Bubble Project Write Up

K^0 Decay

Figure 1: R^+ Measurement. Pixel values were taken at each intersection as marked by a red circle to obtain the chord length and sagitta. The values were then scaled based on the resolution of the image and known dimensions.

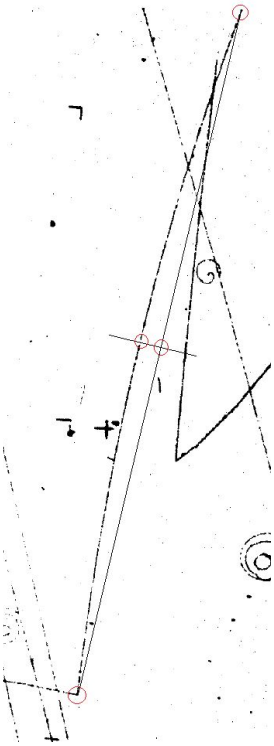
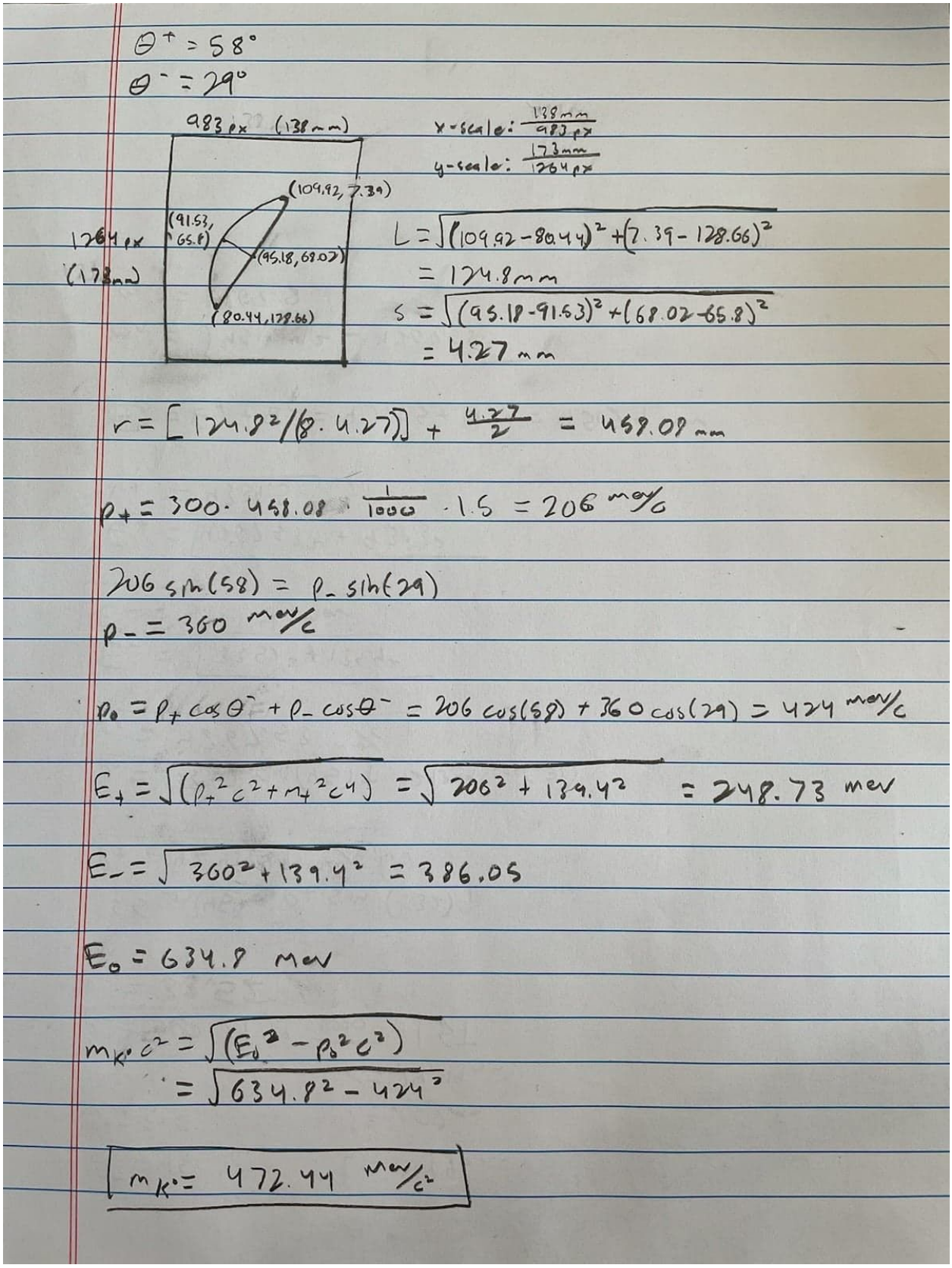


Figure 2: θ^+ Measurement using an online image protractor

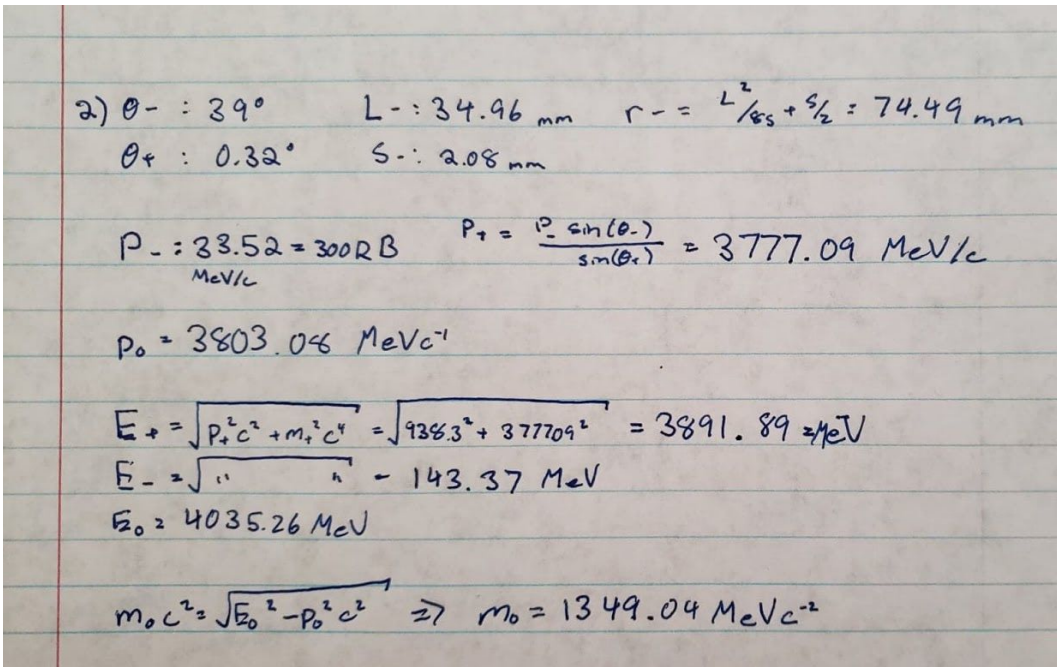
Figure 3: Calculations for rest mass of K^0 particle



Λ^0 Decay

Figure 4: Radius measurement for pion

Figure 5: Calculating all values using the same approach as for K^0 Decay



Notes:

How these values are calculated:

The initial measurements were geometrically based on the angle at which the particle travels as well as the curvature of the path. Because of the relationship between momentum and curvature we are able to obtain the momentum of either particle. The other equations rely on the fact that the components of momentum perpendicular to the parent particle must balance out and the momentum of the parent particle must be the sum of the two components parallel to the initial motion. We can also use conservation of energy to obtain the energy of the parent particle and using momentum and energy, it is possible to calculate the rest mass as above

Error:

Because our initial measurements were by hand, they are extremely prone to errors. It is especially the case when measuring the paths that are barely curved as measuring the sagitta and angle can result in widely different measurements from team member to team member. These values also heavily affect the final rest mass calculation. Even with disregarding the most error-prone measurement for both decays, our final answer is still off from the accepted value (but within the right ballpark). From our calculations, a change in a few degrees for theta can result in roughly 100 MeV/c^2 difference in rest mass for the Λ^0 decay.

Comparison to accepted values

Particle	Calculated Value (MeV/c^2)	Accepted Value (MeV/c^2)	Difference (MeV/c^2)
K^0	472.44	497.648±0.022	~25
Λ^0	1349.04	1115.683±0.006	~235

Our calculations for the K^0 particle were fairly close to the accepted value but our results for the Λ^0 particle were, unfortunately, further off. This might be due to the fact that it was harder to accurately measure the angle and radius for the shorter path