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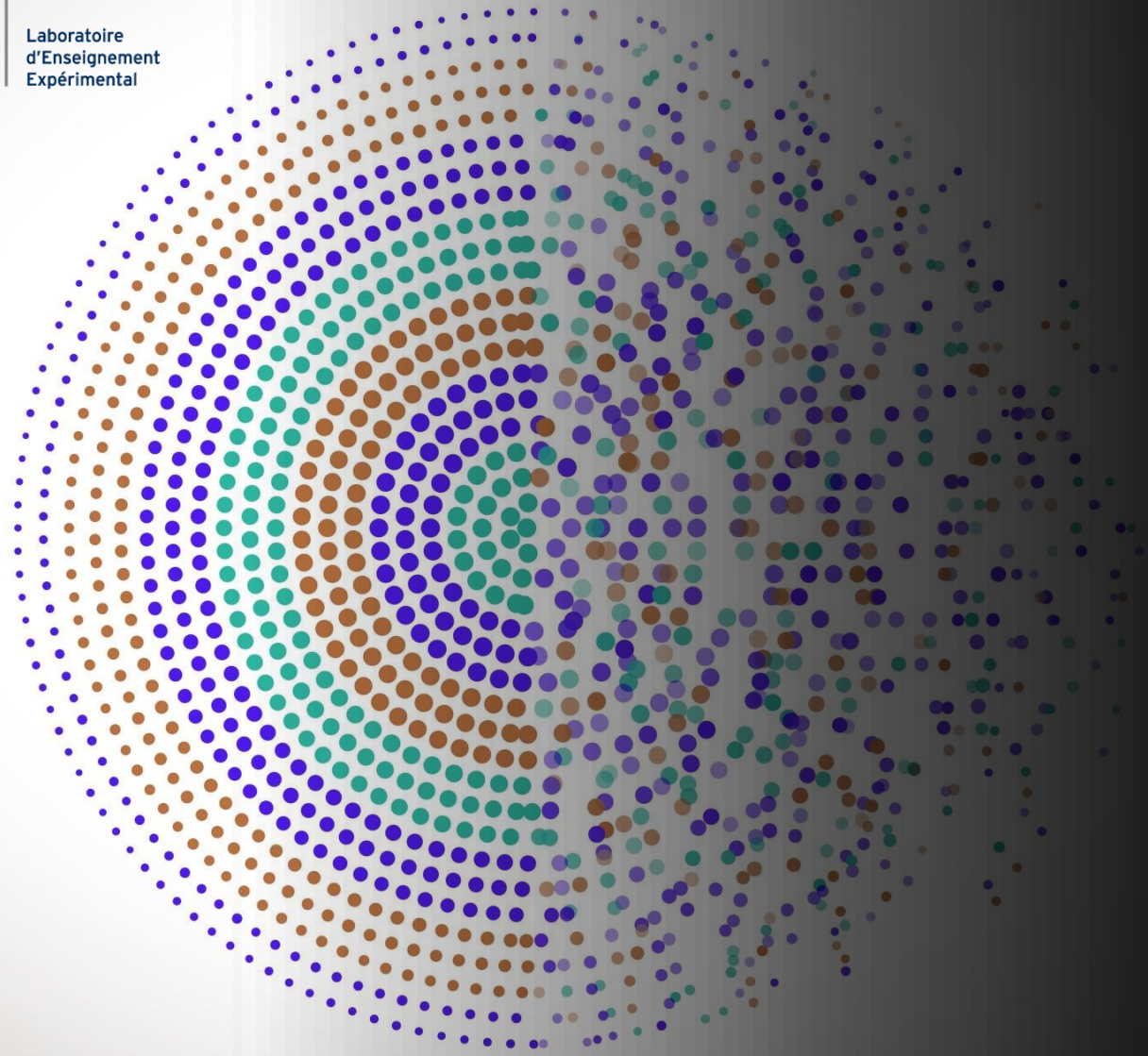


# Python Sciences

# Bonnes pratiques

Outils Numériques / Semestre 5
Institut d'Optique / B3_1

# Vecteurs / matrices / Exemple 1

- Exemple 1a

```
N = 10
vect = []
for i in range(N):
    vect.append(0)
```

- Exemple 1b

```
import numpy as np
N = 10
vect = np.zeros(N)
```

# Vecteurs / matrices / Exemple 1

- Exemple 1a

```
N = 10
vect = []
for i in range(N):
    vect.append(0)
```

```
print(type(vect))
```

```
<class 'list'>
```

- Exemple 1b

```
import numpy as np
N = 10
vect = np.zeros(N)
```

```
print(type(vect))
```

```
<class 'numpy.ndarray'>
```

# Vecteurs / matrices / Exemple 1

- Exemple 1a

```
N = 10
vect = []
for i in range(N):
    vect.append(0)
```

```
print(type(vect))
```

```
<class 'list'>
```

Temps exécution :
N=10 ~1 us
N=1000 ~100 us

- Exemple 1b

```
import numpy as np
N = 10
vect = np.zeros(N)
```

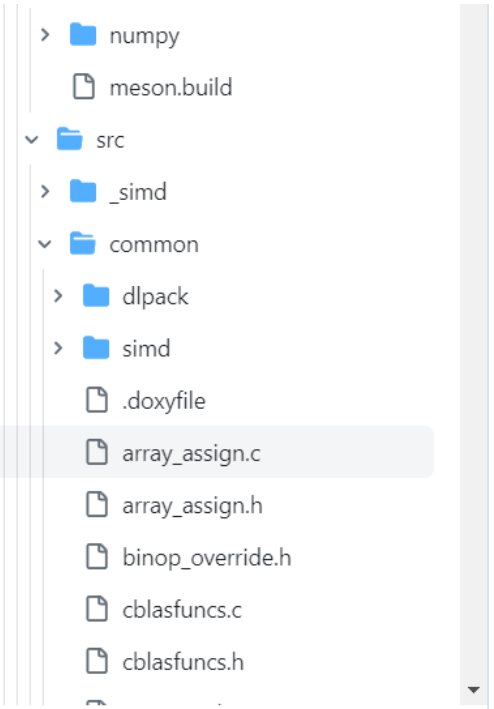
```
print(type(vect))
```

```
<class 'numpy.ndarray'>
```

Temps exécution :
N=10 ~0,25 us
N=1000 ~0,6 us

*Exécution : Core(TM) i7-9750H CPU @ 2.60GHz / 32 Go RAM*

# Vecteurs / matrices / Exemple 1




```
81            Py_DECREF(shape1);
82            Py_DECREF(shape2);
83            return -1;
84        }
85    }
86
87    /* See array_assign.h for parameter documentation */
88    NPY_NO_EXPORT int
89    raw_array_is_aligned(int ndim, npy_intp cons
90                         char *data, npy_intp co
91    {
92
93        /*
94         * The code below expects the following:
95         *  * that alignment is a power of two,
96         *  * that casting from pointer to uintp gives a sensible representation
97         *    we can use bitwise operations on (perhaps *not* req. by C std,
98         *    but assumed by glibc so it should be fine)
99         *  * that casting stride from intp to uintp (to avoid dependence on the
100        *    signed int representation) preserves remainder wrt alignment, so
101        *    stride%a is the same as ((unsigned intp)stride)%a. Req. by C std.
102        *
```

- Exemple 1b

```
import numpy as np
N = 10
vect = np.zeros(N)
```

Temps exécution :
N=10 ~1 us
N=1000 ~100 us

Temps exécution :
N=10 ~0,25 us
N=1000 ~0,6 us

*Exécution : Core(TM) i7-9750H CPU @ 2.60GHz / 32 Go RAM*

# Vecteurs / matrices / Exemple 2

```
import numpy as np
data = np.random.rand(1000,5)
print(data.shape)
```

```
(1000, 5)
```

# Vecteurs / matrices / Exemple 2

```
import numpy as np
data = np.random.rand(1000,5)
print(data.shape)
```

```
(1000, 5)
```

- Exemple 2a

```
v1 = []
v2 = []
for i in range(len(data)):
    v1.append(data[i, 1])
    v2.append(data[i, 2])
print(type(v1))
```

```
<class 'list'>
```

- Exemple 2b

```
v1 = data[:, 1]
v2 = data[:, 2]
print(type(v1))
```

```
<class 'numpy.ndarray'>
```

# Vecteurs / matrices / Exemple 2

```
import numpy as np
data = np.random.rand(1000,5)
print(data.shape)
```

(1000, 5)

- Exemple 2a

```
v1 = []
v2 = []
for i in range(len(data)):
    v1.append(data[i, 1])
    v2.append(data[i, 2])
print(type(v1))
```

<class 'list'>

Temps exécution :
~400 us

- Exemple 2b

```
v1 = data[:, 1]
v2 = data[:, 2]
print(type(v1))
```

<class 'numpy.ndarray'>

Temps exécution :
~0,5 us

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# Fonctions / Exemple 3

```
def sinus(t, A, f):
    return A*np.sin(2*np.pi*f*t)

time_vect = np.linspace(0, 1, 1001)
```

- Exemple 3a

```
TF = np.fft.fft(sinus(time_vect, 1, 10))
plt.figure()
plt.plot(time_vect, sinus(time_vect, 1, 10))
```

- Exemple 3b

```
sig = sinus(time_vect, 1, 10)
TF = np.fft.fft(sig)
plt.figure()
plt.plot(time_vect, sig)
```

# Fonctions / Paramètres optionnels

```
def sinus(t, A=1, f=100):
    return A*np.sin(2*np.pi*f*t)

time_vect = np.linspace(0, 1, 101)
```

```
A1 = sinus(time_vect)
A2 = sinus(time_vect, A=10)
A3 = sinus(time_vect, A=10, f=200)
```

# Fonctions / Paramètres optionnels

```
def sinus(t, A=1, f=100):
    return A*np.sin(2*np.pi*f*t)

time_vect = np.linspace(0, 1, 101)
```

```
A1 = sinus(time_vect)
A2 = sinus(time_vect, A=10)
A3 = sinus(time_vect, A=10, f=200)
```

***PHYSIQUE***

***Te = 1/101 s ≈ 10ms***

***f = 100 Hz***
***T ≈ 10ms***

***Critère de Shanonn-Nyquist non respecté***

# Fonctions / Paramètres optionnels

```
def sinus(t, A=1, f=100):
    if(isinstance(t, np.ndarray)):
        Te = t[0] - t[1]
        if(1/Te < 2*f) print('Shannon
sampling frequency warning !!')
    return A*np.sin(2*np.pi*f*t)

time_vect = np.linspace(0, 1, 101)
```

***PHYSIQUE***

***Te = 1/101 s ≈ 10ms***

```
A1 = sinus(time_vect)
A2 = sinus(time_vect, A=10)
A3 = sinus(time_vect, A=10, f=200)
```

```
Shannon sampling frequency warning !!
```

# Fichiers / Exemple 4

- Différents types de fichiers
  - ASCII / texte
  - Binaires

```
#CHANNEL:CH1
#SIZE=4000
Index,Time(s),Volt(V)
1,0.000000e+00,3.200000e-01
2,4.000000e-05,-8.000000e-02
3,8.000000e-05,-4.400000e-01
4,1.200000e-04,-6.000000e-01
5,1.600000e-04,-6.800000e-01
6,2.000000e-04,-5.600000e-01
7,2.400000e-04,-3.200000e-01
```

**Fichier CSV**

Codage ASCII
Délimiteur de colonnes
(défaut : point-virgule)

| | A | B | C |
|---|---|---|---|
| 1 | #CHANNEL:CH1 | | |
| 2 | #SIZE=4000 | | |
| 3 | Index | Time(s) | Volt(V) |
| 4 | 1 | 0.000000e+00 | 3.200000e-01 |
| 5 | 2 | 4.000000e-05 | -8.000000e-02 |
| 6 | 3 | 8.000000e-05 | -4.400000e-01 |
| 7 | 4 | 1.200000e-04 | -6.000000e-01 |
| 8 | 5 | 1.600000e-04 | -6.800000e-01 |

# Fichiers / Exemple 4

- Selon les applications

**Fichier CSV**

Codage ASCII
Délimiteur de colonnes
(défaut : point-virgule)

**Fichier JPG**

Codage binaire
En-tête spécifique

**En-tête**

**Données**

```
1  #CHANNEL:CH1
2  #SIZE=4000
3  Index,Time(s),Volt(V)
4  1,0.000000e+00,3.200000e-01
5  2,4.000000e-05,-8.000000e-02
6  3,8.000000e-05,-4.400000e-01
7  4,1.200000e-04,-6.000000e-01
8  5,1.600000e-04,-6.800000e-01
```

| JFIF file structure | | |
|---|---|---|
| **Segment** | **Code** | **Description** |
| SOI | FF D8 | Start of Image |
| JFIF-APP0 | FF E0 *s1 s2* 4A 46 49 46 00 ... | see below |
| JFXX-APP0 | FF E0 *s1 s2* 4A 46 58 58 00 ... | optional, see below |
| … additional marker segments (for example SOF, DHT, COM) | | |
| SOS | FF DA | Start of Scan |
| | compressed image data | |
| EOI | FF D9 | End of Image |

https://en.wikipedia.org/wiki/JPEG_File_Interchange_Format

# Fichiers / Exemple 4

- Exemple 4a

```
f = open("B3_data_01.csv", "r")
cpt = 0
N = 10
for line in f:
    if cpt < N :
        print(line)
        cpt += 1
f.close()
```

```
#CHANNEL:CH1

#SIZE=4000

Index,Time(s),Volt(V)

1,0.000000e+00,3.200000e-01

2,4.000000e-05,-8.000000e-02

3,8.000000e-05,-4.400000e-01
```

# Fichiers / Exemple 4

- Exemple 4a

```
f = open("B3_data_01.csv", "r")
cpt = 0
HEADER = 2
NB_DATA = 4000
delimiter = ','
t = np.zeros(NB_DATA )
v = np.zeros(NB_DATA )
```

```
for line in f:
    if (cpt > HEADER) and (cpt < (HEADER + NB_DATA + 1)) :
        data = line.split(delimiter)
        t[cpt-HEADER-1] = float(data[1])
        v[cpt-HEADER-1] = float(data[2])
    cpt += 1
f.close()
```

```
#CHANNEL:CH1

#SIZE=4000

Index,Time(s),Volt(V)

1,0.000000e+00,3.200000e-01

2,4.000000e-05,-8.000000e-02

3,8.000000e-05,-4.400000e-01
```

# Fichiers / Exemple 4

- Exemple 4a

```
f = open("B3_data_01.csv", "r")
cpt = 0
HEADER = 2
NB_DATA = 4000
delimiter = ','
t = np.zeros(NB_DATA )
v = np.zeros(NB_DATA )
```

Temps exécution :
~6 ms (pour 4000 données)

```
for line in f:
    if (cpt > HEADER) and (cpt < (HEADER + NB_DATA + 1)) :
        data = line.split(delimiter)
        t[cpt-HEADER-1] = float(data[1])
        v[cpt-HEADER-1] = float(data[2])
    cpt += 1
f.close()
```

- Exemple 4b

```
data = np.genfromtxt("B3_data_01.csv", delimiter=',', skip_header=2, skip_footer=6)
t = data[:,1]
v = data[:,2]
```

Temps exécution :
~11 ms (pour 4000 données)