Turbulence Photos
Pool Fire
(from U of Utah)
Example Video Image
of Premixed Natural Gas/Air Flame
(MS Burner, 500 slpm Air Flow Rate, $\phi = 1.0$)
Mean PLIF Images of OH in the ATS-Burner (Premixed Natural Gas/Air, Air Flow = 500 slpm)

A) Medium Swirl, $\phi = 0.80$
B) High Swirl, $\phi = 0.80$
C) Medium Swirl, $\phi = 0.65$
D) High Swirl, $\phi = 0.65$
Instantaneous Flame Structure
(Planar Laser Induced Fluorescence of OH)

(B) Test Series 2, HS Injector, $\phi = 0.80$

(C) Test Series 3, MS Injector, $\phi = 0.65$
Turbulence Options

• Direct Numerical Simulation (DNS)
  – Solve complete Navier-Stokes equations with small time scale
    (big computers, small problems)

• Large Eddy Simulation (LES)
  – Same as DNS, but not as fine of scale
  – Sub-grid models for small-scale turbulence, etc.
    • Phil Smith – 36 hrs on 1000 processors for 8 s of pool fire

• Industry Practice
  – k-ε model

• Other Options
  – Reynolds Stress Model
  – Algebraic Stress Model