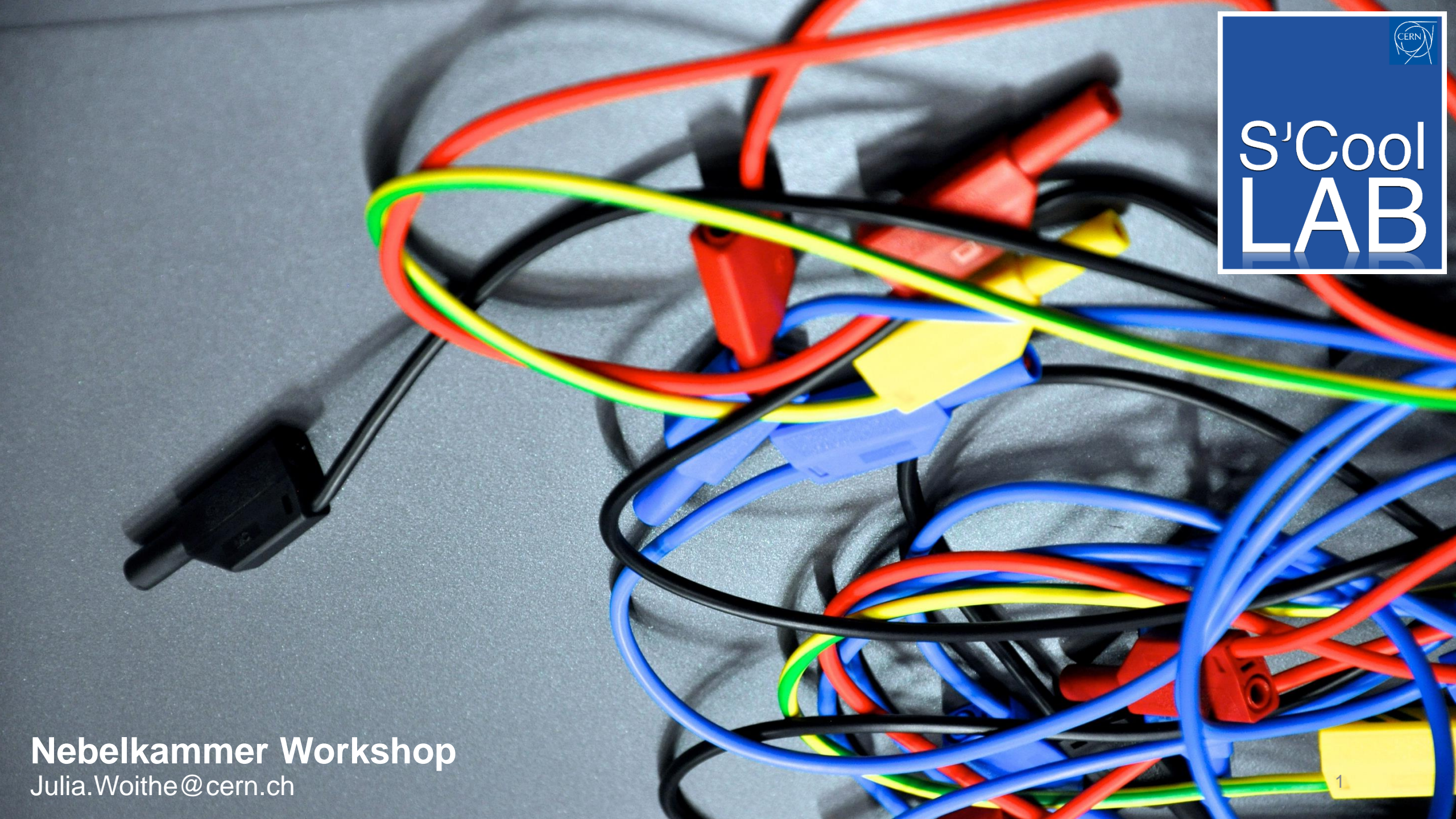




S'Cool
LAB

Nebelkammer Workshop
Julia.Woithe@cern.ch





Outline

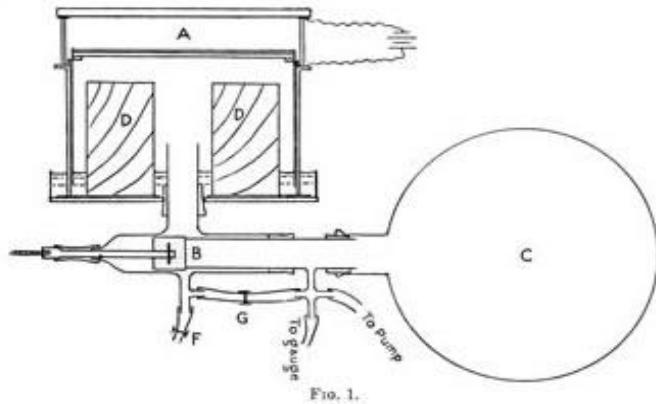
1. Geschichte
2. Anleitung und Sicherheit
3. Selbstbau einer Nebelkammer
4. Abbau
5. Diskussion der Beobachtungen

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.

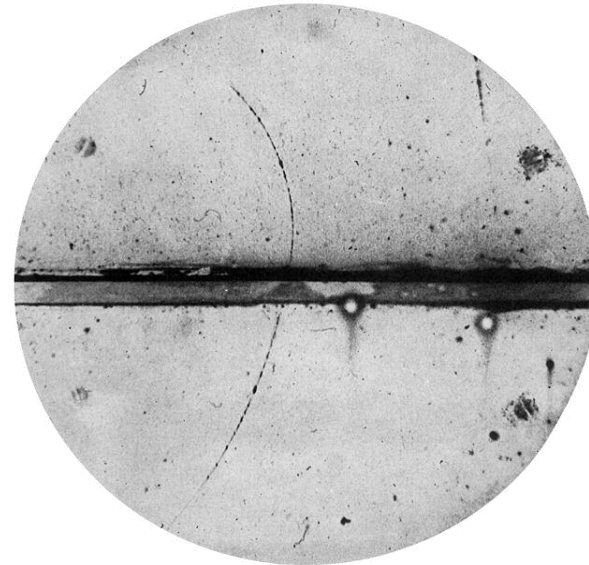


A diagram of Wilson's apparatus. The cylindrical cloud chamber ('A') is 16.5cm across by 3.4cm deep.

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](https://doi.org/10.1098/rspa.1912.0081)

Carl Anderson (1905 - 1991)

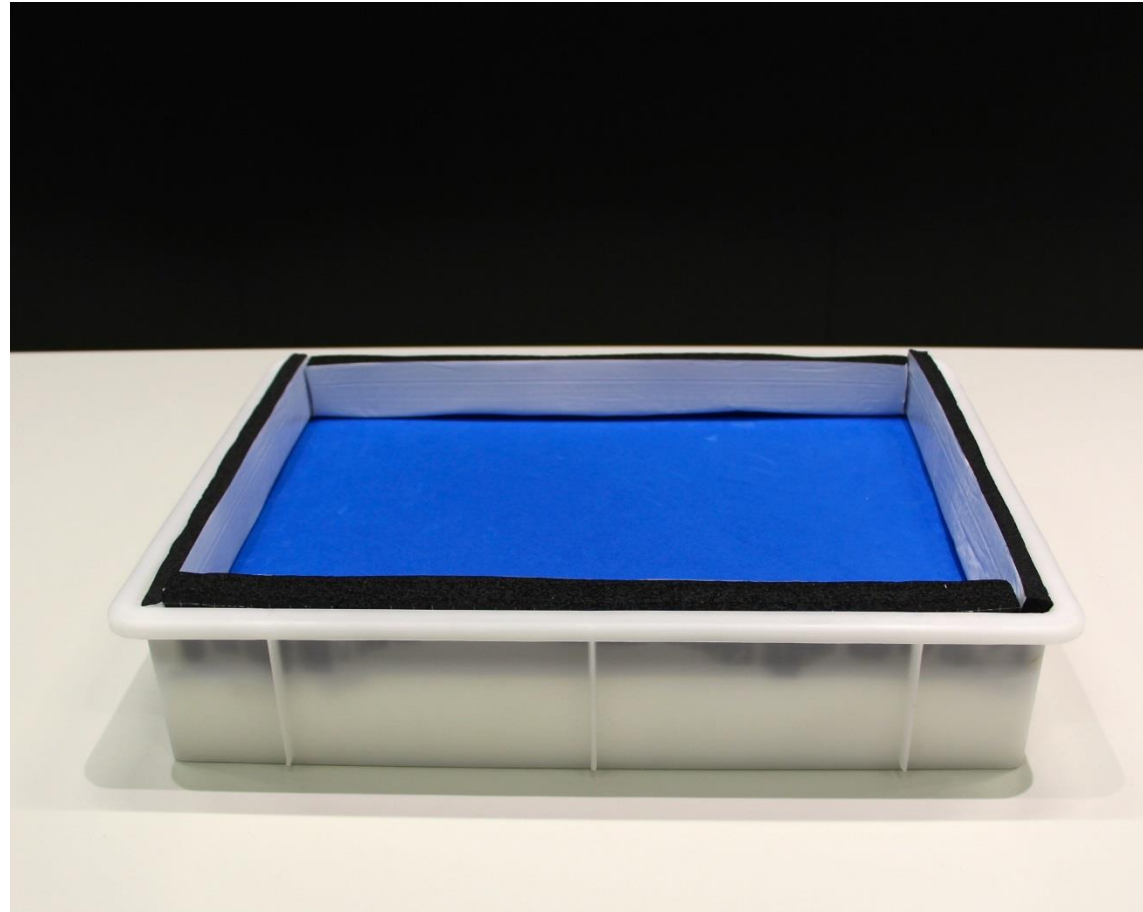
This physicist discovered the positron in 1932 and the muon in 1936 using a cloud chamber. He received the Nobel Prize in 1936.



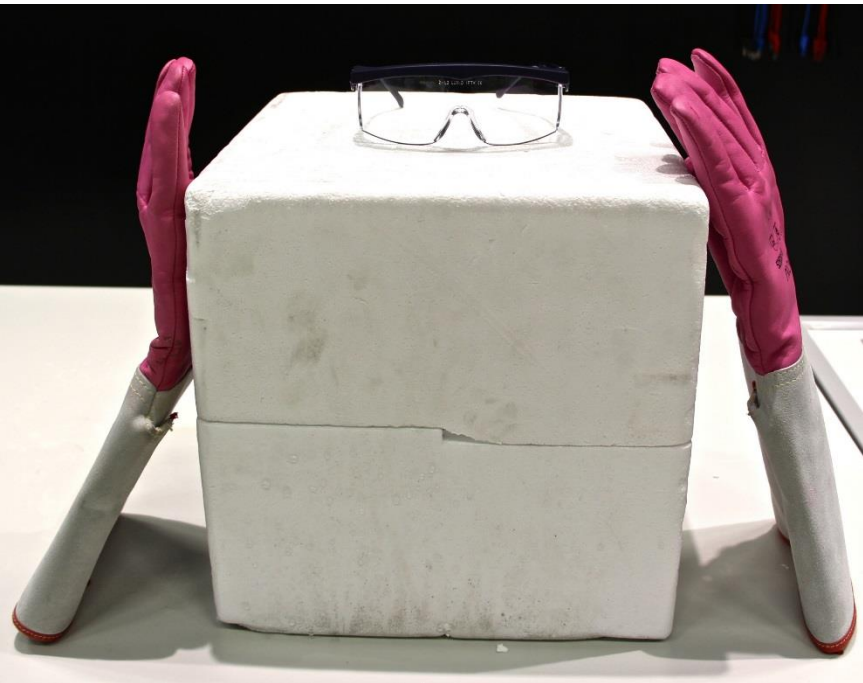
Carl D. Anderson (1905–1991) - Anderson, Carl D. (1933). "The Positive Electron". *Physical Review* 43 (6): 491–494. DOI:[10.1103/PhysRev.43.491](https://doi.org/10.1103/PhysRev.43.491).

Anleitung und Sicherheit

Build your cloud chamber - step by step



Build your cloud chamber - step by step



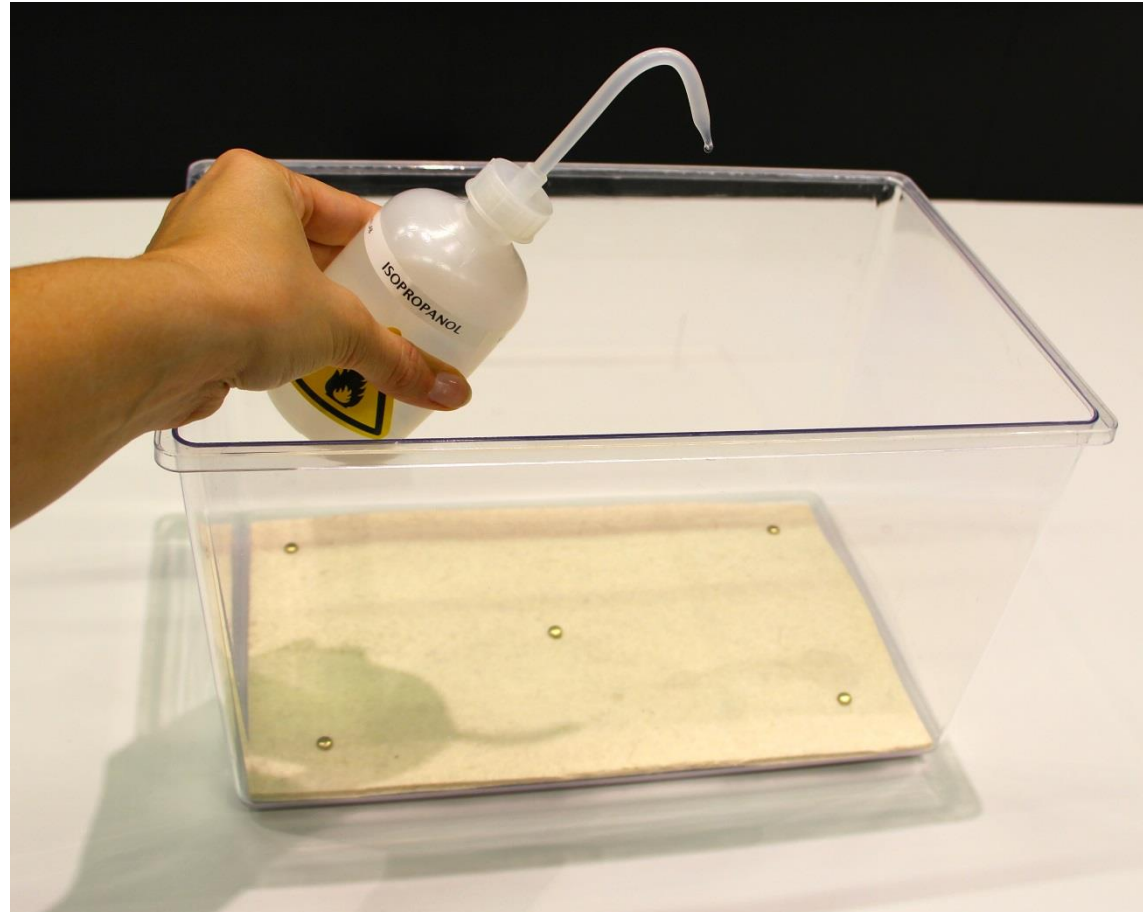
Build your cloud chamber - step by step



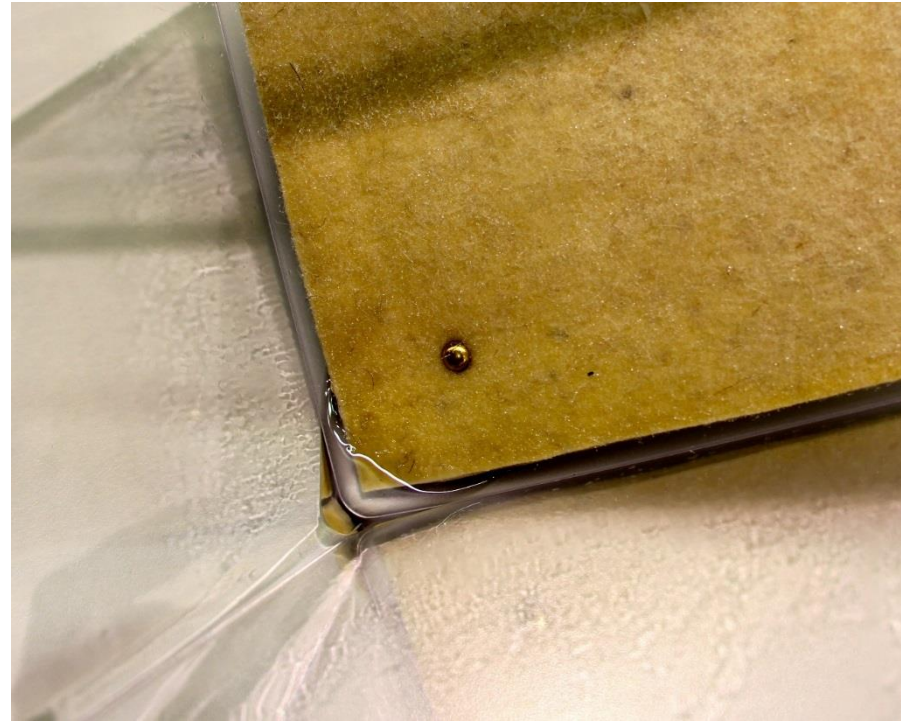
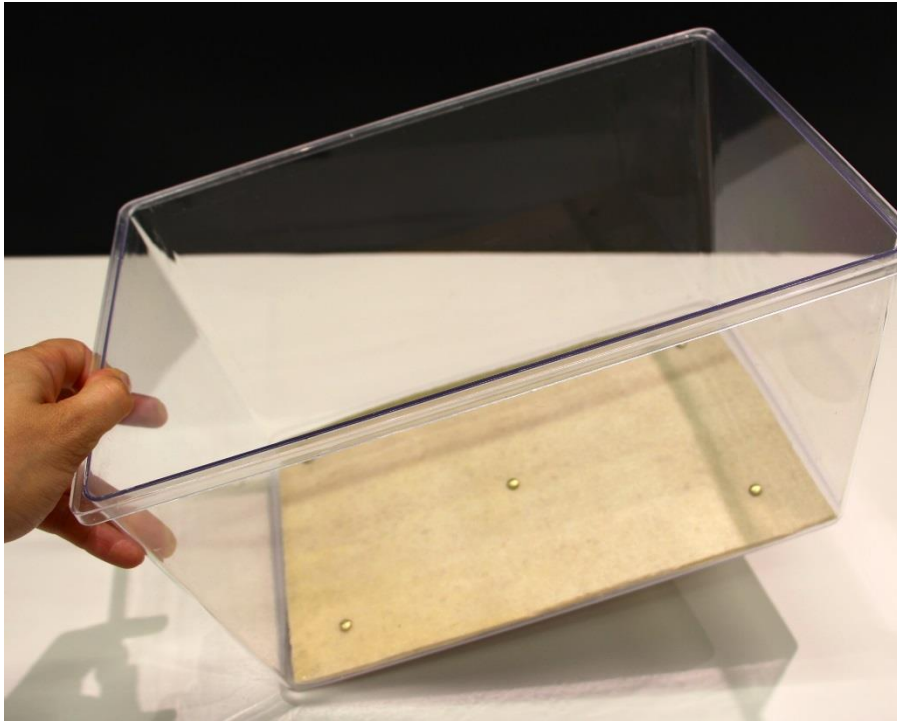
Build your cloud chamber - step by step



Build your cloud chamber - step by step



Build your cloud chamber - step by step



Build your cloud chamber - step by step



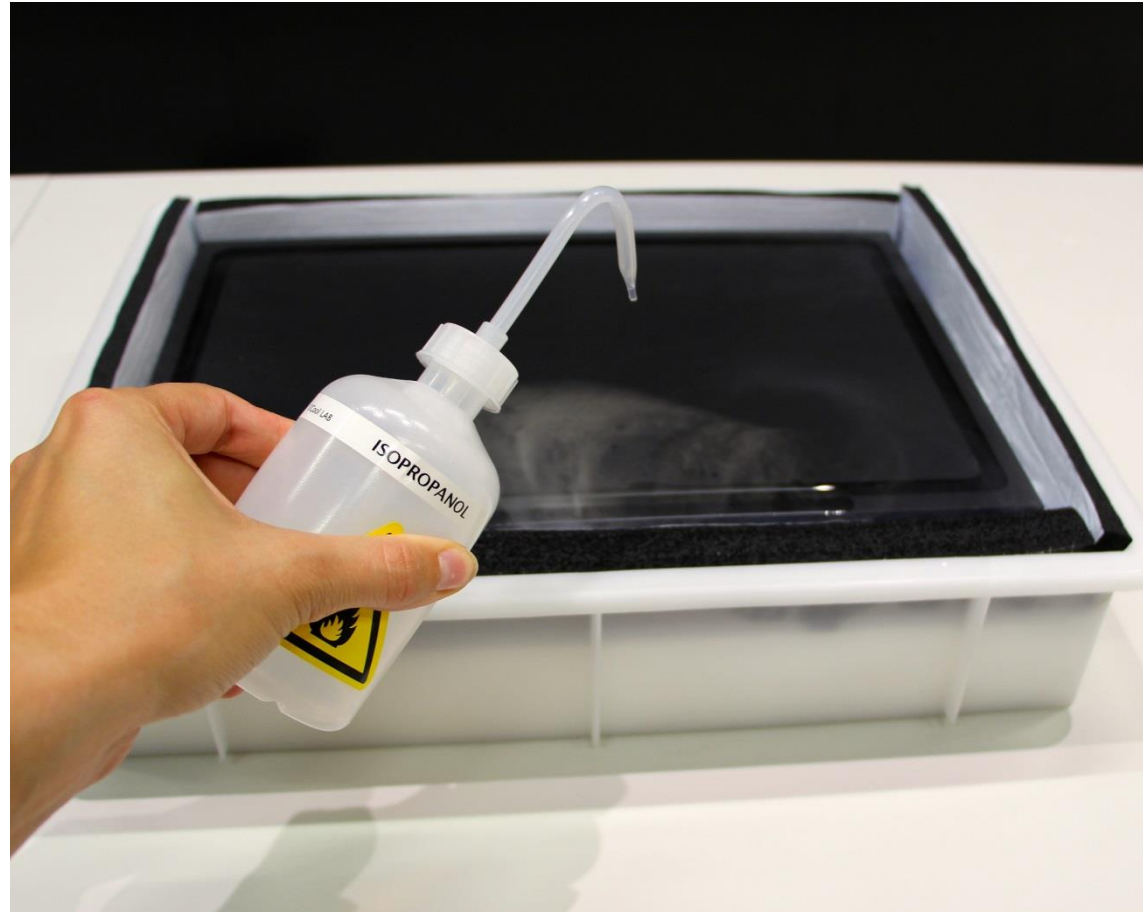
Build your cloud chamber - step by step



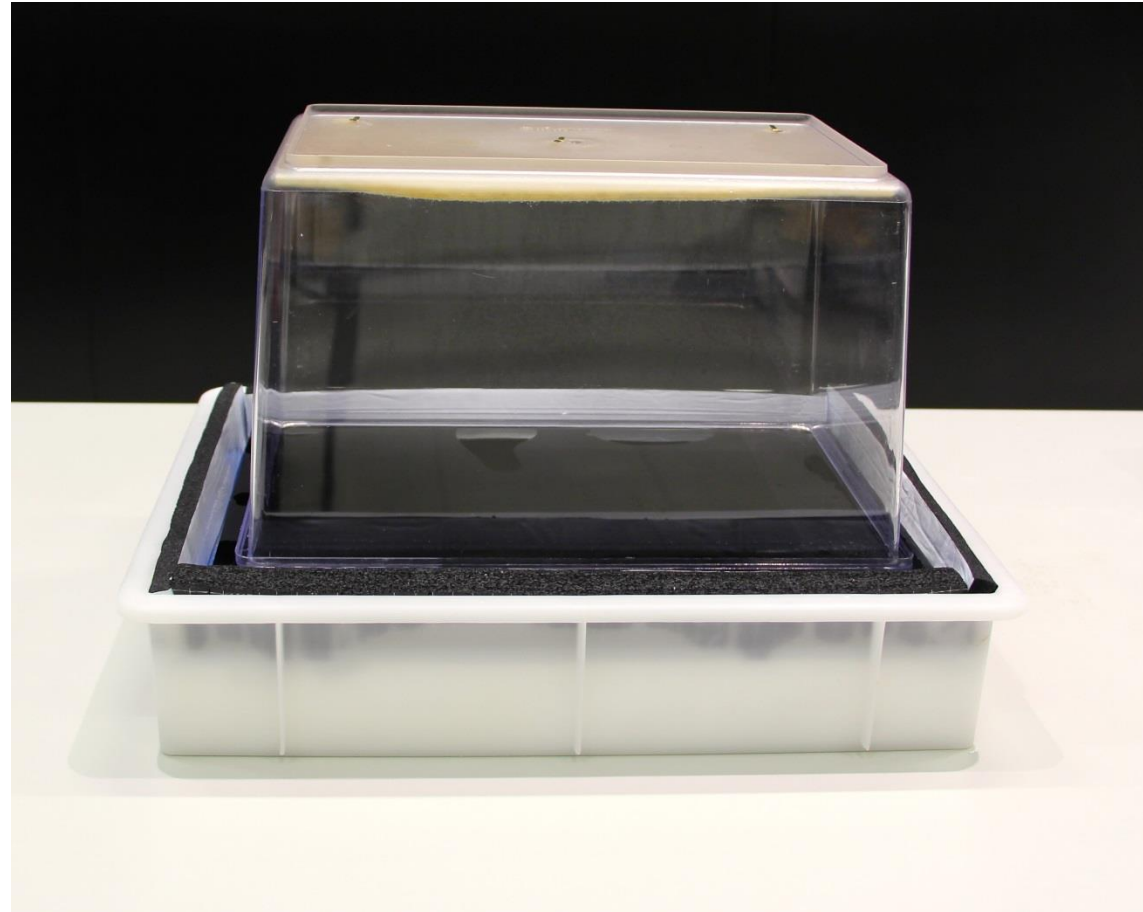
Build your cloud chamber - step by step



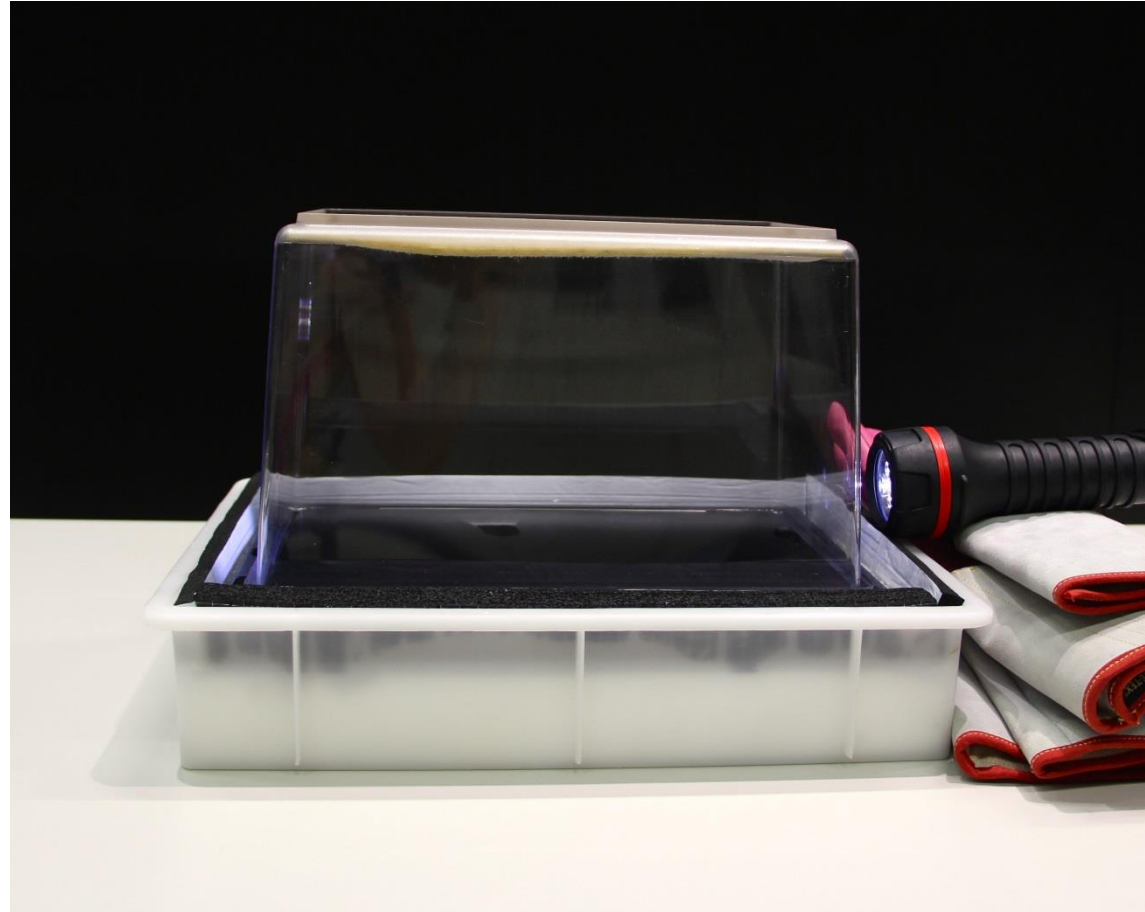
Build your cloud chamber - step by step



Build your cloud chamber - step by step



Build your cloud chamber - step by step



Selbstbau einer Nebelkammer

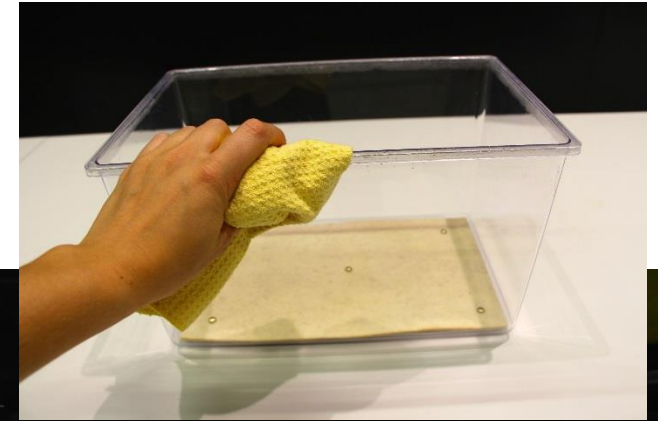
Shopping List



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

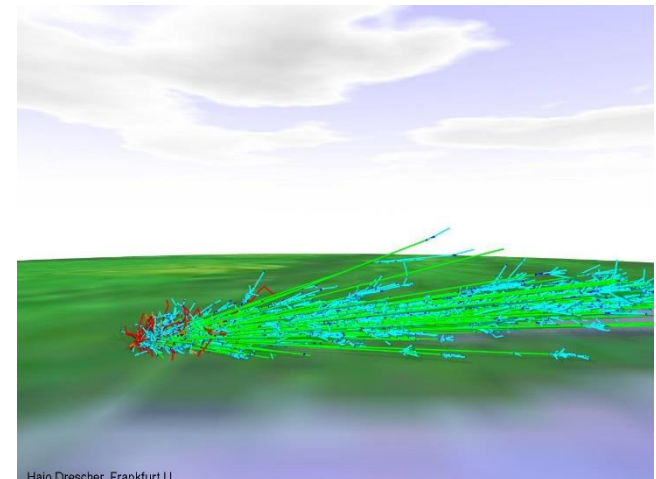
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



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

blue:electrons/positrons

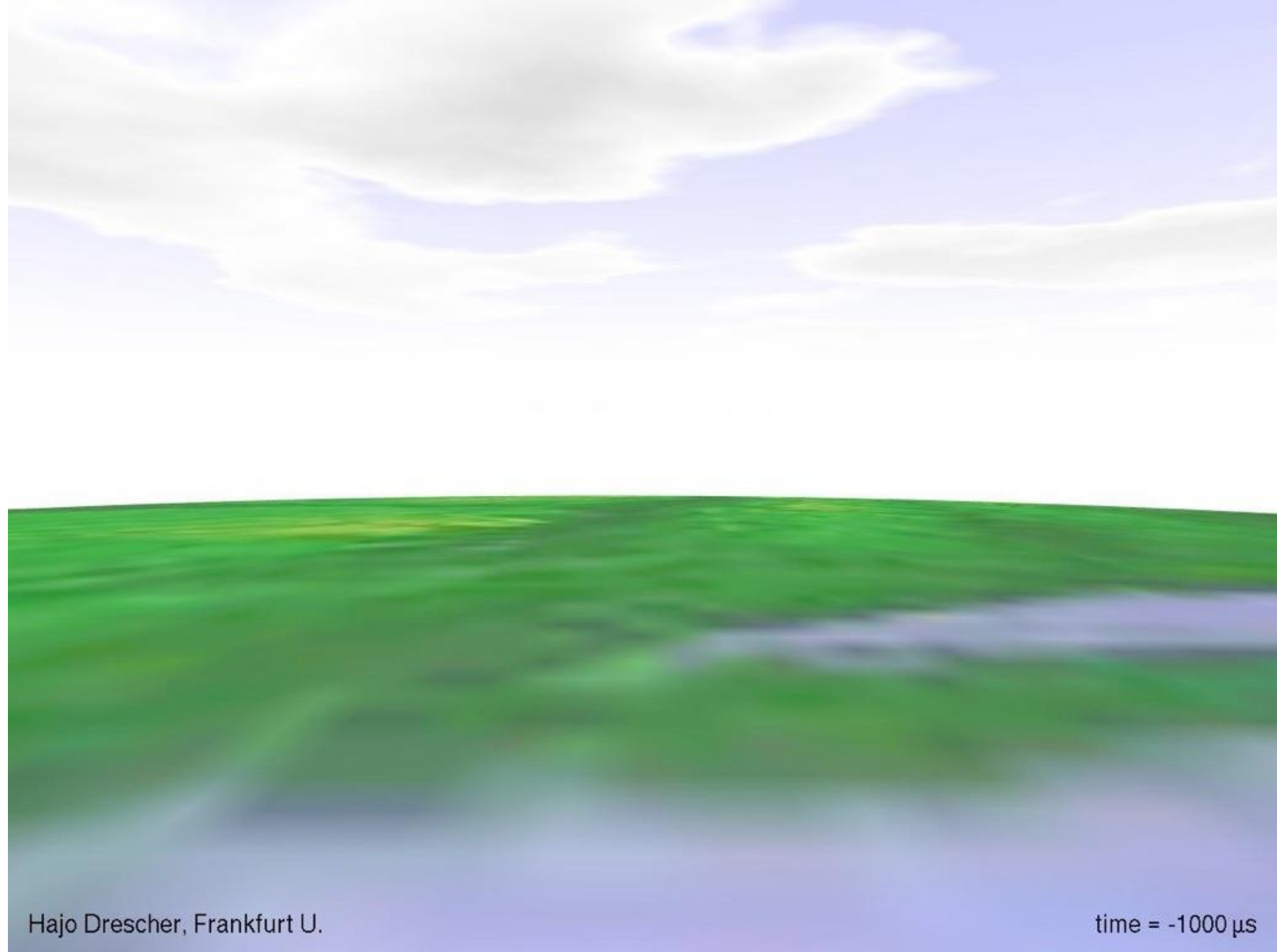
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



blue:electrons/positrons

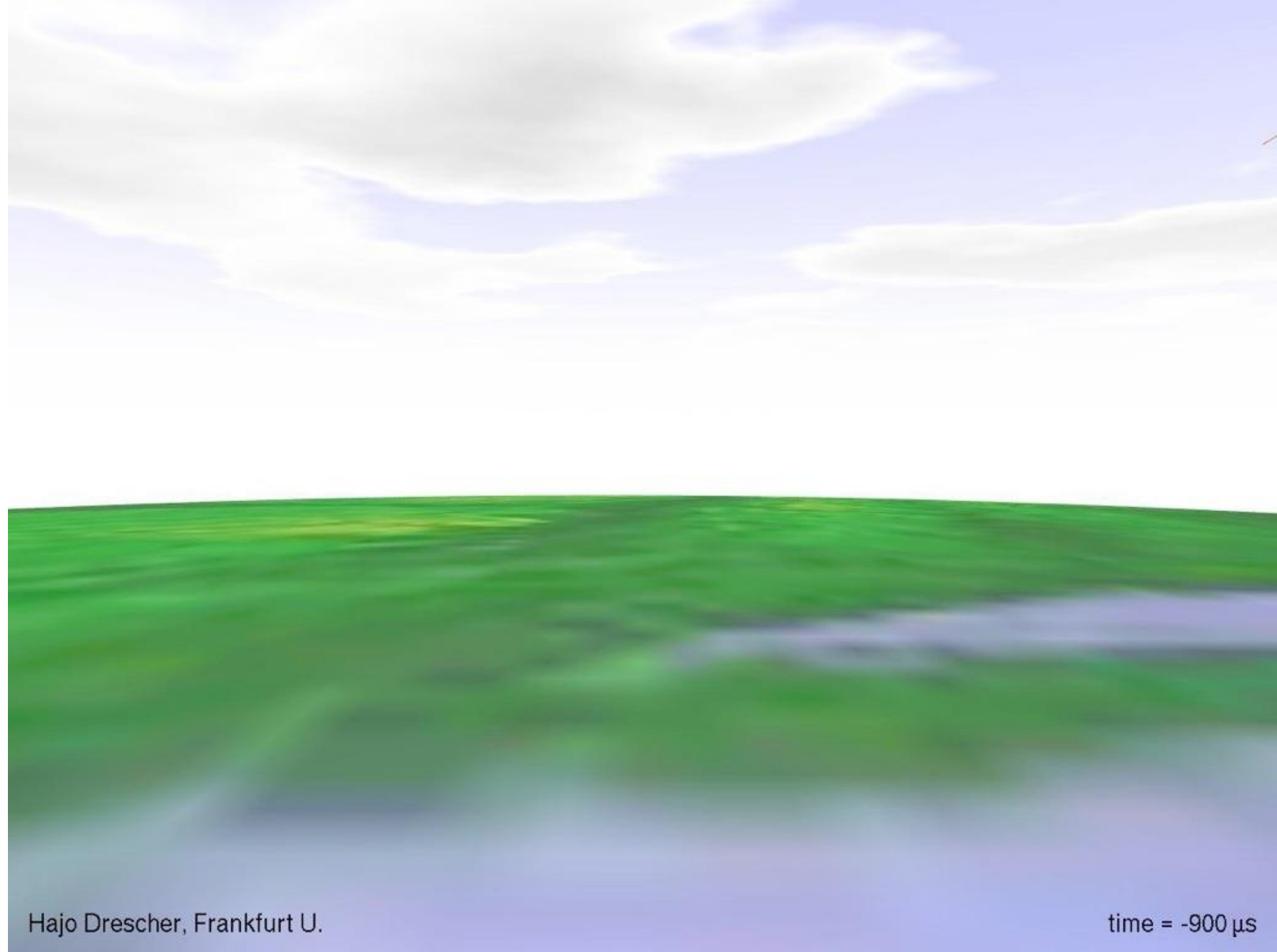
cyan:photons

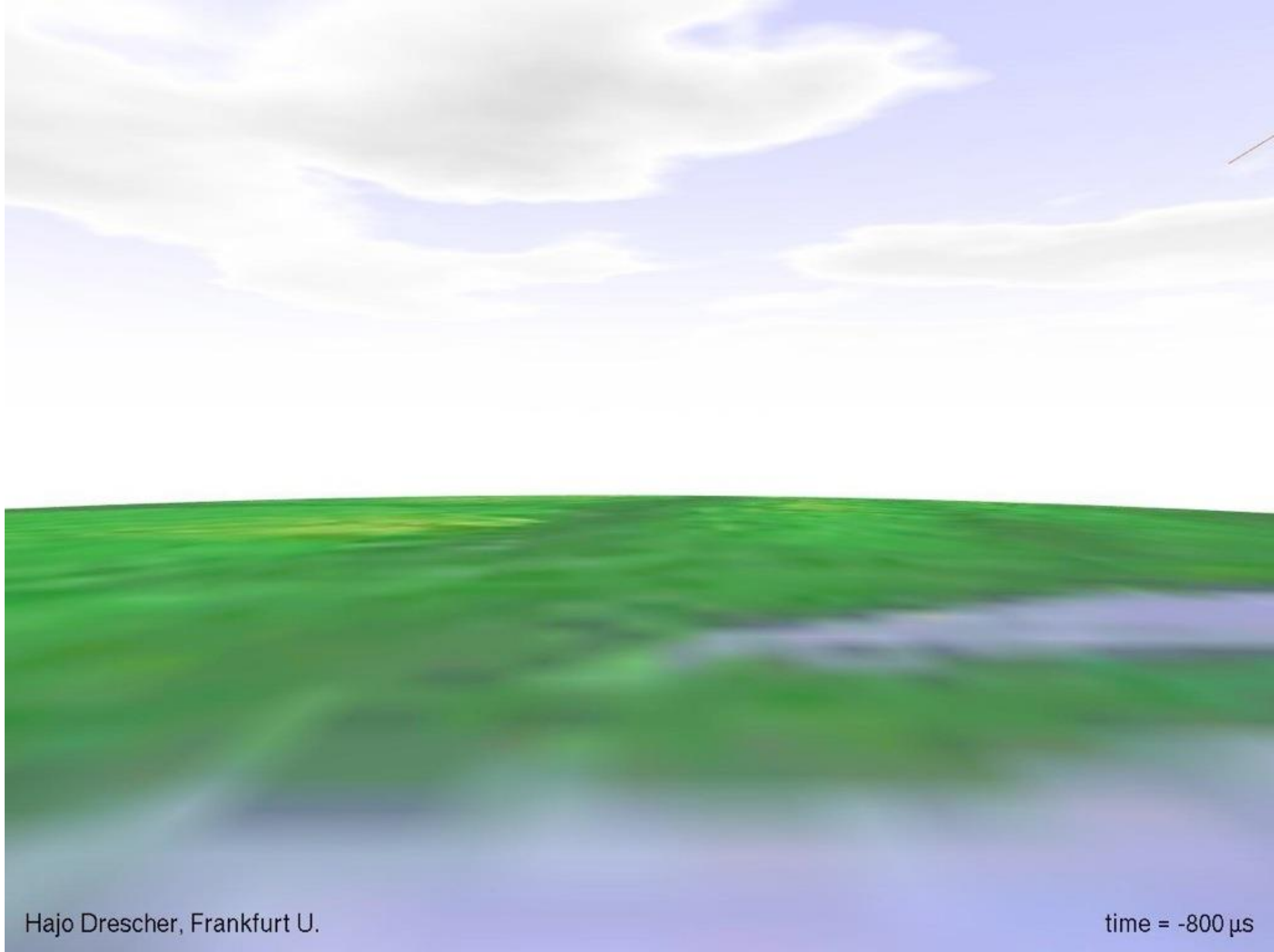
red:neutrons

orange: protons

gray: mesons

green:muons





blue:electrons/positrons

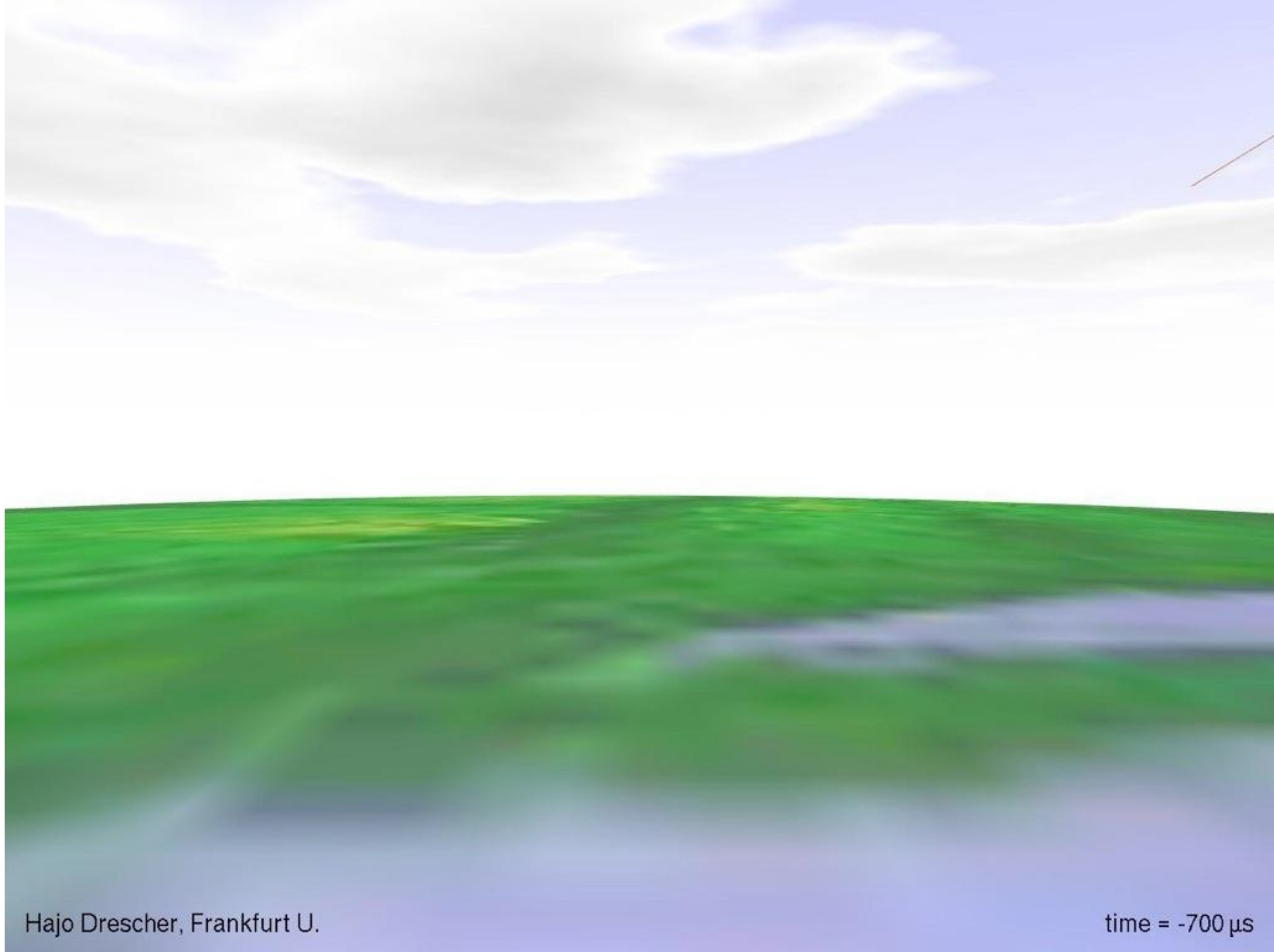
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



blue:electrons/positrons

cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons

blue:electrons/positrons

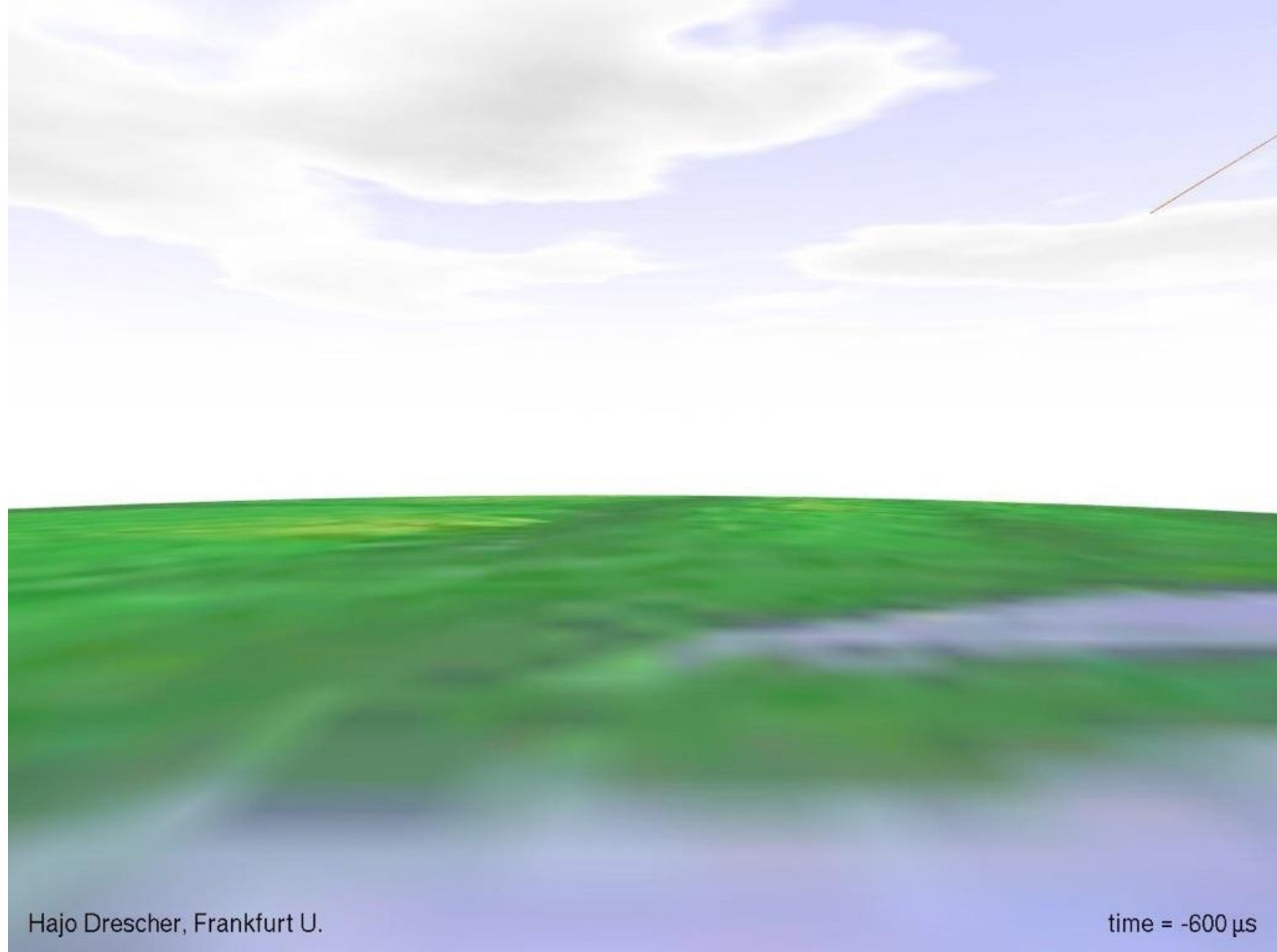
cyan:photons

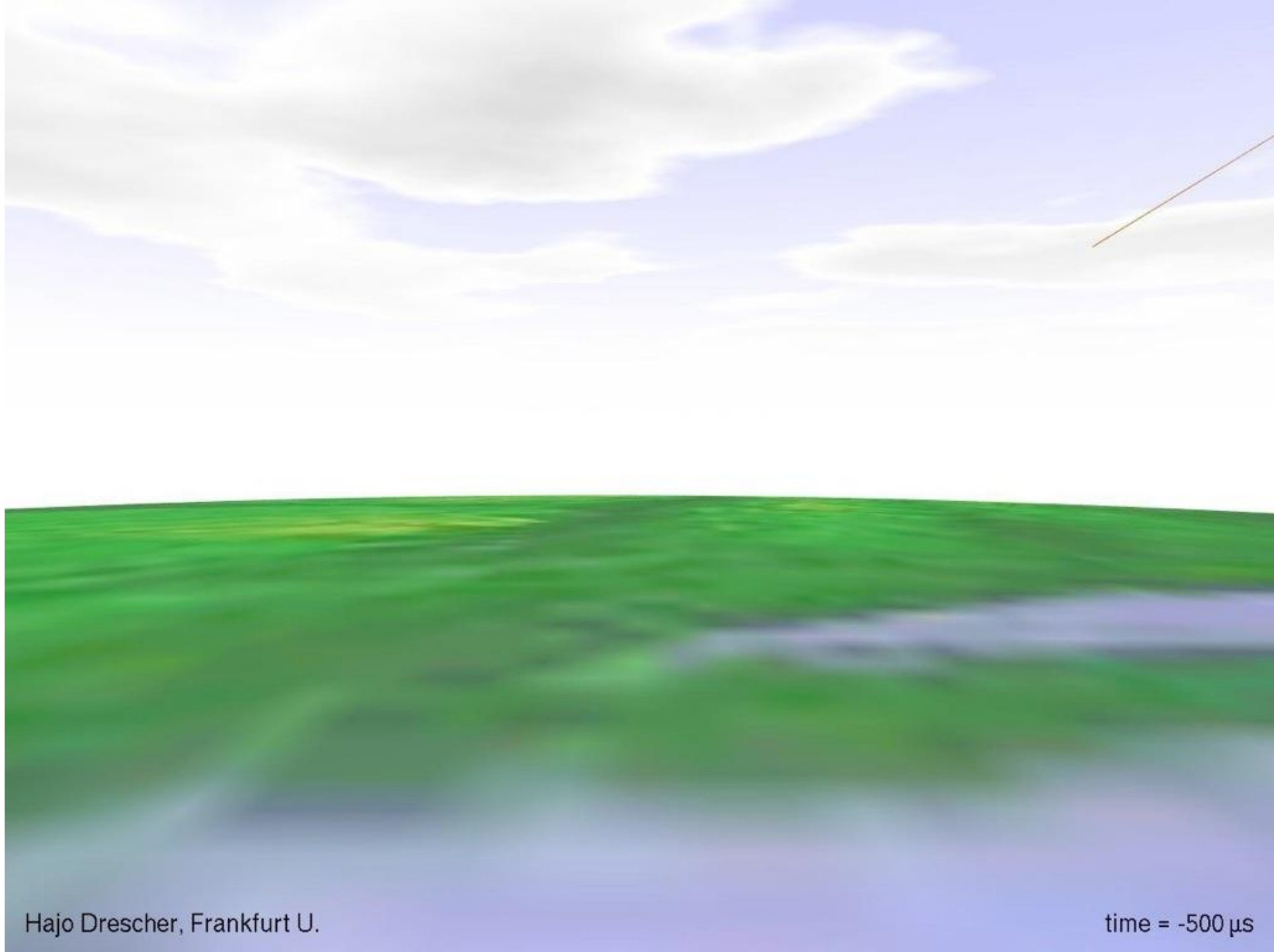
red:neutrons

orange: protons

gray: mesons

green:muons





blue:electrons/positrons

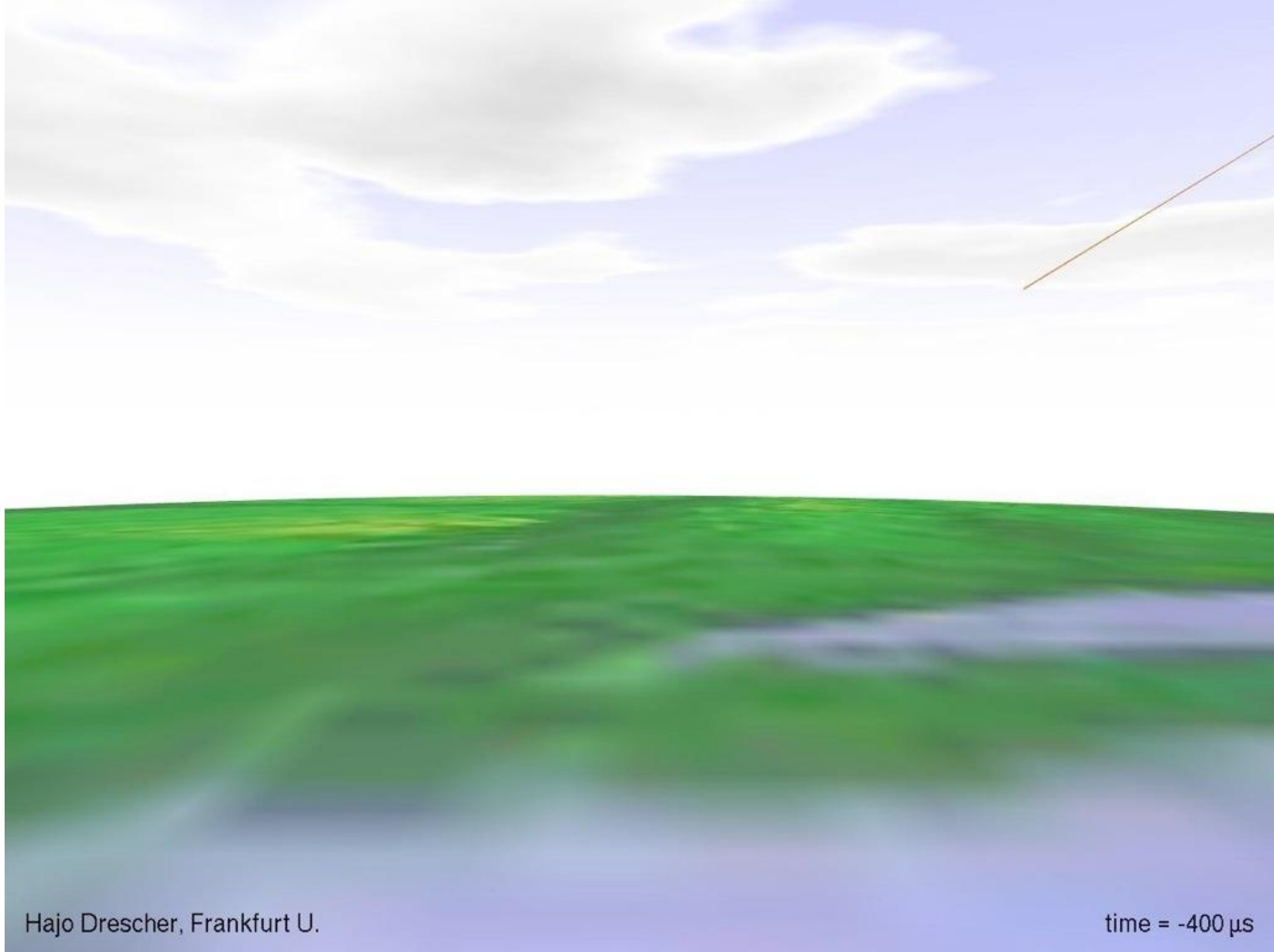
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



blue:electrons/positrons

cyan:photons

red:neutrons

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blue:electrons/positrons

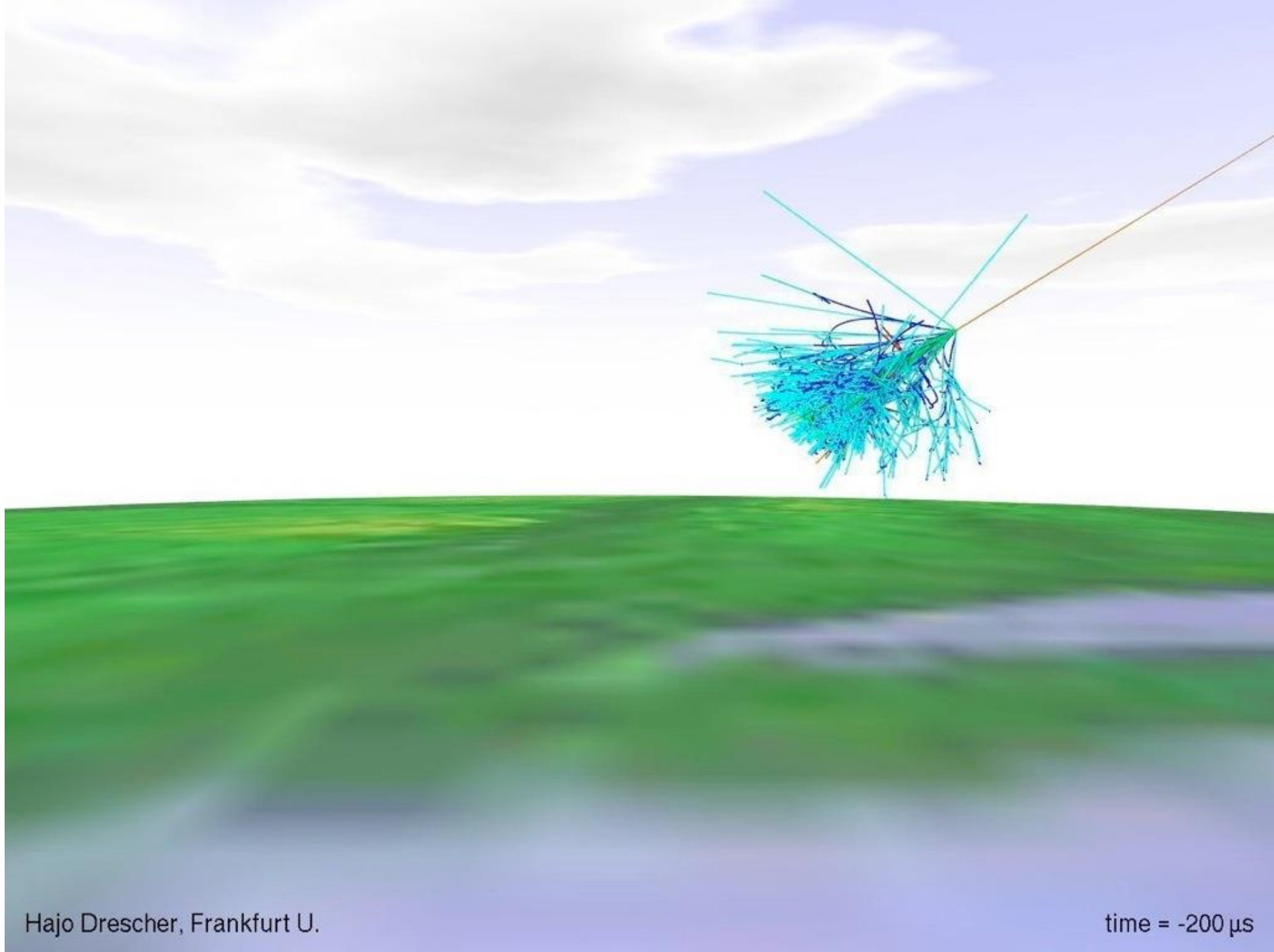
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



blue:electrons/positrons

cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons

blue:electrons/positrons

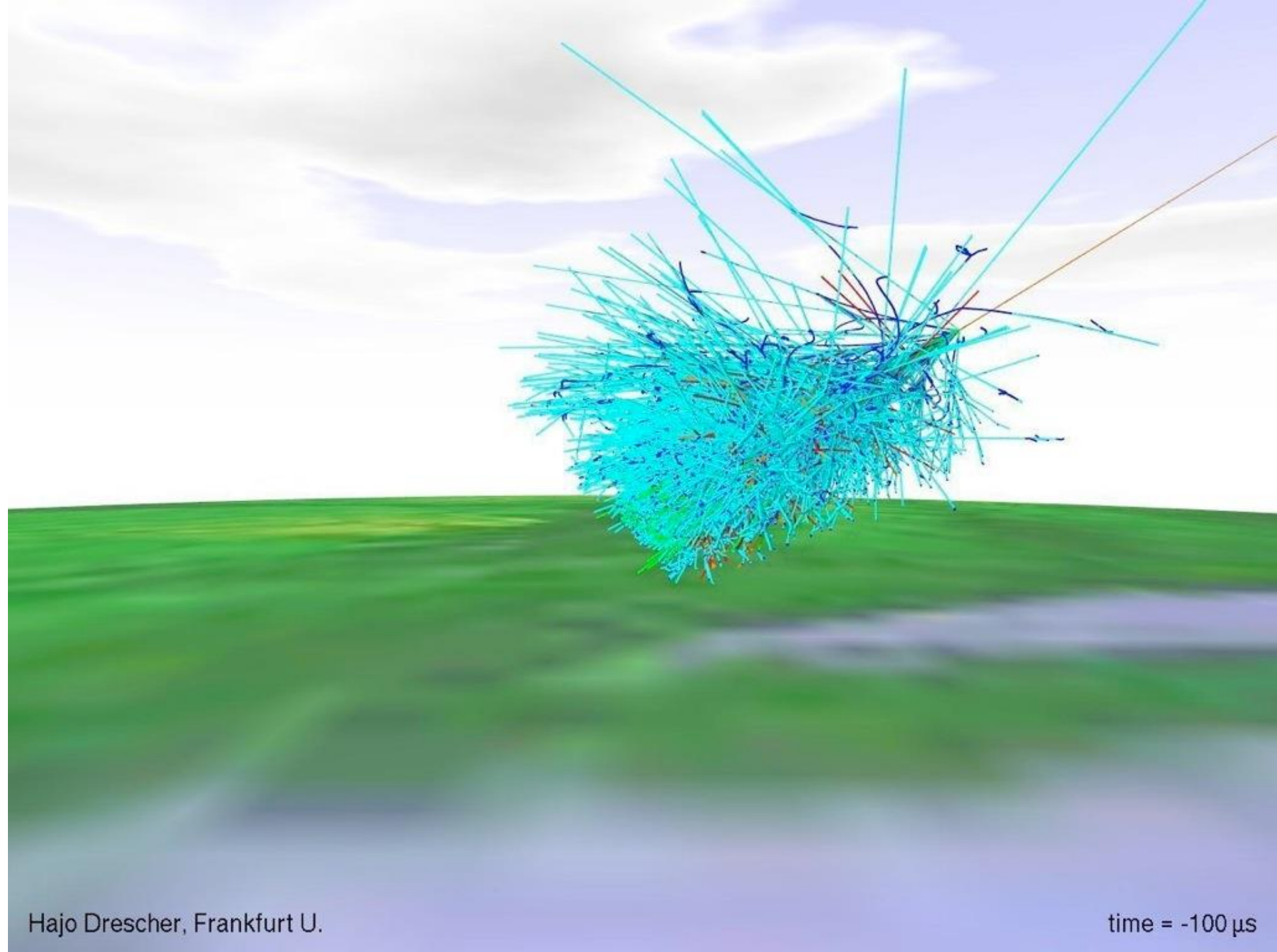
cyan:photons

red:neutrons

orange: protons

gray: mesons

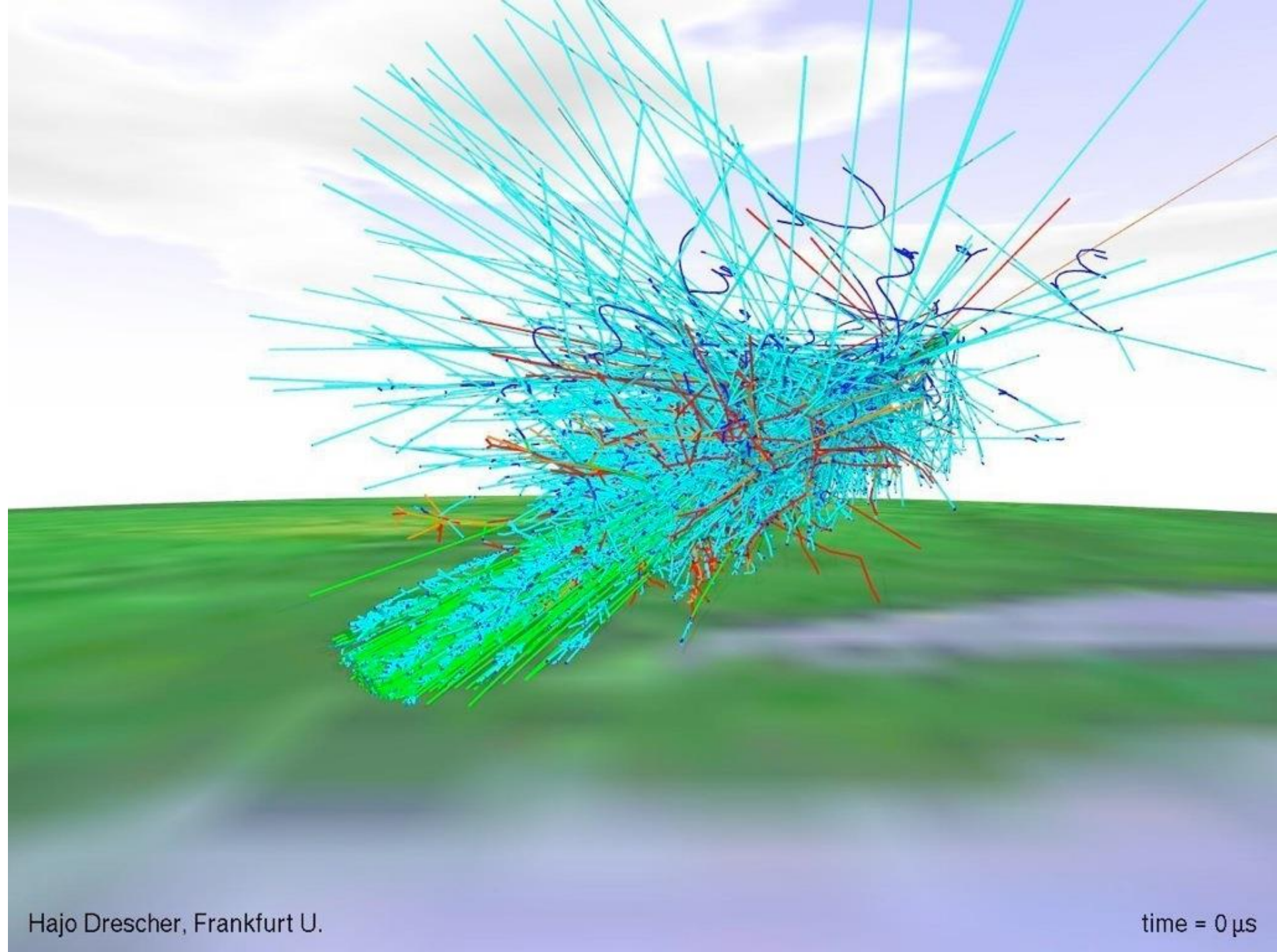
green:muons

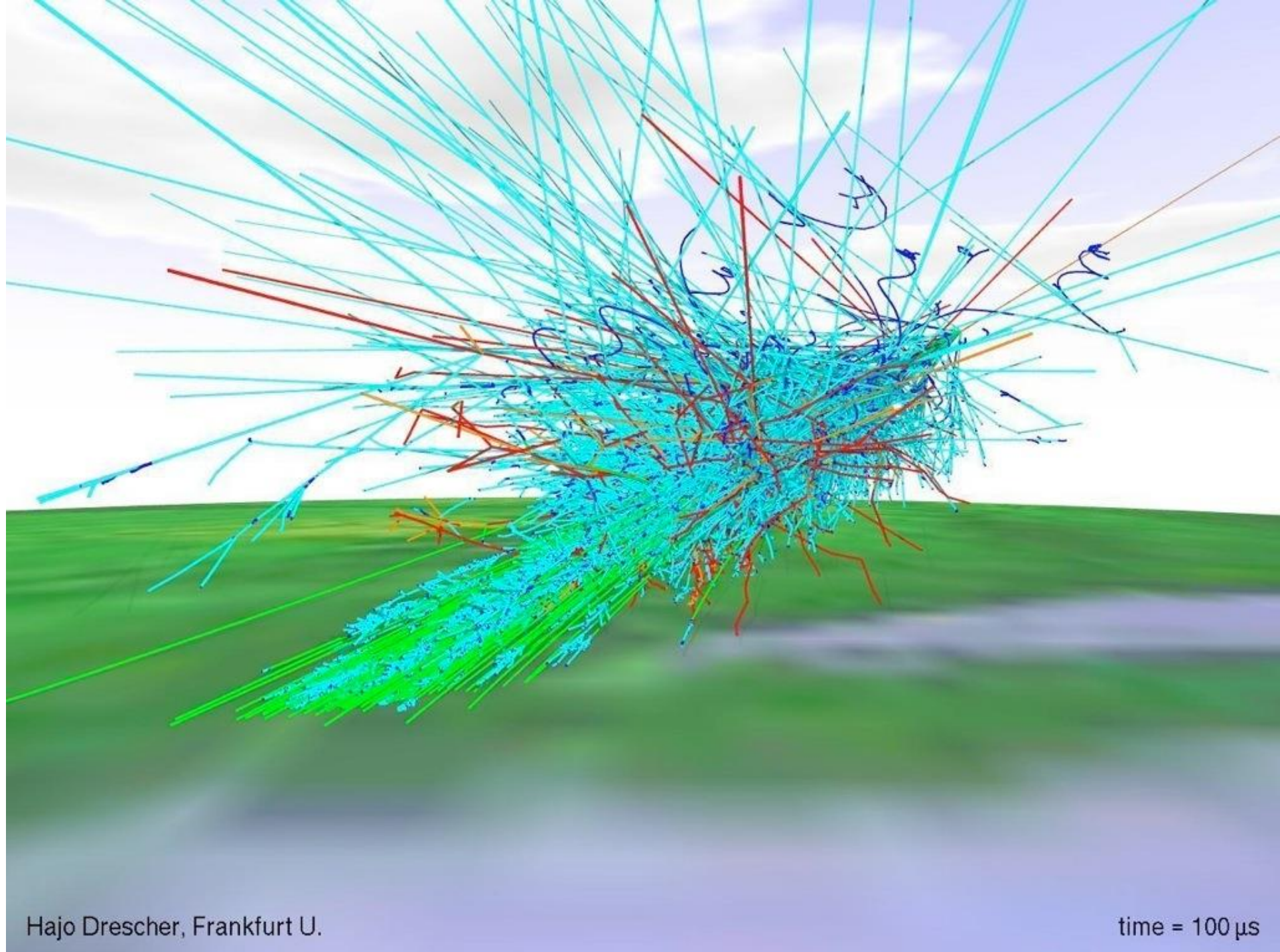


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time = -100 μs

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





blue:electrons/positrons

cyan:photons

red:neutrons

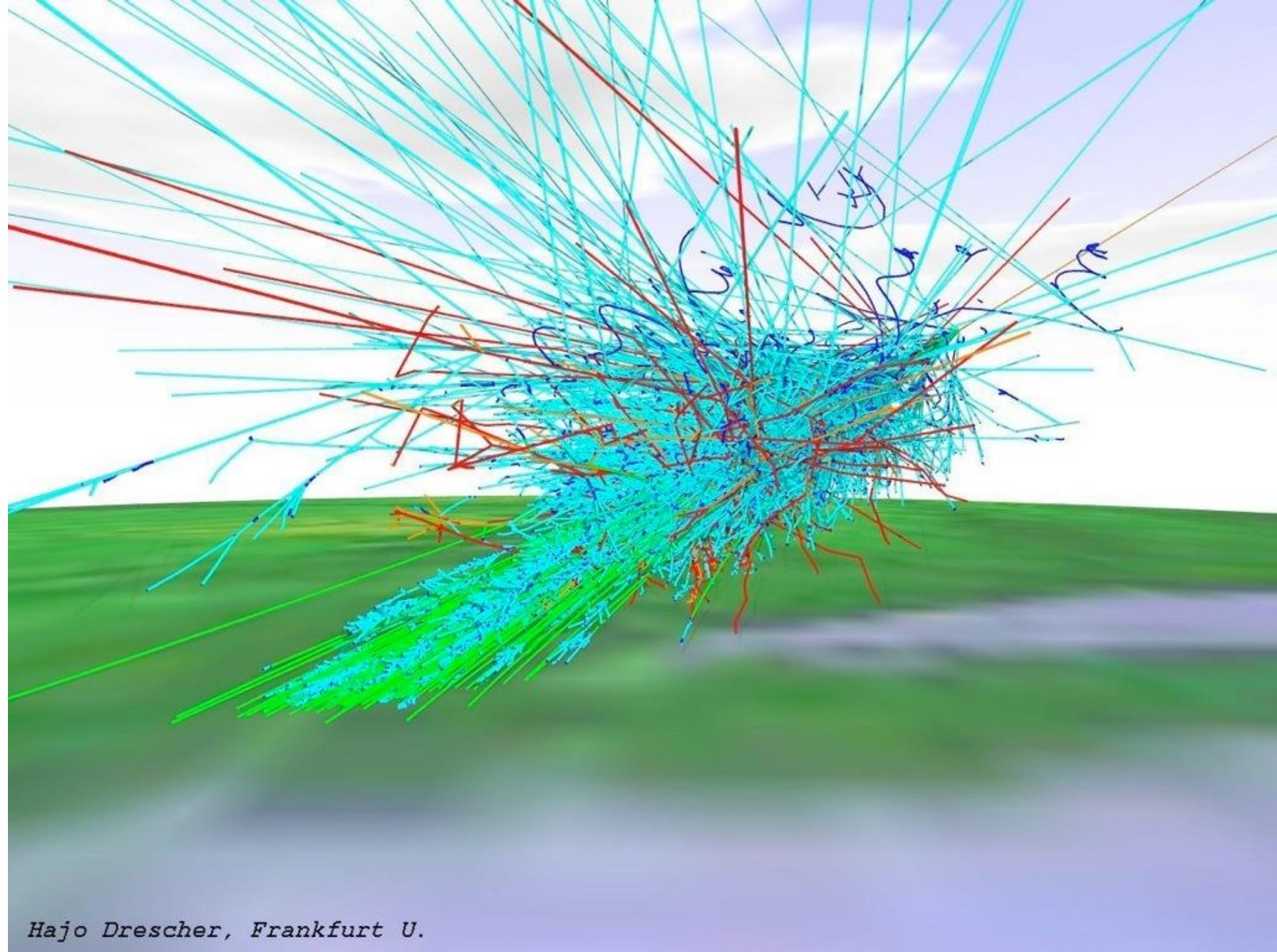
orange: protons

gray: mesons

green:muons

Hajo Drescher, Frankfurt U.

time = 100 μ s



blue:electrons/positrons

cyan:photons

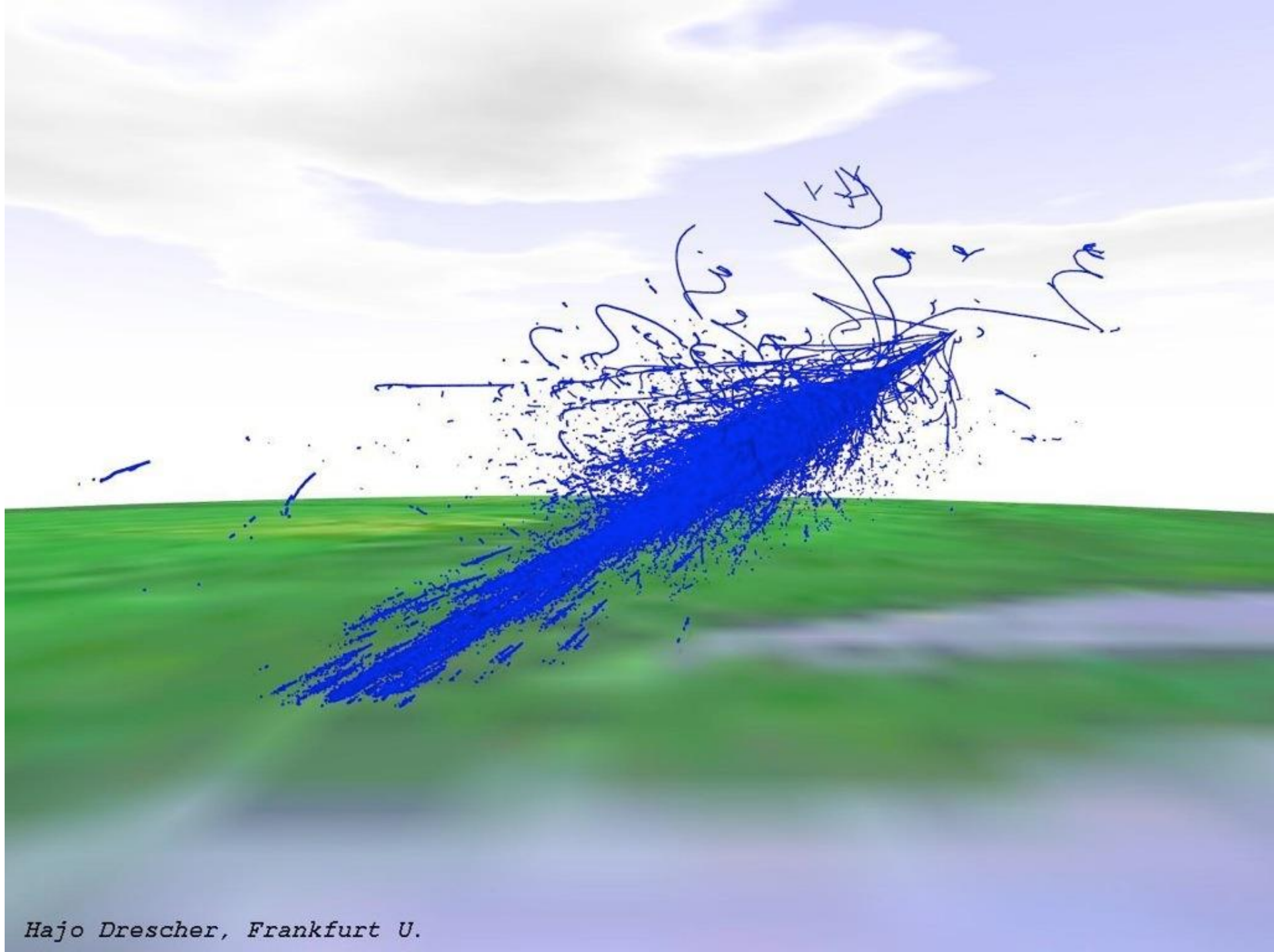
red:neutrons

orange: protons

gray: mesons

green:muons

Hajo Drescher, Frankfurt U.



blue:electrons/positrons

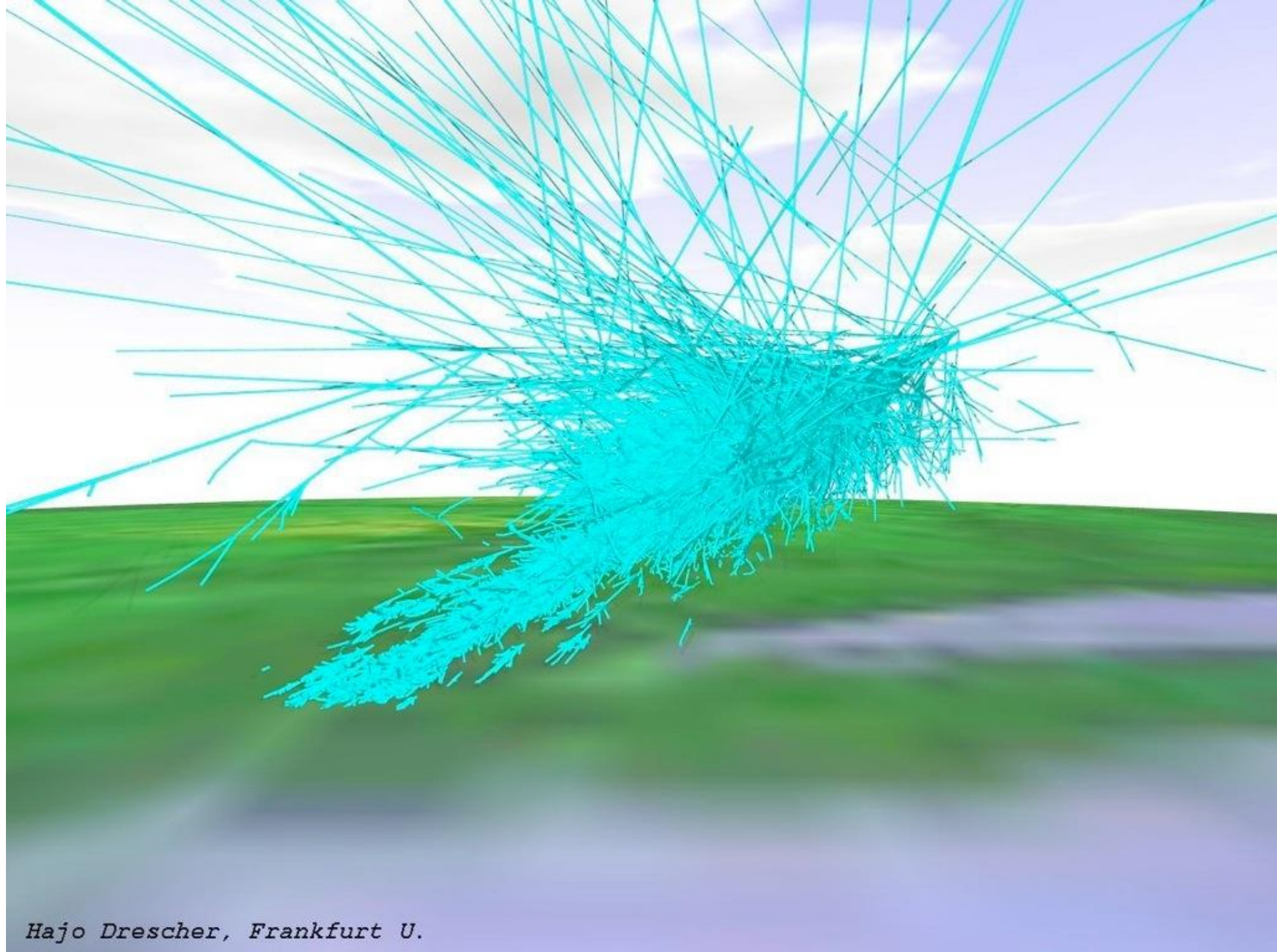
cyan:photons

red:neutrons

orange: protons

gray: mesons

green:muons



blue:electrons/positrons

cyan:photons

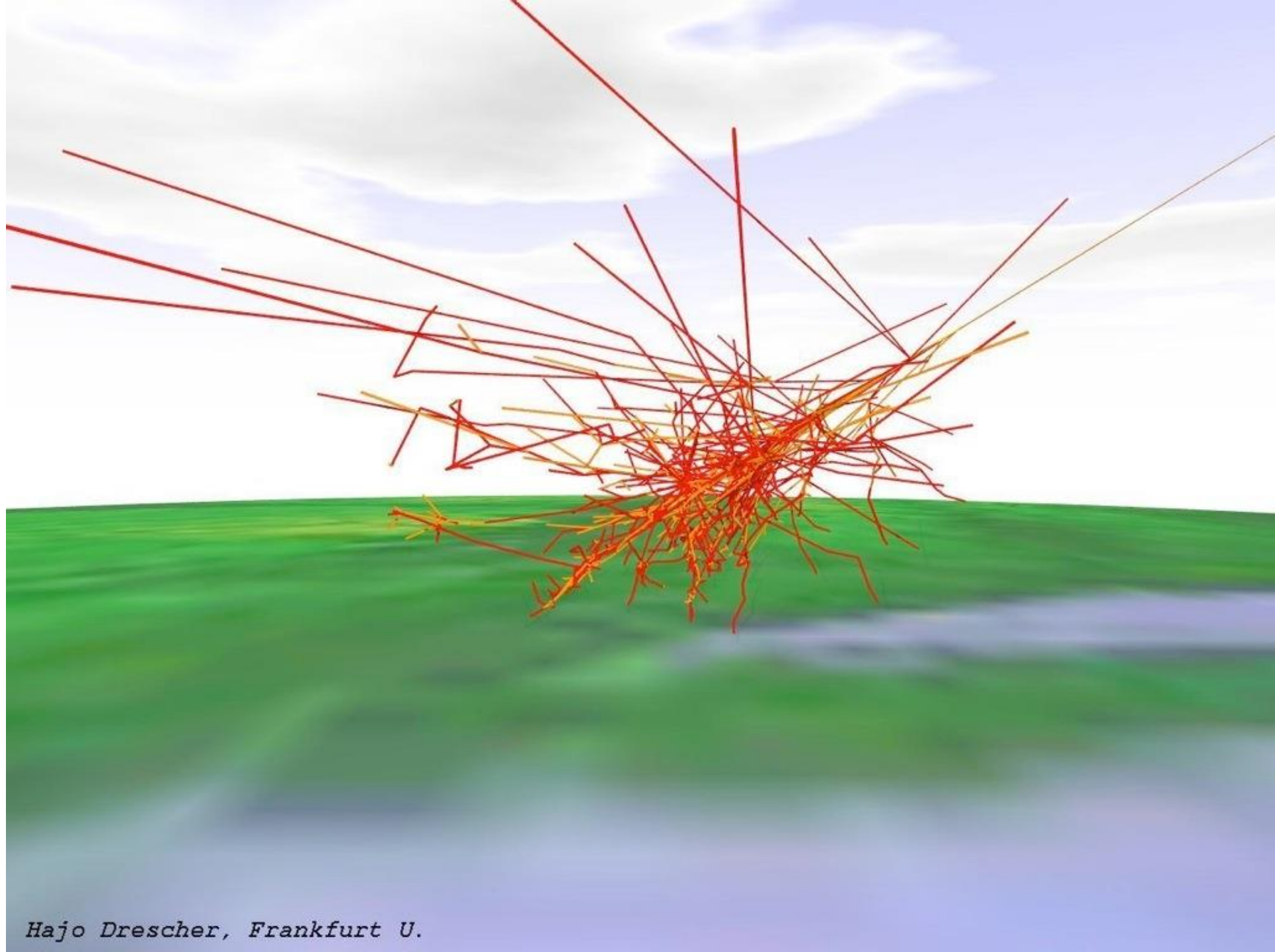
red:neutrons

orange: protons

gray: mesons

green:muons

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blue:electrons/positrons

cyan:photons

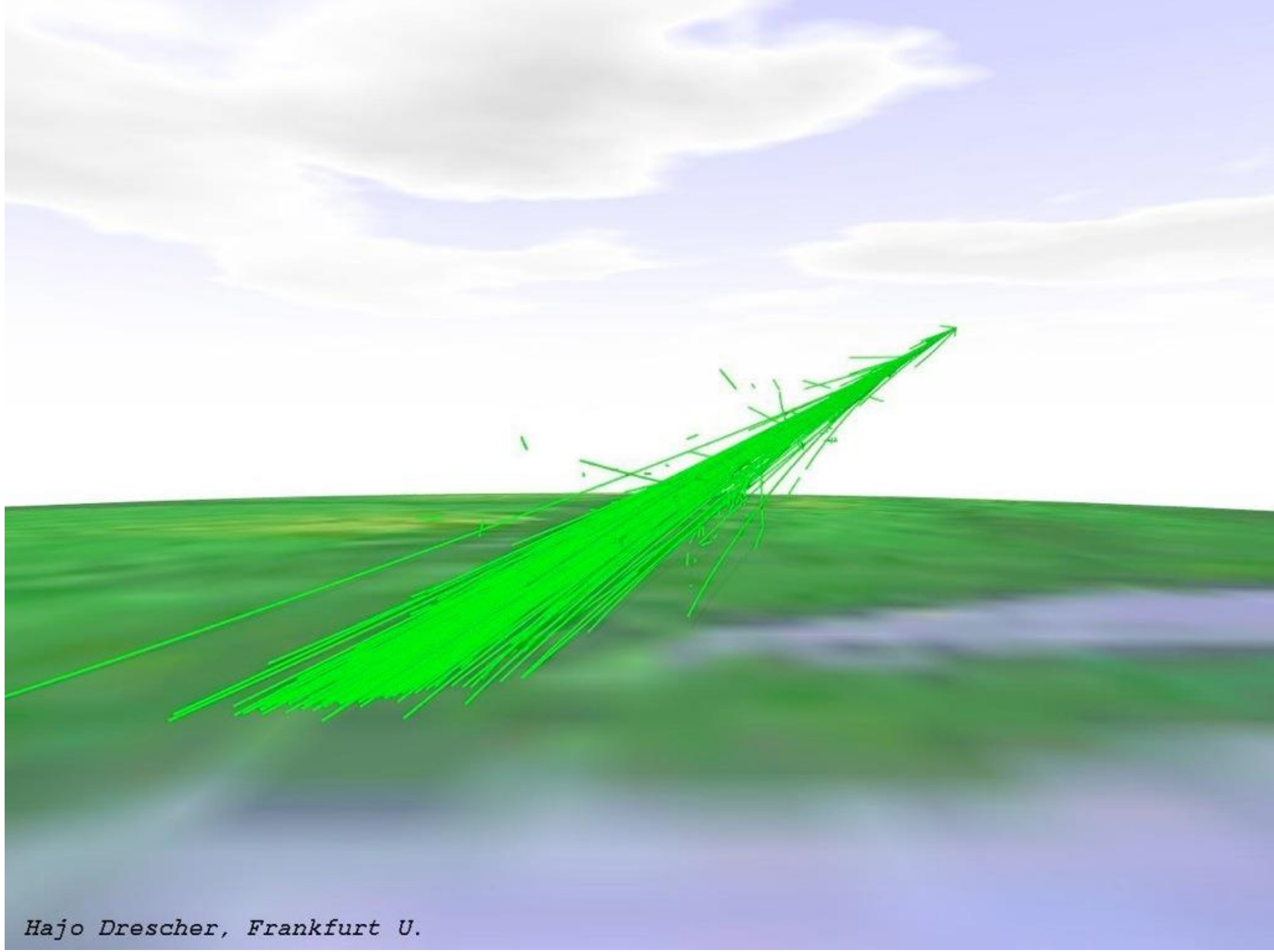
red:neutrons

orange: protons

gray: mesons

green:muons

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blue:electrons/positrons

cyan:photons

red:neutrons

orange: protons

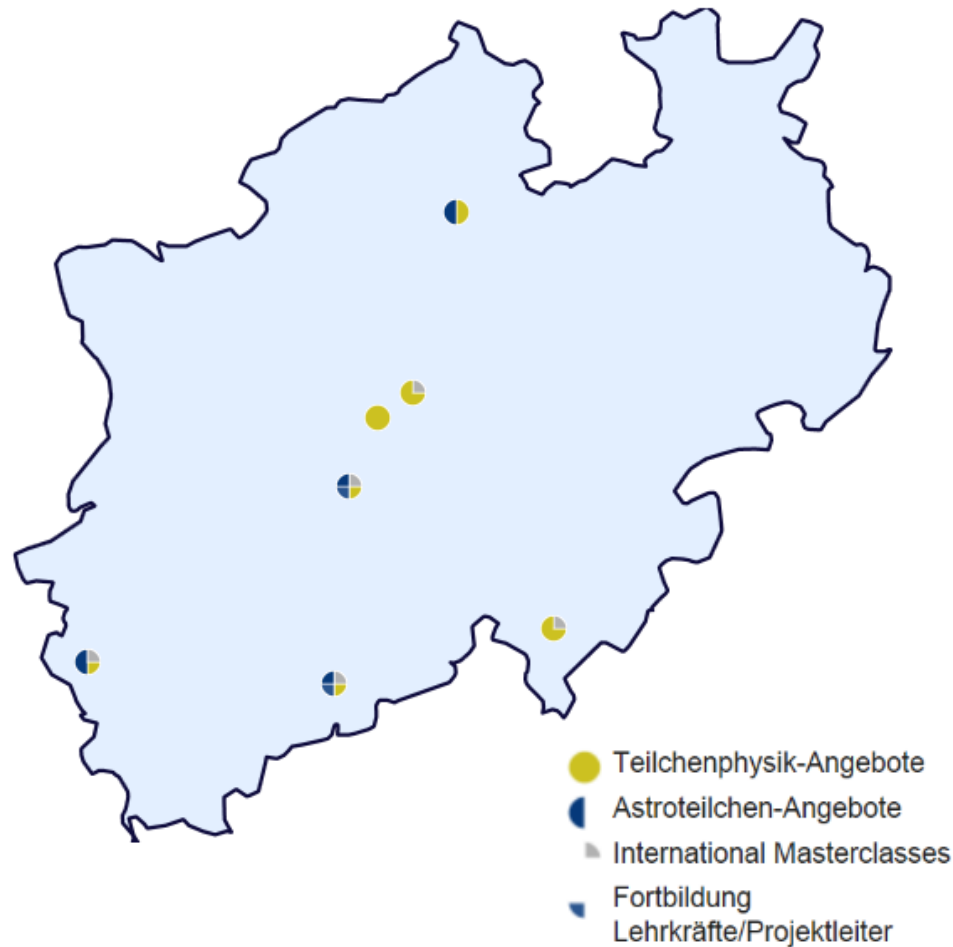
gray: mesons

green:muons

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Ort: Dortmund, Nordrhein-Westfalen



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Ort: Siegen, Nordrhein-Westfalen



Bergische Universität Wuppertal, Fachgruppe Physik am FB Mathematik und Naturwissenschaften

Ort: Wuppertal, Nordrhein-Westfalen

