

Die Basics der Elektroakustik

Kann man „Akustik“ wirklich ausrechnen ?

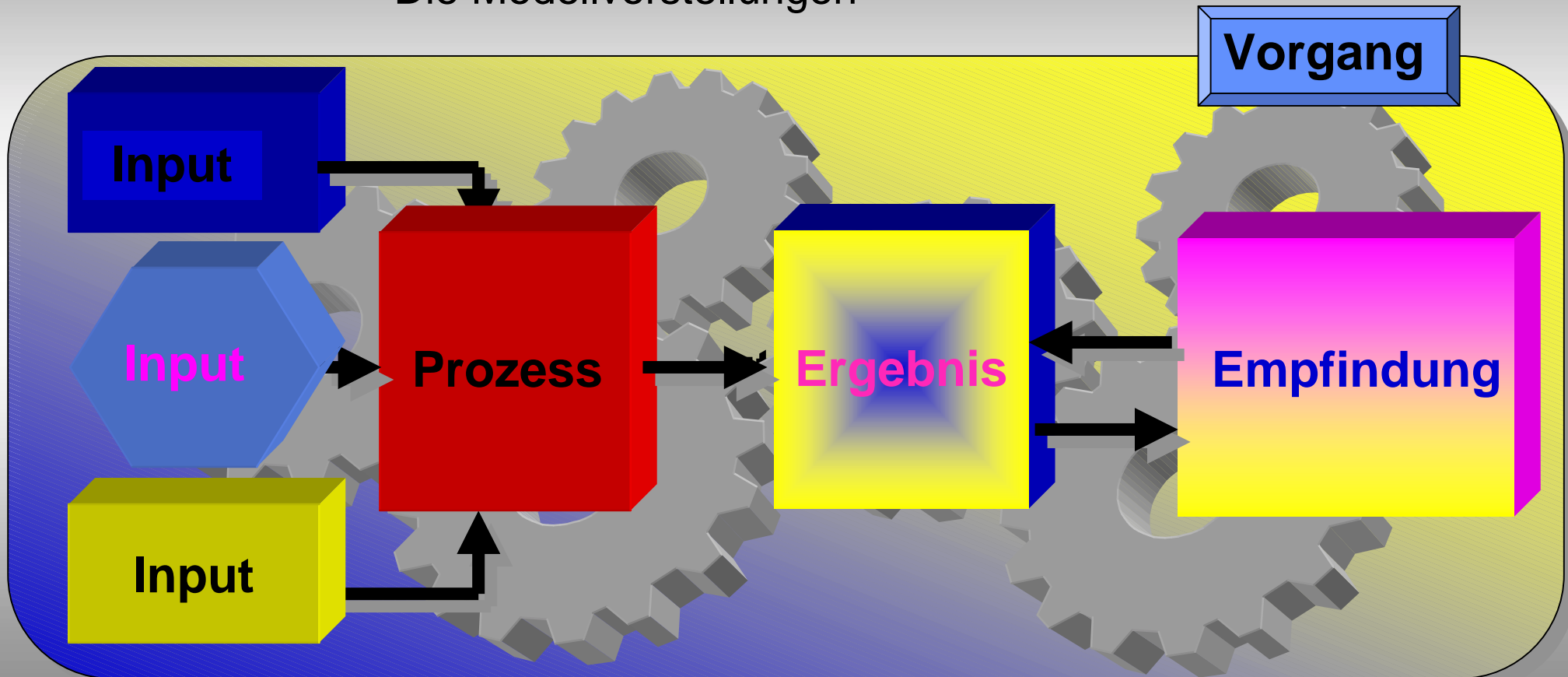
Wie beeinflusst die Akustik eines Raumes den Klang der Lautsprecher?

Referent: Volker Löwer, IFBconsulting



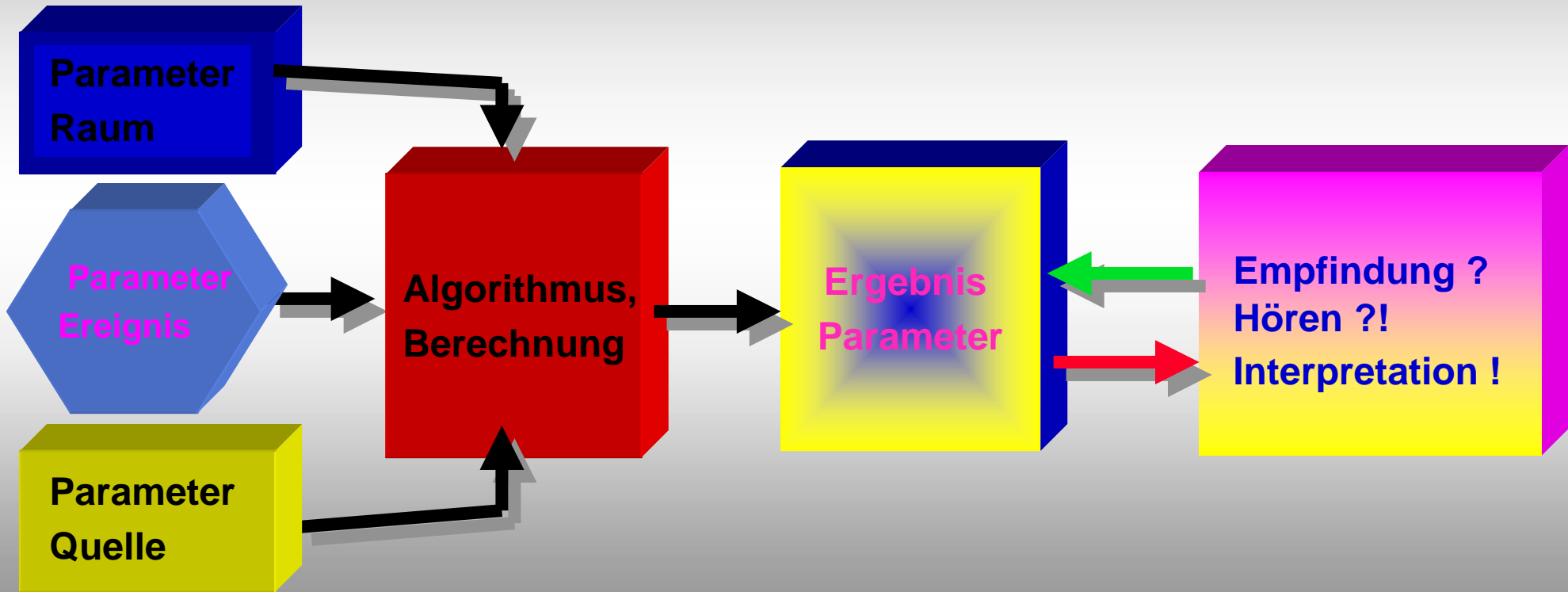
Vorbemerkungen

- Die Vorgänge der Natur
- Das subjektive Empfinden
- Die Modellvorstellungen

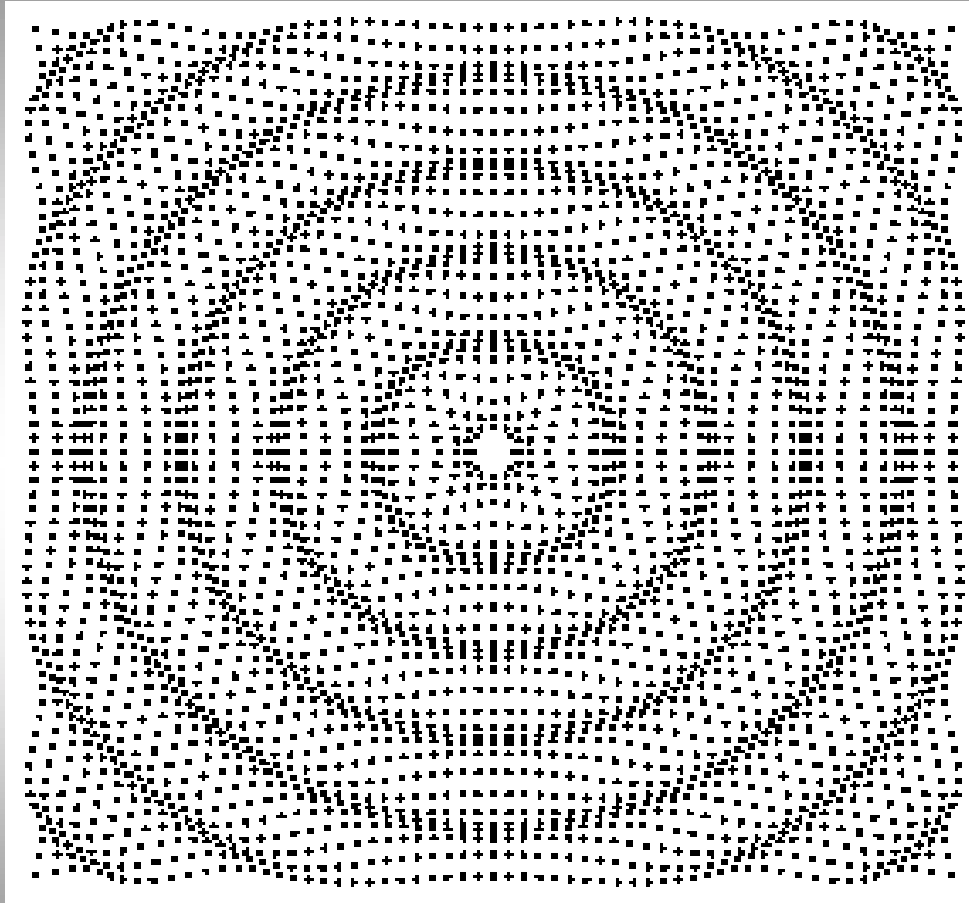


Modelle, Algorithmen

- Die Vorgänge der Natur vereinfachen
- Abhängigkeiten verstehen und erkennen
- Ergebnisparameter berechnen

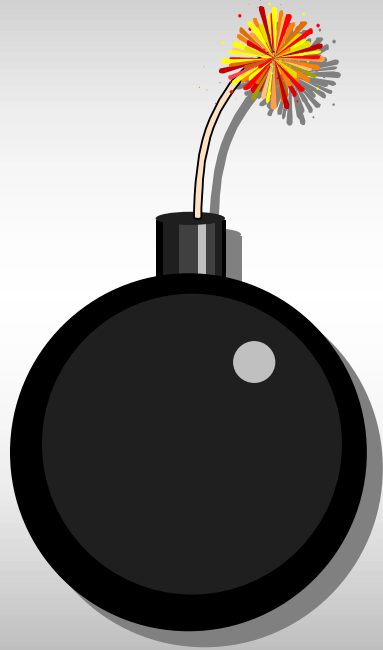


Was ist Schall ?



- Schalldruck, p
- Schallschnelle, v
- Schallgeschwindigkeit, c

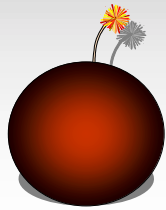
Abstandsgesetz



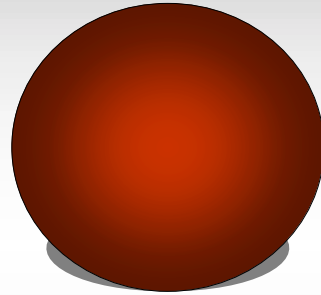
**Impuls-Schallquelle,
omnidirektional ...**

$t = 0$ ms

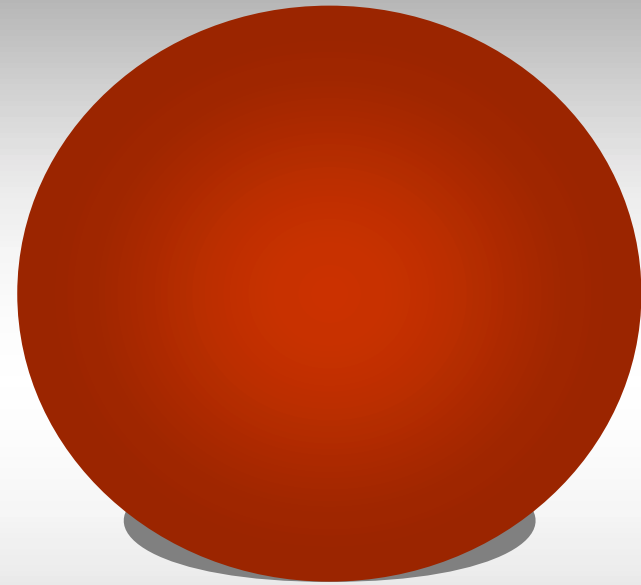
Abstandsgesetz



Ld = 0 dB
R = 1m

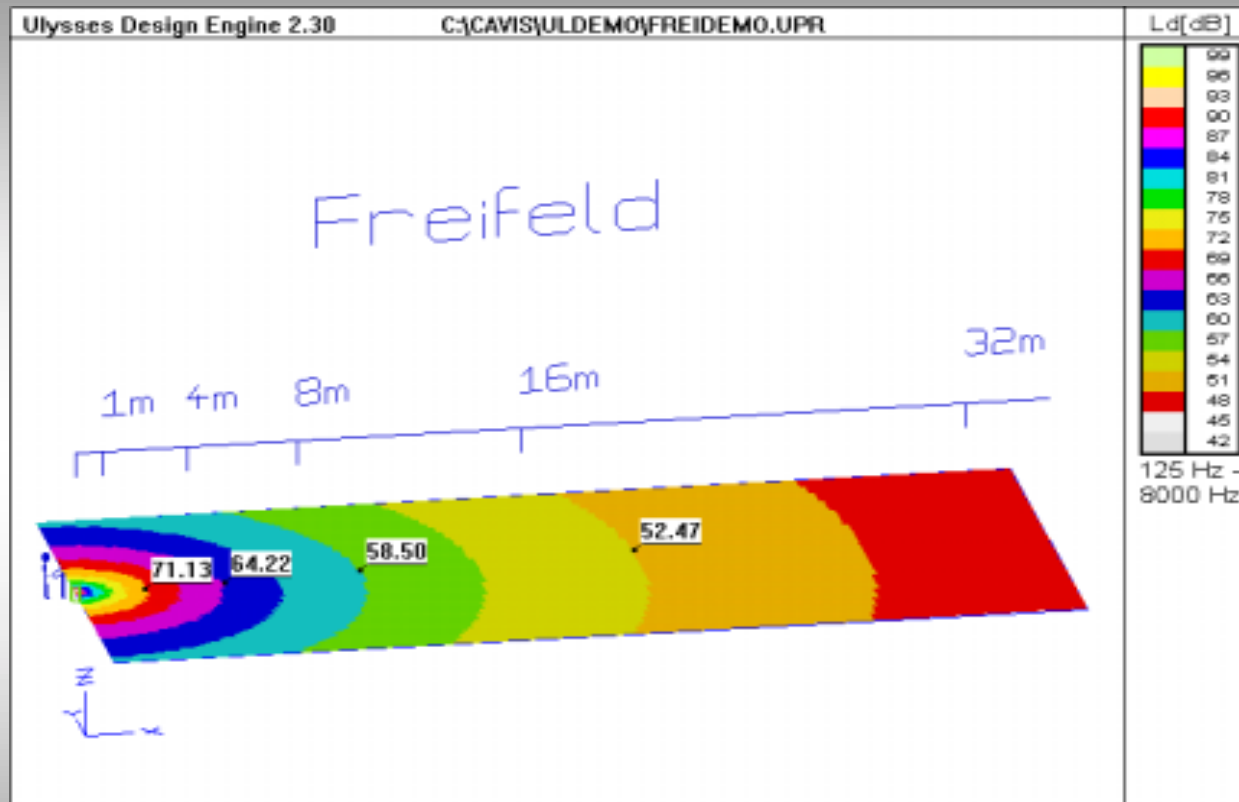


Ld = -6dB
R = 2m

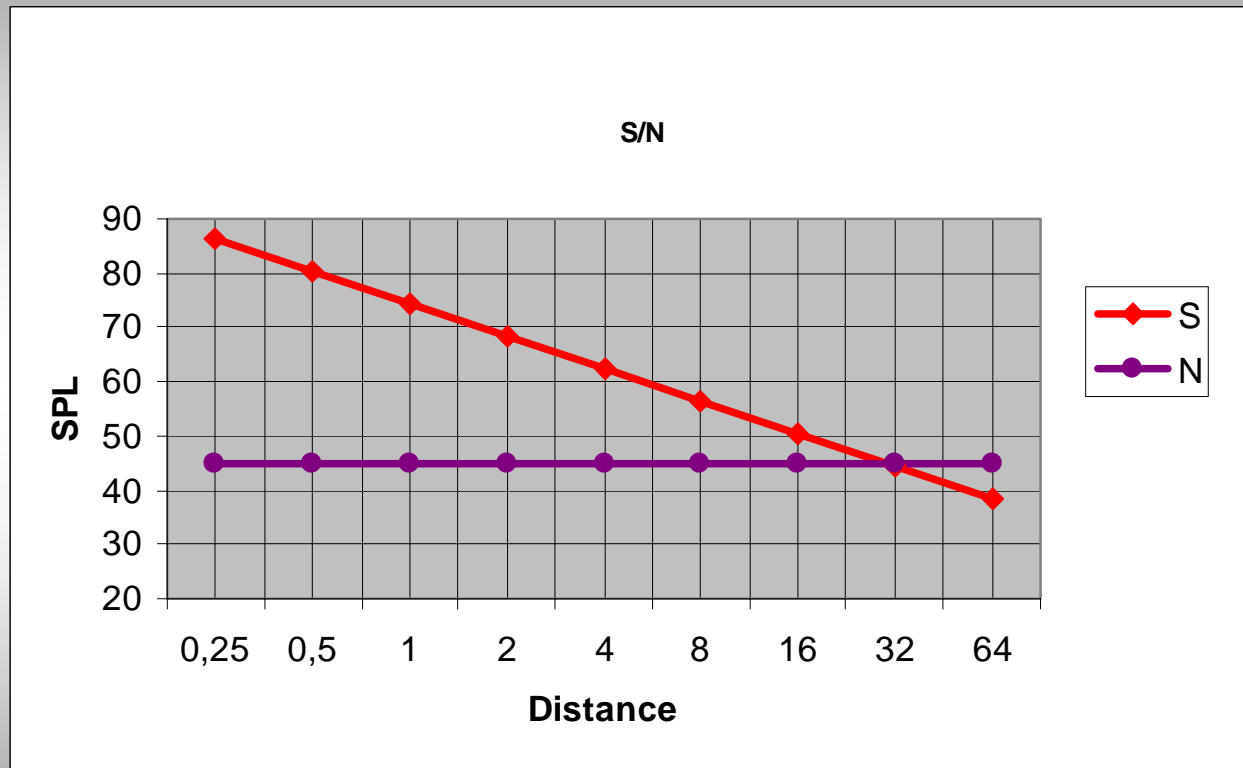


Ld = -12dB
R = 4 m

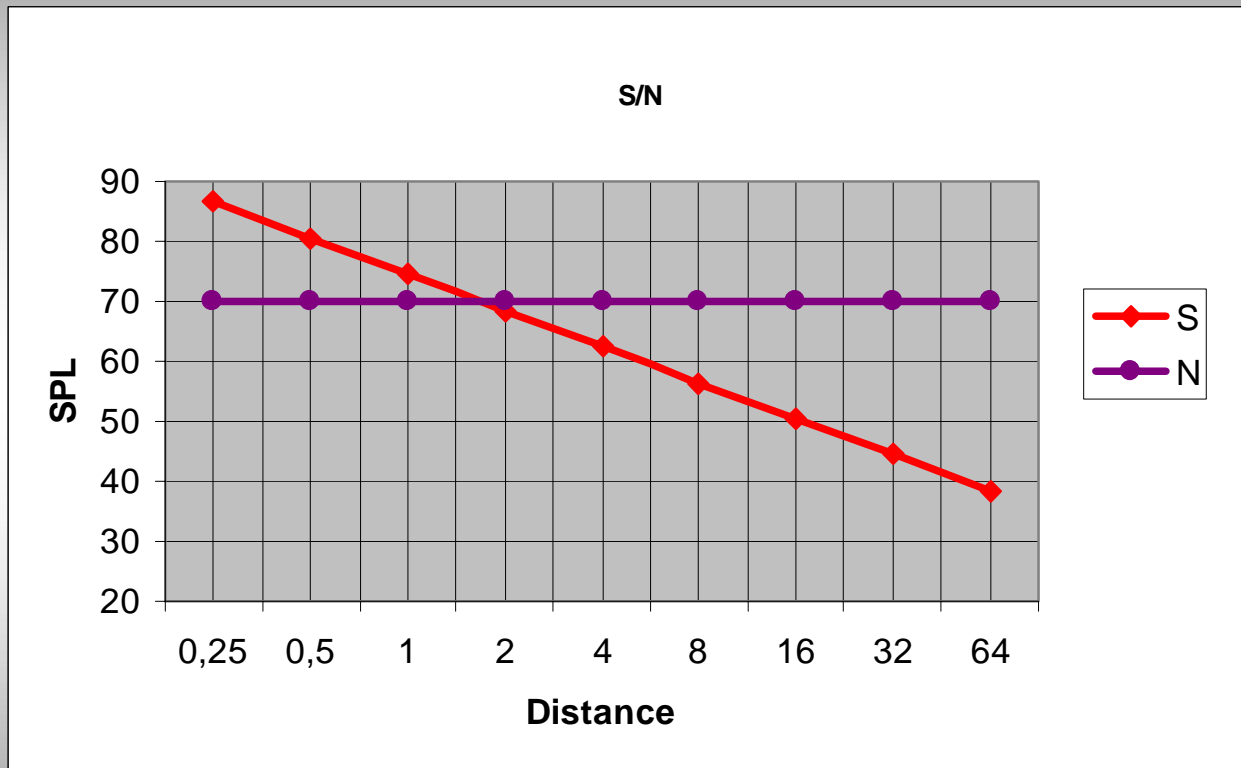
Freifeld



Signal / Noise



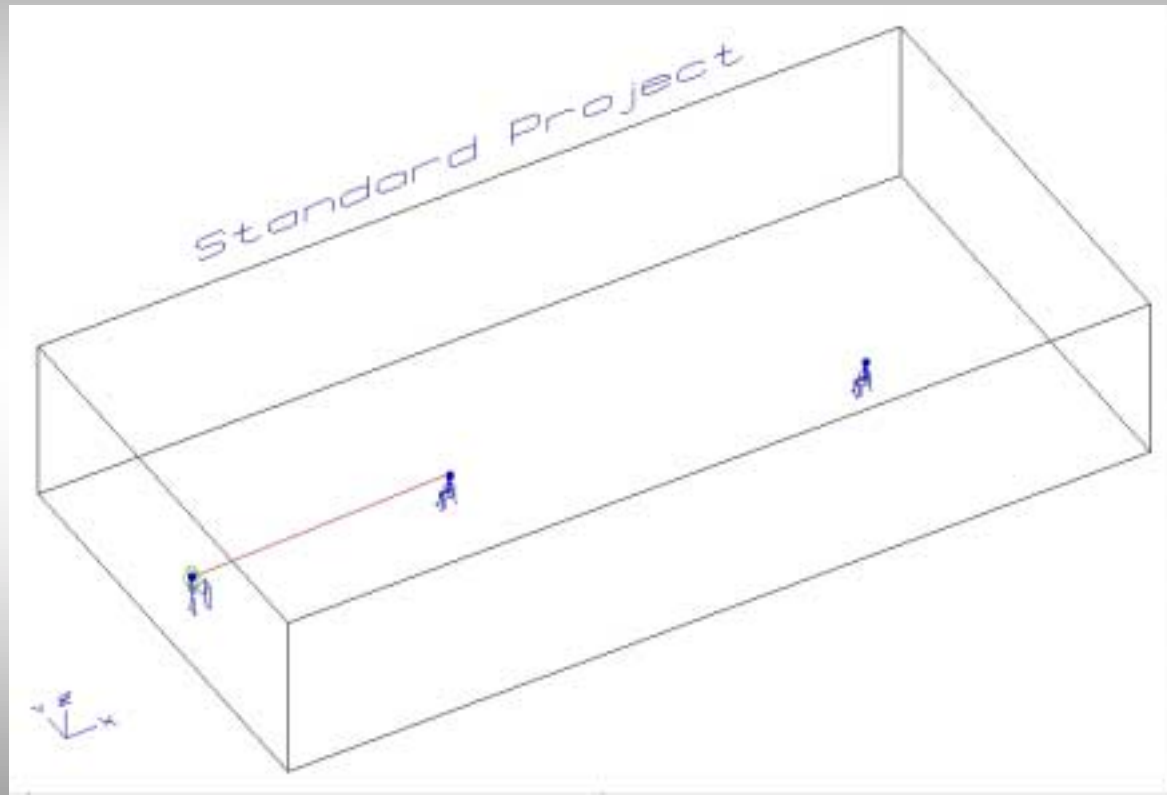
Signal / Noise



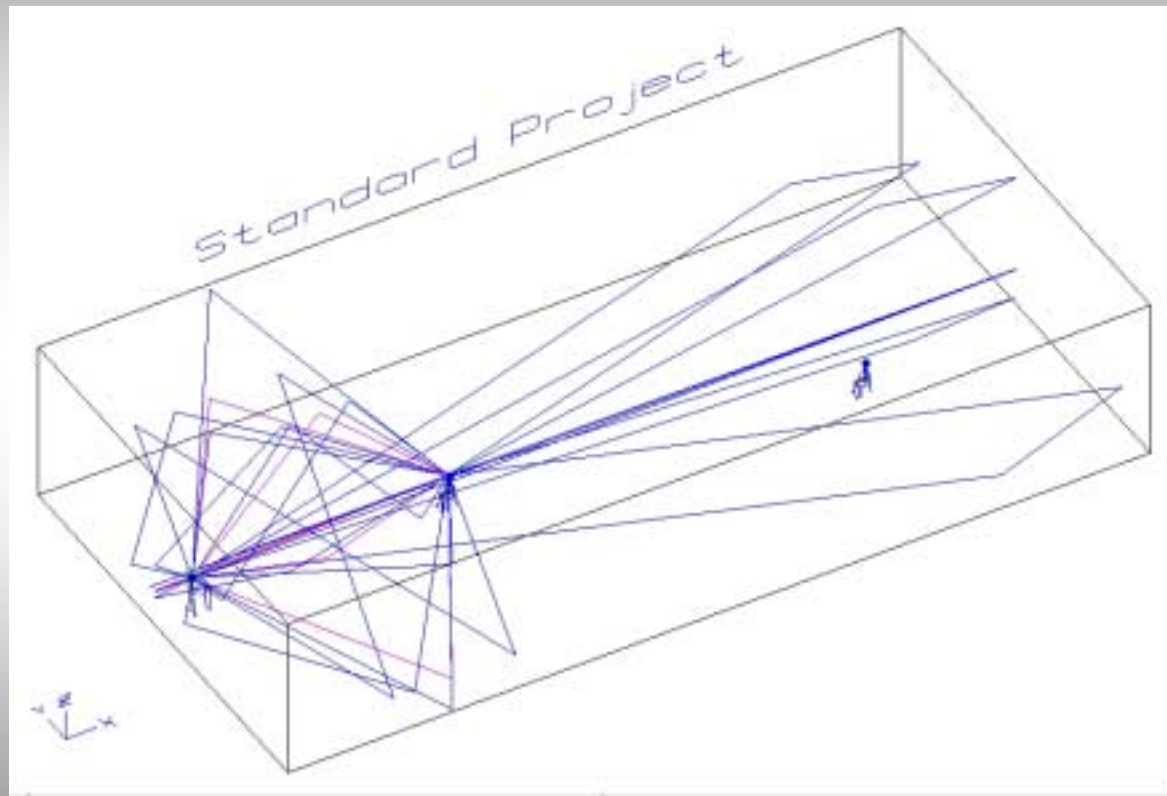
Der Raum



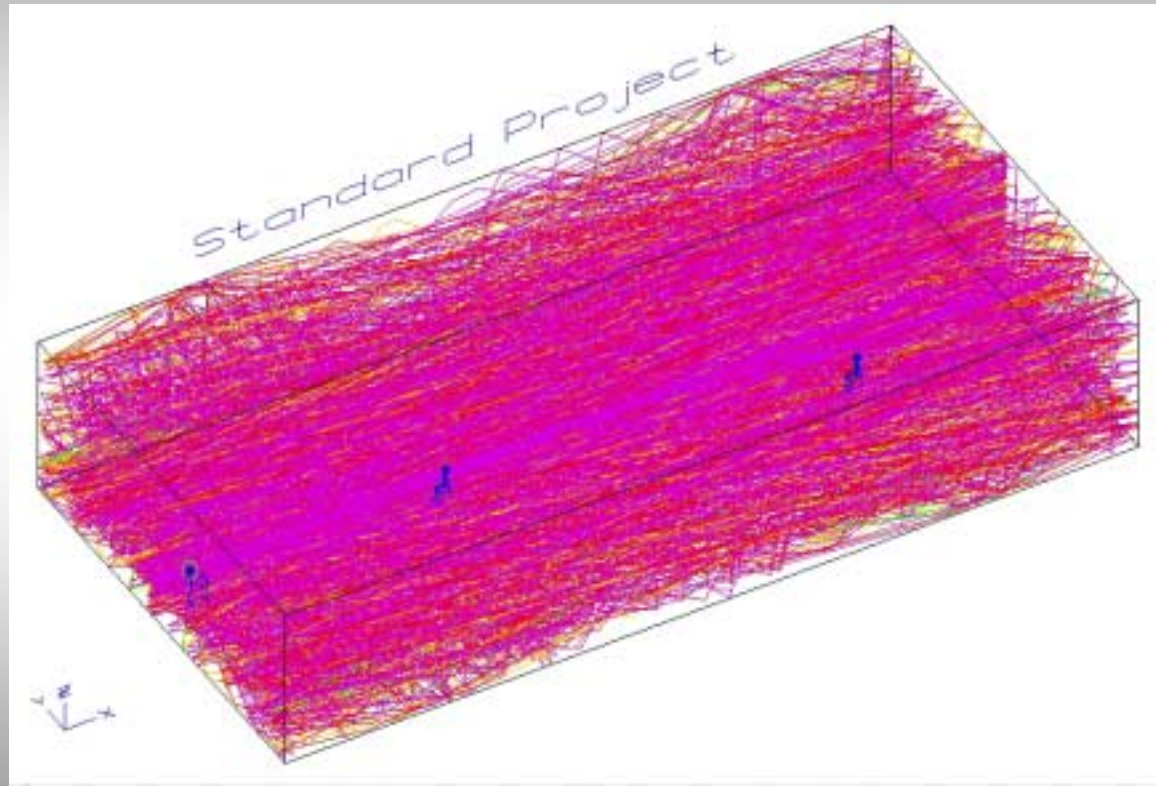
Direktschall Ld



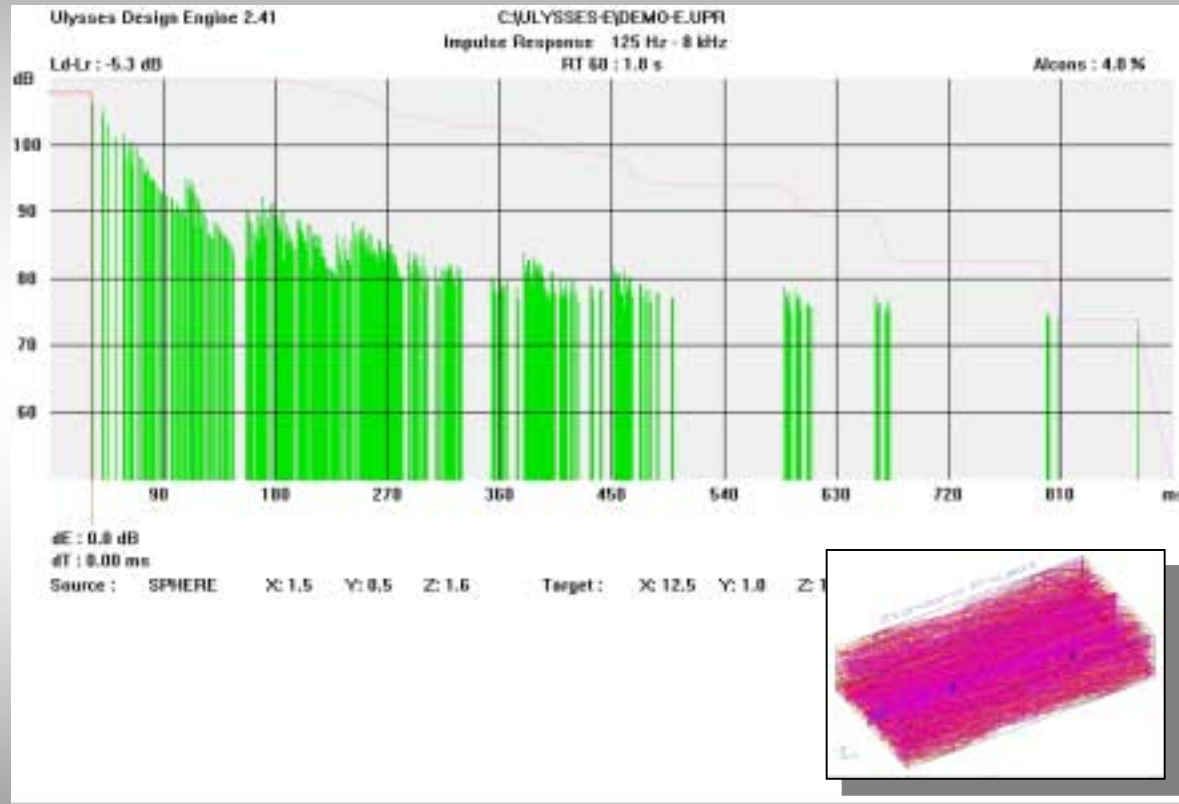
Reflektionen



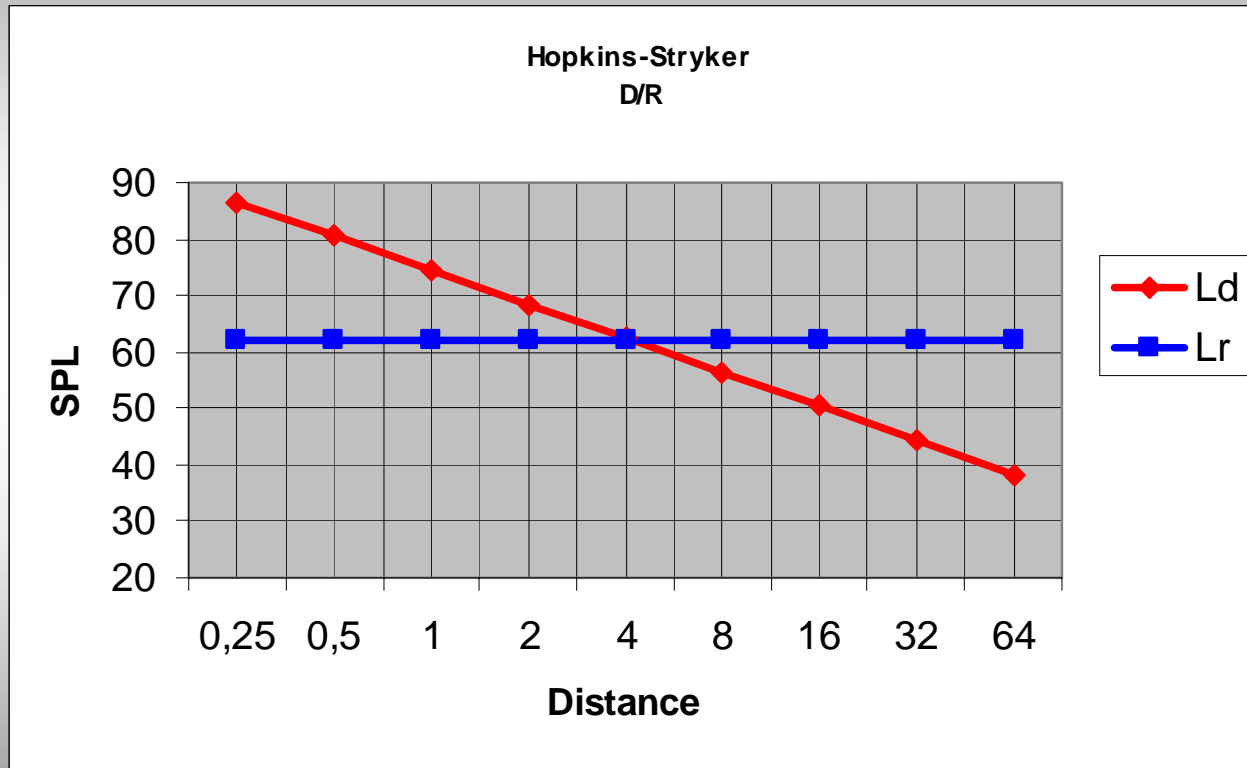
Diffusfeld oder Nachhallfeld, L_r



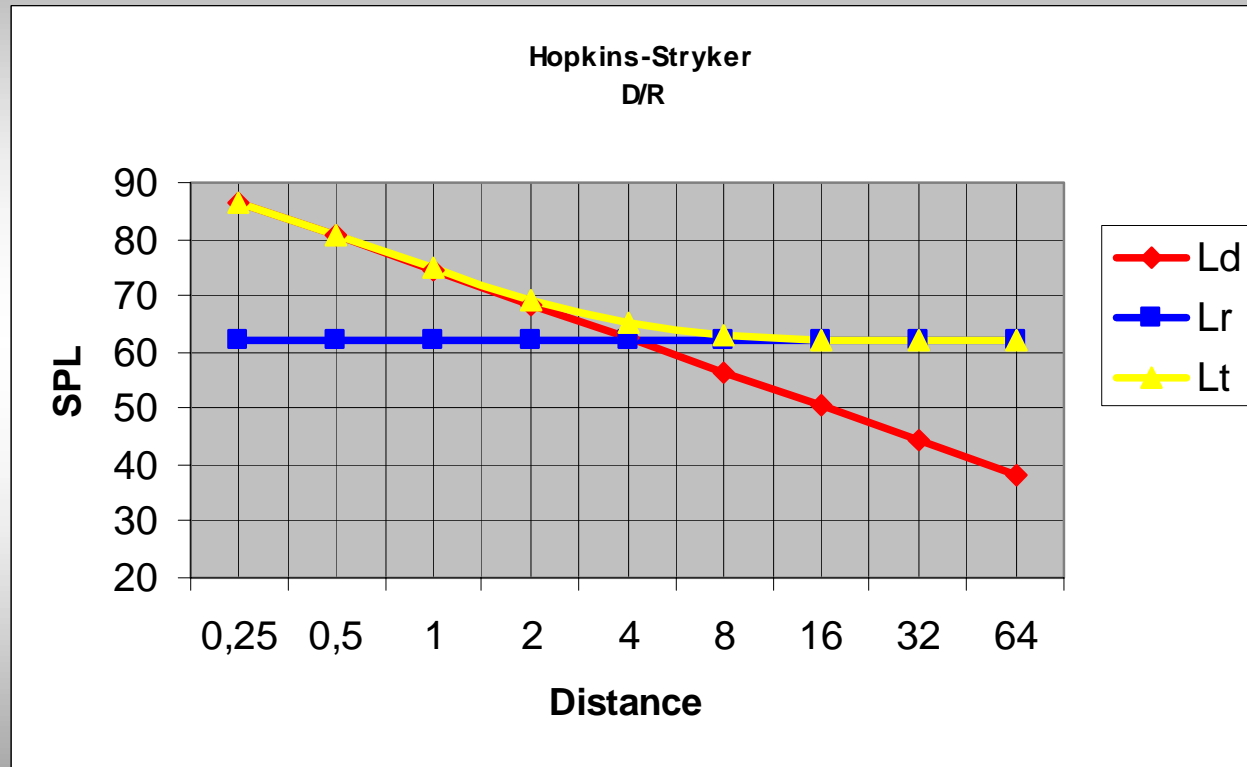
Energie vs. Zeit, Reflektogramm, Nachhall



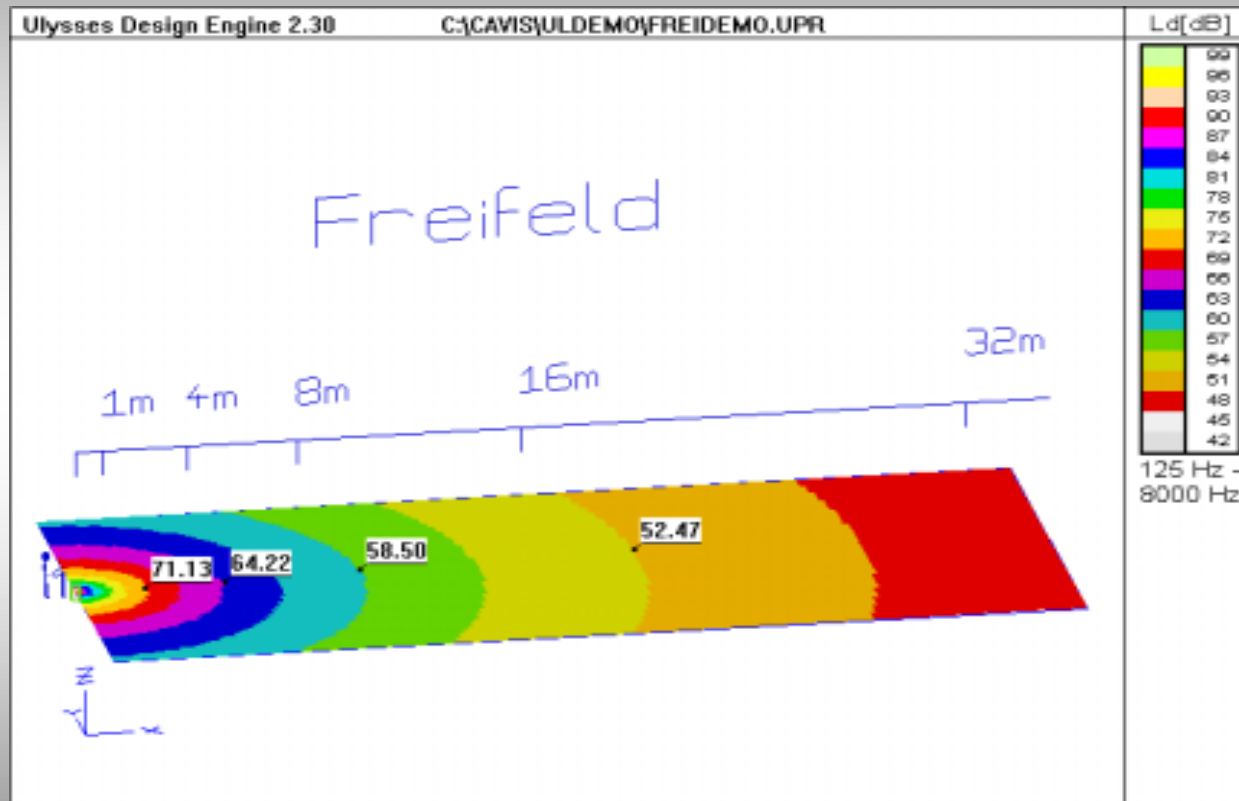
Direktschall und Nachhall, Ld & Lr



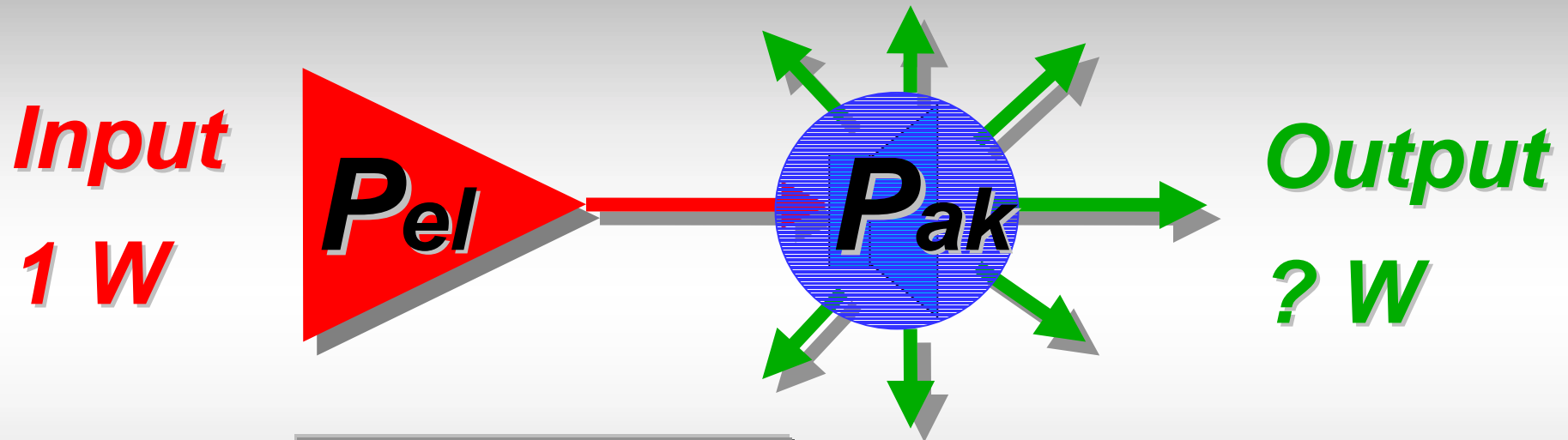
Totales Schallfeld $L_t = L_d + L_r$



Direktschall-Ausbreitung, Speaker Direct Field

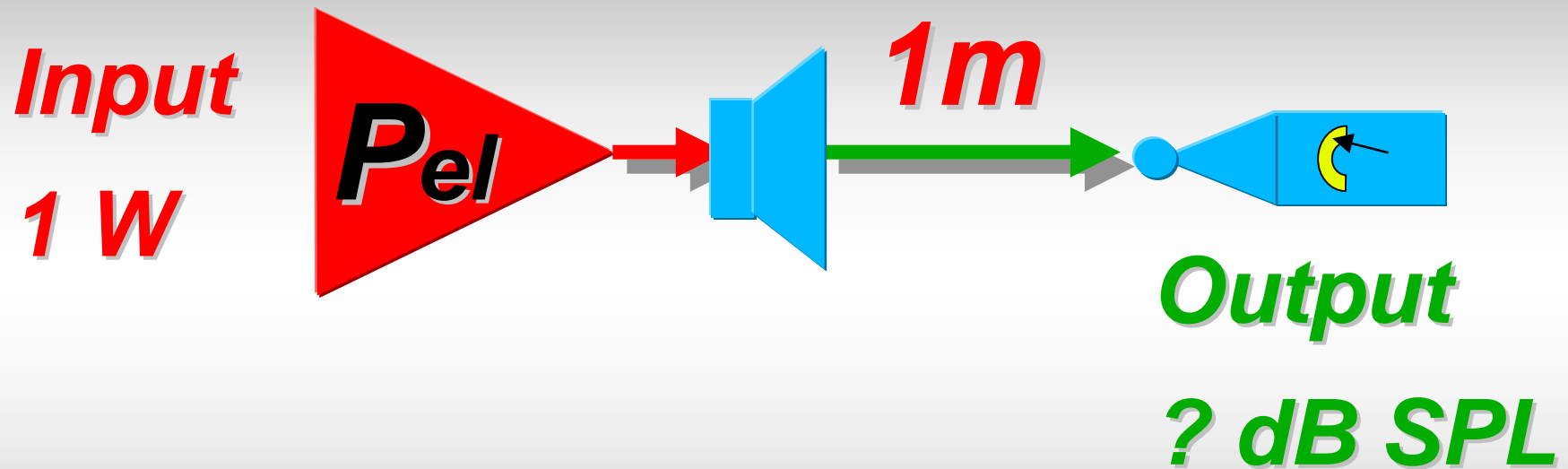


Wirkungsgrad η Efficiency η



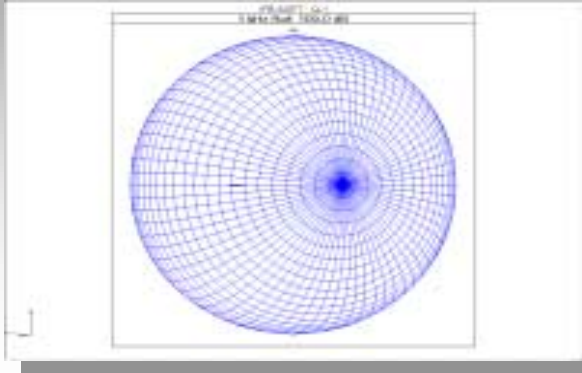
$$\eta = \frac{P_{ak}}{P_{el}}$$

Empfindlichkeit, Sensitivity

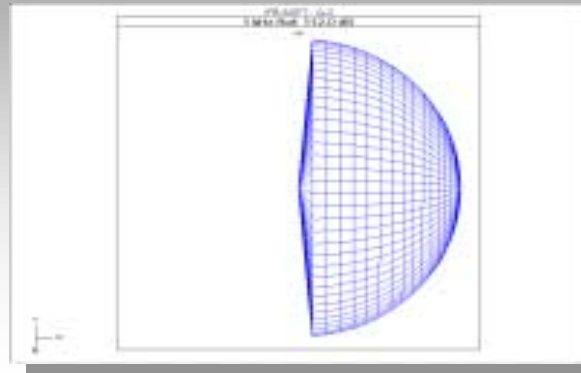


$$L_{sens} = ? \text{ dB SPL} / 1W / 1m$$

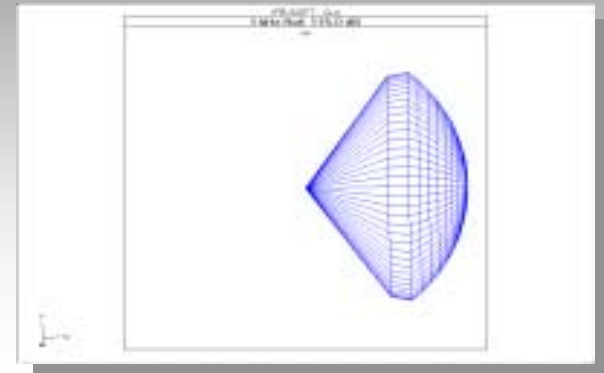
Bündelung Q & DI, Directivity, Q & DI



$Q=1$
 $DI=0\text{ dB}$



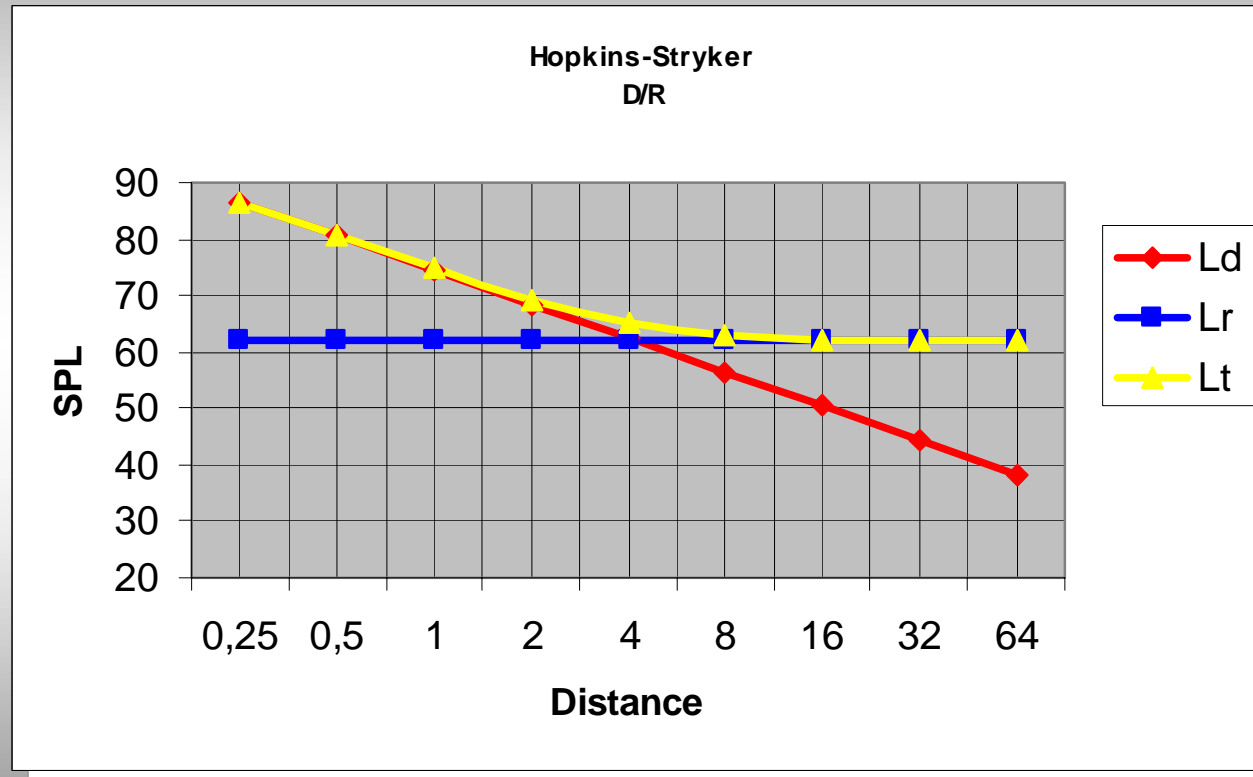
$Q=2$
 $DI=3\text{ dB}$



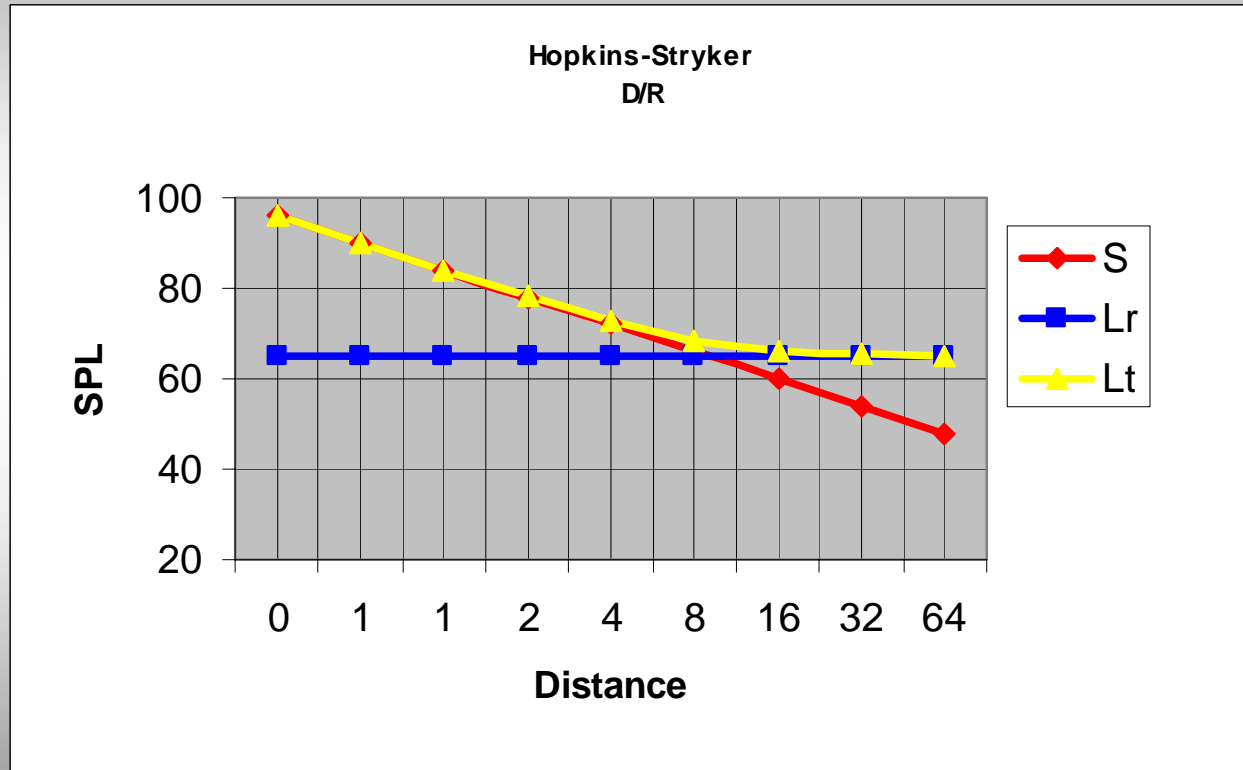
$Q=4$
 $DI=6\text{ dB}$

$$DI = 10 \log Q$$

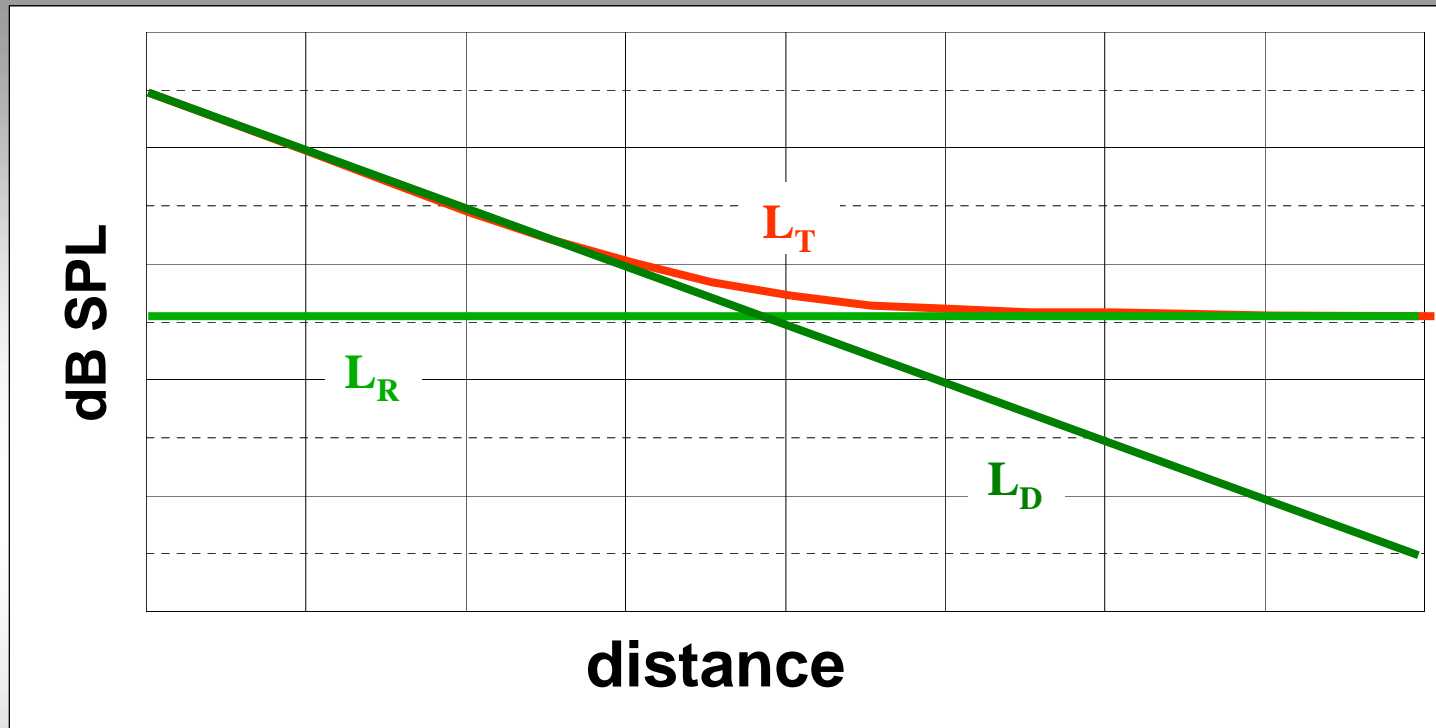
Totales Schallfeld $L_t = L_d + L_r$, $Q= 1$, $D_l= 0\text{dB}$



Totales Schallfeld $L_t = L_d + L_r$, $Q= 8$, $D_l= 9$ dB



Hopkins Stryker Gleichung



$$\Delta L_D = 10 \log \frac{Q}{4 \pi r^2}$$

$$\Delta L_R = 10 \log \frac{4}{S \alpha}$$

$$\Delta L_T = 10 \log \left(\frac{Q}{4 \pi r^2} + \frac{4}{S \alpha} \right)$$

- Jede Frage ist willkommen ...



Vielen Dank für Ihre Aufmerksamkeit !