Fluence calculation for the Jan-1998 proton irradiation

Exposure time:
  23-Jan-1998, 10: 40 Exposure started
  25-Jan-1998, 0: 10 Exposure finished
      Exposure period = 37 h 30 m = 135000 s = 1.5625 d

Al-foil #1
  weight = 0.0305 g
  $N_t = 0.0305 \times 6.022 \times 10^{23} / 26.98 = 6.808 \times 10^{20}$

Al-foil #2
  weight = 0.0283 g
  $N_t = 0.0283 \times 6.022 \times 10^{23} / 26.98 = 6.317 \times 10^{20}$

Atomic weight of Al = 26.98 g/mol, $N_A = 6.022 \times 10^{23}$ / mol

Be-7: $E\gamma = 477$ keV,
    Br = 0.105, σ(Al $\rightarrow$ Be-7) = 7.89 mb,
    $T_{1/2}$(Be-7) = 53.29 d
    $\lambda = \ln2 / T_{1/2} = 0.013007$ /d $= 1.5054 \times 10^{-7}$ /s

Be-7 activity measurements for the Jan-1998 proton irradiation:
For Al-foil #1:
  Date & time; 5-Feb-1998, 15: 37
  measured period = 69593 s
  $E\gamma$ (477 keV) counts = 32833 counts
      intensity = 0.47188 counts/s
For Al-foil #2:
  Date & time; 6-Feb-1998, 10: 58
  measured period = 25938 s
  $E\gamma$ (477 keV) counts = 9463 counts
      intensity = 0.36490 counts/s

Detector efficiency at $E_\gamma = 477$ keV; $E_{ff} = 0.0131$

Time between the activity measurement and proton exposure:
#1; 25-Jan-1998 0: 10 $\leftrightarrow$ 5-Feb-1998, 15: 37 = 11 d 15 h 27 m = 11.644 d = 1006020 s
#2; 25-Jan-1998 0: 10 $\leftrightarrow$ 6-Feb-1998, 10: 58 = 12 d 10 h 48 m = 11.644 d = 1075680 s

Numerical calculations for the Jan-1998 proton irradiation:

Proton flux can be expressed as;

$$\Phi \cong \frac{N_{mes}e^{\lambda(t_d - t_i)}}{N_t \sigma \lambda E_{ff} \Gamma}$$

Here in this measurement we used the following numbers;
For Al-foil #1:
$N_{mes} = 0.47188$ counts/s
$t_d - t_i = 1006020$ s
$N_t = 6.808 \times 10^{20}$

For Al-foil #2:
$N_{mes} = 0.36490$ counts/s
$t_d - t_i = 1075680$ s
$N_t = 6.317 \times 10^{20}$

$\lambda = 1.5054 \times 10^{-7}$ /s
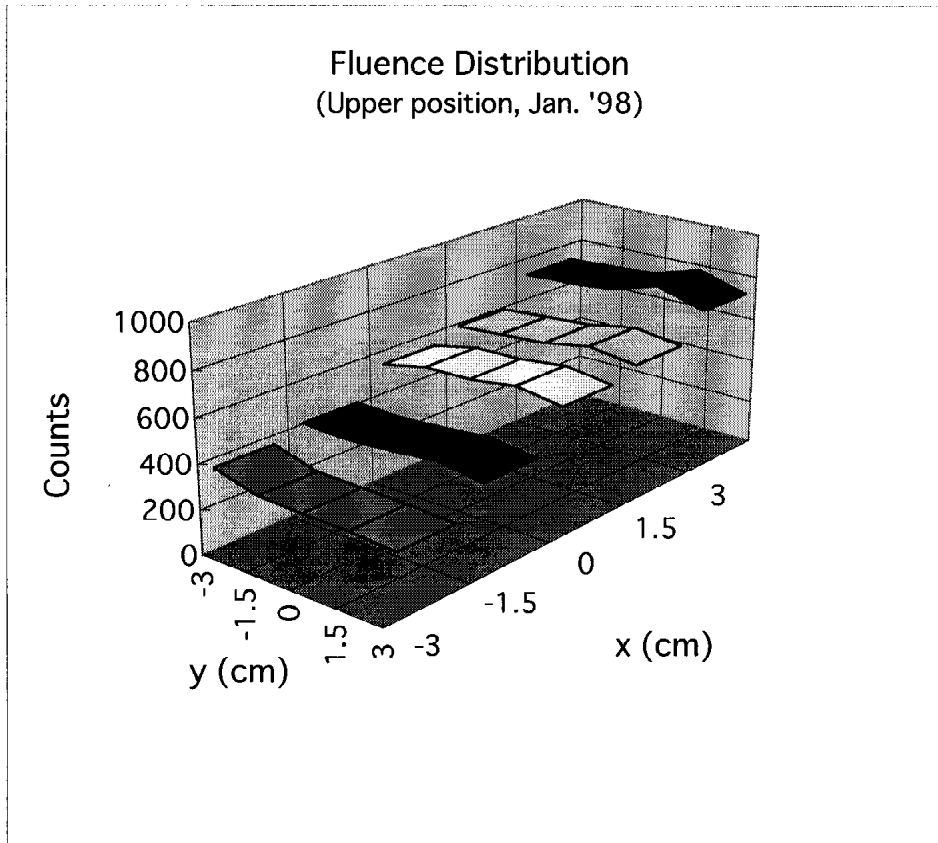$\sigma = 7.89$ mb $= 7.89 \times 10^{-27}$ cm^2
Eff $= 0.0131$
$\Gamma = 0.105$
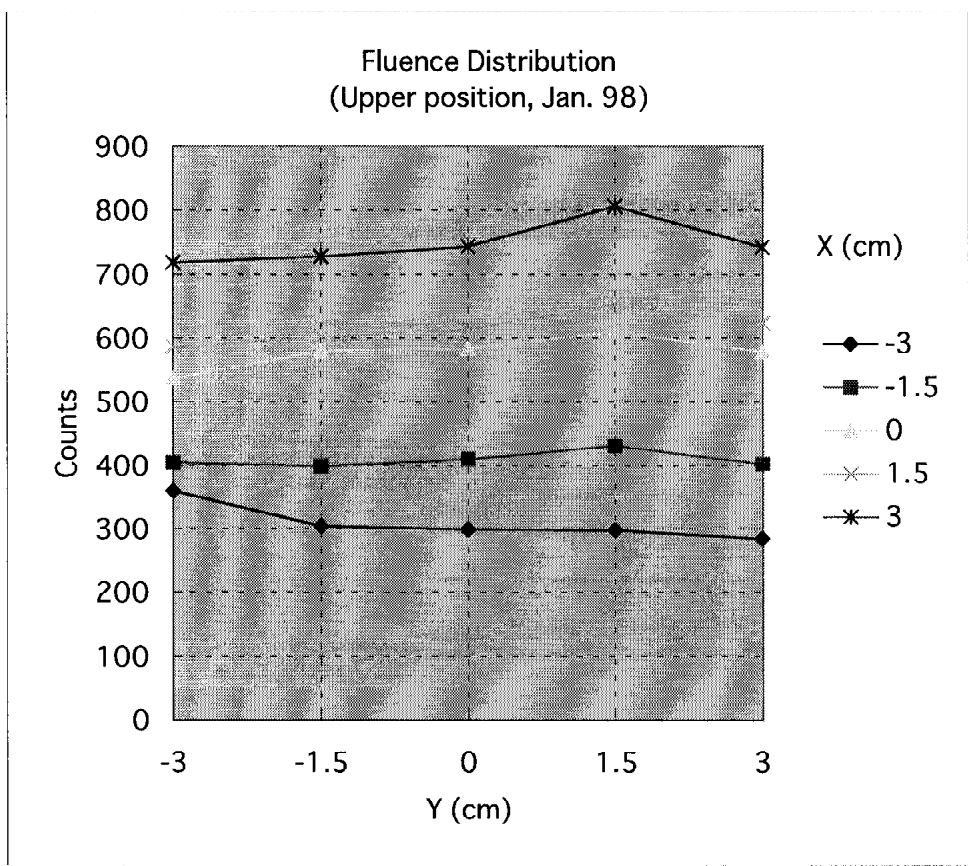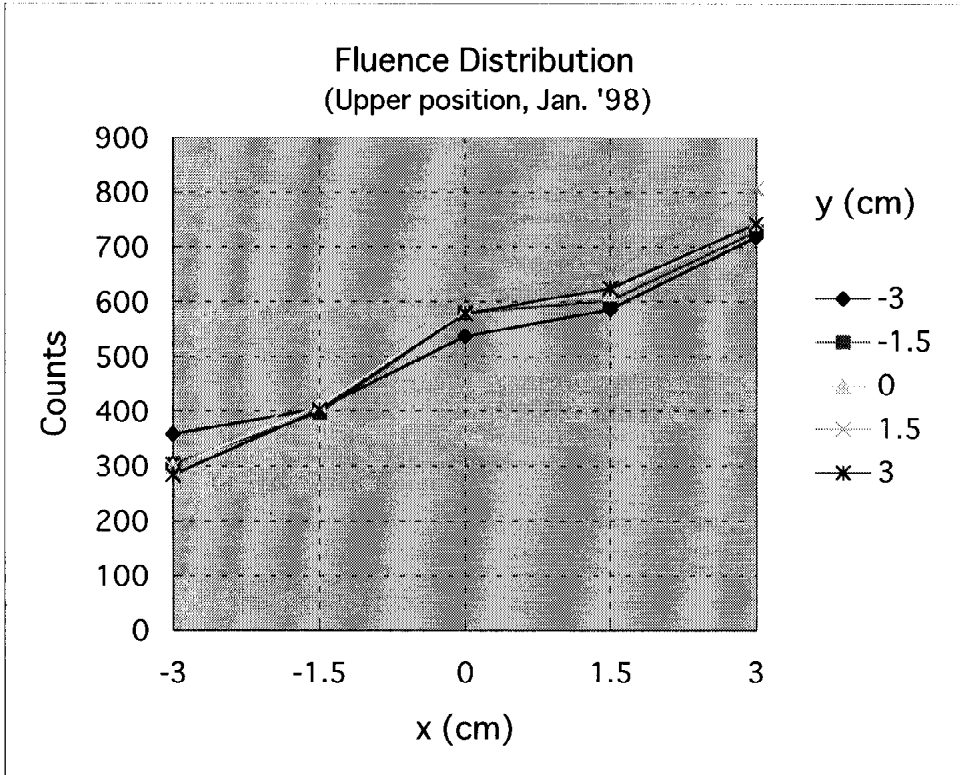
$\Phi(\#1) = 0.47188 \times \exp(1.5054 \times 10^{-7} \times 1006020) /(6.808 \times 10^{20} \times 7.89 \times 10^{-27} \times 1.5054 \times 10^{-7} \times 0.0131 \times 0.105) = 0.54904 / 1.1123 \times 10^{-15}$
$= 4.94 \times 10^{14}$ (protons/cm^2)

$\Phi(\#2) = 0.36490 \times \exp(1.5054 \times 10^{-7} \times 1075680) /(6.317 \times 10^{20} \times 7.89 \times 10^{-27} \times 1.5054 \times 10^{-7} \times 0.0131 \times 0.105) = 0.42904 / 1.03205 \times 10^{-15}$
$= 4.16 \times 10^{14}$ (protons/cm^2)

	-3	-1.5	0	1.5	3
-3	359.51903	405.25677	537.07156	586.17185	718.63328
-1.5	304.37643	398.51522	579.63607	601.78249	728.05672
0	299.22486	410.44129	583.77663	613.70026	744.11829
1.5	297.77359	431.18805	610.34571	653.17373	806.88074
3	284.05793	402.42529	579.10325	624.4903	742.46795

542.50661

Fluence Distribution
(Upper position, Jan. '98)

Fluence Distribution
(Upper position, Jan. '98)

Fluence Distribution
(Upper position, Jan. 98)

	-3	-1.5	0	1.5	3
-3	452.67778	562.9665	408.91153	369.88711	498.31574
-1.5	527.3185	609.3675	457.84553	418.25337	587.54213
0	550.29067	606.61439	457.68104	428.03331	591.71491
1.5	591.83383	654.26276	489.2966	466.39513	650.726
3	534.39899	612.8227	497.46947	477.74413	658.68167

509.74996

Fluence Distribution
(Lower position, Jan. '98)

Fluence Distribution
(Lower position, Jan. '98)

Fluence Distribution
(Lower position, Jan. 98)