number density:

$$w_i = \dot{m}_i \frac{1}{pm_i} \frac{1}{v_{gas}} \frac{1}{a_{inlet}} = \dot{m}_i \frac{1}{pm_i} \frac{1}{Q} = [\frac{\#\ particles}{m^3}]$$

weights (input to arches):

$$w_{qn,i} = w_i / sw$$

$\dot{m}_i$ mass flow rate of particle with diameter size i (computed as $mf_i * CFR$, where CFR is the coal feed rate [kg/s], and mf_i is the mass fraction of particles with size i).

pm_i mass of a particle of size i. This is the dry mass of the particle (free of moisture, but still containing ash) $[kg]$.

v_{gas} velocity of gas phase $[m/s]$.

a_{inlet} area of inlet $[m^2]$.

$Q = v_{gas} a_{inlet}$ volumetric flow rate $[m^3/s]$.

sw scaling factor for the weights.

particle diameter:

$$d_i = d_{i,microns} 10^{-6} = [m]$$

length (input to arches):

$$length_{qn,i} = w_{qn,i} \, (d_i / sl)$$

sl scaling factor for diameters.

particle velocities (flow in x-direction):

$$v_{xi} = v_{gas} = [m/s]$$

$$v_{yi} = 0 = [m/s]$$

$$v_{zi} = 0 = [m/s]$$

currently we assume that the particle inlet velocity for any size is the velocity of gas phase.

ux,uy,uz (input to arches):

$$ux_{qn,i} = w_{qn,i} \, (v_{xi} / sv_x)$$

$$uy_{qn,i} = w_{qn,i}\,(v_{yi}/sv_y)$$

$$uz_{qn,i} = w_{qn,i}\,(v_{zi}/sv_z)$$

sv_x scaling factor for velocity in the x direction.
sv_y scaling factor for velocity in the y direction.
sv_z scaling factor for velocity in the z direction.

raw coal mass:

$$rc_i = pm_i rc_{frac} = [kg]$$

rc_{frac} is the mass fraction of the coal particle that is ash and char free: $coal = C + H + O + N + S + ash + char = 1$, $rc_{frac} = C + H + O + N + S$.

RCmass (input to arches):

$$RCmass_{qn,i} = w_{qn,i}\,(rc_i/src)$$

src scaling factor for raw coal.

char mass:

$$ch_i = pm_i ch_{frac} = [kg]$$

ch_{frac} is the mass fraction of the coal particle that is raw coal and ash free: $coal = C + H + O + N + S + ash + char = 1$, $ch_{frac} = char$.

Charmass(input to arches):

$$Charmass_{qn,i} = w_{qn,i}\,(ch_i/sch)$$

sch scaling factor for char.

particle enthalpy:

$$h_i = h_{coal} rc_i = [J]$$

h_{coal} is the dry ash free enthalpy of the coal at the inlet conditions (T,P,C,H,O,N,S) $[J/kg]$.

pE (input to arches):

$$pE_{qn,i} = w_{qn,i}\,(h_i/sh)$$

sch scaling factor for particle enthalpy.