

DENIM 2016

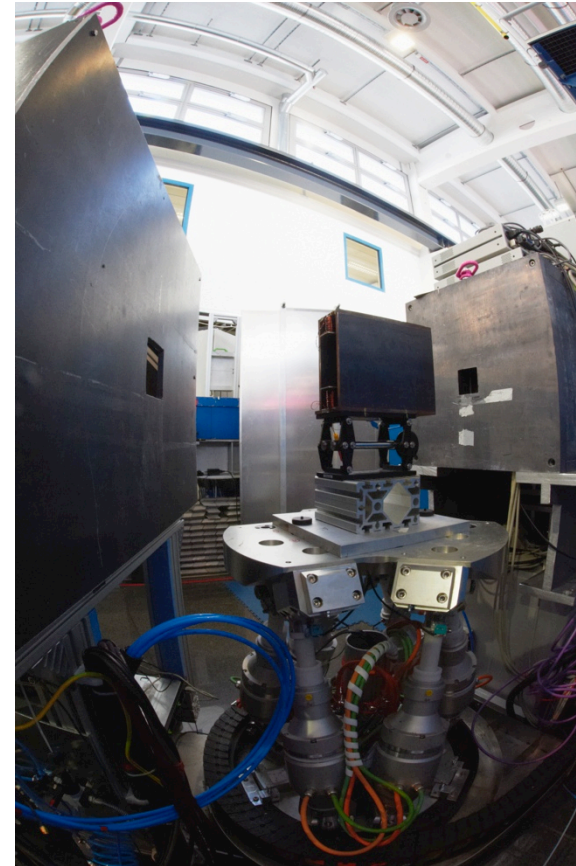
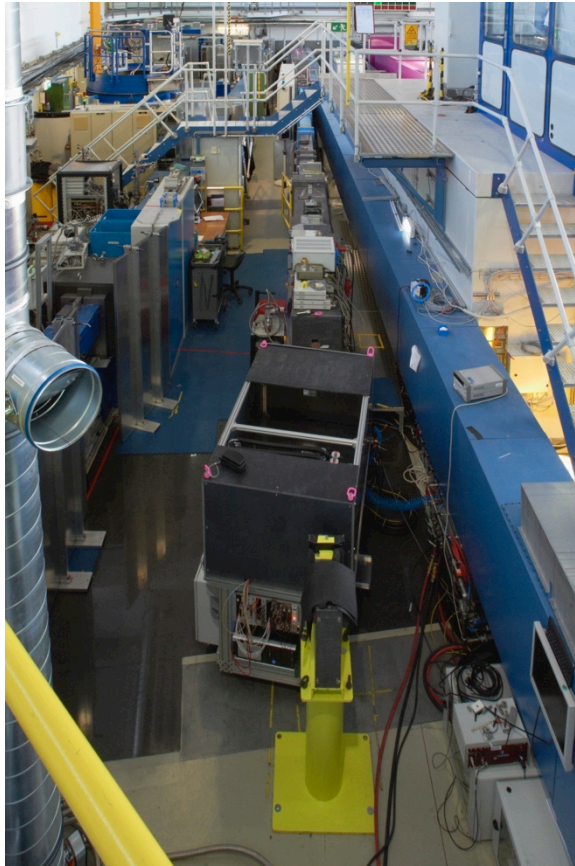
Maria @ FRM2 an EMI survey

Sep 2016 | G. Vehres

Outline

- Causal study
- Basics / Equipment
- Approach
- Results
- Conclusions
- Todo

Maria @ FRM2



Quelle: Forschungsneutronenquelle Heinz Maier Leibnitz W.Schürmann

MARIA: Magnetic reflectometer with high incident angle

Causal study

- He3 polarisation disturbed (depolarisation)
- Interference at the detector system He3 (MWPC)
- Proof of concept „zoneconcept“
- Part of the measurement campaign at the neutron guide hall west @FRM2

Basics / Equipment

Measurement of tethered interferences

- Measure leak current
- Determination of the fundamental frequencies using an high frequency capable current probe and a digital oszilloscope
- Insulation tests

Test equipotential bonding / grounding system

- Four wire tests using a transformer

Basics

Current through vacuum hose ~ 6mA (30kHz)



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Two pumps
Each supply from
different feed.
One within this lab,
one from a
neighborhood lab
25m extension cord



Folie 6

Basics

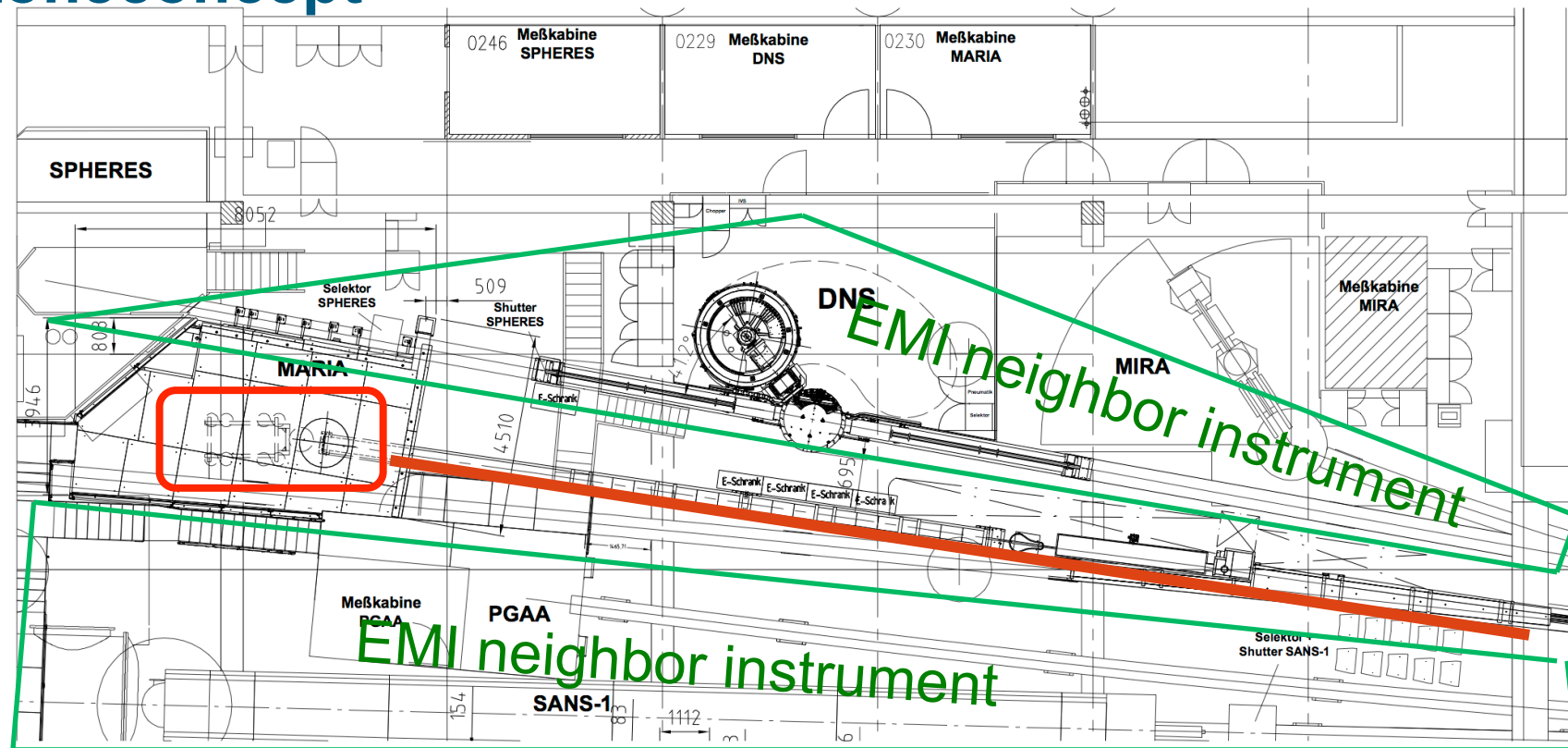
Current through network cable ~ 5mA



System connected to a switch next floor using 30m shielded Network cable.



Zoneconcept



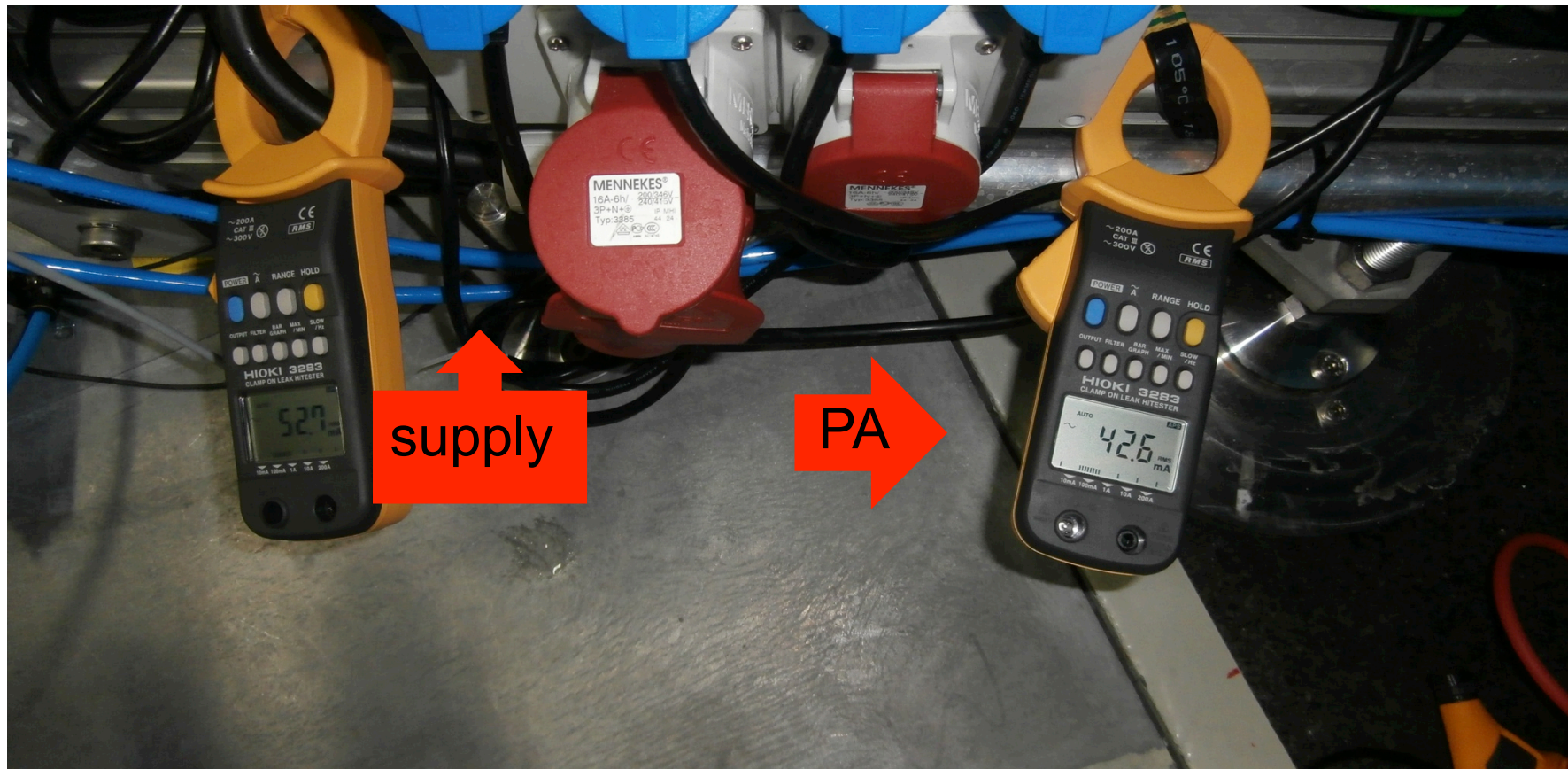
Each instrument is idefined as seperate zone!
 At the border of the zone all supply should be combined on a
 small grounded plate, use isolation if possible!

Approach

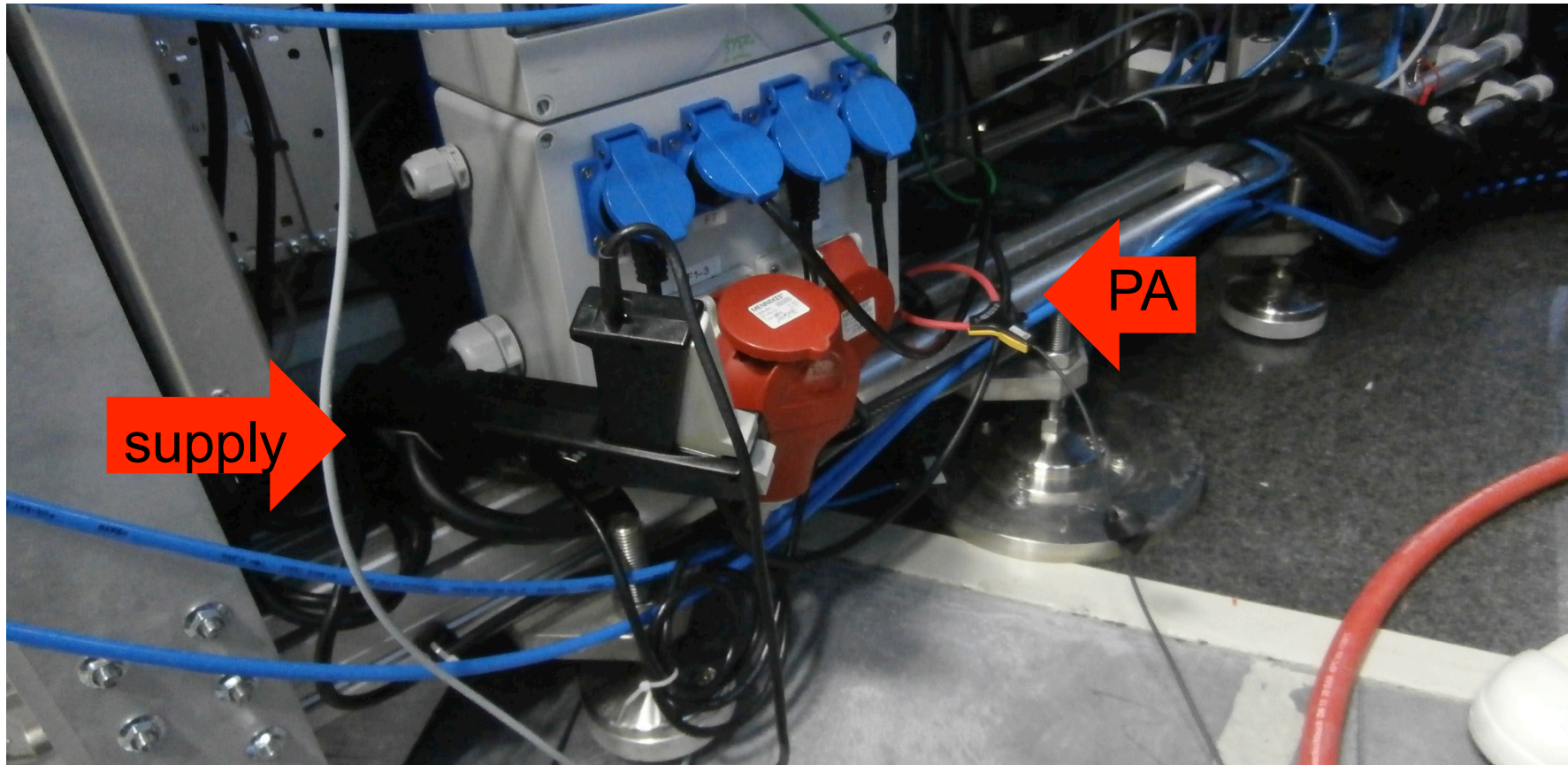
- 1) Determination of fundamental frequencies
 - Within the supply line to power distribution secondary spectrometer
 - Within the supply lines for the He3 polarisation / detector
 - Within the supply lines one motor on secondary spectrometer
 - At the potential equalization point of secondary spectrometer
 - At the potential equalization point of Hexapodsystem

- 2) Determination of the resistance between the main instruments potential equalization point and parts of the instruments using a 4 wire method

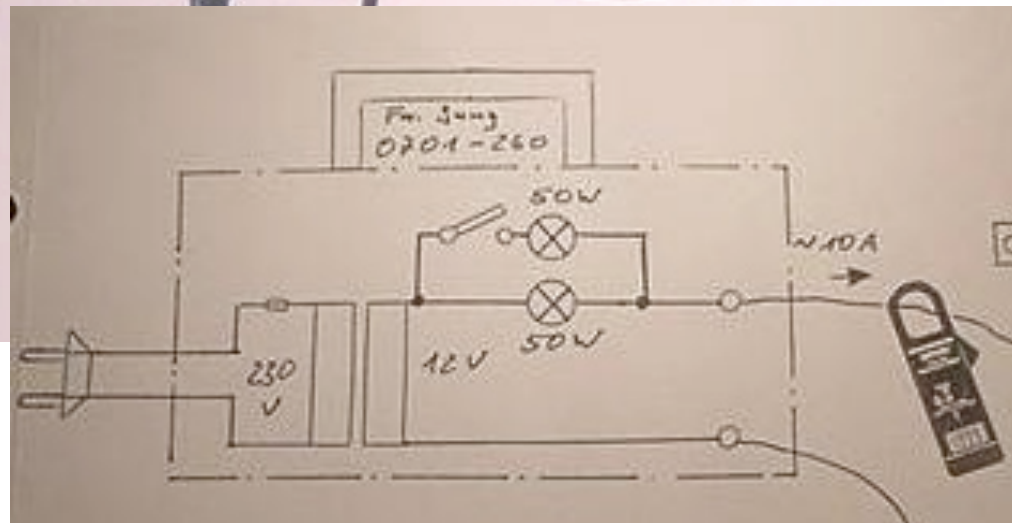
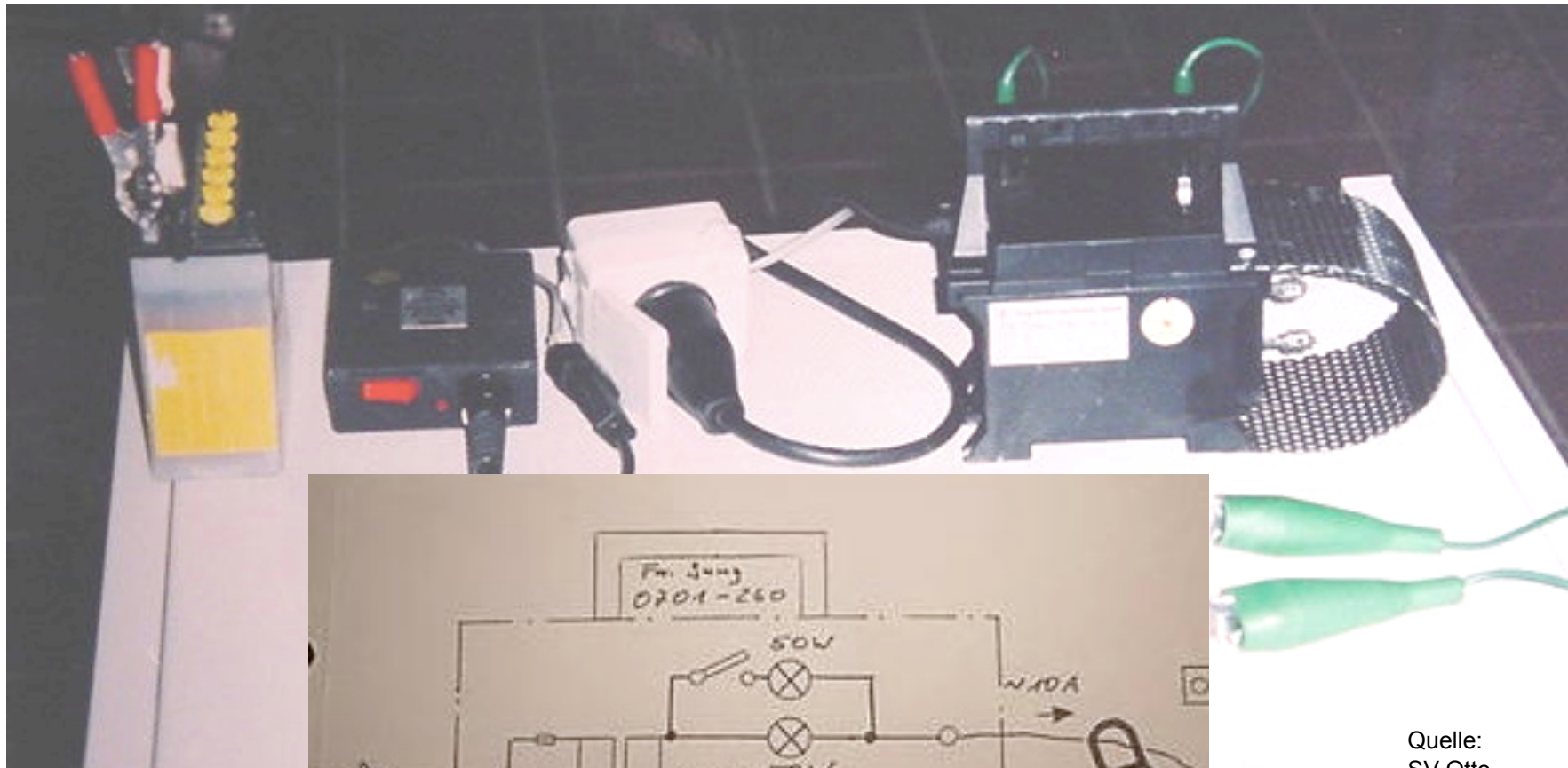
Measuring leak currents



Measuring frequencies using HF probes



4 wire method



Quelle:
SV Otto

Results

Supplied from power distribution of the secondary spectrometer

- He3 polarisation
- Detector system

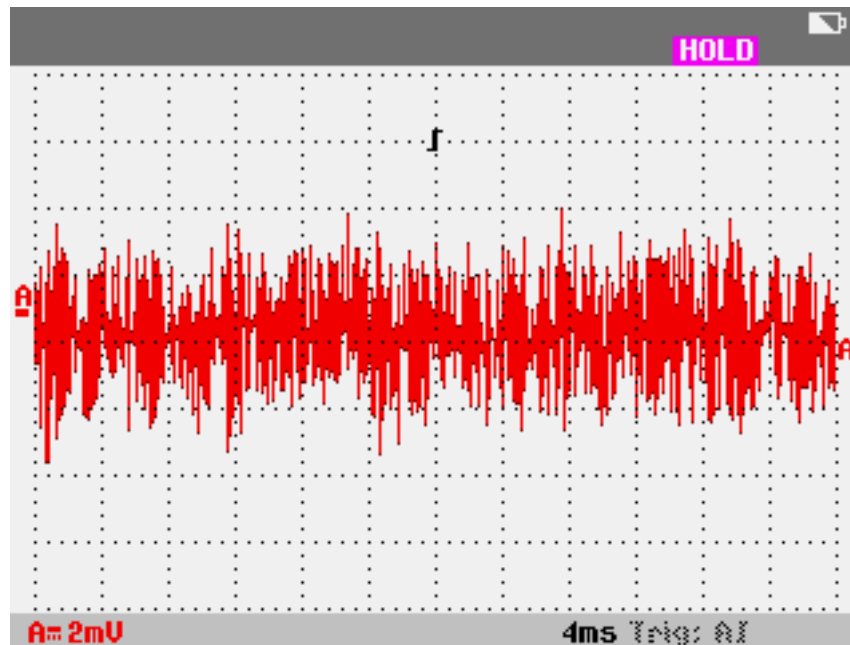
Leakcurrent measured at supply line / potential equalisation cable

- All loads connected 62mA / 50mA
total L1-L2-L3-N = residual current 4,2mA
- Detector system disconnected 56mA / 40mA
- Everything unplugged 0mA / 12mA

There is a current measureable without a load connected !!

Educated guess: the currents is conducted from the ground wire of the power cable to the potential equalisation cable. This current ist conducted through our equipment!!!!!!!!!!

Detector system

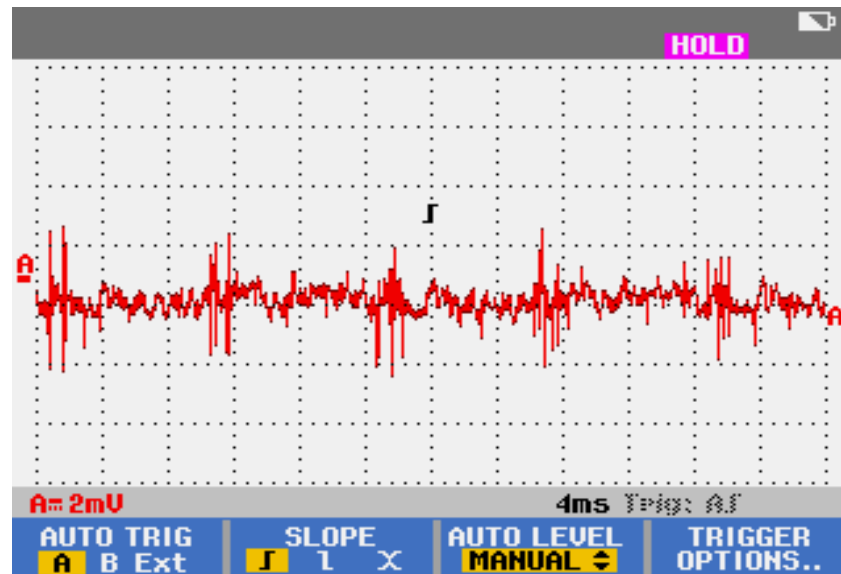


10mA/Unit

Leak current main frequency 250kHz on the supply line of the „Siemens“ rack.
The measured current depends on the position of the ribbon cables

Guess: a ribbon cable is damaged and strikes the rack / ground
Insulation fault! The detector is no more isolated!

Friction wheel / Hexapod



Discontinuous interference measured at the motor cable of the friction wheel

10mA/Unit(20mA) 4ms/Unit

Guess: A Loop is created!!

The motor cable supplying the friction wheel is screened but also includes a ground wire. Both are connected to the equalisation point of the hexapod control unit (at the primary spectrometer).

The motor itself is mounted on the secondary spectrometer without insulation.

Hexapod / friction wheel



First Try:
Disconnect potential
equalisation cable to degrade
contact. Higher impedance of
electric loop?!

- Degrade of potential equalisation cable is not allowed!
Danger of electric shock.
- Metall (conducting) connection through mounting system between sample position and secondary spectrometer.
- Several ground wires within cables

Results of resistance measurements

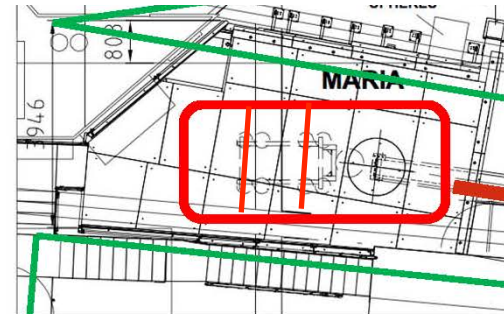
With respect to the equipotential bus bar we measured

Description	Resistance/mΩ (10E-3) Ω	Comment
Kasemattenwand	13,7	Vermascht mit PA?
Selektor-Schrank	142,8	Über Versorgung geerdet
Verschraubung T- Träger	9,2	Metallische Verbindung
IVS Schrank PE-Schiene	3,2	Sehr gut angebunden
Hexapod ohne PA	14,5	Erdung geschwächt
Hexapod mit PA	6,6	
Detektorelektronik	68,8	Nur über USV angebunden
Kabeltrasse Nachbarinstrument	9,4	Vermaschung der Instrumente!

conclusions

- All instruments are interconnected and influence each other.
- Metallic constructions within the instruments (low impedance) also promote spreading of current.
- Zoning concept: „Each instrument is a zone“ is not feasible in the neutron guide hall west.
- The secondary spectrometer must be considered as a zone, which may be subdivided .

Todo



- Dividing an instrument into zones.
- The secondary spectrometer is considered as a zone containing zones for detector, beamstop and polarisation.
- The zones must be electrical isolated, take special care of unintended metallic connections
- Optimise cable management for lower EMI impact.
- Chose / Build isolations that avoid unintended connections

Contributor

- Dr. Peter Göttlicher (Desy)
- Dr. Stefan Mattauch (JCNS)
- Ulrich Bünten (JCNS-1)
- Vladimier Ossovy (JCNS)
- Andreas Nebel (JCNS)
- Abt. G-ELI (Forschungszentrum Jülich)
- Dr. Nikolas Arend (JCNS)

Thanks to all collaborators.