Status of Magnet procurement in EU

Kevin Smith for the F4E Magnet Team

Monaco ITER International Fusion Energy Days (MIIFED)
ITER Business Forum (IBF)
8-11 February 2016

Summary of the presentation

- TF and PF Conductor Supply
- TF Coils Overview
- PF Coils Overview and Scope of Supply
  - Building and Progress to date
  - Manufacturing Process
- PF Coils Procurement Status
- PF6 Progress in China
### the TF and PF superconductors

<table>
<thead>
<tr>
<th>Conductor type</th>
<th>Km of conductor TO BE delivered</th>
<th>Km Fabricated so far</th>
<th>Completion [%]</th>
<th>Expected completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF</td>
<td>20</td>
<td>19.5</td>
<td>98</td>
<td>February</td>
</tr>
<tr>
<td>PF</td>
<td>22</td>
<td>11</td>
<td>50</td>
<td>End 2016</td>
</tr>
</tbody>
</table>

**TF conductor:**
Diam. 43.7mm, 1400 Nb3Sn+Cu strands

**PF conductor**
1400 NbTi + Cu strands

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### the TF coils: Main steps for double pancakes production

- **Winding of the conductor**
- **Heat treatment and transfer to radial plate**
- **Wrapping of turn insulation**
- **Double Pancake Completed**
- **Vacuum Pressure Impregnation**
- **Cover plates welding**
the TF coils: status of the production

<table>
<thead>
<tr>
<th>Production of the Double Pancakes</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP Winding completed</td>
<td>40</td>
</tr>
<tr>
<td>Conductor inserted in RP after HT</td>
<td>33</td>
</tr>
<tr>
<td>DP cover plate welded</td>
<td>23</td>
</tr>
<tr>
<td>DP completed (impregnated)</td>
<td>12</td>
</tr>
</tbody>
</table>

Stacking of the 1st Winding Pack Completed!

PF Coils Overall Strategy

⇒ PF6 Manufacture: done by ASIPP, CHINA
⇒ PF2 to 5 Manufacture: 6 main contracts

1. Engineering Integrator (Ansaldo Superconducting Group)
2. Winding Tooling (SEA ALP)
3. Impregnation/Additional Tooling ELYTT/ALSYOM/SEIV
4. Site & Infrastructure (Dalkia-Veolia)
5. PF Coils Manufacturing & Cold Test (CNIM)
6. Cold Test Facility
### PF COIL TYPICAL LAYOUT

#### Site Organisation

**SIZE AND WEIGHTS OF THE DOUBLE PANCAKES**

<table>
<thead>
<tr>
<th>PF2</th>
<th>R (mm)</th>
<th>Width (mm)</th>
<th>Rmax (mm)</th>
<th>Height (mm)</th>
<th>Weight (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8310</td>
<td>582</td>
<td>8611</td>
<td>117</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>PF3</td>
<td>12208</td>
<td>686</td>
<td>12386</td>
<td>117</td>
<td>34</td>
</tr>
<tr>
<td>PF4</td>
<td>11999</td>
<td>640</td>
<td>12329</td>
<td>117</td>
<td>31</td>
</tr>
<tr>
<td>PF5</td>
<td>8416</td>
<td>615</td>
<td>8634</td>
<td>117</td>
<td>28</td>
</tr>
<tr>
<td>PF6</td>
<td>4382</td>
<td>1094</td>
<td>5174</td>
<td>121</td>
<td>29</td>
</tr>
</tbody>
</table>

**SIZE AND WEIGHTS OF FINISHED WP**

<table>
<thead>
<tr>
<th>PF2</th>
<th>R (mm)</th>
<th>Width (mm)</th>
<th>Rmax (mm)</th>
<th>Height (mm)</th>
<th>Weight (t)</th>
<th>Coils Weight (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8310</td>
<td>602</td>
<td>8611</td>
<td>737</td>
<td>125</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td>PF3</td>
<td>12208</td>
<td>777</td>
<td>12366</td>
<td>282</td>
<td>364</td>
<td></td>
</tr>
<tr>
<td>PF4</td>
<td>11999</td>
<td>660</td>
<td>12329</td>
<td>257</td>
<td>349</td>
<td></td>
</tr>
<tr>
<td>PF5</td>
<td>8416</td>
<td>834</td>
<td>8634</td>
<td>232</td>
<td>342</td>
<td></td>
</tr>
<tr>
<td>PF6</td>
<td>4382</td>
<td>1094</td>
<td>5174</td>
<td>265</td>
<td>309</td>
<td></td>
</tr>
</tbody>
</table>

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**February 2016**
PF Coils Manufacturing Process

Workflow goes from left to right:

- **Conductor spool Storage**
- **DP Preparation & Impregnation**
- **DP Stacking & WP Insulation**
- **Winding & Insulation**
- **Storage area**
- **Clean Areas (ISO Class 9)**
- **WP Impregnation**
- **PF Coils Manufacturing Process**
- **Cold Test**
- **PF Coil working stations**

**FEBRUARY 2016**

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**POLOIDAL FIELD COILS PF2-6 PROCUREMENT**

<table>
<thead>
<tr>
<th>Contracts</th>
<th>Call for tender Publication</th>
<th>Expected Contract signature</th>
<th>Duration</th>
<th>Procurement procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Integrator</td>
<td>Jan-2013</td>
<td>Aug-2013</td>
<td>6 years</td>
<td>Negotiated – Contract signed</td>
</tr>
<tr>
<td>Winding Tools</td>
<td>Jul-2013</td>
<td>Apr-2014</td>
<td>3 years</td>
<td>Negotiated – Contract signed</td>
</tr>
<tr>
<td>Site &amp; Infrastructure</td>
<td>May-2014</td>
<td>Nov-2014</td>
<td>5.5 years</td>
<td>Open – Contract signed</td>
</tr>
<tr>
<td>Impregnation and Additional Tools</td>
<td>September-2014</td>
<td>July-2015</td>
<td>5 years</td>
<td>Open – Contract signed</td>
</tr>
<tr>
<td>Cold Test facility</td>
<td>March-2015</td>
<td>February - 2016</td>
<td>1.5 years</td>
<td>Restricted: Evaluation Completed</td>
</tr>
<tr>
<td>PF6 - ASIPP</td>
<td></td>
<td>Oct-2013</td>
<td>3 years</td>
<td>Co-operation Agreement signed</td>
</tr>
</tbody>
</table>

**FEBRUARY 2016**
DOUBLE PANCAKE WINDING TOOL
SUPPLIER SEAALP - CONSORTIUM

To finish in February 2016

DOUBLE PANCAKE IMPREGNATION AREAS
SUPPLIER ALSYOM/ELYTT/SEIV

To finish in June 2016

All dimensions have been taken between components centerlines
**WINDING PACK ASSEMBLY AND IMPREGNATION AREA**

Supplier: ALSYOM/ELYTT/SEIV

To finish in November 2016

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**COLD TEST and FINAL ASSEMBLY AREA**

Suppliers: ALSYOM/ELYTT/SEIV

?? Order to be placed in February 2016

To finish in September 2017

ALSYOM/ELYTT/SEIV – Subcontract ALE

To finish in July 2017
Poloidal Field Coils PF 6 Progress

Vacuum Test Facility in ASIPP

Winding Tooling for PF6 in ASIPP, China

Further Information:

https://industryportal.f4e.europa.eu/IP_PAGES/ehome.aspx

Contact e-mail:

tenders-operational-MS-MG@f4e.europa.eu

Market Intelligence Contact:

Benjamin.Perier@f4e.europa.eu