A didata acquisition system with optical inputs gital

- Usage in electrical energy technique –

1. Problems to face during measurements in electrical energy technique
2. Behavior during measurements in electrical fields
3. Behavior during measurements in magnetic fields
4. Propagation delay shifting through optical fiber of different length
5. Practical use of optical fibers in High Power Labs
6. Special features needed in High Power Labs

The different measurement tasks in the electrical energy technique are always related with the same kind of problems

High electrical or magnetic Fields which are changing extremely fast

Need for measurements on different electrical potentials

Because measurements typically are not done under laboratory conditions, a mechanically ruggedized measurement system as well as a mechanically ruggedized fiber connection is essential

The measurement System must be placed very close to the data source, because extension of cables reduces the accuracy

There is a very important need of a high EMI robustness. This means immunity against External EMI as well as low electromagnetic emmission

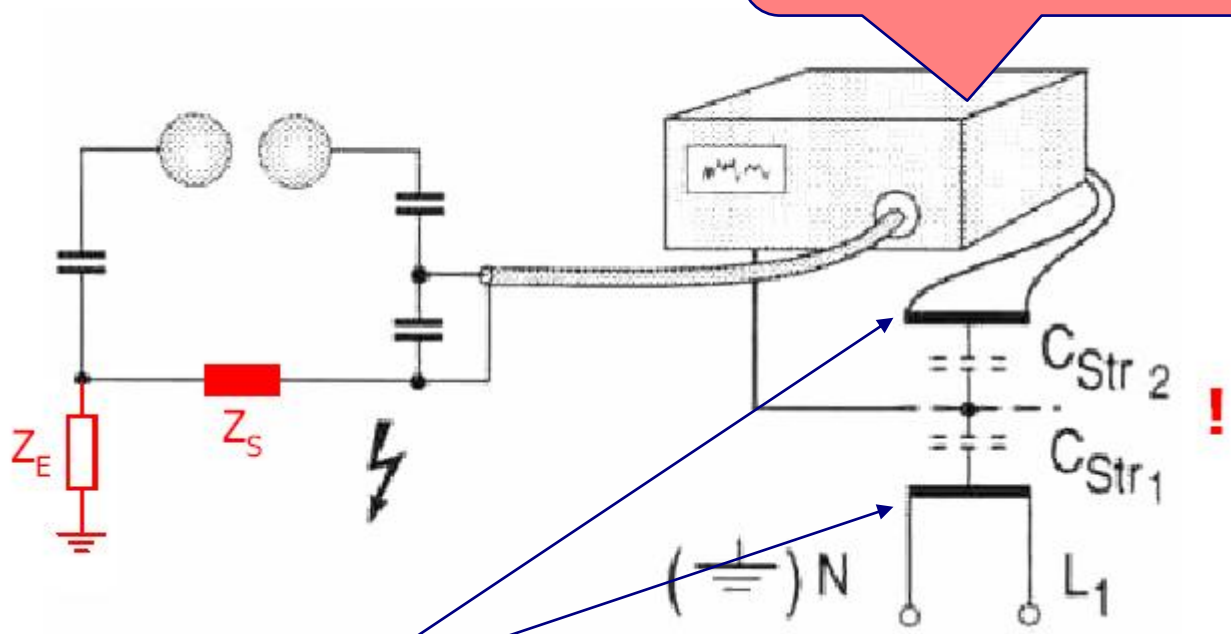
In case of complex electrical energy measurement tasks there is the risk to create ground loops galvanically or due to parasitical capacities

Measurements have to be made in a wide dynamic range - therefore high samplerates together with long measurement times causes the need of big storage capacities

The need for measurements on different potentials

Usage of isolation transformers

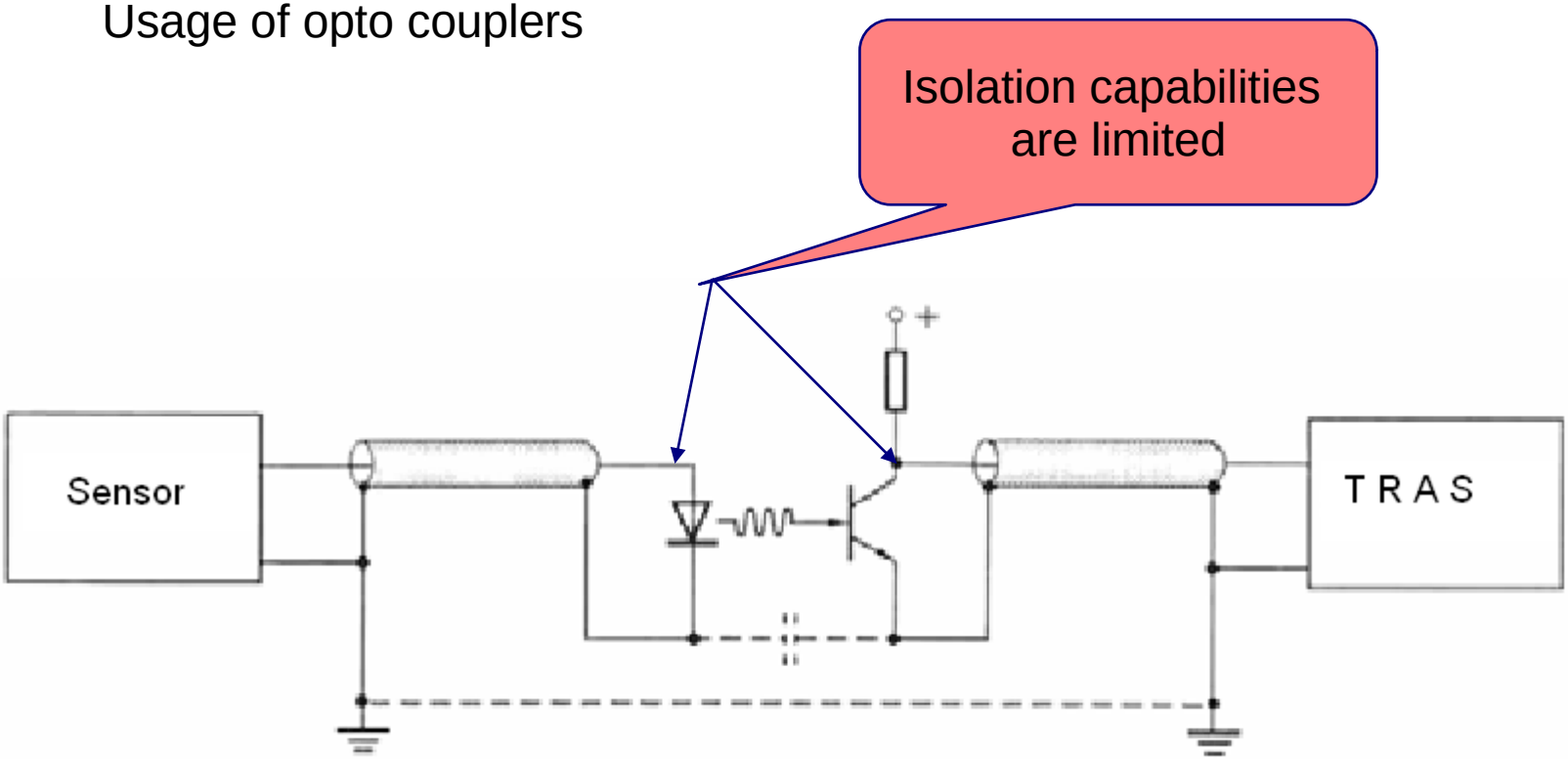
DANGER!!!
Full electrical potential
on the case



Isolation capabilities
are limited

The need for measurements on different potentials

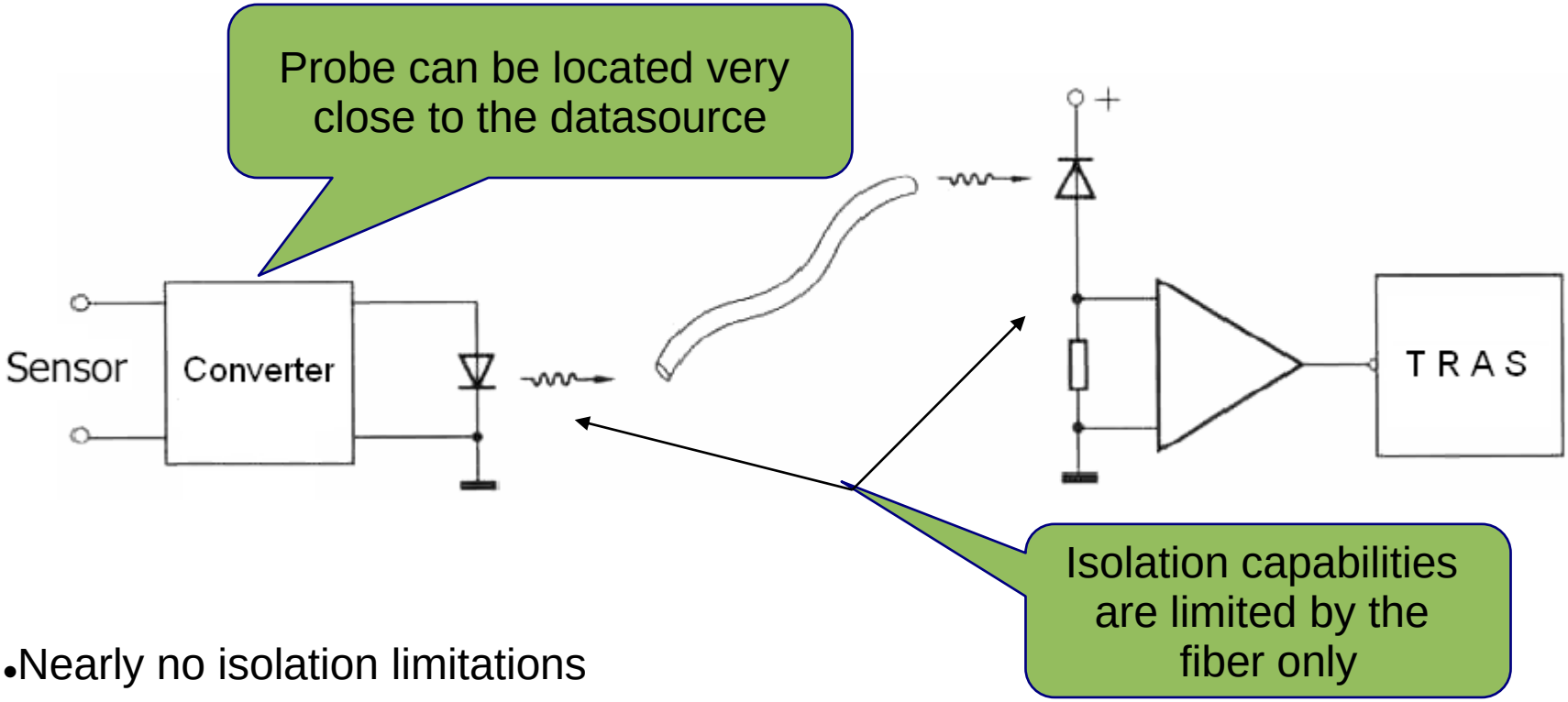
Usage of opto couplers



High influence of electromagnetical fields because of cable length

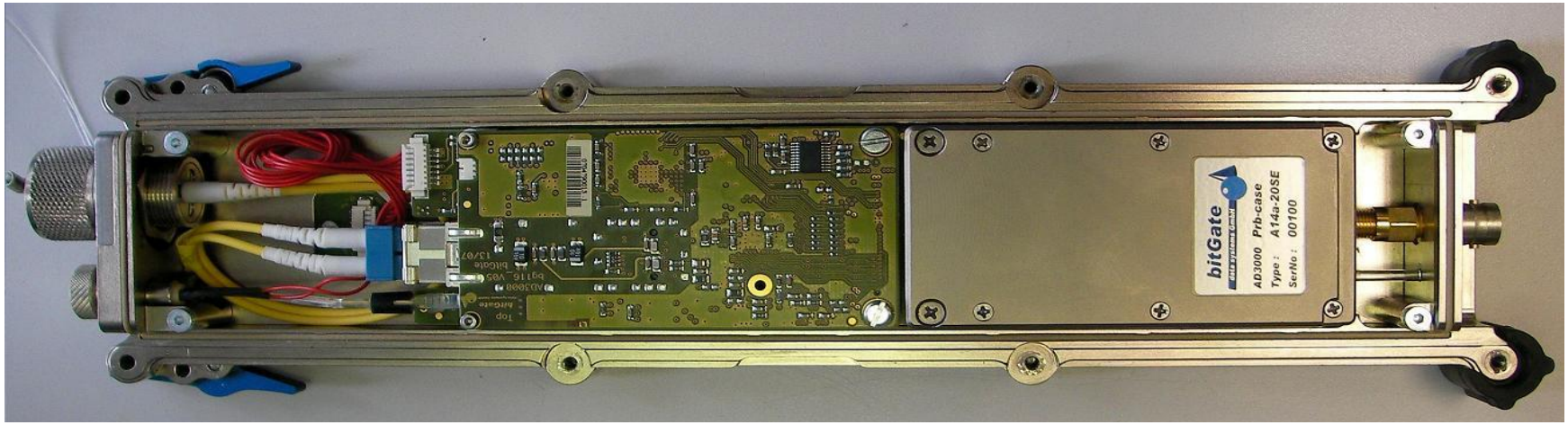
The need for measurements on different potentials

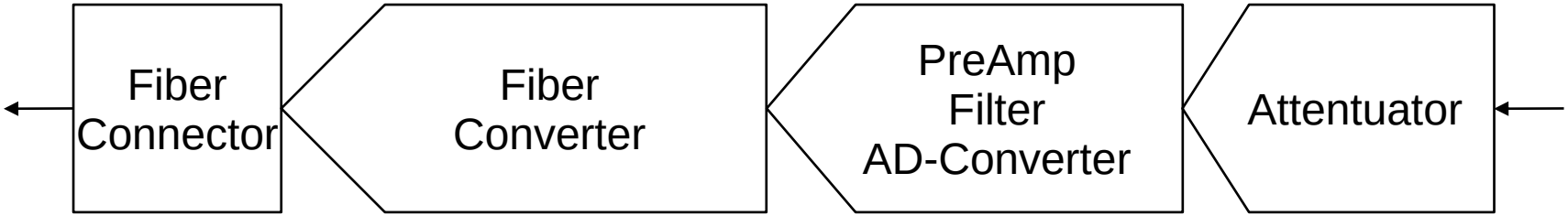
Usage of fiber cables



- Nearly no isolation limitations
- Reduced influence of electromagnetical fields because of short cable length

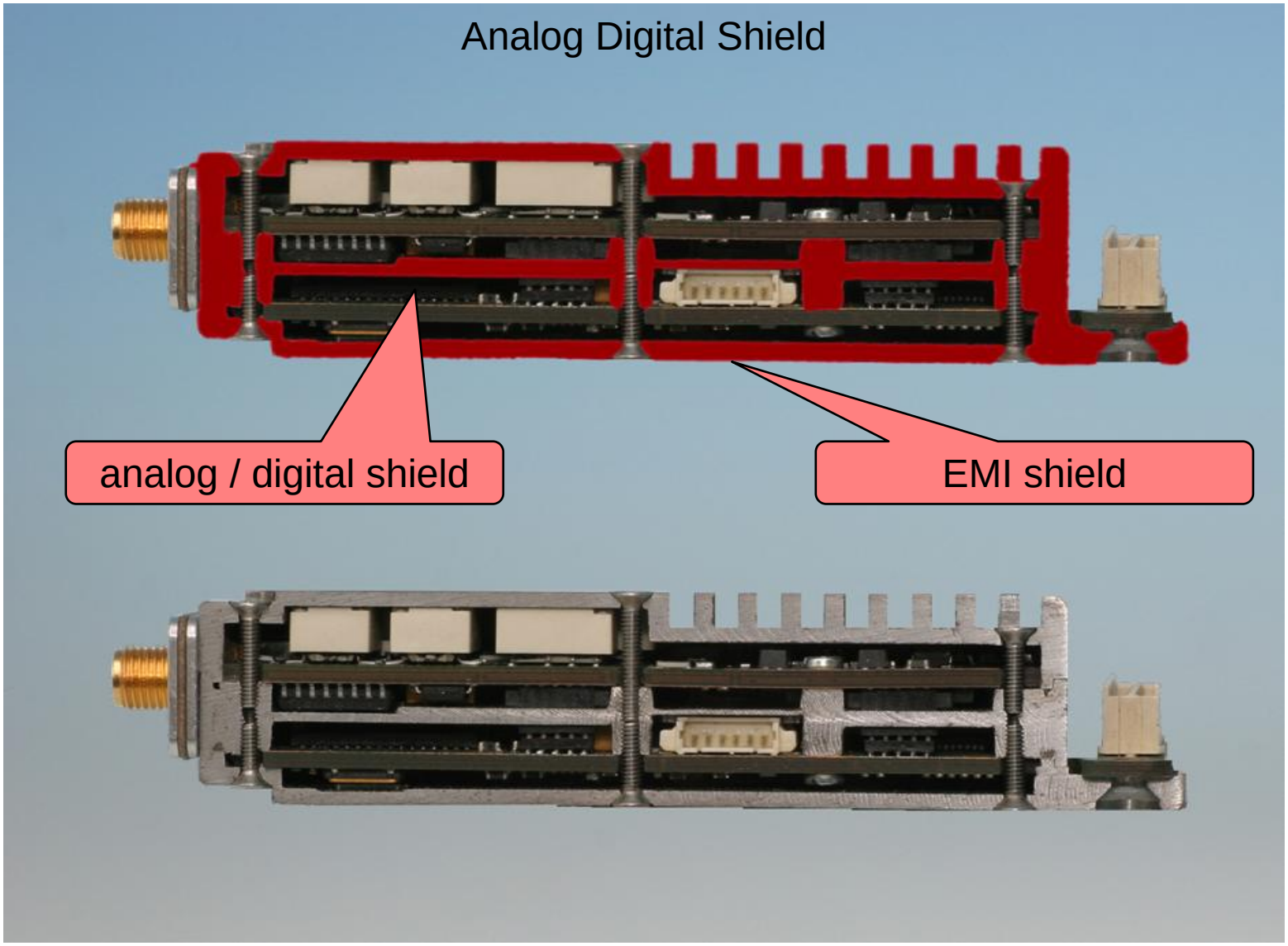
The double shielded bitGate Probe





- High Isolation
- Distances up to 3 km
- Up to 250V input range
- Measurement time up to 16 hours using 2 Battery packs

Shielding of the internal probe



Behavior during measurements in electrical fields

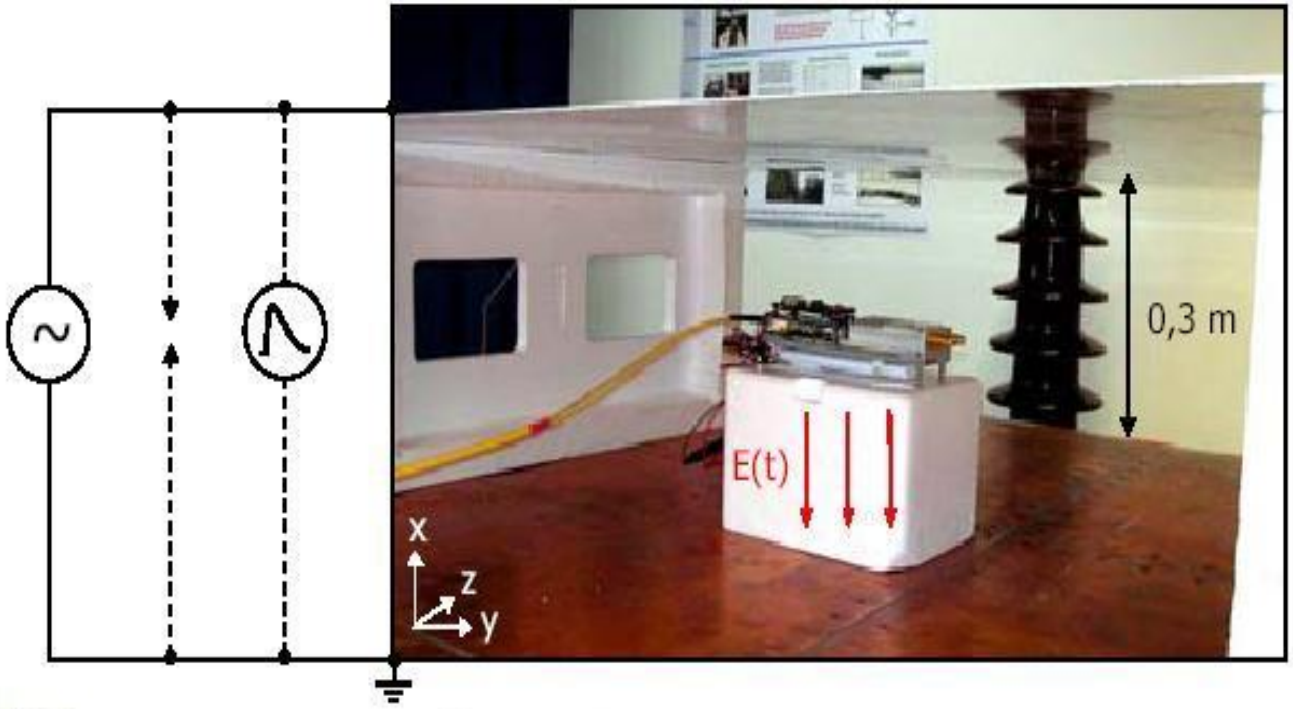
Especially the high frequent electrical fields are penetrating electrical measurement equipment and are influencing their behavior. The EMI norm EN 61000-4-3 describes the needed immunity against electromagnetic interference.

Due to the specific additional shielding of the probe the probe itself can be exposed even to extreme field strength.

During test measurements it could be shown that the probes are shielded enough to work in electrical fields of over 100 kV/m.

Field changes of 30 kV/m per µs had no effect on the operation of the probes, the data acquisition or the triggering.

Behavior during measurements in electrical fields



- AC Voltage 50Hz up to 30 kVolt rms
- Pulse 1,2/50µsec up to 10 kV peak

Behavior during measurements in magnetic fields

The norm EN 61000-4-8 describes the principles how to test and proof the power-frequency magnetic field immunity of systems. The norms EN 61000-4-9 and -10 do cover the pulse magnetic field immunity and the damped oscillator magnetic field immunity tests.

During measurements without any additional shielding first influences could be detected in fields with 30 A/m (50 Hz).

Different shielding materials has been tested

With the right material and proper structure of the shielding the immunity could be improved so that even in fields with 1000 A/m no influences on the operation of the probe could be detected.

Propagation delay shifting through optical fiber of different length

The light propagates through the optical fiber with approximately 2/3 of the speed of light.

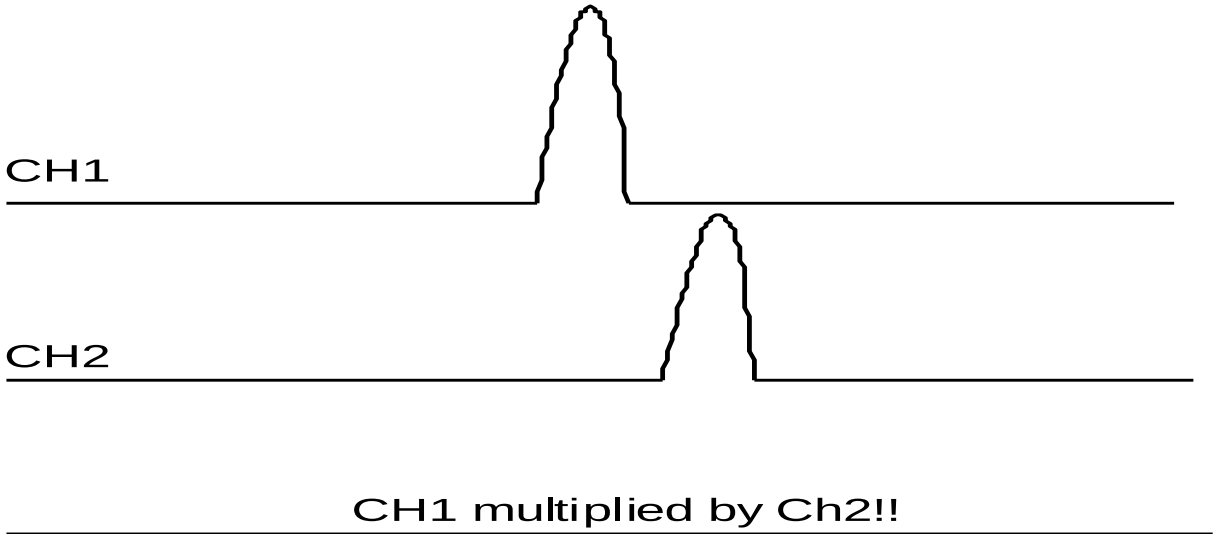
200.000km/sec
200km/ms
200m/µsec
0.2m/ns

The sample rate of the measurement system is 100 MSamples (10nsec)
- 2m cable length causes 1 clock cycle phase shift!!

Solution can be:

- Using always the same cable length
- The system have to compensate the cable length dynamically

measurements with sampling rates of 100 MHz/s (10 ns) causes phase shifts very soon.



This delay can lead to wrong results especially when making arithmetical operations between different channels with different propagation delay.

A propagation delay compensation is therefor absolutely mandatory when using fibers of different length.

Practical use of optical fibers in High Power Labs

Measurements in high power laboratories are very often done under inconvenient environmental conditions.

Fiber optics which is good for the use in standard laboratories show problems and is susceptible to faults under high power lab conditions.

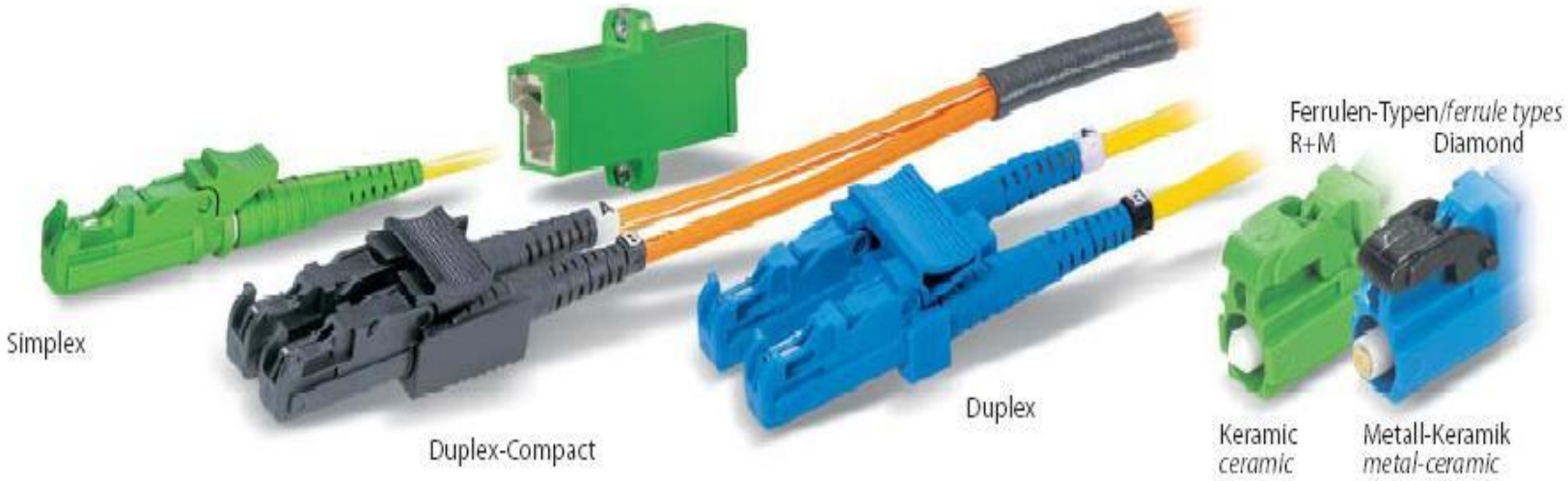
The used connectors and cables need to be robust against mechanical stress and dirt.

Practical use of optical fibers in High Power Labs

However, it is not possible to maintain clean connections in high power lab conditions.

Sooner or later dust will be on the surface of the fiber leading to a signal degradation and attenuation. Too much dust actually leads to expensive system failures.

Proper connectors can help to get the fiber clean.



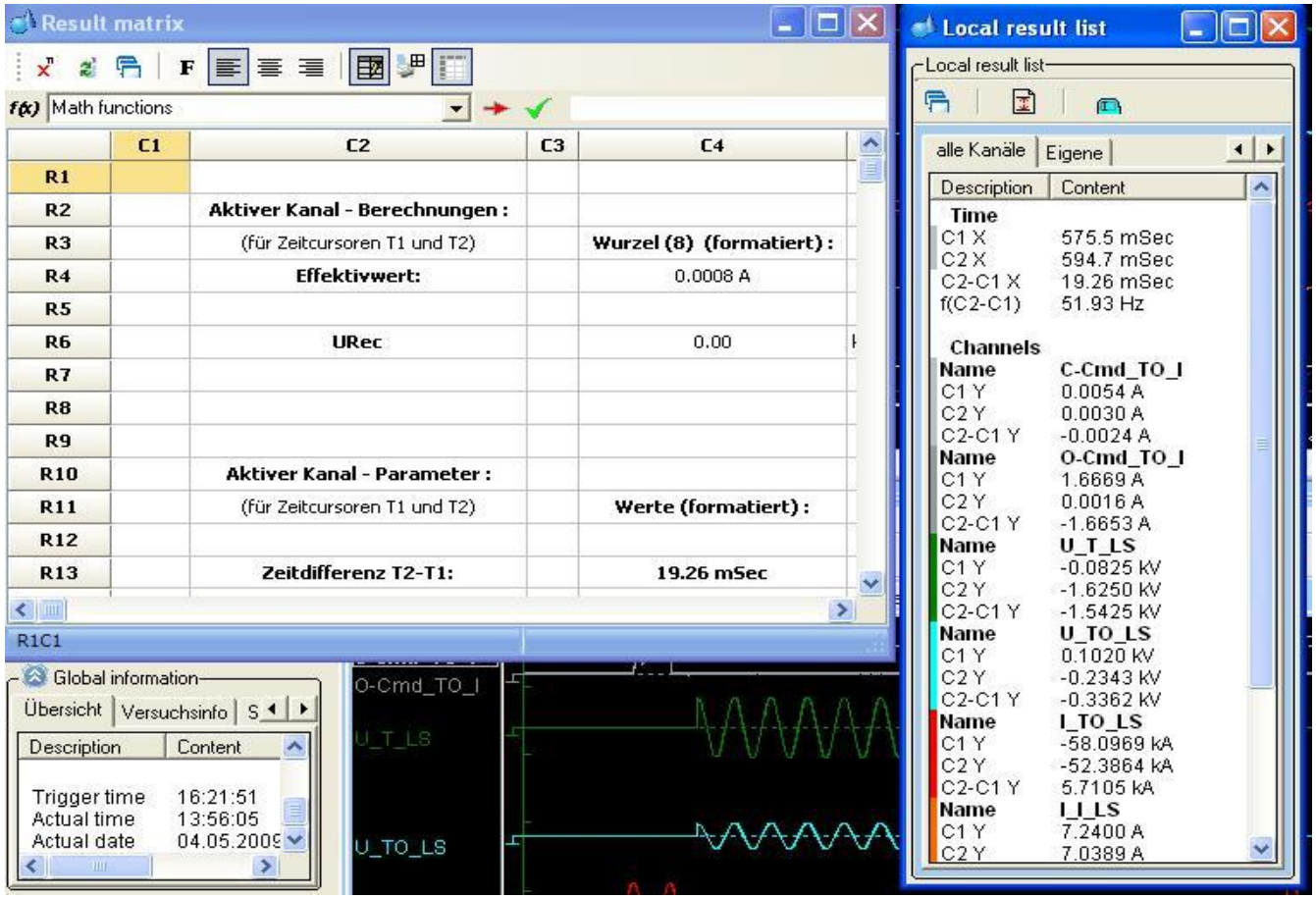
To face these problems the AD3000 systems comprises an automated test of the optical interfaces and cables indicating their optical attenuation

A simple click on “fiber test” shows the current fiber quality

Ico	ChXX	Kanal	Güte	Dämpfung	Güte	Dämpfung
	CH01	Single- #1		-9.4dB		-10.8dB
	CH02	Single- #2		---		---
	CH03	Single- #3		---		---
	CH04	Counter- #4		---		---
	CH05	Counter- #5		---		---
	CH06	Counter- #6		---		---
	CH07	Counter- #7		---		---

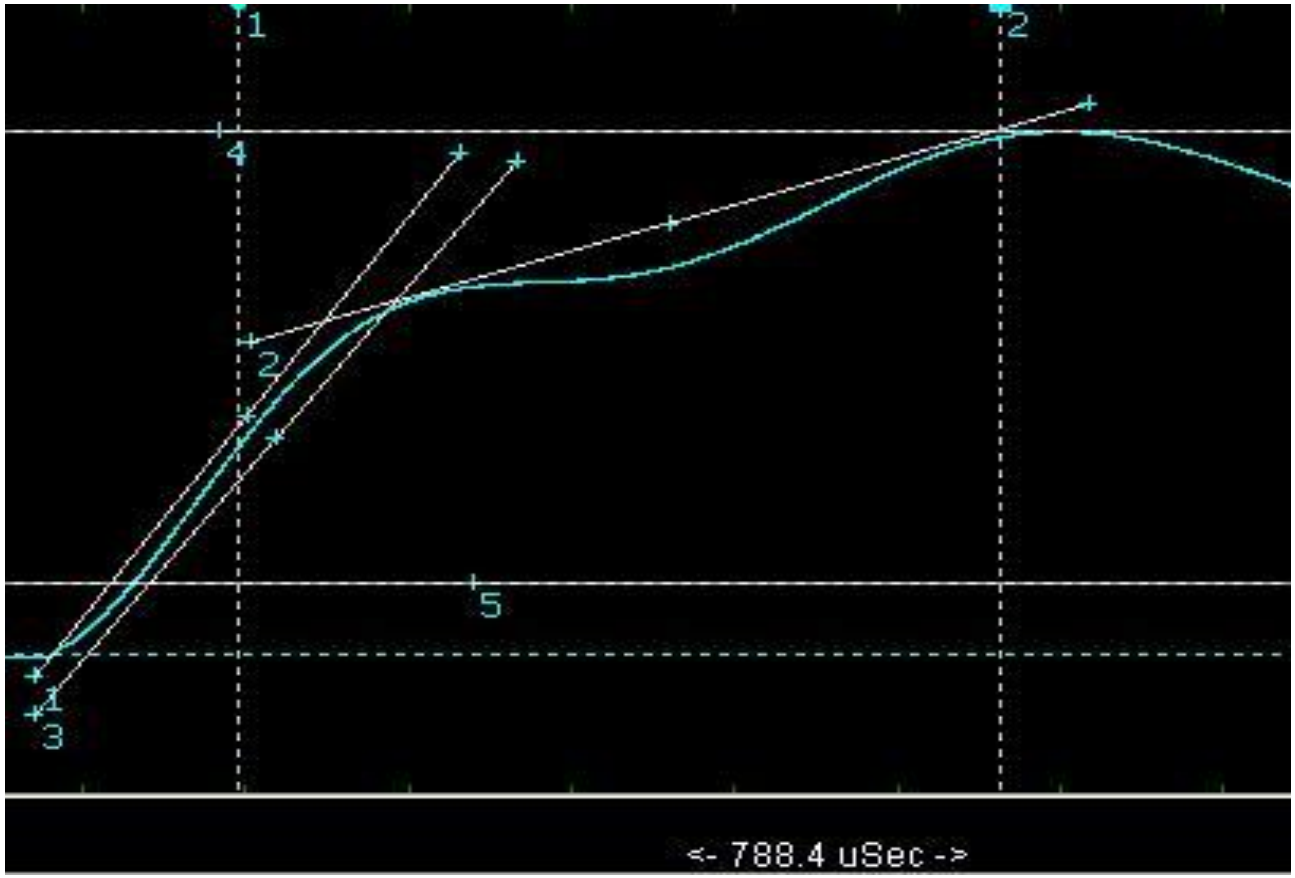
Special features needed in High Power Labs

1. Flexible view of measured results
   - depending on the measurements (No Load, TRV ...)



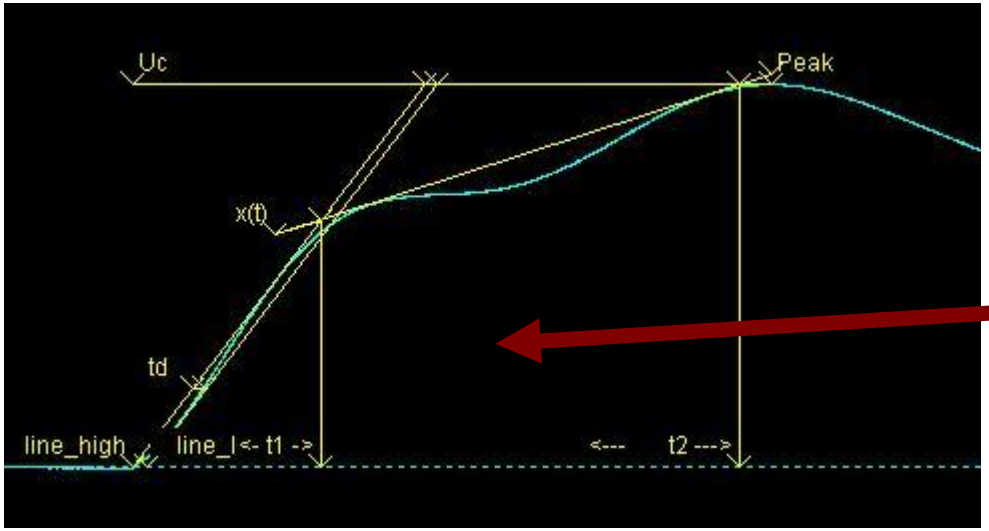
Special features needed in High Power Labs

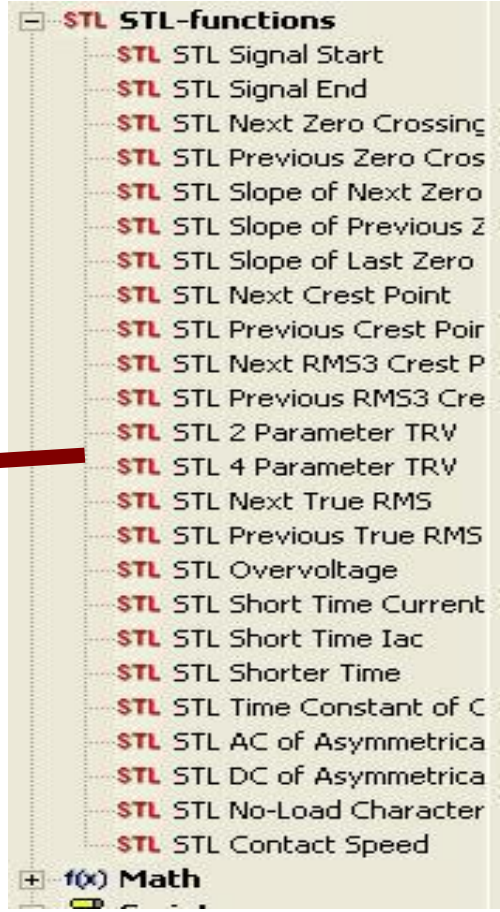
2. Special cursors for TRV measurements



Special features needed in High Power Labs

3. Special methods for automatic evaluation in high power labs
   - basic rules on data processing (STL Task Group)





Special features needed in High Power Labs

4. Special methods to extend the evaluation capabilities to do some evaluation regarding IEC
   - see the switching impulse evaluation

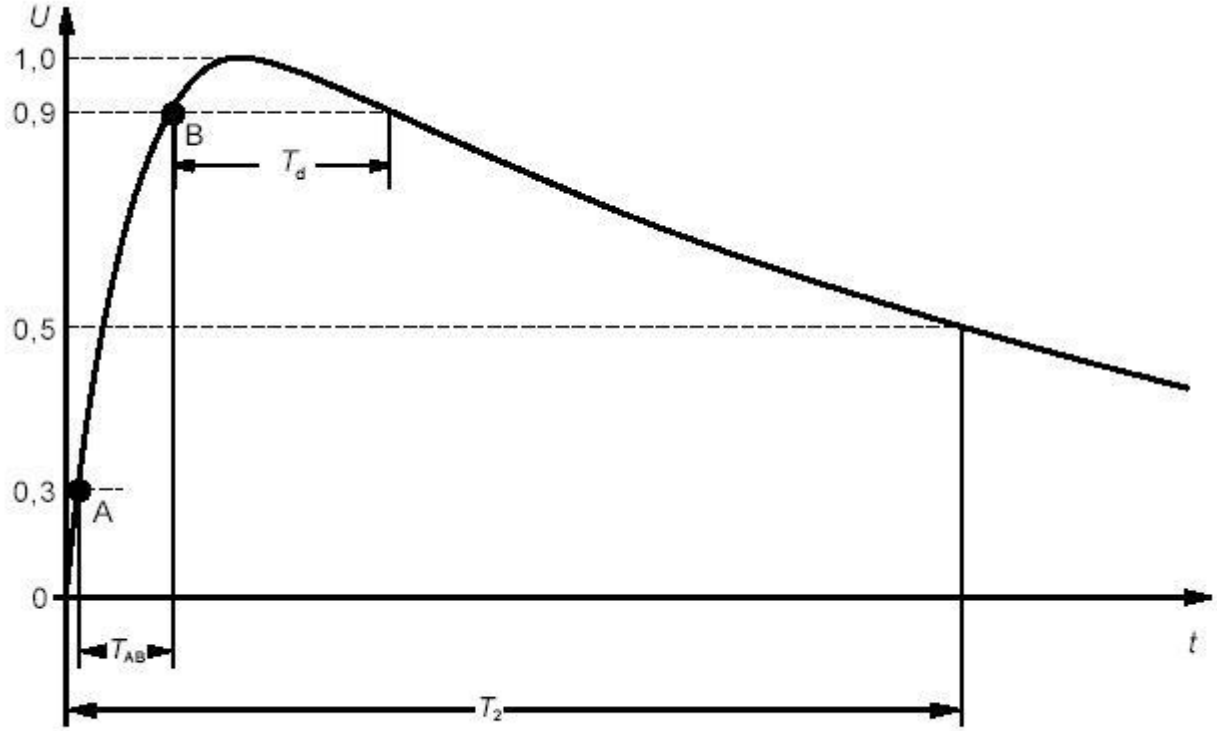
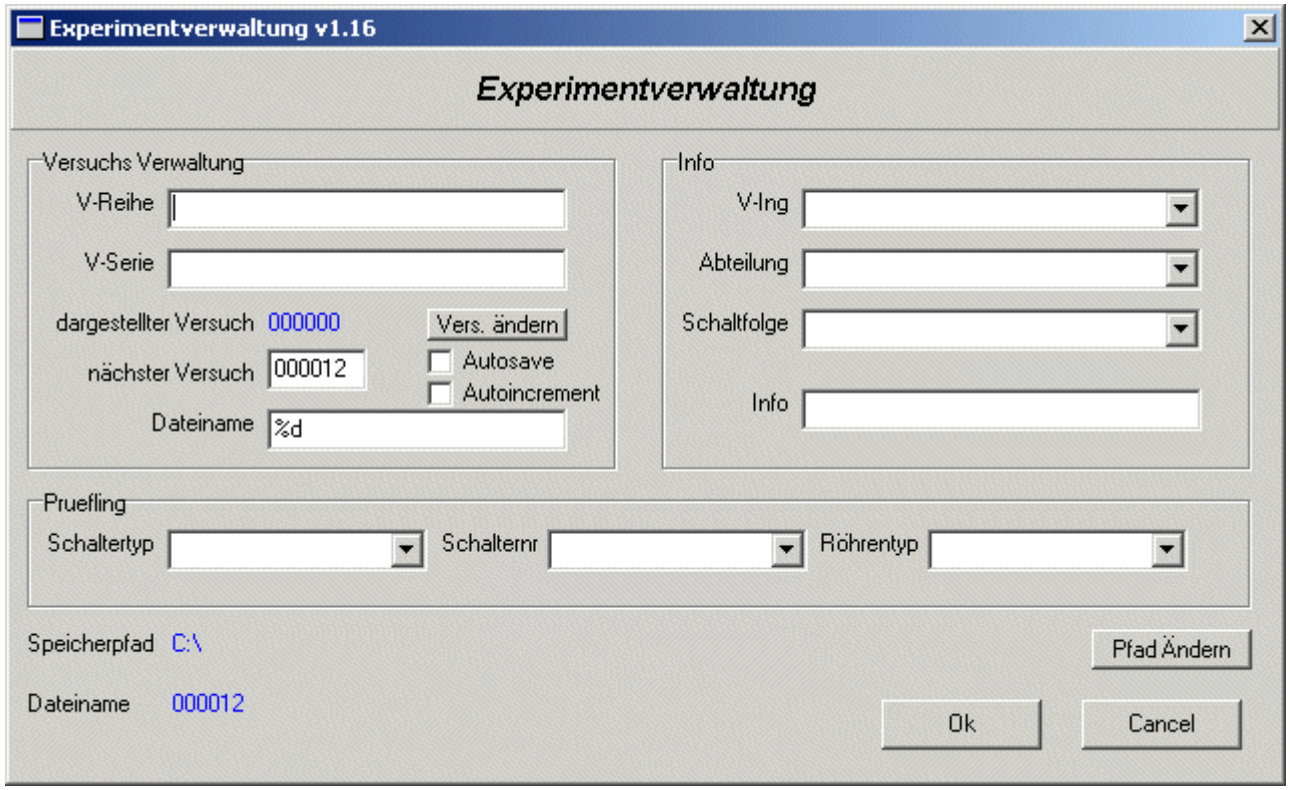


Figure 1 – Full switching impulse

Special features needed in High Power Labs

5. Experiment management

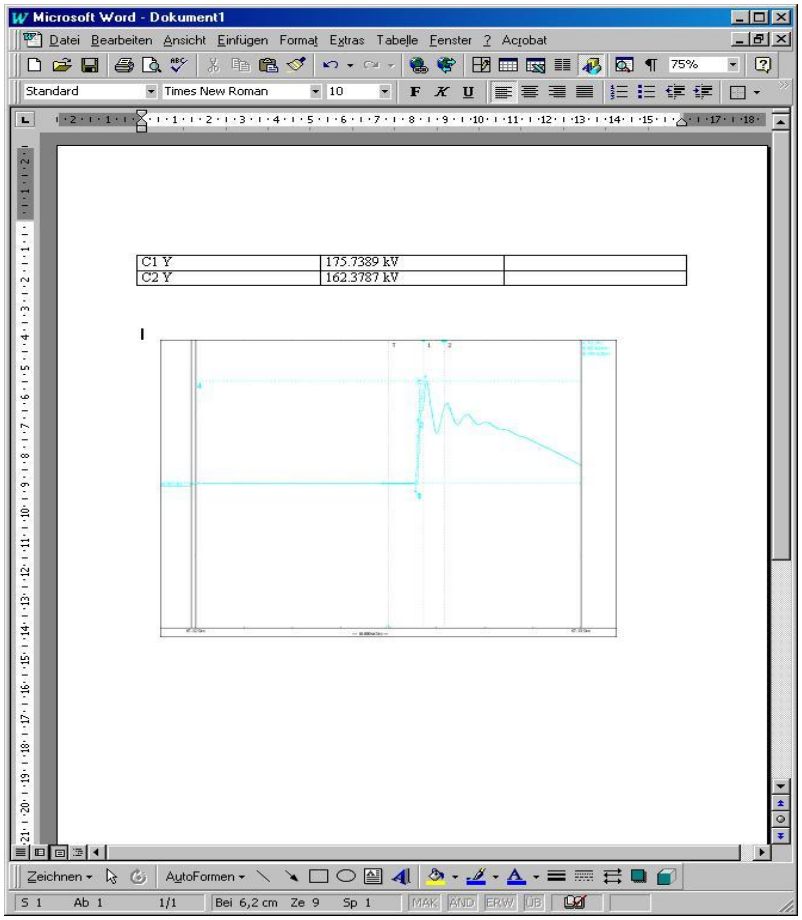
- Dialog to enter specific information regarding the experiment (test engineer, type of breaker ...)

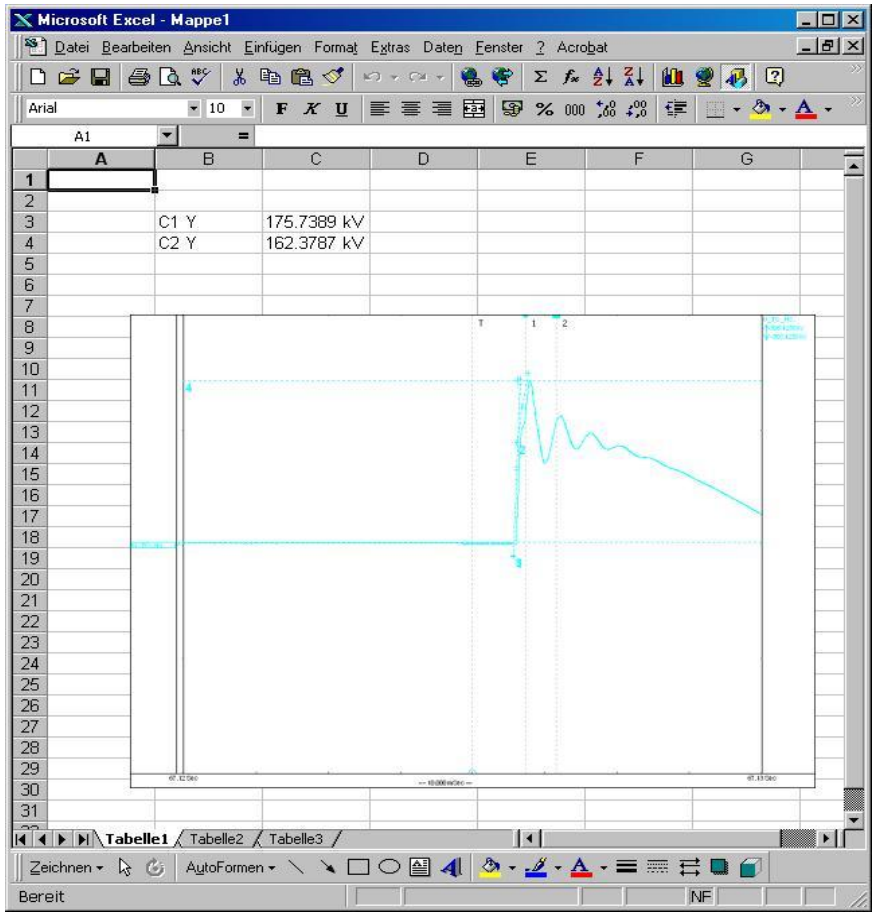


Special features needed in High Power Labs

6. Flexible reporting capabilities „drag and drop“

-measurement results are only a part of the complete test report





bitGate data systems GmbH