Coffee with science and milk

USI 10 Years Anniversary Activities

August 19, 2014

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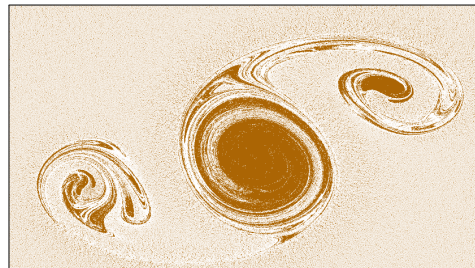
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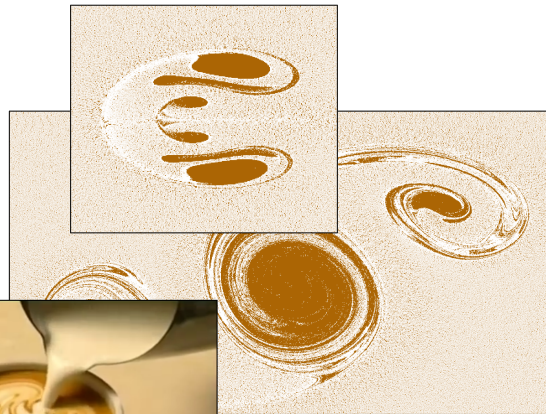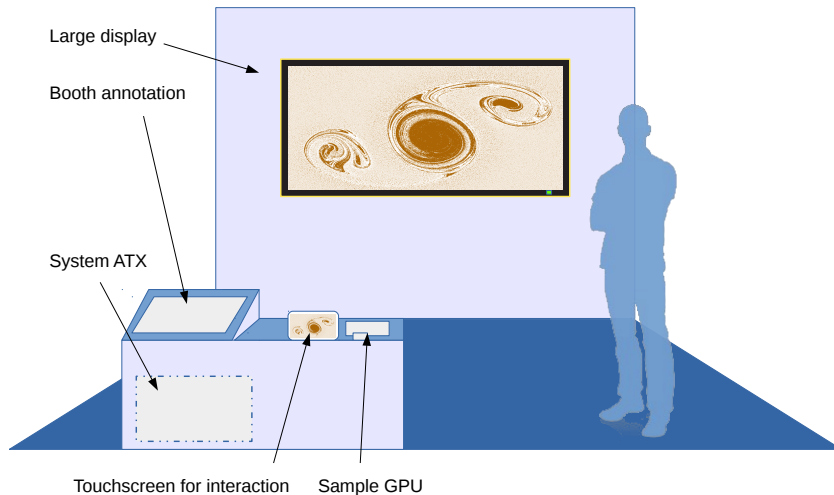
The demonstration

Purpose: introduce general audience into fluid
dynamics by example of e.g. mixing coffee with spoon.

A non-reactive substance injected into the fluid:

- Coffee and milk
- Steam or smoke
- …

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The booth

Large display

Booth annotation

System ATX

Touchscreen for interaction   Sample GPU

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Numerical background

- Navier-Stokes for 2D incompressible fluid, with periodic BC:

    - Advection: method of characteristics
    - Diffusion & projection: FFT, implicit scheme for diffusion
    - Passive particles transfer
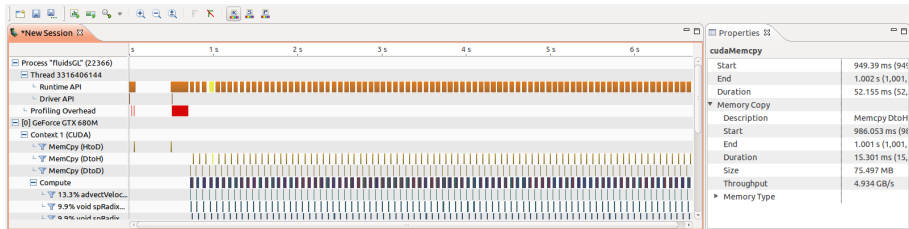
For more details please refer to the paper:

Stam, J. 1999. "Stable Fluids." In Proceedings of SIGGRAPH 1999.
http://www.dgp.toronto.edu/people/stam/reality/Research/pdf/ns.pdf

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Computational background

- GPU implementation – Sample *fluidsGL* – a part of CUDA SDK since 2009

  - CUDA simulation + OpenGL visualization
  - CUDA & OpenGL on the same GPU or on different – for Optimus
    (large FPS loss due to host-gpu data transfers, see profile figure)
  - Up to 35 FPS on GTX 680M with Optimus, 2048×2048

Current source code available here: https://github.com/dmikushin/fluidsGL-optimus