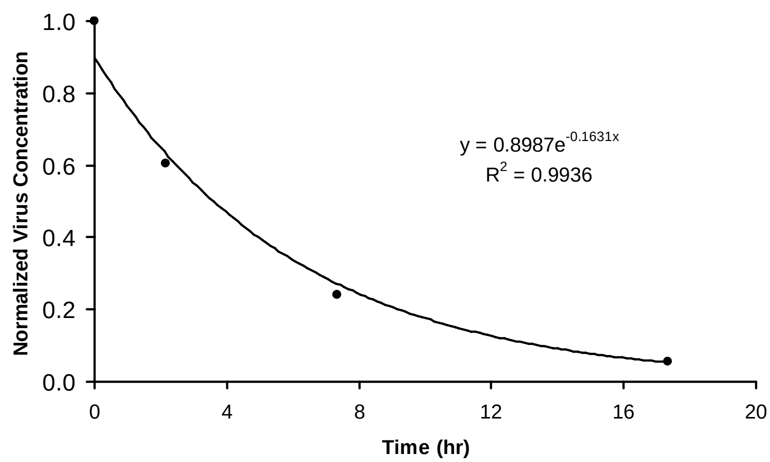
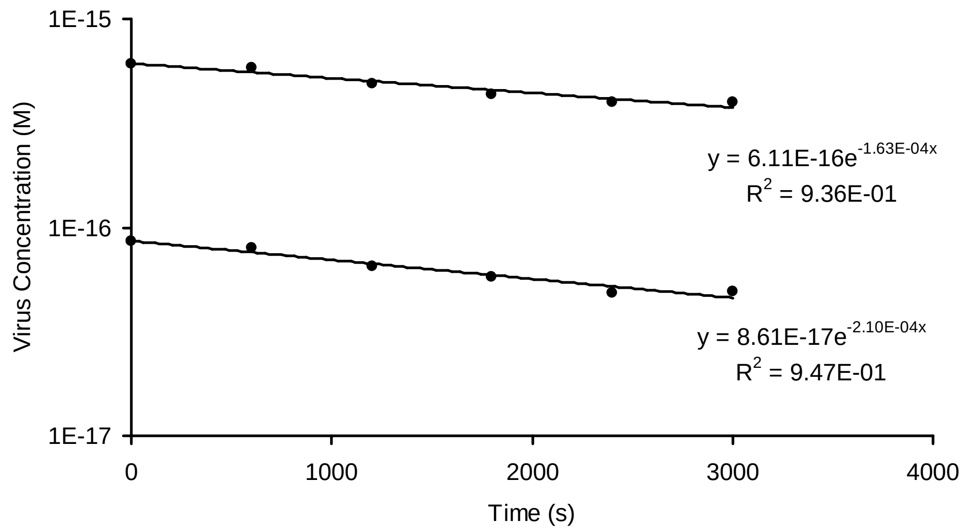
Supplementary Figure 1



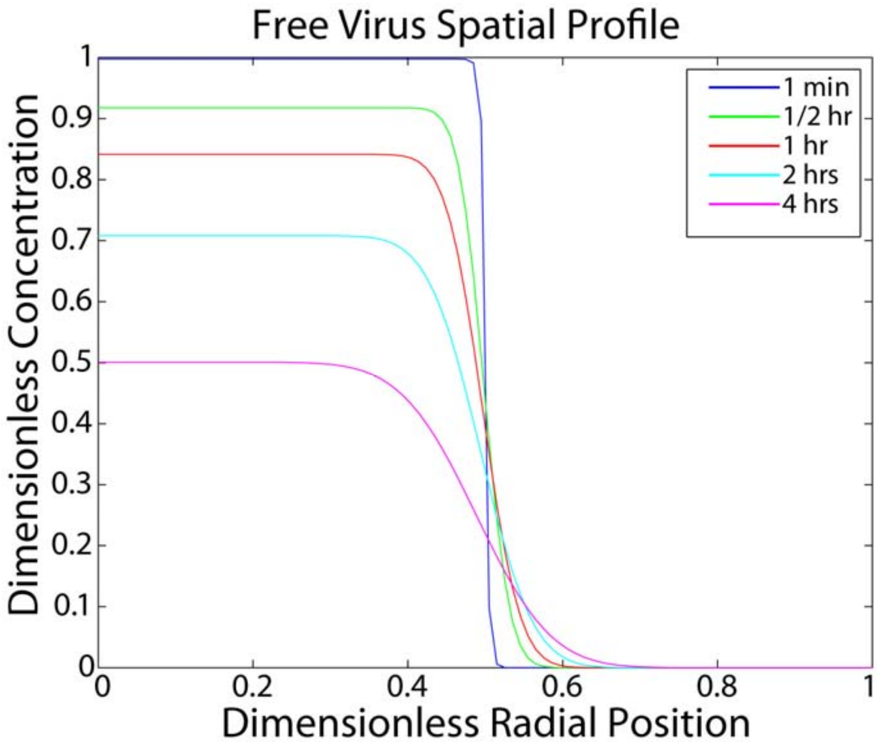
Supplementary Figure 1. Estimation of degradation rate constant. HSV particles were incubated with 24 hour conditioned media from HSTS26T cells at 37^{o}C and the concentration of viable viral particles determined at various time points. The values were normalized to the initial concentration. The data was fit to a first order kinetic rate equation to determine the degradation rate constant.

Supplementary Figure 2



Supplementary Figure 2. Estimation of association rate constant**.** HSV particles were incubated with HSTS26T cells in suspension with gentle agitation. The concentration of unbound virus was determined at various time points. The data was fit to a second order kinetic rate equation to estimate the rate constant for association. Viral degradation and dissociation were ignored in this kinetic model. In the fit equations, the exponential factor is given by the product of the association rate constant and the concentration of viral receptors.

Supplementary Figure 3



Supplementary Figure 3. Free virus spatial profile from simulation without both binding and internalization. There is little diffusion of the virus outside of the initial injection volume. The virus degrades and at 4 hours half of the virus has been degraded as it was expected from the half time of degradation. The concentrations have been normalized to the initial concentration of virus in the injection site and the radial dimension is normalized to the overall tumor radius (with 0 being the tumor center, 0.5 being the edge of the initial injection site and 1.0 being the tumor edge).

Supplementary Model Discussion

The model equations were non-dimensionalized by incorporating the following variables

$$\eta = \frac{r}{R} \qquad s = \frac{Dt}{R^2} \qquad \theta_I = \frac{C_I}{C_0} \qquad \theta_B = \frac{C_B}{C_0}.$$

Terms were then grouped into four Damkohler numbers relating the rates of reaction and diffusion:

$$Da_{on} = \frac{k_{on} R^2 C_{HS}}{\phi D} \qquad Da_{off} = \frac{k_{off} R^2}{D} \qquad Da_d = \frac{k_d R^2}{D} \qquad Da_{\text{int}} = \frac{k_{\text{int}} R^2}{D}.$$

Equations (1) and (2) of the manuscript were thus recast as

$$\frac{\partial \theta_I}{\partial s} = \frac{1}{\eta^2}\frac{\partial}{\partial \eta}\left(\eta^2 \frac{\partial \theta_I}{\partial \eta}\right) - Da_{on}\theta_I\left(1 - a'\theta_B\right) + Da_{off}\theta_B - Da_d\theta_I \qquad (3)$$

$$\frac{\partial \theta_B}{\partial s} = Da_{on}\theta_I\left(1 - a'\theta_B\right) - Da_{off}\theta_B - Da_d\theta_B - Da_{\text{int}}\theta_B \qquad (4)$$

where $a' \equiv \frac{aC_0}{C_{HS}}$.

The differential equations (3) and (4) were solved simultaneously using a numerical finite difference method in Matlab.