

Belle II Germany Meeting

ErUM-FSP T09

30.9.-2.10.2024

DESY



Bundesministerium
für Bildung
und Forschung

Thomas Kuhr
LMU Munich



Belle II
Germany

What is ErUM FSP?

- The Federal Ministry of Education and Research (BMBF) funds joint research of German Universities at large scale research infrastructures („Verbundforschung“)
- We are in the area of research on universe and matter („Erforschung von Universum und Materie, ErUM“, [link](#))
- Extra funding is given to strengthen networking, participation, and promotion of young scientists („Forschungsschwerpunkt, FSP“)

Thanks!



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Who Are We?

- German groups at universities and research centers (thanks Helmholtz and MPG) → www.belle2.de



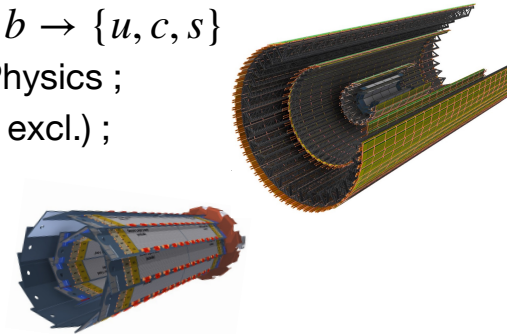
Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)



PIs: Florian Bernlochner, Jochen Dingfelder, Markus Prim, Sally Stefkova

Physics Interests & Activities: (Semi)leptonic and radiative $b \rightarrow \{u, c, s\}$ decays with $\ell\bar{\nu}$, $\tau\bar{\nu}$, $\ell\ell$, $\nu\bar{\nu}$ to test SM and search for New Physics ;
Hadronic Decays to understand X_{clu} states; Tagging (incl. & excl.) ;
Phenomenology of beauty and charm

Hardware Interests & Activities: PXD & VTX Upgrade



Staff: Hans Krüger

Postdocs: Botho Paschen (PXD), Valerio Bertacchi (D^{**} , $B \rightarrow K_S^0 \nu \bar{\nu}$),
Michael Hedges ($B \rightarrow D^{(*)} \ell \bar{\nu}_\ell$)

PhD Students:

Munira Khan (Incl. $|V_{cb}|$), Ilias Tsaklidis (had FEI, had τ : $R(D^*)$ & polarization),
Alina Manthei (SL FEI, lep τ : $R(D^{(*)})$), Daniel Jacobi ($B \rightarrow \mu \bar{\nu}$), Martin Angelsmark ($B \rightarrow J/\psi X$)
Agrim Aggarwal (had FEI, had τ : $R(D^*)$ & D^{**} Dalitz), Melisa Akdag (D^{**} Dalitz),
Jannes Schmitz (PXD), Georgios Giakoustidis (PXD), Ralf Farkas (DATCON / PXD),
Paula Scholz (PXD), Christian Bepin (VTX), Lars Schall (VTX), Andreas Ulm (VTX)

Master Students: Stefanie Meinert (Averages of $R(D^{(*)})$), Bhavesh Sirvi (D^{**} Dalitz),
Nikolas Paessler (PXD), Erik Buechau (PXD), Tobias Blesgen (VTX), Maximilian
Hoverath ($B \rightarrow D^{(*)} \ell \bar{\nu}_\ell$), Nada Gharbi ($B \rightarrow D \pi \ell \bar{\nu}_\ell$), Anna-Maria Heyn (R^{+0})

Bachelor Students: Lars Huebbel (PXD), Shanmeng Li (PXD),

The DESY Belle II Group



... nearly all of us



The DESY Belle II Group



Group: 8 PhD students, 10 PostDocs, 7 Staff

Group leader: Ami Rostomyan

Detector

PXD integration & commissioning

CDC software & tracking performance

Machine detector interface (MDI)

Anselm, Arthur, Carsten, Daniel, Fabian, Jasper, Luisa, Maiko, Yubo

Computing and software

Grid system

NAF analysis facility

Collaborative services & tools

Software

Generators

Andreas, Niharika

Performance

Neutrals

PXD

Event timing

Tracking

Christian, Daniel, Eldar, Luisa, Maiko, Matilde, Paolo, Raimundo, Sasha, Tadeas, Yulan, Xu

Physics

Radiative & electro-weak penguin B decays

Semileptonic B decays

Time-dependent CP violation

τ physics

@all

Justus–Liebig-Universität Giessen

II. Physikalisches Institut (Subatomare Physik)



- **Group leader:** Jens Sören Lange
- **1 PXD data acquisition (ONSEN system)**
2 PXD synchrotron radiation monitor
3 PXD slow control & monitoring
4 Slow pions in PXD (machine learning, ML)
Matthäus Krein (PhD) **1**
Dmytro Meleshko (PhD) **1,2**
Johannes Bilk (PhD) **4**
Simon Reiter (Postdoc, new PXD Technical Coordinator)
1,2,3

- Many small hardware & ML student projects in new MBA programs
 - Data science
 - Applied informatics (e.g. SMD soldering, radiation hardness, sensor readout, Arduino, FPGA, ...)

- **Realtime ML on FPGA hardware**

Peter Lehnhardt (MSc)

Workshop in April 2024

<https://indico.belle2.org/event/10782/>

WP5 in Jennifer3 project

- **Physics Analysis:**

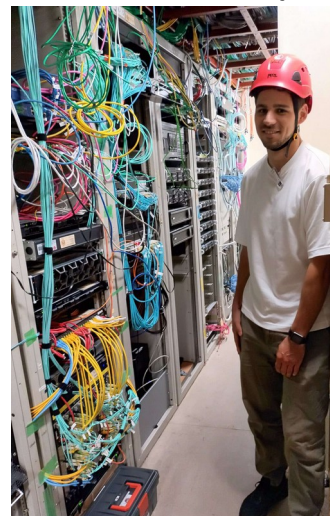
– $[D_s(^*) D_{sJ}]$ tetraquark search and test of chiral symmetry, Dmytro Meleshko

– $[D^*D^*]$ tetraquark search (topic of 5 theses in the past), Lars Galgon (BSc), Nils Ludwig (MSc)

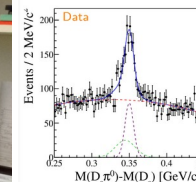
Christian Winklmeier (Msc)

– Magnetic monopole search in PXD, Matthäus Krein

Dmytro Matthäus Johannes



Simon





GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN IN PUBLICA COMMODA
SEIT 1737

Group Leader : Ariane Frey

Current group members: PD Dr. Benjamin Schwenker, Yannik Buch (PhD), Lukas Herzberg (MSc), Dr. Marike Schwickardi (until end of October)

Close collaboration with Helmholtz group of **Thibaud Humair** (DESY and Junior Professor at Göttingen University)

Activities:

BGNET : machine learning tool for SUPERKEKB background modelling (B. Schwenker, Y. Buch, L. Herzberg)

VTX Upgrade: test beam characterizations, lab measurements, geometry optimization, background studies (B. Schwenker, Y. Buch, M. Schwickardi)

Analyses: B -> D Iv** (N.Rauls, left in August)

Benchmarking studies for VTX upgrade in TDCPV (L. Herzberg)

■ Group leaders:

- Torben Ferber (ETP)
- Jürgen Becker (ITIV²)
- Frank Simon (IPE)

■ Software/Computing:

- basf2: Giacomo De Pietro (PD)
- grid: Matthias Schnepf (PD)
- GNN Tracking: Lea Reuter (PhD)
- ECL Clustering: Jonas Eppelt (PhD)
- decfiles: Pablo Goldenzweig (staff)

■ Other

- CDC task force: Thomas Mueller (Emeritus)
- Upgrade Working Group TRG: Torben Ferber

■ Trigger:

- ECL TRG GNN: Isabel Haide (PhD), Marc Neu² (PhD), **Timo Justinger² (MSc)**, **Valdrin Dajaku² (MSc)**
- NeuroZ: Kai Unger² (PhD), **Felix Mältzer² (MSc)**
- GNN Tracking: Greta Heine (PhD)
- ECL TRG GNN UT5/Versal: **Till Rädler² (MSc)**

■ Analysis:

- $A' \rightarrow$ invisible: Giacomo De Pietro (PD)
- $a \rightarrow \gamma\gamma$ in ALP-Strahlung: Alexander Heidelberg (PhD)
- inelastic DM + dark higgs: Patrick Ecker (PhD)
- $B^+ \rightarrow K^{*+}\tau^+\tau^-$: **Lennard Damer (MSc \rightarrow PhD)**
- $a \rightarrow \gamma\gamma$ in photon fusion: **Frederick Schmitt (MSc)**
- $B^+ \rightarrow K^{*+}\tau^+\ell^-$: **Lara Fuchs (MSc)**
- $\mathcal{A}_{\text{FB}}(B \rightarrow X\ell\nu)$: **Ray van Tonder (PD)**

Ludwig-Maximilians-Universität (LMU)



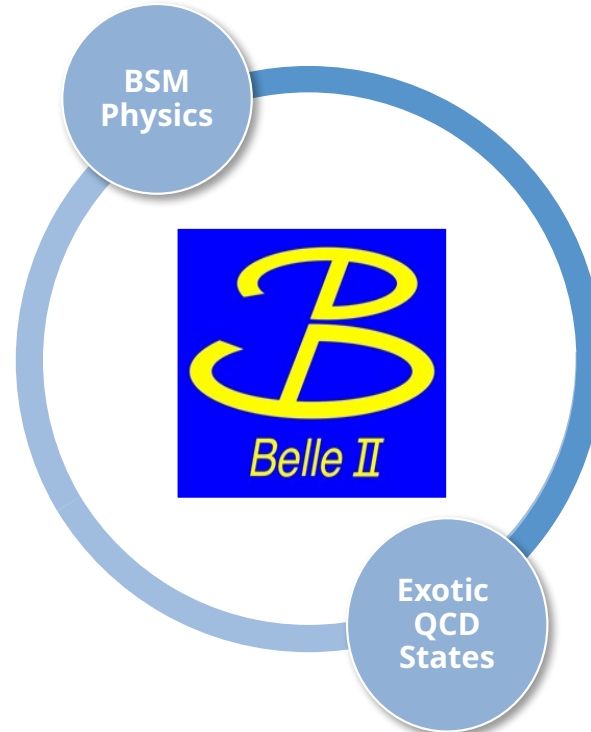
- **Group leader:** Thomas Kuhr
- **PXD power supplies and Tracking:** Thomas Lück (PD)
- **Software/Computing:**
Systematics framework, analysis tools: Sviat Bilokin (PD)
Framework/infrastructure: Nikolai Hartmann (PD), TK
PubDB, analysis technologies: David Koch (technical)
Chat: Chris Mitterer (technical)
LMU site: Günter Duckeck (technical)
- **Machine Learning:**
SmartBG, Hypertagging: Boyang Yu (PhD)
PXD background: Baran Hashemi (PhD), Fabio Novissimo (PhD)
Anomaly detection: David Giesegeh (MSc)
B tagging: Niklas Heckmann (MSc)

- **Public Data**
public likelihoods, reinterpretation (of $B \rightarrow K\nu\bar{\nu}$): Lorenz Gärtner (PhD)
- **Physics Analysis:**
 $B \rightarrow \tau\ell$ @ Belle: Nathalie Eberlein (PhD)
 $Y(4S) \rightarrow B^0\bar{B}^0$ @ Belle: Pascal Schmolz (PhD)
 $X(3915)$ quantum numbers @ Belle: Yaroslav Kulii (PhD)
 $B \rightarrow K^{+}\nu\bar{\nu}$:* Caspar Schmitt (PhD)
 $B \rightarrow X\ell\ell$: Arul Prakash (PhD)
 $B \rightarrow D^{+}l\nu$:* Eylül Ünlü (PhD)
 $R(D^)$ with inclusive tag:* Thomas Ametsbichler (MSc)
 $\Delta B=2$ processes: Melanie Hess (MSc)
 $B \rightarrow D^{()}K$:* Zeynep Su Selcuk (MSc)
Broad CPV search: Beatrice Locatelli (MSc)
- **FSP:** Johanna Häusler → Amanda Clot



Signatures of New Physics in rare decays

M. Sobotzik (PhD)
J. Patel (MSc)
A. Klotzbücher (MSc)



Group Members

- Wolfgang Gradl
- Matthias Hoek
- Felix Keil
- Andre Klotzbücher
- Jigar Patel
- Concettina Sfienti
- Martin Sobotzik
- Björn Spruck

H-Dibaryon / Sexaquark F. Keil (PhD)

Neutronenstern

Schalenstruktur und Materiedichten

äußere Kruste 10^4 g cm^{-3}

Innere Kruste $1.1 \times 10^9 \text{ g cm}^{-3}$

äußerer Kern $1.7 \times 10^{14} \text{ g cm}^{-3}$

innerer Kern $5 \times 10^{14} \text{ g cm}^{-3}$

freie Phase von Quarks und Gluonen

QGP

Neutronenflüssigkeit, neutronenreiche Atomkerne

Nukleonen, Elektronen, Hyperonen, Kaonen

Eisengitter, entartete Elektronen

ultradünne Atmosphäre

0 km

11 km

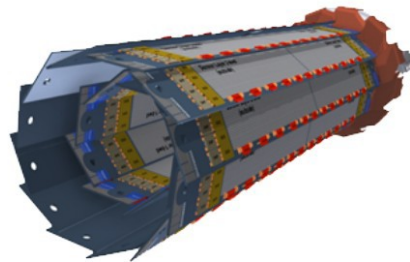
15 km

16 km

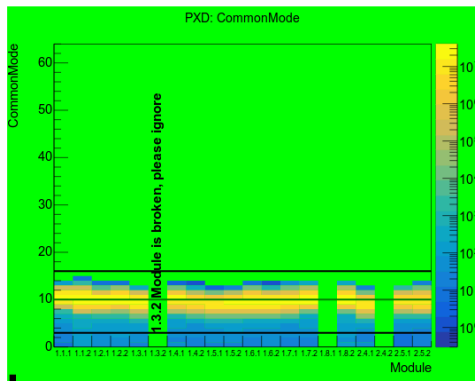
Belle II @ JGU Mainz

Detector & Software

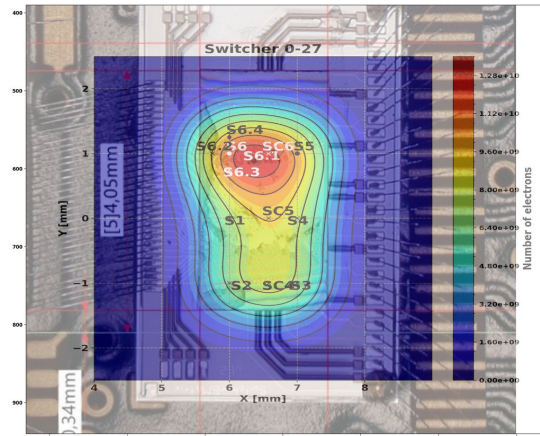
PXD



ONSEN
Slow Control
&
DQM
(B. Spruck)



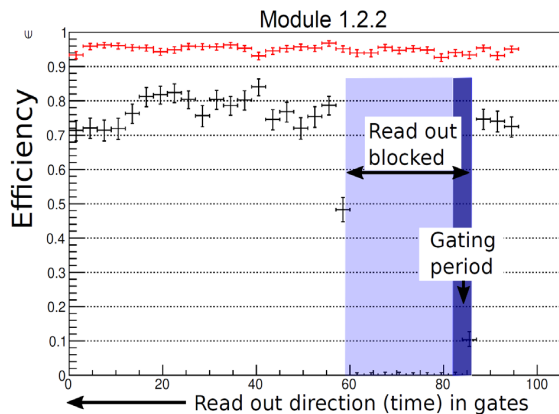
Irradiation
@ MAMI
(M. Hoek)



Switcher Irradiation Profile



PXD PS
Neutron
Irradiation
Setup





Max-Planck-Institut für Physik Werner Heisenberg Institut



Director:	Allen Caldwell	
Group leader:	Hans-Günther Moser	
Postdocs:	Stefan Wallner Sagar Hazra	τ , PWA quantum coherence (J/ψ K^{*0} TDCPV)
PhD students:	Justin Skorupa Markus Reif Oskar Tittel Martin Bartl (Philipp Leitl)	charmless B decays B \rightarrow $K^*\pi$ (Dalitz) B \rightarrow $K^*\pi$ (Dalitz) B \rightarrow J/ψ K^{*0} PWA PXD modules
Master students:	Max Hattenbach Timo Forsthofer Simon Hiesl Yingmin Yang Ceren Ay Vanessa Geier (from October)	quantum coherence NN trigger NN trigger τ (PWA) PWA quantum coherence
Technical/IT	Uli Leis Sven Vogt Stefan Horn Enrico Rochser Carina Schlammer	IBBelle, Replacement Chiller IBBelle IBBelle Ladder production Ladder Production
Emeritus:	Christian Kiesling	NN trigger
MPP Fellow:	Stephan Paul	

Group Members:

Stephan Paul (Prof.)

Daniel Greenwald (Akad. Rat)

Igor Konorov (Tech.)

Andrei Rabusov (Postdoc.)
new

Lukas Bierwirth (Doct. cand)

Katarina Dugić (Doct. cand.)

Lukas Grußbach (Doct. cand.)

new → **Niklas Böhm** (Bach.)

new → **David Schultheiss** (Bach.)

Physics Analyses:

- ▶ $\tau \rightarrow \pi\pi\pi\nu$: spectroscopy (Rabusov, DG, SP)
- ▶ $\Lambda_c \rightarrow \Lambda\ell\nu$: \mathcal{B} , LFU tests, and A_{CP} (Bierwirth, DG, SP)
- ▶ $\tau \rightarrow \bar{K}^0\pi\nu, K^0K\nu, K^0\bar{K}^0\pi\nu$: A_{CP} (Dugić, Schultheiss, DG, SP)
- ▶ $ee \rightarrow \mu\mu$: A_{FB} and the Weinberg angle (Grußbach, DG, SP)

Hardware: **PXD electronics** (Konorov, Böhm)

Other activities:

- ▶ **$ee \rightarrow c\bar{c}$ finder** (Bierwirth)
- ▶ **Syst. framework, B2BII** (Dugić)
- ▶ **tracking and μ -ID efficiency corrections in p and θ** (Grußbach)