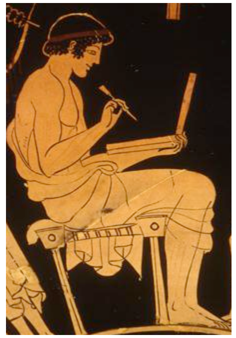
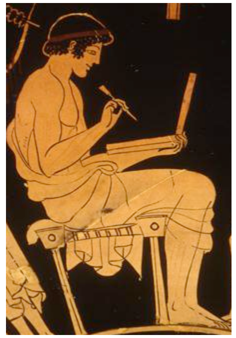


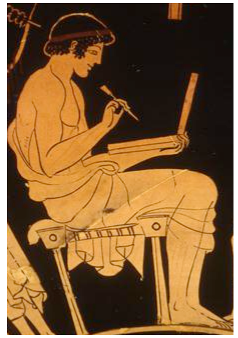
New features in guineapig++ (automatic grid sizing…)

Guy Le Meur

The grid in guineapig

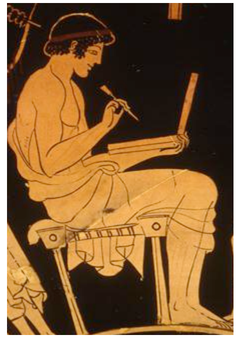


- Computation of the electric field (Poisson equation)
- in transverse dimensions : x and y
- the total size of the grid : ±cut_x, ±cut_y
- Number of cells : n_x, n_y



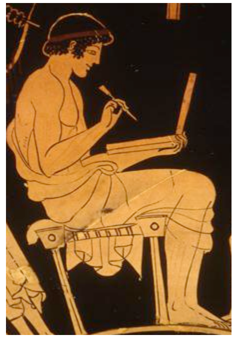
« miss » parameters

- Output :
  - maximum relative amount of interacting particles that were outside the grid during one time step :
    - miss.1 : beam1 ; miss.2 : beam2
  - Maximum number of interacting part. that were outside the grid during one time step :
    - out.1 : beam1 ; out.2 : beam2



Standard user's data :

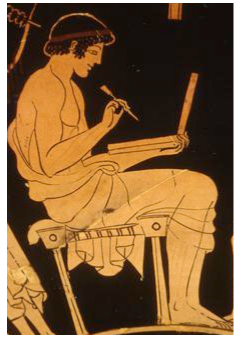
- beta (_x, _y), emitt (_x, _y), sigma (_x, _y)
  - 2 of these 3 parameters must be given by users :
    - If beta given :
      - if emitt given : sigma = f(beta, emitt)
      - if sigma given : emitt = f(sigma, beta)
      - else error
    - else :
      - if emitt and sigma given : beta = f(emitt, sigma)
      - else error
- Cut (_x, _y)
  - if given : this will be the grid size
  - else : default value : 3*sigma



new keyword :

- automatic_grid_sizing :
  - = 0 : as in guineapig « standard »
  - = 1 : automatic determination of cut_x, cut_y, and of n_x, n_y……

automatic grid sizing



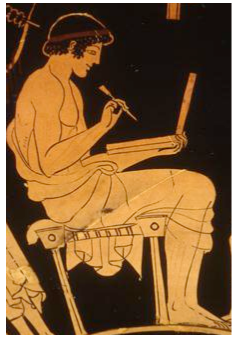
- Cut_x = mp_x + delta_x + size_disrp_x + 4*sigma_x
- Cut_y = mp_y + delta_y + size_disrp_y + 6*sigma_y

- Both beams are taken into account :
  - mp_(x,y) = (mp1_ (x,y) + mp2_ (x,y)) / 2
  - delta_(x,y) = |mp1_(x,y) - mp2_(x,y)| / 2
    - mp1 mean position of beam1
    - mp2 mean position of beam2

size_disrp ?? : size increasing due to center of mass disruption angle….

c.o.m disruption angle : empirical formula

(Yokoya, Chen : beam-beam phenomena in linear colliders)



$$\Theta = \frac{1}{2}\theta_0 F(\delta)$$

$$\delta = \frac{2 * delta}{\sigma}$$ offset between beams

$$\theta_0 = \frac{2Nr_e}{\gamma\left(\sigma_x + \sigma_y\right)}$$ disruption angle

$$D_{x,y} = \theta_0 \frac{\sigma_z}{\sigma_{x,y}}$$ disruption parameter

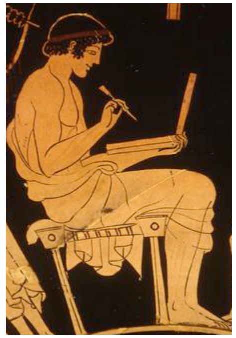
$$A_{x,y} = \frac{\sigma_z}{\beta_{x,y}}$$

Form factor :

$$F(\delta) = \delta\left[C_1 + C_2\delta^2 + \frac{1}{\pi^2}\delta^4\right]^{-1/4}$$

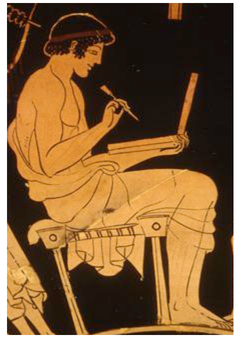
$$C_1 = \left(1 + A^2\right)\left[1 + \frac{0,5}{0,6 + \left(\sqrt{D} - 2,5\right)^2}\right]^2$$

$$C_2 = \left[\frac{1,2D^2}{D + 10}\right]^2$$



Size increasing from disruption angle

- size_defl = f * sigma_z * Θ
  - Θ : the previous c.o.m disruption angle
- determination of the empirical factor f :
  - With respect to the value of h = delta_x/sigma_x (resp. h = delta_y/sigma_z)
    - If h > 2 f = 3
    - If 2 > h > 1.25 f = 4
    - If 1.25 > h > 0.75 f = 5
    - If 0.75 > h f = 6

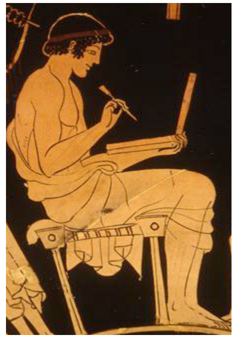


Numbers of cells

- Power of 2 which is nearest from :

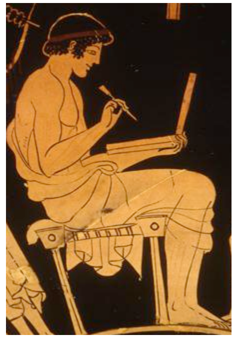
4*cut/sigma

(for both n_x and n_y)



About load_beam

- If load_beam = 3 (except 0, other values are not available)
  - if cuts_from_loaded_beam = 0 : nothing is changed
  - else (cuts_from_loaded_beam = 1) :
    - The cuts are computed from sigma's of actually from files loaded beams, assuming gaussian distribution
      - cut_x = cut_x_factor*sigma_x
      - cut_y = cut_y_factor*sigma_y
      - cut_z = cut_z_factor*sigma_z
    - cut_x_factor, cut_y_factor, cut_z_factor are 3 new keywords with default value 3.



Others :

- A general cleaning and restrucration of the code has been made (much yet remains to make)

- No more results on the « output screen »

- All results on output file : with units and little explanations.