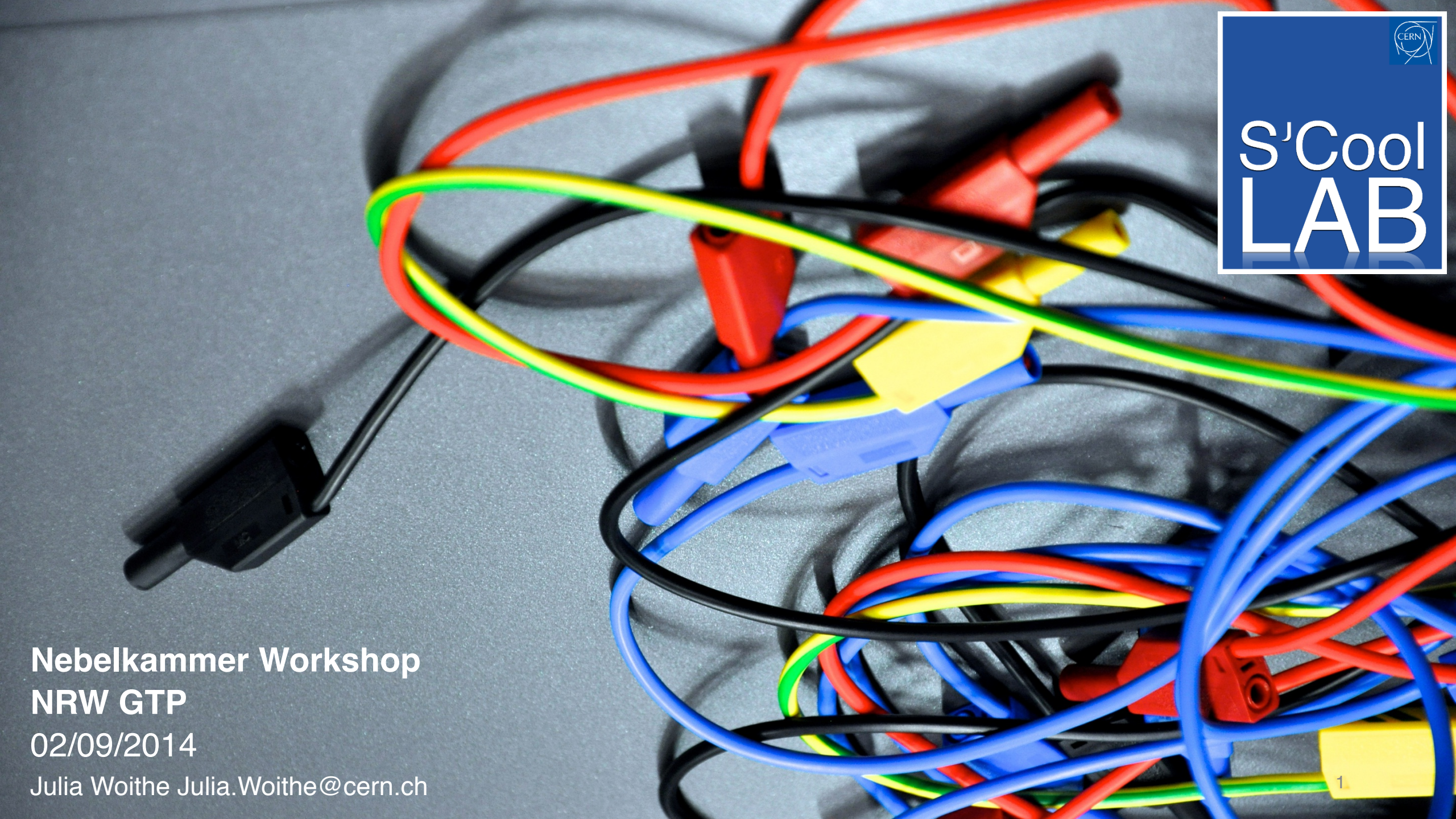


Nebelkammer Workshop
NRW GTP

02/09/2014

Julia Woithe Julia.Woithe@cern.ch

Outline

1. Geschichte
2. Anleitung und Sicherheit
3. Selbstbau einer Nebelkammer
4. Abbau
5. Diskussion der Beobachtungen

Geschichte

History

Charles T. R. Wilson (1869 - 1959)

This Scottish physicist perfected the first (expansion) cloud chamber in 1911 and received the Nobel Prize in 1927.

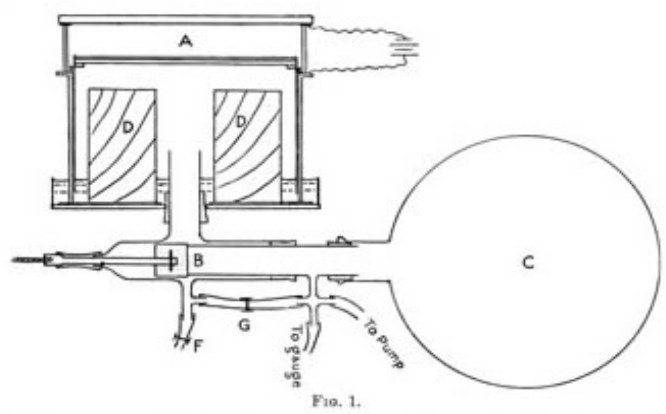


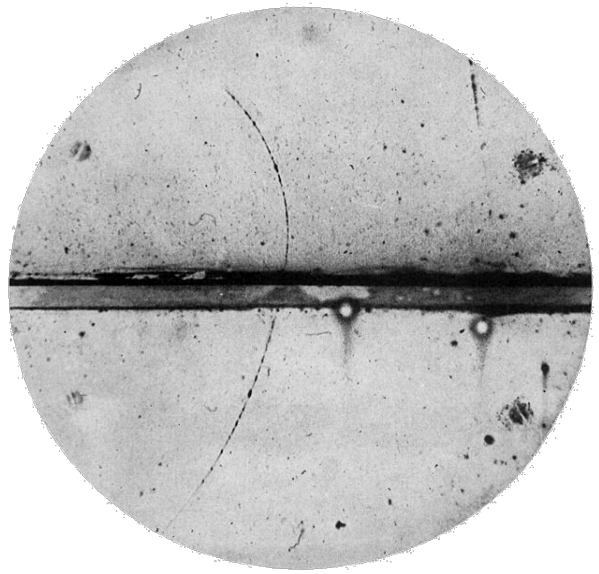
Fig. 1.

A diagram of Wilson's apparatus. The cylindrical cloud chamber ('A') is 16.5cm across by 3.4cm deep.

C. T. R. WILSON: On an Expansion Apparatus for Making Visible the Tracks of Ionising Particles in Gases and Some Results Obtained by Its Use. Proc. R. Soc. Lond. A. 1912 87 277-292 DOI:10.1098/rspa.1912.0081

Carl Anderson (1905 - 1991)

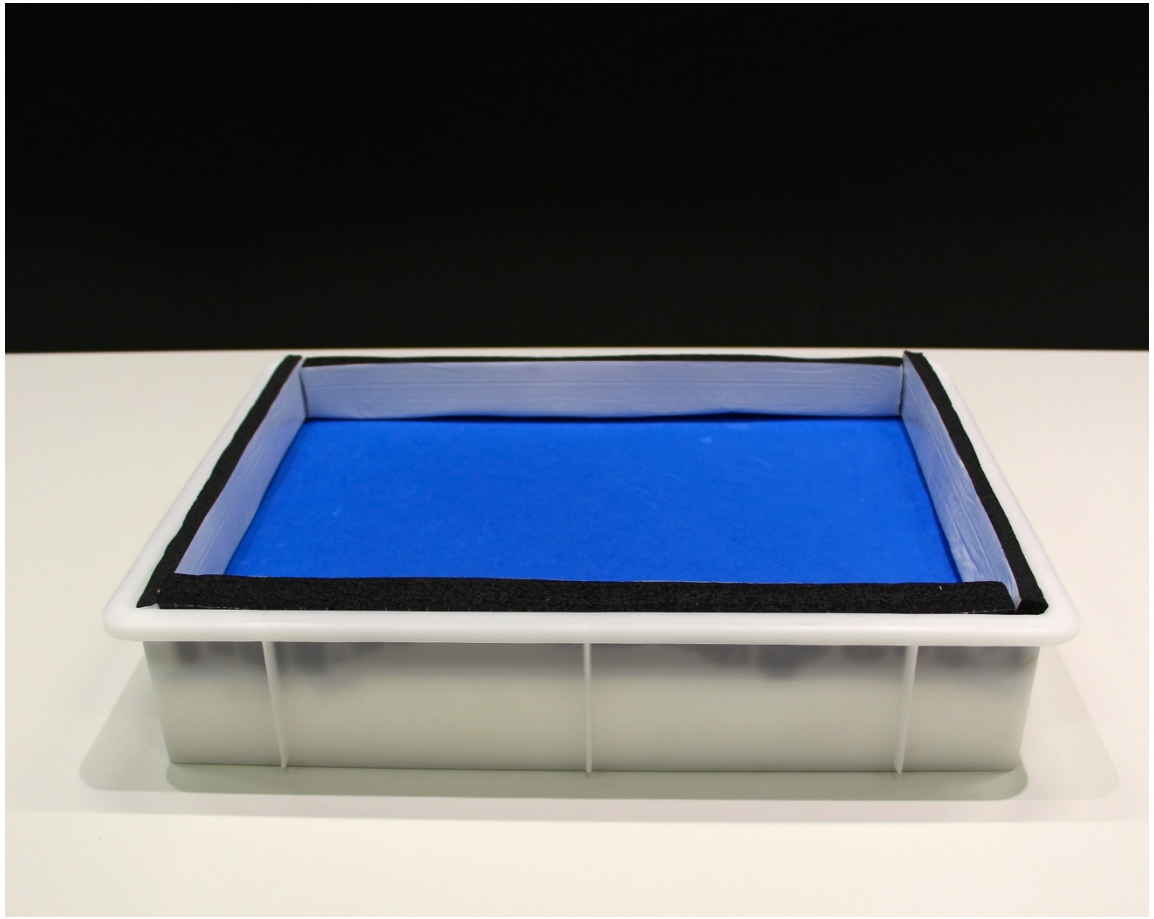
This physicist discovered the positron in 1932 and the muon in 1936 using a cloud chamber. He received the Nobel Prize in 1936.



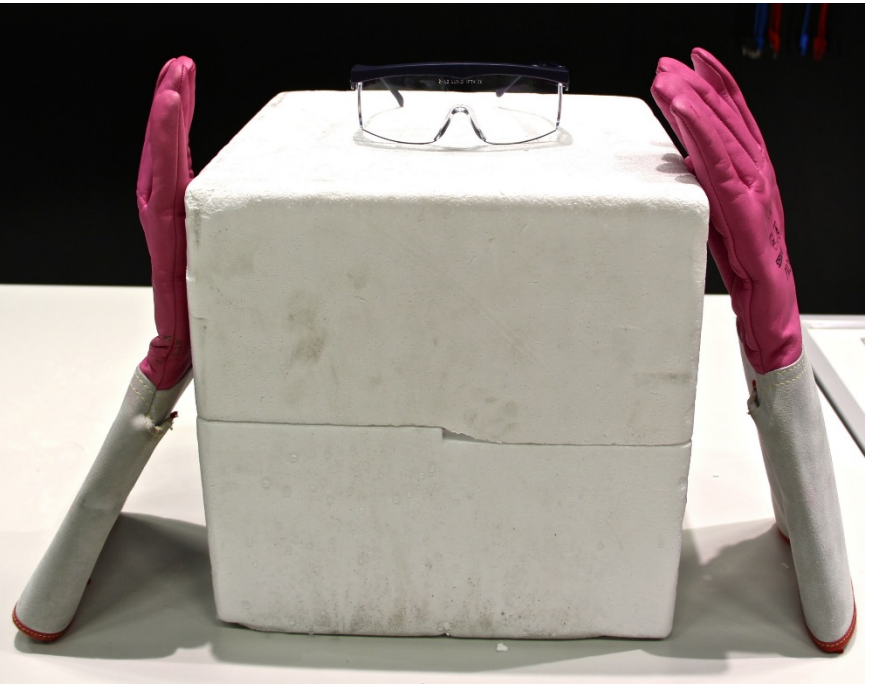
Carl D. Anderson (1905–1991) - Anderson, Carl D. (1933). "The Positive Electron". Physical Review 43 (6): 491–494. DOI:10.1103/PhysRev.43.491.

Anleitung und Sicherheit

Build your cloud chamber - step by step



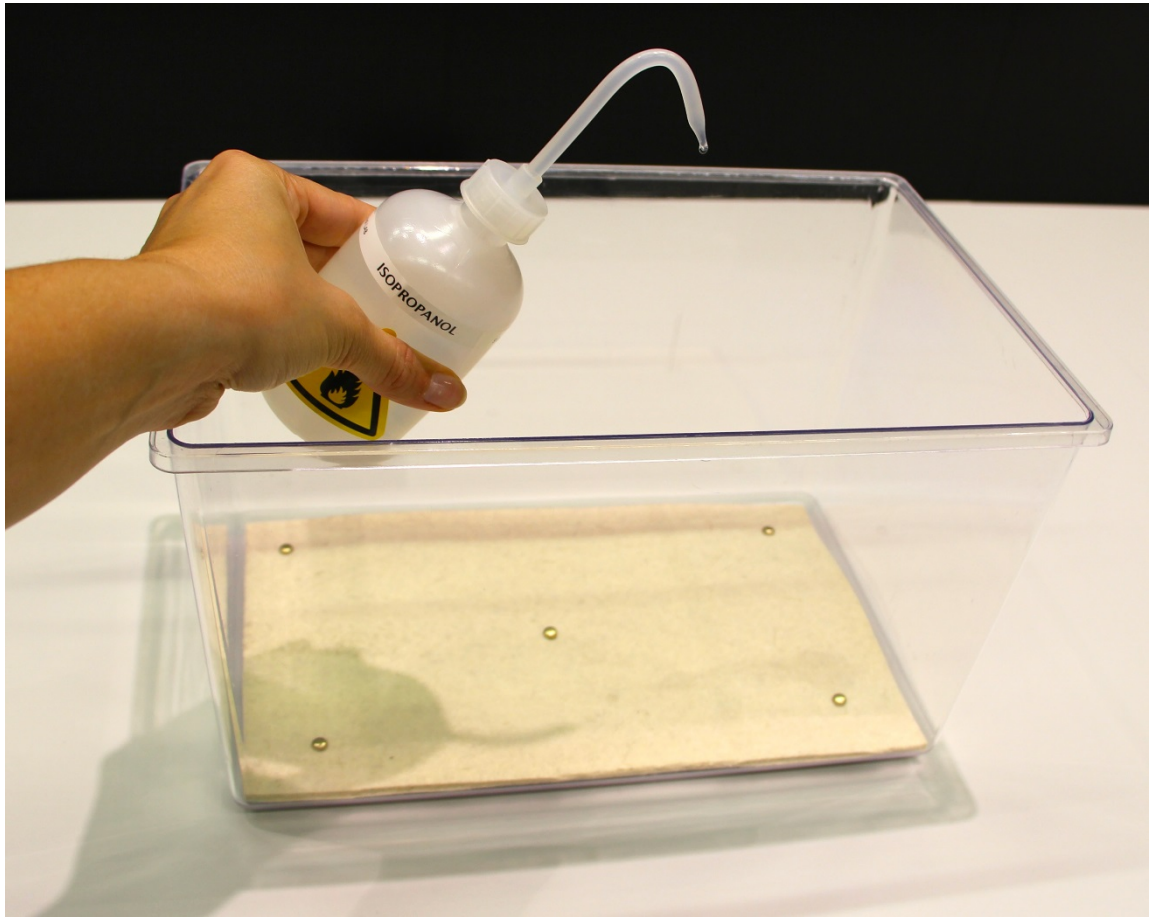
Build your cloud chamber - step by step



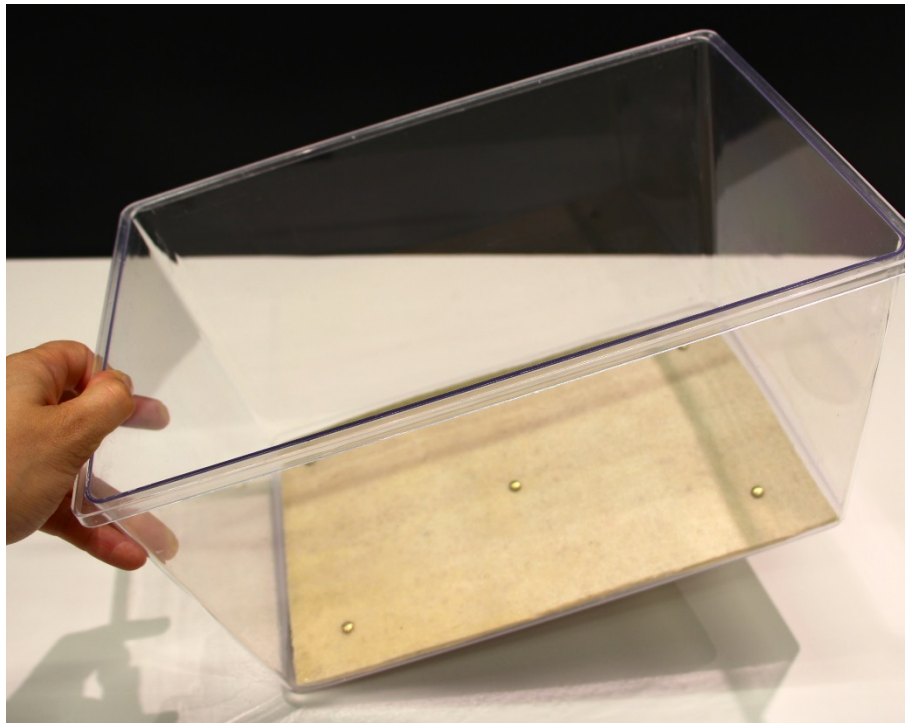
Build your cloud chamber - step by step

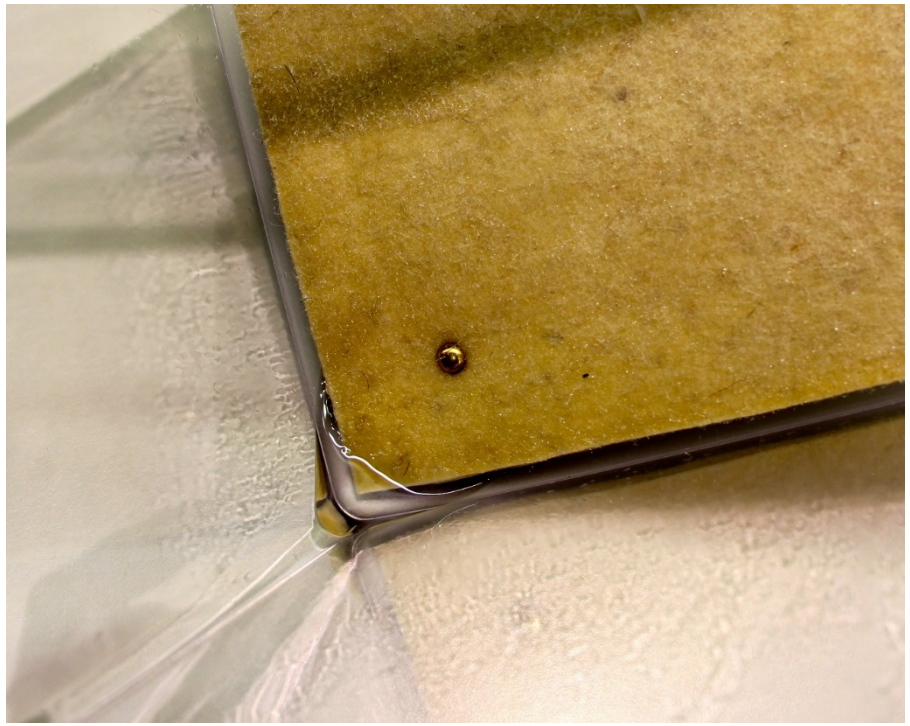
Build your cloud chamber - step by step

Build your cloud chamber - step by step



Build your cloud chamber - step by step

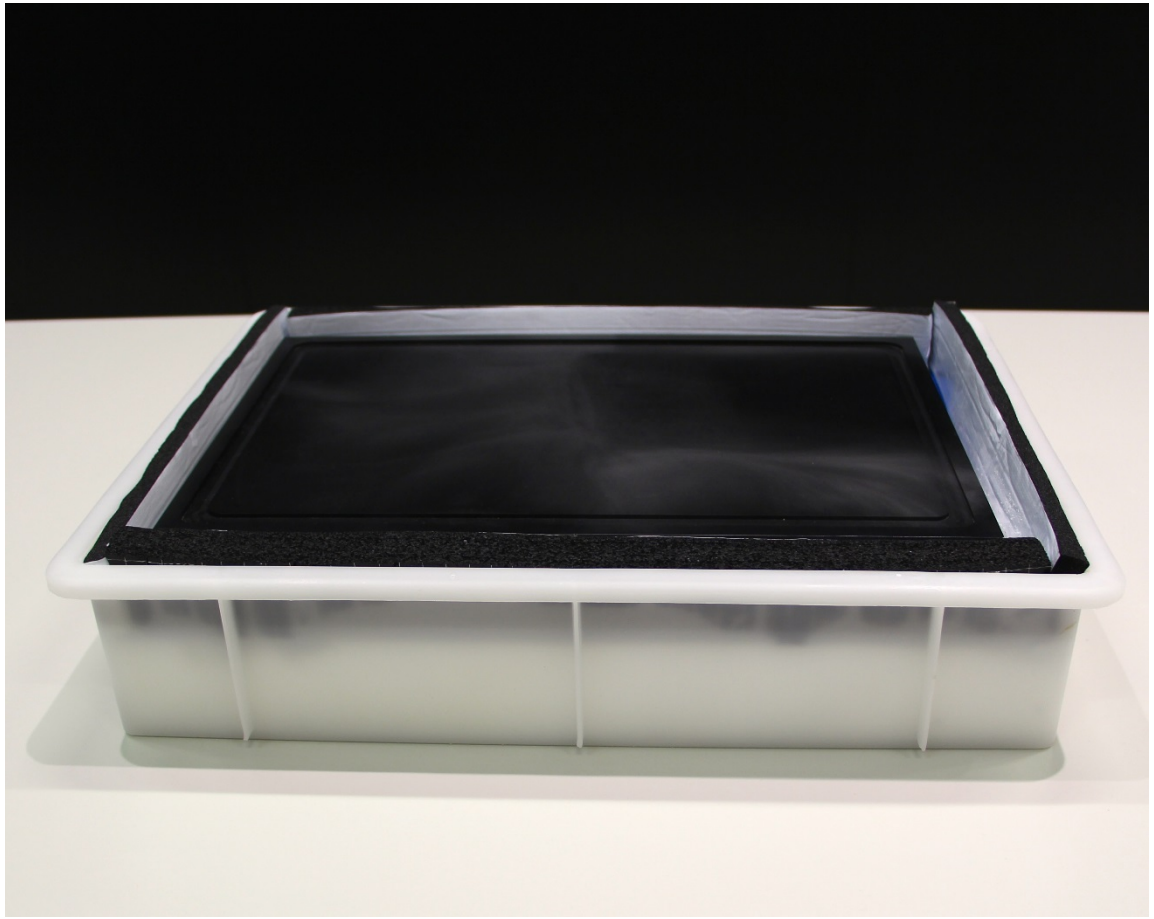




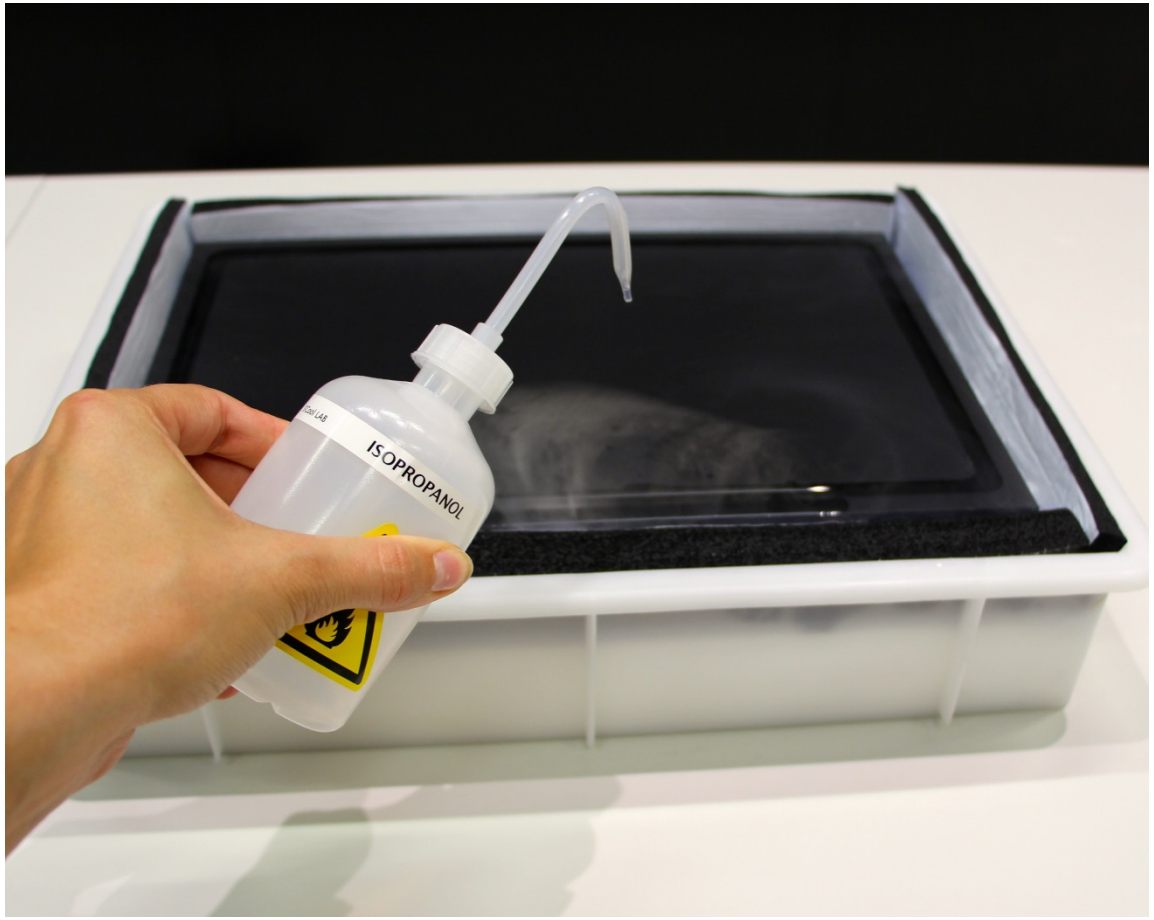
Build your cloud chamber - step by step

Build your cloud chamber - step by step

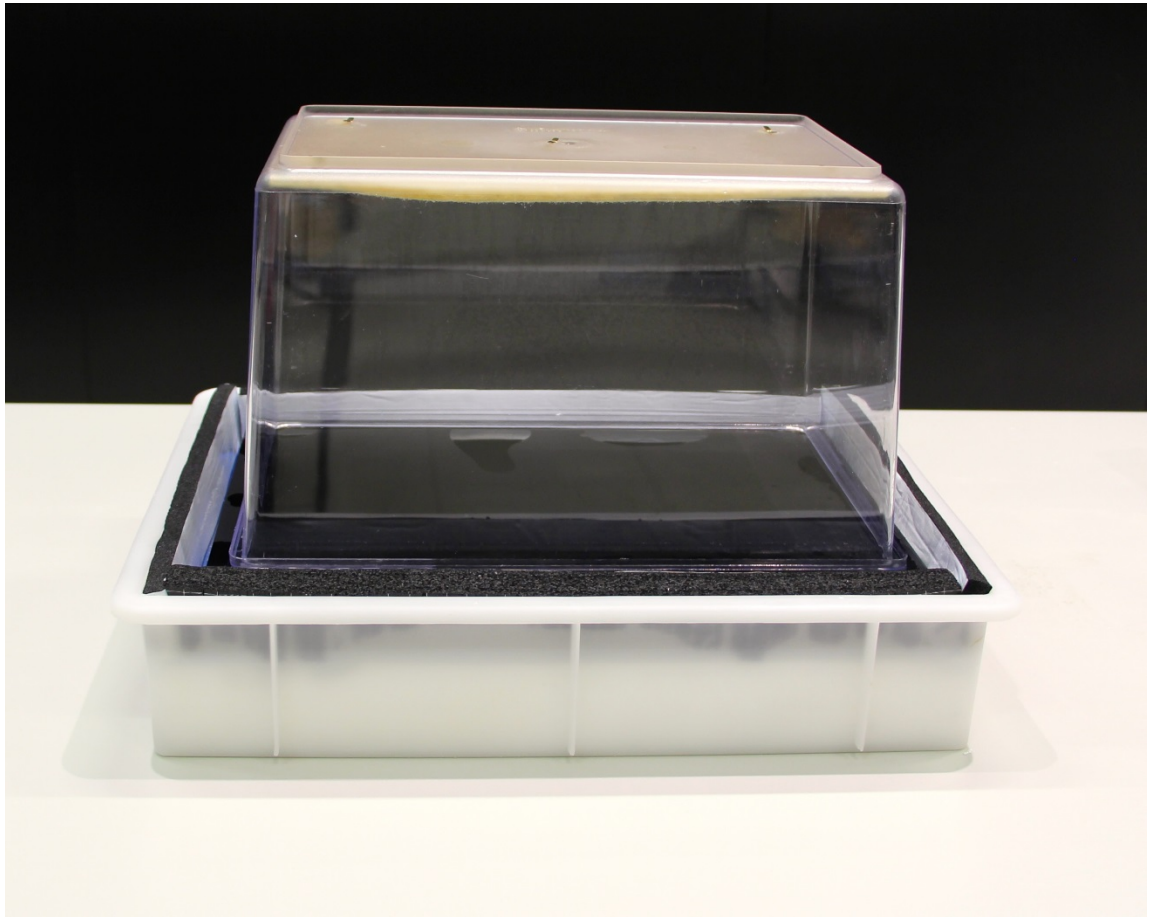
Build your cloud chamber - step by step



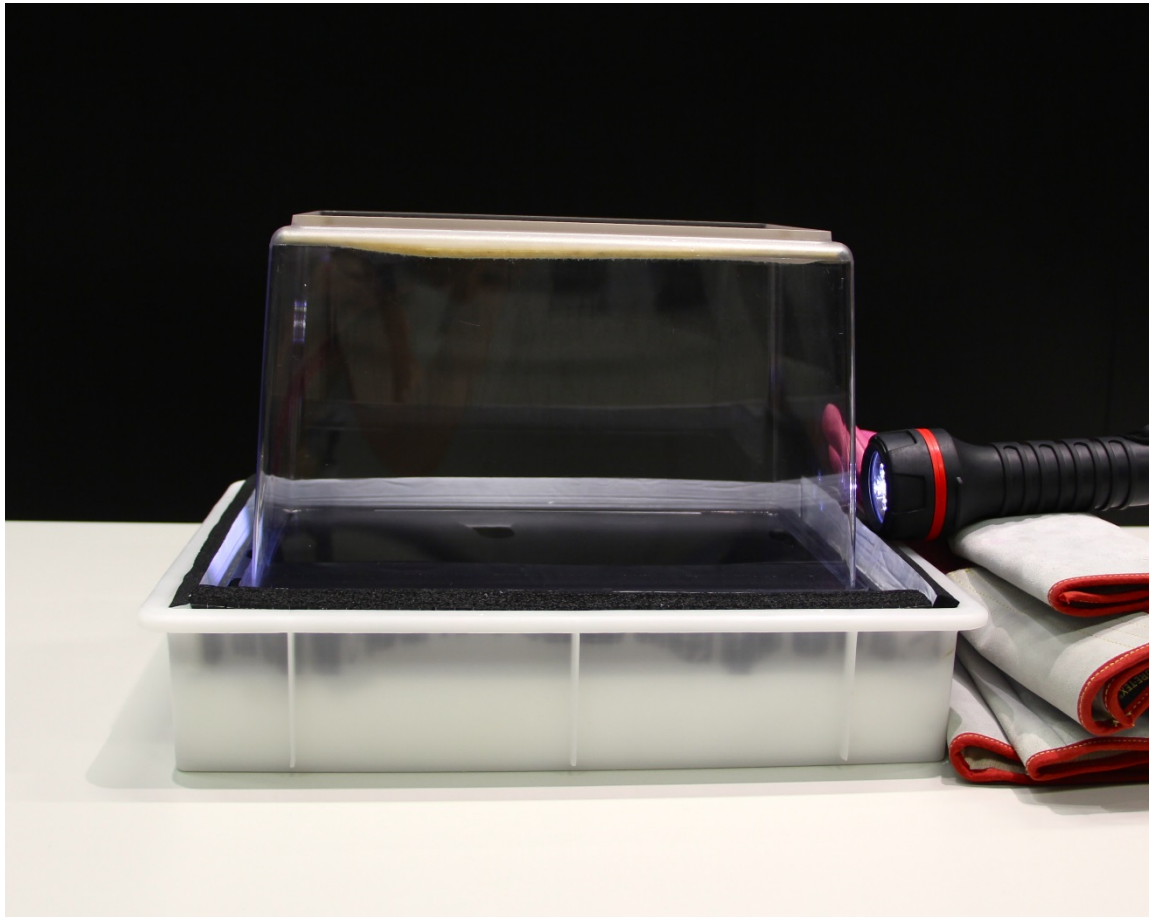
Build your cloud chamber - step by step



Build your cloud chamber - step by step



Build your cloud chamber - step by step



Selbstbau einer Nebelkammer

Shopping List

Aufgabe: Beobachten Sie Ihre Nebelkammer. Beschreiben Sie sichtbare Spuren (Form, Länge, Breite, …). Diskutieren Sie in der Kleingruppe, durch welche Teilchen diese Spuren hervorgerufen werden.

Abbau

Inverse Shopping List

Diskussion der Beobachtungen

… am Whiteboard

Zusatzmaterial

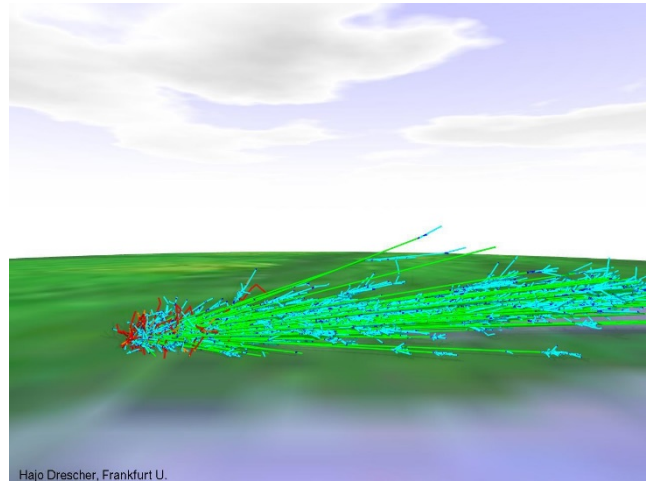
Air Shower Simulation

Cosmic Ray Air Shower Pictures

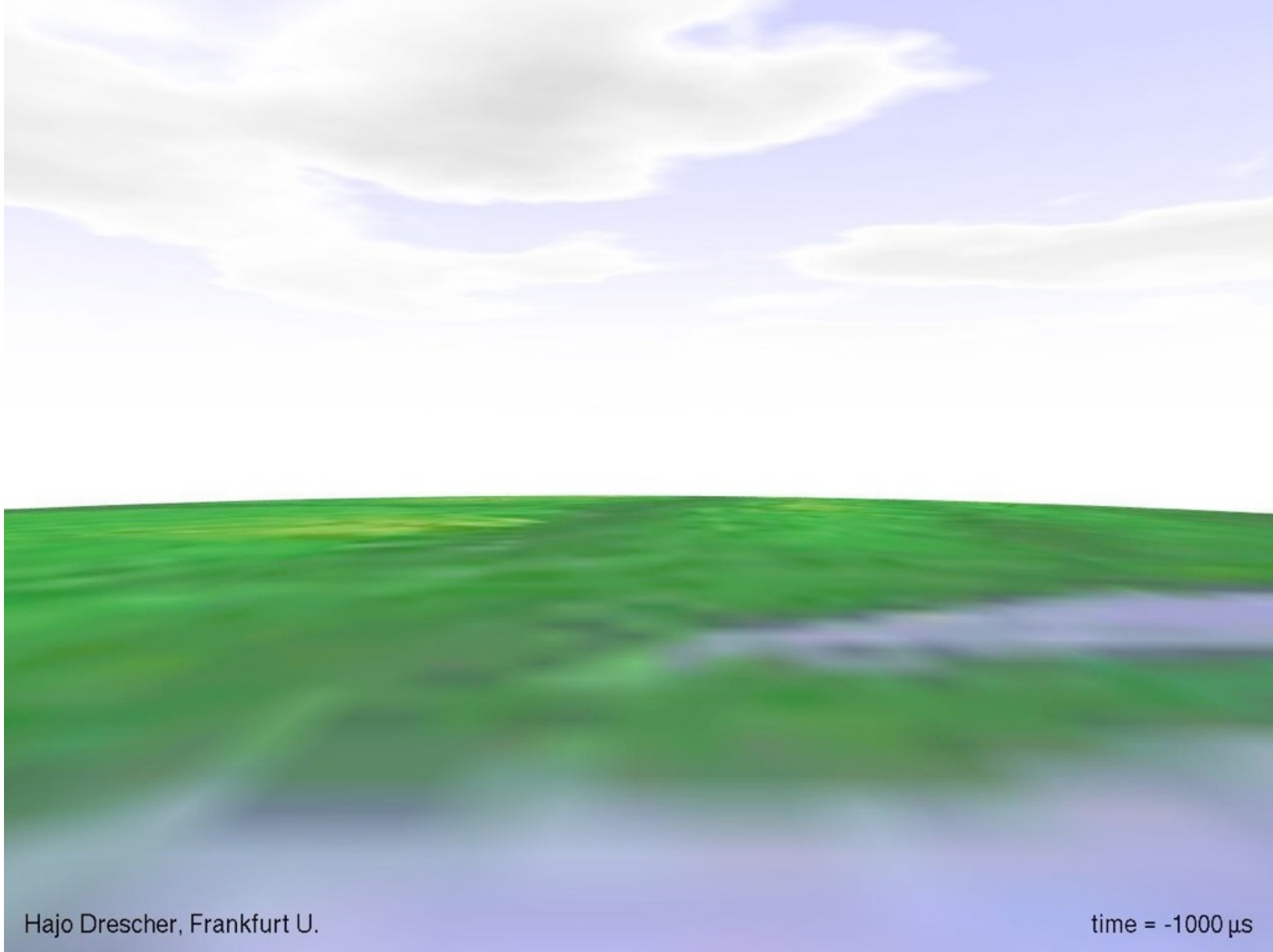
by H.-J. Drescher drescher@th.physik.uni-frankfurt.de.

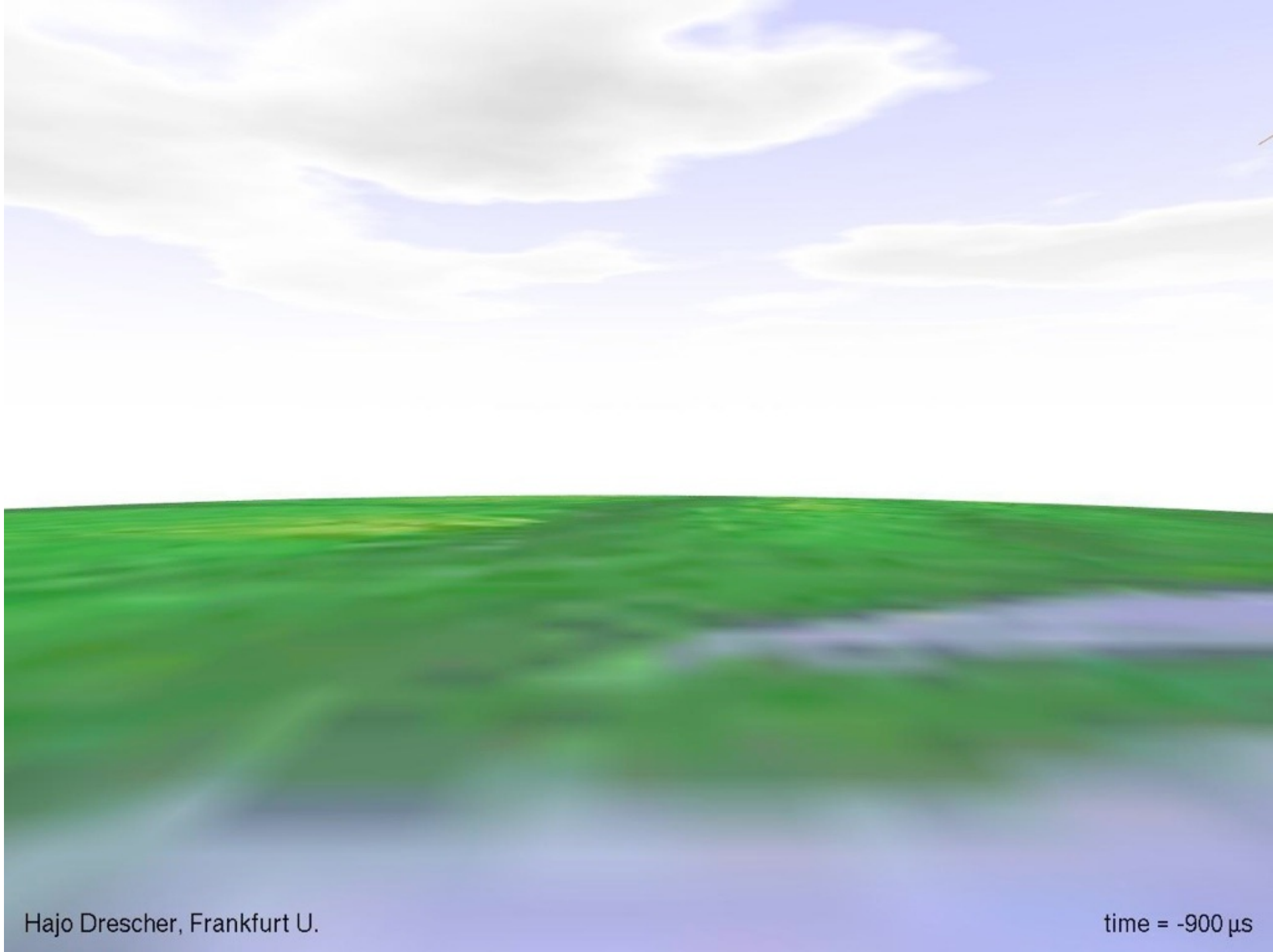
Air showers are cascades of secondary particles induced in the atmosphere by high energy cosmic rays. What you see here is a **visualisation of realistic simulations of these showers**. Of course, not all of the particles in a shower are displayed, there are far too many! The **fraction displayed here is about 1e-6**, sampled with a **thinning algorithm**.

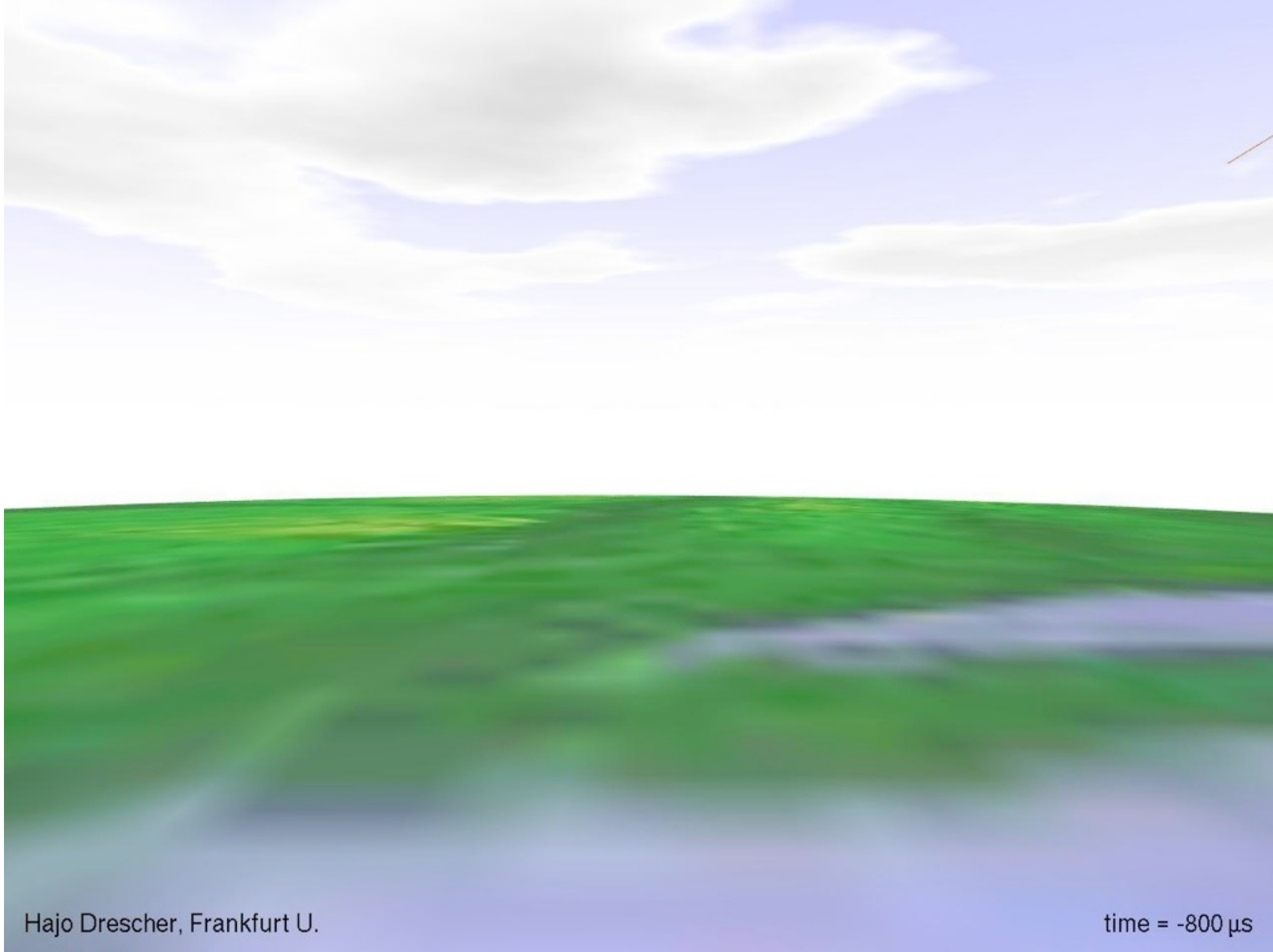
blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons

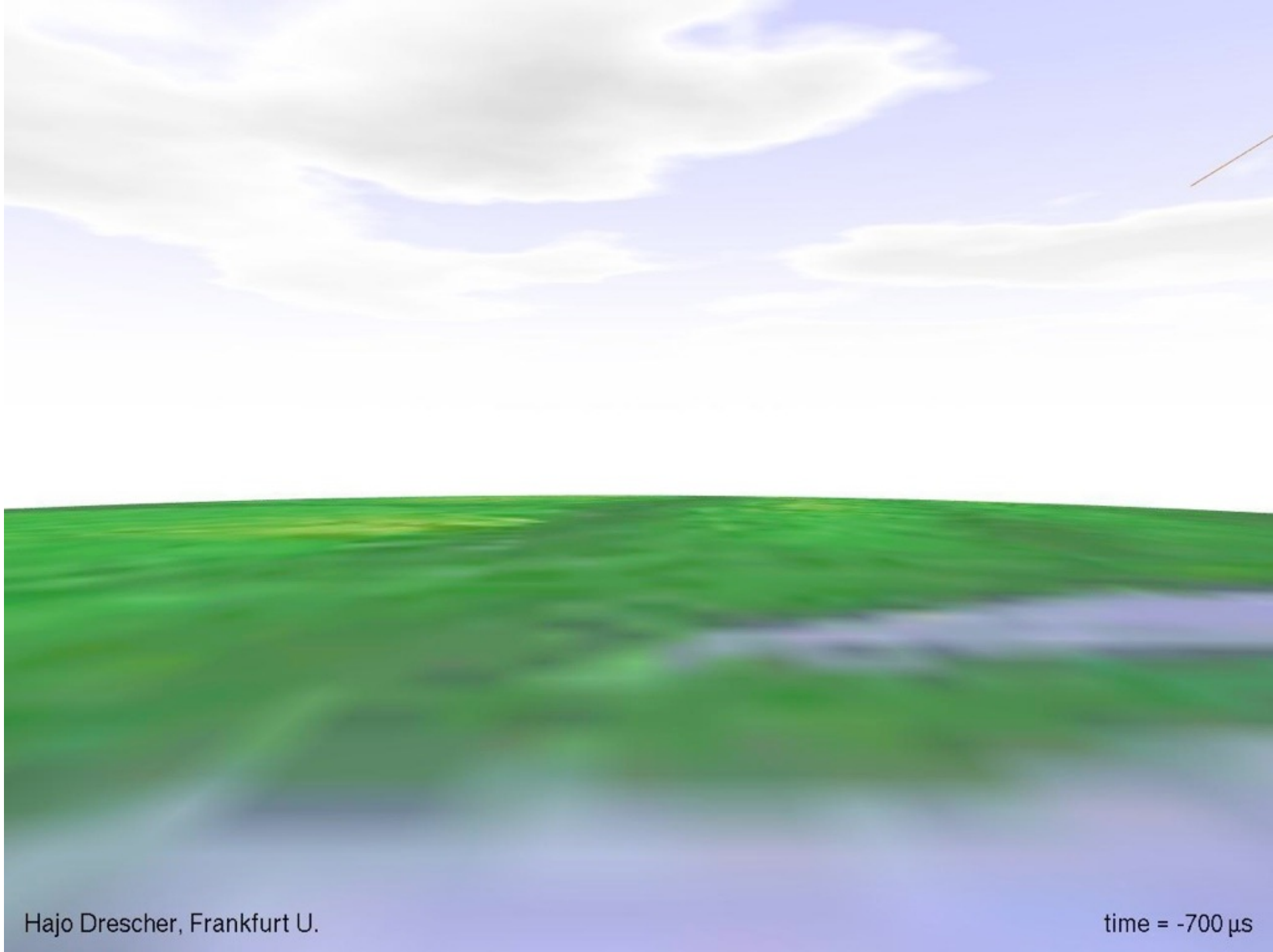


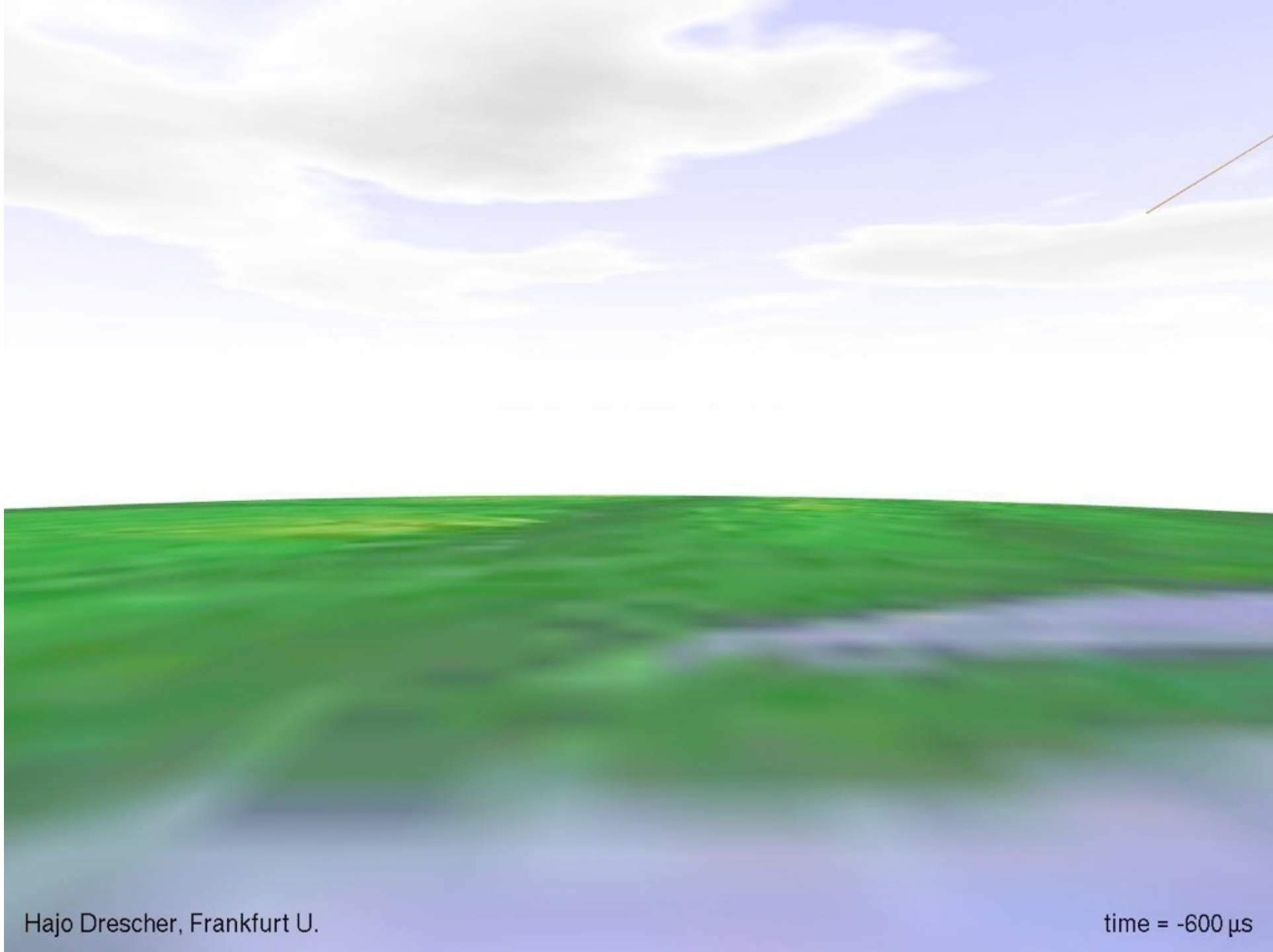
http://th.physik.uni-frankfurt.de/~drescher/CASSIM/

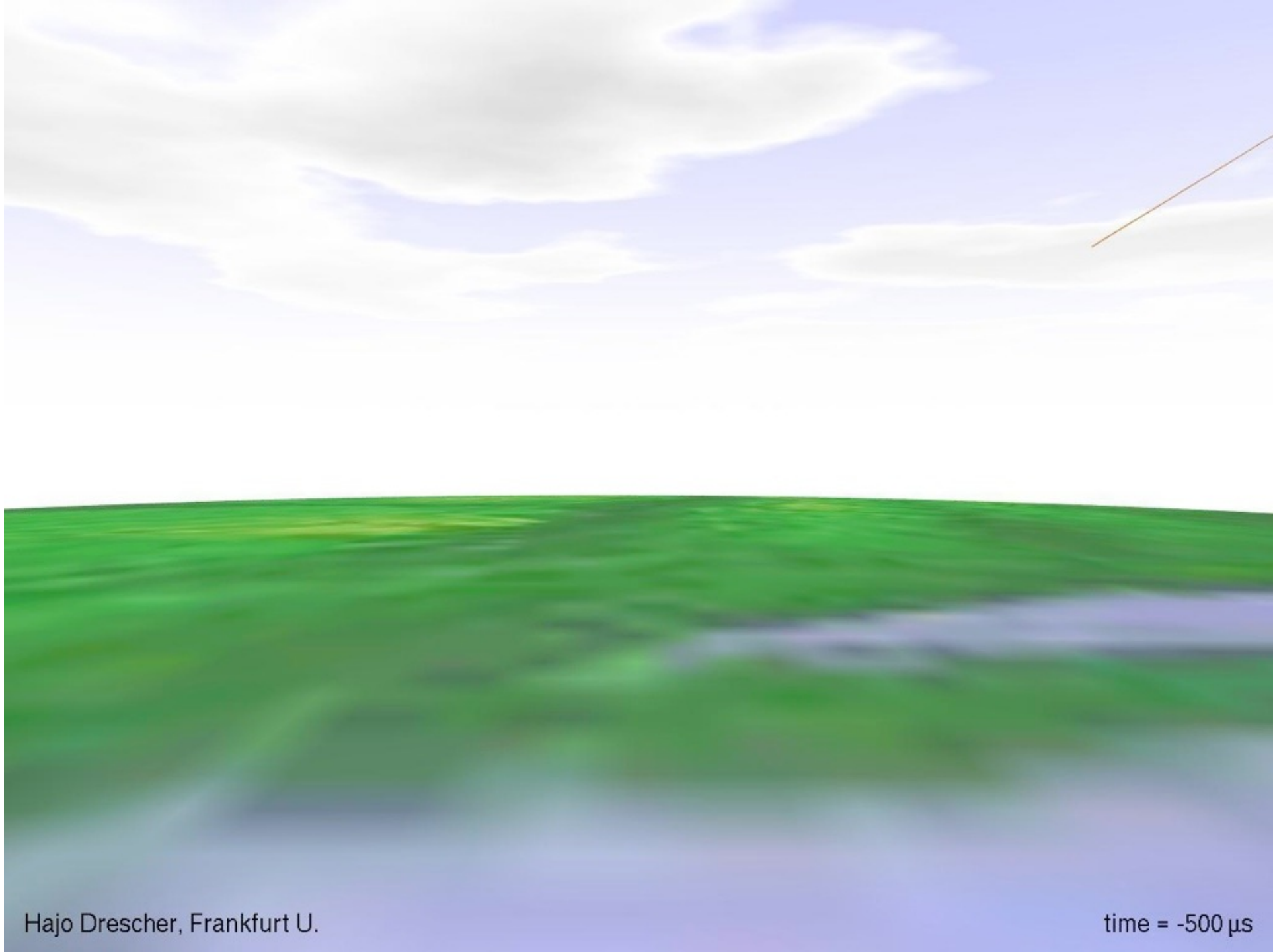

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -1000 µs

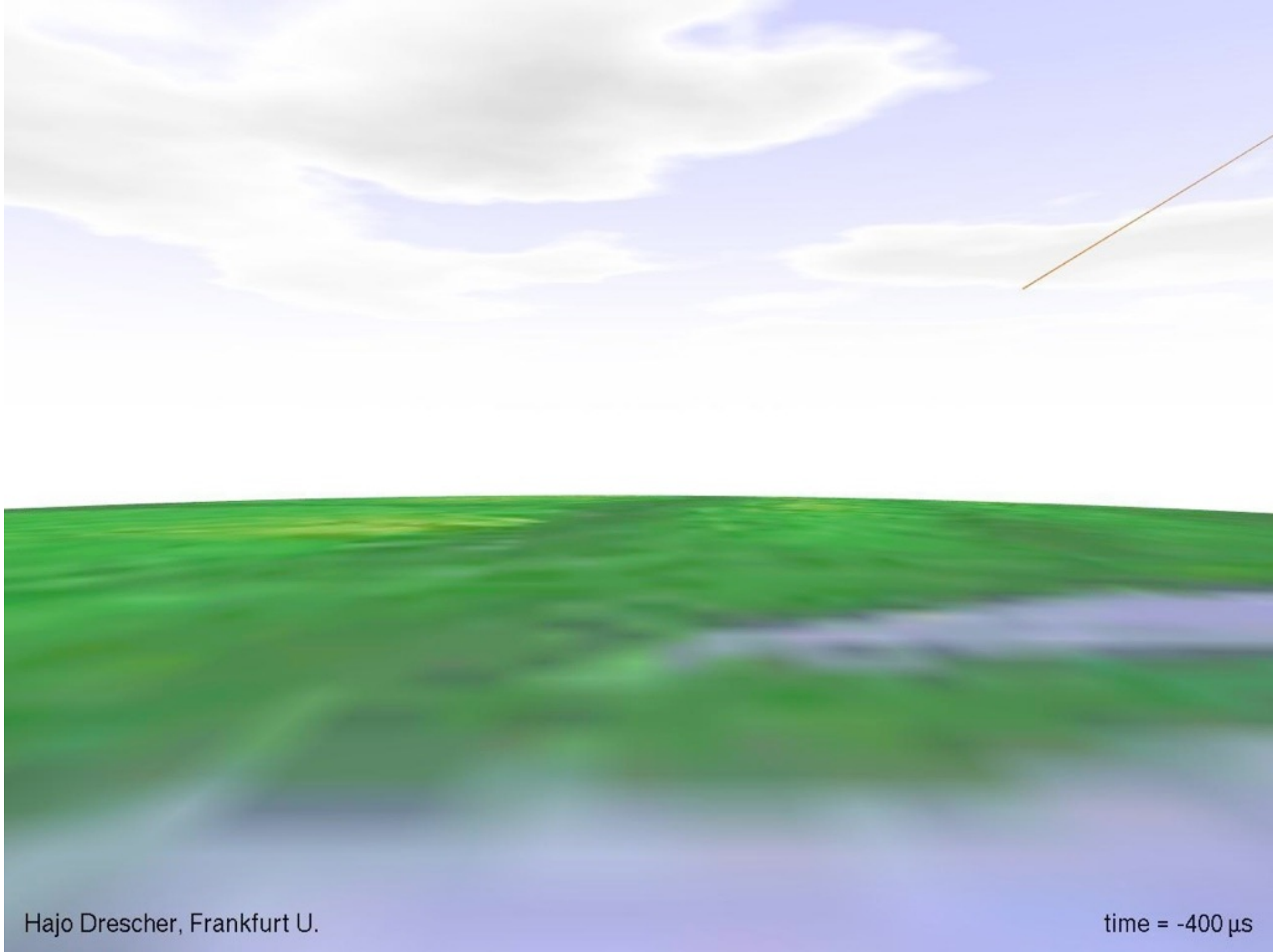

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -900 µs

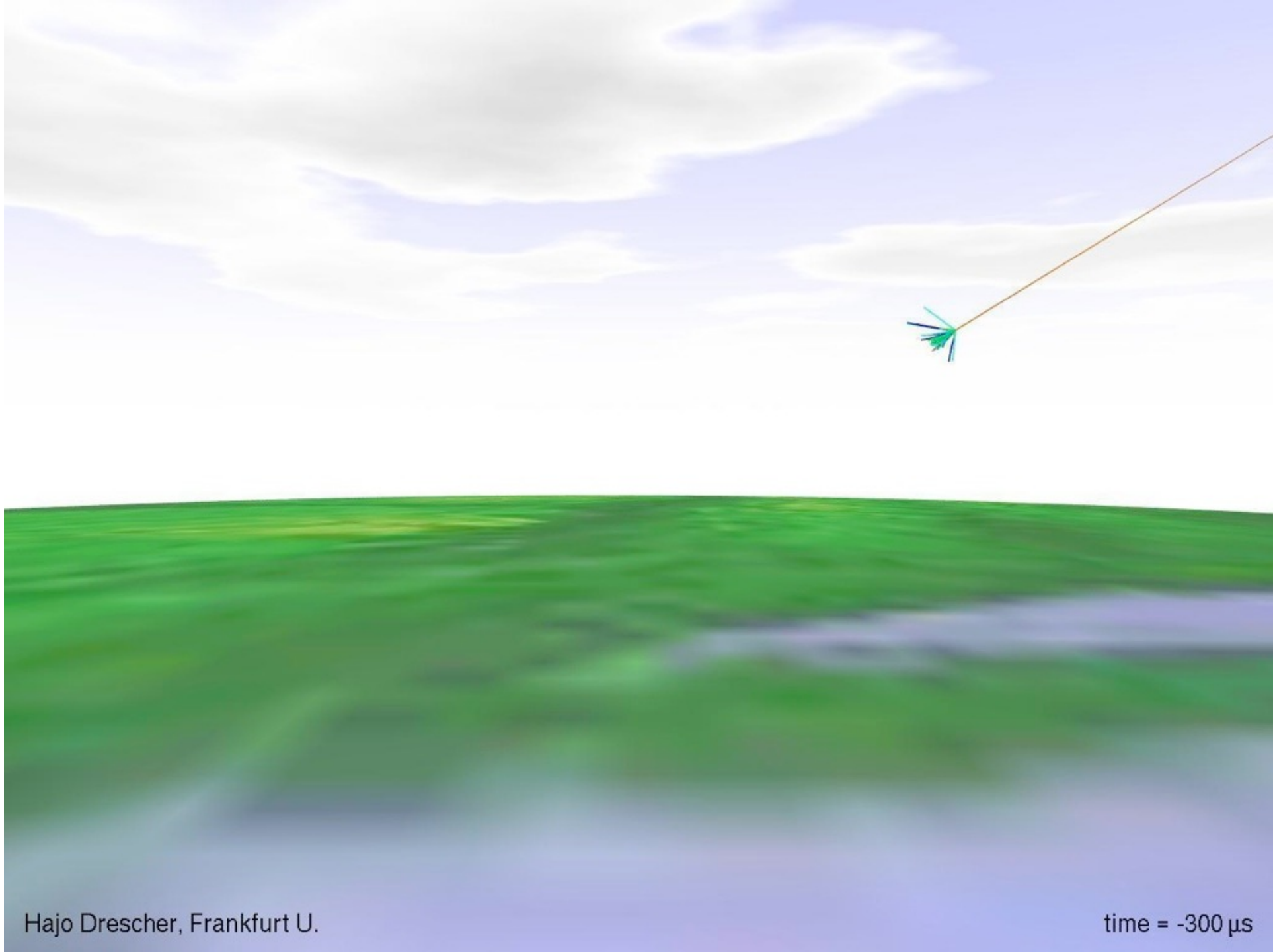

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -800 µs

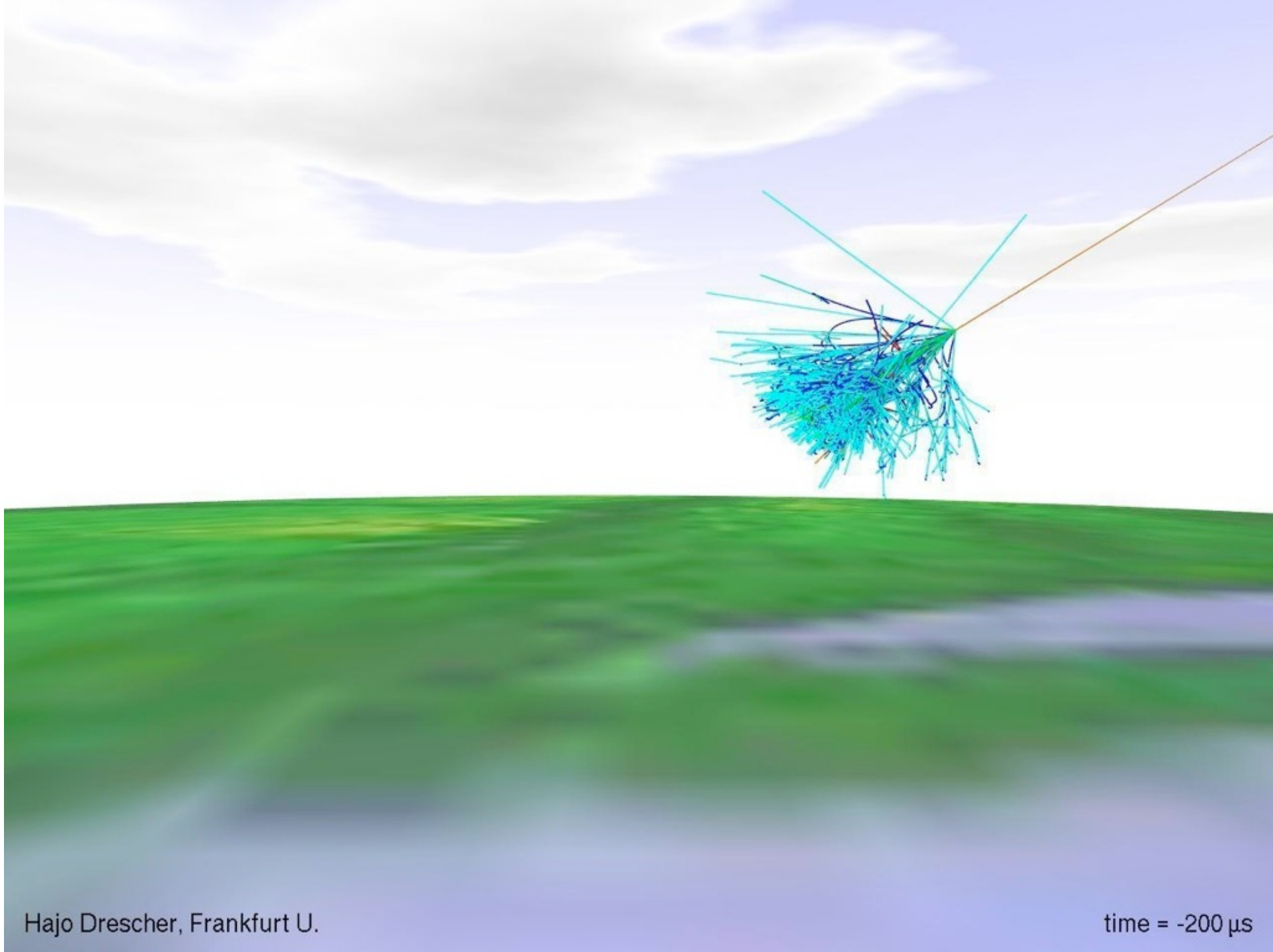

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -700 µs

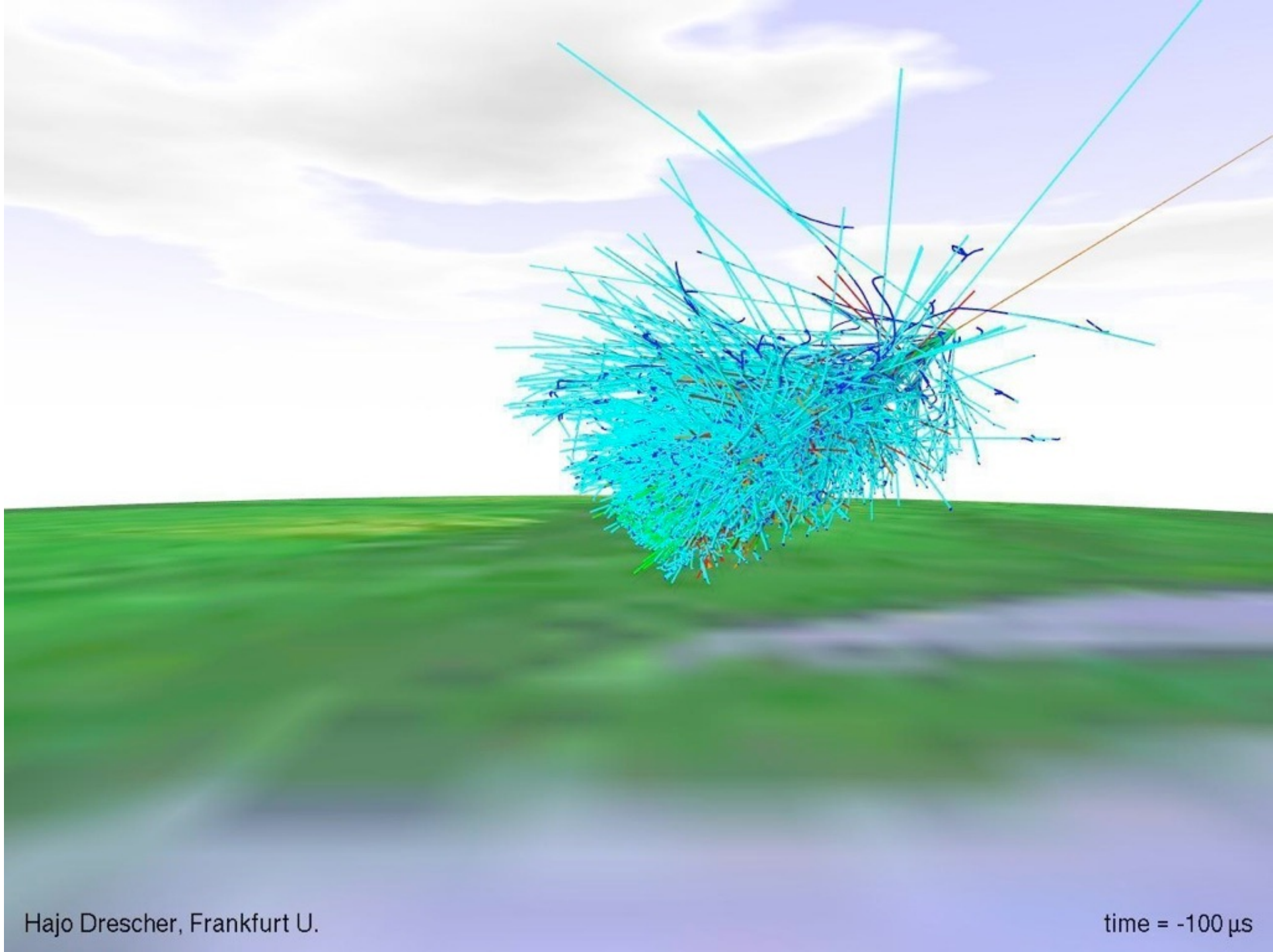

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -600 µs

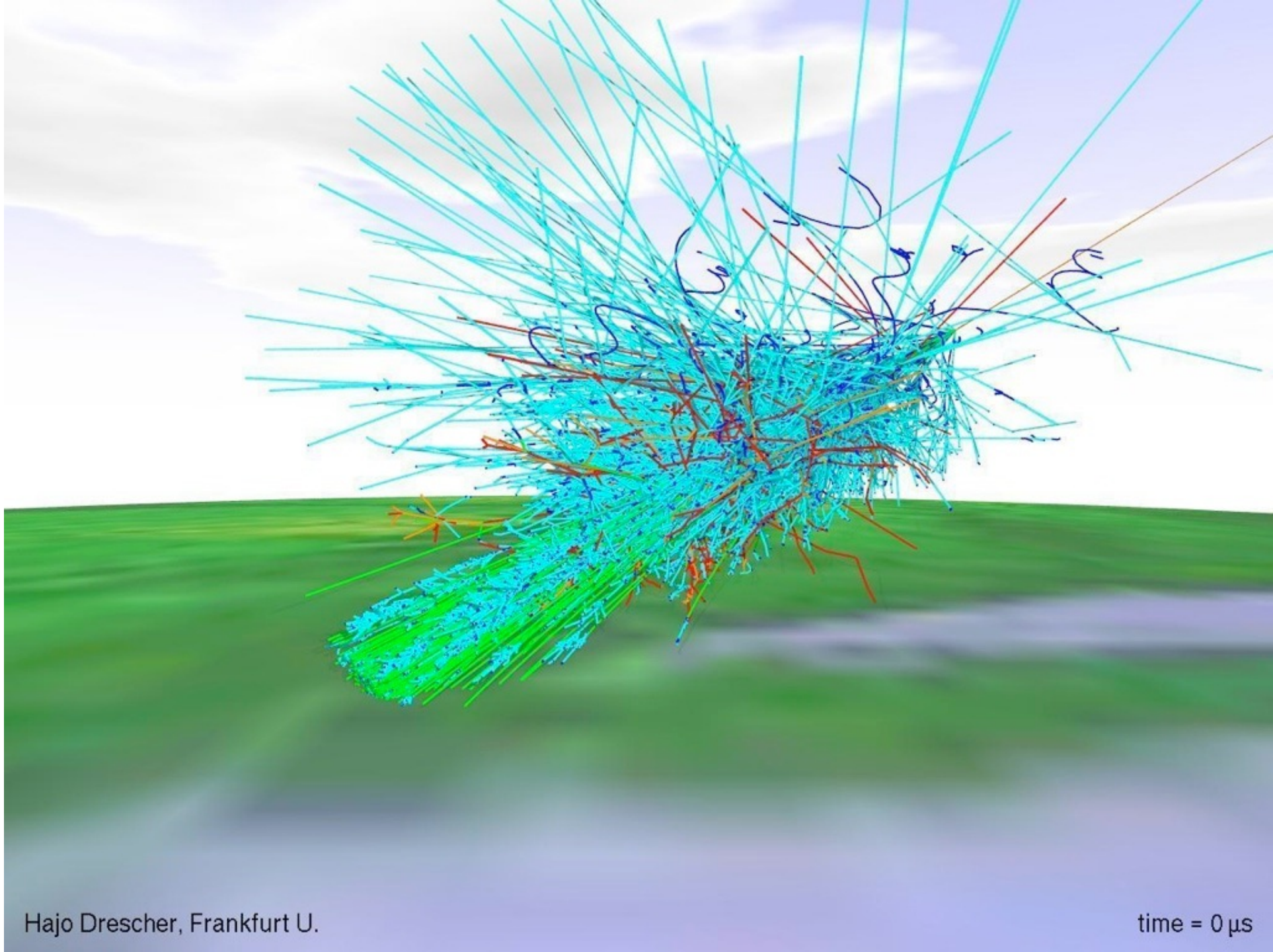

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -500 µs

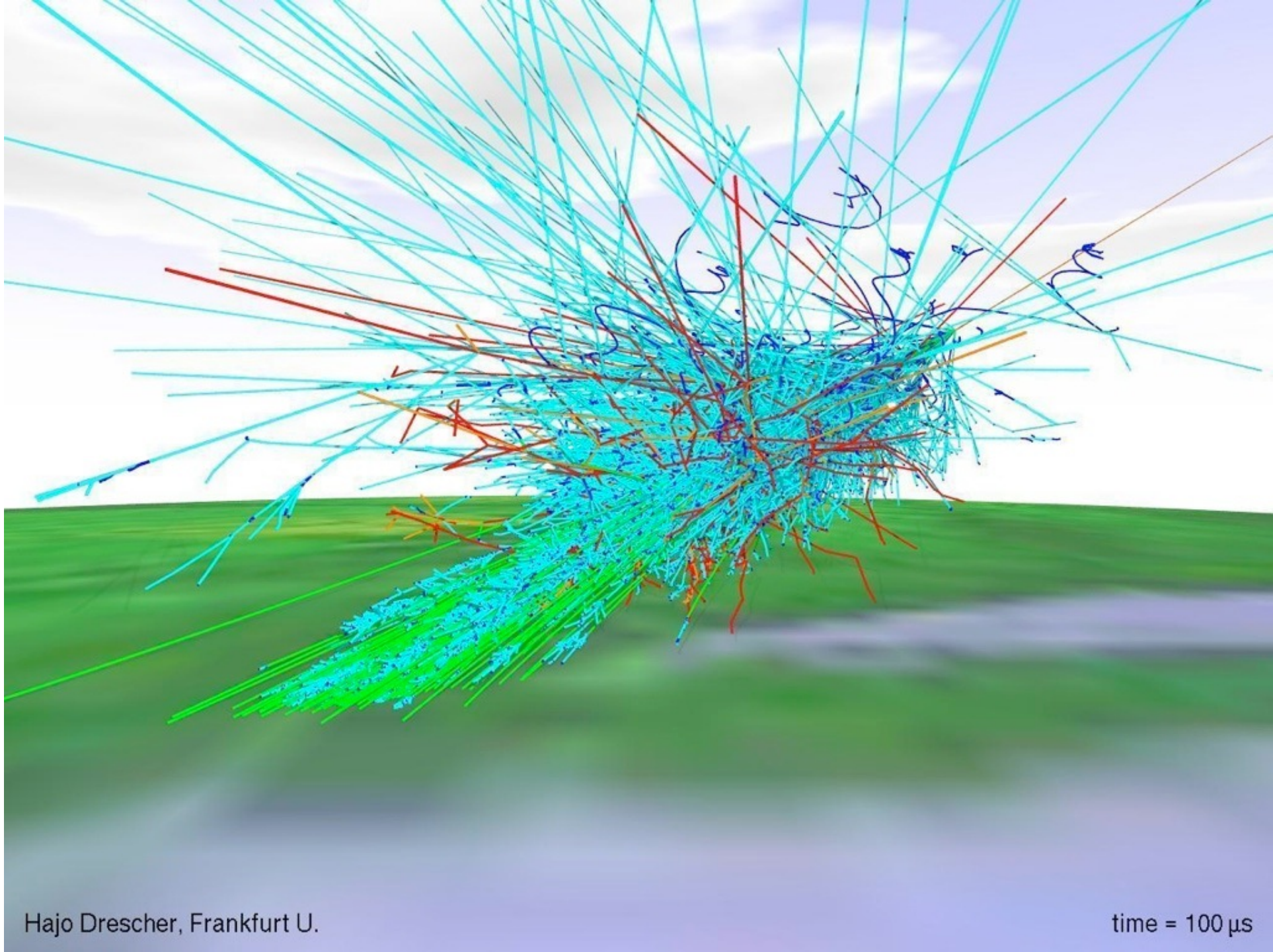

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -400 µs

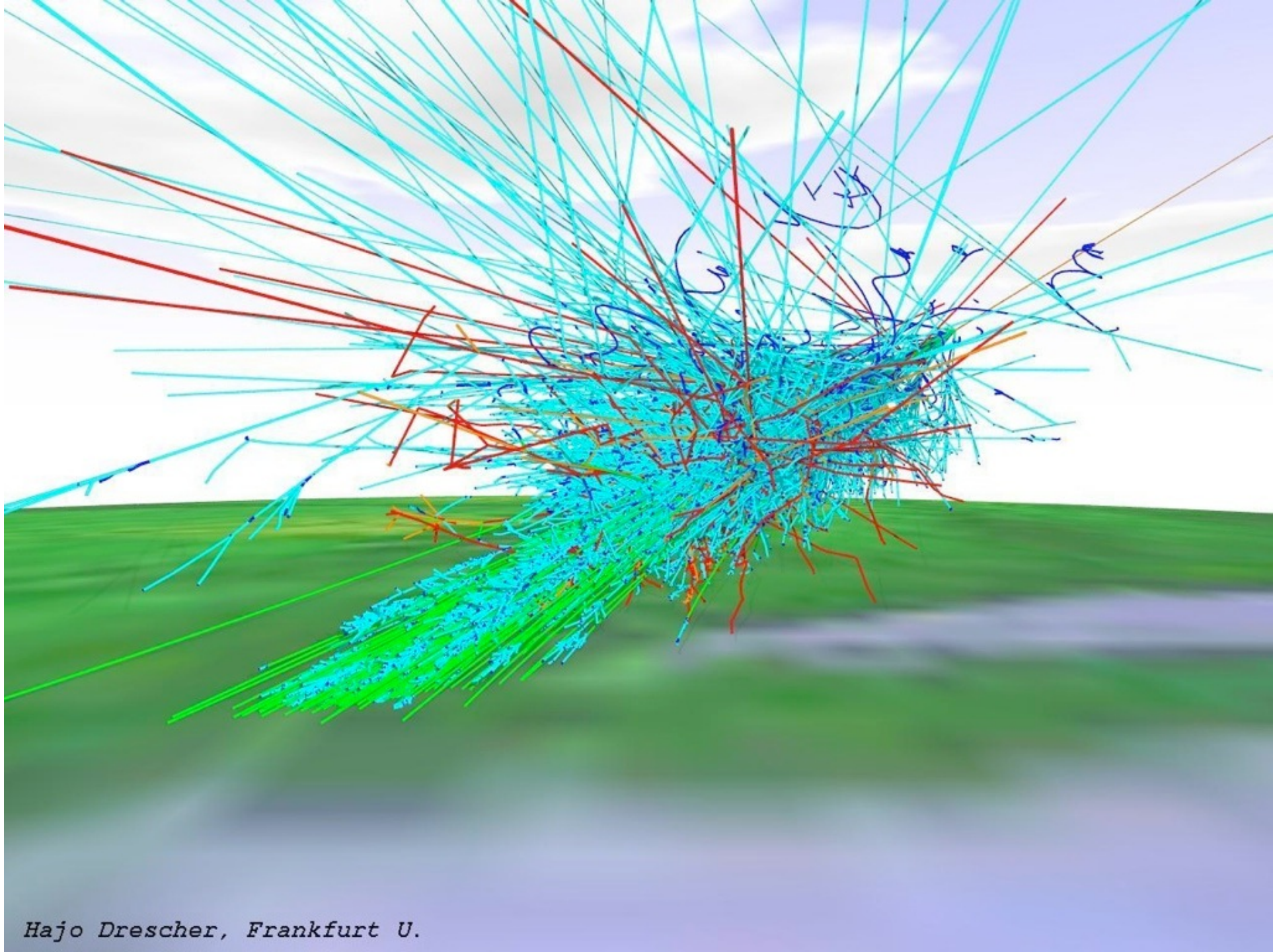

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -300 µs

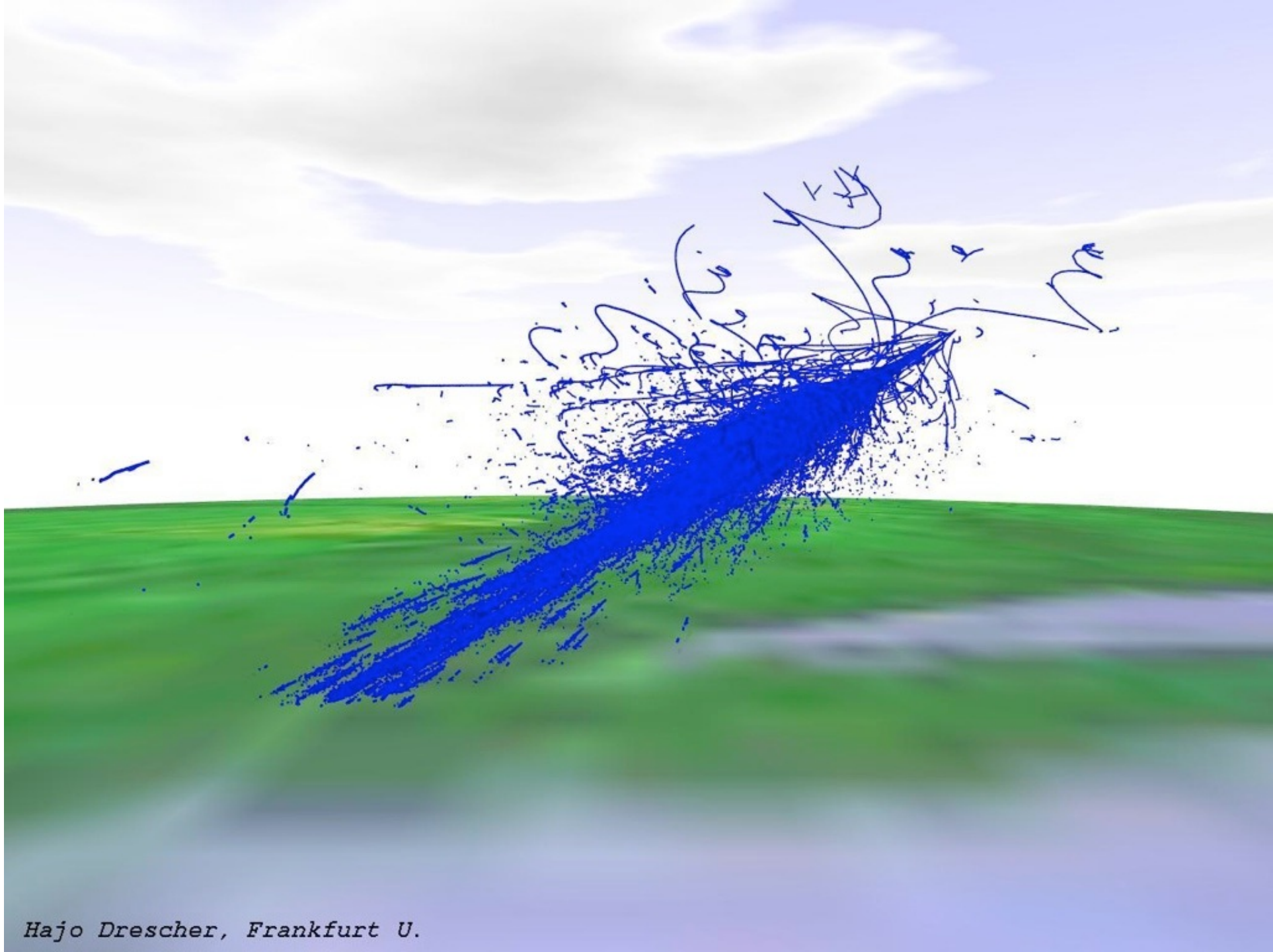

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -200 µs

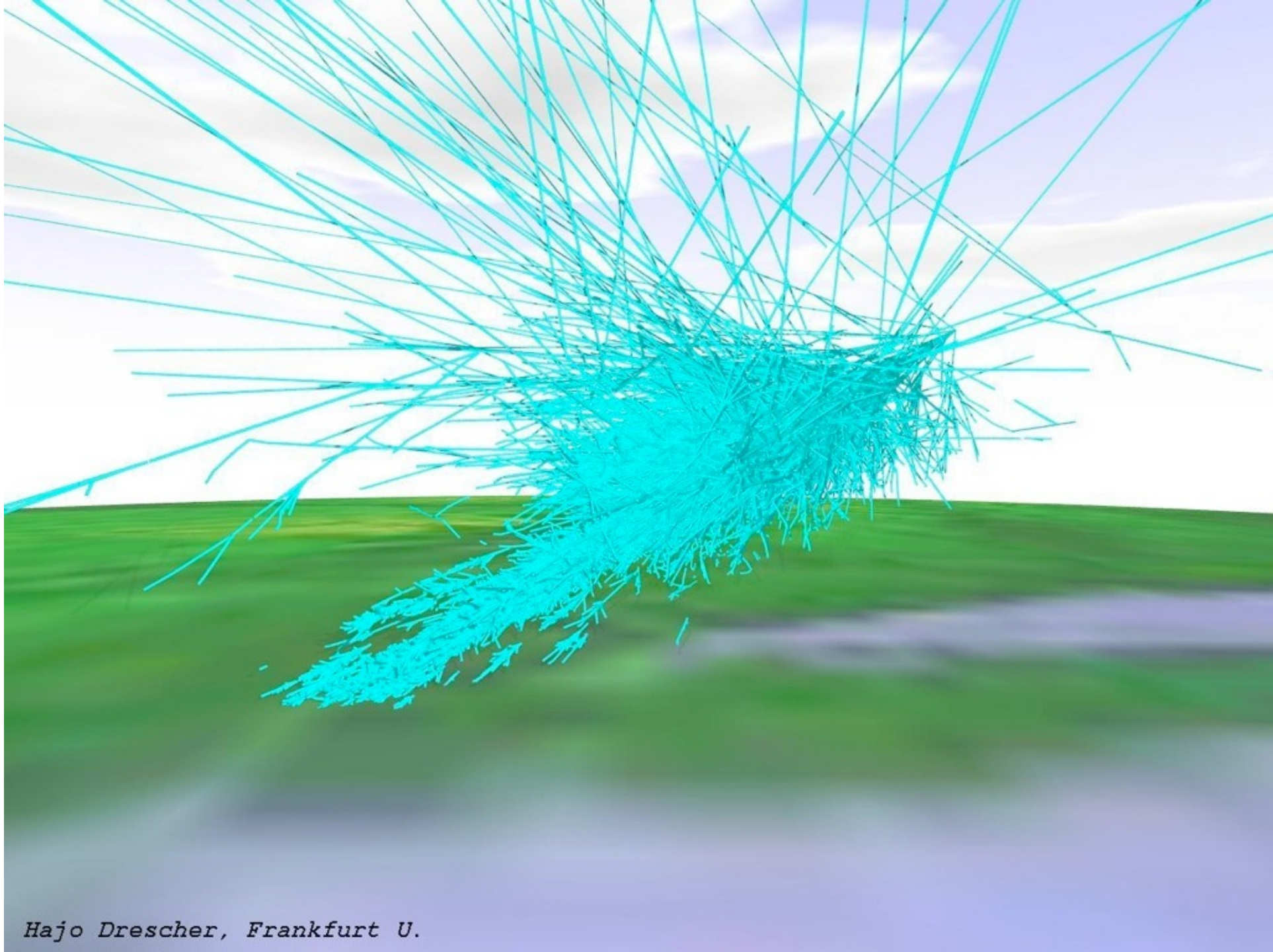

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = -100 µs

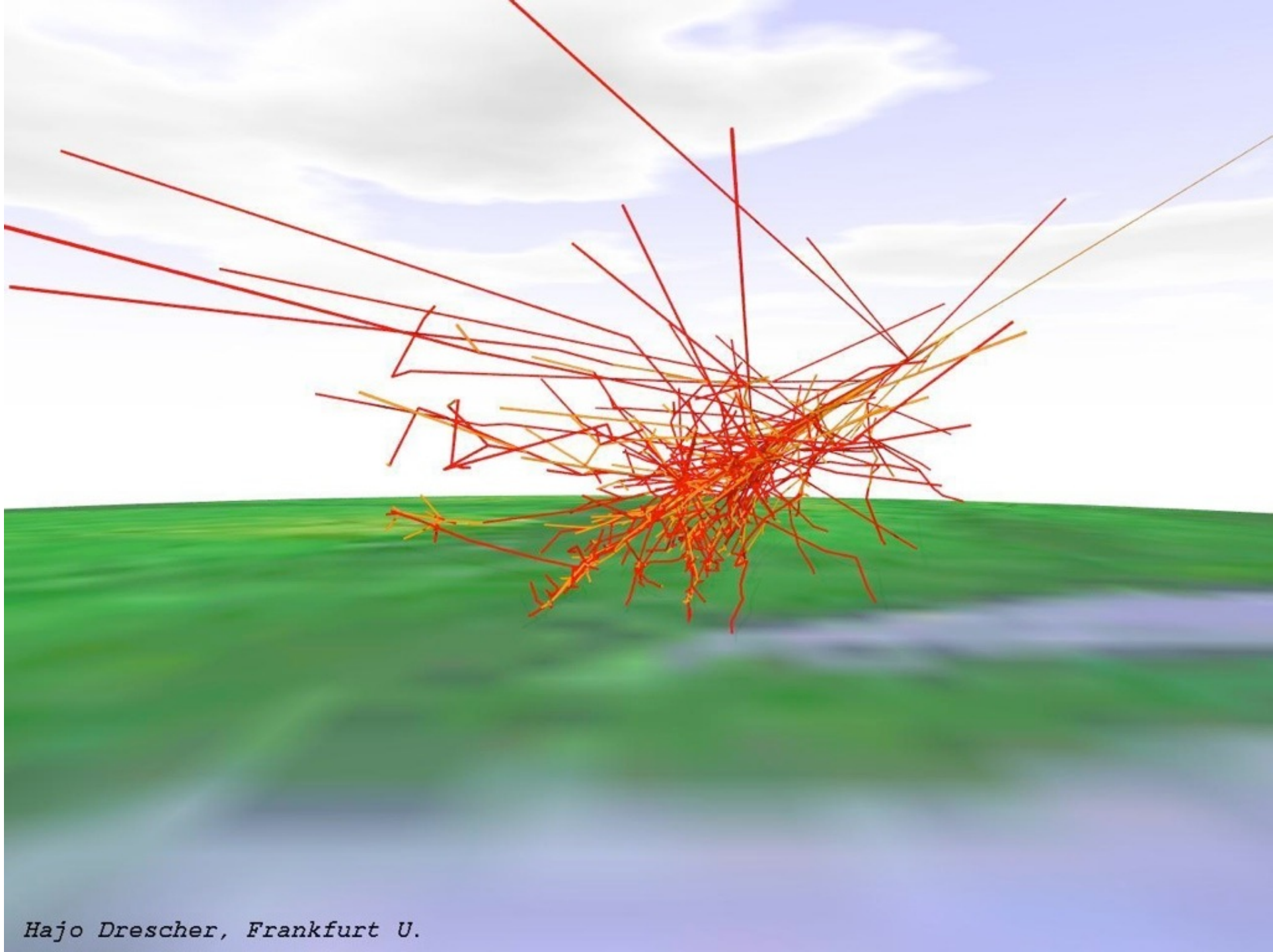

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = 0 µs

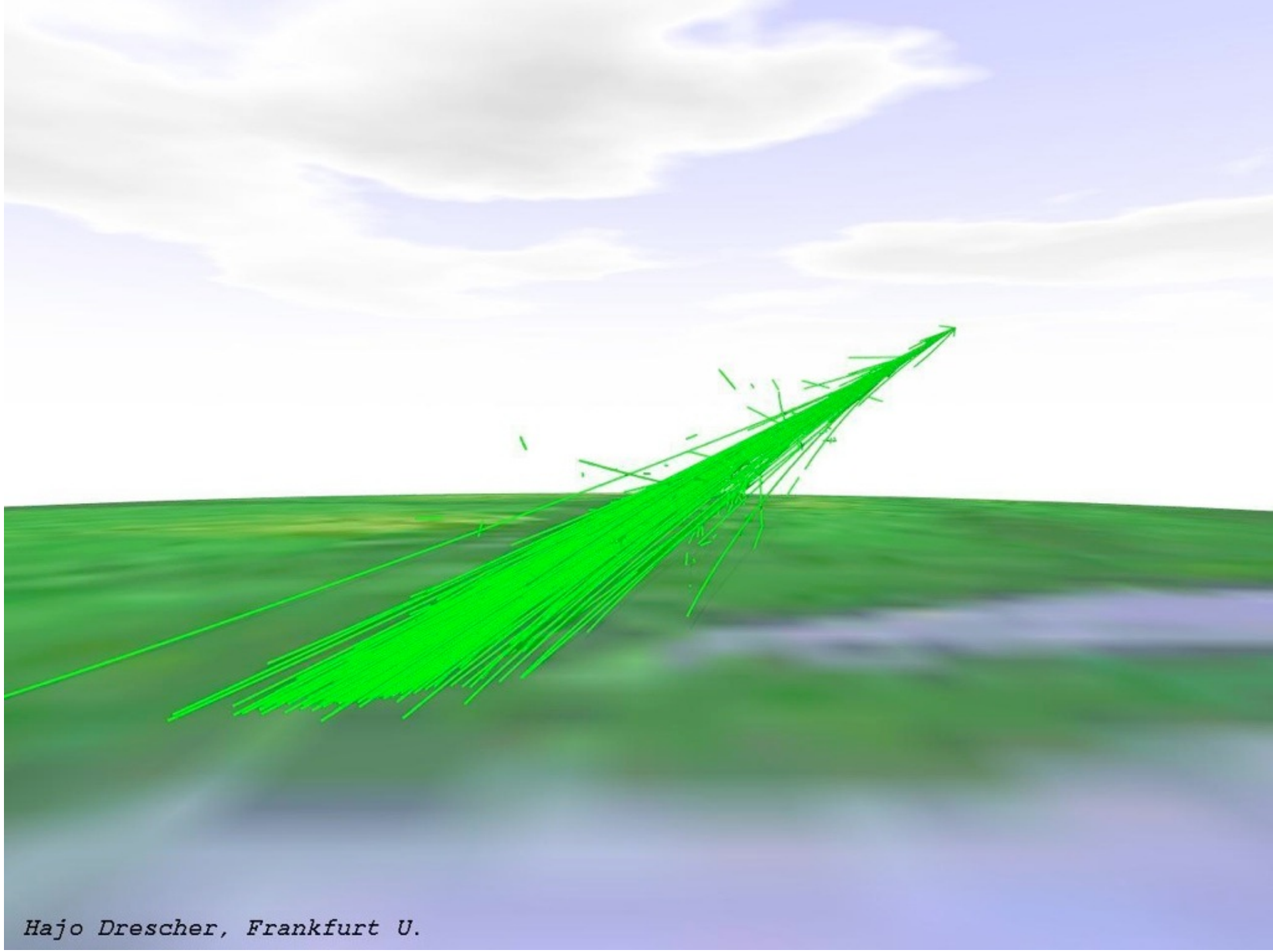

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.
time = 100 µs


blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.


blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.


blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.

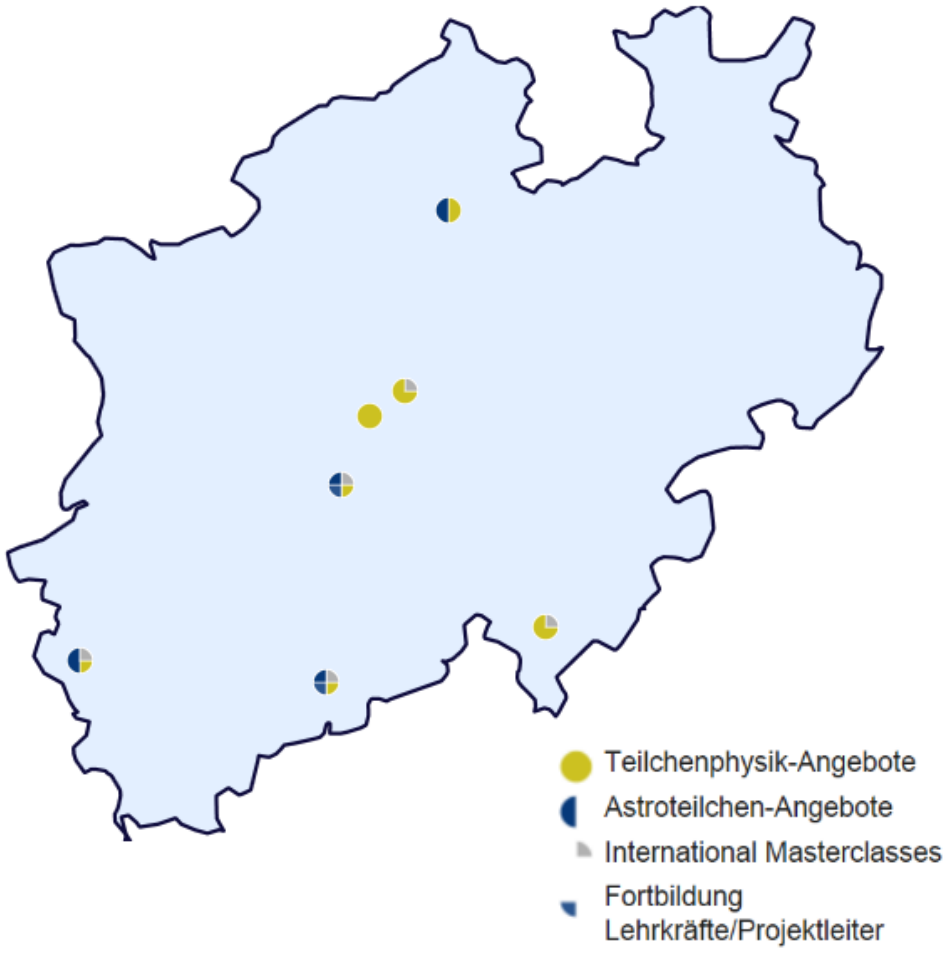

blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.


blue:electrons/positrons
cyan:photons
red:neutrons
orange: protons
gray: mesons
green:muons
Hajo Drescher, Frankfurt U.

NETZWERK TEILCHENWELT ····· QUARKS, ELEKTRONEN & CO. ····

GEFÖRDERT VOM Bundesministerium für Bildung und Forschung

JOACHIM HERZ STIFTUNG



Rheinisch-Westfälischen Technischen Hochschule Aachen, Physikzentrum
Ort: Aachen, Nordrhein-Westfalen

Alfried Krupp-Schülerlabor an der Ruhr-Universität Bochum, Institut für Experimentalphysik
Ort: Bochum, Nordrhein-Westfalen

Rheinische Friedrich-Wilhelms-Universität Bonn, Physikalisches Institut
Ort: Bonn, Nordrhein-Westfalen

Technische Universität Dortmund, Lehrstuhl für Experimentelle Physik 4
Ort: Dortmund, Nordrhein-Westfalen

Westfälische Wilhelms-Universität Münster, Institut für Kernphysik
Ort: Münster, Nordrhein-Westfalen

Universität Siegen, Department Physik
Ort: Siegen, Nordrhein-Westfalen

Bergische Universität Wuppertal, Fachgruppe Physik am FB Mathematik und Naturwissenschaften
Ort: Wuppertal, Nordrhein-Westfalen

www.teilchenwelt.de