test_coordonees_perceptives

Laurent Perrinet (INT, UMR7289)

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In [3]:
```
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [4]:
```
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:  [ 0.          3.76999998  1.37
]
```

In [5]:
```
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
```

1 Testing spherical coordinates

Plotting function:

In [6]:
```
def plot_xyz2azel(motion, vp=VPs[1],  axes_perc=['t', 'r', 'az', 'el', 'rec'], axes_xy
    """
    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 [22]:
```
vp = VPs[1]
print vp
```

```
{'cz': 1.36, 'cy': 4.0, 'cx': 11.057115384615384, 'pc_min': 0.001,
'address': '10.42.0.52', 'y': 4.0, 'x': 0.9428846153846154, 'pc_max':
1000000.0, 'z': 1.36, 'foc': 21.802535306060136}
```

Pointing ahead:

In [24]:
```
print xyz2azel(np.array([vp['cx'], vp['cy'], vp['cz']]), np.array([vp['x'], vp['y'], v
```

```
[ 10.11423077   0.           0.        ]
```

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

In [28]:
```
print xyz2azel(np.array([vp['cx'], vp['cy']+1, vp['cz']]), np.array([vp['x'], vp['y'],
```

```
[ 10.16354584   0.0985503    0.        ]
```

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

In [29]:
```
print xyz2azel(np.array([vp['cx'], vp['cy'], vp['cz']+1]), np.array([vp['x'], vp['y'],
```

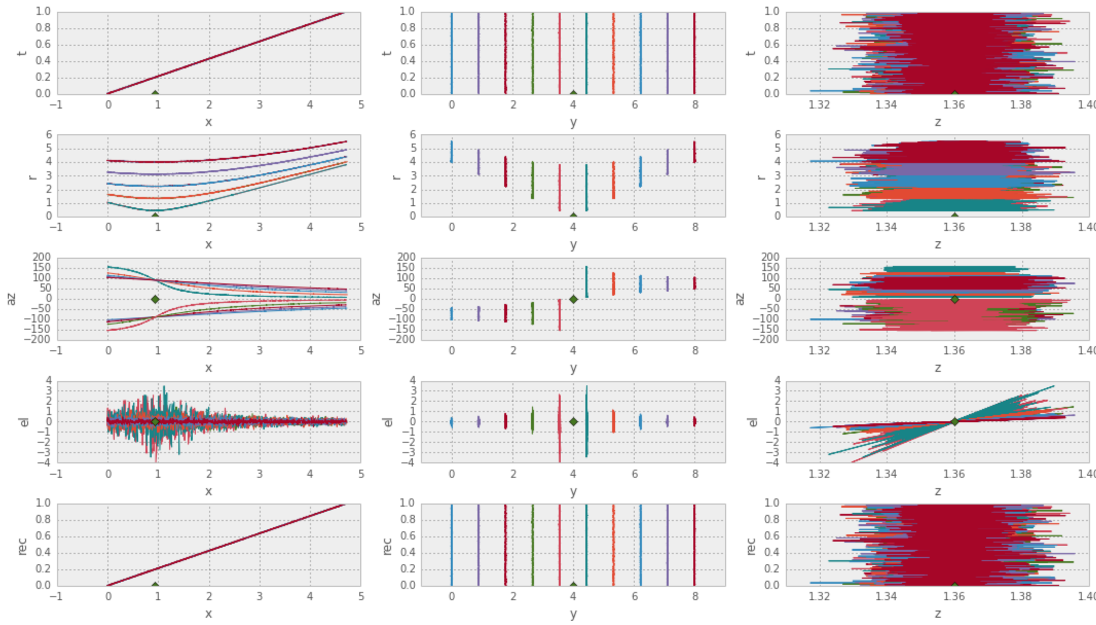
```
[ 10.16354584   0.           0.09855029]
```

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 [8]:
```
N_player, N_t = 10, 1000
```

In [9]:
```
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)
```

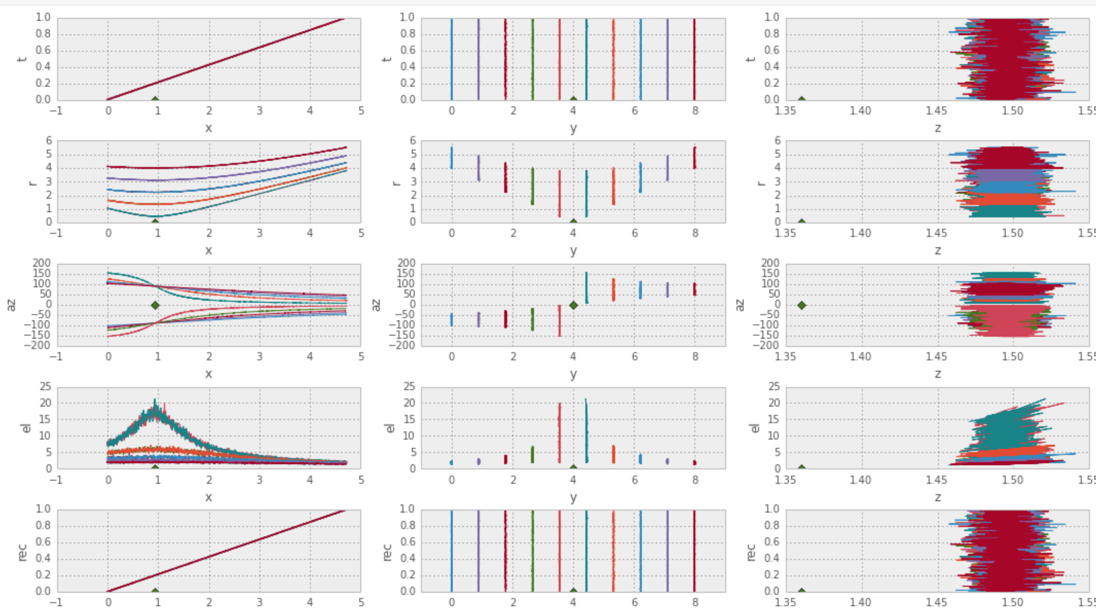


the same but with a motion slightly higer than the VPnote : when azimuth is superior to 90° in absolute value, it means it is behindNote the small elevation:

In [10]:
```
el = rae_VC[2,:,:]
print el.min(), el.max(),  el.mean(),  el.std()
```

```
-0.0694759707467 0.0607342907873 6.00750351743e-08 0.0061162178747
```

In [11]:
```
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)
```

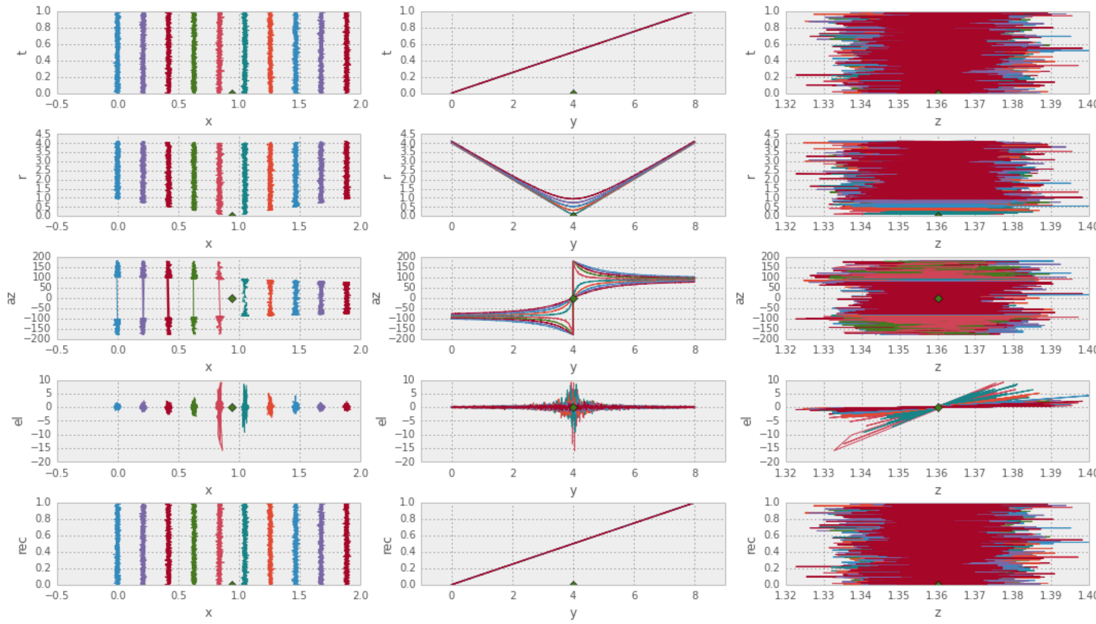


being slightly up creates a small elevation, especially for a trajectory approaching the VP

1.2 Motion in width

In [12]:

```
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)
```

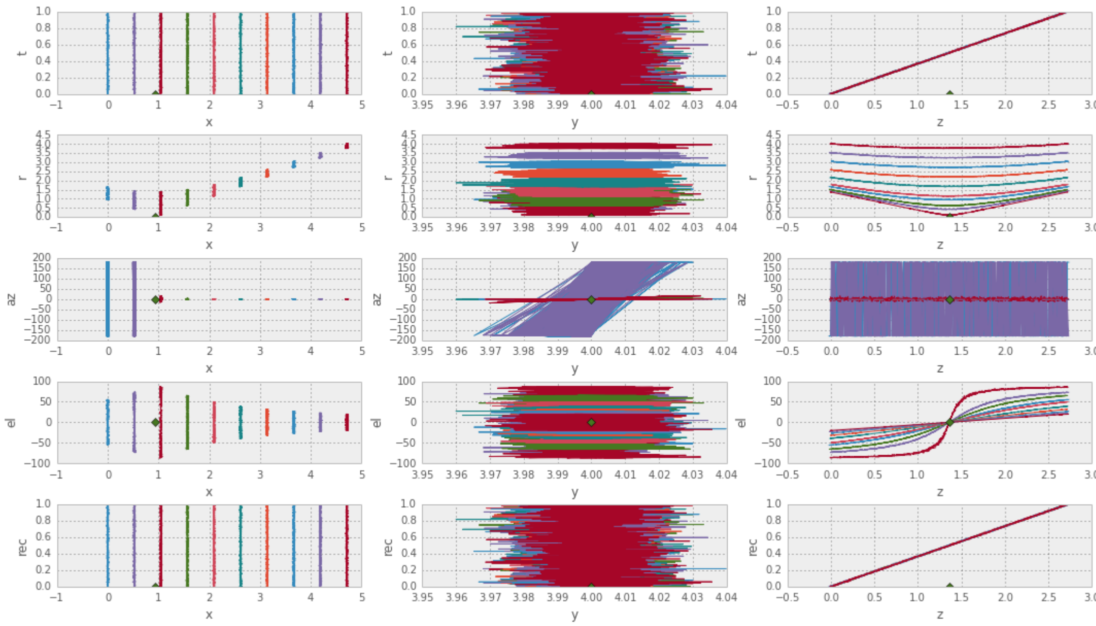


note that when the motion is behind the observer (x < VP[x]), the azimuth flips from -180° to 180°, everything is normal…

1.3 Motion in height

In [13]:

```
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 [14]:
```
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 [15]:
```
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
                 #http://en.wikipedia.org/wiki/Haversine_formula
```

In [16]:
```
def plot_xyz2perceptif(motion, vp=VPs[i_vp], 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']]))
    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 [18]:

```
plot_xyz2perceptif(motion_x)
```

```
        ---------------------------------------------------------------
--------------
    NameError                                 Traceback (most recent
call last)

        <ipython-input-18-c09b8f1ab8b2> in <module>()
    ----> 1 plot_xyz2perceptif(motion_x)

        <ipython-input-16-ccc213330bd4> in plot_xyz2perceptif(motion,
vp, axes_xyz)
         11     motion_rec = rae2xyz(rae_VC, np.array([vp['x'],
vp['y'], vp['z']]))
         12     #print rae_VC.shape
    ---> 13     for i_ax, axe_perc in enumerate(axes_perc):
         14         for j_ax, axe_xyz in enumerate(axes_xyz):
         15             #print i_ax, j_ax, 3*i_ax + j_ax
```

```
NameError: global name 'axes_perc' is not defined
```

```
<matplotlib.figure.Figure at 0x10b905410>
```

In [17]: