HPS ECAL review

Mechanical, thermal and integration aspects

(By P. Rosier)

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Mechanical activity phases from 2004 to 2012

DVCS (2004-2005)

Crystals support frames
Support structure
(internal and external)

Integration of:
Crystals
Apd 5x5
Preamplifiers
Connecting and
motherboard

Insulated box
Cooling circuit
(Chiller compatibility)

Alignment tool
…

ECAL test run (2011-2012)

Crystal frames
Support structure
-space for front light injection
-space to double number of crystals
Thermal box
Cooling circuit
Alignment tool
Motherboard KIV
Connection board
Preamp rail system
ECAL support system
Pre-assembly at Orsay
Transport
Mounting at JLAB

Vacuum chamber

The Orsay Team for the mechanical and integration engineering

For the ECAL test run, the design and construction required 1.5 engineers and 0.6 technicians (men/year FTE)

For the ECAL C1 preparation, the mechanical design and construction will require 0.55 engineers and 0.3 technicians (men/year FTE)

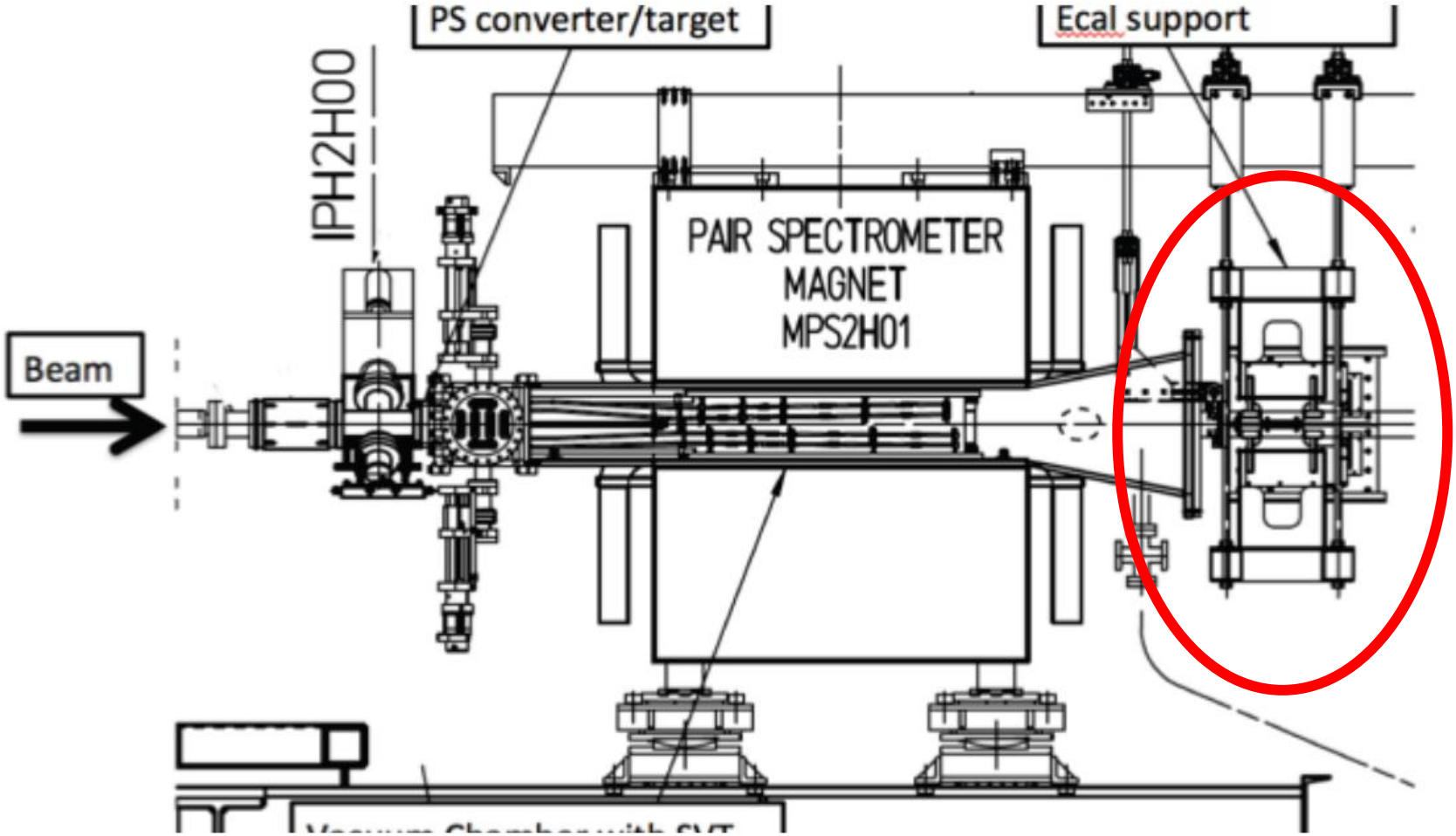
Ph. Rosier (Mechanical and thermal engineering and project manager) = **0.15 FTE**

E. Rindel (Mechanical and integration designer and assembly leader) = **0.4 FTE**

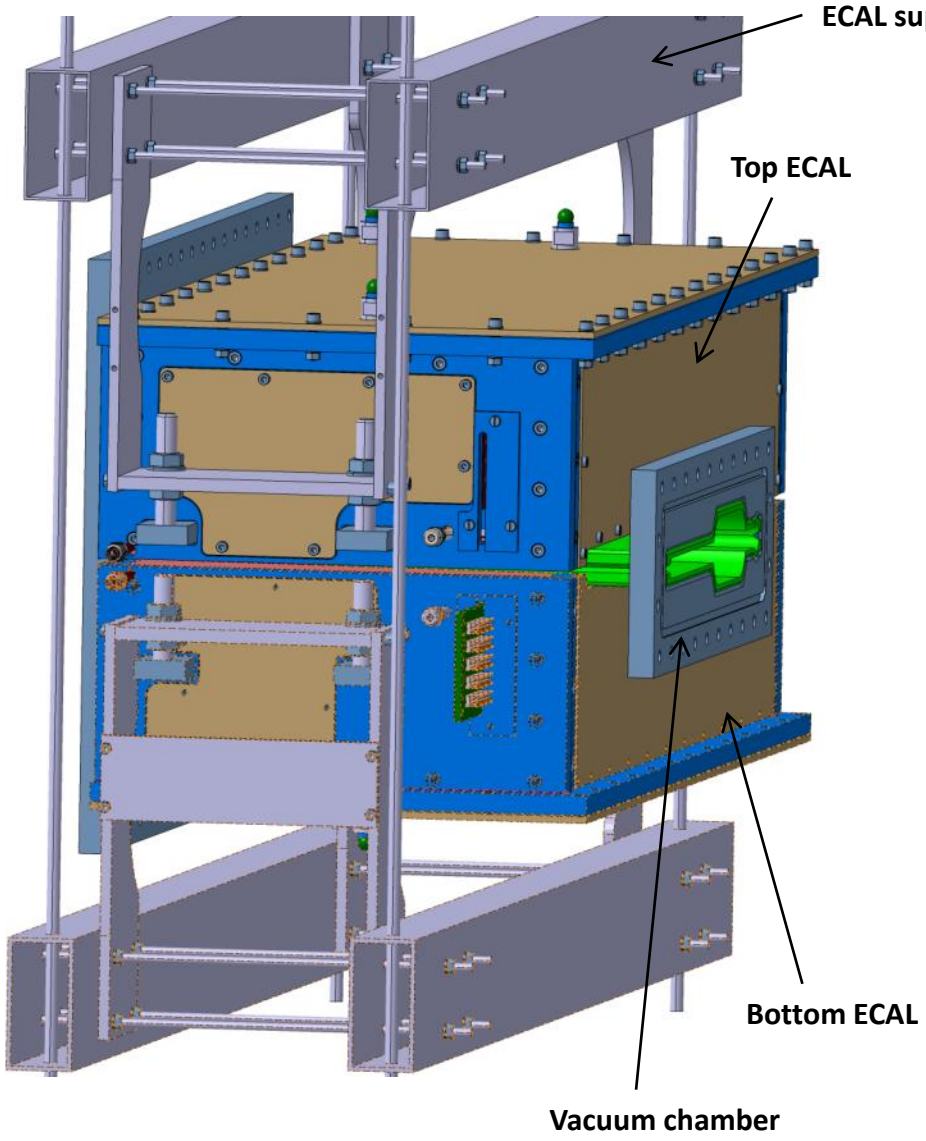
M. Imre (Technical workshop staff) Pre-assembly in Orsay and Participation in the mounting at JLAB = **0.2 FTE**

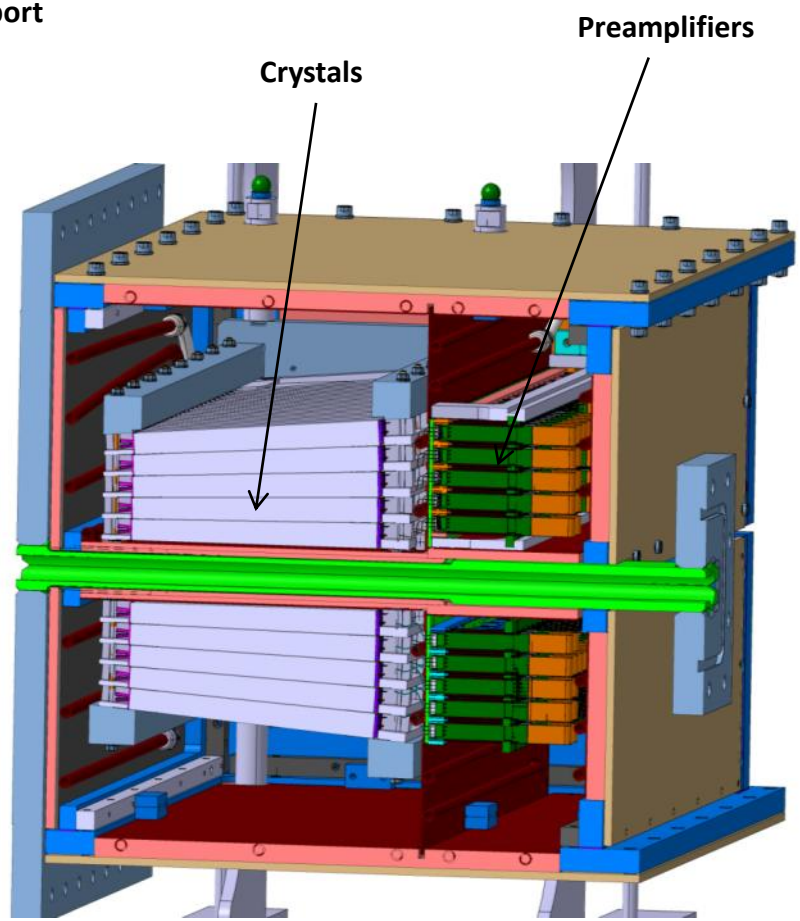
L. Seminor (Technical workshop staff) specialized in cooling circuit manufacturing and rail production = **0.1 FTE**

Ecal test run setup



Ecal for the test run

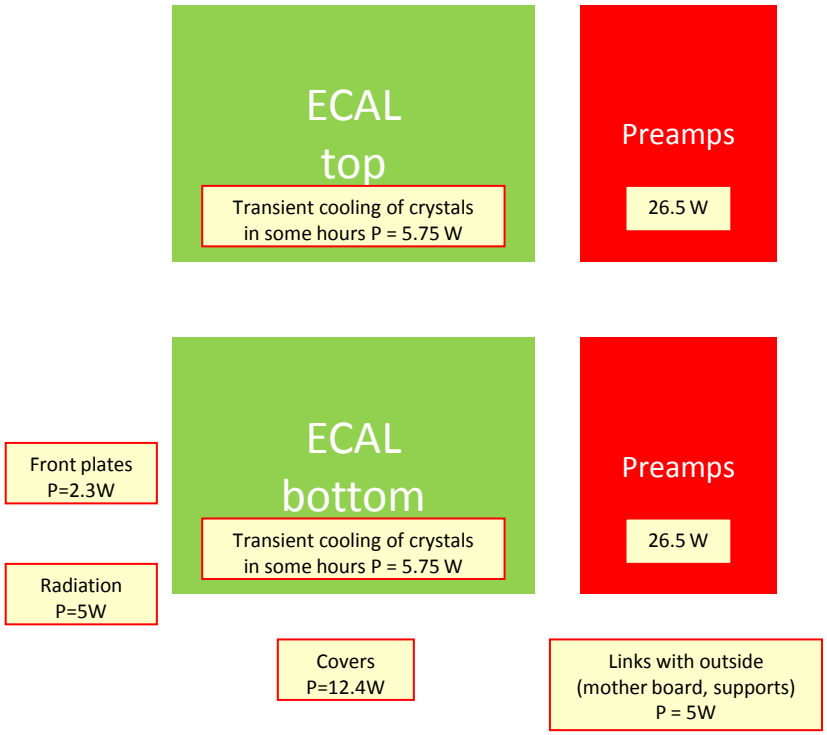




Ecal thermics and temperature measurement for the test run

Based on the DVCS experiment … it uses the same chiller set at 16°C

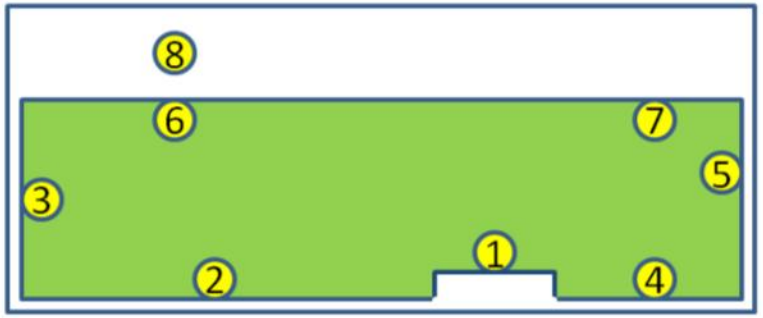
Power summary for the HPS ECAL



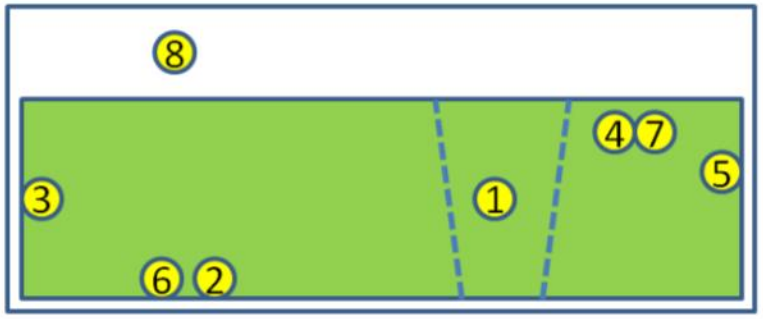
Total ~89W for the HPS ECAL

Thermal sensors positions

FRONT view



TOP view



⇒ **measures in 2012 show stable temperature at 18+/-0.1°C**

Mechanical activity phases for 2013-2014

ECAL test run (2011-2012)

Crystal frames
Support structure
-space for front light injection
-space to double number of crystals
Thermal box
Cooling circuit
Alignment tool
Motherboard KIV
Connection board
Preamp rail system
ECAL support system
Pre-assembly at Orsay
Transport
Mounting at JLAB

Vacuum chamber

ECAL C1 preparation (2013-2014)

Crystal dismounting
Laapd integration

Motherboard KIV
Led integration

Cooling circuit modif.
Thermal box modif.

ECAL support system

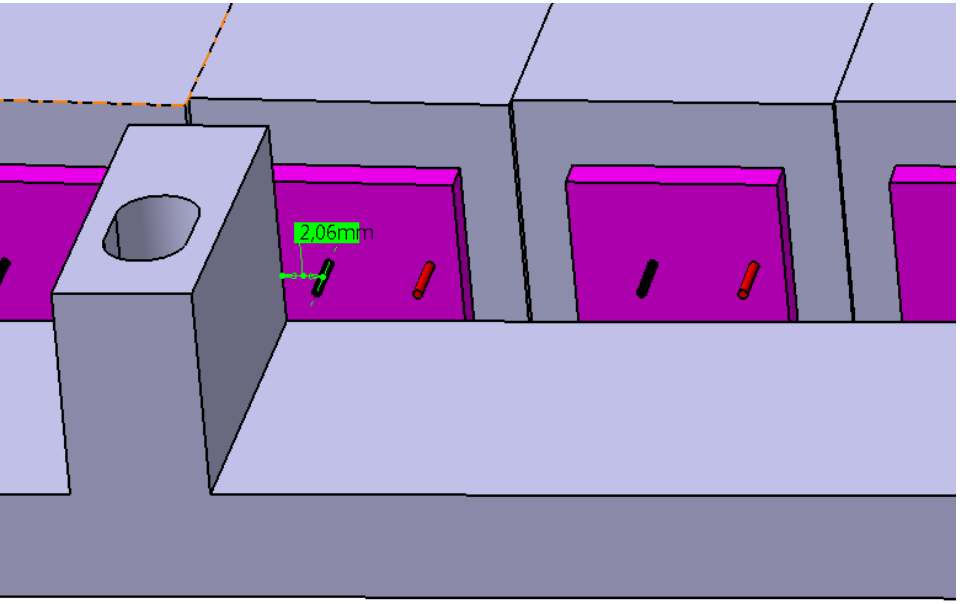
Mounting & assembly

Crystal dismounting and mounting

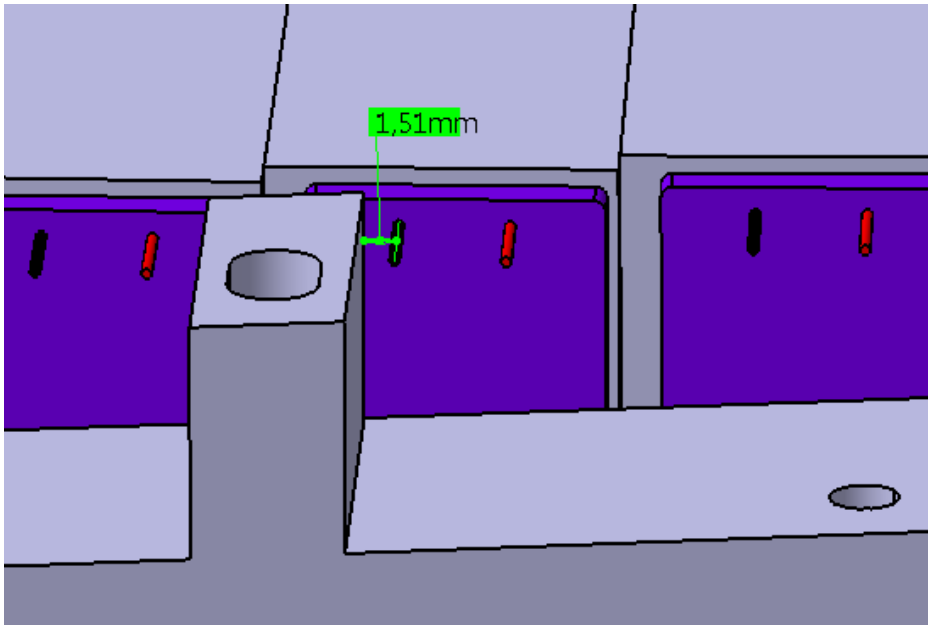
Orsay will participate in the dismounting of ECAL in nov 2013
and on the mounting (after APD change) in 2014

LAAPD integration

ECAL test run = APD 5x5

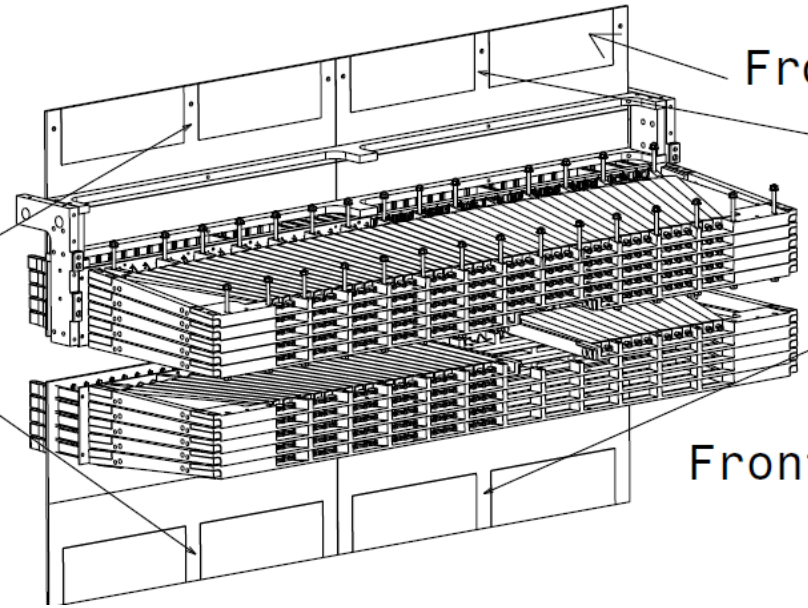


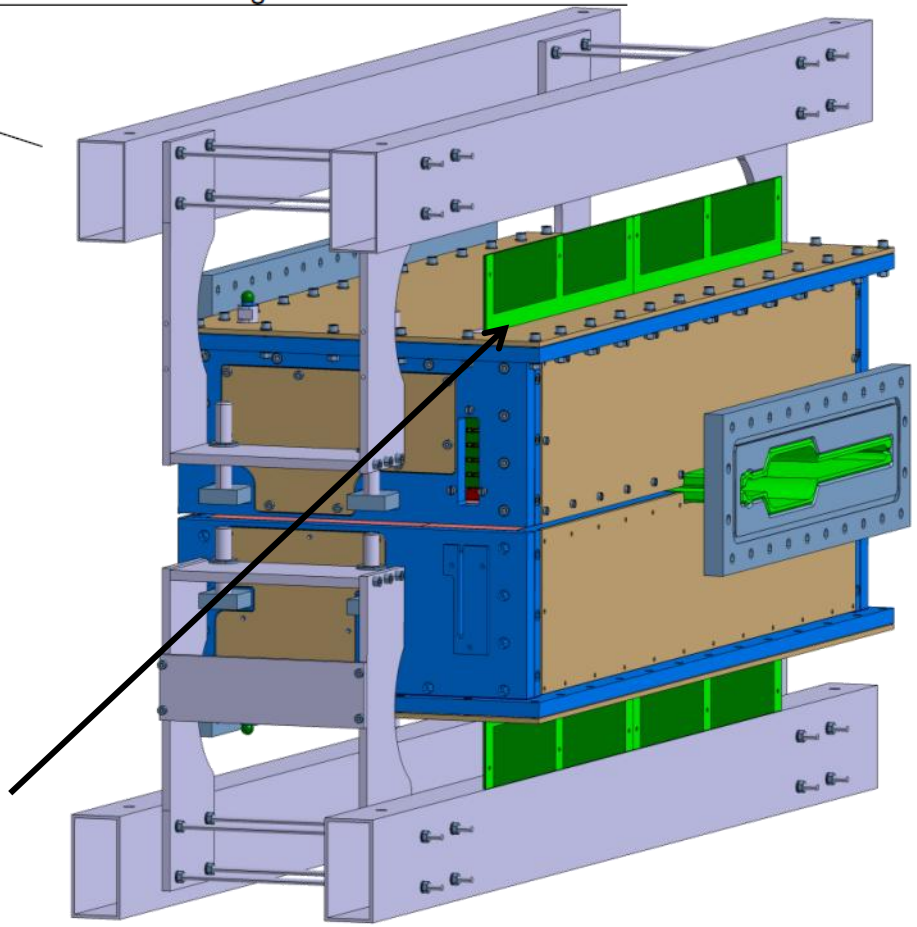
ECAL C1 = APD 10x10



During the crystal dismounting in nov 2013, we'll check the LAAPD mounting

New motherboard





INFN is going to redesign new motherboards in vertical positions.

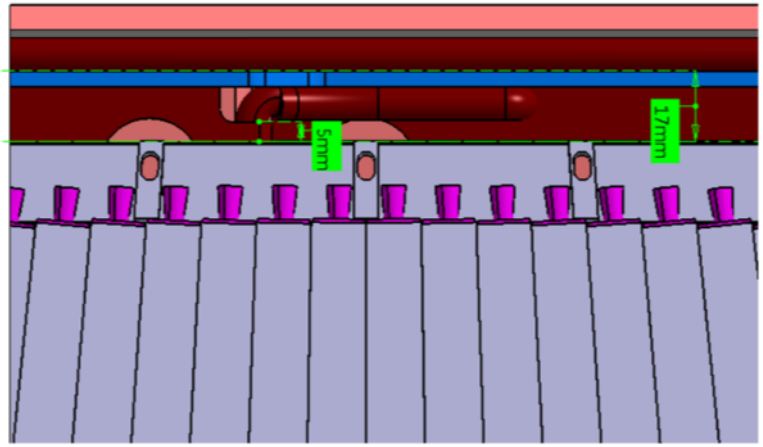
Emmanuel defined in summer 2013 exact size drawings for their Keep In Volume and mechanics.

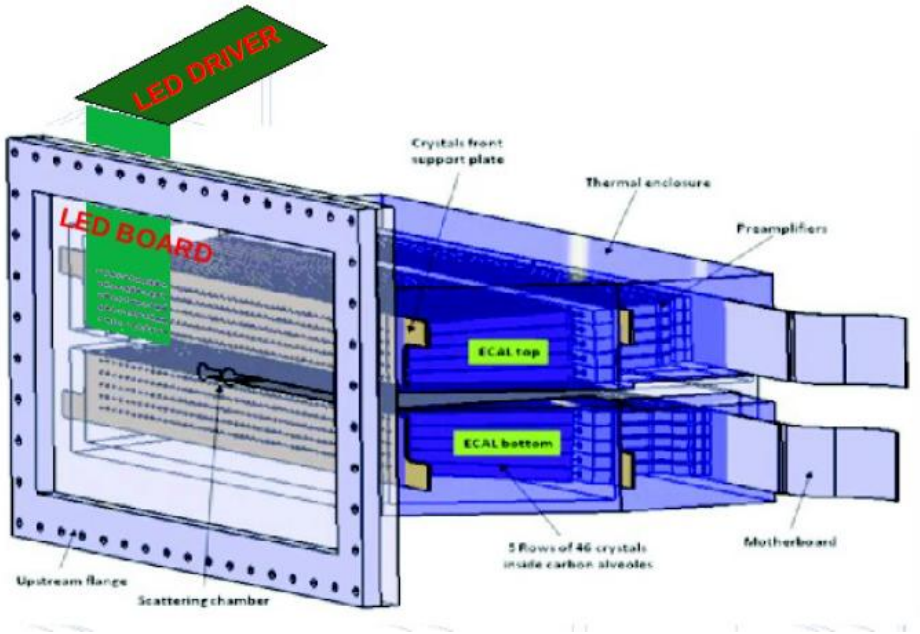
It is necessary to modify the enclosure and to produce new preamplifier rails …

LED system integration baseline

On the 18/09/2013, we had a phone meeting to fix the baseline of the LED system integration

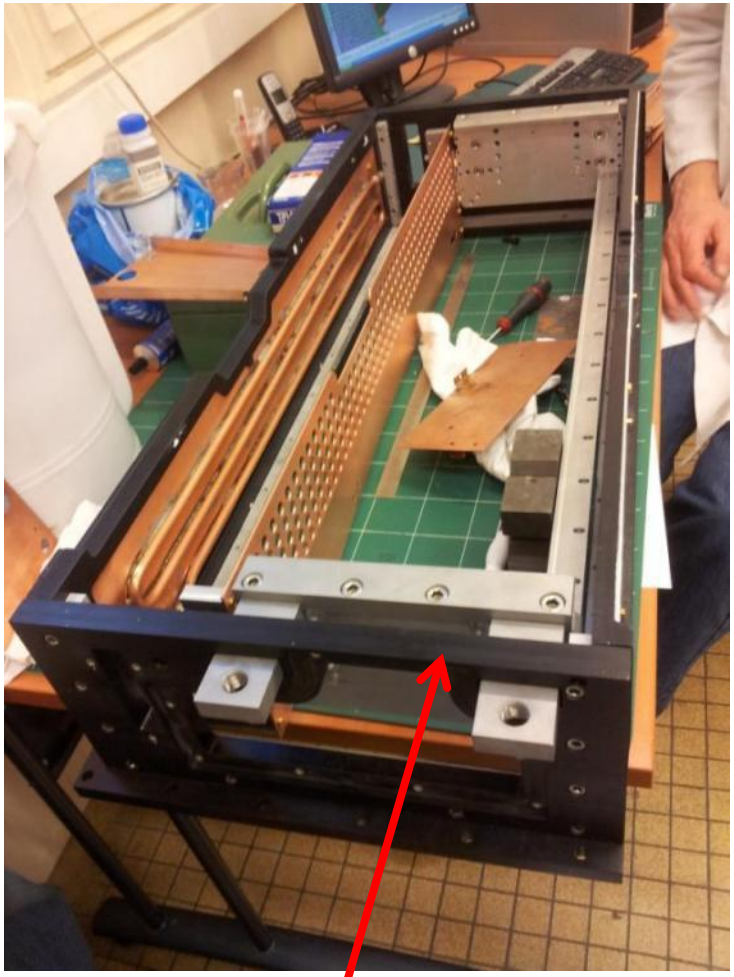
The conclusion is:
- A mechanical study between INFN and Orsay is undergoing.
The idea is to replace the ferule support in front of crystals by a new one comprising the LED.
-The LED driver will stay outside of the ECAL for high power reason . It can be fixed on top of the ECAL.
It is linked by a flat cable through the ECAL enclosure (also to modify).





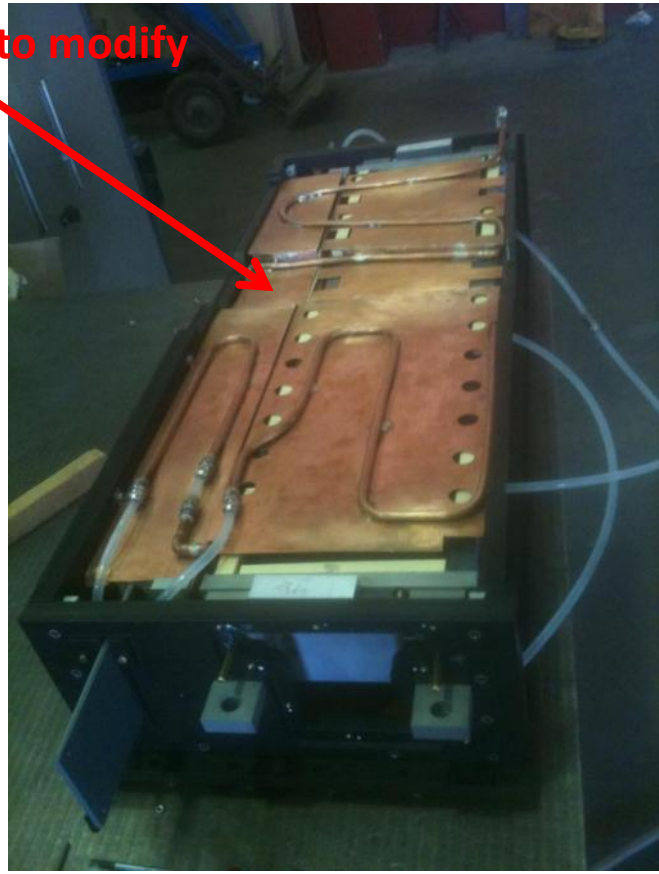
From Celentano presentation of the 9th september

Insulated box and cooling circuit modification



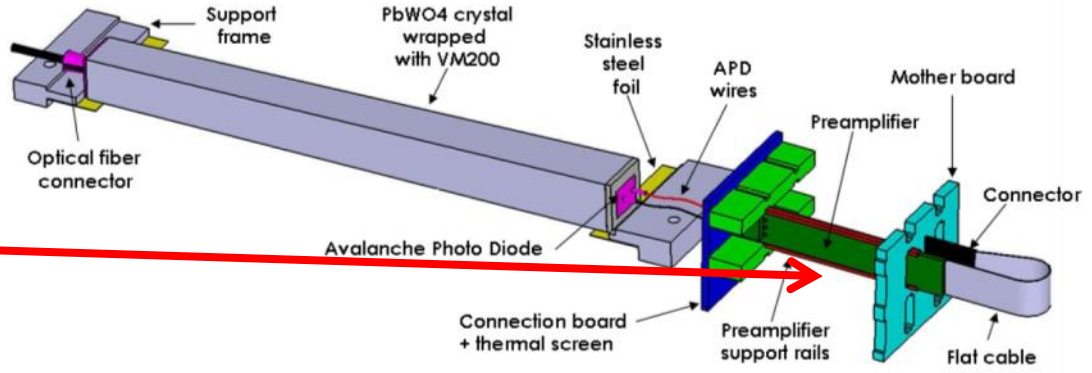
Thermal box to modify

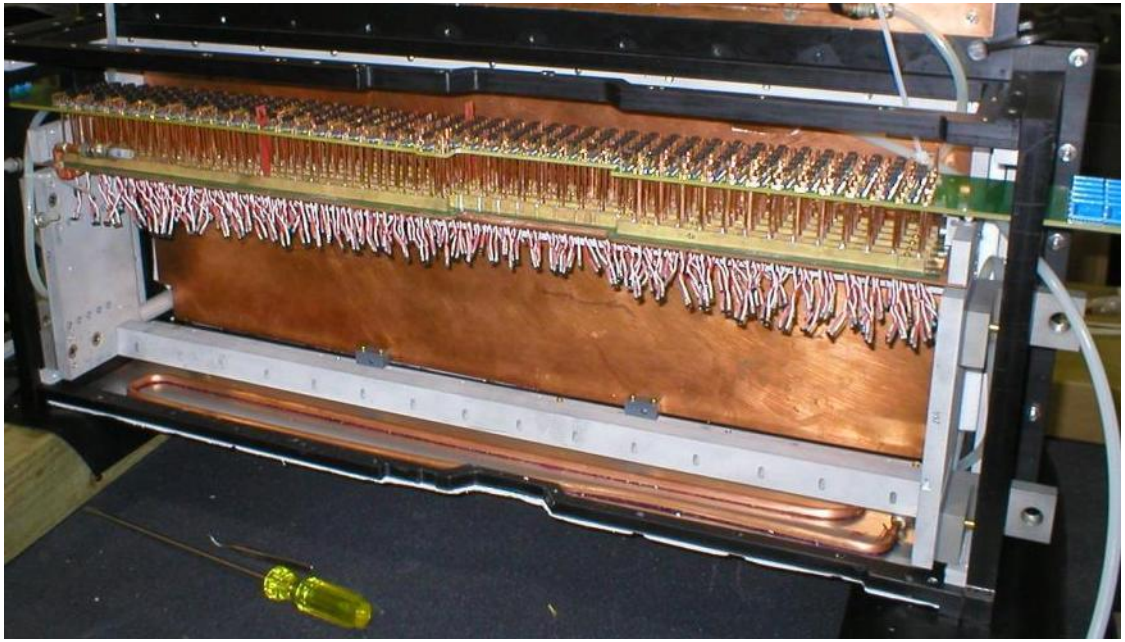
Cooling circuit to modify



Precise design and construction to be done beginning of 2014.

Preamplifier rail and motherboard soldering

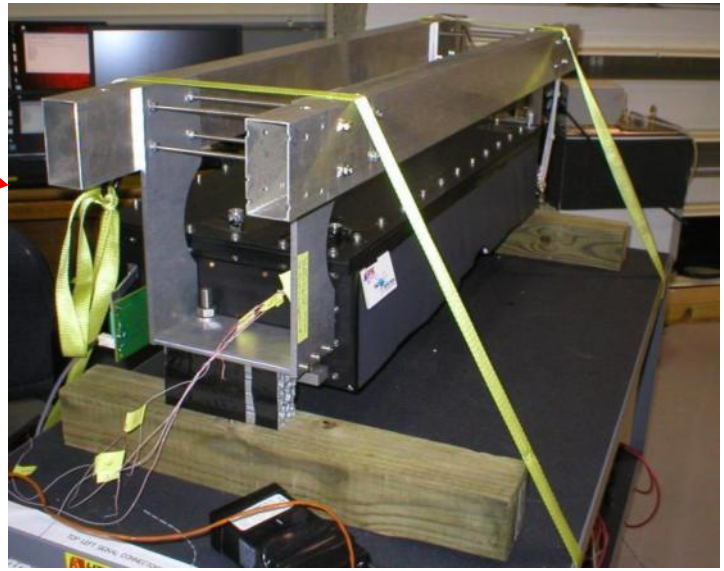


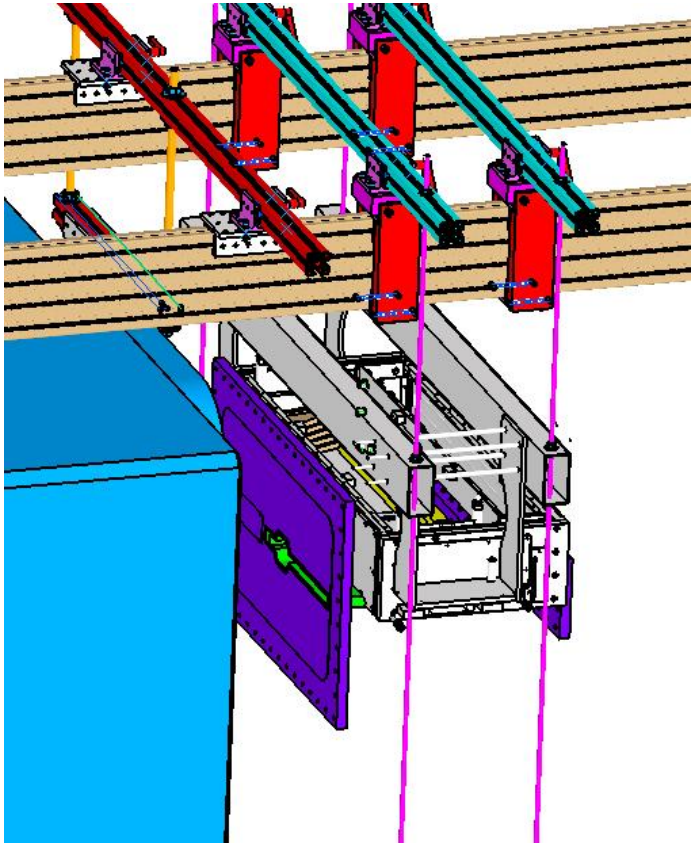


800 copper rails to manufacture and soldering of the new motherboards @ JLAB

ECAL support system

Due to a misunderstanding in the responsibilities and a lack of information in 2011, the existing support must be redesigned.





From the Mike Zarecky CAD (here left), the design of a new support is foreseen beginning of 2014.

Made of NORCAN profile, it will be adjustable, easy to align and stable after alignment.

Budget for 2014

NORCAN profil support = 2500 euros
Cooling circuit modif. = 1000 euros
Rail tool + rails = 500 euros
Thermal box plastic = 500 euros
Transport and customs = 1500 euros (to confirm)

TOTAL around 6000 euros …

Schedule

ECAL Mechanical and integration														
		Task	2013						2014						Responsibility
			July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
ECAL design		Integration of LAAPD and LED													Orsay
		Thermal enclosure modification													Orsay
		Electronic boards		KIV	KIV										INFN Genova
		ECAL support on magnet													Orsay
ECAL construction	ECAL support	construction													Orsay
	Structural parts	Machining													Orsay
	Thermics	Thermal screens manufacturing													Orsay
		Thermal enclosure manufacturing													Orsay
	Electronics side	Preamps rails production													Orsay
	Shipment	Shipment to Jlab													Orsay ?
ECAL assembly		Crystals mounting in frames													?+Orsay
		Electronic boards mechanical mounting													Orsay
		ECAL assembly													?+Orsay

Reviewer questions

- Was the temperature control system in the Test Run adequate? What's the evidence? **YES, 0.5°C stability but calibration to do**
- Lots of parts must fit together during final assembly at JLAB. How will you ensure that they go together correctly ahead of time? **=> CAD is safe + premounting in Orsay**
-The Ecal is supported by vertical rods. How much will it move as temperatures in Hall B vary? **=> 250µm/10°C variation = not an issue because need positioning at 0.5mm.**

- Remote (slow) control of chiller and temperatures ? **No need in DVCS, if not can use a camera to check chiller operation**
- Alarm in case of chiller shutdown and/or temperature excursion? **Temperature sensors in EPICS linked to the alarm system**
- How long does it take to reach stable temperature? **=> 1h30**
- Any opening possible during commissioning or will there be too much isolating wrapping material? **=> upper cover able to be opened**