

## Time Retarded Potentials part 1

**Topics:** Introduction to  $t_R$ , the “retarded time”.

**Summary:** Students are given a sketch of  $J_z$  near the origin, and asked to sketch  $A_z$  at distant points. .

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**Comments:** The activity is meant to be quick and simple: The  $A$  field is an integral of  $J/\text{distance}$ , and thus “matches” the  $J$  field (except for scaling) if the  $J$  field is simple and localized. The main issue here is to think about the time lag – the two sketches look like “right shifted” copies of the original field, the scale on the first sketch is arbitrary (no axis labels are given), but the second sketch should be half the height of the first one.



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The top figure shows the z component of the current density in a small region centered at the origin as a function of time. Sketch the time dependence of the z component of the vector potential in Lorenz gauge at two field points, one 40 feet from the origin and one 80 feet away in the same direction. The time scale is in nanoseconds and the speed of light is approximately 1 foot per nanosecond

