

Research highlights

LHCb VELO upgrades

Production and sensor R&D

01/10/2018 – present

- Worked on assembly and quality assurance of LHCb VELO upgrade I detector modules. This included testing, metrology and communication data analyses, as well as software and database development.
- Contributed towards the development of new iLGAD sensors for improved timing precision of LHCb Upgrade II, simulating performance using TCAD and evaluating prototypes with x-rays and beam tests.
- Started R&D on radiation hard wide-bandgap sensors for the future of LHCb upgrades and beyond.

Single-die bonding technologies

Development of in house interconnect

01/10/2021 – 31/08/2024

- Development and characterization of novel single-die bonding technology, necessary for hybridization of sensor-readout assemblies. The technology enables bonding of multi-project-wafer productions.
- Performing lab and testbeam evaluation of the assemblies with focus on interconnect yield.

Tpx3Cam

Commissioning time stamping optical camera

05/01/2017 – 30/09/2021

- In collaboration with Brookhaven National Laboratory, I commissioned a novel time stamping fast optical camera for imaging applications. I performed experiment setup, measurements and subsequent simulations and analysis focused on different performance aspects.

Research Experience

Czech Academy of Sciences

Institute of Physics

MSCA-Cofund fellow

01/09/2024 – present

- Work in scope of P4F programme <https://p4f.fzu.cz/> developing silicon carbide small pitch LGAD sensors for future of particle physics experiments.

Czech Technical University in Prague

Faculty of Nuclear Sciences and Physical Engineering

Team leader

01/01/2024 – present

- Team leader of CAPADS <https://capads.fjfi.cvut.cz/>, focusing on development of novel semiconductor detector technologies for experimental physics, medical applications and related fields.
- Supervising students, postdocs and technical staff; handling project schedules, finances and reports.

CERN

EP-DT-TP

Senior fellow

01/10/2021 – 31/08/2024

- Work in scope of CERN EP-R&D and AIDAinnova, focus on small pitch pixel detector hybridisation and interconnection technologies based on Anisotropic Conductive Adhesive (ACA) bonding.
- Timepix3 telescope maintenance and upgrades with aim of better temporal precision, testbeam data analysis and environment conditions monitoring.
- (i)LGAD sensor development, beam-testing and analysis for LHCb Upgrade II technology studies in collaboration with universities of Edinburgh, Glasgow, and Manchester.

- Chairing bi-weekly meetings, organization of student workshops on pixel detector operation (e.g. ESIPAP, CERN Summer School) and international workshop on telescope and testbeam (BTTB), supervision and project planning for CERN summer school students as well as supervision of technical interns. Giving guided tours of the LHCb experiment.

Czech Technical University in Prague

Research assistant

Faculty of Nuclear Sciences and Physical Engineering

01/07/2016 – 30/09/2021

- Essential member of the BNL based Tpx3Cam collaboration (www.tpxcam.org) led by Prof. A. Nomerotski, performing experiments, calibrations, Monte-Carlo simulations and analysis.
- Semiconductor detectors R&D in CAPADS team led by Dr. V. Vrba, developed Geant4 models, frontend and backend of detector control software and participated in ATLAS ID shifts in 2017–2018.
- Supervising Bachelors' and Masters' students in years 2019 – 2021.

Education

University of Manchester

Manchester, UK

Department of Physics and Astronomy

01/10/2018 – 30/09/2021

- President's Doctoral Researcher, PhD degree awarded 17/02/2022
- Thesis: *Developing a Silicon Pixel Detector for the Next Generation LHCb Experiment.*

Czech Technical University in Prague

Prague, CZ

Faculty of Nuclear Sciences and Physical Engineering

01/10/2012 – 11/06/2018

- Bachelor's degree awarded 27/10/2015, Master's degree awarded 15/06/2018
- Thesis: *Application of Semiconductor Detectors in Fusion Experiments.*
- Graduated with honours and awarded red diploma as one of the top students.

University of Wisconsin-Madison

Madison, WI, USA

College of Engineering

spring 2016

- Exchange study from CTU in Prague, selected from hundreds of applicants and received scholarship.
- Finished graduate plasma physics courses with exceptional GPA 3.85.

Awards and Prizes

LHCb PhD prize

CERN, CH

For central contribution towards VELO Upgrade I and II

07/06/2023

Forbes Slovakia 30-under-30

Bratislava, SK

For developments and applications of semiconductor detectors

12/05/2023

LHCb-UK PhD prize

Edinburgh, UK

For central contribution towards VELO Upgrade I and II

06/01/2023

iWoRiD 2022 Best Poster Award

Riva del Garda, IT

For poster on *Development of novel single-die hybridisation processes*

30/06/2022

John G Rutherglen Memorial Prize

CERN, CH

For work completed on LHCb and detector development during PhD

10/06/2021

Dean's Award for Best Diploma Thesis

Prague, CZ

For simulations and novel instrumentation for tokamaks.

11/04/2019

President's Doctoral Scholar Award

Manchester, UK

Manchester University's President scholarship given to outstanding students

11/01/2018

Skills

Coding

- Python, C, C++, Qt5, WinCC, L^AT_EX, shell

Data Analysis and Processing

- Python – Pandas, Matplotlib, Numpy, SciPy, ...
- ROOT - data analysis framework
- Corryvreckan - software framework for testbeam data analysis
- Geant4 - simulation toolkit for particle-matter interaction
- Synopsys Sentaurus TCAD - simulation of semiconductor device processing and evaluation
- Django - for PostgreSQL management; Grafana visualization - for MySQL and InfluxDB

Languages

- Slovak (native), Czech (native), English (C1 - certified), French (A1)

Additional References

CERN – testbeam telescope operation, detector testing, fine-pitch bonding

- Dr. Dominik Dannheim (Dominik.Dannheim@cern.ch) - project leader; CERN

LHCb – VELO Upgrade I and II projects

- Prof. Chris Parkes (Chris.Parkes@cern.ch) - PhD supervisor, former LHCb spokesperson; University of Manchester
- Dr. Stefano deCapua (Stefano.De.Capua@cern.ch) - VELO working group leader; University of Manchester
- Dr. Paula Collins (Paula.Collins@cern.ch) - VELO working group leader; CERN

Tpx3Cam

- Prof. Andrei Nomerotski (anomerotski@bnl.gov) - project leader; Brookhaven National Laboratory

Selected Publications

Pixel detector hybridisation

Development of novel single-die hybridisation processes for small-pitch pixel detectors

- Principal author, JINST, 2023, Vol. 18, 10.1088/1748-0221/18/03/C03008

LHCb VELO upgrade

The LHCb upgrade I

- Co-author, JINST, 2024, 10.1088/1748-0221/19/05/P05065

Microchannel cooling for the LHCb VELO Upgrade I

- Co-author, NIM-A, 2022, Vol. 1039, 10.1016/j.nima.2022.166874

Tpx3Cam visible light detection

Fast camera spatial characterization of photonic polarization entanglement

- Principal author, Scientific Reports, 2020, Vol. 10, 10.1038/s41598-020-62020-z

Multivariate Discrimination in Quantum Target Detection

- Principal author, Applied Physics Letters, 2020, Vol. 117, 10.1063/5.0012429

First Demonstration of 3D Optical Readout of a TPC Using a Single Photon Sensitive Timepix3 Based Camera

- Principal author, JINST, 2019, Vol. 14, 10.1088/1748-0221/14/06/P06001

Selected Posters, Talks & Seminars

Low-Gain Avalanche Detectors: path towards precise track timing

- seminar talk

FZU division seminar
Prague–CZ, 11/2024

Small Pitch Detector Hybridisation and Integration

- invited talk

CEPC 2022
remote, Beijing–CN 10/2022

Development of novel single-die hybridisation processes for small-pitch pixel detectors

- poster, best poster award

iWoRiD 2022
Riva del Garda–IT, 06/2022

The LHCb VELO upgrade I

- talk

ICHEP 2020
Prague–CZ, 07/2020