report for SSD

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Contents

1 silicon-strip detector

1.1 introduction

Particle identification of the fragments passing through the target was performed using four-layer-Si-strip-detectors composed of ΔE and E counters located at about 1.2 m downstream of the target. First two layers were composed of 8 Si detectors which were used for position detection. The position and intrinsic energy resolution of ΔE counters were about mm and 2%(FWHM),respectively. The last two layers was the E counter composed of 8 Si(Li) detectors with 3 mm thickness and has its intrinsic energy resolution of 3%(FWHM).

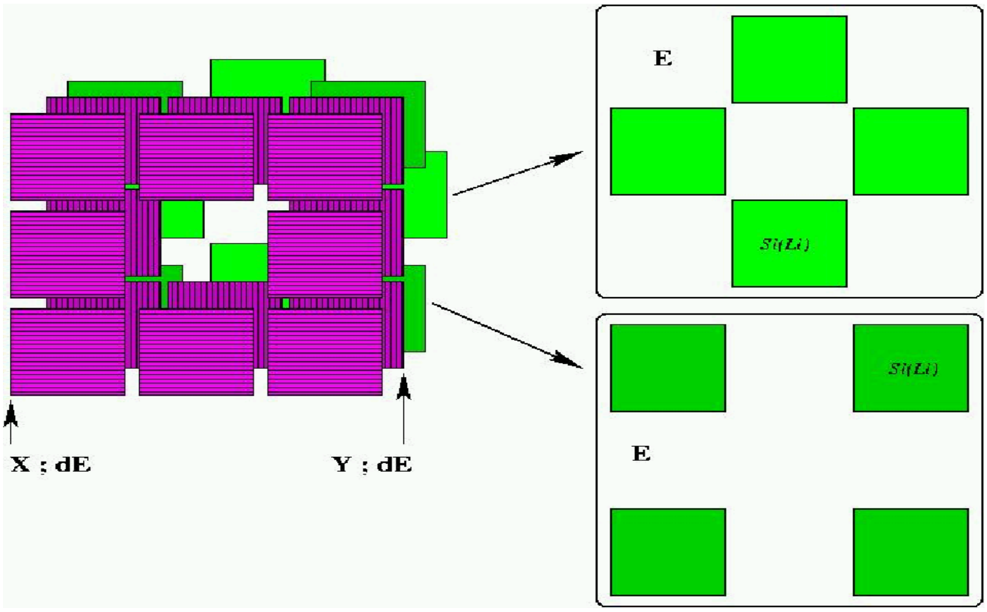

Figure 1: ssd parts

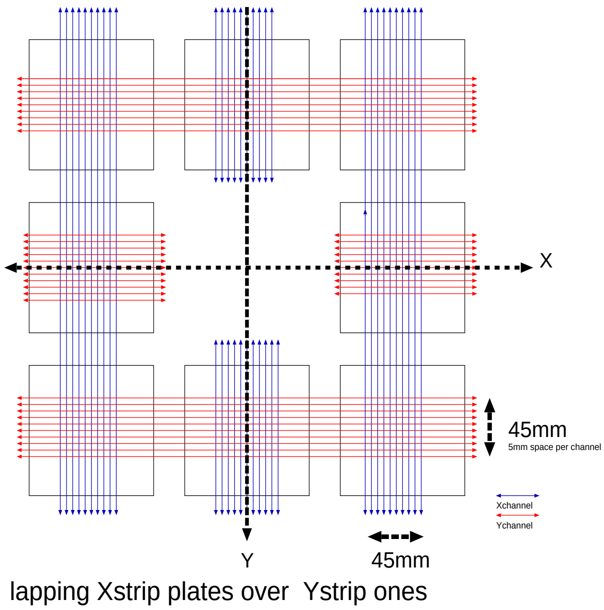

Figure 2: ssd facile picture of readout position

1.2 Energy Calibration ch⇒ MeV

The Energy calibration of each Silicon detectors was performed by using ^{25}Ne beam with 60 MeV/A, 55 MeV/A, and 50 MeV/A respectively. Figure shows the table which is correlation between ch and Energy[MeV].

table of calibration ^{25}Ne beam[MeV/A]				
E_{D2}	$\Delta E_{\mathrm{total}}$	deviation	E_{total}	deviation
60.04 MeV/Acal	10.16		50.0	
exp	10.03	-0.13	49.3	-0.7
55.41 MeV/A cal	11.19		43.91	
exp	11.20	-0.01	43.96	0.05
49.55 MeV/A cal	13.48		36.81	
exp	13.51	0.03	36.83	-0.02

1.3 How to identify the particle

$\Delta E_{\mathrm{total}}$is defined to the total energy loss of the fragments passing thought the ΔE counters and E_{total} is defined to the total kinetic energy of the fragments in front of the SSD counters. Therefore,

$$\Delta E_{\text{total}} = \Delta E_{\text{Xback}} + \Delta E_{\text{Yback}} \tag{1}$$

$$E_{\text{total}} = \Delta E_{\text{total}} + E \tag{2}$$

- ΔE_{total}:the total energy of the $DeltaEcounters$
- ΔE_{Xback},ΔE_{Yback}:the energy loss of the first layer and two layer respectively
- E_{total}:the total energy of the fragments
- E:the energy of the last E counter

In the energy loss of charged particle passing though the material,

$$\Delta E \simeq Z^2 \text{TOF}^2 \tag{3}$$

- Z:the charge of the fragments
- TOF:the time of flight of the fragments

In the total energy of the fragments, this energy is classically equal to the kinetic energy.

$$E_{\text{total}} \simeq \frac{A}{\text{TOF}^2} \tag{4}$$

- A:the mass number of the fragments

Therefore,

$$E_{\text{total}} \Delta E \simeq AZ^2 \tag{5}$$

This picture shows the identification of the fragments from ^{26}Ne incident beam at 58.7MeV/A.

To identify clearly, I did following way which is refereed from R.H.stokes et al,ReV.Sci.Instr.29.61(1958). Firstly the PID is defined following.

E_{total} is redefined following

$$E_{\text{total}} = E + \frac{1}{2}\Delta E \tag{6}$$

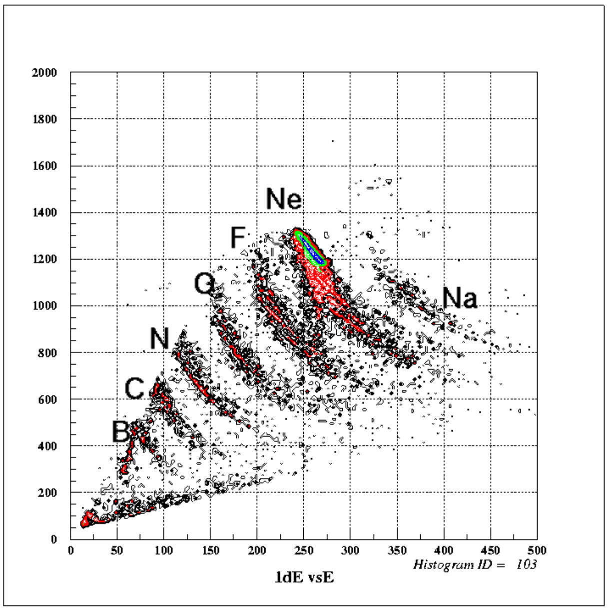

Figure 3: $\Delta E counters vs E counters$

Therefore,

$$\text{PID} = \Delta E(E + \frac{1}{2}\Delta E)^a \simeq AZ^2 \tag{7}$$

a is parameter and the coefficient 1/2 means the mean energy loss of the $DeltaE$.

a$\simeq$0.75(in this analysis)

RUN	^{26}Ne+Pb	^{26}Ne+Al	^{26}Ne+emp
^{26}Ne	0.238	0.242	0.260
^{25}Ne	0.257	0.249	0.258
^{24}Ne	0.242	0.225	0.238
^{23}Ne	0.263	0.229	0.229
^{22}Ne	0.232	0.217	0.217
^{21}Ne	0.251	0.228	0.226
^{20}Ne	0.235	0.215	0.222

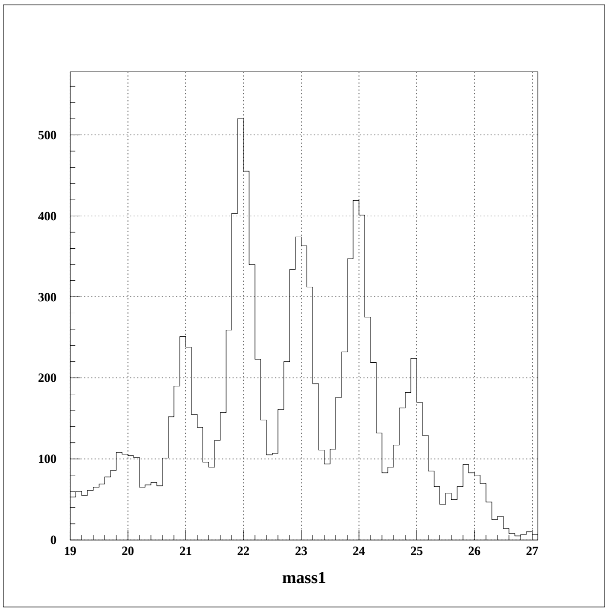

Figure 4: the distribution of ssd in Ne isotope at Pb target in beam⊗ssd⊗neutron

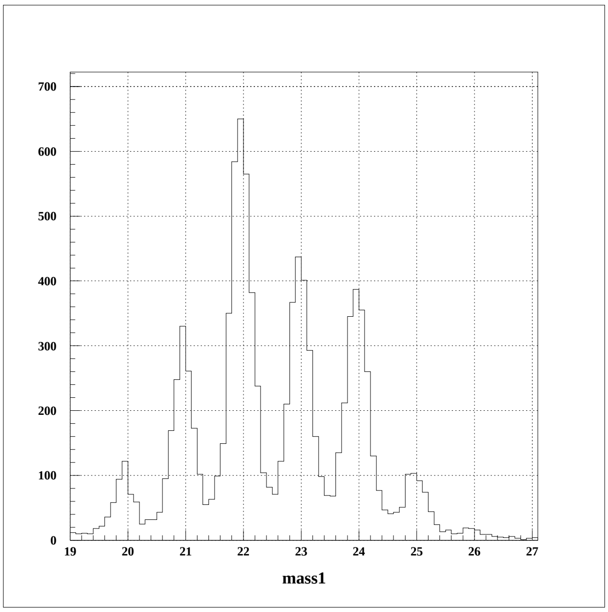

Figure 5: the distribution of ssd in Ne isotope at Al target in beam⊗ssd⊗neutron

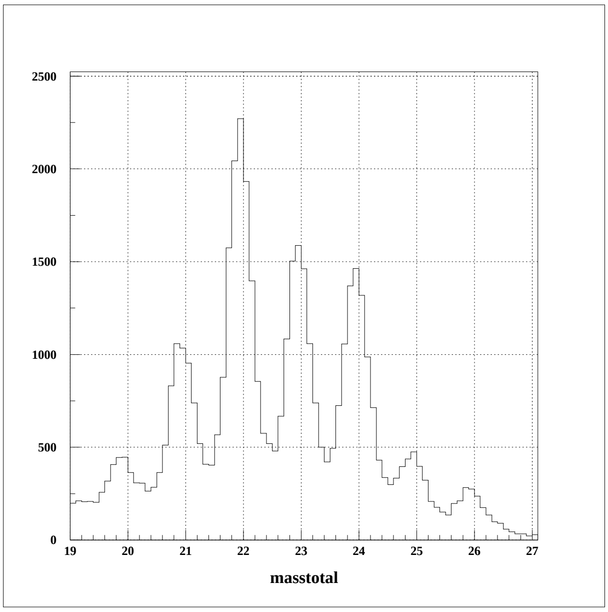

Figure 6: the distribution of ssd in Ne isotope at empty target in beam⊗ssd⊗neutron

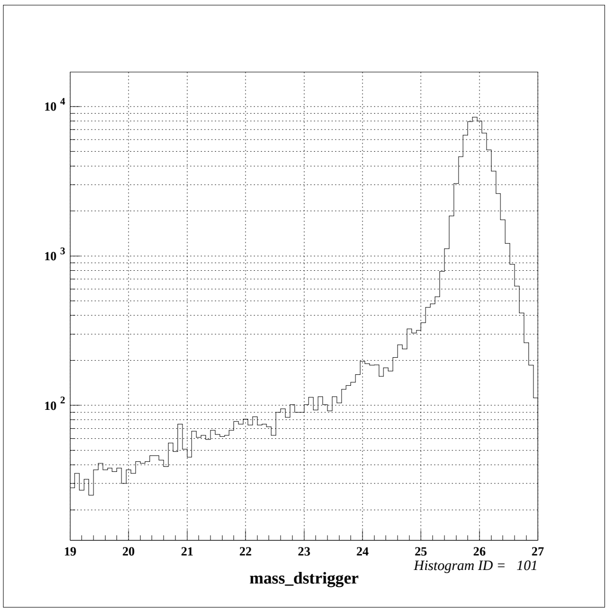

Figure 7: the distribution of ssd in Ne isotope at Pb target in beam trigger

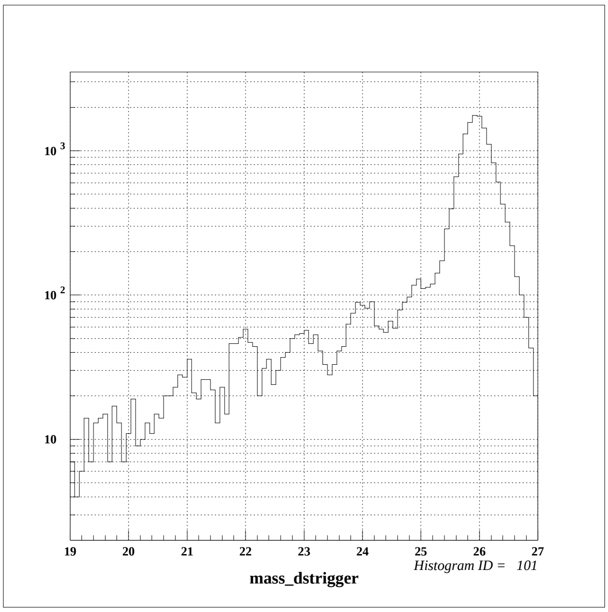

Figure 8: the distribution of ssd in Ne isotope at Al target in beam trigger

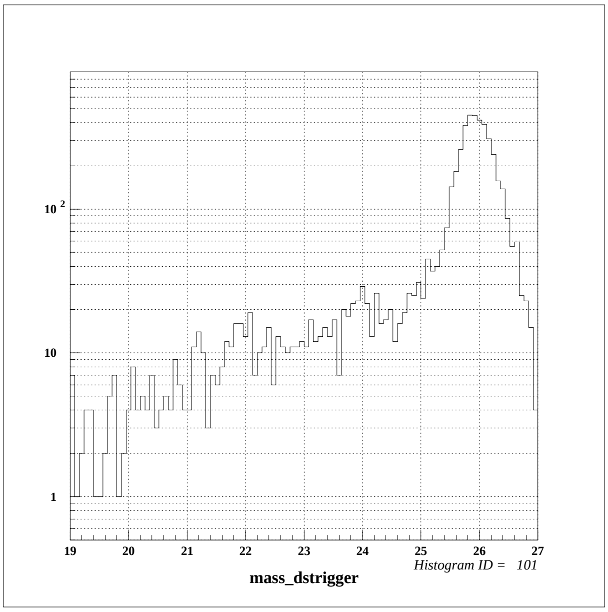

Figure 9: the distribution of ssd in Ne isotope at empty target in beam trigger