Comments on The Hansell experiment

- Several results of the experiment
  - Detect anti neutrino oscillations
  - Measure energy spectra of the anti neutrinos
  - Measure nu bar of ^{252}Cf

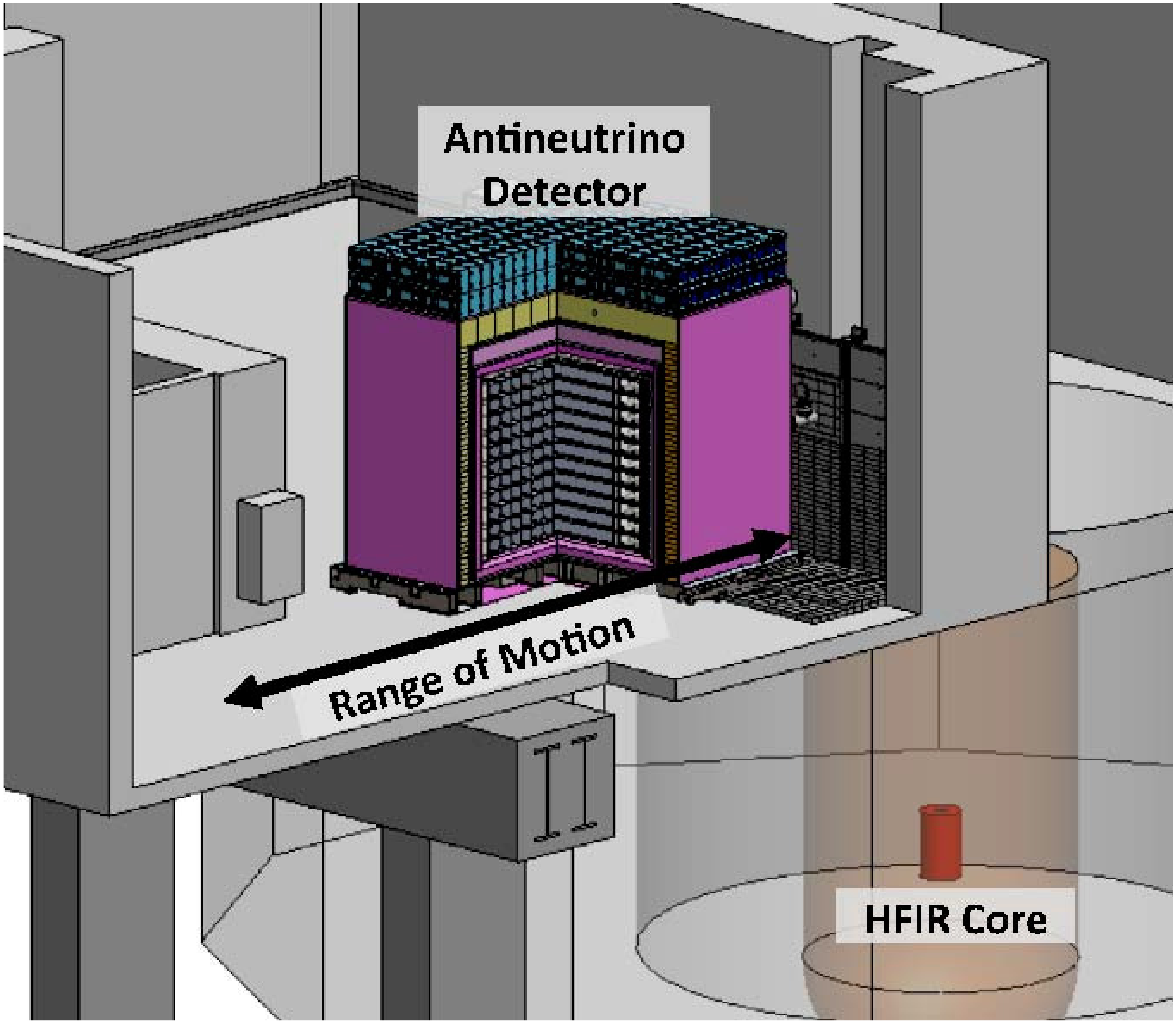
- Work done with the PROSPECT program

- The measurement was made with a large bank of ^{6}Li loaded liquid scintillation detectors. There were 154 individual segments (detectors) with a total of 4 tons of ^{6}Li.

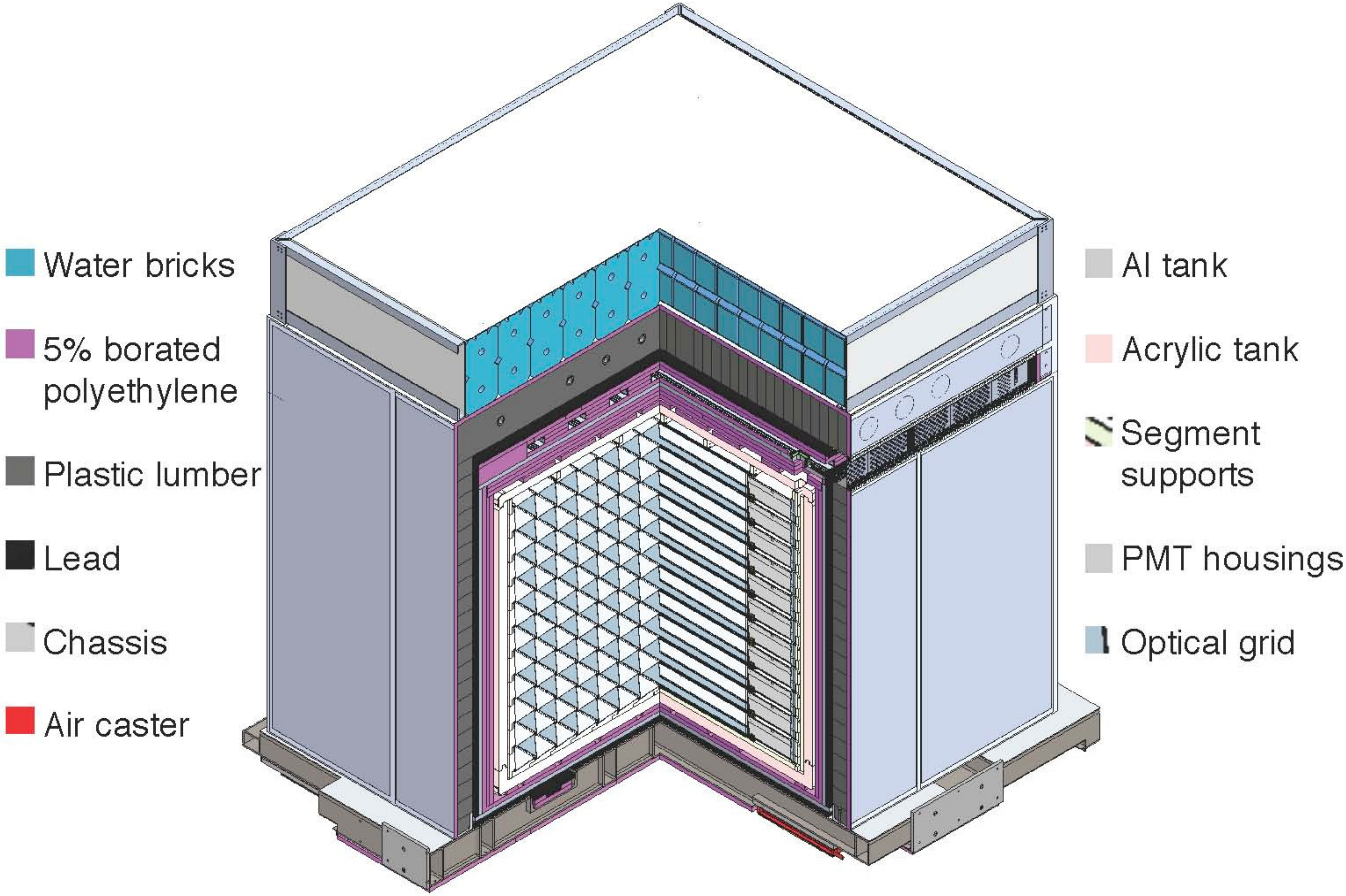
  - It differs from the scintillation tank type measurements since gamma-rays from an intense ^{252}Cf source near the detector start the detection process. Detection of fission fragments in a fission chamber is not used. The neutrons are detected using the ^{6}Li(n,t) reaction.

  - There is high efficiency for neutron detection, about 70%. The understanding of neutron detector efficiency is being studied thoroughly to hopefully reduce the uncertainty in the absolute measurement.

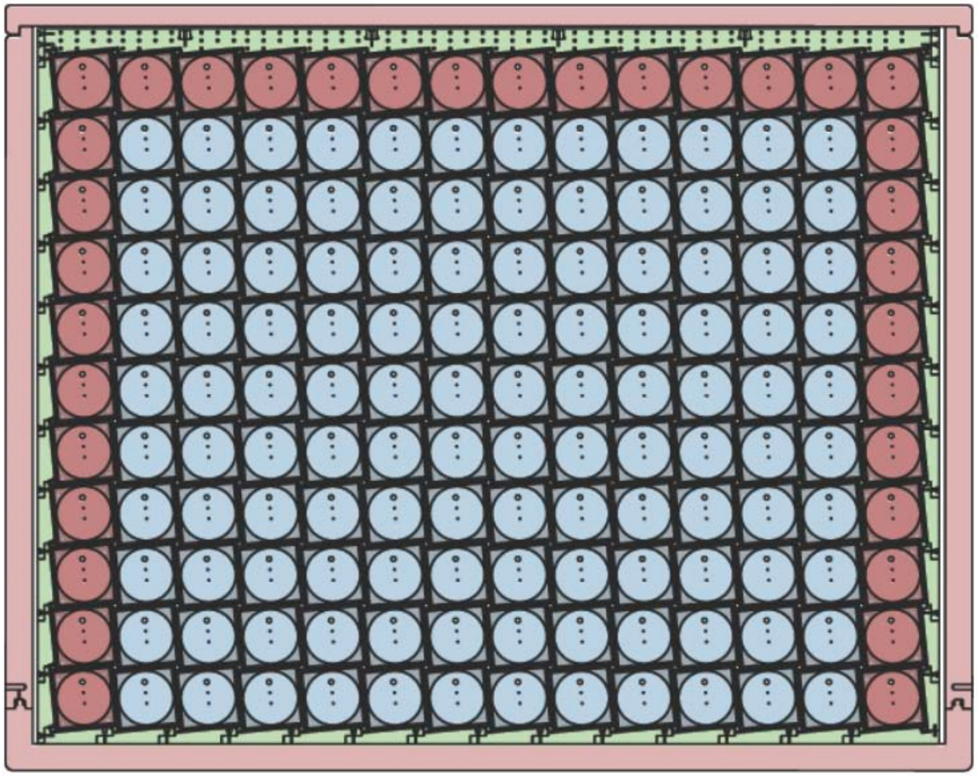
Hansell Detector

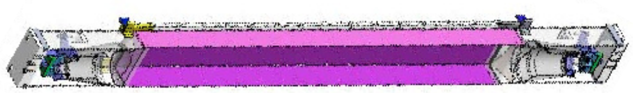


Hansell Neutron Detector



Hansell Neutron Detector

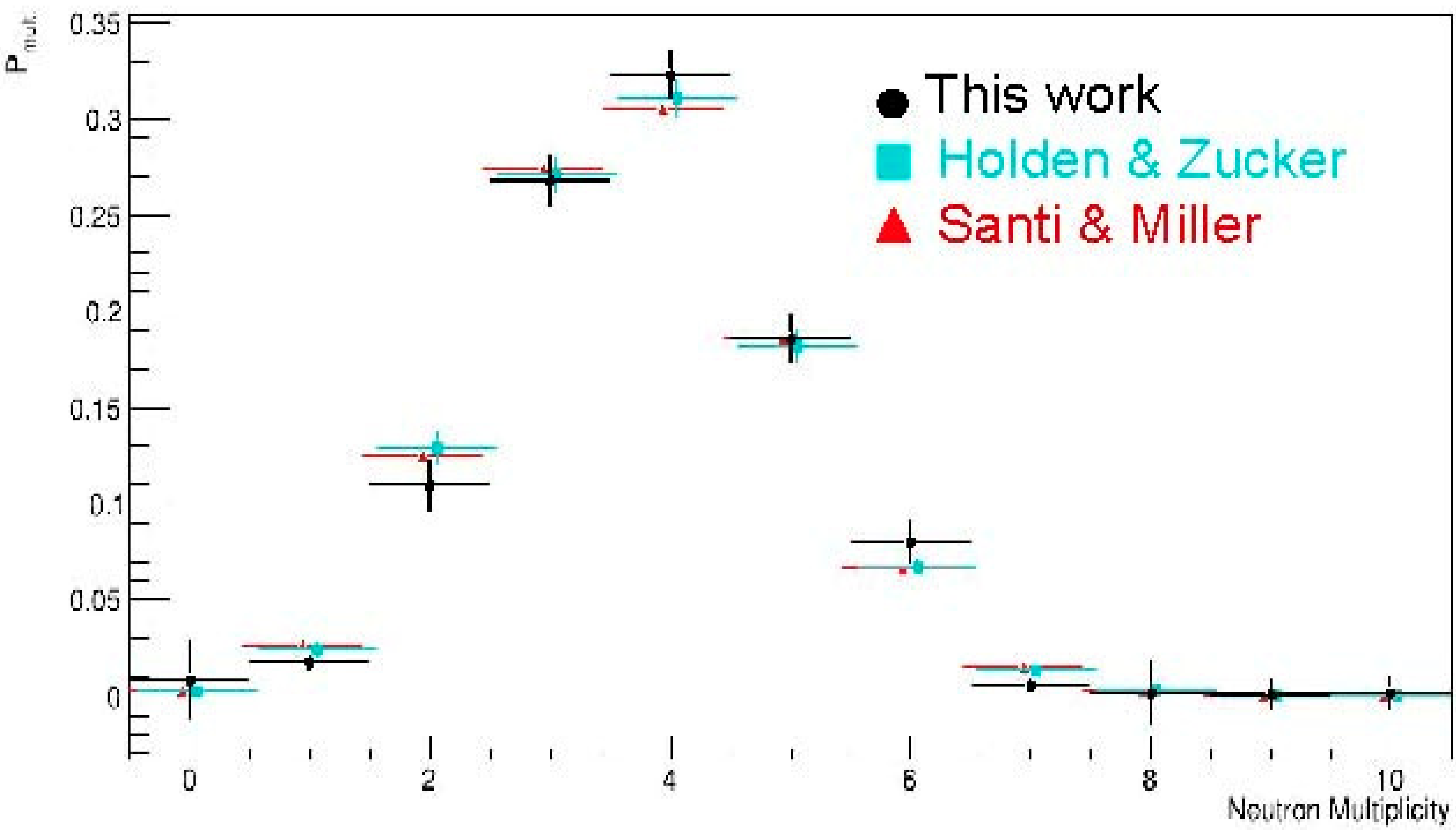




Comments on The Hansell nu bar experiment

- Data were obtained with the ^{6}Li loaded liquid scintillation detectors for the interval from 1μ to 300 μs after the detection of Prompt spontaneous γ rays.
- He determined the number of neutrons in that interval each time prompt spontaneous γ rays were detected. Thus, multiplicity values, P_o to P_{10} were obtained
- A threshold of 3 MeV was used for the detectors. Based on the work of Spencer and Guy this should eliminate delayed γ rays. It also eliminated the 2.2 MeV γ rays from hydrogen capture
- The uncertainty of 2.2 % is dominated by the uncertainty in the efficiency of the neutron detector. The efficiency was calculated based on the amount of ^{6}Li put into the detectors.
- They estimate they may be able to reduce the total uncertainty to about 1%
- Most measurements of nu bar for ^{252}Cf determined their detector efficiency primarily with a proton telescope so the detection of the proton defines the energy and presence of the associated neutron that goes into the detector. So the efficiency is known very well.

252Cf Mullltiplicity



252Cf Multiplicity

Hansell values obtained by normalizing the distribution by the integral of each multiplicity,

	Hansell	1992	1993
	Present Work	Holden & Zucker	Santi & Miller
P_0	0.009 ± 0.021	0.0023 ± 0.00121	0.0021767 ± 0.00012
P_1	0.0173 ± 0.0046	0.024 ± 0.004	0.0259869 ± 0.00123
P_2	0.109 ± 0.014	0.129 ± 0.008	0.1251188 ± 0.00132
P_3	0.268 ± 0.014	0.271 ± 0.001	0.2740459 ± 0.00119
P_4	0.322 ± 0.013	0.310 ± 0.011	0.3050812 ± 0.00144
P_5	0.186 ± 0.013	0.181 ± 0.009	0.1854741 ± 0.00119
P_6	0.080 ± 0.012	0.067 ± 0.004	0.0658998 ± 0.00065
P_7	0.006 ± 0.003	0.013 ± 0.003	0.0142918 ± 0.00096
P_8	0.0014 ± 0.018	0.0027 ± 0.0013	0.0018219 ± 0.0003
P_9	0.0004 ± 0.009	0.00004 ± 0.00007	0.0001022 ± 0.00017
P_{10}	0.0012 ± 0.009	$0.00000043 \pm 0.00000142$	0.0000005 ± 0.0000016
$< v >$	3.805 ± 0.053	3.797 ± 0.020	3.757 ± 0.010

Experimental Values of Neutron Multiplicity of ^{252}Cf (nu bar)

Author	Year	Value (Uncertainty)	Method
Asplund	1963	3.7910 (1.066%)	scintil.
Hopkins	1963	3.7767 (0.838%)	scintil.
Boldeman	1977	3.7549 (0.431%)	scintil.
Zhang	1981	3.7534 (0.490%)	scintil.
Spencer	1982	3.7831 (0.221%)	scintil.
Colvin/Axton*	1966	3.7299 (0.806%)	Mn-bath
DeVolpi	1970/72	3.7507 (0.463%)	Mn-bath
White*	1968	3.8194 (1.033%)	Mn-bath
Axton	1985	3.7547 (0.300%)	Mn-bath
Bozorgmanesh	1977	3.7475 (0.580%)	Mn-bath
Spiegel	1981	3.7828 (0.759%)	Mn-bath
Aleksandrov	1981	3.7618 (0.483%)	Mn-bath
Smith	1984	3.7678 (0.303%)	Mn-bath
Colvin/Ullo	1965	3.7405 (0.438%)	B-pile
Edwards	1982	3.7641 (0.711%)	B-pile