Abstract Many tracking problems lie outside of the traditional situation of linear (or linearizable) Gaussian measurements and dynamics addressed by the Kalman filter and its variants. This is especially true in applications where target measurements are highly ambiguous and visibility is affected by unpredictable phenomenon such as intermittent interference and low signal-to-noise ratios. Bayesian tracking provides the general solution to this more general class of problems. Conceptually, Bayesian tracking is straightforward: given the target measurements, apply Bayes' rule to compute the probability density of the target location at any given time, all the while assuming a target motion model (e.g., constrained target velocity and acceleration). The mean of this target density is typically the best estimate of target position, and the covariance typically indicates the best area of uncertainty of target position. In highly ambiguous scenarios, the density may snake through the state space of target position velocity and may be useful itself. Computationally, Bayesian tracking is notoriously difficult and expensive. There are two basic approaches: sequential Monte Carlo methods such as particle filtering, and deterministic methods that compute the target density directly. This talk presents a new approach to the direct method that is theoretically and computationally novel in several ways. A straight-line motion model based on a Markov jump process for the velocity is assumed. Straight-line motion punctuated by unforeseen changes in target velocity may be a more suitable assumption for target dynamics than the traditional random walk assumed in the Kalman filter and many Bayesian trackers. Computationally, the resulting linear partial differential equation (PDE) that describes the target position density is relatively easy to solve numerically, especially compared to the Fokker-Planck equation that results from the random walk motion assumption. Recent results from the theory of adaptive moving meshes to solve PDEs are modified and applied, an approach that is distinctly different from previously published methods [1] [4] that use variants of fixed meshes. The resulting Bayesian tracking algorithm is shown to run very quickly and appears to be a promising alternative to other methods. This talk will provide a theoretical comparison of the proposed approach against its Monte Carlo competitors. It is shown that the adaptive mesh approach necessarily suffers from the curse of dimensionality, and this cost is quantified roughly and compared to the results of Daum and Huang [2] for particle filters. Justification is given why it may be preferred to a Monte Carlo approach for tracking problems with low dimensions. Simulation results are shown using the example of bistatic radar taken from Ristic et al.’s book Beyond the Kalman Filter [3].