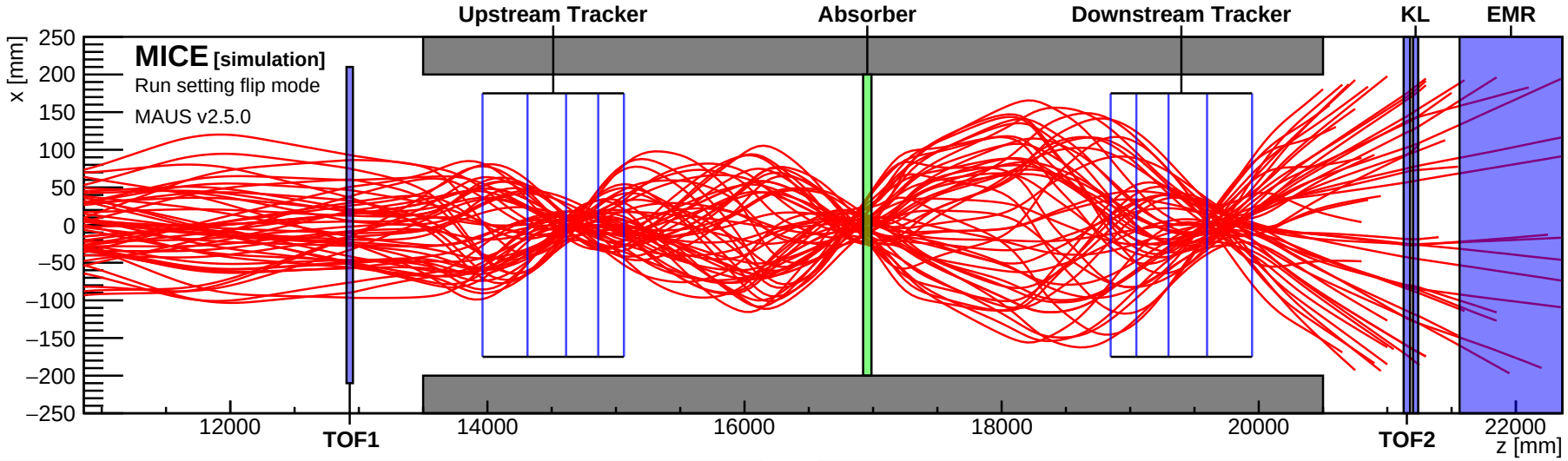
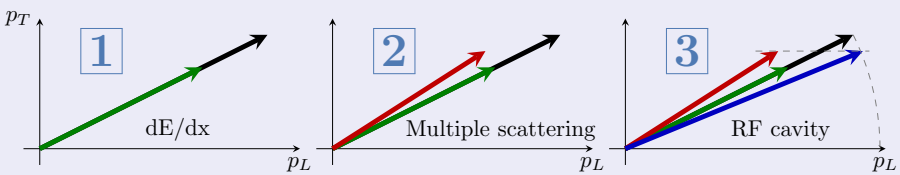
Phase space density evolution in MICE



Ionization cooling only practical solution to prepare high brightness muon beams for a Neutrino Factory.



1. dE/dx reduces p_L and p_T
2. Multiple scattering heats
3. p_L restored by RF cavities

MICE will provide first measurement of muon phase space evolution for

- LiH or LH_2 absorber
- 140–240 MeV/c momentum
- 3–10 mm input emittance

Single particle experiment (200 μ^+/s)

Tracking by scintillating fibre trackers embedded in 3 T solenoid field

Robust particle identification

Phase space density evolution in MICE

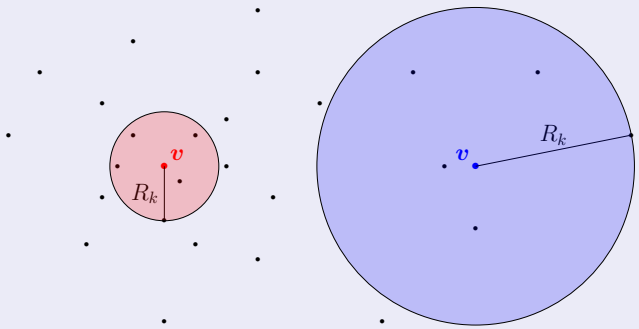
Nonparametric density estimation removes the need for any prior assumption about the underlying probability distributions.

The k Nearest Neighbour method most efficient and robust technique in 4D.
Density at a point $\boldsymbol{v} = (x, y, p_x, p_y)$:

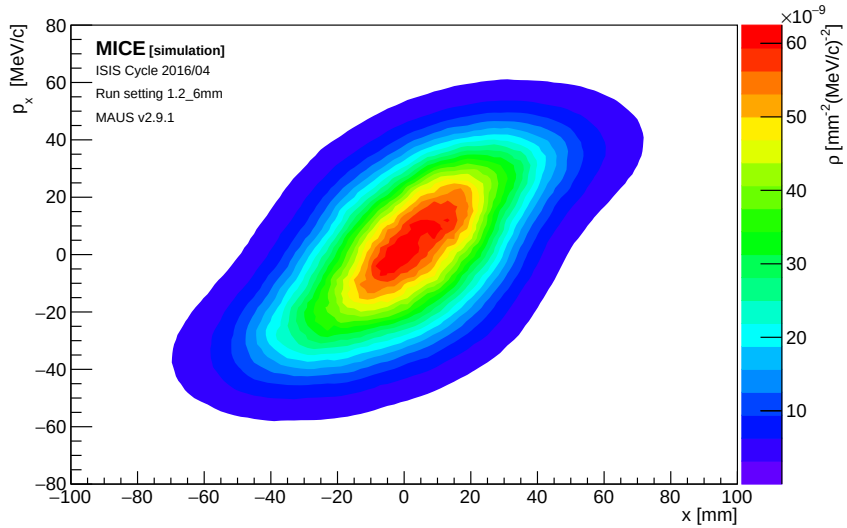
1. Find the k points closest to $\mathbf{v}$
2. Get distance, R_k, to k^{th} point
3. Local density reads

$$\rho(\mathbf{v}) = \frac{k}{nV_k} = \frac{k\Gamma\left(\frac{d}{2}+1\right)}{n\pi^{\frac{d}{2}}R_k^d}, \qquad (1)$$

with V_k volume of d-ball of radius R_k.



Density estimate



Contour volume evolution