



URANOS

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universität**bonn**

HELMHOLTZ
CENTRE FOR
ENVIRONMENTAL
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modeling cosmic-ray neutrons

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Visit us!



- simple user interface
- computationally efficient
- new geometry concept of layers and voxels

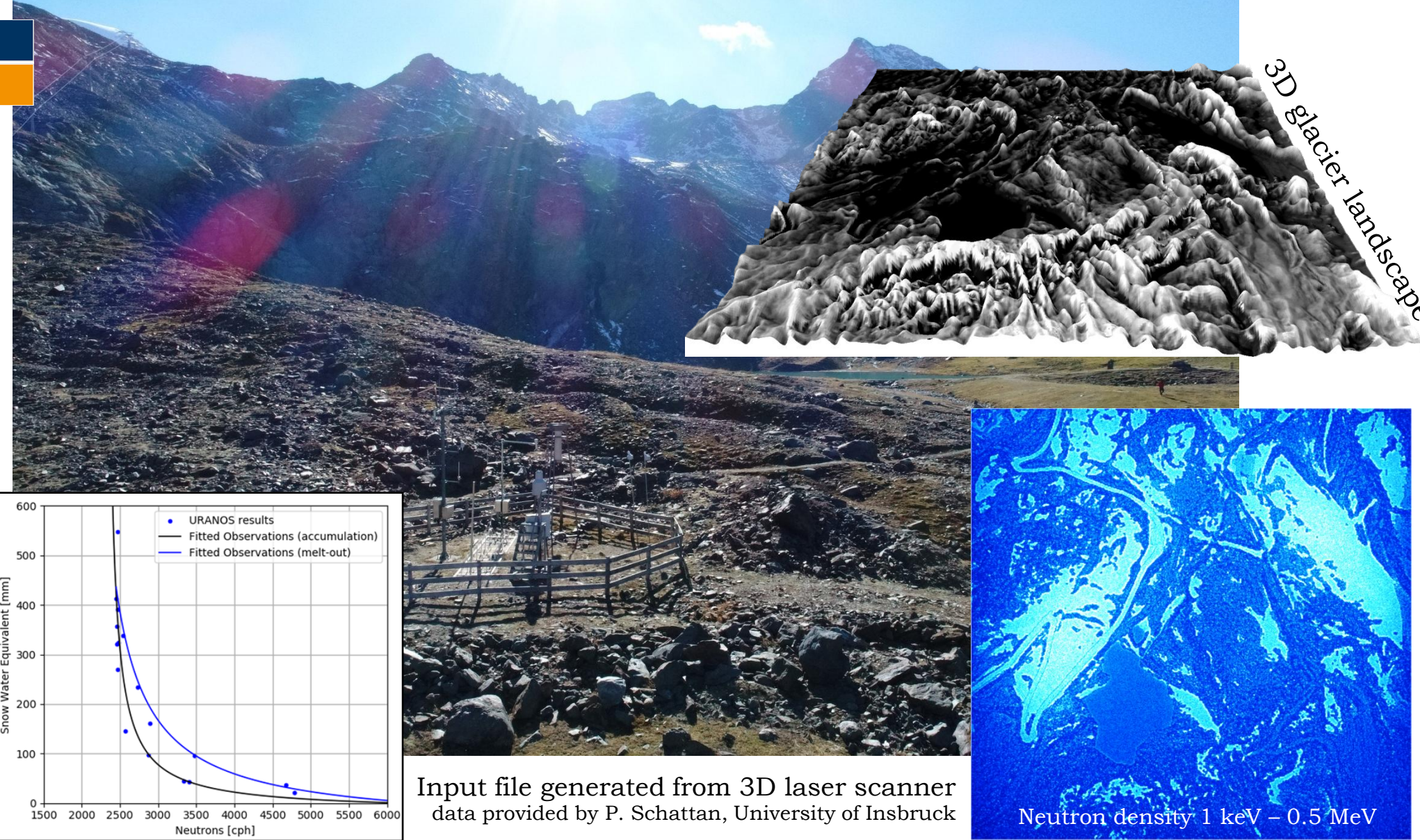
URANOS (Ultra Rapid Neutron-Only Simulation) is a newly developed 3D neutron transport Monte Carlo for the thermal to fast regime. Emerging from a problem solver for detector development in collaboration with environmental physics the project aims towards providing a fast computational workflow and an intuitive graphical user interface (GUI) for small to medium sized projects. It features a ray-casting algorithm based on a voxel engine. The simulation domain is defined layerwise, whereas the geometry is extruded from a pixel matrix of materials, identified by specific numbers. Therefore, input files are solely a stack of pictures, all other settings, including the configuration of predefined sources, can be adjusted by the GUI.

The scattering kernel features the treatment of elastic and inelastic collisions, absorption and emission-like processes like evaporation. Cross sections, energy distributions and angular distributions are taken from the data bases ENDF/B-VII.1 and JENDL/HE-2007. In order to simulate multi-layer boron detectors it also models the charged particle transport following the conversion by computing the energy loss in the boron and its consecutive layer. The electron track is then projected onto a readout unit by longitudinal and transversal diffusion. URANOS is freely available and can be used to simulate the response function of boron-lined or epithermal neutron detectors, small-scale laboratory setups and especially transport studies of cosmic-ray induced environmental neutrons.

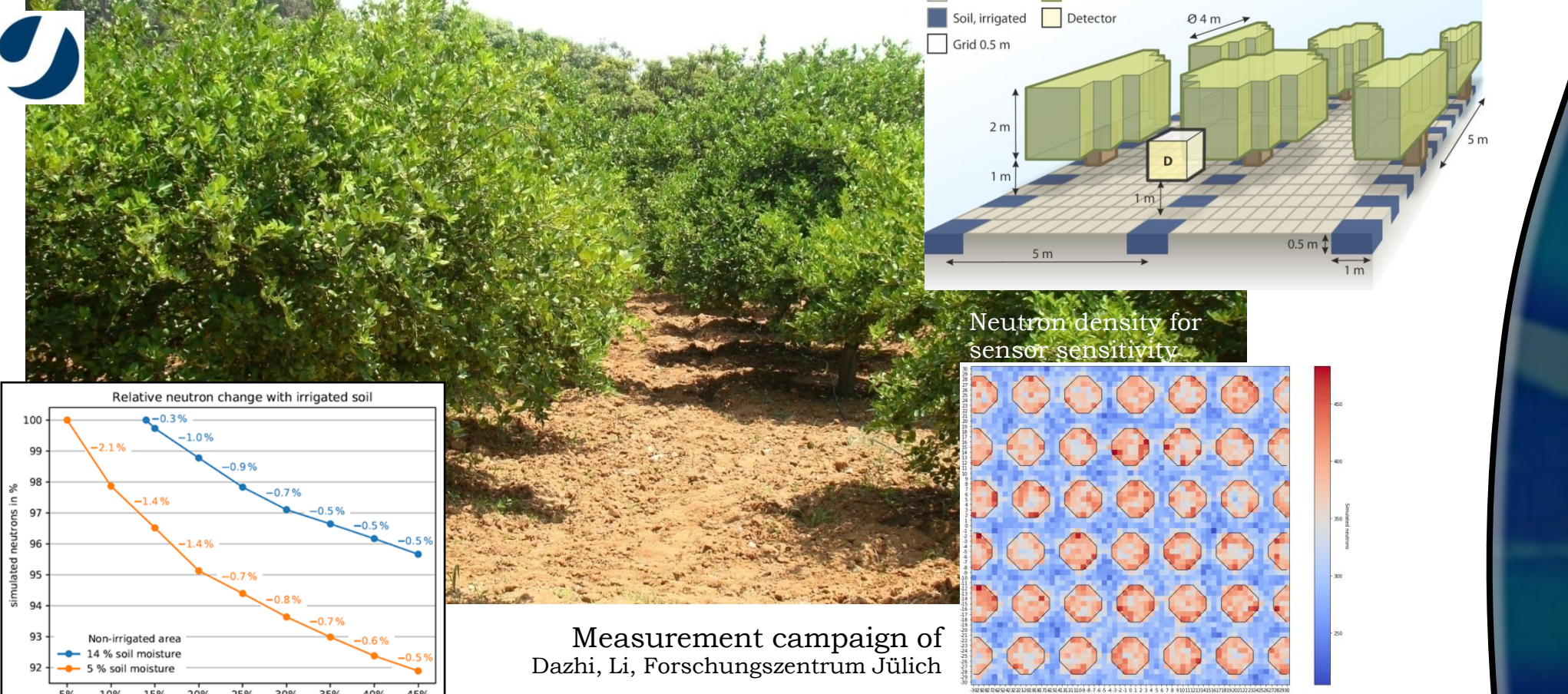
URANOS is freely available from the websites of the Physikalisches Institut Heidelberg and the UFZ Leipzig

Neat Examples

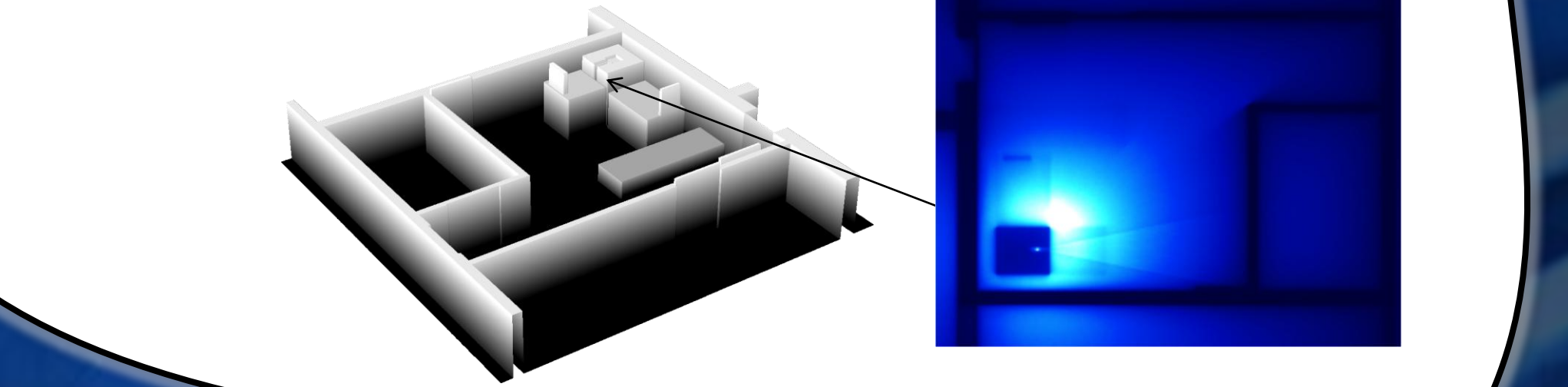
Extremely heterogeneous snow cover at the Kaunertal glacier (Alps):



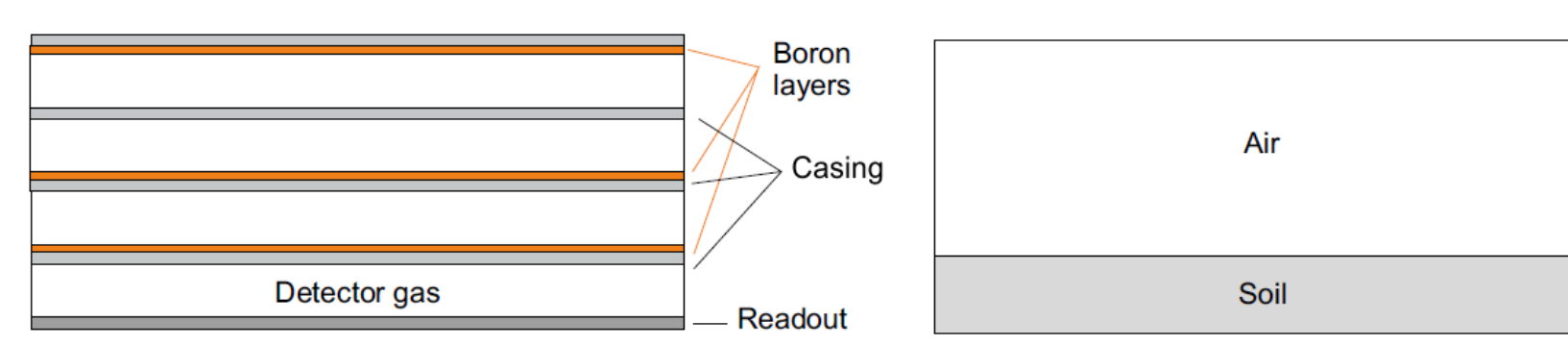
Drip irrigation in Valencia (Spain)



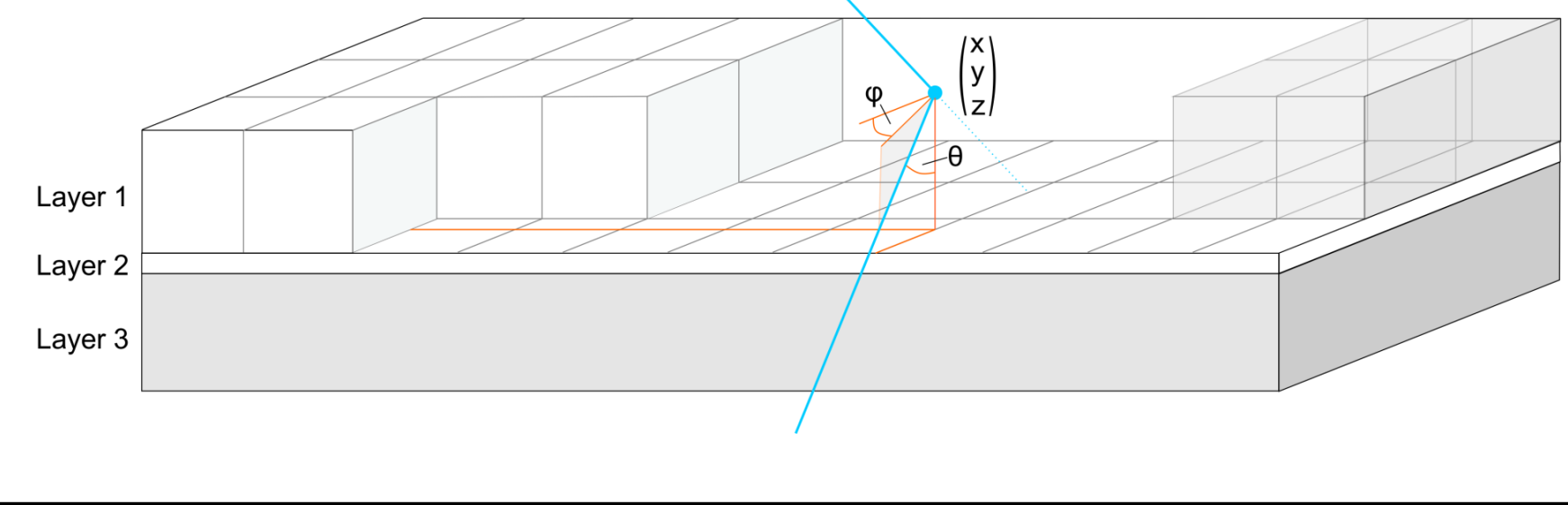
Simulation of the ²⁵²Cf source room in Heidelberg:



Layer and voxel geometry

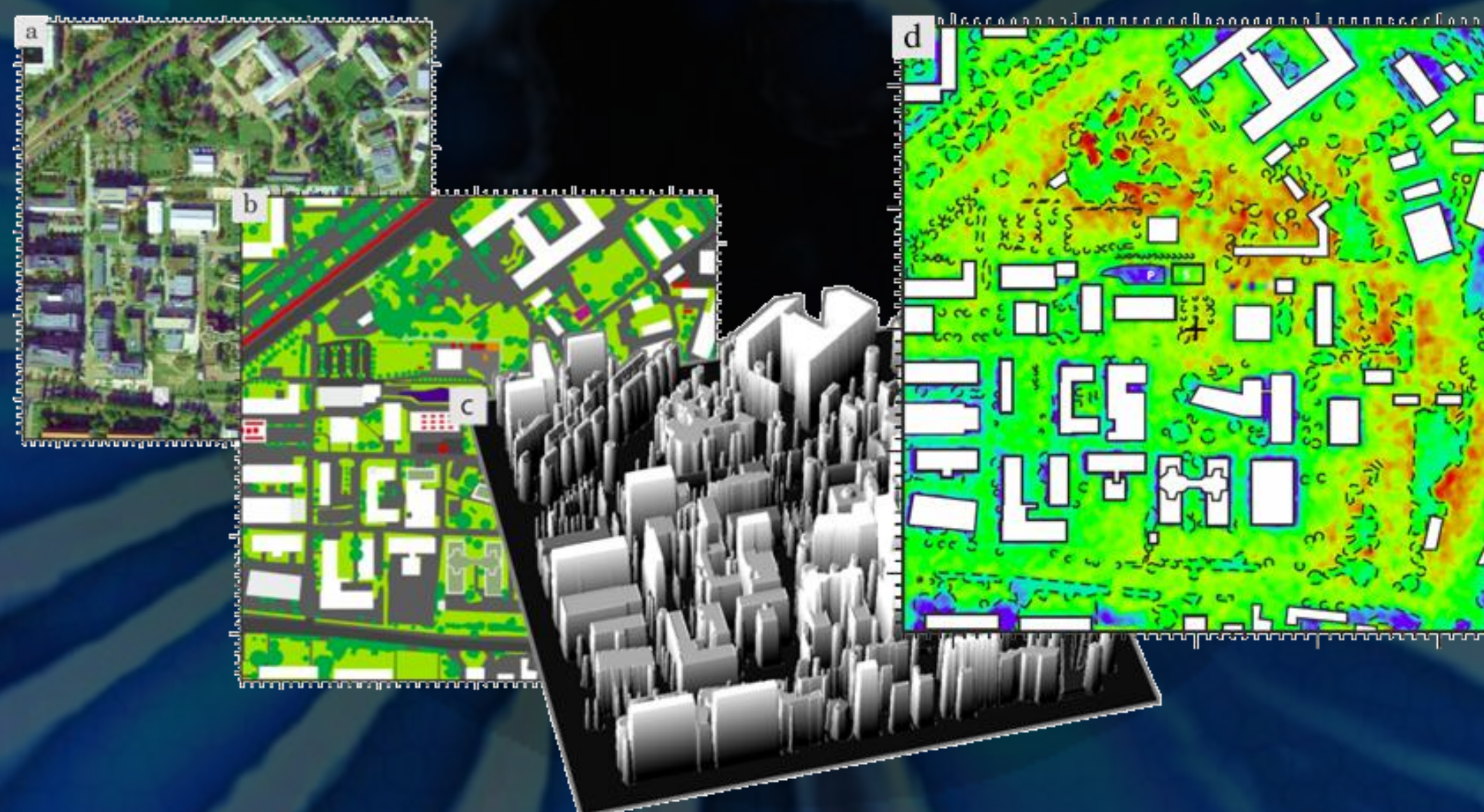


The geometry is organized in layers. This allows to easily build up a stack of homogenous materials with the main parameter being position and height of such a layer. Each layer furthermore can be sub-structured by twodimensional matrices into voxels.

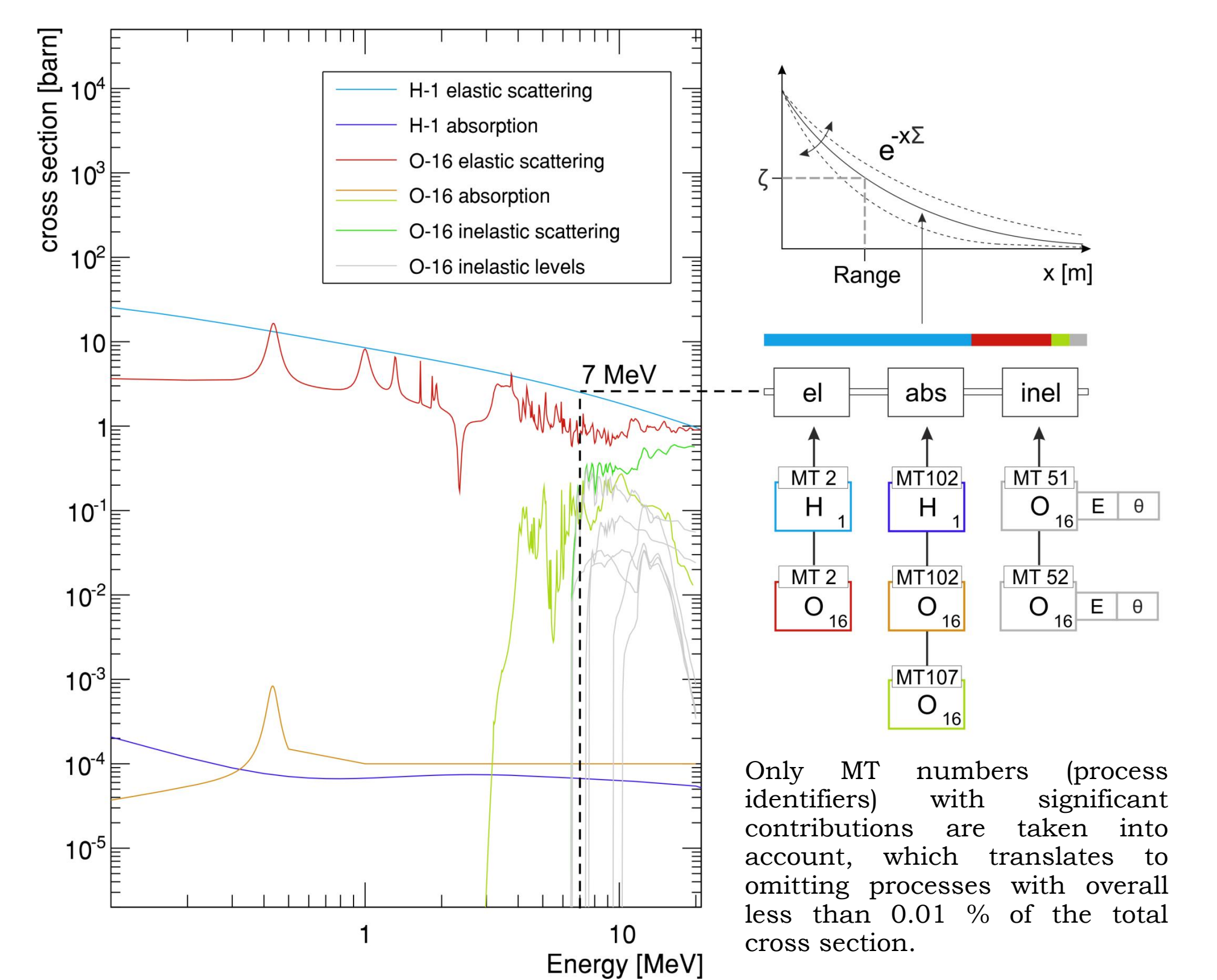


URANOS modeling process, exemplarily for a neutron density in an urban environment:

- Choice of a simulation context (here: UFZ Leipzig),
- Transfer to a (layered) pixelated image,
- Extrusion of a voxel model by the geometry unit and
- Simulation and export of the neutron density.

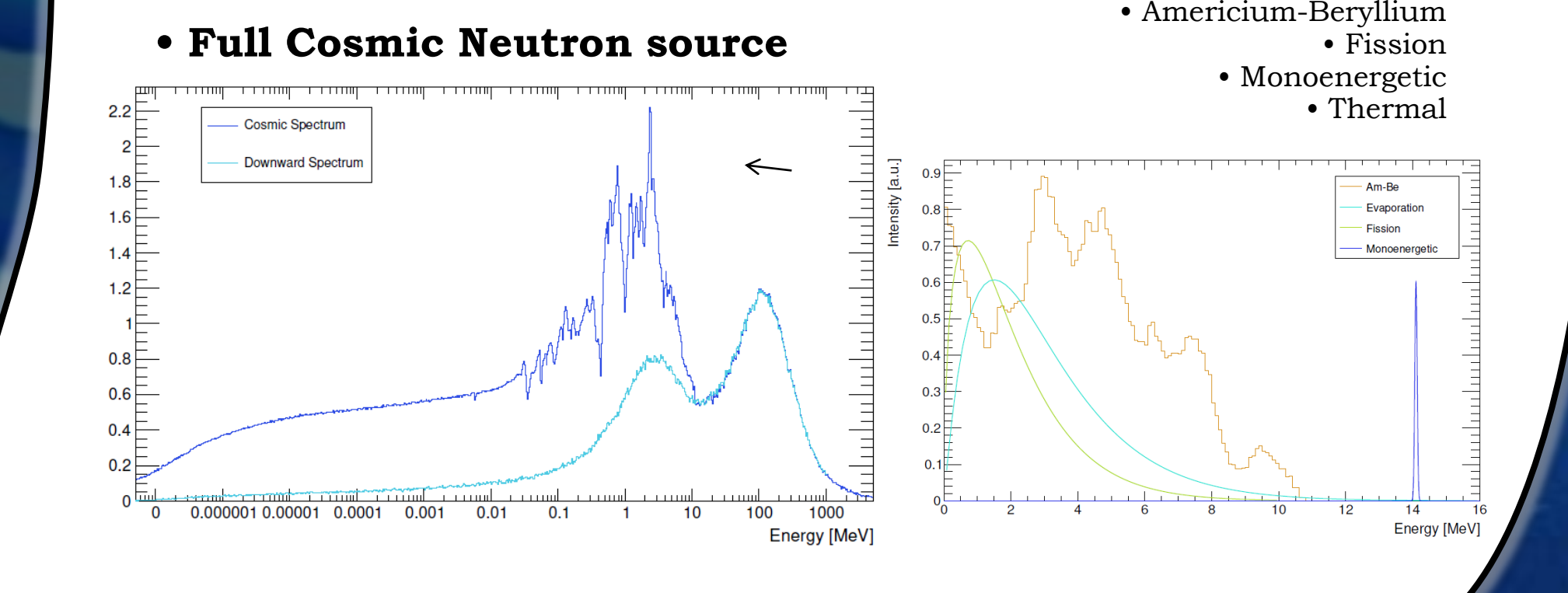


Cross Sections



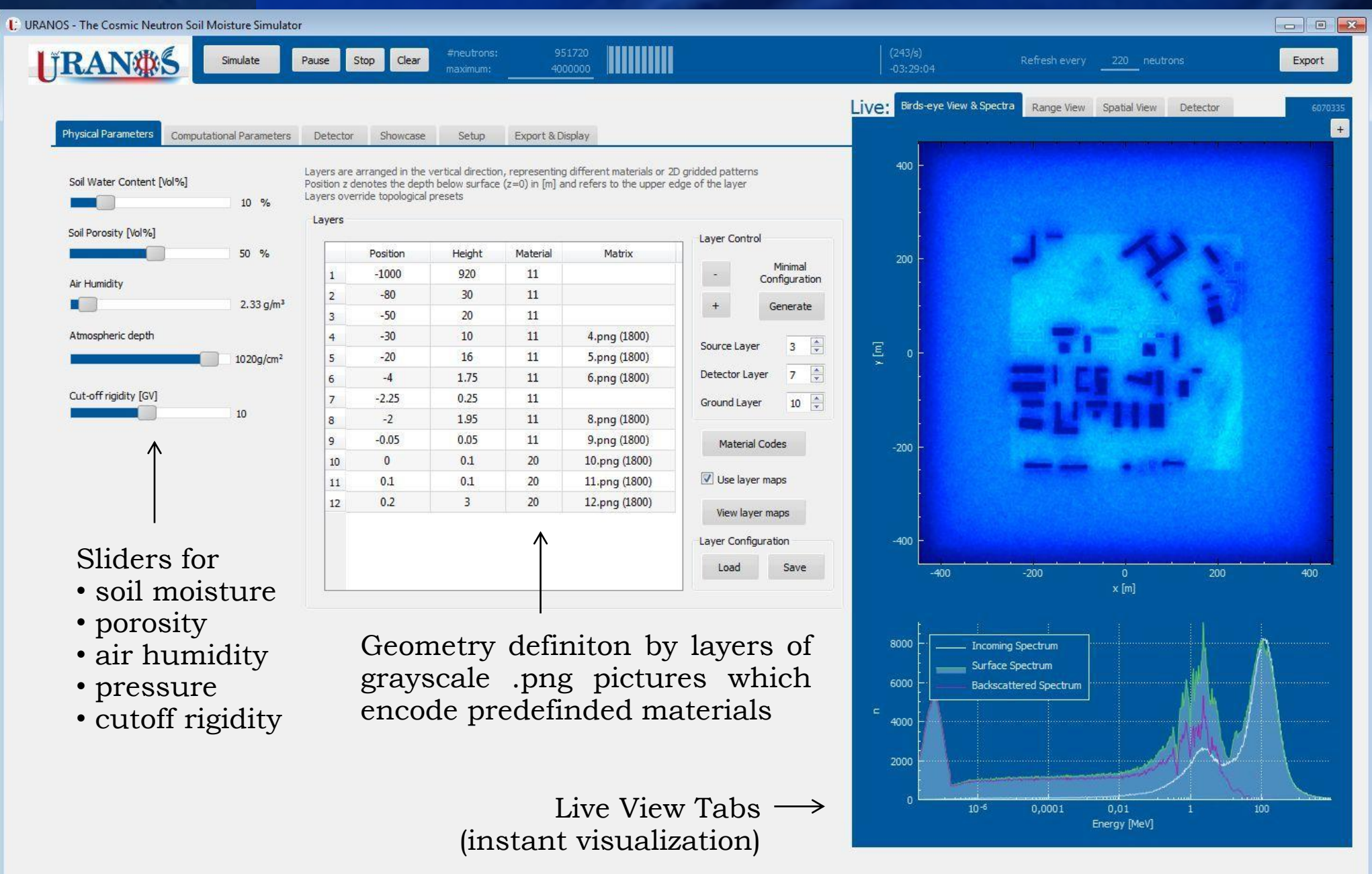
Cross sections and angular distributions are read from tabulated ENDF files. [ENDF/B, JENDL-HE]

Sources

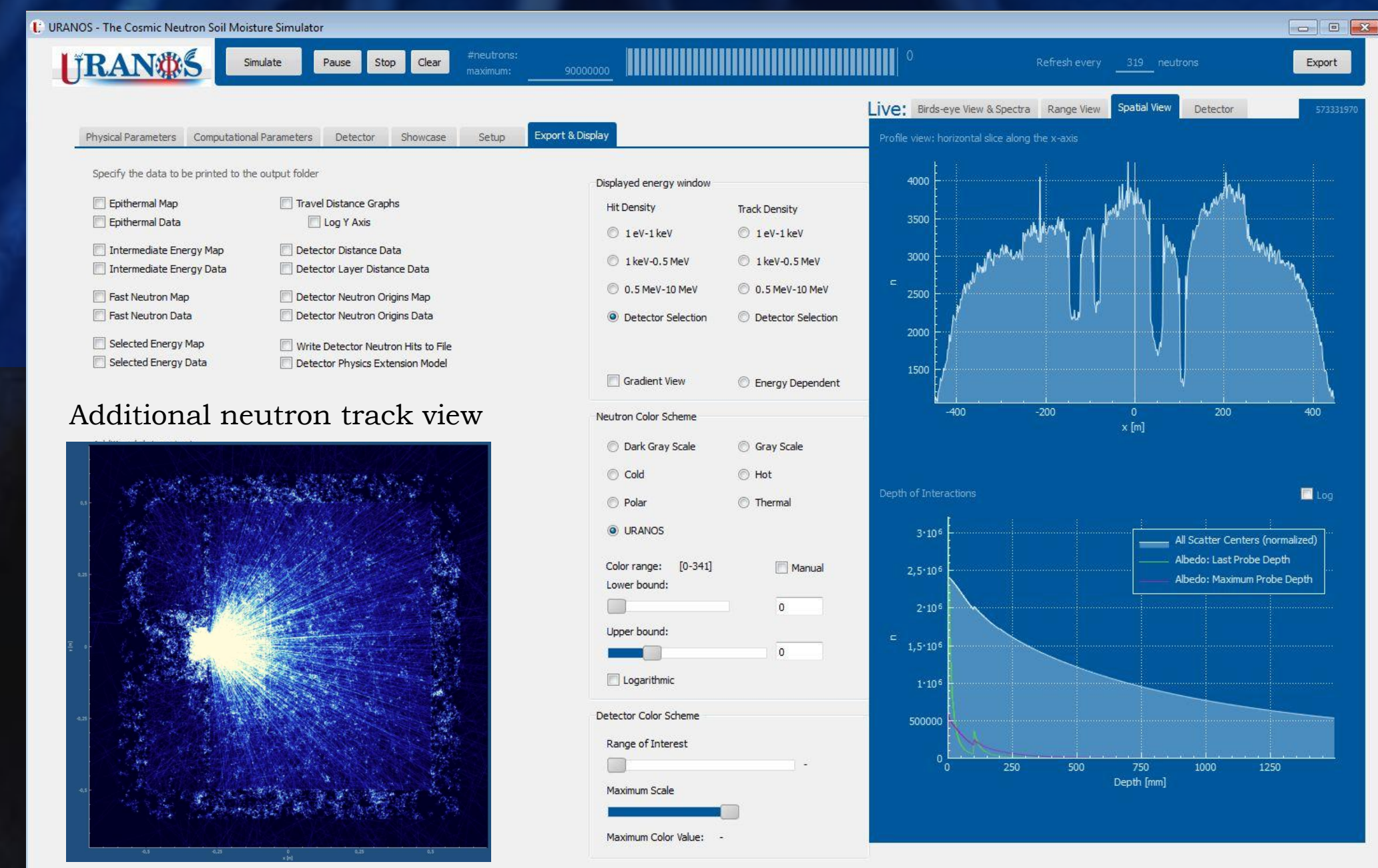


The User Interface

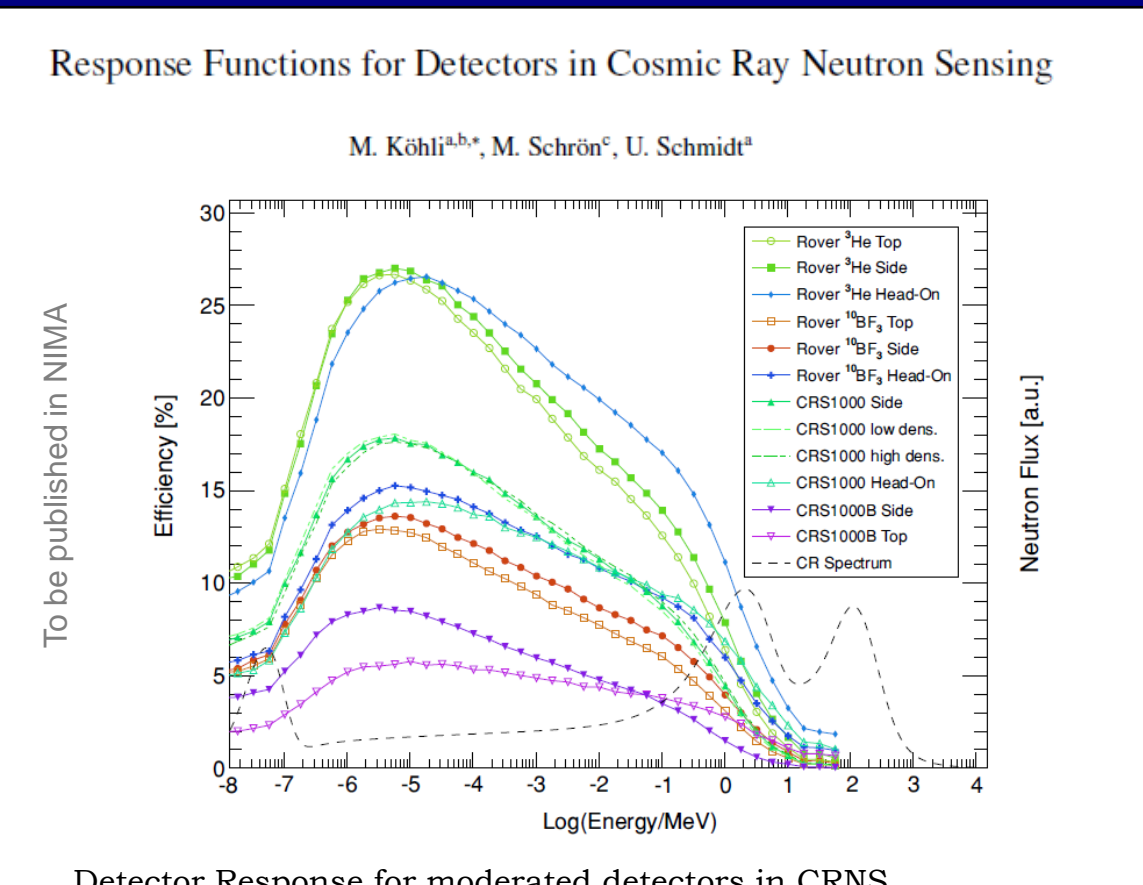
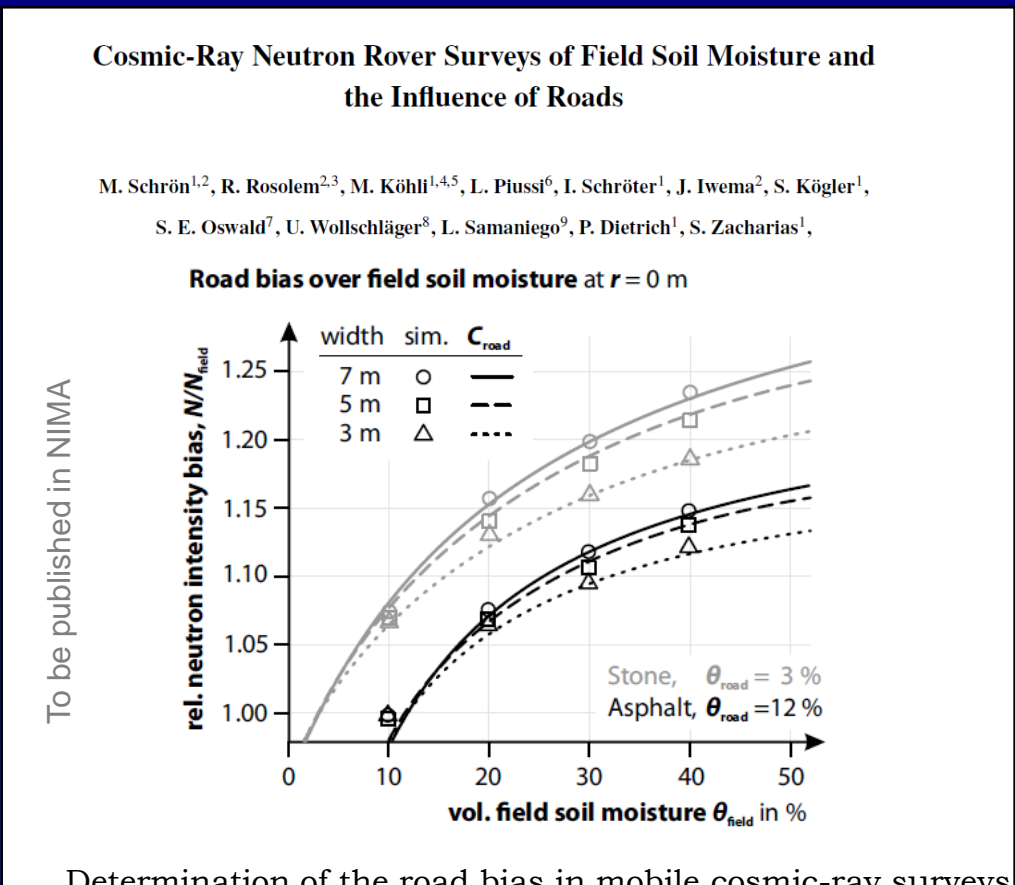
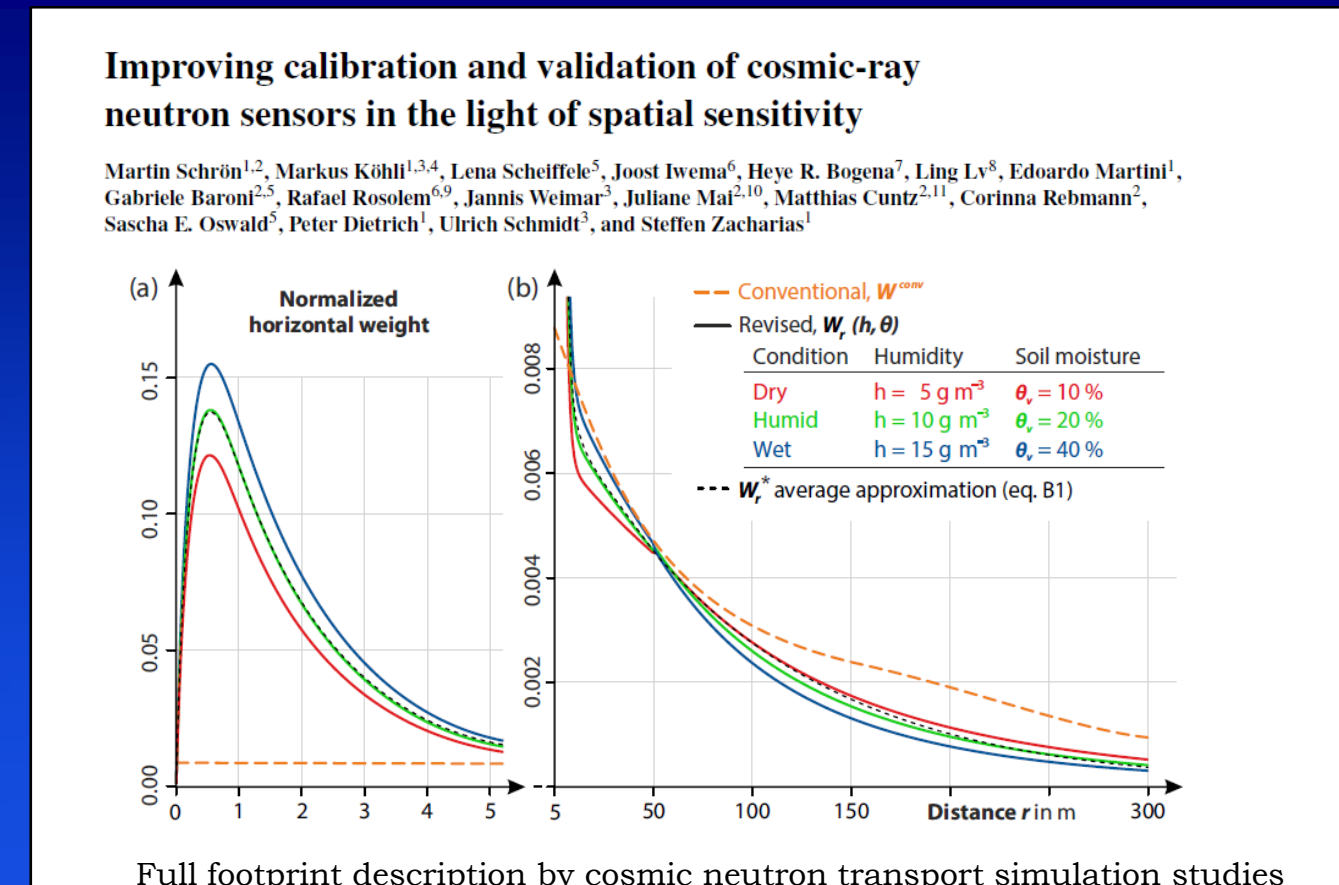
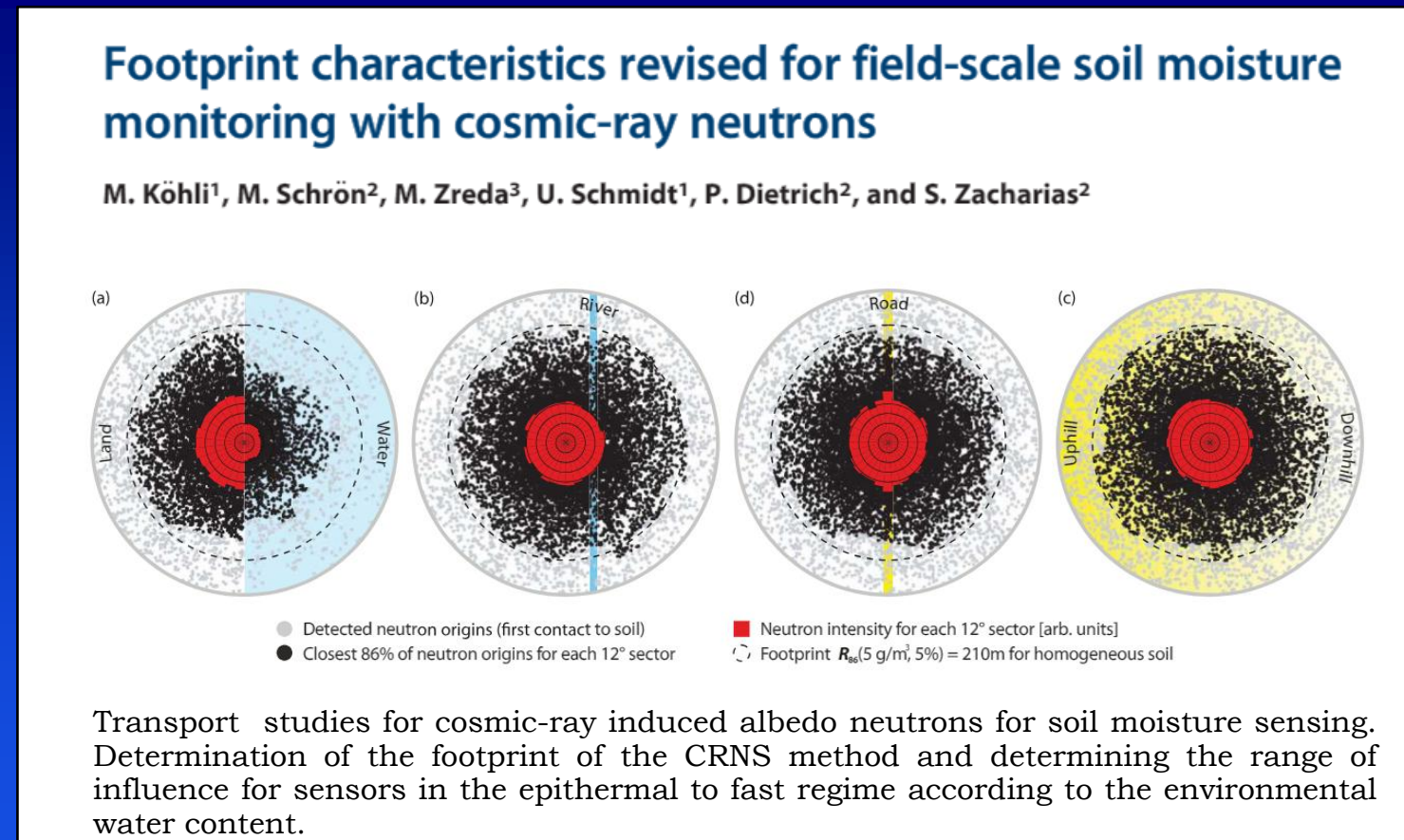
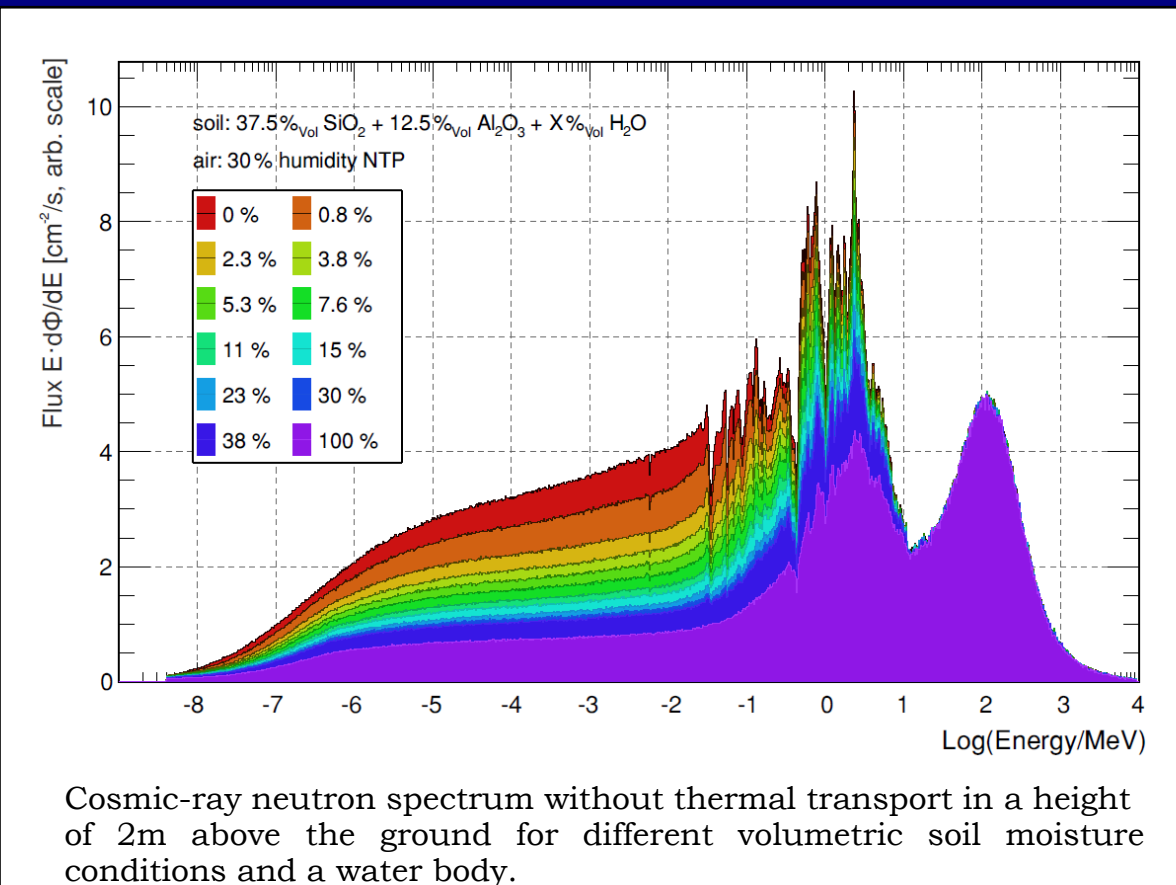
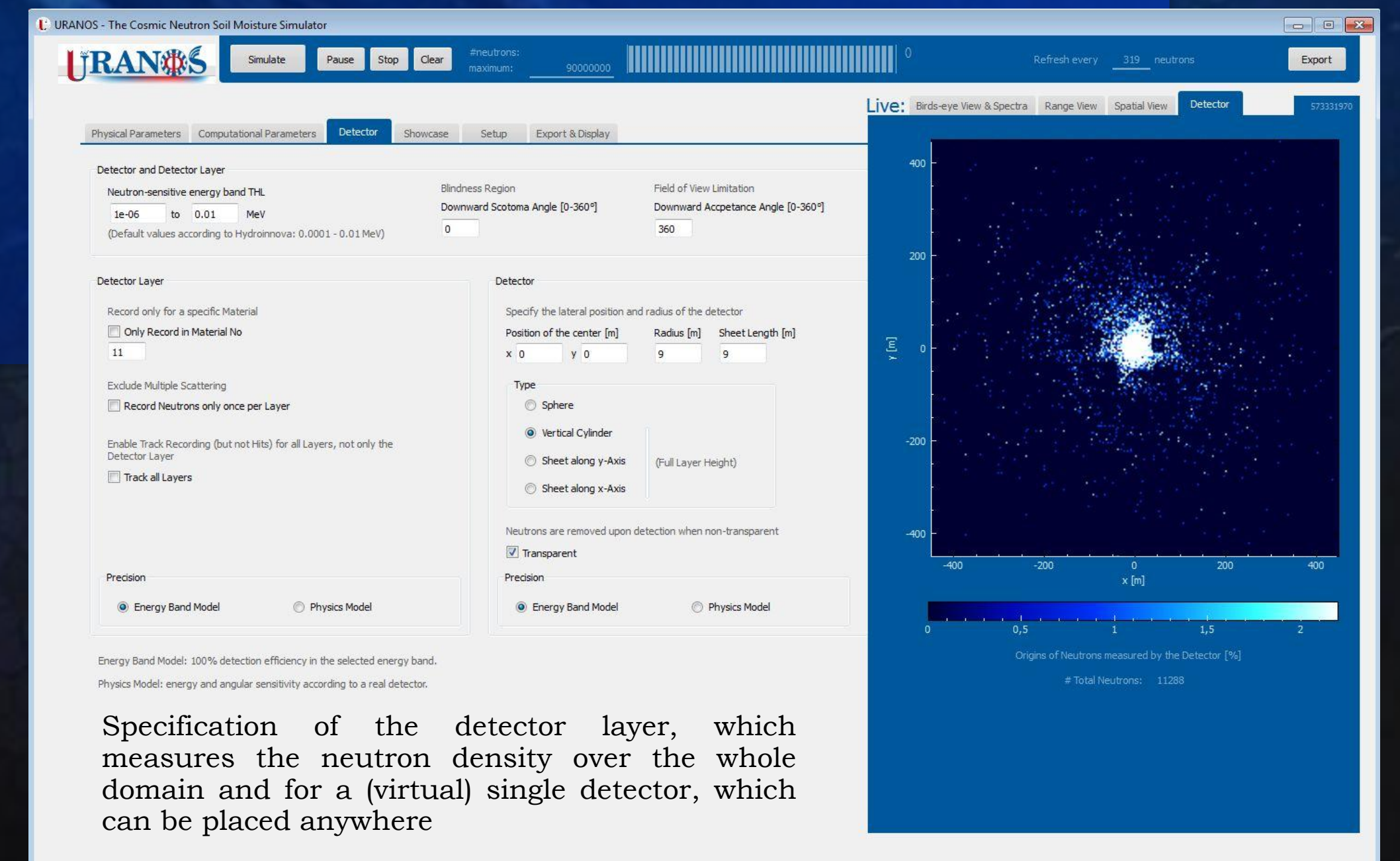
URANOS GUI main tabs: Setup for the layer arrangement for the vertical geometry and environmental parameters (left) and birds-eye view with the above-ground neutron spectrum (right).



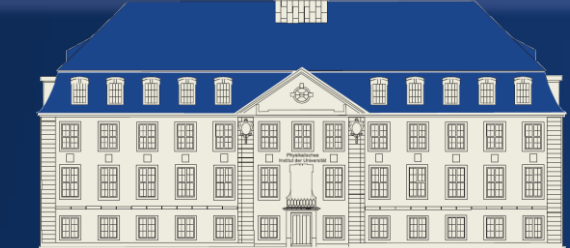
Export options and configurations of the live-view display (left) and spatial neutron distributions (right).



Setup for the scoring of the detector and detector layer (left) and distribution of neutron origins recorded by the virtual detector (right).



Publication Showcase



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