# Prototype Block Detector for low energy neutron measurement

Lab Meeting
2013/08/09
Friday
Benard Mulilo

# Plan Outline

Assembly of the prototype block detector:

- ✓ *July, 2013. ("3 Bicron scintillators" module assembly using old light guide)*
- ✓ *July, 2013. ("3 Bicron scintillators" module assembly using new light guide)*

Tests for the prototypes:

- ✓ *Test 1: 2013/07/16 (old light guide)(using radiation source)*
- ✓ *Test 2: 2013/07/26 (New light guide)(using radiation source)*
- ✓ *Test 3: 2013/08/08 (Test at KIRAMS using proton beam)*

# Plan Outline….

Data analysis:

- ✓ Is on-going
- ✓ First test for the prototype done on 2013/07/16, analysis has been done and awaits approval.
- ✓ So is data collected for the second prototype test done on 2013/07/26.
- Data collection for the test at KIRAMS still awaits analysis.

# Prototype block detector assembly

## Using old light guides


*Fig. 1: Detector assembly process*

# Prototype neutron detector assembly…..

Module with 3 Bicron scintillators.

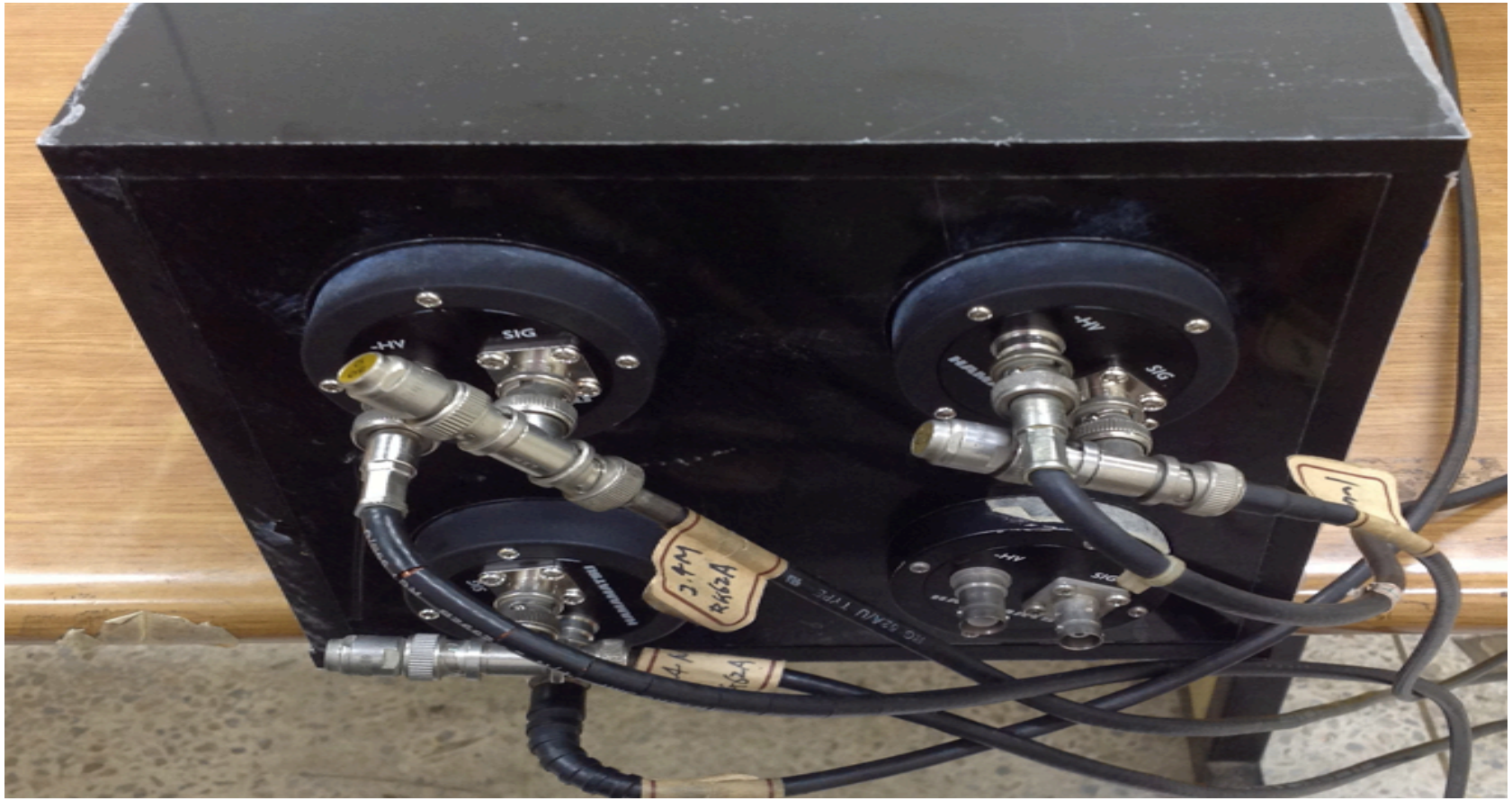



*Fig.2 : Block detector assembly*

# First test of the prototype block detector for low energy neutrons
# [Old light guides]

# Terminal objective

Examine:

- Time of Flight (ToF) distributions and
- Compute the range of energies the prototype is capable of measuring using $^{252}Cf$ radiation source.

# Electronics set-up

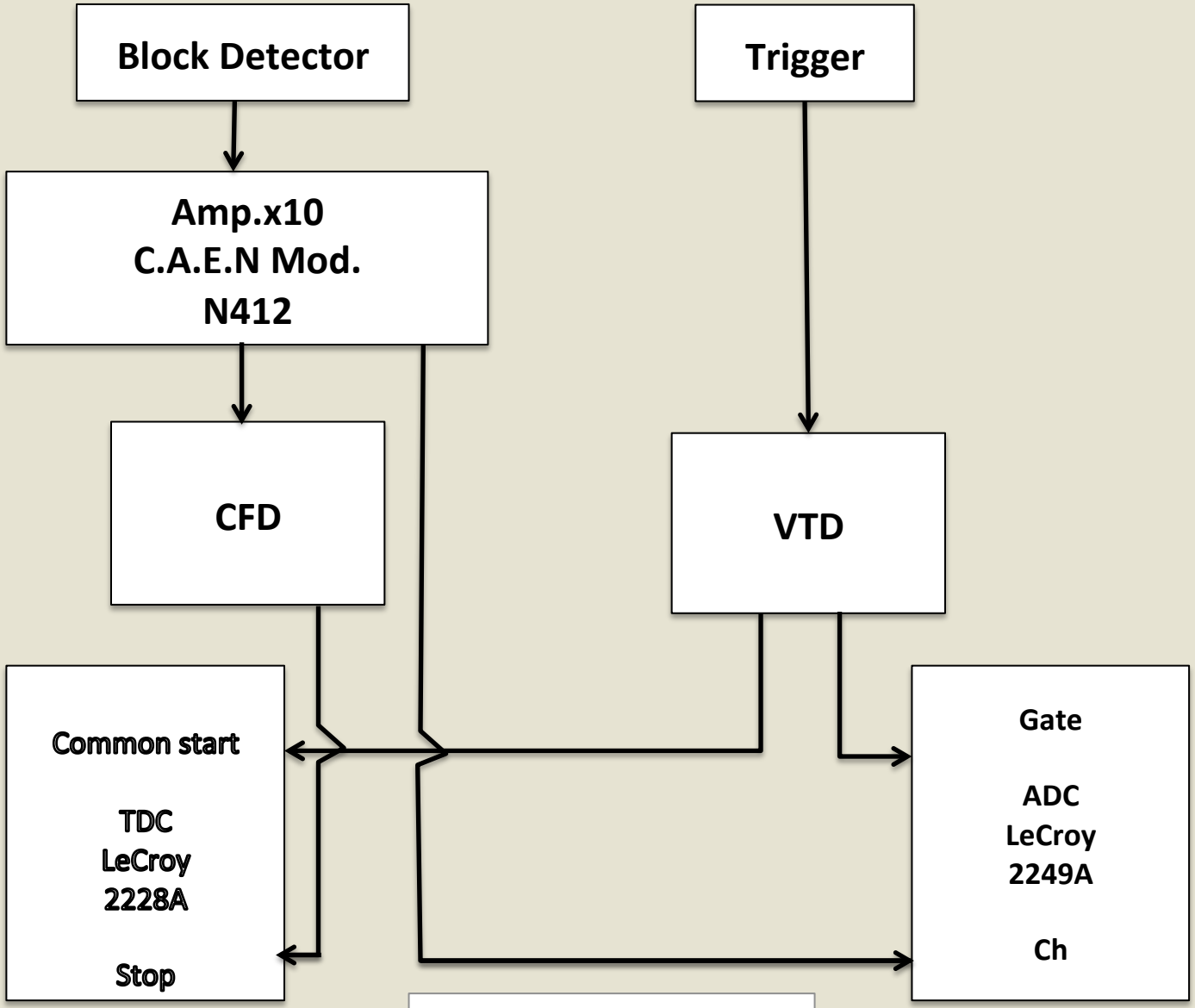



*Fig.3 : Electronics set-up*

# Experimental setup with $^{252}$Cf source

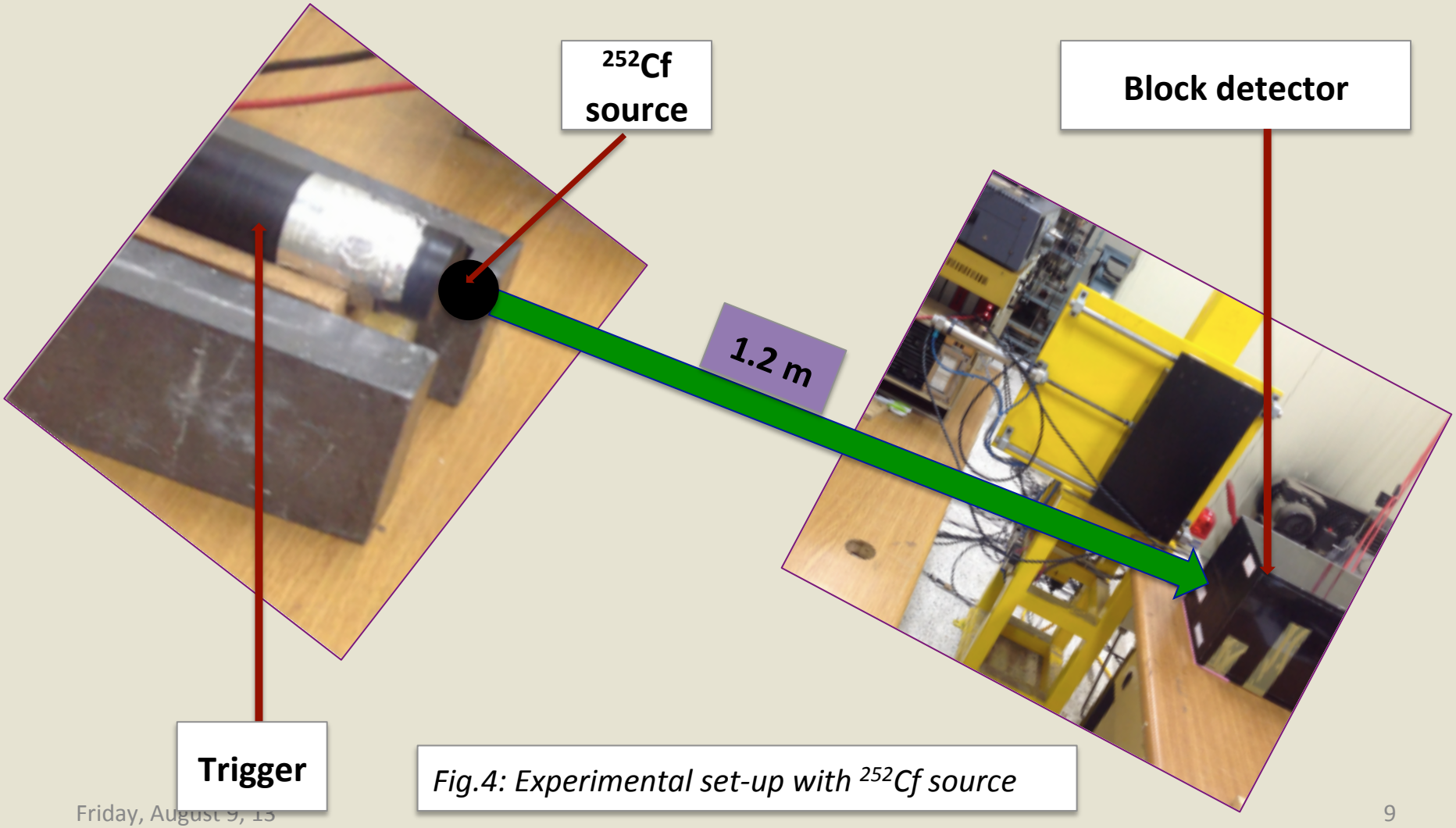
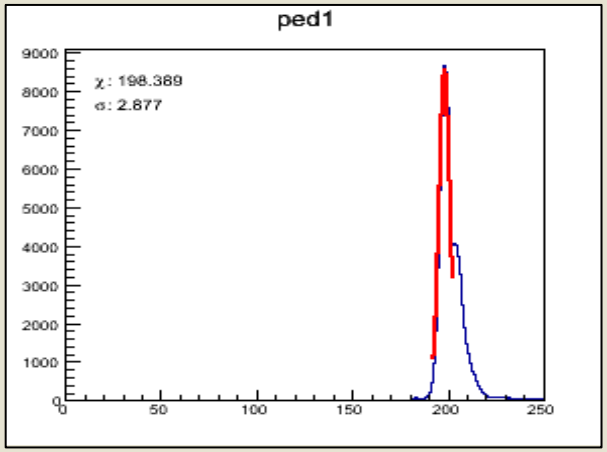
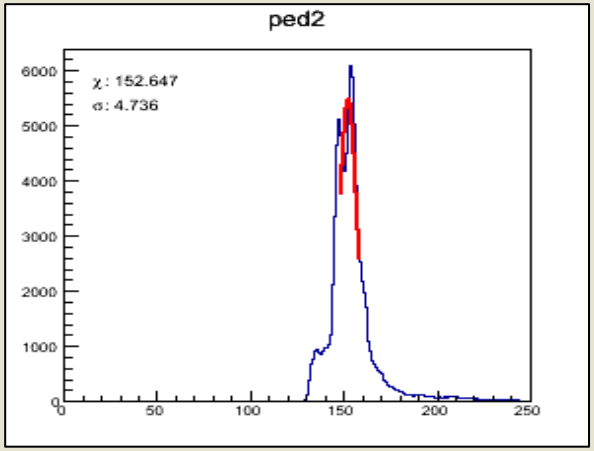



*Fig.4: Experimental set-up with $^{252}$Cf source*

# Test results with $^{252}Cf$ source

CFD pedestal data results



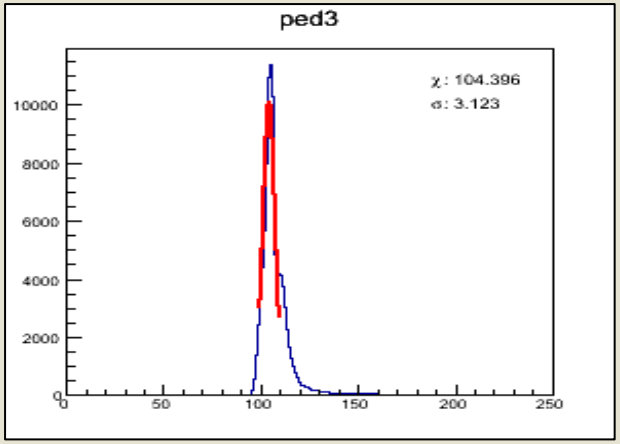




*Fig.5 : Pedestal data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source….

Zero base correction for gammas

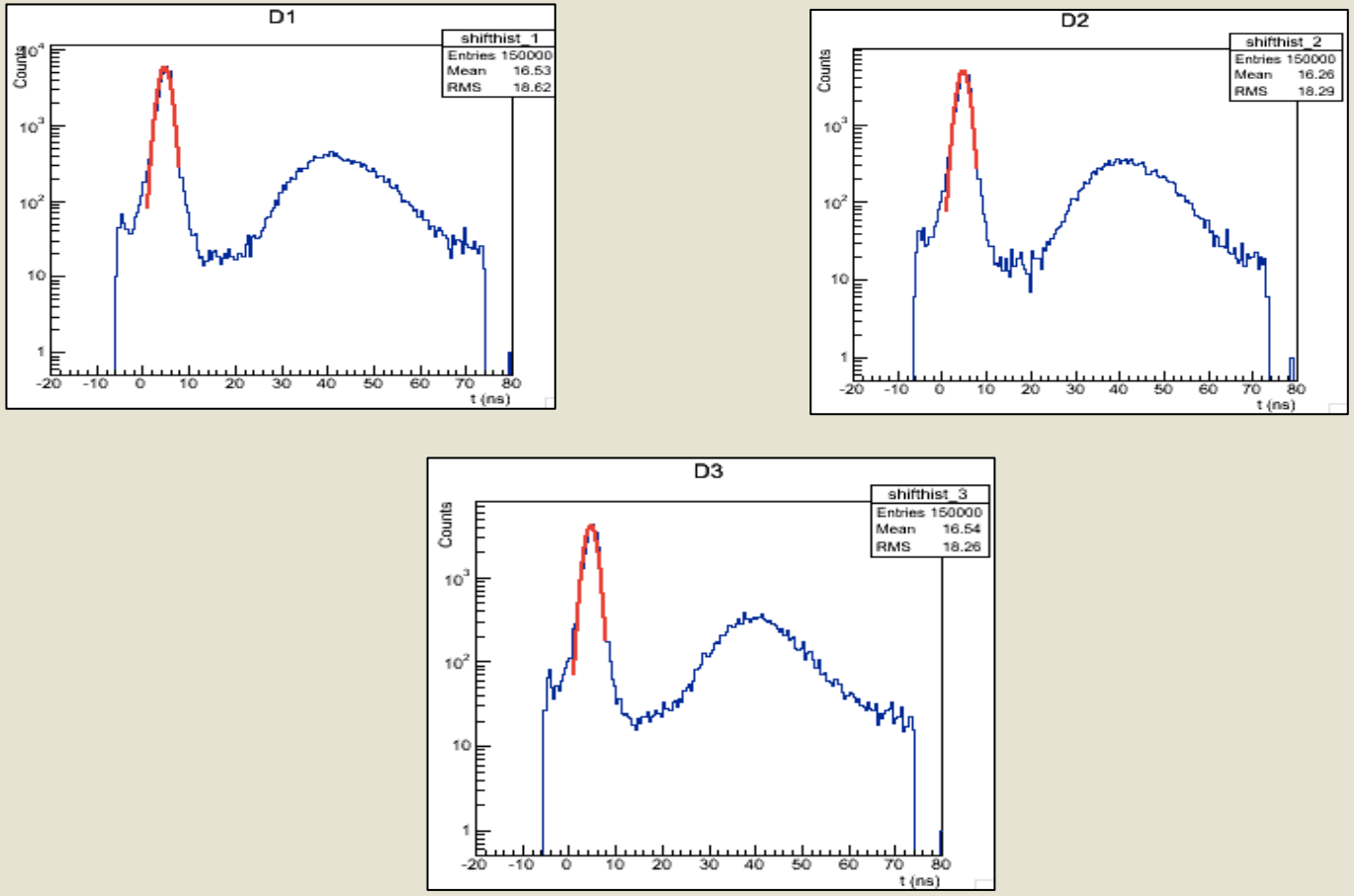
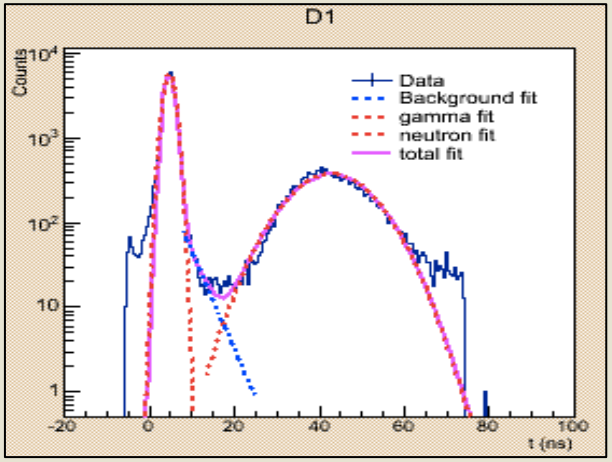
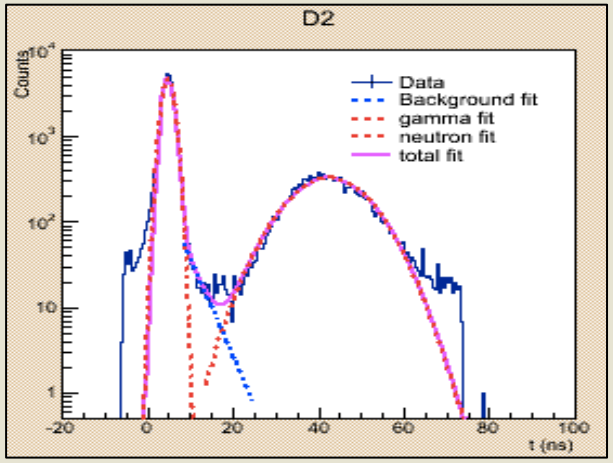



*Fig. 6: Time of flight distribution data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source…

Time of flight distribution fitted data results



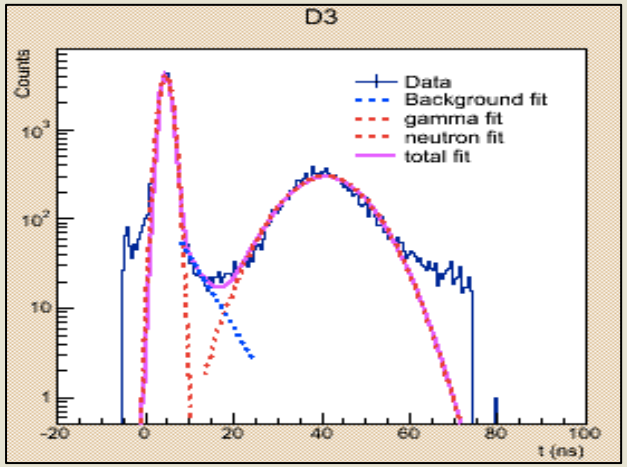
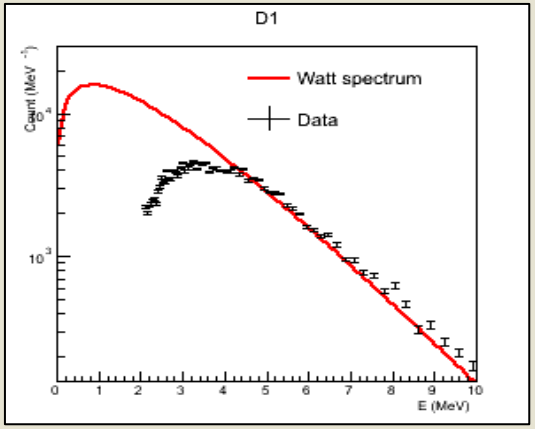
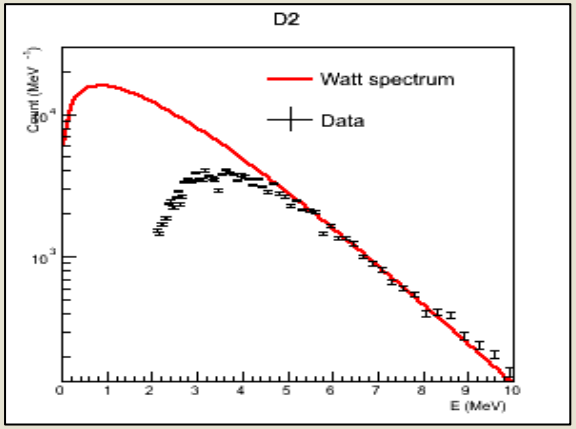



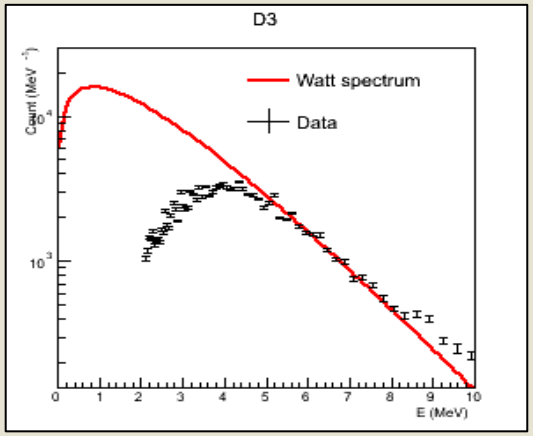

*Fig.7 : Time of flight distribution fitted data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source…..

Neutron energy data results




- Well reconstructed about 3.5 MeV
- Minimum measurable energy was ~ 2 MeV

*Fig.8 : Final neutron energy data results for detectors 1, 2 and 3 respectively.*

# Second test of the prototype block detector for low energy neutrons
# [New light guides]

# Prototype block detector assembly

- With new light guides

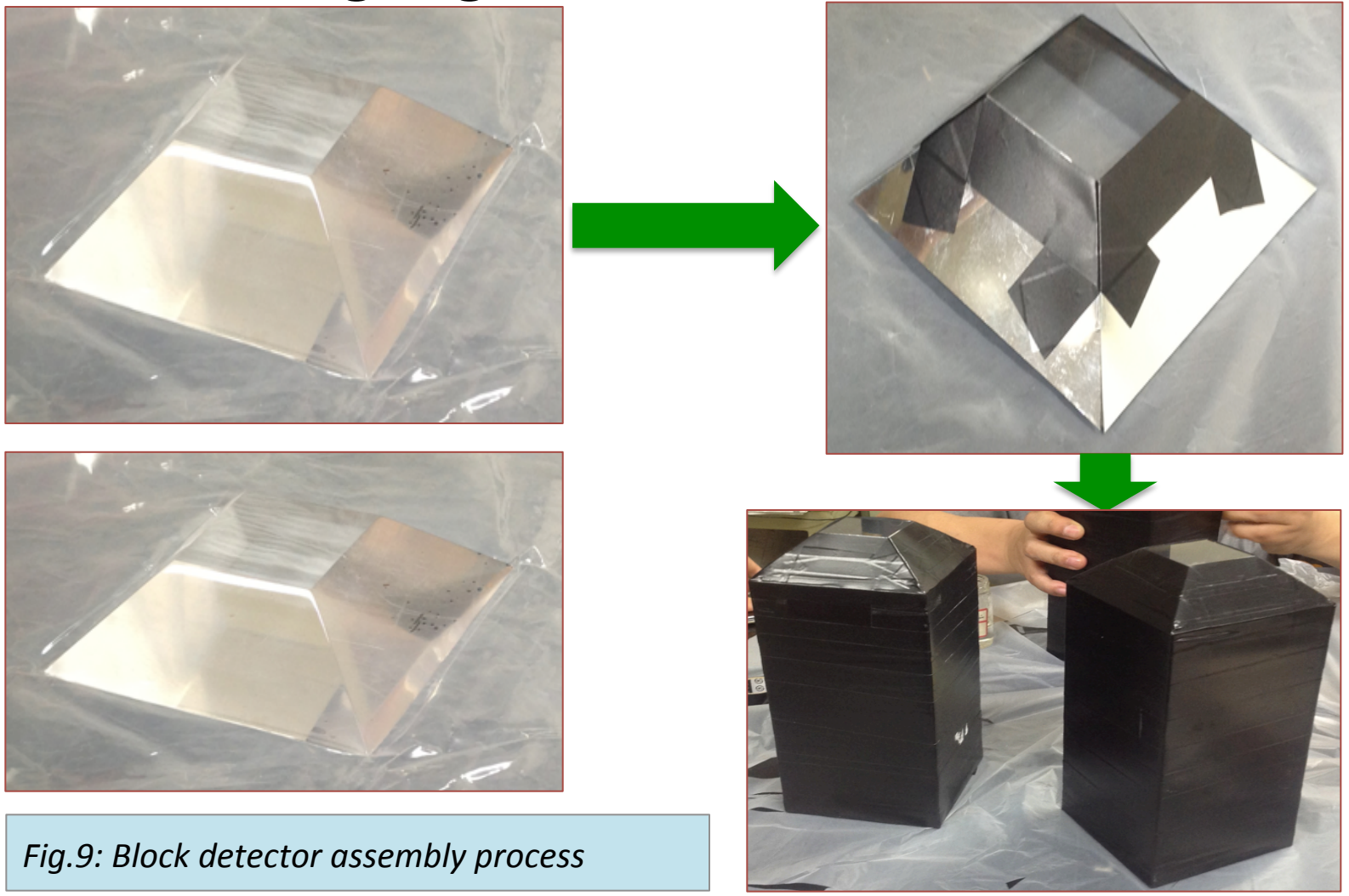
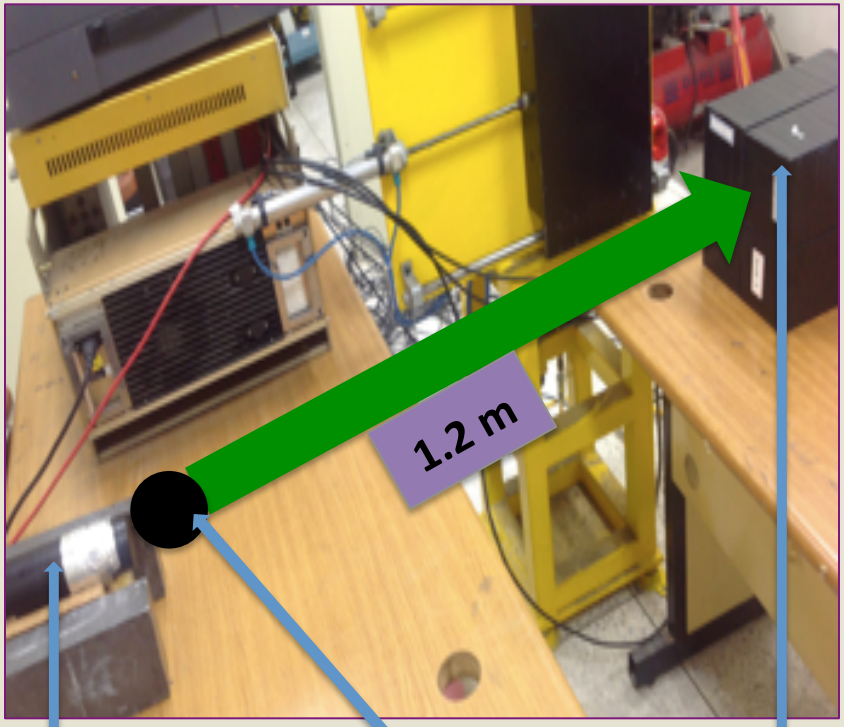


*Fig.9: Block detector assembly process*

# Module with three Bicron scintillators

*Fig. 10: Module with three Bicron scintillators*

# Experimental setup with $^{252}$Cf source



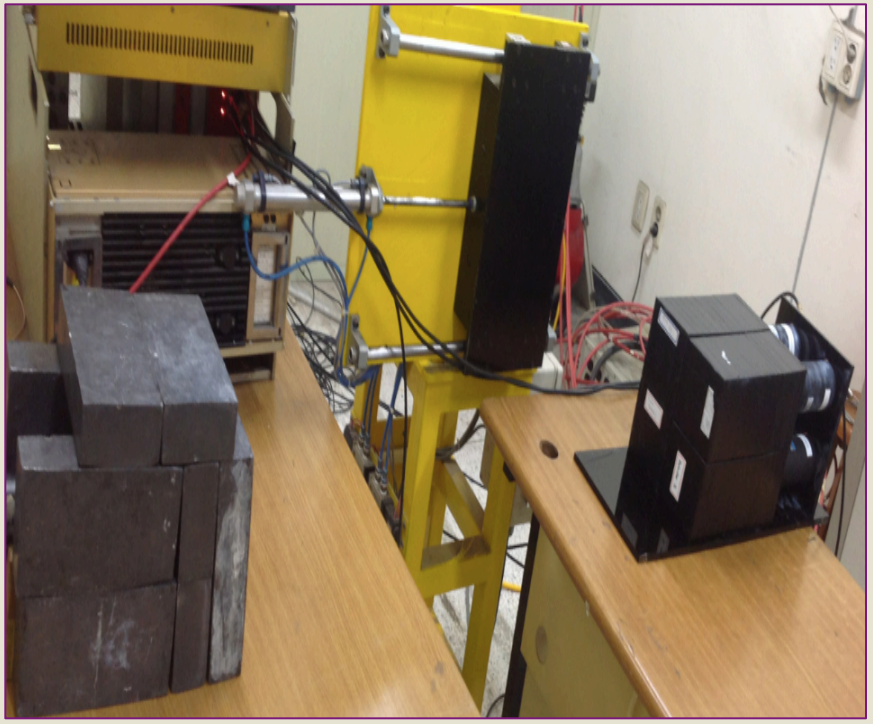
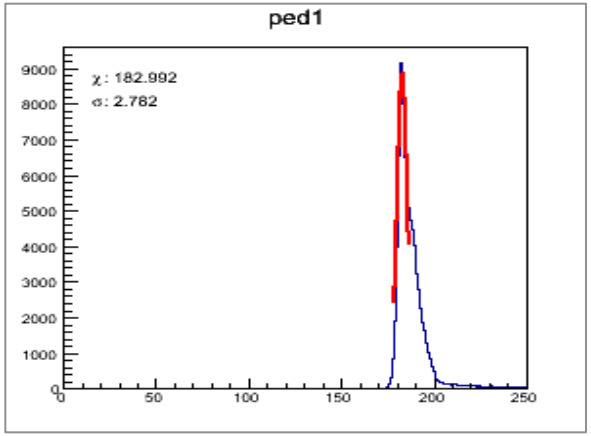
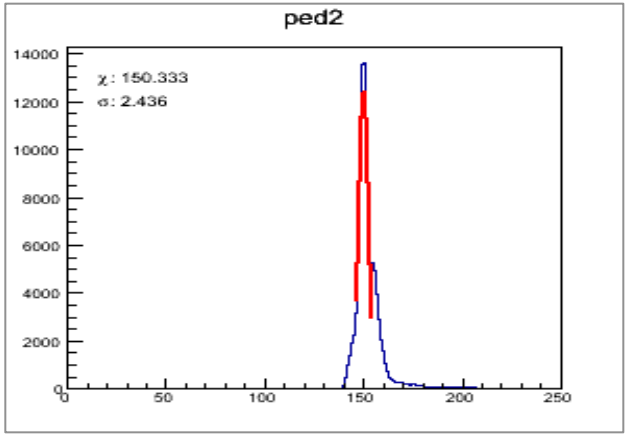



*Fig. 11: Neutron and accidental data collection on the left and right panels respectively*

# Test results with $^{252}$Cf source

- Pedestal results



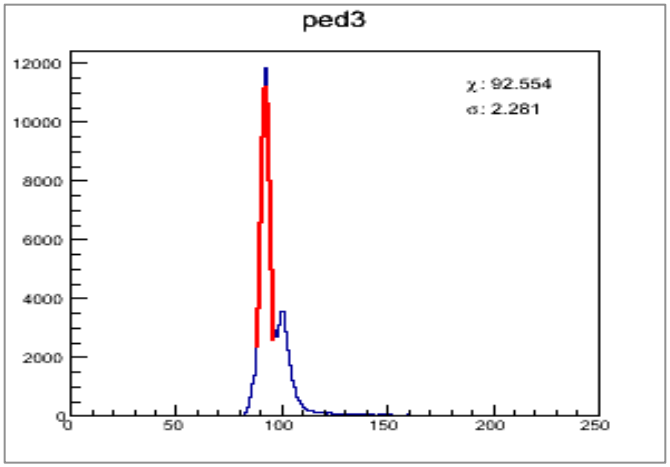




*Fig.12 : Pedestal data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source

- Zero base correction

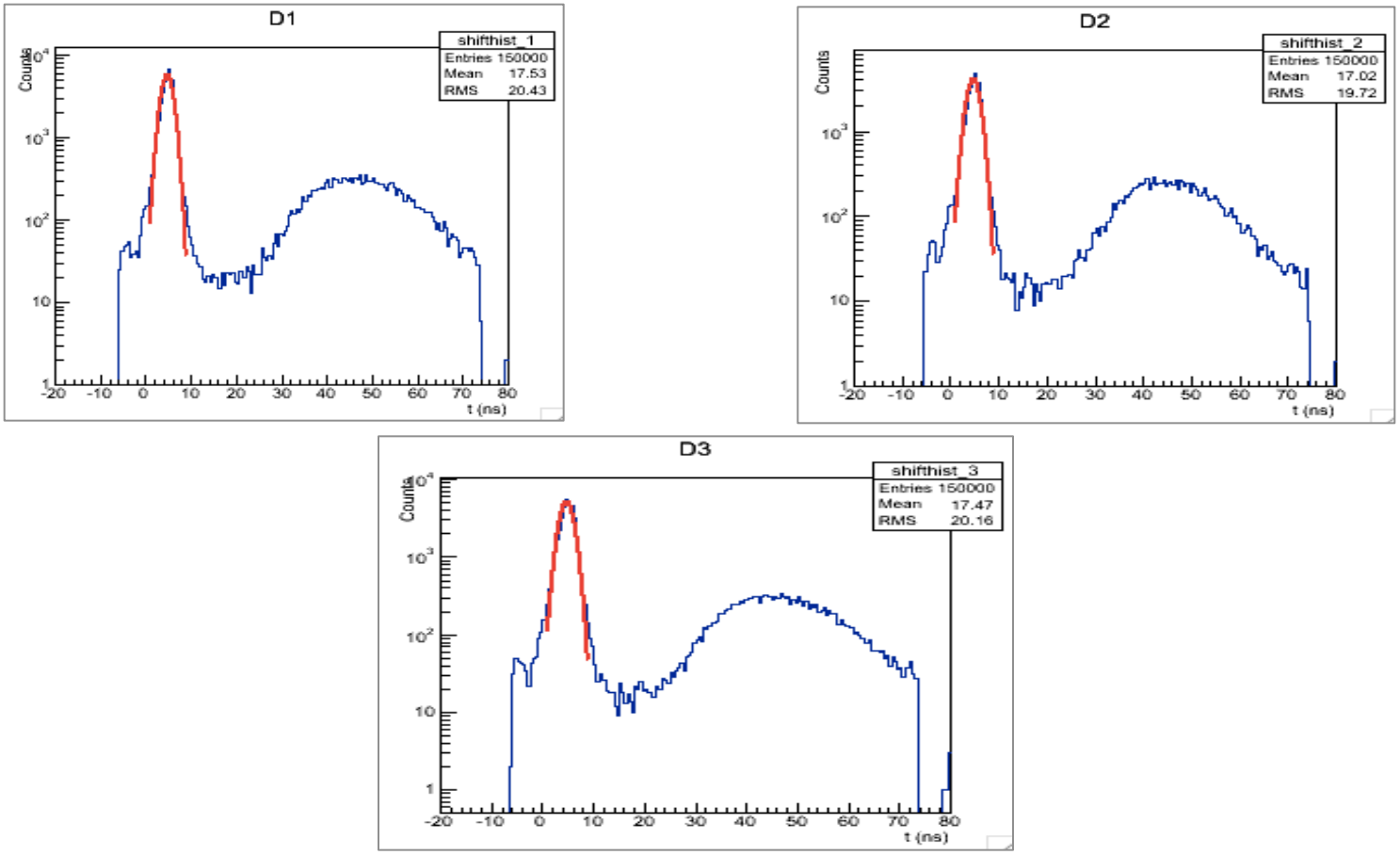
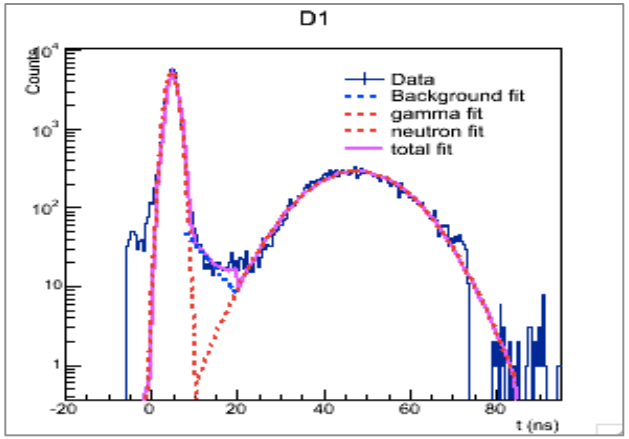
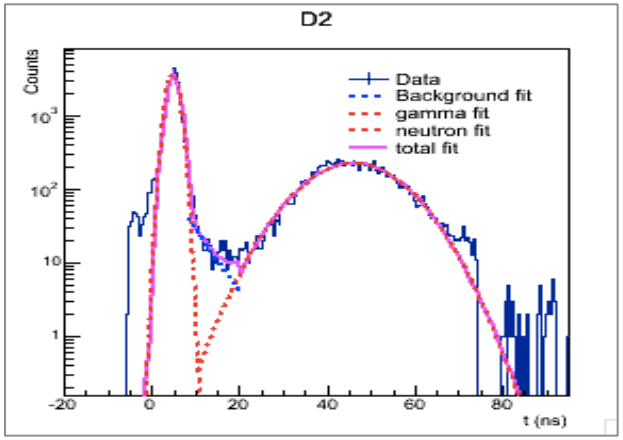



*Fig. 13: Time of flight distribution data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source

- Time of flight distributions



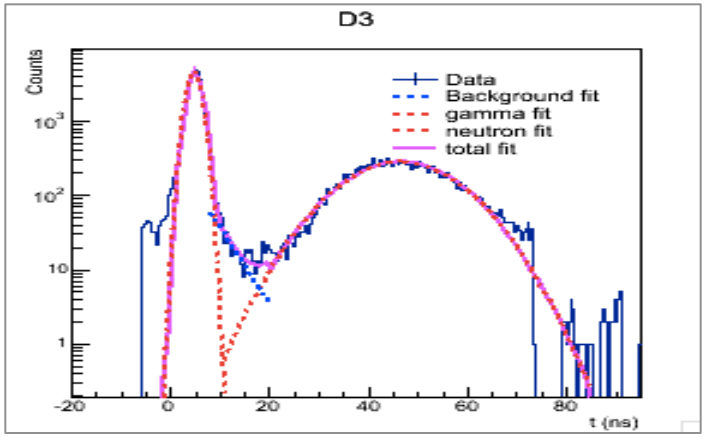
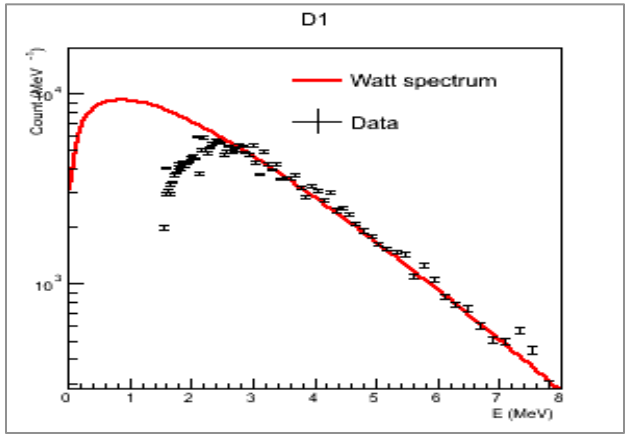
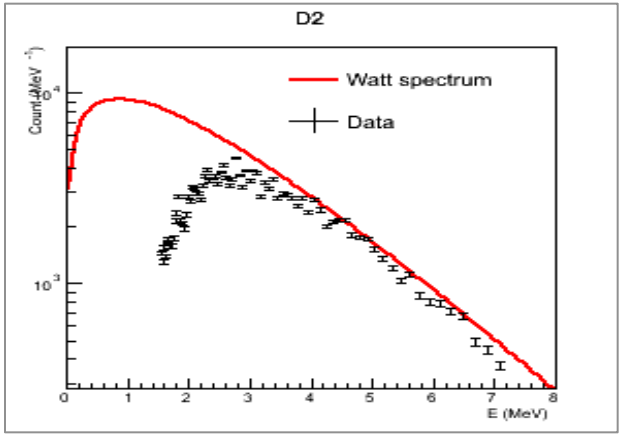



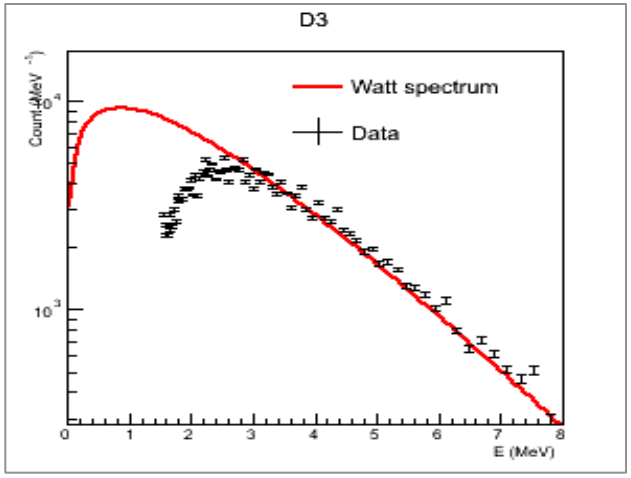

*Fig.14 : Time of flight distribution fitted data results for detectors 1, 2 and 3 respectively.*

# Test results with $^{252}Cf$ source

- Final neutron energy




- Well reconstructed about 2.4 MeV
- Minimum measurable energy being ~ 1.5 MeV

*Fig.15 : Final neutron energy data results for detectors 1, 2 and 3 respectively.*

# Third test of the prototype block detector for low energy neutrons at KIRAMS
# [New light guides]

# Preparations for the test at KIRAMS

*Fig.16 : Flooding of the laboratory during preparations for the test at KIRAMS-2013/08/06; Tuesday-Korea Univ.*

# Test at KIRAMS




*Fig.17: Korea Institute of Radiological & Medical Sciences –KIRAMS (1st & 2nd panels)*

# Future tasks

- Data analysis for the test done at KIRAMS using the proton beam.
- Other tasks yet to be communicated in the next lab meeting.