CM 26 – Riverside

24th – 27th March 2010

AFC / Absorber / Window
Progress & Integration

Presented by Wing Lau on behalf of the MICE AFC team
AFC progress

Key interface issues –

Interface with the absorber
There has been further change request from KEK since reported at CM24.

Brief summary of the request is as follow:-
Change request No. 1
That the nip of the flange ring for the Safety Window be shortened. Currently this nip is 30mm long and Tesla has been asked to trim it down to 10mm in order to provide sufficient clearance between it and the Absorber support stud rods.

**Cost:** Yes

**Schedule:** Will impact on schedule as 6 drawings are needed to be revised

**Technical issue** – none, but KEK could reduce the stud bolt head to avoid any changes on the Tesla supply.
Change request No. 2

That a ring flange of 267.5 outer radius with 48 M6 tapped holes be welded to the Thermal Radiation Shield. This ring is used to secure the LH2 pipes from the absorber, and to anchor the Absorber via the stud bolts (see next slide)
Change implication for request No. 2

Previous design anchors the LH2 pipe work to the Thermal Radiation Shield. This in turn anchors the Absorber into position. 4 blocks with tapped holes are welded onto the thermal shield to provide the fixing.

Cost implication: - Yes

Schedule: - Yes, as they need to revise another 8 drawings, make the ring with 48 M6 tapped holes;

Technical issue: - None, just extra work. However, there are lots of redundant tapped holes which may never be used.
Change request No. 3

That the lower part of the local thinning on the Large End Plate be widened to allow sufficient clearance for the 30 pin feed through Tee off.

This request has been made to Tesla. It was agreed that the local thinning area remains the same, but the Large End Plate will be rotated by 2.5 degree anti-clockwise to make more room for the T-off piece. This requires the bolt hole pattern be slightly re-orientated.

No cost and schedule implication from Tesla.
Change Request No. 4

That the spill bucket be modified to make room for the 30 pin feed through.

Technical issue:-

This is not possible as there is no room to do that, as seen in the diagram on the right.

KEK to examine if the Feed through piece could be bent and modified to suit existing space.
AFC progress

Key interface issues –

  Interface with the absorber

  C&I arrangement
C & I arrangement

This has been discussed thoroughly between Tesla, MICE & KEK.

Matthew Hill has now produced a list of C&I requirements.

Shigeru has confirmed that he is happy with all the KEK items and the list has been forwarded to Tesla

Apart from a few minor details, this is now largely agreed by all 3 parties. There are still some details to work out on the feed-throughs

The list is now posted on the STFC web page that Tom Bradshaw has set up for document repository between MICE and Tesla. Log in code is required.
AFC progress

Key interface issues –

Interface with the absorber

C&I arrangement is now fixed

Vacuum supply and connection

This is in hand – pump type & makes identified.

Pump purchase next on the “to-do” list

No surprise here – pump locations and vacuum pipe routing has been drawn up.

Need to firm up on what type of backing pump the RFCC module uses and whether it is OK to put this outside.

Tim is working with BPG on the design of the pumping platform. 2 of the 6 spaces are allocated for the RFCC backing pumps, so it would be nice to confirm if these are really required.
**AFC progress**

Key interface issues –

- Interface with the absorber
- C&I arrangement
- Vacuum supply and connection with neighbouring modules

*No known issues with the Bellow flange*
AFC progress

Key interface issues –

- Interface with the absorber
- C&I arrangement
- Vacuum supply and connection
- with neighbouring modules
- with MICE Hall infrastructures

*This has not been looked at in anger. Need to do so shortly.*

*All the main service supplies have been identified*
AFC progress

Key interface issues –

Stumbling block

Quench protection design
Status of the Quench Protection design

The original proposal was to rely on the quenchback as a passive system with resistors and diodes across the coils.

TESLA wants to wind the coil with sufficient tension of overbanding to ensure contact with the inner bore of the former and this was supposed to give quenchback.

In January this year Tesla produced a report with predictions of peak temperature and voltage during quench. When we looked at the report we found anomalies and this was due to the use of pure aluminium properties instead of alloy T6061 for the material of the mandrel. This was an error on Tesla’s results;

Remodeling results received on the 23rd of March is still not clear when the quenchback due to eddy currents in the former really happens and what effect it has on the peak temperature, voltage and the AC losses in the conductor.

At this point in time, we can only report that TESLA will continue to work on quench modeling and no final design has been reached.

More discussion on this in the Engineering Parallel session.
AFC progress

Key interface issues –

Stumbling block

quench protection design

Coil winding machine

The issues are that there are a number of parameters that appear not to function as predicted, these being the traverse and the tension, which are key to the winding;

Can manually switch the traverse as a fall back by reading the number of turns, but cannot make the tensioner work properly.

Tesla is taking urgent action to resolve this.
AFC progress

Key interface issues

Stumbling block

Production status – the Gantt chart
### Tesla schedule on AFC – April 09

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<th>Task Name</th>
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<th>Finish</th>
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**Delivery of 1st module:** end Feb 10
Tesla schedule on AFC – March 10

Delivery of 1st module: end Oct 10
The Schedule presented by Tesla in April 09 (after MICE requested design change to accommodate space for the LH2 pipes)
The latest schedule from Tesla (KEK change request is one factor, the technical problem with the coil winding machine, the need to re-quote for most of the outside supply items and the problem with the quench protection design all contribute to the latest delay.
Order long lead item
Material procurement & component manufacturing.
Process development
Manufacturing Module 1
Assembly & Testing

9 months delay

Order long lead item
Material procurement & component manufacturing.
Process development
Manufacturing Module 1
Assembly & Testing
Delay in ordering the cryocooler is the main cause of this. All remaining cryocoolers are now received by Tesla.
Tesla claims that a lot of the bought-in items / outside supply have to be re-quoted as the tender price is now lapsed. Just last week they sent in a claim of £4k for using AL 1100 for the shields. Tender uses AL1050.
Mainly caused by problems surrounding the coil machine – Tesla is putting in measures to overcome this (Mike Natkasu has been assigned to sort this out)

The Quench protection design is dragging the program behind too. Need to resolve this soon

Process Development
- Super Conductor inspection
- Coil Winding Ass Process dev.
- Testing procedure
- Commission Procedure
- Welder Qualification
Manufacturing Module 1

- Cold Mass winding
  Set up coil winder;
  Wind Coil; Coil impregnation;
  Electrical inspection;
  Weld Coil Closure Plate; Weld check

- Suspension system
  Manu.
  - Ass suspension straps
  - Attach to Cold Mass

- Cryostat Manufacturing
  Weld Outer vessel;
  Weld Turrets; Weld check;
  Full dimension check; Vacuum vessel pres. Test

This is the one to keep a close eye on. Straight forward manufacturing. No cock-up expected.

Things to watch out for:- It is not the manufacturing itself that delays things. It is what else is going on in the shop that ours may get pushed aside.
If anything, this is the activity that makes or breaks.

Previous schedule had a float on 1 month to cope for anything unexpected. Latest has this float removed.

Is this schedule realistic?
Pause for thoughts

Small change gives Tesla big opportunity to submit extension and delay claim and they took the full advantage of the situation!

They have now revised the delivery schedule to end of Oct 2010 (from April 2010). While the front end activities have been extended, the Assembly and Testing activity has been compressed. This is the wrong place to compress the schedule.

Tesla was under no pressure to produce a schedule that looks good, but impractical. We always insisted on a realistic and achievable schedule.

We need to interrogate this with Tesla – only received the latest schedule last Friday.
AFC progress

Absorber progress

Shigeru’s progress report
AFC progress
Absorber progress
  Shigeru’s progress report
Window progress
  Don’s short outline of window progress
    Machining
    Burst test
All 20 windows have been roughed out of the 6061-T6 plate;

Windows turned on lathe with a machined backing plate.

First 11 windows completed. Burst test 2 windows at 300K, 120, 122 psi

Window thickness measured at 0 and 15 degree angles using Mississippi’s own designed caliper – “the deep throat caliper”

Independent measurement also taken by LBNL-Berkeley non-contact View Precis 3000 optical CMM (results on next slide).

Plywood hats made for shipping

Coming shortly:

Do liquid nitrogen burst test.
Finish machining 9 safety windows. Burst a window at 300K.
AFC progress

Absorber progress

Shigeru’s progress report

Window progress

Short outline of window progress

Machining

Burst test

Window thickness QC check

A set of window profile data using non-contact CMM was carried out at LBL.

It covers 145 measurement points along the radial distance of the window at every 15 degree at both the concave and the convex surfaces.

These were converted to metal thickness around the window, and those at the crown were plotted out for comparison with the measurement from Mississippi using a deep throat calliper.
Non-contact CMM measurement data

Thickness variation at the crown of the window where it is most sensitive to burst pressure
Thickness requirement in the window design

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<th>C</th>
<th>D</th>
<th>E</th>
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<tr>
<td>18</td>
<td>t (mm)</td>
<td>0.180</td>
<td>0.182</td>
<td>0.186</td>
<td>0.194</td>
<td>0.205</td>
<td>0.219</td>
<td>0.237</td>
<td>0.259</td>
<td>0.285</td>
<td>0.315</td>
<td>0.350</td>
<td>0.390</td>
<td>0.436</td>
<td>0.490</td>
<td>0.551</td>
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</tr>
<tr>
<td>19</td>
<td>t (mm)</td>
<td>0.189</td>
<td>0.181</td>
<td>0.185</td>
<td>0.193</td>
<td>0.203</td>
<td>0.215</td>
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<td>0.396</td>
<td>0.436</td>
<td>0.480</td>
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</table>

Window Profile

- Concave surface
- Convex surface

Thick normal to window surfaces
**AFC progress**

Absorber progress

Shigeru’s progress report

Window progress

Short outline of window progress

- Machining
- Burst test
- Window thickness QC check

**Solid Absorber progress**

*A clamping design that is adaptable for both the AFC and the Spool piece mounting is now complete. Detail of this will be discussed in the Engineering parallel session.*
Mounting adaptor for the AFC

Mounting frame for the spool piece
Progress & Integration summary

No real hardware progress in the last 6 months! – all talks, no action!

Whose fault?

Our fault – to create opportunity for Tesla to make excuses after excuses.

Why? – because we have requested changes after contract release. That gave them good reason to re-schedule!

Could that be prevented? – Probably not. We just have to manage Integration better.

Bi-monthly phone meeting has been running to co-ordinate effort and to pre-empt any potential integration / interface problem.

Things to watch out for

– make sure they make the coil winding machine work asap.
-- Do not let the Quench protection design drag on
-- Thermal performance is the biggest threat that could delay the delivery further.