Education

Begin of studies — 2000

Foreign studies & Student thesis — 2003-2004

Diplom thesis & End of studies — 2005

PhD in Accelerator Physics — 2006-2008

Postdoc Fellow 3 months — 2009

Postdoc Fellow — 2009-2011

Electrical Engineering (Diplom/Master)

TECHNISCHE UNIVERSITÄT DRESDEN

ANKA

NUS National University of Singapore

Singapore Synchrotron Light Source
Makes Light Work For You

- **Thesis:** *Layout and design of a high accuracy magnetic field measurement system for superconducting undulators.*
- **Thesis:** *Phase error reduction in superconductive undulators.*

Physics (PhD)

KIT Karlsruhe Institute of Technology

ANKA

- **Thesis:** ***A Novel Concept for Phase Error Correction in Superconductive Undulators***

Carl Zeiss Stiftung

LHC Collimation

CERN

LHC Collimation Project

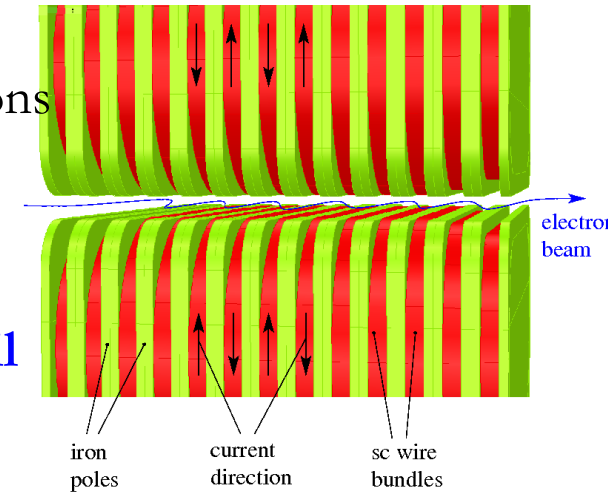
CERN

Superconductive Undulator Development (PhD at KIT, Karlsruhe, Germany)

- **Team (~10)**: Prof. T. Baumbach, A. Bernhard, S. Casalbuoni, E. Mashkina (U Erlangen), R. Rossmanith, …

- Electron **beam operation** and **beam measurements** with the installed superconductive undulator (SCU14) at ANKA.

- **Design** and **development** of **superconductive magnets** (wigglers, undulators) for the production of highly brilliant synchrotron light (SCU-15 for ANKA): 3D-FEM simulations (Opera 3D, static and dynamic), Monte-Carlo simulation.

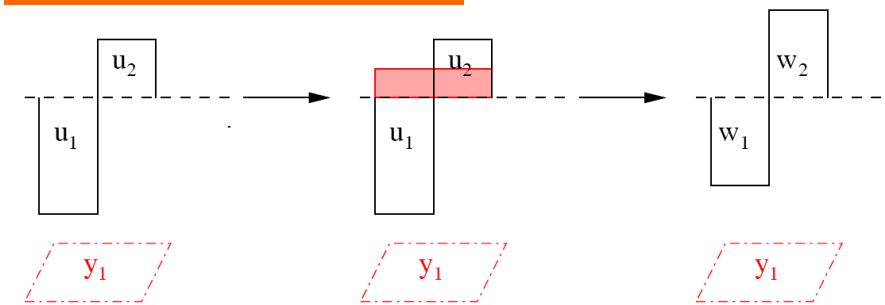


- Participation in the **construction of an undulator test coil** for field error compensation experiments (KIT - CERN).

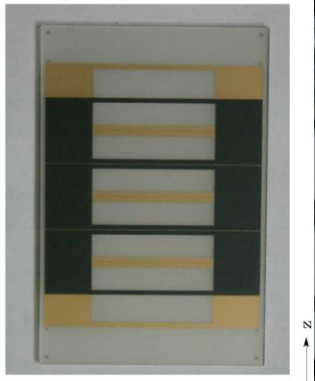
Superconductive Undulator Development (PhD at KIT, Karlsruhe, Germany)

- **Development and experimental verification of a novel field error correction scheme** based on superconductive closed loops (Induction-Shimming):
  - D. Wollmann et al., PRSTAB, 11:100702, 2008; PRSTAB, 12:040702, 2009
  - **European Patent** (EP 2 279 650 A1, 02.02.2011); **German Patent** (10 2010 012 073.1-54, pending)

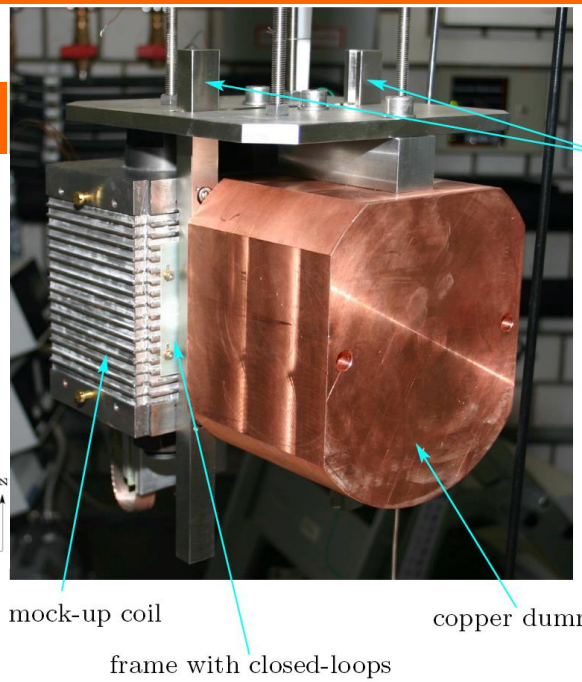
Simplified model



Prototype device

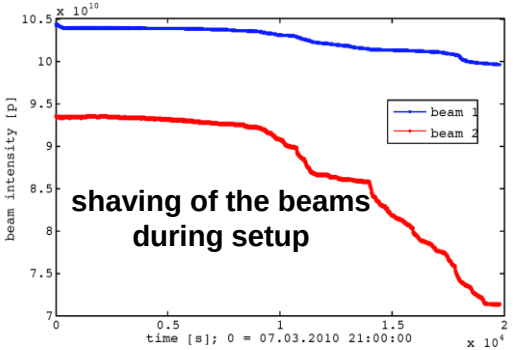


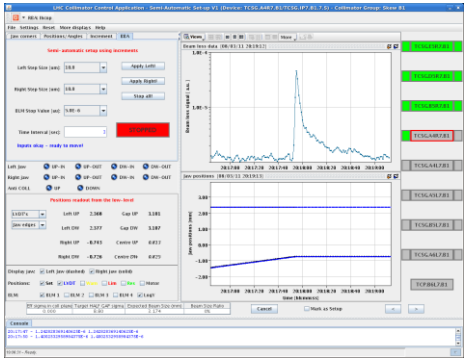
Experimental setup for Magnetic field measurements



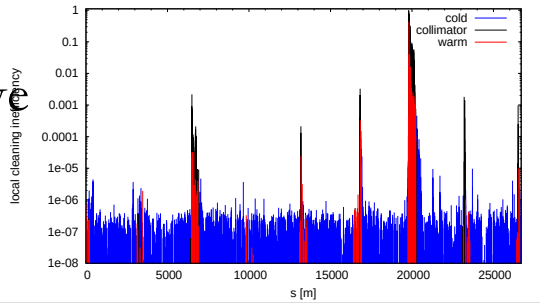
LHC Collimation (Postdoc Fellow, CERN, BE-ABP)

- **Team (~9)**: R.W. Assmann, R. Bruce, L. Lari, A. Rossi, S. Redaelli, 3 PhD students, 1 Master student.
- **Proton beam operation (LHC)** during beam commissioning, setups and regular qualifications (2009, 2010, 2011).
- Further development of **top-level collimation control system.**
- **Machine protection** responsibility (Safety critical RBAC role, MP checklist for LHC intensity increase).
- **Data taking and data analysis** for qualification (loss maps) and performance improvement of the collimation system (JAVA, Mathematica, Matlab).
- **Particle tracking simulations** (MAD-X, SixTrack) to improve the understanding and optimize upgrades of the LHC collimation system



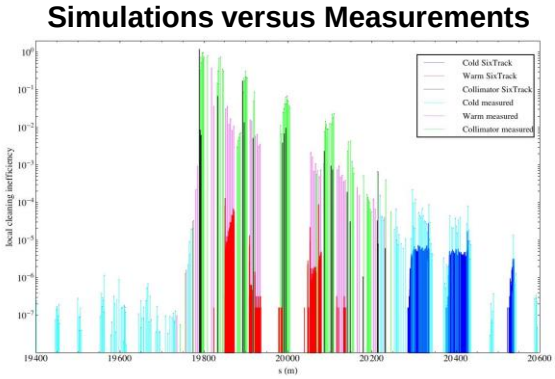


Loss map (qualification)

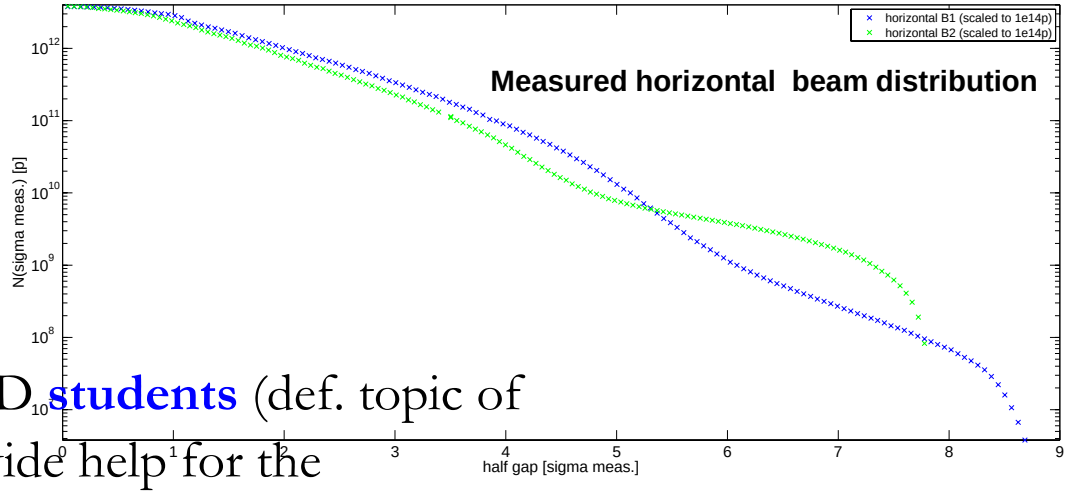


LHC Collimation (Postdoc Fellow, CERN, BE-ABP)

- **Planning and performing** of **experiments** (MDs) in the LHC and the SPS in close collaboration with different groups at CERN (e.g. DS quench test, SPS-MDs on collimators with in-jaw BPM buttons, Halo population).



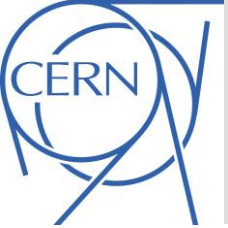
- **Scientific secretary** in the the collimation upgrade project: involvement in **project management** (organize meetings, def. work packages, milestones, follow-up on action items, etc.).



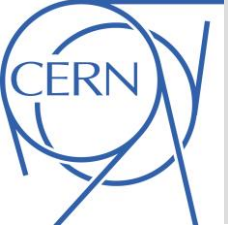
- **Co-supervision** of Master and PhD **students** (def. topic of thesis, follow-up on progress, provide help for the understanding of physics, simulations and methods for data analysis).

Future

- LHC **beam related** performance limiting issues (e.g. measure quench limits).
- LHC **magnet power converter related** performance limiting issues (e.g. simulations for CSCM).
- LHC **operational follow-up**.
- Collimators with in-jaw BPM buttons (beam based qualification of prototypes in the SPS / LHC).
- Material tests (HiRadMat)
- …



End



Backup Slides

Field errors in superconductive undulators and wigglers

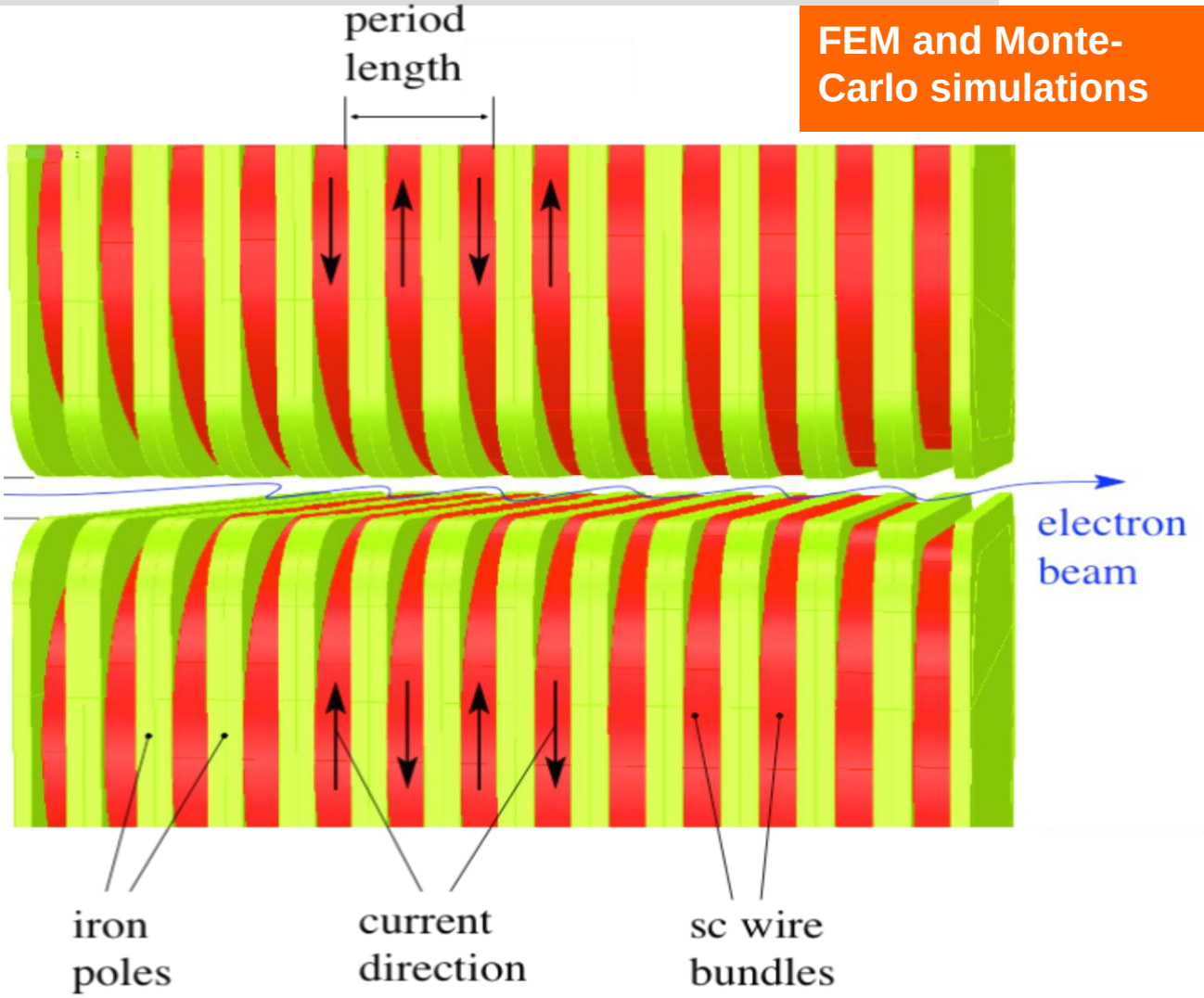
FEM and Monte-Carlo simulations

Field errors disturb the trajectory of the electrons:

- **Reduction of spectral quality** of the emitted synchrotron radiation.
- **Emittance growth** (beam size).

Main source: **Mechanical tolerances**
(Variation of pole, wire bundle position and period length).

Field error correction (shimming) needed.



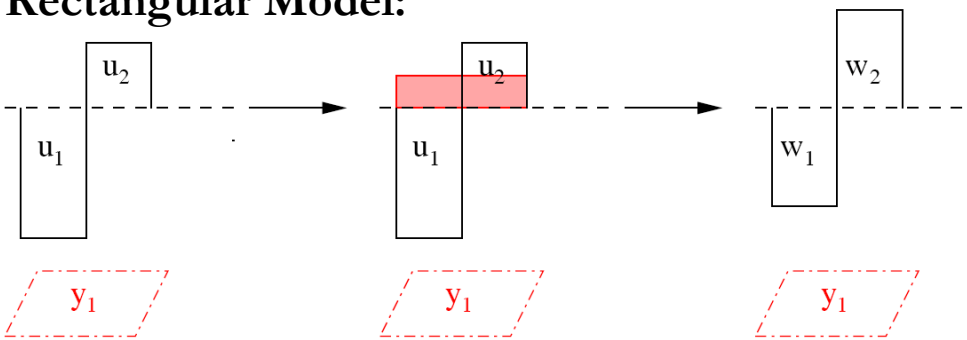
Faraday's law of induction

$$\oint_c \mathbf{E} \cdot d\mathbf{l} = -\frac{d}{dt} \int_S \mathbf{B} \cdot \mathbf{n}\, da$$

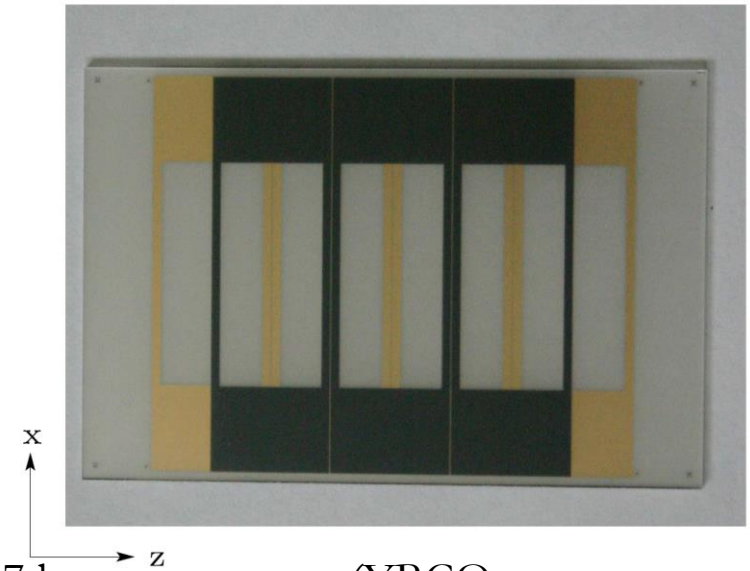
Theory of electro-magnetic fields
System modeling
Hardware design

➔ **Superconductive closed loop** ➔ **change** of the **external magnetic flux** through the surface surrounded by the loop ➔ **current induced** into the loop which **opposes the change** of the external magn. flux ➔ use for **correction of field errors** ➔ **"Induction Shimming"**

Rectangular Model:



The loop **equalizes** the magnetic flux in the two half periods.

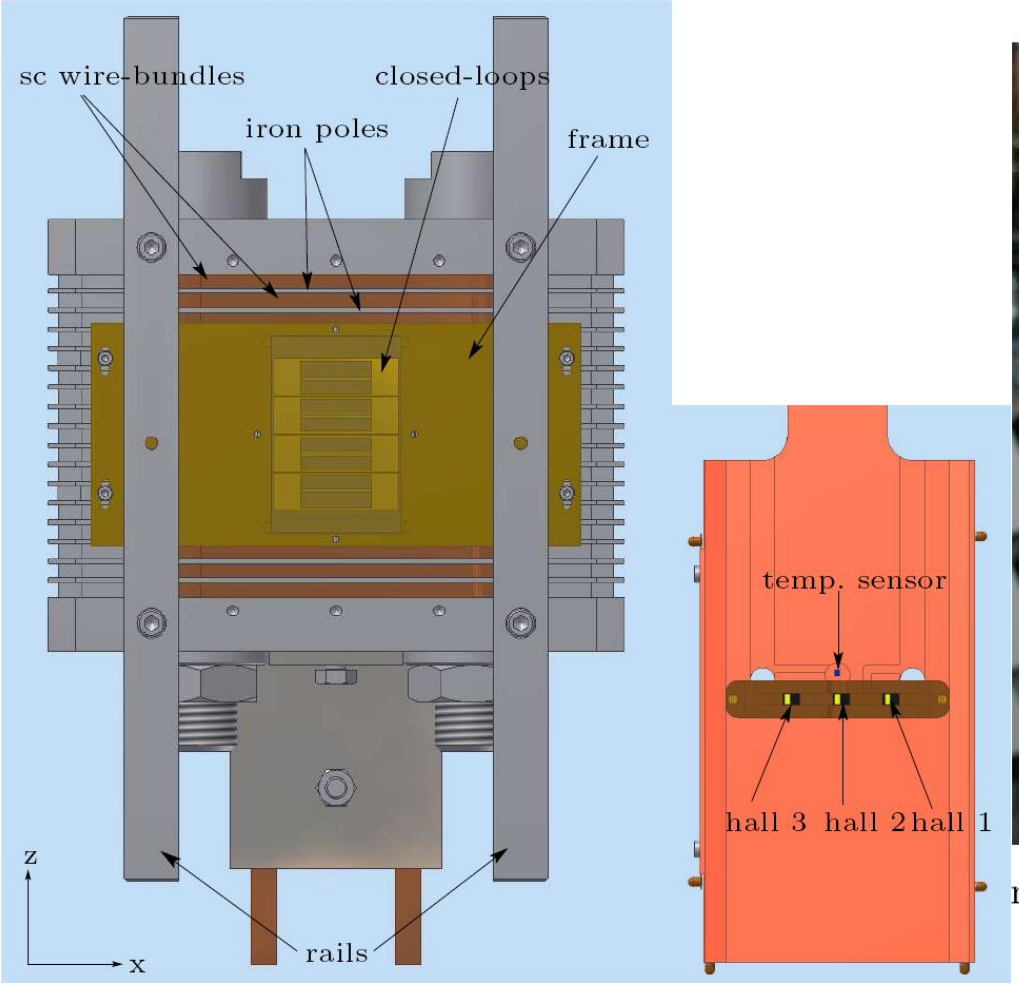


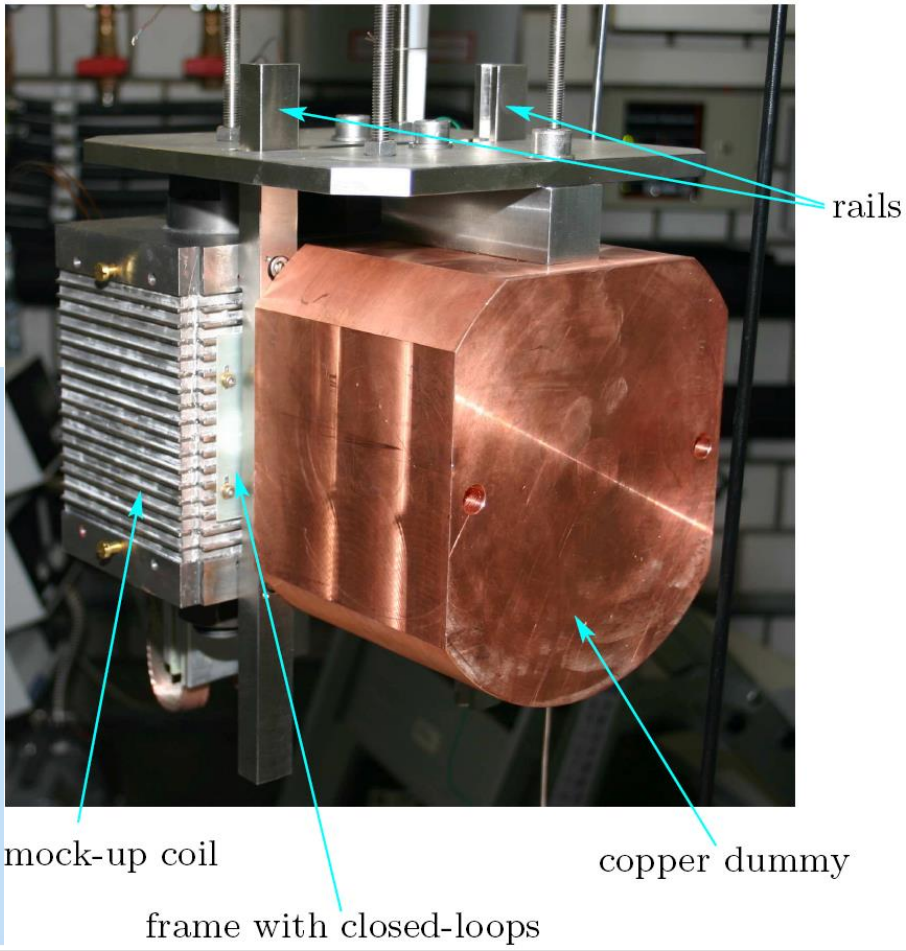
7 loop test system (YBCO on Sapphire)

D. Wollmann, A. Bernhard, P. Peiffer, T. Baumbach, and R. Rossmanith; *Physical Review Special Topics Accelerators and Beams*, 11:100702, 2008.

Measurement - Setup
Test coil and slide

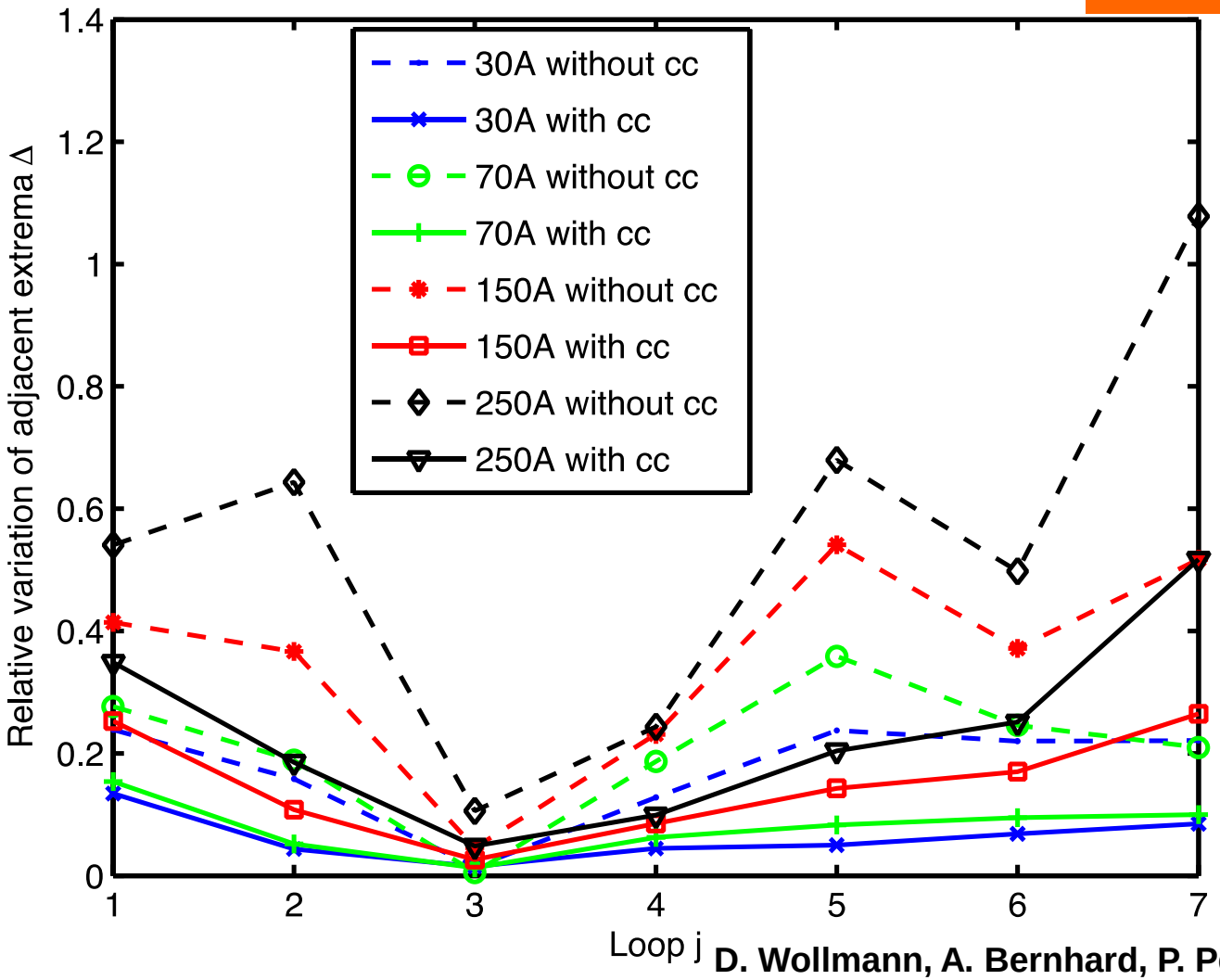
Experimental setup
Magnetic field measurements





Measurement: Variation of adjacent extrema at different currents in test coil

Data analysis and interpretation



Variation **strongly reduced** in all cases.

D. Wollmann, A. Bernhard, P. Peiffer, T. Baumbach, E. Mashkina, A. Grau, and R. Rossmanith. *Physical Review Special Topics Accelerators and Beams*, 12:040702, 2009.