DEACTIVATION: MOTIVATION

- Large Portion of Flowfield 'Deactive' for:
    - Scalar Transport
    - Point Detonations

$\Rightarrow$ Work Only Where Required

$\Rightarrow$ Should Be Extremely Cost-Effective

REFERENCES

Among Others:

Löhner (1999): Point Detonations

Löhner and Camelli (2004): Scalar Transport

SCALAR TRANSPORT

$$c_{,t} + \mathbf{v} \cdot \nabla c = \nabla k \nabla c + S$$

c: Concentration
$\mathbf{v}$: Velocity
k: Diffusivity
S: Source

$\Rightarrow$ Change Can Only Occur In Regions Where:

$$|S| > 0 \quad , \quad |\nabla c| > 0$$

Typically:

- Regions Where $|S| > 0$ Small
- Regions Upwind of Source: $|\nabla c| = 0$

IDENTIFICATION OF ACTIVE/DEACTIVE REGIONS

- Loop 1: Identify Elements Where $|S| > 0$
- Loop 2: Identify Elements/Edges Where $|\Delta c_{el}| > \epsilon_c$
- Surround By Layers (4-5) ('Safety Ring')
- Obtain Active/Inactive Edge Groups
- Proceed as Before

GENERIC WEAPON FRAGMENTATION

- Fully Coupled CFD/CSD
- CSD Fails If Average Strain $> 60\%$
- After Final Breakup: $O(1200)$ Objects in Flow
- Typical Mesh Size: `O(8.0) Mtets`
- Typical Timings: `O(50) Hours` (SGI O2K, 32 Procs)

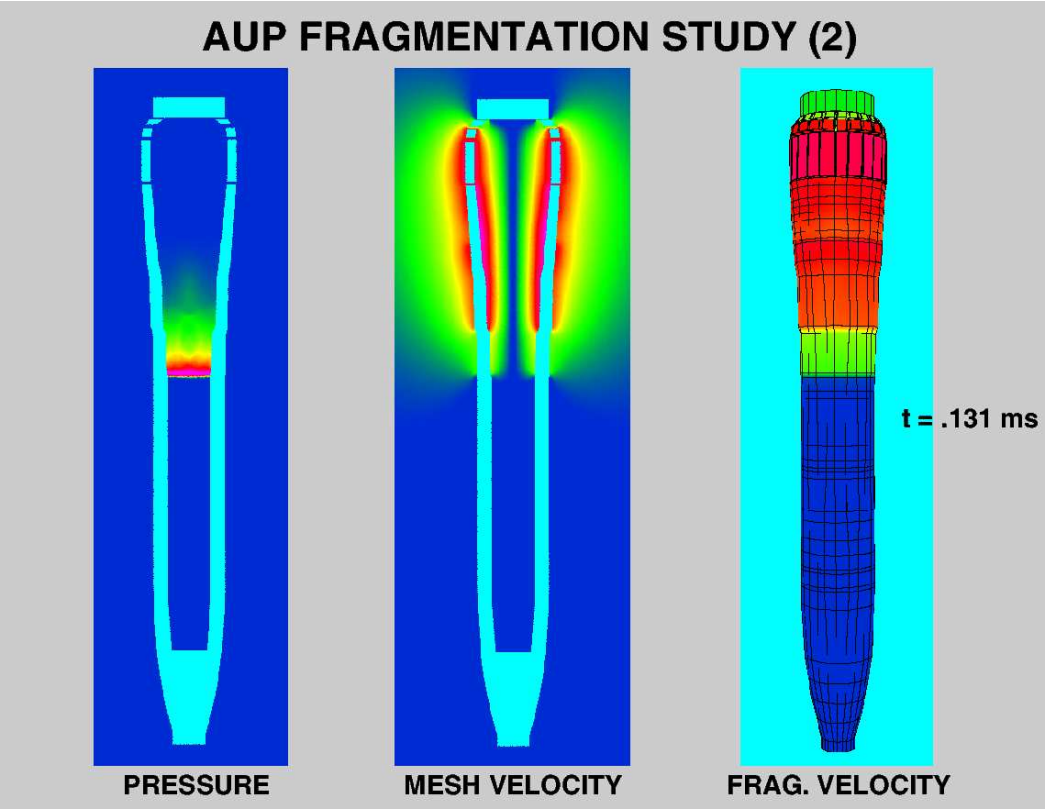


Figure 1a Pressure, Mesh Veloc and Frag Vel

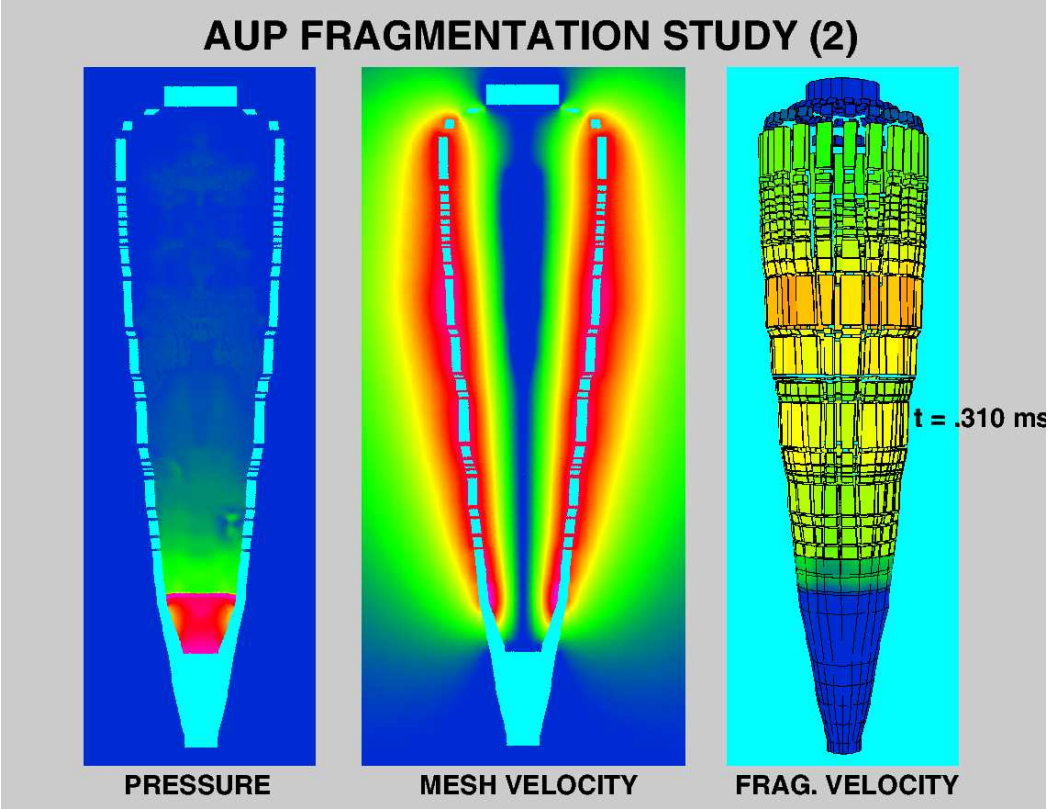


Figure 1b Pressure, Mesh Veloc and Frag Vel

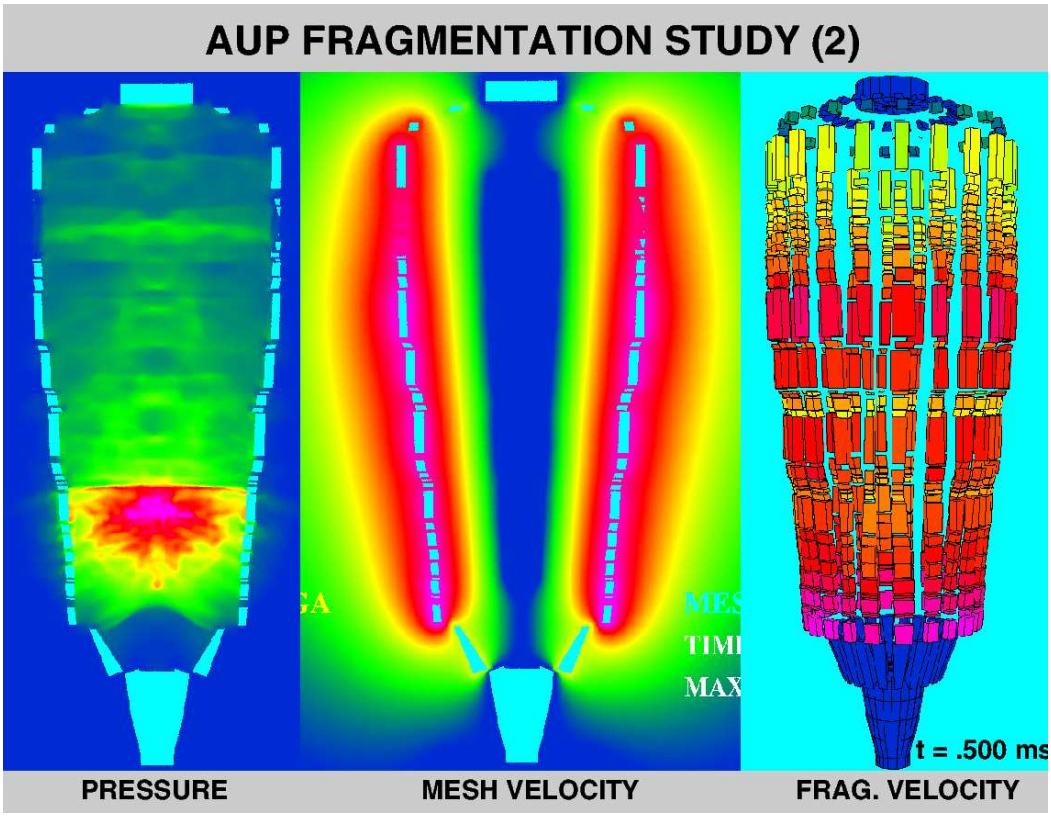


Figure 1c Pressure, Mesh Veloc and Frag Vel

SUBWAY STATION

- Instantaneous Release in Side Platform
- Time Dependent Inflow on End-Side:

$$v(t) = b\,(t-60)^3\,e^{-a(t-60)} + v_0$$

  $b = 0.46\ m/s$, $a = 0.5\ 1/s$, $v_0 = 0.4\ m/s$ (NYC Subway Data)
- Incompressible Navier-Stokes
- Smagorinsky, Law of the Wall
- Flowfield Precomputed and Stored
- Grid: `730 Kels, 144 Kpts`
- Dispersion: RK3, $C = 0.6$
- Deactivation Checks: Every 5 Timesteps
- Physical Time: 485 sec
- Machine: Dec Alpha (0.67Ghz, 4Gbyte RAM, Linux OS, Compaq Comp)
- CPU Without Deactivation: `T=5,296 sec`
- CPU With Deactivation: `T=526 sec`

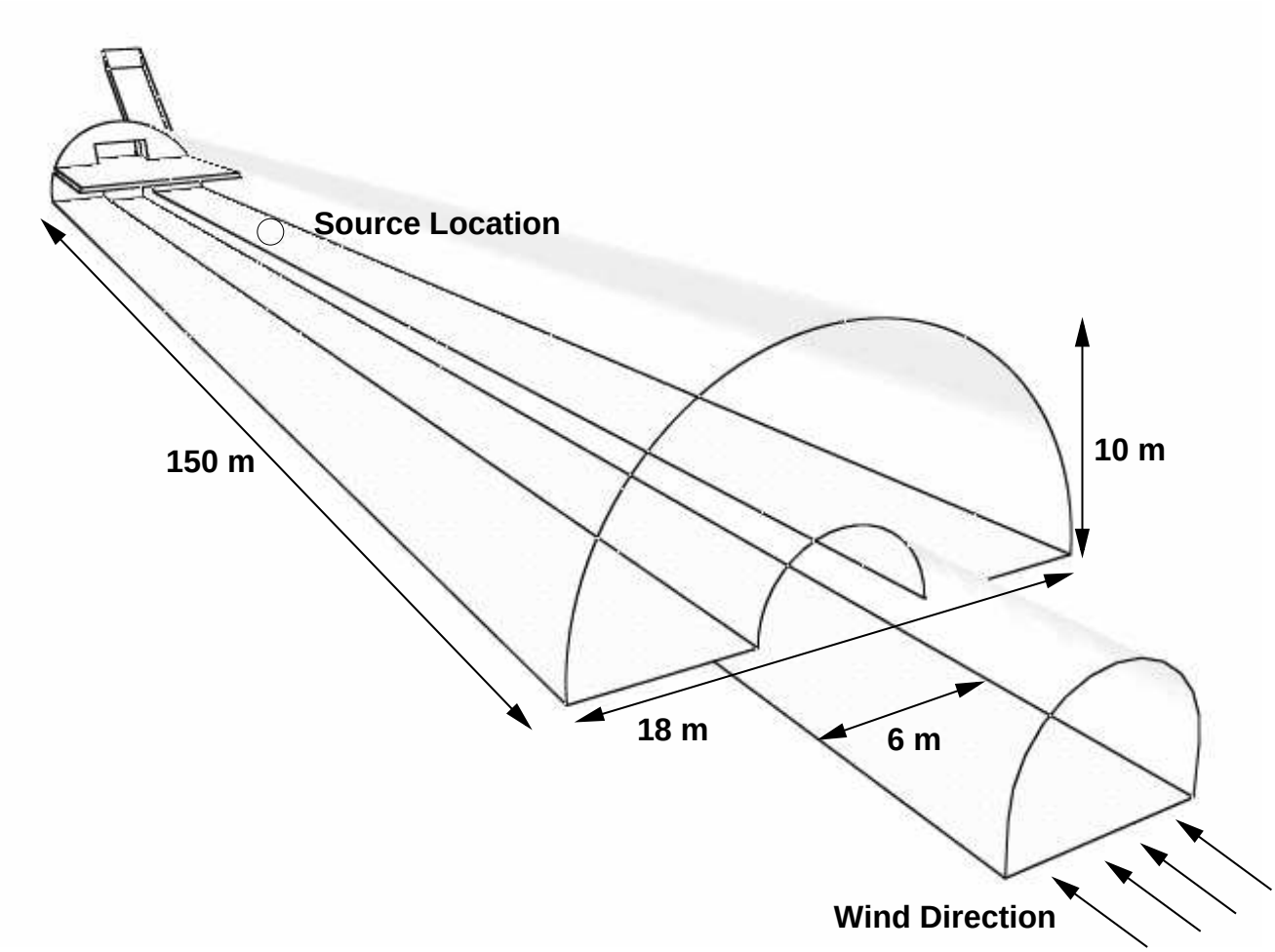
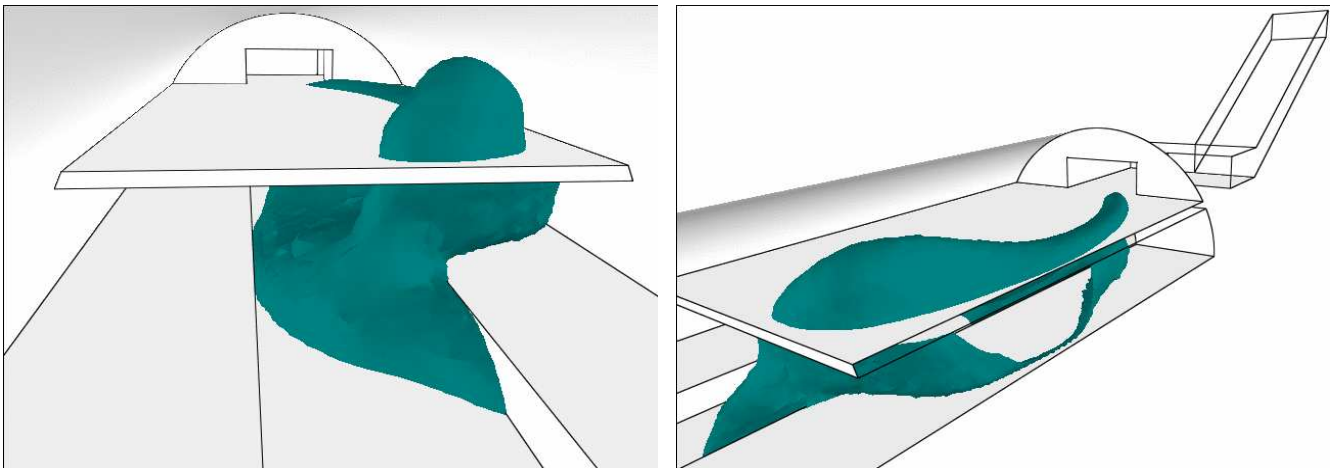
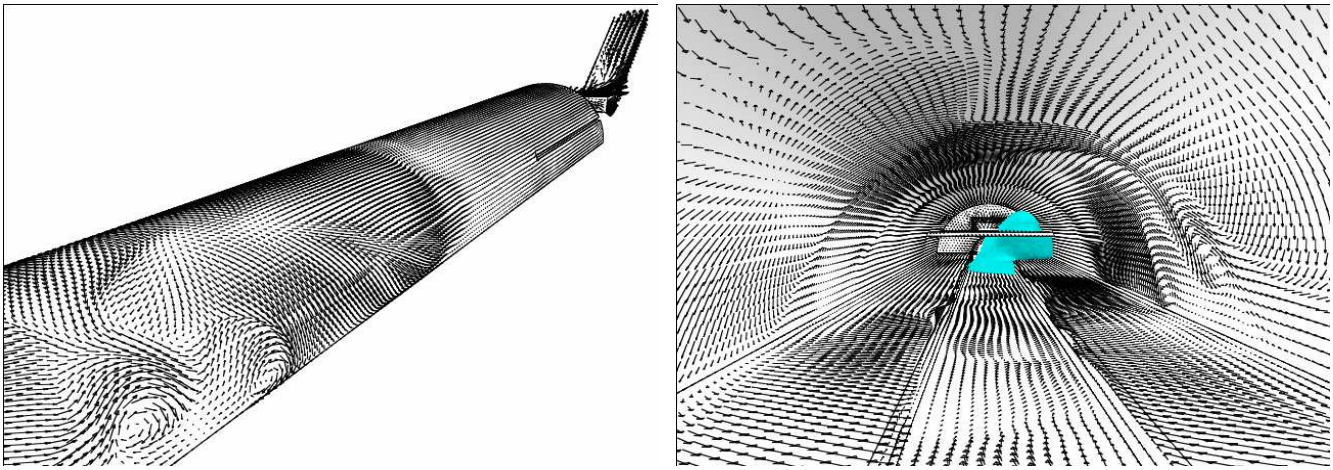


Figure 2a: Problem Definition



Figures 2b,c: Iso-Surface of Concentration $c = 0.0001$



Figures 2d,e: Surface Velocities