FP7 2 NMI3

Business Meeting

Work Package 21

Detectors

Nigel Rhodes STFC ISIS

FRM II 29 November 2013

WP 21 Detectors

Aim: Development of Large Area Neutron Detectors for Neutron Scattering Application without using ^{3}Helium

Two technologies selected for development

Task 21.1
Development of scintillation detectors

Julich ISIS CNR

Task 21.2
Development of gas detectors based on solid 10B converter

TUM HZB BNC CEA

Observers ILL and ESS

WP 21 Detectors

Structure of Task 21.1

Task 21.1 Development of scintillation detectors

Mainly concerned with ZnS/^{6}LiF scintillation detectors + WLS fibre readout

Divided into 5 sub tasks

- **21.1.1 Detector Hardware development**
- **21.1.2 Electronics hardware development**
- **21.1.3 Signal processing development**
- **21.1.4 Evaluation of SiPM potential**
- **21.1.5 Evaluation of final detectors and report**

JÜLICH FORSCHUNGSZENTRUM

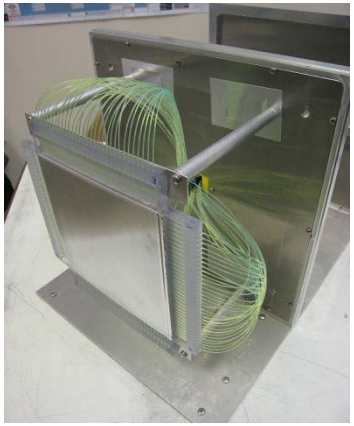
Science & Technology Facilities Council ISIS

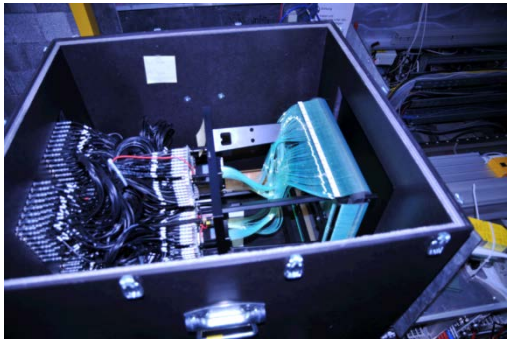
Consiglio Nazionale delle Ricerche

WP 21 Detectors

Task 21.1: Development of scintillation detectors

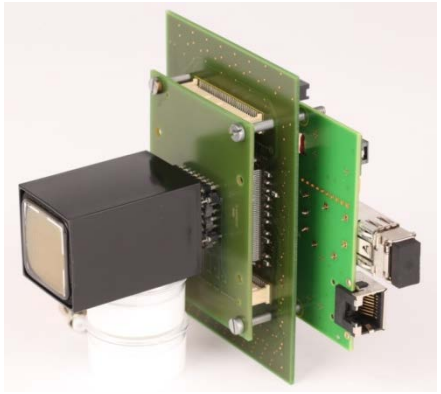
21.1.1 Detector Hardware development





D 21.1,2,3 Month 24

21.1.2 Electronics hardware development



D 21.4 Month 24

D 21.5,6 Month 36

21.1.3 Signal processing development

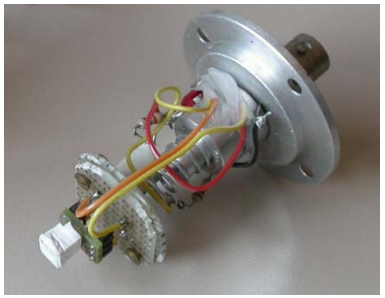
D 21.7 Month 36

Signal processing algorithms which determine how well the detectors will perform

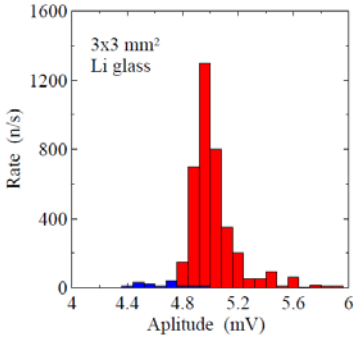
WP 21 Detectors

Task 21.1: Development of scintillation detectors

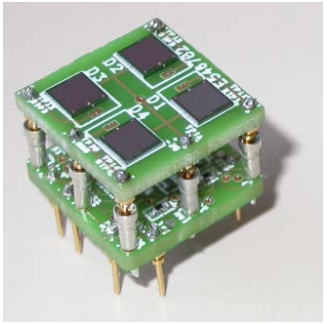
21.1.4 Evaluation of SiPM potential



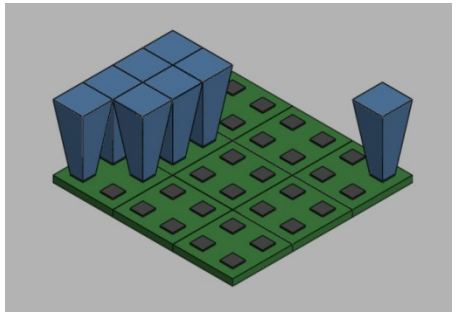
Prototype detector



Experimental Results



Stackable Electronics



Stackable Detector Concept

D 21.8 Interim report due Month 24

21.1.5 Evaluation of final detectors and report

D 21.9 Due Month 48

WP 21 Detectors

Structure of Task 21.2

Task 21.2 Development of gas detectors based on solid 10B converter

Divided into 4 sub tasks

- **21.2.1 Optimisation of substrate and ^{10}B production parameters**
- **21.2.2 Exploration of alternative production techniques**
- **21.2.3 Measurements with a test detector**
- **21.2.4 Concept study for a large area detector**
  - **a) Based on macro grooved structures with wire readout**
  - **b) Based on layered structure with micromegas readout**

HZB Helmholtz Zentrum Berlin

FRM II Forschungs-Neutronenquelle Heinz Maier-Leibnitz Technische Universität München

BNC Budapest Neutron Center

Orphée Laboratoire Léon Brillouin

ILL Neutrons for Science

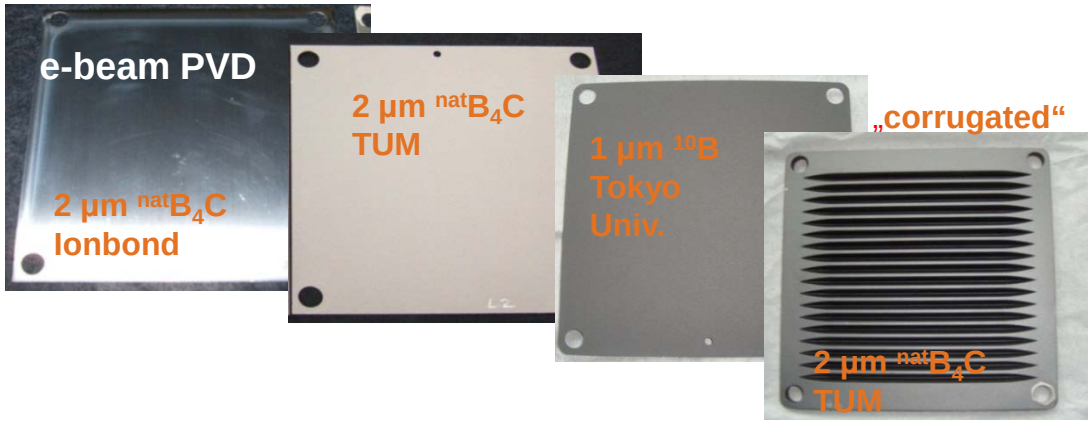
ESS European Spallation Source

WP 21 Detectors

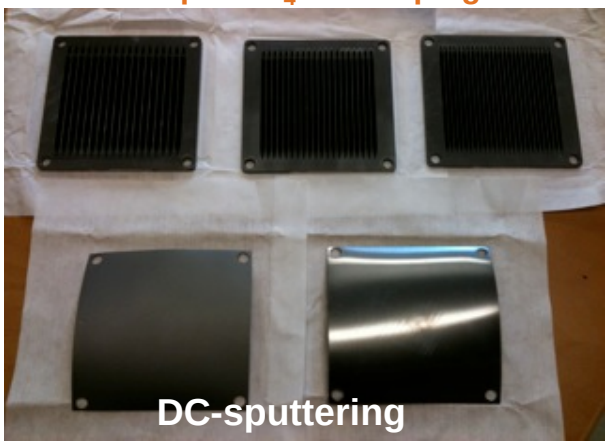
Task 21.2: Development of gas detectors based on solid ^{10}B

21.2.1 Optimisation of substrate and ^{10}B production parameters

- Linköping solved many production issues before JRA began
- Lead role switched from HZB to TUM
- TUM measured neutron performance of variety of films
- Little difference between manufacturer or technique
- Linköping able to supply high quality research quantities



2.5 µm $^{10}B_4C$ Linköping

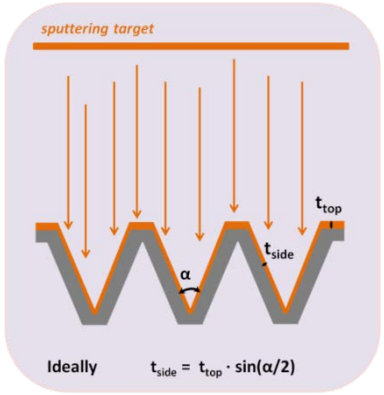


WP 21 Detectors

Task 21.2: Development of gas detectors based on solid ^{10}B

21.2.1 Optimisation of substrate and ^{10}B production parameters

TUM Developed Macro structured converter



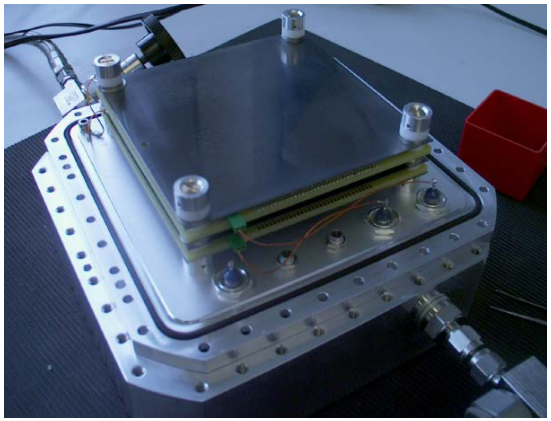
Gives 40% increase in efficiency cf flat layer

Almost complete – aging study underway

D 21.10 Report due Month 36

D 21.13 Report due Month 36

21.2.3 Measurements with a test detector



Measurements carried out with

Small test detector designed and built for JRA

D 21.12 Month 12 Complete

WP 21 Detectors

Task 21.2: Development of gas detectors based on solid ^{10}B

21.2.2 Exploration of alternative production techniques

HZB Leading this task

D 21.11 Month 36 Report

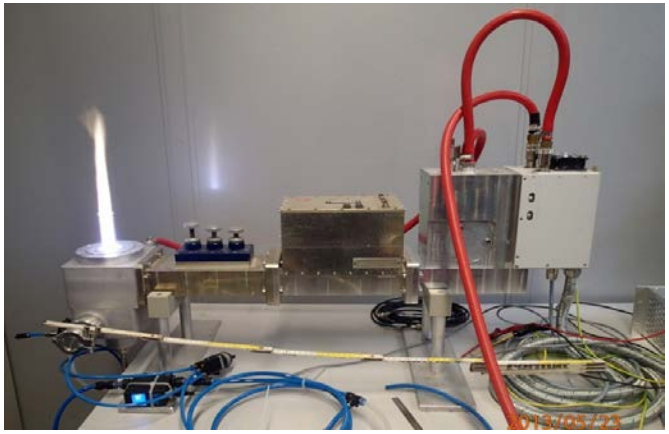
Explored a variety of alternative techniques

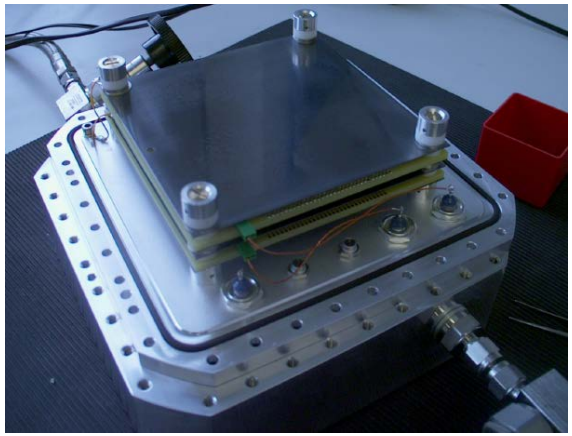
Thermal plasma powder spray deposition selected

Required parameters for deposition calculated

Equipment now delivered

New 2D PSD to be produced in collaboration with BNC for layer evaluation



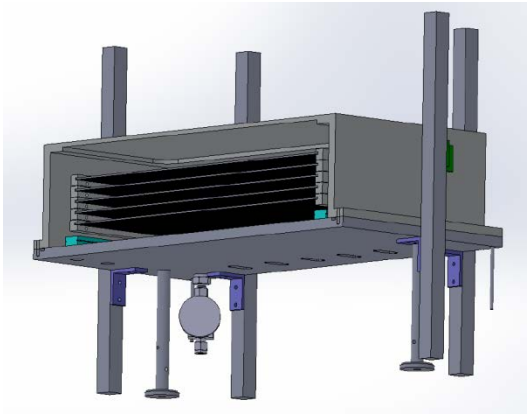


WP 21 Detectors

Task 21.2: Development of gas detectors based on solid ^{10}B

21.2.4 Concept study for a large area detector

a) Based on macro grooved structures with wire readout TUM

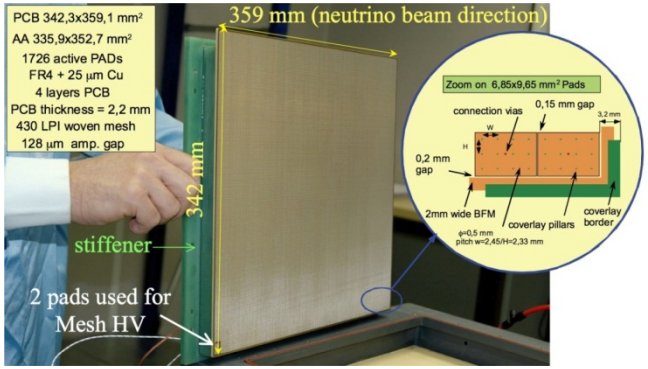


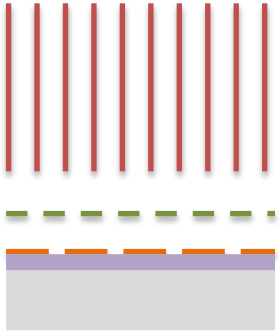
The demonstrator will incorporate a stack of 3 macro structured planes and 2 wire planes

Change from extruded tube concept

Components in production

b) Based on layered structure with micromegas readout LLB





Recruitment difficulty

Post doc now started Oct 2103

D 21.14 and D 21.15 Month 48

WP 21 Detectors

Task 21.1 Development of scintillation detectors

- **21.1.1 Detector Hardware development**
- **21.1.2 Electronics hardware development**
- **21.1.3 Signal processing development**
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Task 21.2 Development of gas detectors based on solid 10B converter

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Complete **Ongoing** **Not yet started**