HRRL vs. IAC

HRRL experiment

HHRL experiment outline:

Bremsstrahlung radiator – 1 mil Ti (radiation length 3.59 cm);

Energy of electorns – 14 MeV;

Repetition rate – [900 Hz - 1kHz];

Current ~ 100 mA (??);

Pulse width ~ 25 ns;

Neutron counting rates obtained in HRRL experiment (Det A up, Det C side), polarized photpons:

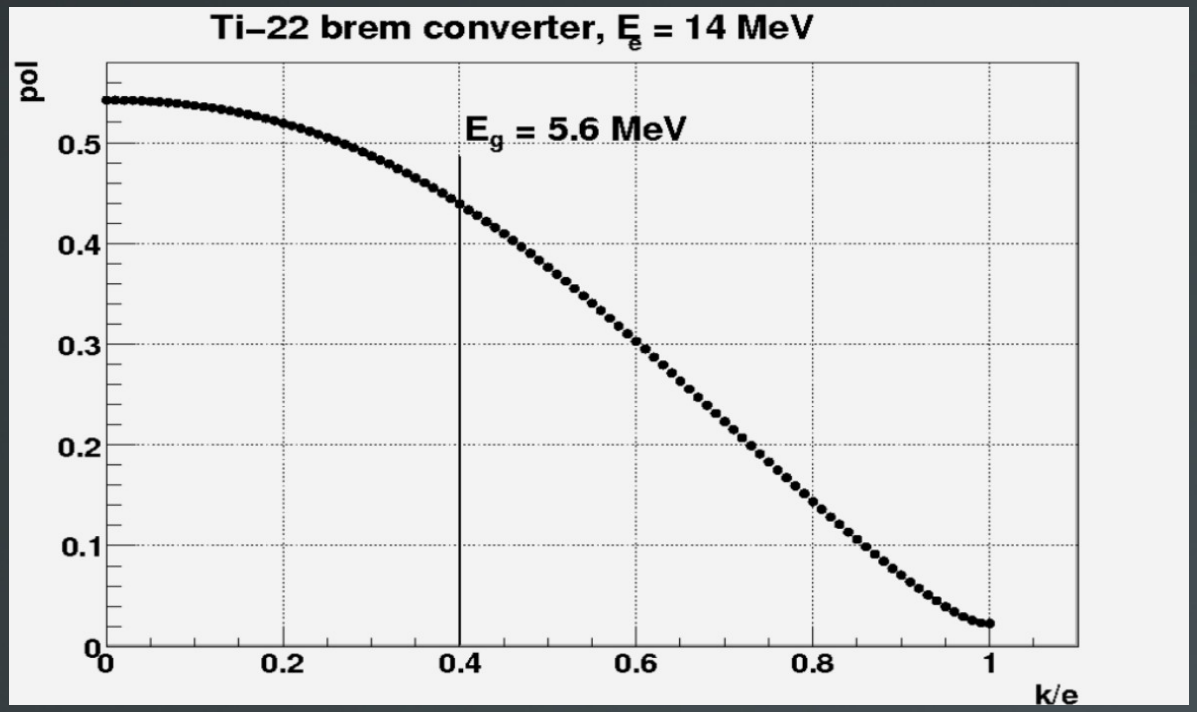
D_2O target – 32.8 n/s, 34.6 n/s (statistics 60000 neutrons); runs [102-105]

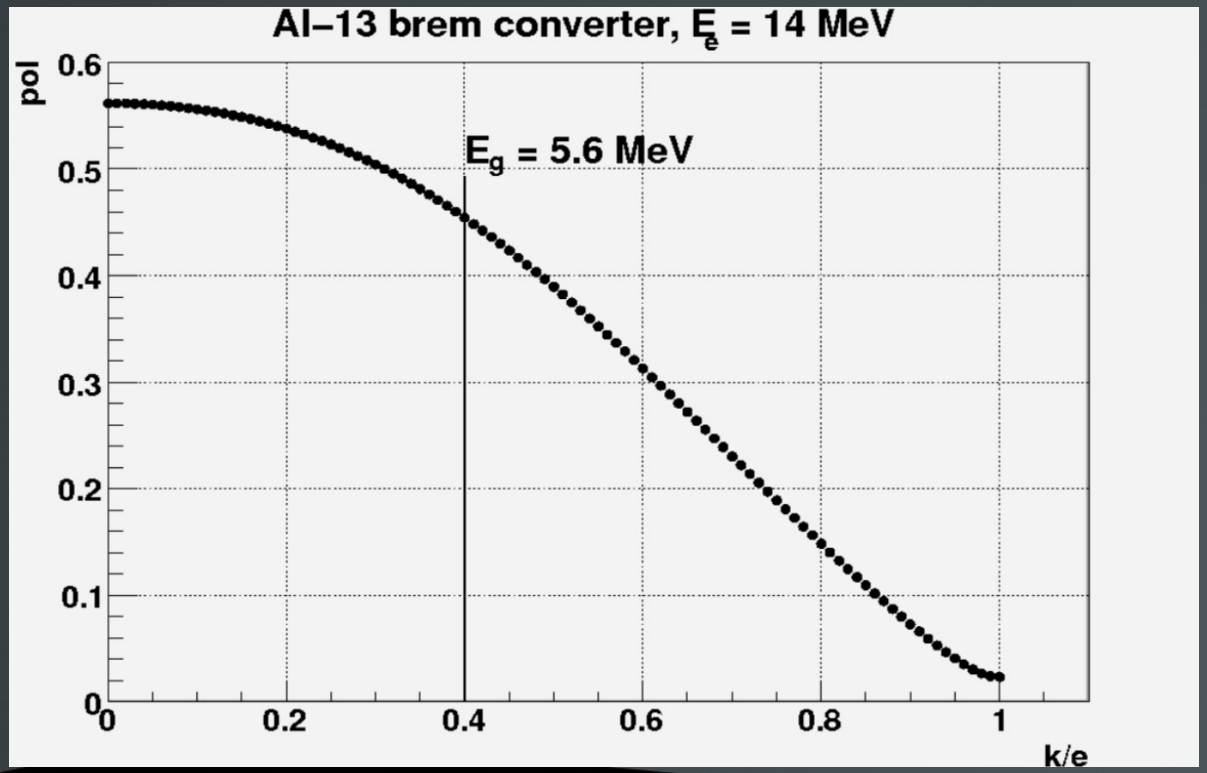
DU plate target – 46 n/s, 51 n/s (statistics 155000 neutrons); runs [126-129]

U_3O_8 powder target – 8.1 n/s, 7.38 n/s (statistics 30000 neutrons); runs [170-173]

No target run – 0.66 n/s, 1.49 n/s (statistics 2500 neutrons); runs [118-121]

Empty plastic bottle – 1.45 n/s, 0.64 n/s; runs [122-125].





Polarizarion was calculated for characteristic angle

$$\theta = 0.511 \text{ MeV} / 14.0 \text{ MeV} = 2.09^0$$

IAC experiment

IAC experiment outline:

Bremsstrahlung radiator – 1 mil Al (radiation length 8.9 cm);

Energy of electorns – 25 MeV;

Repetition rate – 180 Hz;

Current ~ 120 mA;

Pulse width ~ 2 ns;

Neutron counting rates obtained in IAC experiment, polarized photpons:

D_2O target & radiator IN & beam UP – 0.11 n/s (statistics 443 neutrons) run# 2544

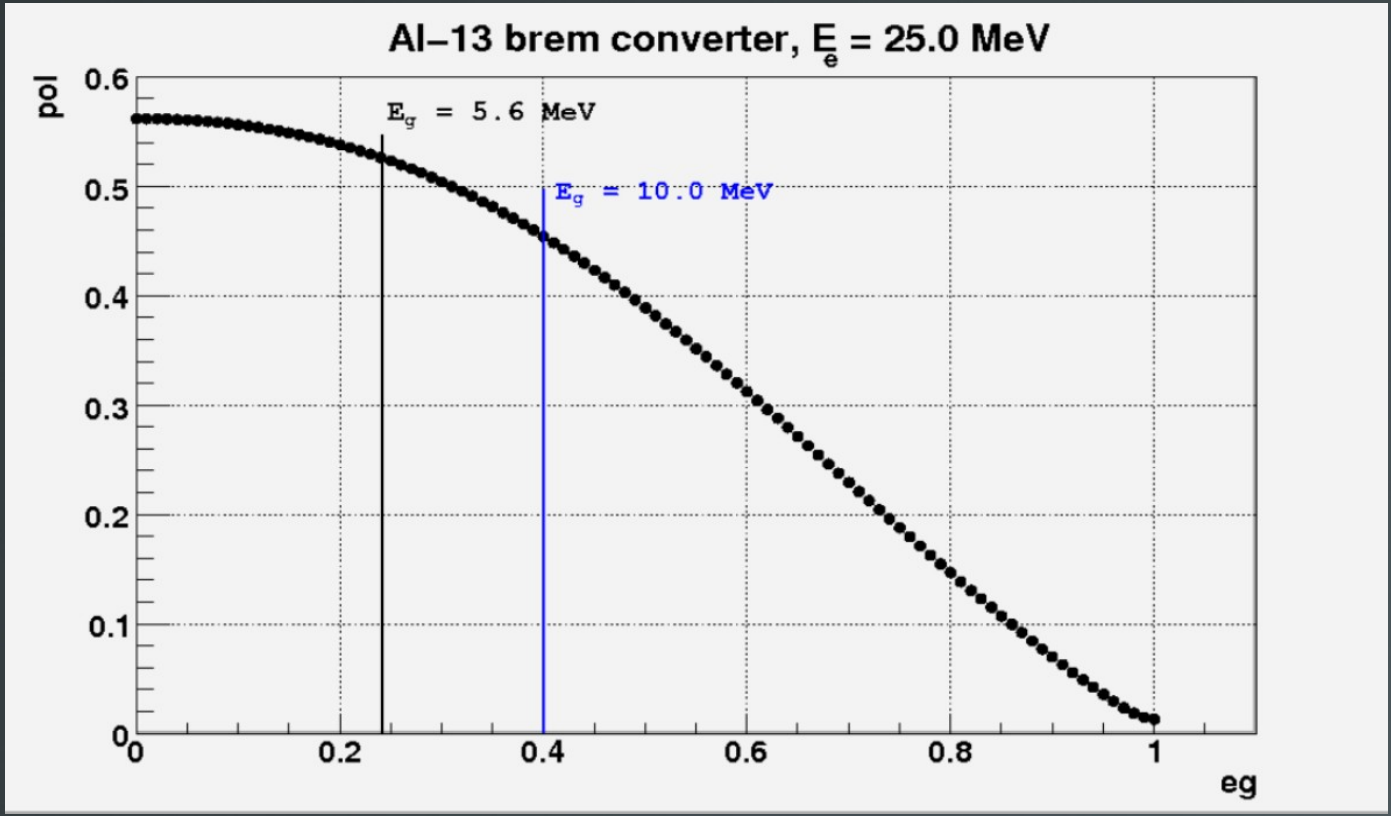
DU cylinder target & radiator IN & beam UP – 0.113 n/s (statistics 119 neutrons); run# 2494

DU cylinder target & radiator OUT & beam UP – 0.0 n/s (statistics 0 neutrons) run# 2497

No target & radiator IN & beam DOWN – 0.0047 n/s (statistics 1 neutron); run# 2500

Polarizarion was calculated for characteristic angle

$\theta = 0.511 \text{ MeV} / 25.0 \text{ MeV}$
$= 1.171^0$



Conclusions

Comparing two data sets it may be concluded that:

- HRRL was better in neutron production rate (DU target example):

46 n/s (HRRL) / 0.113 n/s (IAC) = 407;

- We've got better background at the IAC:

0.66 n/s (HRRL) / 0.0047 n/s (IAC) = 140

- According to the theory we will get worse polarization at HRRL (5.6 MeV photons, Al bremsstrahlung converter example):

45 % (HRRL) VS. 53% (IAC)

- At the IAC we've got better timing resolution of gamma peak and neutron region. IAC data show ~40 ns gap in between the photon peak and neutron area, while HRRL data don't show any gap in between the photon peak and neutron area. It maybe due to low statistics in the IAC data.