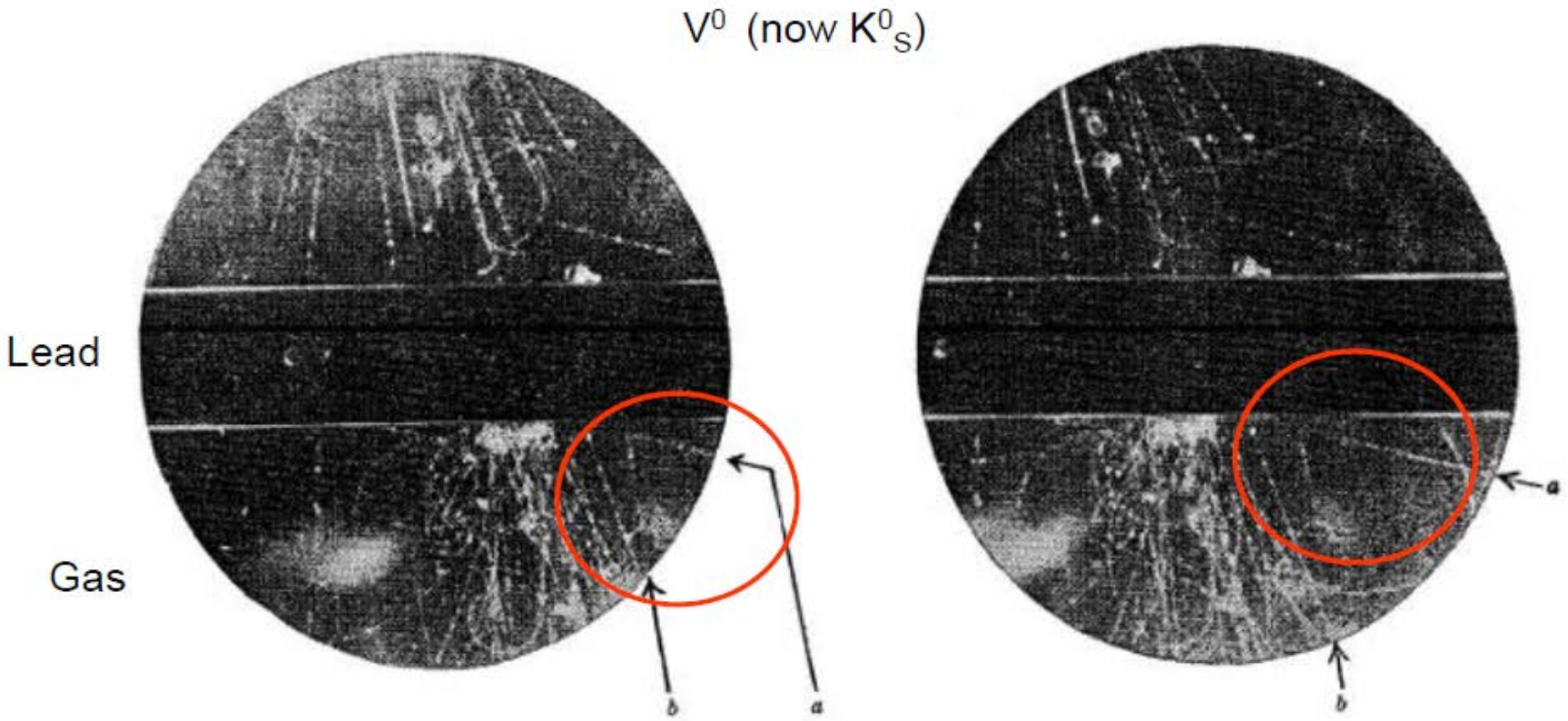
Discovery of the K_s

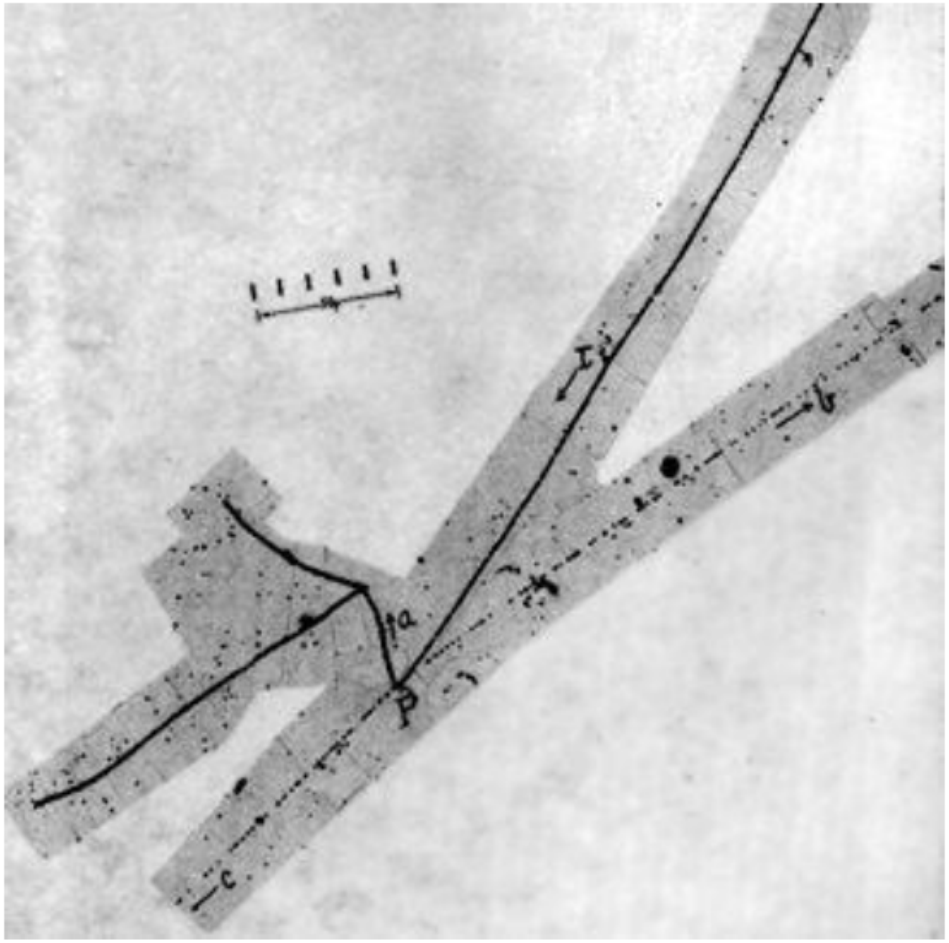


Rochester & Butler, 1947 in a cloud chamber exposed to **cosmic rays**

" Forked tracks of a very striking character "

Discovery of $K^+ \rightarrow \pi^+ \pi^- \pi^+$

τ^+ historical name

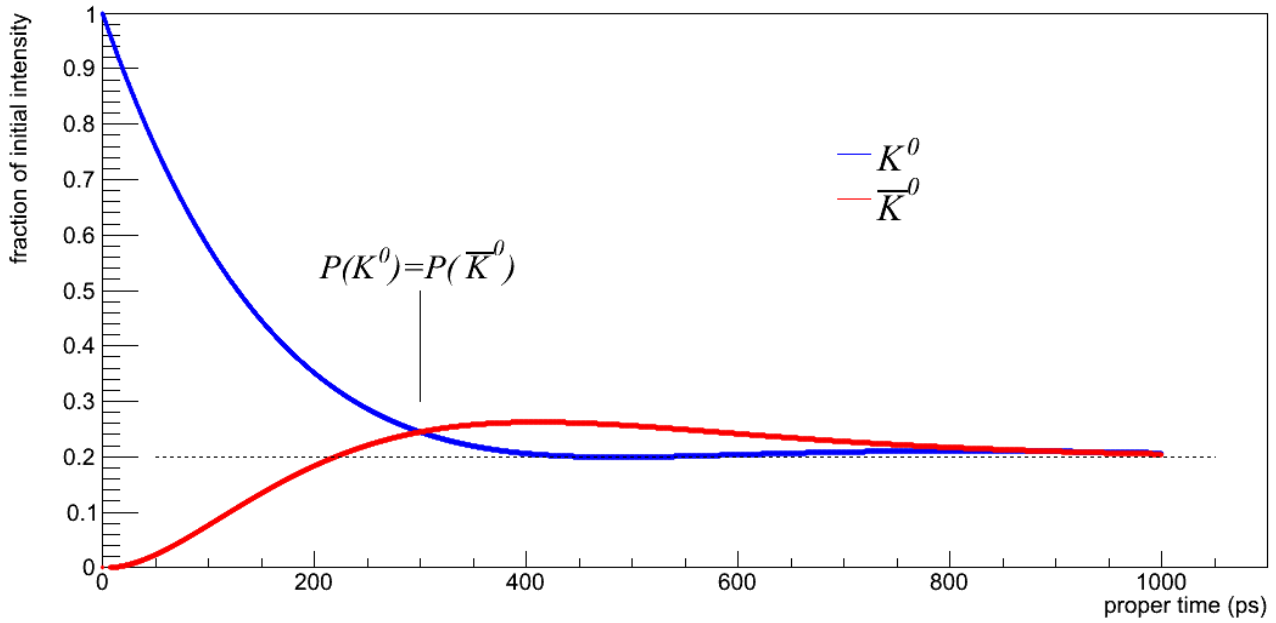


Old Name	New Name
τ	$K_{\pi 3}$: $K^+ \rightarrow \pi^+ \pi^+ \pi^-$
V_1^0	$\Lambda^0 \rightarrow p\pi^-$
V_2^0 (θ^0)	$K^0_S \rightarrow \pi^+ \pi^-$
κ	$K_{\mu 2}$: $K^+ \rightarrow \mu^+ \nu$
	$K_{\mu 3}$: $K^+ \rightarrow \mu^+ \pi^0 \nu$
χ (θ^+)	$K_{\pi 2}$: $K^+ \rightarrow \pi^+ \pi^0$
V^+, Λ^+	$\Sigma^+ \rightarrow p\pi^0$, $n\pi^+$

Emulsion technique, Bristol group, 1949

K^0 - $\overline{K^0}$ oscillation

Pure K^0 beam at t=0



K^0 - $\overline{K^0}$ oscillation

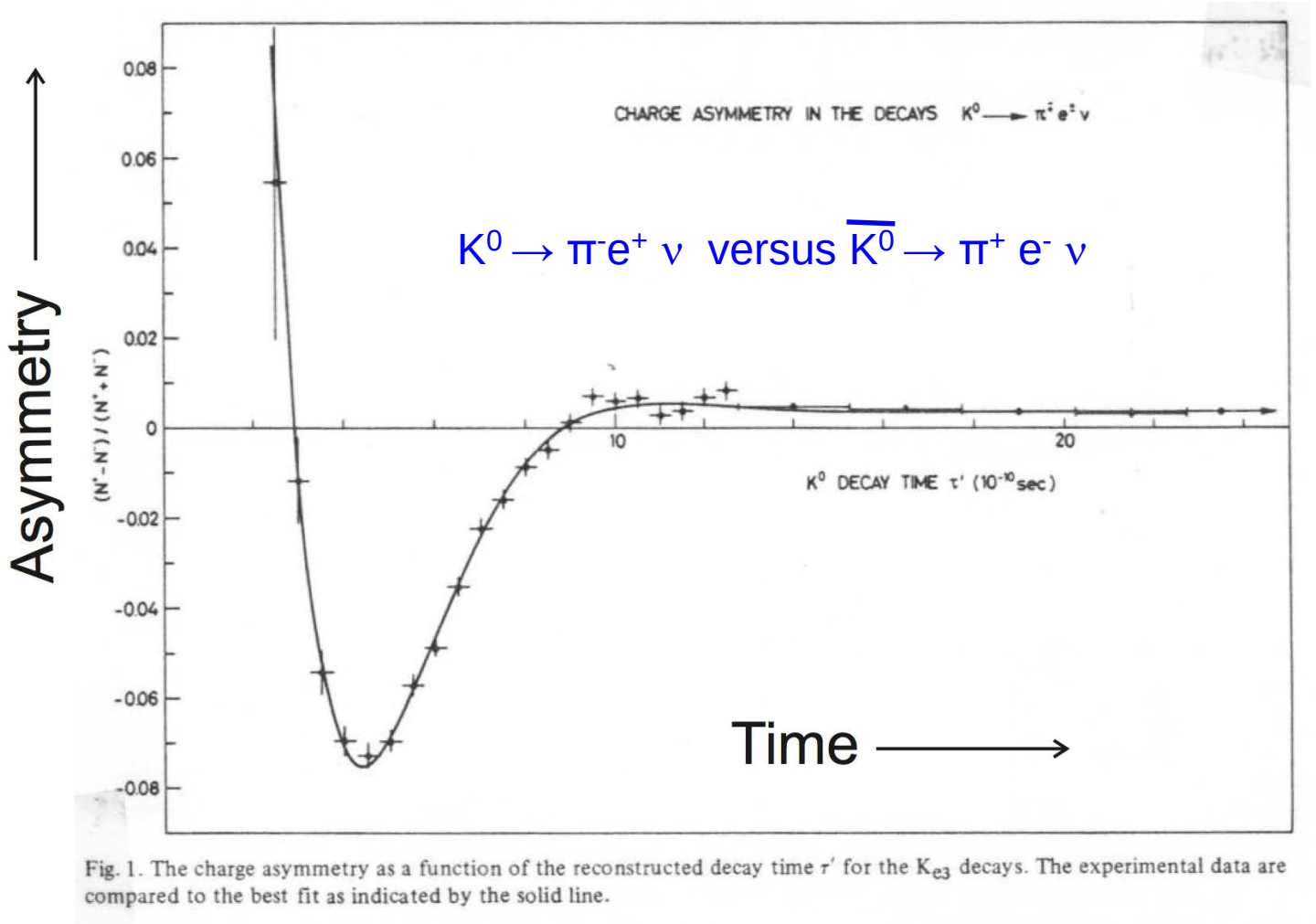
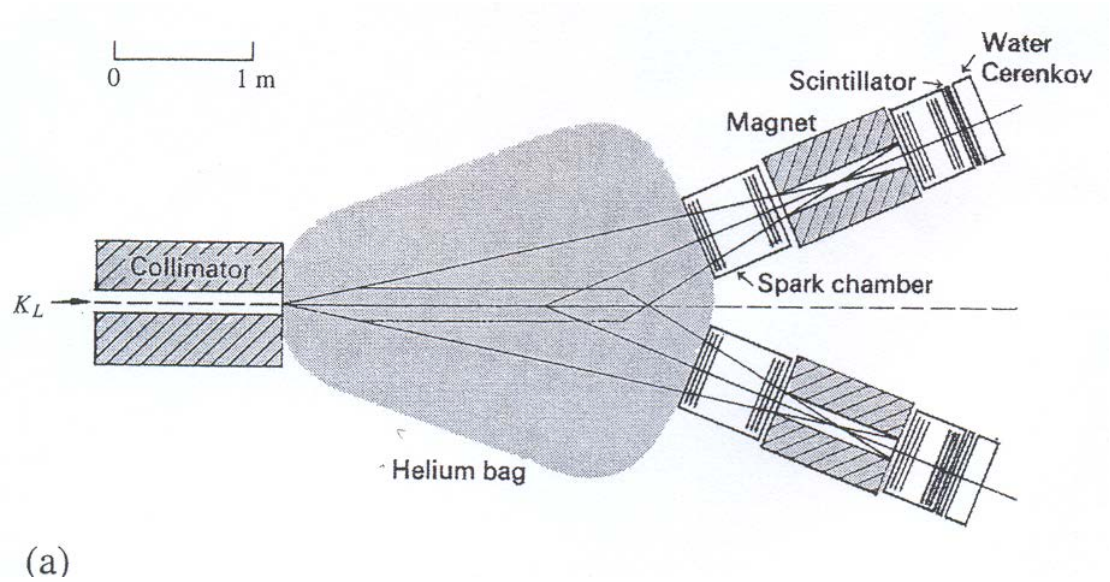
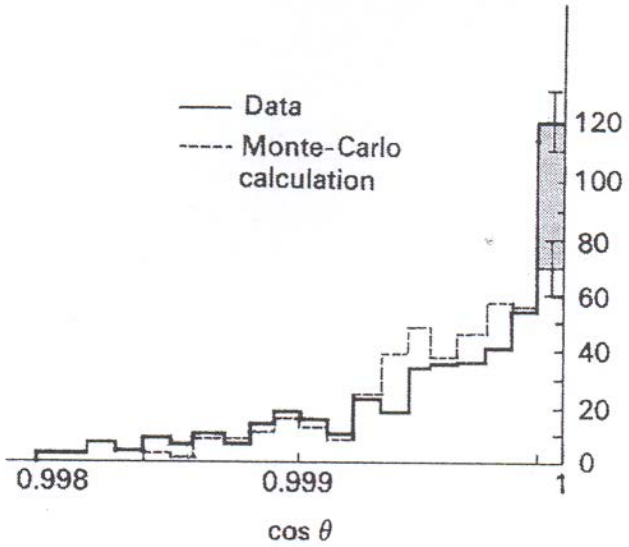


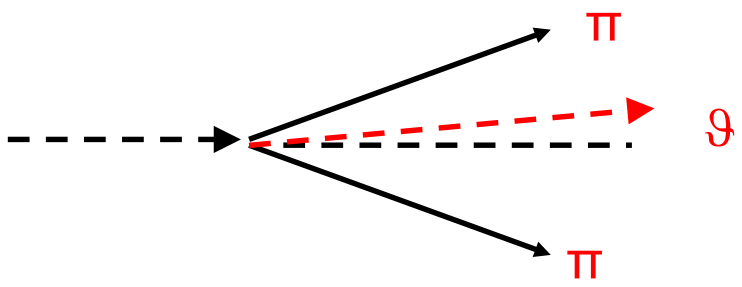
Fig. 1. The charge asymmetry as a function of the reconstructed decay time τ' for the K_{e3} decays. The experimental data are compared to the best fit as indicated by the solid line.

Observation of CP Violation

Christenson, Cronin, Fitch, Turlay, 1964





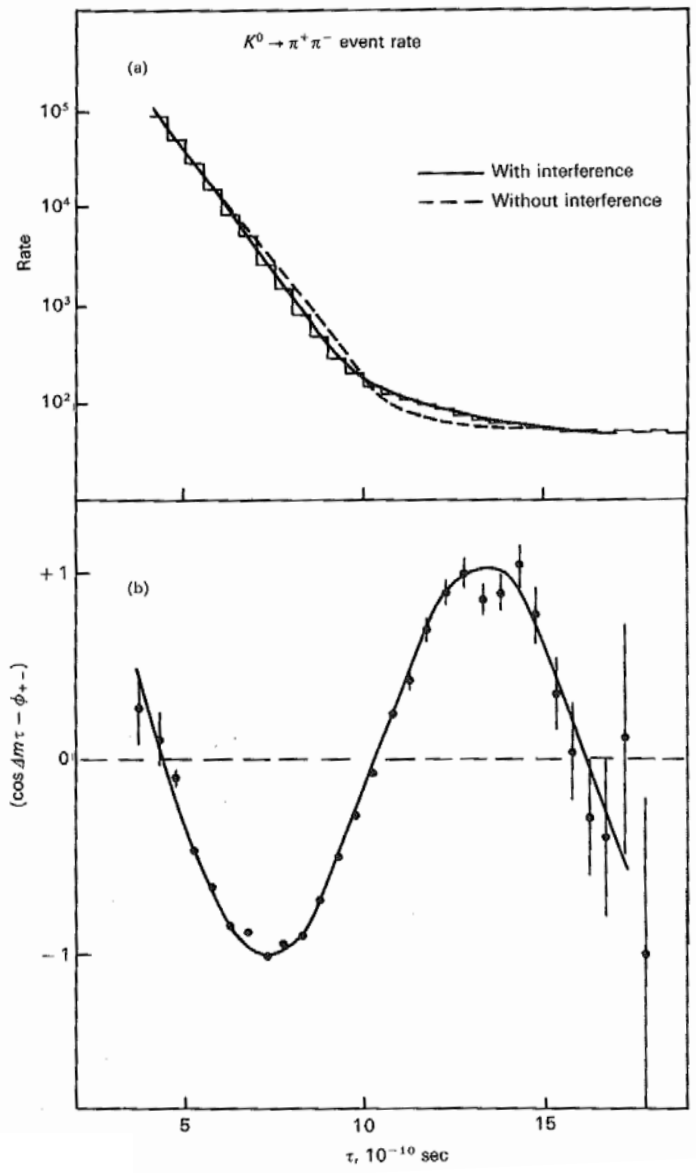


$$K_L \to \pi^+\pi^-$$

$$\mathrm{CP} = +1$$

$$BR \sim 2 \cdot 10^{-3}$$

CP Violation: Interference-effect



$K_L \to \pi\pi$ and $K_S \to \pi\pi$ can interfere:

We see not only the effect of regenerated $K_S \to \pi\pi$ but also effect of interference term which oscillates in time.

Figure 7.26 (a) Event rate for $\pi^+\pi^-$ decays from a neutral-kaon beam as a function of proper time, demonstrating that the best fit needs the existence of interference between K_L- and K_S-amplitudes. (b) The interference term extracted from the results in (a). From the fit one can obtain the $K_L - K_S$ mass difference Δm and the phase angle ϕ_{+-} between the two amplitudes. (After Geweniger *et al.* 1974.)