

Bedarfsorientierte Wartung mittels TE-Sensoren an Leistungstransformatoren

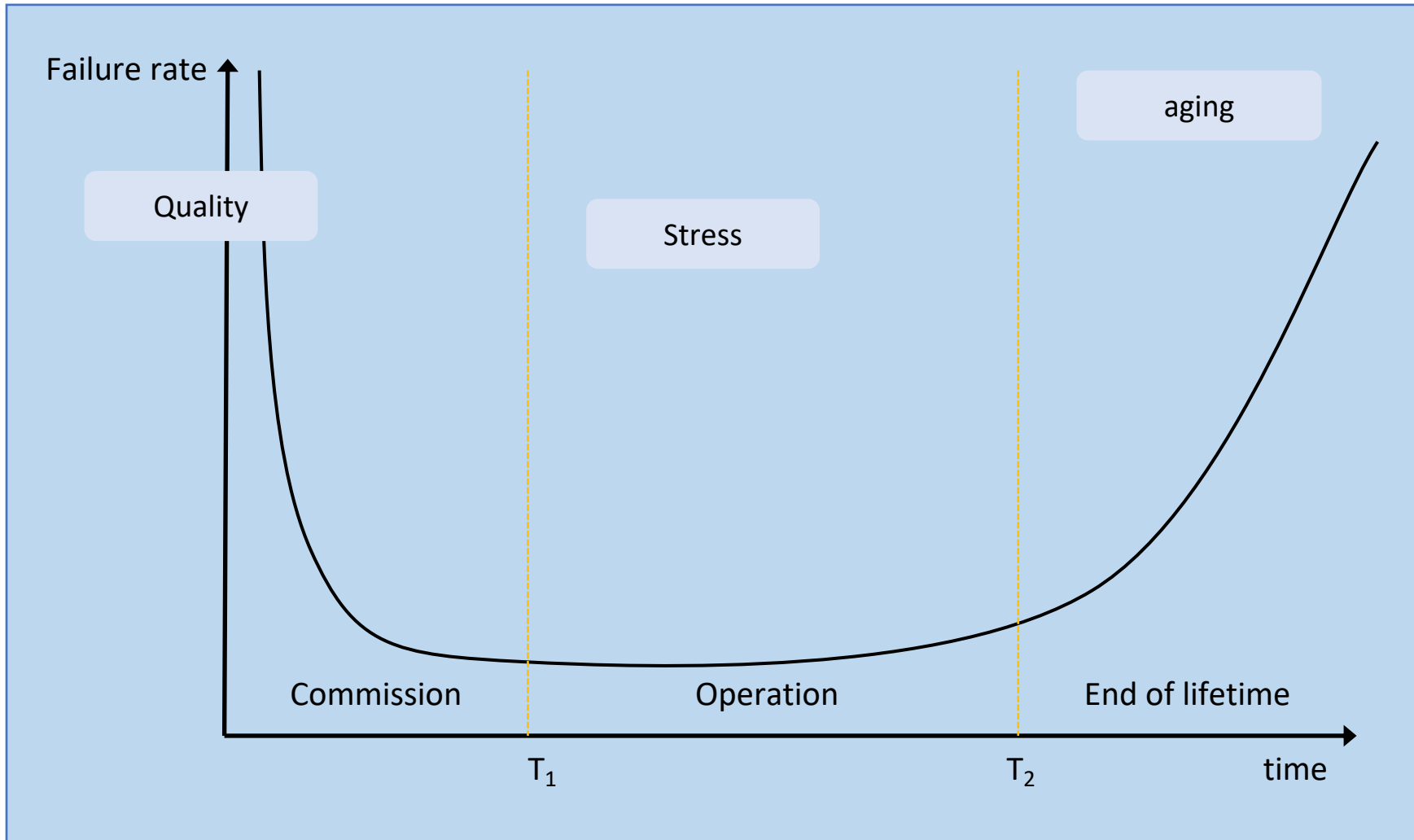
Dr. Detlef Hummes

Agenda Risikomanagement

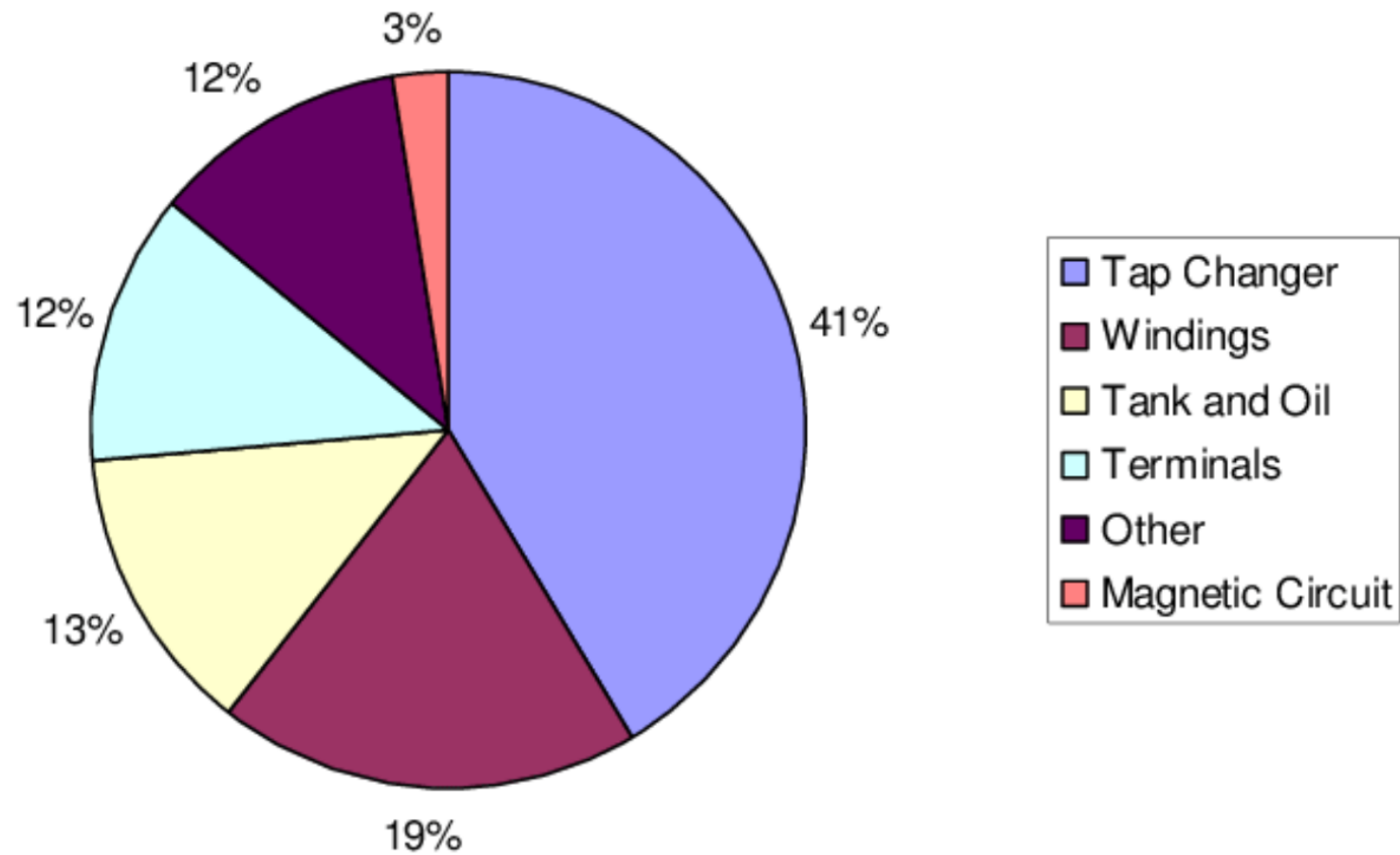
- Teilentladungsmessung durch UHF Sensoren
- Überwachung via Cloud
- Fallbeispiele aus der Halbleiterindustrie



Ausfallrate über die Lebenszeit



Fehlerstatistik an Transformatoren



Source: Failure statistics for transformers as published by Doble [1]

Fehlerursachen an Transformatoren

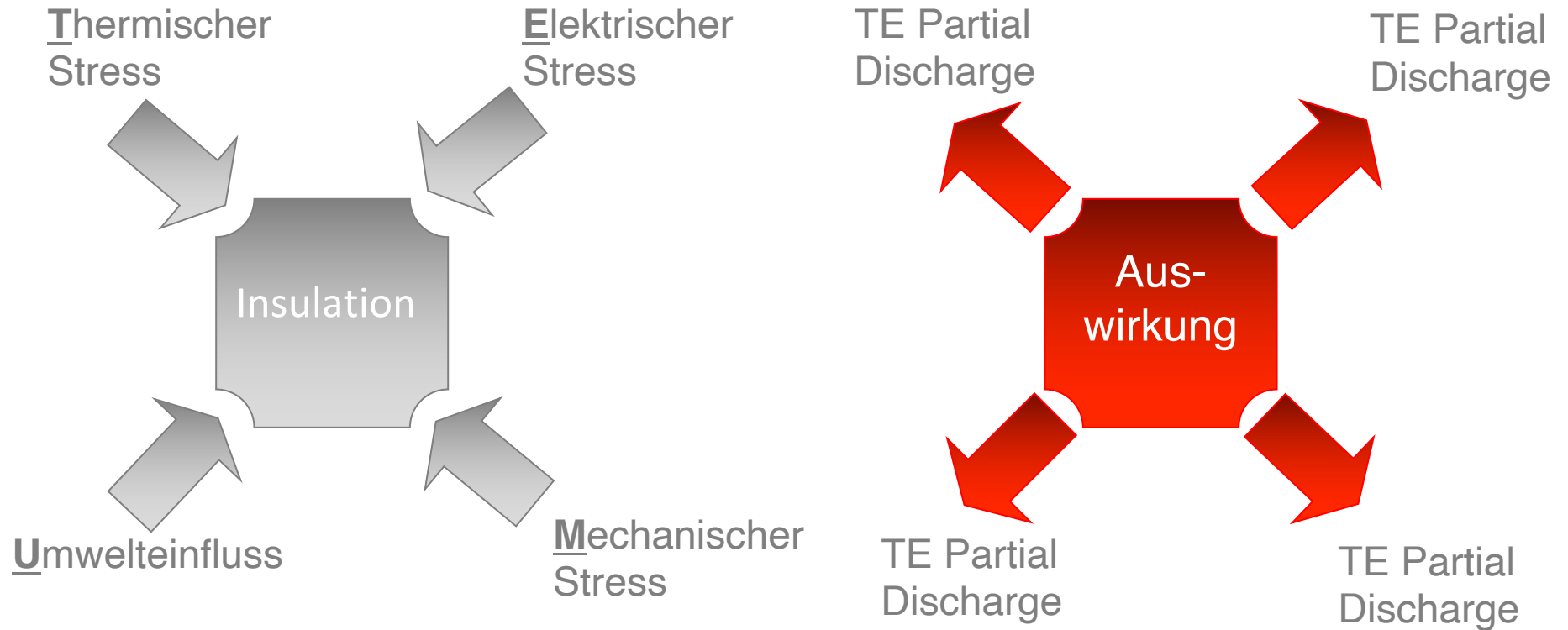
Verschleiß an Transformatoren ist unvermeidbar

- 2-3% Ausfall in Industriestaaten
- 12-17% in Schwellenlaendern (z.B. Indien)

Ursachen sind

- Elektrischer Stress
- Thermischer Stress
- Mechanischer Stress (Vibration)
- Umweltbedingungen

Teilentladung TE Partial Discharge Measurement



Partial Discharge Phenomena



Transformer Failure

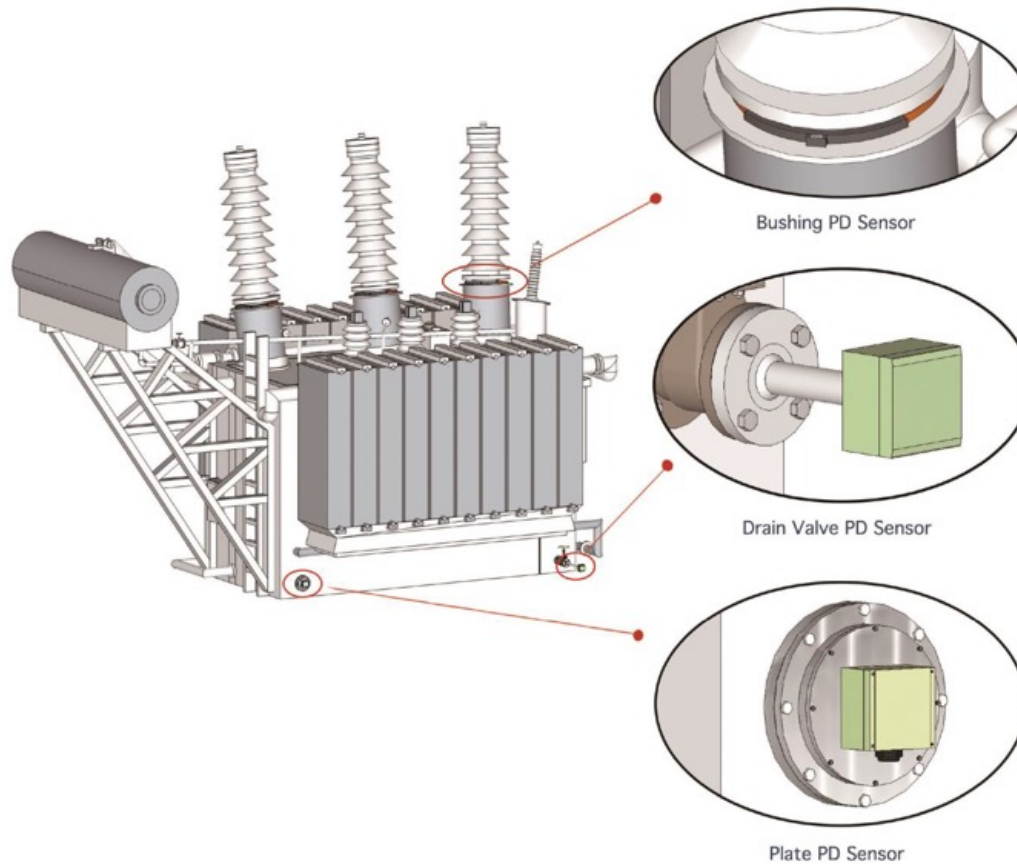


Kuwait Az Zour South 2018



Kuwait 2020

Teilentladungsmessung Partial Discharge Measurement

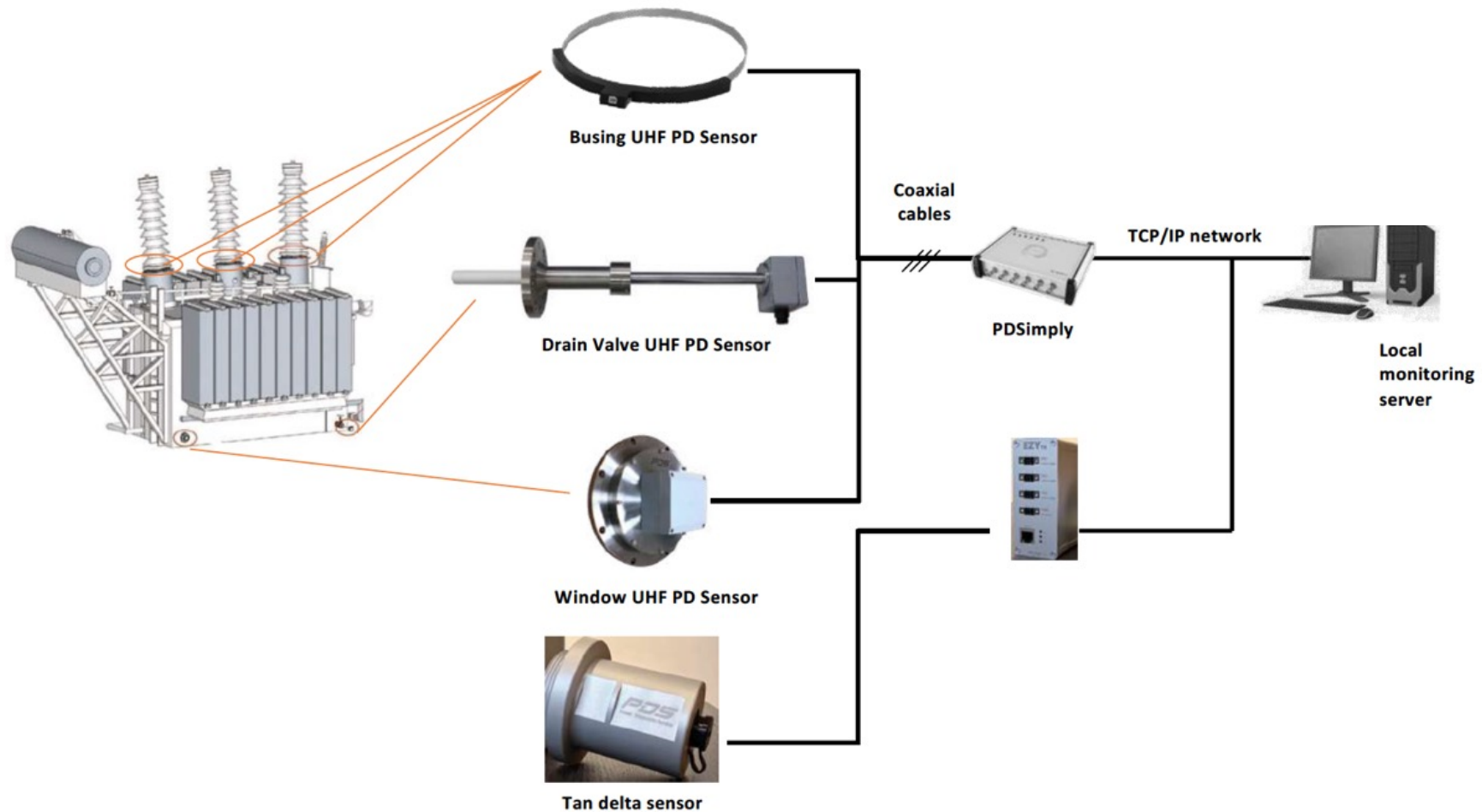


Teilentladungsmessung mit UHF Sensoren

Warum UHF Sensoren

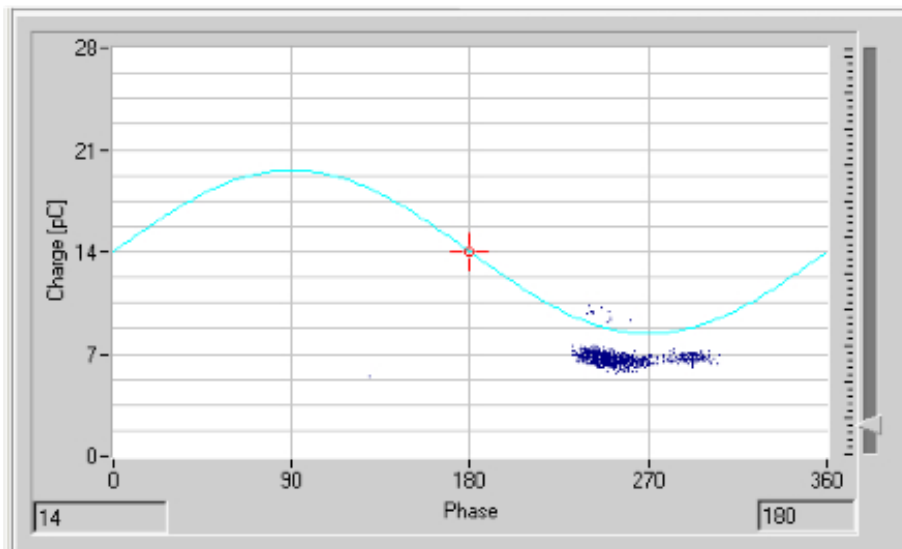
- Einfache Installation
- Problemlose Rauschunterdrückung
- Einsetzbar für Öl- als auch Trockentransformatoren
- Günstiger Preis
- Universelle Einsetzbarkeit

Teilentladungsmessung Partial Discharge Measurement

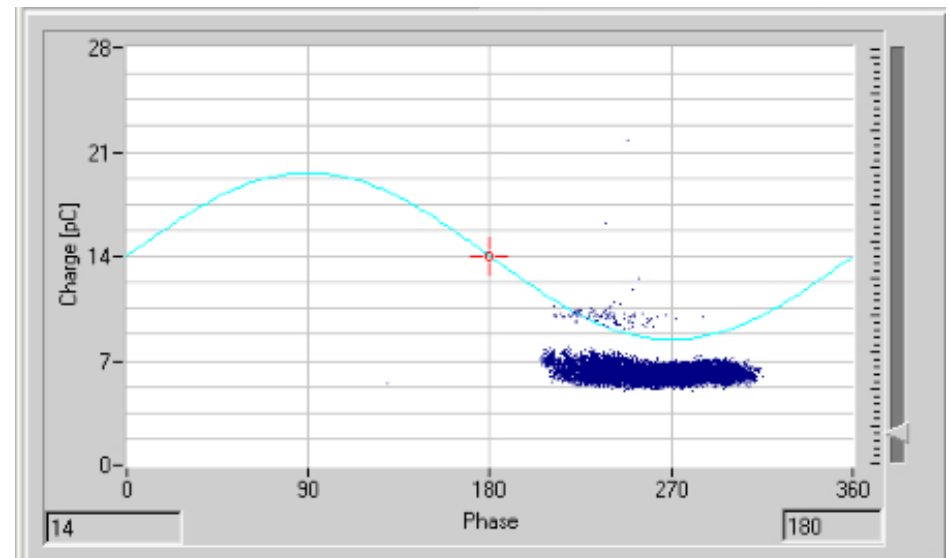


Teilentladungsmessung Partial Discharge Measurement

- PRPD Pattern Identifikation
- Corona



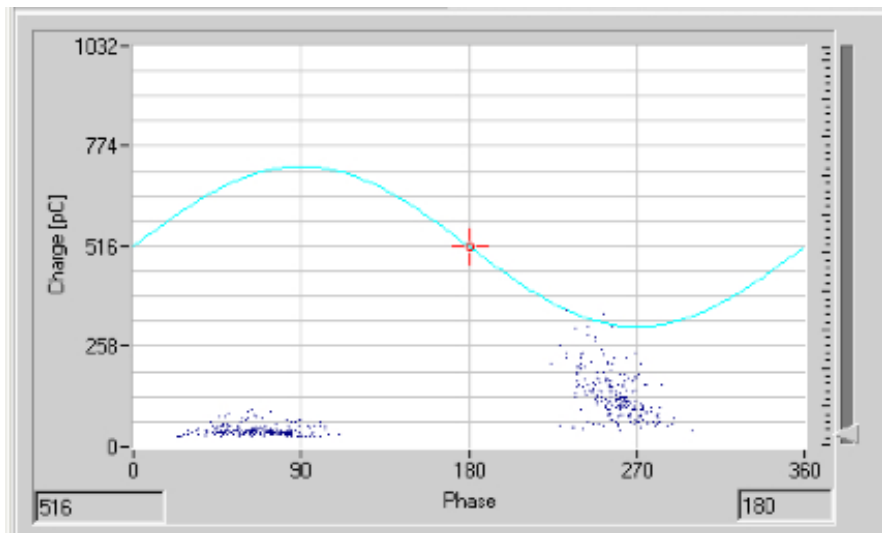
10 kV



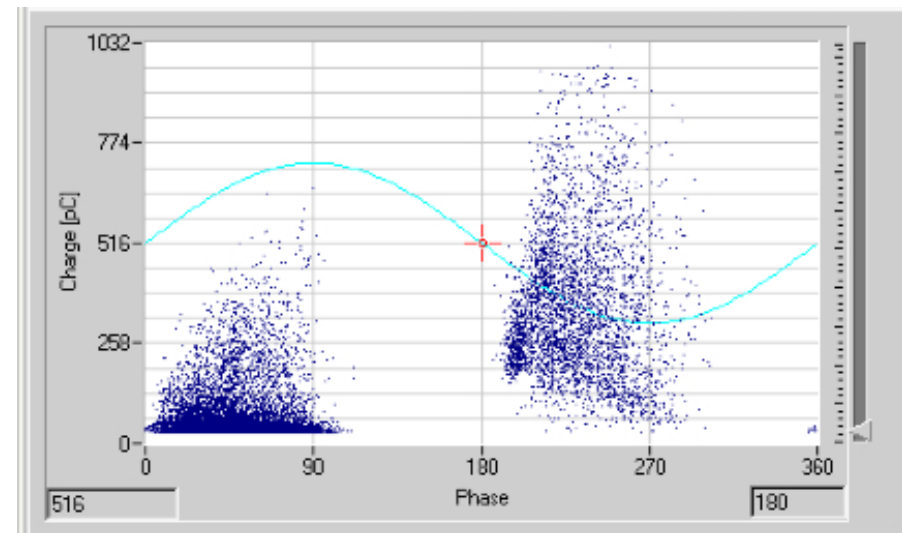
15 kV

Teilentladungsmessung Partial Discharge Measurement

- PRPD Pattern Identifikation
- Oberflaechenentladung



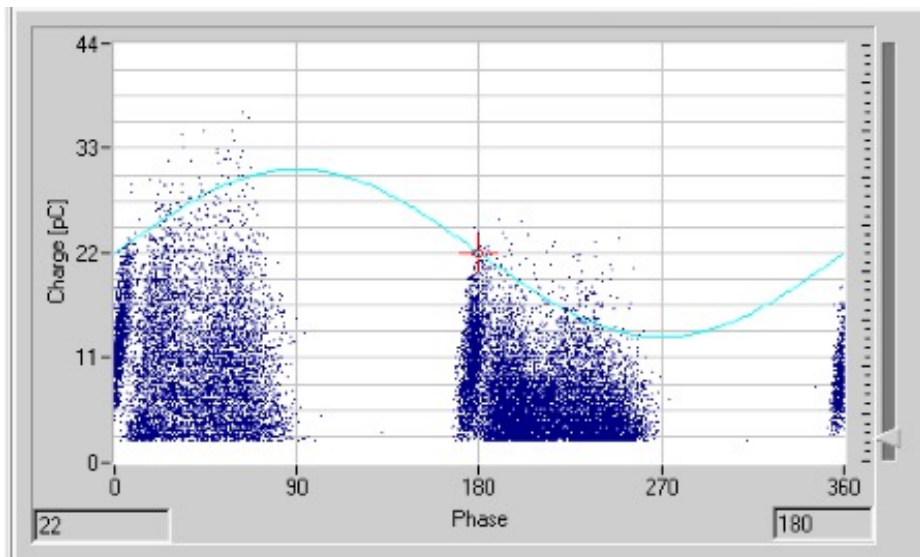
3.6 kV



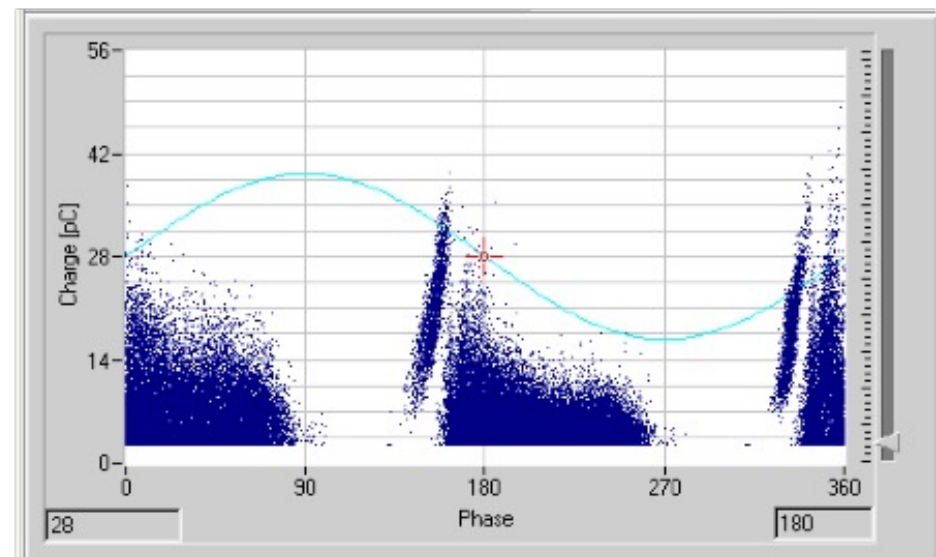
6 kV

Teilentladungsmessung Partial Discharge Measurement

- PRPD Pattern Identifikation
- Interne Entladung

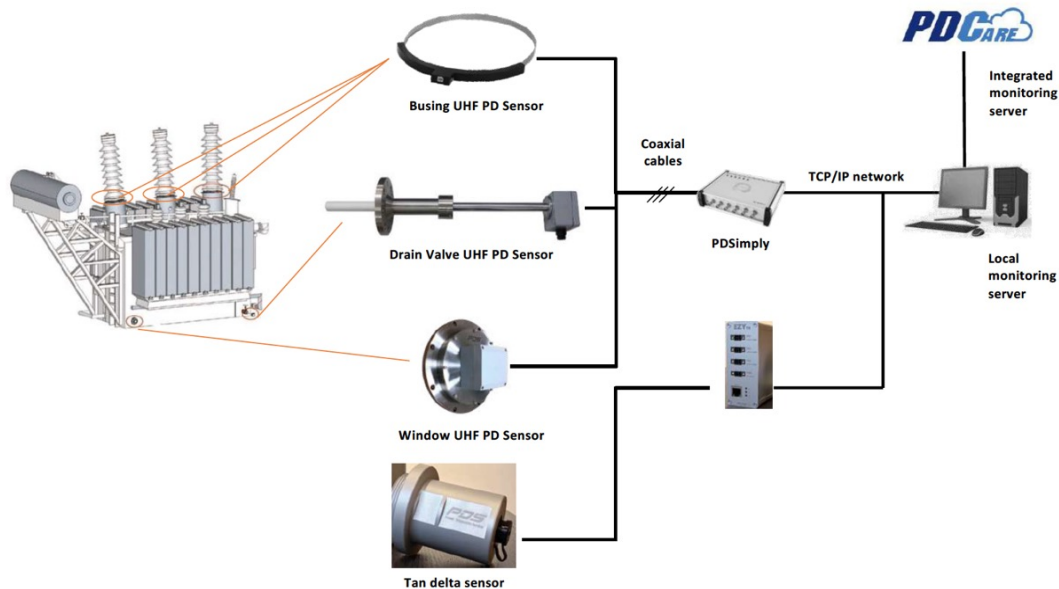


3 kV

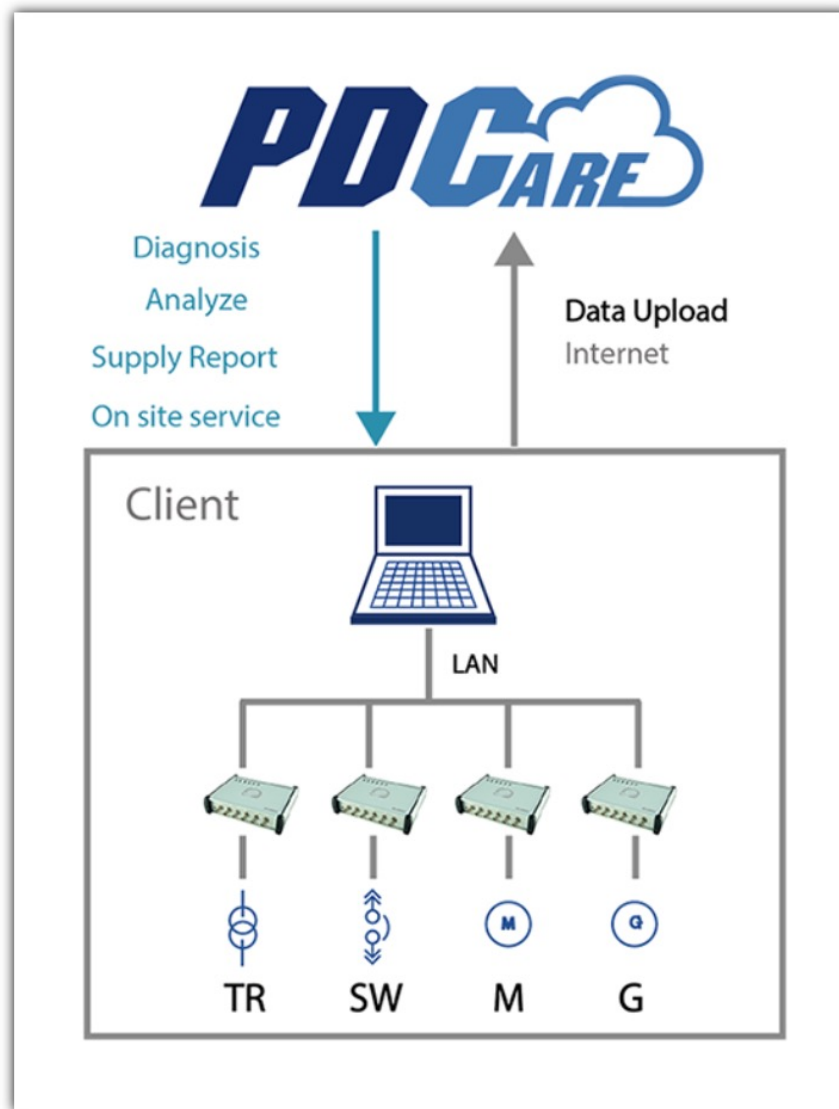


6 kV

Cloudlösung



Transformatoren
Schaltanlagen
Motoren
Generatoren



Cloudlösung

- Echtzeitüberwachung zu jeder Zeit inkl. Trends von jedem Ort
- Direkte Kommunikation mit dem Kunden im Falle eines Alarms
- 24/7 Überwachung durch qualifiziertes Personal
- Online Analyse verhindert unnötigen Austausch von Equipment
- Kostenersparnis durch Reduktion

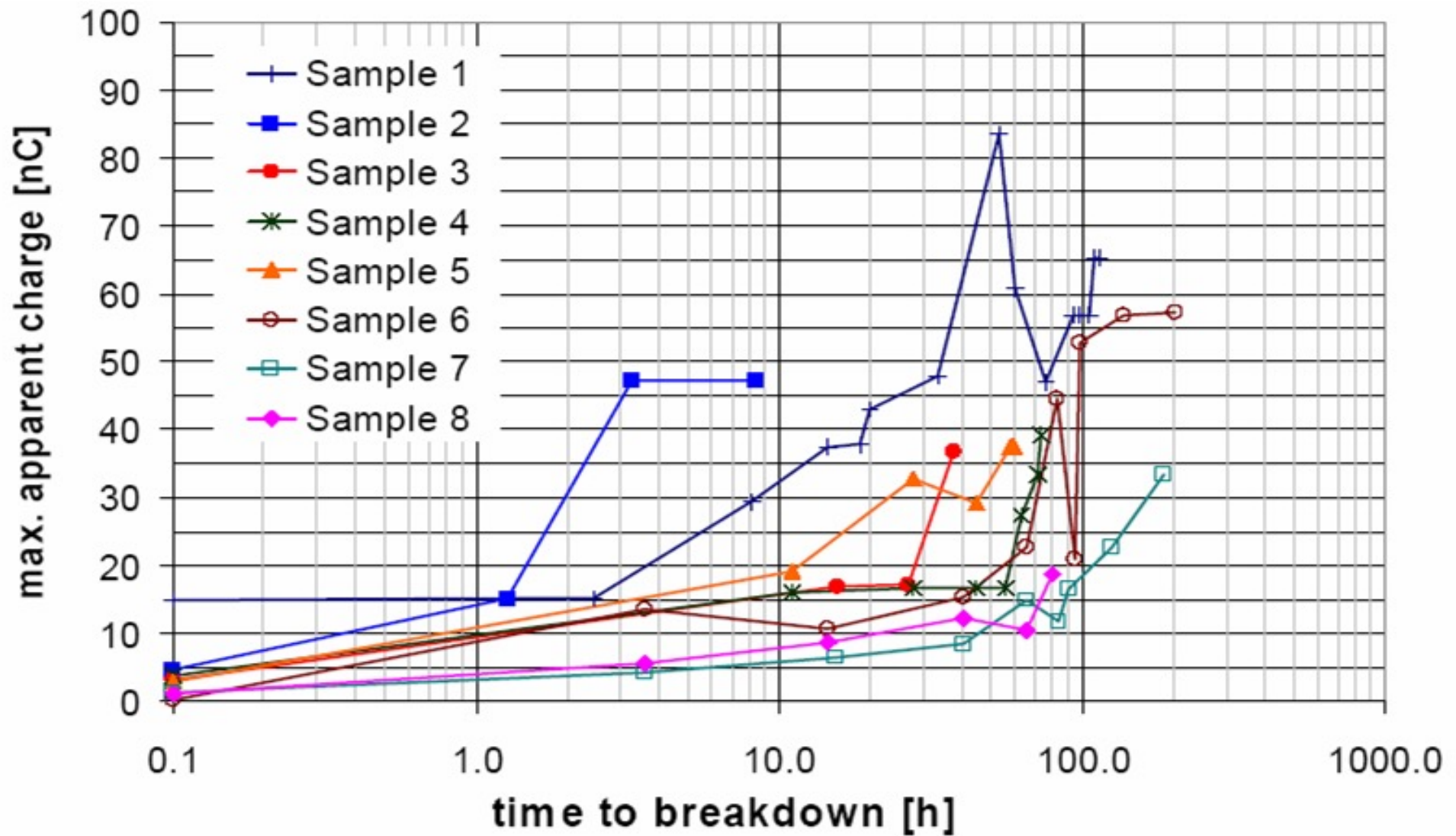
References

Company	Sites	Target Facilities	Voltage (V)
AUO 	12 (Taiwan, China, Singapore)	    	161k / 22.8k / 11k
TSMC 	28 (Taiwan, China)	    	161k / 110k / 22.8k / 4.16k
UMC 	14 (Taiwan, China, Singapore)	    	161k / 35k / 11k
KLPP  	1 (Malaysia)		362k
Micron Memory 	2 (Taiwan)	  	161k / 22.8k / 13.6k
EDC 	2 (Philippines)		230k / 13.8k
SSMC 	1 (Singapore)	 	22.8k
Corning Display 	1 (Taiwan)	 	161k
Innolux 	3 (Taiwan)	   	22.8k
SEB 	3 (Malaysia)	  	275k / 33k / 11k
KOEN Power Plant 	2 (Korea)	 	161k / 35k / 22.8k
TPC 	3 (Taiwan)	 	345k / 161k

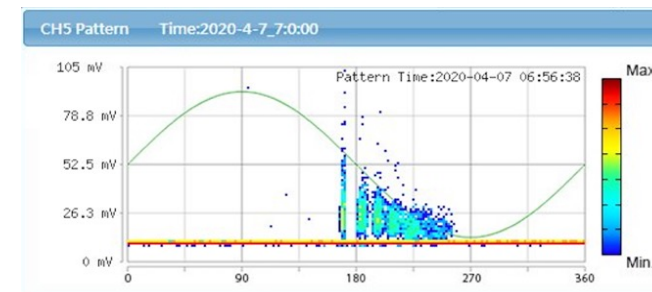
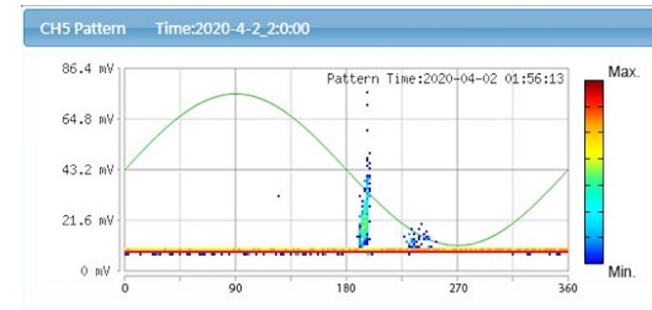
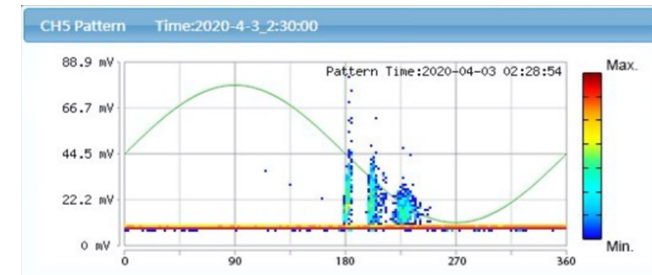
Cloudlösung

	Periodische Wartung	TE Selbst- monitoring	PDCare Service
Minimierung des Risikolevels	**	****	*****
Service Kosten	***** (Jaehrlich)	***	*****
Service Equipment	**	***	*****
After Service	-	***	*****
Reaktionszeit im Fehlerfall	**	**	*****

The Trend is your Friend



Teilentladungsmessung Partial Discharge Measurement



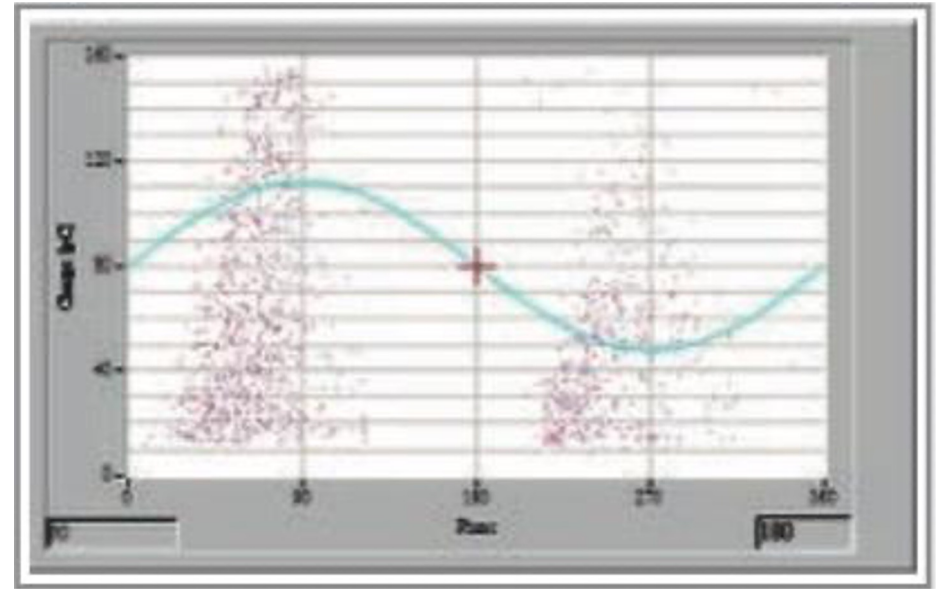
In April 2020, a PD alarm was received at PDS Monitoring Center, triggered by a 161kV/22.8kV power transformer.

TE Ortung



Fallstudie #2

22,8 kV Trockentransformator



Fallstudie #2

Herstellerfehler



Referenzen

Year/Month	Customer	Property 產業	Quantity 數量	Country 國家	Application 應用
2012/4	Taiwan Semiconductor Manufacturing Company F3	IC	3	Taiwan	Transformer
2012/6	Taiwan Semiconductor Manufacturing Company F12P4P5	IC	6	Taiwan	TR
2012/11	Taiwan Semiconductor Manufacturing Company F3	IC	2	Taiwan	MTR
2013/2	Taiwan Semiconductor Manufacturing Company F15P1P2	IC	37	Taiwan	GIS\MTR\TR
2013/3	Micron Memory Taiwan Co., Ltd	RAM	33	Taiwan	Transformer
2013/3	Taiwan Semiconductor Manufacturing Company F12P3	IC	3	Taiwan	Transformer
2013/5	Taiwan Power Company	Power	3	Taiwan	Transformer
2013/7	Kinmen Power Plan	Power	1	Taiwan	Transformer
2013/8	National Synchrotron Radiation Research Center		1	Taiwan	TR
2013/8	Taiwan Semiconductor Manufacturing Company F12P6	IC	26	Taiwan	GIS\MTR\TR
2013/9	Taiwan Semiconductor Manufacturing Company F14P1P2	IC	3	Taiwan	Transformer
2013/9	Taiwan Semiconductor Manufacturing Company F3-Stage2	IC	8	Taiwan	Transformer
2013/10	Taiwan Semiconductor Manufacturing Company F12P4P5	IC	24	Taiwan	MTR\TR\GIS
2013/11	Taiwan Semiconductor Manufacturing Company F15P3P4	IC	36	Taiwan	GIS\MTR\TR
2014/3	Sun Ba Power Plant	Power	4	Taiwan	Generator
2014/4	AU Optronics Corp., L3C	LCD	4	Taiwan	HV
2014/4	Micron Memory Taiwan Co., Ltd	RAM	1	Taiwan	
2014/4	Taiwan Power Company	Power	3	Taiwan	
2014/4	Taiwan Semiconductor Manufacturing Company F14P1P2	IC	6	Taiwan	
2014/6	China Southern Power Grid	Power	2	China	
2014/6	Taiwan Semiconductor Manufacturing Company F3E	IC	1	Taiwan	Transformer
2014/7	Taiwan Semiconductor Manufacturing Company BP2B FAC	IC	4	Taiwan	TR
2014/7	Taiwan Semiconductor Manufacturing Company F12P4P5P6	IC	39	Taiwan	TR\HV
2014/7	Taiwan Semiconductor Manufacturing Company F14P5P6	IC	14	Taiwan	GIS\MTR\HV
2014/7	Taiwan Semiconductor Manufacturing Company F3	IC	3	Taiwan	HV
2014/7	Taiwan Semiconductor Manufacturing Company F3E	IC	3	Taiwan	Transformer
2014/8	Taiwan Power Company	Power	3	Taiwan	
2014/8	Taiwan Semiconductor Manufacturing Company F12P4P5	IC	18	Taiwan	HV
2014/9	AU Optronics Corp., HY (L3D&L5D)	LCD	121	Taiwan	GIS\MTR\TR\HV
2014/9	Taiwan Power Company	Power	1	Taiwan	
2014/9	Taiwan Semiconductor Manufacturing Company F2	IC	23	Taiwan	GIS\MTR\TR\HV
2014/9	Taiwan Semiconductor Manufacturing Company F5	IC	28	Taiwan	GIS\MTR\TR\HV
2014/10	Taiwan Power Company	Power	2	Taiwan	
2014/10	Taiwan Semiconductor Manufacturing Company F12P1P2	IC	10	Taiwan	GIS\MTR\TR\HV
2014/10	Taiwan Semiconductor Manufacturing Company F14P1P2	IC	24	Taiwan	GIS\MTR\HV
2014/10	Taiwan Semiconductor Manufacturing Company F14P3P4	IC	17	Taiwan	GIS\MTR\HV

Referenzen

2014/10	Taiwan Semiconductor Manufacturing Company F14P5P6	IC	33	Taiwan	GIS\IMTR\TR\HV	
2014/10	Taiwan Semiconductor Manufacturing Company F15P1P2P3P4	IC	10	Taiwan	HV	
2014/11	HITEC Power Solutions CO., LTD.		1	Korea		
2014/12	Taiwan Power Company	Power	2	Taiwan		
2015/3	Hsin Ning Power Plant	Power	3	Taiwan	Generator	
2015/4	AU Optronics Corp., L3C	LCD	39	Taiwan	GIS\IMTR\TR\HV	
2015/4	AU Optronics Corp., LT (L4A&L5A&L5B)	LCD	141	Taiwan	GIS\IMTR\TR\HV	
2015/4	Innolux Corporation Fab7	LCD	36	Taiwan	TR	
2015/5	AU Optronics Corp., LK (L6B)	LCD	164	Taiwan	GIS\IMTR\TR\HV	
2015/5	AU Optronics Corp., TC1	LCD	111	Taiwan	GIS\IMTR\TR\HV	
2015/5	Shanghai 6th People's Hospital		5	China	TR\HV	
2015/5	Taiwan Semiconductor Manufacturing Company F10	IC	6	China	GIS\IMTR\HV	
2015/5	Taiwan Semiconductor Manufacturing Company F14P5P6P7	IC	79	Taiwan	TR	
2015/5	Taiwan Semiconductor Manufacturing Company F15P1P2P3P4	IC	14	Taiwan	TR	
2015/6	AU Optronics Corp., TC2	LCD	96	Taiwan	GIS\IMTR\TR\HV	
2015/6	National Synchrotron Radiation Research Center		1	Taiwan	TR	
2015/7	AU Optronics Corp., HL (L8B)	LCD	97	Taiwan	GIS\IMTR\TR\HV	
2015/7	AU Optronics Corp., TC3	LCD	109	Taiwan	GIS\IMTR\TR\HV	
2015/7	Maxchip Electronics Corp.	IC	2	Taiwan	TR	
2015/7	Taiwan Semiconductor Manufacturing Company F3E	IC	2	Taiwan	TR\HV	
2015/8	Kuo Kuang Power Plant	Power	5	Taiwan	Generator\IMTR	
2015/9	Taiwan Semiconductor Manufacturing Company F12P7	IC	8	Taiwan	TR\GIS	
2015/11	Taiwan Power Company No. 3 Nuclear Power Plant	Power	17	Taiwan	BUS WAY	
2015/11	United Microelectronics Corporation 12AP5	IC	43	Taiwan	GIS\IMTR\TR\HV	
2015/11	WaferTech Limited Liability Company	IC	2	USA	TR\HV	
2015/11	SI Group	Chemical	2	China	TR\HV	
2015/12	Maxchip Electronics Corp.	IC	5	Taiwan	GIS\IMTR	
2015/12	System on Silicon Manufacturing Co., Pte. Ltd.	IC	2	Singapore	TR	
2015/12	Taiwan Semiconductor Manufacturing Company F12P3	IC	14	Taiwan	GIS\IMTR\TR	
2015/12	United Microelectronics Corporation 12AP3P4	IC	11	Taiwan	GIS\IMTR\TR\HV	
2015/12	United Microelectronics Corporation 8AB	IC	19	Taiwan	GIS\IMTR\TR\HV	
2016/1	AU Optronics Corp., AUST	LCD	38	Singapore	GIS\IMTR\TR\HV	
2016/1	HeJian Technology (Suzhou) Co., Ltd.		2	China		
2016/1	United Microelectronics Corporation SG	IC	87	Singapore	GIS\IMTR\TR\HV	
2016/1	AU Optronics Corp., AUKS	LCD	110	China	GIS\IMTR\TR\HV	
2016/1	United Microelectronics Corporation 12AP1P2	IC	59	Taiwan	GIS\IMTR\TR\HV	
2016/5	Ever Power Plant	Power	6	Taiwan	GIS\IMTR	

Referenzen

2016/5	National Synchrotron Radiation Research Center		1	Taiwan	TR	
2016/5	Taiwan CFI Co., Ltd. Kaohsiung		29	Taiwan	GIS\MTR\TRI\HV	
2016/5	United Microelectronics Corporation Xiamen	IC	42	China	GIS\MTR\TRI\HV	
2016/7	Taiwan Power Research Institute	Power	4	Taiwan	GIS\Joint	
2016/7	Taiwan Power Company KS	Power	1	Taiwan	TR	
2016/7	Sarawak Energy Berhad	Power	2	Malaysia	TR\HV	
2016/9	Taiwan Semiconductor Manufacturing Company F10	IC	3	China	HV	
2016/9	Macronix International Co. LTD. F5	RAM	35	Taiwan	GIS\MTR\TRI\HV	
2016/9	System on Silicon Manufacturing Co., Pte. Ltd.	IC	5	Singapore	TR\HV	
2016/10	ChipMOS Technologies Inc.		2	Taiwan	TR	
2016/10	Taiwan Semiconductor Manufacturing Company F14P7	IC	2	Taiwan	GIS	
2016/12	United Microelectronics Corporation 8F	IC	14	Taiwan	MTR\TRI\HV	
2016/12	United Microelectronics Corporation 8AB	IC	12	Taiwan	TR\HV	
2016/12	United Microelectronics Corporation 8CD	IC	6	Taiwan	TR	
2016/12	United Microelectronics Corporation 12AP5	IC	4	Taiwan	TR\HV	
2017/1	United Microelectronics Corporation 12AP1P2	IC	20	Taiwan	TR\HV	
2017/1	AU Optronics Corp., TN	LCD	43	Taiwan	GIS\MTR\TRI\HV	
2017/1	AU Optronics Corp., AUST	LCD	2	Singapore	HV	
2017/2	United Microelectronics Corporation 8D	IC	23	Taiwan	MTR\TRI\HV	
2017/2	United Microelectronics Corporation 8C	IC	23	Taiwan	MTR\TRI\HV	
2017/2	United Microelectronics Corporation 8S	IC	40	Taiwan	MTR\TRI\HV	
2017/2	United Microelectronics Corporation 8AB	IC	8	Taiwan	TR\HV	
2017/3	United Microelectronics Corporation 8AB	IC	10	Taiwan	TR\HV	
2017/4	United Microelectronics Corporation 8E	IC	30	Taiwan	MTR\TRI\HV	
2017/4	Taiwan Semiconductor Manufacturing Company F3E	IC	6	Taiwan	TR\HV	
2017/4	Micron Memory Taiwan Co.,Ltd .	RAM	16	Taiwan	TR	
2017/4	National Synchrotron Radiation Research Center		1	Taiwan	TR\HV	
2017/4	AU Optronics Corp., AUXM	LCD	7	China	GIS\MTR\TRI\HV	
2017/5	AU Optronics Corp., AUKS	LCD	4	China	TR\HV	
2017/6	United Microelectronics Corporation 8F	IC	8	Taiwan	MTR\TRI\HV	
2017/6	Vanguard International Semiconductor Co. Fab2		28	Taiwan	TR\HV	
2017/7	Vanguard International Semiconductor Co. Fab2		15	Taiwan	TR\HV	
2017/7	Taiwan Semiconductor Manufacturing Company F16P1	IC	20	China	TR\HV	
2017/7	Taiwan Semiconductor Manufacturing Company F15P5	IC	17	Taiwan	GIS\MTR\HV	
2017/7	Macronix International Co. LTD. F5	RAM	19	Taiwan	TR\HV	
2017/7	Taiwan Power Company	Power	1	Taiwan	HV	
2017/8	Vanguard International Semiconductor Co. Fab2		18	Taiwan	MTR\TRI\HV	

ANY QUESTIONS?

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Thank you



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