HERON

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HERON-PROJECT

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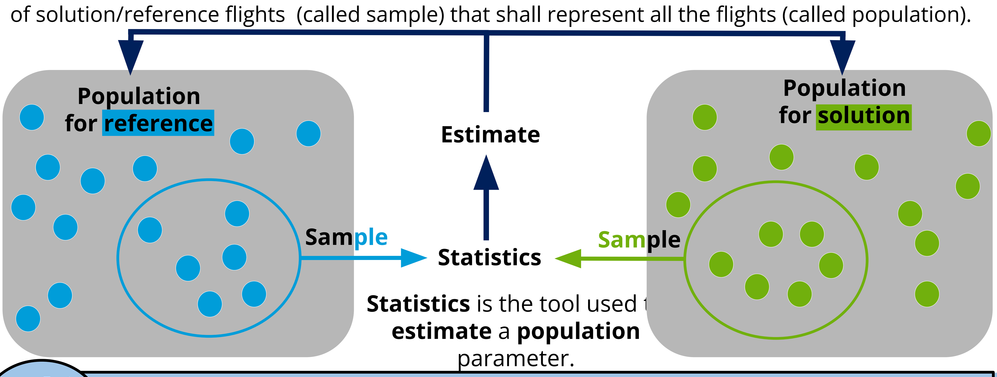
THE AVERAGE IS NOT ENOUGH

Heron project is a Digital Sky Demonstrator with the realisation of real flights applying HERON solutions on a **restricted** number of flights.
The need of the different actors is then to be able to take a **decision** based on this limited number of solution/reference flights (called sample) that shall represent all the flights (called population).



1st step — Formulate what you are trying to prove

What you are trying to prove

The population of flights using the solution has less fuel consumption than the other flight population not applying the solution.

2nd step — Find the trade off number of flights / rate of false negative

Example with **Student's t-test** or **Welch's t-test**

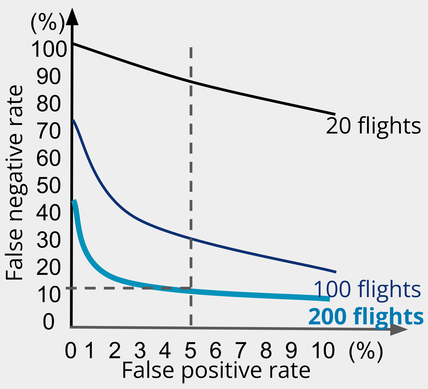
For performance benefit assessment, it is recommended to consider a **small false positive rate**
- Low risk of concluding a performance benefit when there is none.

at the price of a **higher false negative rate**
- Higher risk to fail capturing a performance benefit while it exists.

Example: THEORETICAL IMPROVEMENT at 50 kg

Assume the **false positive rate is fixed at 5%**,
a theoretical improvement of 50 kg and
a hypothesized standard deviation of 150kg,

the following plot illustrates the computed trade-off.
With 200 flights, the **rate of false negative at 10%** is satisfactory.



3rd step — Collect the data

Fuel and hence CO_2 are very sensitive to a lot of flight parameters (aircraft type, mass, weather...).

The variation around its mean in the collected data has an impact on the **chance** to prove an effect with the **available number of flights**.

Method 1: **Delta Trajectory***	Method 2: **Delta Fuel Burn***	Method 3: **Standard Method***
Statistics on the trajectory Ex: Top of descent position, Delta in flown distance	**Statistics on a normalized fuel** Requires to compute an optimum fuel	**Statistics on the fuel data** Requires to use clustering

From statistics applied on the flights **inputs** to statistics applied on the flight **outputs**

**Hypothesis on sample: randomly selected, both sample means normally distributed*

My takeaway list to assess that **observed benefits** are not caused by **chance**

Average & **Standard Deviation** with **N** Number of Flights

- **Trade off with EXE assumptions**
- **Collect the data**
- **Compute p-value, confidence interval**

SUPPORTED BY sesar JOINT UNDERTAKING

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