

# Lightning Physics and Effects

Vienna, Austria, May 25 to 27, 2009

## **Resumption of Lightning Measurements at the TV-Tower “Hoher Peissenberg”**

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# Removal of the top of the Peissenberg Tower October 2007

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# Installation of the new top of the Peissenberg Tower October 2007

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# Current measurement



**Tower top**  
Current sensor  
di/dt- sensor  
Franklin rod



**Tower base**  
Shielded cabin with the  
measuring equipment

# Combined sensor

## Metallic cage

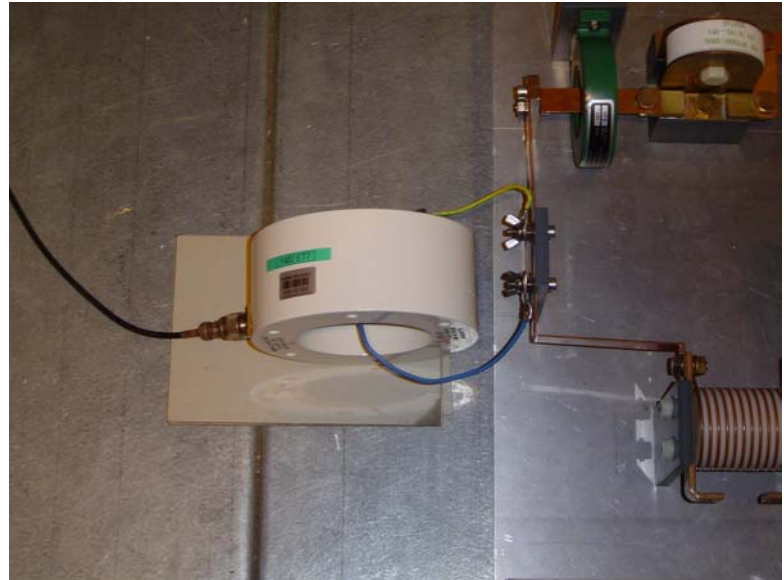
- Shielding
- Protection against pollution, insects and rain





# di/dt- Sensor

- Type: EG&G, IMM-4
- Technical data:  
 $U = M \cdot di/dt, \quad M = 0,5 \cdot 10^{-9} \text{ H}$ 
  - Bandwidth limit  $> 1,4 \text{ GHz}$
  - Rise time  $< 0,25 \text{ ns}$
  - Mass  $\sim 6 \text{ kg}$
  - Connector  $50 \Omega$ , type N
- Current risetime:
  - $\leq 1 \mu\text{s}, \quad \text{error: } < 2 \%$
  - $\sim 10 \mu\text{s}, \quad \text{error: } 17 \%$
  - $\sim 25 \mu\text{s}, \quad \text{error: } 34 \%$



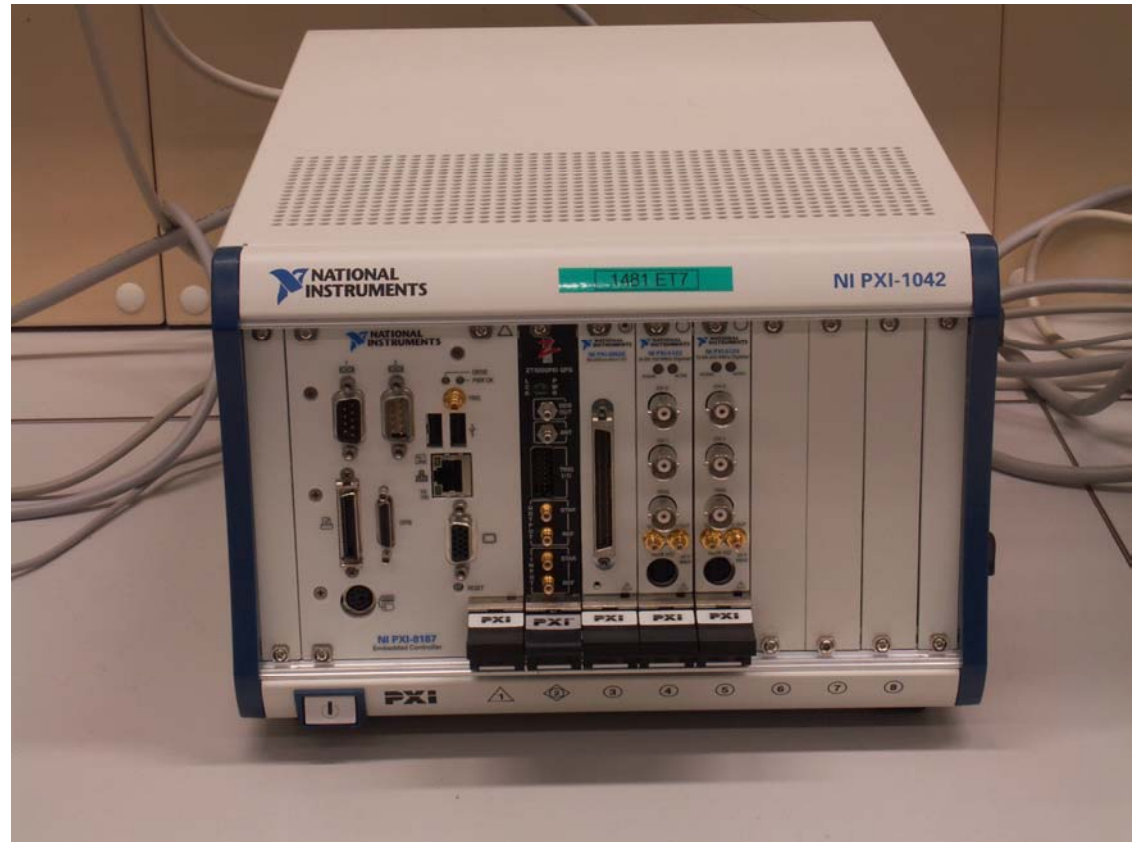
# Measuring cable from tower top

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- Cable
  - Type: RG 218/U, 50  $\Omega$ , about 120 m
  - Type: RG 214, 50  $\Omega$ , about 30 m
- Attenuation
  - Upper bandwidth limit: ~ 40 MHz (3 dB)

# Recording system

- NI PXI-1042 Chassis
  - PXI - Controller
  - 8 PXI – slots
  - PXI – bus
- Software
  - Windows XP
  - Labview



# PXI - Cards

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- **NI PXI – 5122: 2 channel digitizer card**
  - 14 Bit digitizer, 100 MHz sampling, 512 Mbyte RAM/channel
  - Measuring time: 2,56 s with 10 ns sample interval
  - Used for the current measurements
- **NI PXI – 5124: 2 channel digitizer card**
  - 12 Bit digitizer, 200 MHz sampling, 512 Mbyte RAM/channel
  - Measuring time: 1,28 s with 5 ns sample interval  
(2,56 s with 10 ns sample interval)
  - Used for the measurement of the current derivative
- **ZT 1000 PXI Star card clock**
  - Time stamp via GPS

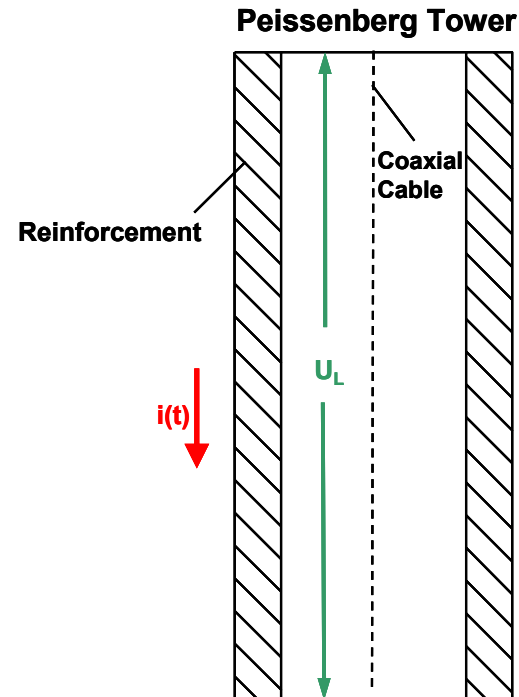
# Grounding

- Maximum voltage drop:

$$U_{L/\max} = i_{\max} \cdot R_{\text{Reinforcement}}$$

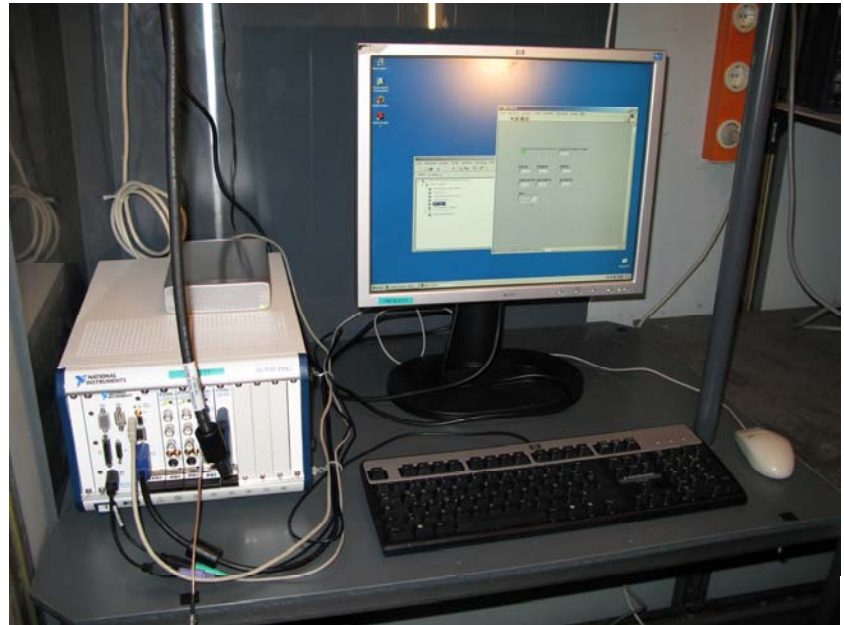
$$R_{\text{Reinforcement}} \approx 2,7 \text{ m}\Omega$$

- Grounding only at tower top
  - Isolation at the tower base
  - Power supply by isolating transformer
  - Data transfer by fibre optical link

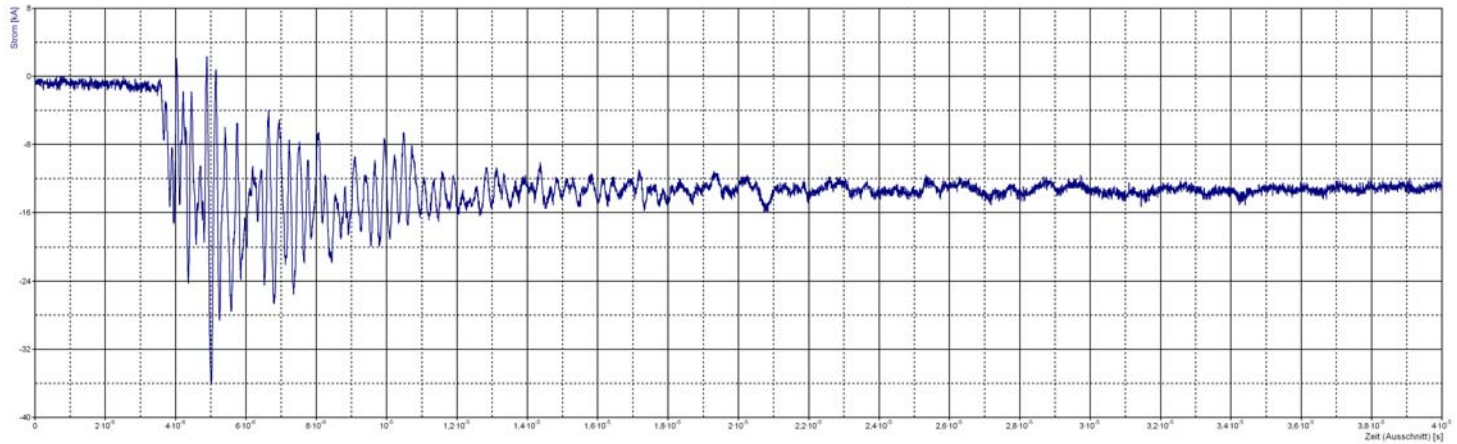
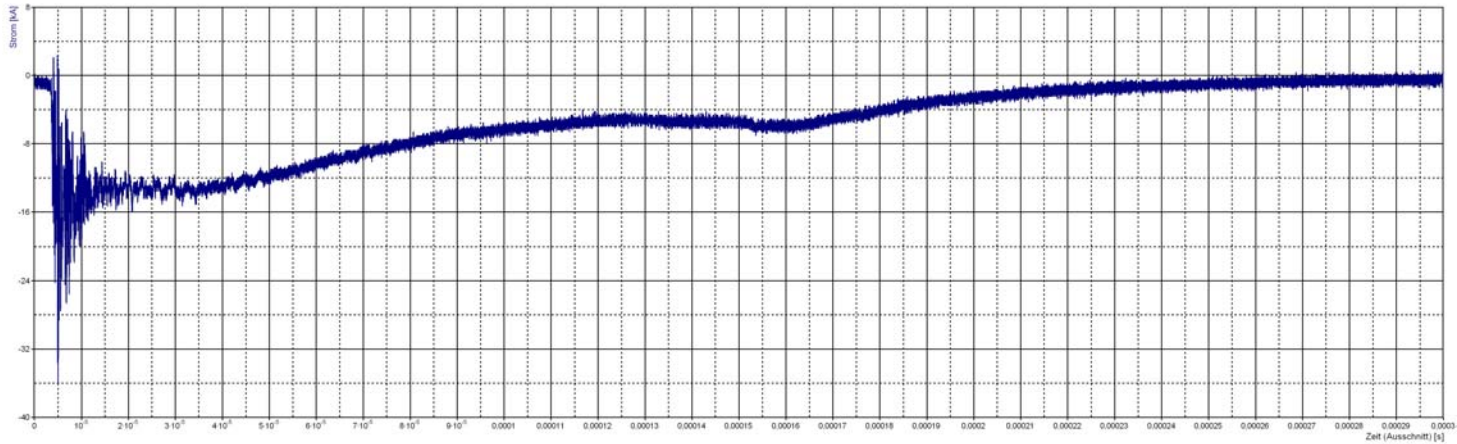


# Measuring cabin

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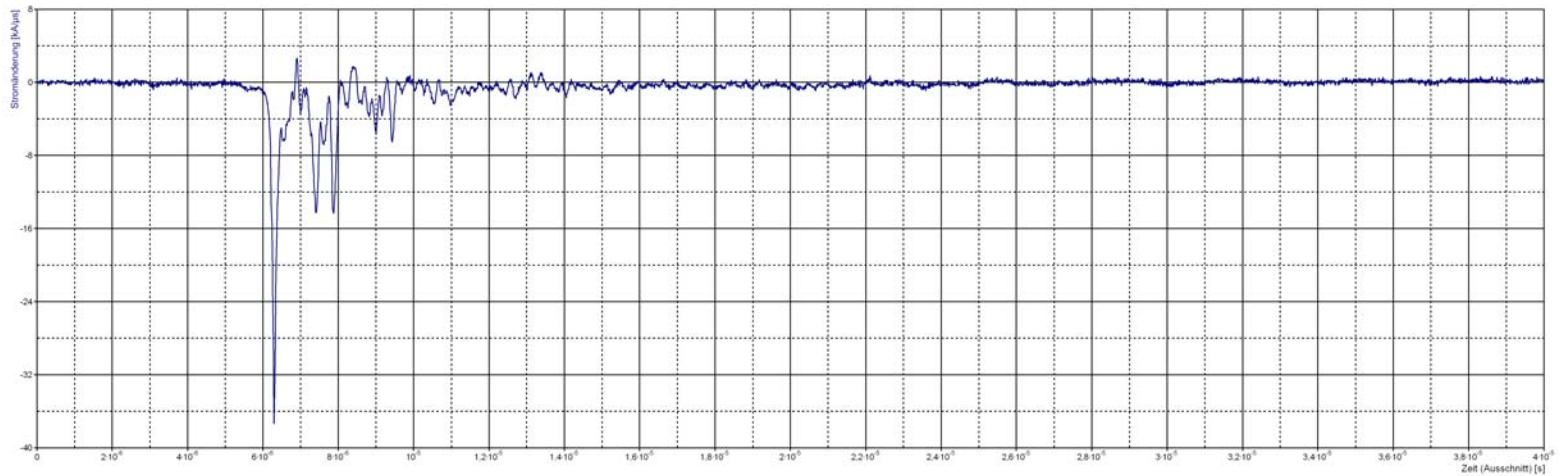


# Example of impulsive current



# Current derivative of impulsive current

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# Conclusion

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- Since October 2008 the currents and current derivatives of 5 lightning to the tower are recorded. The currents show typically oscillations during the rise.
- In 2009 a field measuring station will be installed in about 200 m distance from the tower.

