Minutes engineering meeting 11 September 2001

Main points:

Beam pipe:

- Support requirements need to be defined between ITS and beam pipe group, then *the responsible group for the design* have to be defined.
- Protection of the beam pipe against leakages from the cooling system requires further work. The use of kapton seems to offer a solution.
- An inventory of the displacements of the beam pipe including the effects of the TPC have to be made.

Alignment:

- The proposed monitoring system has been successfully tested.
- The system can not be used for monitoring the position of the second cone, due to the stray light from the system.
- A references needs to be defined, to which the position of the forward cone can be monitored.
- There will most likely be parts directly in front of the PMD

Services:

- An inventory of the services was presented
- The effect on the radiation length of the use of plastics instead of SS for the cooling services at the front side will be evaluated.
- Currently all proposed connector systems are again under discussion.

Corrosion:

- There have been several meeting with experts.
- After the next meeting at a France corrosion institute, a program of work to be done will be defined.

Cones:

- The length for the SSD ladders has been defined with +/- 5mm.
- A prototype of the SSD cone will be made around the end of October.

Installation:

- A remote system for lifting the ITS was presented and accepted

FMD & T0:

- The space envelope of the FMD classes with the requirements of the ITS. An alternative third cone will be designed.
- The service panel for installation needs to be detailed to be included into the discussions
- An air supply has to be defined to ensure the removal of the heat produced by the FMD & T0. (More then 50 Watt)
- Lines of communication have been defined

Cooling:

- SSD starts testing the ladder with end ladder electronics around half October
- SPD successfully tested a two phase cooling system
- There is now news yet from the CFD work
- An airflow will be supplied between the ITS and the TPC, eliminating possible problems with condensation.

- A schedule for the planning of the cooling of each subgroup
- The ST/CV group will take care of the cooling system outside the ITS
- Leakage detection still requires the attention of the subgroups

Beam pipe

Support: requirements for the support have to be defined. Important is that the beam pipe will not be over constraint. It was proposed to fixate the Z movement of the beam pipe at the position of the bellows near the PMD.
The current proposal for the beam pipe support would over constrain the beam pipe, causing an unwanted increase of stresses in the beam pipe.
Mentioned was that wire supports are favorable because of the low mass of the support.
To enable a good design of the beam pipe supports first the design criteria for the beam pipe support have to be defined.
Primary criteria are:

Which degrees of freedom are to be constraint at the ITS
Loads at the supports
Needed adjustment range off the supports
Stiffness of the supports
Use of temporary supports and the fixation from temporary to final supports.

The requirements for the temporary supports can be different from the requirements for the final supports.

Protection: The preliminary conclusion on protecting the beam pipe against water leakage from the cooling system is that the beam pipe could be protected with a foil of kapton (thickness 0.15 mm), though there is a serious concern that encapsulation of the beam pipe might also lead to more aggressive environment around the beam pipe during normal operation, increasing the risks of chemical induced corrosion. The foil and the enclosed air might cause harmful chemical products under the influence of the radiation. As these gasses are enclosed within the kapton foil, the beam pipe is continuously exposed to these gasses. As direct coating of the beam pipe with kapton would avoid gas enclosures, coating the beam pipe will be further investigated.

Displacement of the beam pipe: The effects of the TPC where up to now not included in determining the displacement of the beam pipe. There are the following main situations:

1. Movement of the TPC will cause displacement of the rails which in terms causes displacement of the beam pipe.
2. The connection of the ITS to the TPC and the therefore necessary displacements.
3. The movement of the TPC in it's final position, in case of the use of a vibration isolation system.

This point has been taken up with the TPC group.

Alignment

The proposed holographic alignment system has been experimentally tested at Ohio State University, with promising results.
As summarized the alignment system consists of two parts:

1. The monitoring the position of the front cone with respect to a reference
2. The monitoring of the position of the second cone with respect to the front cone.

The use of the holographic system would most likely not be possible because of the stray light. As an alternative one is looking at replacing the hologram with an special light source. The light source should provide a specific pattern which could be used in a similar way as the hologram. (The alternative monitoring system is becoming very much a like the Rasnik system which is used in Atlas.)

To allow the monitoring of the front cone 3 unobstructed light pads have to be ensured at the inside of the cable support cylinder and also on the SSD cone. The light pad is assumed to be a cylinder with a diameter of 40mm.

To allow further work the references for the monitoring of the front cone have to be defined. The position of the references have to be regarded carefully as they will be within right in front of the PMD.

Services

An inventory list of the services was shown. The list is mainly missing the electrical services for the SSD.

For the cooling service at the front side, the improvement in radiation length with using plastics instead of SS will be evaluated. The first estimates though indicate that the use of SS might be better. This is because for SS standard pipes with a wall thickness of 0.3mm can be used, as for plastics the minimum wall thickness for standard pipes is approximately 3mm.
To minimize the effect of the cooling tubes on the PMD the will be put as other layer around the services on the services support structure.

Connectors:
Electric: There is still discussion about the electronics connectors.

Optical: The optical connectors are assumed to be taken as proposed by the SPD, though work for these connectors is still ongoing.

Cooling patch panel: For the cooling connectors one is also looking for an alternative as with the current proposed connectors the O-rings providing the seal can not be replaced without replacing the full connector. An alternative from SMC was proposed and will be investigated.

Thin tubes: From SMC also a connector to be used on the thin tubes was shown. This connector was tested for leak tightness at Torino for several days,

showing no leaks at a test pressure of 7 Bars. The proposed connectors are standard, though the hole for the pipe needs to widend.

Corrosion

Outside the engineering meeting there has been a meeting with a special corrosion institute and with the ST/CV group.
From these meetings the main points where:

- Qualification of the pipe material
- Choice between AISI 304 or AISI 316
- Heat treatments for passivation and stress annealing.
- Surface treatments for improving the corrosion resistance
- Agents to be added to the cooling fluid to reduce the corrosion
- Concentration of oxygen in the cooling fluid for repassivation
- Level of de-ionization of the cooling fluid.
- The influence of plastics
- The corrosion influence from at the outside of the pipe
- Galvanic corrosion effects due to the grounding
- Cleanliness of the installed system.
- Possibilities for tests

The next step is that there will be a meeting with CETIM (a France corrosion institute which as previously done work for CERN, for this meeting someone from the metallurgy group from CERN will go with us.

After this meeting a report will be written to define the work to be done and where we can outsource this work.

Cones

The length of the ladders of the SSD is now defined within +/- 5 mm (516mm and 501mm from the center, for layer 6), allowing the design of the cone to continue. The chance in length of the ladders will be accommodated by changing the position of the ladder support rings.

It is expected that a prototype of the SSD cone will be made by the end of October.

Installation

A system to lift the ITS from the end of the rails was presented and accepted. The system is based on the current installation scenario, which needs to be checked with respect to the requirements in displacement of the beam pipe.

FMD, T0

Space envelope: The current used space envelope used by the FMD and T0 is in conflict with the space required for the ITS. The third cone in it's present design classes with the space requested for the FMD. The third cones primary function was the support of the beam pipe. A proposal was put forward for a

different design of the third cone. In this design the third cone also supports the FMD and T0, with the idea that the FMD and T0 can be fully pre-installed on the third cone in the laboratory, leaving only the connections to be made to the patch panel.

The new proposed design for the third cone will be reviewed by the ITS, FMD and beam pipe group.
The idea of the new proposed design is assumed to be baseline.

Service panel: Mostly disregarded in the discussion was the services panel which is currently not well enough defined to be taken into account in the discussion though might very well be with the current space envelope of the FMD. The design of the service panel though should avoid the space envelope of the FMD and V0.

Cooling: The FMD and T0 are expected to dissipate at least 50 Watt, to this end an air flow is required to ensure the cooling. This should also be taken into account in the design of the service panel and the third cone.
Currently this air supply is not foreseen at the patch panel level.

Communication: There was concern about the communication difficulties between ITS and FMD up to now. Agreed was that communications will basically go by Lars Leistamm with copies to Flavio Tosselo. Flavio Tosselo will further distribute the information within the ITS.

Cooling

Status: SSD will start tests with ladder and ladder end electronics around half October. SPD has tested the two phases cooling system, the tests showed that with a two phase cooling system one can assure a much smaller temperature gradient between in- and outlet. SDD, no news.

CFD: at CERN a start is made with a simulation of the heat flows inside the ITS. The simulation currently focuses on the SDD. As this work just started there is nothing to report, yet.

Humidity control and heat leak to TPC: to prevent heat leaks to the TPC a moderate airflow will be ensured between the ITS and the TPC. (Airflow 0.1 m/s or less). This airflow would also ensure that there will be no problems because of condensation along cooling supply lines between the ITS and the patch panels.
For the heat leak to the TPC it is assumed that 10 % of the heat produced at the services is not taken out directly by the cooling shield around the services. The 10 % would be less then 75 Watt, of which the transferred amount of heat to the TPC should be further should be further reduced by the moderate airflow.
The idea of the airflow is to prevent convection currents and so should provide an isolation layer between the ITS and the TPC

Cooling outside the ITS: it is now assumed that the CERN ST/CV group will take care of the design and construction of the cooling system outside the ITS. To this end there will be a meeting between the ST/CV and the ITS group on 11 or 12 October.
In preparation for this meeting the requirements from each sub detector have to be defined. The document on cooling of the ITS already gives the main requirements, though each group should check the document and if necessary send comments to Gert-Jan Nooren so the document can be updated.
In terms of control a basic documents will be send around by Jarl Buskop as a start for the definition of the requirements for the control of the cooling.

Planning: A planning on the completion of the cooling of the ITS was requested by the technical coordinator. A proposal was put forward on the basic milestones that should be covered within this planning. It was accepted that this planning should be made in project according to the standard Alice template.

Leak detection: the main point which still is not sufficiently covered with regard to the cooling system outside the ITS is the leak detection. Support can be given by the ST/CV group though still this to be further regarded within the ITS group.
One point for example is the use of blocking valves to minimize the effects of disasters leakages, this might also require the use of extra drainage lines to drainage the system in case of a calamity.