



Doctoral Thesis

Direct measurement of the final-sticking probability in muon catalyzed dt fusion using the "survived muon method"

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and report of Institute for Particle Physics of ETHZ

**Direct Measurement of the Final-Sticking
Probability in Muon Catalyzed dt Fusion Using
the "Survived Muon Method"**

**ABHANDLUNG
Zur Erlangung des Titels
DOKTOR DER NATURWISSENSCHAFTEN
der
EIDGENÖSSISCHEN TECHNISCHEN HOCHSCHULE ZÜRICH**

**vorgelegt von
KEGANG LOU
geboren am 4. Februar 1963
V.R. China**

**Angenommen auf Antrag von
Herrn Prof. Dr. H.-J. Gerber ETH, Referent
Herrn Dr. C. Petitjean PSI, Korreferent**

1993



full anodes.

Therefore, the value of ω_s with R free presented above is not considered to be as reliable as the first value and is not quoted in table 9.5.

9.5 Result of this thesis

We have presented the results of ω_s using the “survived muon method”, we deduced

$$\omega_s = (0.565 \pm 0.046(stat.) \pm 0.025(syst.))\%,$$

and using the “direct method”:

$$\omega_s = (0.562 \pm 0.015(stat.) \pm 0.039(syst.))\%,$$

with stripping probability fixed at the theoretical calculation $R = 0.31(3)$.

It is difficult to determine R from the data because the systematic uncertainties of the shape of $\mu\alpha$ and stripping events are too large.

The full anode values of ω_s are in good agreement with the results of the inner anodes; all are listed in table 9.5.

ω_s [%]	Survived Muon Method	Direct Method	
		R fixed	R free
inner anodes	$0.574 \pm 0.065 \pm 0.020$	$0.555 \pm 0.021 \pm 0.030$	$0.539 \pm 0.020 \pm 0.056$
full anodes	$0.565 \pm 0.046 \pm 0.025$	$0.562 \pm 0.015 \pm 0.039$	—

Table 9.5: Results on the final sticking parameter ω_s from the 1992-run data; see also [90] [91] [92].

We use as best values in table 9.5,

$$\omega_s = (0.565 \pm 0.046(stat.) \pm 0.025(syst.))\%$$

in the “survived muon method” from the data of the full anodes,
and

$$\omega_s = (0.555 \pm 0.021(stat.) \pm 0.030(syst.))\%$$

in the “direct method” from the data of the inner anodes.

Combining the errors of statistics and systematics, we have,

$$\omega_s = (0.565 \pm 0.052)\% \text{ using the “survived muon method”,}$$

and

$$\omega_s = (0.555 \pm 0.037)\% \text{ using the “direct method”}.$$

In the first case, the statistical error dominates, being 78% of the total error ¹. In the second case, the systematic error dominates, representing 67% of the total error. This is the main result of this thesis.

¹The contribution to the total error is calculated quadratically.