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INFORMAL REPORT

GALLEX INTERNAL NOTE GX 79 (July 1995)

Update of the major results from the GALLEX Cr-neutrino source experiment

GALLEX collaboration

1. INTRODUCTION

Preliminary results of the GALLEX Cr-neutrino source experiment were published in Ref.[1] (submitted November 1994). This covered counting data acquired until 8 November 1994, and preliminary source activity determinations. The major published results are:

$\tilde{A}_0$ = ^{51}Cr source activity at E.O.B. deduced from ^{71}Ge production in Ga = 64.1 ± 7.4 PBq
A_0= calibrated ^{51}Cr source activity at E.O.B. = 61.9 ± 1.2 PBq
$R = \tilde{A}_0 / A_0 = 1.04 \pm 0.12$.

Meanwhile, we have

- completed counting and continued the evaluation of counting results
- added more source activity measurements, and expanded and improved earlier activity determinations.

It is planned to publish the final result together with the results from the upcoming second Cr-source irradiation, about one year from now. Meanwhile, we give here an update which should be very close to but not necessarily identical with the final result. Experimental details in addition to those given in [1] will be contained in Ref.[3], now in preparation.

2. COUNTING UPDATE

The individual counting run results are given for all 11 runs in Table 1 and illustrated in Figure 1. (Note that in Ref.[1] we had only data on the first seven [uncompleted] runs). The overall result is expressed as apparent source activity at E.O.B. with neutrino capture cross section and path length in the gallium target taken as before [1]. The background due to solar neutrinos and side reactions is updated to be 0.76 ^{71}Ge atoms produced per day [2]. We obtain

$\tilde{A}_0 = 60.4 \pm {}^{5.9}_{5.6}$ (stat.) ± 3.1 (syst.) PBq or, with errors added in quadrature,
$\tilde{A}_0 = 60.4 \pm {}^{6.7}_{6.4}$ PBq.

3. MEASUREMENT OF THE SOURCE ACTIVITY

We have now acquired 8 individual data sets which fall into 4 categories:

1. calorimetry
2. reactor monitoring (neutronics; γ-scanning)
3. γ- spectrometry (ionization chamber; Ge(HP)-detectors)
4. chemical analysis of the decay product ^{51}V.

The first two categories are integral methods, the last two categories depend on sampling. The results for data sets S1 - S8 are given in Table 2. The individual errors quoted include systematical errors. Relative to Ref. [1], Sets S7 and S8 are completely new. S5 and S6 are now based on 27 samples , only 5 had been available before. For S1-S4, data evaluations have been refined and upgraded.

The weighted mean from these determinations is
$A_0 = 62.5 \pm 0.4$ PBq.
A most conservative ('maximum error') approach yields
$A_0 = 62.5 \pm {}^{1.9}_{1.2}$ PBq (range of individual results).

4. CONCLUSIONS

For the ratio of the radiochemically measured and of the expected activity the updated result is $\mathbf{R = \tilde{A}_0 / A_0 = 0.97 \pm 0.11}$, fully consistent with the preliminary value published in [1]. Summarizing, we find 97 % of the expected neutrino signal with an 1σ-uncertainty of $\approx$11%. The earlier conclusions given in [1] remain unchanged: unknown systematical errors in GALLEX can at most be of order 10%.

Table 1: Parameters and results of *all* source runs
see Table 2 of Ref.[1] for further explanations . The mean lives deduced from the data are $T_{1/2} = 12.3 \pm {}^{1.4}_{1.2}$ d for ^{71}Ge and $T_{1/2} = 23.8 \pm {}^{4.2}_{3.4}$ d for ^{51}Cr.

Source run number	Exposure number	Exposure time Start	Stop	Duration [days]	Total counting life time	$\tilde{A}_0$ [PBq]
Cr 1	S 107	23.06.94	27.06.94	3.35	193.7	65.4 ± 18.0
Cr 2	S 108	27.06.94	01.07.94	4.00	189.7	73.6 ± 17.7
Cr 3	S 109	01.07.94	06.07.94	5.00	184.6	58.9 ± 16.3
Cr 4	S 110	06.07.94	13.07.94	7.00	206.7	58.3 ± 14.1
Cr 5	S 111	13.07.94	20.07.94	7.00	198.9	62.8 ± 17.5
Cr 6	S 112	20.07.94	27.07.94	7.00	192.7	52.8 ± 17.7
Cr 7	S 113	27.07.94	09.08.94	13.00	179.6	67.9 ± 17.9
Cr 8	S 114	09.08.94	24.08.94	15.00	189.4	43.0 ± 20.2
Cr 9	S 115	24.08.94	07.09.94	14.00	174.5	70.6 ± 29.6
Cr 10	S 116	07.09.94	28.09.94	21.00	168.5	5.2 ± 32.1
Cr 11	S 117	28.09.94	10.10.94	12.00	203.6	94.5 ± 53.2

Table 2: ^{51}Cr - source calibrations

Set# *)	Method *)	Lab	Reported in Ref.[1]?	Updated Result [PBq]
S1	Calorimetry	Grenoble/Saclay	yes	61.9 ± 3.0
S2	Neutronics	Grenoble	yes	64.4 ± 5.2
S3	γ-scanning	Grenoble	yes	64.0 ± 5.2
S4	Ionization chamber	Saclay	yes	61.3 ± 0.8
S5	Ge(HP) γ-spectrom.	Karlsruhe	only small part	63.1 ± 0.9
S6	Ge(HP) γ-spectrom.	Heidelberg	only small part	63.2 ± 0.9
S7	Ge(HP) γ-spectrom.	Brookhaven	no	63.1 ± 1.0
S8	Vanadium yield	Brookhaven	no	62.3 ± 1.1
mean				**62.5 ± 0.4**

*) see text

REFERENCES

[1]GALLEX collaboration, P.Anselmann et al., First results from the ^{51}Cr neutrino source experiment with the GALLEX detector. Phys.Lett. B 342 (1995) 440-450

[2]GALLEX collaboration, P.Anselmann et al., GALLEX solar neutrino observations: complete results for GALLEX II. GX 75-1995, accepted Phys.Lett.B (July 1995, to appear).

[3] M.Cribier et al, Production of a 62 PBq ^{51}Cr low energy neutrino source for GALLEX. to be submitted to NIM, fall 1995.

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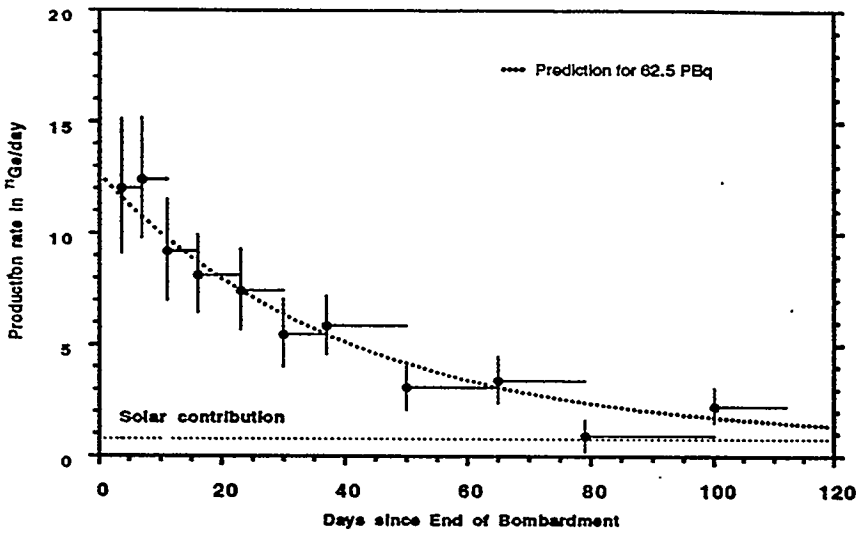
Figure 1: Individual run results vs. time since E.O.B.
see Fig.6 of Ref. [1] for further explanations



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