

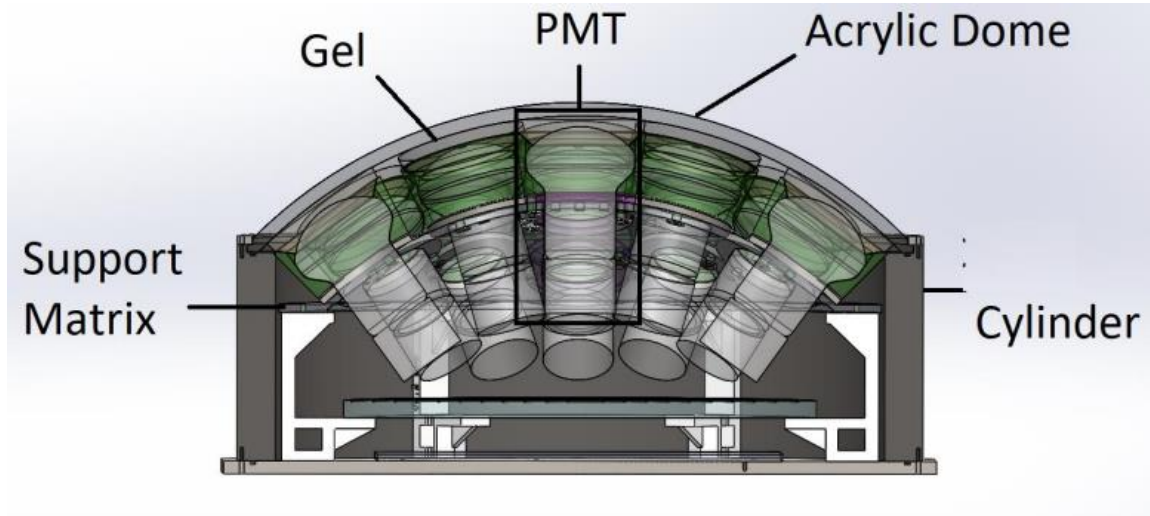
FD mPMT at WCTE

Luigi Lavitola on behalf of INFN

Introduction

- First of all it's a pleasure to be here in person and to meet all you, finally!
- INFN group plan is to realize some FD mPMTs to be installed in WCTE
 - To test the assembly and the integration of the overall system
 - To test the electronics and DAQ system in a real situation
- The status of the FD mPMT will be reported and our plans to fit WCTE schedule

The FD mPMT



- 19 3" PMTs with HV and FE board on the PMT base
- INFN Main Board as core of the acquisition system
- Mechanics reinforced to sustain the pressure of the FD

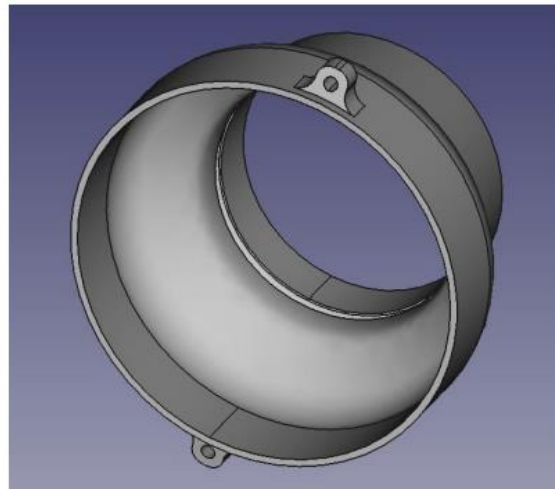
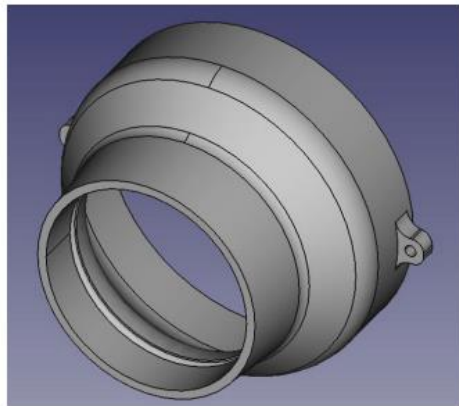
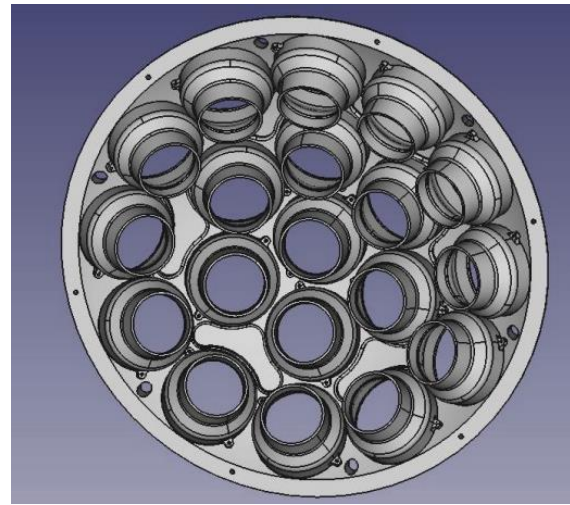
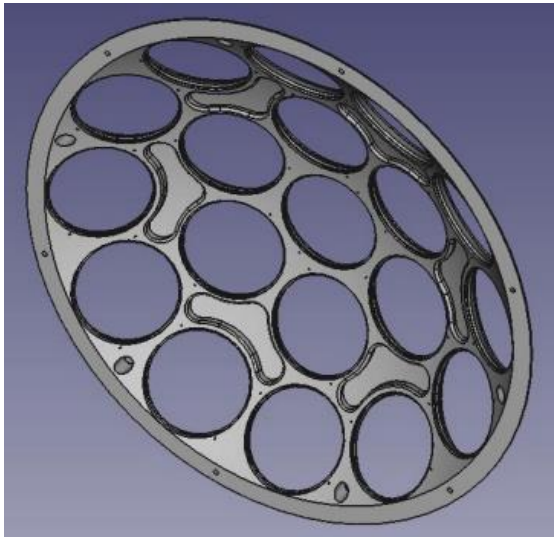


Prototype for the Implosion test, passed however

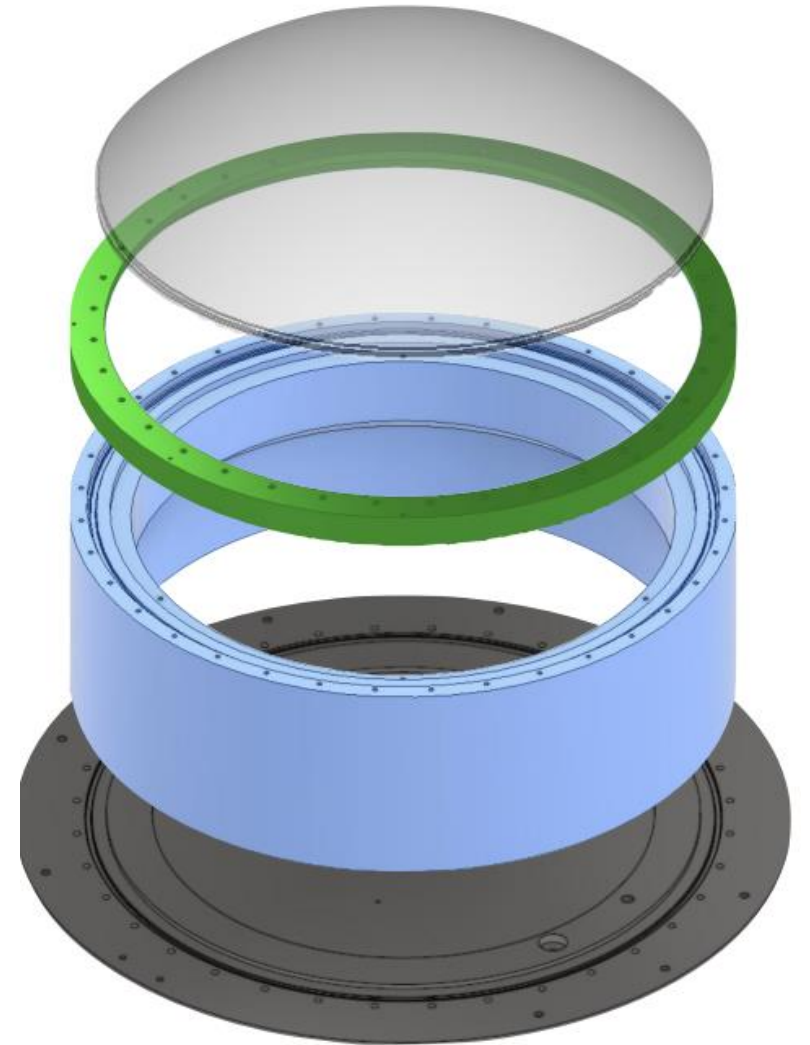


Installation in the mockup frame

The FD mPMT: Mechanics



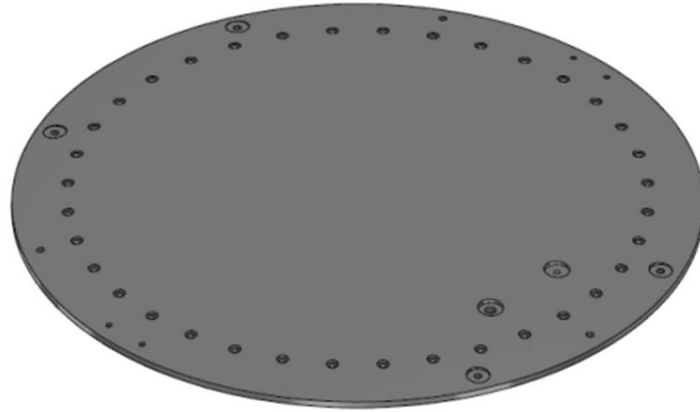
Internal mechanics in case of KM3Net type gelling



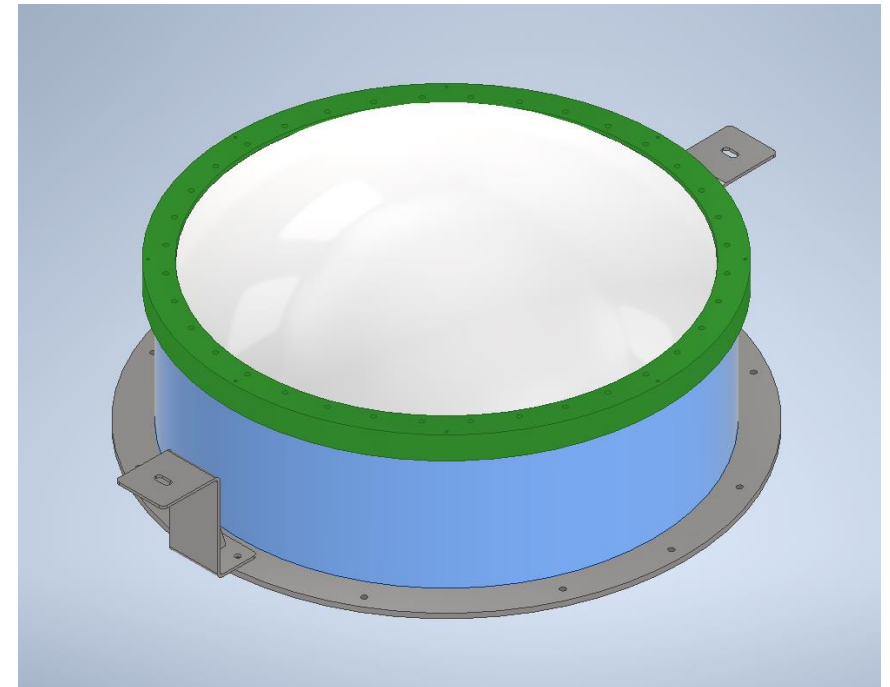
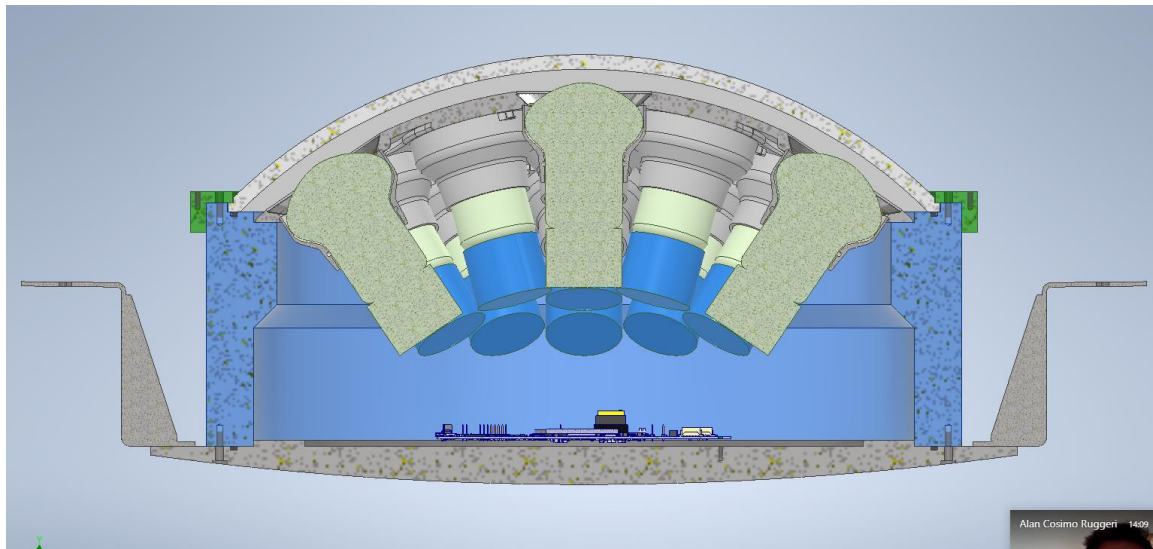
External components

The FD mPMT: Mechanics

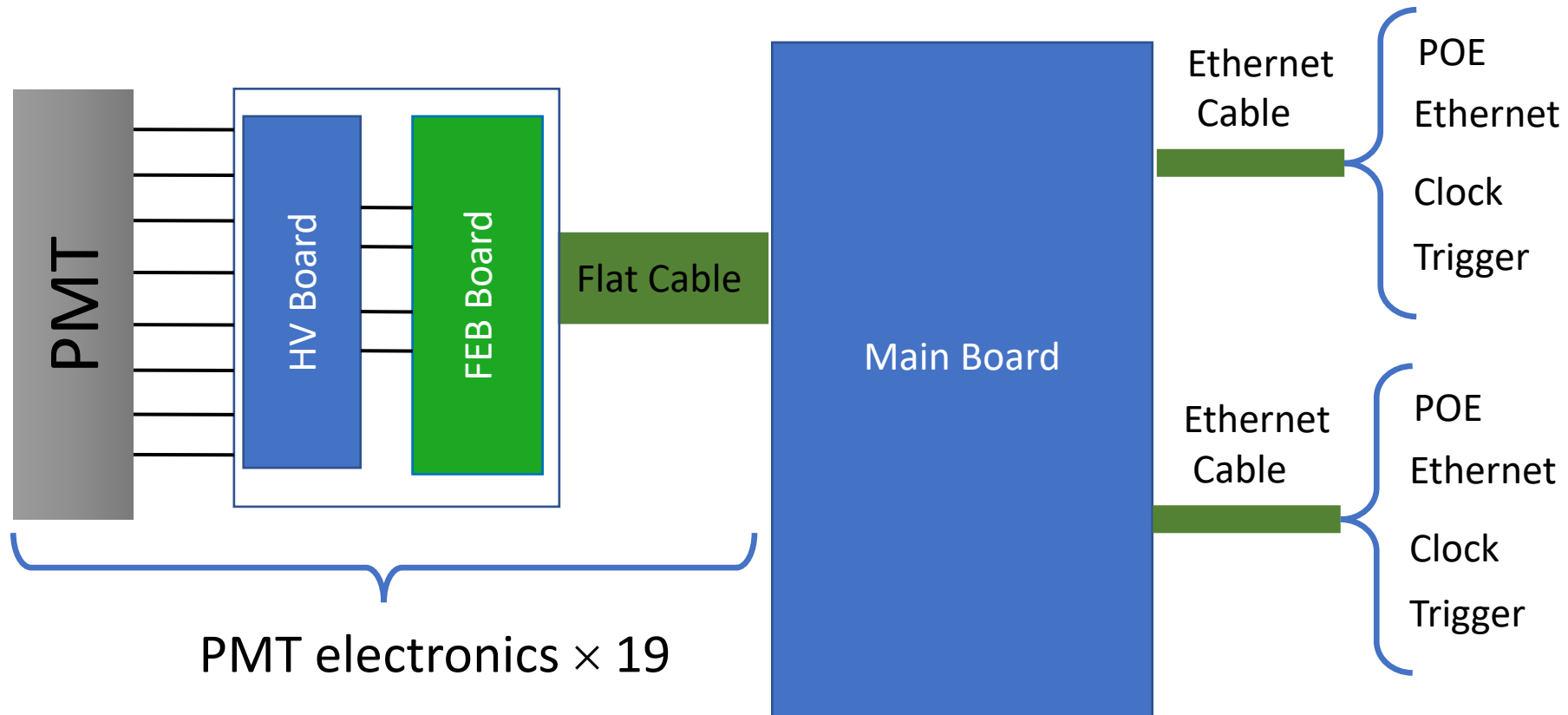
The holes close to the edge are to install: hooks for raising and transport; for brackets for the frame connections



The holes for the frame connections can be modified according to WCTE structure



The FD mPMT: Electronics



Requirement : Total Power consumption <4W

HV board



Basic Cockcroft-Walton (CW) voltage multiplier circuit designed for $-HV$ up to 1500V

Electrodes	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	P
Ratio	3	2	1	1	1	1	1	1	1	1	1	1
Ratio	3	1	1	1	1	1	1	1	1	1	1	1

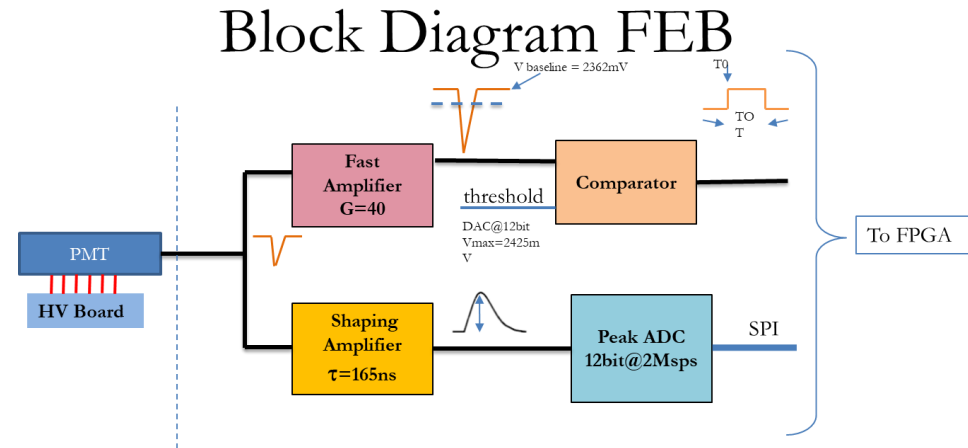
K: Cathode,
Dy: Dynode,
P: Anode

Updated Gerber and BoM for WCTE production, maybe switching to that version also for FD production to keep uniformity

PCB can accommodate more version of the same component to overcome procurement delays

Naples can study the failures on the boards already produced, to increase the strength of the design

FrontEnd board

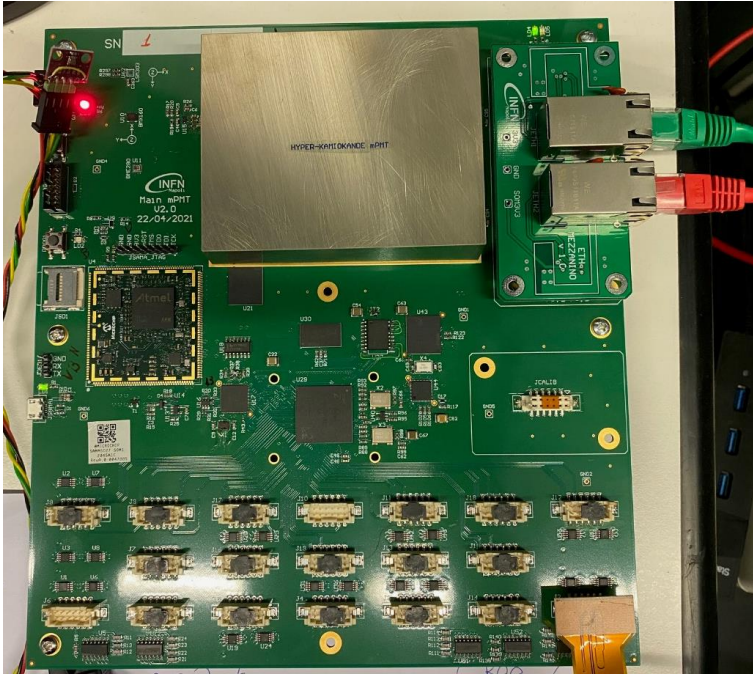


New MCU to support real time OS and ModBUS fully tested.

Firmware tested and safety feature in implementation.

BoM and Gerber ready uploaded to WIKI to start reliability validation and mass production.

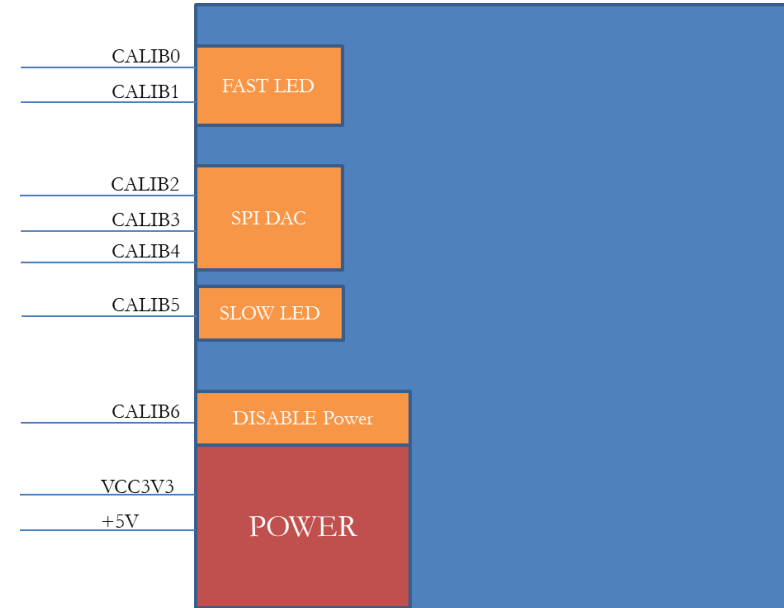
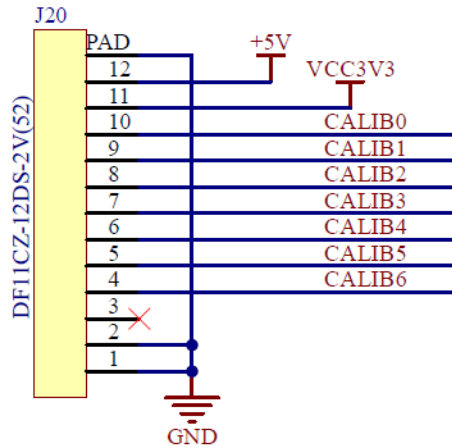
mPMT main board V2



New connector, locking system really strong

- For WCTE our plan is to implement a new feature in the acquisition chain
 - We will acquire two types of events:
 - The 'standard' one with charge and ToT from the PMTs with a maximum 1 MHz rate
 - The 'new' one with ONLY the ToT information with almost no dead time (during ADC busy time)
 - This addition will give us the possibility to study the pile up also with FD mPMTs and it is important to test this functionality also for HK
- We are also studying the Precision Time Protocol (PTP) that can be useful also later in HK

Calibrator Mezzanine



Modifications to IWCD mezzanine:

- Connectors -> DF11C-12DP-2V(57) (possible change)
- DC/DC 5V to 12V (we can provide max 5 V)
- Power Switch to disable the 3V3 and 5V (safety reason) -> (similar to AP2152AMPG-13)

With this changes test possible in few weeks

Can you also provide the firmware for the FPGA?

Main Concern: are you sure the LED is stable thermically? Have you checked no triggers from off LEDs on PMTs?

Our plans!

- Funding request for WCTE mPMTs production started, results in September
 - Plan is to produce at least 5 FD mPMTs
 - The timeline is not a problem at the moment.
 - Electronics production for 5 mPMTs already started, in particular the FPGA will arrive in November (12 pieces) thanks to Avnet 'Proto Expedite' program
 - Other critical components will be ordered in autumn after fundings approval
- INFN requested also the necessary budget for the assembly of WCTE at the end of 2023, for 2024 the request will be submitted in 2023.