Detector Development

T. Bergauer
• Task Force started to identify main detector technology challenges to be met (both mandatory and highly desirable to optimize physics returns for the next large planned experiments and the long term, e.g. FCC-hh for >2045

• Main Document published (approval by RECFA in Nov 2021) and 8 page synopsis brochure prepared for less specialists audience
  https://indico.cern.ch/e/ECFADetectorRDRoadmap

• More details in Presentation at VCI conference by S. Kühn: https://indico.cern.ch/event/1044975/contributions/4700292/

They lead to these Detector R&D Themes for solid-state detectors:
• **Ion Imaging** (in collaboration with TU Wien)
  - Detector Construction for MedAustron
    - Mechanical stages, Scintillators and Triggering
    - Construction/operation/upgrades of a Beam telescope
  - Data taking at MedAustron
  - Image Reconstruction
  - Innovative new ion imaging based on Time-of-flight (LGAD/4D detectors)

• **HiBPM: Beam Intensity and Position Monitor**
  - Silicon Carbide Sensor development (high radiation hardness)
  - ASIC/ CMOS readout chip development

• **Depleted Monolithic Active Pixel Sensor (DMAPS) and ASIC chip development based on CMOS technologies**
  - RD50 sensor design & testing
  - Belle-II Upgrade OBELIX
  - AIDAinnova
  - HiBPM readout ASIC
Projects:
- Proton CT at MedAustron
- RD50-DMAPS (HV-CMOS)
- FFG-HiBPM

• Staff:
  – Thomas Bergauer
  – Albert Hirtl (*pCT*, TU Wien)
  – several engineers and technicians from electronics and mechanics groups: Irmler, Steininger, Thalmeier, Schultschik, Bauer, Brandner, Fischer, Yin, Buchsteiner, Stark,…

• Postdocs:
  – Florian Pitters (*pCT*, LGAD, HGCal@CMS) until June 2021
  – Simon Waid (*HiBPM*, FFG-funded) since September 2021

• PhD Students:
  – Felix Ulrich-Pur (*pCT*, FFG-funded)
  – Stefanie Kaser (*pCT*, FFG-funded)
  – Patrick Sieberer (*DMAPS*, FFG-funded)
  – Philipp Gaggl (*HiBPM*, FFG-funded) started September 2021
  – Maximilian Babeluk (*DMAPS*, FFG-funded) started September 2021
  – Andreas Gsponer (*HiBPM*, FFG-funded) starting April 2022

• Master Students: 9 (within last 3 years)
• Bachelor/Project Students: 16 (within last 3 years)
• **Finished Grants:**
  - EU: EUDET (2005-2010): Detector R&D towards the International Linear Collider
  - EU: AIDA (2011-2014): Advanced infrastructures for detectors at accelerators
  - Houska Prize 2014 [Johannes Grossmann]
  - FFG Project "Entwicklung von Teststrukturen und -systemen zur Überwachung des Herstellungsprozesses von Siliziumdetektoren" (2017-2020) [Viktoria Hinger]
  - FFG Project "Entwicklung von Siliziumsensoren für die Energiemessung in einem Kalorimeter" (2018-2021) [Peter Paulitsch]

• **Running Grants:**
  - FFG Project "Entwicklung eines bildgebenden Verfahrens mittels Protonenstrahlen" (2018-2021)
  - FFG Project "Ion Imaging: Bildgebung mit hochenergetischen Protonenstrahlen für eine verbesserte Krebsbehandlung" (2019-2022) [Stefanie Kaser]
  - FFG Project "DMAPS: Entwicklung eines ultraschnellen monolithischen CMOS Pixeldetektors für ionisierende Strahlung" (2020-2023) [Patrick Sieberrer]
  - FFG Project "HiBPM: Hi-Precision Beam Position and Intensity Monitor for Accurate Cancer Treatment with Ions : 1 Postdoc + 2 PhD [Simon Waid, Philipp Gaggl, Andreas Gsponer]
  - AIDAinnova: Second AIDA follup up, now with focus on DMAPS ((1.4.21-31.3.25) [Maximilian Babeluk]

• **Some Submitted / Planned projects in the pipeline**
• **Ion Imaging:** Stefanie Kaser

• **Silicon Carbide as new detector material for beam intensity and position monitoring:** Philipp Gaggl

• **ASIC chip development based on CMOS technologies:** Simon Waid

• **RD50-MPW3 as example of a “Depleted Monolithic Active Pixel Sensors” (DMAPS):** Patrick Sieberer