

Zukunft Bau

STRUKTUR / GLIEDERUNG KURZBERICHT

Title **AkuMess**

Development of a software tool for easy room acoustic assessment in architectural education

Background

In architectural education only a rather small number of lessons is scheduled for teaching room acoustics. Nevertheless comprehension shall be achieved by bringing the students into practical room acoustic analysis soon after giving them a short introduction into acoustical basics. The new software is aimed to be an appropriate tool turning the students' own notebook computers with just an attached low cost microphone into a measurement device.

Objectives

Development was done in two phases with intermediate technical and didactic testing.

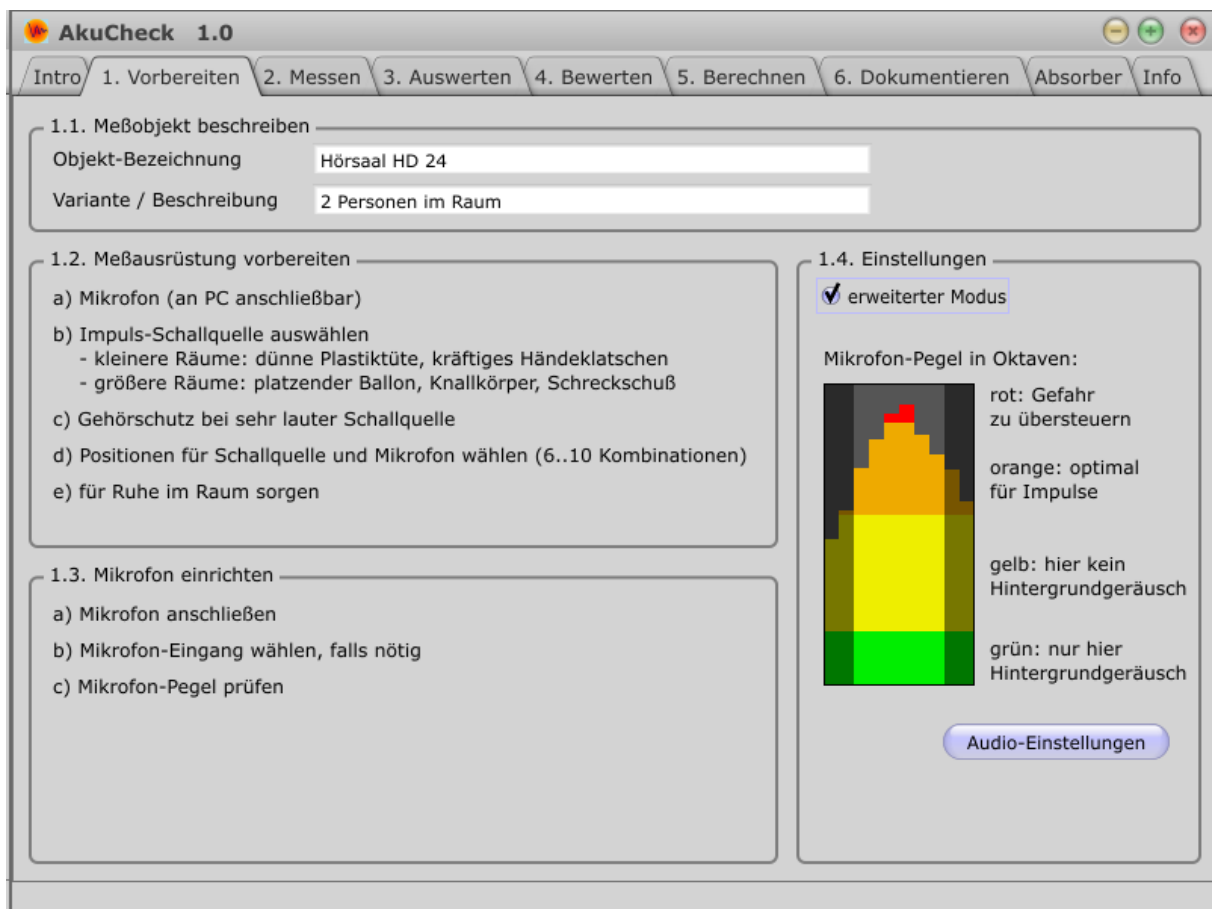


Image 1: On page 1 of the AkuCheck user interface measurements are prepared (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

The first development phase

In the first development phase basic software features were implemented. At its end a feature-limited version of the software was applicable for practical work. The basic features include measurement of room impulse responses using impulse acceleration, calculation of octave reverberation times from these impulse responses, and assessment of measuring results using standardized criteria.

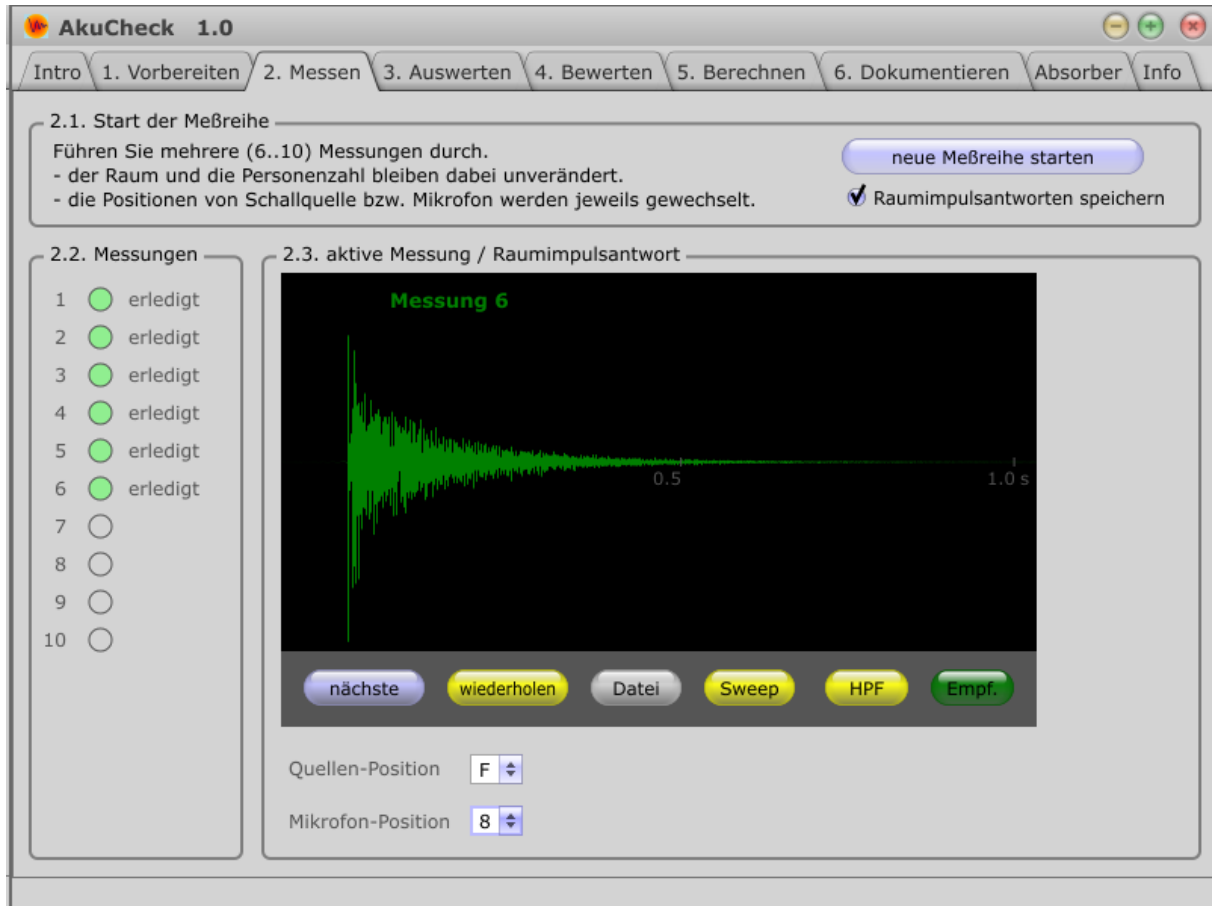


Image 2: Page 2 shows oscillograms of the measured room impulse responses (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

Technical testing

In the first technical test phase emphasis was on comparison of evaluation algorithms to several established scientific and commercial software applications as references. Results that all applications including the new software agreed within a narrow tolerance.

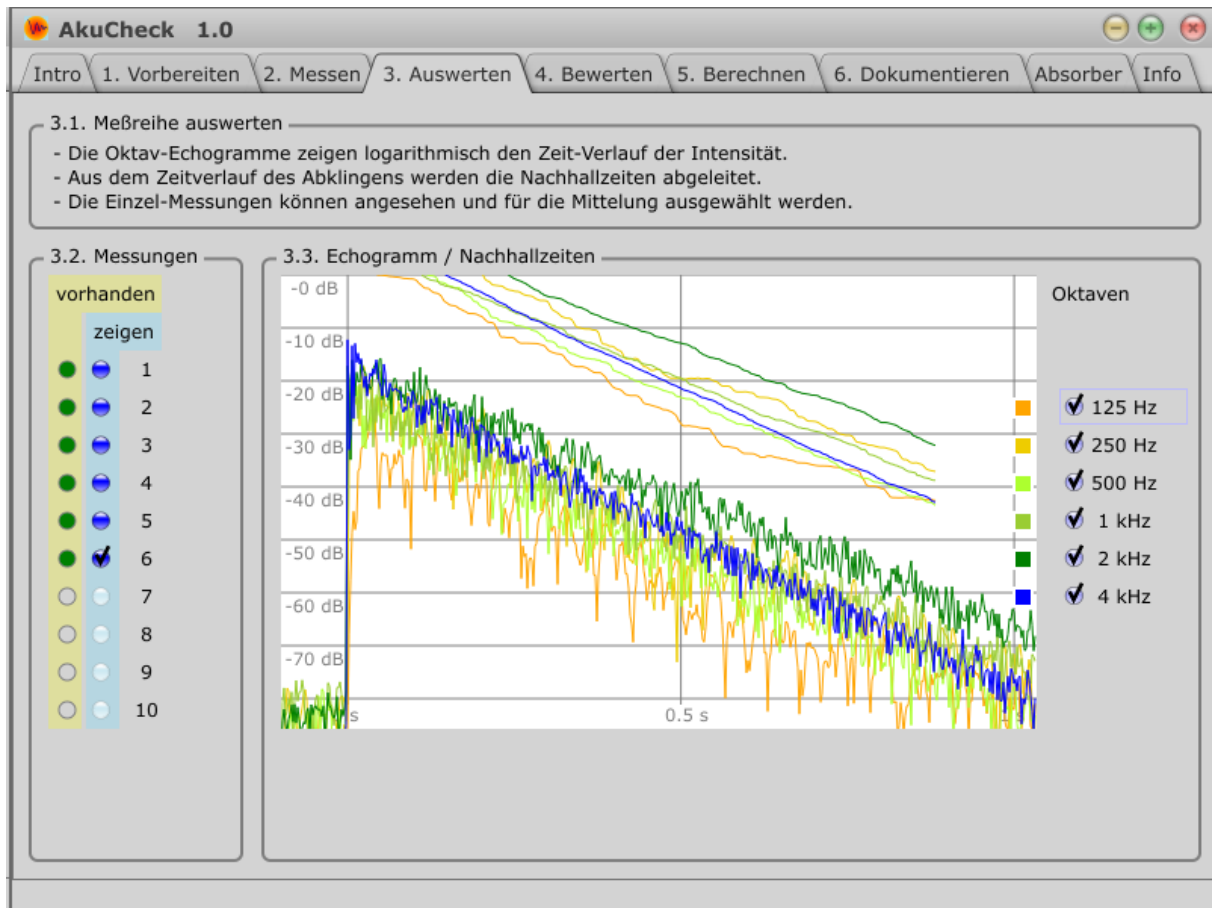


Image 3: Backward integration of logarithmic impulse responses is drawn on page 3 of the user interface (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

Didactic testing

In didactic tests the basic software version has been integrated into the students' practical seminar work. It was approved, that the students could easily apply the new software after a short introduction. Experience from these tests was used for improvement, in particular a real time octave analyser was integrated as a microphone levelling utility.

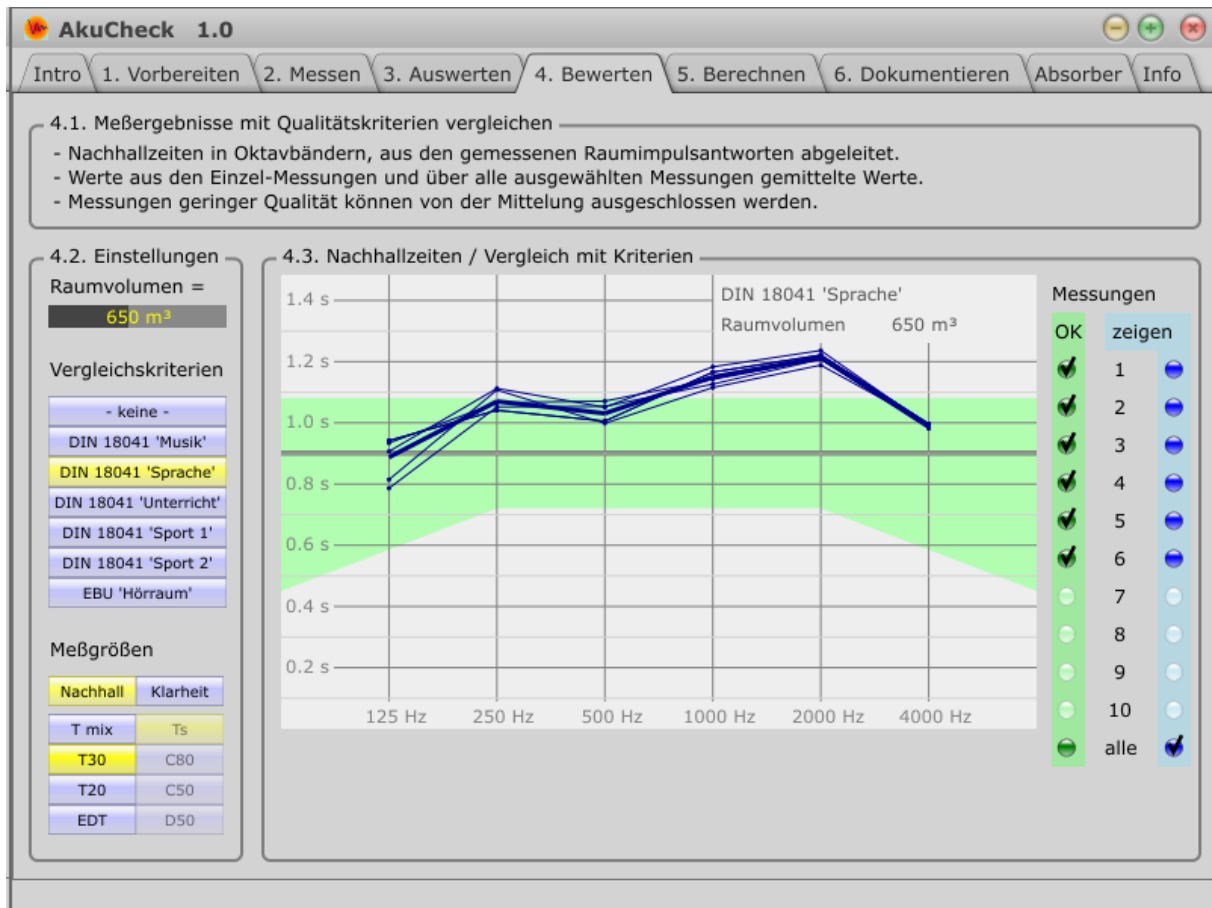


Image 4: On page 4 of the AkuCheck user interface measured octave reverberation times and other measures are shown and compared to standardized references (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

The second development phase

In the second development the all of the projected features were implemented into the software.

Sinus sweep accelerated measuring was integrated as a more accurate and robust method. Besides the reverberation times (T_{30} , T_{20} , EDT) measures for clarity of individual transmission paths (T_s , C_{80} , C_{50} , D_{50}) can be evaluated. Effects of additional persons on reverberation times can be calculated. Similarly room acoustic improvement by additional absorbers can be evaluated. A user extensible absorber data base is added as background for calculations.

All measuring and calculation results are shown graphically and can be exported into text files.

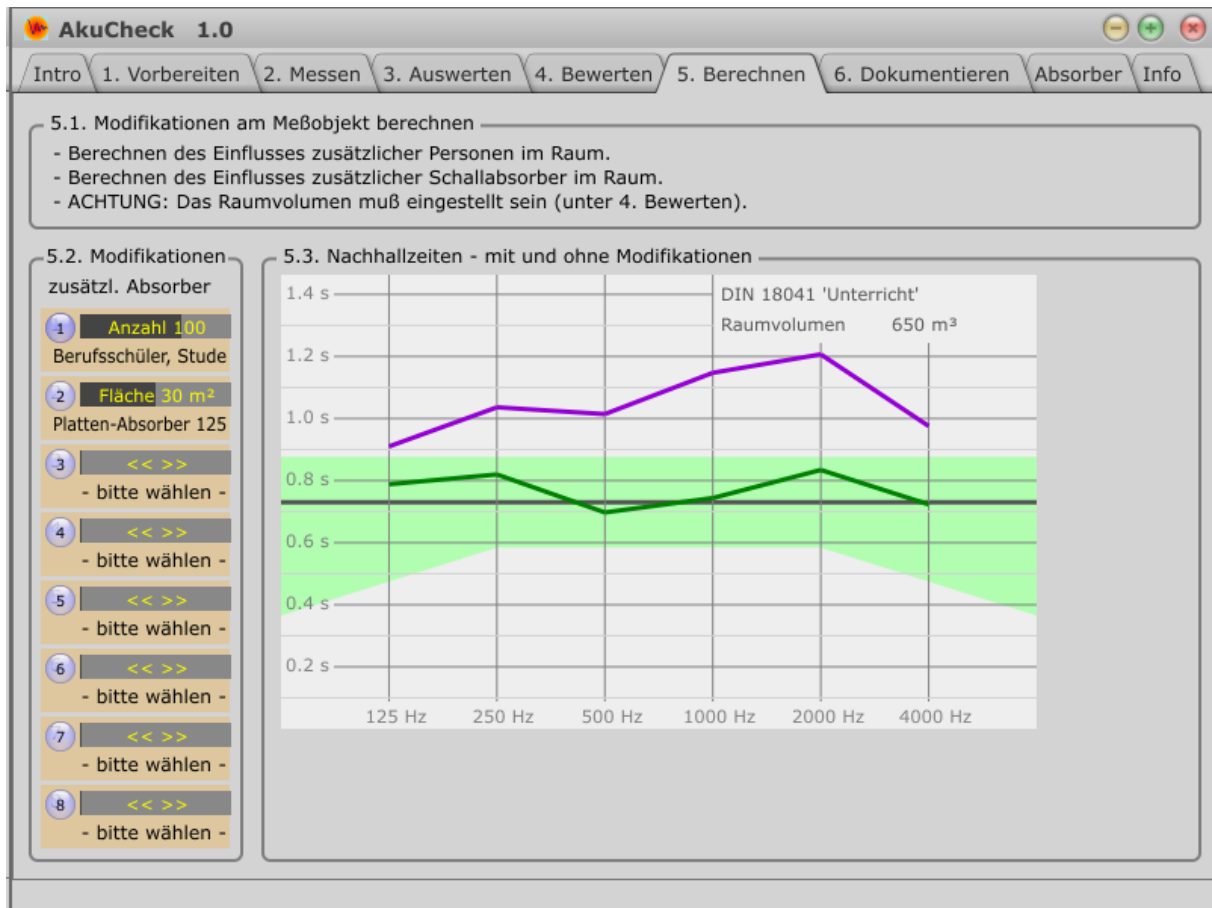


Image 5: Calculated effects of additional persons or absorbers on AkuCheck's page 5 (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

The final test phase

The completed software underwent a final phase with additional technical and didactic test. A major objective of a beta test was the integration of additional absorber data supplied by supporting manufacturers. In addition a number of software bugs was detected and fixed. Technical tests included additional algorithm reviewing and examination of acceleration effects on the quality of measuring results. During summer term at Wuppertal university the second didactic testing was performed including the students' autonomous measurements as well as subsequent calculations of room acoustic improvements.

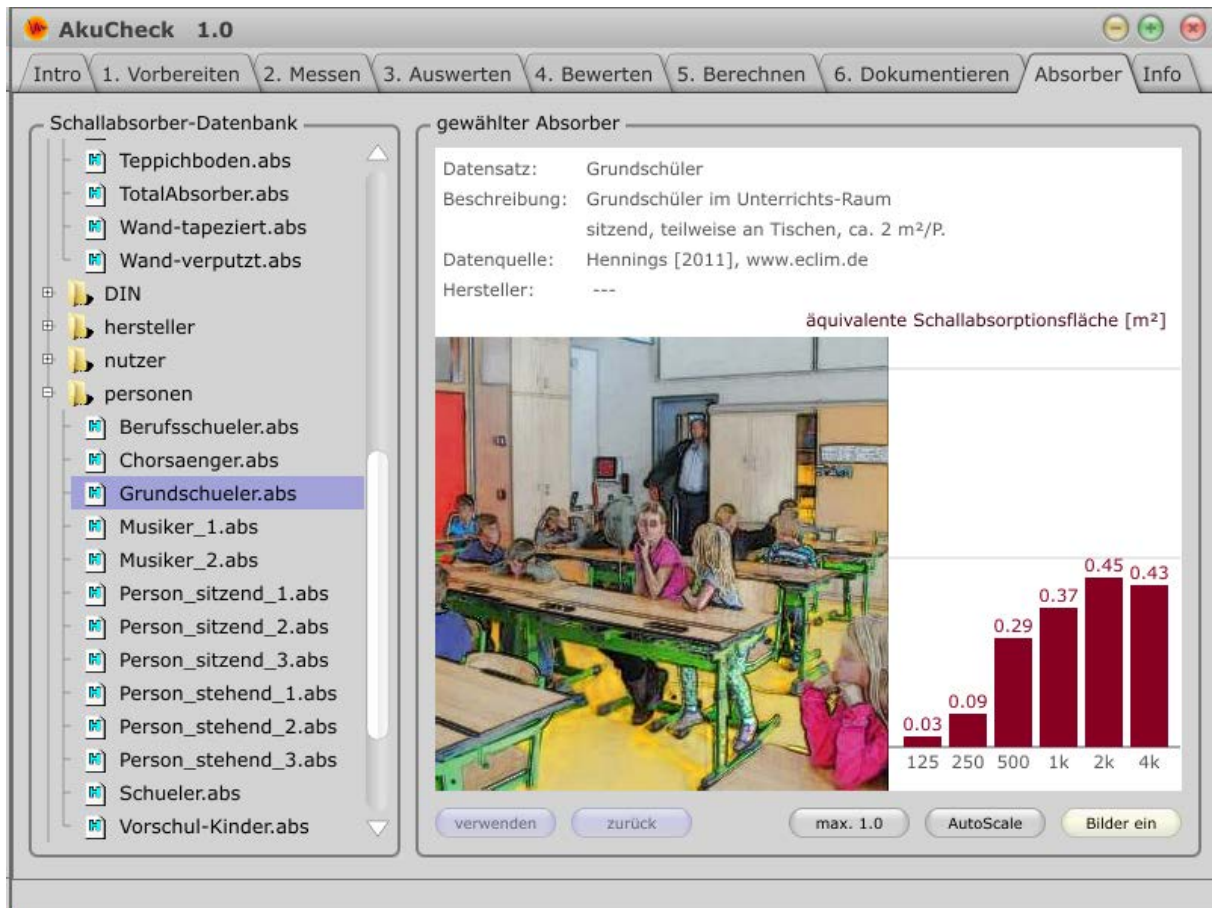


Image 6: An integrated sound absorber database is used for calculations (screenshot). © D. Hennings, 51065 Köln, www.eclim.de

Communication and publications

During the project period two regular meetings were held. In addition several informal meetings with project advisors took place.

At two conferences (CESBP 2013 at Vienna and DAGA 2014 at Oldenburg) the new software was presented in operation. Conference participants were not only interested in using the software in their own work but also in future development towards transcoding to additional operating systems and a multilingual user interface

Conclusions

The new software opens up new opportunities in education of architects and related professionals. Now despite of lacking time students can be brought to practical work including room acoustic assessment, and thus gain their own experience and understanding.

The accuracy of measuring results meets requirements for room acoustic quality assessment in rooms for communication and education. In addition effects of room acoustic improvements can be predicted. Thus all project aims were achieved.

Eckdaten

Kurztitel: AkuMess

Forscher / Projektleitung: Dr. Detlef Hennigs / Prof. Dr.-Ing Karsten Voss

Gesamtkosten: 85.425,- €

Anteil Bundeszuschuss: 56.482 €

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