Biocam / LuSEApher NUMerEnv Meeting Status Sept. 2021

Mercredi 29 Septembre 2021

CPPM

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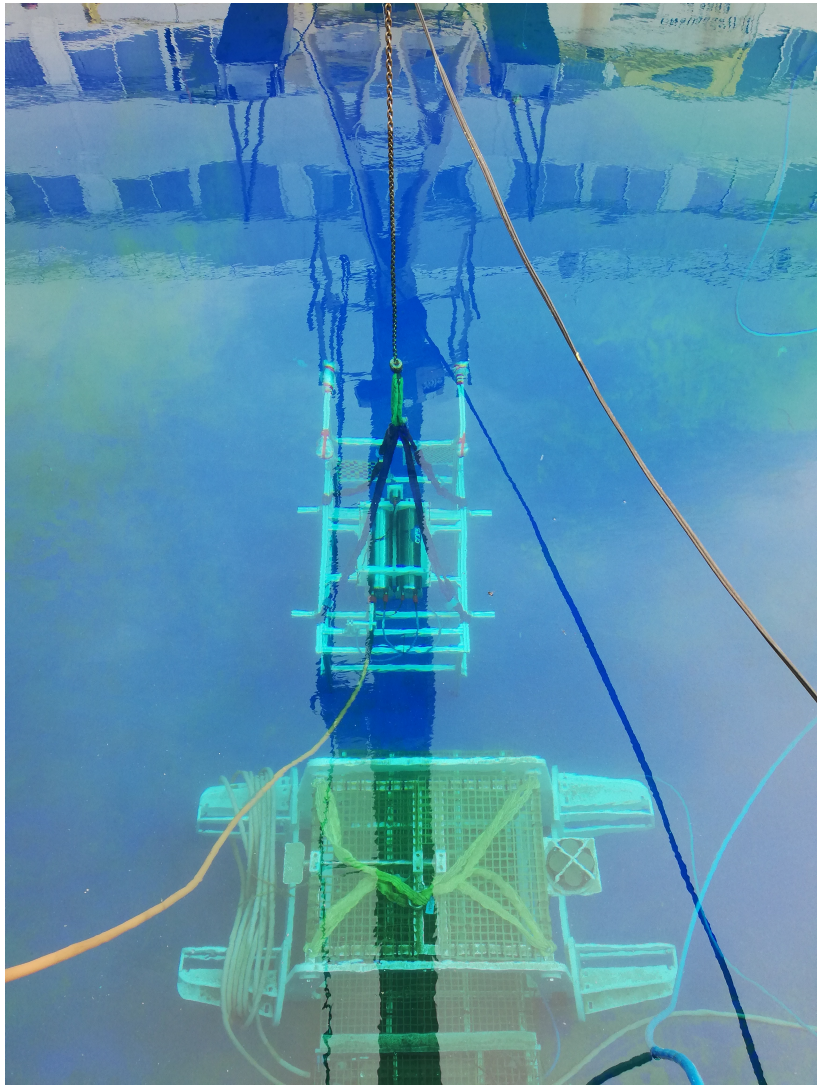
Status Septembre 2021

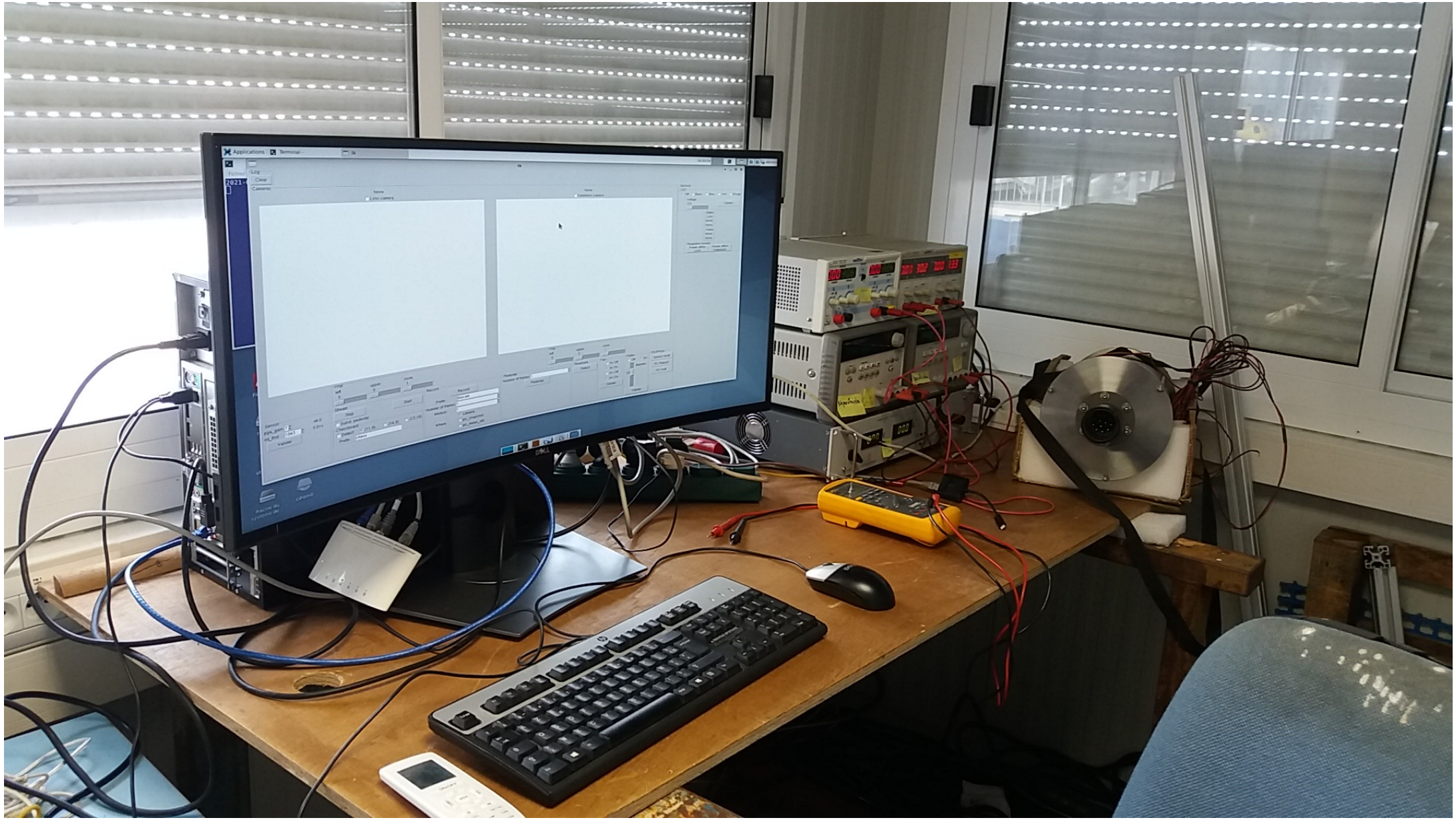
- Test en Bassin à La Seyne sur Mer - DT-INSU -IFREMER
  - Du 13 au 16 Septembre 2021
    - Montage et Verification le 13
    - Plongeurs MiO le 14/09 (Calibration 1) et le 16/09 (Calibration 2 + Color Checker)
  - <u>Objectifs du tests :</u>

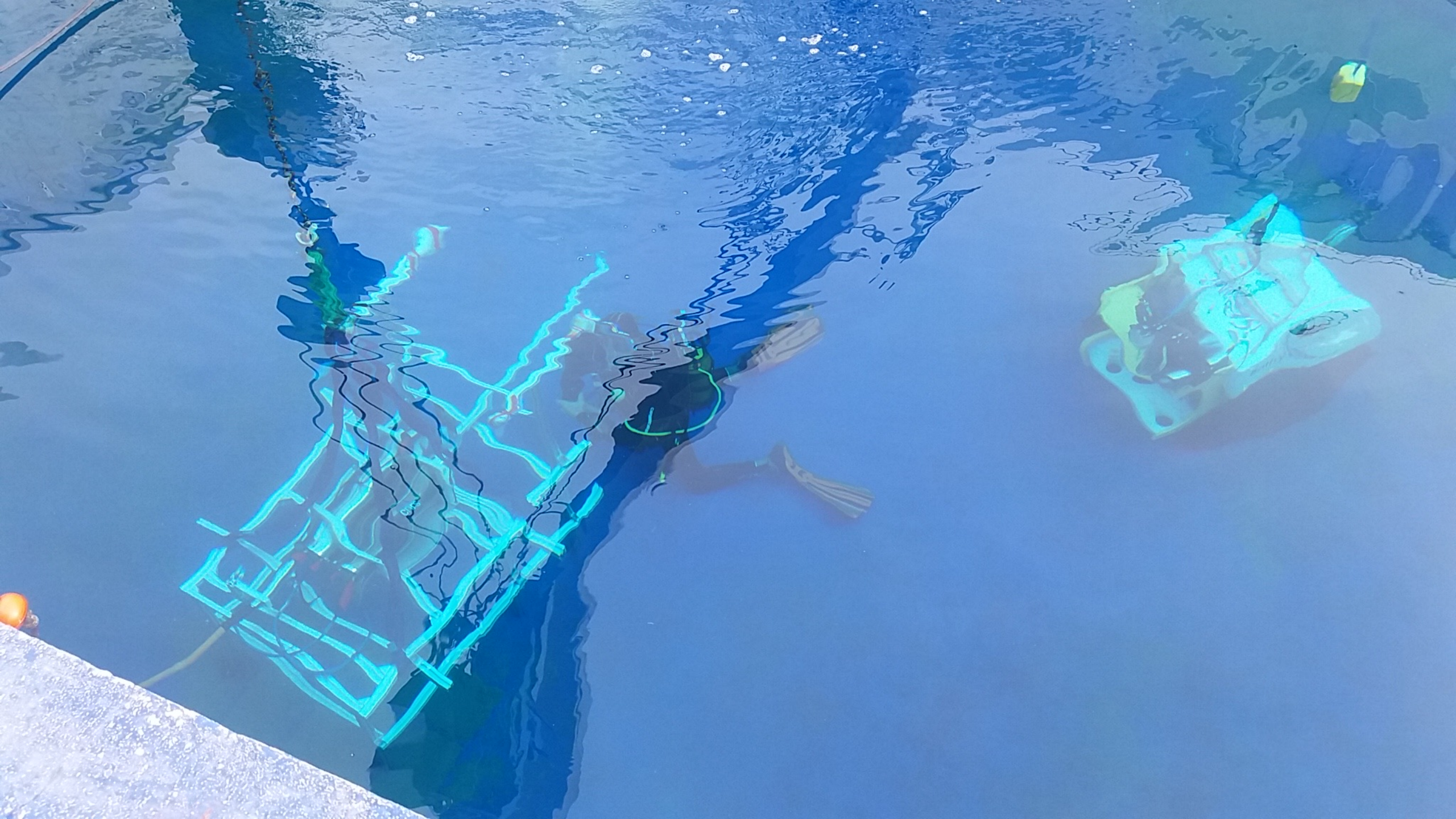
    Steréo
    - Calibrations Caméras [intrinsic] des deux cameras (focale / distortions / centre optique)
    - Calibration Stéréo [extrinsic] (Rotation / Translation relative entre les deux cameras)
    - Validation de la correction de distortion
    - Validation de la Calibration stereo
    - Validation reconstruction de Z
    - Validation de la mesure de la taille des objets pour une distance Z mesurée par stereo

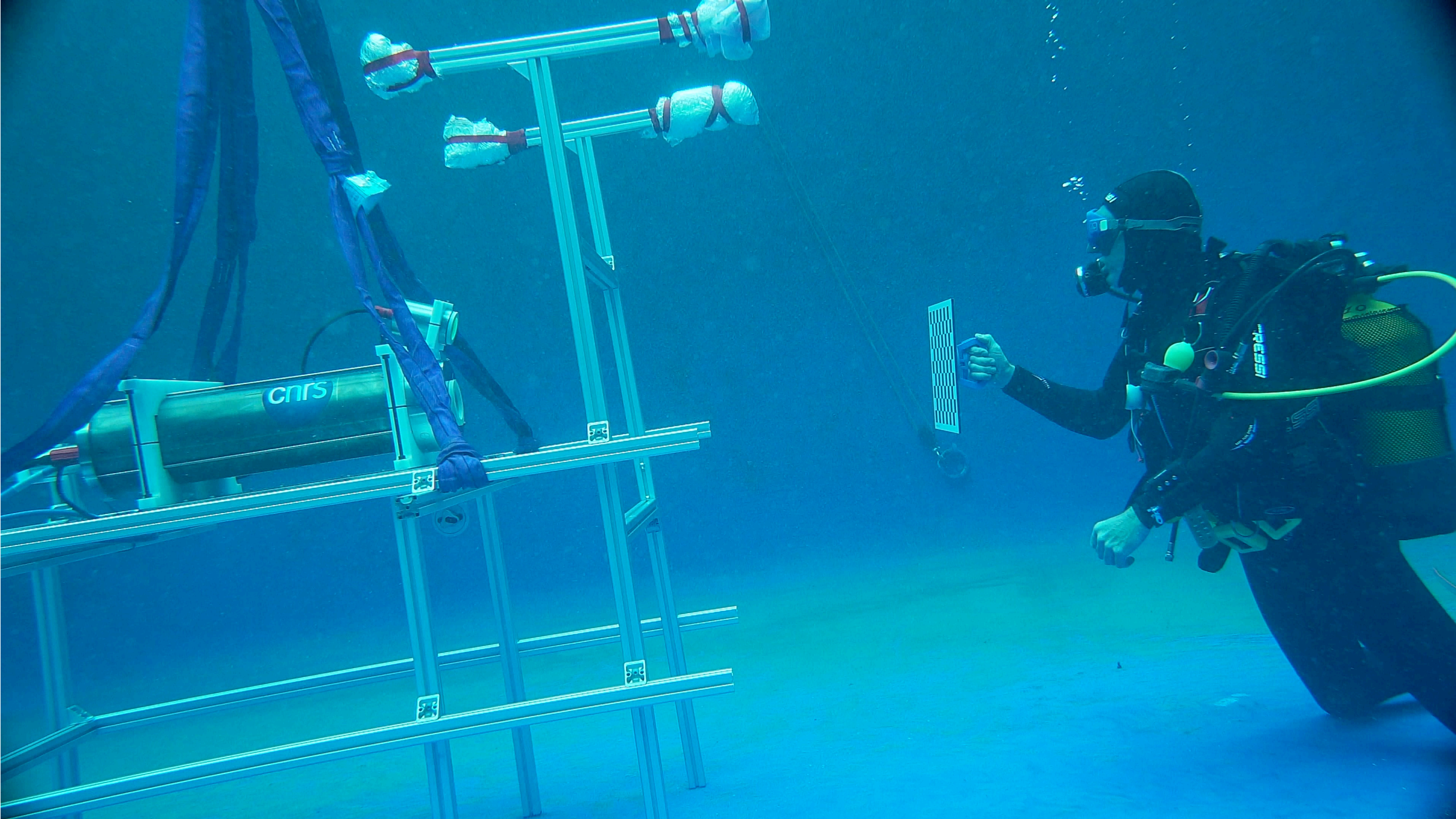
    Radiométrie
    - Calibration de la réponse des pixels couleurs RGBN dans l'eau
    - Validation du Spectre des illuminants LED
    - Mesure Réflexion versus [V_LED, Z], sur Color Checker 12 couleurs : Coordonnées colorimétriques métrique L*a*b (X,Y,Z)
      - Objectif reconstruire la vrai couleure à partire de la Color Correction Matrix dans l'eau
      - Mesure d'attenuation par bande de couleur bande de couleur

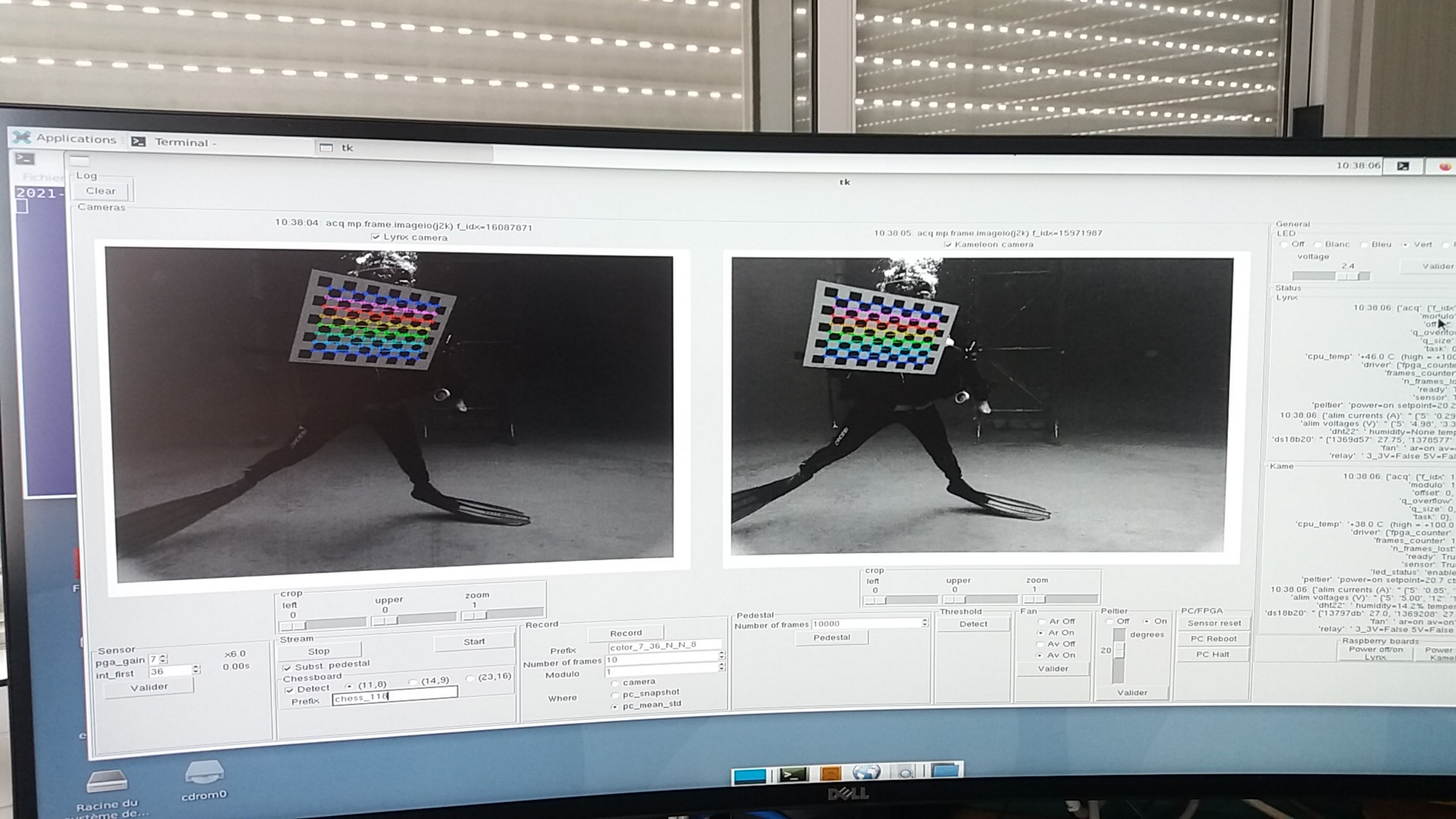
Structure de Test + les 2 cameras intégrées




Applications
Terminal
Log
Clear
Cameras

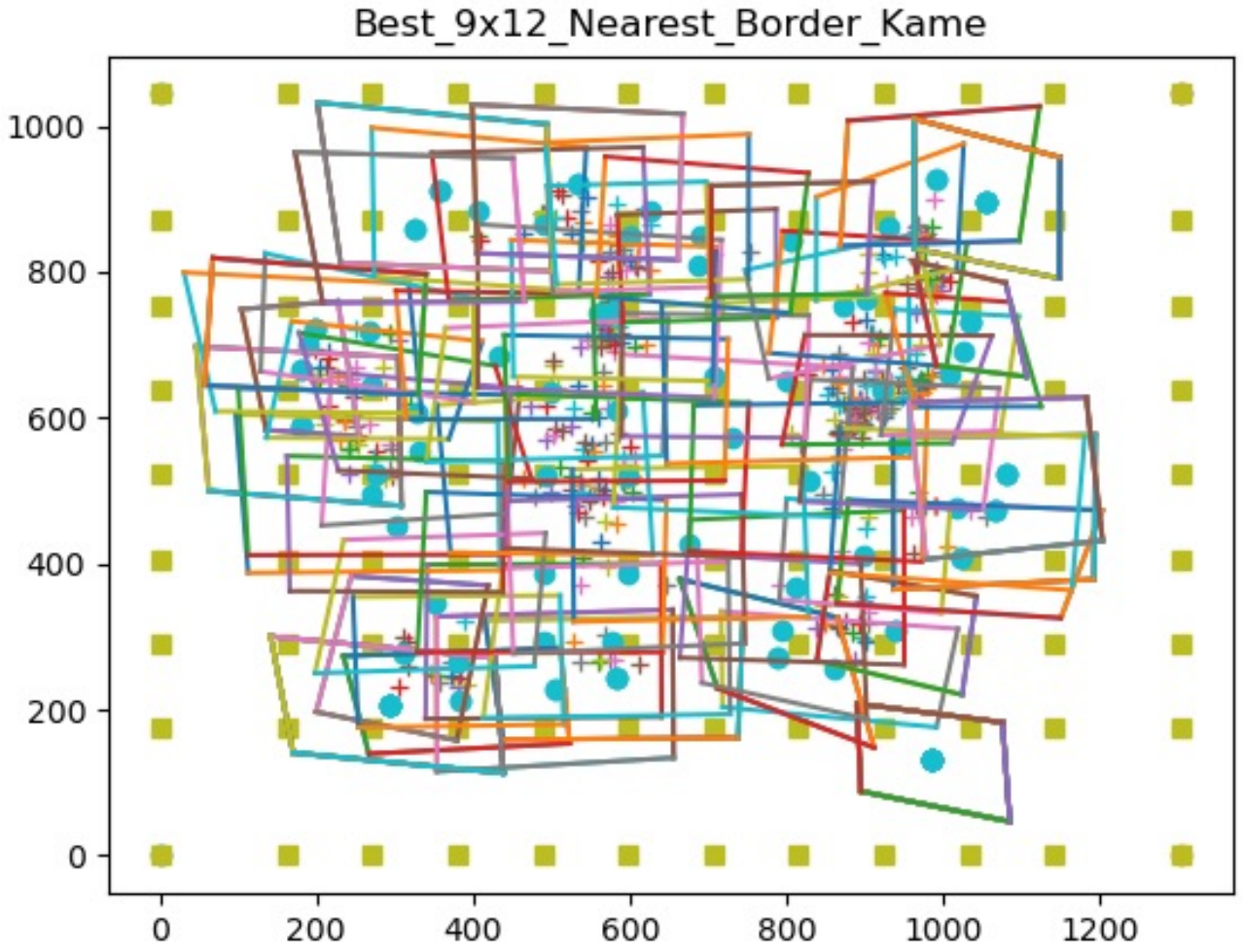


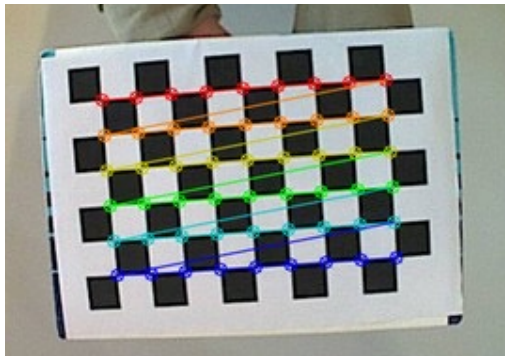

cnrs


Applications
Terminal -
tk
Log
Clear
Cameras
10:38:04 acq.mp.frame.imageio(j2k) f_idx=16087871
Lynx camera
10:38:05 acq.mp.frame.imageio(j2k) f_idx=15971987
Kameleon camera
crop
left
upper
zoom
Sensor
pga_gain
int_first
Valider
Stream
Stop
Start
Subst. pedestal
Chessboard
Detect
(11,8)
(14,9)
(23,16)
Prefix
chess_116
Record
Record
Prefix
color_7_36_N_N_8
Number of frames
Modulo
Where
camera
pc_snapshot
pc_mean_std
Pedestal
Number of frames
Pedestal
Threshold
Detect
Fan
Ar Off
Ar On
Av Off
Av On
Valider
Peltier
Off
On
degrees
Valider
PC/FPGA
Sensor reset
PC Reboot
PC Halt
General
LED
Off
Blanc
Bleu
Vert
voltage
Valider
Status
Lynx
Kame
Raspberry boards
Power off/on Lynx
Power Kame
Racine du
cdrom0

Selection des images pour la calibration de la distortion

Optimization par selection des images de la couverture du champ de vue.





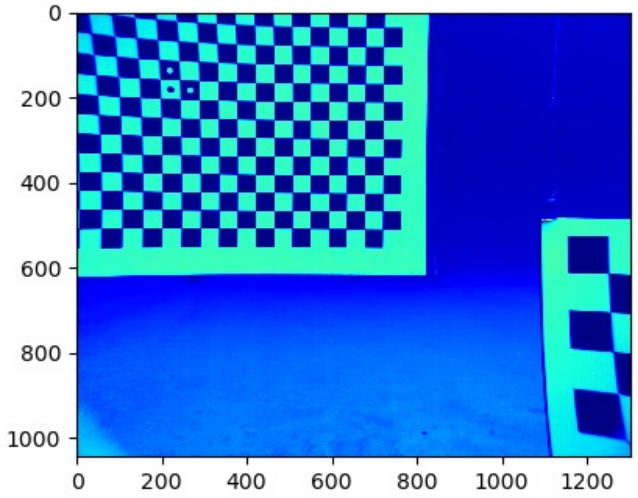

Ifremer
cnrs

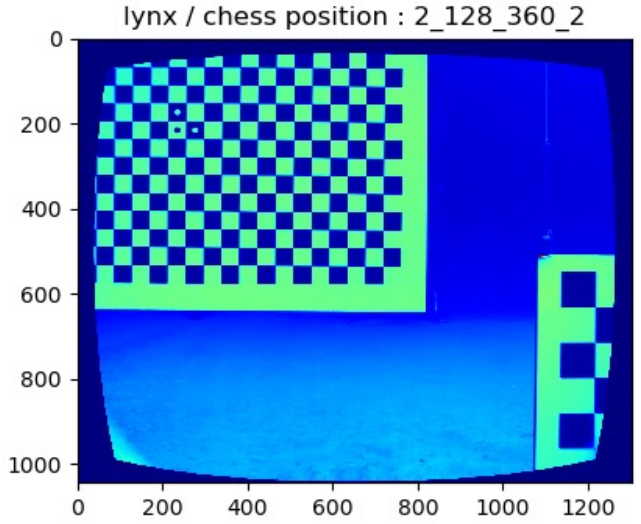
Validation de la calibration de la distortion

AVANT

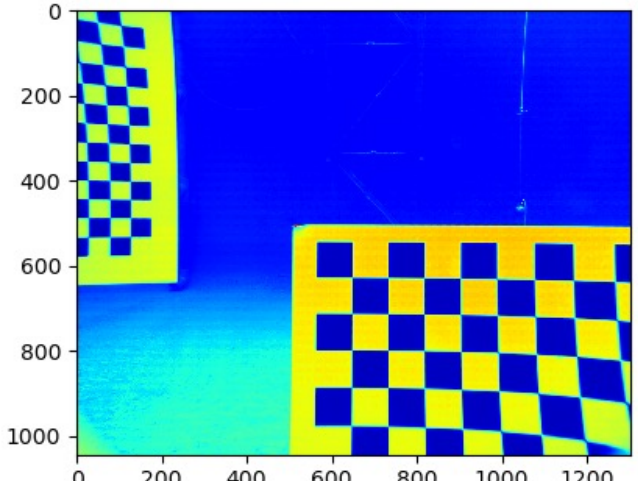
APRES CALIBRATION

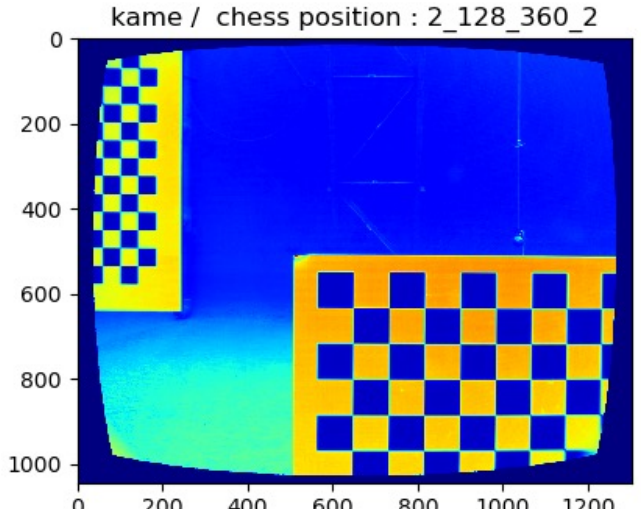
LYNX (B/W)



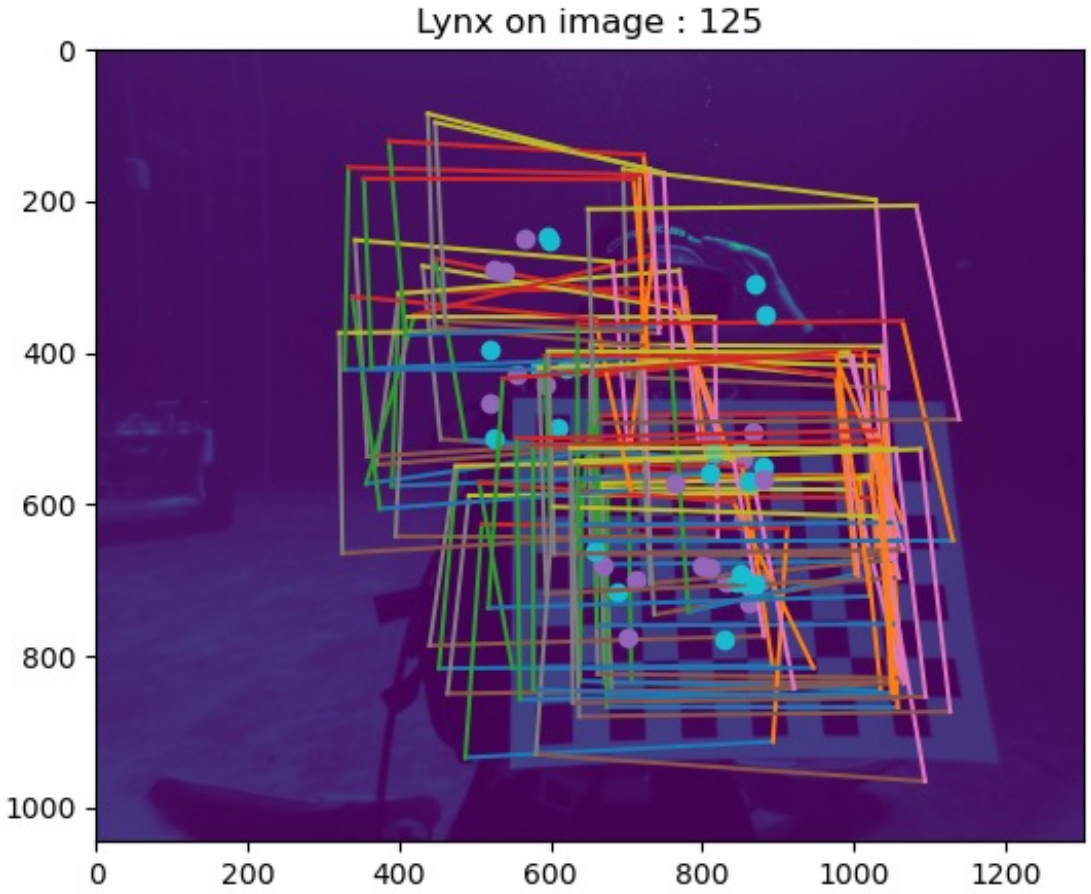


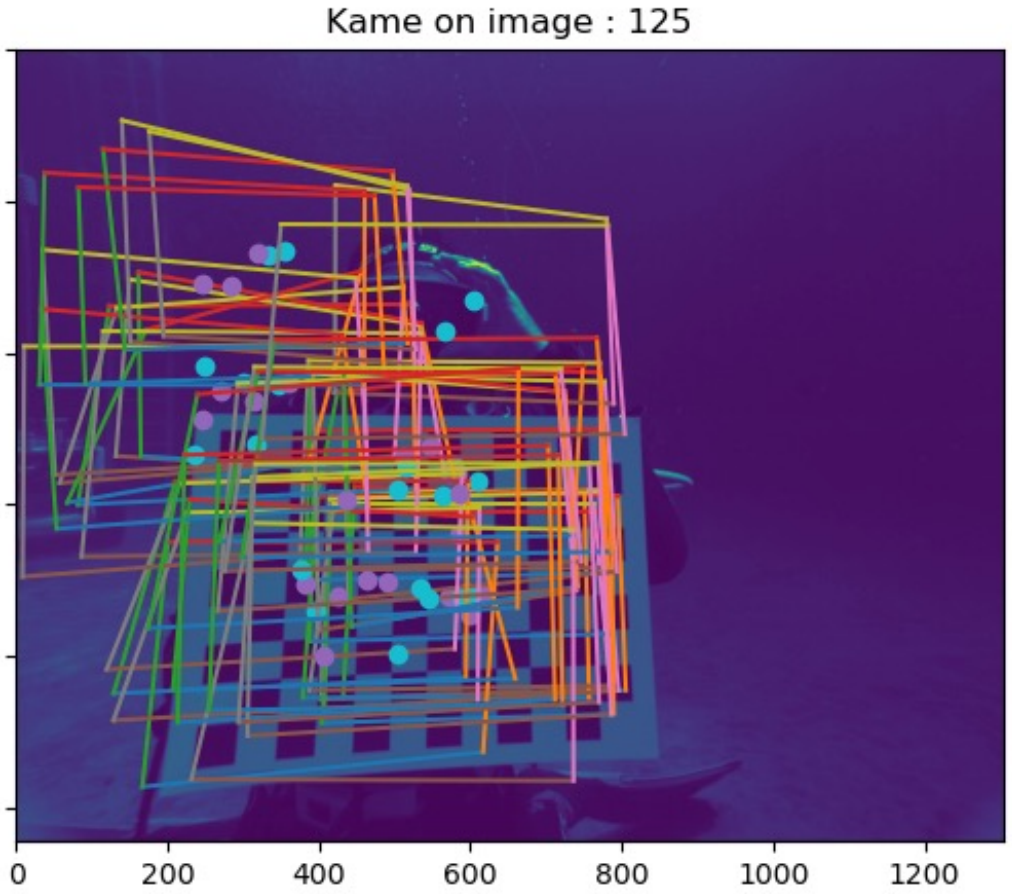
KAMELEO (RGB)



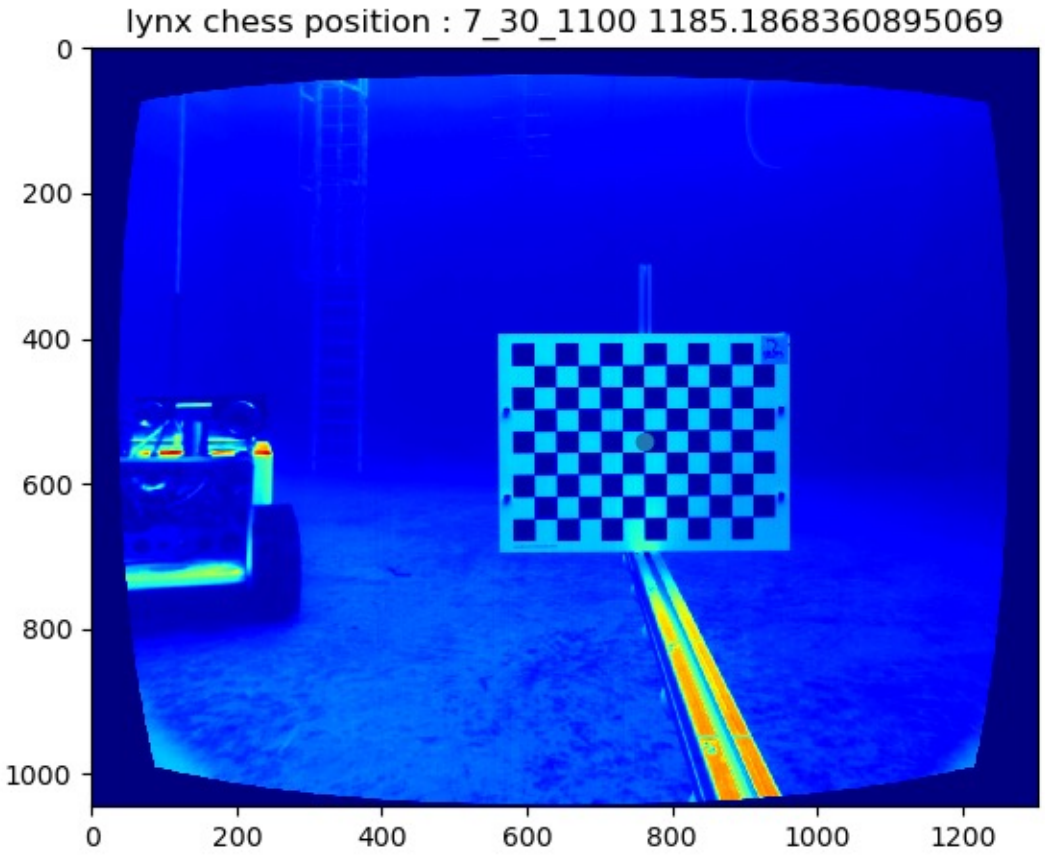


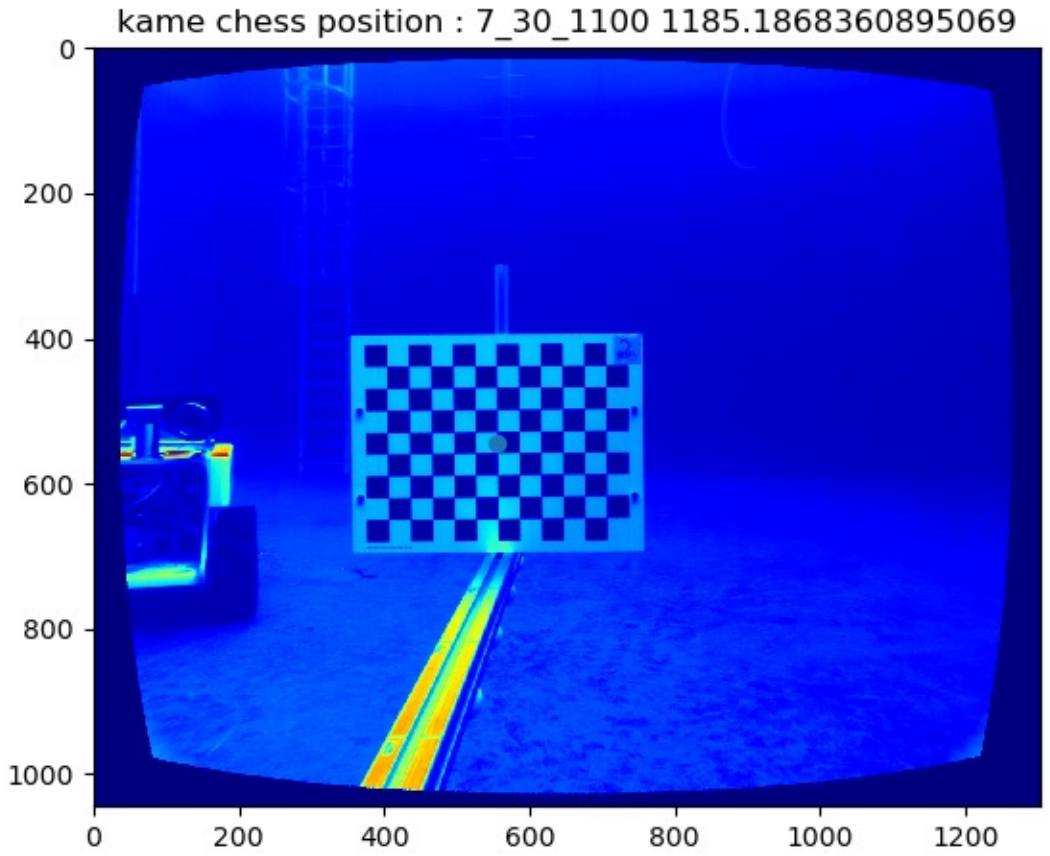
Calibration Stereo – Synchronization des détections



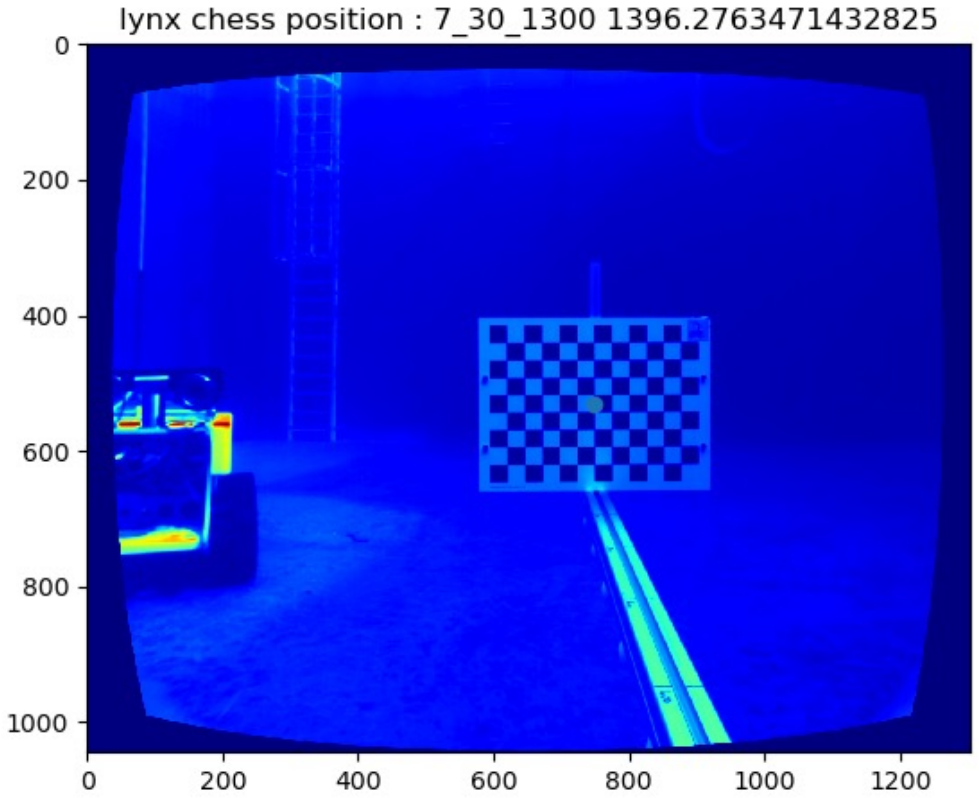


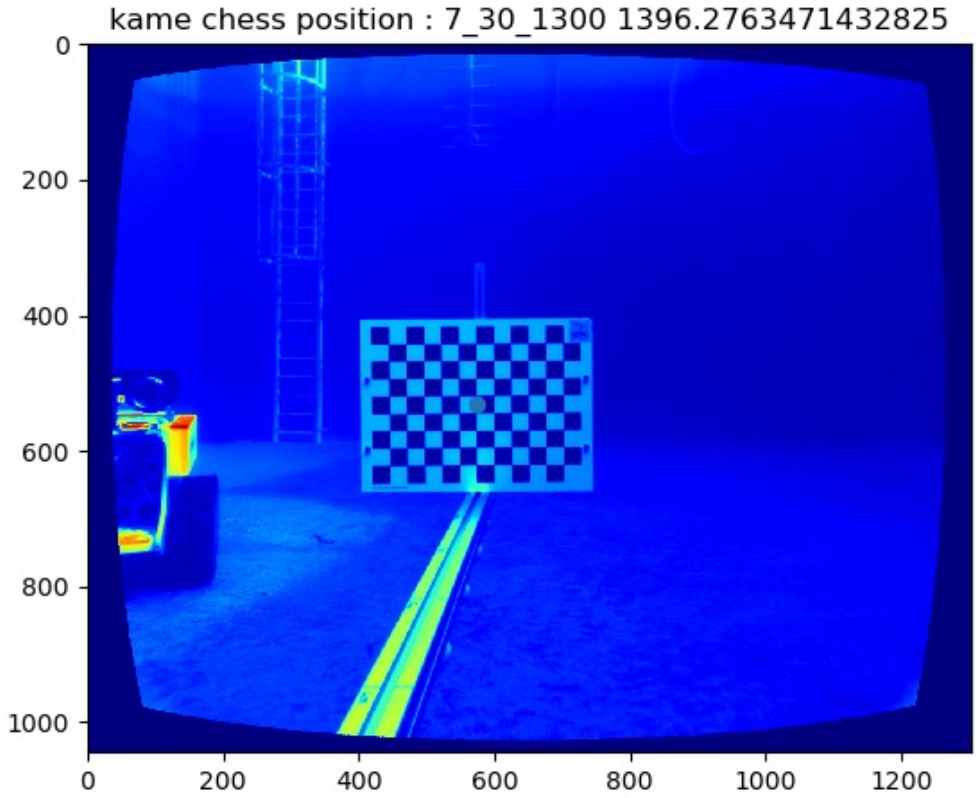
Validation de la mesure de taille versus Z par stereo : 118.5 cm



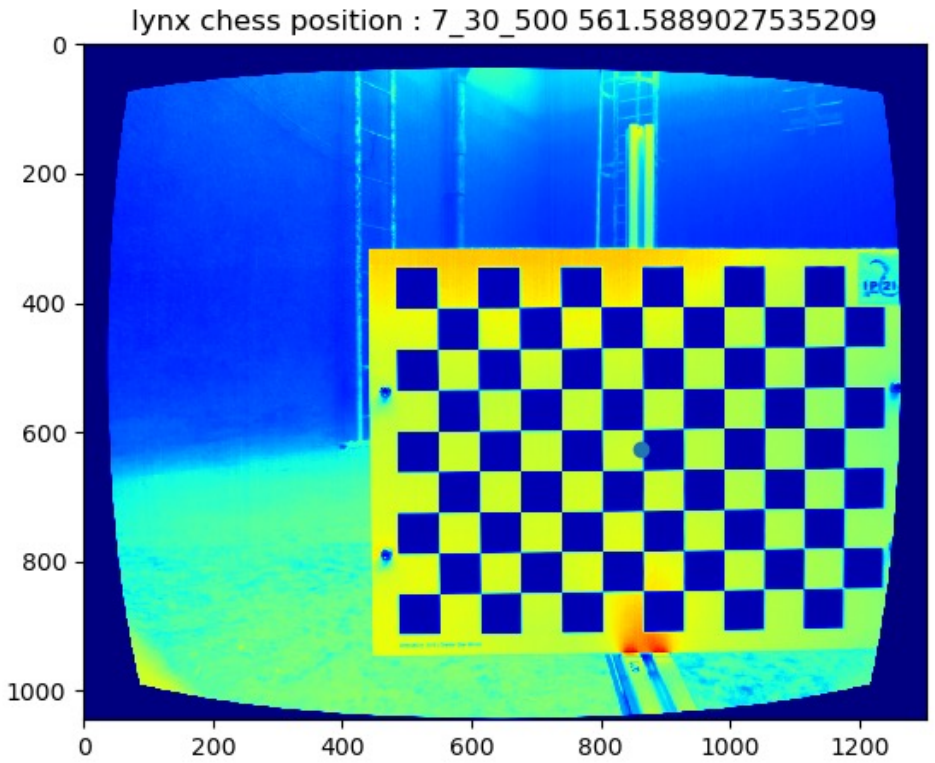


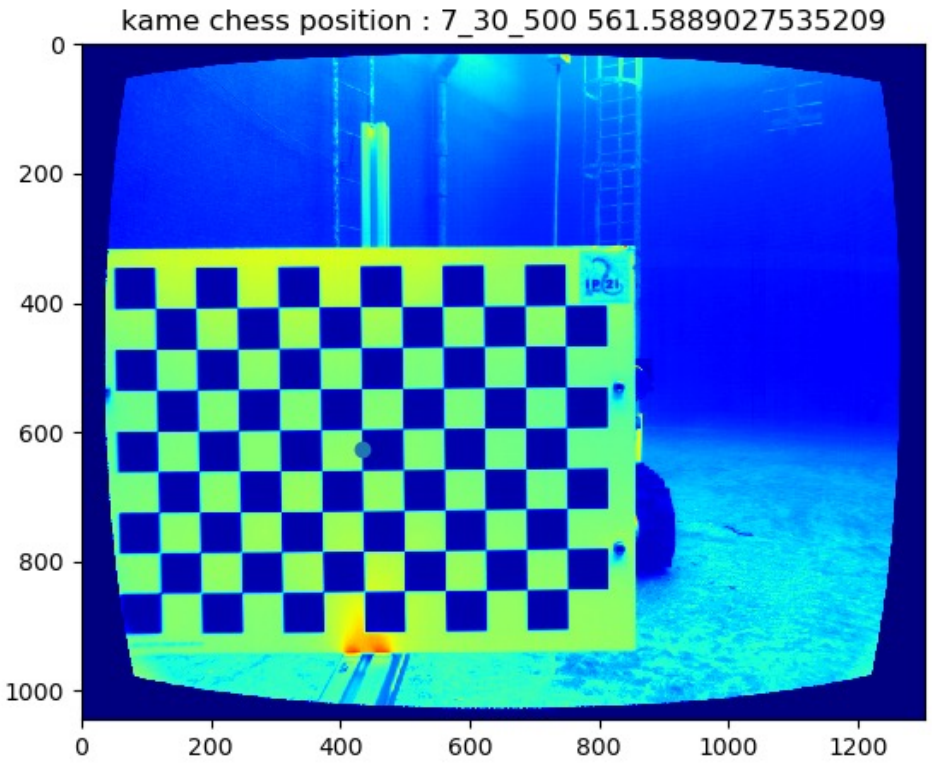
Validation de la mesure de taille versus Z par stéreo : 139.6 cm





Validation de la mesure de taille versus Z par stéreo : 56.2 cm





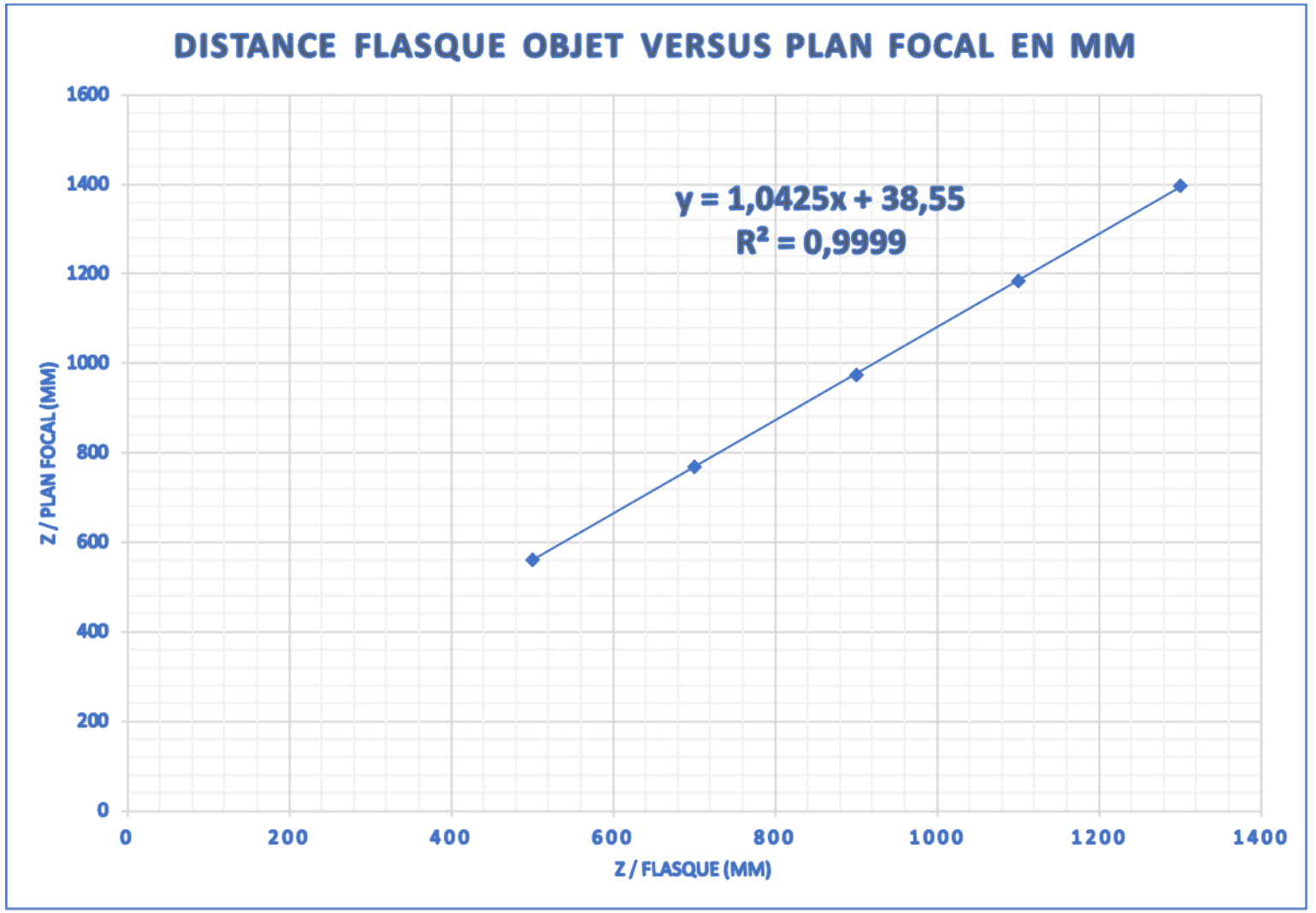
Mesure de distance – calcul d'Offset

Offset =
Distance entre

Le flasque
(repère physique)

&

le centre optique
Caluclé par calibration



Verfication de la taille des objets : Chessborad corners

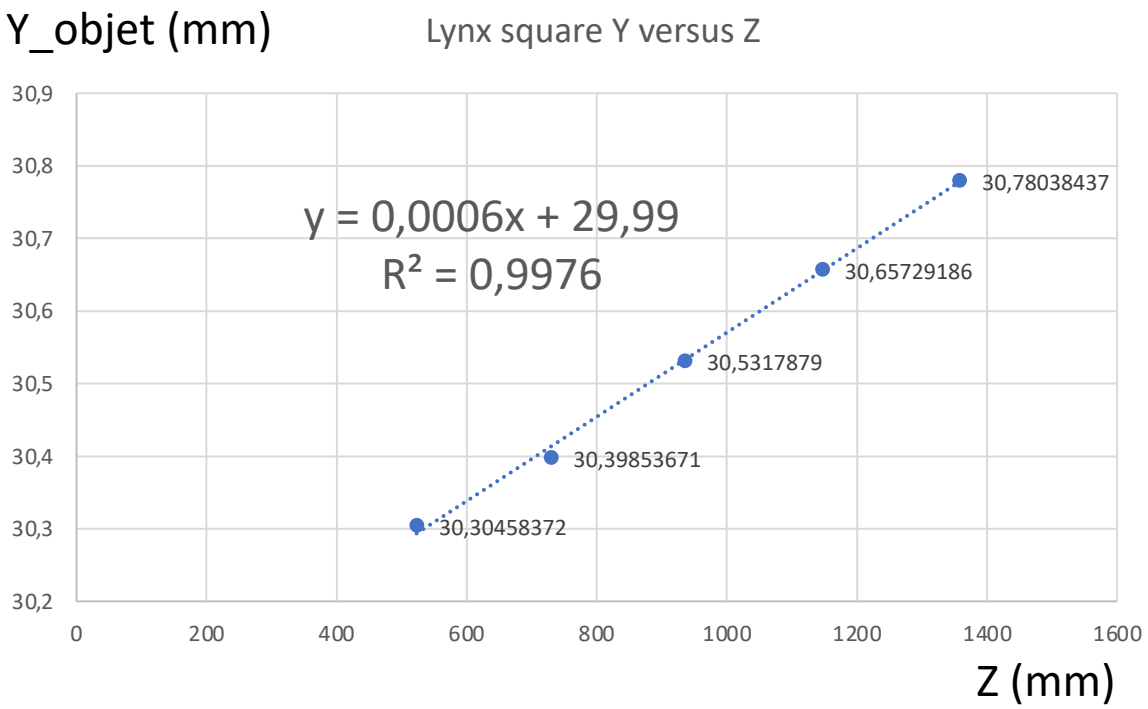
Mesure de la taille du carré de l'échiquier de 30 mm
Moyenne des mesure de 10*7 *2 carrés de l'échiquier (findChessboardcorners => corners)
Taille Objet = Taille image / f * Z

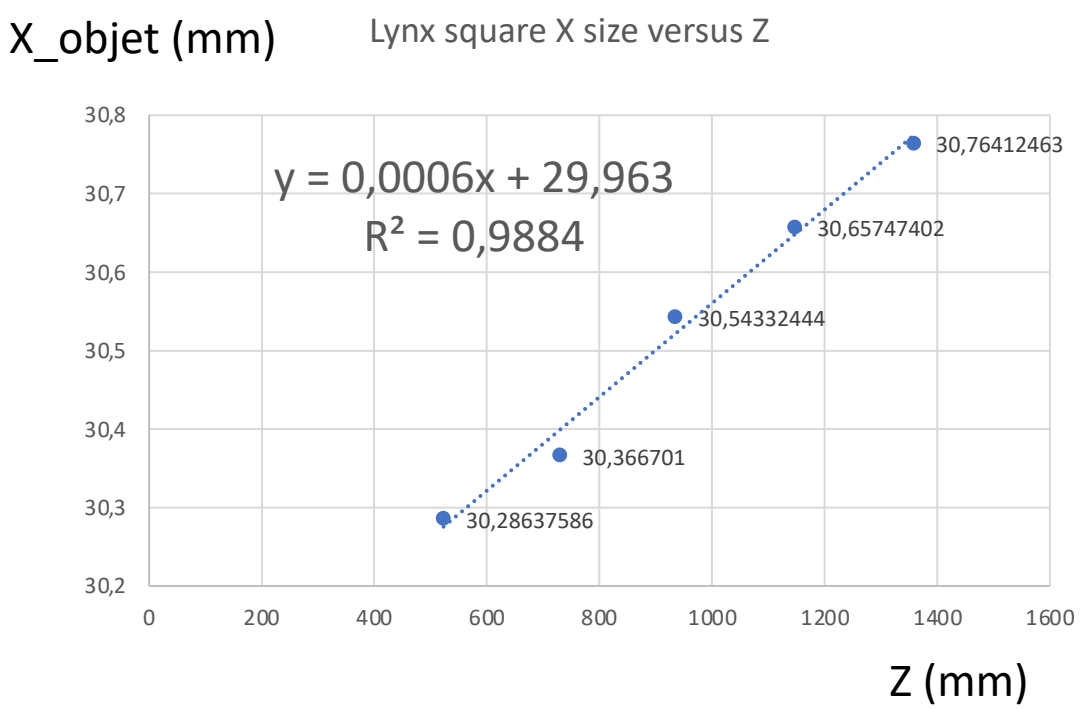
Offset Flasque	Z Flasque	True Z	Square Size Lynx Axe X	Square Size Lynx axe Y	Square Size Kame Axe X	Square Size Kame axe Y
38,55		mm	mm	mm	mm	mm
	561,531	522,9812804	30,28637586	30,30458372	30,59765082	30,45876571
	768,027	729,4774655	30,366701	30,39853671	30,66561909	30,52052112
	973,373	934,8227314	30,54332444	30,5317879	30,69261244	30,62830361
	1185,19	1146,636836	30,65747402	30,65729186	30,76722083	30,7248257
	1396,28	1357,726347	30,76412463	30,78038437	30,86828819	30,82797978

RMS mm	0,198151455	0,191632352	0,103538708	0,149562675
RMS/MEAN %	0,649174589	0,627592544	0,337058956	0,488255056

RMS/MEAN = 0.6% sur la taille du carre de 30 mm entre 0.5 et 1.3 m

Correction du biais versus Z : Lynx

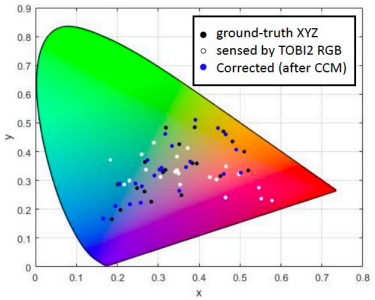


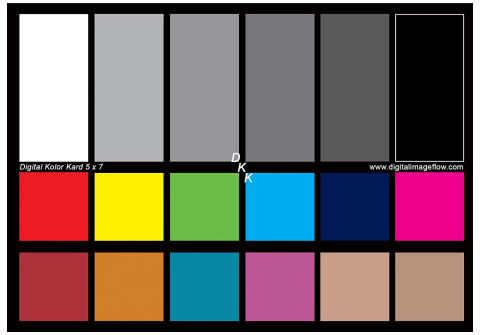



cnrs
cnrs


Terminal -
tk
tk
13:34:51
Clear
13:34:51: acq.mp.frame.imageio(j2k) f_idx=1420384
Lynx camera
13:34:52: acq.mp.frame.imageio(j2k) f_idx=1418089
Kameleon camera
General
LED
Off Blanc Bleu Vert Rouge
voltage
2.5
Valider
Status
Lynx
13:34:50: {'acq': {'f_idx': 1420103,
'modulo': 1,
'offset': 0,
'q_overflow': 0,
'q_size': 0,
'task': 0},
'cpu_temp': '+49.0 C (high = +100.0 C, crit = +100.0 C)',
'driver': {'fpga_counter': 1362,
'frames_counter': 1420312,
'n_frames_lost': 15,
'ready': True,
'sensor': True},
'peltier': 'power=on setpoint=20.2 ctn_measure=20.2'}
10:19:07: {'alim currents (A)': " {'5': '0.29', '12': '1.03', '3.3': '0.
'alim voltages (V)': " {'5': '4.98', '12': '11.89', '3.3': '3.34'}"
'dht22': ' humidity=None temperature=None',
'ds18b20': " {'136d0b4': 29.562, '1378577': 32.5, '1369d57': 2
'fan': ' ar=on av=on',
'relay': ' 3_3V=False 5V=False 12V=False'}
Kame
13:34:51: {'acq': {'f_idx': 1417959,
'modulo': 1,
'offset': 0,
'q_overflow': 0,
'q_size': 0,
'task': 0},
'cpu_temp': '+43.0 C (high = +100.0 C, crit = +100.0 C)',
'driver': {'fpga_counter': 1311,
'frames_counter': 1417966,
'n_frames_lost': 33,
'ready': True,
'sensor': True},
'led_status': 'disable',
'peltier': 'power=on setpoint=20.7 ctn_measure=19.7'}
13:34:51: {'alim currents (A)': " {'12': '1.08', '3.3': '0.14', '5': '0.47'}
'alim voltages (V)': " {'12': '11.93', '3.3': '3.32', '5': '5.00'}"
'dht22': ' humidity=14.5% temperature=28.1C',
'ds18b20': " {'136cb58': 33.75, '13797db': 27.687, '1369208': 28.0
'fan': ' ar=on av=on',
'relay': ' 3_3V=False 5V=False 12V=False'}
Raspberry boards
Power off/on Lynx
Power off/on Kameleon
crop
left upper zoom
0 0 1
crop
left upper zoom
0 0 1
Sensor
pga_gain 1
int_first 16
Valider
x1.2
0.01s
Stream
Stop
Start
Subst. pedestal
Chessboard
Detect (11,8) (14,9) (23,16)
Prefix chess_test
Record
Record
Prefix pong_1_
Number of frames 3000
Modulo 1
Where camera pc_snapshot pc_mean_std
Pedestal
Number of frames 1
Pedestal
Threshold
Detect
Fan
Ar Off
Ar On
Av Off
Av On
Valider
Peltier
Off On
degrees
20
Valider
PC/FPGA
Sensor reset
PC Reboot
PC Halt
Racine du système de...
cdrom0
DELL

Calibration Colorimétrique



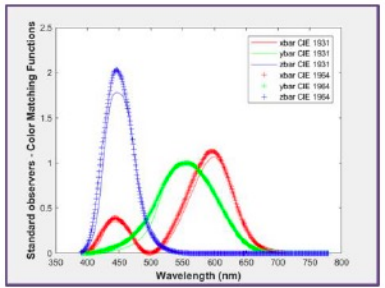


Colot Patch L*a*b

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} CCM_1 & CCM_2 & CCM_3 \\ CCM_4 & CCM_5 & CCM_6 \\ CCM_7 & CCM_8 & CCM_9 \end{bmatrix} . \begin{bmatrix} WB_1 & 0 & 0 \\ 0 & WB_2 & 0 \\ 0 & 0 & WB_3 \end{bmatrix} . \begin{bmatrix} R \\ G \\ B \end{bmatrix} - \begin{matrix} Voffset1 \\ Voffset2 \\ Voffset3 \end{matrix}$$

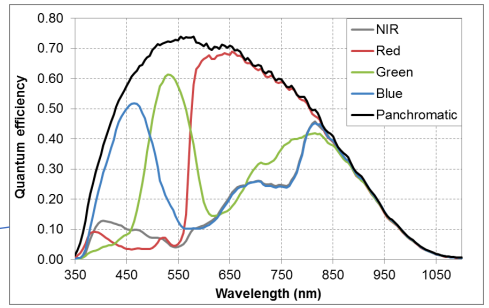
$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \int_{380}^{780} R(\lambda) . I(\lambda) . \begin{matrix} \bar{x}(\lambda) \\ \bar{y}(\lambda) \\ \bar{z}(\lambda) \end{matrix} d\lambda$$

Color Matching Function

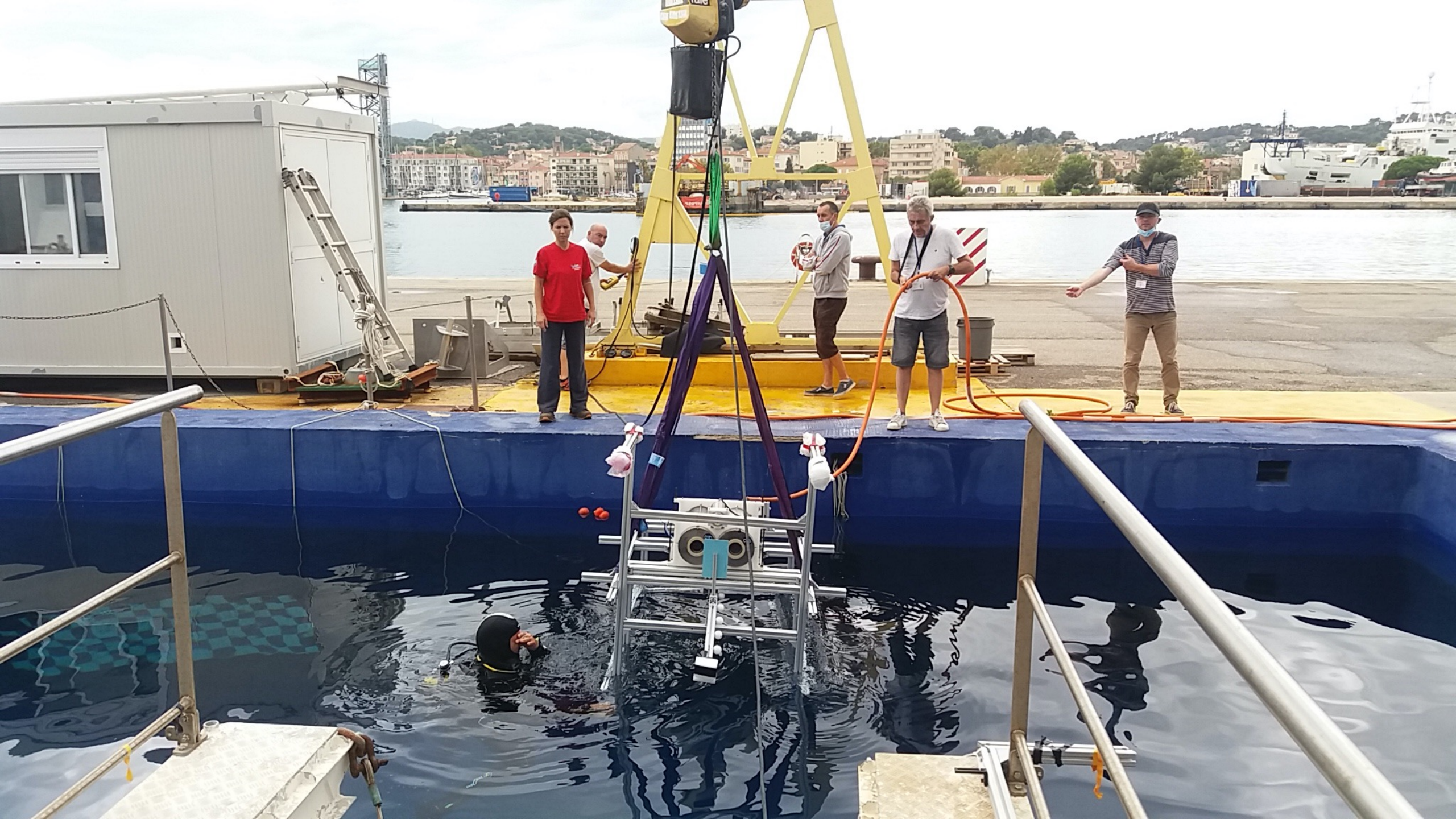


L*a*b

Espace des couleurs



Kameleon



CONCLUSION

- Calibration is successful
- Thx to DT-INSU : Karim, Céline et Carl
- Thx to MIO : Denis and to Dorian

- We are ready now