POPS-B: Project update and Feedback from POPS Experience

LIU-PSB Meeting 175  07 June 2016

Fulvio Boattini TE/EPC
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POPS-B project power converters

POPS-B main power converters
POPS-B project power converters

POPS-B main power converters

POPS-B quadrupole converters

POPS-B MPC 1&4

Magnet string 1&4

2 BHZ coils ring 1&4

R = 11.4mΩ
L = 3mH

128 QFO coils rings 1,2,3,4

BR QFO

N1&4

2 Ref Magnet coils rings 1&4

POPS-B MPC 2&3

Magnet string 2&3

2 BHZ Extraction coils ring 1 & 4

R = 60mΩ
L = 2.08mH

BR QDE

N2&3

64 QDE coils ring 1,2,3,4

P1&4

R = 11.4mΩ
L = 3mH

R = 60mΩ
L = 2.08mH

P2&3

R = 60mΩ
L = 2.08mH

2 BHZ Injection coils ring 1 & 4

R = 60mΩ
L = 2.08mH

2 BHZ Extraction coils ring 2 & 3

R = 60mΩ
L = 2.08mH

R = 60mΩ
L = 2.08mH

2 BHZ Extraction coils ring 2 & 3

INJ_TRIM1&4

EXT_TRIM1&4

INJ_TRIM2&3

EXT_TRIM2&3

N1&4
POPS-B project power converters

- POPS-B main power converters
- POPS-B quadrupole converters
- POPS-B Injector Trims converters
POPS-B project Status: B245 civil engineer

B245 construction is completed
POPS-B project Status: B245 civil engineering

Converter hall
False floor
False floor
Loading platform
Capacitors room
EN/EL Room
EN/CV Room
Ref magnet Room

and now installation starts
POPS-B project Status: equipment integration

- Cooling towers
- Air Conditioning
- Power transformers
- Config Switches
- Main PCs
- Storage caps
- Quads
- Trims
- Ref magnet
- Cable ladders & pipes
- Magnetics
POPS-B project Status: POs

POPS-B purchase orders until EYETS:

**Main Power Converters (6 MCHF):**
- Done April 2016

**Power cables (200 kCHF):**
- Planned for next week

**Injector Comet (210 kCHF):**
- Ongoing (126 kCHF so far)

**Cooling & Ventilation system:**
- Planned October 2016

**QTR Dummy load and MPS spare (160 kCHF):**
- Planned September 2016

**Storage Capacitors (2 MCHF):**
- Planned January 2017

**Main Power Transformers (200 kCHF):**
- Planned March 2017
### POPS-B project Status: activities until EYETS

<table>
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<tr>
<th>Month</th>
<th>2016</th>
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<tr>
<td>June</td>
<td>B245 lightning &amp; 1st part of cable ladders</td>
<td>MPC kick-off</td>
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<td>July</td>
<td>False floor &amp; 2nd part of cable ladders</td>
<td>Aux power cabinets installation</td>
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<td>August</td>
<td>Configuration switches installation</td>
<td>Power cabling (B245 to B271)</td>
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<td>September</td>
<td>Cable ladders for dummy load (b367)</td>
<td>FC storage capacitors</td>
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<td>October</td>
<td>FC CV Plant</td>
<td>PO power transformers</td>
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<td>November</td>
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<td>February</td>
<td>PO power transformers</td>
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<tr>
<td>March</td>
<td>PO power transformers</td>
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POPS experience feedback on POPS-B

Recall

First fault on power converter side:
Lesson learned: failure on one leg propagates to all DCDC converter

Second fault on power converter side:
Lesson learned: need to test repaired stacks before restarting.

Fault on storage capacitors:
Lesson learned: capacitors can fail and release lots of energy
POPS experience feedback on POPS-B

POPS experience feedbacks:

Reduce the fault energy in case of capacitor short circuit

Improve design of capacitors with ageing tests

Improve design of capacitor room following explosion analysis

Study alternative protections in the power converter

Build an off-line testing platform
POPS experience feedback on POPS-B

POPS experience feedbacks:

Reduce the fault energy in case of capacitor short circuit

Implementation ongoing for POPS
POPS experience feedback on POPS-B

POPS experience feedbacks:

- Improve design of capacitors with ageing tests

Ageing + discharge tests shall be completed by October 2016
POPS experience feedbacks:

Improve design of capacitor room following explosion analysis

Pressure wave calculation

PO for consultancy to be released in the next days (60kCHF)

Effects on the structure

Possible remedies (POPS)
POPS experience feedback on POPS-B

POPS experience feedbacks:

- Study alternative protections in the power converter
- Build an off-line testing platform
- Check repair before restarting

Design ongoing

Fast DC circuit breaker

Diode freewheel
POPS-B planning update

Late modification of the B245 BC 76805

Additional 4 months to build Main PCs

Main PCs installation and commissioning shrinks
Thank you for your attention
Questions?