

# Tricycle Project

## Dick Dastardly

### Crystal Ball

## Review

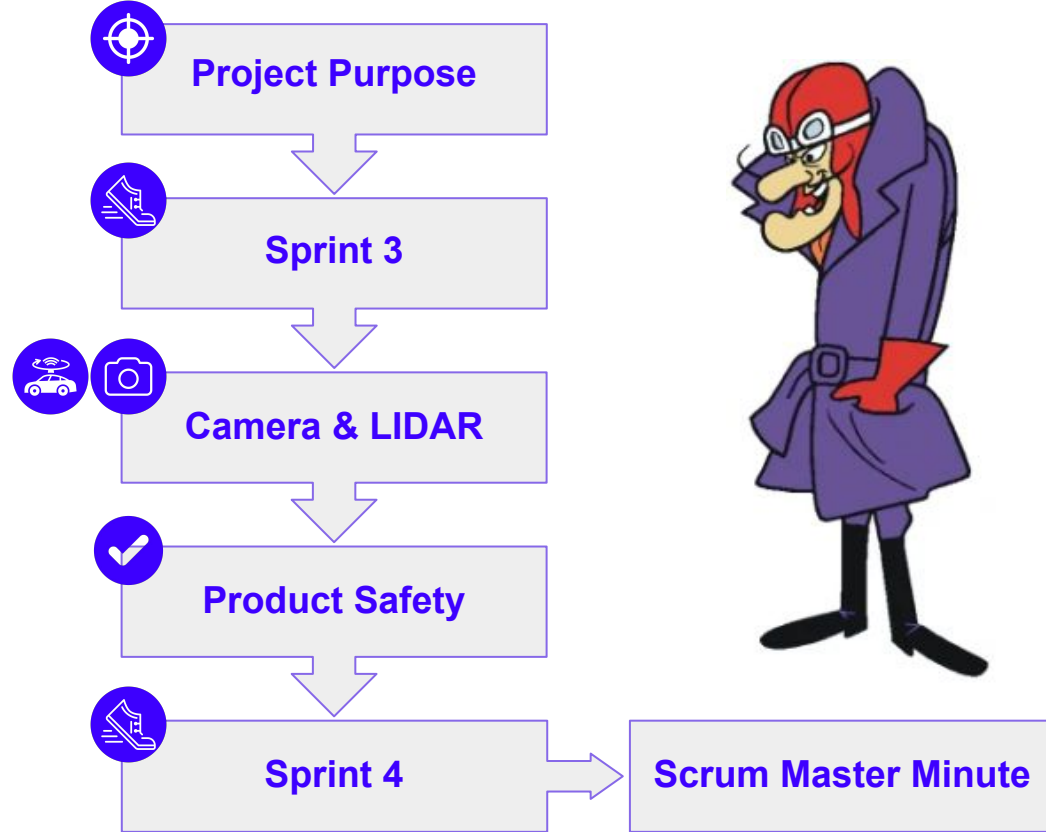
07/12/2021

-Sprint 3-

Pierre Calmettes  
Romain Choulot  
Yixia Liu  
Gautier Martin  
Nikita Mikhin  
Valentin Piqueras

Sebastien Delautier  
Sebastien Di Mercurio  
Pierre-Emmanuel Hladik  
Gwendoline Le Corre  
Thierry Monteil  
Paul Scanlan  
Audine Subias

# Presentation plan



A tricycle with multiple integrated sensors and actuators, conscious of its surrounding.



- Equip a car with sensors
- Use **AI** algorithms to assist the driver
- **Warn** in case of danger



- Avoid personal injury or material damage
- React faster than humans
- Automation of conditional driving



Organisation

Technical

Document

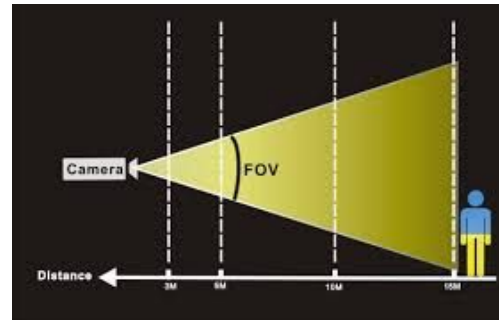
## Main goal : Fusion

### Stories

Plan the fusion  
between the  
Camera and the  
LIDAR



Link object  
type and its  
distance



Establish a priority  
between the  
Camera and the  
LIDAR



## Story : Fusion LIDAR & Camera

**First step : Create a rosbag**

Bag = File format to save ROS messages

**Record**



## Story : Fusion LIDAR & Camera

### Second step : Calibration of the camera

Determine the geometric  
parameters of the image  
formation process

```
distortion_coefficients:
```

```
rows: 1
```

```
cols: 5
```

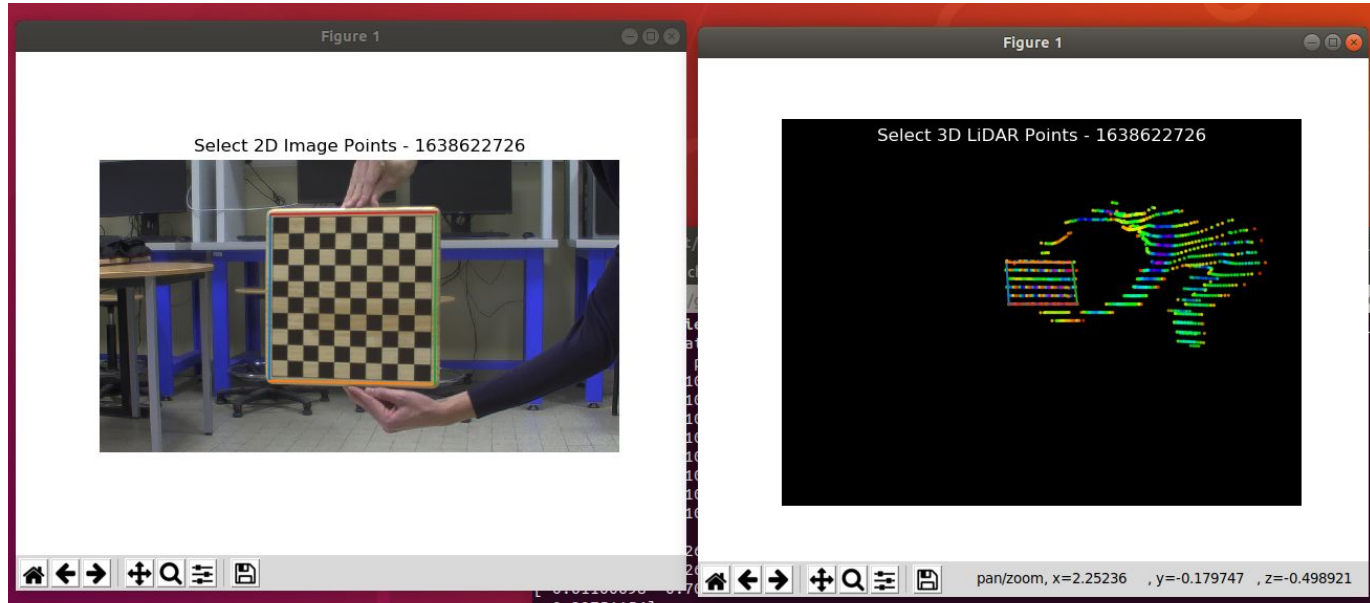
```
data: [-0.184986, 0.542450, -0.000183, 0.001270, 0.000000]
```

Correct the distortion

*Distortion coefficients found by Paul Thebault*

## Story : Fusion LIDAR & Camera

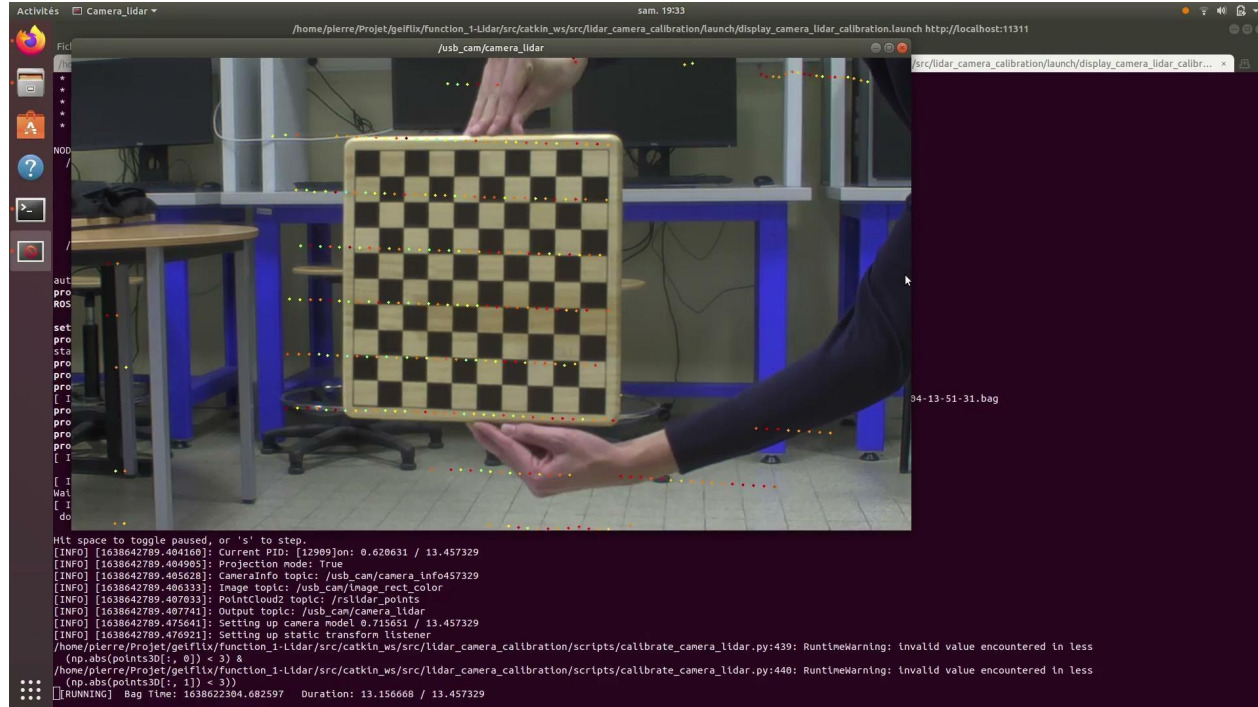
### Third step : Calibration of the Camera and the LIDAR



# Fusion



## Story : Fusion LIDAR & Camera



Result : DEMO





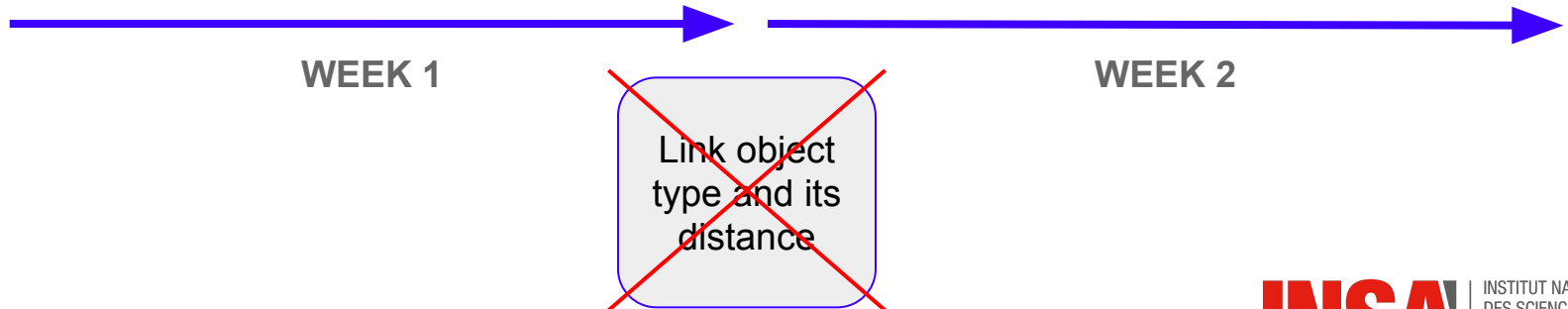
# Fusion



## Story : Fusion LIDAR & Camera

Establish a priority  
between the Camera  
and the LIDAR

Plan the fusion between the Camera and the LIDAR  
approx 20 h



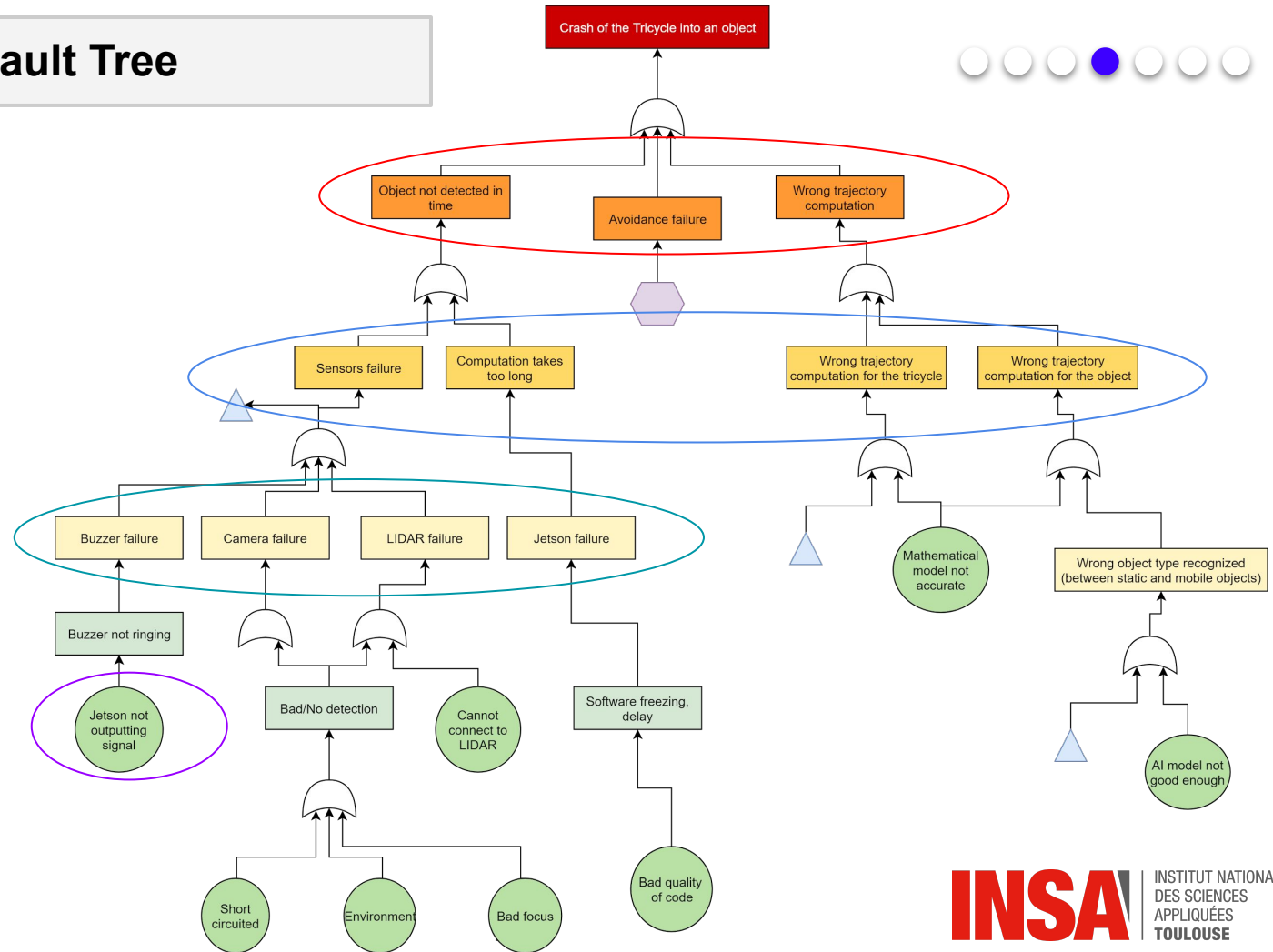
# AMDEC/FMEA



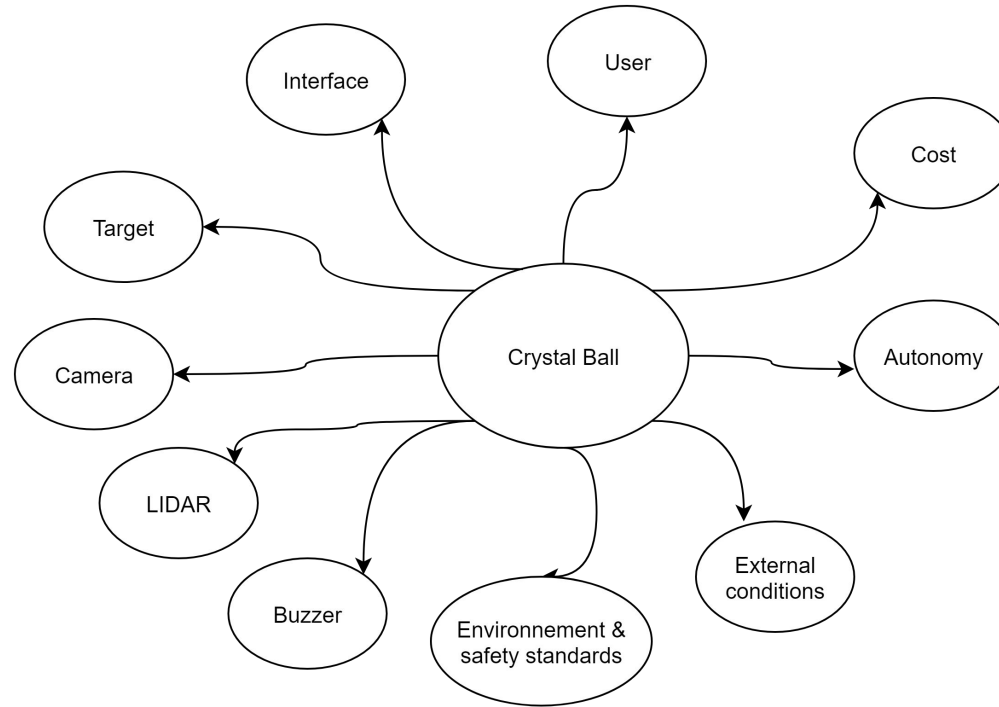
Component	Failure modes	Causes	Effects	Detection	Frequency	Severity	Criticality
Camera	Blurry image	Dust, bad focus, rain, etc	Bad/No detection	Nothing detected for > 30s. Not corresponding with LIDAR data	2	8	16
	Disconnected	USB link failure			1	9	9
Jetson	Crash	Failure in program	Freezes, does not respond	Test code intensively	3	9	27
	Overheat	Overload, too much calculations	Software freezing, delay	Temperature sensor, monitoring fps	5	7	35
Buzzer	Not ringing	Jetson not outputting signal	People not warned	Redundancy of buzzers	2	9	18
LIDAR	Wrong distance measurement	Low reflectivity material	Bad/No detection	If measured distance is outside threshold (>150m)	5	10	50



# Fault Tree



# Functional analysis



### LIDAR

#### What we want to know

- Simulation of the LIDAR data via Robosense Simulator
- Obtain the precision of distance detection

#### Tests

- An object was simulated at a distance of 3 meters

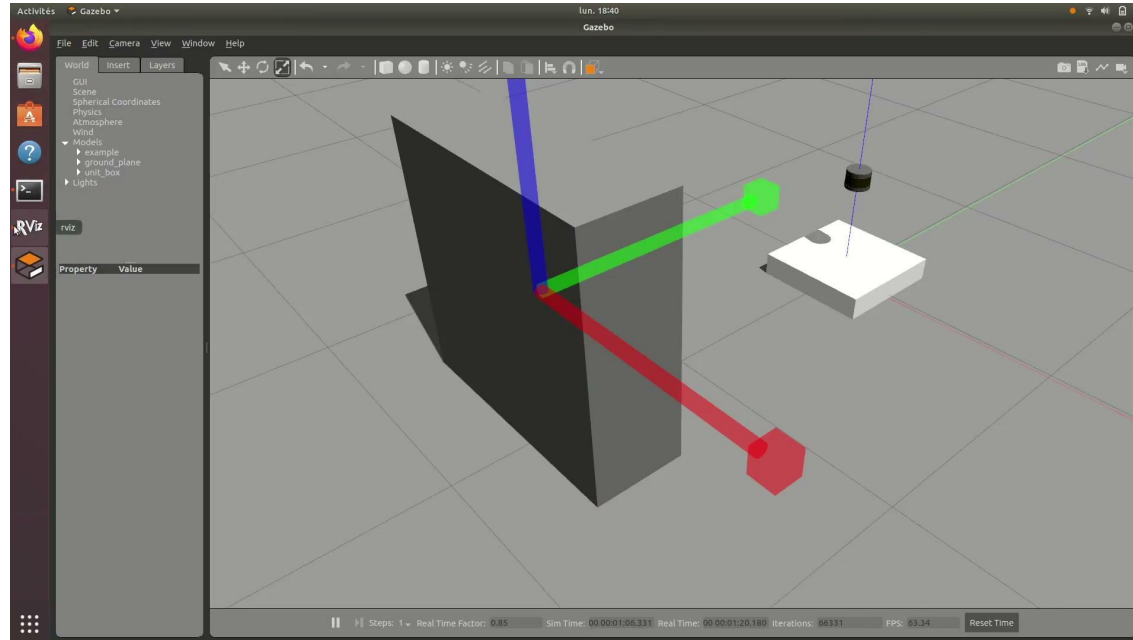
#### Performances

- The object was detected with precision of 3 cm

# Tests and performances

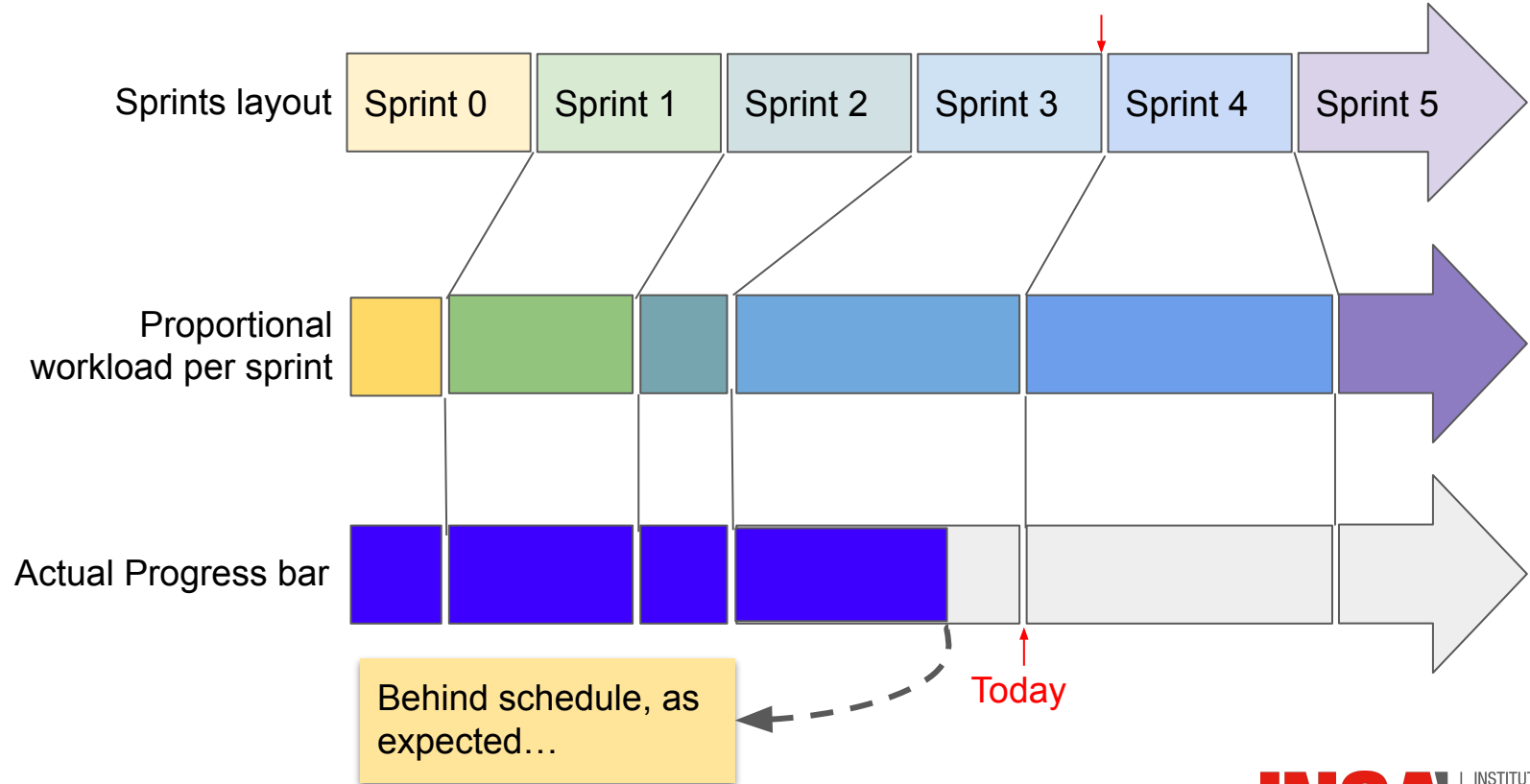


## Robosense Simulator Demonstration





## Sprint 4



## Main Objective : LIDAR & camera fusion cont. + Trajectory Computation

### Stories

#### Calibration

continued: in real-time

L

#### Distinction

between static and mobile objects

M

#### Trajectory

Compute the tricycle's trajectory

XL

### Tests & Demos

Image from camera with dots from LIDAR, in real-time

Along its label, add "mobile object" or "static object" tag

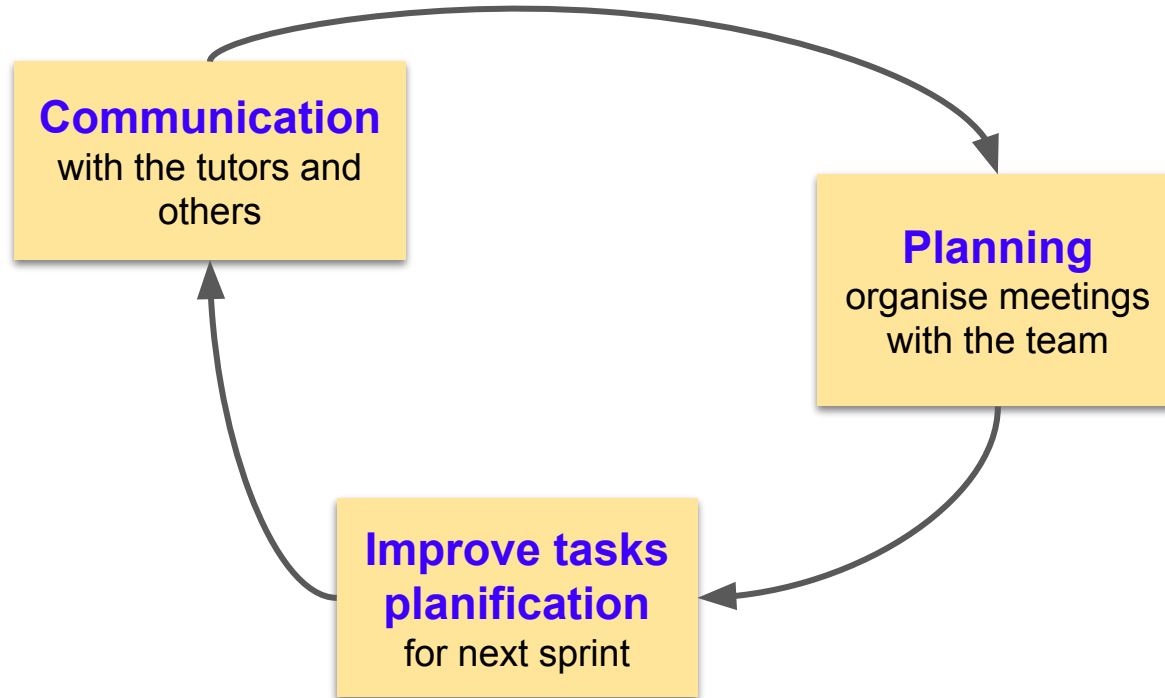
Draw the tricycle's predicted trajectory that refreshes when we turn the wheel

Small tasks



Big tasks





Thank you !

Pierre Calmettes  
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