UK Proposal for 4 x DQW CM for HiLumi

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CERN 18th October 2018
1. Proposal for 4 x DQW Cryomodules
2. Current Status
3. Issues/ Concerns
4. Discussions
RFD Pre-series Cryomodule to be assembled at DL in 2020. Area for cryostating, lifters, trolleys, tooling and clean rooms are currently being prepared.

In HL-LHC-UK2 we propose to build the double quarter wave cryomodules for HL-LHC at Daresbury.

In addition, we propose to provide support to CERN on cavity production, cavity testing, and the SPS tests of the RFD pre-series.
The UK is about to enter a Spending Review in 2019. The current assumption is approximately flat funding, but other uncertainties may dominate.

Main UK interests for high energy physics are:

- Specific grants for HL-LHC and AWAKE
- Future colliders (ILC, CLIC, laser plasma wakefield etc.) via institute grants to the accelerator institutes (CI, JAI) and ASTeC.

For HL-LHC, the Sol went to our Accelerator Strategy Board that recommended inviting a full proposal to our peer review process. Current grant runs formally to March 2020.
Collaborators

1. STFC Daresbury Laboratory
2. University of Lancaster
3. CERN
4. US-AUP
5. We welcome TRIUMF to the collaboration

The UK CC team
UK CC team has been a key player in the development of Cryomodule for the last 7 years

Has been working with CERN as a single integrated team

Sharing of the efforts (and budgets) in design and procurements between CERN and UK have been well drafted for the RFD-CM

Some tooling and facilities are being modified to suit available infrastructure at Daresbury

We intend to continue with the same approach in future for the new proposal.
HL-LHC Crab Cavities Global Schedule

Long Term Vision – to build and supply series cryomodule for HL-LHC

This Proposal

Support SPS-CM

STFC ongoing project

Courtesy: M. Garlaschè

Shrikant Pattalwar, HL-LHC 8th Annual Meeting, 16-18 Oct 2018, CERN
Project Organisation (Existing project)

- **RF Engineer (ULAN)**
  - Mach. Design Engineer
  - Mach. Engineer Nickan Templeton
  - Mech/Vac. Assembly Technician
  - Mech/Vac. Assembly Technician
  - Mech/Vac. Assembly Technician
  - Survey Technician

- **STFC Technical Team**

- **WP1 Leader**
- **WP3 Leader**
- **WP4 Leader**
- **Rob Appleby Programme Sponsor**
  - Gramme-Burt Programme Manager
  - HL-LHC UK

- **Lucio Rossi**
  - CERN HL-LHC Project Leader

- **Roma Calapa**
  - CERN Crab Cavity Project Leader

- **Shrikant Pattalwar**
  - Task 2.2 Project Manager
  - Task 2.2 Technical Team Leader

- **Ofelia Capatina**
  - CERN Crab Cavity Project Manager/Technical Lead

Communication link

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Scope of Work

To design, procure and assemble 4 (DQW) Crab-Cavity-Cryomodules

Included

- Review the design of pre-series and undertake any design modifications
- The procurement from industry of the required components to produce 4 cryomodules. The design and procurement efforts and costs will be shared with collaborators based on the funding allocations to respective organisations.
- Assembly of cavity/coupler strings and associated ancillaries in ISO-4 clean room
- Assembly of the cryomodules (cryostating)
- Undertake vacuum leak tests after thermal cycling with liquid nitrogen
- Design and fabrication of the transport frame
- Organise shipment of Cryomodules to CERN
- QA management for all the above
This Proposal - The Scope of Work

Excluded

- Design and procurement of cavities, tuners, couplers and beam pipe components (will be supplied by CERN)
- Conducting Cryogenics performance tests at 4K and 2K
- Conducting RF performance tests at 4K and 2K
- The conditioning and testing of the RF input couplers (It is assumed that the conditioning and testing of the RF input couplers will be performed at and by CERN)
- Any-reprocessing of the cavities in case the cavities or beam pipes get contaminated at any stage between arrival and shipment.

Facilities

The project will utilise the infrastructure developed for the RFD-prototype cryomodule located within ETC at Daresbury Laboratory.

- Modify, Procure and maintain the tools required to perform assembly in clean room
- Modify, Procure and maintain the tools required to perform cryostat assembly
- Modify, Procure and maintain the tools and equipment required for leak checks and thermal cycling (acceptance tests)
- Modify, Procure and maintain the tools required to comply with the relevant safety regulations
**This Proposal - The Scope of Work**

### Assumptions

- STFC will share the efforts for design with CERN and University of Lancaster.
- Procurement responsibility will also be shared with the collaborators depending upon respective funding allocations.
- The series cryomodule will be a modified version of the prototype cryomodule and will require minimal efforts for modifications if required..
- The project will utilise the infrastructure developed for the RFD-prototype cryomodule. Only the cost of annual inspection, certification and maintenance is included in the estimates.
- All required cavity/cryomodule drawings and CAD will be delivered by CERN to STFC upon project initiation.
- Assembly procedures for the cryomodule will be shared by CERN at timescales appropriate for the STFC project delivery.
- Drawings and/or CAD models for cryomodule assembly tooling will be made available to STFC by CERN at timescales appropriate for the STFC project delivery.
- Periodical review/progress meetings will be held with the collaborators.
- STFC staff will participate in the construction of CM1 at CERN as a part of training and support.
- CERN staff will provide guidance and supervision during some of the key stages of the assembly steps.
HL-LHC Global Plan

Ongoing project

CM1 built at CERN

Proposed project

Cold Tests to be conducted at CERN

Colour Codes

Clean Room Assembly
Cryostat Assembly
Acceptance tests
Cold tests at CERN

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Some Concerns / Issues 1, 2

1. Only 5 months for completing the assembly of the first RFD prototype
2. Acceptance Criteria yet to be defined and agreed.

Can we move the delivery from Dec 2020 to end of March 2021?
Some Concerns / Issues (3)

Several activities in parallel
- Assembly of RFD prototype at DL
- Assembly of DQW series CM1 at CERN
- Facility upgrade at DL

Clean Room Assembly | Cryostat Assembly | Acceptance tests | Cold tests at CERN
Some Concerns / Issues (4)

4. Transportation from DL (*TRIUMF*) to CERN
Summary

• The UK team has been playing a key role in HL-LHC since 7 years.

• The UK-CERN collaboration has been working successfully as a single integrated team and we intend to work with the same approach in future.

• SOI for the proposal to assemble 4x DQW-CM at DL has been submitted to STFC/ CERN. Detail submission will be made in Q1 2019.

• In the mean time, some of the concerns/ issues need to be addressed.

• We welcome Bob and his team from TRIUMF to the collaboration.

Thank you