Minutes of PLUME meeting
- 2009, December 4 -

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Contents

Participants

- **University of Bristol**: Joel Goldstein,
- **Desy, Hamburg**: Lena Bachynska, Ingrid Gregor, Ulrich Koetz,
- **University of Oxford**: Andrei Nomerotski,
- **IPHC, Strasbourg**: Jerome Baudot, Nathalie Chon-Sen, Mathieu Goffe, Rira De Masi, Marc Winter.

1 Talks brief summary

The meeting started with 2 presentations, please consult the slides on http://indico.cern.ch/conferenceDisplay.py?confId=74676 for details. Here is a very sort summary.

Overview of Plume activity in 2009 by Nathalie

→ first double-sided ladder concept based on analog sensor (MIMOSA 20) and short sensitive area 4×1 cm^2,

→ two double-sided ladders were built,

→ material budget reached 0.6 % X0 if only the sensitive area is considered (the flex is much wider than the sensor),

→ one ladder was extensively tested in-beam (SPS) .

Flex design for 2010 by Andrei

→ first flex (really never done before) incorporating 6 MIMOSA sensors,

→ focus on electrical functionality,

→ almost ready, submission end 2009 or very beginning of 2010,

→ vendor contacted for quote: Graphics, UK,

→ propose flex-PCB version first to validate design.

2 Discussion

2.1 PLUME goals

Our gaol is to obtain by the end of 2012, a prototype double-sided ladder with about 1x12 cm2 sensitive area and a material budget ranging between 0.3 to 0.4 % of X0. We note that either the LOI number (0.11 % for a single sided ladder and 0.16 % for a double sided ladder) or TDR numbers (0.06 % X0) are unrealistic with respect to the time scale. The ladder will have to be tested in-beam in the following operational conditions: air cooling and power-pulsing.

Characterizing the sensor is not the goal of the project. MIMOSA 26 is considered as the unique sensor for the project. Nevertheless, it could be that, by 2012, MIMOSA 26 is replaced by a newer version if the added value of this change is substantial according to our goal.

The collaboration will be opened to integrate another kind of sensor, once the know-how is acquired.

2.2 Main milestones

- **2010 :** electrically functional full double-sided ladder,
- **2011 :** first material budget optimized ladder,
- **2012 :** best optimized ladder.

For now, we plan to have 3 operational double-sided ladders for each prototype model (each year).

2.3 Task definition and organisation

- Sensor provision and thinning/dicing
  - IPHC

  - dicing probably through our LBNL colleagues whose industrial partner offers a quite small dead zone by dicing.
  - the stock in MIMOSA 26 wafer is currently enough to equip 3 ladders for each of the 3 years.

- Electrical design
  - Oxford for the flex.
  - The currently considered vendor is Graphics. Other possibilities include the ones used by ATLAS (Cicorel, OpticPrint) and STAR (Datex Instruments).
  - A PCB version prior the kapton one will be produced for debugging the design.
  - Quantity: around 4 PCB samples and 12 kapton samples for the main vendor.
  - Discussion on which ends the readout occurs for each side. This choice impacts the design of the mechanical ladder support, the behavior with power-pulsing in magnetic field and the position of sensors wrt the flex width. No decision reached yet.
  - How to study the sensitivity of the sensor to lines running just below? Produce a dedicated flex or build a setup which would position lines just near the sensor (seems complicated). Probably a PCB version of an advanced flex could be designed and produced after the current 2010 version. Will be decided after first flex PCB-version tests.
  - IPHC will provide an auxiliary boards for the connection of the flex to the acquisition system. This board should have the necessary components for the power pulsing.

- Mechanical design
  - this task includes the design of the ladder stiffener (material type, dimensions) and design of the ladder support structure
  - Bristol will engage simulations for the choice of the stiffener. SiC foam at 8% is quite rigid and hold the full structure. A less stiff material could be used to evolve toward a sandwich-type rigidity (stress on the outer layer and middle material is just a spacer).
  - Bristol will design and fabricate the support which holds the ladder for tests and transportation. The ladder will be glued to a base and enclosed in a box allowing air flow and both optical and thermal measurements (similar to what was used for other Bristol projects but without the cryogenic temperature requirement).
  - A solution for air cooling has to be designed and fabricated (probably simply purchased). Both Bristol and IPHC will participate here. Hopefully (only about 12 Watts have to be dissipated) the system will be small and easily transportable for tests.

- Assembly

  - IPHC for the mounting of sensors onto the kapton flex (makes a module),
  - Bristol for the mounting of modules onto the stiffener (makes a ladder).
  - We need a mechanical mock-up for the sensors to be used first.
  - Bristol will use a very precise granite vacuum fixture system for the mounting and an automatic glue dispenser.
  - IPHC will also use a vacuum fixture system for the mounting but with aluminum jigs. Possibly, these jigs will be used for module transportation and should be designed to fit in Bristol granite piece.

- Electrical tests
  - Oxford should be able to test the bare flex (before sensor mounting).
  - DESY is setting-up a system to operate MIMOSA 26, including in the power pulsing mode.
    First, the system will handle the analog outputs of one sensor; in 2010, the system should handle the full flex readout.
  - After the first analog tests in DESY, we will consider the feasibility of more advanced (EMI) testing. We note there is a test bench to study the EM interaction with the beam at the Flash Facility in DESY.

- Mechanical tests
  - we ambition that a position measurement system will be able to provide the initial positions of the sensors on the ladder and control these positions while the ladder is operated (cooled by air flow, power-pulsed and with data acquired).
  - an existing system at Bristol may be used to control XYZ position of sensors on the ladder:
    $\rightarrow$ it is important to have marks on the sensor for reference,
    $\rightarrow$ we need to assess wether this system can be used to monitor the positions and potential vibrations while the ladder is operated.
  - The DESY laboratory has a Nikon microscope allowing very precise (XYZ) position determination. It belongs to the XFEL dpt, it should be possible to use it punctually. Nevertheless, the usefulness has to be checked.

- Thermal tests
  - Measure the temperature map of MIMOSA 26 and then of the ladder while in operation.
  - Some possibility at DESY and Bristol (using available RAL set-up).

- DAS design and replication
  - IPHC has a PXI-based system ready for acquiring 6 sensors at once,
  - The IPHC system still requires documentation and some fix before possible release to collaborators : 3 months

  - DESY is equipped with a PXI crate but will probably have to get a new board (to be checked with Mathieu/Gilles).
  - IPHC takes in charge the development to read a full ladder, 12 sensors, to be ready by the end of 2010.

- Operation set-up
  - At least two systems should exist to operate ladders, one for beam tests the other for electrical/mechanical/thermal tests.
  - An operational system includes a DAS and air cooling.
  - Currently, IPHC and DESY are the best placed to have them ready. The IPHC one will be movable for beam tests.

2.4 Tentative schedule for 2010

On the short term (in 2010)

January	submit the finalized 2010-flex design for an equivalent PCB fab.	Oxford
January-Feb	design and fabricate an auxiliary board to allow connection flex-DAS	IPHC
February	test of bare PCB-flex model	Oxford
	mounting of 1 sensor on the PCB-flex and test	IPHC
March	start mounting electrical test setup for MIMOSA 26 analog part	DESY
	ordering of final 2010-flex	Oxford
January-March	design study for both ladder stiffener (foam) and mechanical ladder support	Bristol
January-April	submission and realization of the thinning down to 50 um of one wafer of MIMOSA 26 sensors	IPHC
April	test of 2010 flex	Oxford
	start of mounting one and then several sensors on flex	IPHC
	study of power pulsing on analog outputs	DESY
May	start of mounting one and then several sensors on flex	IPHC
	mounting of electric test setup for MIMOSA 26 digital part	DESY

On a longer term

- Starting from April 2010 we may expect to start the assembly procedure of the 3 ladders we aim for in 2010. The detailed schedule will be prepared beginning of 2010 in view of the flex-PCB test results and reviewed on our next "general" meeting early May.
- In autumn 2010, the 2011-flex design shall start.

3 Organisation, next meetings

- there is now a mailing list : plume-l@in2p3.fr,
  it is widely open, not only to project contrubutors, but also interested collaborators.
- web-page of the project : http://iphc.in2p3.fr/plume.html,
- we decided to held 2 to 3 full-meetings a year at CERN,
  $\Rightarrow$ next one around early May 2010,
- and have one phone-call every month,
  $\Rightarrow$ next phone meeting on Tuesday 12, January 2010.