$n \rightarrow n'$ Disappearance simulation in HIBEAM

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$n \rightarrow n'$ disappearance with HBEAM

HIBEAM source file : tracks_mlguide_only_15m.mcpl

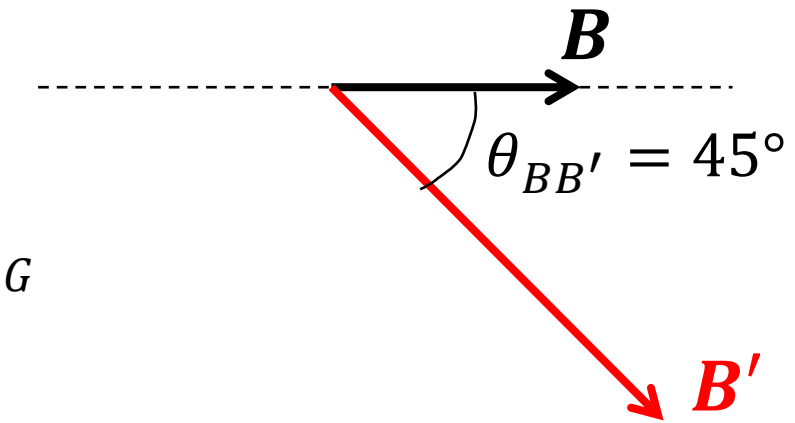
HIBEAM flight path from 15 m to 65 m

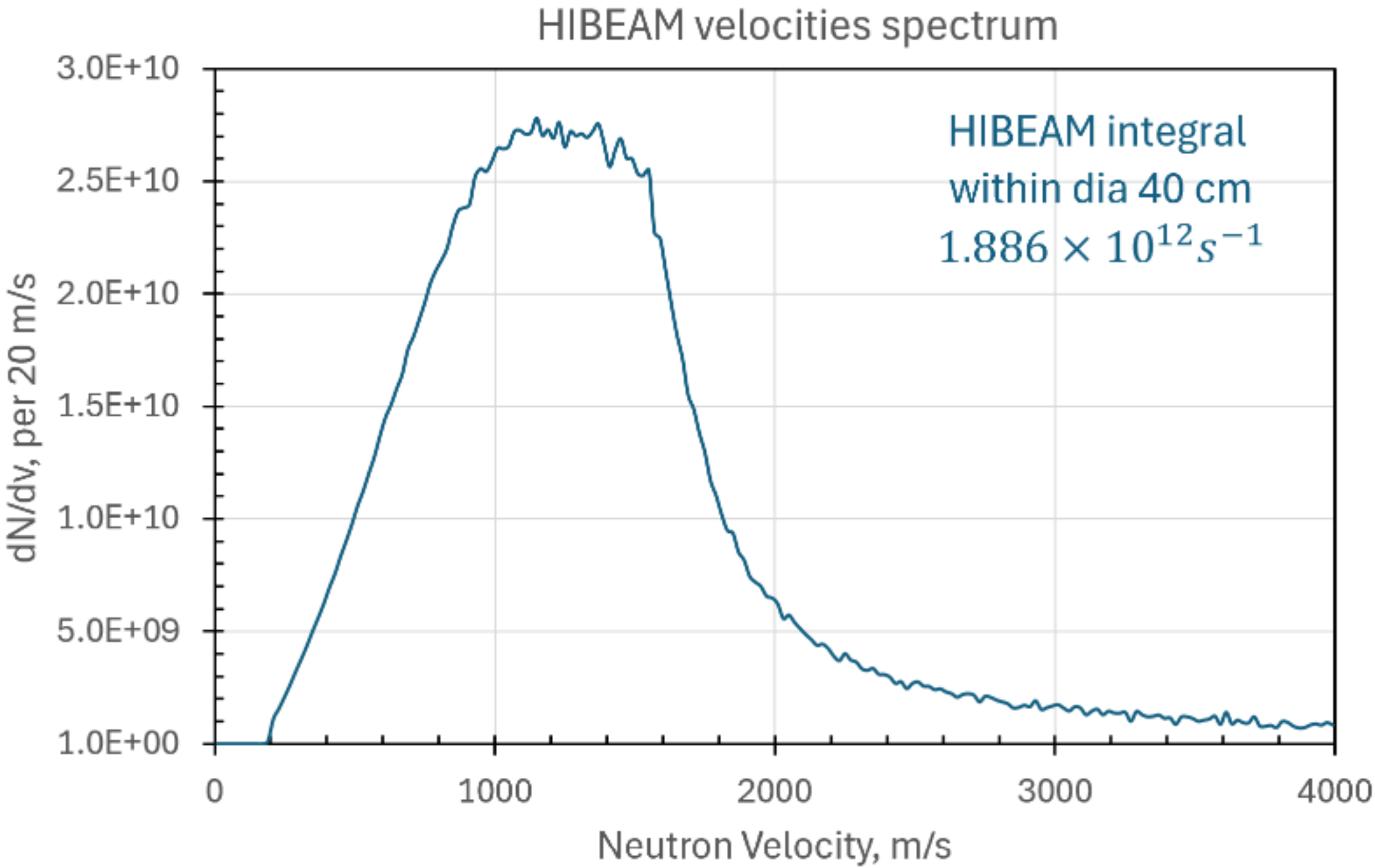
Beam intensity: 2.49×10^{12} n/s
In tube dia 40 cm 1.89×10^{12} n/s

Calculation of probability of $n \rightarrow n'$ is based on Eqs. (1), (2), (3) in Z. Berezhiani's 2012 paper
https://link.springer.com/article/10.1140/epjc/s10052-012-1974-5

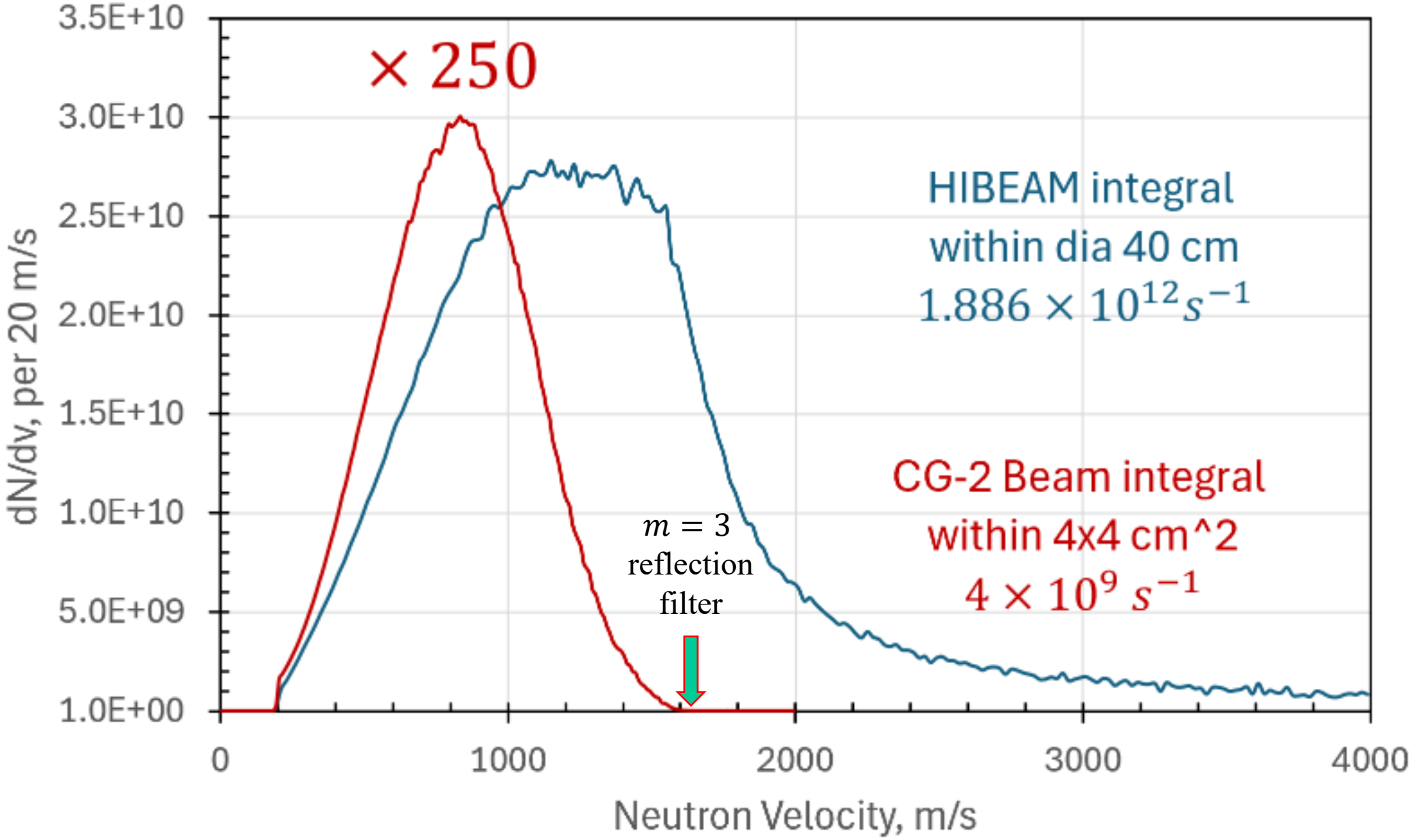
Parameters:

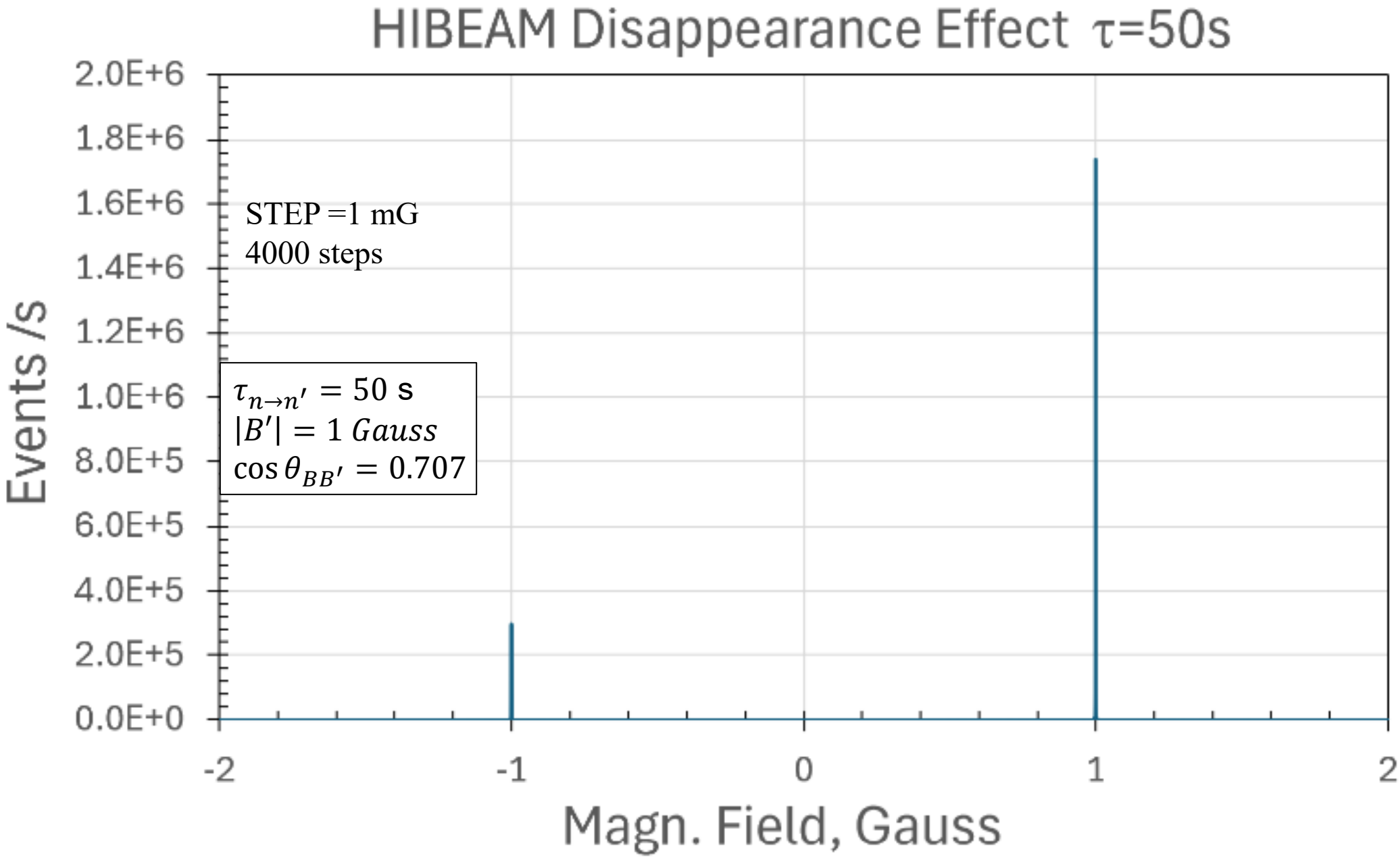
$\tau_{n \rightarrow n'} = 50$ s
$|B'| = 1\ Gauss$
$\cos\theta_{BB'} = 0.707$
Assuming solenoidal magnetic field varying by scan from $-2\ G$ to $+2\ G$



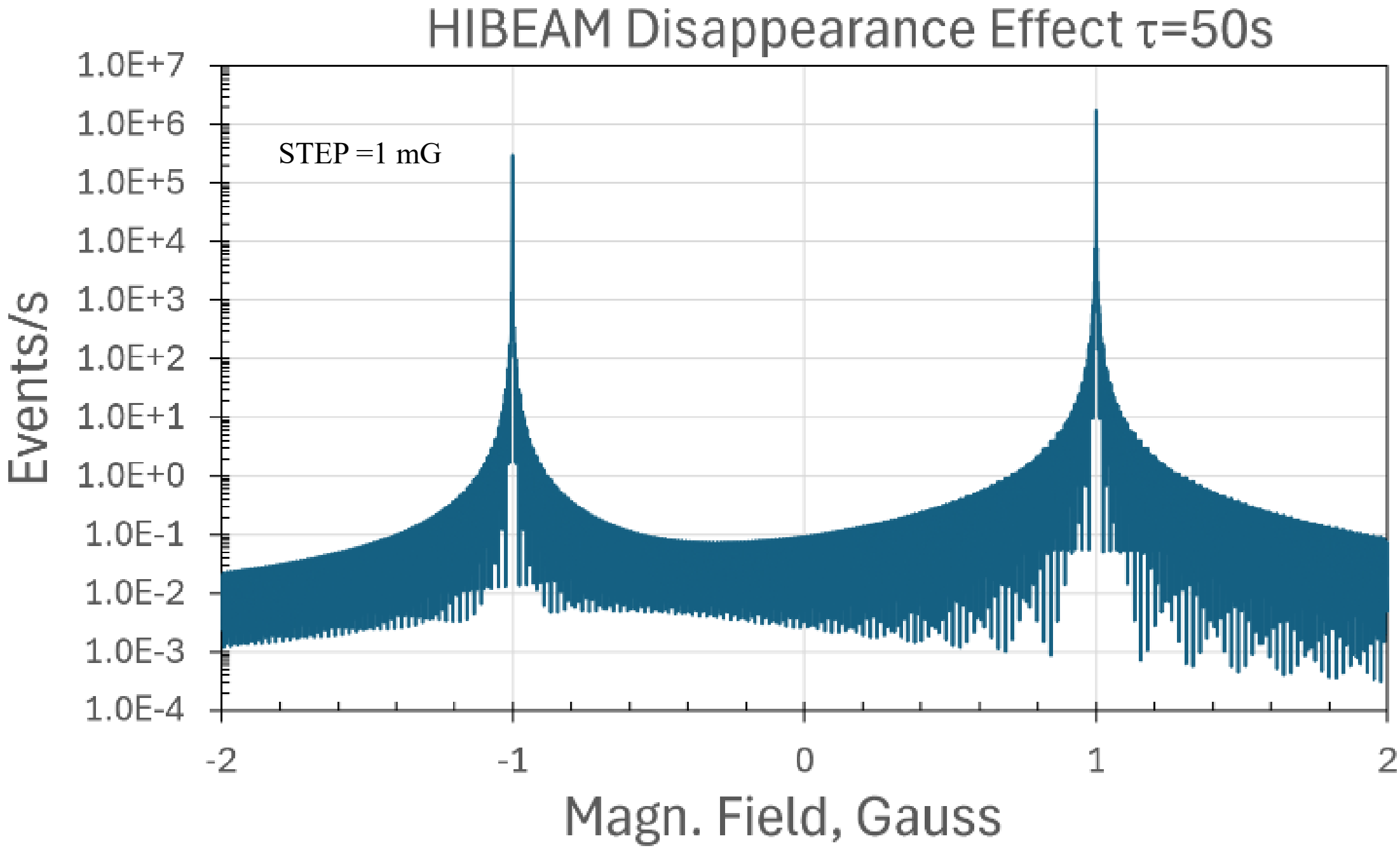

HIBEAM velocities spectrum
HIBEAM integral
within dia 40 cm
$1.886 \times 10^{12} s^{-1}$
dN/dv, per 20 m/s
3.0E+10
2.5E+10
2.0E+10
1.5E+10
1.0E+10
5.0E+09
1.0E+00
0
1000
2000
3000
4000
Neutron Velocity, m/s

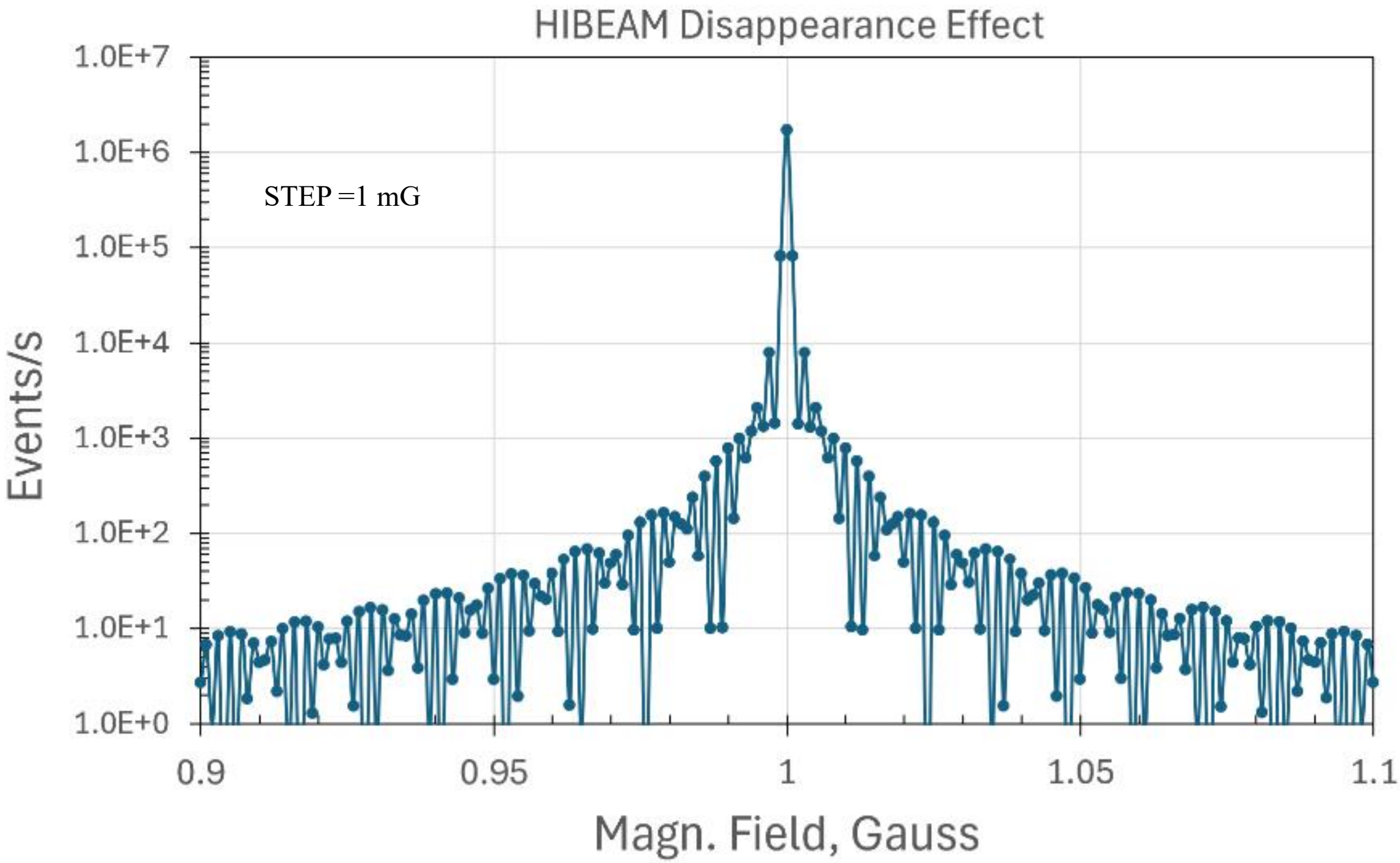
Comparison of HBEAM and CG-2 GP-SANS HFIR Spectra

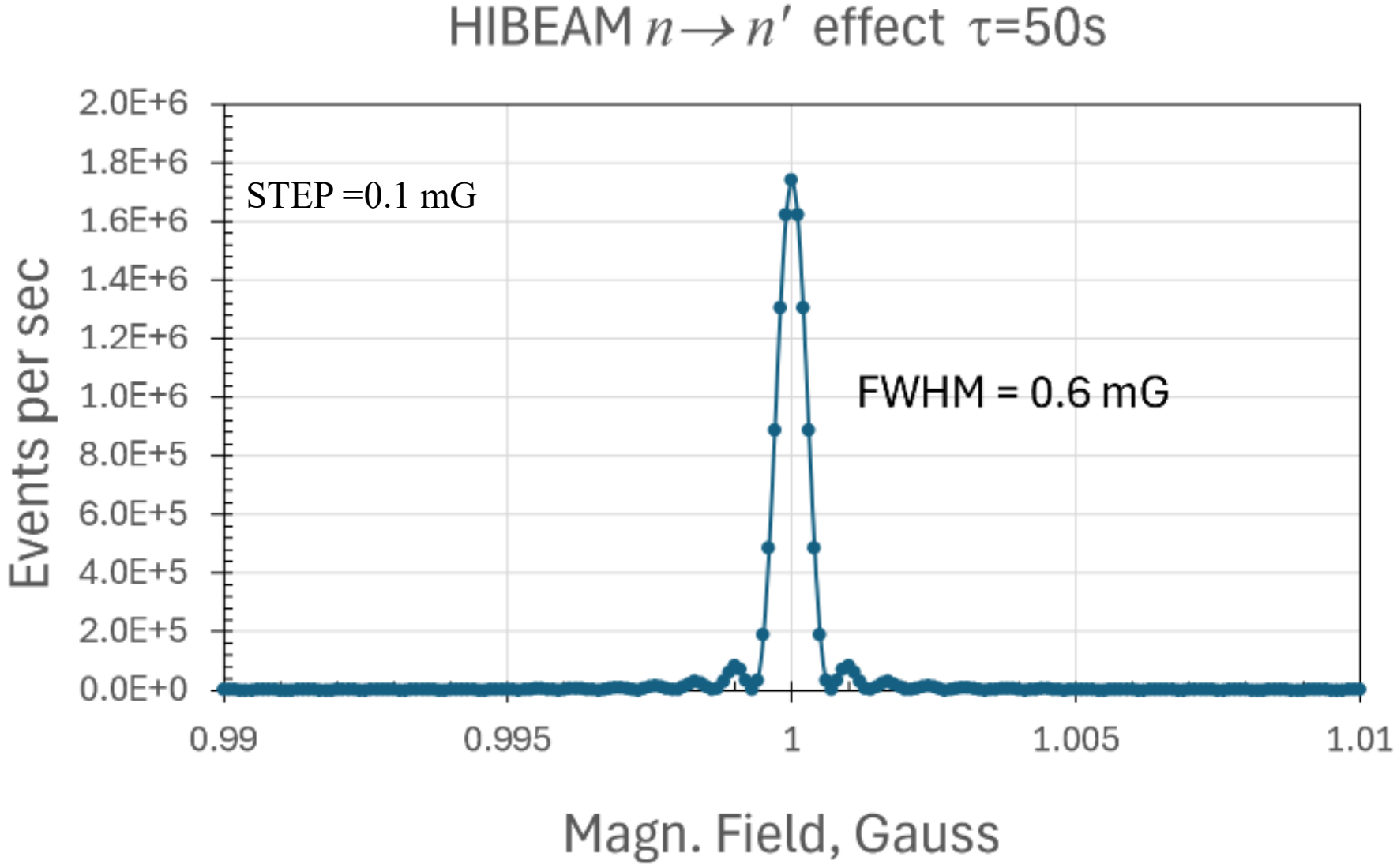




How not to miss the peak in the scan?


HIBEAM Disappearance Effect τ=50s
STEP =1 mG
Events/s
1.0E+7
1.0E+6
1.0E+5
1.0E+4
1.0E+3
1.0E+2
1.0E+1
1.0E+0
1.0E-1
1.0E-2
1.0E-3
1.0E-4
-2
-1
0
1
2
Magn. Field, Gauss


HIBEAM Disappearance Effect
STEP =1 mG
Events/s
1.0E+7
1.0E+6
1.0E+5
1.0E+4
1.0E+3
1.0E+2
1.0E+1
1.0E+0
0.9
0.95
1
1.05
1.1
Magn. Field, Gauss



For $\tau = 50\ s$ Peak Count 1.741×10^6

Disappearance effect $(1.89\text{E}12 - 1.74\text{E}6)/\ 1.89\text{E}12 = (1 - 9.21 \times 10^{-7})$

For $\tau = 500\ s$ effect is 100 times smaller

With line FWHM=0.6 mG reasonable step size would be e.g. 0.4 mG

To cover search range ±2 G one would need 10,000 steps by 0.4 mG

It is possible to perform less steps, e.g. 1,000 with step size 4.0 mG
on expense of correspondingly reducing sensitivity (can be optimized)