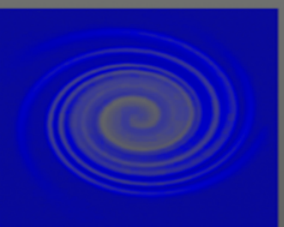
INTECOCIS Scientific Afternoon

13 Décembre 2013

Numerical Slot Burner

Emilien Courtine

Doctorant - IMFT

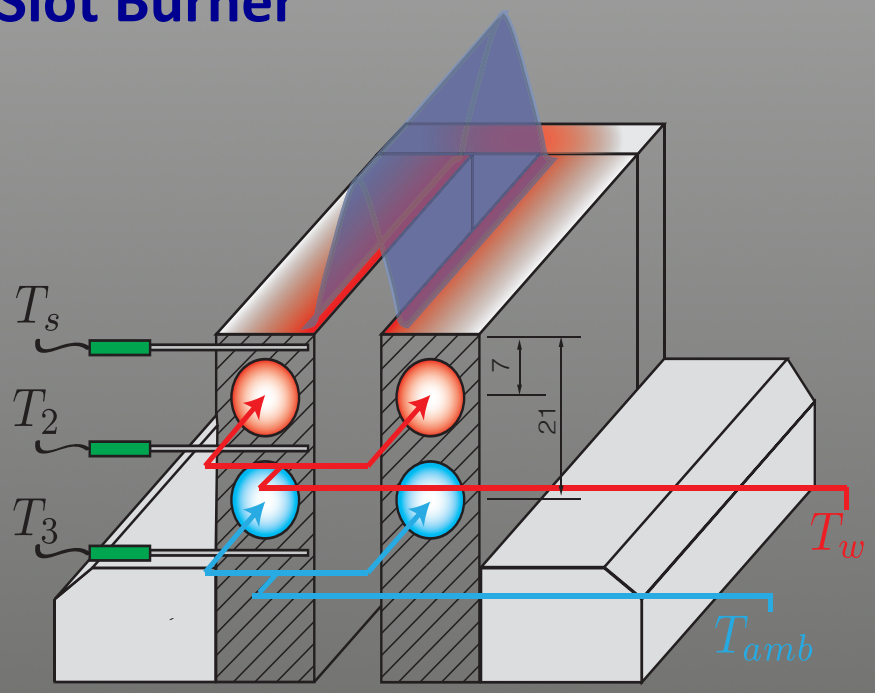


IMFT
INSTITUT DE MECANIQUE
DES FLUIDES DE TOULOUSE

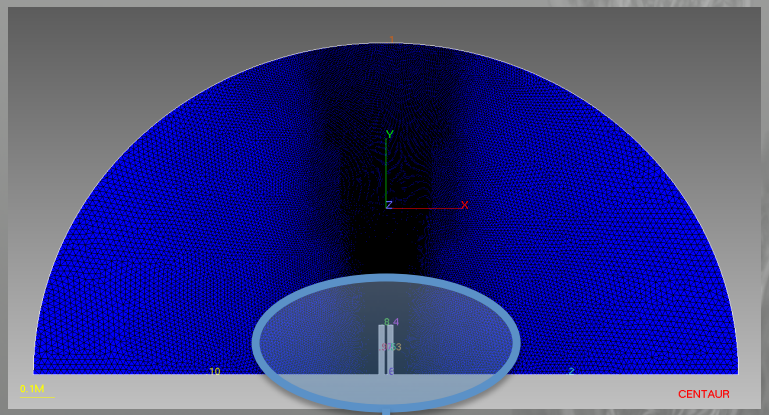
INTECOCIS
Introducing Exascale Computing in Combustion Instabilities Simulations

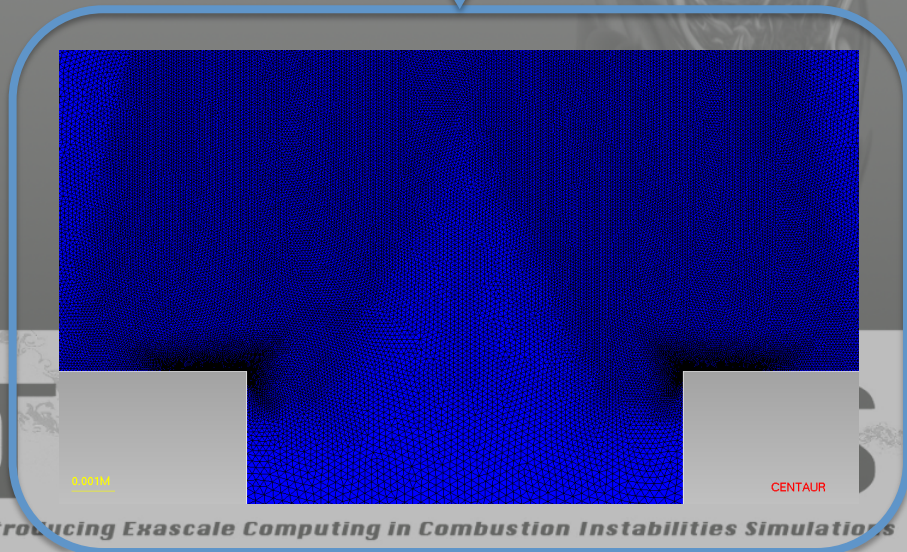
Slot Burner – Numerical Setup

Experimental Set up of the Slot Burner



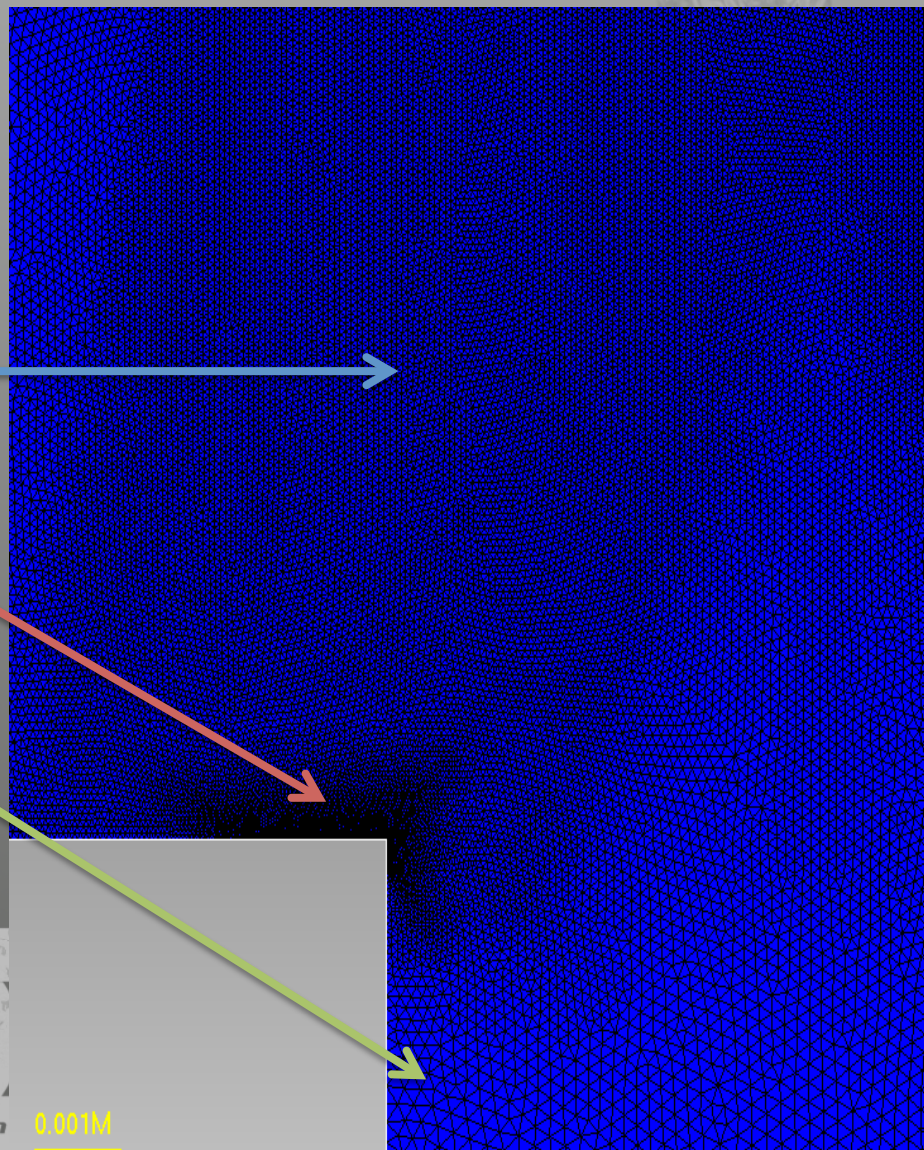
Numerical Mesh





Slot Burner – Numerical Setup

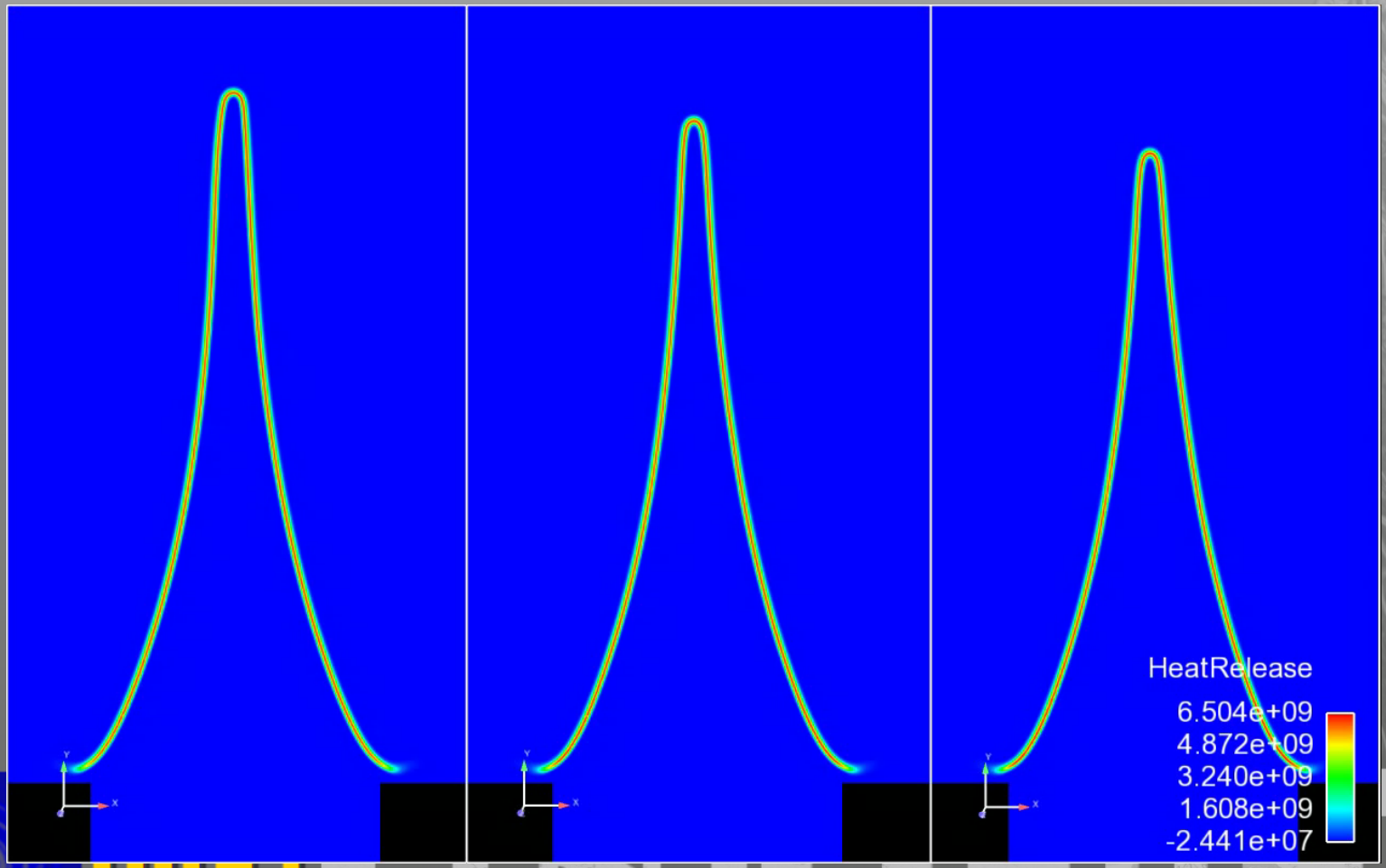
- Direct Numerical Simulation with very high mesh resolution :
  - Flame front : 50 microns
  - Flame anch. : 10 microns
  - Acoustic BL : 100 microns



INSTITUT DE MECANIQUE DES FLUIDES DE TOULOUSE

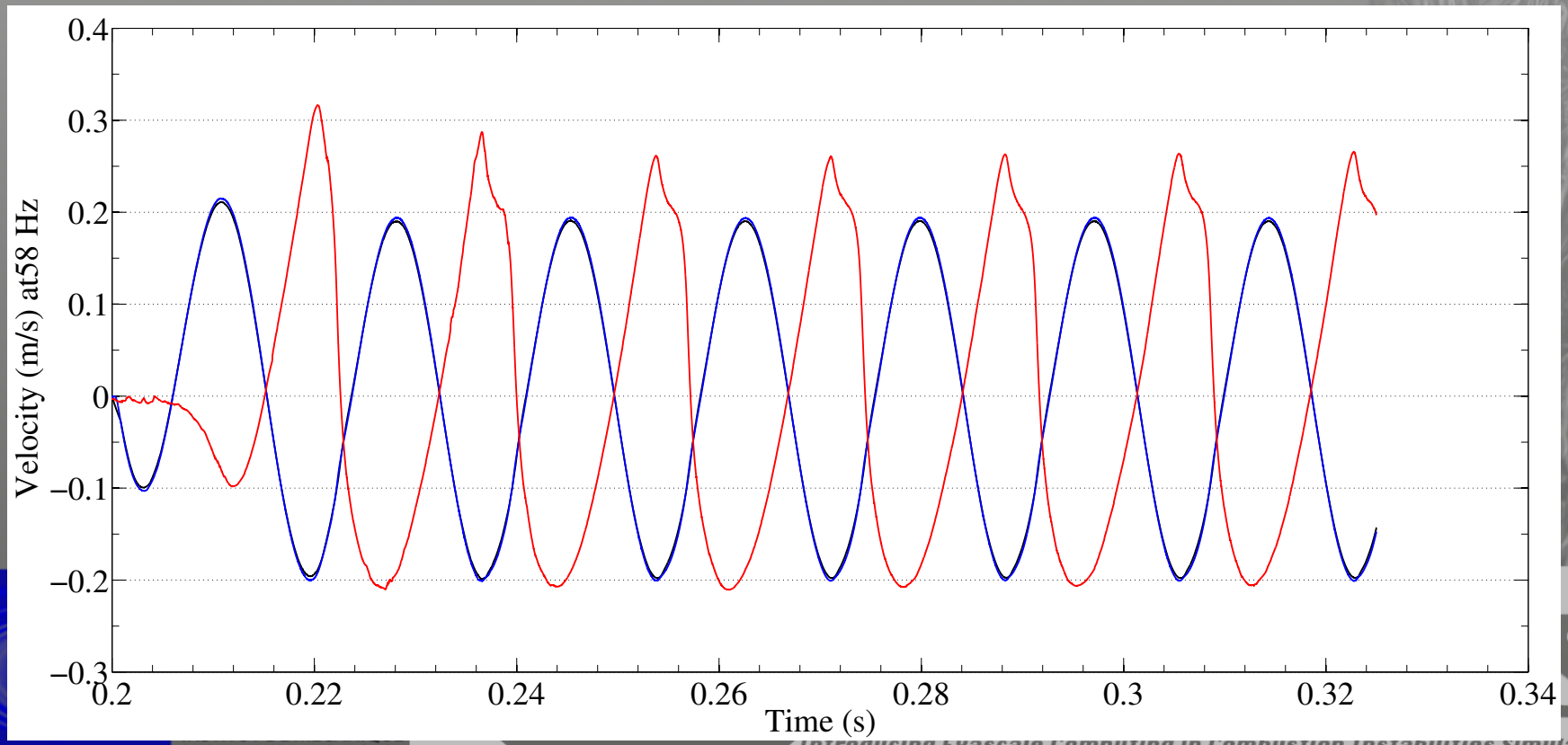
Slot Burner - FTF

T 50º T 90º T 120º

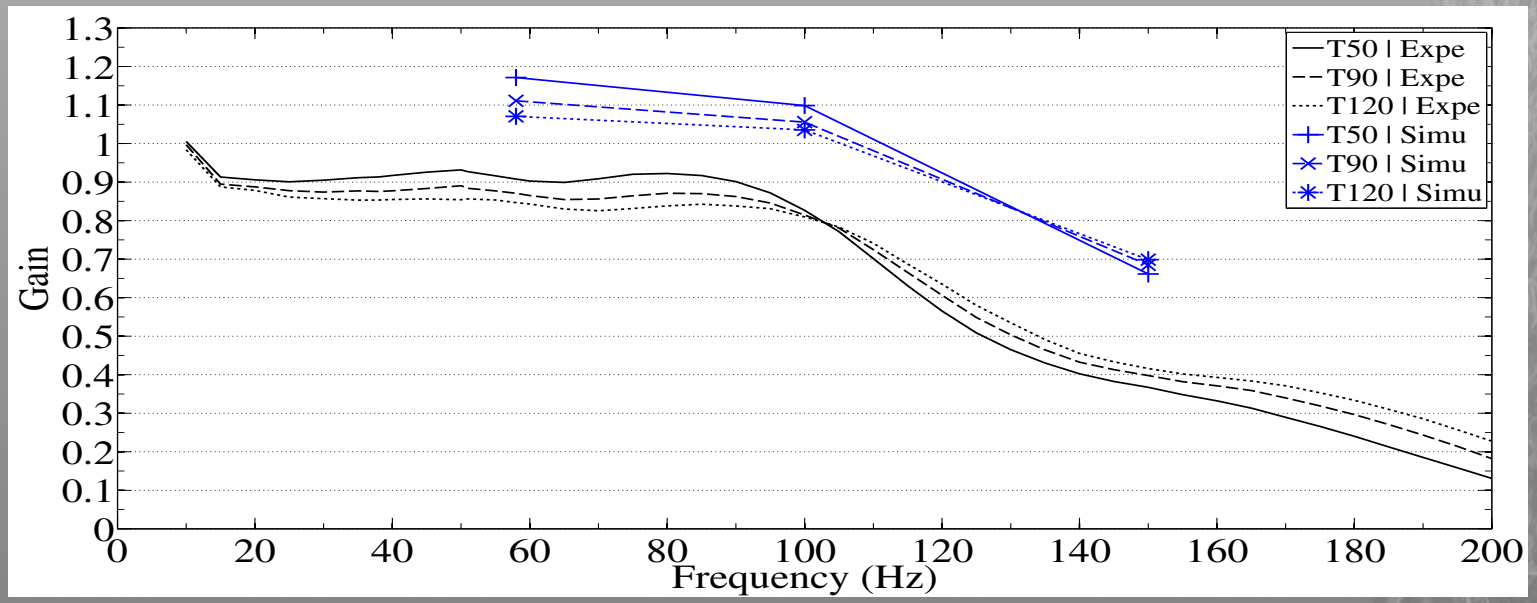


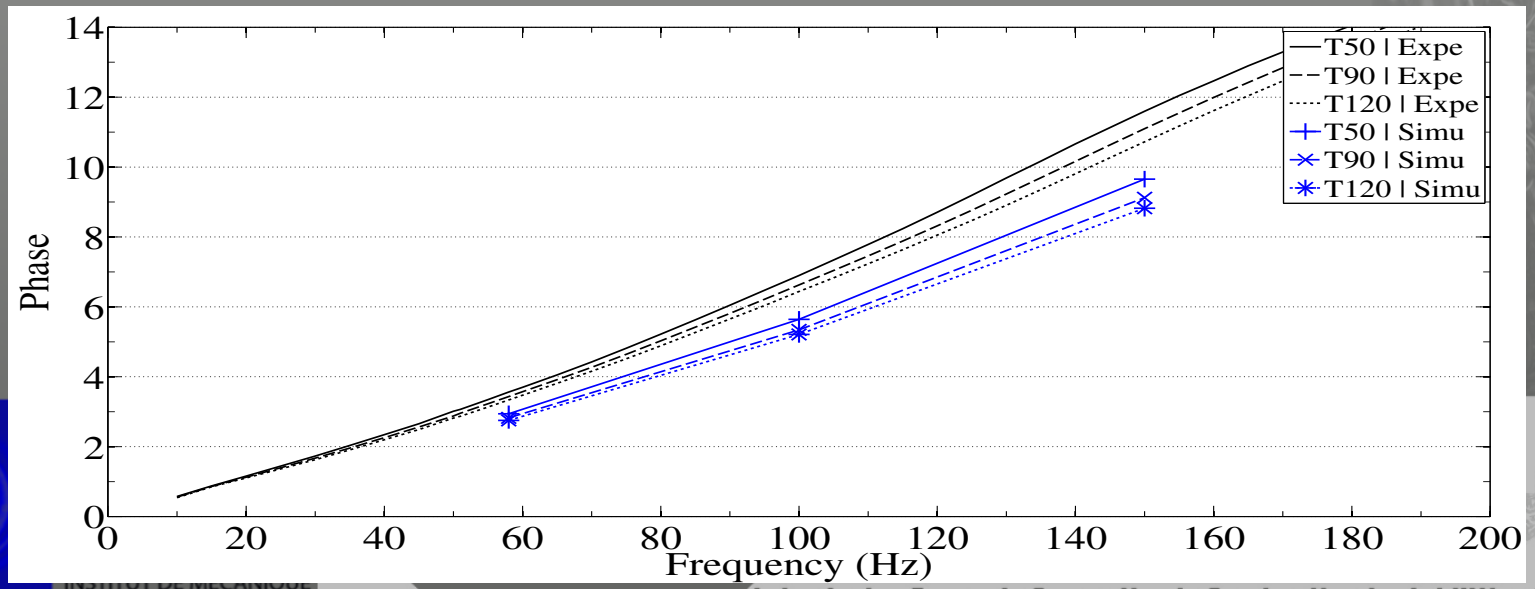
Slot Burner - FTF

- Temporal signals (T = 50 degrees)
  - Inlet velocity & Top velocity (almost the same)
  - Heat release



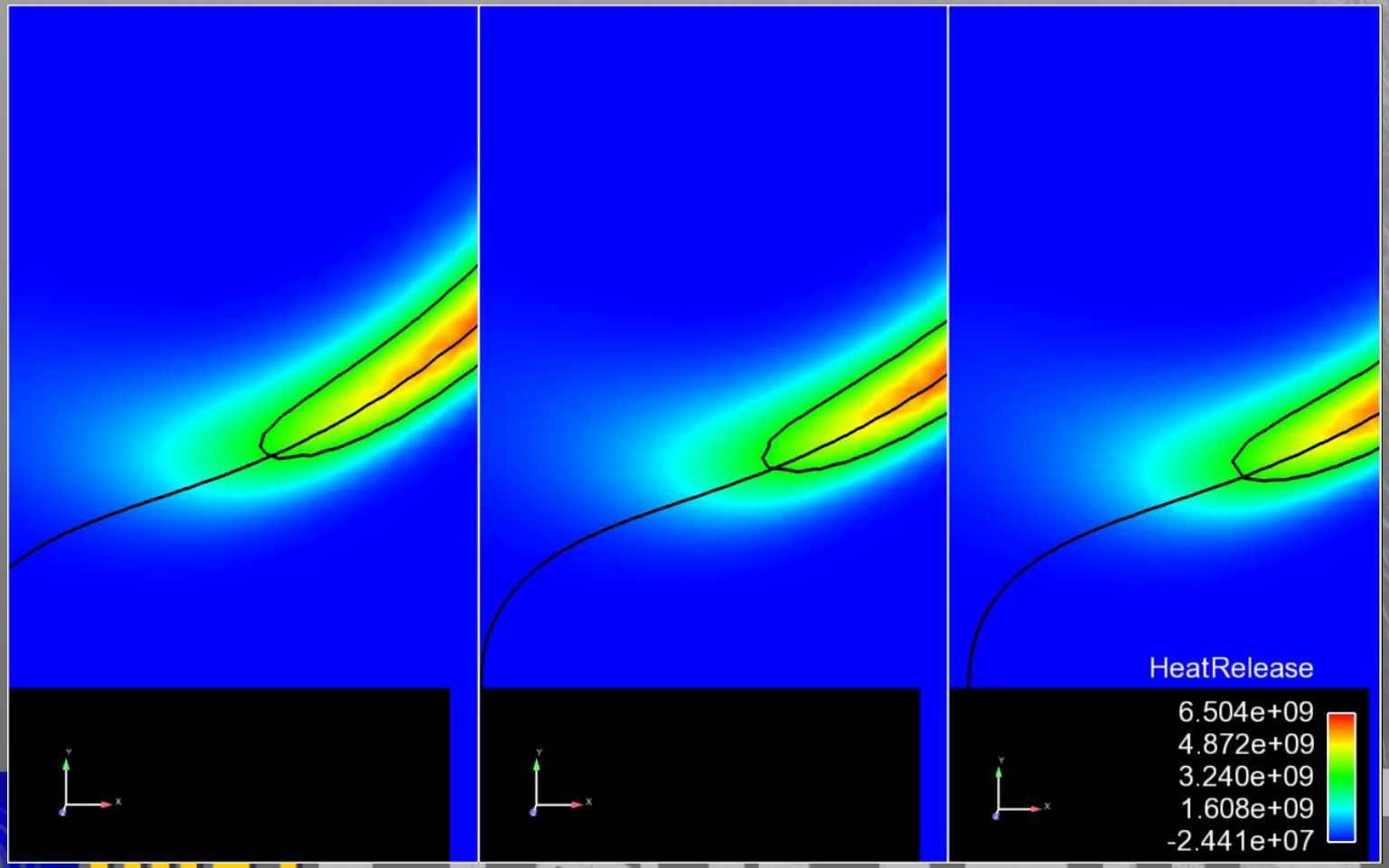
Slot Burner - FTF





Slot Burner – Flame Anchoring

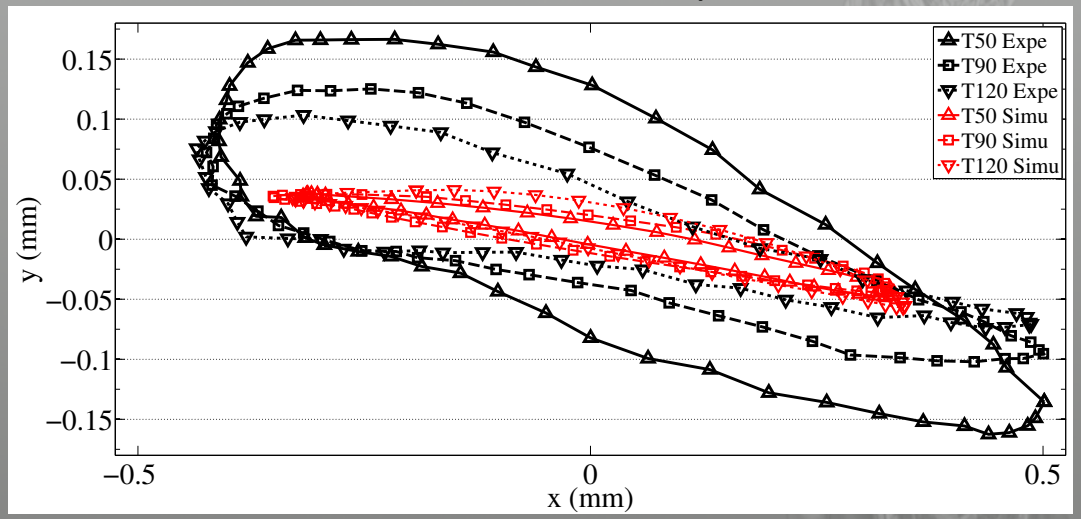
T 50º T 90º T 120º



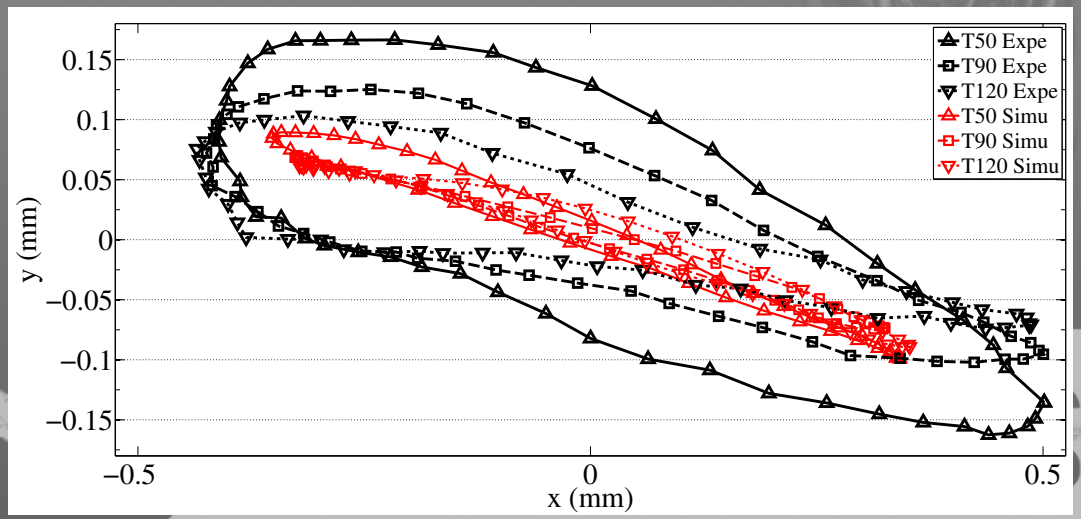
Slot Burner – Flame Anchoring

- Comparison between
  - Experimental visualization
    - OH/CH chemiluminescence
    - Photo multiplicator
  - Numerical simulation data fields
    - Iso – Heat Release
    - Iso – species (reduced chemical schemes)
- Open problem…

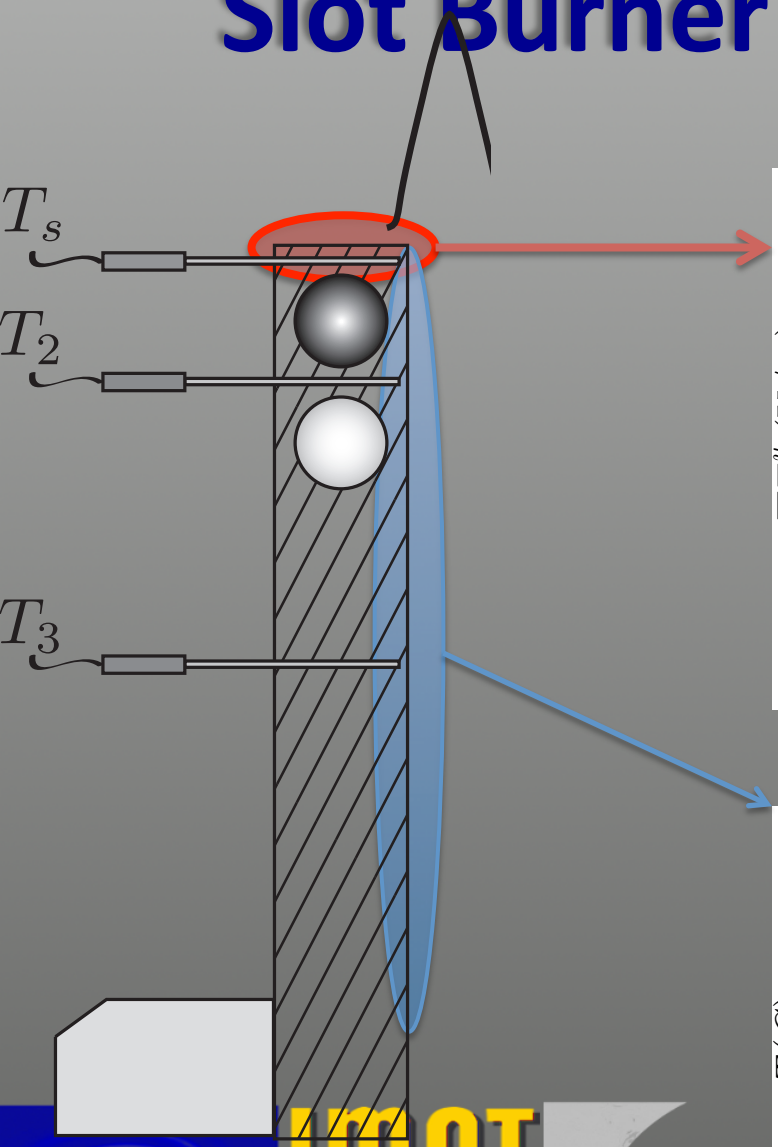
Iso-HR = 3.0×10^{09} W/m^3



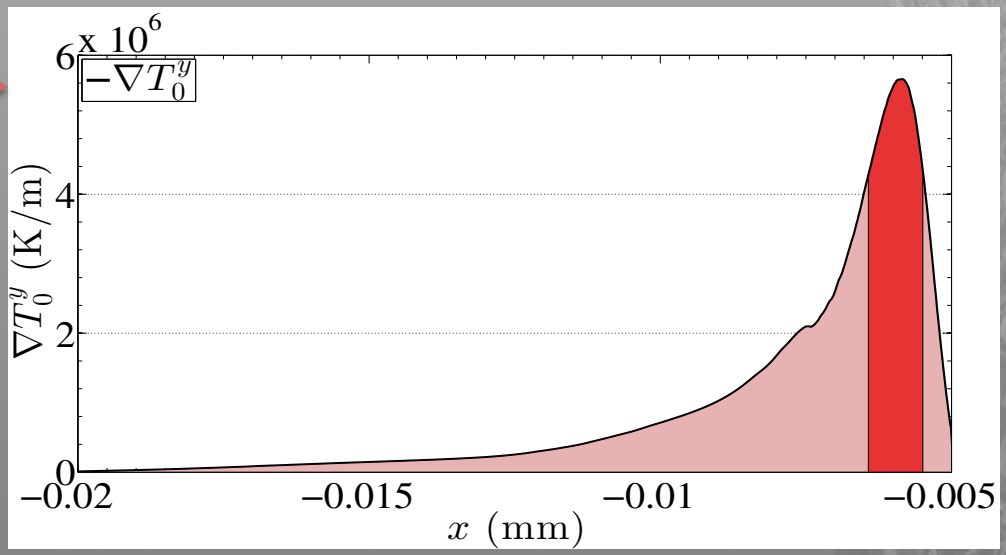
Iso-HR = 5.0×10^{09} W/m^3



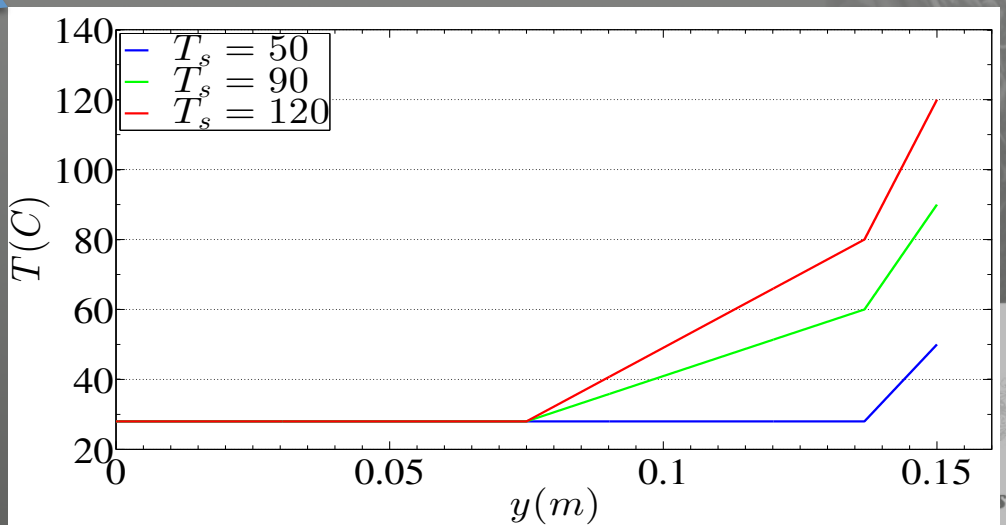
Slot Burner – Flame Anchoring



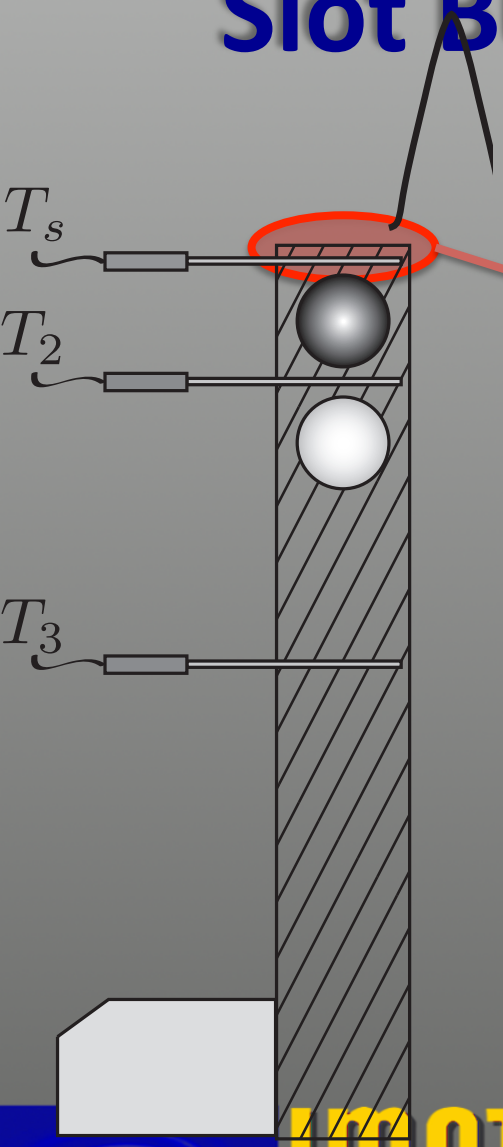
Temperature gradient given by AVBP



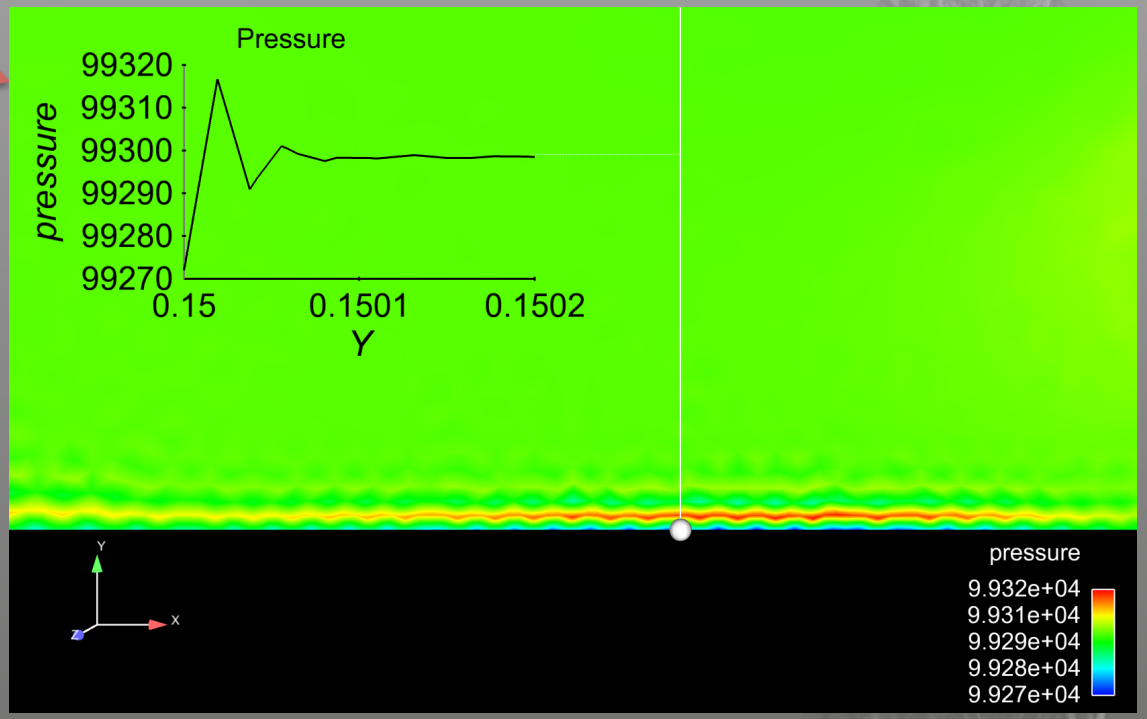
Imposed temperature



Slot Burner – Flame Anchoring



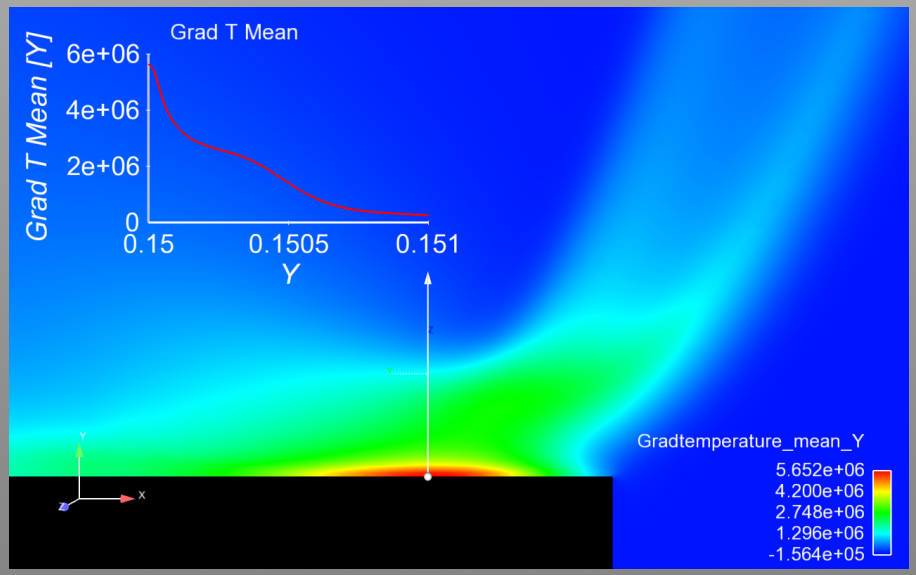
- Pressure wiggles



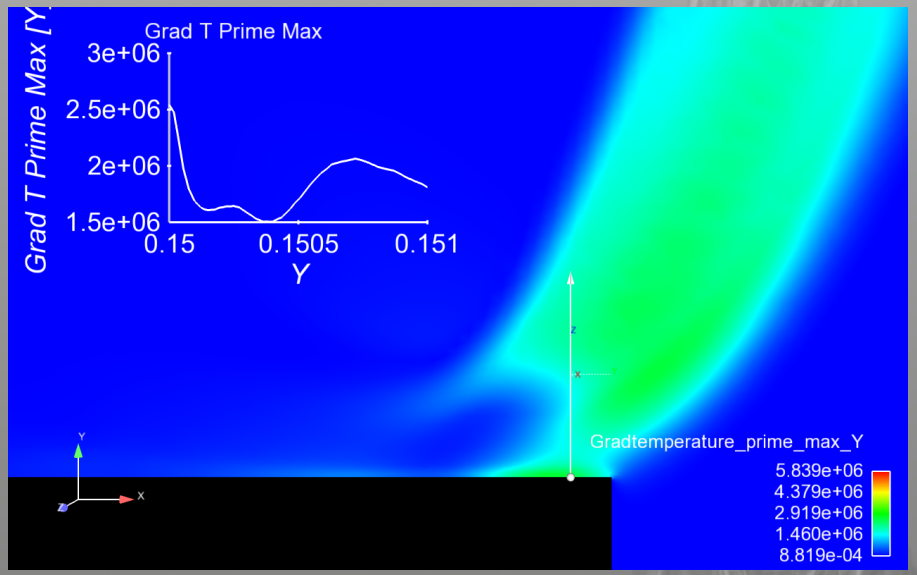
INSTITUT DE MECANIQUE DES FLUIDES DE TOULOUSE
INTECOCIS
Introducing Exascale Computing in Combustion Instabilities Simulations

Slot Burner – AVBP Fields

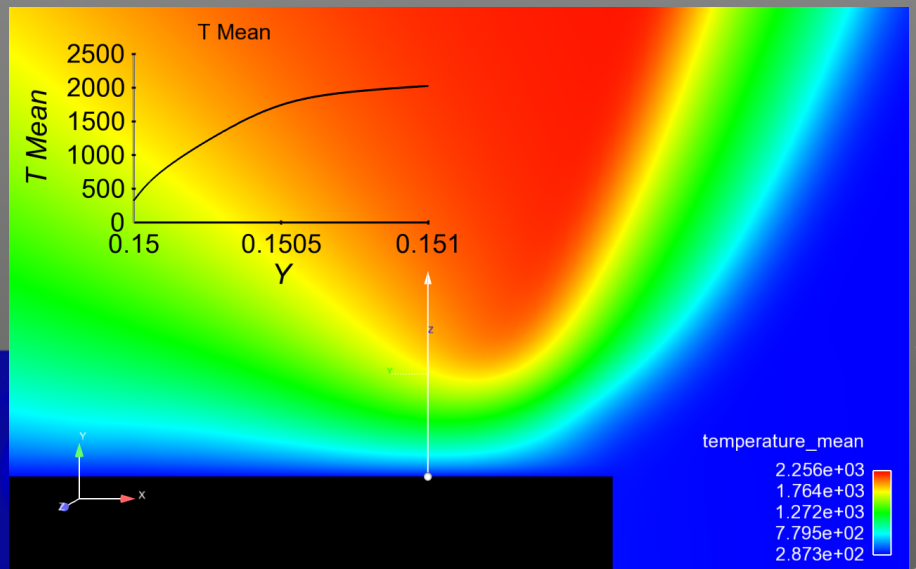
Grad T mean



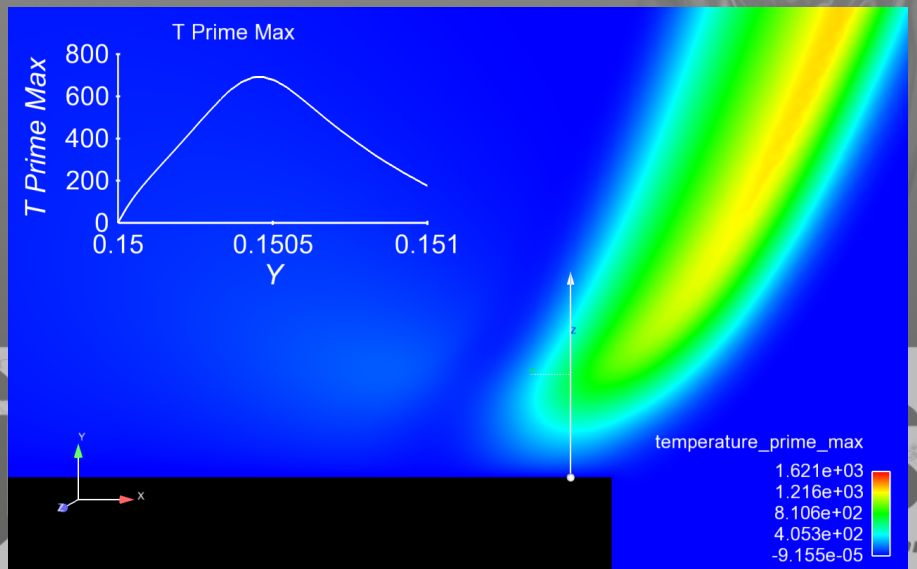
Grad T prime

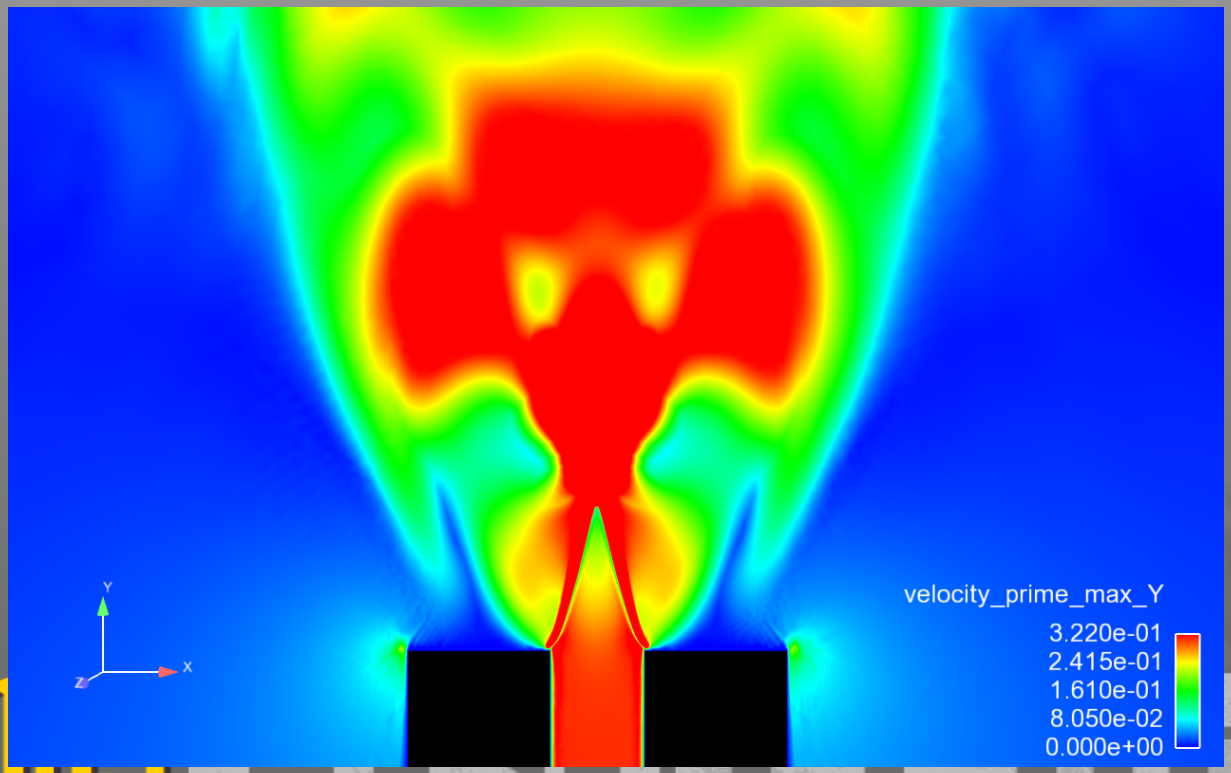


T mean



T prime max



Slot Burner – AVBP Fields

- Questions ?