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Extremely high resolution 3D electrical resistivity tomography to depict archaeological subsurface structures

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Electrical resistivity tomography (ERT) methods have been increasingly used in various shallow depth archaeological prospections in the last few decades. These non-invasive techniques are very useful in saving time, costs, and efforts. Both 2D and 3D ERT techniques are used to obtain detailed images of subsurface anomalies. In two surveyed areas near Nonnweiler (Germany), we present the results of the full 3D setup with a roll-along technique and of the quasi-3D setup (parallel and orthogonal profiles in dipole-dipole configuration). In area A, a dipole-dipole array with 96 electrodes in a uniform rectangular survey grid has been used in full 3D to investigate a presumed Roman building. A roll-along technique has been utilized to cover a large part of the archaeological site with an electrode spacing of 1 meter and with 0.5 meter for a more detailed image. Additional dense parallel 2D profiles have been carried out in dipole-dipole array with 0.25 meter electrode spacing and 0.25 meter between adjacent profiles in both direction for higher- resolution subsurface images. We have designed a new field procedure, which used an electrode array fixed in a frame. This facilitates efficient field operation, which comprised 2376 electrode positions. With the quasi 3D imaging, we confirmed the full 3D inversion model but at a much better resolution. In area B, dense parallel 2D profiles were directly used to survey the second target with also 0.25 meter electrode spacing and profiles separation respectively. The same field measurement design has been utilized and comprised 9648 electrode positions in total. The quasi-3D inversion results clearly revealed the main structures of the Roman construction. These ERT inversion results coincided well with the archaeological excavation, which has been done in some parts of this area. The ERT result successfully images parts from the walls and also smaller internal structures of the Roman building.