Step 1: adjust beam current for tolerable singles rates

Singles rates (BigBite)

BigBite Singles Rate Evaluation for the SRC Experiment

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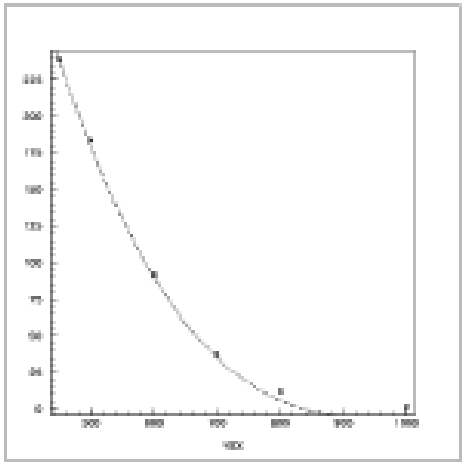


(Fig 1) Measured (points) and calculated (dashed line) hit rates [Hz] Vs Proton Momentum [MeV/c]

Summary

Measured rate [MHz] based on test	Estimated rate [MHz] based on Geant and test	Estimated rate [MHz] based on proposal estimate
3.5	4.5	8

Table 3: Measured and Simulated rates

In the proposal condition based on the test with the beam we estimate BigBite singles rate to be 3.5 ± .5 MHz.

For 0.25mm/20 deg taget:

2.5+-0.5 MHz

Singles rates n - array

		during 89-044	beam test (C)	beam test(D)
		Feb 2000	April 2001	April 2001
beam energy[GeV/c]		4.8	4.	2.561
beam current[uA]	I	100	10	10
target		3He	9 foils C	15cm LD2
target width [mg/cm^3*cm]	D	60*10	9*50=450	170*15
nucleon luminosity [10^{37} cm^{-2}sec^{-1}	L	22.5	1.7	9.6
line of sight shield		2" lead	2" lead	2" lead
other shield		none	none	none
threshold [MeVee]		10	?	?
angle of det. center[deg.]		124	90	90
detector size [cm^3]	V	160x10x10	160x10x10	160x10x10
distance from TGT [cm]	S	520	440	440
run numbers		2170-2474	61184-61217	60573-60624
comments		1st layer	1st layer	1st layer
measure rates [Hz]	R	850k	150k	700k

180 kHz

~300 kHz

260 kHz

		parasitic test	experiment	
		Nov 2001	2003/4	
beam energy[GeV/c]		?	5.0	
beam current[uA]	I	110	100	
target		15 cm LD2	C 1 mm	
target width [mg/cm^3, cm]	D	170*15	200	
nucleon luminosity	L	105	7.5	
line of sight shield		2" lead	2" lead	
other shield		none	none	
threshold [MeVee]		6.84(10.26)	10	
angle of det. center[deg.]		120 (BL)	100	
detector size [cm^3]	V	50*10*10	100*10*10	
distance from TGT [cm]	S	700	500	
run numbers	-	-	-	
comments		det 1	1st layer	
measure rates [Hz]		210k(150k)	-	

Experiment 2005

0.25 mm
20 deg

5 10^{37}

50 kHz

Proposal 168 kHz

Singles rates (summary): For 0.25mm/20 deg target:

With 100 μA beam the expected n singles rates :

For PM in the 1st layer : **250 ± 50 kHz** **200 ± 50 kHz**

For the whole 1st layer : **~ 7.5 MHz** **~ 5 MHz**

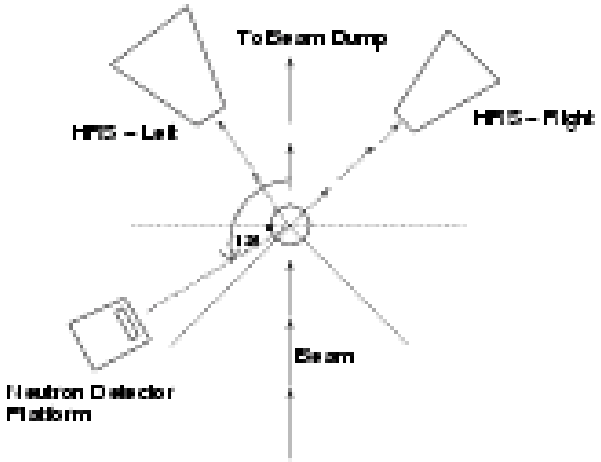
That is without taking into account possible help from BigBite upstream.

With 100 μA beam the expected charge singles rates in BB:

3.5 ± 0.5 MHz **2.5 ± 0.5 MHz**

We will chose the beam current to give an average singles rate of about 150 kHz per front PM. We expect that to give us a current of 50 – 100 μA.

n – array shield



Floor plan of Hall A – shows the position of the neutron detectors relative to the beamline and target. Neutron detector is about 9m from the centre of the target.

BigBite Neutron Bar Shielding Tests

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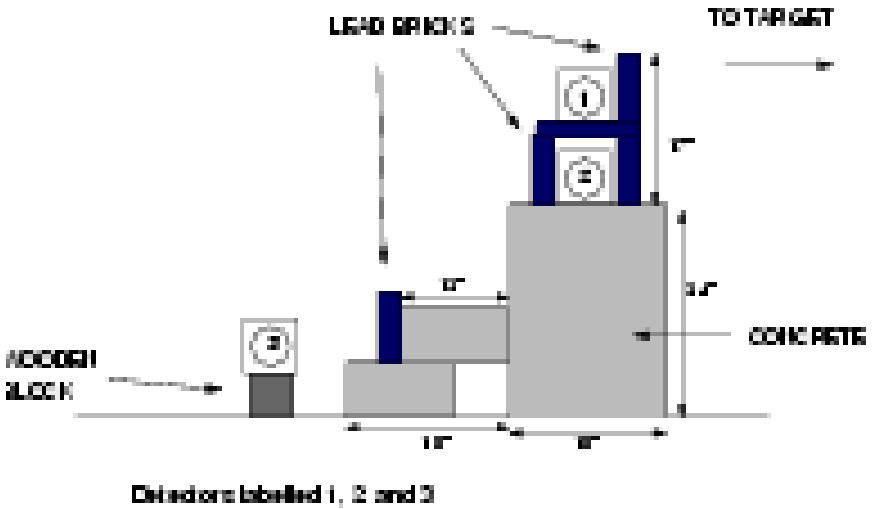

Detectors labelled 1, 2 and 3

Figure 1: The different amounts of shielding used for each neutron bar are shown; beam height is about 2 feet above bar # 1.

With threshold of about 10 Mev ee and only line of site 2 “ lead shield the room background is only 5 %

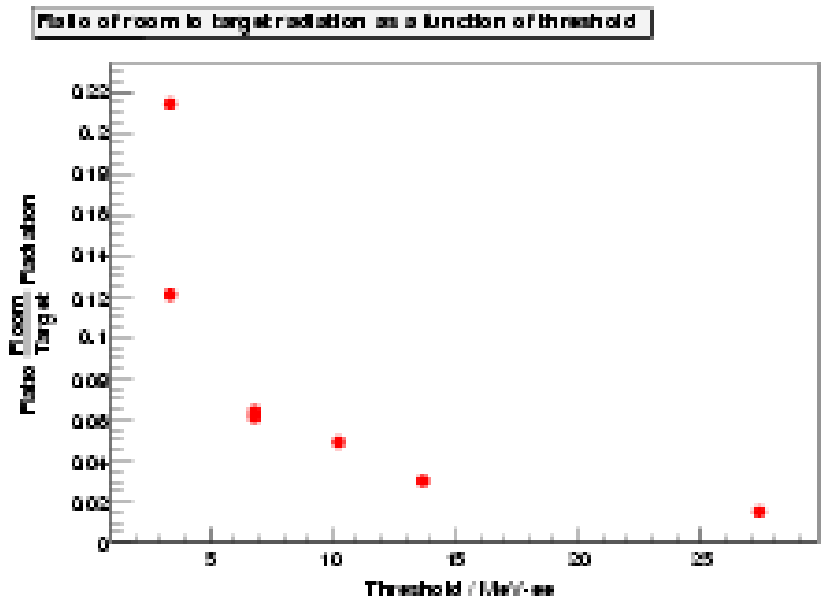

Figure 4: The ratio of the number of counts from bar # 3 (room) to bar # 1 (target) as a function of threshold energy of the incoming neutron (in MeV - electron equivalent). Note, that two of the points at the lowest thresholds were duplicated from two tests at a different time from the rest of the tests.

With threshold of about 10 Mev ee and only line of site 2 " lead shield the room background is only 5 %

Bar #	Duration	Threshold mV	Threshold MeV−ee	Current	Counts	Error on
1 2 3	25 mins	-60 mV	3.42	109 uA	866 060 502 711 158 224 182 529 699	0.214
1 2 3	24 mins	-60 mV	3.42	110 uA	662 809 913 733 382 234 80 508 176	0.121
1 2 3	28 mins	-120 mV	6.84	109 uA	340 265 396 346 901 725 21 735 303	0.064
1 2 3	26 mins	-120 mV	6.84	110 uA	334 153 059 330 163 520 20 494 541	0.061
1 2 3	26 mins	-180 mV	10.26	109 uA	235 662 810 236 009 916 11 455 693	0.049
1 2 3	26 mins	-240 mV	13.68	110 uA	183 005 721 177 960 767 5 369 794	0.03
1 2 3	25 mins	-480 mV	27.36	109 uA	42 748 383 33 083 387 637 698	0.015

running conditions	current	target	nucleon luminosity
proposal	100 uA	C, 2 gr/cm^2, 1 mm	$7.5 * 10^{37} cm^{-2} sec^{-1}$
^{3}He parasitic run	100 uA	^{3}He, 0.06 gr/cm^3, 10 cm	$22.5 * 10^{37} cm^{-2} sec^{-1}$
triple coinc. beam test	10 uA	LD2, 0.17 gr/cm^3, 15 Cm	$9.6 * 10^{37} cm^{-2} sec^{-1}$
triple coinc. beam test	10 uA	9 C foils, 9X50 mgr/cm^2	$1.7 * 10^{37} cm^{-2} sec^{-1}$

Exp. 2005 100uA 0.25 mm at 20 deg. 5 10^{37}

MCEEP simulation of d(e,e'pn)