General Meeting
Summary and plans for 2020

Analyses and Simulation

- Finalise ^{55}Fe analisys: camera+PMT (Igor) [January]

- Evaluate sensor noise behavior for threshold settings (Brazilian) [February]

- AmBe data (Camera and PMT) analysis toward a PID efficiency and rejection factor paper (Emanuele) [February]

- finalise BTF analysis for the “Tracking performance paper” (Giovanni M) [February]

- “digitise” Marconato data on 1 keV->100 keV nuclear recoils for CMOS (Fabrizio/Flavio) [January]

- “digitise” Marconato data on 1 keV->100 keV nuclear recoils for PMT (GSSI) [January]

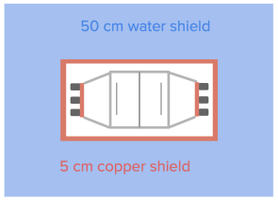
- analyse them (PMT+CMOS) and compare results with same energy electron recoils to get a rejection factor (Fabrizio) [February]

- we need an evaluation of CYGNO rejection factor in the 1-20 keV range: 10^3? 10^4? [February]

Geant simulation

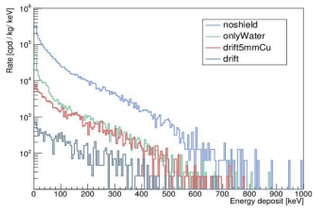
Shielding option 1

1) 50 cm water + 5 cm Cu



Cost of materials:
- Cu : ~25 euro/kg
- Lead : ~5 euro/kg
- PE : ~5 euro/kg

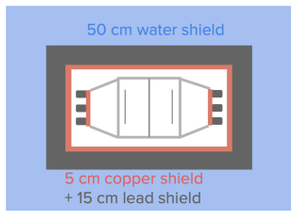
Material	Thickness [cm]	Mass [kg]	Cost [keuro]
Water	50	16e3	-
Cu	5	8.7e3	217.5



Rate [0-20] keV = 7 10^2 cpd/kg/keV ➙ **8 10^6 cts/yr** in CYGNO detector

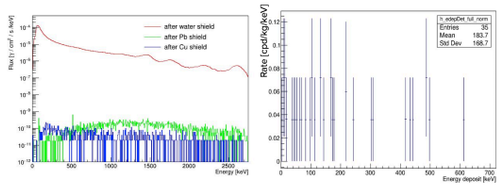
Shielding option 2

2) 50 cm water + 15 cm Pb + 5 cm Cu



Cost of materials:
- Cu : ~25 euro/kg
- Lead : ~5 euro/kg
- PE : ~5 euro/kg

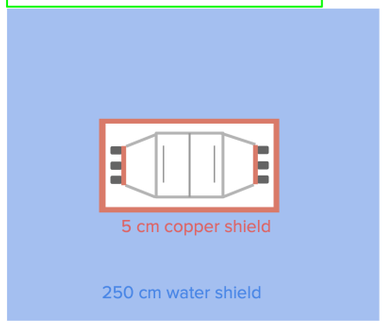
Material	Thickness [cm]	Mass [kg]	*Cost [keuro]
Water	50	16e3	-
Pb	15	42e3	210
Cu	5	9e3	225



Rate [0-20] keV = 0.054 cpd/kg/keV ➙ **630 cts/yr** in CYGNO detector

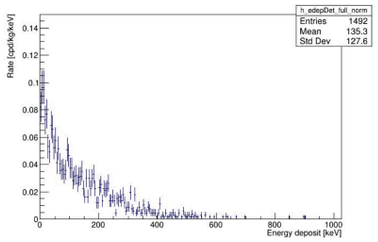
Shielding option 3

3) 250 cm water + 5 cm Cu



Cost of materials:
- Cu : ~25 euro/kg
- Lead : ~5 euro/kg
- PE : ~5 euro/kg

Volume	Material	Thickness [cm]	Mass [kg]	Cost [keuro]
Shield2	Water	250	312e3	-
Shield3	Cu	5	8.7e3	217.5



Rate [0-20] keV = 7 10^2 cpd/kg/keV ➙ **8 10^6 cts/yr** in CYGNO detector

Option 1:

Too light. It needs for a very high rejection power

Summary shielding options

- 50 cm water + 15 cm Pb + 5 cm Cu is good in terms of
  - ambient gammas
  - neutrons and secondary gammas
  - compact size

  ➙ **But**

  - **expensive**
  - **need to use archaeological lead (even more expensive), otherwise too radioactive**

- 2.5 m water + copper (no lead) shielding is good in terms of
  - ambient gammas
  - neutrons and secondary gammas
  - low radioactivity
  - low cost **in fact it is expensive too**

  ➙ **But**

  - **large size**

- Is there a third way between H_20:Pb:Cu:Plexiglass (50:15:5:5) and H_20:Pb:Cu:Plexiglass (250:0:5:5)? Do we gain something in adding more Plexiglass and Cu to remove part of H_2O? (Roma1) [February]

Background effect simulation

It would be possibile that we have to survive with some background in the detector;

What would be the performance of CYGNO?

Study with the simulation the performance of CYGNO in different background scenarios (GSSI).

[February]

CYGNO drawings

To start we need last inputs from Simulation about:

- plexiglass width;

- copper width;

Roma1 [February]

- Once we have, we can close drawings of these parts; LNF [April]

Meanwhile we choose low radioactive materials and techniques GSSI (?) [February]

- Once we have we can start material procurement; Roma1 [July]

We can start assemble CYGNO sensitive part ([er] Core); LNF [September]

Radioactivity

- Contact people working with low radioactive Plexiglass and understand how to get it (Betta); [February]

- Contact people working with low radioactive Cupper and understand how to get it (Betta); [February]

- Contact people working with low radioactive quarz-glass for lens (Heraeus) and understand how to get it (Davide); [February]

- Get results of radioactivity measurements of sensors and measure the new cameras: Fusion, Teledyne (Betta) [March]

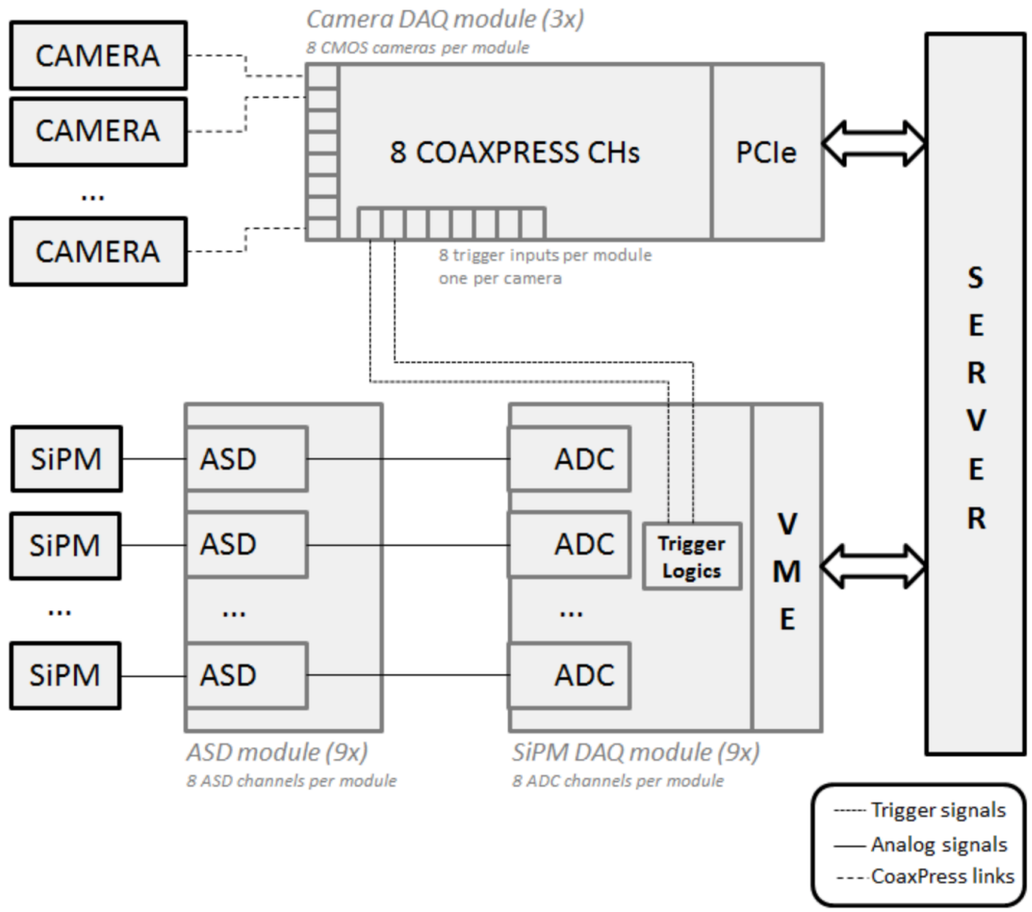
DAQ

After a couple of meetings, DAQ group is studying a structure based on commercial boards for:

- digitization of PMT/SiPM signals;

- acquisition of CMOS via USB3/“cameraLink”;

FPGA onboard will run dedicated trigger firmware and selected events are then stored for higher level analysis.



Brazilian team has a lot of experience in electronics, DAQ and trigger (having worked on neutrino experiments e.g. CHOOZ) and will enter in the game;

Organise a meeting with them (Andrea, Francesco I.); [January]

Test all PMT/SiPM we have to decide what to use (Francesco I.); [February]

Shopping

- New HV-GEM+Crate
- Redell cables and connectors
- Camera ORCA Fusion
- Optics (possibly not radioactive)
- PC for DAQ + PC for slow control
- HV cathode (spare)
- 3 Switches for LNGS
- Gas (LNF + LNGS)
- Chiller
- Electronics VME (LNF + LNGS) - Lista Francesco
- Sensors for environmental parameters

Collaboration

- Integrate document prepared by Betta with an appendix on items that groups will follow:

- English teams on:
  - Neil et al: Gas purification + Camera studies + PMT Machine Learning;
  - Boulby team: background studies + measurements;
- Brazilian team on:
  - DAQ;
  - Sensor study and simulation;
  - L0 software trigger with Machine Learning;
- Portuguese team:
  - Study of different MPGD;

- Send them a proposal (Giovanni for Brazil and Betta for other ones) [January]

- Organise a General Meeting (Betta). [February]

Pubblications

- Solar neutrino proposal (Elisabetta)
- Nuclear recoils in CYGNO, with head-tail (Emanuele)
- Tracking performance at BTF (Giovanni+Luca)
- Comparison of performance 60/40 and 70/30 with ^{55}Fe +PMT (Igor+Rafael)
- Effect of filters on CYGNO images (Brazilian team)
- The Cygno Experiment (Davide)