

Research highlights

Single-die bonding technologies

CERN, CH

01/10/2021 – present

- Development and characterization of novel single-die bonding technology, necessary for hybridization of sensor-readout assemblies. The technology is a necessity for multi-project-wafer productions where common bump-bonding technologies cannot be used.
- Performing lab and testbeam evaluation of the assemblies with focus on interconnect yield.
- The work was presented at international workshops and conferences: iWoRiD 2022, CEPC 2022, BTTB11 2023.

LHCb VELO upgrades

University of Manchester, UK

01/10/2018 – 30/09/2021

- 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.
- The work was presented at conferences: IEEE 2019, LHCC 2020, ICHEP 2020.
- Finally, I have contributed towards the development of new iLGAD sensors for improved timing precision required by the LHCb Upgrade II, evaluating their performance using TCAD.

Tpx3Cam

Czech Technical University in Prague, CZ

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.
- This work was published in a number of peer-reviewed journals, see list of publications (Scientific Reports, Review of Scientific Instruments, Applied Physics Letters).

Research Experience

CERN

Senior fellow

EP-DT-TP

01/10/2021 – present

- 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, help with organization of student workshops on pixel detector operation (e.g. ESIPAP, CERN Summer School), supervision and project planning for CERN summer school students as well as supervision of technical interns. Giving guided tours of the LHCb experiment.

- University of Manchester** PhD student
Department of Physics and Astronomy 01/10/2018 – 30/09/2021
- Work on LHCb VELO upgrade (module production and testing; software and database development, LGAD sensor R&D – TCAD simulations and probe station measurements).
 - Setting up Alibava experiment for 3rd year physics laboratory.
- CERN against COVID-19** Software development
LHCb High Energy Ventilator collaboration spring 2020
- Essential member of the HEV software team led by Dr. P. Collins and Dr. K. Hennessy, developing modular touchscreen GUI, HDLC based communication and ESP32 firmware.
 - Performed testing and optimization of the device and its communication/alarm propagation.
- 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 led by Dr. V. Vrba, developed Geant4 models, frontend and backend of GUI detector control software.
 - ATLAS Inner Detector control room shifter during 2017 – 2018 operation.
 - Measurements and data analysis using Medipix-family and PH32 detectors at tokamaks.
 - 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 01/10/2015 – 11/06/2018
- 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 study travel 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 pixel 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 <i>Development of novel single-die hybridisation processes for small-pitch pixel detectors</i>	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
Leadership Recognition Award	Madison, WI, USA
For outstanding work in Tripp, Adams and Slichter residence halls	26/04/2016

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, arXiv, 2023, arXiv:2305.10515

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

Posters, Talks & Seminars

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

LHCb VELO upgrade

- seminar talk

Bohr's seminar
Manchester-UK, 09/2019