Ciemat Mechanical Workshop and test of the Stainless steel plate machining for the CALICE-HCAL.

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The aim of this presentation is the interest of ciemat group to study the DHCAL mechanical structure for 1m2, prototype and ILD future detector is behind.

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1.- Ciemat mechanical workshop.

Milling Machines:

- 1 CNC machine of aprox 4x1 m2 working table. Accuracy of aprox 0.03 mm/m, with temperature compensation.

This is the machine that can be used to produce the plates for the HCAL prototype.

2 CNC machines of aprox. 0.7x0.4 m2 working table. Accuracy of aprox 0.02 mm, with temperature compensation.

•1 milling machines of aprox. 2x0.5 m2 working table. Accuracy of aprox 0.03 mm/m, with temperature compensation.

•2 milling machines of aprox. 0.8x0.35 m2 working table. Accuracy of aprox 0.03 mm, with temperature compensation.

Turn:

- 2 CNC turn machines of aprox diam 0.3x0.6 m. Accuracy of aprox 0.02 mm, with temperature compensation.

2 parallels torn of aprox diam 0.4x2 m. Accuracy of aprox 0.03 mm/m, with temperature compensation.

2 parallels torn of aprox diam 0.2x0.6 m. Accuracy of aprox 0.03 mm/m, with temperature compensation.

1 parallels torn of aprox diam 1x2 m. Accuracy of aprox 0.04 mm/m, with temperature compensation.

1 parallels torn of aprox diam 0.6x4 m. Accuracy of aprox 0.04 mm/m, with temperature compensation.

Other machines

Weld:

- Mig/Tig.
- Arc.
- Oxyacetylene…

•**Hydraulic Shears** machine up 15 mm and 4 m long carbon steel.
•**CNC Press Brake** machine of 4 m long and 20 Tn.

•**CNC Punch Press** machine of 4x1.5 m2 working table.

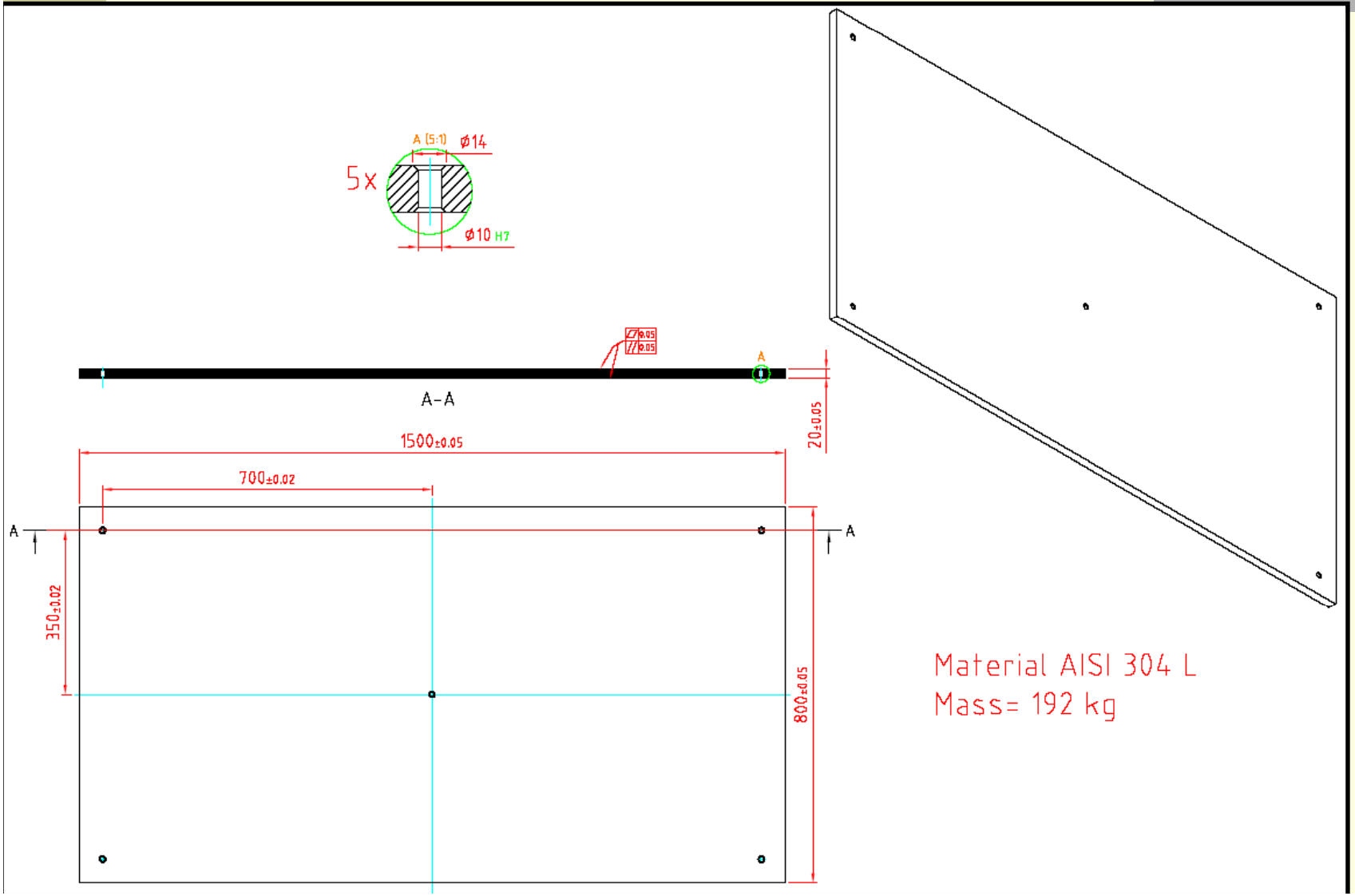
•**Electro erosion** machine and **Electro erosion wire cut** machine.

•Several **drill column** machines, **cut** machine and **adjust** machines.

2.-Test on a plate of 1510x810x25 mm3

To study the capacity and posibilities of the Ciemat workshop to produce the prototype:

- We was machining a plate of AISI 304 L, to obtain the following plate:
- To verify the planarity of the plate we was used a comparator on the CNC machine. And to verify the CNC machine we will use interferometer measurements (not yet finished). The final planarity of the plate will be measure by the interferometer, if this is considered necessary.



Results:

- We obtain a planarity of aprox. 0.6-0-7 mm, mainly due to the internal stress of the material. Because we do not take care to use thermal stabilized plate. The rest of the test was stoped. We need to buy this material type, and also start of pre-calibrated plates.
- To do this test we take aprox 3-4 ‘Ciemat’s working days’.The plate weigh aprox 190 kg. This mean that it is necessary lot of time during the several manipulation and positioning operations to produce the piece.

Consequences:

- To produce 40 plates of 1.5x0.8 of different dimension and dispositions, we need more of 1 year of job.
  - To produce the different plates we need to re- programmer the CNC.
  - And modify the fixation/positioning system of the plate on the table.

Constrains:

- During this year our workshop it is very busy with other projects mainly until September.
- Probably during next year, the workshop will be remodelated and this can take 6-9 months. During this operation the big CNC machine will be not operative.

To minimize the time schedules:

- Minimize the mechanical dimension of the mechanics pieces to fit with the detector devices.
- Minimize the numbers of different plates to produce.
- Minimize the operation on each plate.
- Utilize smaller intermediate plates.
- Minimize the requirements of accuracy for the plates, almost on the not contact or attachments surfaces, to fulfill with the particles physic requirements for the test of the calorimeter prototype.

3.-Lyon Meeting agreement

We have agree that:

- 0.1 mm deformation on the detector wafer it is admissible.
- The parallelism tolerance of the absorber plates can be around +-0.5 to 0.8 mm. Should be produced directly on the supplier company of the stainless steel plates with this tolerances.
- A stainless steel base of 1x1 m2 for the PCB will be made at Ciemat. And delivered to Lyon during September. The fabrication drawing will be supplied to Ciemat next days. The planarity and parallelism will be around 0.3 mm, and the thinness of the plate will be around 4 mm.
- Dimension of the prototype module of the calorimeter will be between 0.7x0.7 m2 to 1x1 m2 with the layer as identical as can be possible. During the Geneva meeting will be fixed those parameters. From the point of view of the mechanical fabrication the difficult the 0.7x0.7 m2 prototype means the 30% of 1x1 m2.
- Ciemat will present a 3D sketch for this prototype module during September. From the point of view of the support absorber structure. To start this we need the input of the a 3D drawing of one detector module. And open the discussion to obtain a solution for the guiding fixation of the detector modules on the absorber. Also to include the possibly of incorporate photo target on the module to study the positioning of the detector after the assembly of the module prototype.
- We will be celebrate a monthly meeting (also how video-conference).

4.-Next steps

- Fix the design of the calorimeter module prototype, to start the fabrication as soon as possible.
- Frequently interaction with the different designers to finalize the design and optimize the machining operations.
- Fix the positioning tolerances of each detector module in the calorimeter module prototype.