Simple viruses consist of RNA and proteins that form a shell (called a capsid) that protects the RNA. The capsid is highly ordered, with the proteins being arranged in an icosahedral shell. Many simple viruses are self-assembled: you can mix the RNA and the capsid proteins in a test tube, and they will spontaneously form infectious viruses in high yield. This result suggests that we can understand RNA virus self-assembly from the perspective of statistical physics. The central question is how a random process like self-assembly can lead to a high yield of well-formed viruses. To address this question, we have developed an interferometric technique that allows us to measure the scattering of individual assembling viral particles (MS2 bacteriophage) on time scales ranging from 1 ms to 1000 s. By comparing the scattered intensity to that of the wild-type virus, we infer the mass of proteins that have attached to the central RNA as a function of time. We find that individual particles grow to nearly full size in a short time following a much longer delay period. The distribution of delay times suggests that the assembly follows a nucleation-and-growth pathway. I will discuss how such a pathway might allow the virus to assemble with such high yield.