TÜBİTAK

Yeni Akustik Ölçüm Teknolojileri

Akustik Paydaşlar Toplantısı

Enver SADIKOĞLU
Ulusal Metroloji Enstitüsü

23 Ocak 2013
TÜBİTAK UME, Gebze

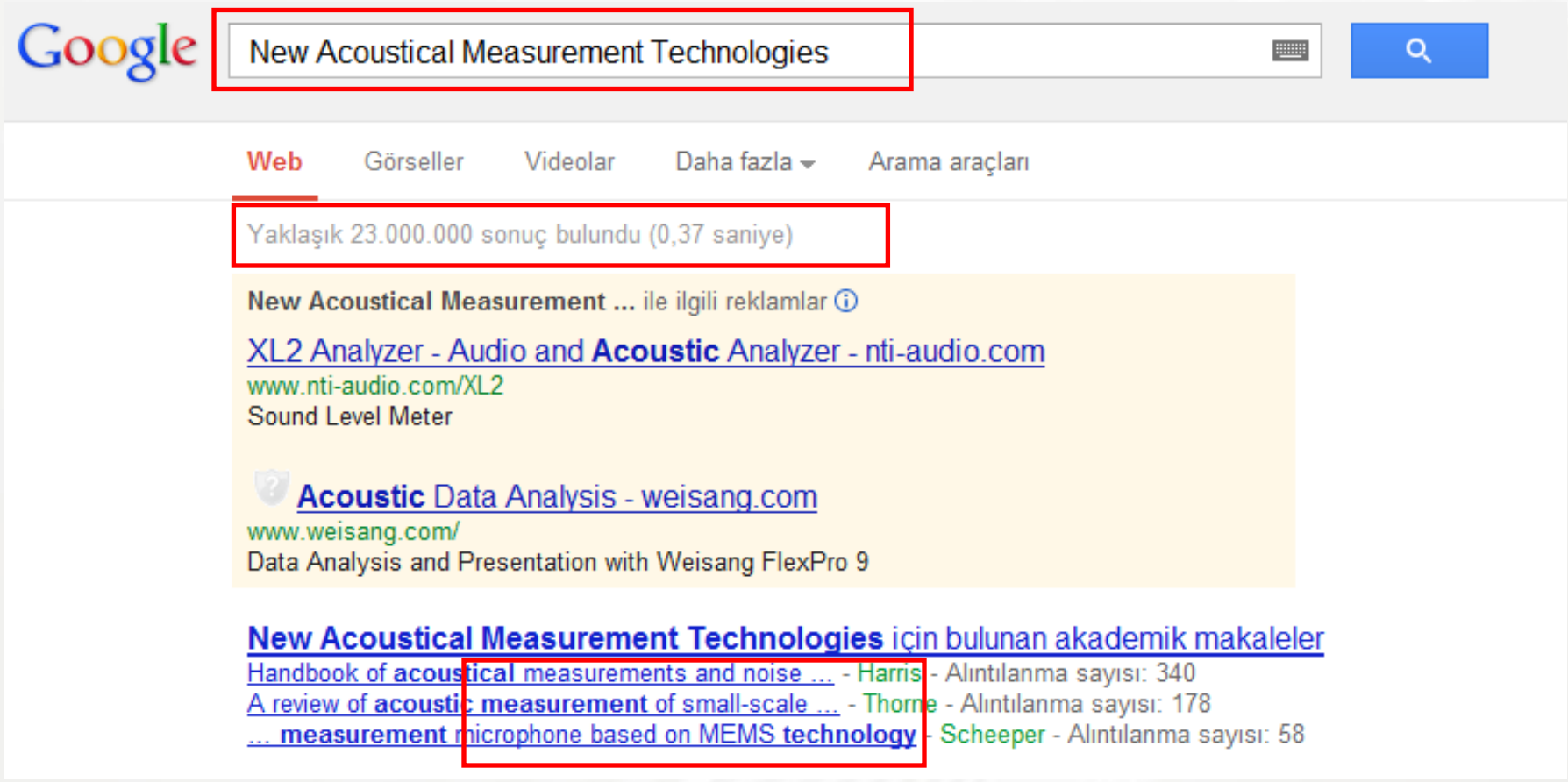
İçerik

- Yeni Teknolojiler Taraması
- Optik Yöntemlerle Akustik Ölçümler
- Gürültü Haritalama Araçları
- Ses Gücü Birimi Standardı

Yeni Teknolojiler Taraması

0,35 saniyede 118000 sonuç.

Yeni Teknolojiler Taraması



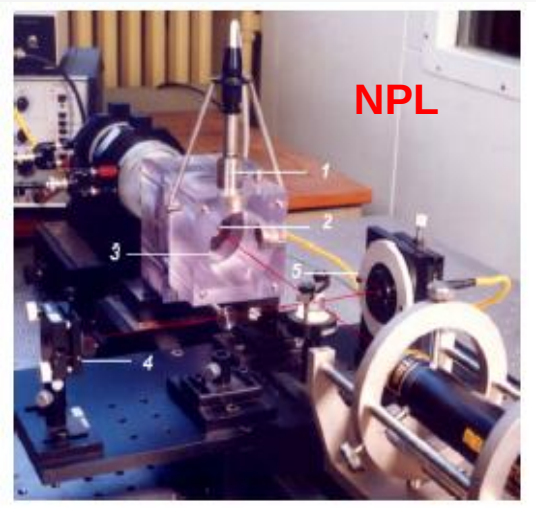
0,37 saniyede 23 000 000 sonuç.

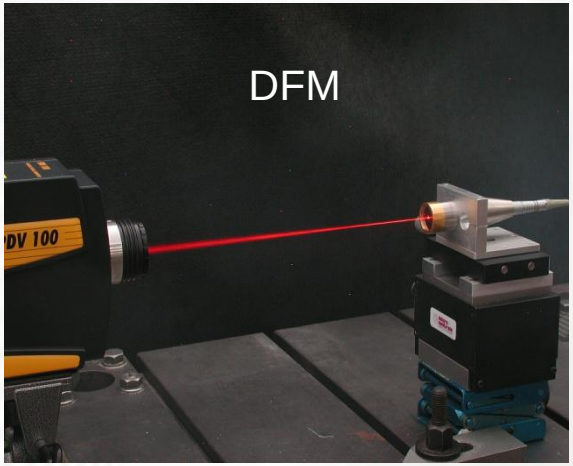
TÜBİTAK

Ön Plana Çıkan Konular

- Optik Ölçüm Yöntemleri
- MEMS Tabanlı Mikrofonlar
- Sinyal İşleme Yöntemleri ve Yazılımlar
- Ölçüm Birimi Standartları İçin Yeni Girişimler

Optik Yöntemlerle Akustik Ölçümleri





Görseller, NPL(İngiltere) ve DFM (Danimarka)'den temin edilmiştir.

Optik Yöntemlerle Akustik Ölçümleri

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A laser pistonphone based on self-mixing interferometry for the absolute calibration of measurement microphones

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Available online 20 May 2004

Abstract

A laser pistonphone for the absolute calibration of microphones at low frequencies has been developed at UME. The motion of an electro-dynamically driven piston in a small close cavity produces a sound pressure. Accurate measurement of the piston displacement, by self-mixing interferometry, enables this sound pressure to be calculated, and consequently the pressure sensitivity of a microphone, exposed to this sound pressure, to be determined. Absolute calibrations of type LS1P and WS1P microphones have been carried out with an uncertainty of less than 0.15 dB. The performance of the laser pistonphone has been validated by comparing the measured microphone sensitivities with those obtained by the closed coupler reciprocity method.

Keywords: Laser pistonphone; Absolute microphone calibration; Self-mixing interferometer

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Metrologia 44 (2007) 210–216 — doi:10.1088/0026-1394/44/3/007

The application of the NPL laser pistonphone to the international comparison of measurement microphones

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Abstract

NPL has chosen to use the laser pistonphone as the basis for some of its measurements for international key comparison CCAUV.A-K2. The other laboratories taking part in the key comparison have all used the reciprocity technique for their low-frequency measurements, thus the use of a laser pistonphone allows the verification (or otherwise) of this technique at low frequencies. Since the use of this device for the calibration of microphones is not currently included in international standards, this paper describes this calibration method and gives a full account of the associated measurement uncertainty. While the NPL laser pistonphone has existed since the 1970s, its true value to the international community is only now being revealed.

This paper also provides the necessary background information to support the key comparison data when they are eventually published.

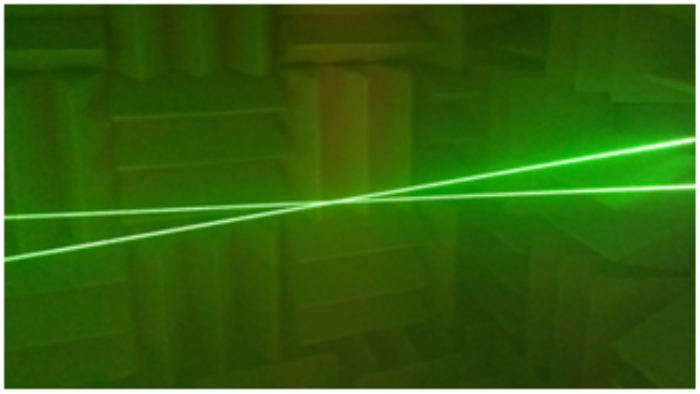
(Some figures in this article are in colour only in the electronic version)

TÜBİTAK

A new generation of acoustic measurements

NPL scientists have made the first measurements of airborne acoustic free-field pressures using a laser technique based on photon correlation spectroscopy.

This optical measurement technique directly measures particle velocities and realises the acoustic pascal - the SI derived unit of pressure - and could potentially be used to calibrate microphones. It is being developed as part of a wider initiative to base future primary acoustic standards on optical methods.

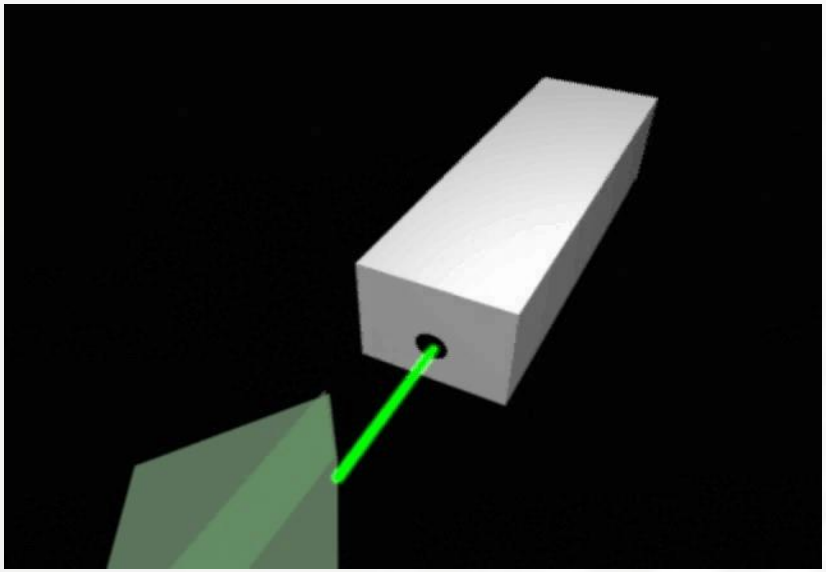


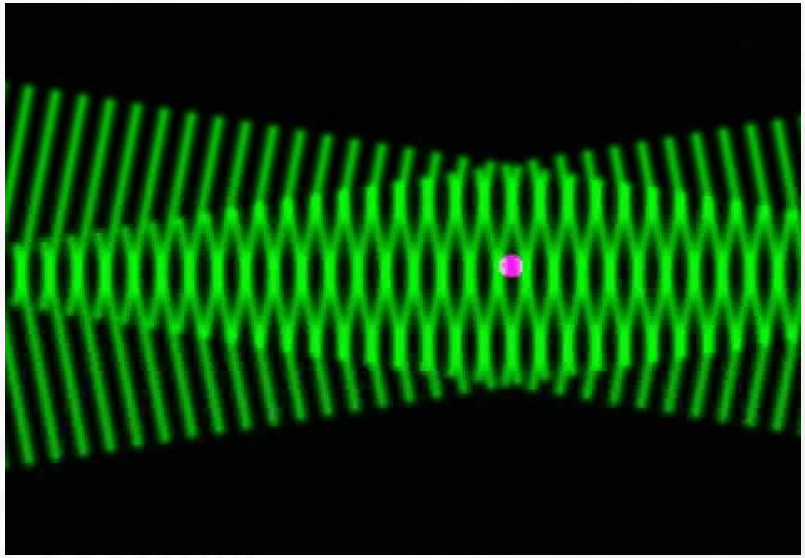
The new technique uses two laser beams that intersect at a point, producing an interference fringe pattern

The new technique uses two lasers that are set up so that their beams intersect at a point in space and produce an interference fringe pattern. When sound is produced by a source (such as a loudspeaker), the intensity of light scattered by particles in the air as they pass through the fringe pattern changes. This intensity change can be detected, and the acoustic free-field pressure calculated.

Kaynak: www.npl.co.uk

Optik Yöntemlerle Akustik Ölçümleri





- Girişim saçakları bölgesinden saçılan lazer ışınının frekansı **parçacık hızı** bilgisi içermektedir.
- Parçacık hızının hesaplanması için **foton korelasyonu** yöntemi kullanılmaktadır.

Görseller, NPL(İngiltere)'den temin edilmiştir.

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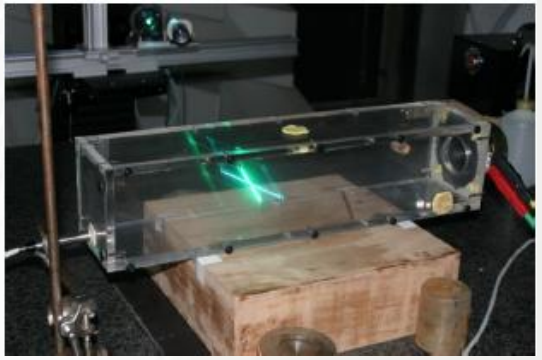
İlk Sonuçlar Umut Verici...

Function generator (V)	Particle velocity (mm s^{-1})	Pressure (Pa)	Pressure (dB re:20 µPa)
0.05	3.9	1.1	94.8
0.08	6.1	1.8	99.1
0.10	7.9	2.2	100.8
0.12	9.1	2.6	102.3
0.14	10.7	3.0	103.5
0.16	12.3	3.2	104.1
0.18	13.6	3.7	105.3
0.20	15.4	4.1	106.2

LDA Sonuçları



Function generator (V)	Pressure (Pa)	Pressure (dB re:20 µPa)
0.05	1.1	94.8
0.08	1.7	98.6
0.10	2.1	100.4
0.12	2.5	101.9
0.14	2.9	103.2
0.16	3.3	104.3
0.18	3.7	105.3
0.20	4.1	106.2

Kalibrasyonlu Kapasitif Mikrofonla Elde Edilen Sonuçlar

Ölçüm sonuçları, NPL(İngiltere)'den temin edilmiştir.

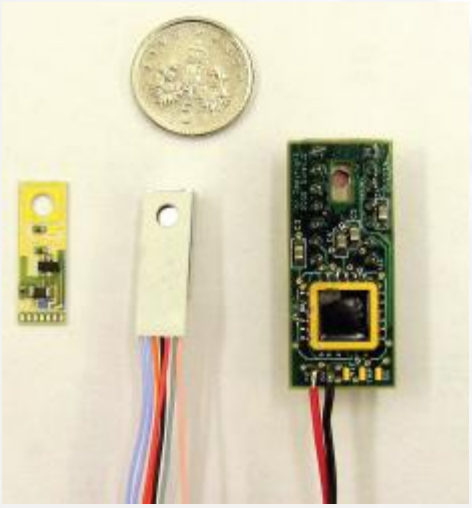
MEMS Tabanlı Mikrofonlar

Mikro Elektromekanik Sistemler (MEMS)

- Kompakt, küçük boyutlarda
- Ucuz
- Çok değişik çevre şartlarında kullanım imkanları
- Kablosuz haberleşme imkanı

Yaygın kullanım alanı: cep telefonları

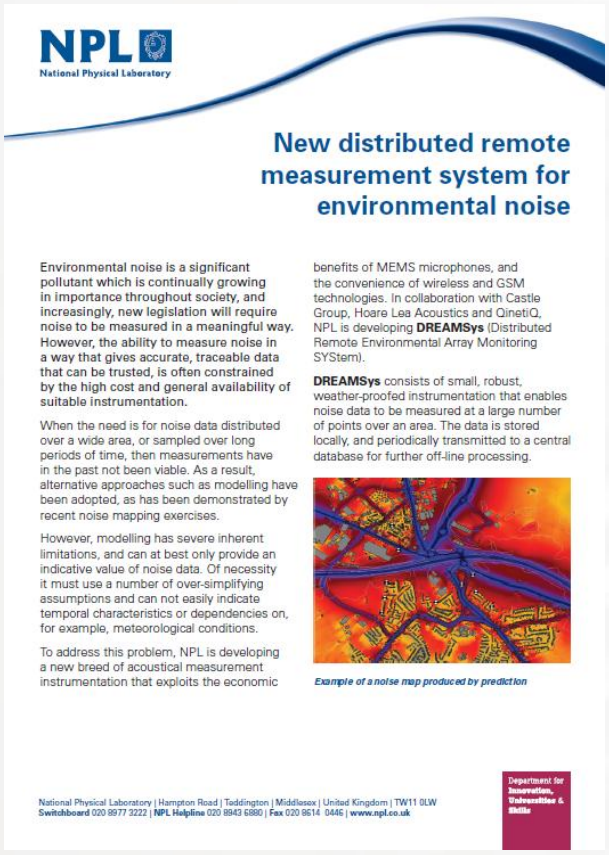
MEMS Tabanlı Mikrofonlar



- Hassasiyet: 50 mV/Pa
- Frekans Bölgesi: 100 Hz – 20 kHz
- Beslenme: 3 V (saat pili)

Görseller, NPL(İngiltere)'den temin edilmiştir.

MEMS Tabanlı Mikrofonlarla Haritalama



NPL
National Physical Laboratory

New distributed remote measurement system for environmental noise

Environmental noise is a significant pollutant which is continually growing in importance throughout society, and increasingly, new legislation will require noise to be measured in a meaningful way. However, the ability to measure noise in a way that gives accurate, traceable data that can be trusted, is often constrained by the high cost and general availability of suitable instrumentation.

When the need is for noise data distributed over a wide area, or sampled over long periods of time, then measurements have in the past not been viable. As a result, alternative approaches such as modelling have been adopted, as has been demonstrated by recent noise mapping exercises.

However, modelling has severe inherent limitations, and can at best only provide an indicative value of noise data. Of necessity it must use a number of over-simplifying assumptions and can not easily indicate temporal characteristics or dependencies on, for example, meteorological conditions.

To address this problem, NPL is developing a new breed of acoustical measurement instrumentation that exploits the economic benefits of MEMS microphones, and the convenience of wireless and GSM technologies. In collaboration with Castle Group, Hoare Lea Acoustics and QinetiQ, NPL is developing **DREAMSys** (Distributed Remote Environmental Array Monitoring SYStem).

DREAMSys consists of small, robust, weather-proofed instrumentation that enables noise data to be measured at a large number of points over an area. The data is stored locally, and periodically transmitted to a central database for further off-line processing.

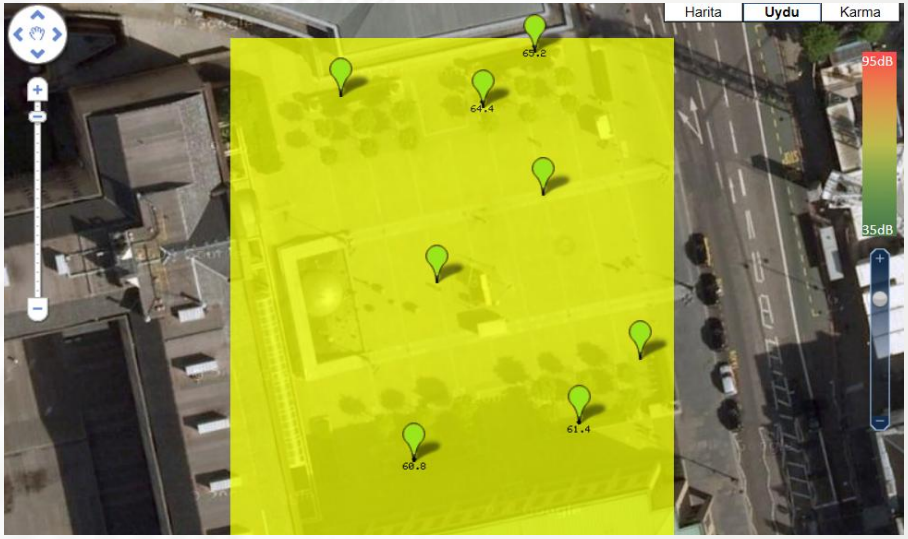
Example of a noise map produced by prediction

National Physical Laboratory | Hampton Road | Teddington | Middlesex | United Kingdom | TW11 0LW
Switchboard 020 8977 3222 | NPL Helpline 020 8943 6880 | Fax 020 8614 0446 | www.npl.co.uk

Department for Innovation, Universities & Skills

DREAMSys

- Geniş bölgeye çok sayıda mikrofon yerleştiriliyor
- Ölçüm verileri lokal olarak kayd ediliyor
- Periyodik olarak merkezi veri tabanına aktarılıyor



Görseller, NPL(İngiltere)'den temin edilmiştir.

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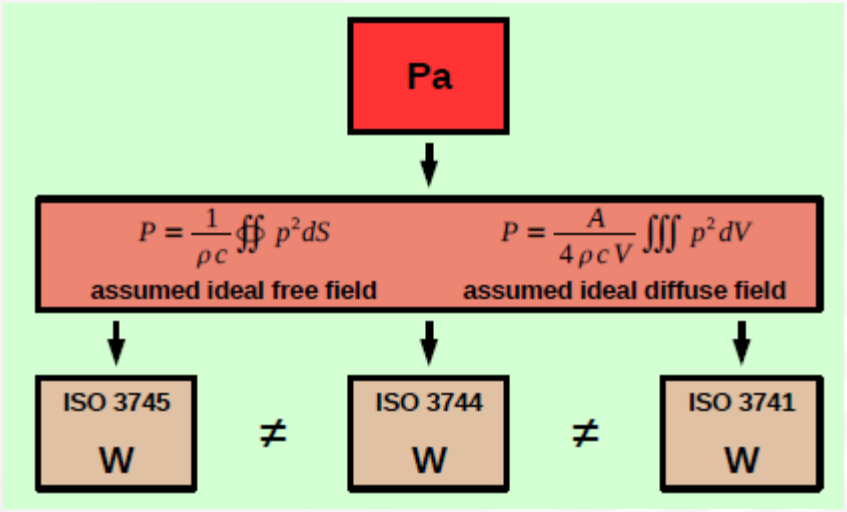
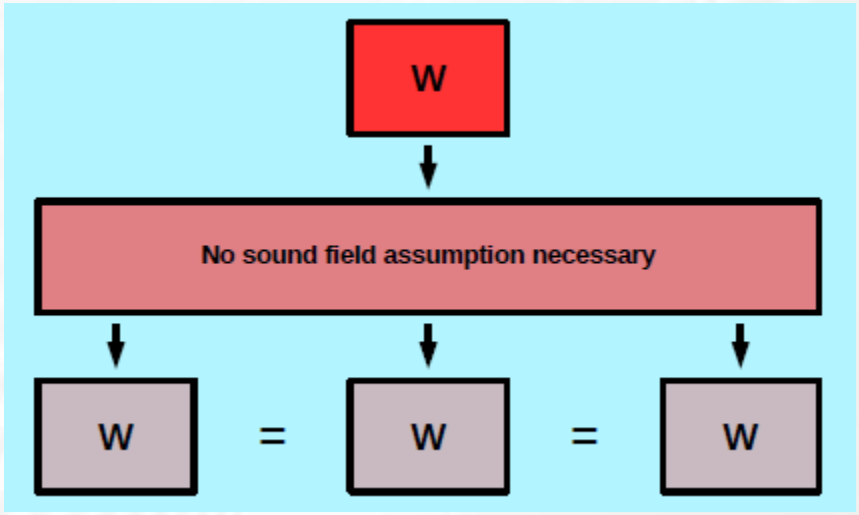
Ses Gücü Birimi Standardının Oluşturulması



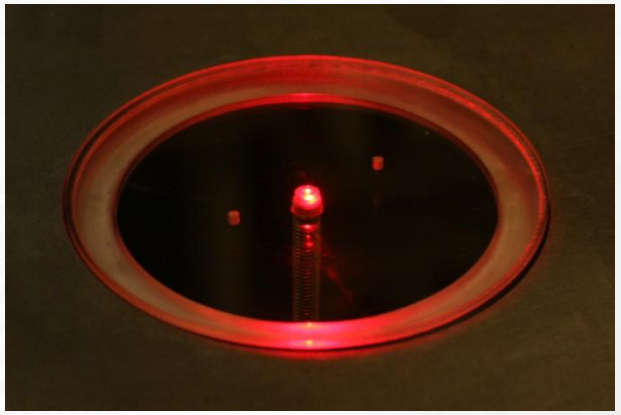


- Ses Gücü Ses Basıncı Değeri Kullanılarak Belirleniyor
- Hesaplamalarda ideal koşullar varsayımları mevcut

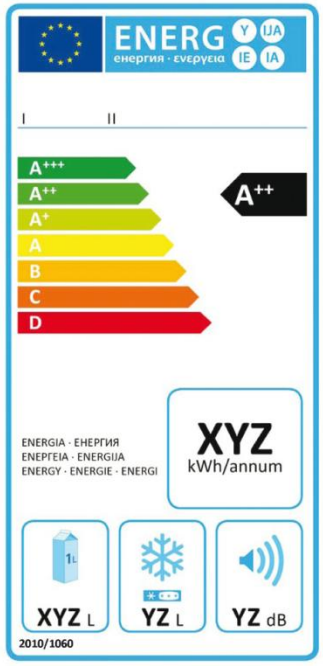
Elde edilen sonuçlar bazen karşılaştırılamıyor.

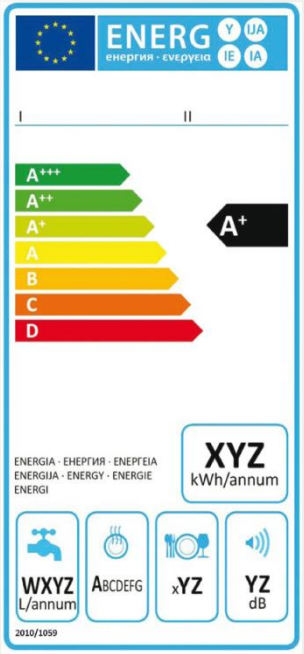
Ses Gücü Birimi Standardının Oluşturulması

- Havada ses için Watt biriminin oluşturulması, dağıtılması ve uygulamaları (Realization, dissemination and application of the unit watt in airborne sound), AB 7.Çerçeve Programı Kapsamında Proje (2013 – 2016)



- Titreşen Piston Tabanlı Birincil Ses Gücü Standardının Oluşturulması
- Titreşim değerinin lazer vibrometresi ile ölçülmesi
- Ses gücünün piston hızı değeri kullanılarak belirlenmesi
- Birincil standart değerinin alt seviyelere aktarılması





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Teşekkürler...