

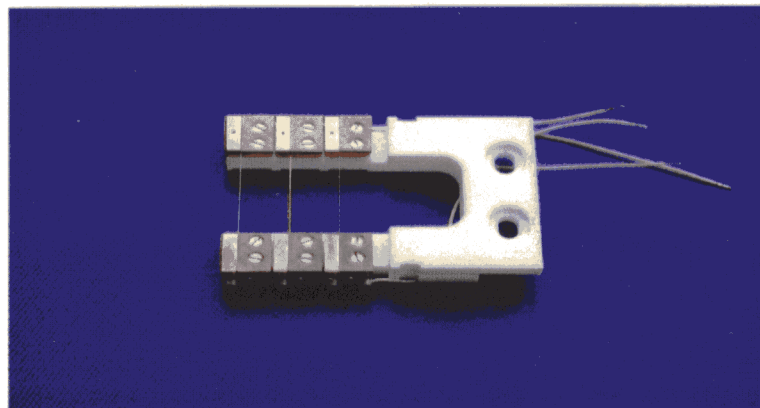
Wirescanner

dient zur Bestimmung der Strahlage

im

Bereich der Undulatoren

für TTF II – FEL



Einführung

Bild 1

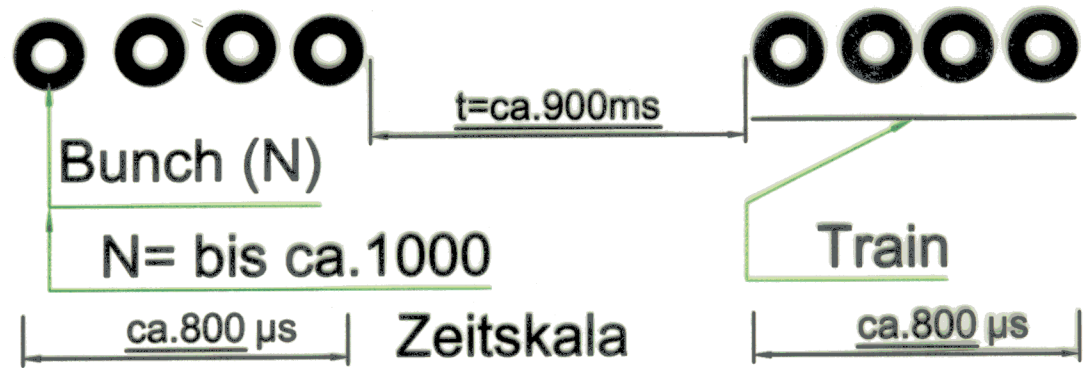


Bild 2

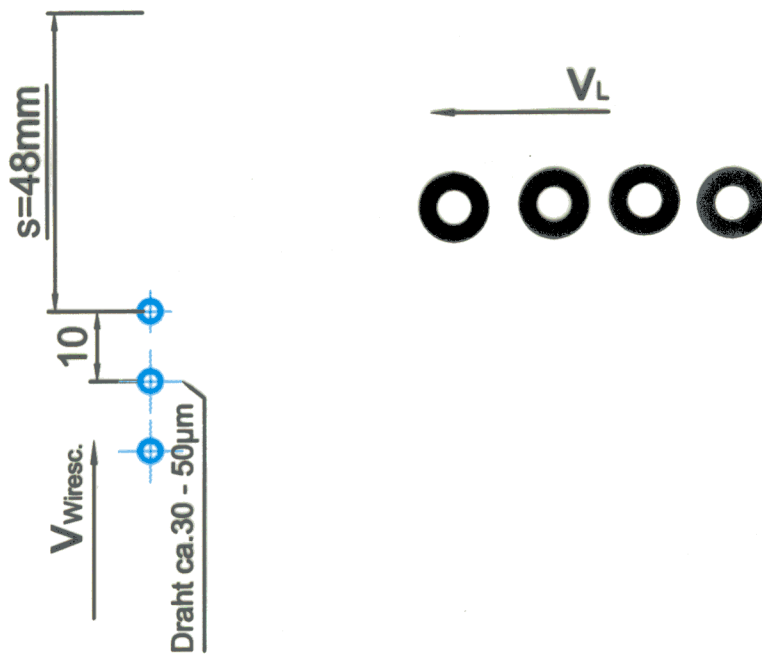
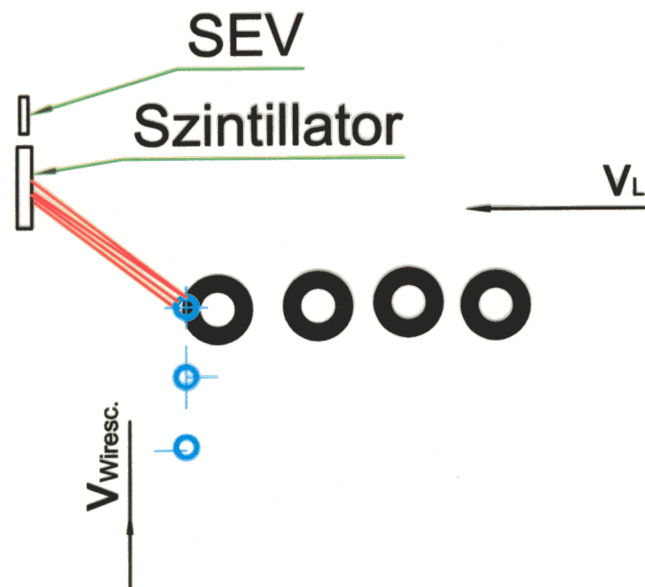
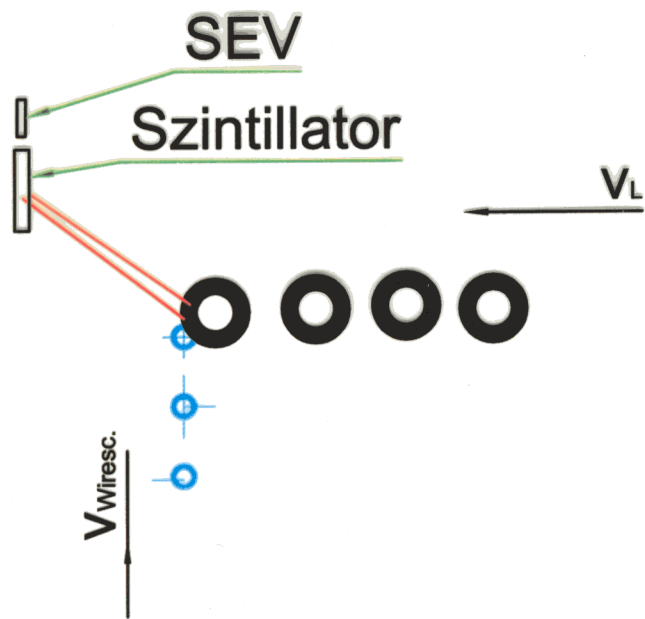


Bild 3



Aufgabenstellung

Technische Parameter:

- großer variabler Geschwindigkeitsbereich v bis 1 m/s
- Hubbereich $s = 30$ mm mit konstanter Geschwindigkeit
- Maximaler Hub $s < 50$ mm
- Positioniergenauigkeit $\Delta s < 0,003$ mm.
- Messgenauigkeit $\Delta s < 0,001$ mm

Nutzereigenschaften:

- übersichtliche, leichtverständliche Menü-Software zur Steuerung/ Bedienung des WS

Weitere Eigenschaften für eine schnelle und bequeme Bereitstellung der WS

- einfacher Austausch der WS an jeder Station
- einfache Eichungsmethode für den neu eingespannten Draht zum Meßmaßstab
- einfache Gabeljustage um ein zerstörungsfreies Führen der Drähte durch einen 1 mm breiten Spalt im Strahlrohr zu gewährleisten.

Technische Parameter des Wire-Scanners

- Spanndrähte Durchmesser $d = 0,005$ bis $0,03$ mm
- Gabel - Material Macor – Keramik
- Signalleitungsausführung $n = 4$
- Hubweg $s = 48$ mm
- Geschwindigkeitsbereich $v = 0,1$ bis 1000 mm/s
- max. Beschleunigung $a = 65,4$ m/s²
- Schrittfrequenzbereich des Motors $f_{\text{mot}} = 40 - 1400$ Hz
- Schrittwinkel des Motors $\varphi = 1,8^\circ$
- Mikroschritt des Motors $\Delta\varphi = 1,8/256^\circ$
-
- Meßtaster:
 - Meßbereich $s = 60$ mm
 - Meßgenauigkeit $\Delta s = 0,001$ mm

Bewegungsgesetz	Normierte Übertragungsfunktion	$f'(z)$	$f''(z)$	$f'''(z)$	$f'(z) \cdot f''(z)$
Gerade 1 Polynom 1. Potenz	$f(z) = z$				
quadratische Parabel	$z = 0 \dots 0,5: f_1(z) = 2z^2$				
2 Polynom 2. Potenz	$z = 0,5 \dots 1: f_2(z) = 1 - 2(1-z)^2$				
kubische Parabel	$f(z) = 3z^2 - 2z^3$				
3-4 Polynom	$z = 0 \dots 0,5: f_1(z) = 8(z^3 - z^4)$				
4. Potenz	$z = 0,5 \dots 1: f_2(z) = 1 - 8[(1-z)^3 - (1-z)^4]$				
3-4-5 Polynom	$f(z) = 10z^3 - 15z^4 + 6z^5$				
3-4-5-6 Polynom	$z = 0 \dots 0,5: f_1(z) = \frac{8}{3}(5z^3 - 15z^4 + 24z^5 - 16z^6)$				
6. Potenz	$z = 0,5 \dots 1: f_2(z) = 1 - \frac{8}{3}[5(1-z)^3 - 15(1-z)^4 + 24(1-z)^5 - 16(1-z)^6]$				
3-4-5-6-7-8 Polynom	$z = 0 \dots 0,5: f_1(z) = \frac{8}{3}(7z^3 - 35z^4 + 712z^5 - 224z^6 + 256z^7 - 128z^8)$				
8. Potenz	$z = 0,5 \dots 1: f_2(z) = 1 - \frac{8}{3}[7(1-z)^3 - 35(1-z)^4 + 712(1-z)^5 - 224(1-z)^6 + 256(1-z)^7 - 128(1-z)^8]$				
Sinuslinie (einfache Sinoide)	$f(z) = \frac{1}{2}[1 - \cos(\pi z)]$				
Sinoide von Besthorn $\alpha = 0$	$f(z) = z - \frac{1}{2\pi} \sin(2\pi z)$				
beschleuni- gungs-optima- le geneigte Sinuslinie $\alpha = +0,134$	$f(z) = z - \frac{1}{2\pi} \sin(2\pi z)$ $g(z) = z - \frac{0,134}{2\pi} \sin(2\pi z)$				
momenten- optimale geneigte Sinuslinie $\alpha = +0,41$	$f(z) = z - \frac{1}{2\pi} \sin(2\pi z)$ $g(z) = z - \frac{0,41}{2\pi} \sin(2\pi z)$				

Tabelle 1: Bekannte normierte Übertragungsfunktionen der Kurvengetriebe

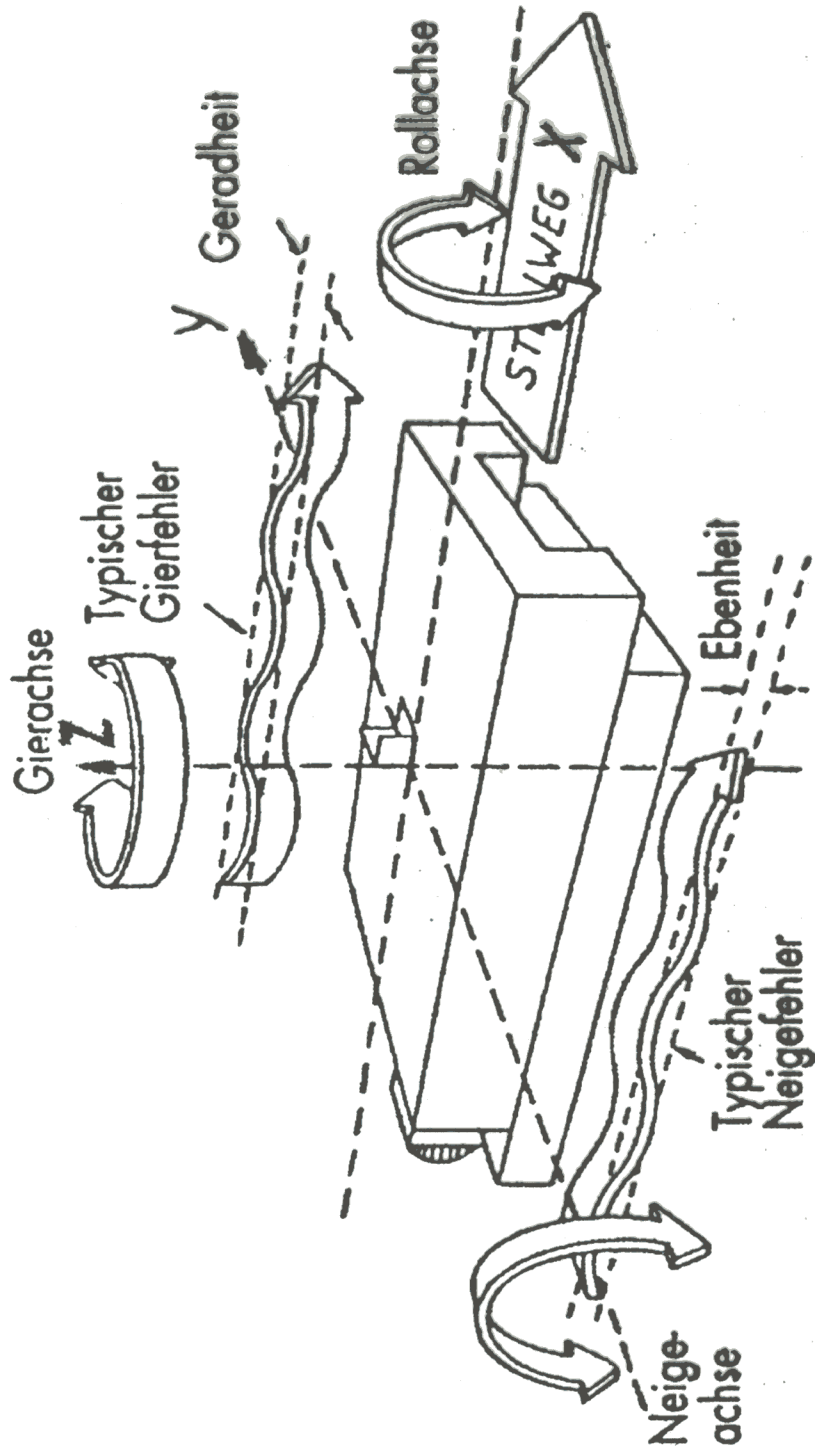
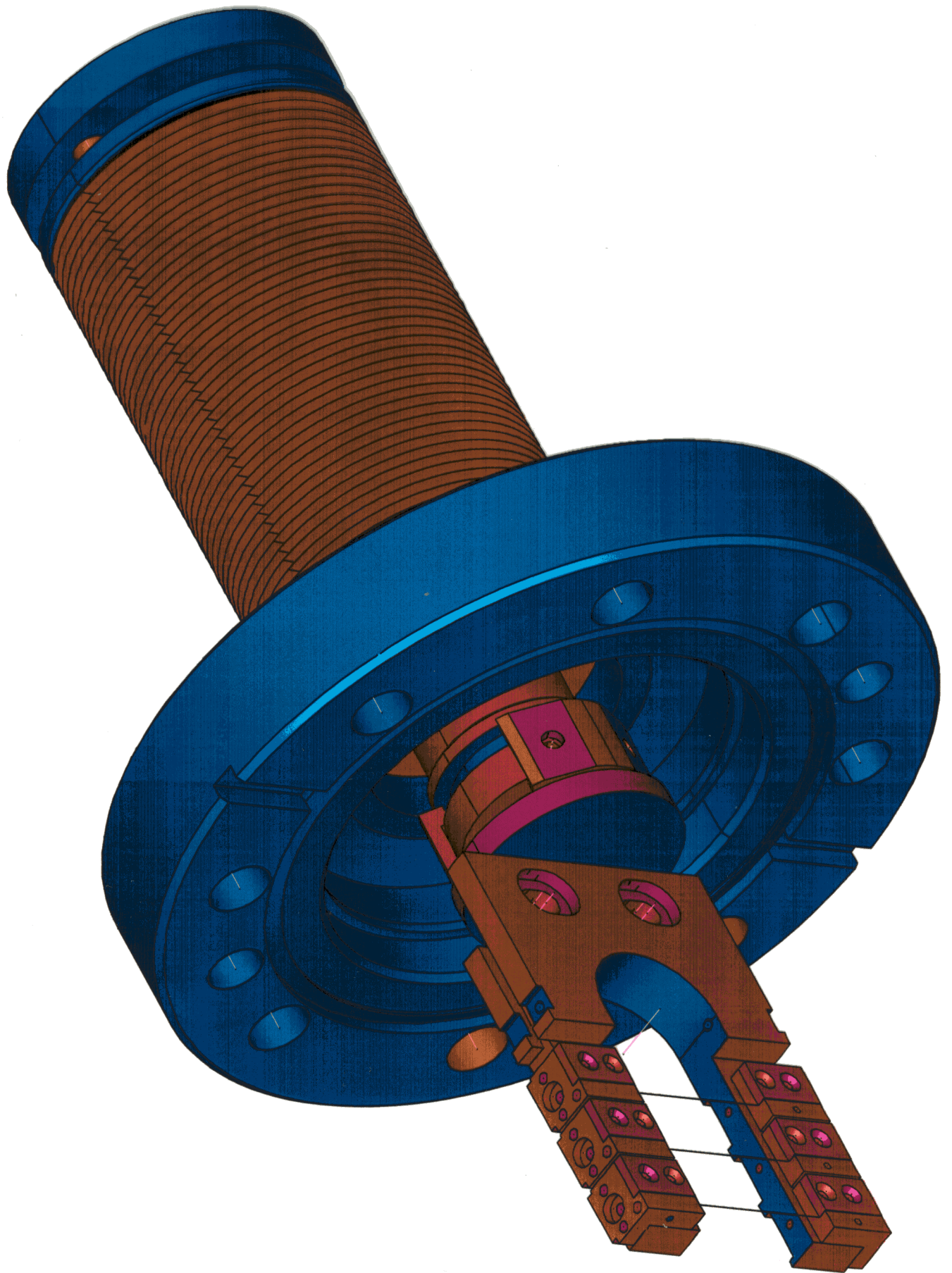


Bild : Typische mögliche Führungsfehler



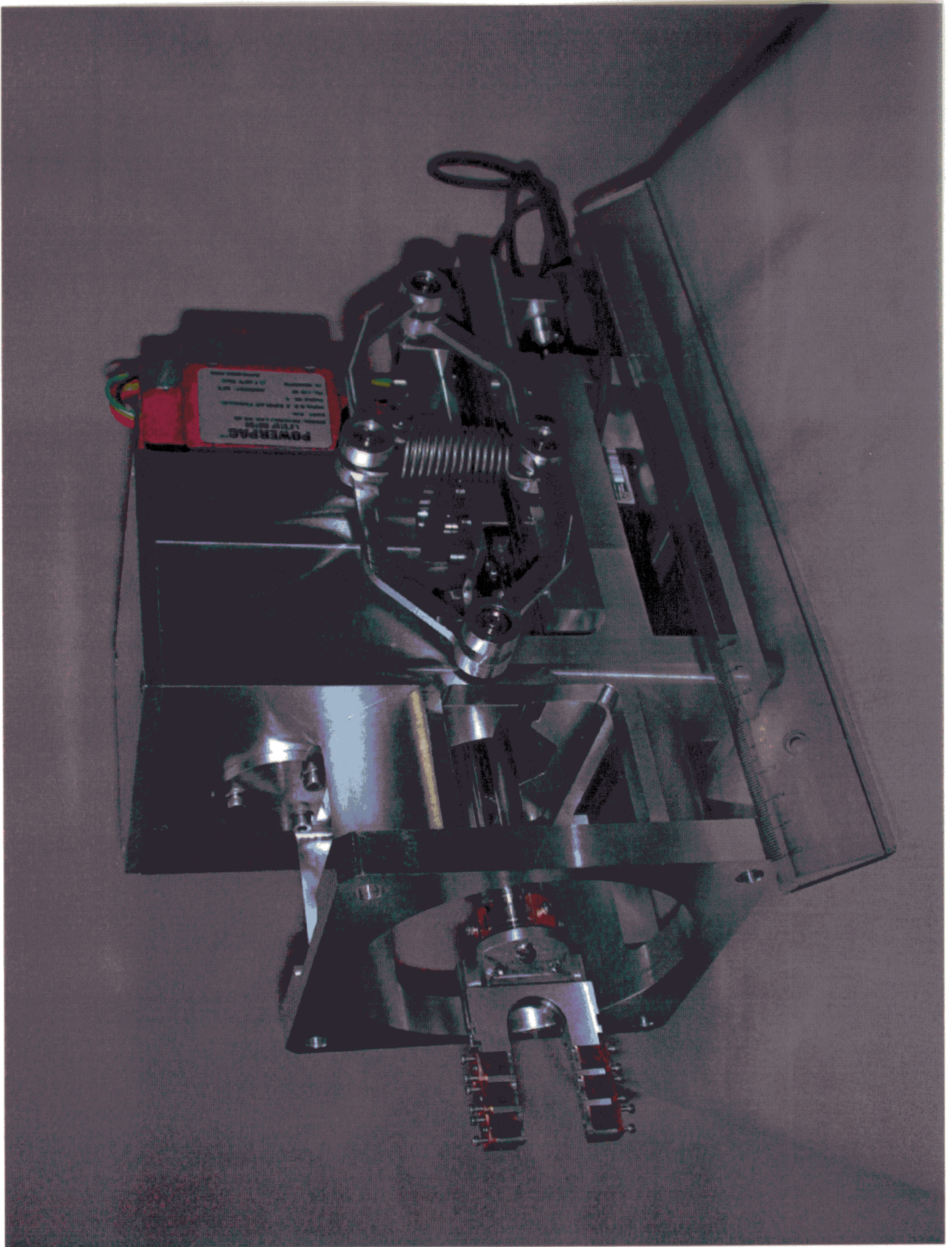


Abbildung 1: Abbildung des Wirescanners.

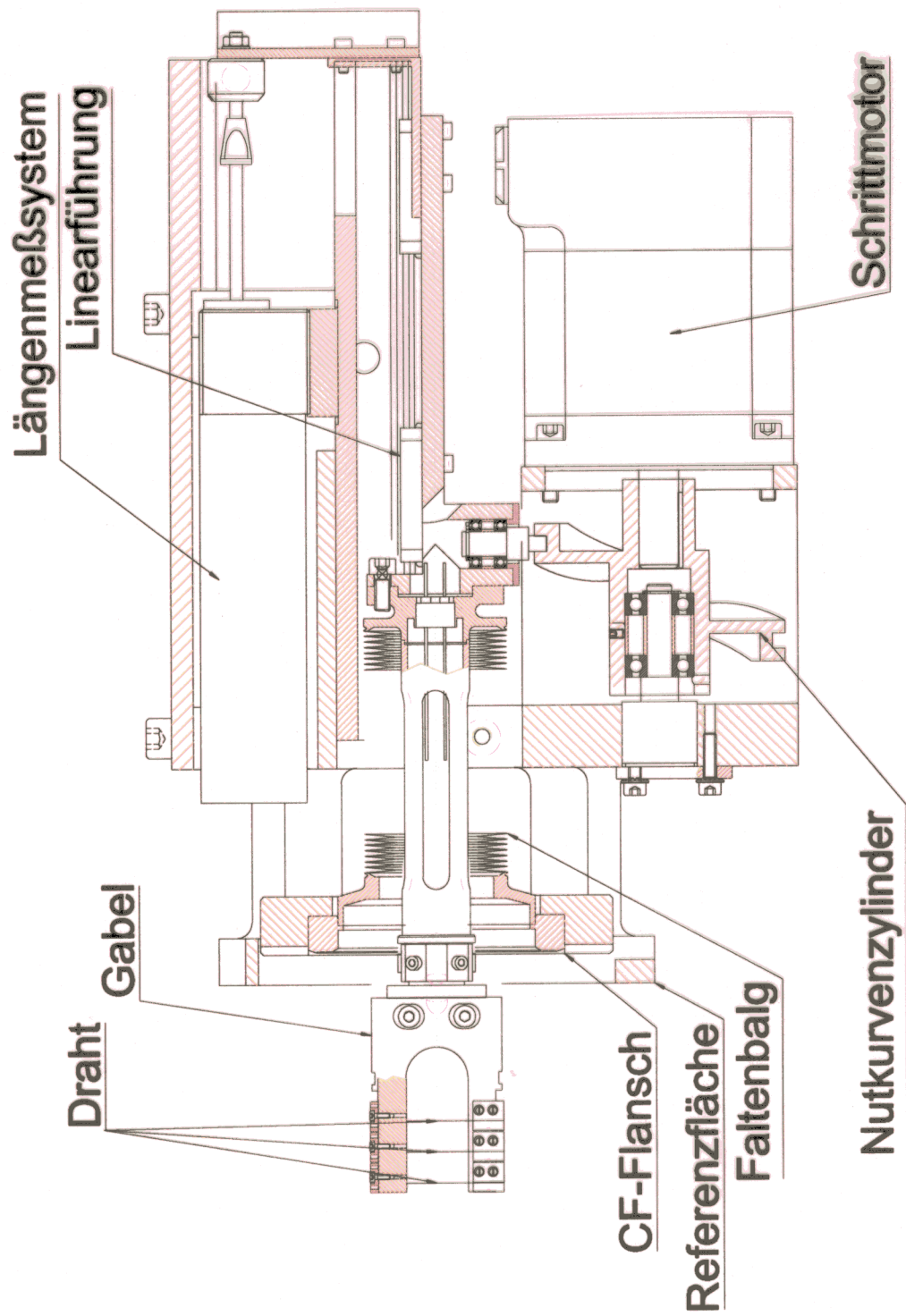


Abbildung 2: Technische Zeichnung des Wirescanners.



Abbildung 3: Nutkurvenzylinder des Wirescanners.

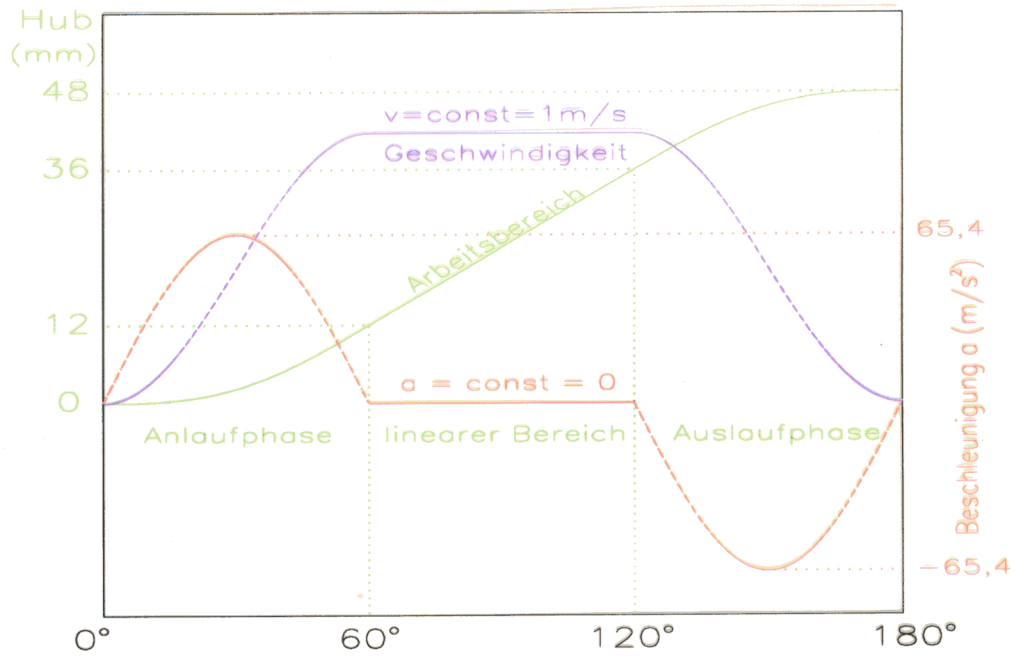


Abbildung 4: Übertragungsfunktion des Nutkurvenzylinders

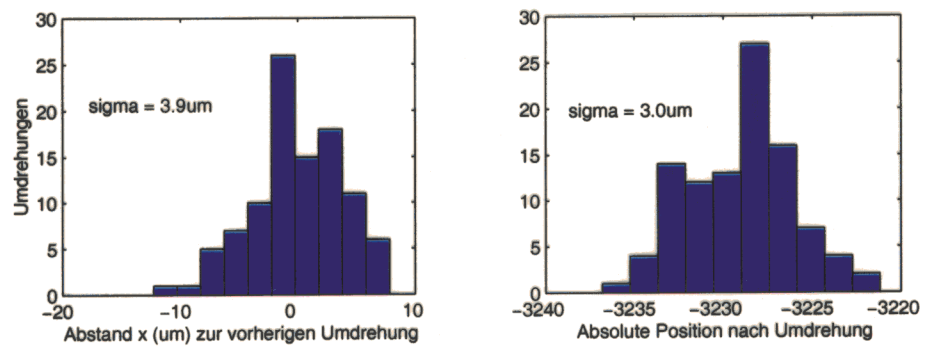


Abbildung 5: Positionierungsgenauigkeit für eine Umdrehung des Nutkurvenzylinders.

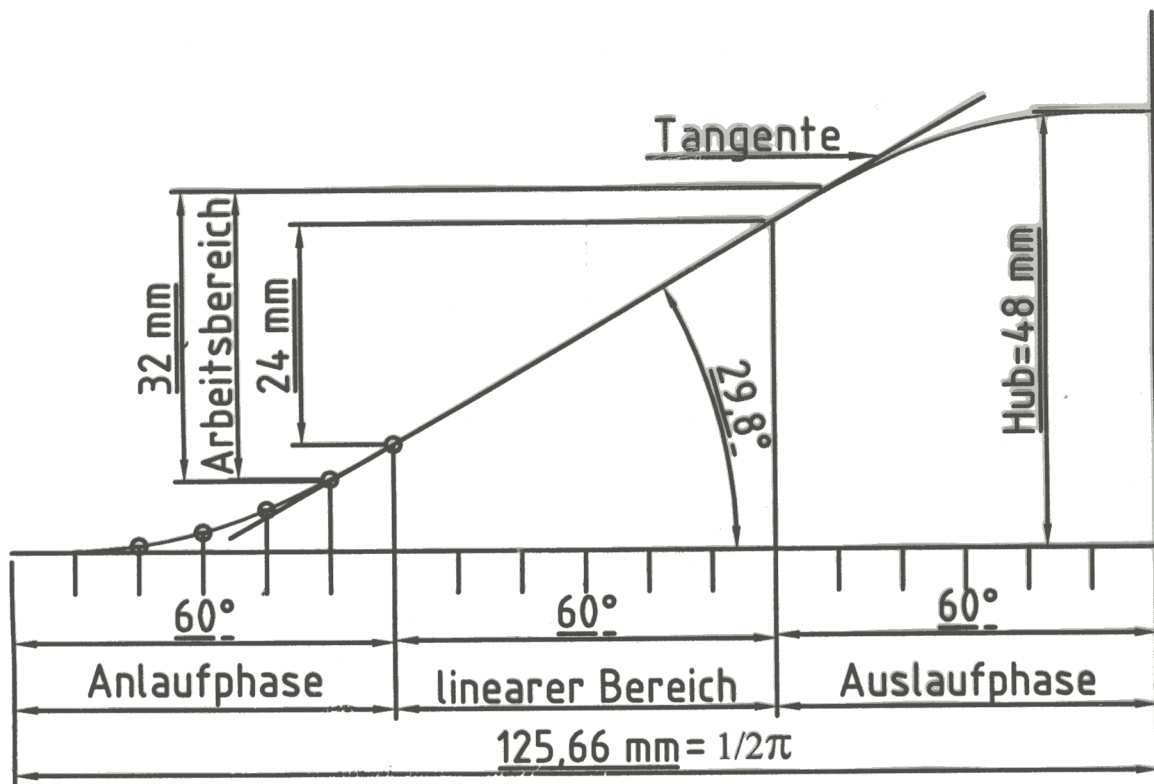
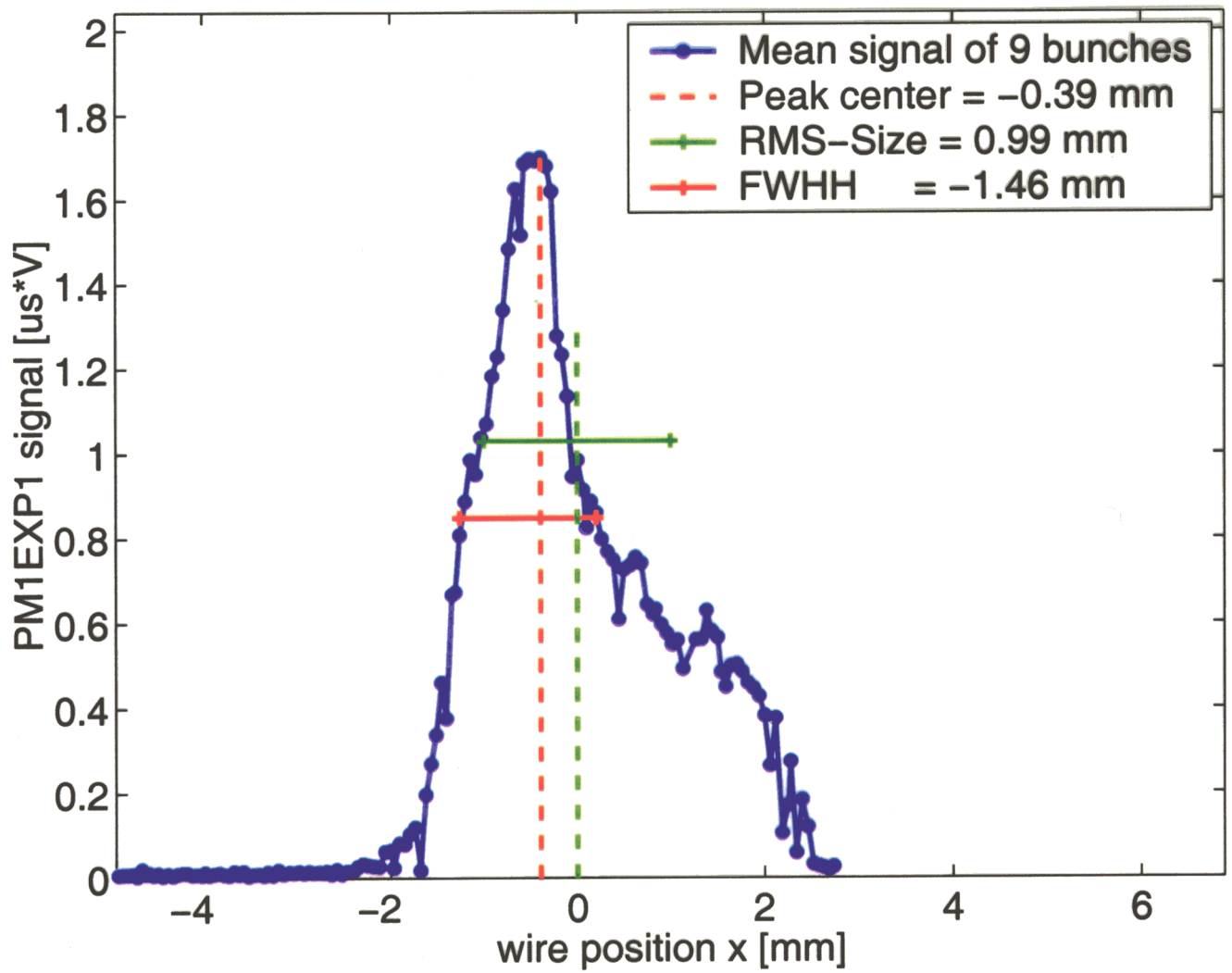
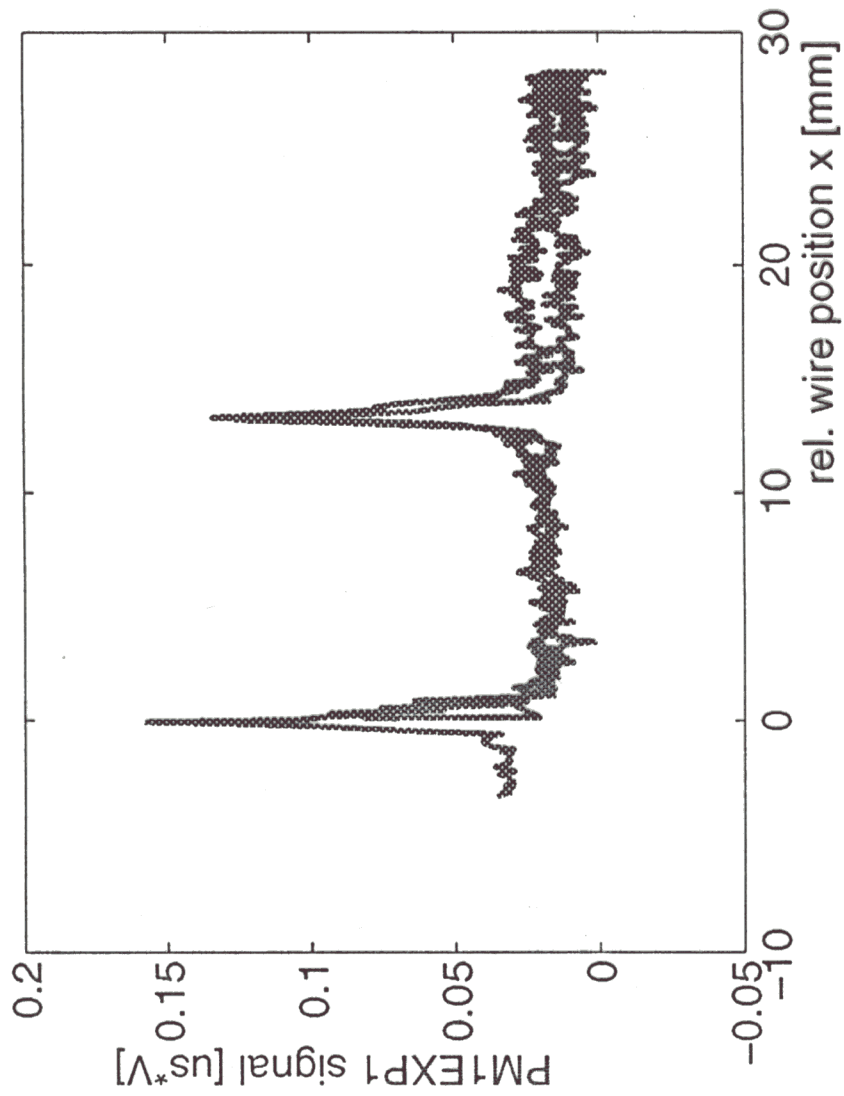


Bild 2: Übertragungsfunktion des Nutkurvenzylinders für den Vorlauf



Met.: W



20 μm Molybdän

10 μm vergoldeter
Sulfuram

Signal level = $z^2 \cdot D^2$

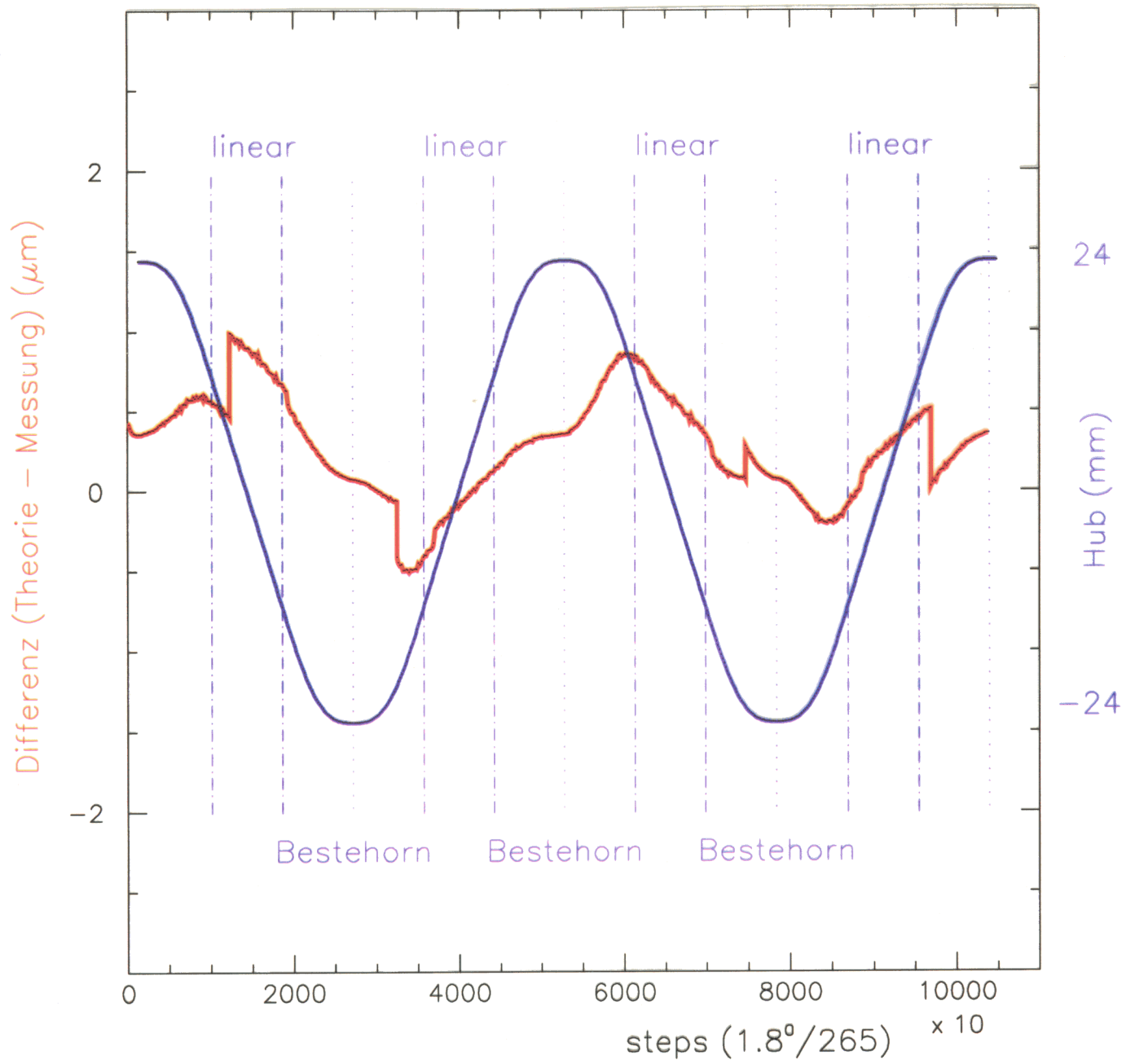
$K_0 \Rightarrow z = 42$

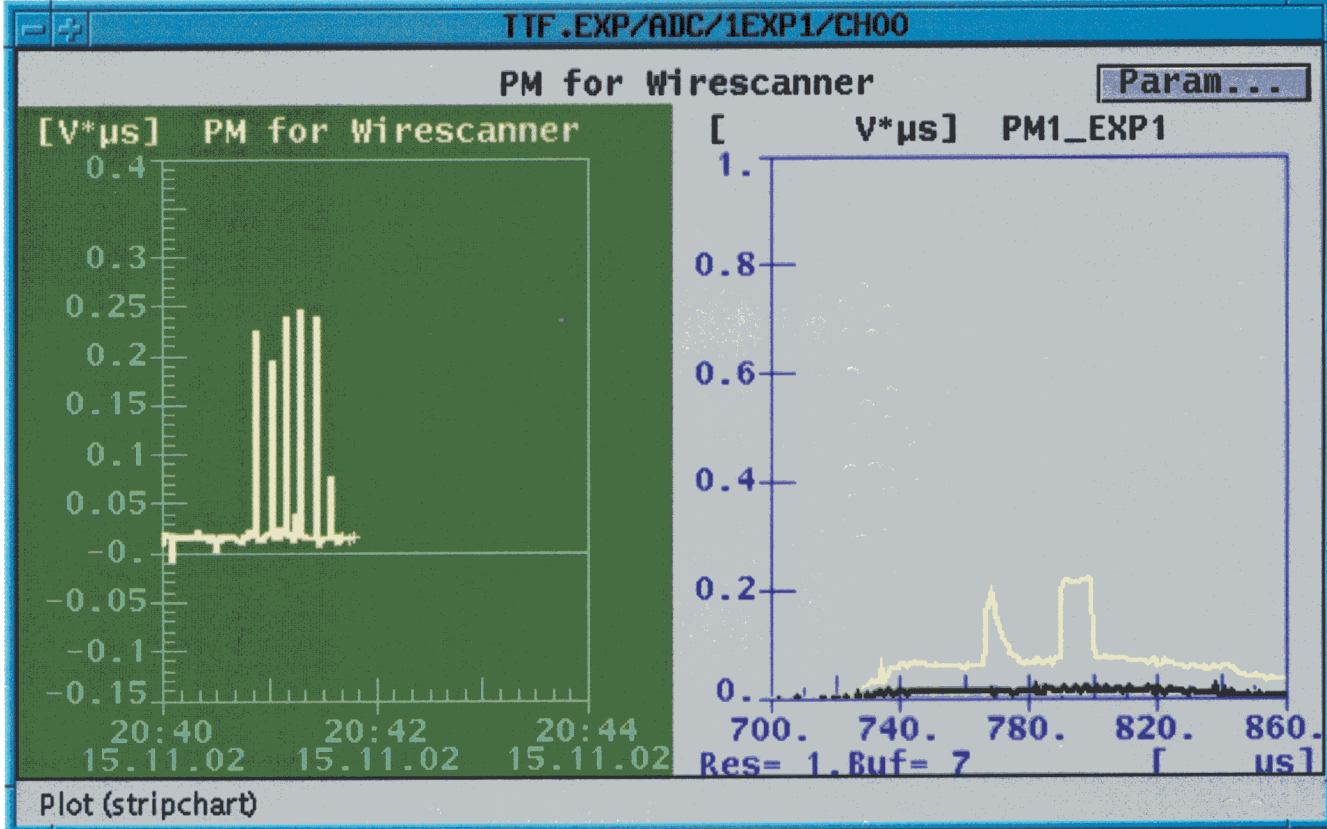
$W \Rightarrow z = 74$

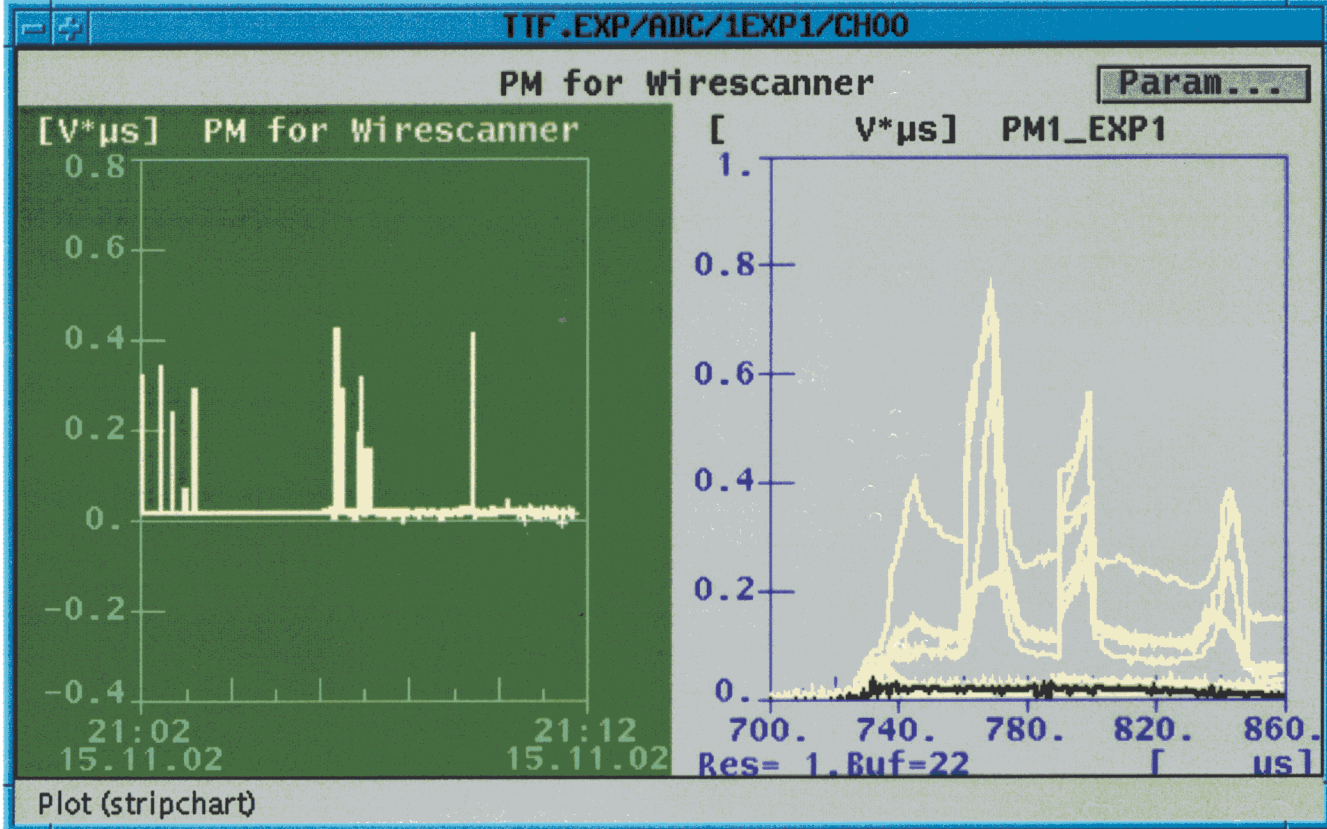
K_0
 \updownarrow
 W
 \updownarrow
 A

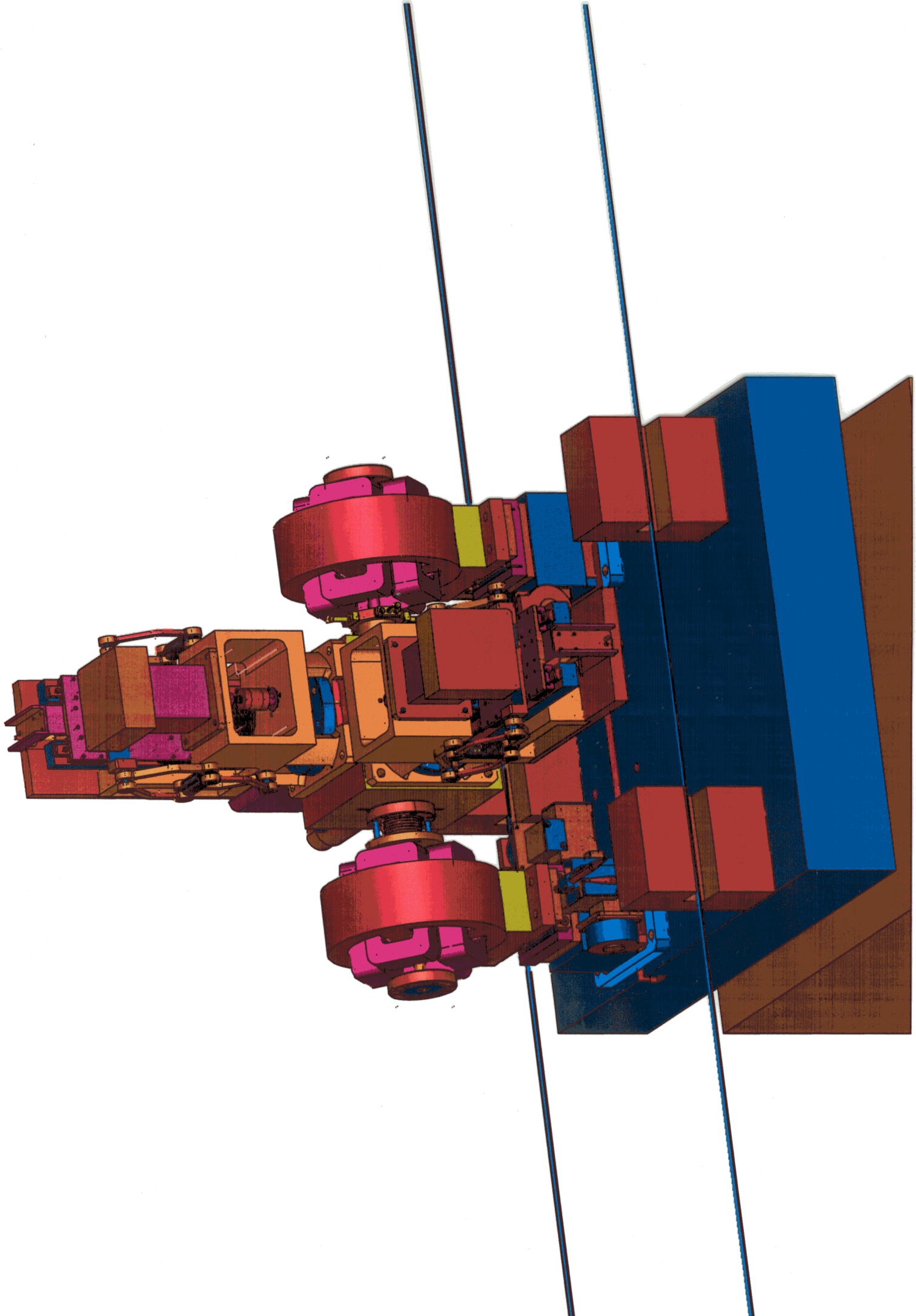
Abbildung 5: Signal des Szintillators PM1EXP1 bei Durchqueren des 10 und 20 μm Drahts.

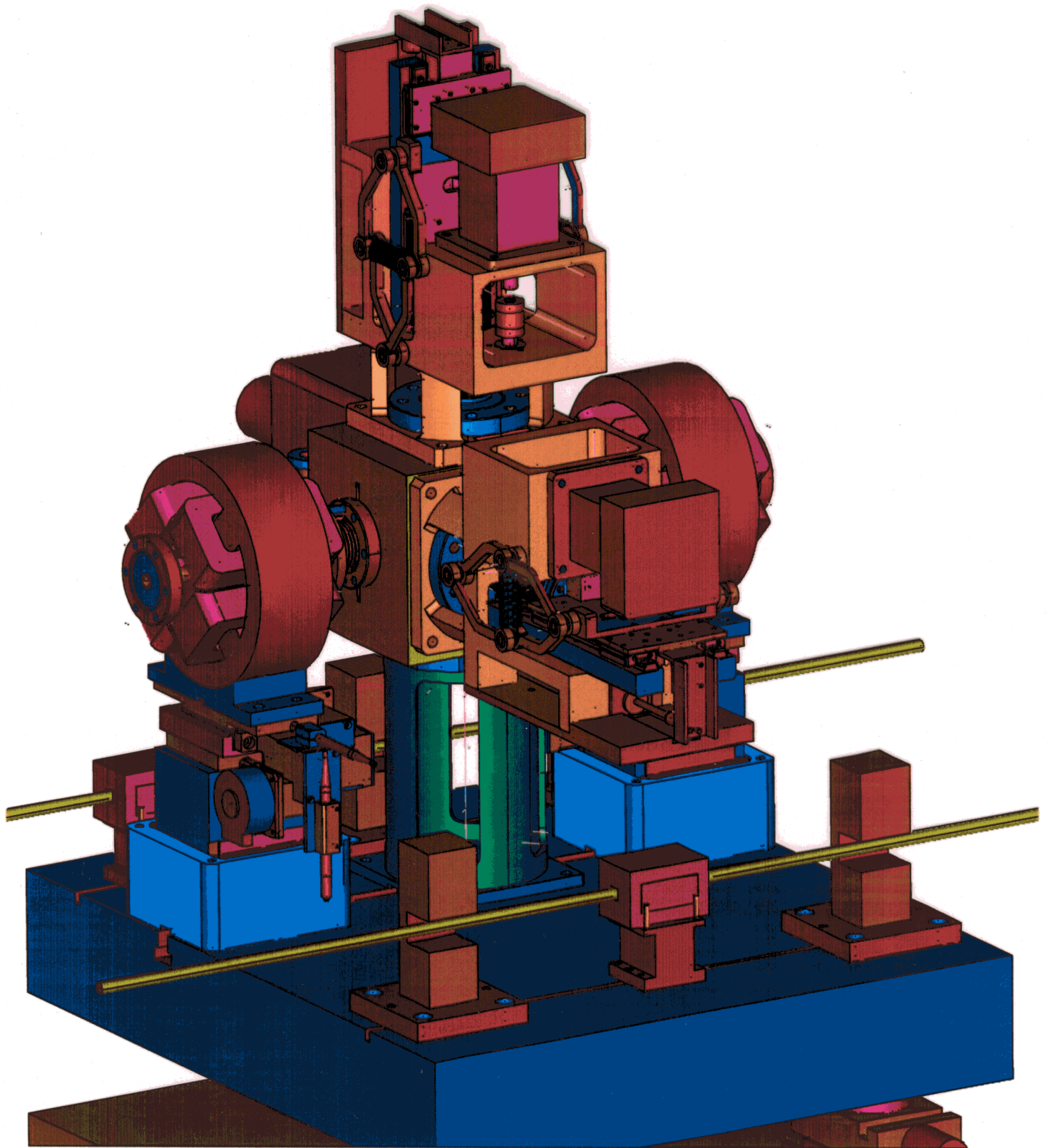
Wirescanner











An der Entwicklung des Wirescanners

haben mitgewirkt

N. von Bargaen

U. Hahn

O. Hensler

S. Karstensen

M. Sachwitz

H. Schlarb

H. Thom

G. Schmidt

Gefertigt wurde der Wirescanner

In den Werkstätten

Zeuthen

und

Hamburg

FEATURES

- Wide Bandwidth: 0.1 GHz to 2.5 GHz Min
- High Dynamic Range: 70 dB to ± 3.0 dB
- High Accuracy: ± 1.0 dB over 65 dB Range @ 1.9 GHz
- Fast Response: 40 ns Full-Scale Typical
- Controller Mode with Error Output
- Scaling Stable Over Supply and Temperature
- Wide Supply Range: +2.7 V to +5.5 V
- Low Power: 40 mW at 3 V
- Power-Down Feature: 60 μ W at 3 V
- Complete and Easy to Use

APPLICATIONS

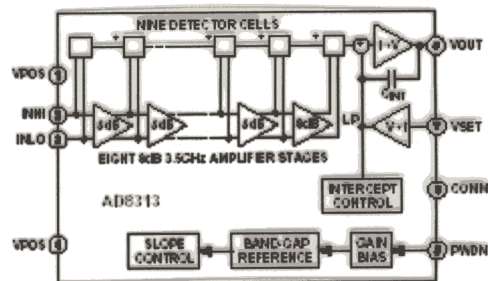
- RF Transmitter Power Amplifier Setpoint Control and Level Monitoring
- Logarithmic Amplifier for RSSI Measurement
- Cellular Base Stations, Radio Link, Radar

PRODUCT DESCRIPTION

The AD8313 is a complete multistage demodulating logarithmic amplifier, capable of accurately converting an RF signal at its differential input to an equivalent decibel-scaled value at its dc output. The AD8313 maintains a high degree of log conformance for signal frequencies from 0.1 GHz to 2.5 GHz and is useful over the range of 10 MHz to 3.5 GHz. The nominal input dynamic range is -65 dBm to 0 dBm (re: 50 Ω), and the sensitivity can be increased by 6 dB or more with a narrow band input impedance matching network or balun. Application is straightforward, requiring only a single supply of 2.7 V–5.5 V and the addition of a suitable input and supply decoupling. Operating on a 3 V supply, its 13.7 mA consumption (for $T_A = +25^\circ\text{C}$) amounts to only 41 mW. A power-down feature is provided; the input is taken high to initiate a low current (20 μ A) sleep mode, with a threshold at half the supply voltage.

The AD8313 uses a cascade of eight amplifier/limiter cells, each having a nominal gain of 8 dB and a -3 dB bandwidth of 3.5 GHz, for a total midband gain of 64 dB. At each amplifier output, a detector (rectifier) cell is used to convert the RF signal to baseband form; a ninth detector cell is placed directly at the input of the AD8313. The current-mode outputs of these cells are summed to generate a piecewise linear approximation to the logarithmic function, and converted to a low impedance voltage-mode output by a transresistance stage, which also acts as a low-pass filter.

FUNCTIONAL BLOCK DIAGRAM



When used as a log amp, the scaling is determined by a separate feedback interface (a transconductance stage) that sets the slope to approximately 18 mV/dB; used as a controller, this stage accepts the setpoint input. The logarithmic intercept is positioned to nearly -100 dBm, and the output runs from about 0.45 V dc at -73 dBm input to 1.75 V dc at 0 dBm input. The scale and intercept are supply and temperature stable.

The AD8313 is fabricated on Analog Devices' advanced 25 GHz silicon bipolar IC process and is available in a 8-lead μ SOIC package. The operating temperature range is -40°C to $+85^\circ\text{C}$. An evaluation board is available.

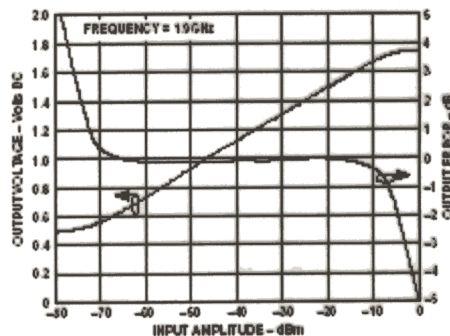
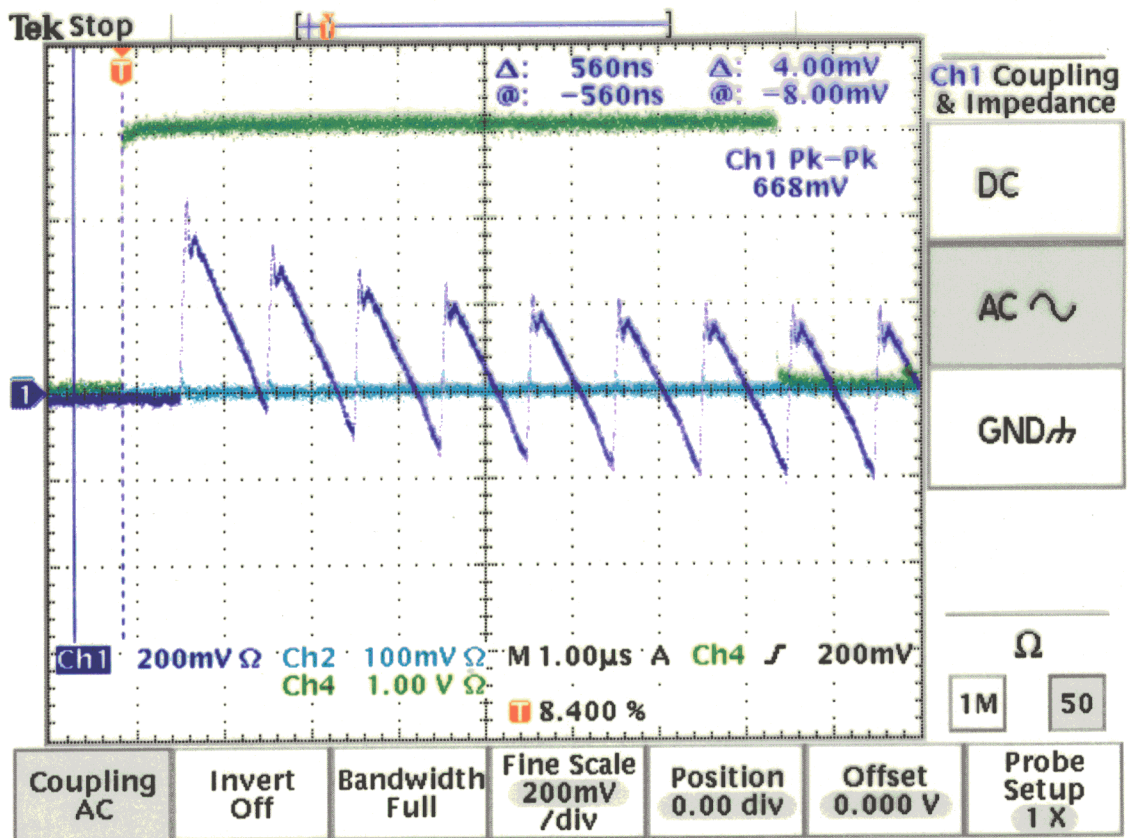
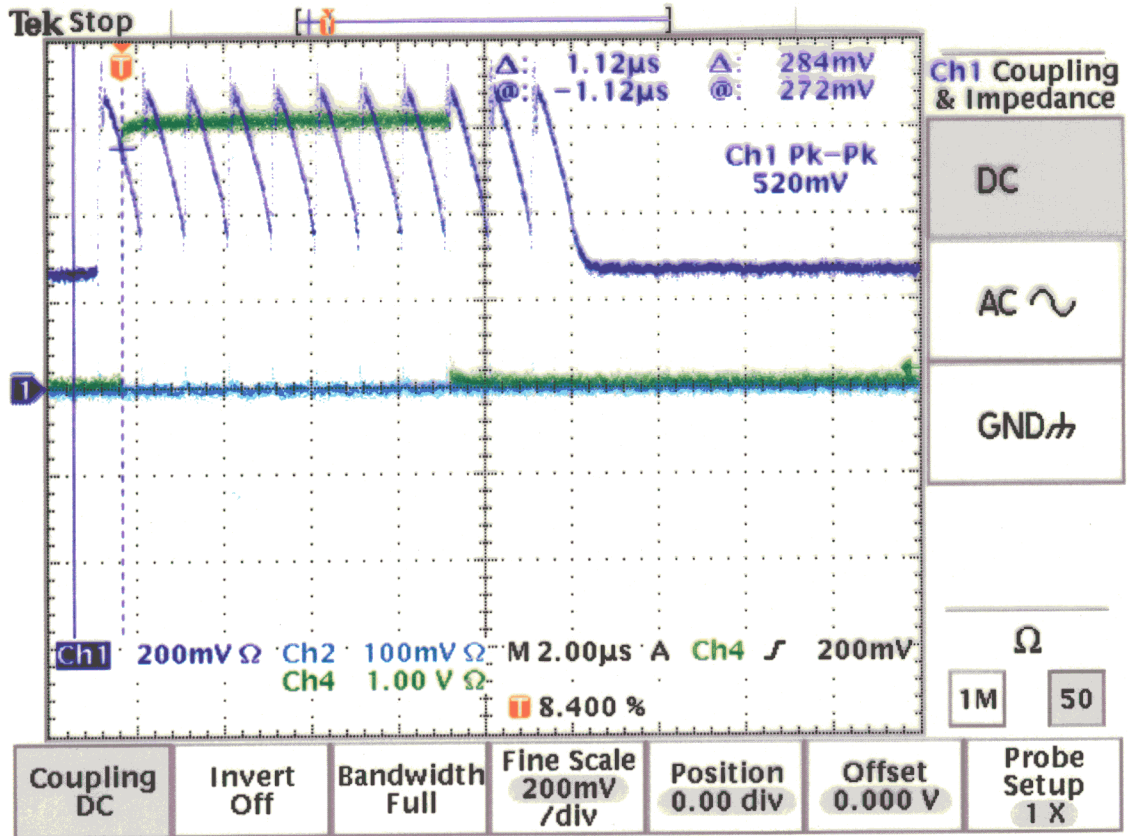


Figure 1. Typical Logarithmic Response and Error vs. Input Amplitude



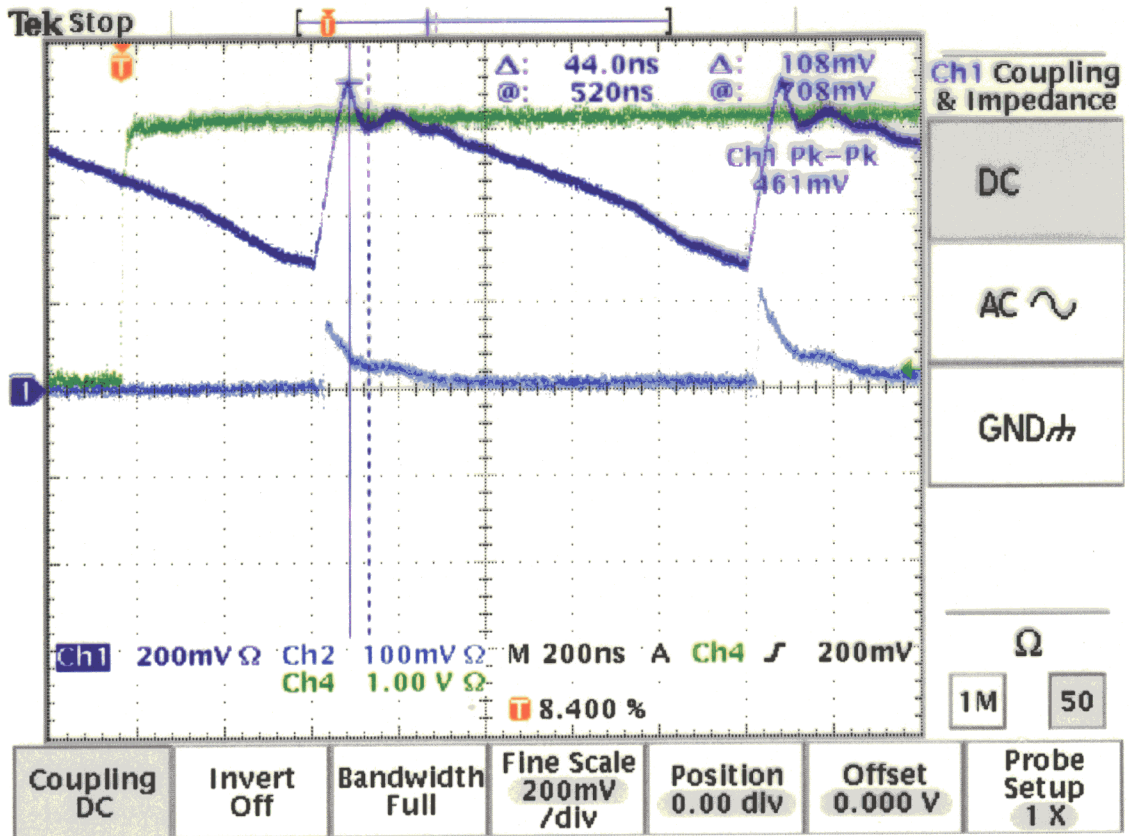
Trigger Signal : Event= A6, Delay Time=2.2ms

Green: Trigger
 Yellow: PED-Signal , AC-coupled
 Blue: PMT-Output Signal



Trigger Signal : Event= A6, Delay Time=2.2ms

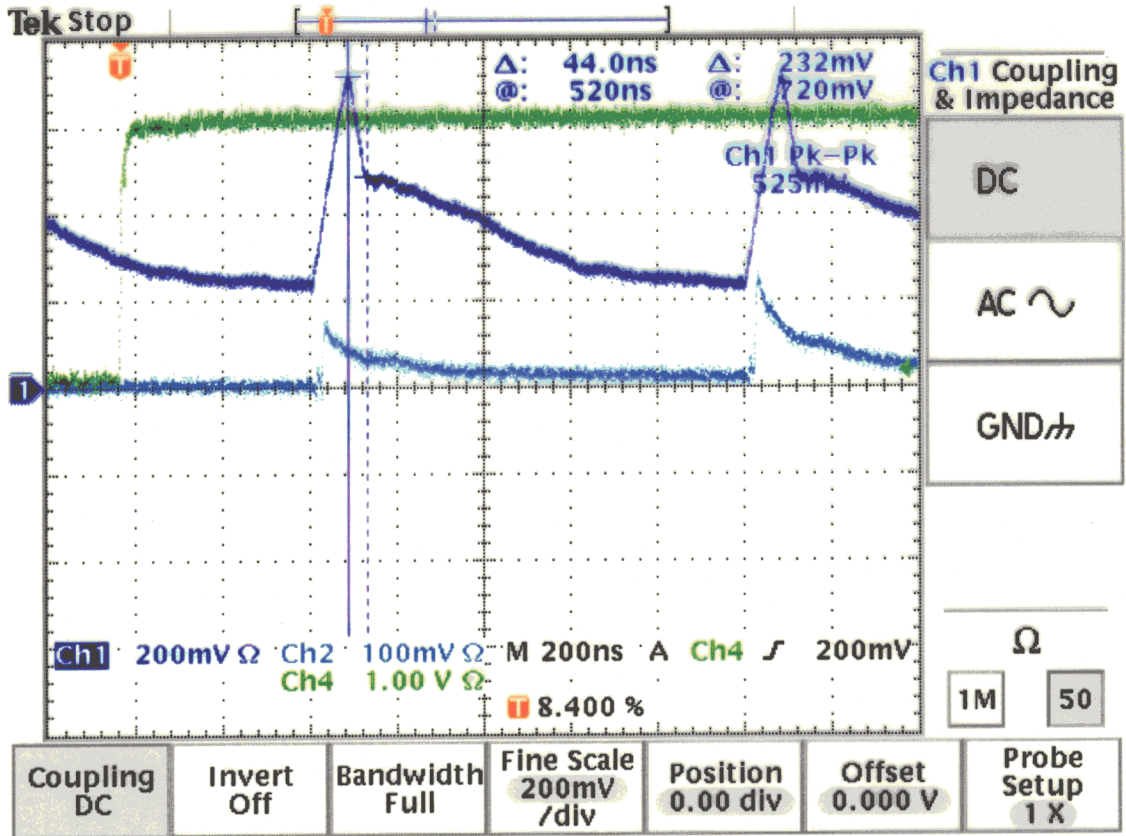
Green: Trigger
 Yellow: PED-Signal , DC-coupled
 Blue: PMT-Output Signal



Trigger Signal : Event= A6, Delay Time=2.2ms

Green: Trigger
Yellow: PED-Signal , DC-coupled
Blue: PMT-Output Signal

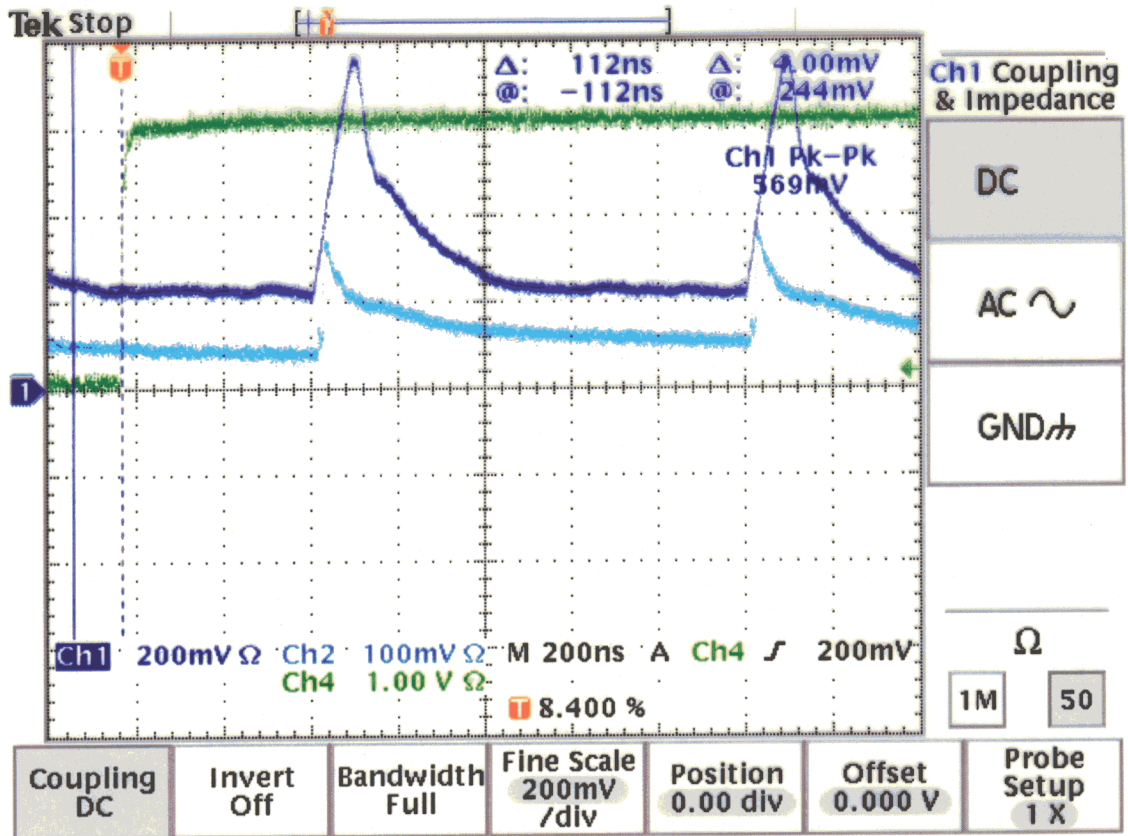
Wirescanner at Position : full OUT



Trigger Signal : Event= A6, Delay Time=2.2ms

Green: Trigger
 Yellow: PED-Signal , DC-coupled
 Blue: PMT-Output Signal

Wirescanner at Position : half IN

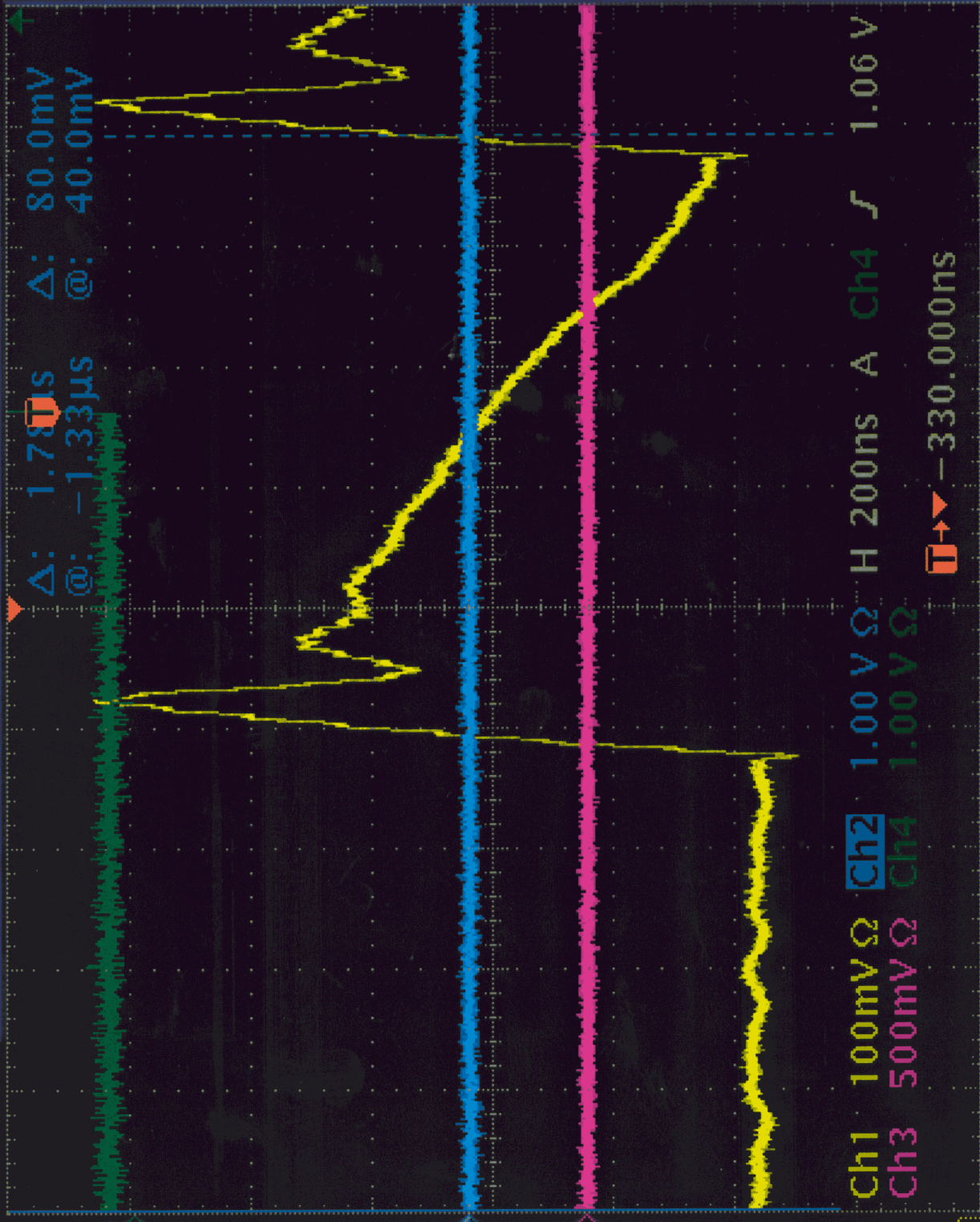


Trigger Signal : Event= A6, Delay Time=2.2ms

Green: Trigger
 Yellow: PED-Signal , DC-coupled
 Blue: PMT-Output Signal

Wirescanner at Position : full IN

lek Stop



Δ : 1.78 μ s
 Δ : 80.0 mV
 Δ : 1.33 μ s
 Δ : 40.0 mV
 Δ : 1.33 μ s
 Δ : 40.0 mV

Ch1 100 mV Ω Ch2 1.00 V Ω H 200 ns A Ch4 \int 1.06 V
 Ch3 500 mV Ω Ch4 1.00 V Ω
 $\square \rightarrow$ -330.000 ns

ch2 Kopplung & Impedanz

DC

AC \sim

GND $\#$

Ω

1M 50

Tastkopf-einstellung 1X

Offset 0.000 V

Position 200 mdiv

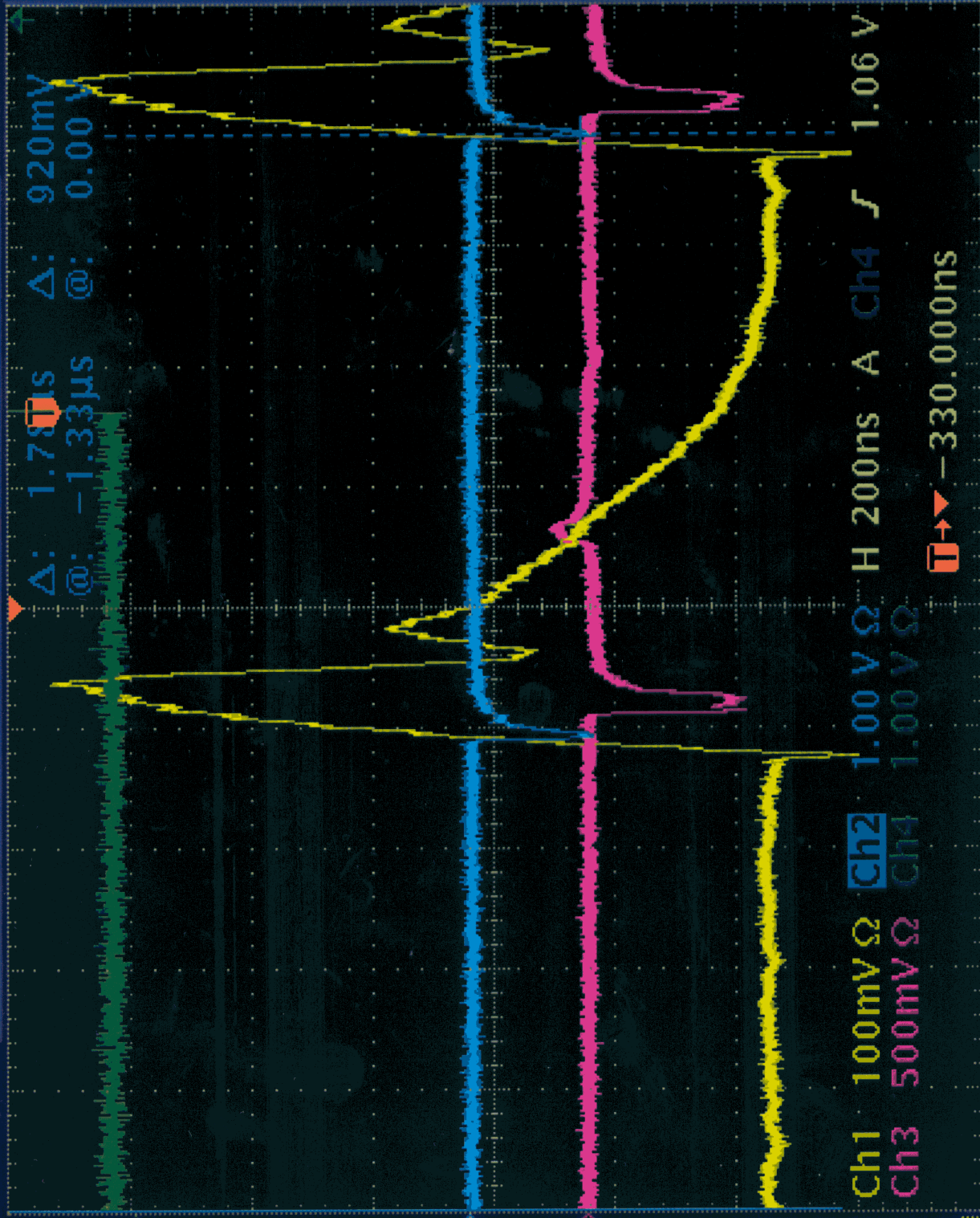
Feinskal. 1.00 V /div

Bandbreite Voll

Invertier. Aus

Kopplung DC

lek Stop



ch2 Kopplung & Impedanz

DC

AC ~

GND

Ω

1M 50

Tastkopf-einstellung 1 X

Kopplung Invertier. Aus

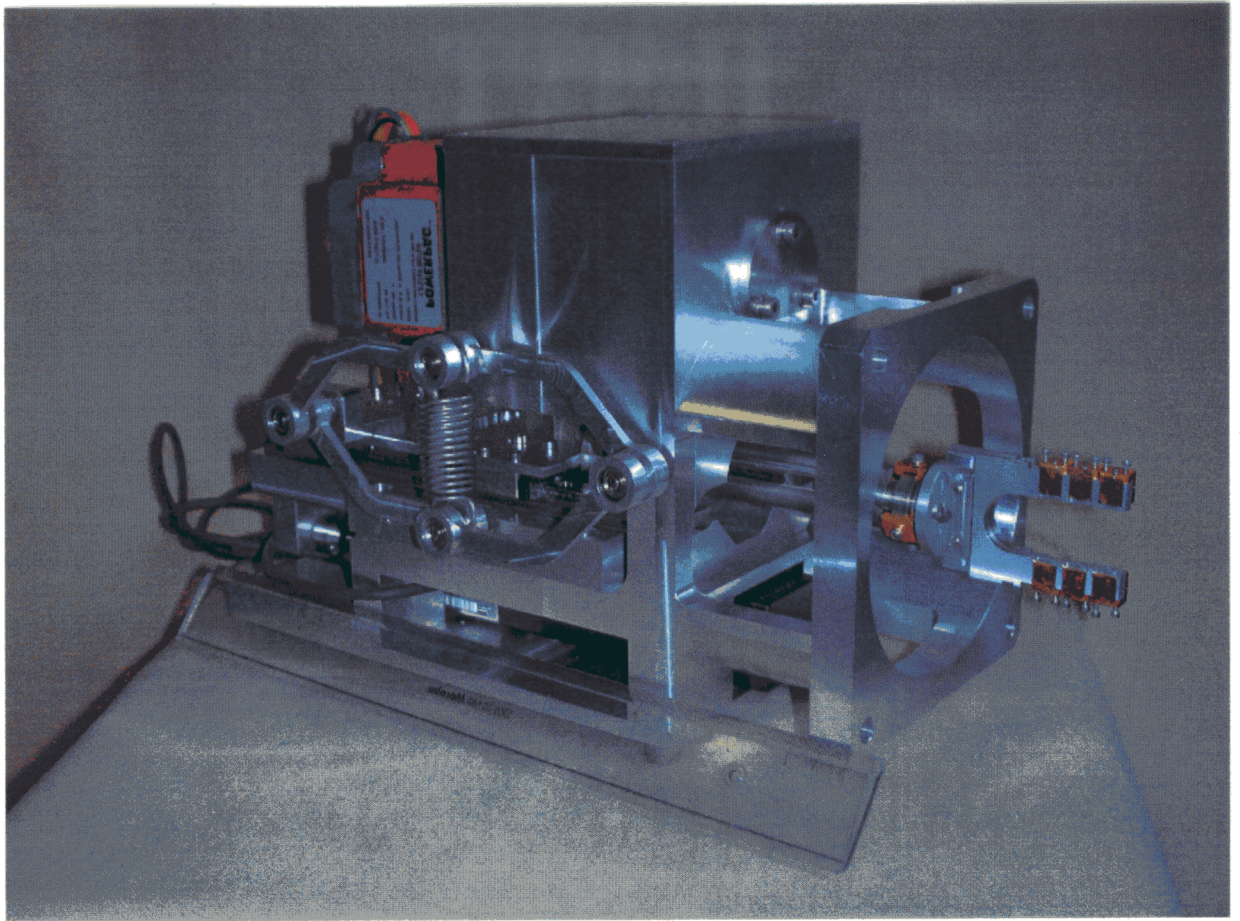
Bandbreite Voll

Feinskal. 1.00 V /div

Position 200mdiv

Offset 0.000 V

Wirescanner für TTF II



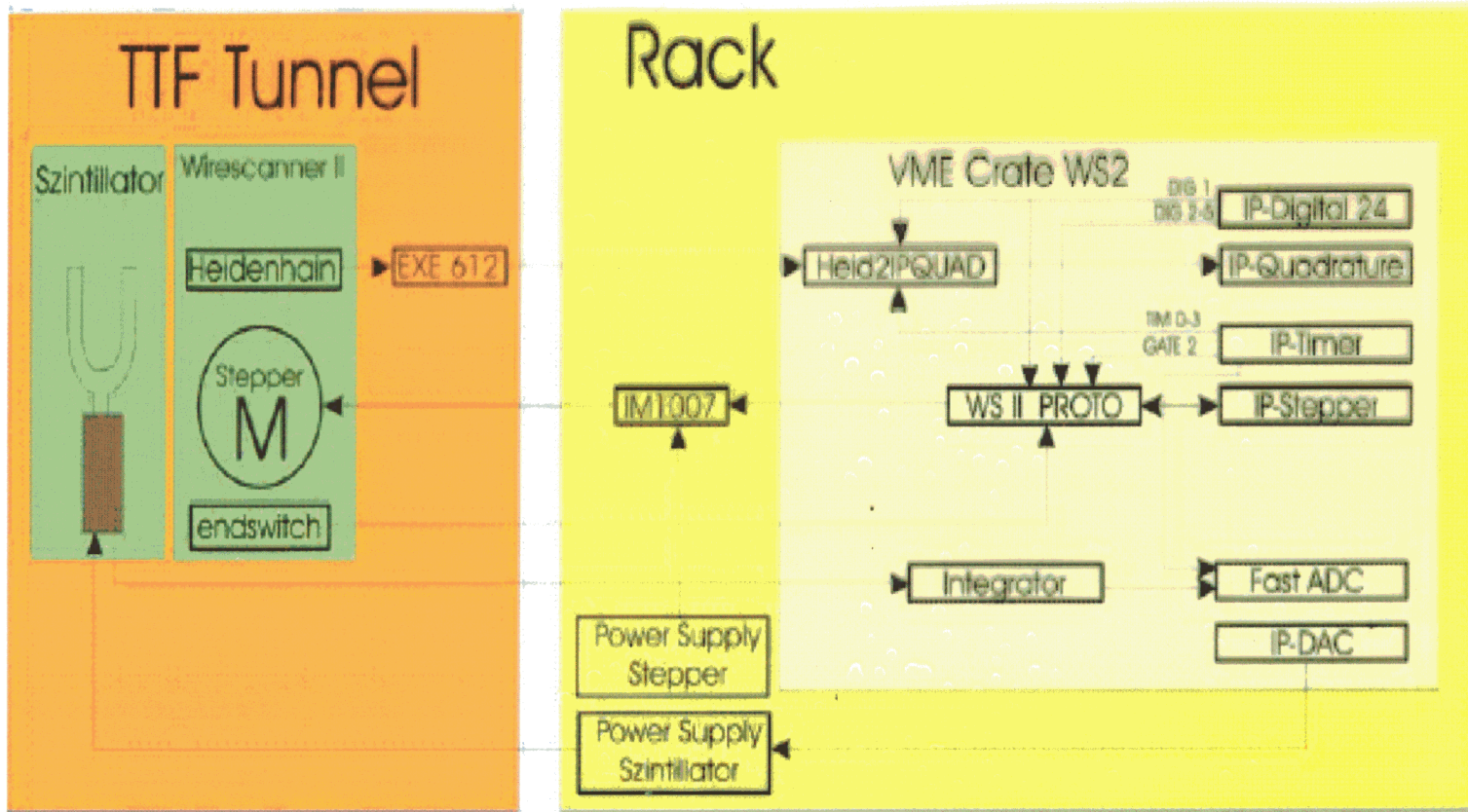
Blockschaltbild

Wirescanner II

Steuerung

Wirescanner II

Blockschaltbild Wirescanner II



Aufgaben Wirescanner Server

Aufnahme der Position mit Hilfe des Heidenhain Meßsystems aus dem IP- Quadrature Module.

Slow Scan: *Einstellung der Scangeschwindigkeit*

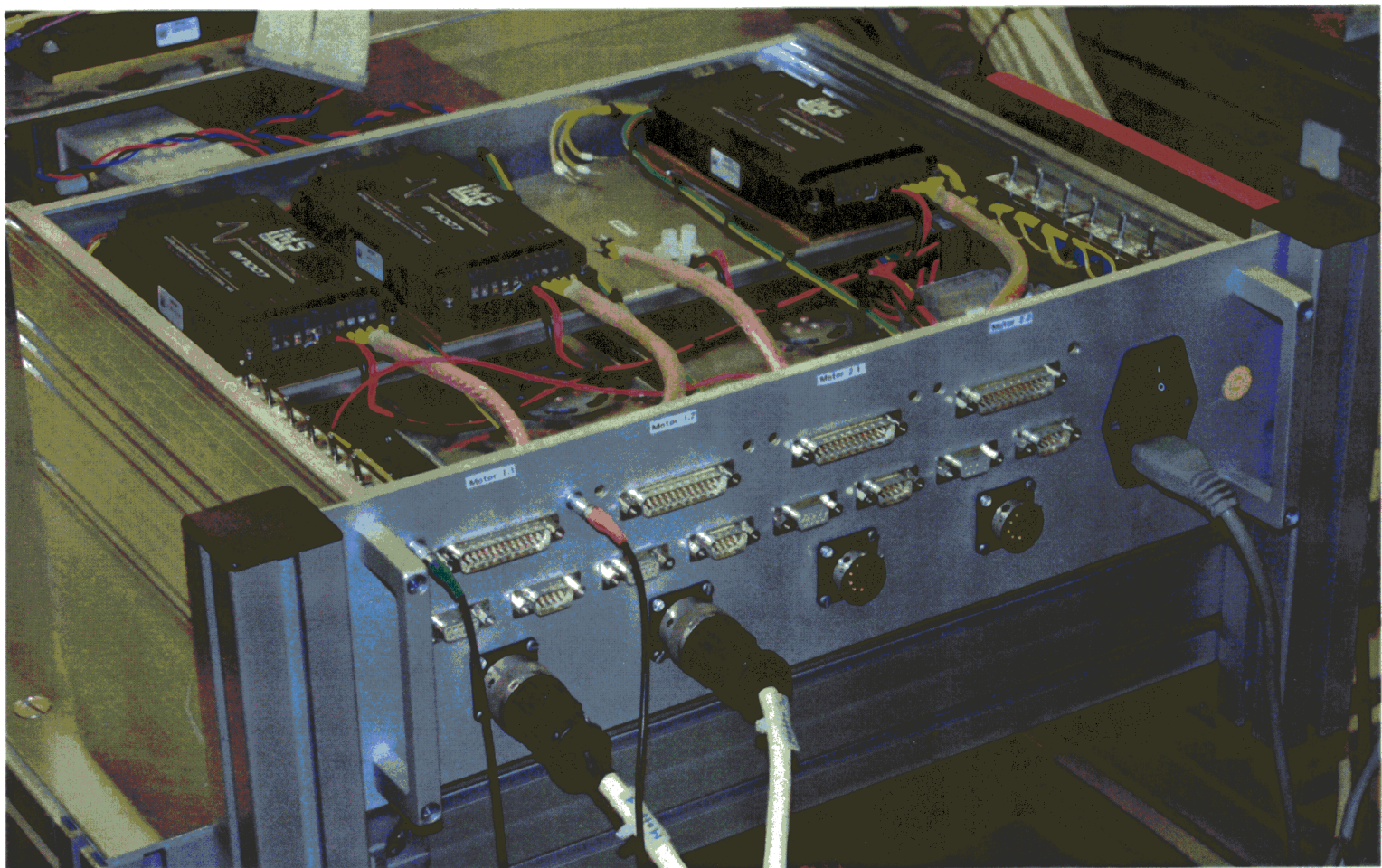
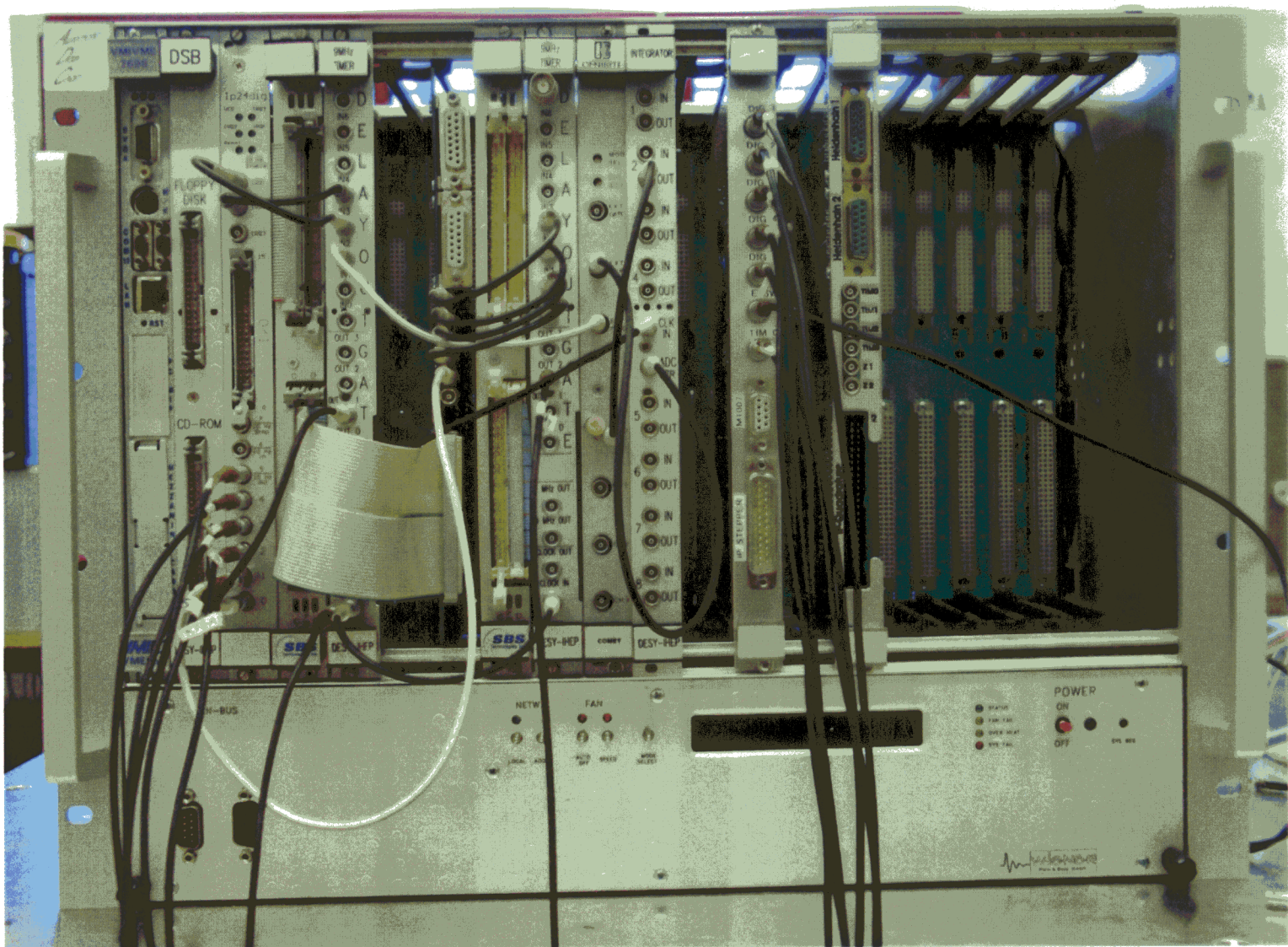
Fast Scan: *Mit Hilfe einer Tabelle (Schritte gegenüber der Drahtposition) Berechnung der nötigen Fahrschritte des Schrittmotors aus Ist- und Sollposition.*

Steuern des Scans :

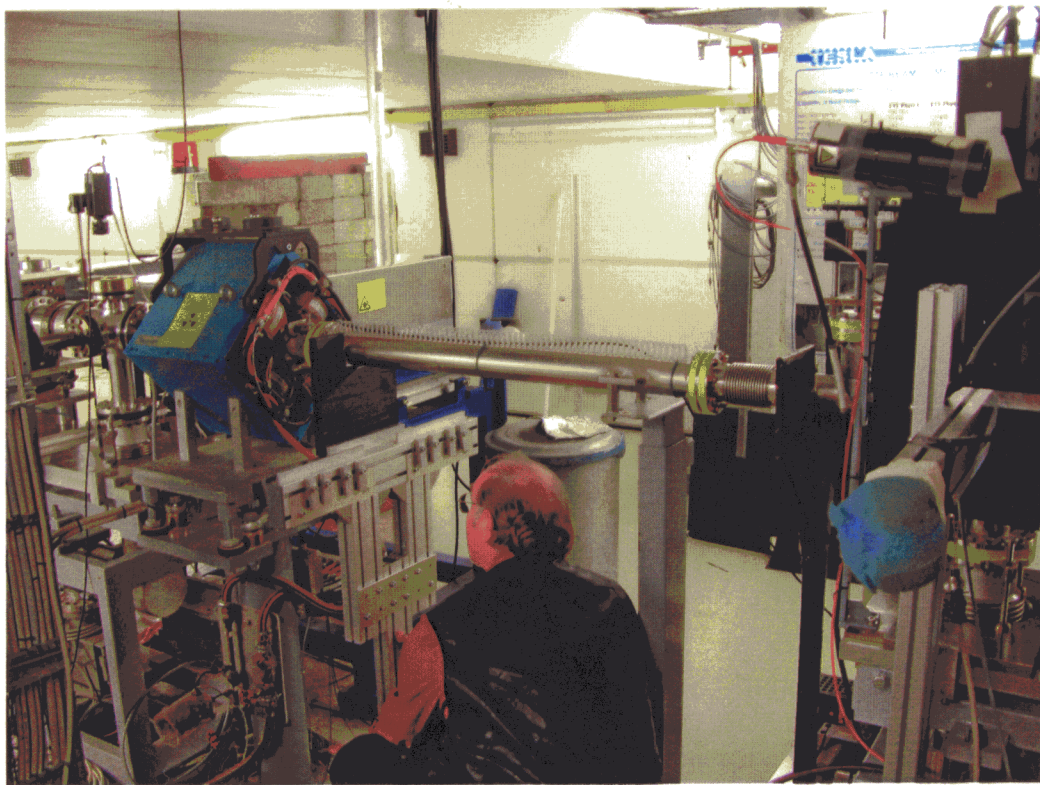
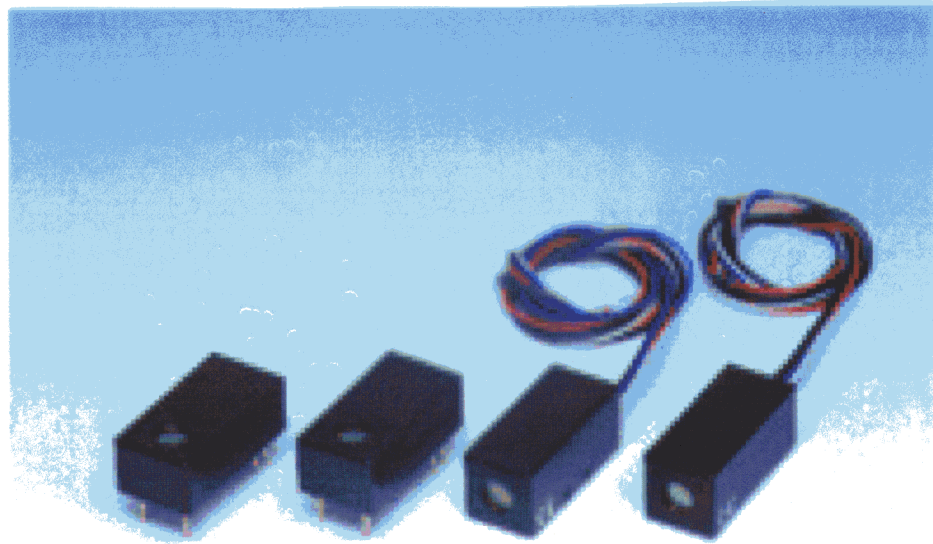
Start/ Stop über Stepper Server

Auslese Szintillator

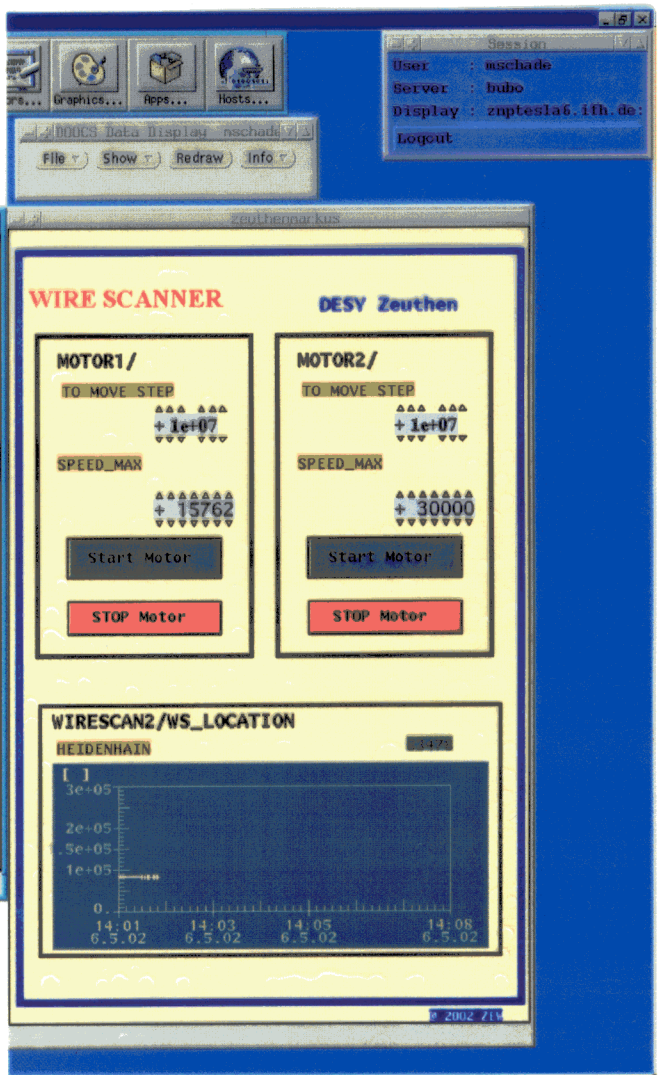
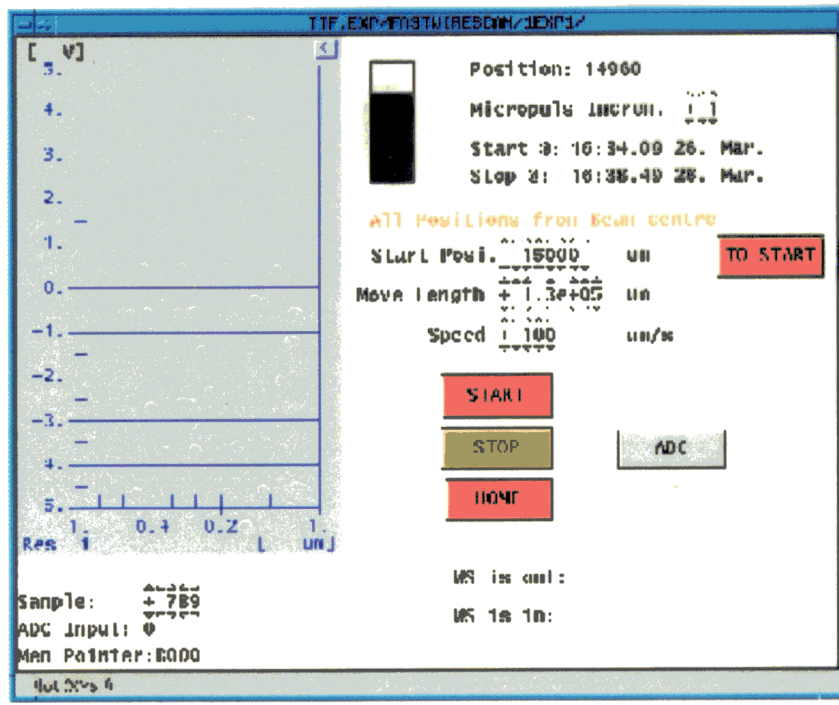
Auslese aus dem Fast ADC



Szintillator Wirescanner II



Steuerung Wirescanner II



Hamburg

Zeuthen