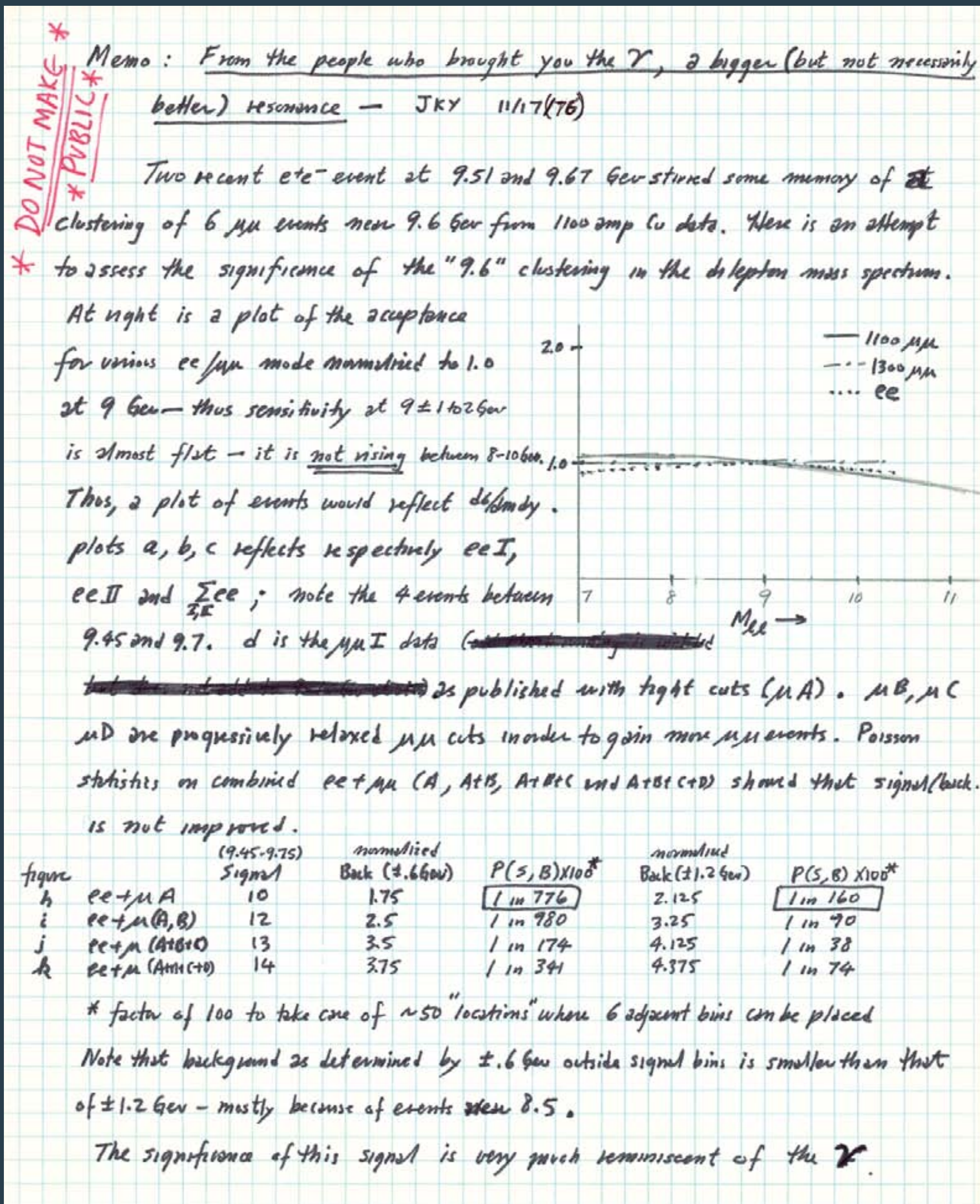

* DO NOT MAKE * PUBLIC *

Memo: From the people who brought you the Υ, a bigger (but not necessarily better) resonance — JKY 11/17/76

Two recent e⁺e⁻ event at 9.51 and 9.67 Gev stirred some memory of clustering of 6 μμ events near 9.6 Gev from 1100 amp Cu data. Here is an attempt to assess the significance of the "9.6" clustering in the dilepton mass spectrum.

At right is a plot of the acceptance for various ee/μμ mode normalized to 1.0 at 9 Gev — thus sensitivity at 9 ± 1 to 2 Gev is almost flat — it is not rising between 8-10 Gev. Thus, a plot of events would reflect dσ/dm dy. plots a, b, c reflects respectively ee I, ee II and Σee (I,II); note the 4 events between 9.45 and 9.7. d is the μμ I data [redacted] as published with tight cuts (μA). μB, μC μD are progressively relaxed μμ cuts in order to gain more μμ events. Poisson statistics on combined ee + μμ (A, A+B, A+B+C and A+B+C+D) showed that signal/back. is not improved.

figure		(9.45-9.75) Signal	normalized Back (±.6 Gev)	P(S,B) x100*	normalized Back (±1.2 Gev)	P(S,B) x100*
h	ee + μA	10	1.75	1 in 776	2.125	1 in 160
i	ee + μ(A,B)	12	2.5	1 in 980	3.25	1 in 70
j	ee + μ (A+B+C)	13	3.5	1 in 174	4.125	1 in 38
k	ee + μ (A+B+C+D)	14	3.75	1 in 341	4.375	1 in 74

* factor of 100 to take care of ~50 "locations" where 6 adjacent bins can be placed

Note that background as determined by ±.6 Gev outside signal bins is smaller than that of ±1.2 Gev – mostly because of events near 8.5.

The significance of this signal is very much reminiscent of the Υ.

Document courtesy of John Yoh

This memo by John Yoh, written on November 17, 1976, certainly caught the attention of the Columbia-Fermilab-Stony Brook collaboration (Fermilab experiment E288). Based on a few events that he found with his "bicycle online" analysis program, John was proposing a new particle (or resonance) at a mass of about 9.5 GeV.

The collaboration had seen statistical fluctuations before. We had even published one (at a mass of 6 GeV) earlier that year, naming it "Upsilon" (Υ) in a footnote to our *Physical Review* Letter—only to see it fade away as more data came in. We were thus predisposed to skepticism about yet another bump in the mass distribution (see John's graph below). John was too, choosing a cautious title for his memo. His comment at the end of the memo ("significance…reminiscent of the Υ") didn't do much to convince us that this new bump was real. Yet John went so far as to label a bottle of champagne "Υ9.5" and put it in our group's refrigerator—so he was sticking his neck out!

When we reconfigured the experiment to study muon pairs and were able to take data in May 1977 at about 1000 times the original rate, lo and behold, the Upsilon 9.5 was real. As it turned out, it was the discovery of a new quark: the bottom quark. The 9.5 GeV resonance actually comprised three closely-spaced excitations of "bottomonium," now known as Υ, Υ′, and Υ″.

Leon Lederman, E288 spokesperson