

Dipl.-Ing. Dr. techn.

Stefan E. Brunner

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Profile

Stefan E. Brunner is a curious researcher and engineer with an affinity for high time precision of gamma-radiation detection. The idea of detecting single optical photons and making use of them fascinates him since his first practical experience with the underlying detector technology. He believes that especially solid state detectors such as silicon photomultipliers have a big potential of becoming the future's primary single photon counters. For this reason he has already investigated them within several international collaborations comprising leading institutions of academia and industry for almost a decade now.

Work Experience

PostDoc, Delft UT; Delft, The Netherlands - 09/2015-Present

This PostDoc position is granted for two years by a Marie Skłodowska-Curie Individual Fellowship of the EU commission in the framework of Horizon2020. The research involves the development of a gamma-radiation detector with high detection efficiency and unprecedented time resolution employing large sized inorganic scintillators and digital silicon photomultipliers targeted on application in positron annihilation lifetime spectroscopy and time-of-flight positron emission tomography.

R & D Engineer, Philips Digital Photon Counting; Aachen, Germany – 11/2014-06/2015
Responsible of technical support for users of the Philips digital photon counter (DPC), giving introductory lessons to customers (e.g. for Avago, Regensburg) and development of characterisation experiments for the Philips DPC.

Consultant, Philips Digital Photon Counting; Aachen Germany - 07/2014-10/2014
Co-editor for user manuals.

Junior Scientist, Austrian Academy of Sciences; Vienna, Austria – 09/2010-06/2014
Employed at the Stefan-Meyer-Institute for Subatomic Physics. Development and characterisation of SiPM-based detectors for application in high energy physics and medical imaging (TOF-PET) including Monte Carlo simulations with a focus on high time precision.

PR Administrator, Caritas Headquarters; Vienna, Austria – 2010
Editor of press releases and project sheets and responsible for press releases on the Caritas and Caritas related websites.

Scientific Employee, Austrian Institute of Technology; Vienna Austria – 2007
Training on CAD and simulations of wind loads for the new Vienna Main Station using the finite element method.

Education

Vienna UT and Austrian Academy of Sciences; Vienna, Austria – Dr. techn., 2015, passed with distinction

Research for the PhD thesis was done within the employment at Stefan-Meyer Institute of the Austrian Academy of Sciences. Thesis title: Fast single photon detection for low energy scintillation and Cherenkov applications using silicon photomultipliers.

Vienna UT, Vienna, Austria and CERN, Geneva, Switzerland - Dipl.-Ing., 2010, passed with distinction

Studies of technical physics including project management. The studies included an ERASMUS semester at ETH Zurich in 2008 (5 months) and a research stay for the master thesis at CERN in 2009 (12 months) in the group of P. Lecoq. Thesis title: New methods for improvement of time-of-flight positron emission tomography.

Skills

Languages

German (native), English (fluent), French (beginner), Dutch (beginner)

Software and Programming

CAD, C++, Geant4, LabView, Matlab, ROOT.

Experience

Know-how in particle detection with focus on scintillation and Cherenkov detectors for high energy physics and medical applications (TOF-PET), single photon detection with focus on analog and digital SiPM, signal processing (NIM, Camac, VME, offline waveform analysis). Organization and participation of particle beam measurements including project planning (beam times at COSY, Forschungszentrum Jülich - 2012, at INFN Frascati - 2012, at PS, CERN - 2011, and at SPS, CERN - 2009) and conduction of a short-term research visit at FBK Trento - 2016. Experience as reviewer for scientific journals (Journal of Instrumentation, IEEE Transactions on Nuclear Science, Medical Physics). Practiced supervisor by advising 5 master students. Editorial experience as author for peer-reviewed journals and editor for user manuals. Know-how in non-scientific publications, press releases and content maintenance for several webpages. Presentation skills acquired at participation of international conferences.

Fellowships

Marie Skłodowska-Curie Individual Fellowship of the EU commission - 2015-2017

The project “positron annihilation detection beyond the limits” was awarded to S. E. Brunner for 2 years of research at Delft UT with the amount of 166k€. Consortium partners: Philips Digital Photon Counting, Aachen, Germany and Stefan-Meyer-Institute for Subatomic Physics of the Austrian Academy of Sciences, Vienna, Austria.

Technical Student, CERN; Geneva, Switzerland - 2009

Costs for 12 months of research for the master thesis at CERN.

Institutional responsibilities	Official responsible for laboratory safety (with certificate) - 2011-2014
Commission of trust	Board member of the Austrian Physical Society - 2011-2015 Leader of students division of the Austrian Physical Society. Organisation, review and assignment of the students-award of the Austrian Physical Society for the best master thesis of the year (awarded with 1000€).
Memberships	IEEE, since 2015 European Physical Society, since 2014 Austrian Physical Society, since 2008
Collaborations	PALADIN (Marie Skłodowska-Curie action of the EU commission, H2020) Development of highly efficient scintillation detectors with high time precision using silicon photomultipliers. Project consortium consisting of Delft UT, Philips Digital Photon Counting, Austrian Academy of Sciences. [link] FAST (COST action of the EU commission, H2020) Project consisting of leading European institutions and companies in the field of fast scintillators and photo-detectors. [link] HadronPhysics 2 and 3 (Integrating activity of the EU commission, FP7) Research activity on Hadron Physics. Funding and research within the work package “Silicon Photomultipliers”. [link] PANDA at FAIR, Gesellschaft für Schwerionenforschung, Darmstadt, Germany Involvement in detector development for the DIRC detector and responsibilities for the SciTil detector. [link] Crystal Clear Collaboration Investigation of scintillator materials for high energy and nuclear physics, astrophysics, dark matter search, beam diagnostics, medical imaging and industrial applications. [link]
Other research projects	ETH Zurich and CERN, Geneva, Switzerland for the Ax-PET collaboration - 2008 Development of a test setup for radiation-damage-measurements of wavelength shifters for Axial-PET. Austrian Institute for Atomic and Subatomic Physics, Vienna Austria - 2007 Dating of archeological finds using thermoluminescence. Medical University Vienna, Austria - 2005 Development of an automatic digitisation routine for radiographs using commercial negative scanners.

Scientific dissemination

Stefan E. Brunner

Researcher ID: A-2572-2013
Google scholar: S E Brunner
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Invited Talks

Terascale workshop; Freiburg, Germany - 2016
Fast timing with scintillation detectors

COST meeting: Fast Advanced Scintillator Timing (FAST); Trento, Italy - 2016
Cherenkov photon detection with SiPM for fast e-/e+ annihilation detection

Winter school on medical physics (representing Philips); Pichl, Austria - 2016
Detector developments for TOF-PET

EIROforum School on instrumentation (representing Philips); Garching, Germany - 2015
The development of the digital Silicon Photomultiplier

Symposium of the Danish Society for Medical Physics; Nyborg, Denmark - 2015
TOF-PET employing SiPM: current limits of time resolution and ways to overcome them

Symposium of the Danish Society for Medical Physics; Nyborg, Denmark - 2015
Plenary talk: Applications and potential of the Cherenkov-effect in medical imaging

Symposium on PET; Cracow, Poland - 2014
Status and prospects for using fast Cherenkov emission for TOF-PET

Talks

IEEE Nuclear Science Symposium; Strasbourg, France - 2016
From ultimate towards cost effective timing for PET and its system integration

IEEE Nuclear Science Symposium; Strasbourg, France - 2016
Comparative study on the time resolution of Co-doped LSO:Ce, LYSO:Ce and LFS

IEEE Nuclear Science Symposium; Strasbourg, France - 2016
BGO as hybrid scintillator / Cherenkov radiator for cost-effective time-of-flight PET

COST meeting: Fast Advanced Scintillator Timing (FAST); Vilnius, Lithuania - 2016
Application of the Philips Digital Photon Counter in Time Correlated Single Photon Counting for Pulse Shape Characterisation of Fast Luminescent Materials

ICTR-PHE; Geneva, Switzerland - 2014

Plenary talk: Potential of detection of fast Cherenkov photons for improved TOF-PET

DIRC workshop on fast Cherenkov detectors; Rauischholzhausen, Germany - 2013

Comparative timing performance study of SiPMs for gamma detectors using hybrid Cherenkov-scintillation readout

EANM annual congress; Lyon, France - 2013

Improving TOF-PET by studying scintillation photon propagation and the Cherenkov effect

SCINT; Shanghai, China - 2013

Studies of the Cherenkov effect for improvement of TOF-PET and DOI determination

Posters

Vienna conference on instrumentation; Vienna, Austria - 2016

Exploring the limits of time resolution in Cherenkov photon detection of e^-/e^+ annihilation events

Vienna conference on instrumentation; Vienna, Austria - 2013

New approaches for improvement of TOF-PET

Annual meeting of the Austrian and Swiss physical societies; Linz, Austria - 2013

Improving the time-of-flight method for positron emission tomography

ICTR-PHE; Geneva, Switzerland - 2012

Improving time-of-flight PET using silicon photomultipliers

Theses

PhD thesis; Vienna UT and Austrian Academy of Sciences; Vienna Austria - 2014

Fast single photon detection for low energy scintillation and Cherenkov applications using silicon photomultipliers. [[link](#)]

Master thesis; Vienna UT and CERN; Vienna, Austria and Geneva, Switzerland - 2010

New methods for improvement of time of flight positron emission tomography. [[link](#)]

Patents

Patent in preparation for submission - Nov. 2016.

Peer reviewed articles

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- (I) S. E. Brunner, D. R. Schaart, "BGO as hybrid scintillator / Cherenkov radiator for cost-effective time-of-flight PET", prepared for submission to Phys. Med. Biol.
- (II) S. E. Brunner, A. Ferri, A. Gola, C. Piemonte, D. R. Schaart, "Comparative study on the time resolution of Co-doped LGSO:Ce, LFS, LSO:Ce and LYSO:Ce", prepared for submission to IEEE Trans. Nucl. Sci.
- (III) S. E. Brunner, L. Gruber, A. Hirtl, J. Marton, K. Suzuki, D. R. Schaart, "A comprehensive characterization of the time resolution of the Philips Digital Photon Counter", Jour. Instr. 11 (2016) P11004.
- (IV) L. Gruber, S. E. Brunner, C. Curceanu, J. Marton, A. Romero Vidal, A. Scordo, K. Suzuki, O. Vazquez Doce, "Recovery Time Measurements of Silicon Photomultipliers Using a Pulsed Laser", Proc. Sci. (2015), arXiv: 1510.06906 (2015).
- (V) L. Gruber, S. E. Brunner, J. Marton, H. Orth, K. Suzuki, On behalf of the PANDA TOF group, "Barrel time-of-flight detector for the PANDA experiment at FAIR", Nucl. Instr. Meth. A 824 (2015) 104-105. doi: 10.1016/j.nima.2015.10.108.
- (VI) D. Steinschaden, S. E. Brunner, H. Dichtl, H. Fuchs, D. Georg, A. Hirtl, J. Marton, A. Pichler, "Investigation of prompt γ -ray emission for online monitoring in ion therapy", Jour. Phy. Conf. Ser. 599-1 (2015) 012042.
- (VII) Y. Bilevych, S. E. Brunner, H. W. Chan, E. Charbon, H. van der Graaf, C. W. Hagen, G. Nützel, S. D. Pinto, V. Prodanović, D. Rotman, F. Santagata, L. Sarro, D. R. Schaart, J. Sinsheimer, J. Smedley, S. Tao, A. M. M. G. Theulings, "Potential applications of electron emission membranes in medicine", Nucl. Instr. Meth. A 809 (2015) 171-174; doi:10.1016/j.nima.2015.10.084.
- (VIII) S. E. Brunner, L. Gruber, J. Marton, H. Orth, K. Suzuki, "Time resolution below 100 ps for the SciTil detector of PANDA employing SiPM", J. Instrum. 9 (2014) C03010; doi:10.1088/1748-0221/9/03/C03010, arXiv:1312.4153.
- (IX) S. E. Brunner, L. Gruber, J. Marton, K. Suzuki, A. Hirtl, "Studies on the Cherenkov Effect for Improved Time Resolution of TOF-PET", IEEE Trans. Nucl. Sci. 61 (2014) pp. 443-447; doi:10.1109/TNS.2013.2281667, arXiv:1305.6257.
- (X) S. E. Brunner, L. Gruber, J. Marton, K. Suzuki, A. Hirtl, "New approaches for improvement of TOF-PET", Nucl. Instr. Meth. A, vol. 732, pp. 560–563, 2013; doi:10.1016/j.nima.2013.05.028, arXiv:1305.1560.
- (XI) L. Gruber, S. E. Brunner, J. Marton, and K. Suzuki, "Over saturation behavior of SiPMs at high photon exposure", Nucl. Instr. Meth. A, vol. 737, pp. 11–18, 2013; doi:10.1016/j.nima.2013.11.013, arXiv: 1304.2493.

- (XII) M. Rihl, S. E. Brunner, L. Gruber, J. Marton, and K. Suzuki, “Efficiency and uniformity measurements of a light concentrator in combination with a SiPM array”, *Nucl. Instr. Meth. A*, vol. 732, pp. 419–422, 2013; doi:10.1016/j.nima.2013.05.187.
- (XIII) S. E. Brunner, J. Marton, K. Suzuki, L. Gruber, A. Hirtl, M. Jankovec, P. Knoll, A. Gamal, “Improving Time-Of-Flight PET using silicon photomultipliers”, *Radiotherapy and Oncology*, vol. 102, suppl. 1, pp. S137 – S138, 2012; doi:10.1016/S0167-8140(12)70228-1.
- (XIV) L. Gruber, G. S. M. Ahmed, S. E. Brunner, P. Bühler, J. Marton, and K. Suzuki, “Position sensitive SiPM detector for Cherenkov applications”, *J. Instrum.*, vol. 6, no. 11, pp. C11024–C11024, 2011; doi:10.1088/1748-0221/6/11/C11024.
- (XV) F. Powolny, E. Auffray, S. E. Brunner, M. Despeisse, E. Garutti, M. Goettlich, H. Hillemanns, P. Jarron, P. Lecoq, T. Meyer, F. Powolny, W. Shen, H.-C. Schultz-Coulon, M. C. S. Williams, “Time-Based Readout of a Silicon Photomultiplier (SiPM) for Time of Flight Positron Emission Tomography (TOF-PET)”, *IEEE Trans. Nucl. Sci.*, vol. 58, pp. 597 – 604, 2011; doi:10.1109/TNS.2011.2119493.
- (XVI) F. Powolny, E. Auffray, S. E. Brunner, E. Garutti, M. Goettlich, H. Hillemanns, P. Jarron, P. Lecoq, E. T. Meyer, H. C. Schultz-Coulon, W. Shen, and M. C. S. Williams, “A time driven readout scheme for PET and CT using APDs and SiPMs”, *Nucl. Instr. Meth. A*, vol. 617, pp. 232–236, 2010.
- (XVII) P. Lecoq, E. Auffray, S. E. Brunner, H. Hillemanns, P. Jarron, A. Knapitsch, T. Meyer, and F. Powolny, “Factors Influencing Time Resolution of Scintillators and Ways to Improve Them”, *IEEE Trans. Nucl. Sci.*, vol. 57, no. 5, pp. 2411–2416, 2010.
- (XVIII) E. Auffray, D. Abler, S. E. Brunner, B. Frisch, A. Knapitsch, P. Lecoq, G. Mavromanolakis, O. Poppe, and A. Petrosyan, “LuAG material for dual readout calorimetry at future high energy physics accelerators”, *IEEE Nucl. Sci. Symp. Conf. Rec. (NSS-MIC)*, pp. 2245–2249, Oct. 2009.
- (XIX) P. Lecoq, E. Auffray, S. E. Brunner, H. Hillemanns, P. Jarron, A. Knapitsch, T. Meyer, and F. Powolny, “Factors Influencing Time Resolution of Scintillators and Ways to Improve Them”, *IEEE Nucl. Sci. Symp. Conf. Rec. (NSS/MIC)*, pp.1880–1885, Oct. 2009.
- (XX) P. Jarron, E. Auffray, S. E. Brunner, M. Despeisse, E. Garutti, M. Goettlich, H. Hillemanns, P. Lecoq, T. Meyer, F. Powolny, W. Shen, H.-C. Schultz-Coulon, M. C. S. Williams, “Time based readout of a silicon photomultiplier (SiPM) for time of flight positron emission tomography (TOF-PET)”, *Nucl. Sci. Symp. Conf. Rec. (NSS/MIC)*, pp. 1212–1219, Oct. 2009; doi:10.1109/NSSMIC.2009.5402391.