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In this paper the measurements are reported of the life-times of two excited states of 235.7 and 263.2 keV in ^{182}Re which can be studied in the disintegration of the 22 h ^{182}Os . The main features of the decay of ^{182}Os are shown in Fig.1. This scheme is based on combined γ and β spectroscopy measurements, which will be published independently.

Experimental Procedure

The sources of ^{182}Os were obtained by bombarding the Au target with 660 MeV protons in the Dubna synchrocyclotron. The osmium fraction separated from the products of the spallation reaction contained mainly two radioisotopes of ^{182}Os/$T_{½}$= 22^h/ and ^{183}Os / $T_{½}$ = 12^h/. Because of the existence of the 8 nsec excited state in ^{183}Re , the activity of the ^{183}Os could disturb the life-time measurements, hence the sources were left to decay for five days after the separation. The growing ^{182}Re activity was removed from the source before each measurement. The purity of the source was checked with a lithium-drifted Ge(Li) gamma ray spectrometer. Life-time measurements were performed with NaJ(Tl) scintillators (2.5"x2.5") and (0.75"x 1.25") coupled to RCA 6810A photomultipliers and with a time to amplitude converter (TAC) based on a start-stop principle. The converter output pulses were amplified and then analysed with a 512-channel pulse-height analyzer (PHA). Single-channel analyzers were used to select from the spectra the particular energy regions of the gamma rays and fed inputs of a slow coincidence circuit which provided the gate pulses to the multichannel PHA. The TAC was calibrated by measuring the centroid positions of the prompt coincidence curves (taken with ^{22}Na) for various delays. The delay cables were calibrated to an accuracy of 2%. The output from the TAC was linear against a delay from 10 nsec to 500 nsec. The apparatus was checked by the half-life measurements for the 481 keV state in ^{181}Hf .

The Life-Time of the 235.7 keV State

The life-time of the 235.7 keV state was measured using two Na J(Tl) detectors. One of them, gating the 274±25 keV energy, provided the start pulses and the second, gating the 180±20 keV energy, provided the stop pulses. The example of the time spectrum after substraction of the accidental coincidences is shown in Fig.2. The least-square fit of the slopes for three independent measurements gives the average value of $T_{1/2}$ =(0.57±0.04) μsec for the half-life of the 235.7 keV level in ^{182}Re .

In order to prove that the measured life-time really belongs to the 235.7 keV level in ^{182}Re , the delayed $\gamma-\gamma$ and $\gamma X-\gamma$ -coincidences were measured using the Ge(Li) -detector in coincidence with the NaJ(Tl) counter. The delvaed gamma rav spectra measured with the 350 nsec delay with respect to KX rays and to the 274 keV gamma rays are shown in Figs.3a and 3b, respectively. The spectra are very similar and reveal three delayed gamma transitions, 55.5 keV, 180.2 keV, and 235.7 keV. This is consistent with the proposed decay scheme of ^{182}Os (Fig.1) with the 235.7 keV isomeric state responsible for the delayed coincidences.

The Life-Time of the 263.2 keV State

The life-time of the 263.2 keV state was measured with the same apparatus about 5 days after each separation of the osmium fraction, when the ^{183}Os activity substantially diminished. Delayed coincidence measurements were performed for the cascade (130+115) - 263) keV. The half-life is obtained from the slope of the delayed coincidence curve (Fig.4). The weighted average of three independent experiments is : $T_{1/2}$ =(5.27 ±0.16) nsec .

The assignment of the 5.27 nsec half-life to the 263.2 keV level in ^{182}Re was supported by a measurement with the energy gates accepting both 246.6 and 263.2 keV gamma transitions, not resolved with the NaJ(Tl) counters. In this case the delayed coincidence curve had slopes corresponding to the $T_{1/2}$=5.27 nsec on both sides (Fig.5). When the gates were set on 382 keV and 168 keV energies where photopeaks of the strong gamma transitions occurred from ^{183}Os , slightly remaining in the source, the half-life of (7.90±0.20) nsec was obtained (Fig.6). This is in excellent agreement with the result of Gerdau et al. /1/ for the $T_{1/2}$ of the 496 keV state in ^{183}Re .

Furthermore, a separate measurement was carried out with a pure source of the ^{182}Re and , with similar energy gate settings, the delayed coincidence curve was the prompt curve. This excludes the assignment of the 5 nsec life-time to any of the ^{182}W level.

The authors wish to thank Professor G.N.Flerov for enabling us to work in his Laboratory and for his interest in this work.

References

1. *E.Gerdau et al. Intern. Conference on Hyperfine Interaction Detected by Nuclear Radiation, Asilomar 1967.*

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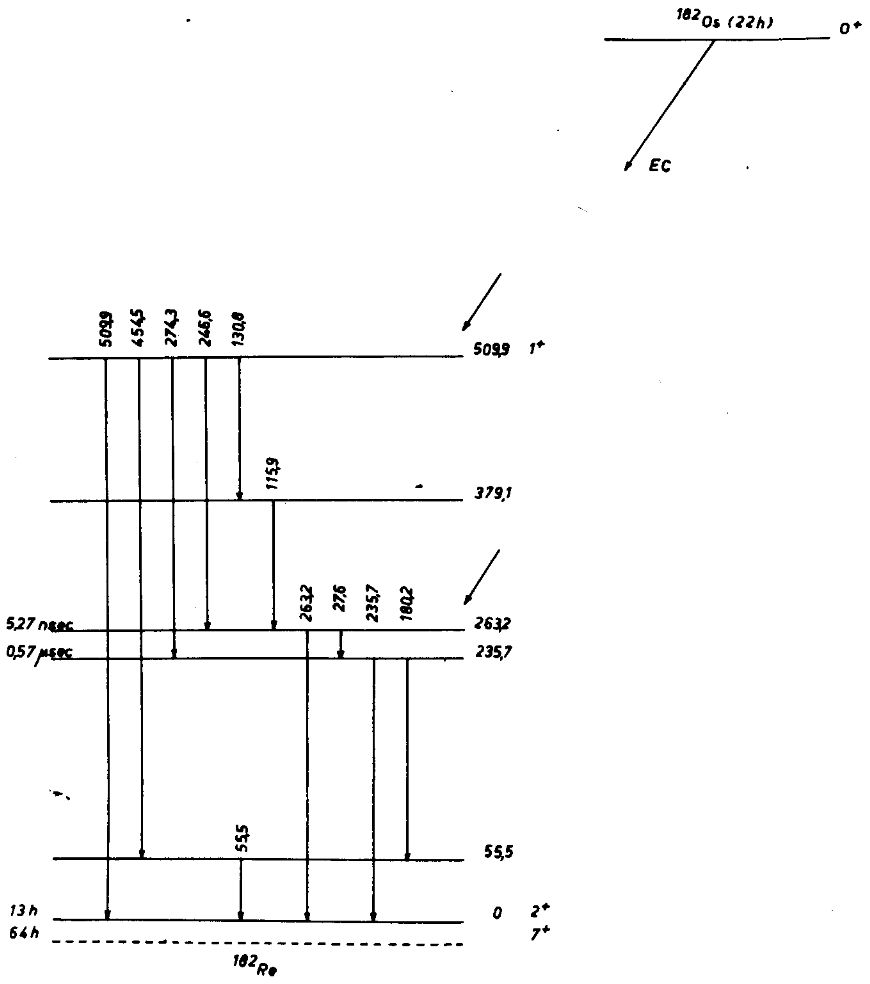

Fig.1 Part of the ^{182}Re scheme.

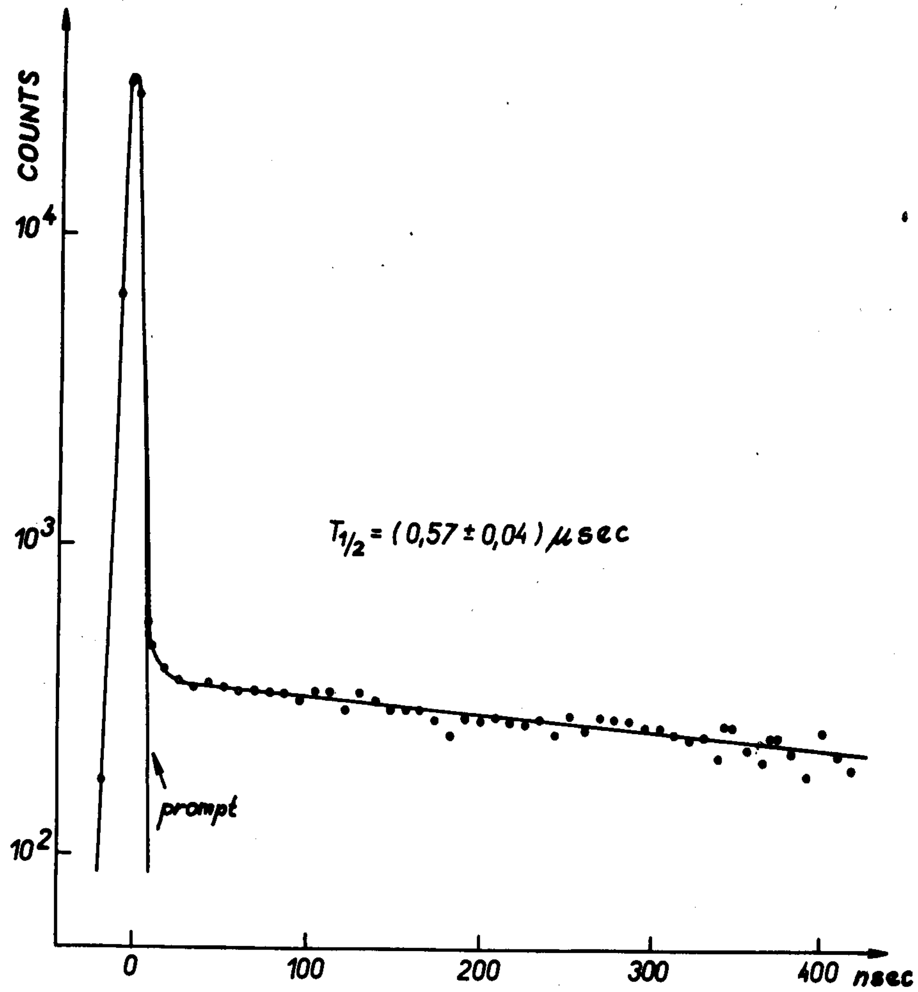

Fig.2. The decay curve of the 235.7 keV state.

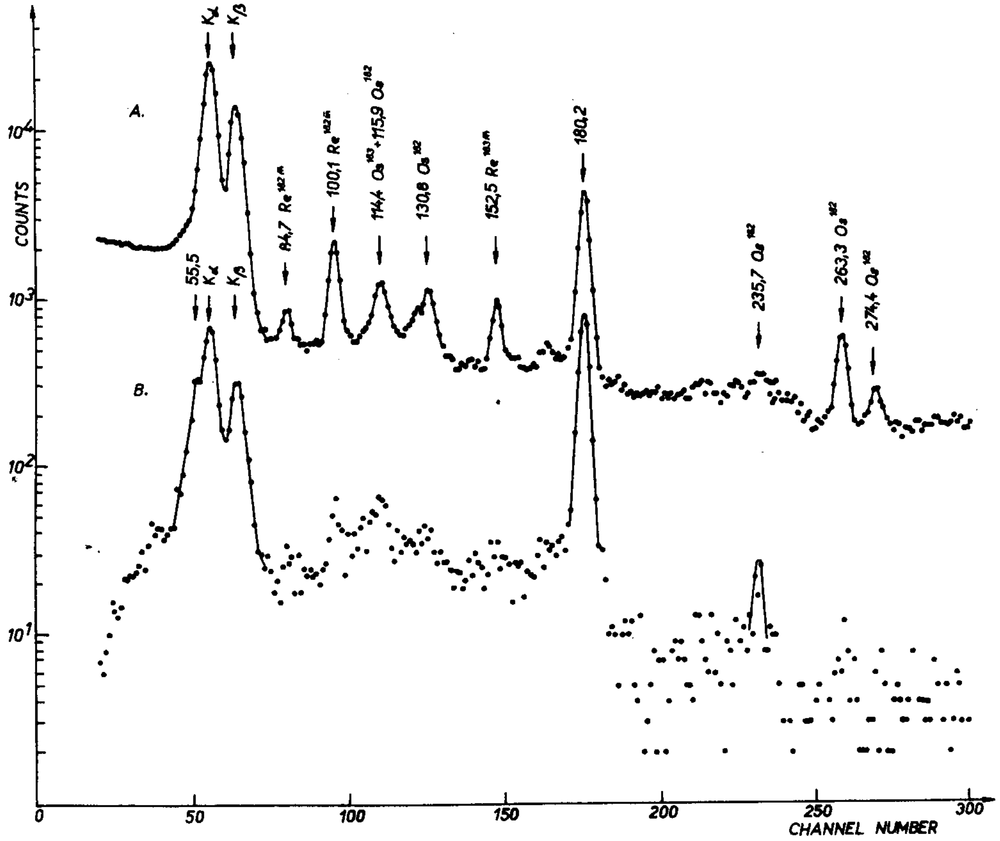

Fig.3a The delayed gamma ray spectrum measured with the 350 nsec delay with respect to KX rays (B).

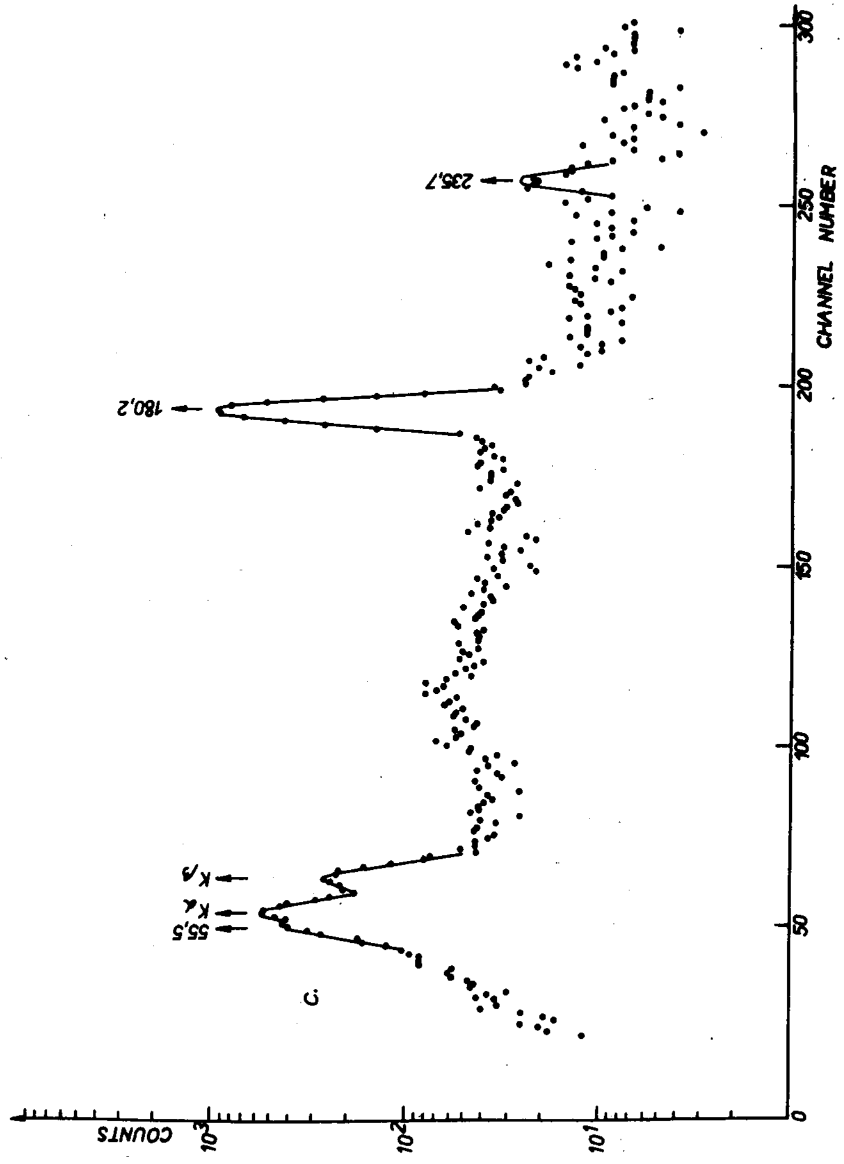

Fig.3b The delayed gamma ray spectrum measured with the 350 nsec delay with respect to 274 keV gamma rays.

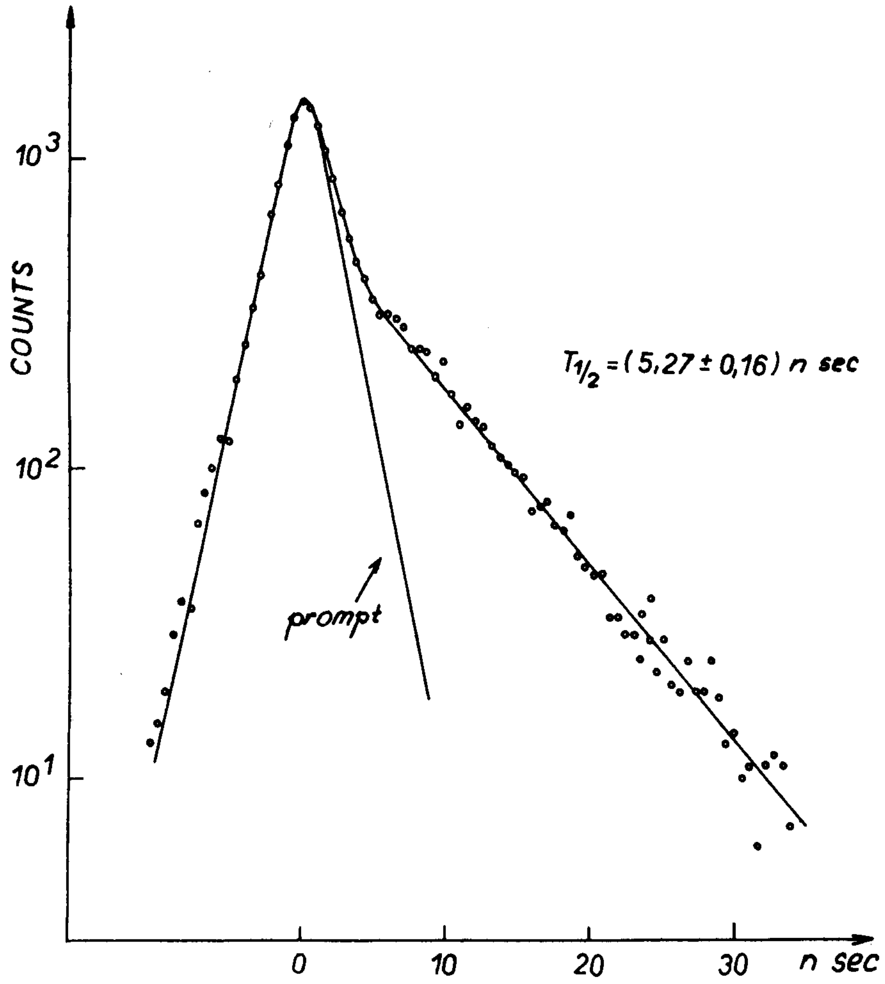

Fig.4 The decay curve of the 263,2 keV state.

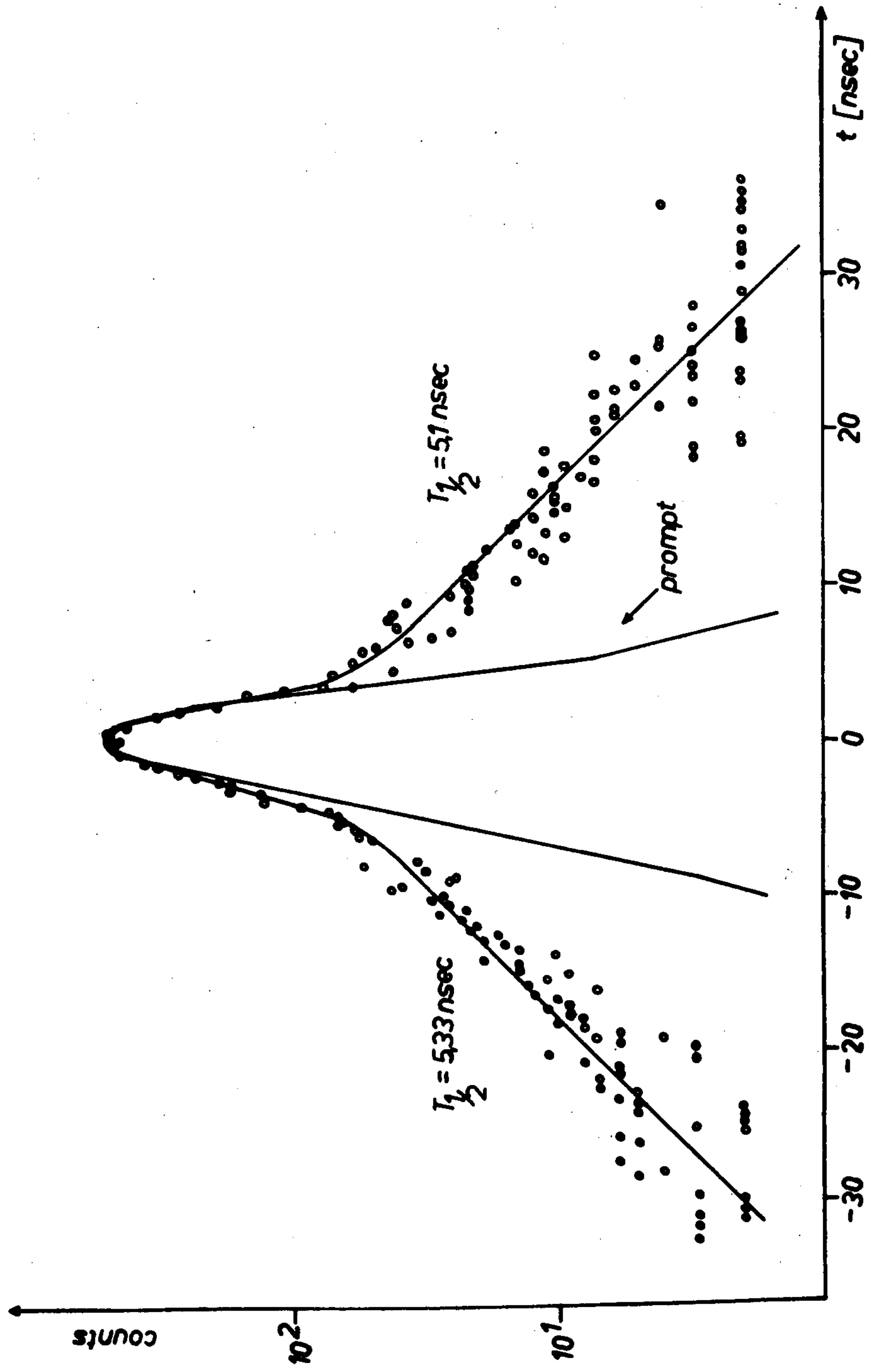

Fig.5 The decay curve of the 263,2 keV state. The measurement with the energy gates accepting 246,6. and 263,2 keV gamma transitions.

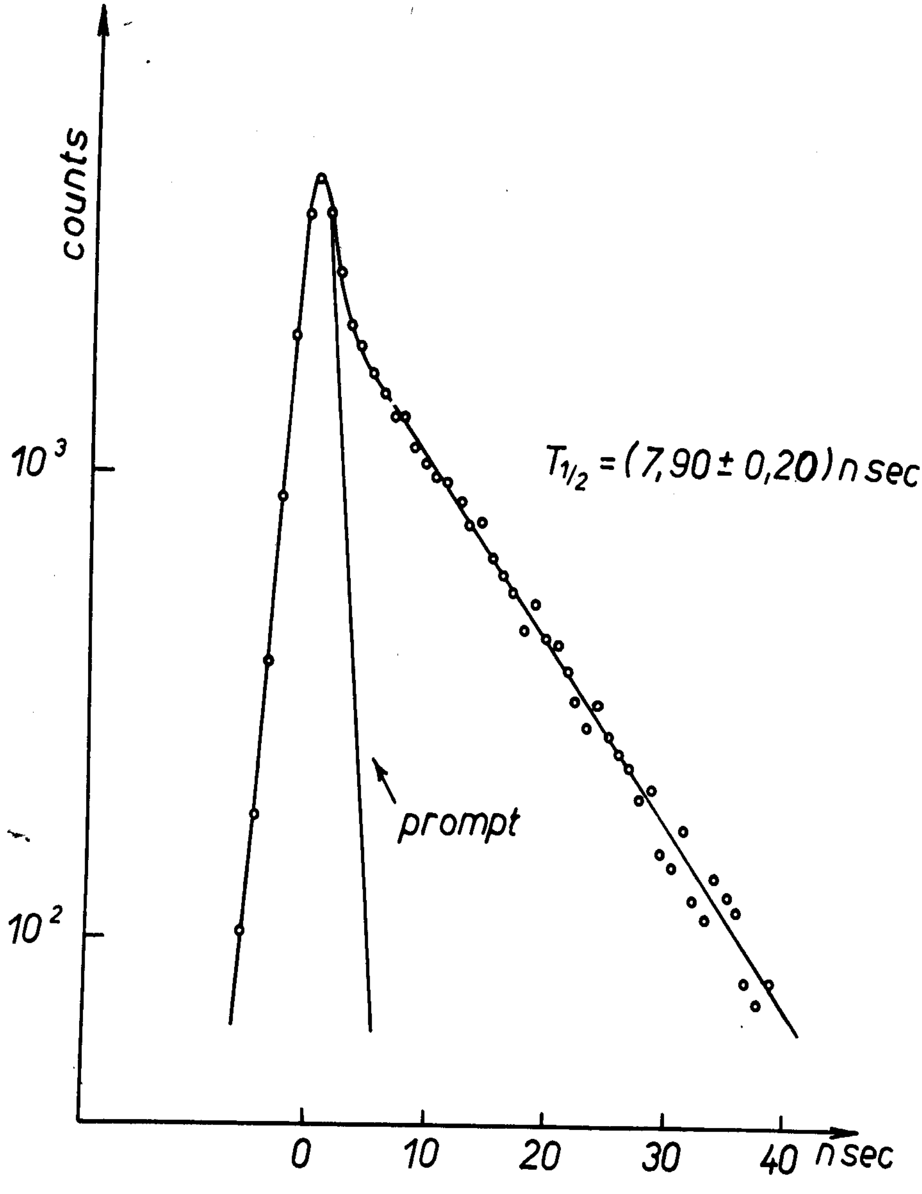

Fig.6 The decay curve of the 496. keV state of ^{183}Re .