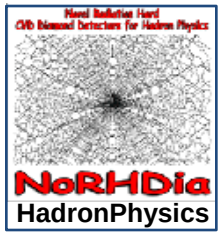
3rd MC-PAD Training event

Midterm Review

27-30 September, JSI



Shahinur Rahman

ER at GSI

Diamond Detectors

My background

1 PhD in Physics

- May 2009, University of Ioannina, Greece
- Thesis topic:

"Reliability Issues and Electrical Characteristics of REOs and their Gate Stacks grown on Ge Substrates"

2 M. Sc. in Physics

- June 2002, University of Dhaka, Bangladesh
- Thesis topic:

"Studies of the properties of NTA film with the reaction of $T(d,n)^4He$"

3 Home country: **Bangladesh**

Present status
(as an MC-PAD Fellow)

- At the Detector Laboratory of GSI – Diamond Detector Group since 01 June 2009

- **MC-PAD project: WP-11 (Front End Electronics), ER**

Group Members

- Elèni Berdermann

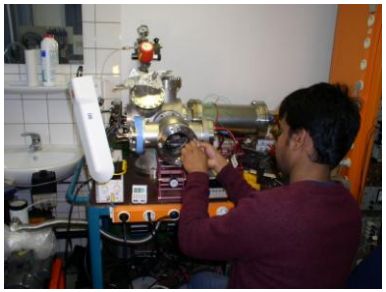
Supervisor and group leader

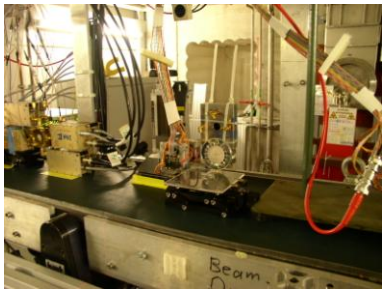
- M. Ciobanu
- M. Traeger
- M. Schreck
- C. Stehl,
- S. Dunst

} Univ. Augsburg

Objectives

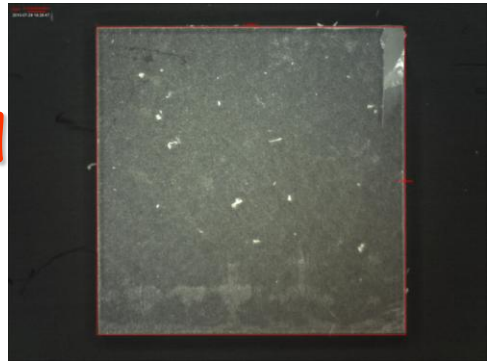
- Detectors Realization, Tests, Methodology for Qualification
- Electrical characterization of CVD Diamond materials for Detector Applications: pcCVDD, scCVDD, Diamond-on-Ir (DoI).
- Test of different Front-End Electronics (FEE) for Diamond Detectors (DD)
- Heavy ion beam test at the SIS of GSI

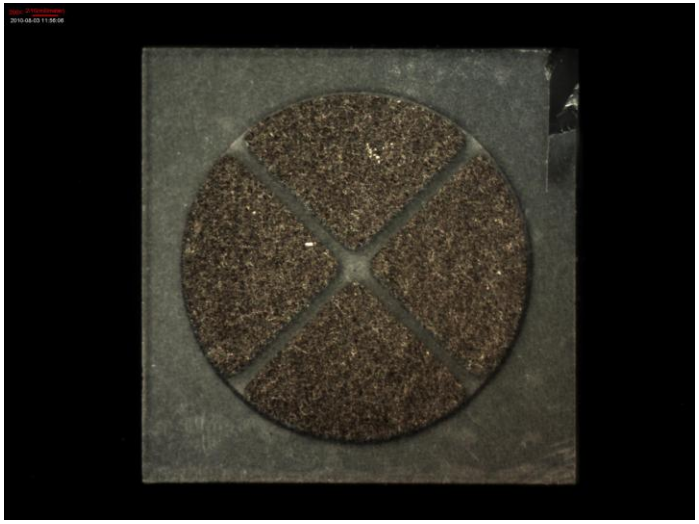


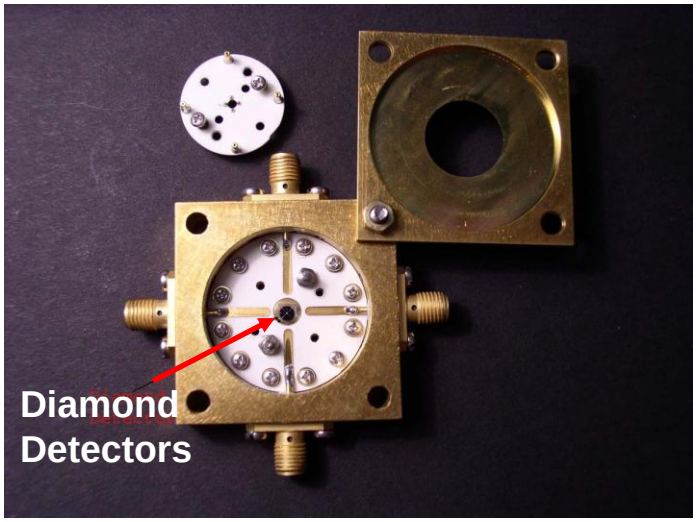


Diamond Detectors

Diamond

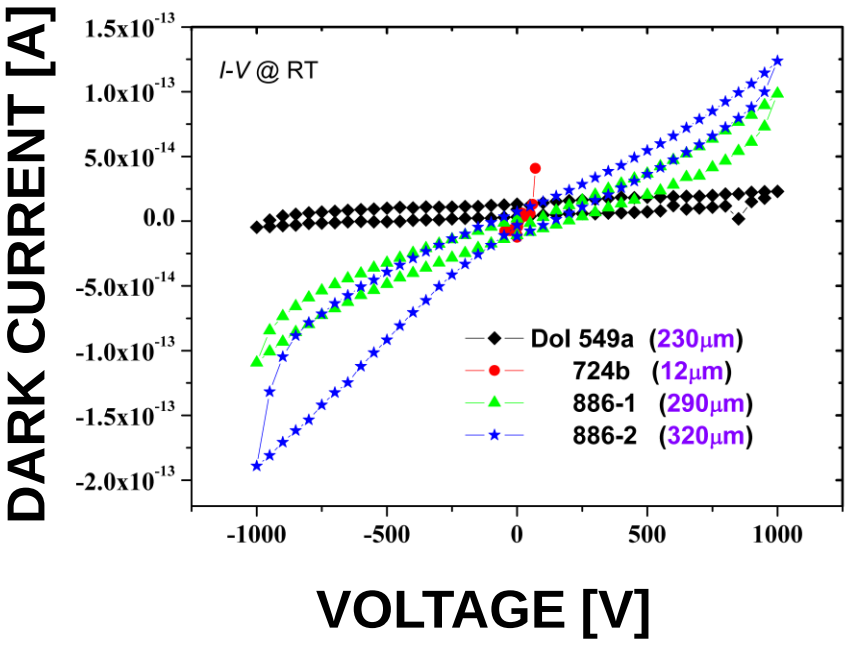




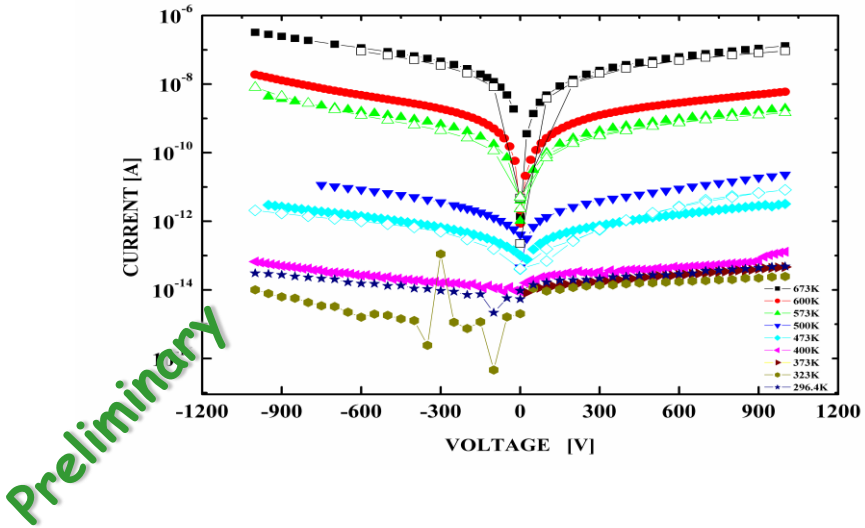


Diamond Detectors

Electrical characteristics



***I-V* characteristics**



Activation Energy

E^{ac}=1.53±0.01 eV

$$\ln(I) = A + \frac{-E^{ac}}{k_b}.\frac{1}{T}$$

Dominant conduction Schottky emission ?

Φ_{SB}=1.72±0.02 eV

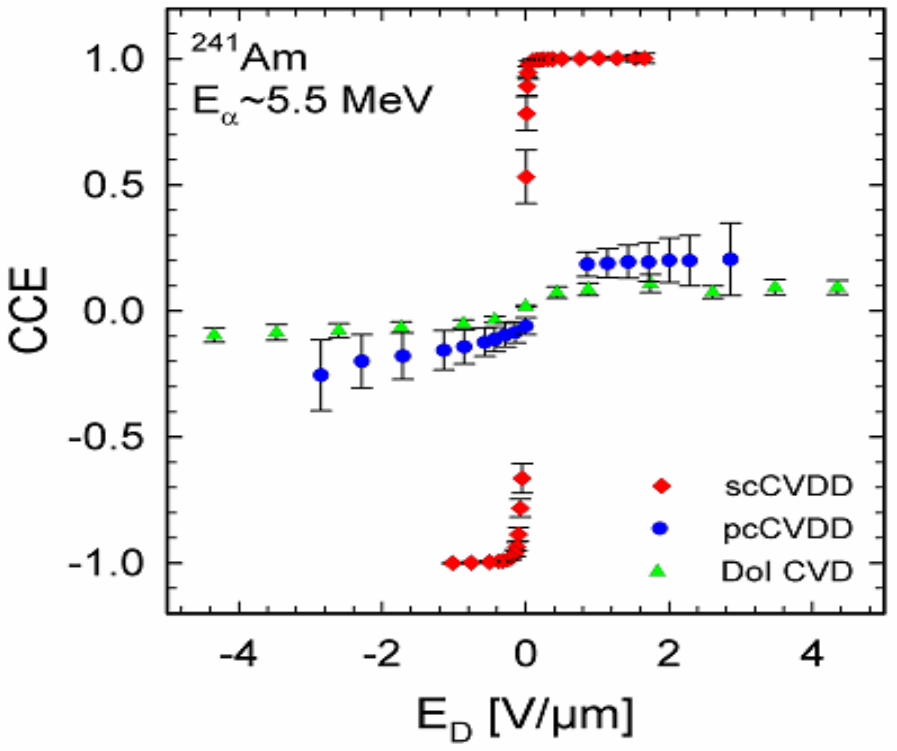
$$\ln\left(I/T^2\right) = \ln(A^*) - \left(\frac{q\phi_b}{k_b}\right).\frac{1}{T}$$

***I-V* characteristics at High Temp.**

Electronic properties

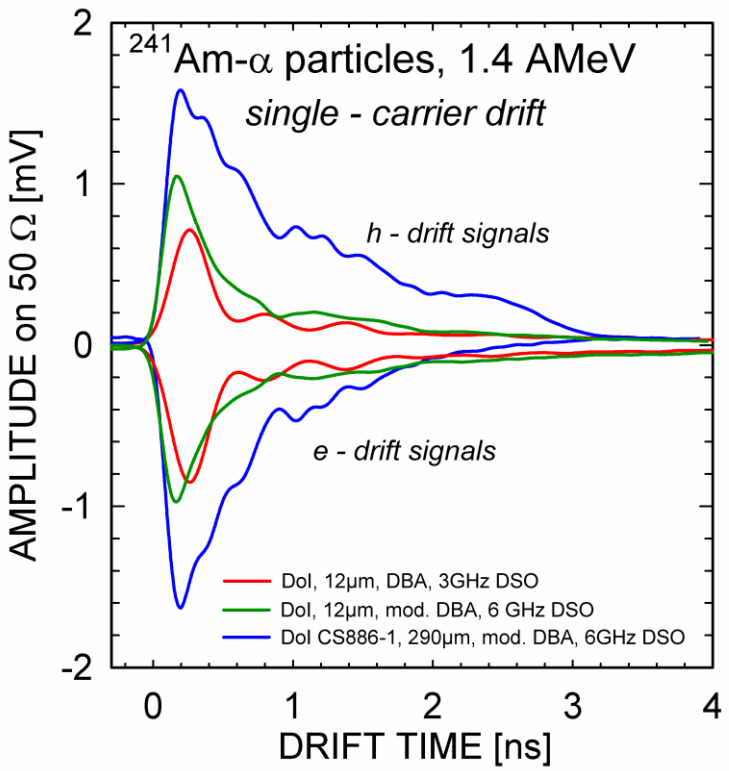
DBA II: 2.2GHz, 50 Ω

$$CCE = Q_{collected}/Q_{generated}$$



Charge Collection Efficiency (*CCE*)

modified DBA II: 3.4GHz, 50 Ω



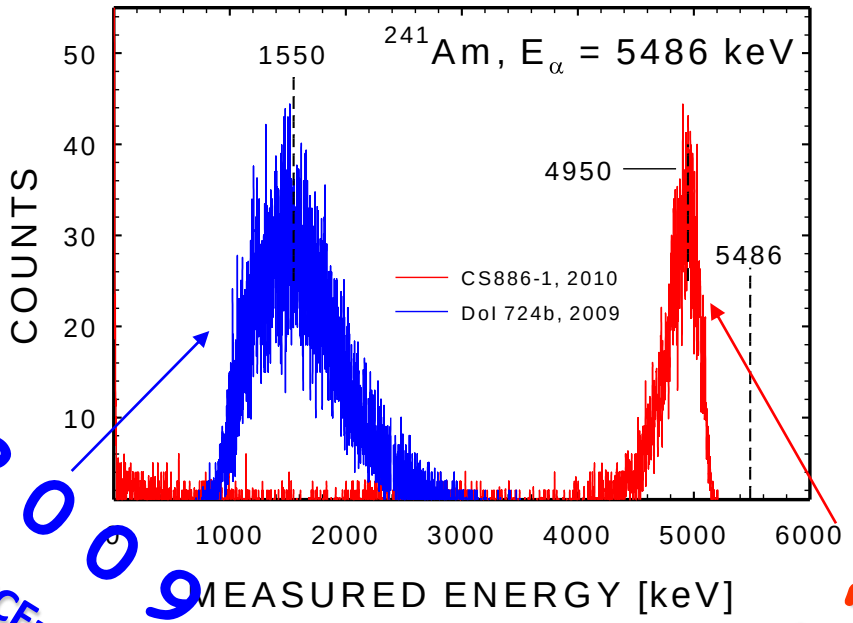
Different Broadband Signal (BB) of DoI Diamond Detectors

Energy & Time Resolution

CSTA

$\delta E/E_{(FWHM)}$=18%

$\delta E/E_{(FWHM)}$= 4.7%



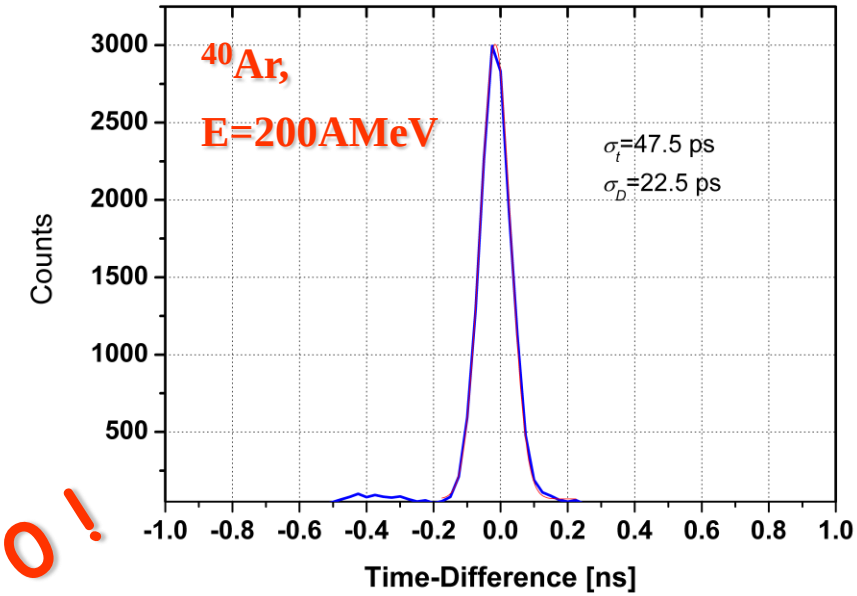
2009

CCE=28%

2010!

CCE=91%

ToF measurement for 290μm/320μm DoI



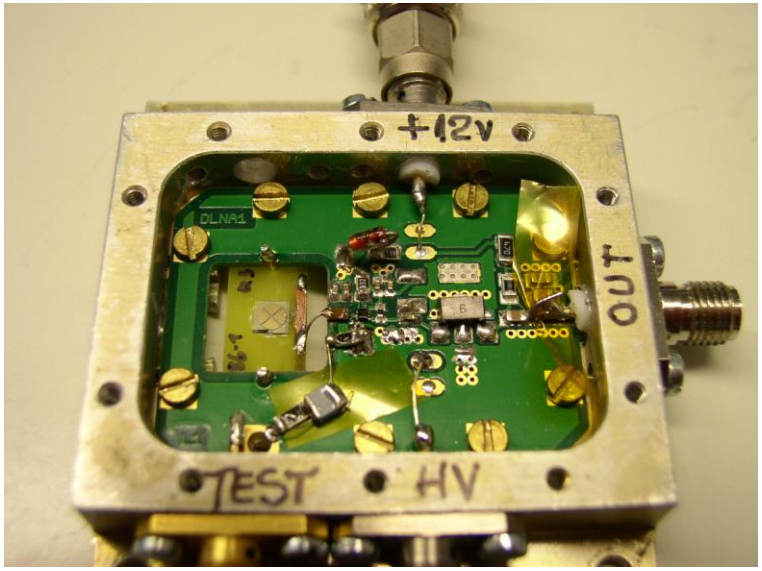
Energy Resolution

Time Resolution

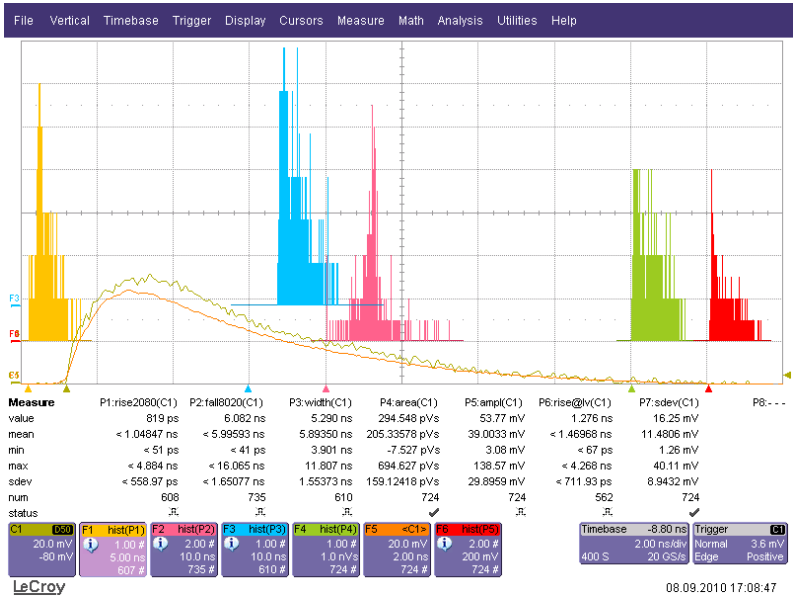
Technical progress in FEE

New Low Noise Front-End Electronics (FEE) for ultra-fast Detectors

by M. Ciobanu, DL-GSI



Diamond Low Noise Amplifier (DLNA)



first α-measurements (BB) with DLNA

Milestones/Deliverables

MILESTONES	Delivery date	Remarks
(M1) Single channel discrete amplifier for diamond detector (prototype)	*m15* *Sept. 2010*	*√* *designer:* M. Ciobanu, DL (GSI)

DELIVERABLES	Delivery date	Remarks
(D1) Multi-channel high-speed FEE	*m31*	*in-progress*
(D3) Test beam results of a multi-channel Diamond Detectors system	*m43*	*in-progress*

Training

☺ Language:

- ☺ German language course

✵ Diamond Detectors:

- ✵ 1st CARAT Workshop at GSI, Germany, December 2009
- ✵ Hasselt Diamond Workshop 2010 SBDD XV, Belgium, February 2010
- ✵ Diamond 2010 Conference, (Budapest, Hungary), September 2010

❀ MC-PAD Training events:

- ❀ 1st Network Training on *Readout Electronics* (Krakow, Poland), *Sept. 2009*
- ❀ General training on *Presentation Techniques* (CERN), *Nov. 2009*
- ❀ 2nd Network Training on "*Geant4 and ROOT Data Analysis*" (Hamburg, Germany), *Jan. 2010*
- ❀ Marie Curie Conference, *ESOF 2010*, (Turin, Italy), *Jun. 2010*

Programming:

- CAMDA readout
- LabVIEW *Basic I*
- SRIM

Publications and Presentations

❑ Publications:

- ✦ E. Berdermann, M. Ciobanu, M. Henske, M. Kiš, W. Koenig, **M. S. Rahman,** and M. Traeger,"*Time resolution of Diamond Detectors for Relativistic Ions and Protons*" **GSI Ann.Rep. p.287 (2009).**
- ✦ E. Berdermann, M. Ciobanu, S. Dunst, **M. S. Rahman,** M. Schreck, and M. Traeger, "*First results of CVD-diamond detectors grown on large Iridium substrates*" **GSI Ann.Rep., p.295 (2009).**
- ✦ E. Berdermann, M. Pomorski, W. de Boer, M. Ciobanu, S. Dunst, C. Grah, M. Kiš, W. Koenig, W. Lange, W. Lohmann, R. Lovrinčić, P. Moritz, J. Morse, S. Mueller, A. Pucci, M. Schreck, **M.S. Rahman**, and M. Traeger,"*Diamond detectors for hadron physics research*" **Dia. Rel. Mat. 19, p.358 (2010).**
- ✦ E. Berdermann, W. de Boer, M. Ciobanu, S. Dunst, M. Kiš, W. Koenig, P. Moritz, J. Morse, S. Mueller, C. Nociforo, M. Pomorski, M. Schreck, **M.S.Rahman,** M. Traeger, H. Weick,"*CVD-Diamond Detectors – R&D Status and New Results*", ***PoS(BORMIO2010) 040.***

❑ Presentations:

-Conferences

- ✦ **22-24Feb. 2010:** Hasselt Diamond Workshop 2010 SBDD XV, Belgium, **poster** *"Electrical conduction in heteroepitaxial CVD Diamond on Ir/YSZ/Si(001)"*

-Group meetings

- ✦ Detector Lab seminar, GSI, **talk** *"Diamond Detectors Beam Tests using relativistic 6Li, 2AGeV ions in CAVE A, GSI"*

-MC meetings

- ✦ **1-2 July:** Marie Curie conference-ESOF2010, **poster** *"The role of heteroepitaxial single crystal-CVD diamond detectors for the heavy-ion & hadron physics research"*

Acknowledgements