Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Research Plan

for the Dissertation of Michael Reichmann
born on 15th December 1988

submitted in May 2018

High Rate and High Resolution Studies of planar and 3D Poly-Crystalline Diamond Detectors

Zürich, May 3, 2018

version 0.0

The Collaboration

This dissertation is done within the CERN's RD42 Collaboration which investigates diamond as a future material for high energy particle detectors. Aiming to build a fully functional tracking detector that can be operated in the extremely high radiation environment of the LHC's (and the HL-LHC's) innermost layers close to it's beam pipe the RD42 Collaboration is involved in every process leading to that purpose.

Starting from the close relation and constant exchange with the manufactures of artificial diamonds which grow diamonds using a Chemical Vapour Deposition (CVD) process the collaboration is investigating the bulk and surface properties of this interesting material and develops own procedures on preparing the diamonds for different detectors designs which are namely are pad, pixel and 3D detectors. Theses prototypes are then qualified using various different testing methods including long time current and irradiation studies as well as the investigation of their signal behaviour depending on incident particle flux and high resolution studies of the detector structure.

The collaboration has already shown that diamonds are radiation tolerant up to a fluence of $1 \times 10^{16}\,\mathrm{hadrons/cm^2}$ and can operate for several years in the environment of the HL-LHC and that they do not show evidence of any damage due to electrons and photons up to 100 Mrad.

Research Topics

Within the RD42 Collaboration Mr. Reichmann is investigating the behaviour the signal response of planar and 3D poly-crystalline CVD (pCVD) diamond detectors in pad or pixel geometries depending on incident particle flux and characterising their internal structure with a high resolution beam telescope. The rate tests are solely performed at Paul Scherrer Institut (PSI) using the beam line piM1 with a positive 260 MeV/c pion beam and tunable particle fluxes from $1\,\mathrm{kHz/cm^2}$ up to $10\,\mathrm{MHz/cm^2}$ whereas the high resolution test are performed at CERN using the SPS beam H6 with pions or protons up to momenta of 200 GeV/c.

Mr. Reichmann is in charge of organising and conducting the RD42 high rate beam tests at PSI assisting also other members of the collaboration performing experiments.

Pad Detectors:

Pixel Detectors:

3D Detectors:

Time Frame

empty

Results & Progress

empty

Teaching

25 % of Mr. Reichmann's working time is designated to the function as teaching assistent at ETH Zürich.

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Department of Physics

Research Plan

Doctoral thesis:

Investigation of the Rate Dependence of pCVD Diamond Pad, Pixel and 3D-Pixel Detectors
Doctoral thesis title (provisional)

02/12/2016
Beginning date of doctoral thesis

Doctoral student:

12-946-414
Student number

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E-mail

Institution (if external doctoral thesis)

Date, signature

Supervisor:

Prof. Dr. R. S. Wallny
Name, title

Date, signature

Co-examiner (if already known):

Name, title

Affiliation

E-mail

Please hand in this form together with the research plan and the form "Approval of the research plan" to the Doctoral Administration Office of D-PHYS

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Genehmigung des Forschungsplans

(Definitive Zulassung zum Doktorat)

Approval of the Research Plan

(Full admission to doctoral studies)

Studierenden-Nummer
student number 12 - 946 - 414

Name
family name Reichmann

Vorname
first name Michael

Departement
department D - PHYS

Der Forschungsplan wurde eingesehen und angenommen durch:
The research plan has been seen and approved by:

Prof. Dr. R. S. Wallny		
Name Dissertationsleiter/in *Name of supervisor*	Datum *Date*	Unterschrift *Signature*
Name Bevollmächtigter Doktoratsausschuss *Name of representative of doctoral board*	Datum *Date*	Unterschrift *Signature*

Für Kandidaten mit weiteren Zulassungsbedingungen:
Die Zulassungsbedingungen müssen **vor** Genehmigung des Forschungsplans erfüllt sein!

For candidates who have to fulfil further conditions of admission:
*These conditions must be fulfilled **before** the research plan can be approved!*

Frist für Einreichung des Forschungsplans

Frühestens nach erfüllen und offiziell verfügtem Bestehen der Zusatzbedingungen, spätestens ein Jahr nach der Einschreibung

Vorgehen zur Genehmigung des Forschungsplans

Lassen Sie dieses Formular und den Forschungsplan von Ihrer Leiterin / Ihrem Leiter unterzeichnen und senden Sie danach beides an das zuständige **Studiensekretariat**. Dieses kümmert sich um die Unterschrift des Bevollmächtigten des Doktoratsausschusses und schickt das Formular anschliessend an die Doktoratsadministration.

Deadline for submission of the research plan

Only after having passed and received official notification of having successfully fulfilled the further conditions of admission, one year after registration at the latest.

Procedure for approval of your research plan

Please ask your supervisor to sign this form and your research plan and send both to the **Study Administration Office of your department**. They will take care of having it signed by the representative of the doctoral board and will forward it to the Doctoral Administration Office afterwards.