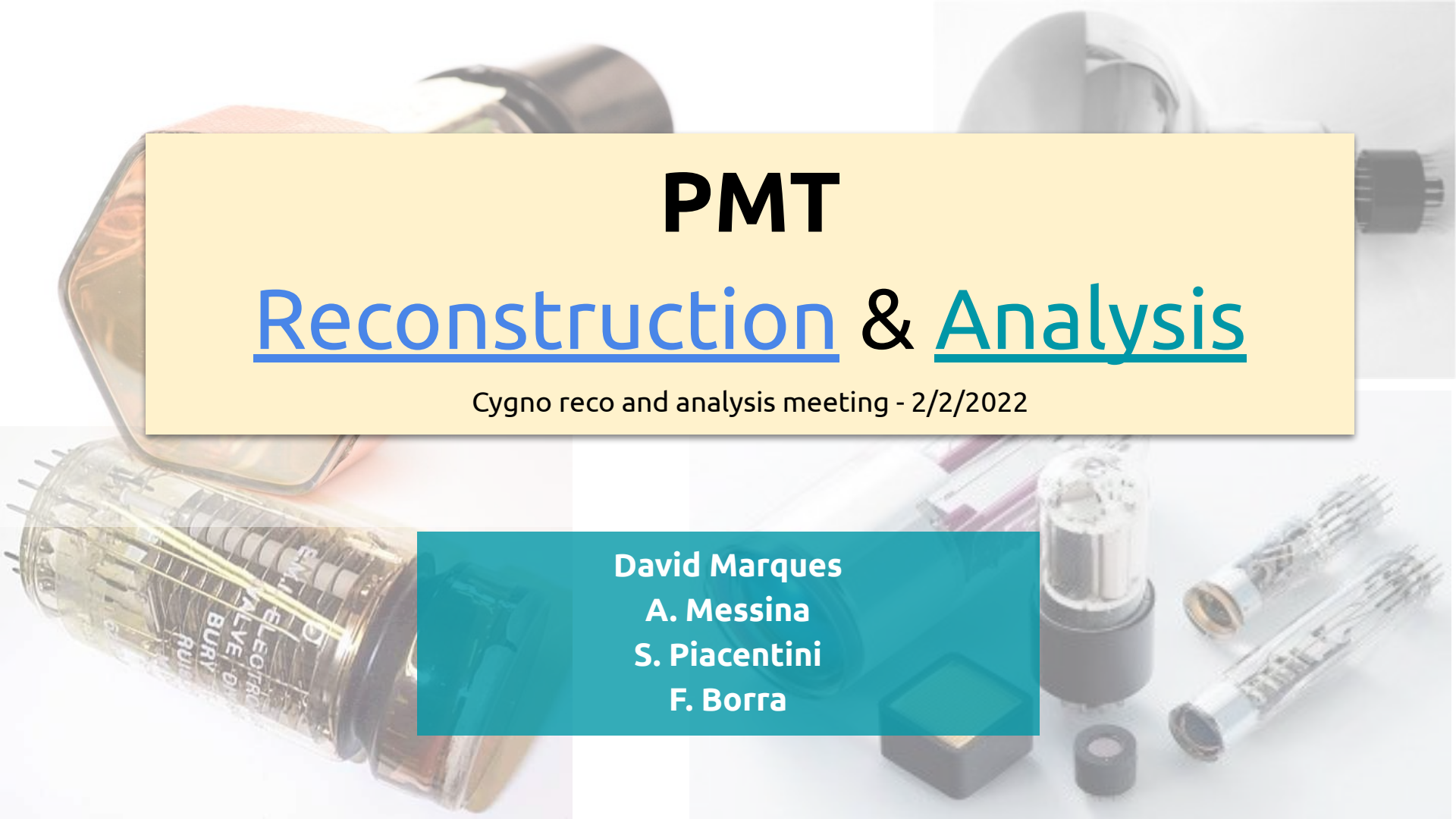

PMT

Reconstruction & Analysis

Cygno reco and analysis meeting - 2/2/2022

David Marques
A. Messina
S. Piacentini
F. Borra

Team

- *For the moment…*
  - David Marques (Ph.D. L'Aquila)
  - Stefano Piacentini (Post-Doc Sapienza)
  - Andrea Messina (Professor / Researcher Sapienza)
  - Francesco Borra (soon to become CYGNO-intern)
- *"Honorable mentions":*
  - Rafael Nobrega & Mariana (PMT Simulation)
  - Giovanni Mazzitelli (PMT DAQ-related)

If someone would like to join, please let us know!

We met last week in Sapienza and discussed the **main tasks** to carry, **work-division** and **final goals**.

Tasks - Resume & people

1. **(L,x,y) study aka find alpha** [Stefano; Francesco]
    a. Measure the **dependence of light** collected by PMTs with angle of incidence → **$L(R) \propto R^{\alpha}$**
        i. Use this information to deduce ^{55}Fe spots' **(x,y) coordinates.**
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Git repository already set up :)

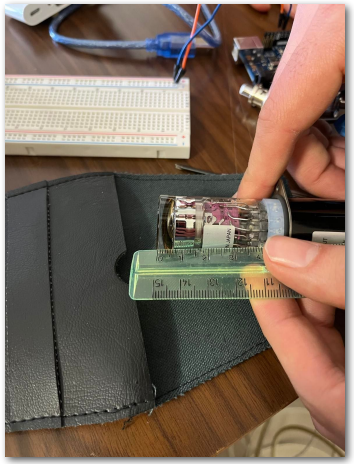
★ **Correction tables for PMT waveforms**
   - Already ~finished

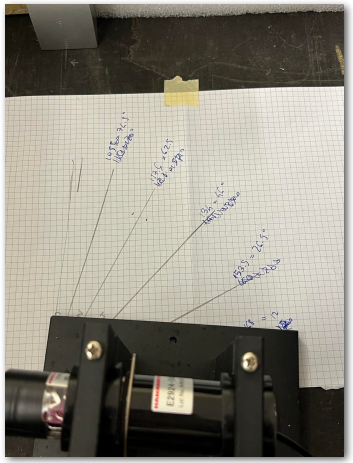
★ **Automatic focalization/alignment**

Tasks - 1. (L,x,y)

➔ **(L,x,y) study aka find alpha** [Stefano; Francesco]

- We went to Frascati and used the “laser setup”.
- ***Scanned various angles on light incidence.***
- Calculated the relative light intensity.





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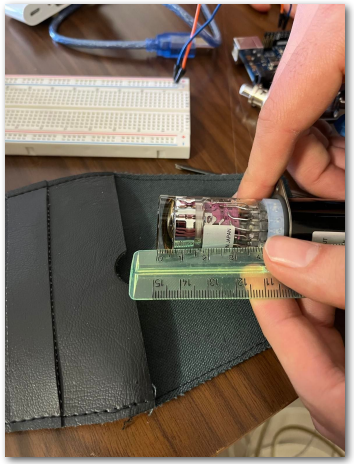

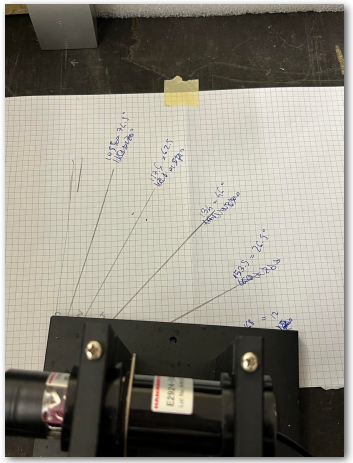

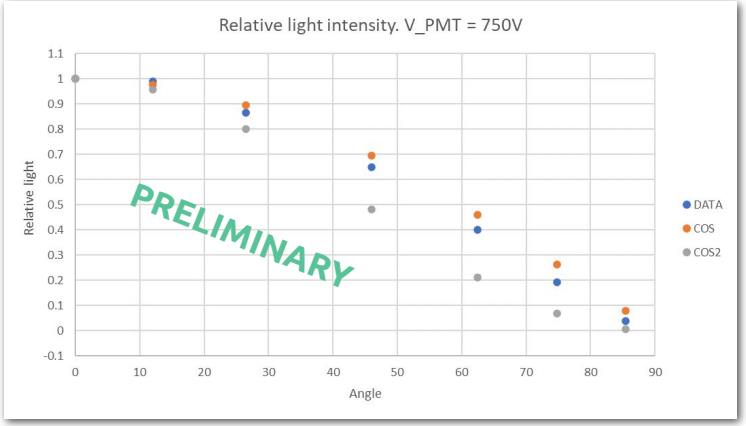

➔ Found a **cos** dependence (as expected), but not a **cos²** dependence.

➔ Work/analysis in progress.

➔ **Better results coming soon!**

Tasks - 2. PMT Reconstruction

➔ **PMT reconstruction** [David; Francesco]

- Objective: Reconstruct basic properties of PMT waveforms, similarly to the camera

Tasks - 2. PMT Reconstruction

PMTReco.root -> TTree *Events():

- ➔ Trigger
  - ◆ Run
  - ◆ Pic
  - ◆ 4 ***waveforms*** (for each ch)
    - RMS & Baseline ⇒ build **pedestal(μ,σ)** ⇒ ped(baseline,RMS) ⇒ from average of first X points
    - Total integral/charge
    - Max voltage
    - (bol) If saturated or not
    - **Number of structures**
    - ***For peak_i :***
      - ○ Peak_charge
      - ○ t_start & t_end ⇒ build peak_width; peak_position
      - ○ V_max within t_width
      - ○ [more complicated] #local maxima ⇒ build substructures ⇒ repeat previous steps.

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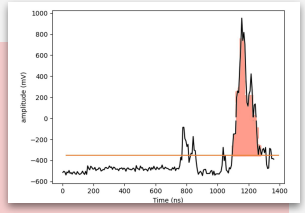

Find separated above noise structures:

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2. Define t_start & t_end
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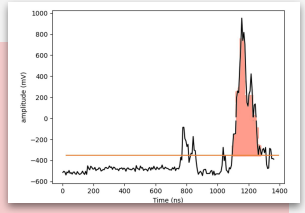

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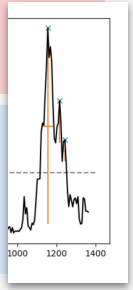

Analyse individual structures:

1. Make use of py.PeakFinder()
   a. Find variables

Tasks - 3. Integration with camera reconstruction

Integration with camera reconstruction → *To be discussed!*

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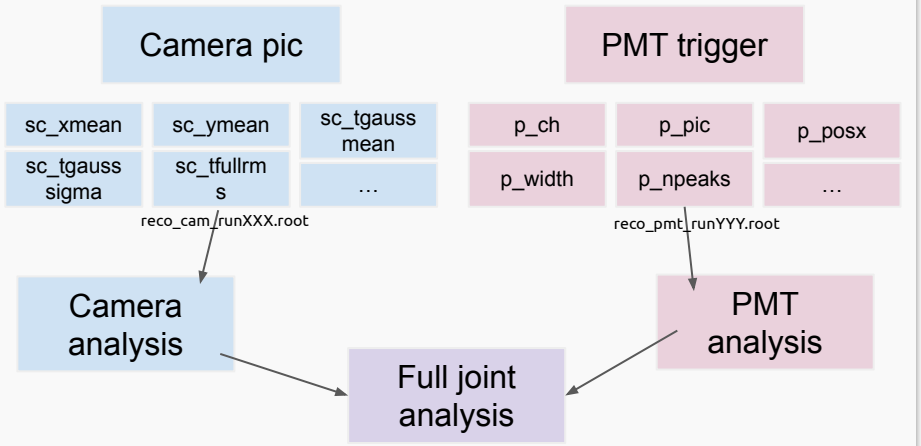
1. Initial idea

- ➔ PMT is an **independent analysis** from the camera.
- ➔ Allows for easier ***PMT-only* analysis** from different people.
- ➔ To be merged with camera output at the end.



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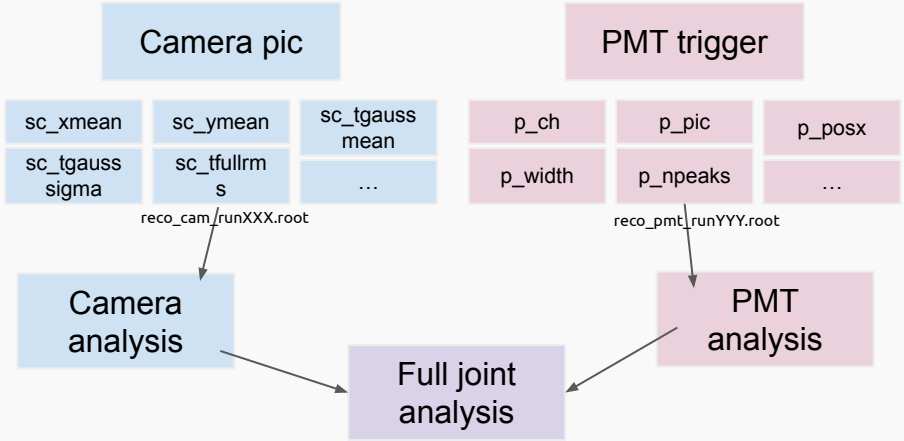
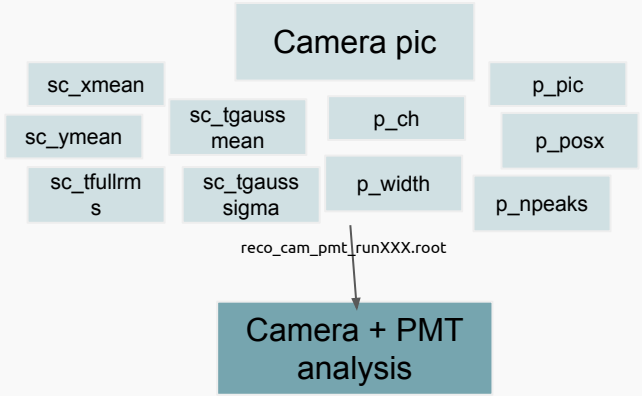


2. Other possibility

- ➔ PMT waveforms are a **subset** of variables of a **camera picture**.
- ➔ Could make the data structure complicated/complex.
- ➔ Depends on the definition of event: ***interaction*** or ***picture***?



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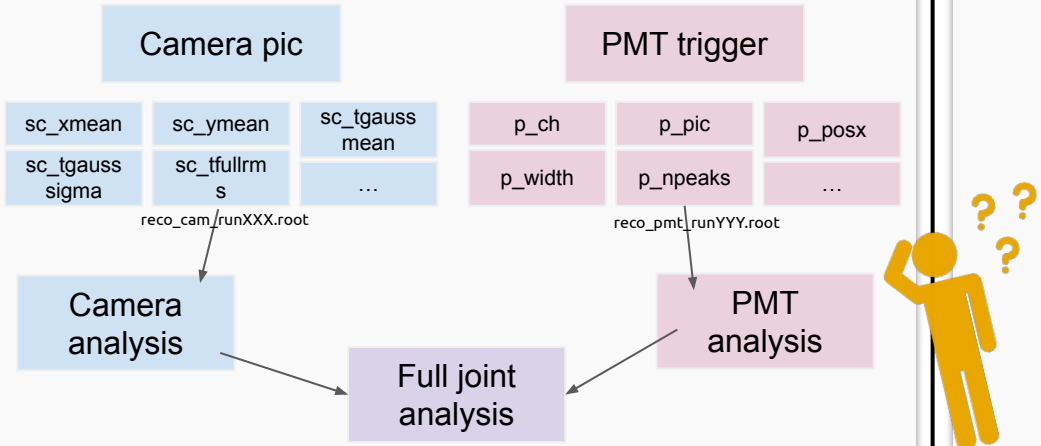

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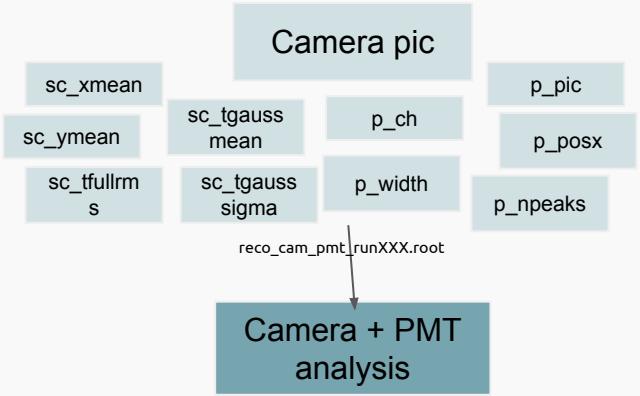

Final goal

What's the final goal:

➔ Have a full PMT events' reconstruction such as the camera.

- ◆ With this, many other analysis can be performed:
  - (L, x, y)
  - Z coordinate
  - PMT NR vs ER discrimination
  - 3D tracking
  - …