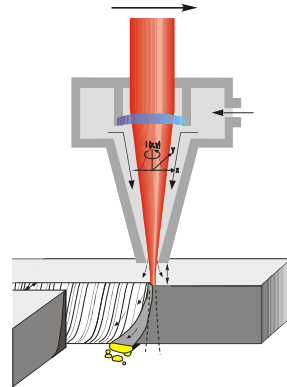

The power of light

Laser hoher Strahlqualität: Technik und Anwendungen

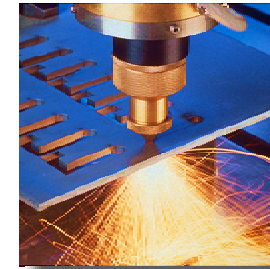
Wolfram Rath
Rofin Sinar Laser GmbH
Hamburg Germany

Laseranwendungen Makro

Schneiden

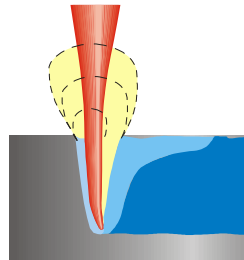


- * Flexibel
- * Genau
- * Schnell
- * Berührungslos



- Stahl
- Aluminium
- Holz
- Papier
- Kunststoffe

Schweißen



- * Schnell
- * Geringe Wärme
- * Hohe Festigkeit
- * Einfach automatisierbar



- Stahl
- Aluminium
- Messing
- Kupfer
- Edelmetalle
- Kunststoffe

Oberflächen

- * Flexibel
- * Einfach zu programmieren
- * Schnell
- * Berührungslos

- Stahl
- Kunststoffe
- Holz
- Keramik
- Glas

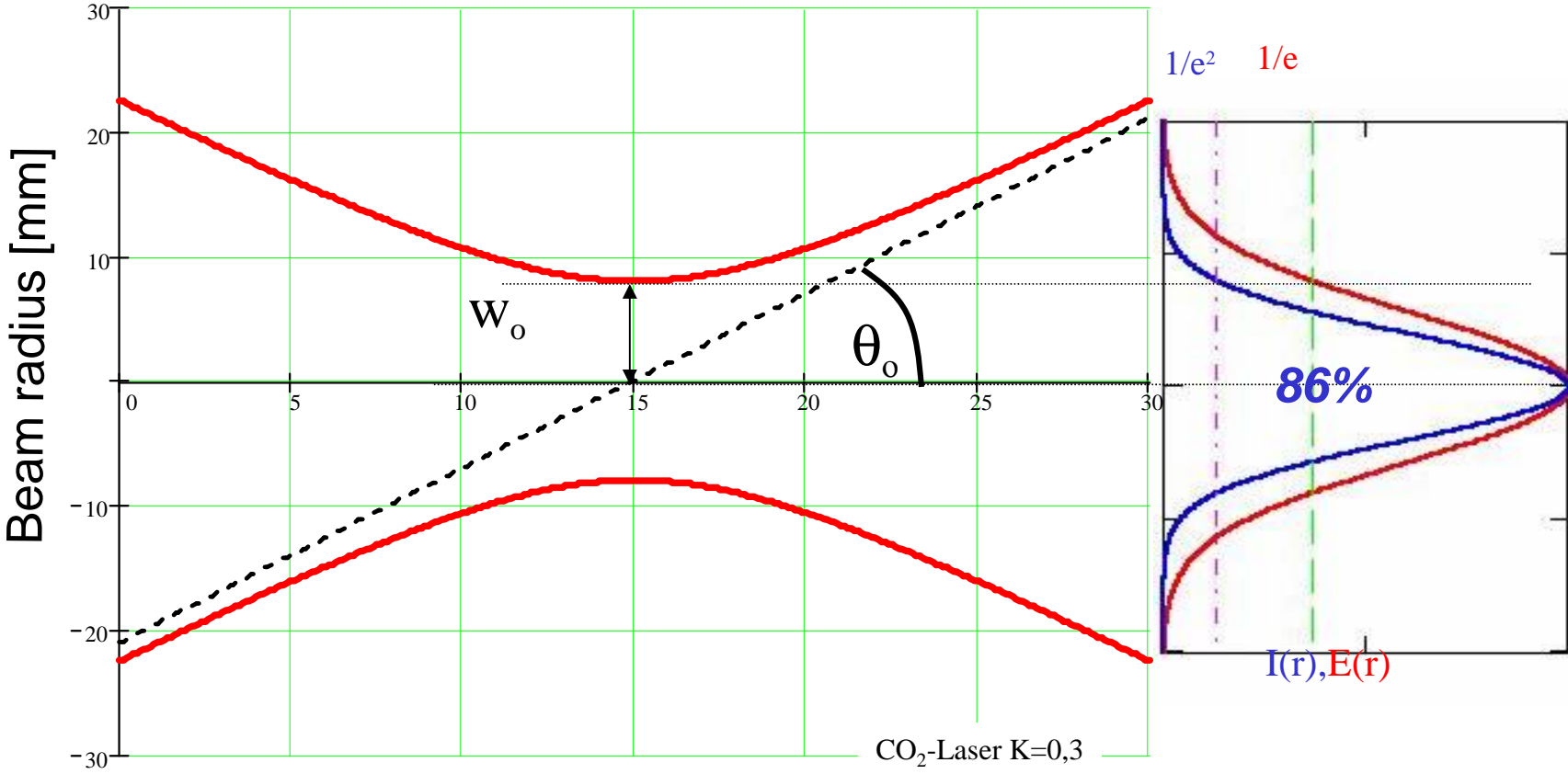
Laser Parameter

The power of light

- **Leistung**
- **Wellenlänge**
- **Fokussierbarkeit / Strahlqualität**

Strahlausbreitung

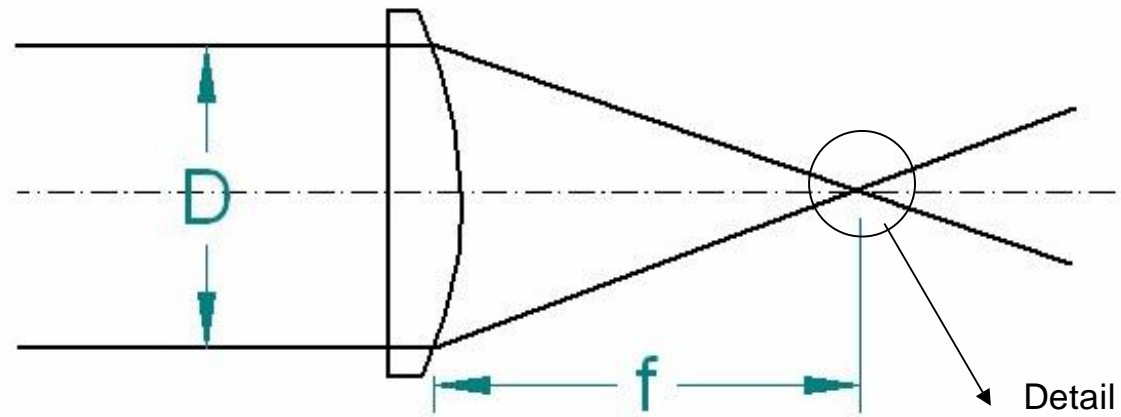
The power of light



Stahlparameterprodukt $w_0 \cdot q_0$

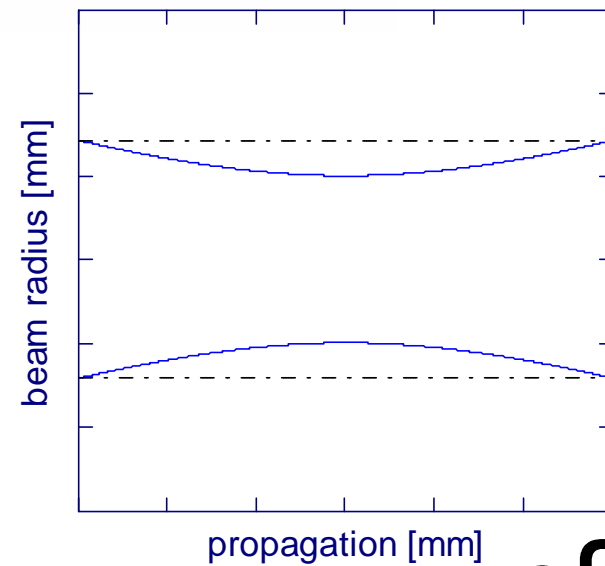
Fokussierung

The power of light



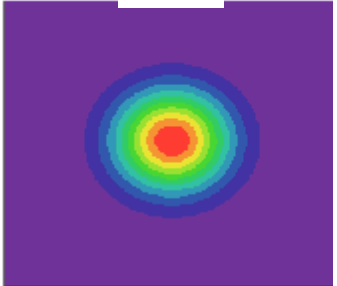
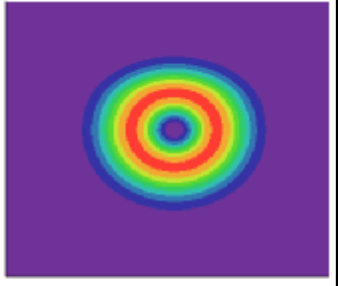
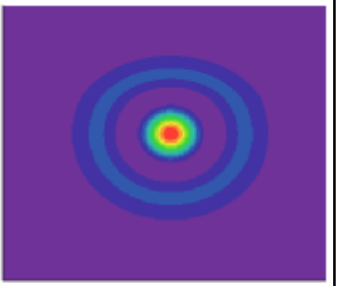
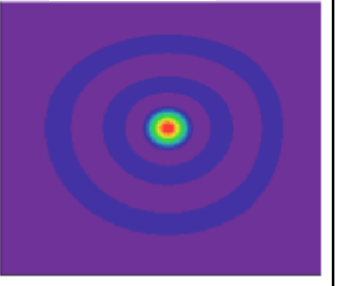
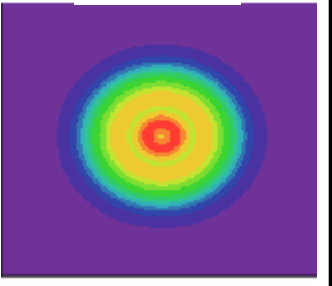
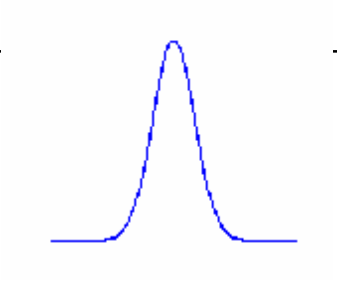
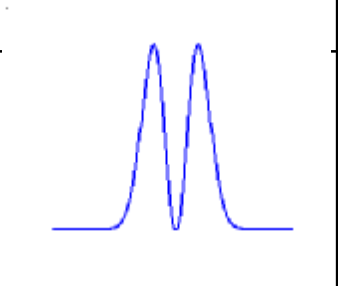
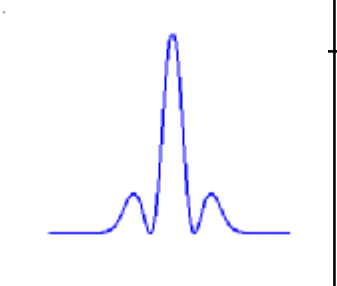
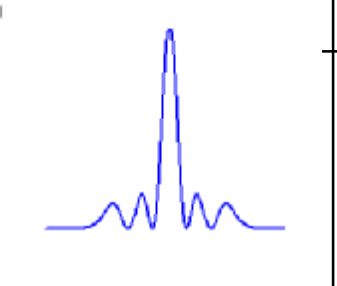
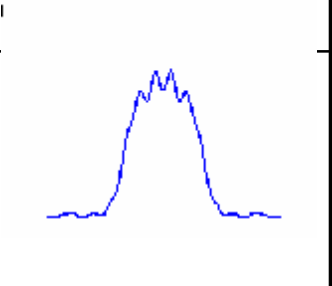
$$d_f := 4 \cdot \frac{f}{D} \cdot (w_o \cdot \theta_o)$$

$$\text{DOF} := \frac{f}{D} \cdot d_f$$



Laser Moden

The power of light

				
				
TEM 00	TEM 01*	TEM 10	TEM 20	Multi
$K = 1$ $M^2 = 1$	$K = 0.5$ $M^2 = 2$	$K = 0.33$ $M^2 = 3$	$K = 0.2$ $M^2 = 5$	$K = 0.15$ $M^2 = 6.6$

Stahlqualität

The power of light

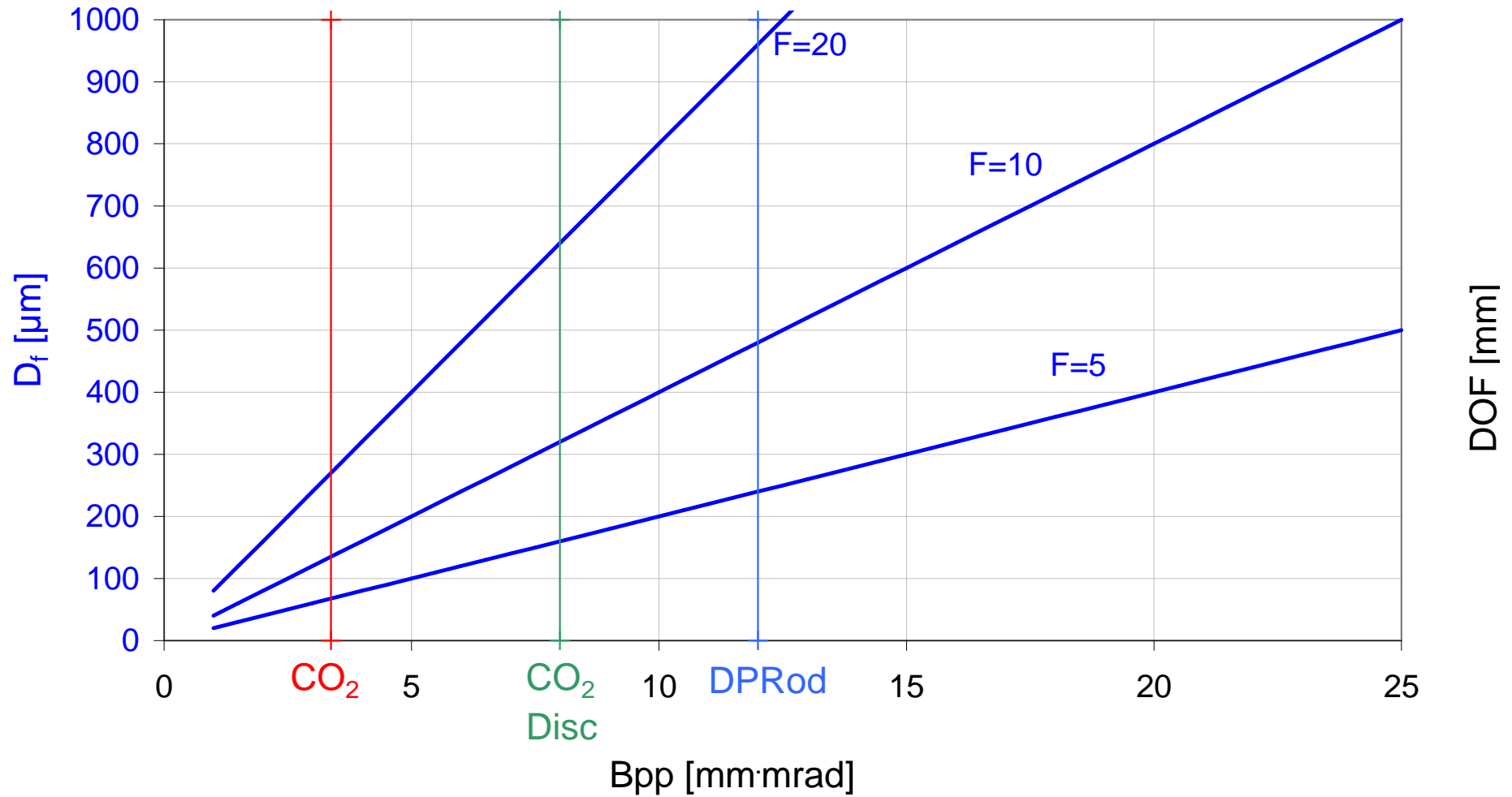
- **hyperbolische Ausbreitung**
- **Fokusburchmesser und Tiefenschärfe bestimmt von der Strahlqualität**
- **Unterschiedliche Größen zur Beschreibung:**

$$w_o \cdot \theta_o \geq \frac{\lambda}{\pi}$$

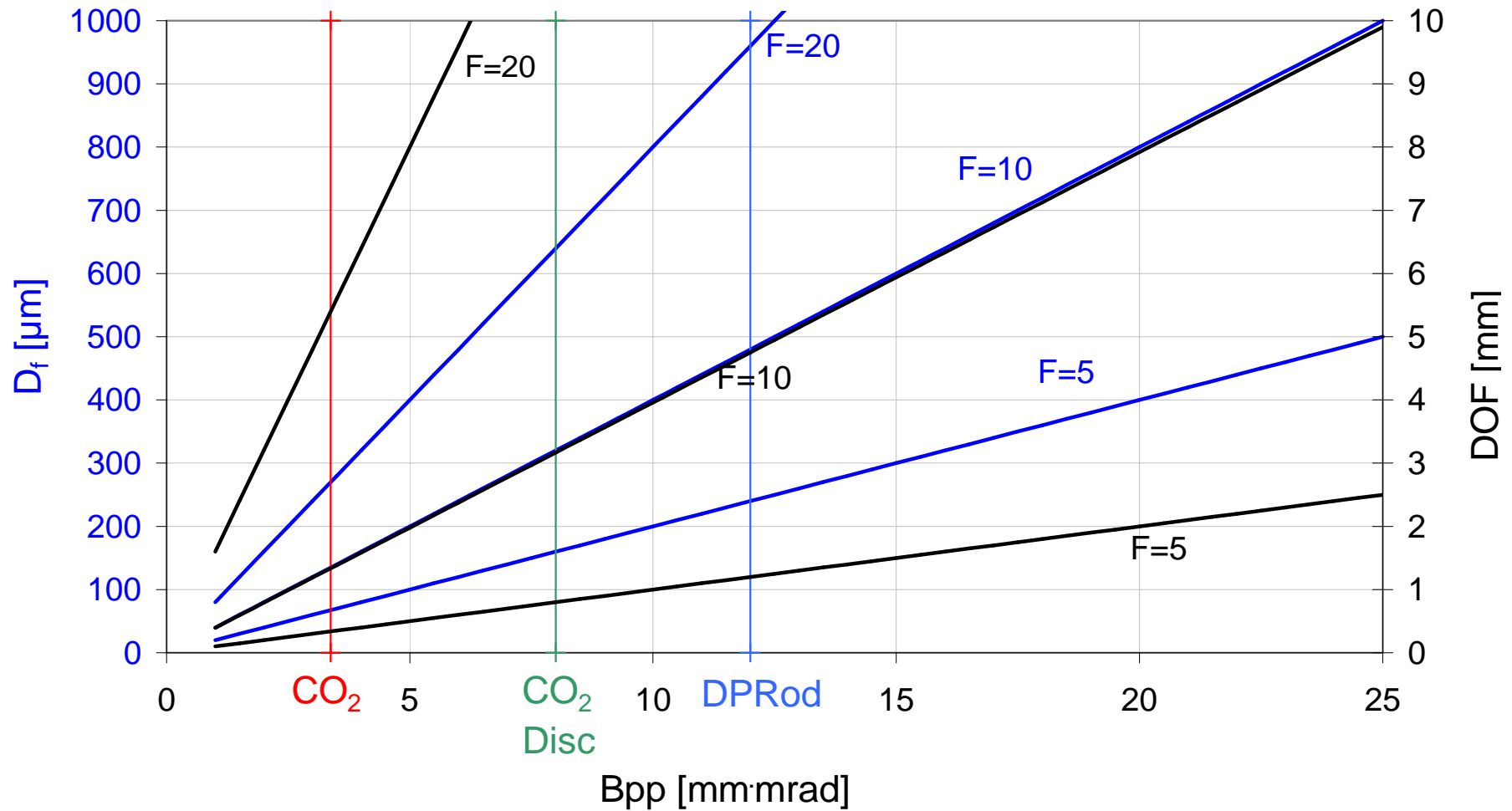
$$K := \frac{w_o \cdot \theta_o}{\frac{\lambda}{\pi}}$$

$$K := \frac{1}{M^2}$$

Typische Werte: $F=f/D$



Typische Werte

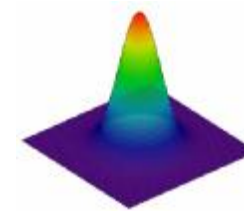
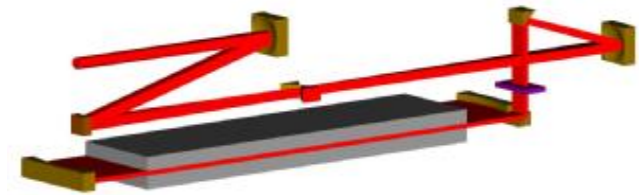
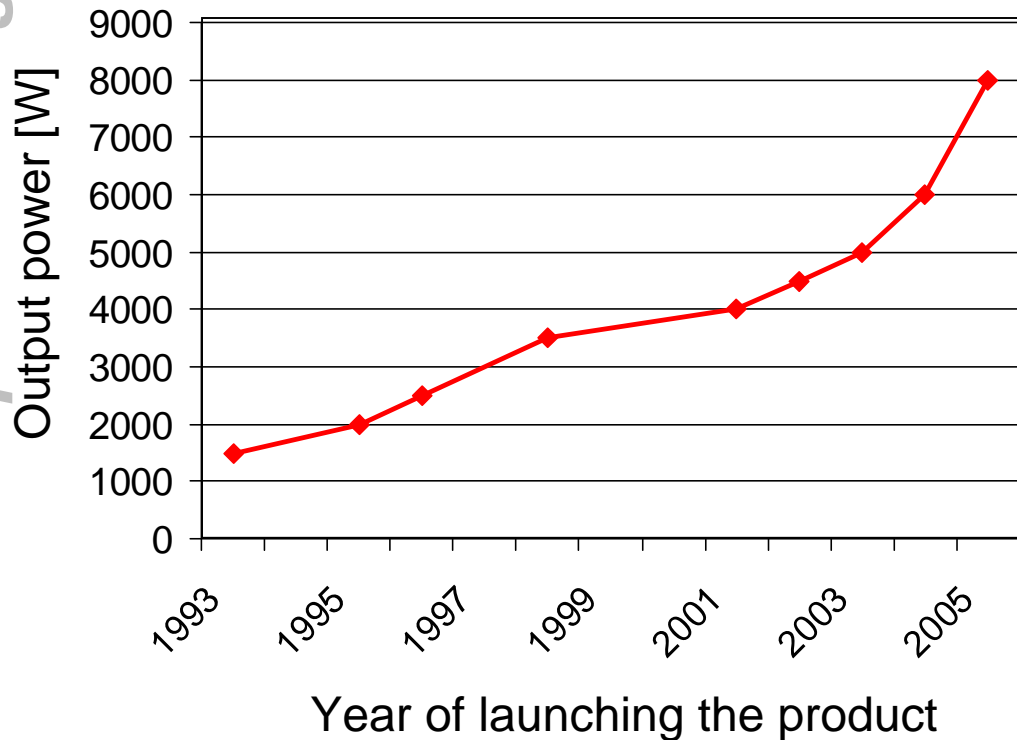


CO₂ Slab Laser

ROFIN DC Series

- low service requirements
- min. gas consumption
- *high beam quality --> long focal length
high DOF*
- diamond window & reflective optics

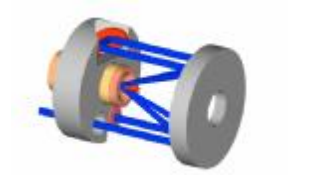
The power of light



K=0.9



ROFIN DS Serie



The power of light

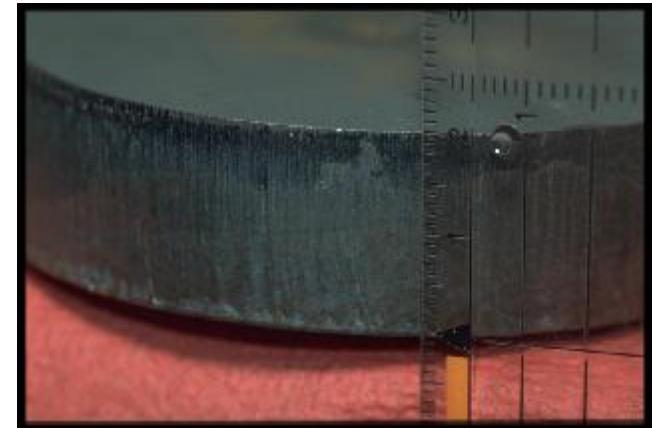
- keine thermische Linse
 - ↳ hohe Strahlqualität
- 940 nm Diode
 - ↳ verbesserte Daten
 - ↳ effizient
- 1030 nm
 - ↳ Nd:YAG Optiken
 - ↳ Fasern verfügbar
- geringes Bauvolumen
- unempfindlich gegen Rückreflexionen
 - ↳ lange Fasern möglich
- stackmanagement



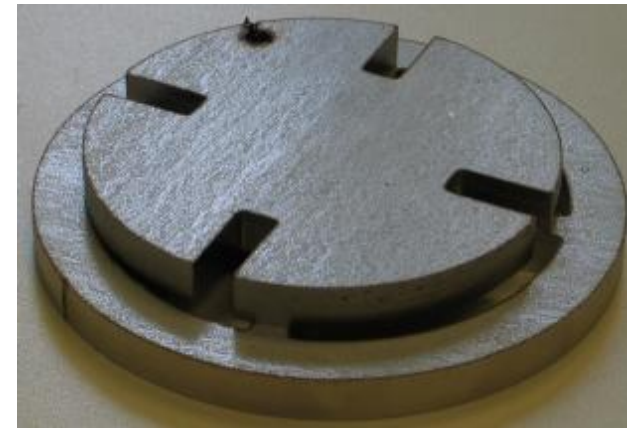
Lasercutting

The power of light

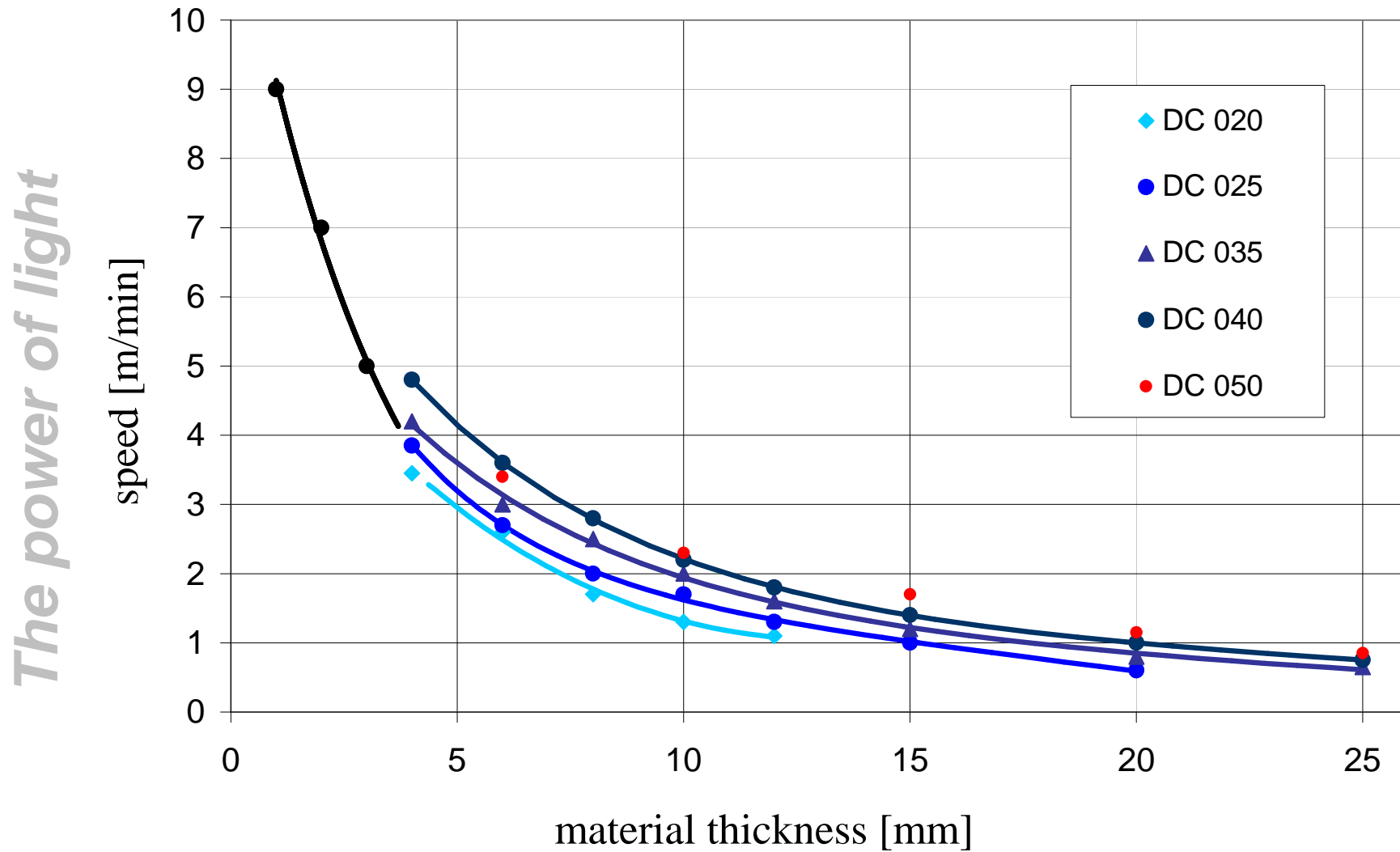
Laser Brennschneiden: O₂



Laser Schmelzschnneiden: N₂



Laser Brennschneiden Baustahl



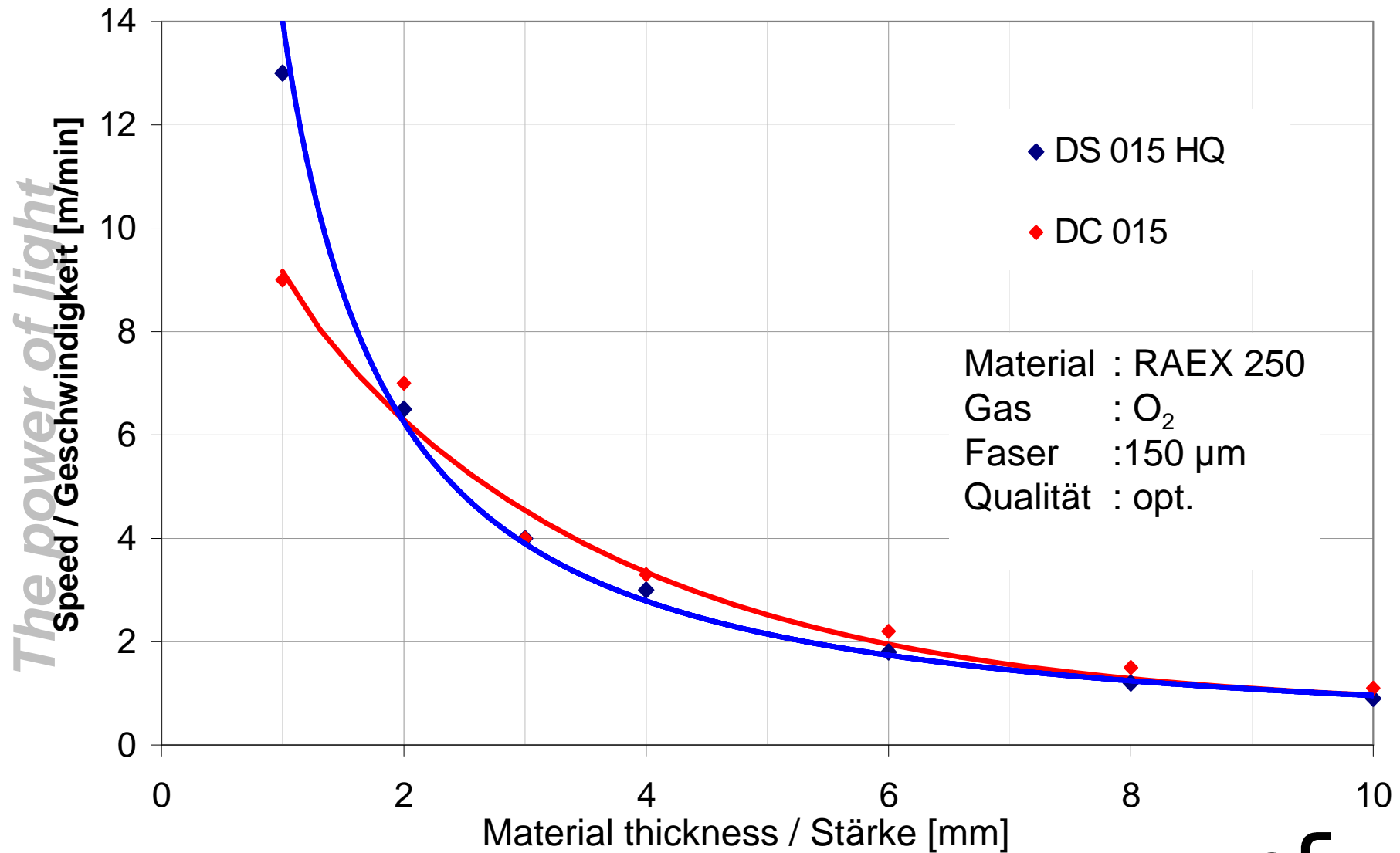
Einfluß der Strahlqualität

The power of light

- Sehr gute Schneidqualität 0 bis 25 mm im Leistungsbereich esamten Leistungsspektrum DC 010 bis DC 040
- Kleine Schnitffugen bei geringen Materialstärken
- Schnelles Einstechen

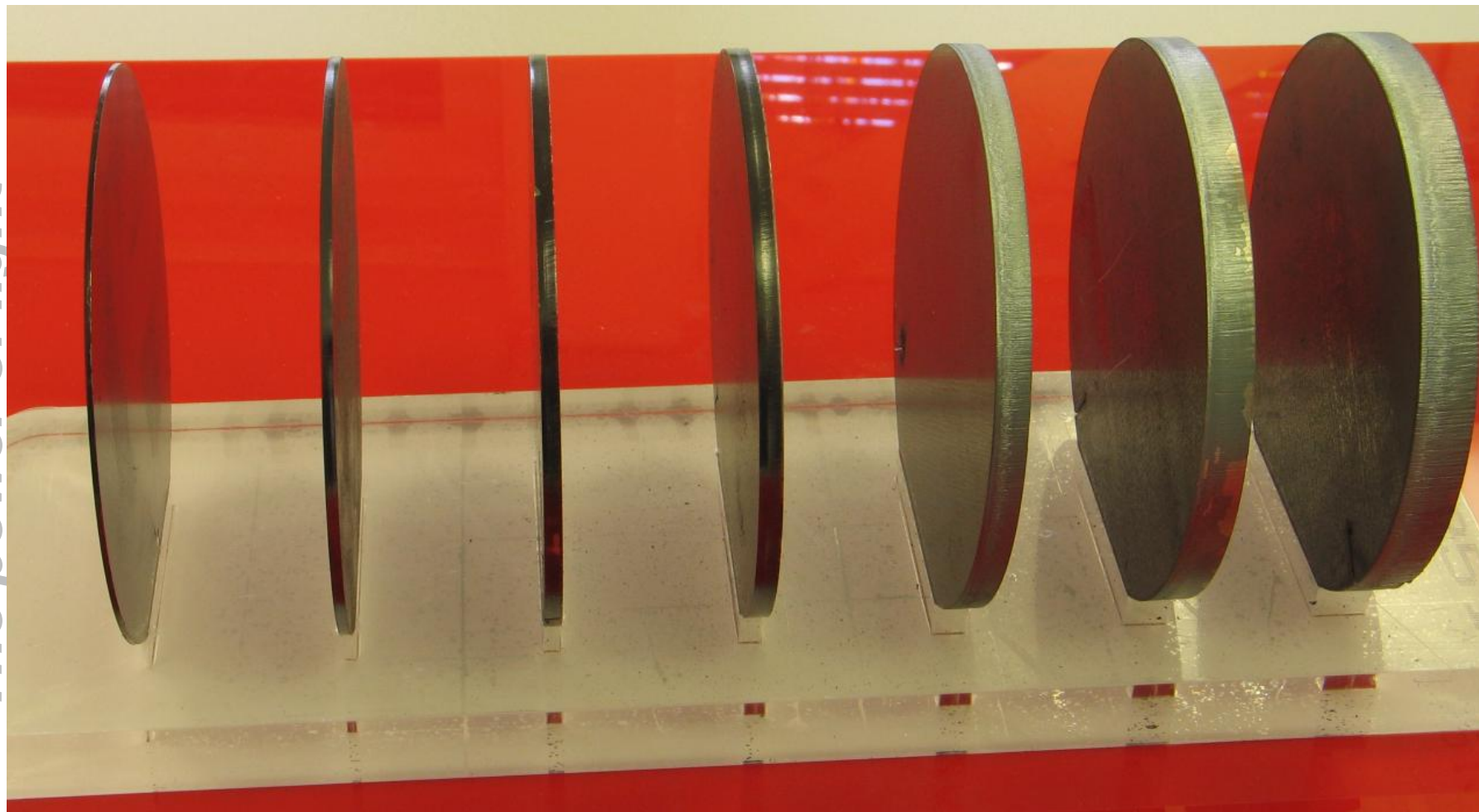
Laser Brennschneiden 1 μm und 10.6 μm

Scheibe / CO_2 (Slab) DS 015 HQ / DC 015

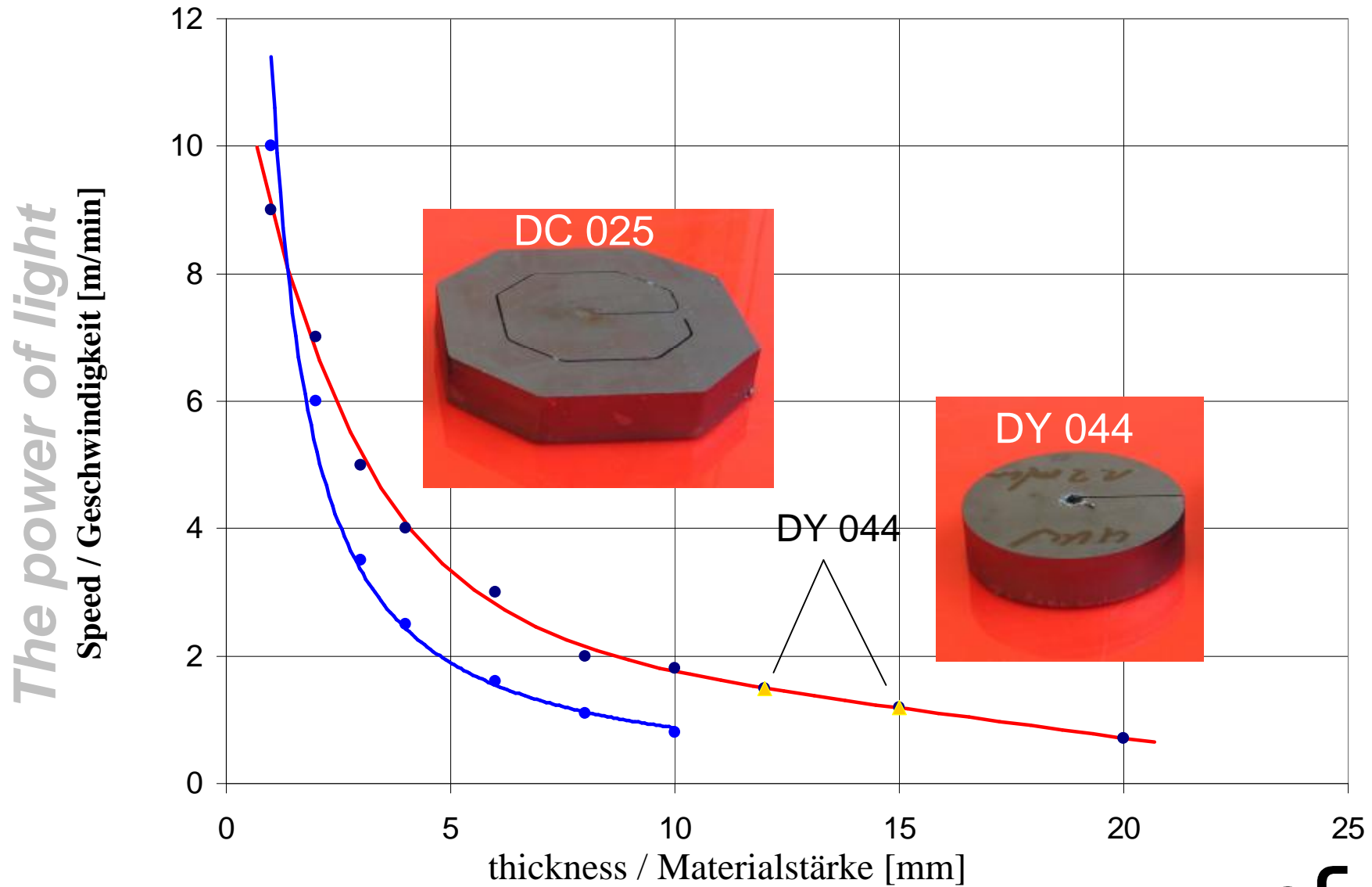


Qualität: DS 015 HQ Baustahl

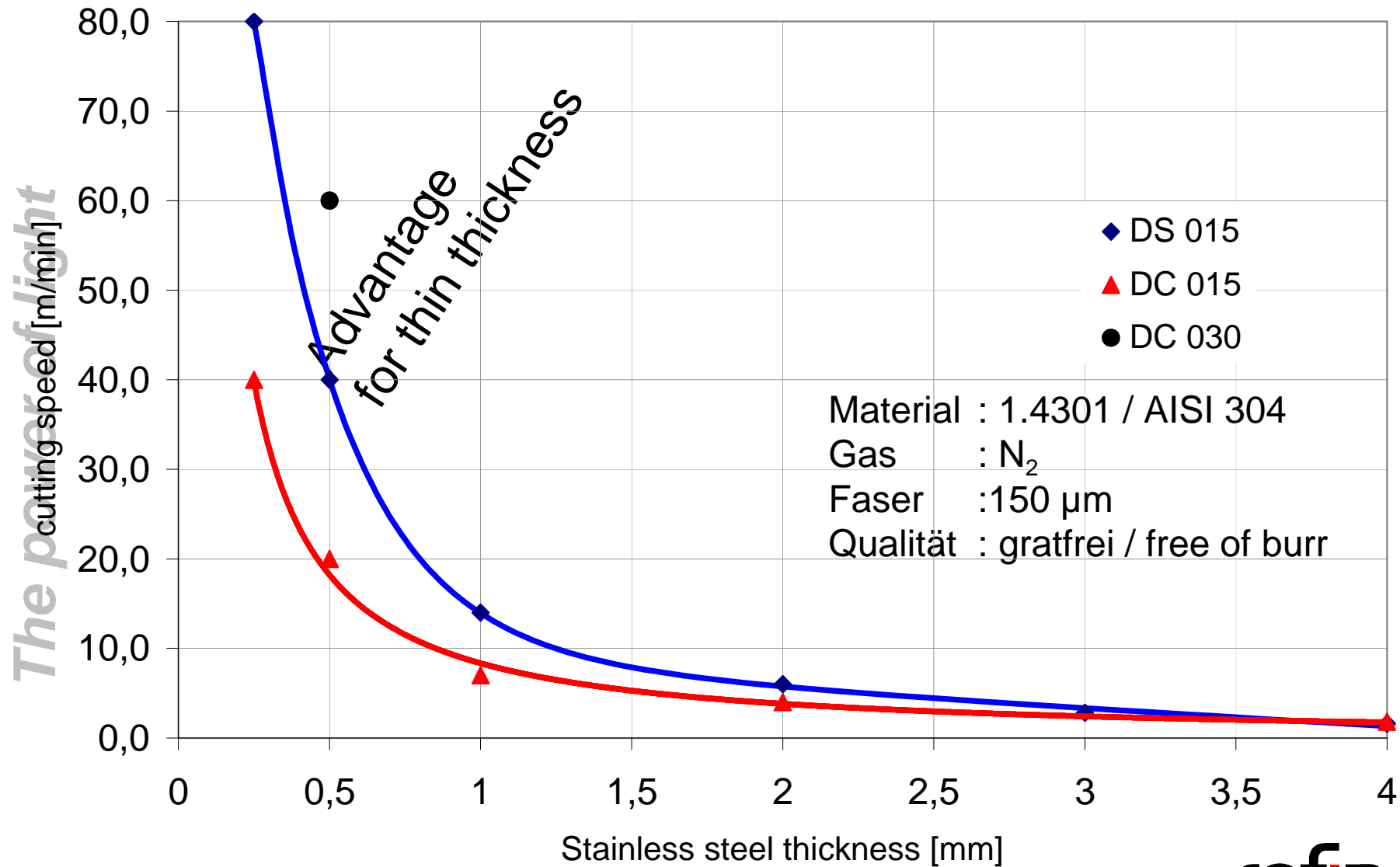
The power of light



Brennschneiden Baustahl: DC 025 / DS 015 HQ / DY 044



Solid State Laser (Disc): DS 015 HQ Cutting Stainless Steel



Schweißen: CO₂ DC 035

The power of light

With courtesy from DaimlerChrysler

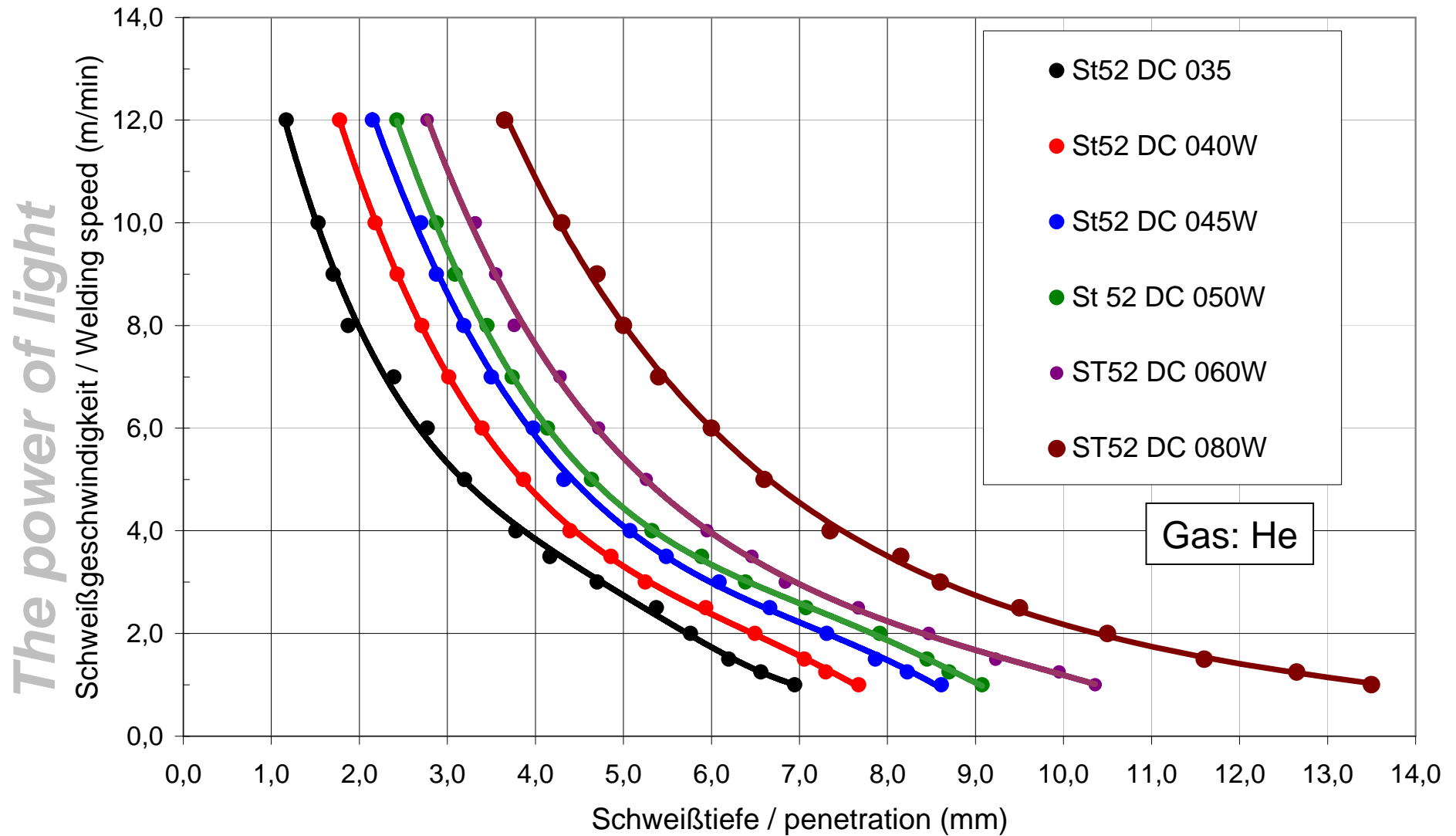
1,2 kW 1,5 m/min
2,2 mm

2,6 kW 1,5 m/min
4,25 mm

2,7 kW 1,5 m/min
2,8 mm

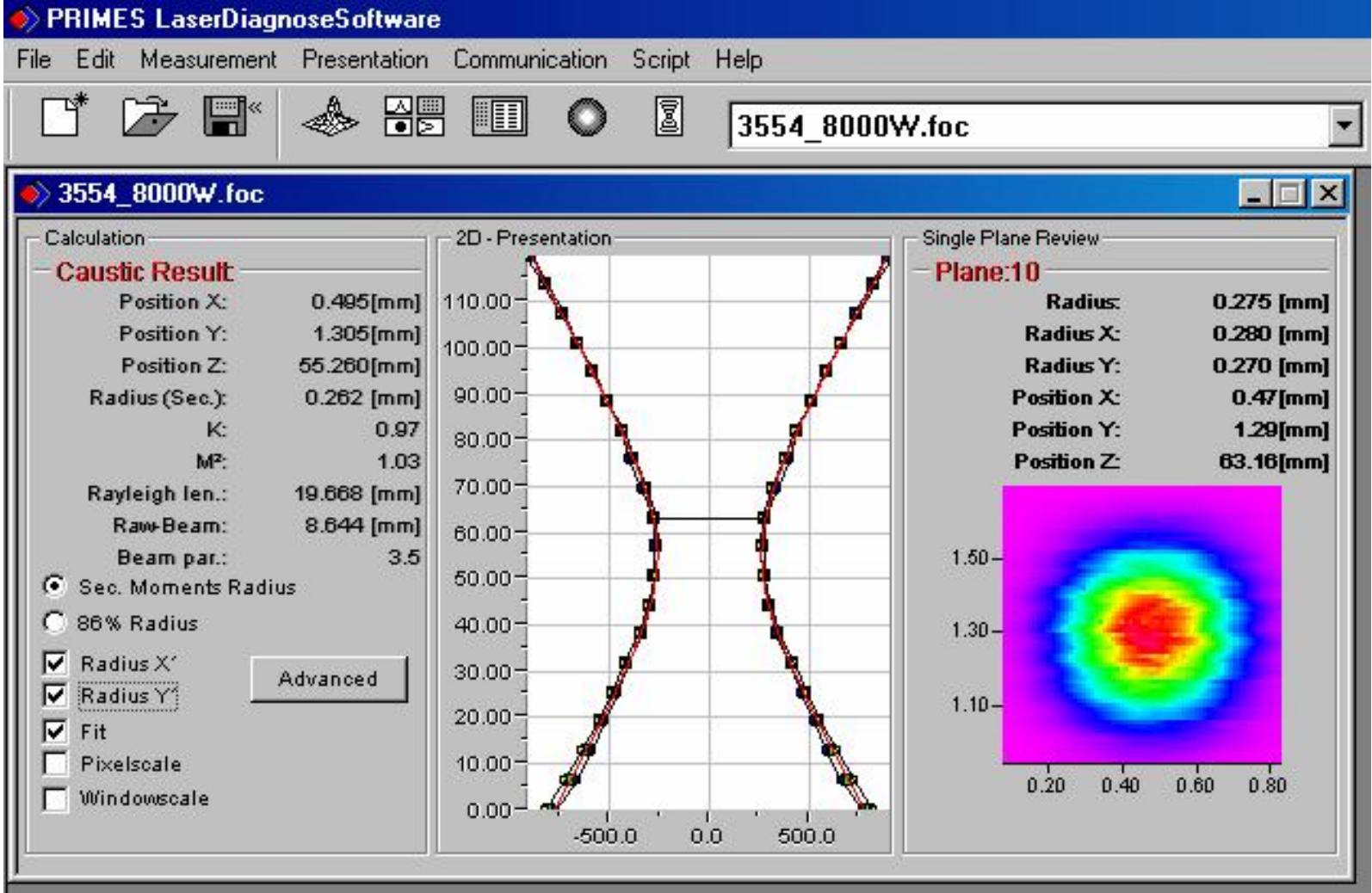
3,5 kW 7,2 mm
1,5 m/min

Schweißen: CO₂ Slab



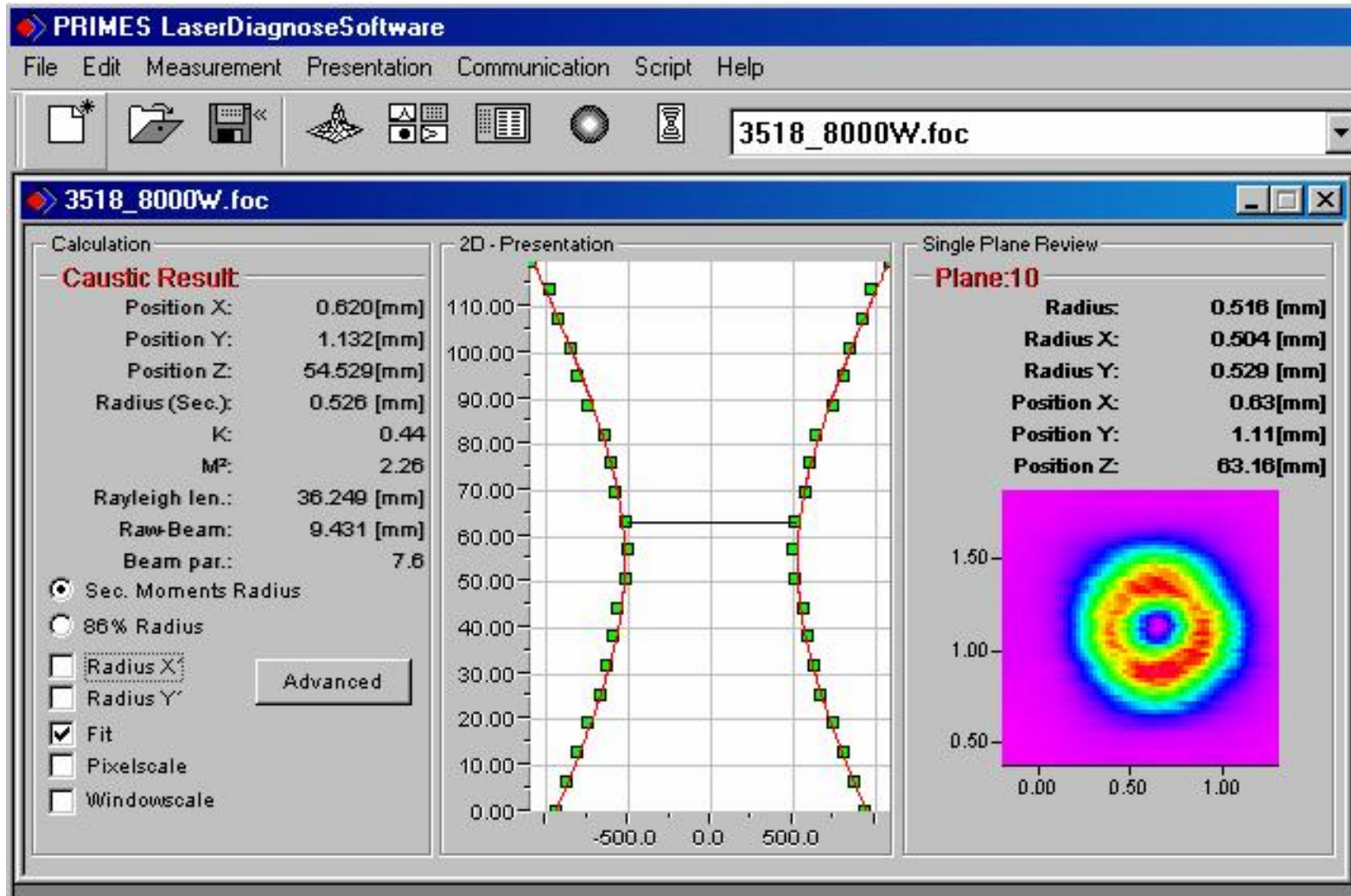
Fokuskaustik DC 080

The power of light

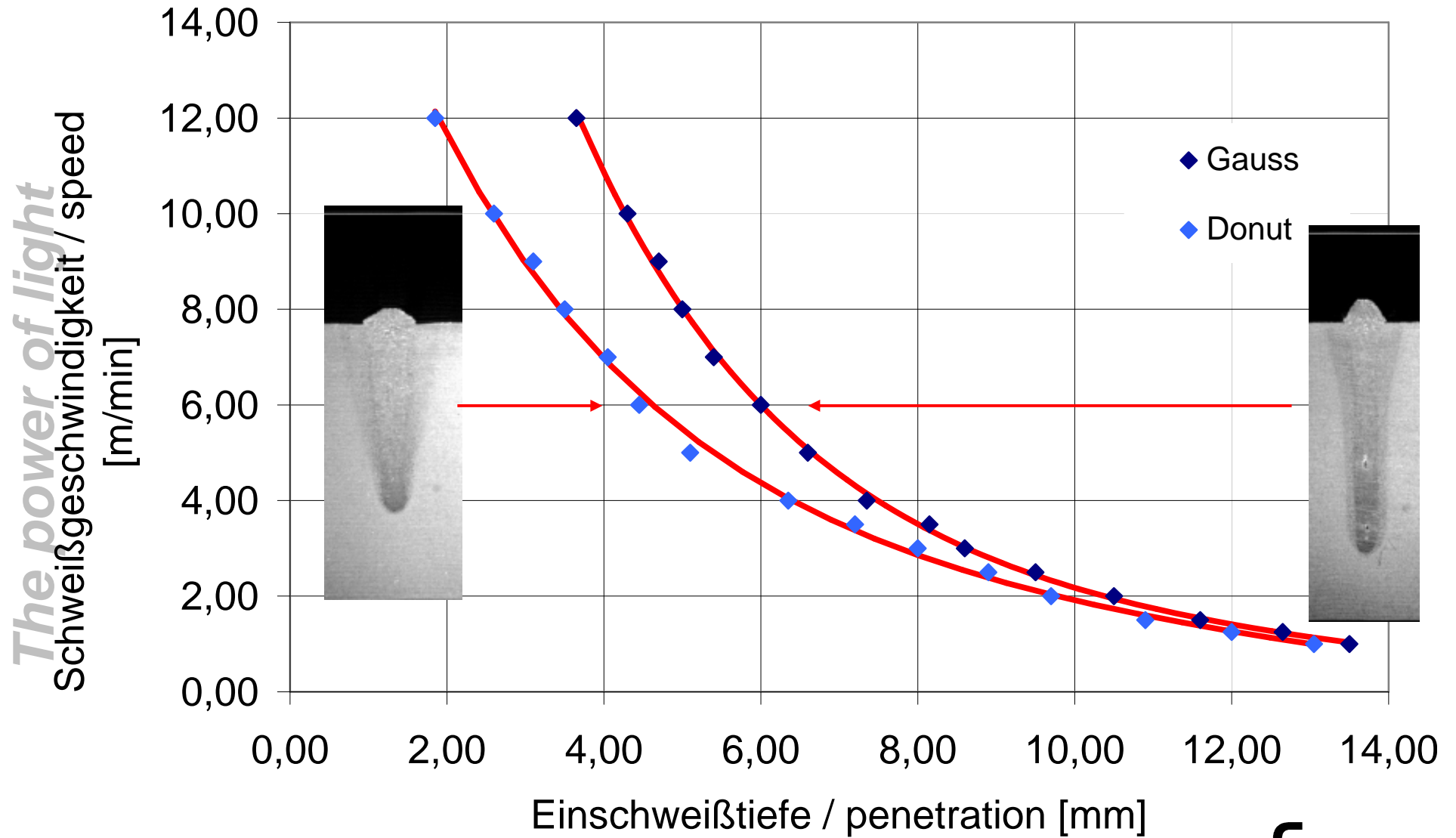


Donut DC 080

The power of light



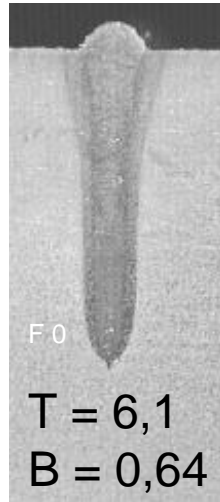
DC 080 W Welding of Mild Steel: $f = 300 \text{ mm}$



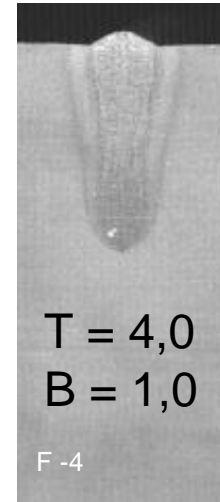
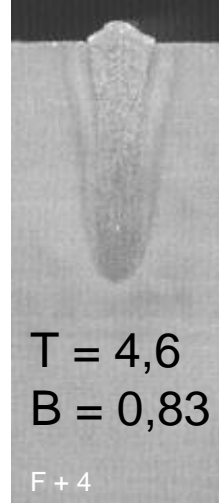
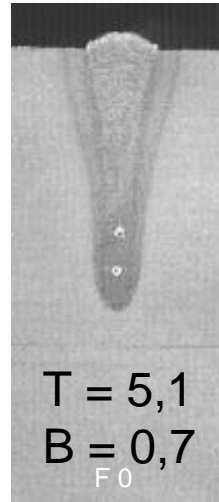
Nahtformung: DC 060 6 kW 4m/min $f = 300$ mm

The power of light

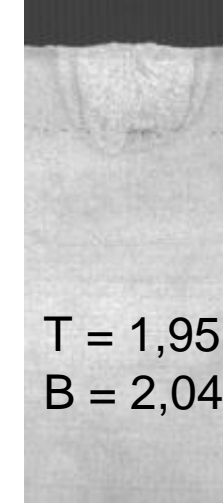
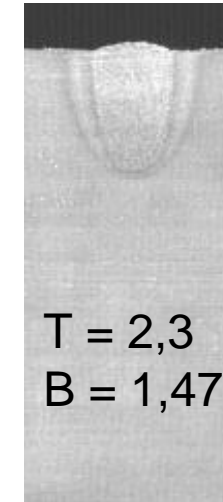
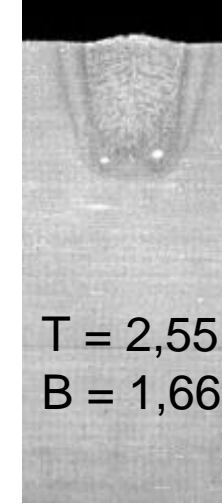
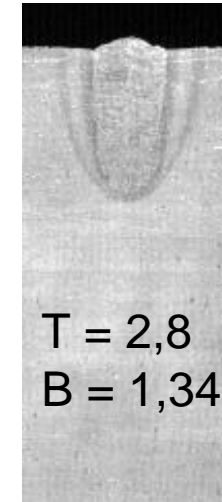
Gauß



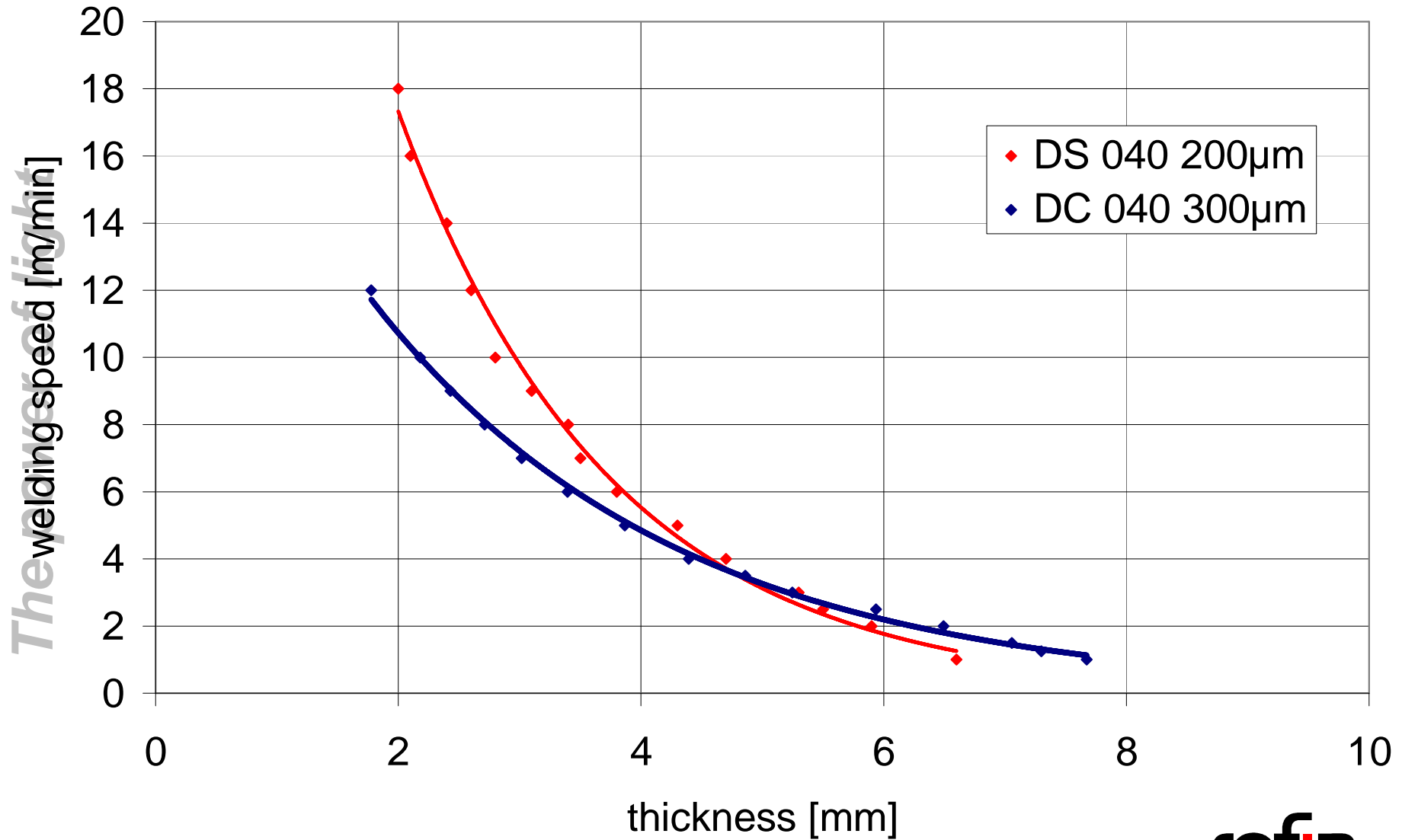
Donut



DF



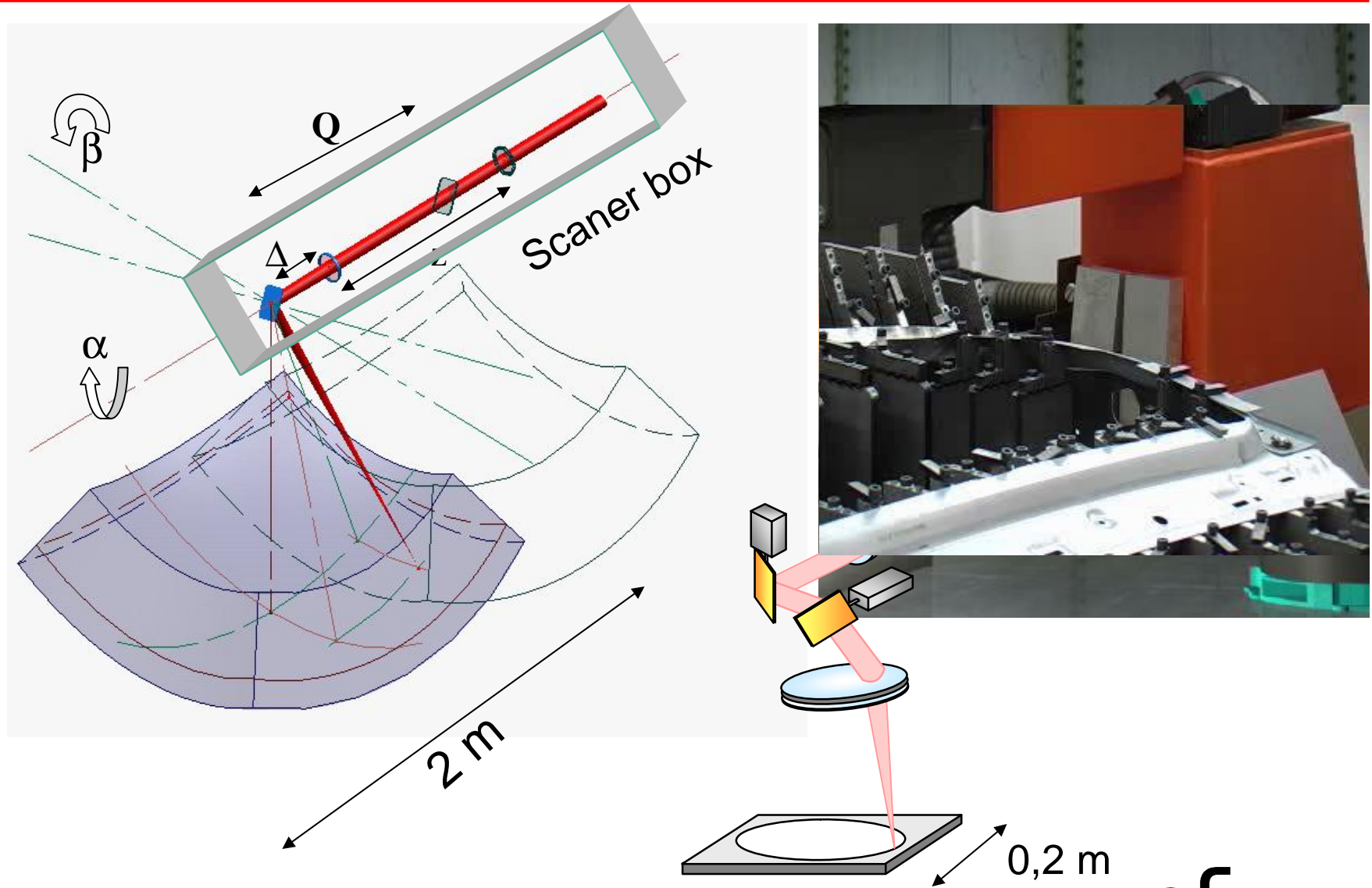
Schweißen Baustahl Scheibe /Slab 4000 W



Remote welding

& CO₂-Laser Scanner Welding DPSS-Laser

The power of light

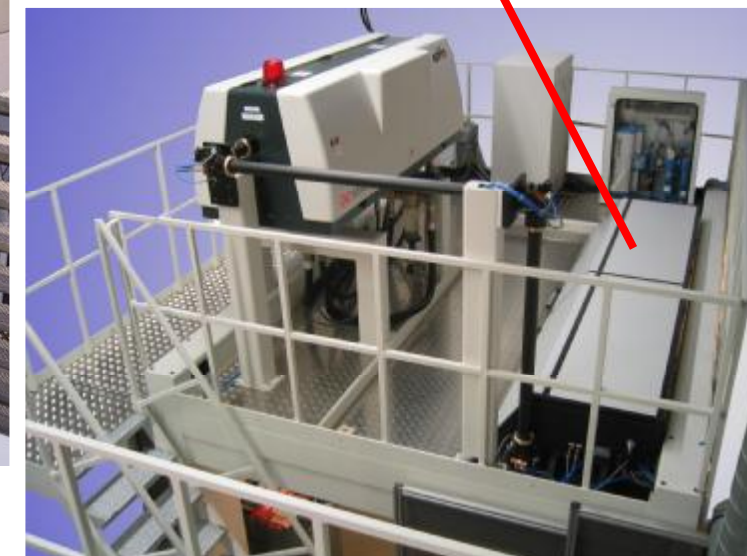


Remote welding system

The power of light



Scannerbox



rofin
LASER MACRO

Remote Welding System
Welding of Bumpers

ROFIN DC 050

THE POWER OF LIGHT

Zusammenfassung

The power of light

- Rofin bietet Laser hoher Strahlqualität als CO₂ Slab Laser und als Scheibenlaser an
- höhere Strahlqualität bietet Vorteile bei schmalen Schweißnähten und geringen Schnittspaltbreiten.
- kurze Wellenlänge erlaubt höhere Prozeßwirkungsgrade vor allem für geringere Bleckstärken