

# **Experimental investigations to the joint resistance of bolted substation and transmission line connectors and its conformity to test standards**



Dresden, 15.04.2010

## Overview

1. Introduction
2. Test-Setup
3. Experimental results for straight, T- and PG-connectors
4. Calculation results for straight connectors
5. Conclusion

## Introduction

Investigation of:



Straight Connectors



T-Connector



PG-Connector

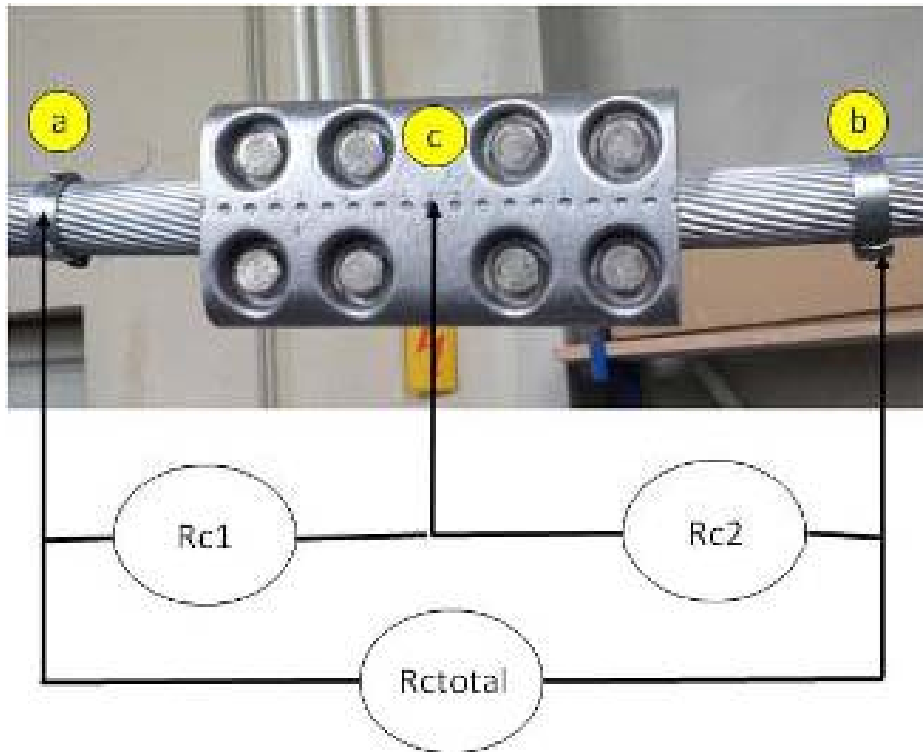
Experiments and calculations to determine:

- joint resistance
- current distribution along the clamp body



Evaluation of the connection quality for newly installed joints

## Test-Setup

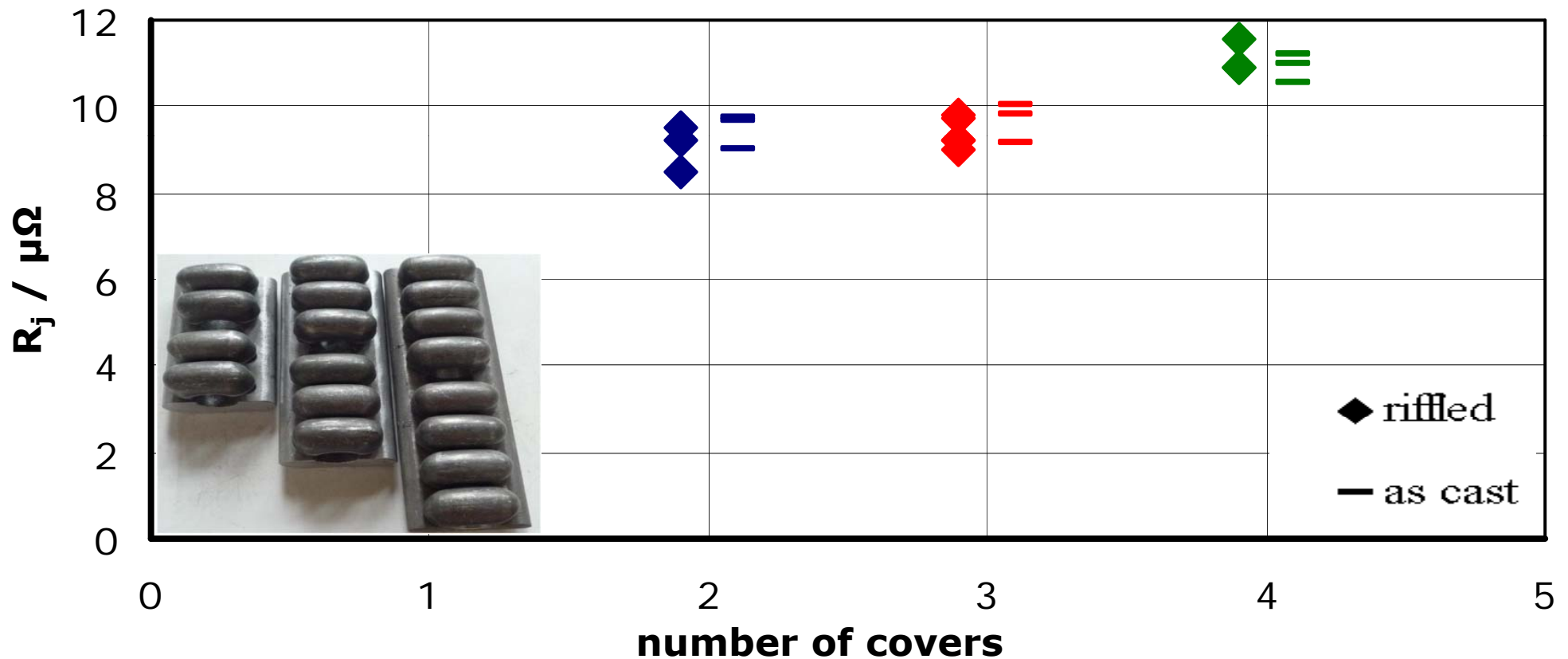


- OHL-conductor cleaned by steel wire brush
- Installation with nominal bolt torque  $M = 46 \text{ Nm}$
- Resistance measured at points a, b and c one week after the installation with DC
- Measurement according to DIN EN 61284 [1]

[1] DIN EN 61284; Freileitungen. Anforderungen und Prüfungen für Armaturen.(IEC 1284:1995), Juni 1996

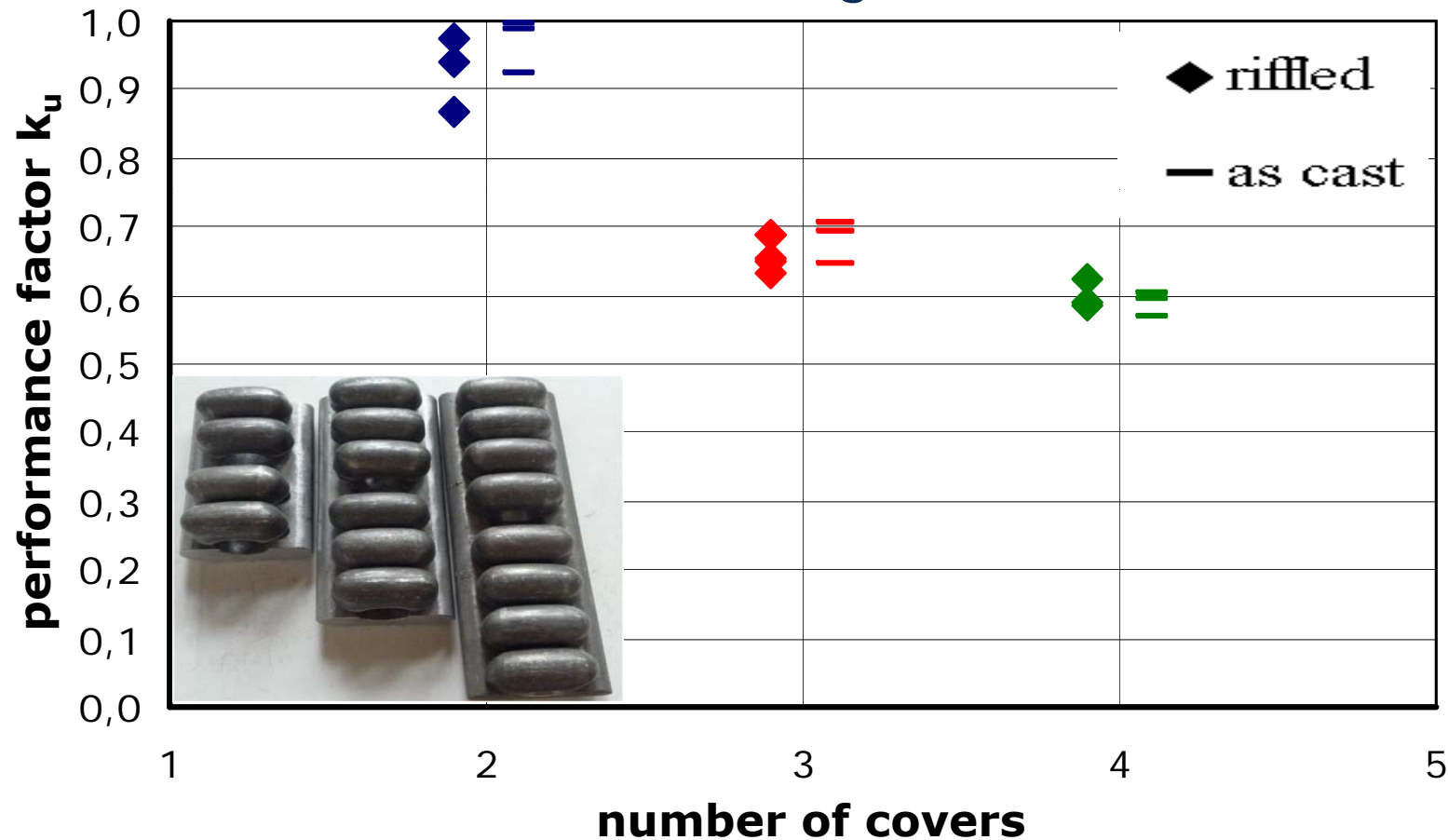
# Experiments

## Joint resistance - straight connector



# Experiments

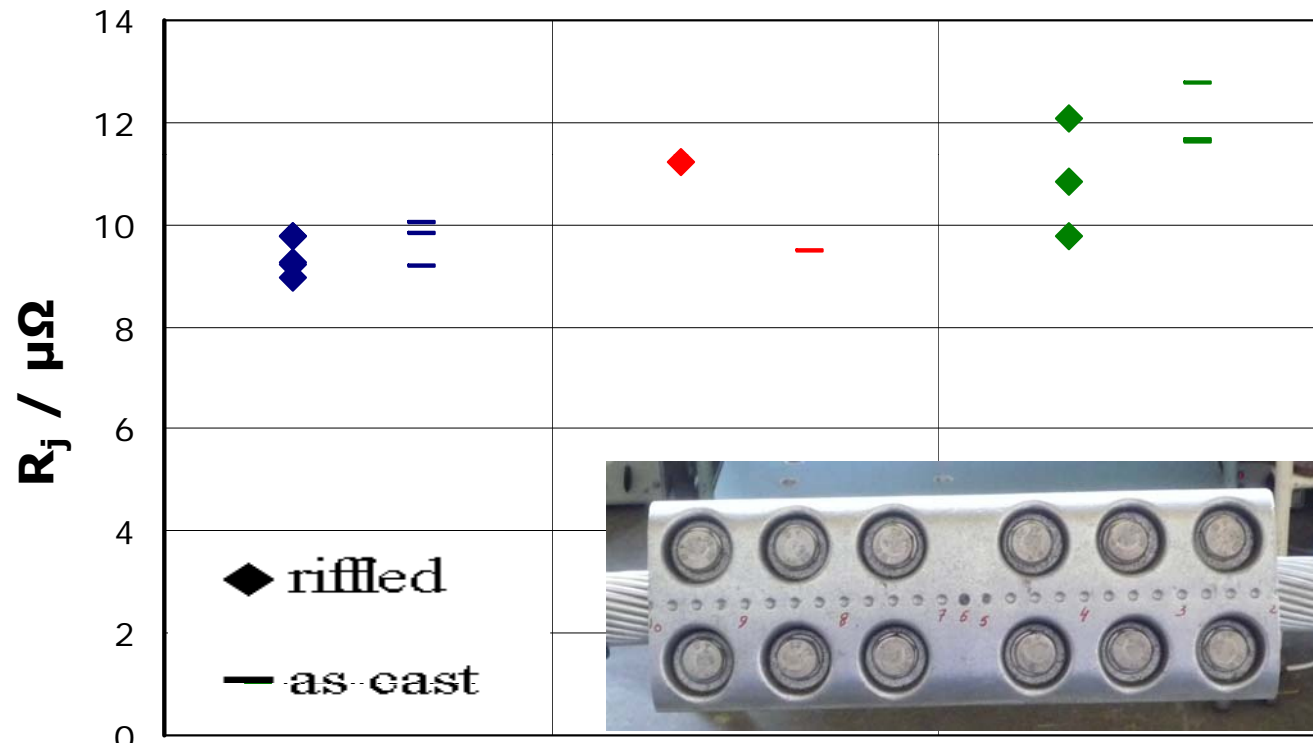
## Performance factor - straight connector



$$k_u = \frac{R'_j}{R'_{OHL}}$$

# Experiments

## Joint Resistance - straight connector, 3 covers



Cleaning the

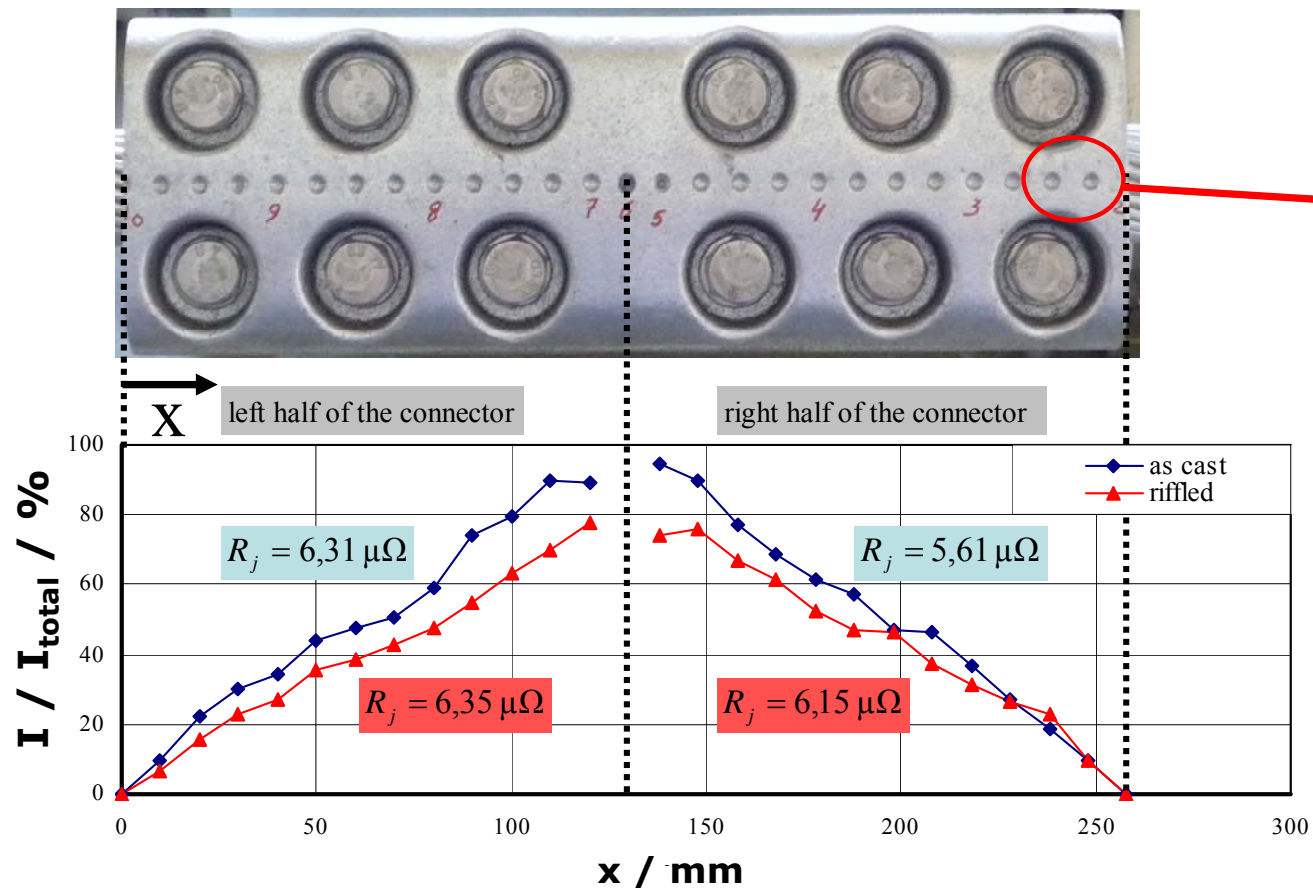
OHL-conductor: steel wire brush

fleece

not cleaned

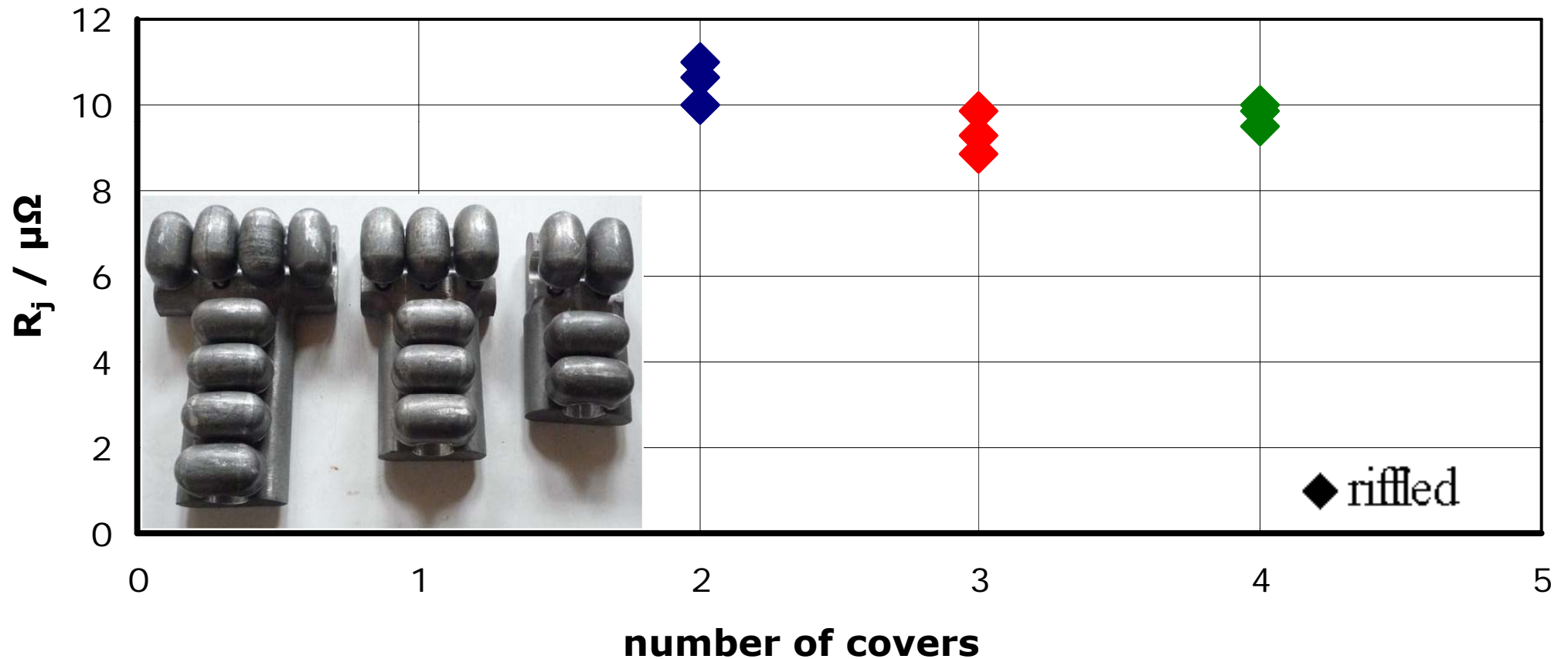
# Experiments

## Current Distribution - straight connectors



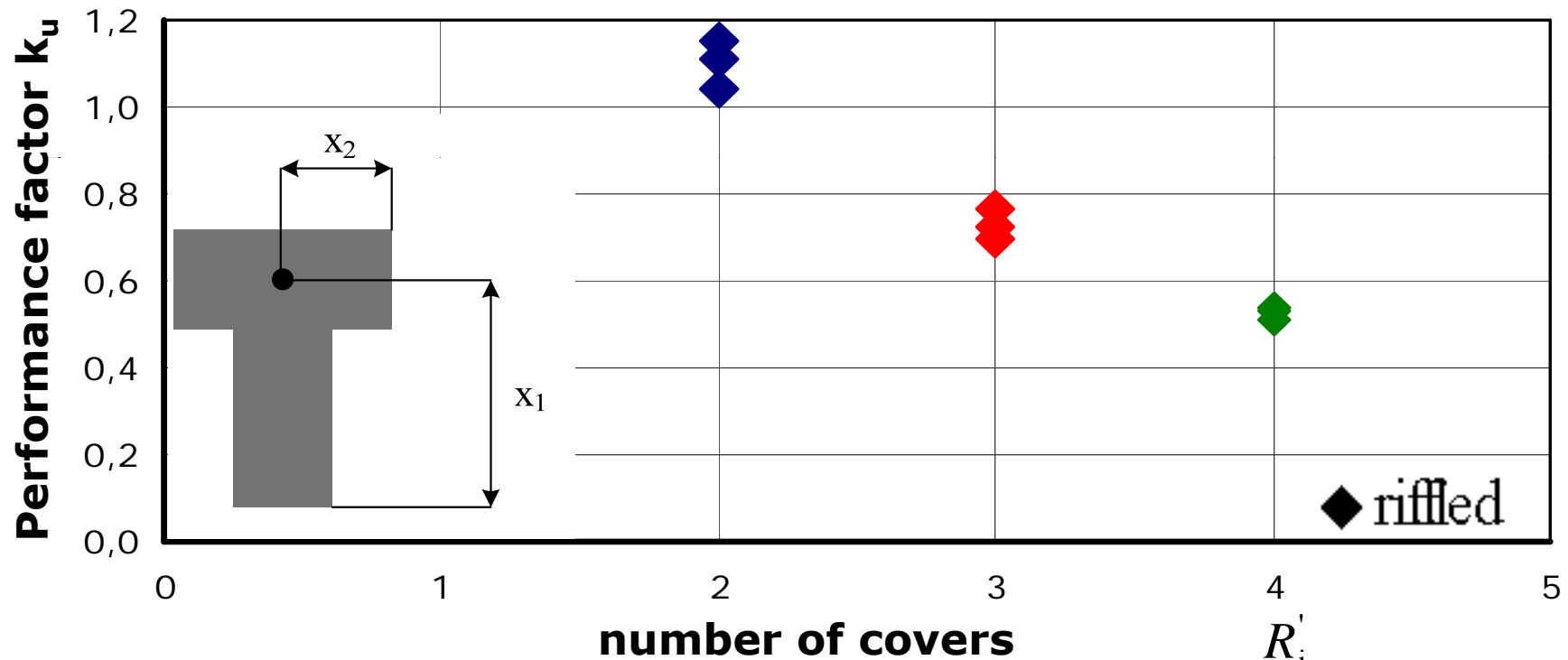
# Experiments

## Joint resistance – T-connector



# Experiments

## Performance factor – T-connector



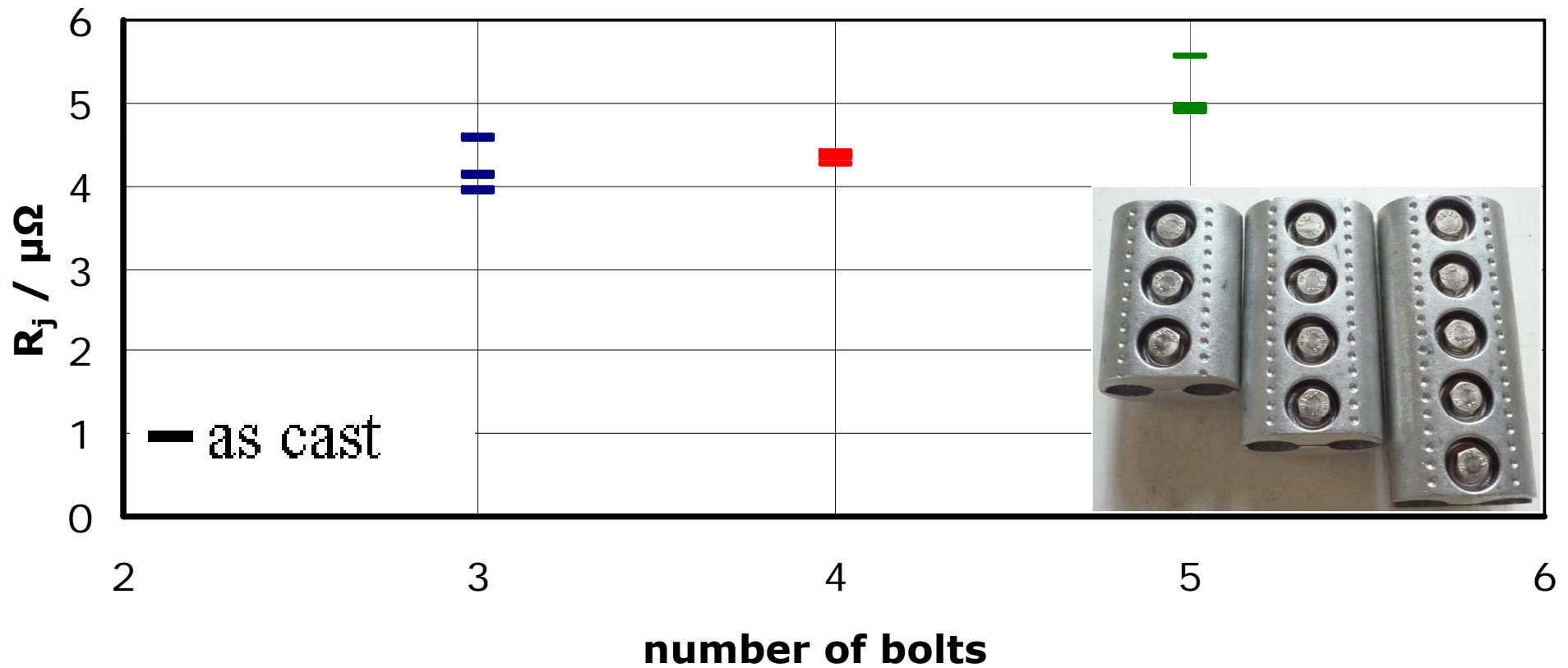
$$x_{ges} = x_1 + x_2 \quad [1]$$

$$k_u = \frac{R'_j}{R'_{OHL}}$$

[1] DIN EN 61284; Freileitungen. Anforderungen und Prüfungen für Armaturen. (IEC 1284:1995), Juni 1996

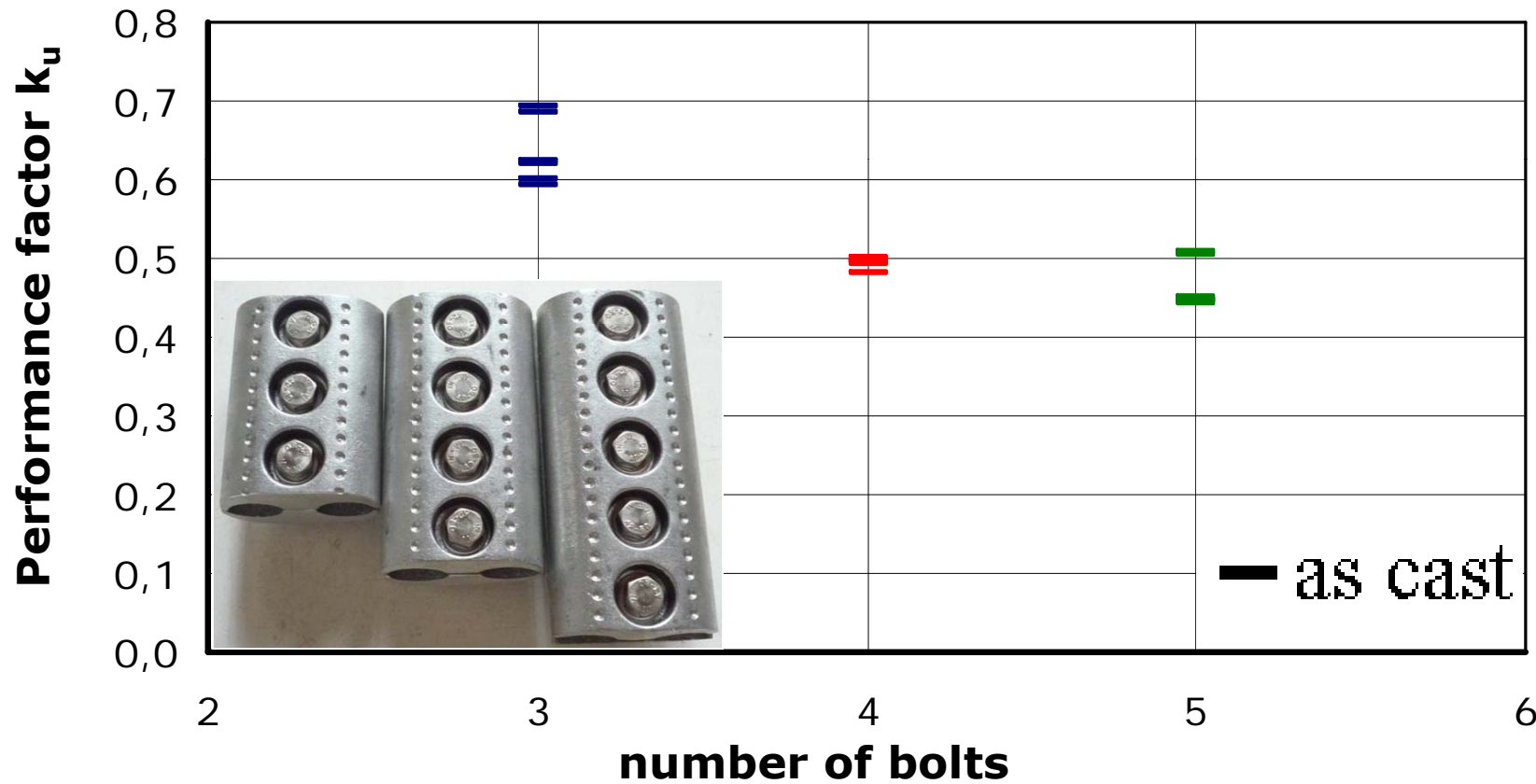
# Experiments

## Joint resistance – PG-connector



# Experiments

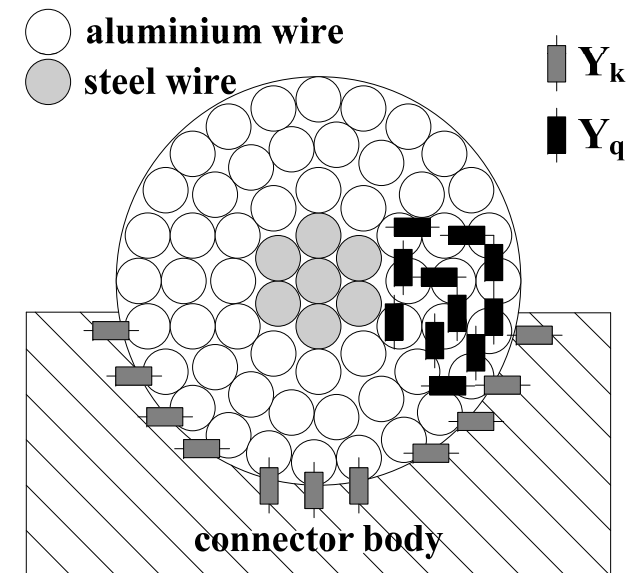
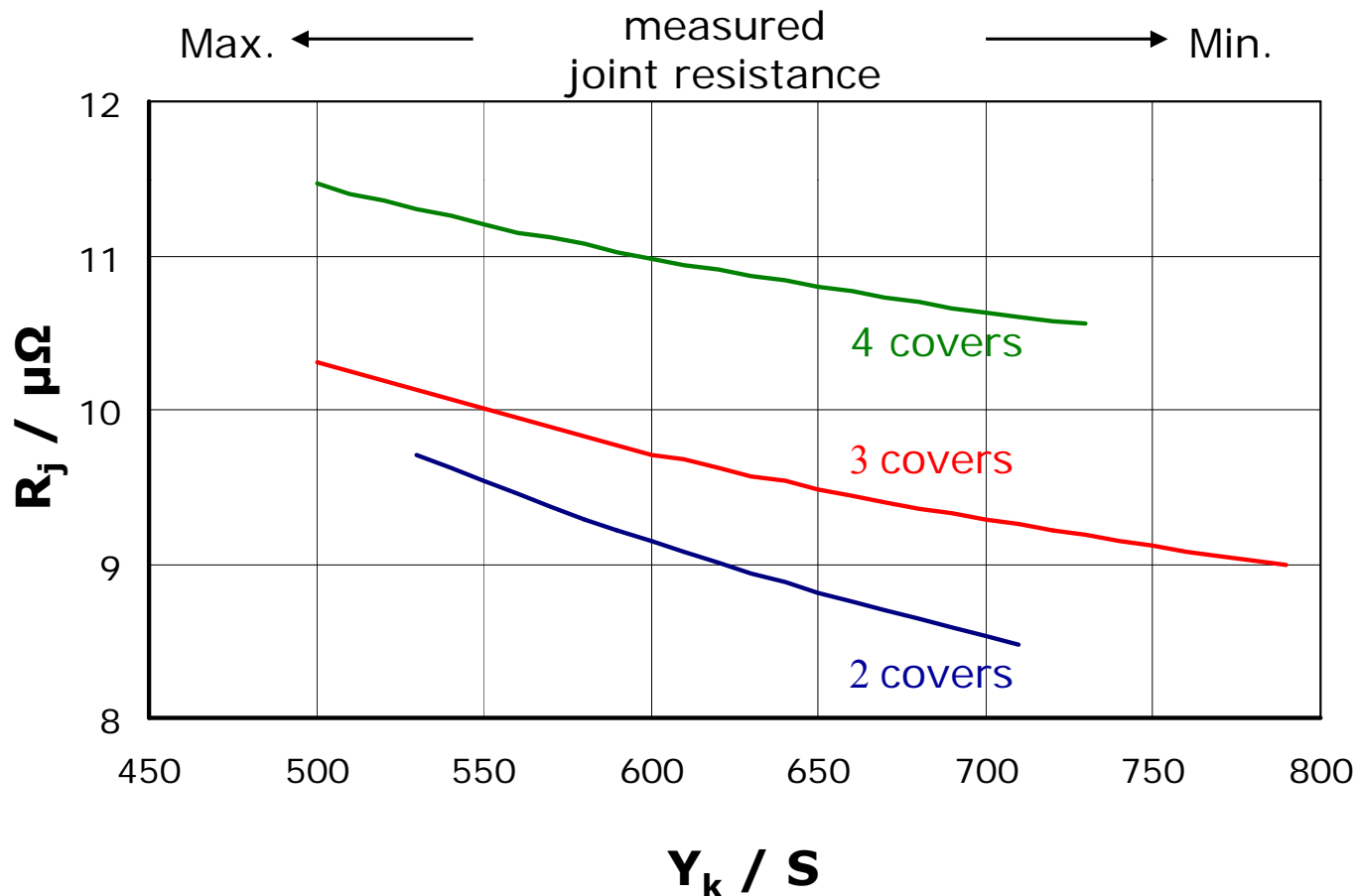
## Performance factor – PG-connector



$$k_u = \frac{R'_j}{R'_{OHL}}$$

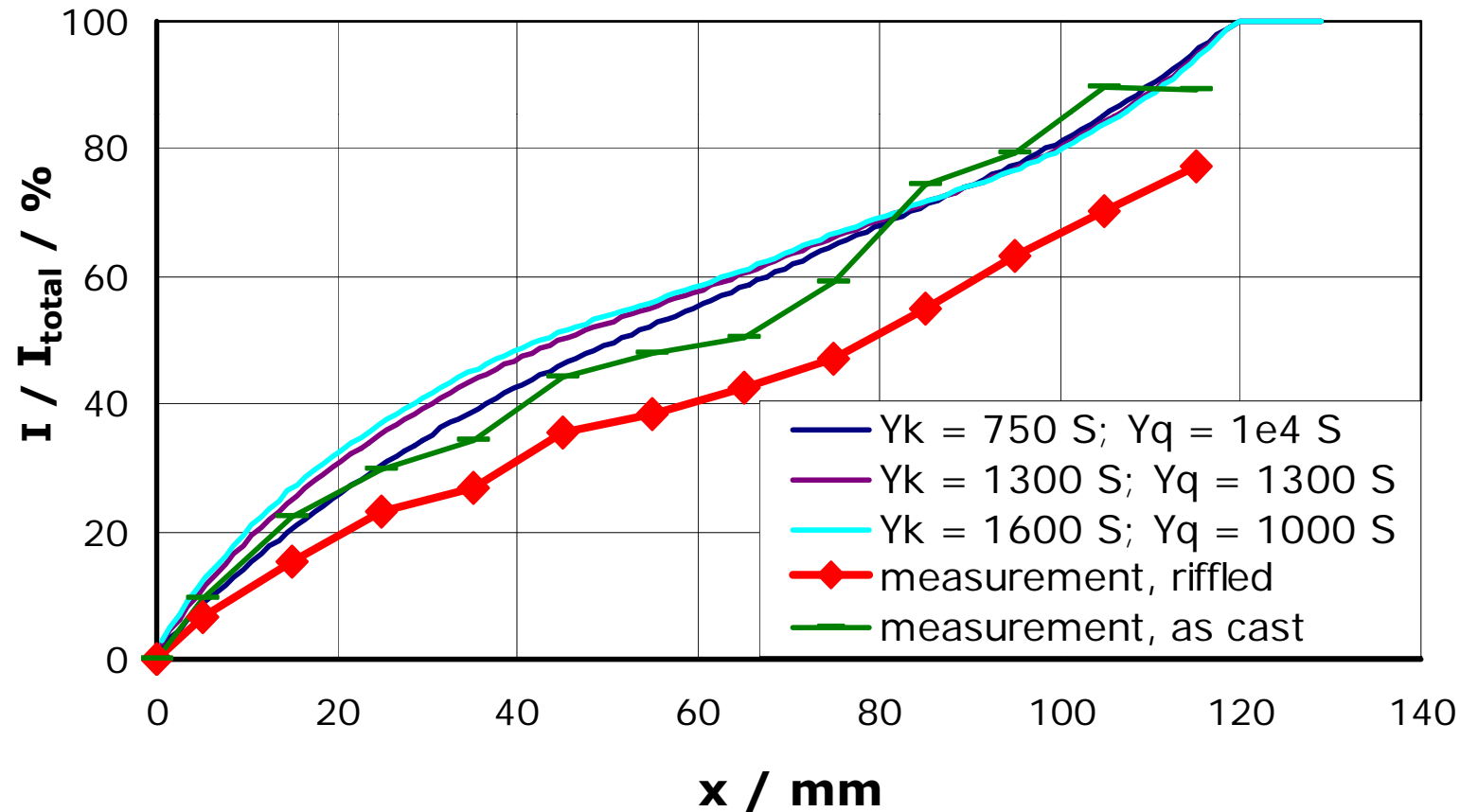
# Calculation

Joint resistance - straight connector,  $Y_q = 1e4 \text{ S}$



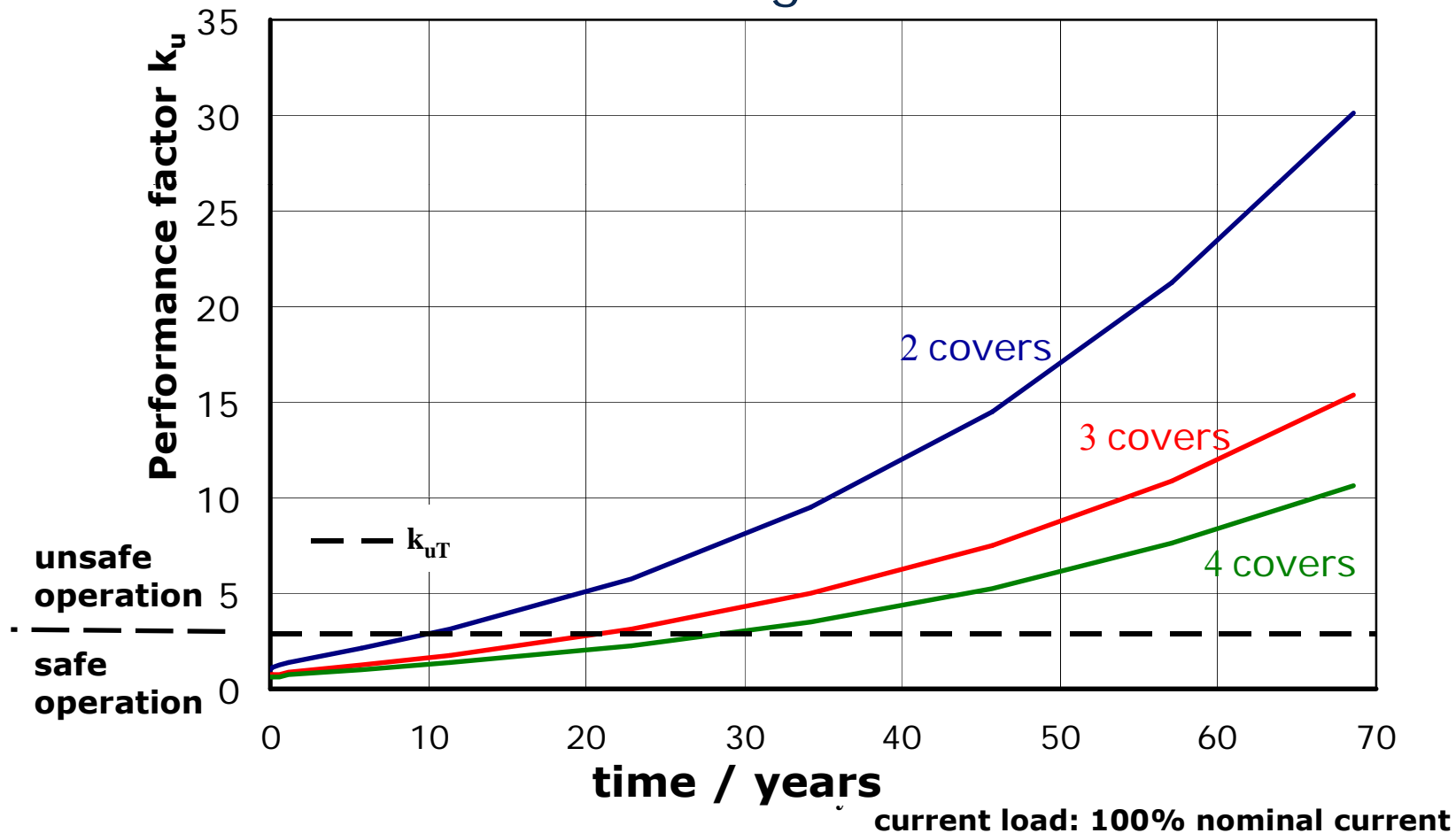
# Calculation

## Current distribution - straight connector




# Calculation

## Lifetime estimation - straight connector



## Conclusion

- cleaning the OHL-conductor leads to similar joint resistances for riffled and as cast contact surfaces
  - the joint resistance of riffled connectors is lower, if the OHL-conductor was not cleaned
  - for larger connectors the initial performance factor decreases
  - the estimated lifetime of a joint increases with the size of the connector
-  further experiments have to be carried out in order to determine the actual long term behavior

Thank you for your attention!

