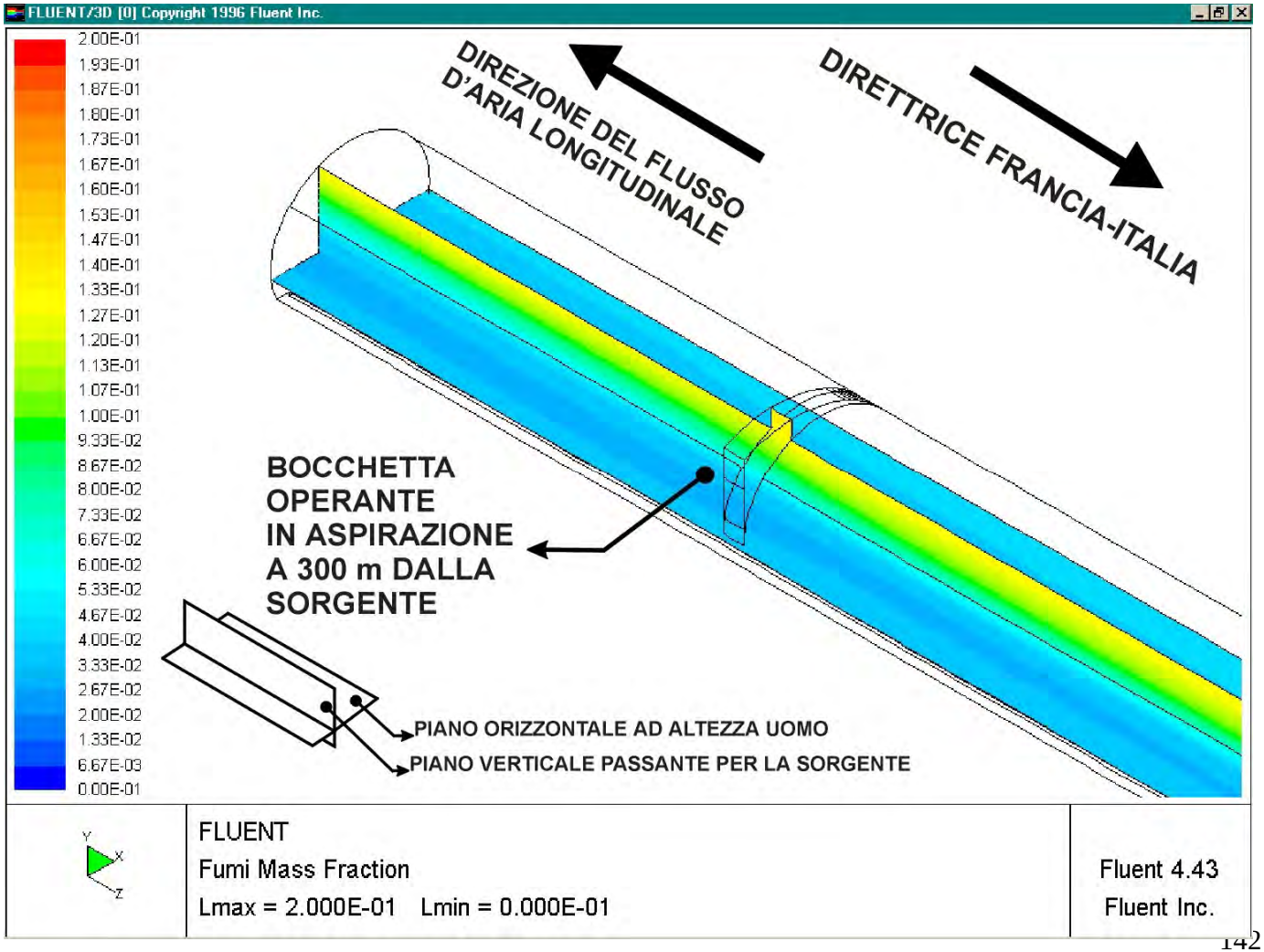
4.77E-01
4.58E-01
4.40E-01
4.22E-01
4.03E-01
3.85E-01
3.67E-01
3.48E-01
3.30E-01
3.12E-01
2.93E-01
2.75E-01
2.57E-01
2.38E-01
2.20E-01
2.02E-01
1.83E-01
1.65E-01
1.47E-01
1.28E-01
1.10E-01
9.17E-02
7.33E-02
5.50E-02
3.67E-02
1.83E-02
1.02E-17
BOCCHETTA OPERANTE IN IMMISSIONE
SORGENTE
Y
X
FLUENT
Fumi Mass Fraction
Lmax = 5.501E-01 Lmin = 1.023E-17
Fluent 4.43
Fluent Inc.


FLUENT/3D [0] Copyright 1996 Fluent Inc.
3.00E-01
2.90E-01
2.80E-01
2.70E-01
2.60E-01
2.50E-01
2.40E-01
2.30E-01
2.20E-01
2.10E-01
2.00E-01
1.90E-01
1.80E-01
1.70E-01
1.60E-01
1.50E-01
1.40E-01
1.30E-01
1.20E-01
1.10E-01
1.00E-01
9.00E-02
8.00E-02
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E-01
DIREZIONE DEL FLUSSO D'ARIA LONGITUDINALE
DIRETTRICE FRANCIA-ITALIA
PIANO ORIZZONTALE AD ALTEZZA UOMO
PIANO VERTICALE PASSANTE PER LA SORGENTE
Y
X
Z
FLUENT
Fumi Mass Fraction
Lmax = 3.000E-01 Lmin = 0.000E-01
Fluent 4.43
Fluent Inc.


FLUENT/3D [0] Copyright 1996 Fluent Inc.
BOCCHETTA OPERANTE IN IMMISSIONE
1.23E+01
1.18E+01
1.14E+01
1.10E+01
1.06E+01
1.02E+01
9.75E+00
9.34E+00
8.92E+00
8.50E+00
8.09E+00
7.67E+00
7.25E+00
6.84E+00
6.42E+00
6.00E+00
5.59E+00
5.17E+00
4.75E+00
4.34E+00
3.92E+00
3.50E+00
3.09E+00
2.67E+00
2.26E+00
1.84E+00
1.42E+00
1.01E+00
5.89E-01
1.72E-01
SORGENTE
Y
X
FLUENT
Velocity Vectors (M/S)
Lmax = 1.225E+01 Lmin = 1.723E-01
Fluent 4.43
Fluent Inc.


FLUENT/3D [0] Copyright 1996 Fluent Inc.
BOCCHETTA OPERANTE IN ASPIRAZIONE
SORGENTE
2.00E-01
1.93E-01
1.87E-01
1.80E-01
1.73E-01
1.67E-01
1.60E-01
1.53E-01
1.47E-01
1.40E-01
1.33E-01
1.27E-01
1.20E-01
1.13E-01
1.07E-01
1.00E-01
9.33E-02
8.67E-02
8.00E-02
7.33E-02
6.67E-02
6.00E-02
5.33E-02
4.67E-02
4.00E-02
3.33E-02
2.67E-02
2.00E-02
1.33E-02
6.67E-03
0.00E-01
FLUENT
Fumi Mass Fraction
Lmax = 2.000E-01 Lmin = 0.000E-01
Fluent 4.43
Fluent Inc.


FLUENT/3D [0] Copyright 1996 Fluent Inc.
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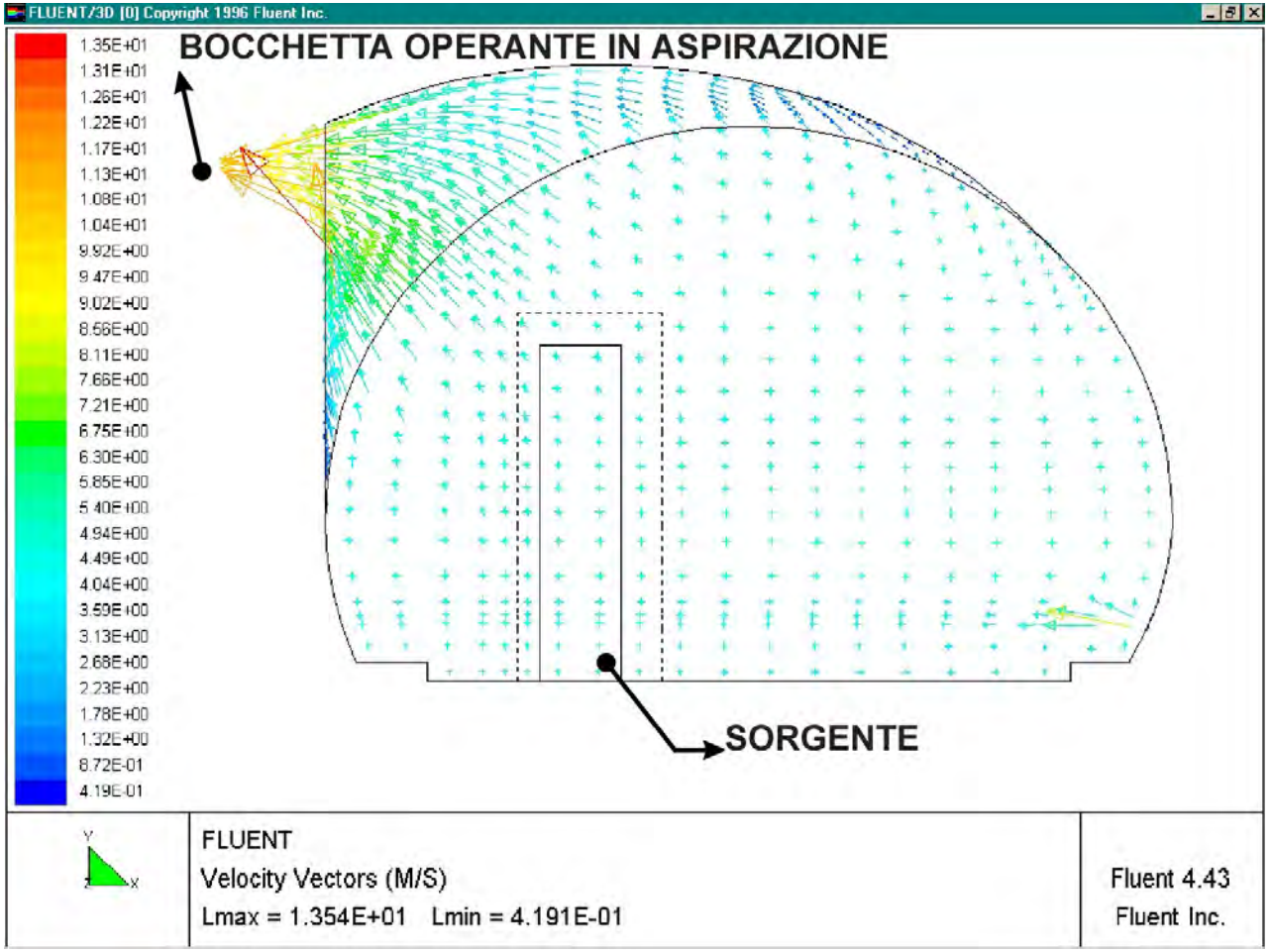
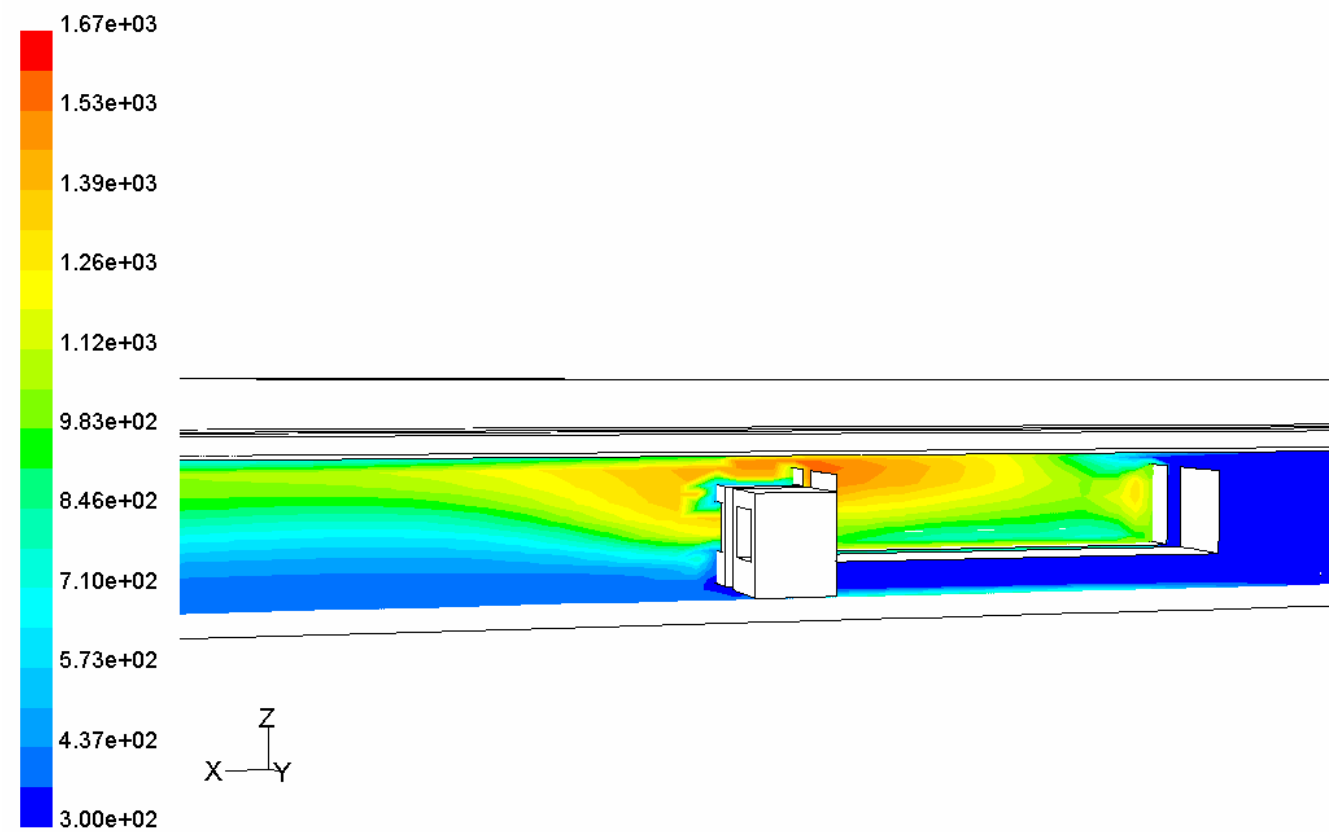
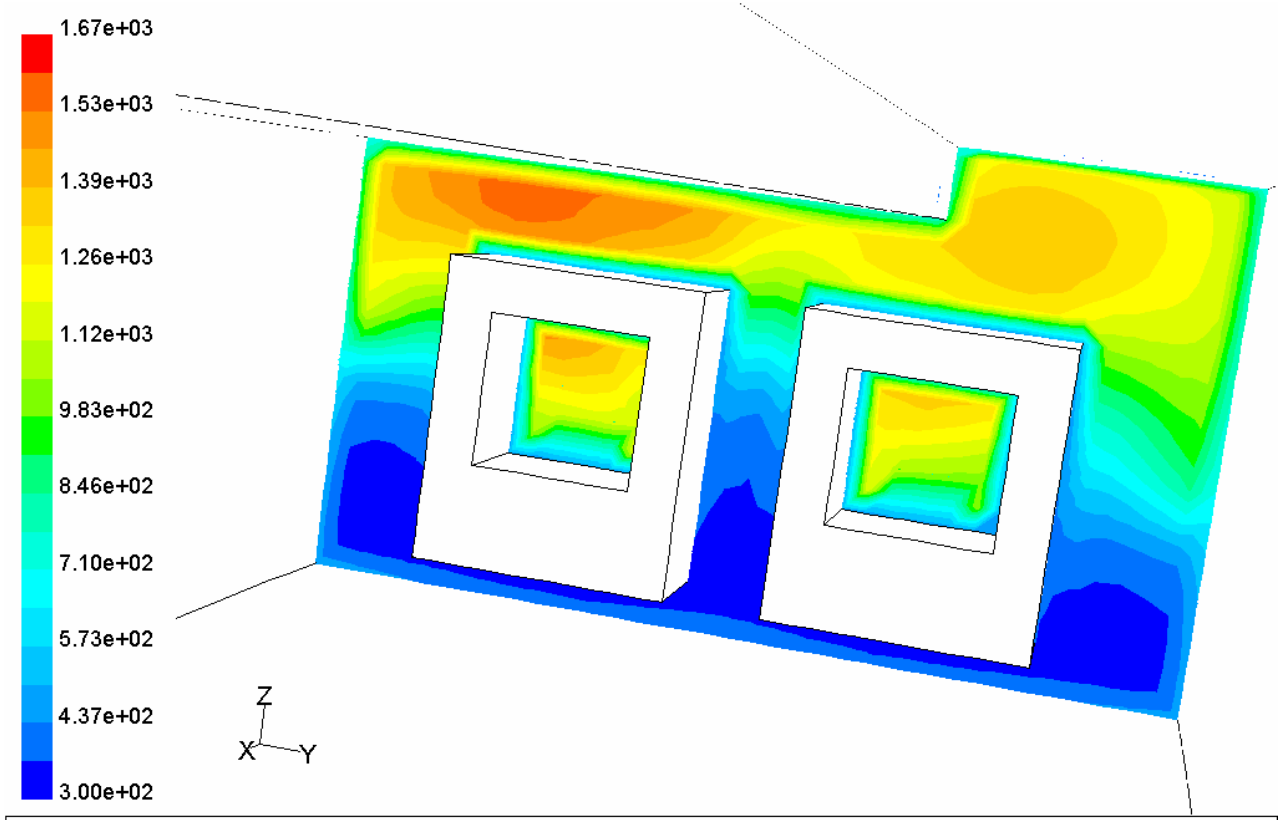
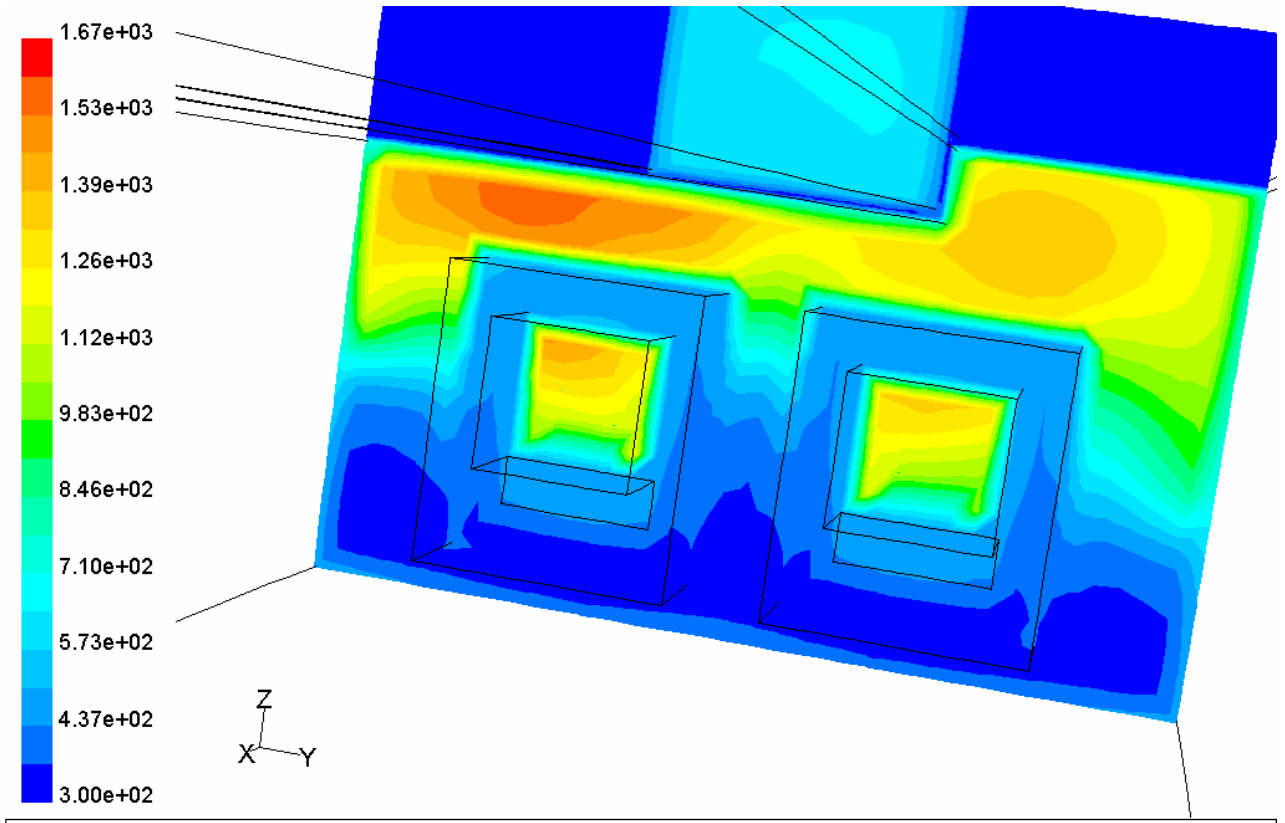
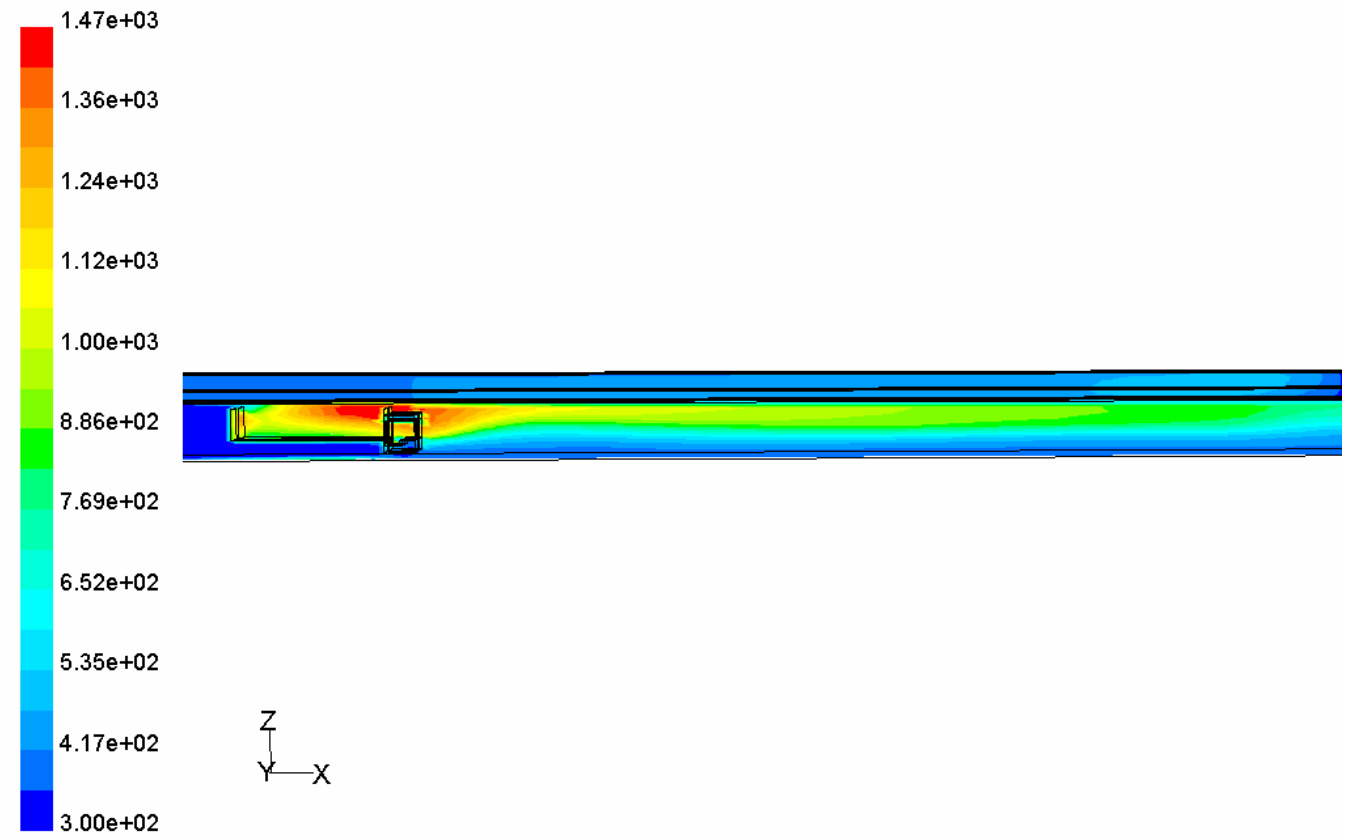
1.80E-01
1.73E-01
1.67E-01
1.60E-01
1.53E-01
1.47E-01
1.40E-01
1.33E-01
1.27E-01
1.20E-01
1.13E-01
1.07E-01
1.00E-01
9.33E-02
8.67E-02
8.00E-02
7.33E-02
6.67E-02
6.00E-02
5.33E-02
4.67E-02
4.00E-02
3.33E-02
2.67E-02
2.00E-02
1.33E-02
6.67E-03
0.00E-01
DIREZIONE DEL FLUSSO D'ARIA LONGITUDINALE
DIRETTRICE FRANCIA-ITALIA
BOCCHETTA OPERANTE IN ASPIRAZIONE A 300 m DALLA SORGENTE
PIANO ORIZZONTALE AD ALTEZZA UOMO
PIANO VERTICALE PASSANTE PER LA SORGENTE
FLUENT
Fumi Mass Fraction
Lmax = 2.000E-01 Lmin = 0.000E-01
Fluent 4.43
Fluent Inc.

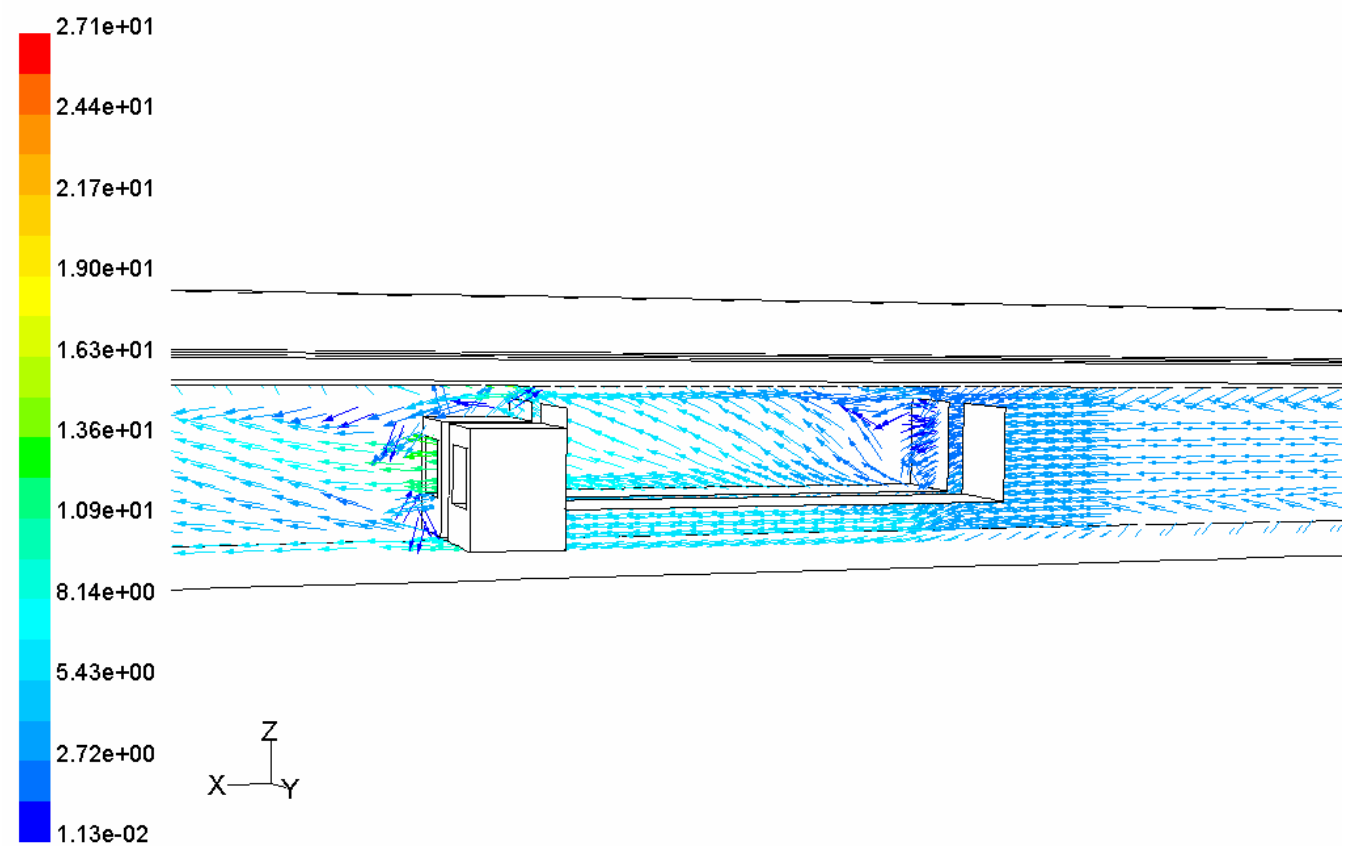

FLUENT/3D [0] Copyright 1996 Fluent Inc.
BOCCHETTA OPERANTE IN ASPIRAZIONE
1.35E+01
1.31E+01
1.26E+01
1.22E+01
1.17E+01
1.13E+01
1.08E+01
1.04E+01
9.92E+00
9.47E+00
9.02E+00
8.56E+00
8.11E+00
7.66E+00
7.21E+00
6.75E+00
6.30E+00
5.85E+00
5.40E+00
4.94E+00
4.49E+00
4.04E+00
3.59E+00
3.13E+00
2.68E+00
2.23E+00
1.78E+00
1.32E+00
8.72E-01
4.19E-01
SORGENTE
FLUENT
Velocity Vectors (M/S)
Lmax = 1.354E+01 Lmin = 4.191E-01
Fluent 4.43
Fluent Inc.


1.67e+03
1.53e+03
1.39e+03
1.26e+03
1.12e+03
9.83e+02
8.46e+02
7.10e+02
5.73e+02
4.37e+02
3.00e+02
Z
X
Y
Contours of Static Temperature (k) (Time=1.8000e+03)
Mar 17, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)

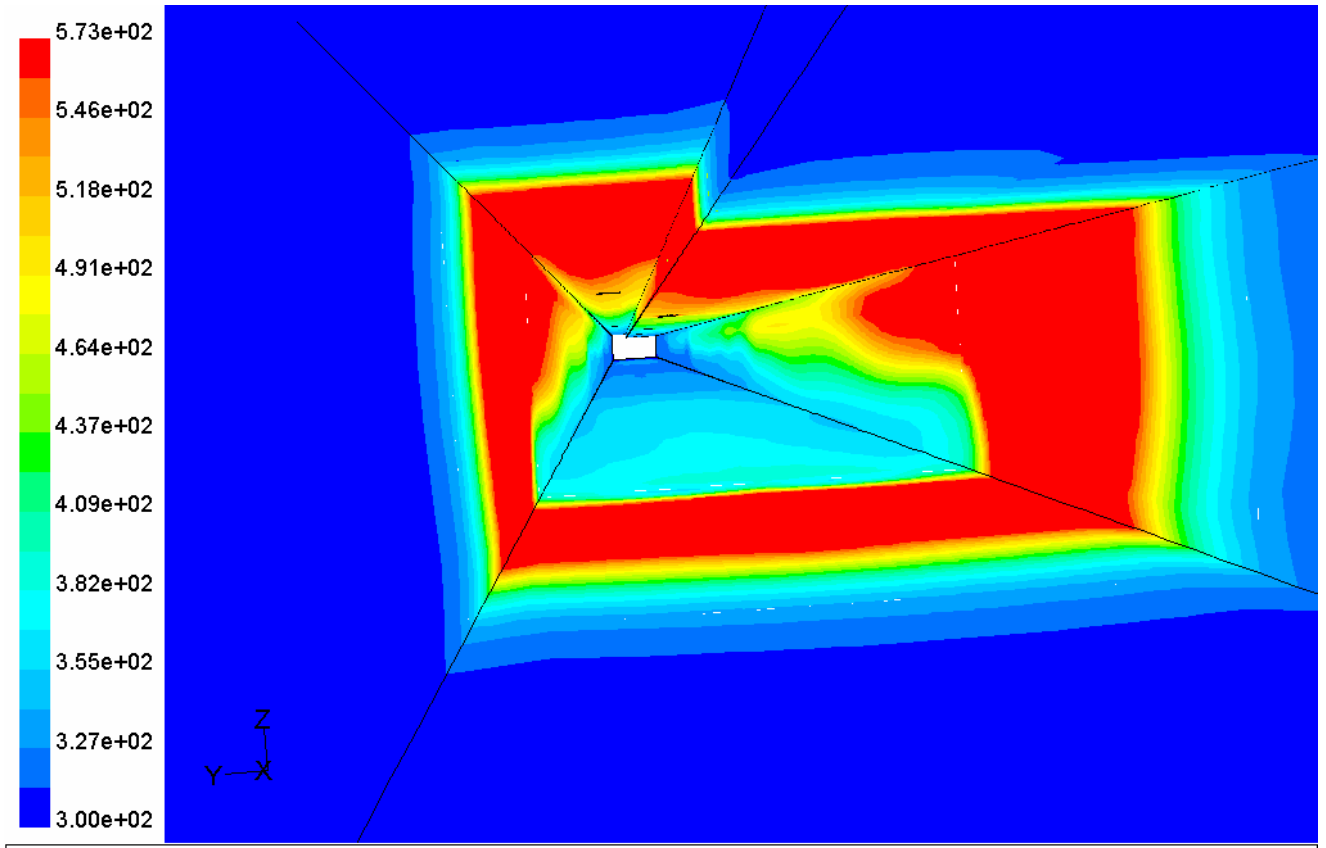

1.67e+03
1.53e+03
1.39e+03
1.26e+03
1.12e+03
9.83e+02
8.46e+02
7.10e+02
5.73e+02
4.37e+02
3.00e+02
Z
X
Y
Contours of Static Temperature (k) (Time=1.8000e+03)
Mar 17, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)

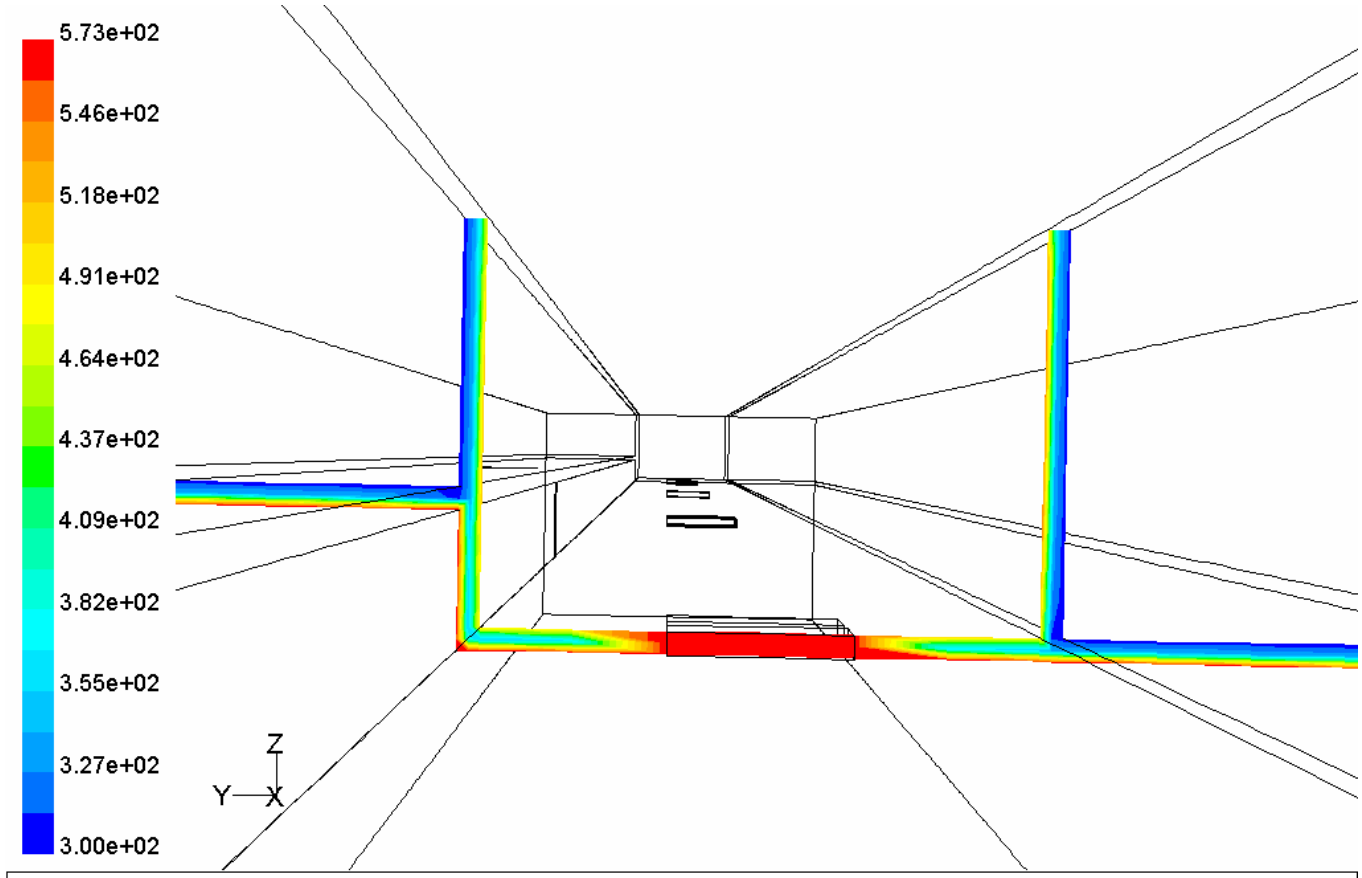

1.67e+03
1.53e+03
1.39e+03
1.26e+03
1.12e+03
9.83e+02
8.46e+02
7.10e+02
5.73e+02
4.37e+02
3.00e+02
Z
X
Y
Contours of Static Temperature (k) (Time=1.8000e+03)
Mar 17, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)

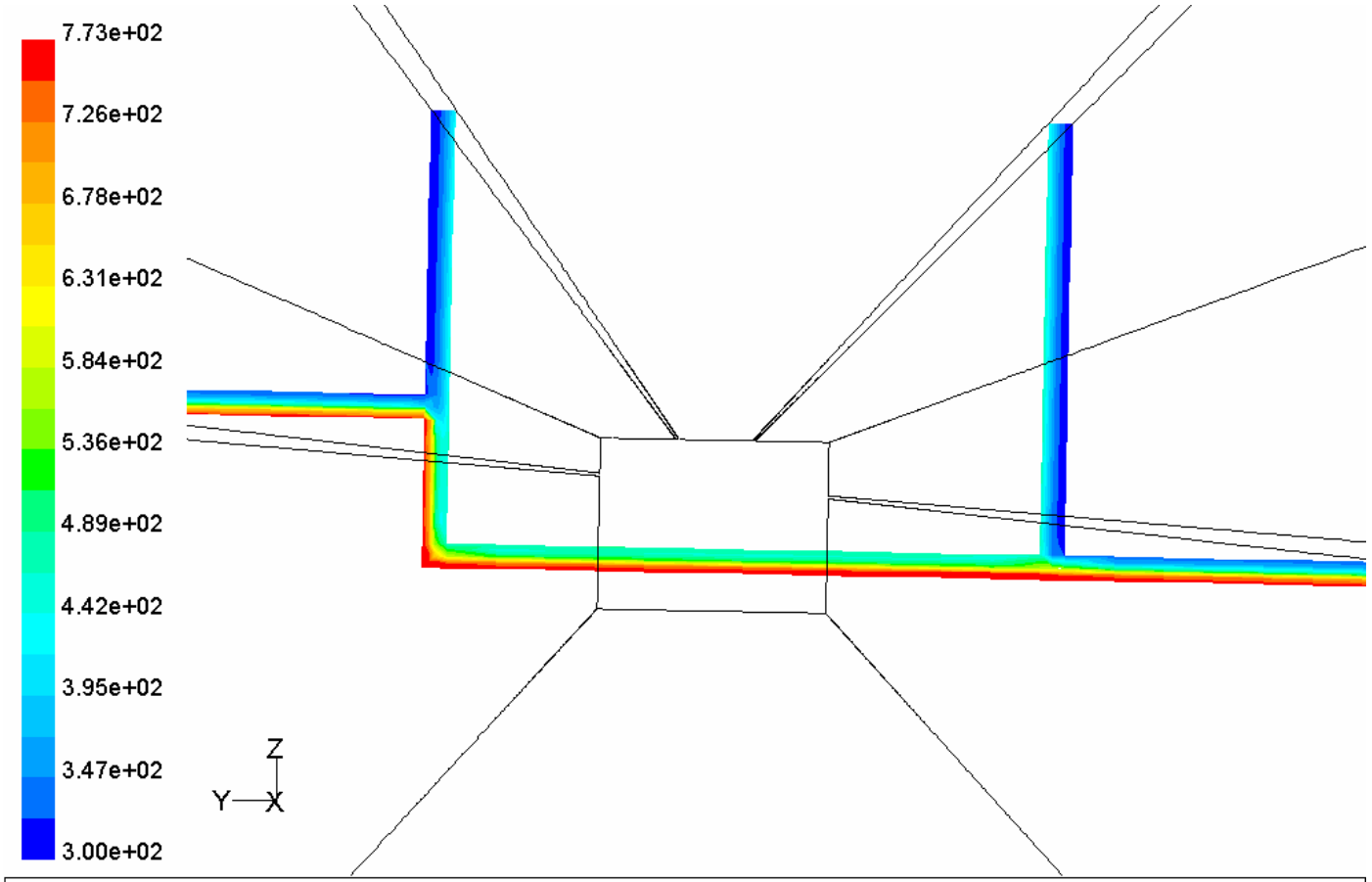

1.47e+03
1.36e+03
1.24e+03
1.12e+03
1.00e+03
8.86e+02
7.69e+02
6.52e+02
5.35e+02
4.17e+02
3.00e+02
Z
Y
X
Contours of Static Temperature (k) (Time=1.8000e+03)
Mar 17, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)



Velocity Vectors Colored By Velocity Magnitude (m/s) (Time=1.8000e+03) Mar 17, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)


5.73e+02
5.46e+02
5.18e+02
4.91e+02
4.64e+02
4.37e+02
4.09e+02
3.82e+02
3.55e+02
3.27e+02
3.00e+02
Z
Y
X
Contours of Static Temperature (k) (Time=3.2000e+03)
Mar 18, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)


5.73e+02
5.46e+02
5.18e+02
4.91e+02
4.64e+02
4.37e+02
4.09e+02
3.82e+02
3.55e+02
3.27e+02
3.00e+02
Z
Y
X
Contours of Static Temperature (k) (Time=1.9200e+03)
Mar 25, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)

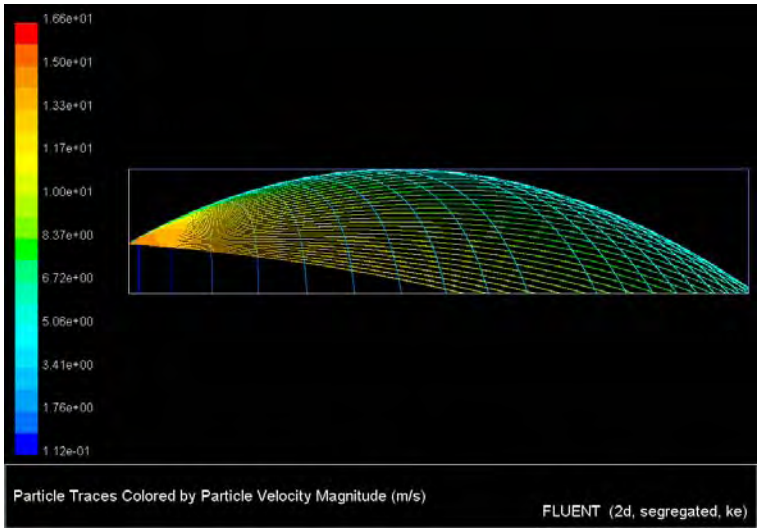

7.73e+02
7.26e+02
6.78e+02
6.31e+02
5.84e+02
5.36e+02
4.89e+02
4.42e+02
3.95e+02
3.47e+02
3.00e+02
Z
Y
X
Contours of Static Temperature (k) (Time=3.6000e+03)
Mar 25, 2002
FLUENT 5.3 (3d, segregated, spe2, ke, unsteady)

151

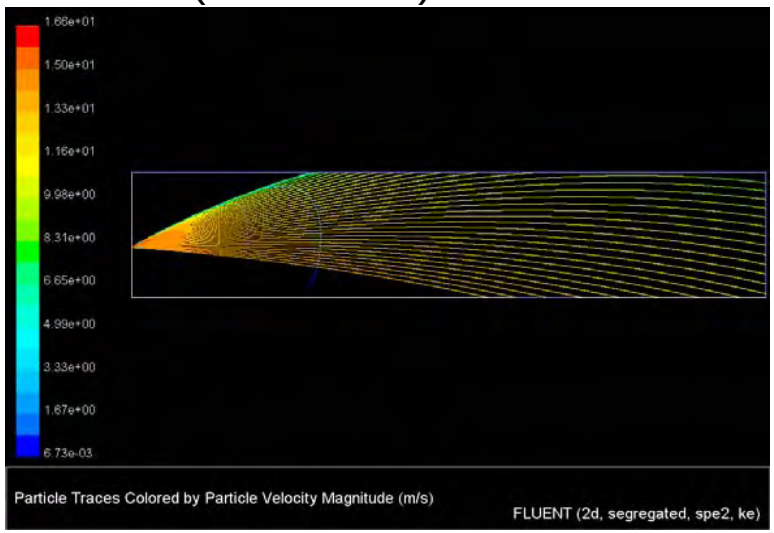
Simulazione sistemi di spegnimento

Modello di campo

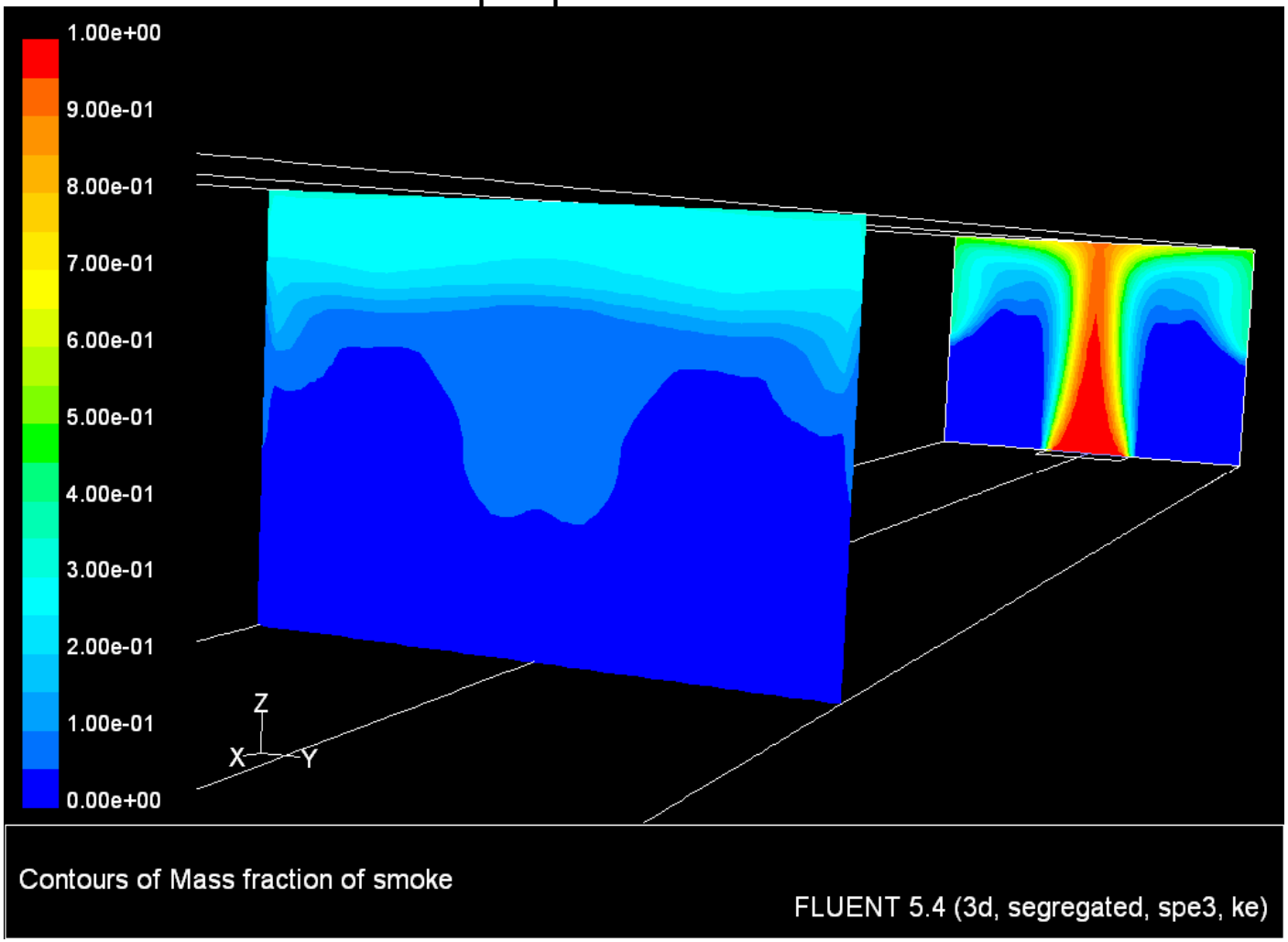
Traiettoria getto libero



Interazione getto –focolaio
(Tf = 800°C)

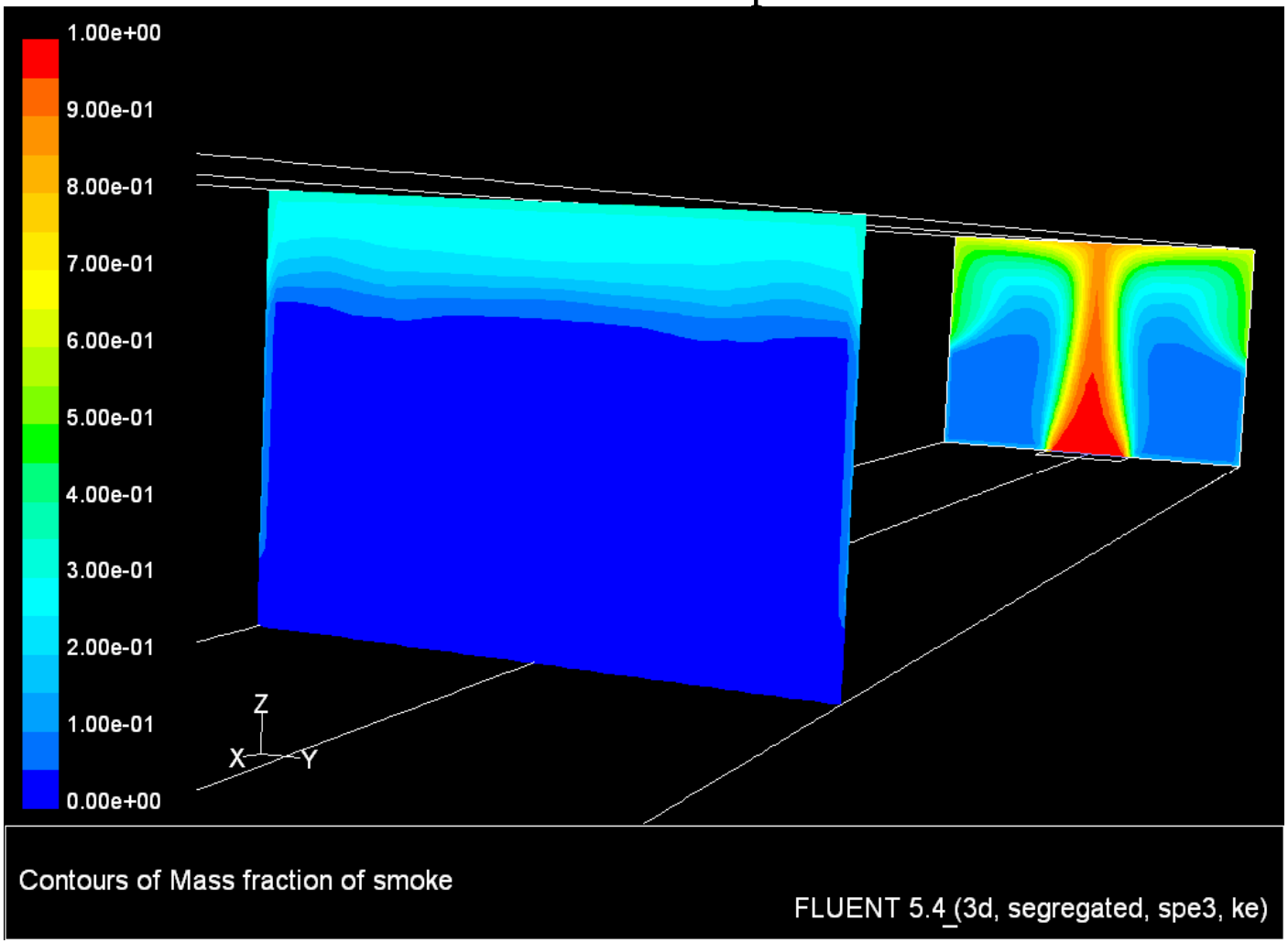


Modello di campo: potenza focolaio = 20 MW



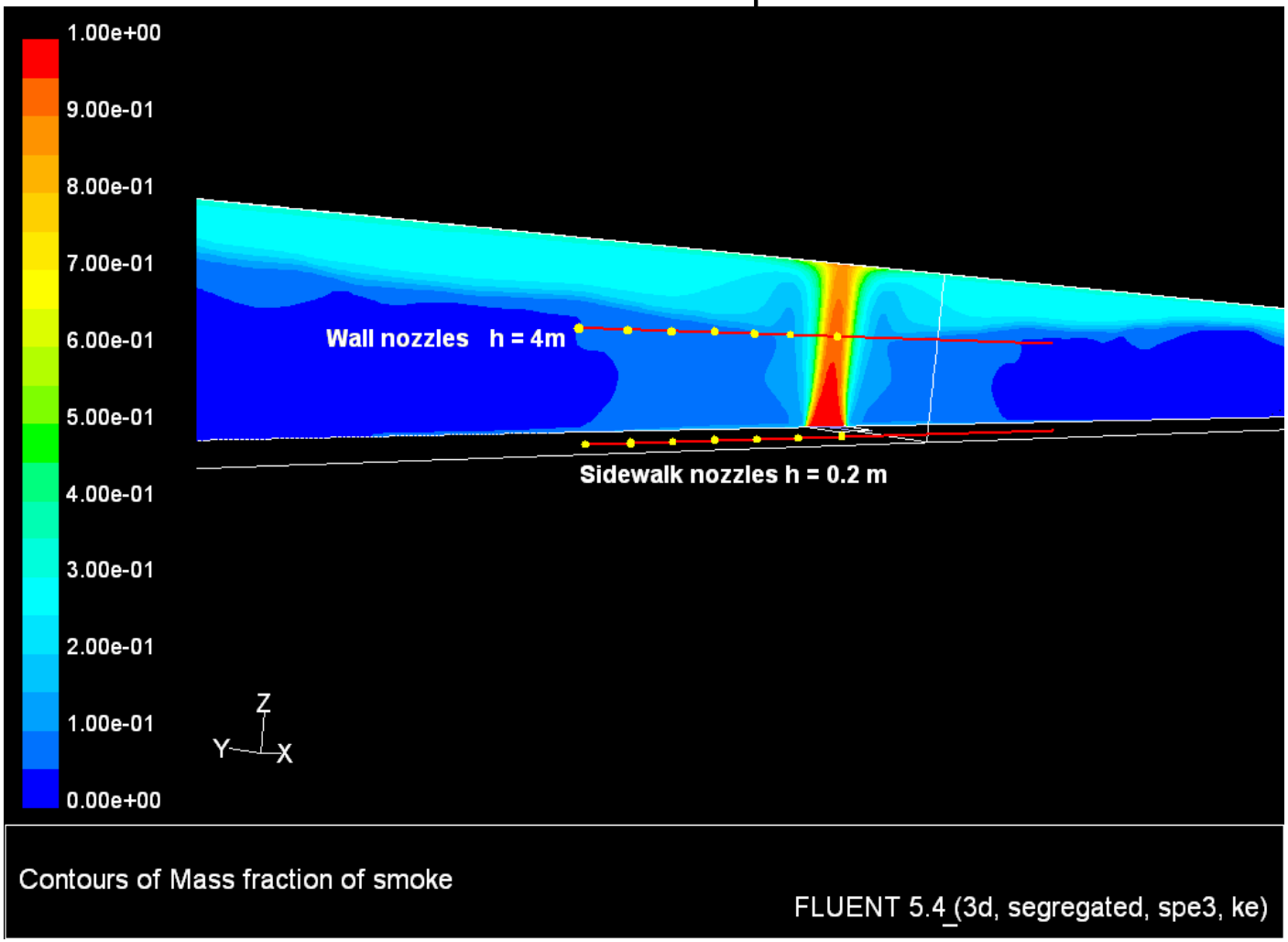
Frazione in massa dei fumi sistema attivato

Modello di campo



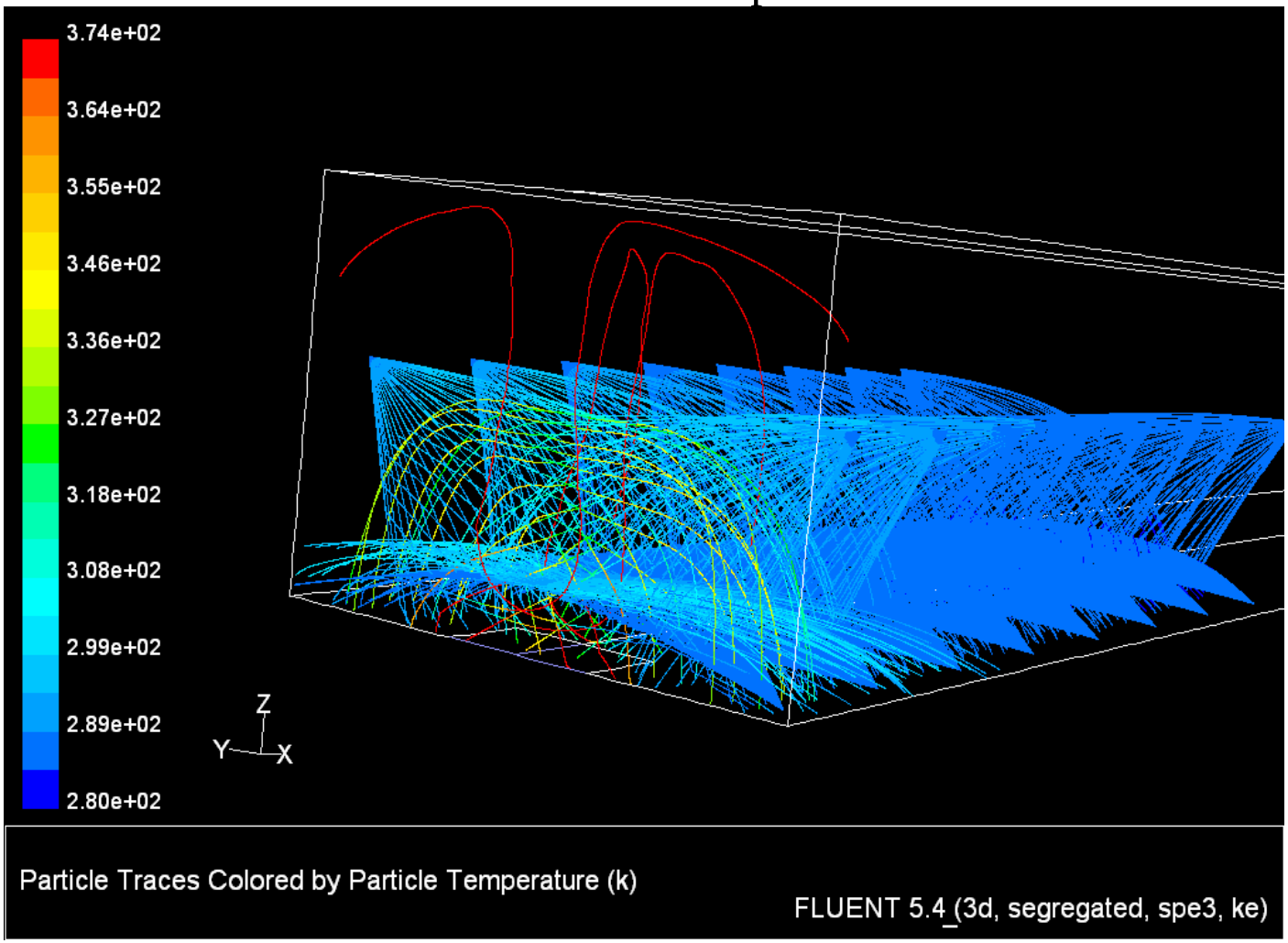
Frazione in massa dei fumi sistema non attivato

Modello di campo



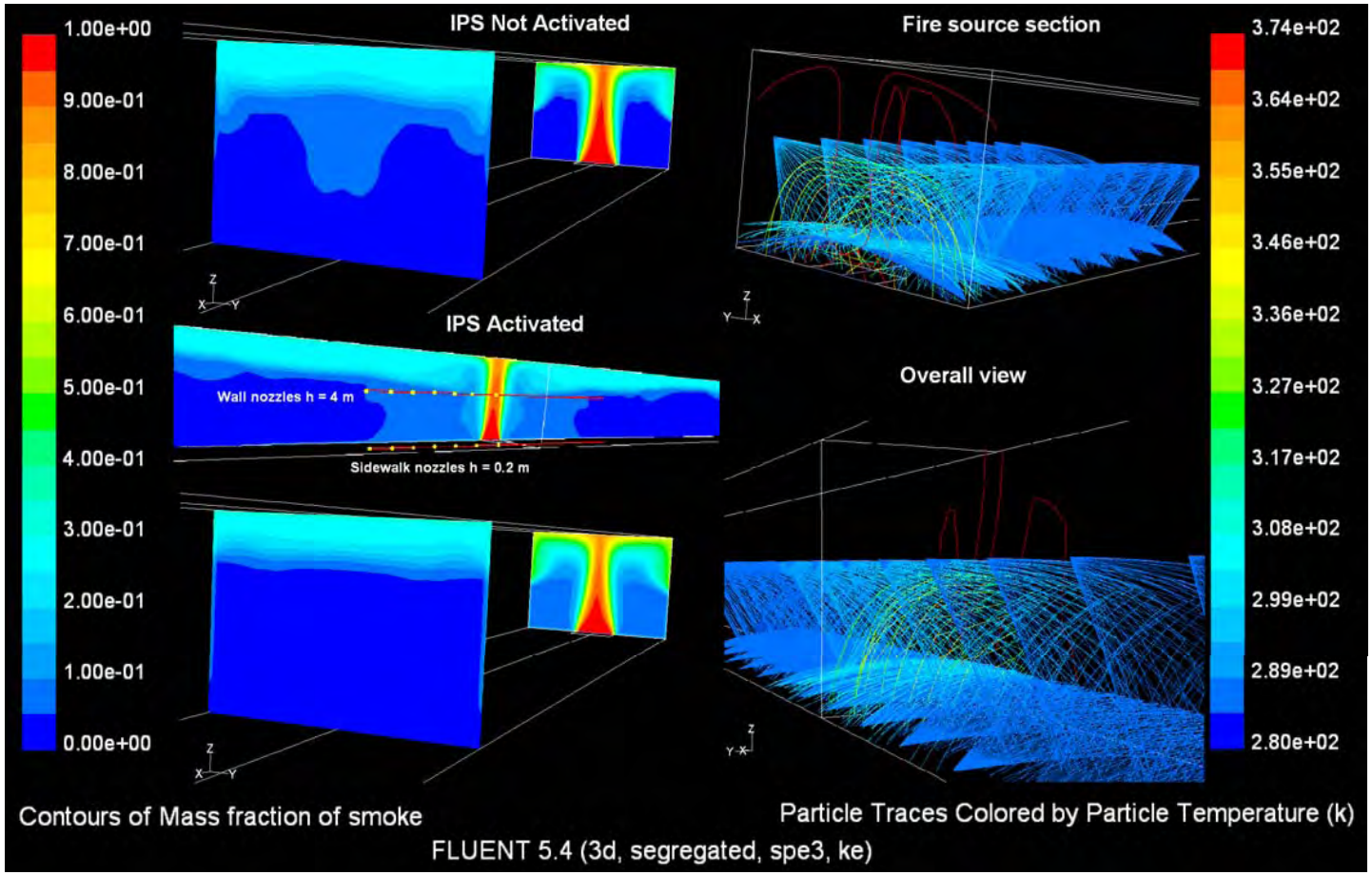
Frazione in massa dei fumi sistema attivato

Modello di campo



Traiettorie getti

Modello di campo



Sintesi interazione fumi-sistema di spegnimento