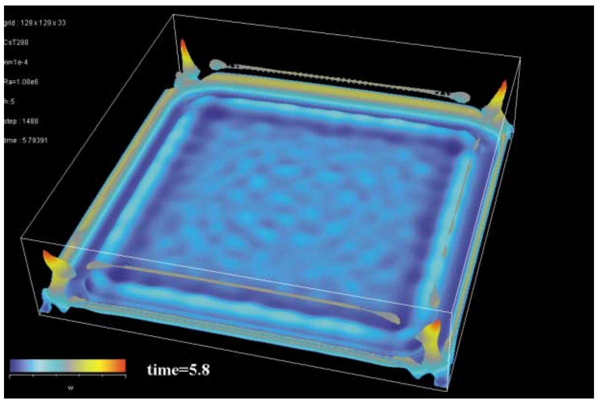
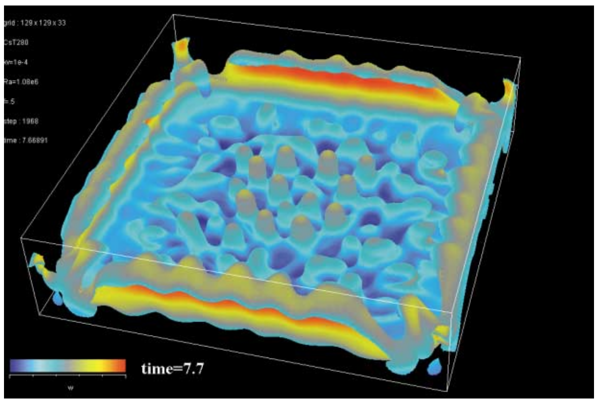
1. Time Evolution of Thermal Plumes in a Three-dimensional Enclosure Due to Heating from below at Rayleigh Number = 1.06×10^6

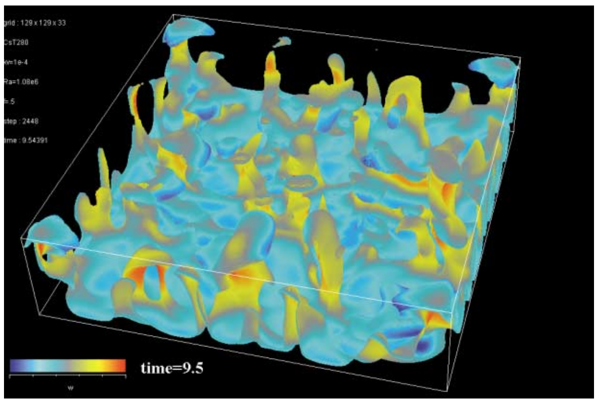
Tsuchiya, T.[1] ***and Kuwahara, K.***[2]

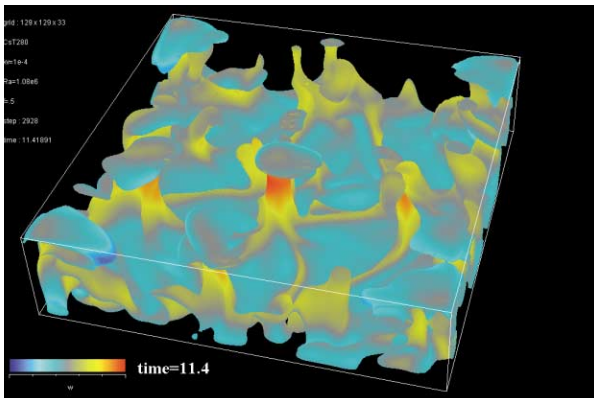
1) *Institute of Computational Fluid Dynamics, 1-22-3 Haramachi, Meguro-ku, Tokyo 152-0011, Japan. E-mail : tsuchiya@icfd.co.jp*

2) *The Institute of Space and Astronautical Science, 3-1-1 Yoshinodai, Sagamihara, Kanagawa 229-8510, Japan. E-mail : kuwahara@pub.isas.ac.jp*









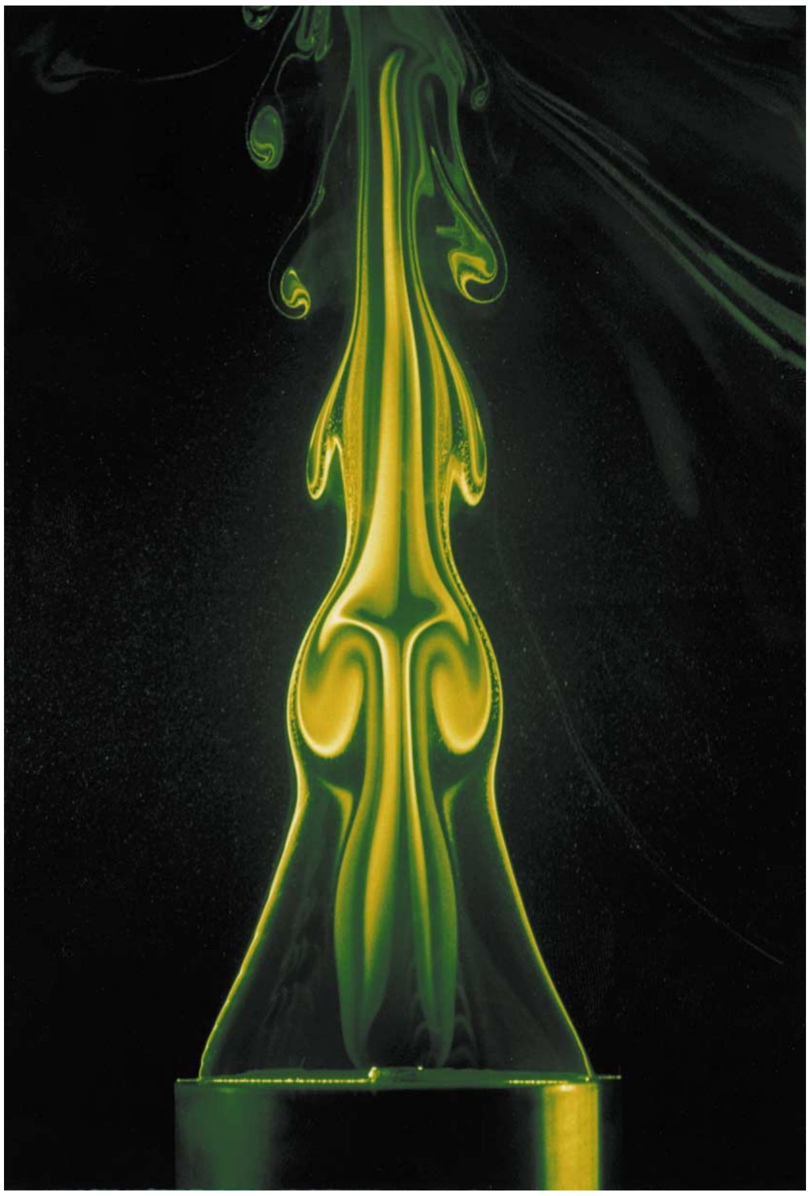
The figures show the time evolution of an isothermal surface (280 K) in a three-dimensional enclosure. Rayleigh number is estimated 1.06×10^6 based on the height of the enclosure. The value of the vertical velocity (w-component) is used for color-shading. Initially, the fluid is of rest and isothermal ($T_{initial}$ = 273 K). At t = 0, a vertical differential temperature ($\Delta T = T_{bottom} - T_{top}$, T_{top} = 273 K, T_{bottom} = 293 K) is imposed while other walls are kept under adiabatic conditions. At all walls, the no-slip condition is imposed. To reproduce the flow field, the Navier-Stokes equations are solved using the multi-directional third-order upwind finite-difference method in an uniform rectangular mesh system ($128 \times 128 \times 32$ grids), while the buoyancy force is modeled by Kuwahara's approximation.

2. Visualization Using Reactive Mie Scattering for Buoyant Diffusion Flames

***Chung, S. H.*[1], *Hwang, J. Y.*[1], *Lee, H. H.*[1] and *Lee, W.*[2]**

1) *Department of Mechanical Engineering, Seoul National University, Seoul 151-742, Korea.*

2) *Department of Mechanical Engineering, Dankook University, Seoul 140-714, Korea.*

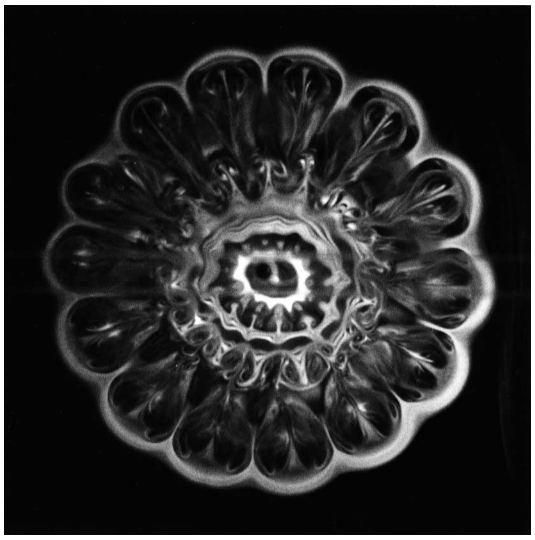


The photograph shows oscillating laminar diffusion flame in a co-flow burner due to buoyancy driven instability. Reactive Mie scattering (RMS) technique with the sheet beam from a Nd:YAG laser visualizes the flame structure. Propane and dry air were supplied through an inner tube (i.d. 10.6 mm, 10 cm/s) and outer tube (i.d. 101 mm, 7 cm/s), respectively. Small amount of $TiCl_4$ vapor is added to dry air to produce TiO_2 particles by the reaction of $TiCl_4$ with either water vapor existed in the ambient air (outer most traces) or water vapor formed in a flame. The inner most traces are due to the scattering from soot particles.

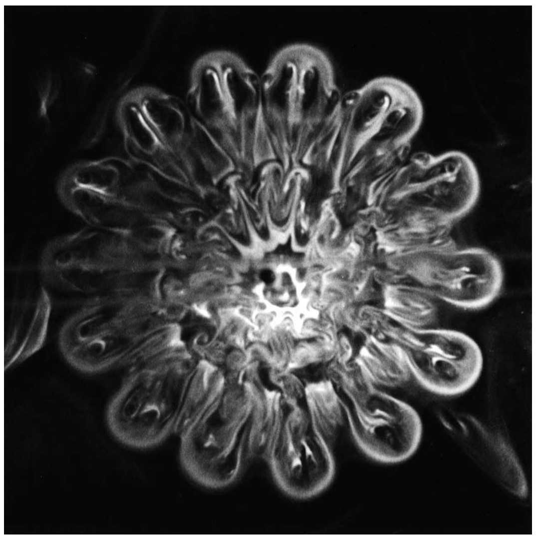
3. Longitudinal Vortex Structure in the Flow Field Produced by a Vortex Ring Impinging on a Flat Plate

Naitoh, T.[1] ***, Banno, O.***[1] ***and Yamada, H.***[1]

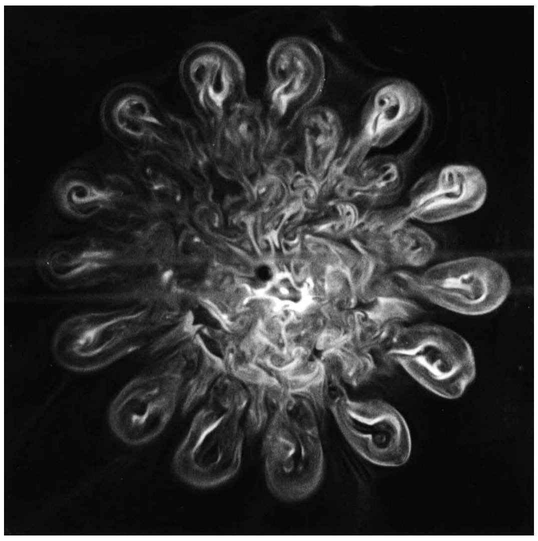
1) *Department of Systems Engineering, Nagoya Institute of Technology, Gokiso-cho, Showa-ku, Nagoya 466-8555, Japan.*



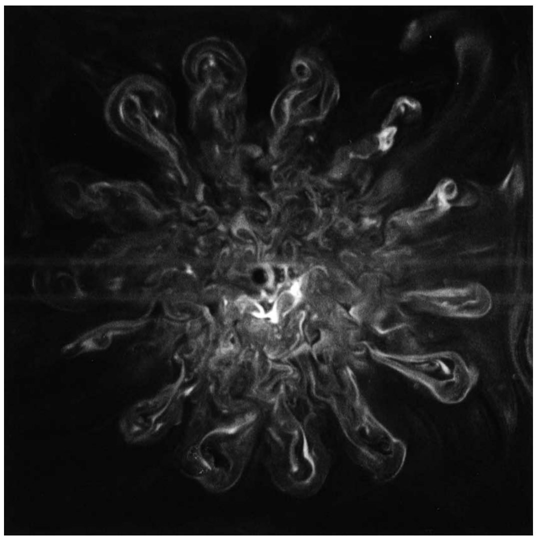
(a) t = 740 ms



(b) t = 760 ms



(c) t = 780 ms

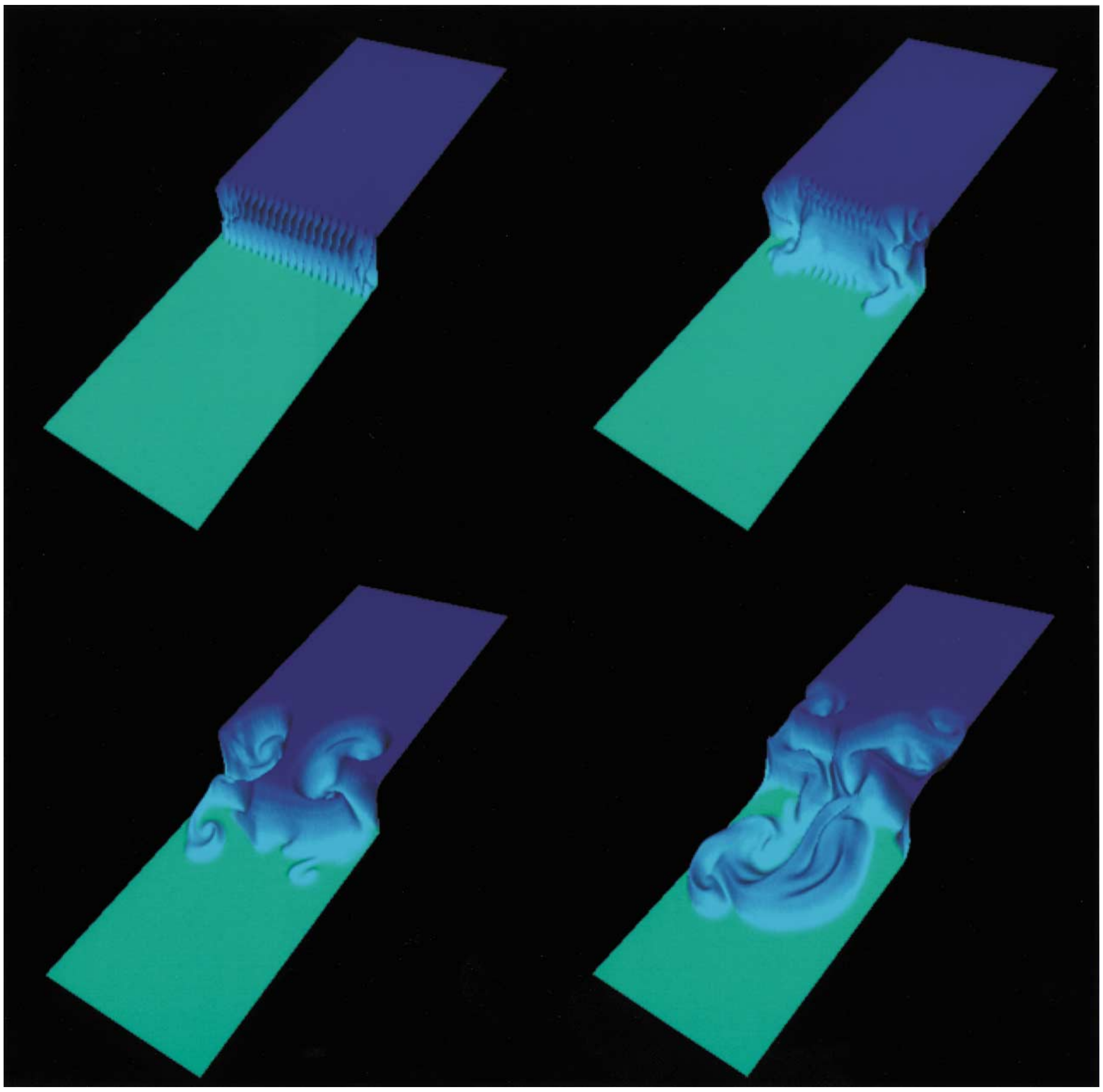


(d) t = 800 ms

These pictures, obtained by a smoke visualization method, show the successive frontal cross sections of the flow field produced by a vortex ring impinging on a flat plate at Re = 2600, defined by traveling speed and diameter of the ring. Owing to the mutual interactions of the main and induced vortices, generated by the boundary layer separation on the impinging plate, the longitudinal vortex structure that we call fingers vortex appears. Because the fingers vortex possesses a vorticity component perpendicular to the vorticity lines of the toroidal structure of the main vortex, it plays a crucial role in forming azimuthal coherent structure with a cross section resembling that of an orange. Then this structure promotes the flow field into turbulent state.

4. Reyleigh-taylor Instability of Buoyancy Driven Exchange Flow

***Hirahara, H.*[1], *Kawahashi, M.*[1] *and Hashimoto, S.*[1]**
1) *Faculty of Engineering, Saitama University, Shimo-Okubo 255, Urawa, Saitama, 338-8570, Japan.*



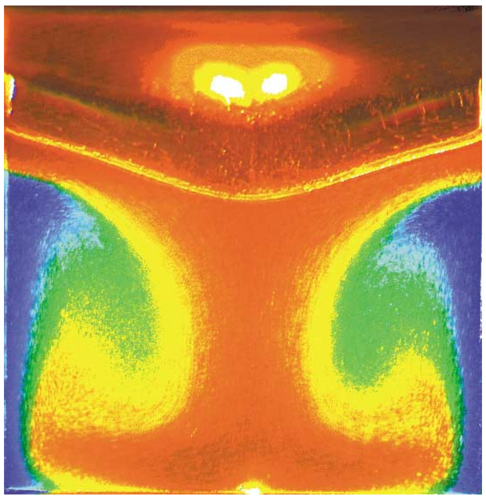
Starting Process in buoyancy driven exchange flow is shown in this figure. The numerical simulation was carried out for Helium and Air in two-dimensional duct. The density ratio is 7.0 Rayleigh-Taylor instability dominates the starting process in this problem. It is very hard to investigate Rayleigh-Taylor instability experimentally because of lack of superior technique for gaseous interface formation. A set of motion of fluid dynamics equations was solved with SMAC type's finite difference scheme. Initially, 20 vortices were assumed as small disturbance. Initial disturbance is diffused with time and large scale vortex dominates on the flow. Exchange flow speed and rate are influenced by the vortex pattern.

5. Particle Image Velocimetry and Thermometry in Freezing Water

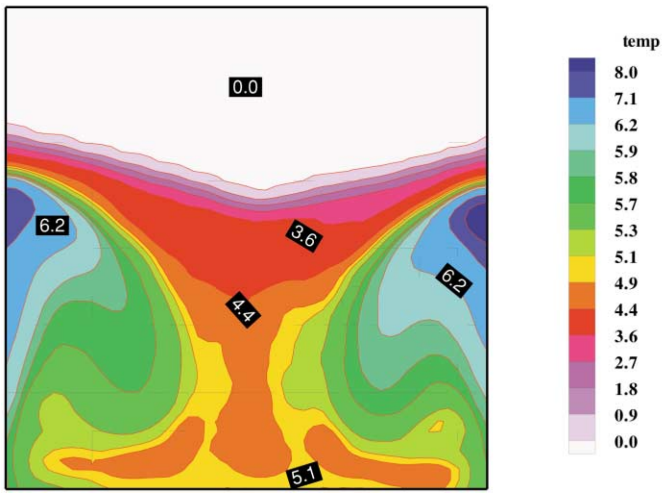
Kowalewski, T. A.[1] and Cybulski, A.[1]

1) *Polish Academy of Sciences, IPPT PAN, Swietokrzyska 21, PL-00049 Warsaw, Poland.*
http://www.ippt.gov.pl/~tkowale/

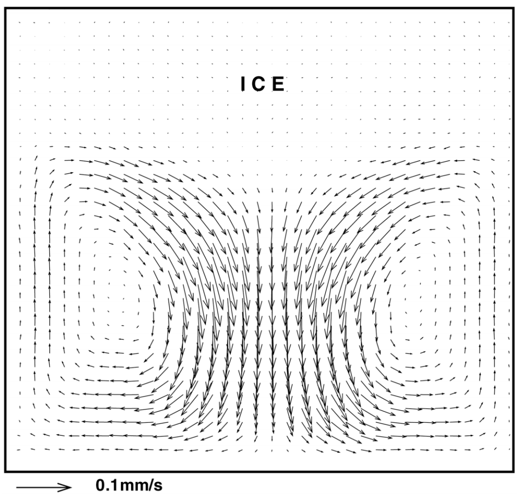
Ice crystal growing from the top in a lid cooled cavity. Thermochromic Liquid Crystals are used as tracers to evaluate both the temperature and velocity flow fields. A plexiglas cube is immersed in an external water bath of temperature +20 °C. The isothermal metal lid has temperature -10 °C. Flow is observed at the center vertical plane of the cavity. Figure illustrates flow circulation with a cold stream along the cavity axis (red colour response of the TLCs) and a warm reverse flow along side walls (green to blue colours of the TLCs). Analysis of the tracers colour allows to evaluate the temperature field (b). Cross-correlation performed for a sequence of 2-5 images is used to evaluate the flow velocity field (c).



(a)



(b)



(c)

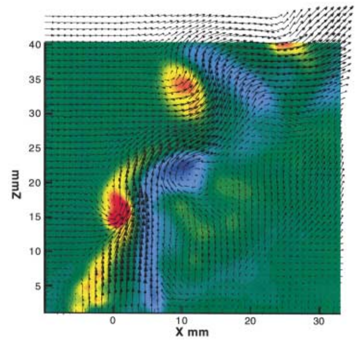
6. The Vortical Structure of a Round Jet in Cross Flow

Kim, K. C. [1)]

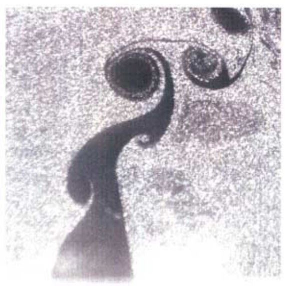
1) *Professor, School of Mechanical Engineering, Planning and Steering Director, Institute for National Project Operation, Pusan National University, Pusan 609-735, Korea.*

Tel : 82-51-510-1464 or 2324   Fax : 82-51-582-8581

E-mail : kckim@hyowon.cc.pusan.ac.kr



Instantaneous velocity vector and vorticity field of the center plane of a cross flow jet. The round air jet is issued nomally from a nozzle whose diameter is 14 mm to the main duct having 100 mm by 100 mm square section. The average velocity of the cross flow is 0.7 m/s and the jet velocity is 2.1 m/s. The plane velocity vectors are obtained using an Nd:Yag laser (200mJ/pulse) based PIV system with a 1K by 1K pixels CCD camera. TSI's INSIGHT-NT software is used to capture and interrogate the PIV velocity field. The red color corresponds the counter clockwise vortex while the blue color denotes the clockwise vortex.



An instantaneous laser tomographic image of the center plane of the cross flow jet. The experimental conditions are same as above. The laser sheet whose thickness is about 1 mm is illuminated by the 200mJ/pulse Nd:Yag laser during 5ns. To clarify the boundary of the jet fluid, particles are supplied only to the cross flow duct. The roll-up structures are vividly appeared in both front and rear boundaries of the jet.

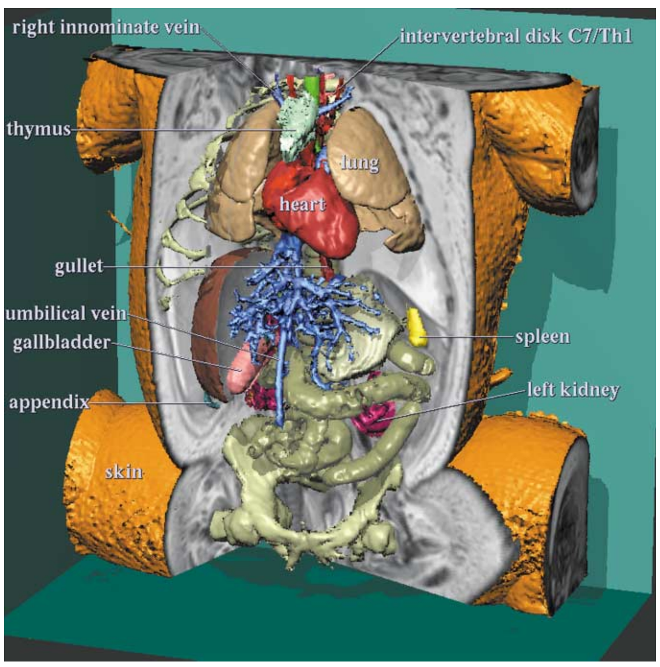
7. Volume Based VOXEL-MAN Anatomy Atlas

***Krämer, H.*[1)], *Höhne, K. H.*[1)], *Maas, R.*[2)], *Pommert, A.*[1)], *Richter E.*[3)], *Riemer, M.*[1)], *Schiemann, Th.*[1)], *Schubert, R.* [1)] *and Tiede, U.*[1)]**

1) *Institute of Mathematics and Computer Science in Medicine, University Hospital Eppendorf, 20246 Hamburg, Germany.*

2) *Department of Radiology, University Hospital Eppendorf (address same as above)*

3) *Department of Pediatric Radiology, University Hospital Eppendorf (address same as above)*



Data were collected as a sequence of magnetic resonance tomograms of a 30 week old stillborn fetus. The resulting image volume was segmented into about 200 anatomical objects. The VOXEL-MAN system allows the linkage of the volume model to a semantic network knowledge base. Thus the model cannot only be arbitrarily viewed and dissected, but also inquired concerning the stored knowledge. Here a user has asked the system to annotate the objects by mouse click.

More information:

http://www.uke.uni-hamburg.de/idv