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How to model a large and complex apparatus with high precision - from

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Today's particle detectors for high-energy physics are >10m in size and have <100 micrometer spatial resolution. This is for the detector elements which measure particle momenta by curvature in magnetic fields. Other detector elements do measurements by absorbing the energy of particles.
Large size paired with fine resolution are due to the very high energy of the elementary particles observed in the detector. These particles emerge from the interactions happening in the center of the detector and which are of primary physics interest.
We will have a look at how a particle detector such as ATLAS, built of many elements of complex shapes, is described in terms of relatively few geometrical elements which yet allow the path of particles through the detector to be reconstructed with full precision. The magnetic fields which bend the particle
paths are a complication in reconstruction. Coordinate transformations along the path help. All this requires a large amount of computing software and apparatus.
Finally the interactions of interest are analyzed, using the particles measured in the detector as well as simulation of the interactions, thus verifying or falsifying existing physics theories or better, developing fresh ideas.

Presenter: VON DER SCHMITT, Hans (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

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