test_coordonees_perceptives

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In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:
```
from parametres import VPs, volume, p, d_x, d_y, d_z, calibration, DEBUG
from modele_dynamique import arcdistance, orientation, xyz2azel, rae2xyz
```

```
DEBUG parametres , position croix:  [ 10.85000038   5.19000006
1.36000001]
```

In [3]:
```
print xyz2azel.__doc__
```

```
    renvoie le vecteur de coordonnées perceptuelles en fonction des
coordonnées physiques

    xyz = 3 x N x ...

    Le vecteur OV désigne le centre des coordonnées sphériques,
    - O est la référence des coordonnées cartésiennes et
    - V les coordonnées cartesiennes du centre (typiquement du
videoprojecteur).

    cf. https://en.wikipedia.org/wiki/Spherical_coordinates
```

In [4]:
```
i_vp = 1
```

1 Testing spherical coordinates

Plotting function:

In [5]:
```
def plot_xyz2azel(motion, vp=VPs[i_vp],
                  axes_perc=['t', 'r', 'az', 'el', 'rec'], axes_xyz=['x', 'y', 'z']):
    """
    Let's define a function that displays for a particular motion
    (a collection of poistions in the x, y, z space --- usually
    continuous) the resulting spherical coordinates (wrt to vp).

    """
    fig = plt.figure(figsize=(18,10))
    t = np.linspace(0, 1, motion.shape[1])[:, np.newaxis]*np.ones((1, motion.shape[2])
    rae_VC = xyz2azel(motion, np.array([vp['x'], vp['y'], vp['z']]))
    motion_rec = rae2xyz(rae_VC, np.array([vp['x'], vp['y'], vp['z']]))
    #print rae_VC.shape
    for i_ax, axe_perc in enumerate(axes_perc):
```

```
        for j_ax, axe_xyz in enumerate(axes_xyz):
            #print i_ax, j_ax, 3*i_ax + j_ax
            ax = fig.add_subplot(len(axes_perc), len(axes_xyz), 1 + len(axes_xyz)*i_ax
            if axe_perc == 't':
                #ax.plot(t, rae_VC[i_ax, :, :])
                #print motion_x[j_ax, :, :].shape, t.shape
                ax.plot(motion[j_ax, :, :], t)
            elif axe_perc == 'rec':
                ax.plot(motion_rec[j_ax, :, :], t)
            else:
                if axe_perc in ['az', 'el']: scale = 180./np.pi
                else: scale = 1.
                #print motion_x[j_ax, :, :].shape, rae_VC[i_ax-1, :, :].shape
                ax.plot(motion[j_ax, :, :], rae_VC[i_ax-1, :, :]*scale)
            ax.plot([vp[axe_xyz]], [0.], 'D')
            ax.set_xlabel(axe_xyz)
            ax.set_ylabel(axe_perc)
    plt.show()
    return rae_VC
print plot_xyz2azel.__doc__
```

```
    Let's define a function that displays for a particular motion
    (a collection of poistions in the x, y, z space --- usually
    continuous) the resulting spherical coordinates (wrt to vp).
```

In [6]:
```
vp = VPs[i_vp]
print vp
```

```
{'cz': 1.36, 'cy': 5.19, 'cx': 10.85, 'pc_min': 0.001, 'address':
'10.42.0.56', 'y': 5.19, 'x': 0.55, 'pc_max': 1000000.0, 'z': 1.36,
'foc': 21.802535306060136}
```

Pointing ahead:

In [7]:
```
print xyz2azel(np.array([vp['cx'], vp['cy'], vp['cz']]), np.array([vp['x'], vp['y'], v
```

```
[ 10.3    0.     0. ]
```

Pointing left (bigger y) should give positive azimuth, zero elevation:

In [8]:
```
print xyz2azel(np.array([vp['cx'], vp['cy']+1, vp['cz']]), np.array([vp['x'], vp['y'],
```

```
[ 10.34842983   0.09678405   0.        ]
```

Pointing up (bigger z) should give positive elevation, zero azimuth:

In [9]:
```
print xyz2azel(np.array([vp['cx'], vp['cy'], vp['cz']+1]), np.array([vp['x'], vp['y'],
```

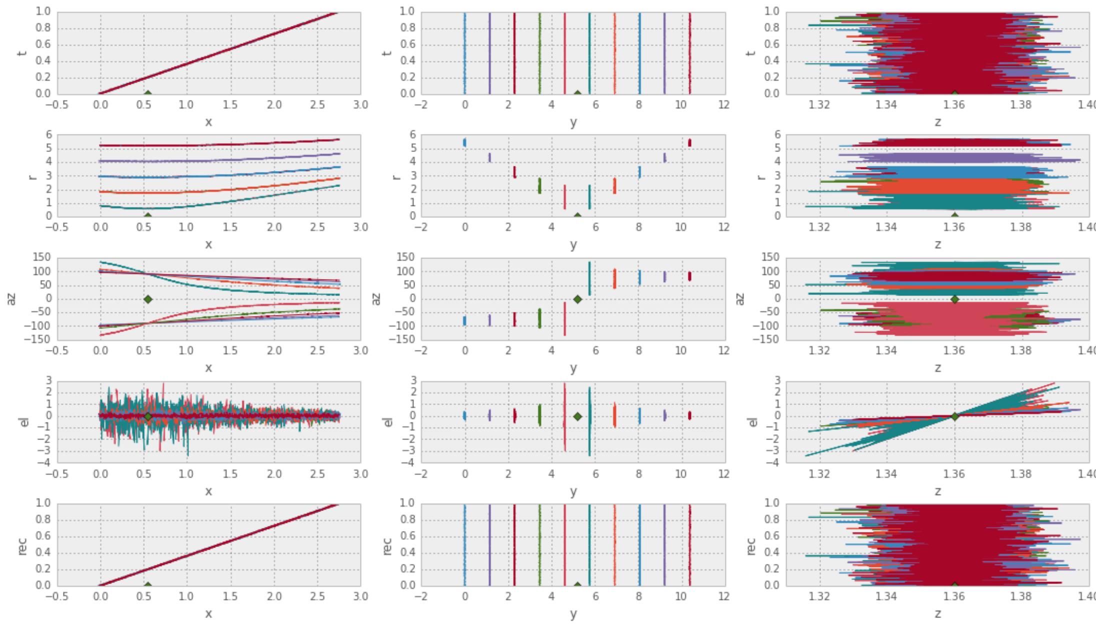
```
[ 10.34842983   0.          0.09677466]
```

1.1 Motion in depth

Let's define N_player trajectories of N_t points, where players are distributed in the width (y) and move in the axis of the VP (x):

In [10]:
```
N_player, N_t = 10, 1000
```

In [11]:
```
x = vp['x']*(np.linspace(0., 5., N_t)[np.newaxis, :, np.newaxis]*np.ones((1, 1, N_play
y = vp['y']*np.ones((1, N_t, 1))*np.linspace(0, 2, N_player, endpoint=True)[np.newaxis
z = vp['z']*np.ones((1, N_t, N_player)) # constant
#print x.shape, y.shape, z.shape
motion_x = np.vstack((x, y, z))
motion_x += .01*np.random.randn(3, N_t, N_player)
motion_x.shape
rae_VC = plot_xyz2azel(motion_x, vp=vp)
```

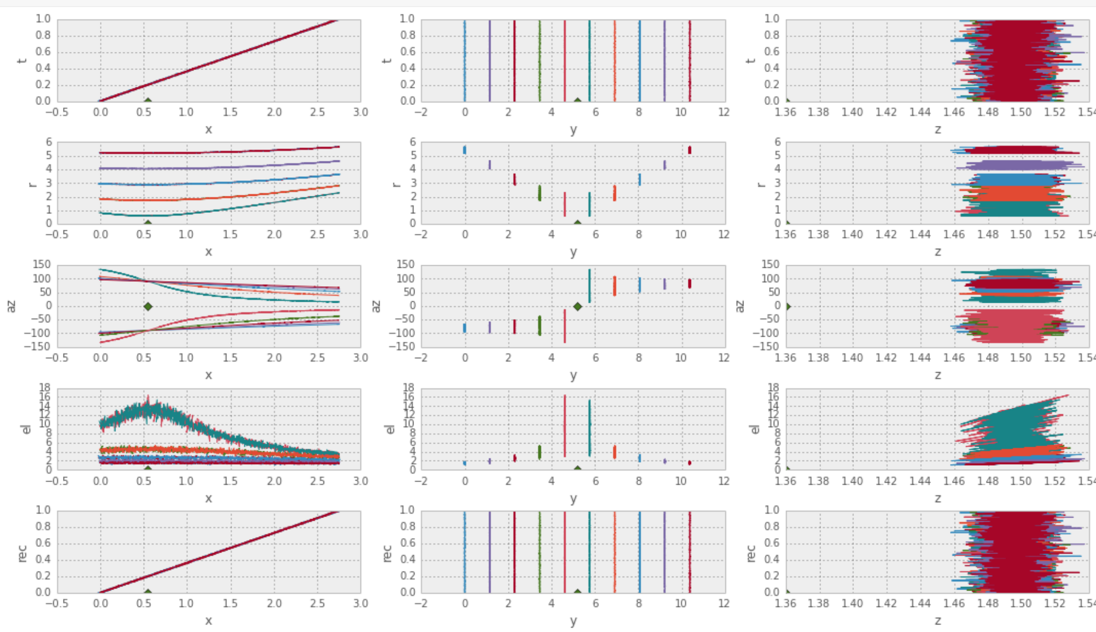


the same but with a motion slightly higer than the VPnote : when azimuth is superior to 90° in absolute value, it means it is behindNote the small elevation:

In [12]:
```
el = rae_VC[2,:,:]
print el.min(),  el.max(),   el.mean(),   el.std()
```

```
-0.0598712630086 0.0486784810272 -5.69271522877e-05 0.0059929398253
```

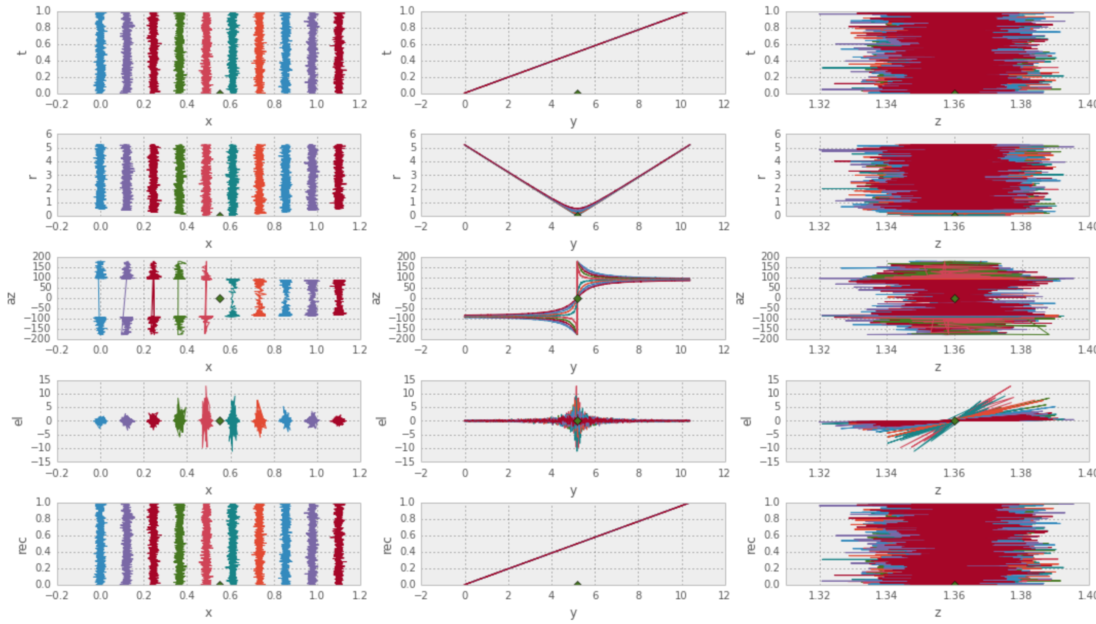
In [13]:
```
z = 1.1*vp['z']*np.ones((1, N_t, N_player)) # constant
#print x.shape, y.shape, z.shape
motion_x = np.vstack((x, y, z))
motion_x += .01*np.random.randn(3, N_t, N_player)
rae_VC = plot_xyz2azel(motion_x, vp=vp)
```



being slightly up creates a small elevation, especially for a trajectory approaching the VP

1.2 Motion in width

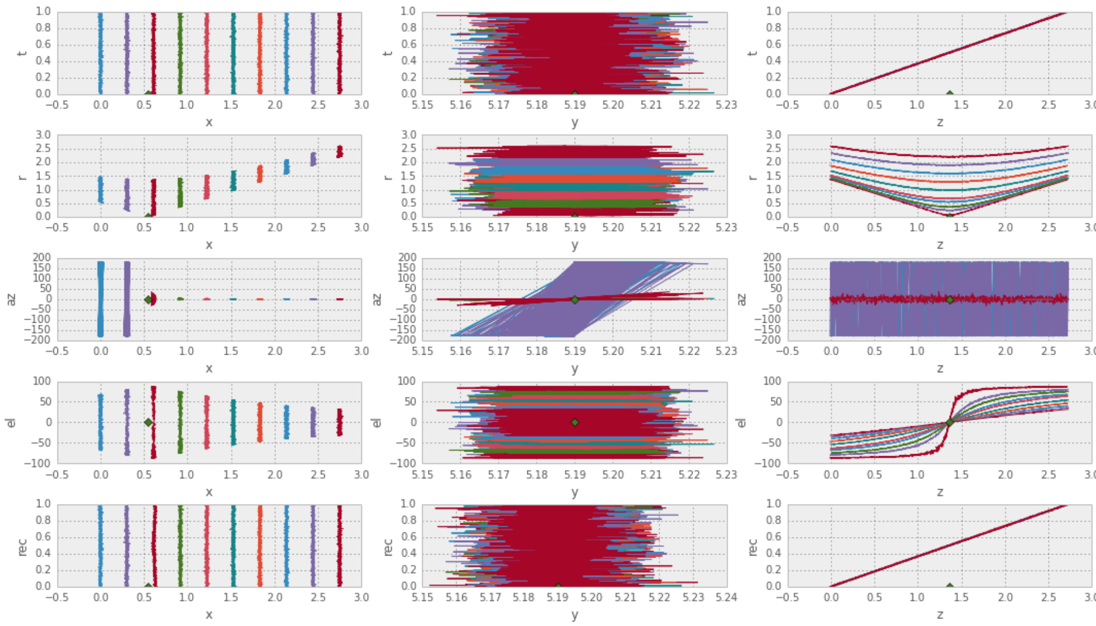
In [14]:
```
x = vp['x']*np.ones((1, N_t, 1))*np.linspace(0., 2., N_player, endpoint=True)[np.newax
y = vp['y']*(np.linspace(0, 2, N_t)[np.newaxis, :, np.newaxis]*np.ones((1, 1, N_player
z = vp['z']*np.ones((1, N_t, N_player)) # constant
motion_y = np.vstack((x, y, z))
motion_y += .01*np.random.randn(3, N_t, N_player)
rae_VC = plot_xyz2azel(motion_y, vp=vp)
```



note that when the motion is behind the observer (x < VP[x]), the azimuth flips from -180° to 180°, everything is normal…

1.3 Motion in height

In [15]:
```
x = vp['x']*np.ones((1, N_t, 1))*np.linspace(0, 5., N_player, endpoint=True)[np.newaxi
y = vp['y']*np.ones((1, N_t, N_player)) # constant
z = vp['z']*(np.linspace(0, 2., N_t)[np.newaxis, :, np.newaxis]*np.ones((1, 1, N_playe
motion_z = np.vstack((x, y, z))
motion_z += .01*np.random.randn(3, N_t, N_player)
rae_VC = plot_xyz2azel(motion_z, vp=vp)
```



2 Testing great circle navigation

Similar tests, but now looking at the `arcdistance` and `orientation` functions:

In [16]:
```
print arcdistance.__doc__
```

```
    renvoie l'angle sur le grand cercle (en radians)

    # rae1 ---> rae2

     r = distance depuis le centre des coordonnées sphériques (mètres)
     a =  azimuth = declinaison = longitude (radians)
     e =  elevation = ascension droite = lattitude (radians)

    http://en.wikipedia.org/wiki/Great-circle_distance
    http://en.wikipedia.org/wiki/Vincenty%27s_formulae
```

In [17]:
```
print orientation.__doc__
```

```
    renvoie le cap suivant le grand cercle (en radians)

     r = distance depuis le centre des coordonnées sphériques (mètres)
     a =  azimuth = declinaison = longitude (radians)
     e =  elevation = ascension droite = lattitude (radians)

     http://en.wikipedia.org/wiki/Great-circle_navigation
```

In [18]:
```
def plot_xyz2perceptif(motion, vp=VPs[i_vp], center=np.array([2.0, 5.19, 1.36]),
                       axes_perc=['t', 'arcdistance', 'orientation'],
                       axes_rae=['r', 'a', 'e'], axes_xyz=['x', 'y', 'z']):
    """
    Let's define a function that displays for a particular motion
```

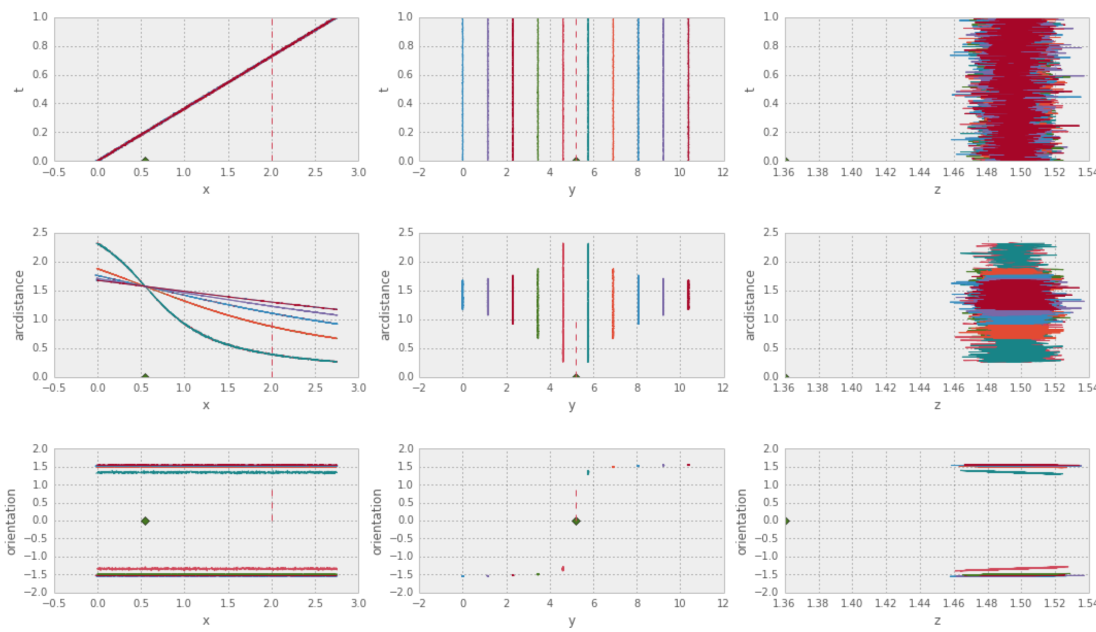
```
    (a collection of positions in the x, y, z space --- usually
    continuous) the resulting orientation and arcdistance.

    """
    fig = plt.figure(figsize=(18,10))
    t = np.linspace(0, 1, motion.shape[1])[:, np.newaxis]*np.ones((1, motion.shape[2]))
    rae_VC = xyz2azel(motion, np.array([vp['x'], vp['y'], vp['z']]))
    rae_VO = xyz2azel(center[:, np.newaxis, np.newaxis], np.array([vp['x'], vp['y'], v
    print rae_VC.shape, rae_VO.shape
    for i_ax, axe_perc in enumerate(axes_perc):
        for j_ax, axe_xyz in enumerate(axes_xyz):
            ax = fig.add_subplot(len(axes_perc), len(axes_rae), 1 + len(axes_xyz)*i_ax
            if axe_perc == 't':
                ax.plot(motion[j_ax, :, :], t)
            elif axe_perc == 'arcdistance':
                ax.plot(motion[j_ax, :, :],
                        arcdistance(rae_VO, rae_VC))
            else:
                ax.plot(motion[j_ax, :, :],
                        orientation(rae_VO, rae_VC))
            ax.plot([vp[axe_xyz]], [0.], 'D')
            ax.plot([center[j_ax], center[j_ax]], [t.min(), t.max()], '--')
            ax.set_xlabel(axe_xyz)
            ax.set_ylabel(axe_perc)
    plt.show()
    return rae_VC
print plot_xyz2perceptif.__doc__
```

```
    Let's define a function that displays for a particular motion
    (a collection of positions in the x, y, z space --- usually
    continuous) the resulting orientation and arcdistance.
```

In [19]:

```
rae_VC = plot_xyz2perceptif(motion_x)
```

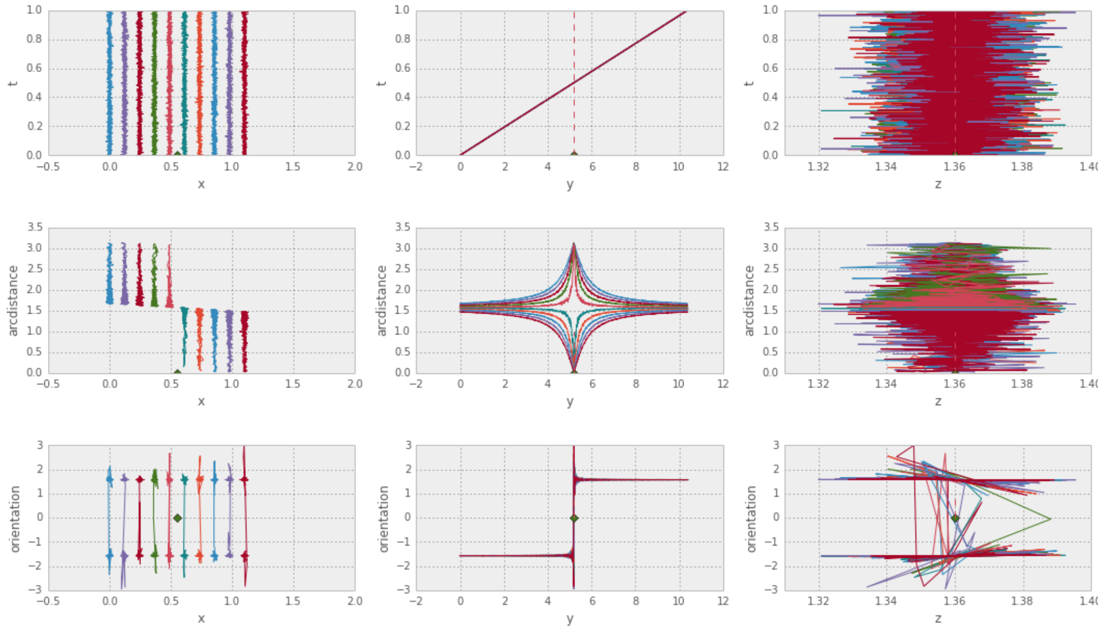
```
(3, 1000, 10) (3, 1, 1)
```



In [20]:

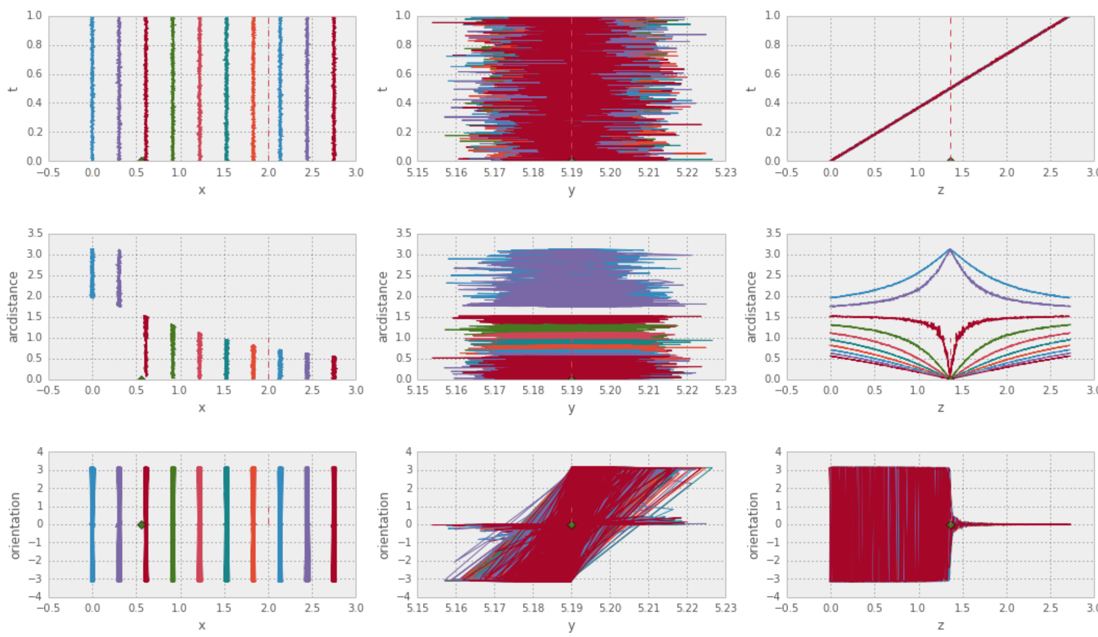
```
rae_VC = plot_xyz2perceptif(motion_y)
```

(3, 1000, 10) (3, 1, 1)




```
rae_VC = plot_xyz2perceptif(motion_z)
```

In [21]: (3, 1000, 10) (3, 1, 1)



In [21]: