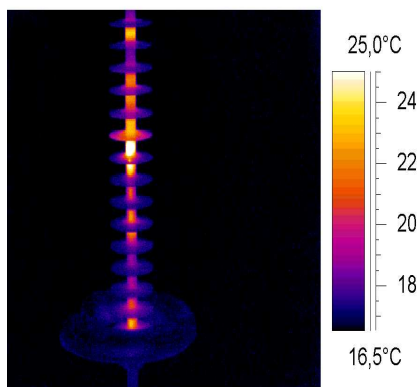


Elkvalitetsmätningar

Mats Häger
STRI

STRI

Teknikområden



- Isolationslösningar
- Kompakta lösningar
- Elkraftsystem
- **EMC – Elkvalitet**
- Optimalt nätutnyttjande
- Underhåll och diagnostik
- Högspännings- och temperaturstegringsprov



Instruments

Multifunction Power System Analyzer TR-16, Multirec

- 16 channels (U/I)
- Short- & long term monitoring,
- Harmonics (61000-4-7)
- Flicker (61000-4-15)
- Unbalance
- 'Real-time' registration
- GPS, modem



Gasutveckling i transformator

Förutsättningar

- Gasutveckling i transformatorer
- Okänd orsak

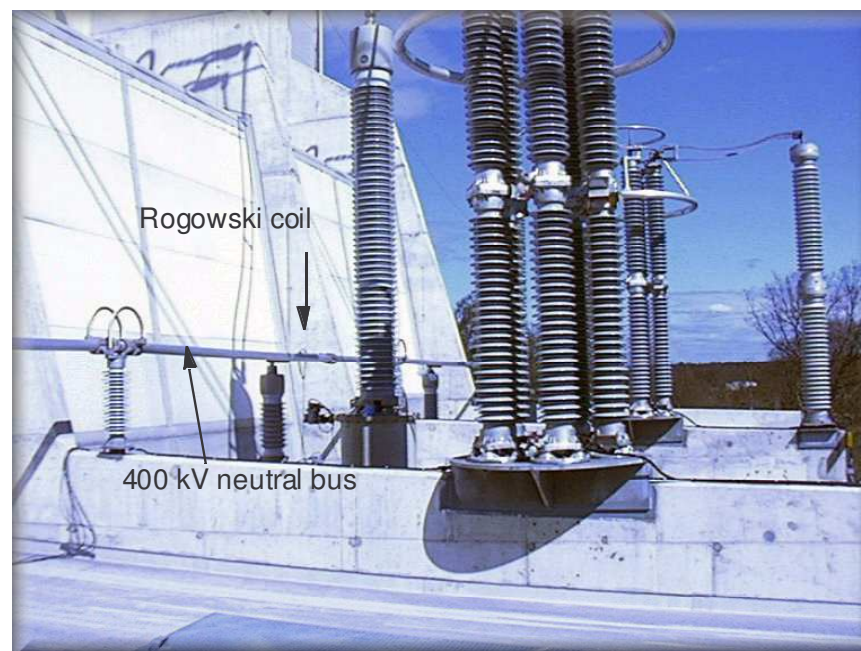
Mätningar utfördes av bl a

Övertoner (U/I),

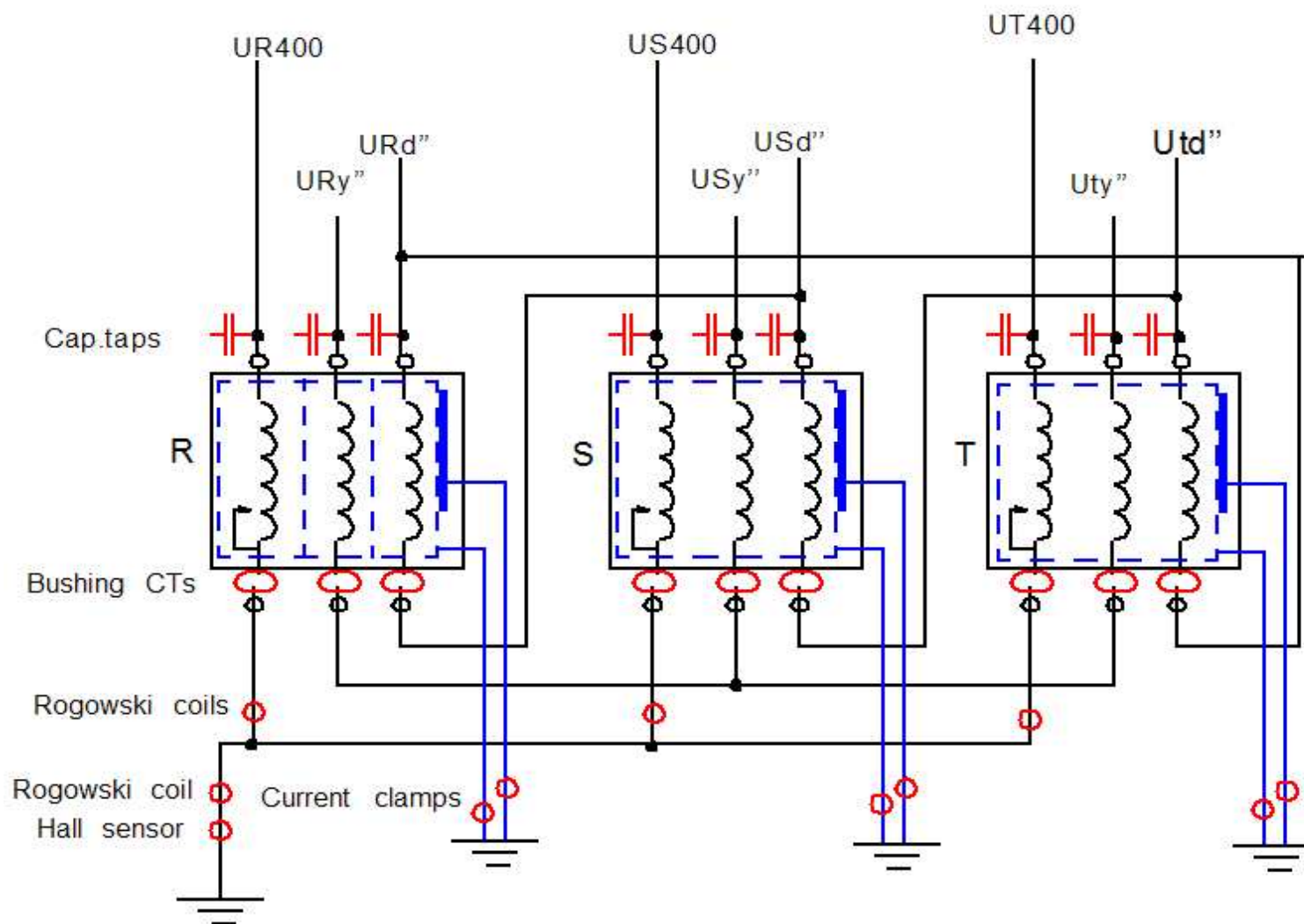
DC-ström, vibrationer

Jordning kärna/tank

Magnetiseringsström

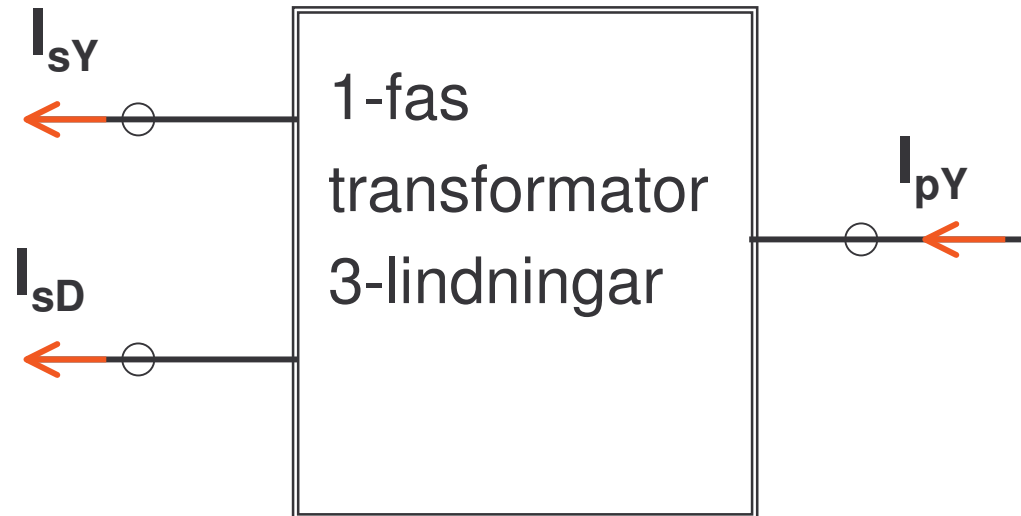


Gasutveckling i transformator



Magnetiseringsström

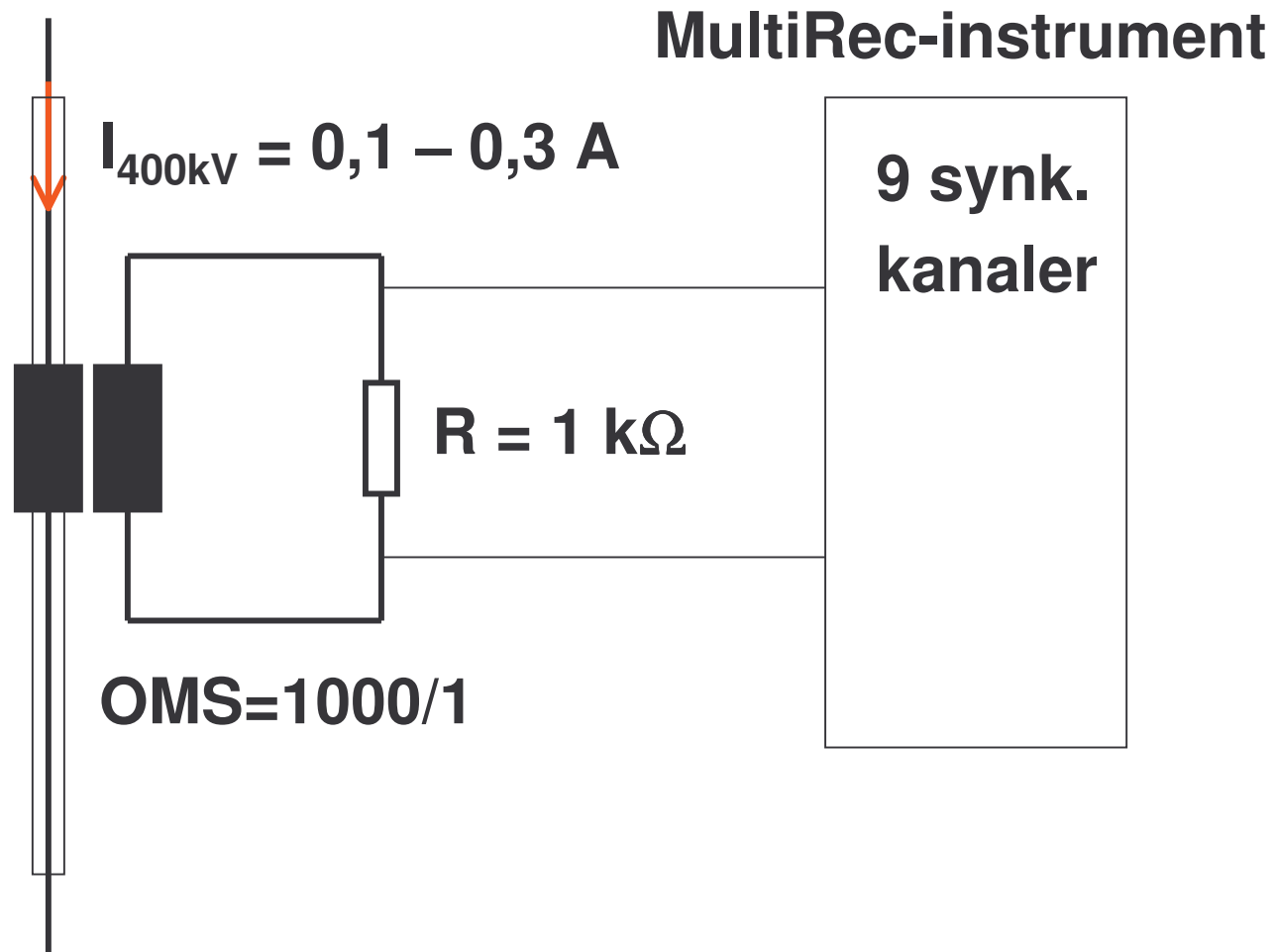
$$I_m = I_{pY} + I_{sY} + I_{sD}$$



$$I_{xm} = I_{x400} - I_{xY} * 181100/415130 - I_{xD} * 181100/415130 * \text{sqrt}(3)$$

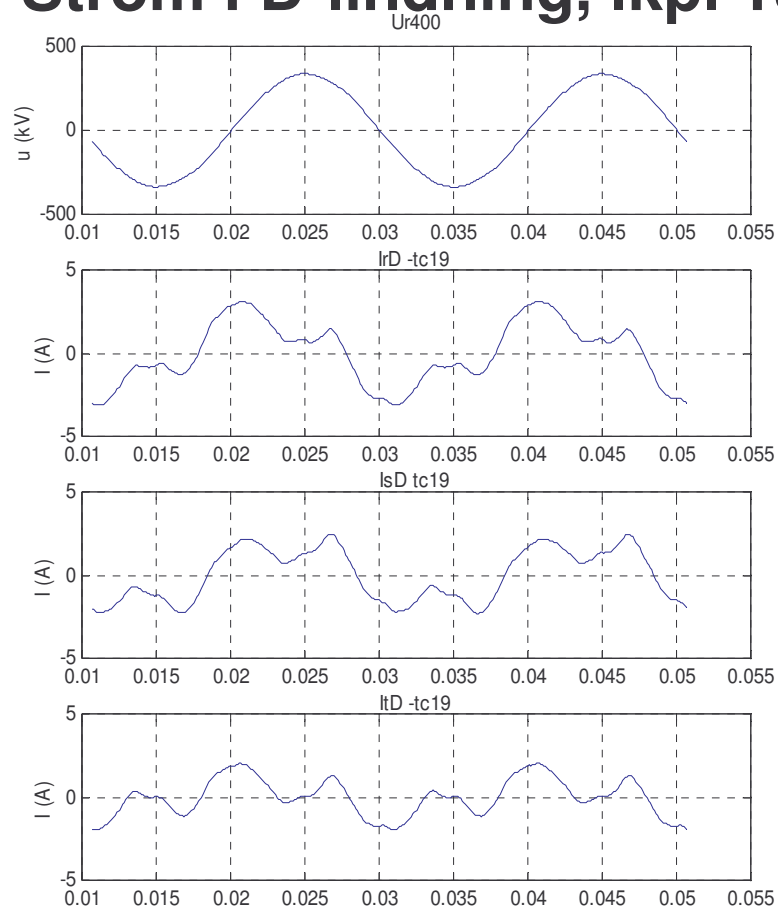
($x = fas R, S, T$)

Magnetiseringsström

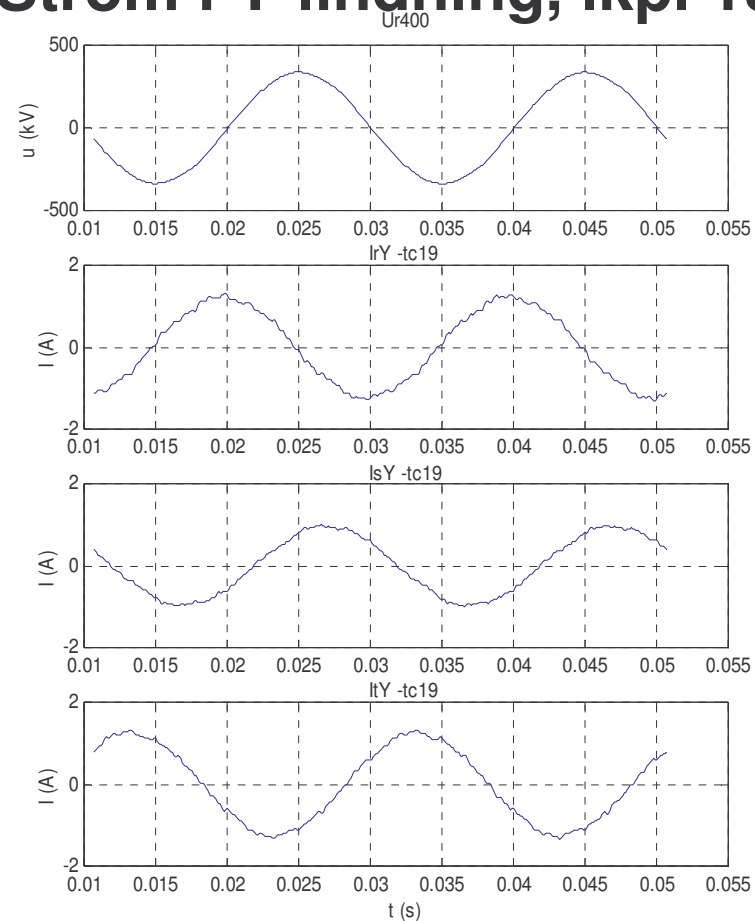


Magnetiseringsström

Ström i D-lindning, Ikpl 19

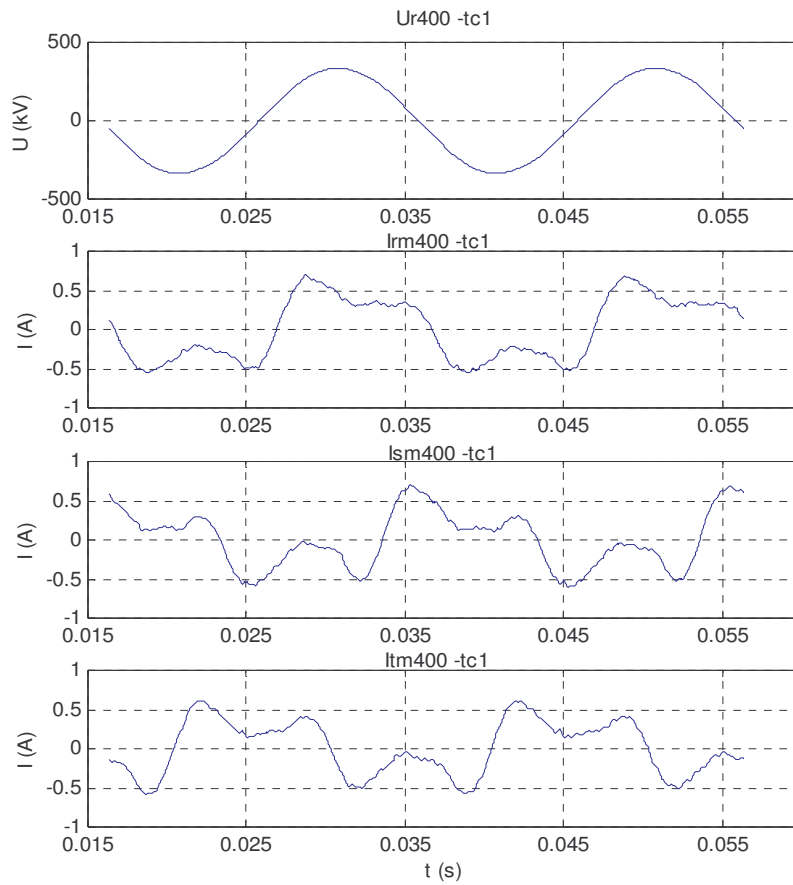


Ström i Y-lindning, Ikpl 19

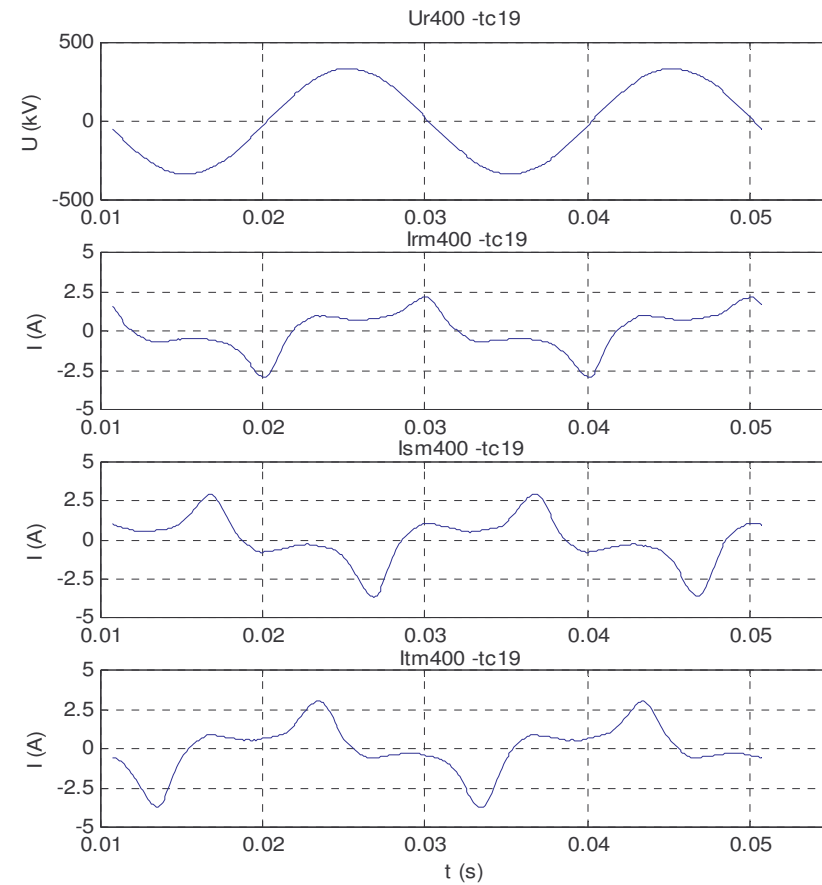


Magnetiseringsström

I_m , Ikpl 1



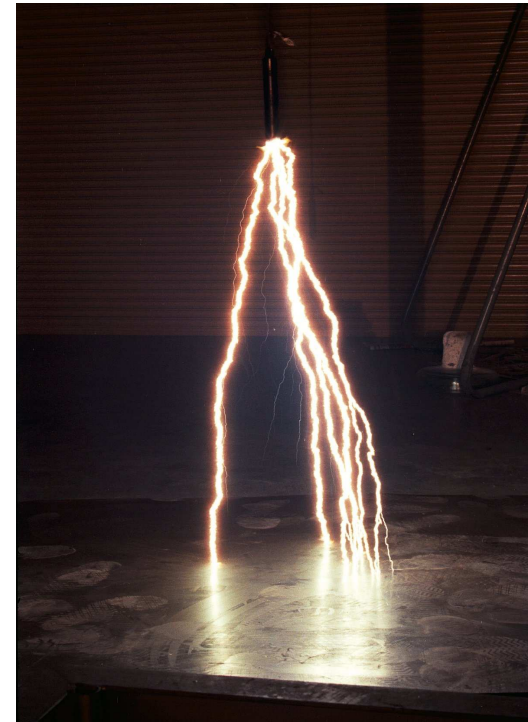
I_m , Ikpl 19



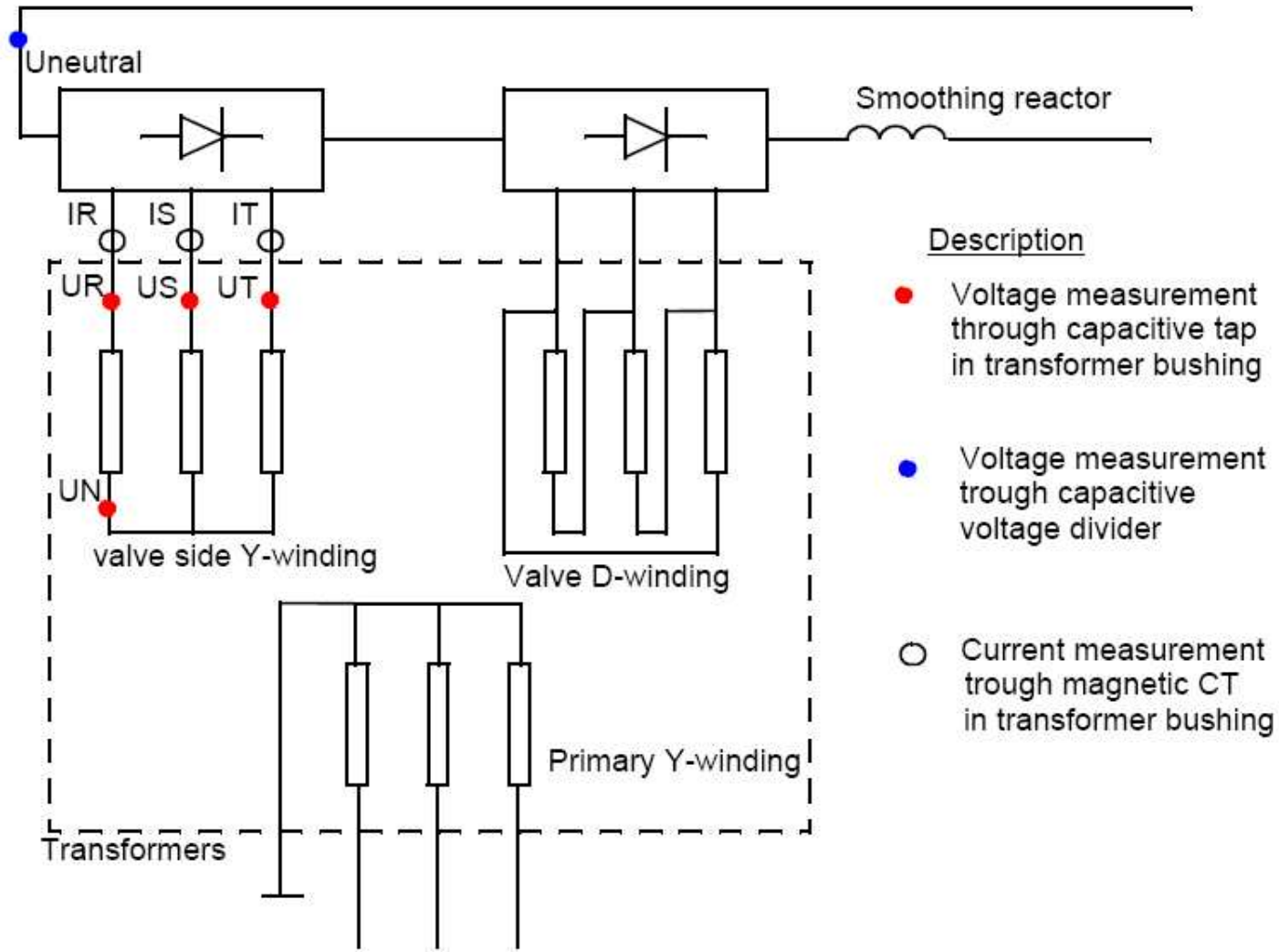
Mätning av spänningstransienter på hög potential

Förutsättningar:

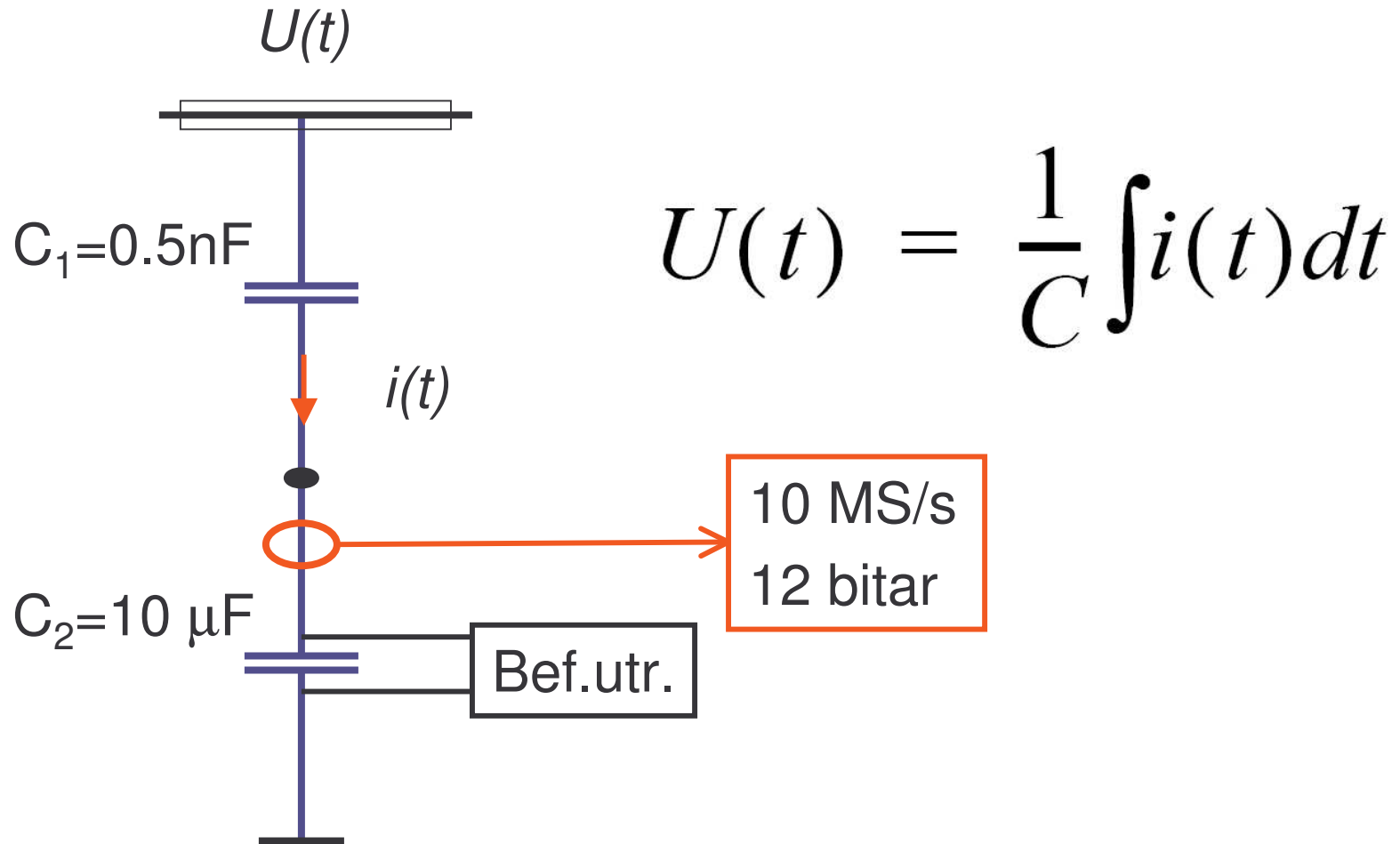
- amplitud upp till +/- 500 kV
- >1 MHz bandbredd
- förlopp med ca 400 ms varaktighet
- 'common-mode' och 'differential-mode'
- mätperiod 3–4 månader



Mätpunkter

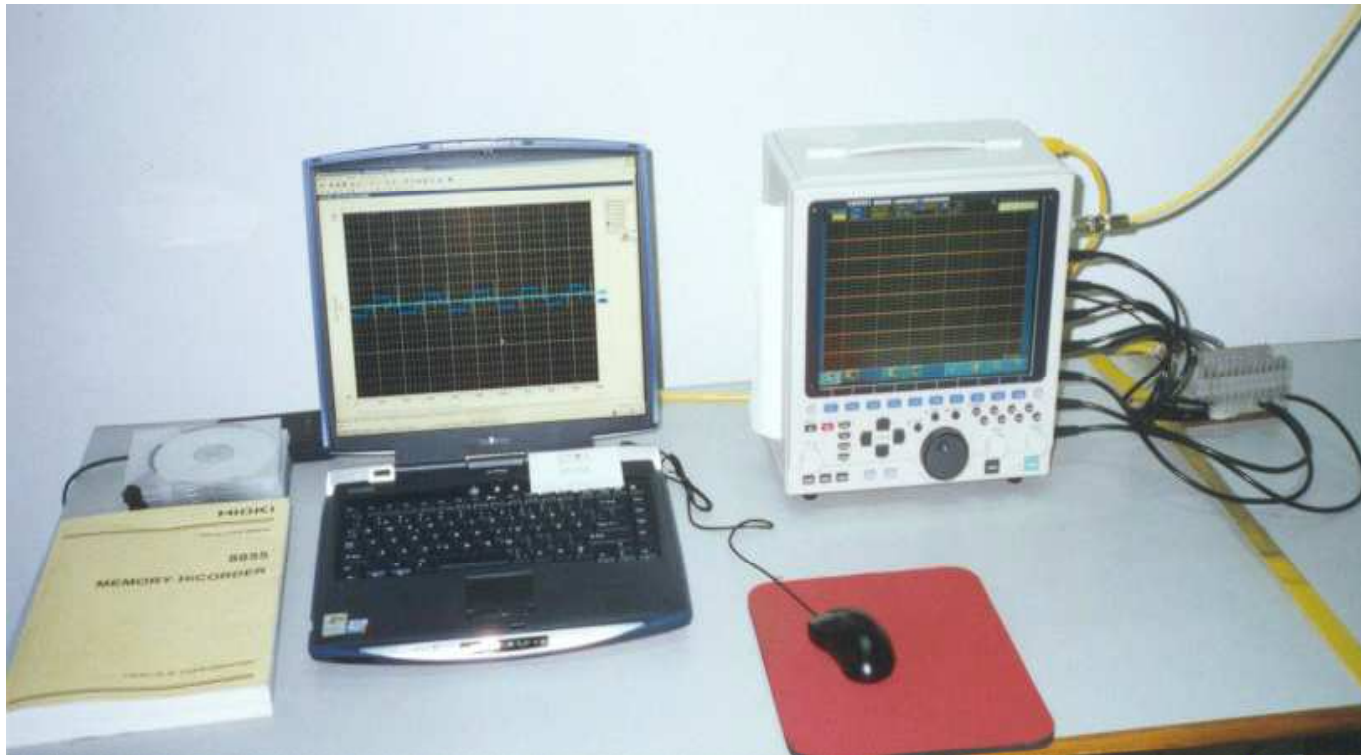


F-uttag ('capacitive tap')

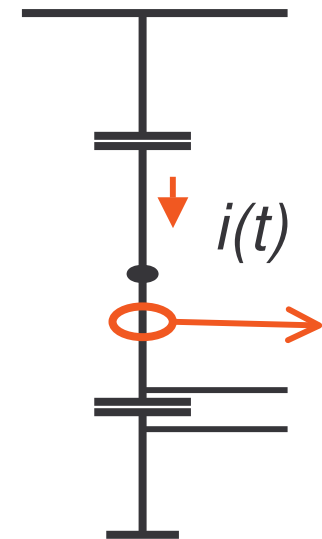
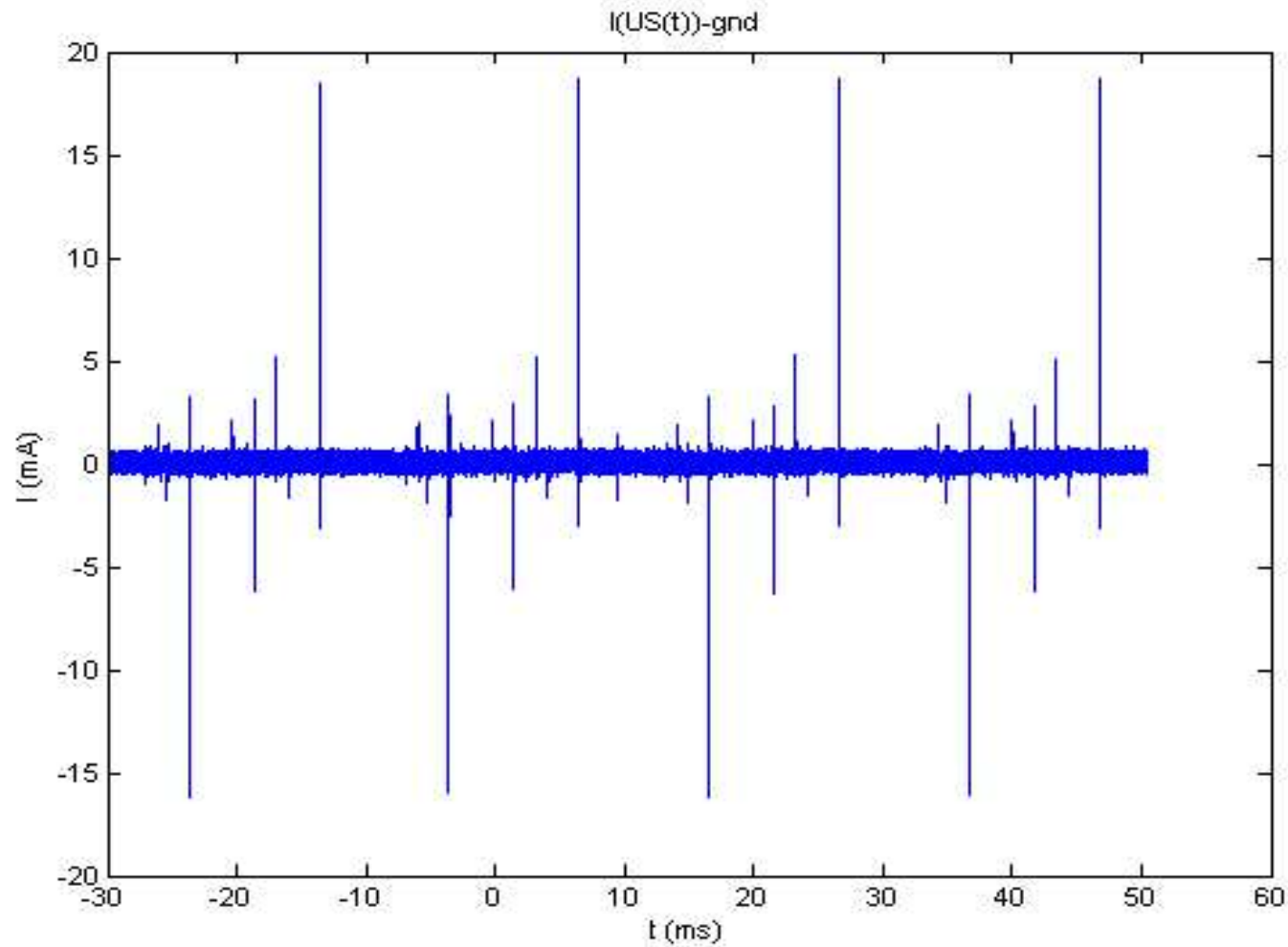


Mätsystem

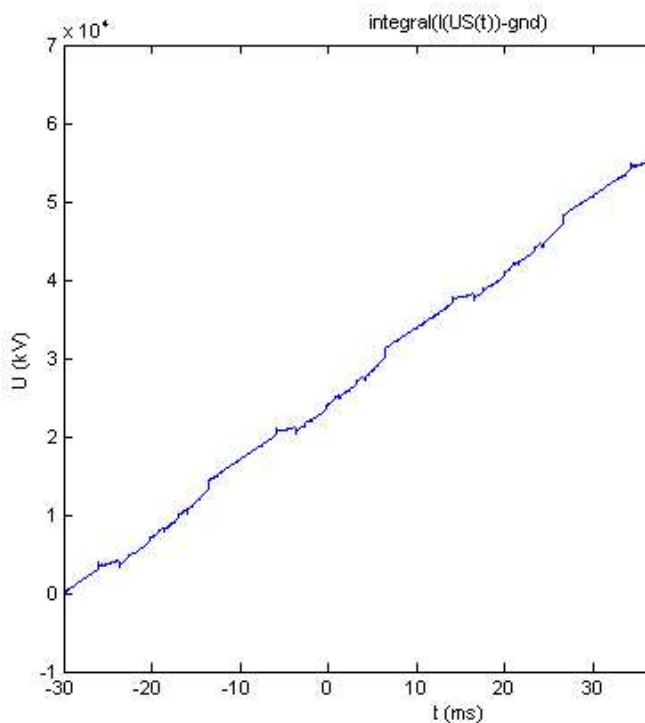
- Hioki Transient Recorder – 10 MHz/ 12 bit/ 8ch
- Pearson Current Probe / 5 MHz / 1A/1V



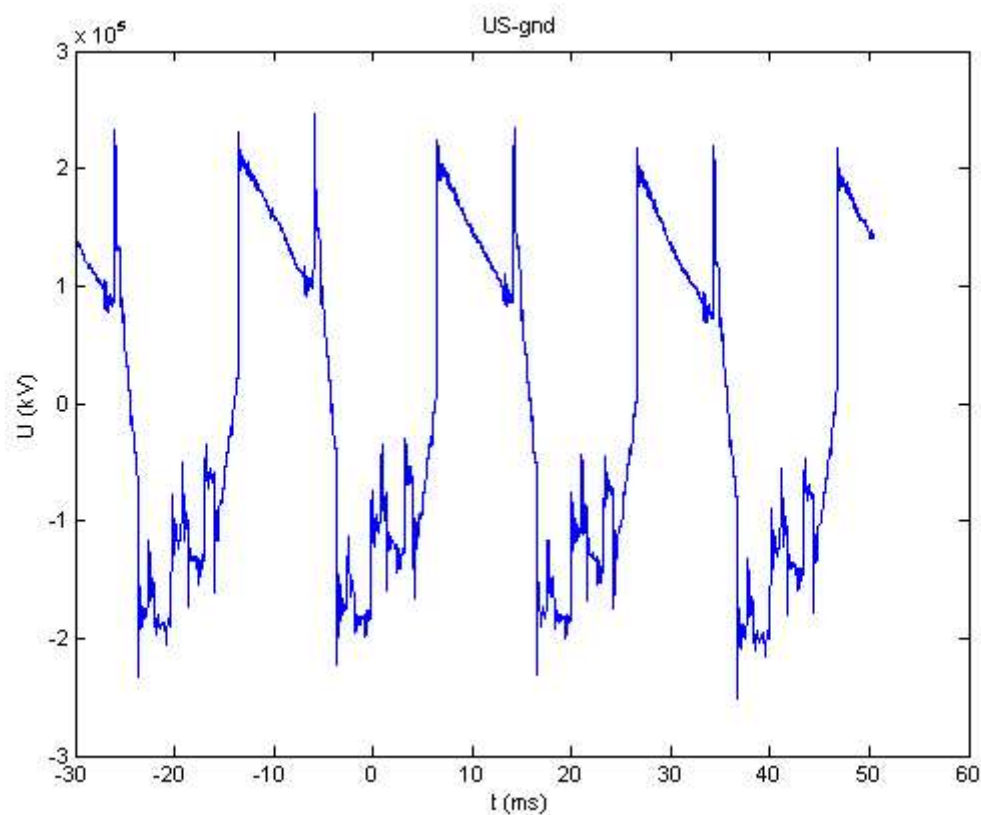
Registrering av ström genom F-uttag



'Signalbehandling'



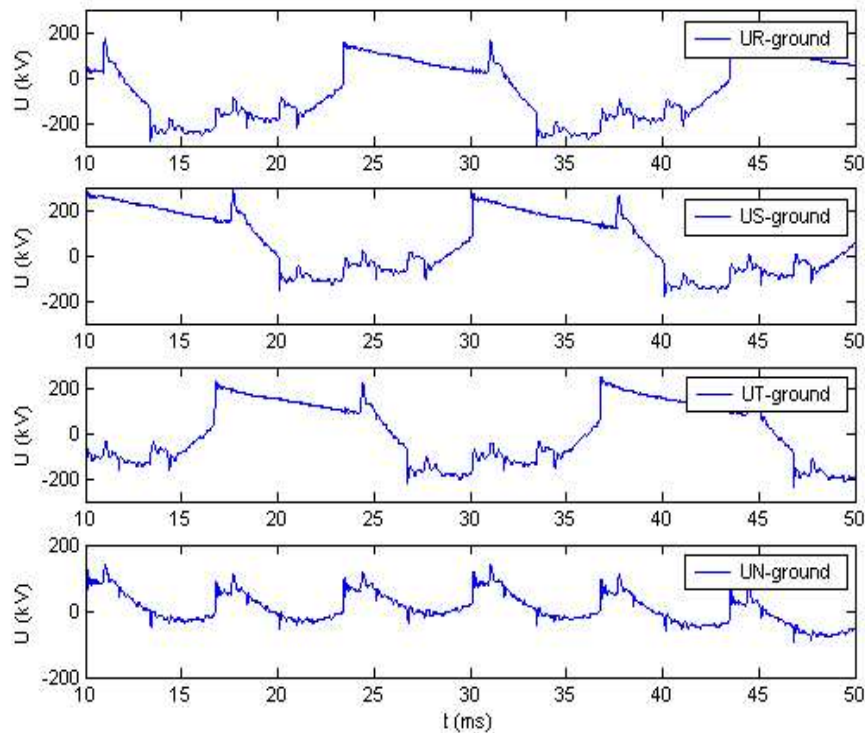
Efter offset-korrigering



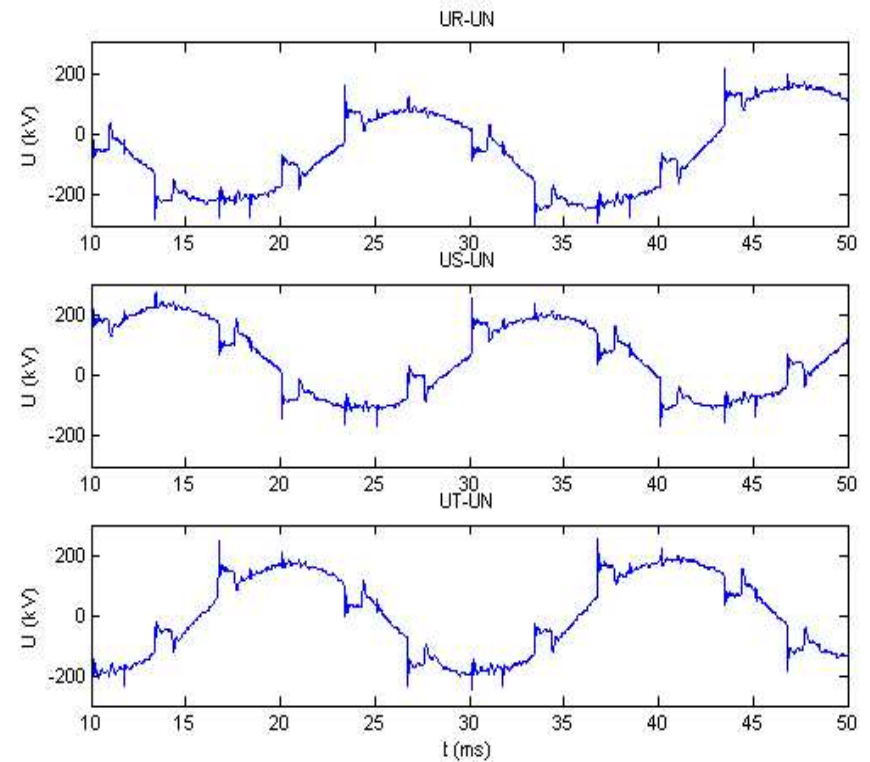
Integrering av ström
-lutning pga offset
i mätsystem

Resultat

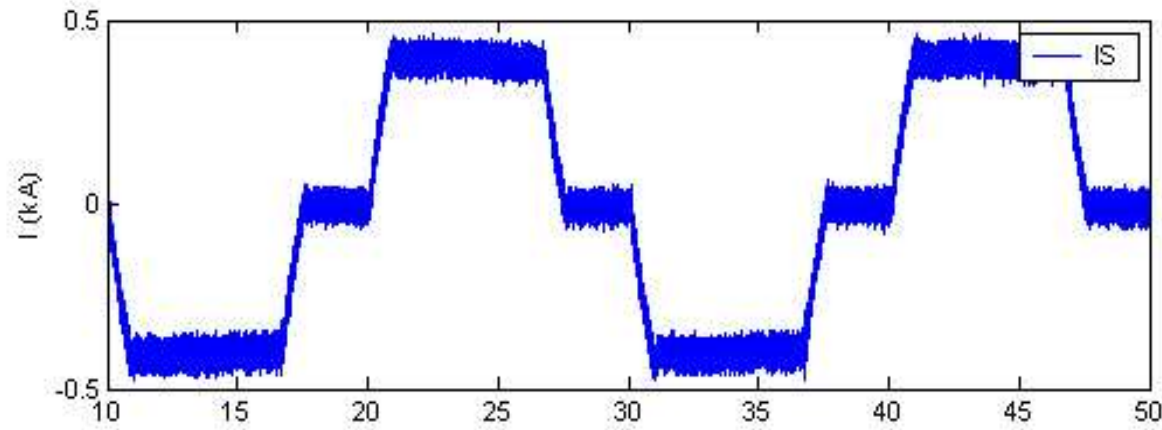
Spänning fas-jord
& nollpunkt-jord



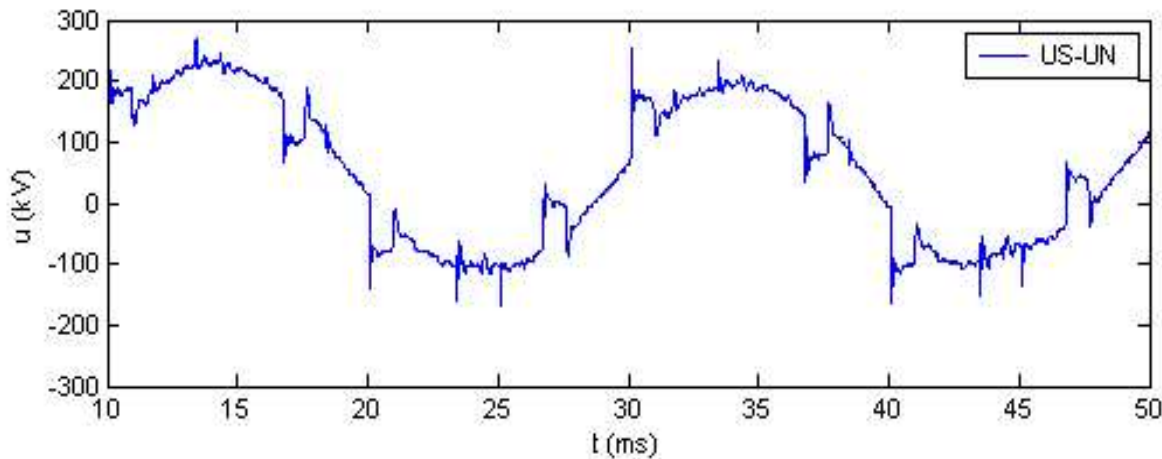
Spänning över
transformatorlindning



Resultat – normal drift

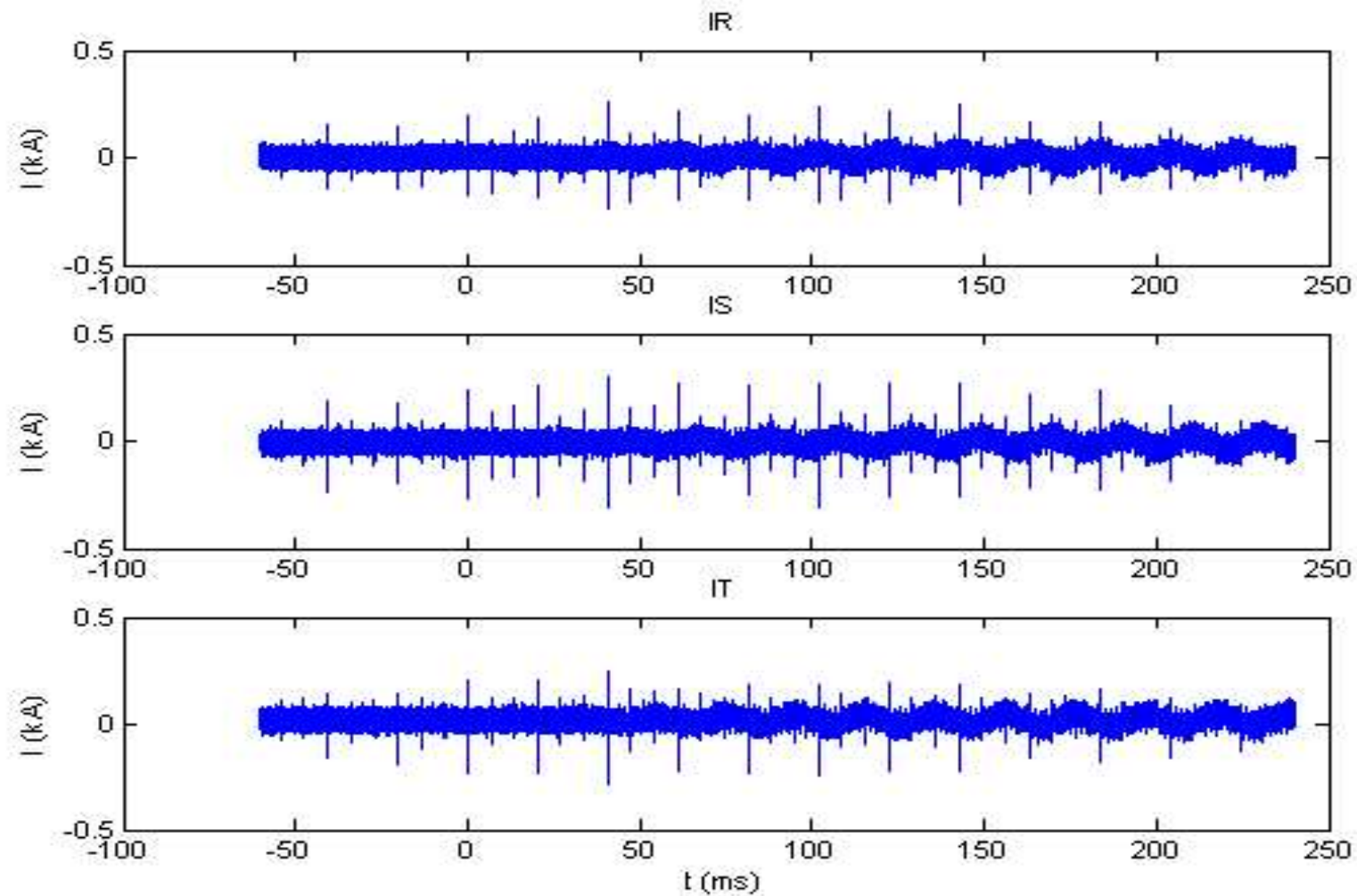


Ström genom
transformatorlindning

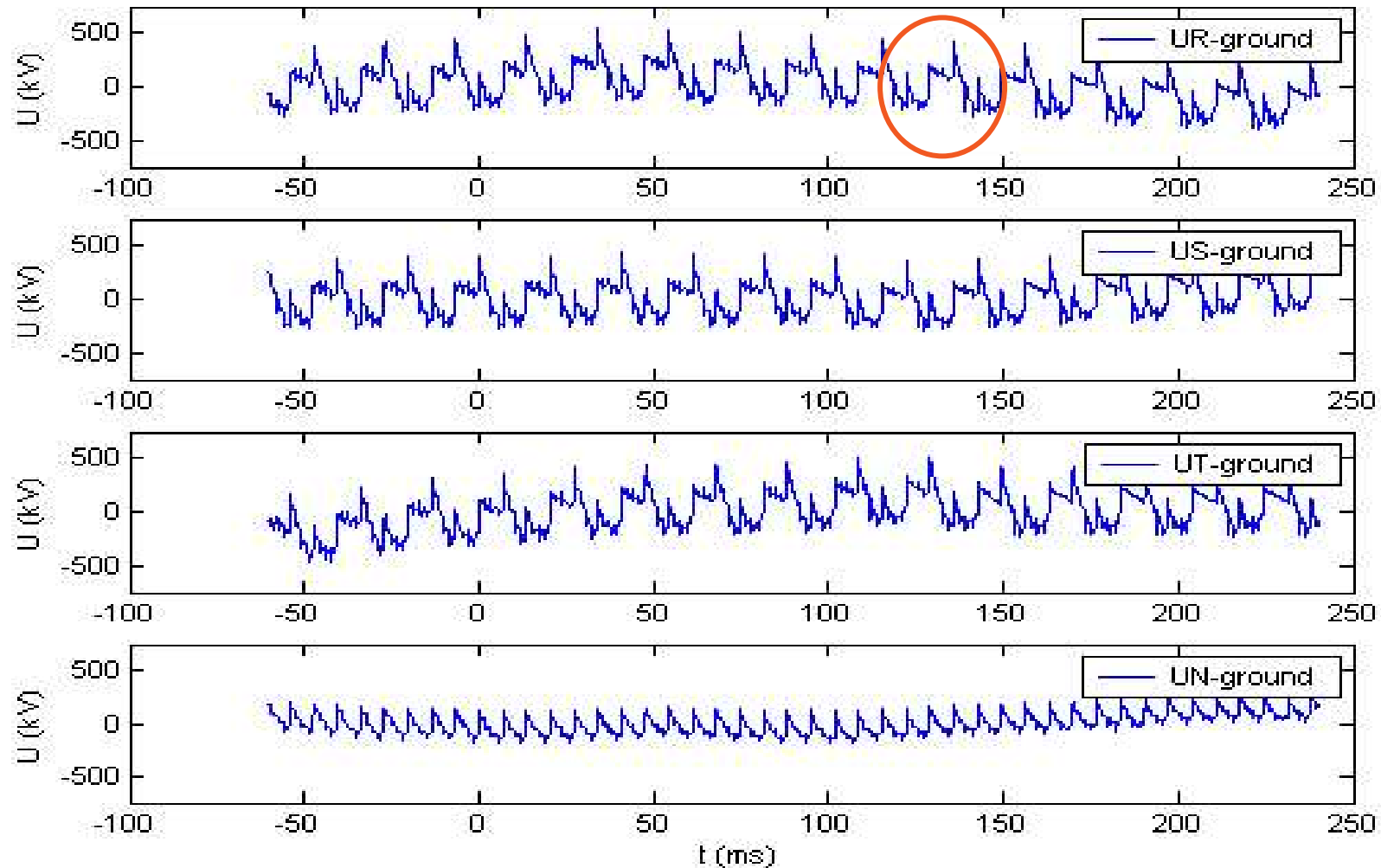


Spänning över
transformatorlindning

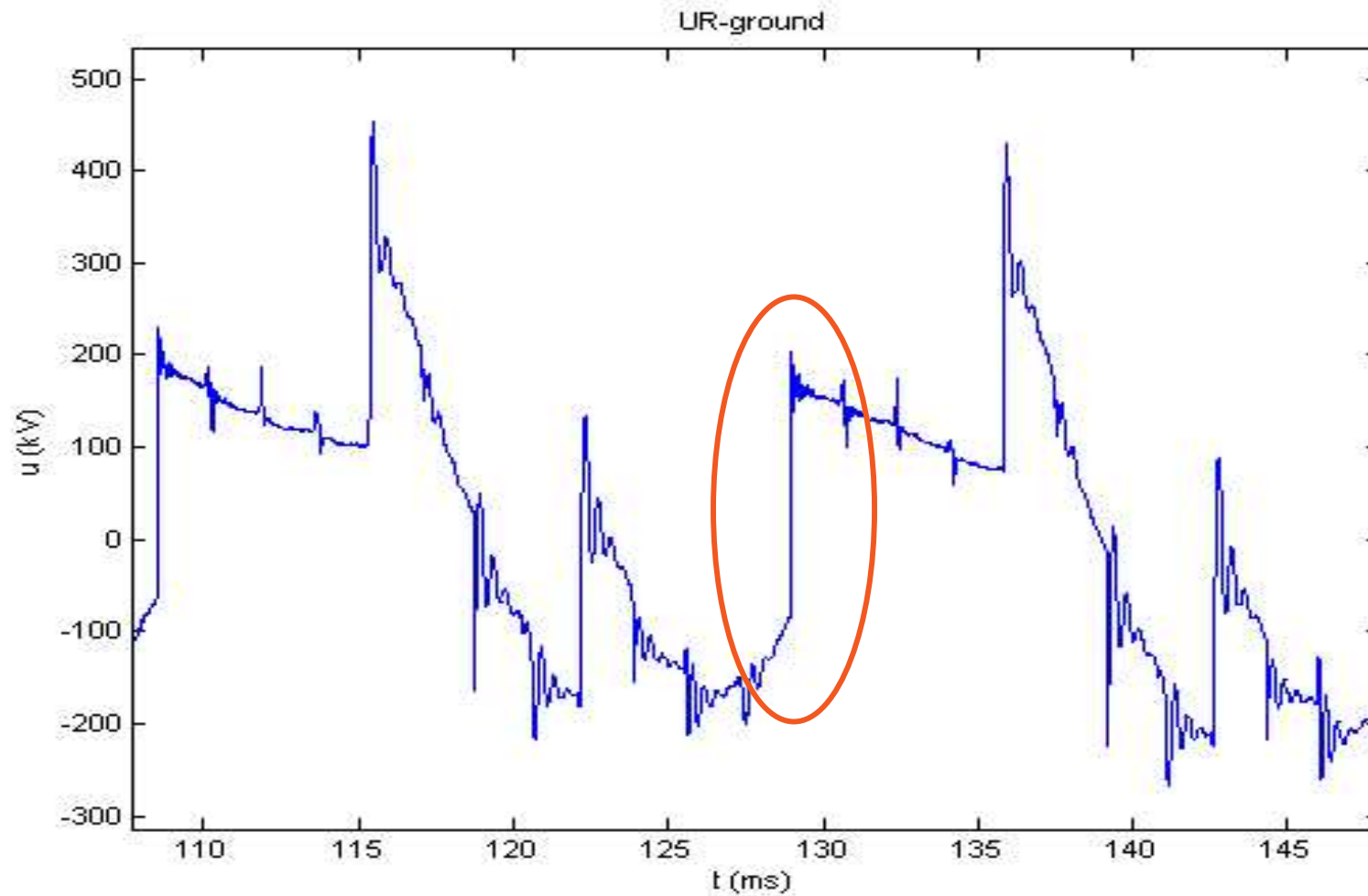
Resultat – start av pol



Resultat – start av pol



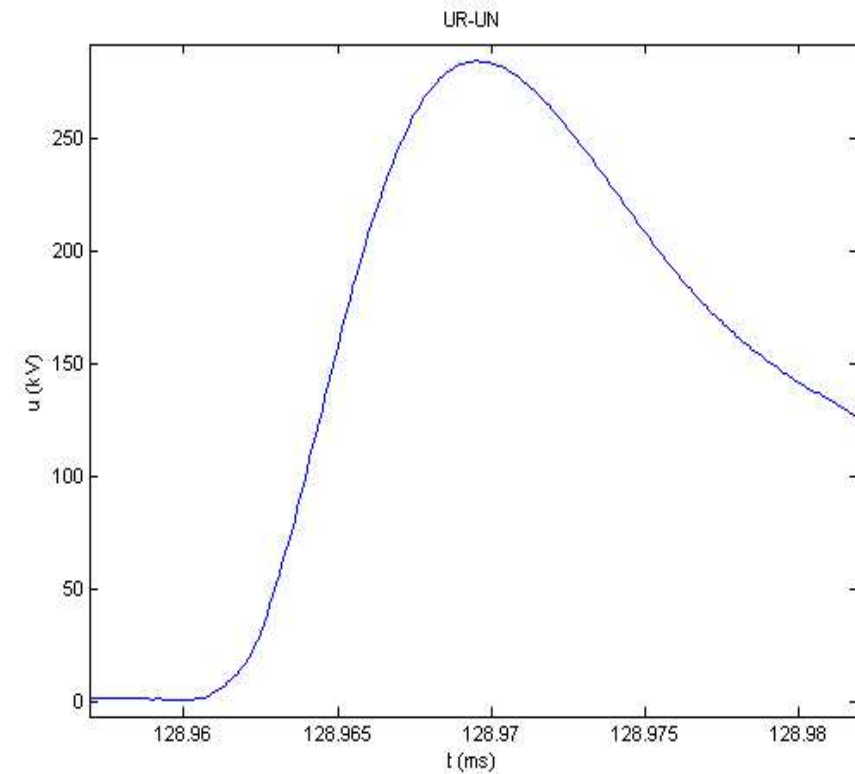
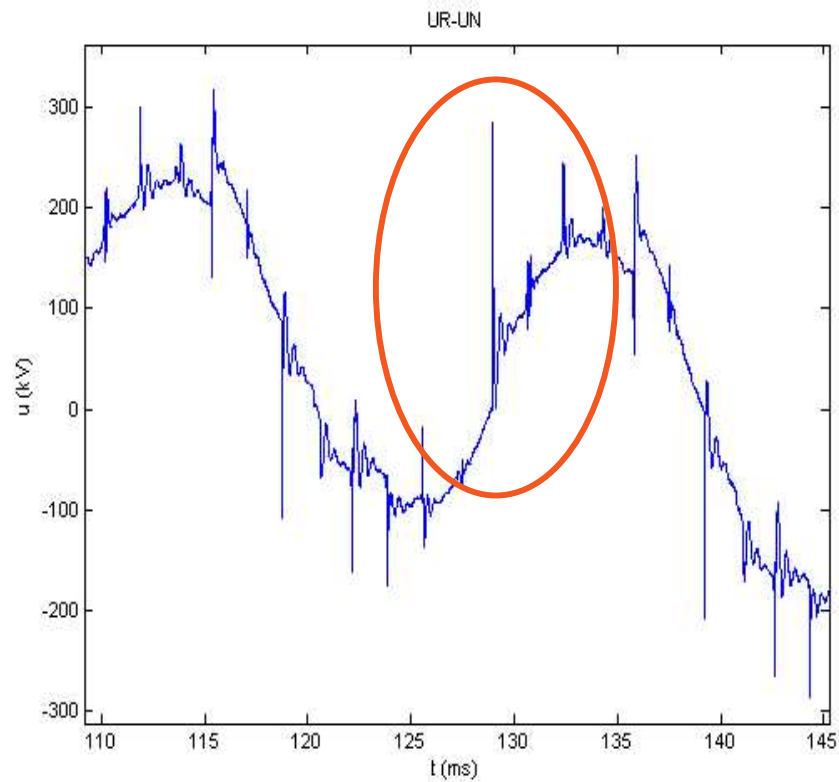
Resultat – start av pol



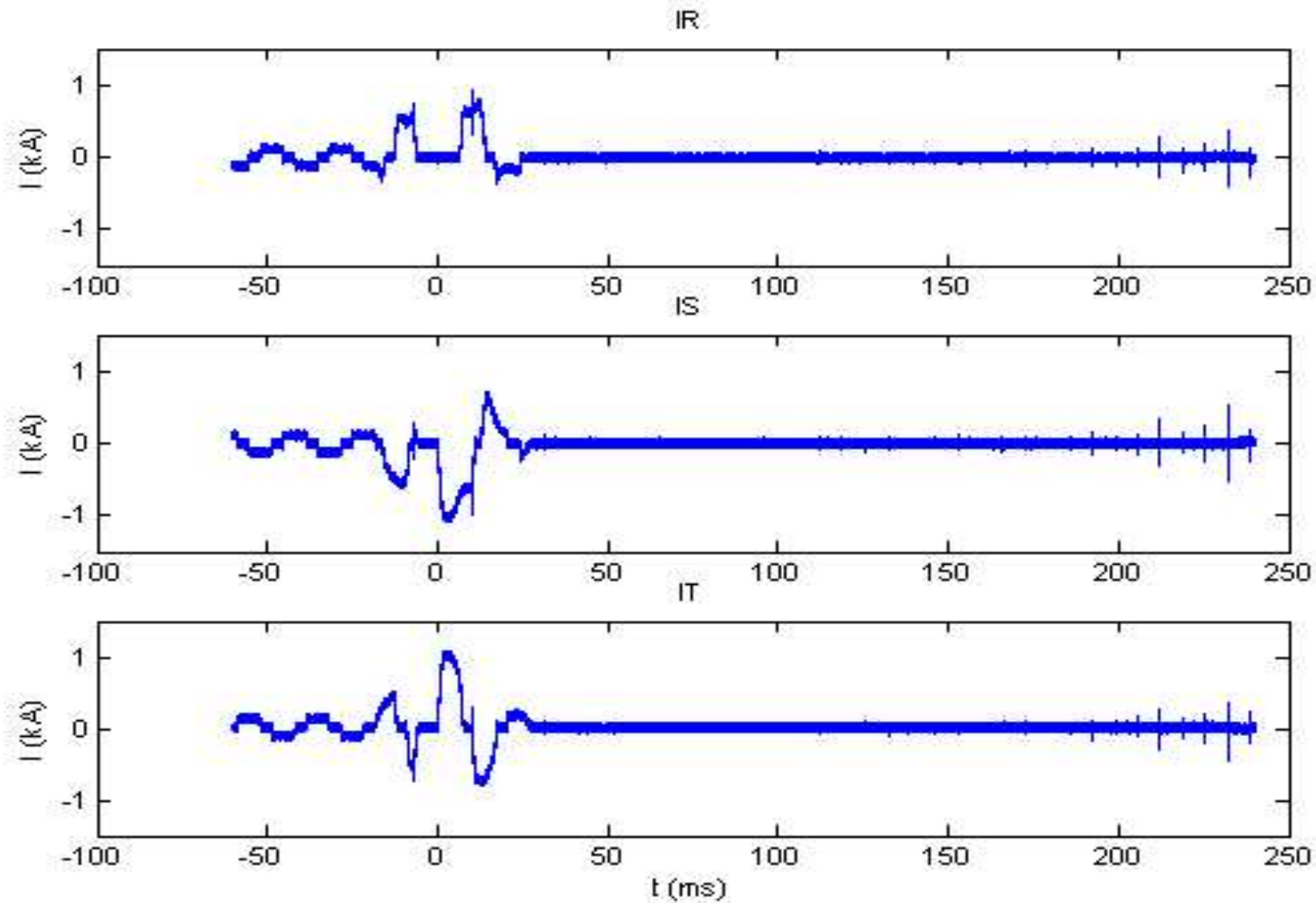
Resultat – start av pol

Spänning över
transformatorlindning

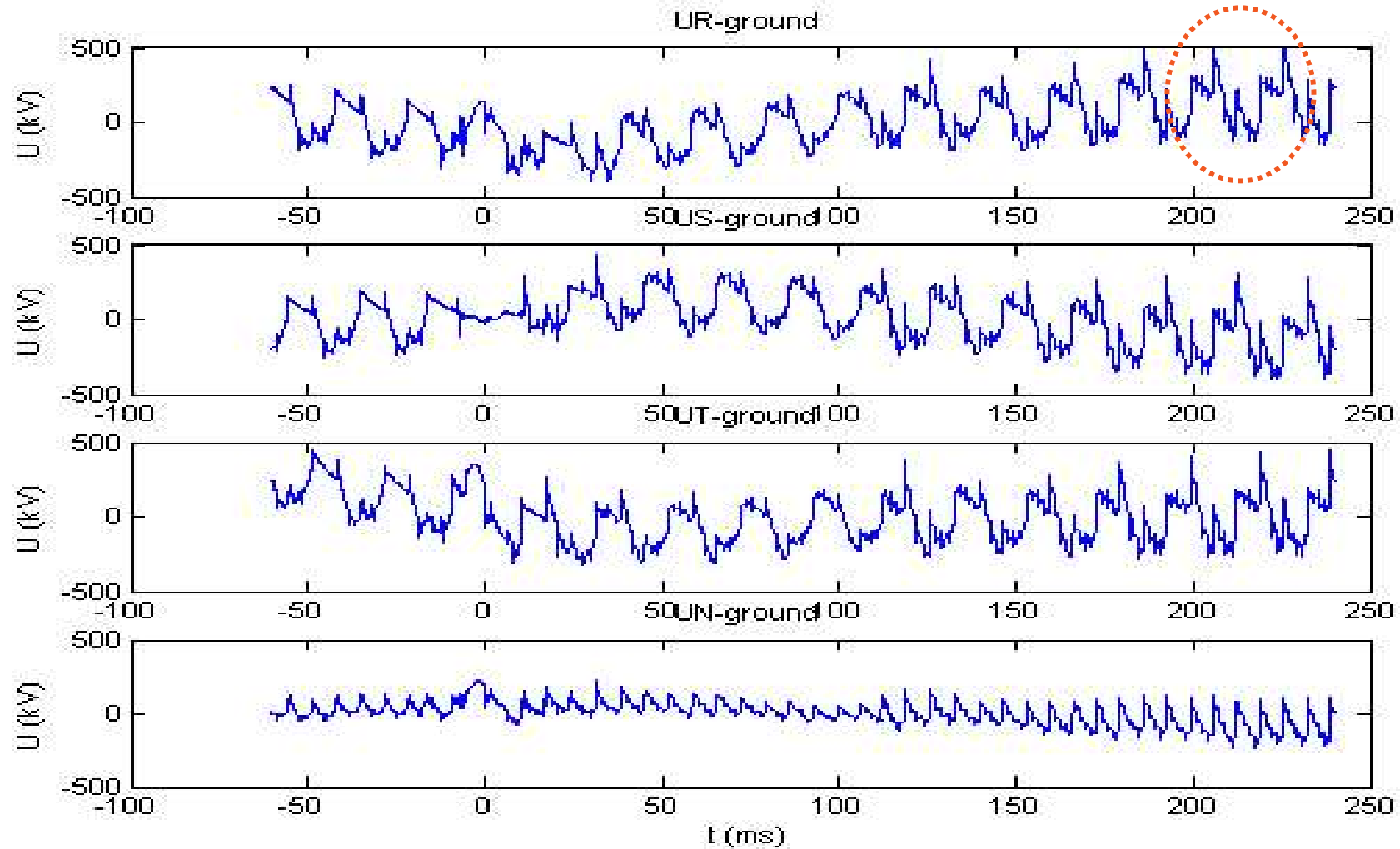
dU: ca 290 kV
dt: ca 5 μ s



Resultat – kommuteringsfel



Resultat – kommuteringsfel



Resultat – kommuteringsfel

