

2003

Multichannel Analyzer(MCA)
Development of Hand - Held Multichannel Analyzer and Performance
Test

, , ,
, ,

825

1300 - 5

16,000

Multichannel Analyzer(MCA)

MCA

CPU LCD

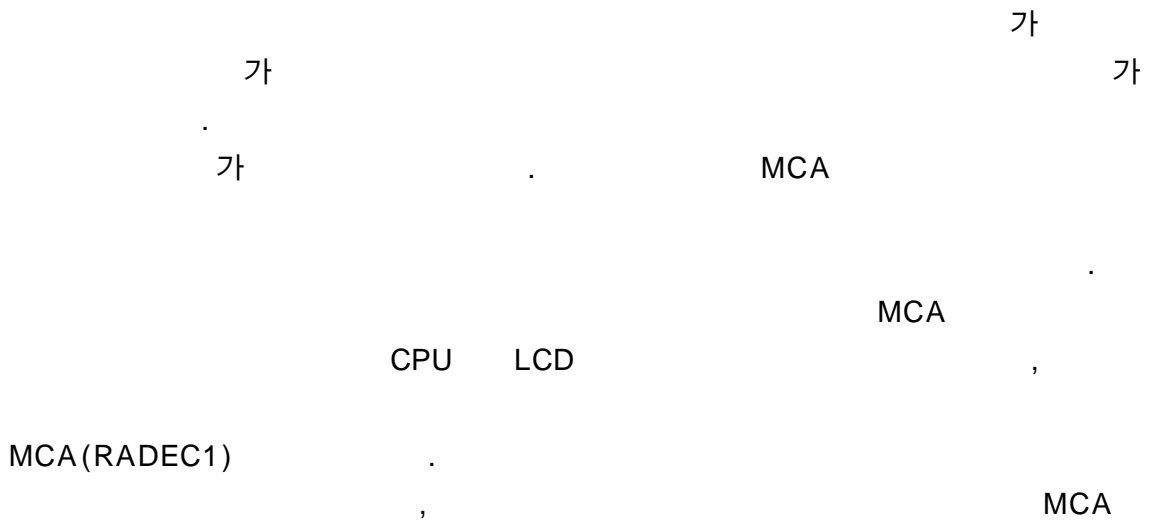
MCA

, ,

Abstract

16,000 Channel Hand - Held type Multichannel Analyzer(MCA) is developed and verified its performance. Developed MCA is designed compact shape and integrated modules applying equivalent function in normal type MCA using in laboratory including LCD display and CPU to handle measuring data, also High Voltage Power Supply and Pre - Amplifier Gain controlled by digital signal. Developed MCA was compared resolution, linearity and dead time with other common MCA. As the result of test, performance of the developed MCA is enough to use at field as portable as well as in laboratories.

1.



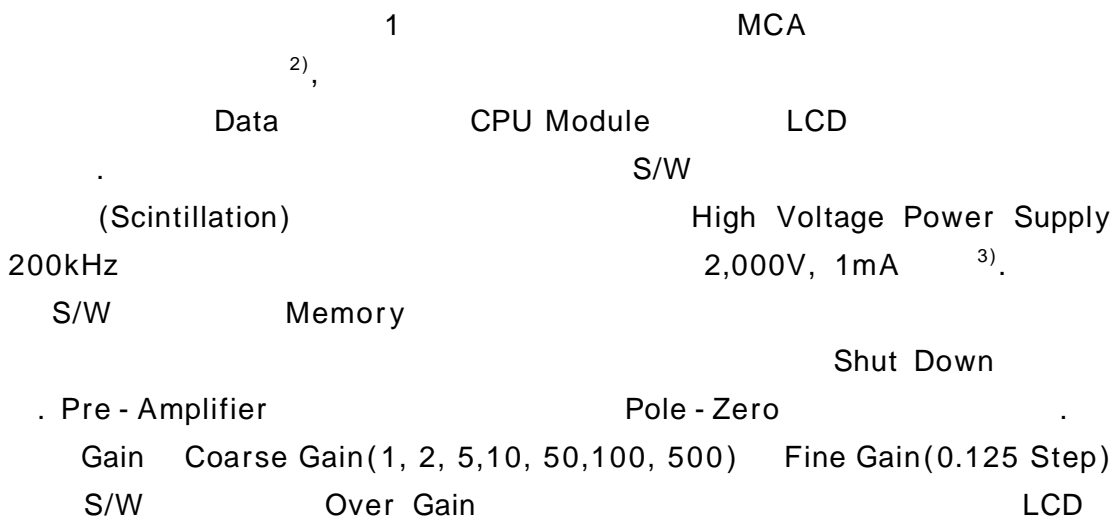
2.

Multichannel Analyzer(MCA)

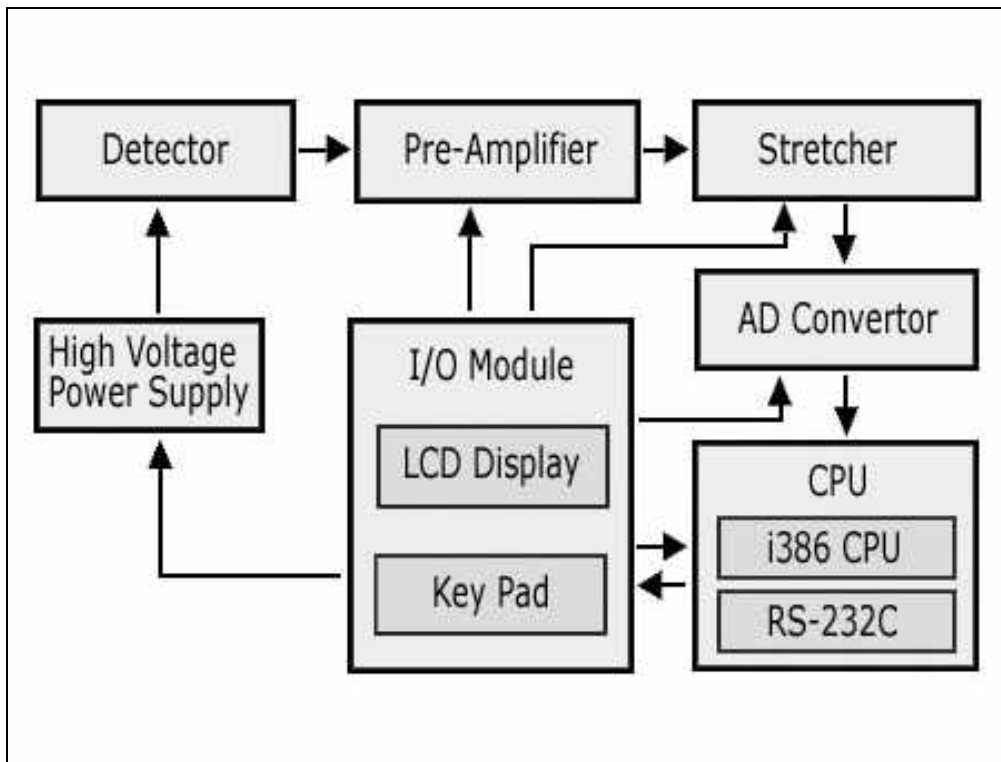
1)

MCA
 16,000 Channel Hand - Held MCA

2.1

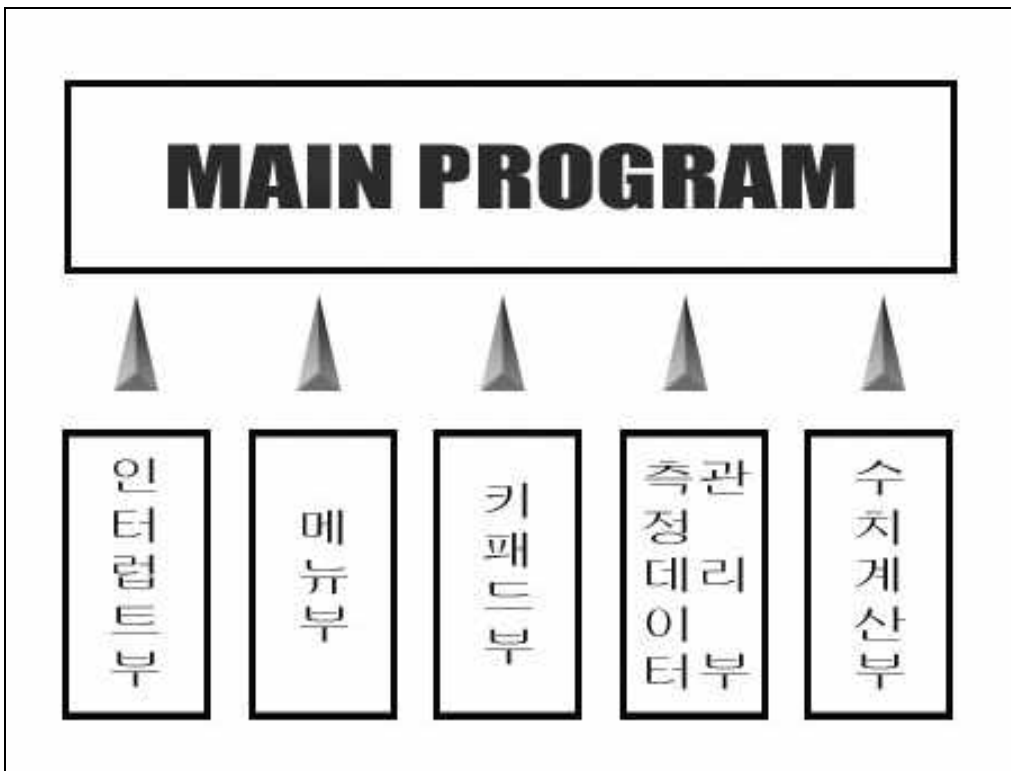
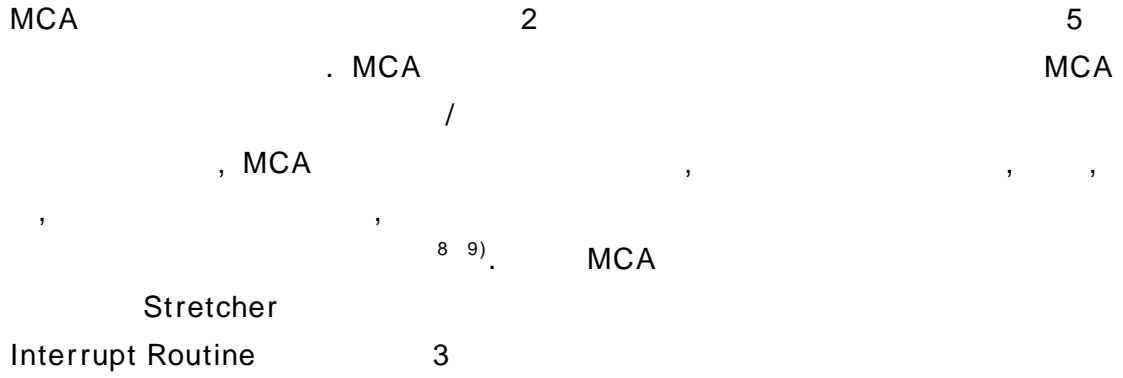


. Stretcher(Pulse Detector) 40Kev 3.2Mev
 Analog to Digital Sample & Hold
 (Start Conversion)
⁴⁾ ADC 16bit 2.5Mbps Pipeline ADC16061
⁵⁾ Data 32bit i386 CPU
 DOS Machine(TB - 386)⁶⁾ . TB - 386 Stretcher
 Interrupt Routine
 Memory Software . ADC 8
 8 Address Memory 1 . TB -
 386 Interrupt Routine 12 μ sec MCA
⁷⁾ Data 240 × 128 LCD
 , Data RS232 PC Data
 가 PC Data .

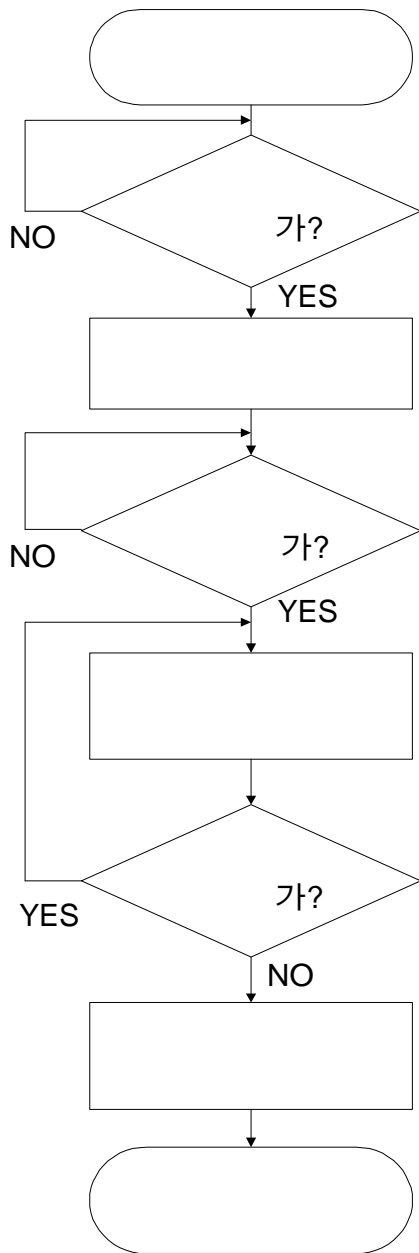


1. Block Diagram of MCA Hardware

2.2



2 Block Diagram of Software Module



```

// 0x0Dh ( )
void interrupt new_int0Dh(void)
{
    WORD wdGetData;
    int nTemp;
    wdGetData = 0;
    enable();
    wdGetData = inportb(ADC_CHANNEL_HIGH);
    wdGetData <<= 8;
    wdGetData += inportb(ADC_CHANNEL_LOW);
    nTemp = wdGetData;
    wdGetData = abs(nTemp);
    wdGetData <<= 1;
    wdGetData >>= gbySCGain;

    if (gbAnalysisFlag)
    {
        gwdarDATA[wdGetData]++;
        gwdarDISPLAY[wdGetData / gnDSPRate]++;
        if (gnSec % 1 == 0 && gnSec != 0)
            gbDisplayFlag = TRUE;
        glLIVEcnt++;
        outportb(0x20, EOI);
    }
}
  
```

3. Flow Chart of Interrupt Routine and Program

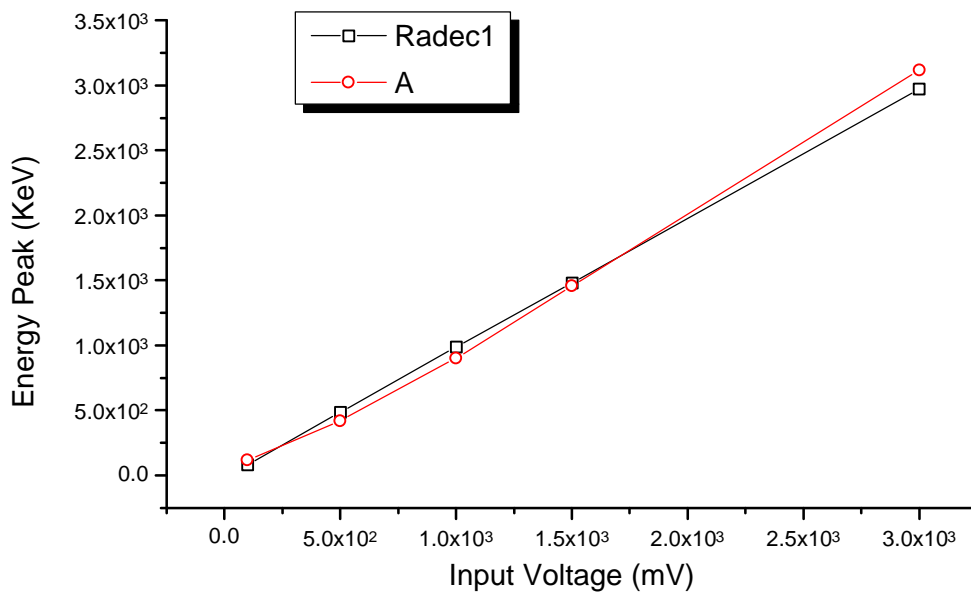
3.

3.1 Function Generator

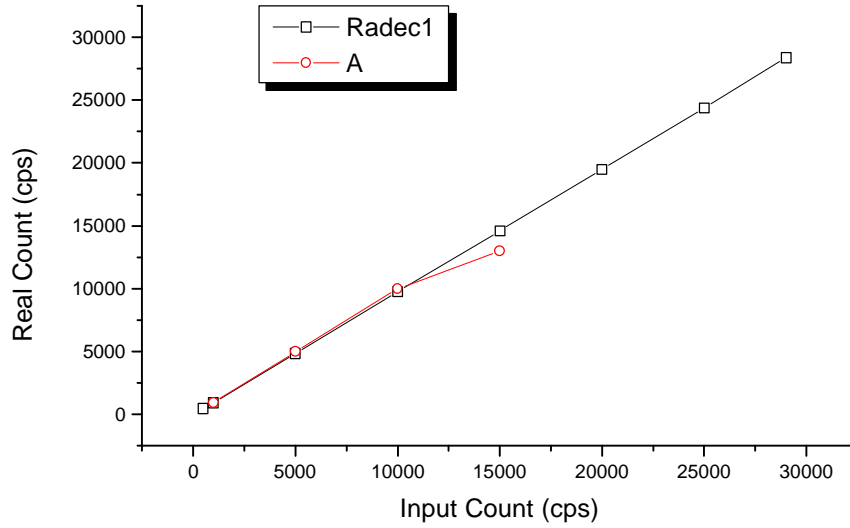
MCA 가 input pulse peak channel, total count,
MCA . input pulser
function generator(A33250A)
100mV - 300mV, 500Hz - 30kHz 가

3.2 Function Generator

4 input pulse peak channel
MCA RADEC1 가
5 input pulse total count
5 MCA
RADEC1 가



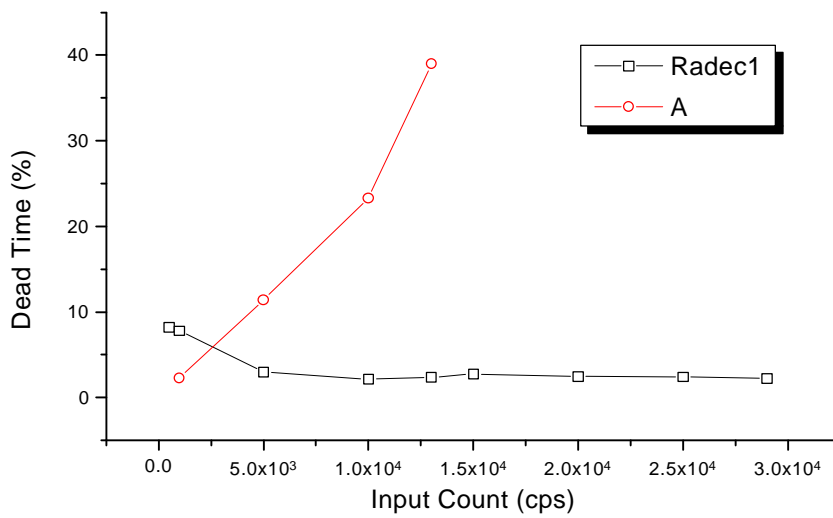
4. input pulse vs. peak channel



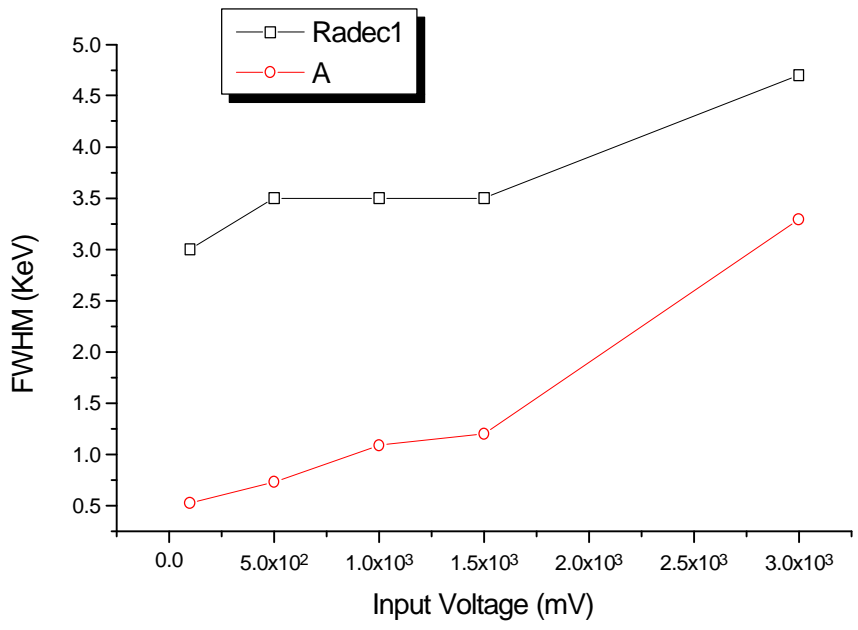
5. input pulse vs. real count

6 input count MCA 가
input count 가 (Dead Time)

input pulse FWHM 7 가



6. input count vs. dead time



7. input voltage vs. FWHM

3.3 -

가

¹³³Ba, ¹³⁷Cs ⁶⁰Co ¹³³Ba, ¹³⁷Cs ⁶⁰Co

- HP - Ge (10⁻¹¹)

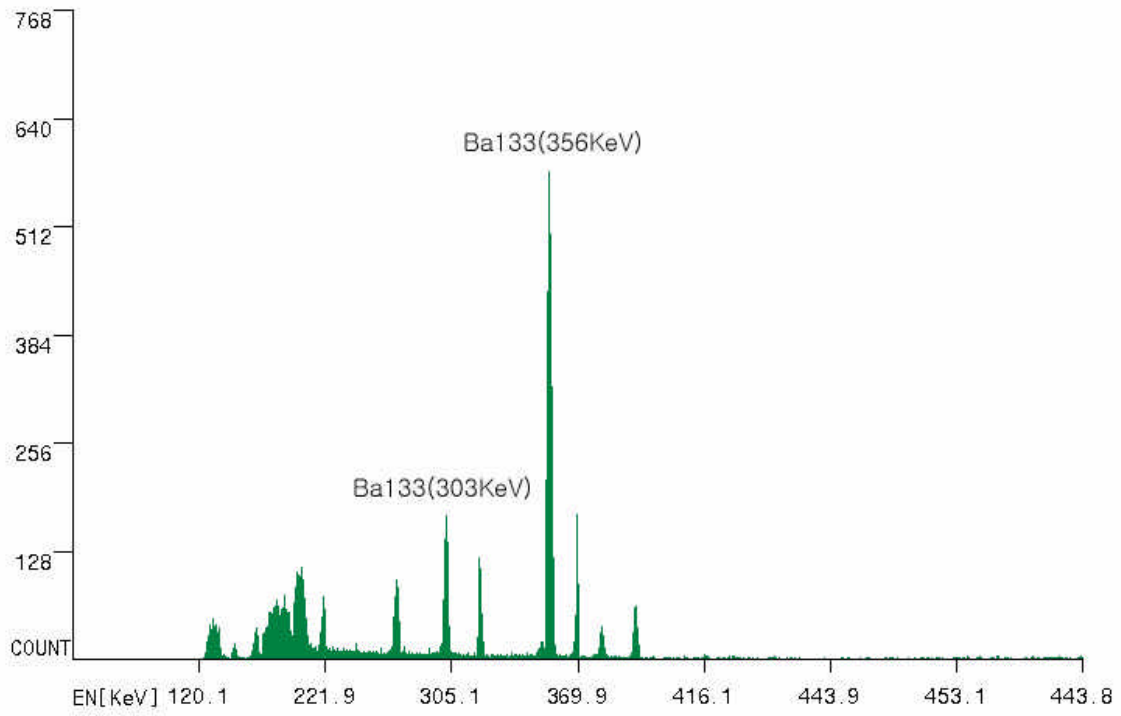
3.4 -

A 8

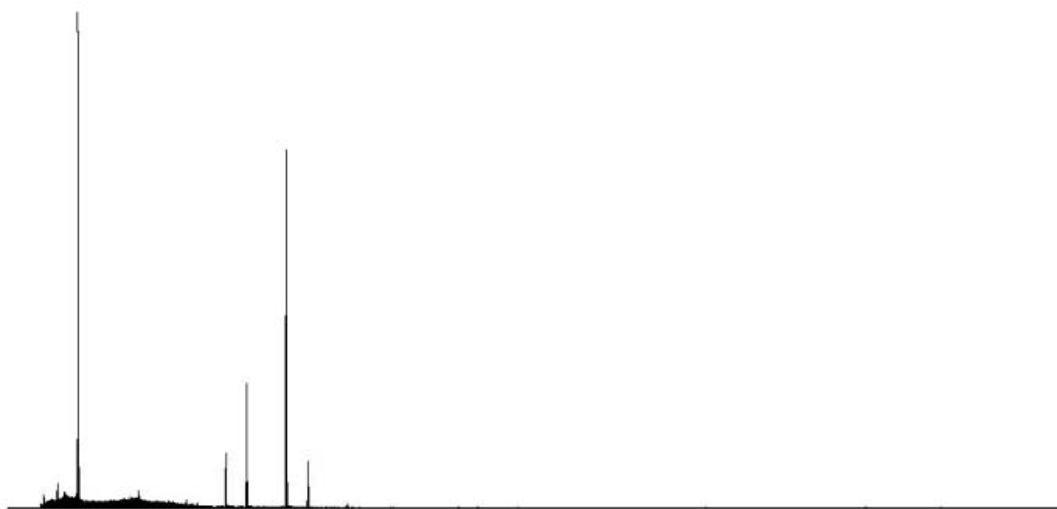
9 ¹³³Ba , 10 11 ¹³⁷Cs,

13 14 ⁶⁰Co

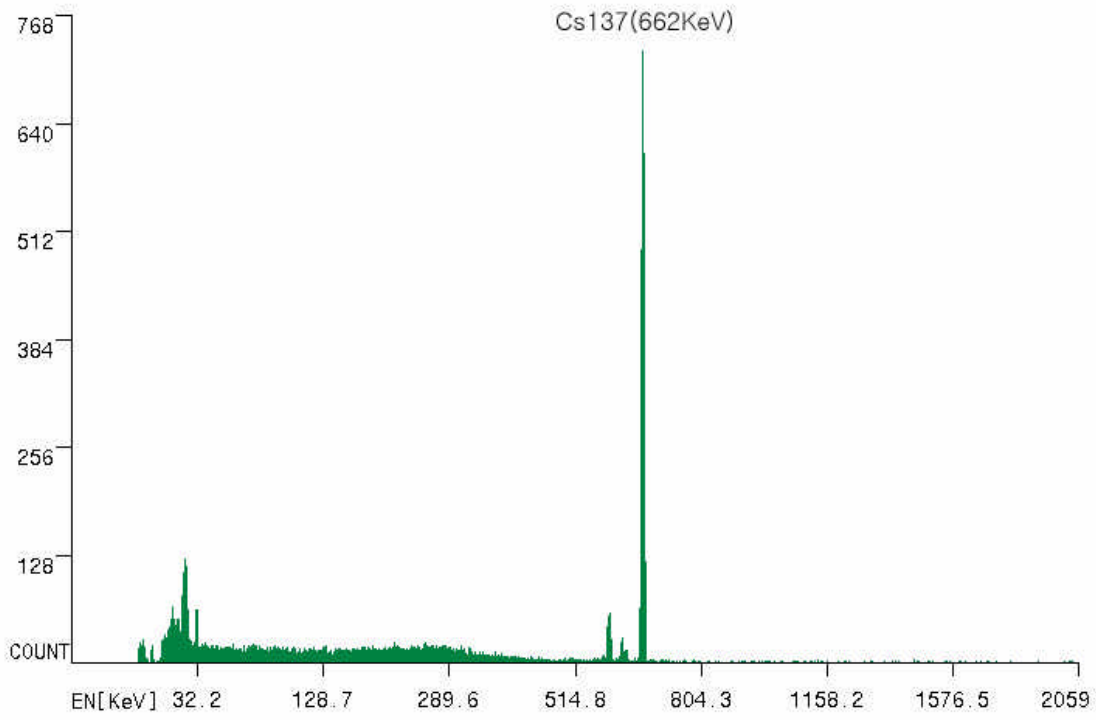
RadecViewer A Viewer



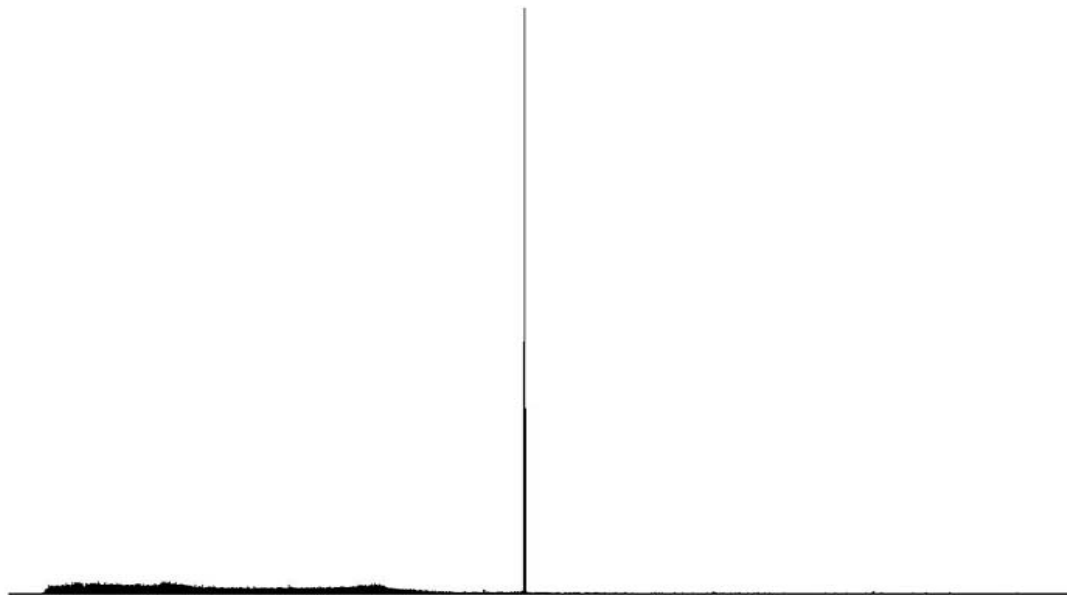
8. Radecl ^{133}Ba -



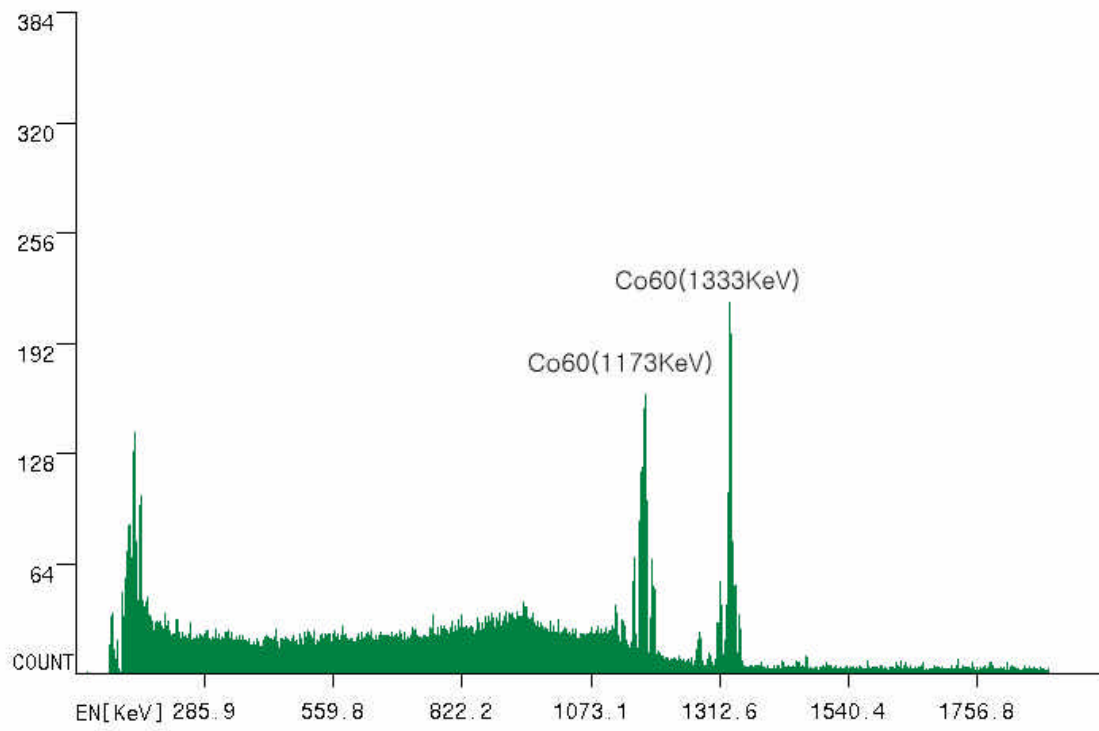
9. A ^{133}Ba -



10. Radecl ¹³⁷Cs -



11. A ¹³⁷Cs -

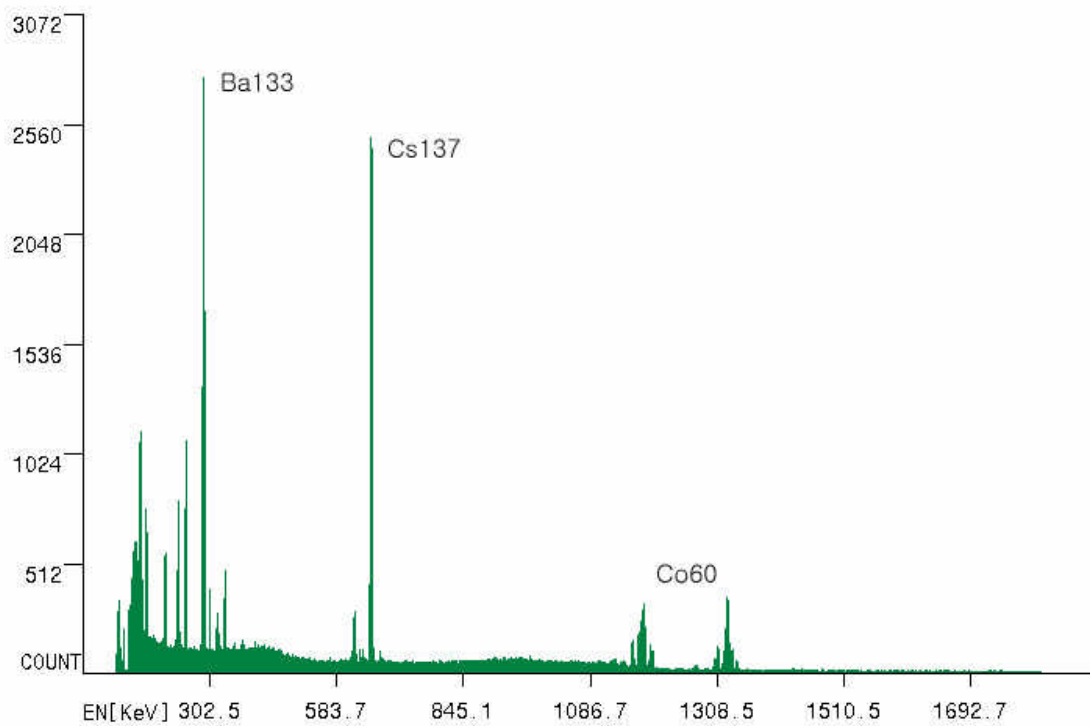


12. Radecl ^{60}Co -

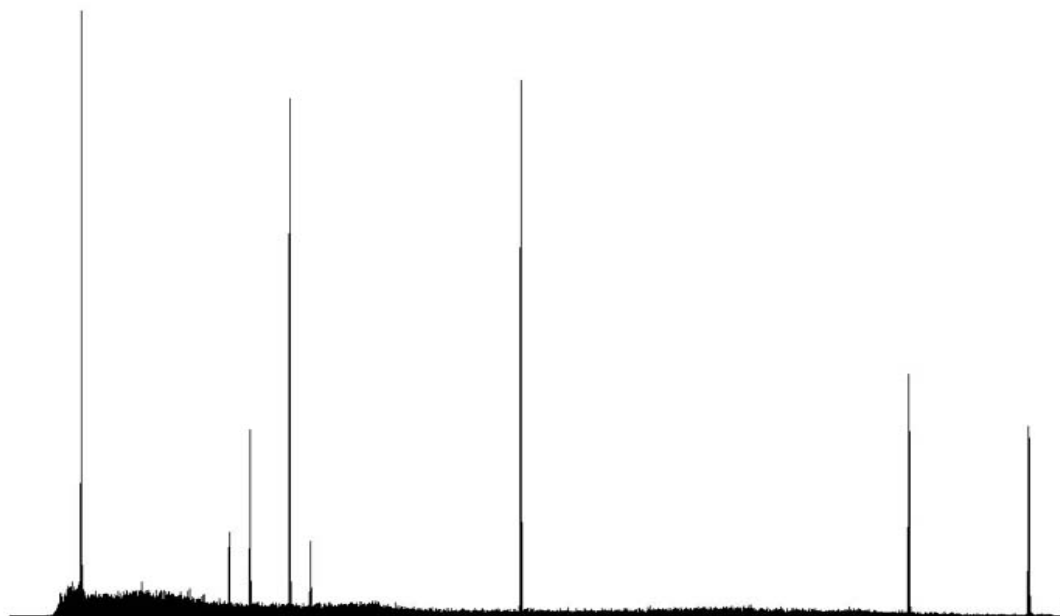


13. A ^{60}Co -

14 15 ^{133}Ba , ^{137}Cs , ^{60}Co



14. Radecl ^{133}Ba , ^{137}Cs , ^{60}Co -



15. A ^{133}Ba , ^{137}Cs , ^{60}Co -

4.

MCA peak channel pulse MCA
 RADEEC1 가 . input
 count 가 real count 가 MCA
 /
 input count 가 가
 RADEEC1 RADEEC1
 가 .
 가 Integration MCA
 RADEEC1 A 가 . ¹³³Ba,
¹³⁷Cs ⁶⁰Co ¹³³Ba
 가 가 .
 가 .
 Software
 Activity Gross count ¹³³Ba(0.8905μCi) RadeC1 732 count,
 A 514 count , ¹³⁷Cs(1.052μCi) RadeC1 1157
 count, A 514 count , ⁶⁰Co(0.9211μCi) RadeC1
 1663count A 254count . Dead time
 RadeC1 0%, A 4.5% . FWHM
¹³³Ba(356keV) RadeC1 0.70keV, A 1.0keV, ¹³⁷Cs(662keV)
 RadeC1 1.95keV A 1.28keV, ⁶⁰Co 1173keV RadeC1
 13.29keV A 1.64keV 1333keV + RadeC1 7.2keV
 A 1.75keV . A 가 RadeC1
 A RadeC1
 MCA 11)
 가
 가

- 1) P.W. Nicholson "Nuclear Electronics", John Willy & Sons(1974)
- 2) "Genie 2000 Spectroscopy System", Canberra, USA(2001)
- 3) , " ", , (1995)
- 4) "David E. Johnson and V. Jayakuman,"Operation Amplifier Circuits Design and Application", Prentice Hall(1982)
- 5) "Application Note, ADC16061(National Analog and Interface Products Data Book)", National Semiconductor(2002)
- 6) "TB - 386EX/TBDOS - 386 User Manual ", (), (2001.9)
- 7) , , , Vol.2, May(1989)
- 8) , "C " , 가 , (2002)
- 9) , " ", , (2002)
- 10) Adrian C. Melissinos, "Experiments in Modern Physics" Academic Press(1969)
- 11) " " (1992)