



Detlef Hennings

Dr. rer. nat.

A new tool for quick room acoustic assessment in architectural education

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Background and Aims

- **Improving the room acoustic education of architects.**
- **Only a few lessons are available for room acoustics.**
- **Intensive learning instead of overstuffing.**
- **After a concentrated introduction the students are 'thrown' into practical work.**
- **Small student groups analyse existing rooms on their own. Tutors are assisting if necessary.**
- **The new software supplies measurement and calculation tools and guides through the analysis process.**
- **The students' own notebook computers are used with a low cost (< 20 €) microphone attached.**

Software Features

Basic features :

- **Measure room impulse responses**
- **Impulse acceleration for simplicity**
- **Derive octave band reverberation times**
- **Algorithms according to ISO 3382**
- **Averaging of individual measurements**
- **Compare to recommendations (DIN 18041, ...)**
- **Graphical and numerical output**

Software Features

Advanced features :

- **sine sweep acceleration for measurements**
- **additional quality measures acc. to ISO 3382**
- **integrated calculation of additional absorber effects**
- **integrated calculation of additional person effects**
- **integrated absorber data base (user extensible)**

Software Development Phases

1st development phase :

- integration of basic software features
- technical tests
- didactic tests

2nd development phase :

- integration of advanced software features (now)
- technical tests
- didactic tests

Final tuning ...

Project Structure

Project team

- K. Voss (Wuppertal University)
- D. Hennings (freelancer)
- E. Rotzal (Wuppertal University)

Advisory board

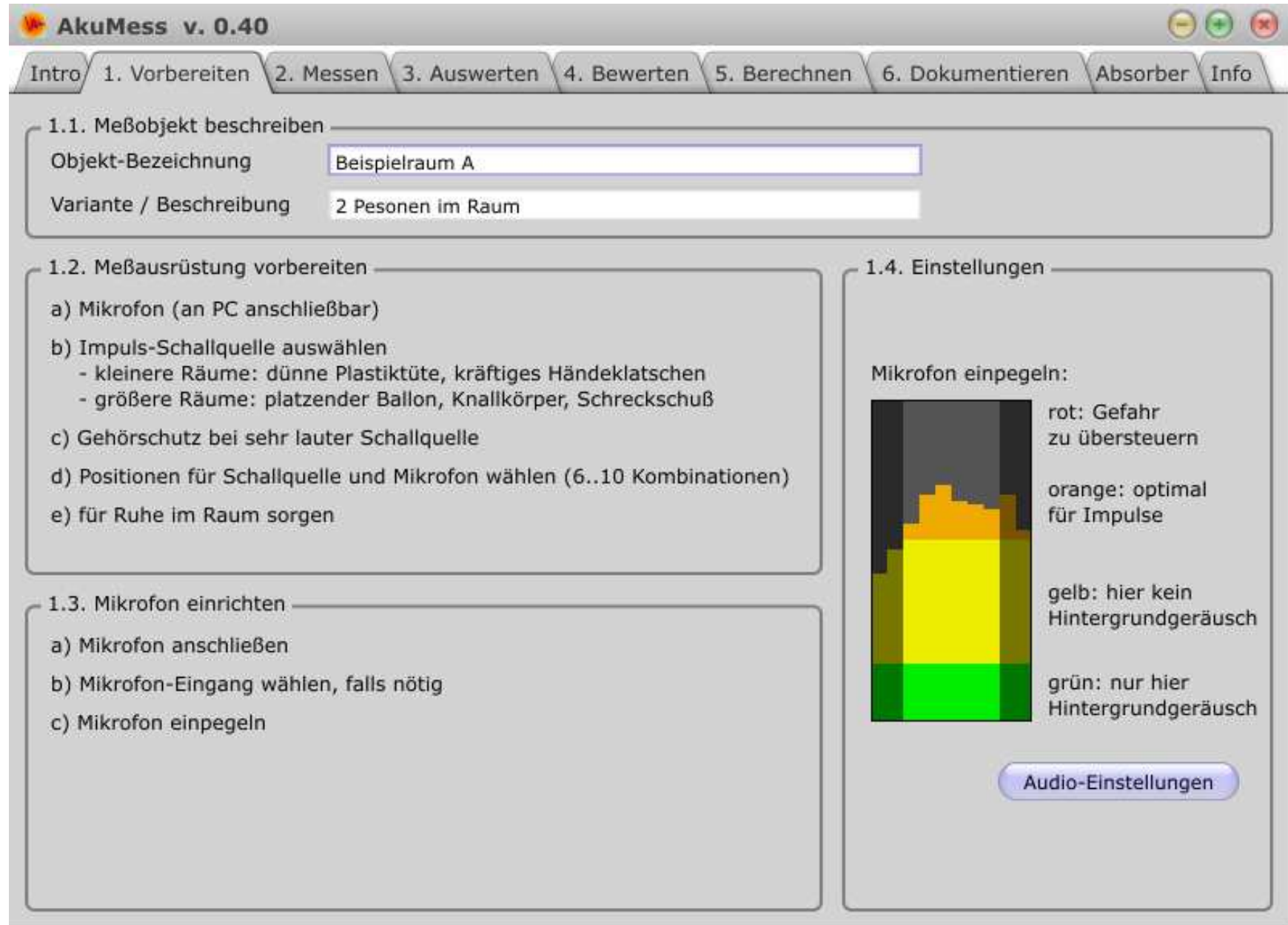
- Advisors with theoretical and practical background in acoustics

Funding and support

- Funded by the 'Forschungsinitiative Zukunft Bau'
(German Fed. Ministry of Transport, Building and Urban Development)
- Supported by the industry:
Akustik & Raum - Caparol - Lignotrend - OWAconsult

Software User Interface

1 preparation page :



The screenshot shows the 'AkuMess v. 0.40' software window. The interface is divided into several sections for preparing a measurement:

- 1.1. Meßobjekt beschreiben**
 - Objekt-Bezeichnung: Beispielraum A
 - Variante / Beschreibung: 2 Pesonen im Raum
- 1.2. Meßausrüstung vorbereiten**
 - a) Mikrofon (an PC anschließbar)
 - b) Impuls-Schallquelle auswählen
 - kleinere Räume: dünne Plastiktüte, kräftiges Händeklatschen
 - größere Räume: platzender Ballon, Knallkörper, Schreckschuß
 - c) Gehörschutz bei sehr lauter Schallquelle
 - d) Positionen für Schallquelle und Mikrofon wählen (6..10 Kombinationen)
 - e) für Ruhe im Raum sorgen
- 1.3. Mikrofon einrichten**
 - a) Mikrofon anschließen
 - b) Mikrofon-Eingang wählen, falls nötig
 - c) Mikrofon einpegeln
- 1.4. Einstellungen**
 - Mikrofon einpegeln:
 - rot: Gefahr zu übersteuern
 - orange: optimal für Impulse
 - gelb: hier kein Hintergrundgeräusch
 - grün: nur hier Hintergrundgeräusch
 - Audio-Einstellungen

Software User Interface

2 measurement page :

The screenshot displays the '2. Messen' (Measure) page of the 'AkuMess v. 0.40' software. The interface is organized into several sections:

- Navigation:** A top bar contains tabs for 'Intro', '1. Vorbereiten', '2. Messen', '3. Auswerten', '4. Bewerten', '5. Berechnen', '6. Dokumentieren', 'Absorber', and 'Info'. The '2. Messen' tab is currently active.
- 2.1. Start der Meßreihe:** This section provides instructions: 'Führen Sie mehrere (6..10) Messungen durch.' followed by two bullet points: '- der Raum und die Personenzahl bleiben dabei unverändert.' and '- die Positionen von Schallquelle bzw. Mikrofon werden jeweils gewechselt.' A radio button labeled 'Raumimpulsantworten speichern' is selected.
- 2.2. Messungen:** A vertical list of 10 measurement slots. Slots 1, 2, and 3 are marked as 'erledigt' (completed) with green circles. Slots 4 through 10 are marked with empty white circles.
- 2.3. aktive Messung / Raumimpulsantwort:** This section features a large black window displaying a green impulse response waveform for 'Messung 3'. The x-axis is labeled with '0.5' and '1.0 s'. Below the waveform are four buttons: 'nächste' (blue), 'wiederholen' (yellow), 'HPF' (green), and 'Empf.' (green). Below these buttons are two dropdown menus: 'Quellen-Position' set to 'B' and 'Mikrofon-Position' set to '2'.

Software User Interface

3 evaluation page :

AkuMess v. 0.40

Intro | 1. Vorbereiten | 2. Messen | 3. Auswerten | 4. Bewerten | 5. Berechnen | 6. Dokumentieren | Absorber | Info

3.1. Meßreihe auswerten

- Die Oktav-Echogramme zeigen logarithmisch den Zeit-Verlauf der Intensität.
- Aus dem Zeitverlauf des Abklingens werden die Nachhallzeiten abgeleitet.
- Die Einzel-Messungen können angesehen und für die Mittelung ausgewählt werden.

3.2. Messungen

vorhanden

zeigen

<input checked="" type="radio"/>	<input type="radio"/>	1
<input checked="" type="radio"/>	<input type="radio"/>	2
<input checked="" type="radio"/>	<input checked="" type="radio"/>	3
<input type="radio"/>	<input type="radio"/>	4
<input type="radio"/>	<input type="radio"/>	5
<input type="radio"/>	<input type="radio"/>	6
<input type="radio"/>	<input type="radio"/>	7
<input type="radio"/>	<input type="radio"/>	8
<input type="radio"/>	<input type="radio"/>	9
<input type="radio"/>	<input type="radio"/>	10

3.3. Echogramm / Nachhallzeiten

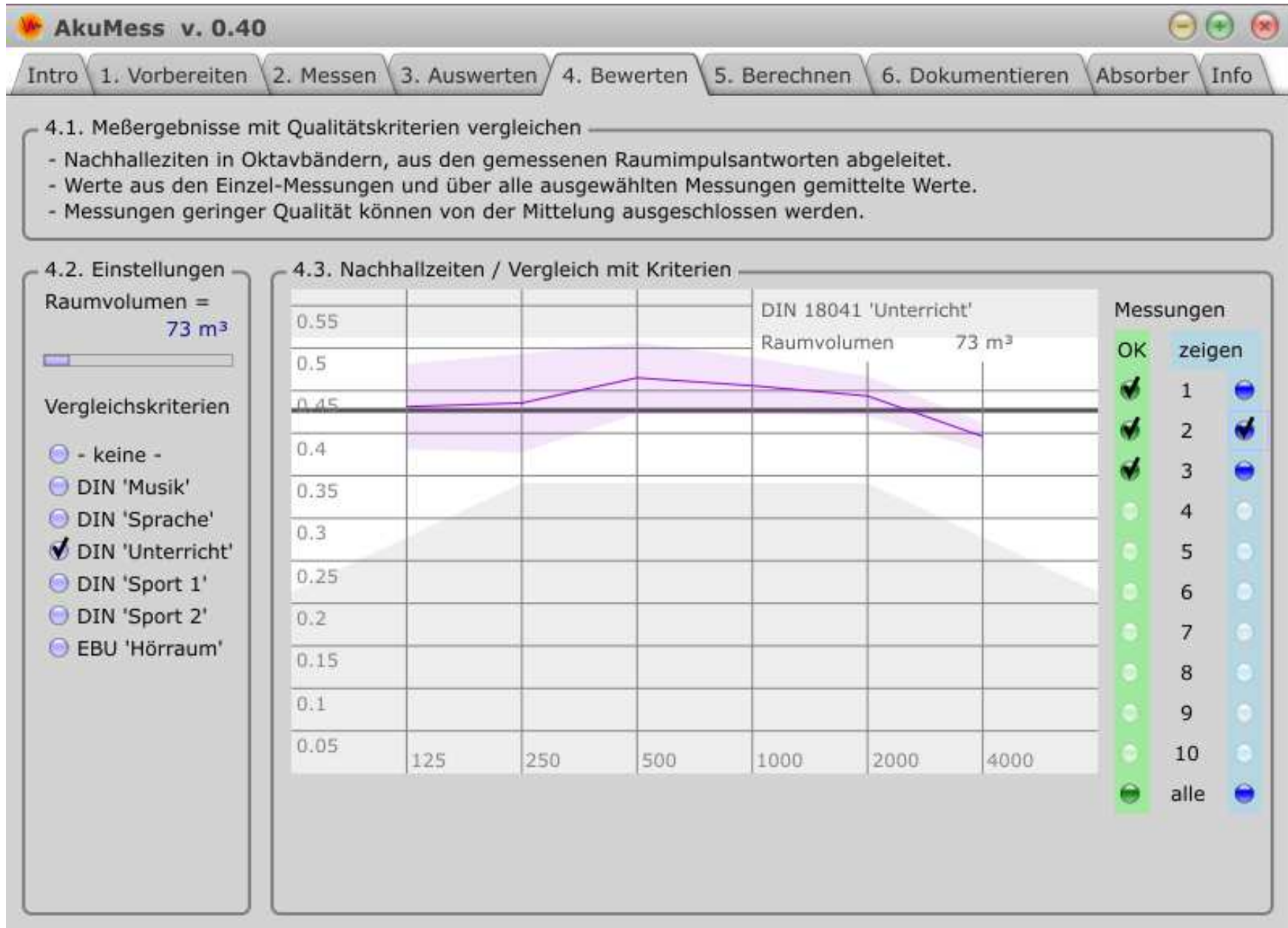
Oktaven

<input checked="" type="checkbox"/>	125 Hz
<input checked="" type="checkbox"/>	250 Hz
<input checked="" type="checkbox"/>	500 Hz
<input checked="" type="checkbox"/>	1 kHz
<input checked="" type="checkbox"/>	2 kHz
<input checked="" type="checkbox"/>	4 kHz

The graph displays octave echograms for various frequencies (125 Hz to 4 kHz) over time. The y-axis represents intensity in dB (from -80 to -0) and the x-axis represents time in seconds (from 0 to 1.0). The curves show a characteristic decay over time, with higher frequencies generally decaying faster than lower frequencies.

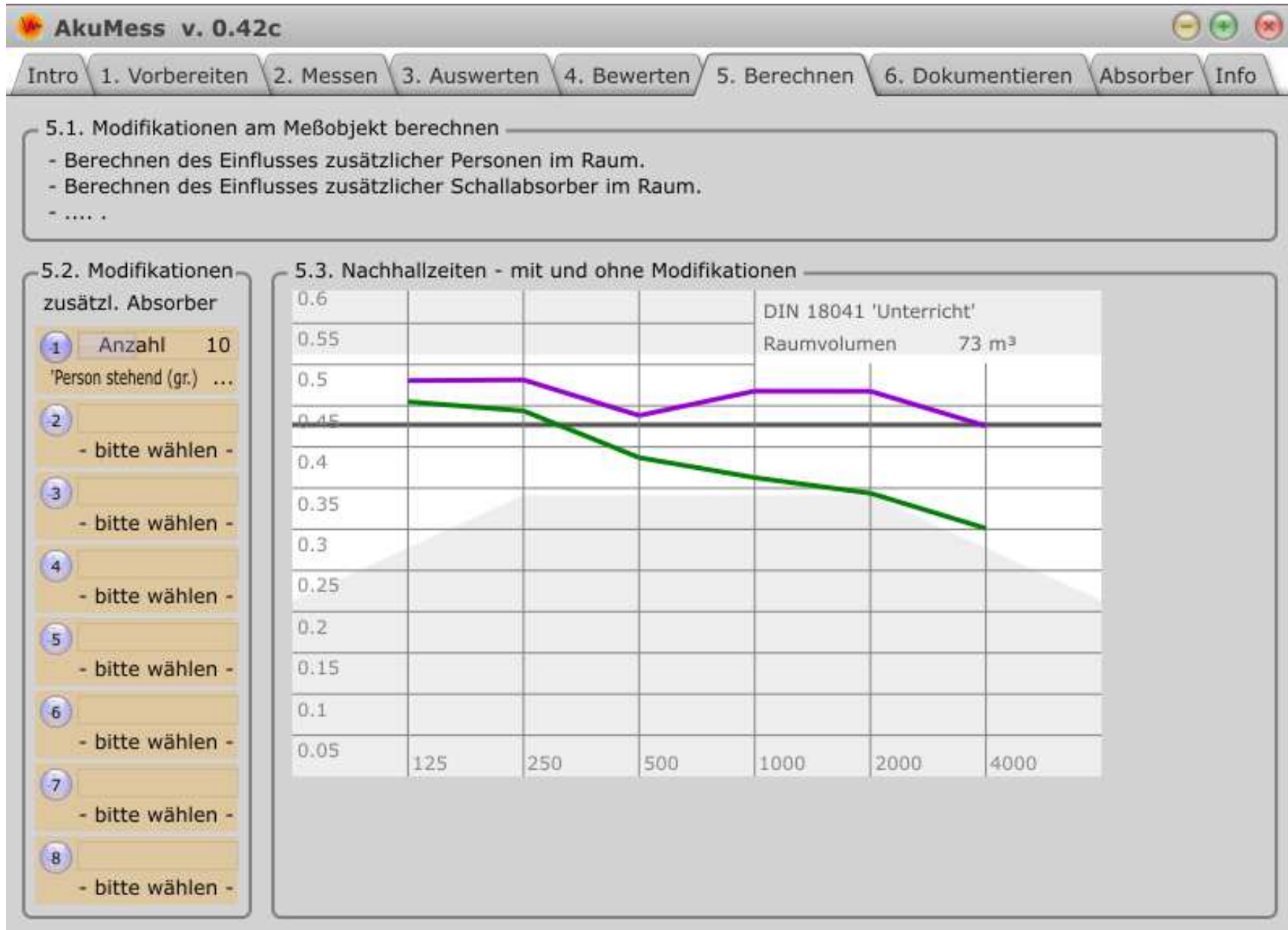
Software User Interface

4 averaging and comparison page :



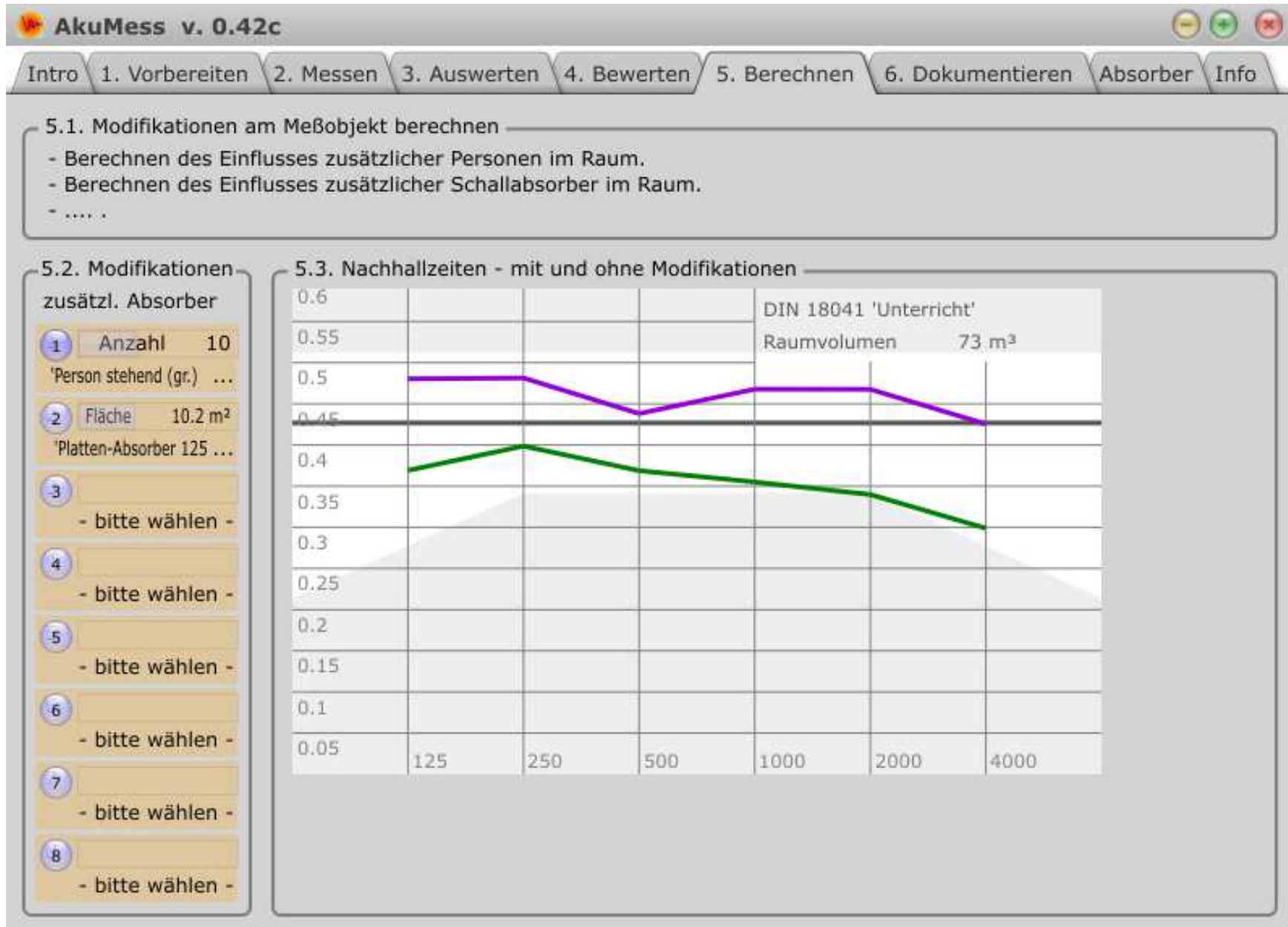
Software User Interface

5 calculation page : additional Persons



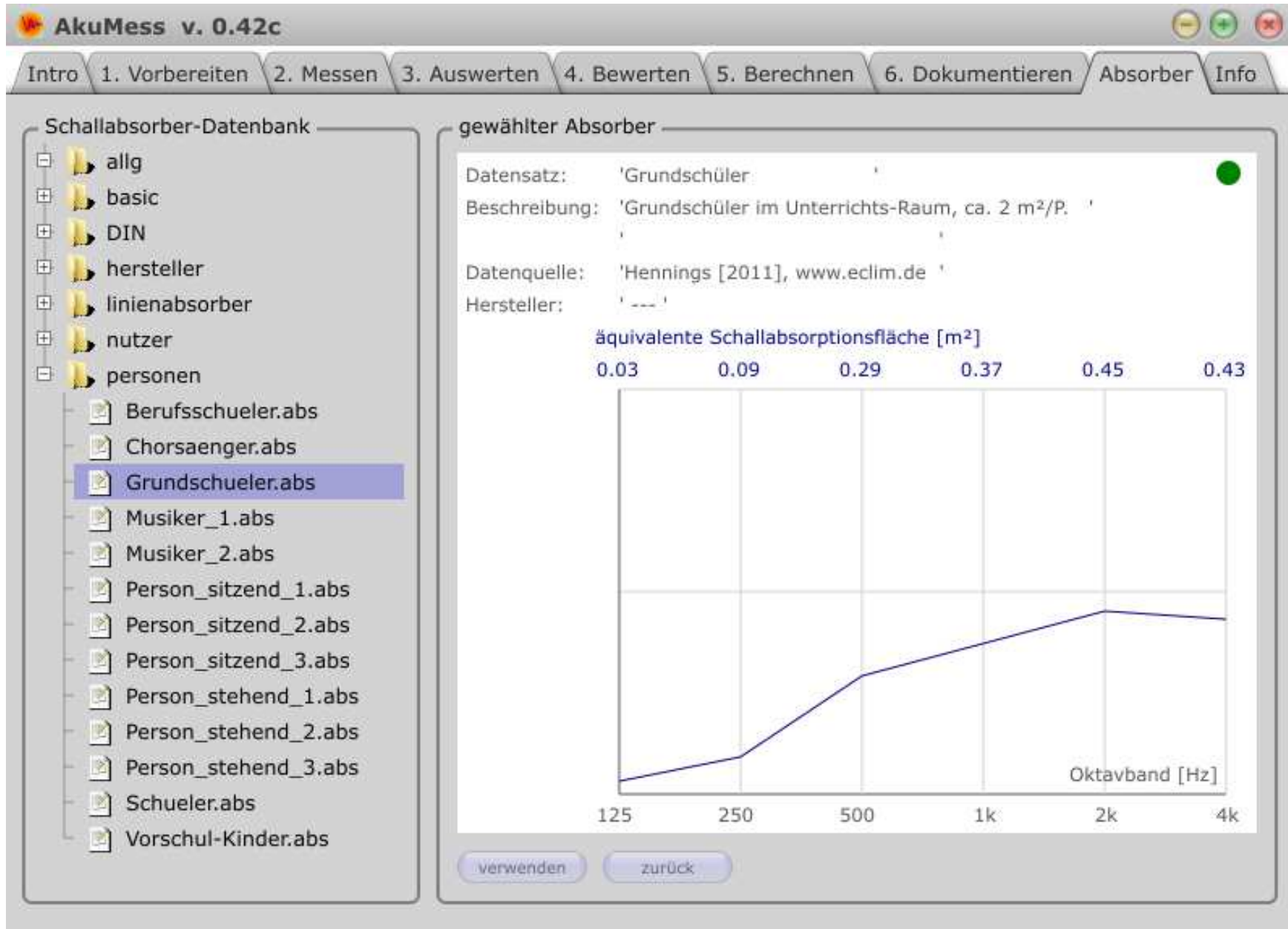
Software User Interface

5 calculation page : additional Persons and Absorbers



Software User Interface

7 data base page :



Release and future plans

The release of the new software is scheduled for Summer 2014 and it will be free for non-commercial use.

Those who wish to be informed about the release and the further development may contact the authors:

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Future plans include

- an 'internationalization' of the software (exchangeable user interface language)**
- an extension to other software platforms (MAC-OS, iOS, Android)**

Thank you !