



# **SECTOR A**

**SLOVAKIA DAYS – 21<sup>st</sup> – 23<sup>rd</sup> May, 2008**

**PAPER A06**

**a.c. corrosion experiences in ENERGINET.DK**

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## CeoCor Plenary Days 2008 in Slovakia

Investigation for AC-corrosion on a Danish transmission pipeline  
interfered by HVAC lines

Using

ER-probes

ILI inspection

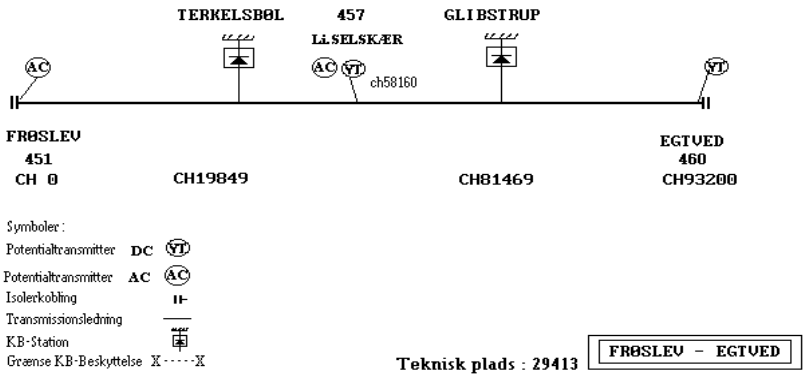
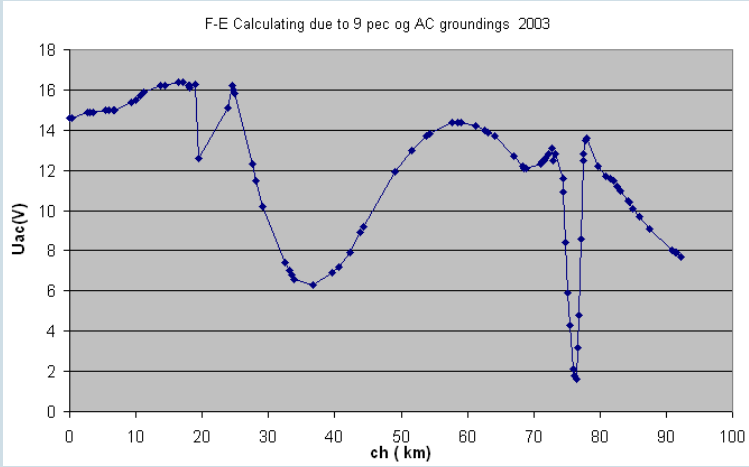
Coating defect location

Fieldinvestigations

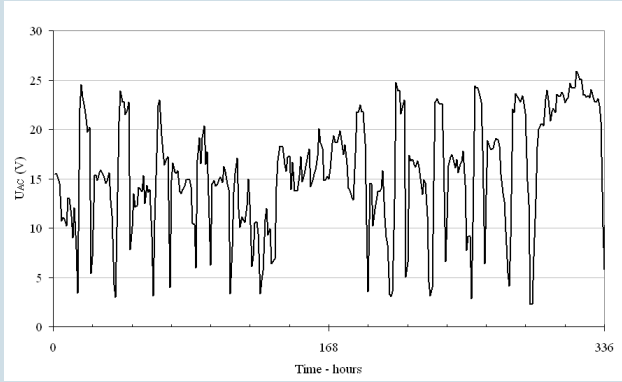
Peter Cohn Energinet.dk

# Location and facts

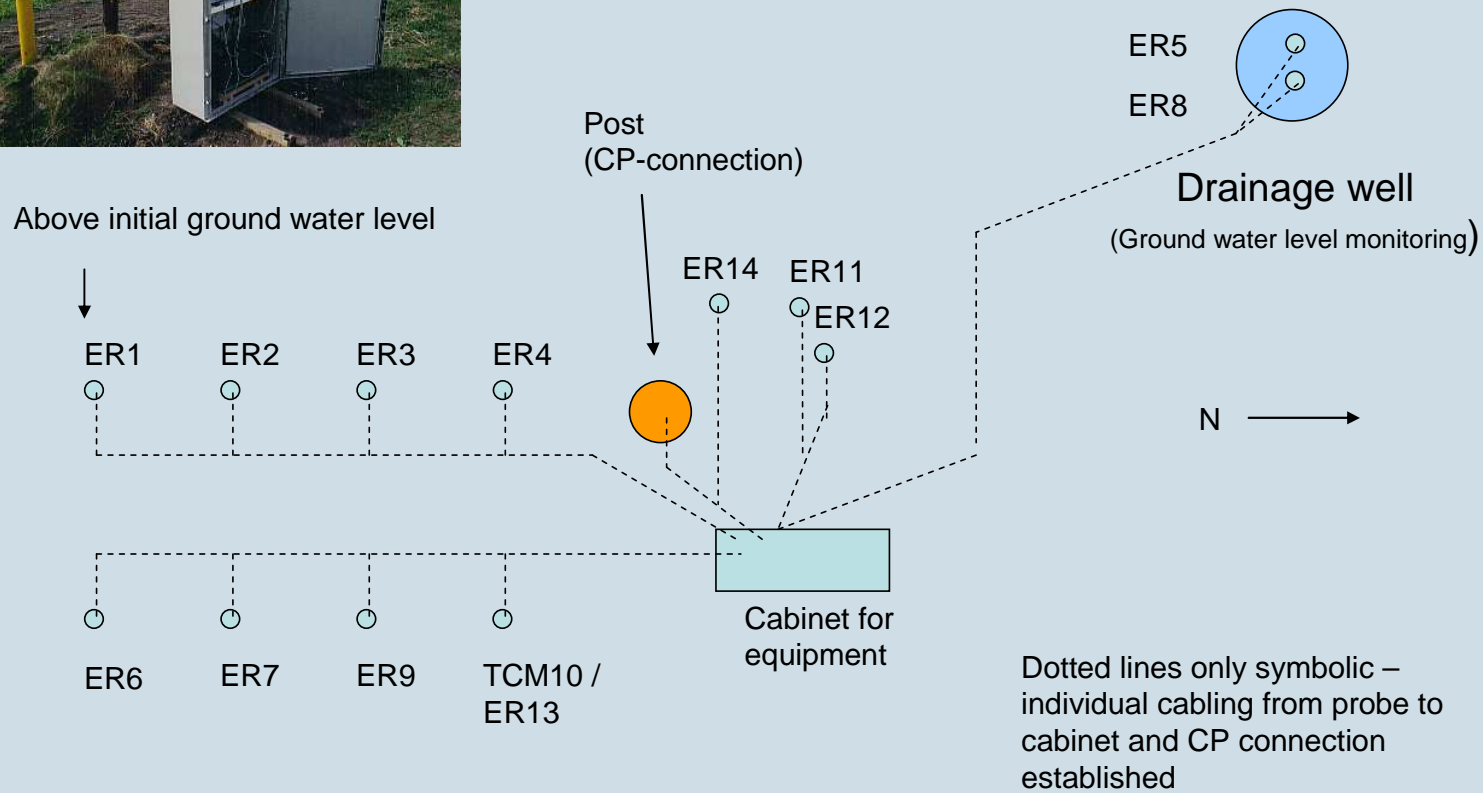
- Ø = 605mm - PE coated / asphalt / 3-M sleeves - Year 1980
- CP- app 25mA - Uoff = -1000mV
- Uac Calculated



## Uac measured

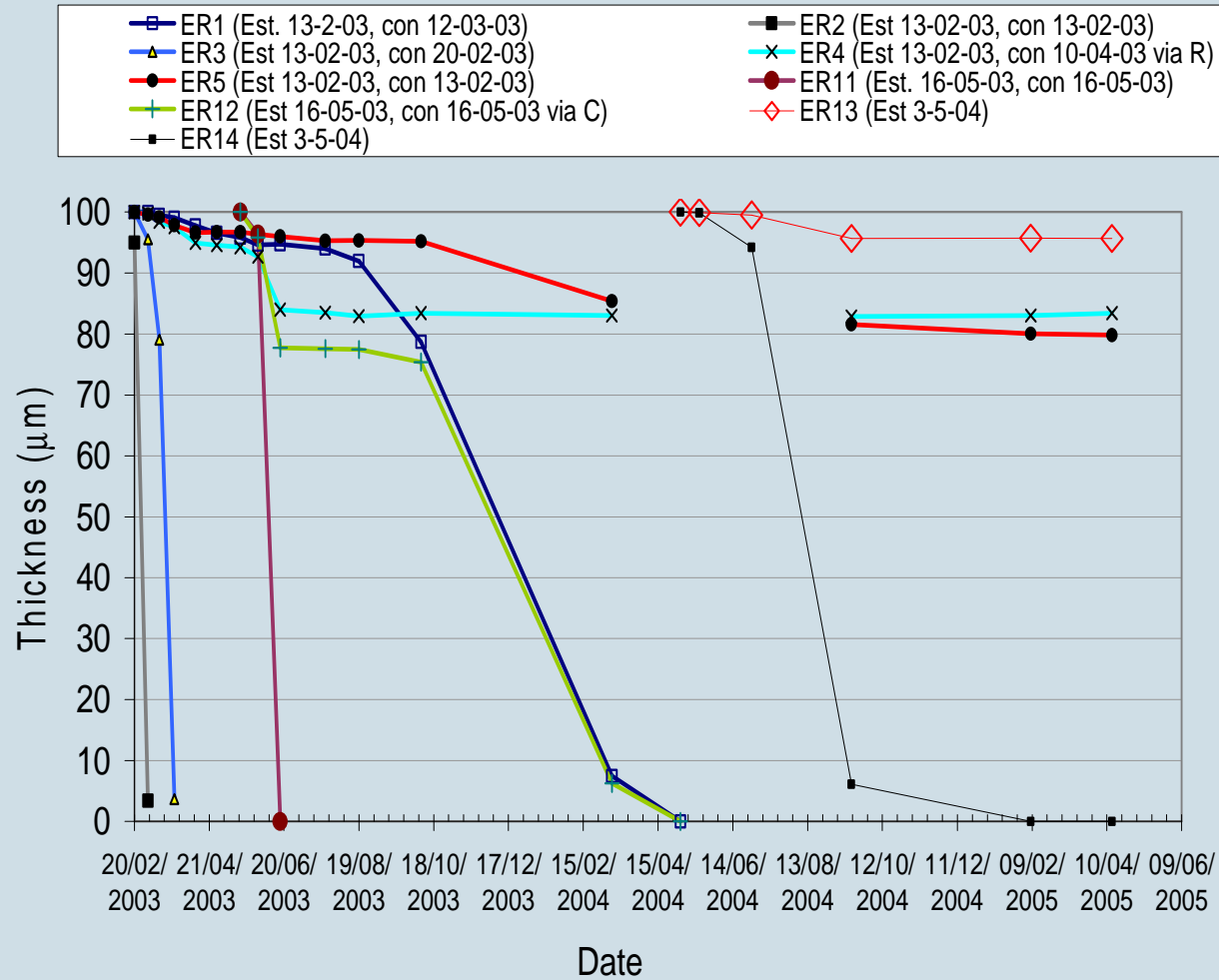


# Investigation for AC – corrosion - setup



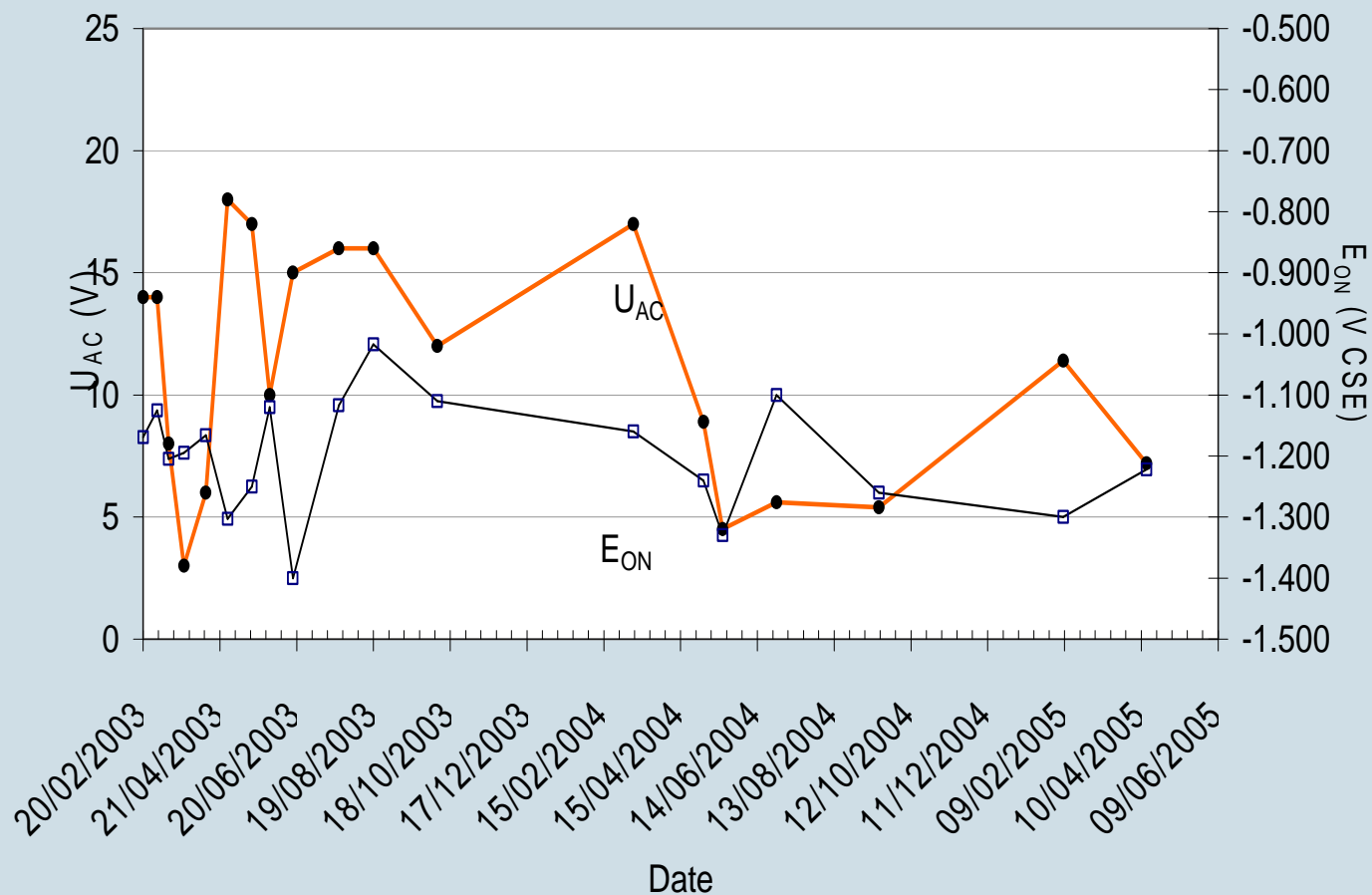
# Corrosion at different ER- coupons

Frøslev-Egtved km 0.9 - ER accumulated 100 micron probes



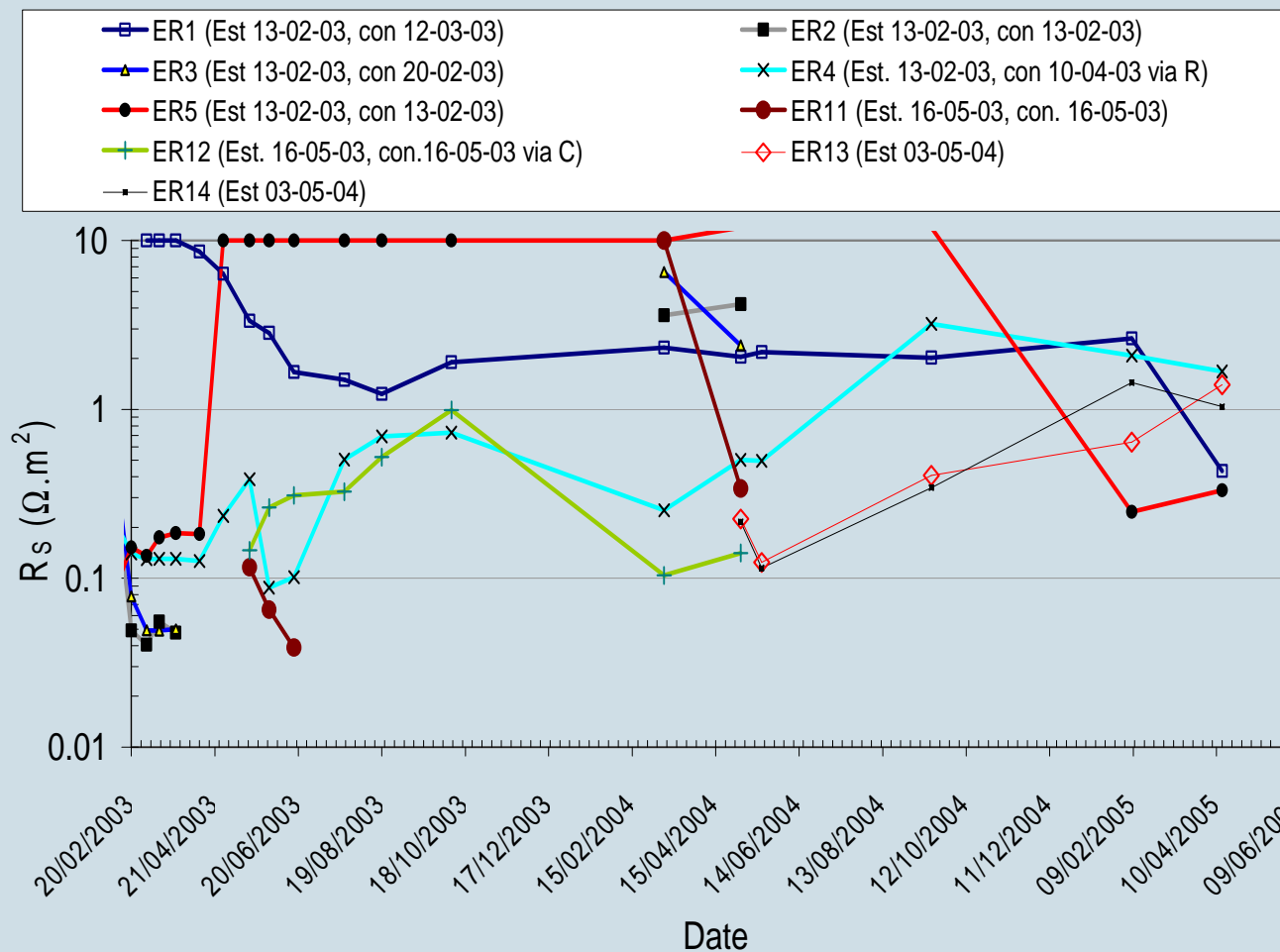
# Uac measured at testsite

Frøslev-Egtved km 0.9 - Pipe spotwise AC voltage and  $E_{ON}$ .

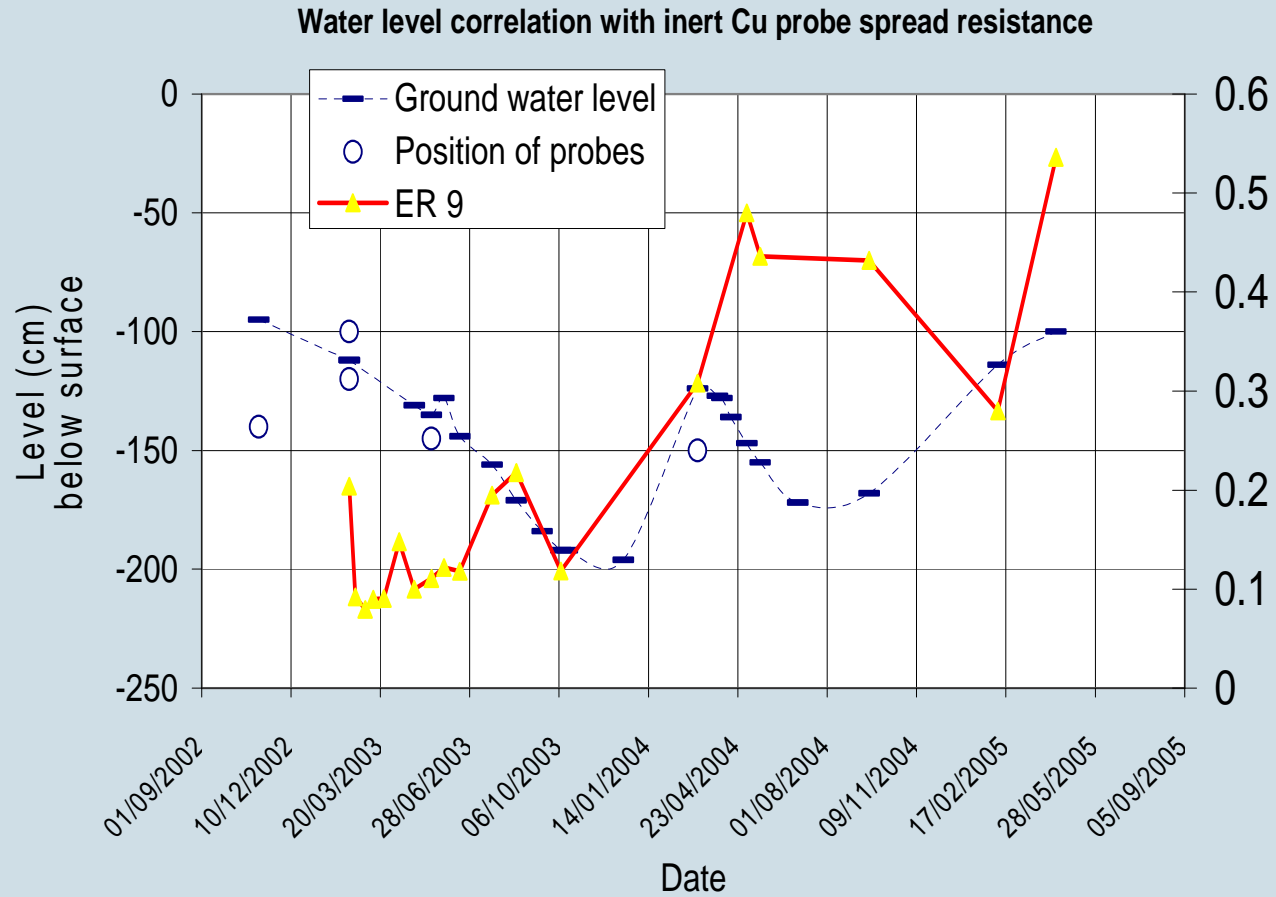


# Calculated spread resistance for ER - coupons

Frøslev-Egtved km 0.9 - Spread resistance data



# Waterlevel measured in well





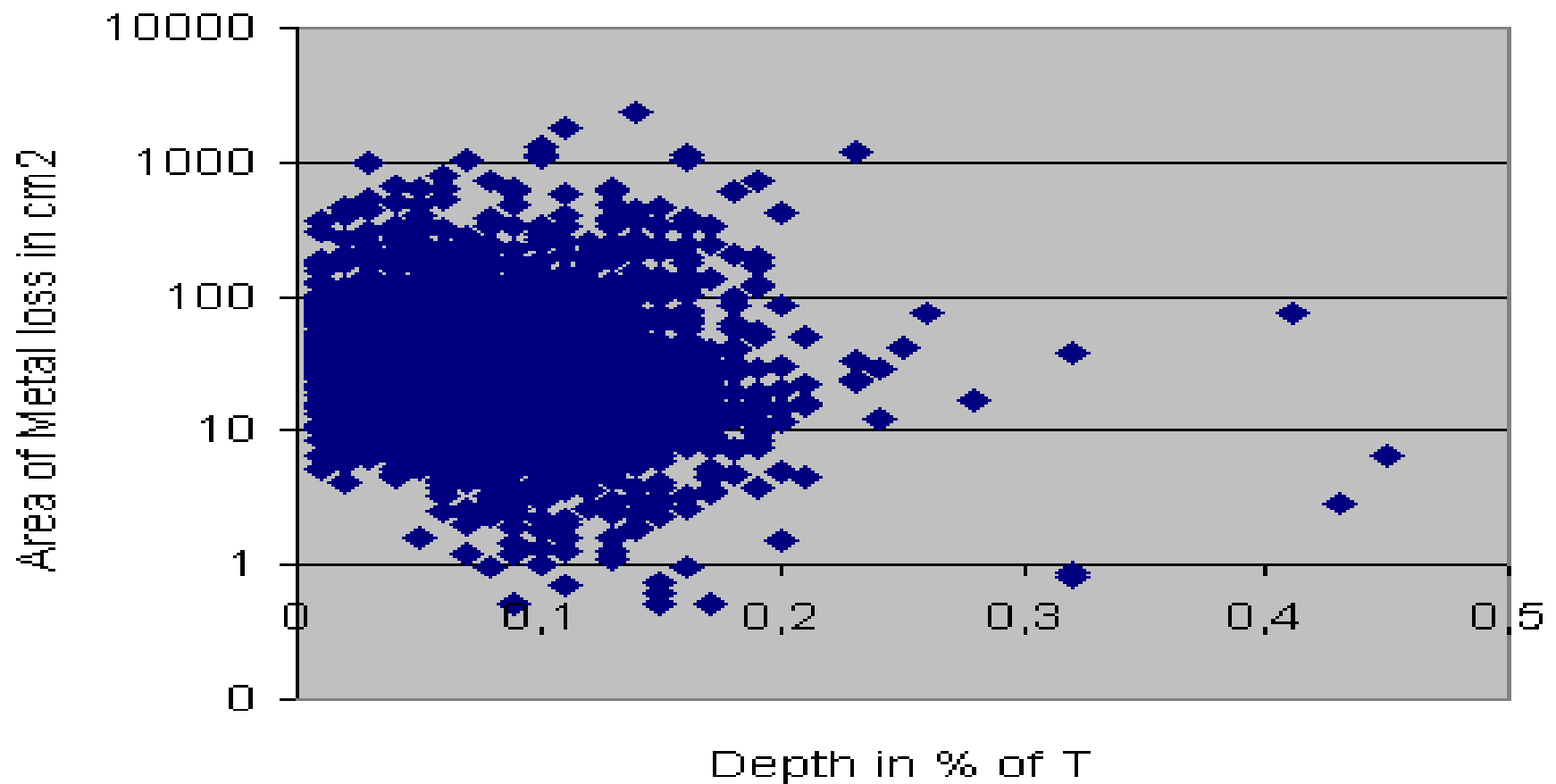
# What next?

- ILI inspection ? – Yes

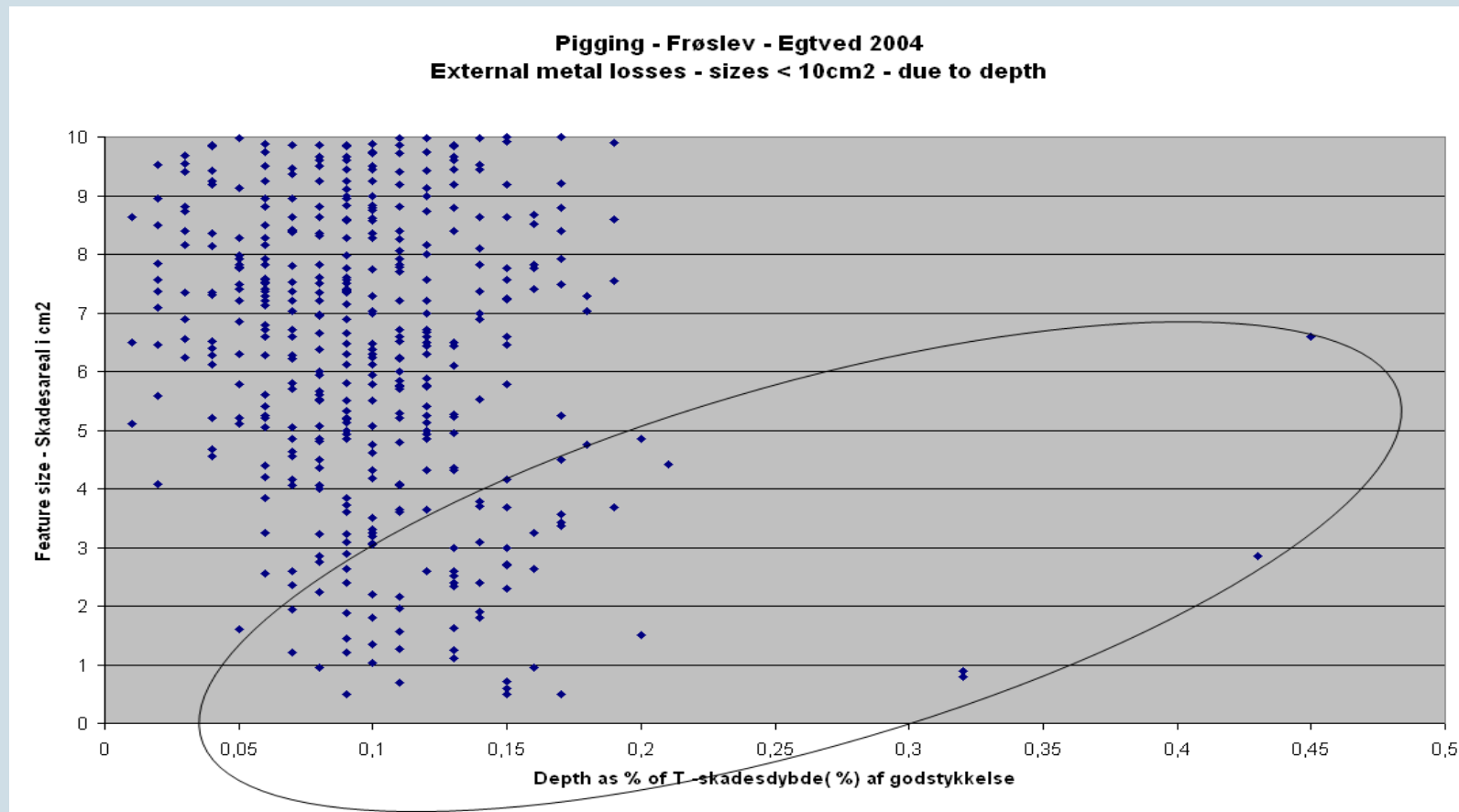
(PII Year 2005) - looking for metal losses

# All metal losses – all detections - 1556 internal and 1073 external

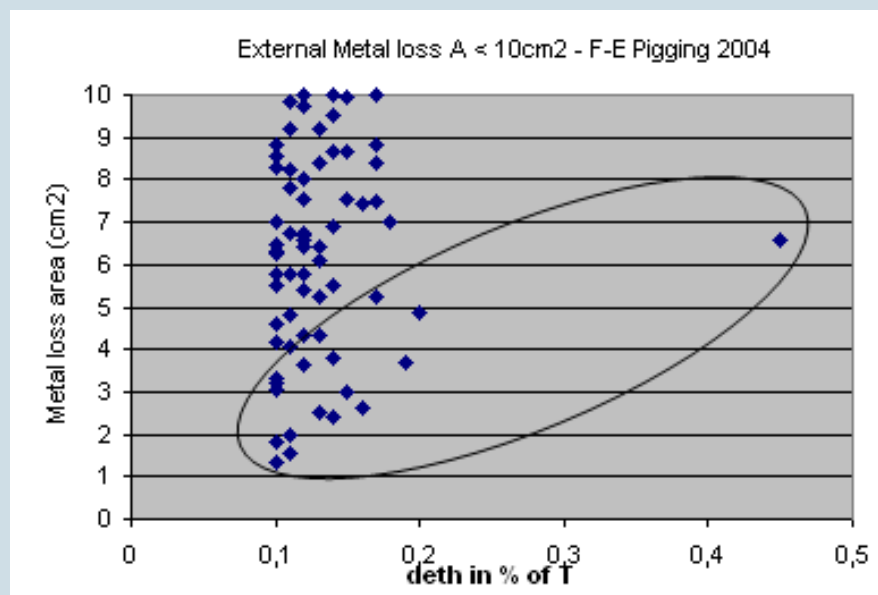
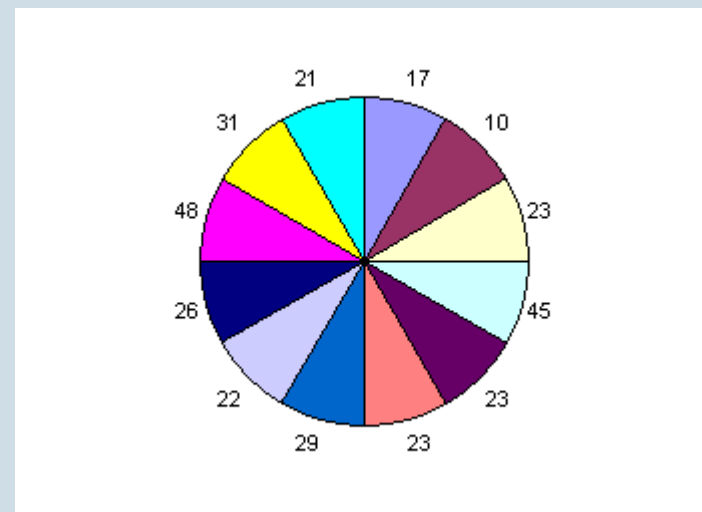
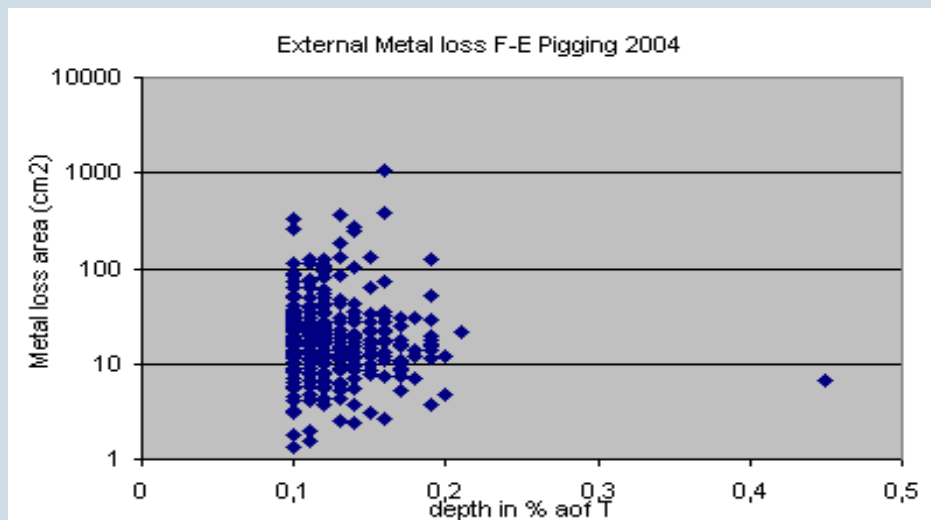
Frøslev - Egtved pigging 2004  
Internal and External metal losses



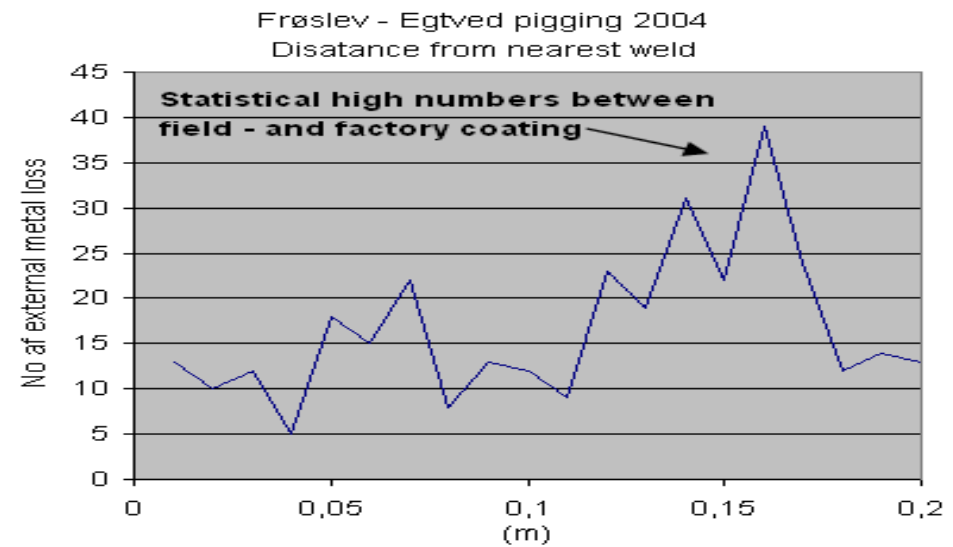
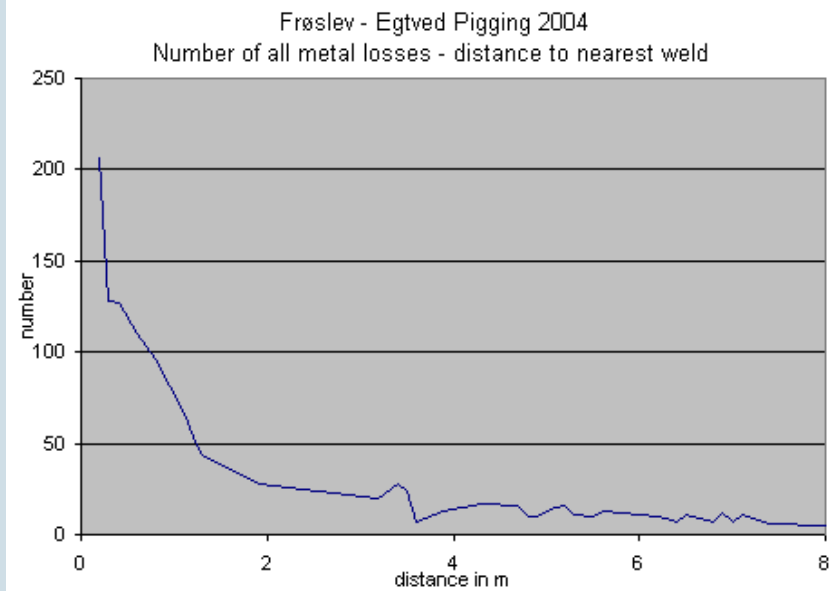
# All external metal loss less 10cm2



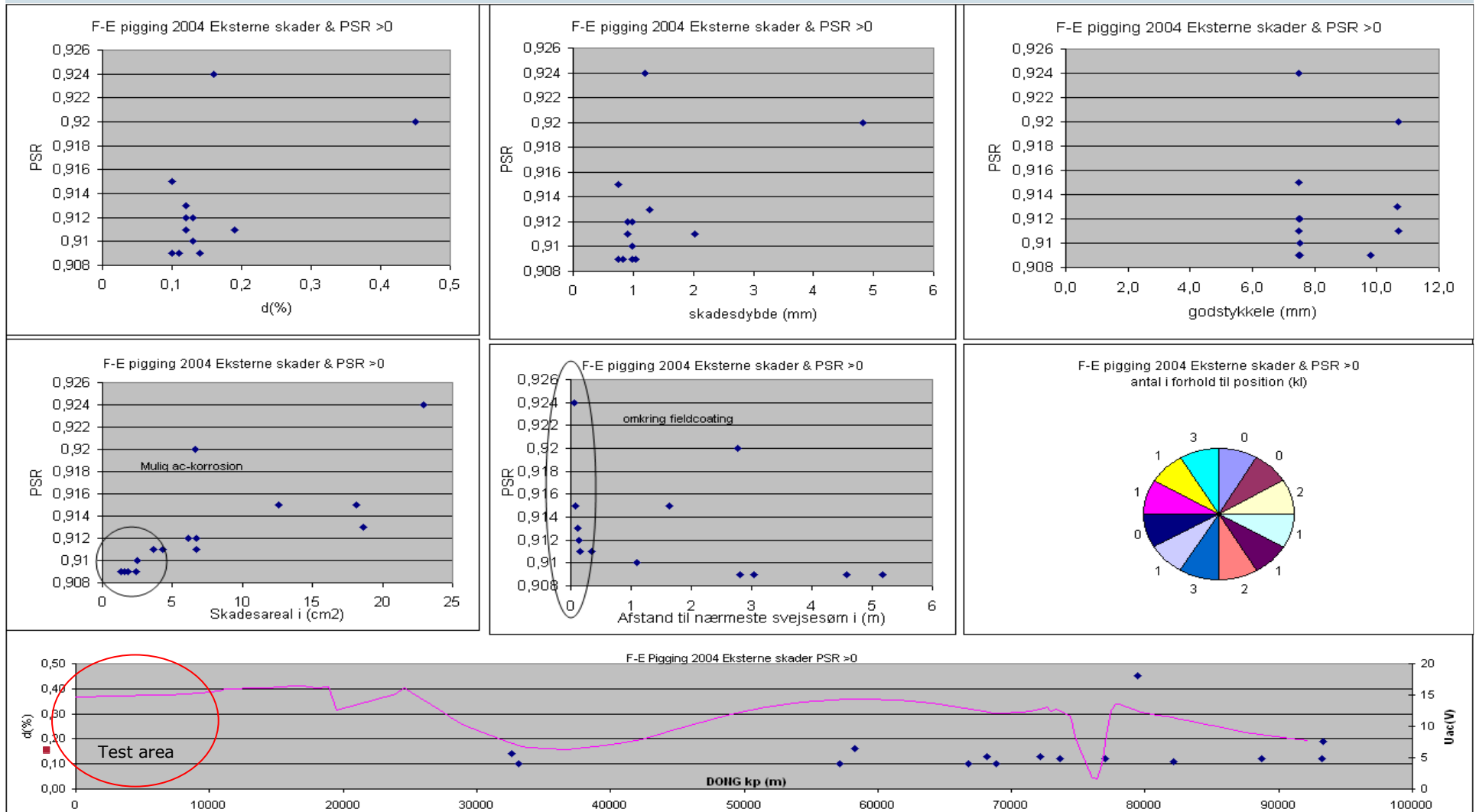
# External metal loss - analyses



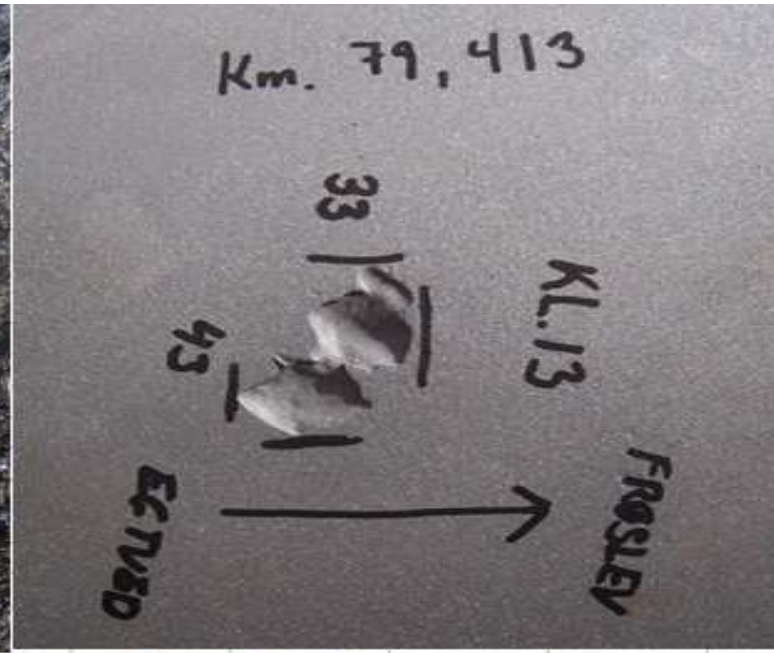
# Location on a pipelength



# More analyses – comparison to AC Voltage



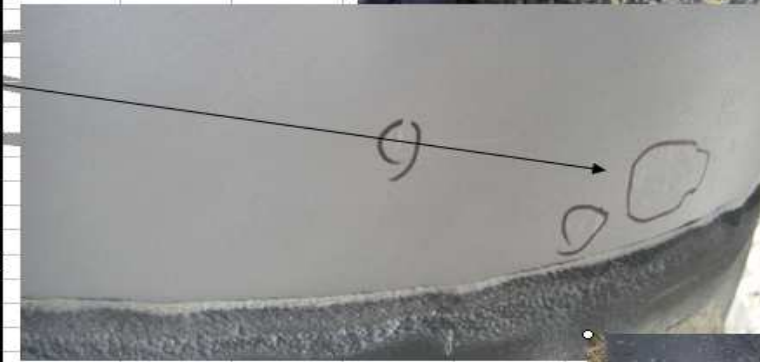
# Metal loss detected by ILI – Milling defect – no coating defect – clock spring





# Metal loss – detected by ILI – no coating defect – “mechanical defect” – polished before fieldcoating

Strækning:	F-E	Ch:	77.016,61
Frilægningsdato:	05-09-2007	Initialer:	pco/kej
Årsag:	Pll pigrun -notat	137527/07	
PSP	35-0202-01-03		
<b>Lokation :</b>			
Factory coating :	2-lags PE	Vedhæftning	100%
Fieldcoating	asfalt bitumen m	Krympemuffe	
Overlap (cm)			5,00
Vedhæftning til rør			100%
Gennemslag ved 25kV			ja
Korrosionsfri			ja
fugt/vand under fieldcoating			0%
EVT Skadesdybde ( beskrives separat)			
<b>Bemærkning</b>			
Recoating	rengøring	sandblæst	
	primer	denso	
	tape	denso AS40Plus	
	entreprenør	Pihl Coating	
Pigging data:		svejsesøm	836
Skadesdata:			
I (mm)	23	b (mm)	29
d (mm)	0,9	KI :	05:05
afstand fra svejsesøm (cm)			13,6
Måleværdi "3-M"			0
Frilægningsdata ( målt på skade)		svejsesøm	661
Skadesdata:			
I (mm)	20	b (mm)	30
d (mm)	0,9	KI :	05:05
Position (afstand fra svejsesøm)			13
<b>Bemærkning: Ingen coatingskade over mekanisk skade</b>			
Mekanisk skade - fra anlæg			
Lap kl 0 ca 100*100 mm i kant af fieldcoating - 100% ok			
coatingskade kl 6 ca 6 cm opstrøms svejsesøm uden korrosion			
forårsaget af sten-fundet ved frilægning			
Billedreference :	Q:\6 Diverse Fotos\20070905 - F-E frilægning		



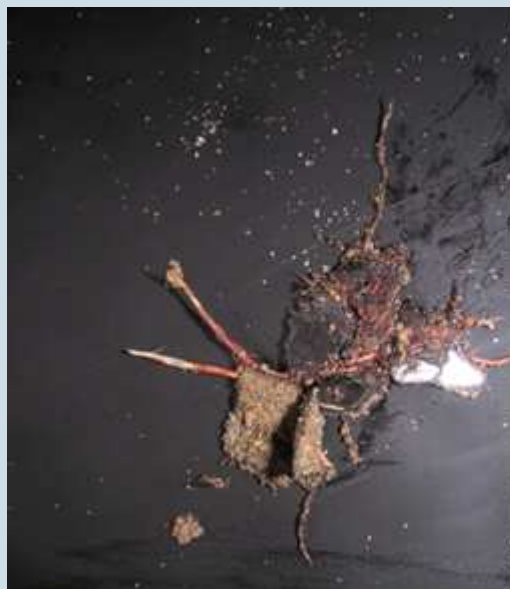


# Coating defect detected by ACVD – No metal loss detected by ILI - corrosion – lack of workmanship

Inspektion af "Fieldcoated svejsesøm"		
Strækning:	Freslev - Eghed	Chc 1,936
Fri lægningsdato:	26-10-2006	Initialet: J0J
Årsag:	Fundet ved ICB-måling	
PSP:	35-0202-01-03	
Lokation:		
Factory coating:	Vedhæftning til rør	2-lags PE 100%
Fieldcoating	Type	asfalt på ståloverflade til niveau med PE derefter Reychem krympemuffe med få cm overlæg
	svejsesøm (no)	
	Overlap (cm)	0 til 3 cm 123
	Bredde af fieldcoating	
	Gennemslag ved 25kV	ja
	Vedhæftning til rør	50%
	Vedhæftning til Factorycoating	0%
	Korrosionsfri	overfladerust
EVT Skadesdybde (beskrives separat)		
Fri for fugt/vand under fieldcoating	delvis	
Bemærkning		
Recoating	rengøring	sandblest
	primer	denso
	tape	denso AS40Plus
	entreprenør	Pihl Coating
lap	dimension (cm)	
	position ca 2m nedenstrøms svejsesøm	
	Gennemslag ved 25kV	ja
	Vedhæftning	
	Korrosionsfri	
Fri for fugt/vand under fieldcoating		
Bemærkning		
Recoating	rengøring	
	primer	
	tape	
	entreprenør	
(Rating)		



# Raychem sleeve – with asphalt and tree roots



# Results from excavations

- 8 ILI metal loss indications has been inspected
- Coating defects has been located with ACVD over a distance of 5 km next to the ER test site resulting in 3 extra inspections
- ILI data shows fine accuracy (distance to weld and depth etc)
- ILI evaluations says "no corrosion", no corrosion was found
- 2 locations were due to mill defects
- 3 indications has been "polished", **indicating** that the metal loss is from pipe laying
- None of the metal loss indications has any corrosion
- Investigations on factory coating (PE) shows no decomposition due to age or other
- Investigations of fieldcoating (bitumen and shrinkable sleeves) shows lack of cleaning before applying – sleeve too little overlap

- What can be done "looking for ac – corrosion ?
- DCVD or ACVD surveys may indicate coating defects – sizing is bad – only dig ups may verify corrosion
- What do the statistics say: How many coating defects shall be found – to find one where AC- corrosion is active?
- Will ILI be able to indicate AC-corrosion metal losses  $\ll 1\text{cm}^2$  ?