



Status of DFX Design

A. Ballarino for the WP6a

TCC Meeting, 18/12/2018

Design work: Y. Yang and R. Bailey (Univ. of Southampton)

Contributions from the WP6a DFX Working Team:

Y. Yang (Coordinator), A. Ballarino, R. Bailey, R. Betemps, S. Claudet, I. Falorio, J. Fleiter, Y. Leclercq, V. Parma, A. Perin, D. Perini

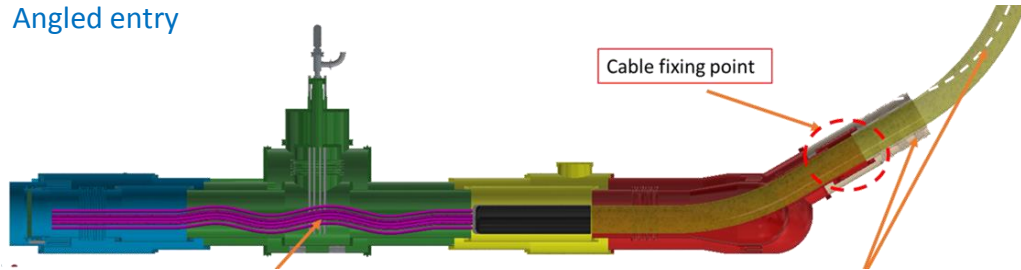
Introduction

- Work carried out in the framework of the **UK HL-LHC Collaboration Agreement** (design and assembly of one prototype DFX cryostat)
- **Design evolving** from July 2019 till December 2019
- As from November 2019, **Weekly Meetings** – Friday afternoon
Presentations available at:
<https://indico.cern.ch/category/10765/>
- **Conceptual design well advanced**
- **Conceptual Design Review** in January 2019 (31st January)
- Aiming at **Detailed Design Review** by end of March 2019

Design evolution

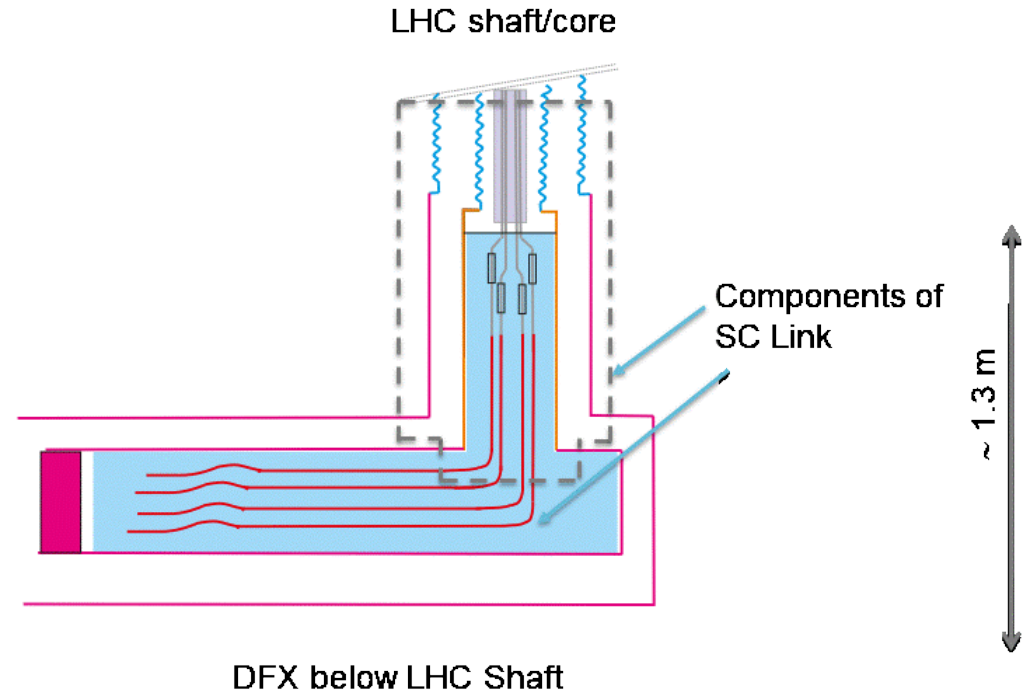
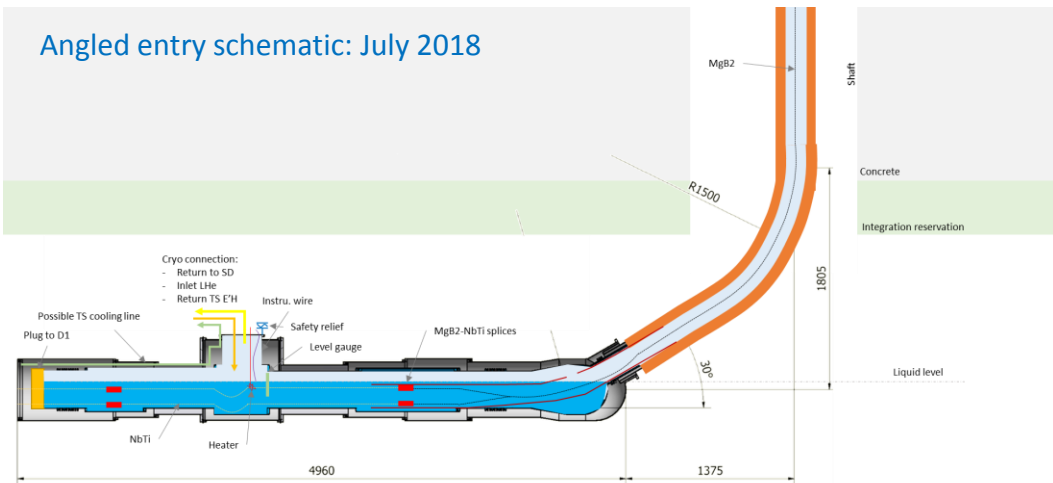
The SC Link will incorporate at the cold end an *ad-hoc* designed **termination**

Angled entry



SOTON presentation July 2018, DFX review meeting, Y. Yang and W.Bailey

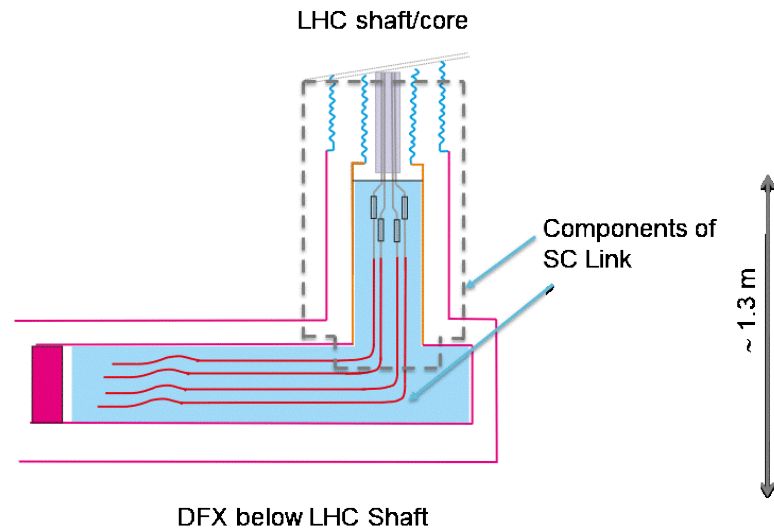
Angled entry schematic: July 2018



A. Ballarino, July 2018

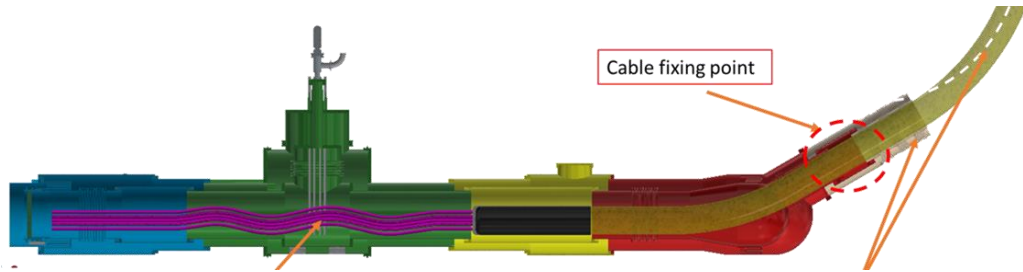
Design evolution

- The **MgB₂ cable assembly is fully protected** in the rigid pipe and not handled during integration in the tunnel. **The same applies to the MgB₂ to Nb-Ti splices;**
- **No need to bend the MgB₂ cable assembly;**
- **Only Nb-Ti cables are routed and bent inside the DFX** (with generous space for routing and splicing);
- The **configuration is suitable for pre-testing the SC Links before integration in the tunnel:** longer Nb-Ti cables will be connected to the MgB₂ cables. The terminations of the Nb-Ti cables will be used for the electrical connections required for the tests (and then cut before installation in the tunnel);
- Some **extra length of SC Link will be provided.** This will be located in the tunnel at the top of the shaft, and it will enable compensating requirements driven by civil engineering.



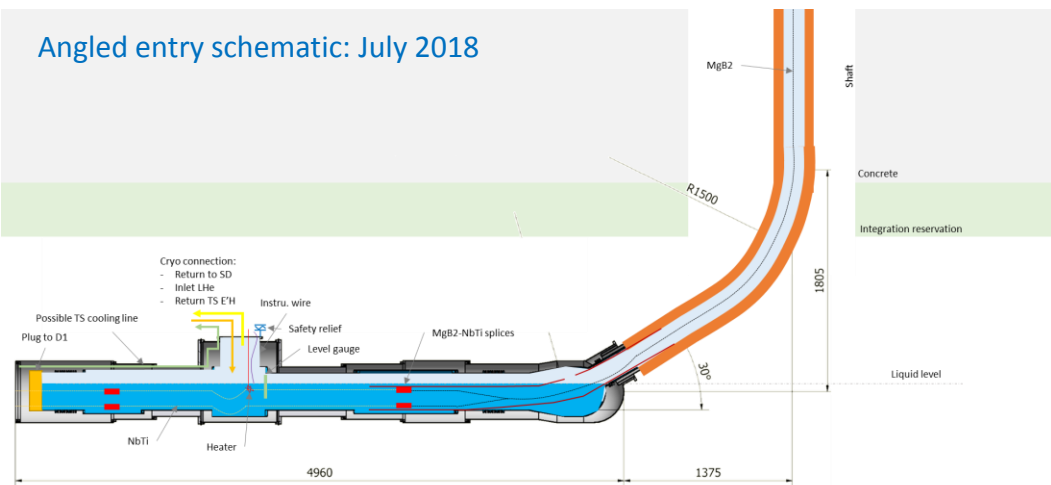
Space below the shaft appears to be sufficient

Design evolution

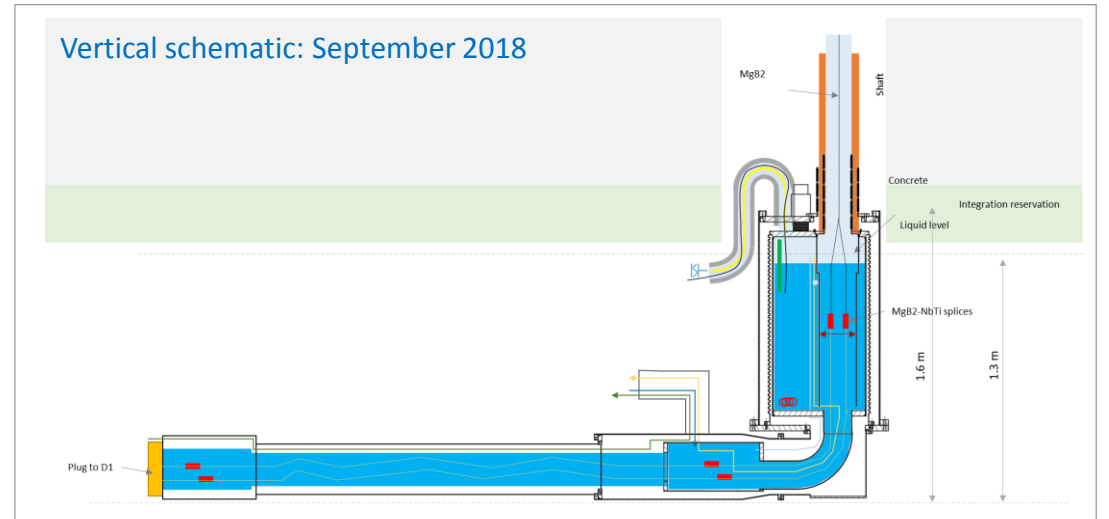


SOTON presentation July 2018, DFX review meeting, Y. Yang and W.Bailey

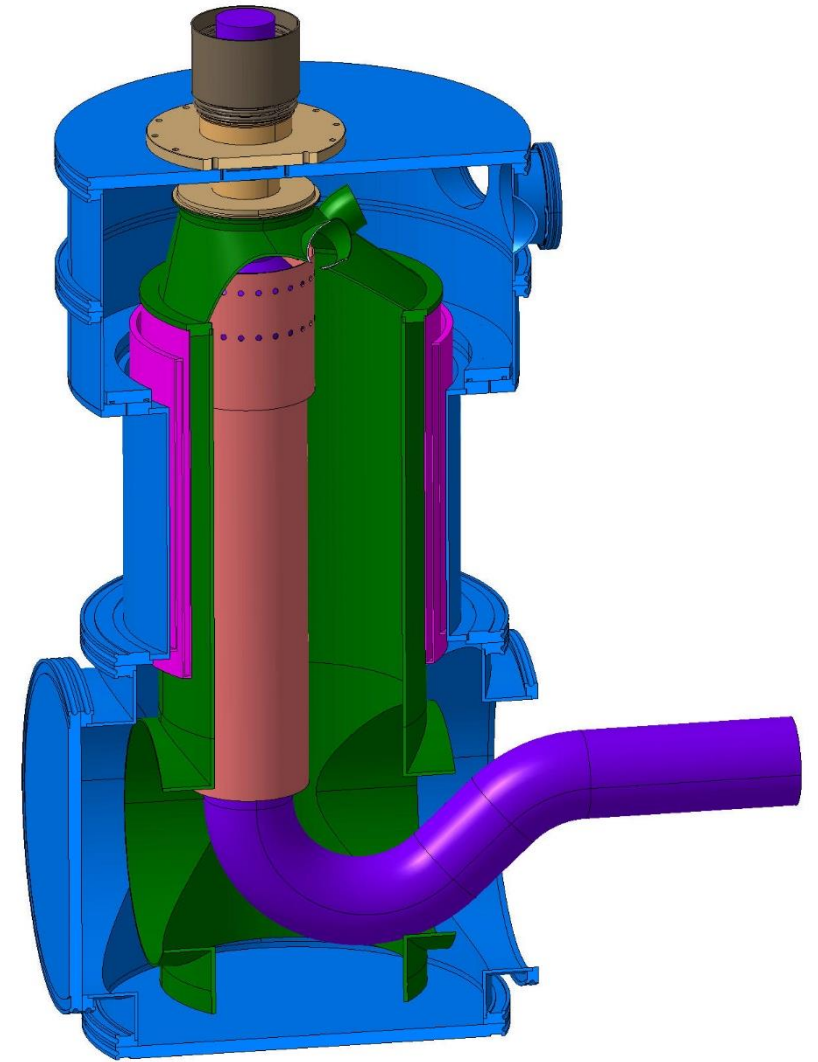
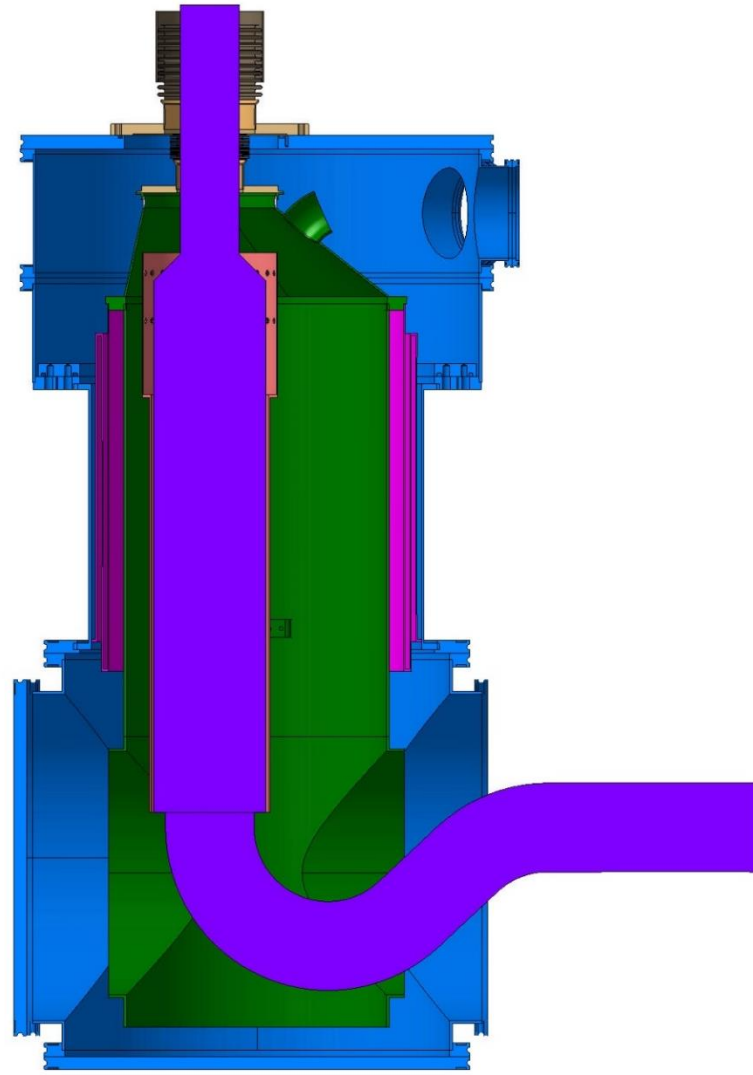
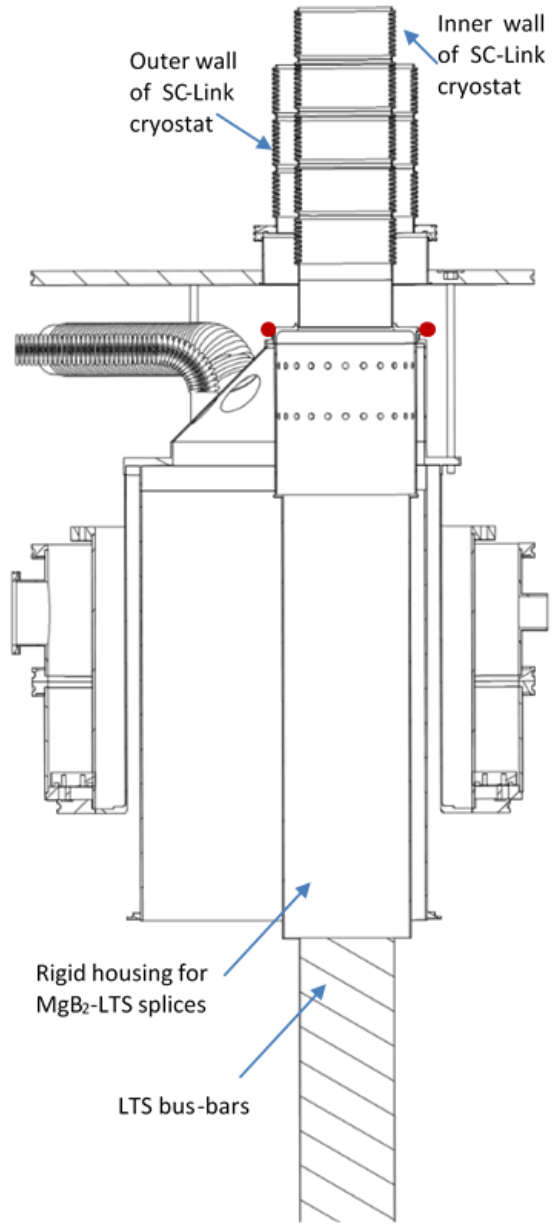
Angled entry schematic: July 2018



Vertical schematic: September 2018



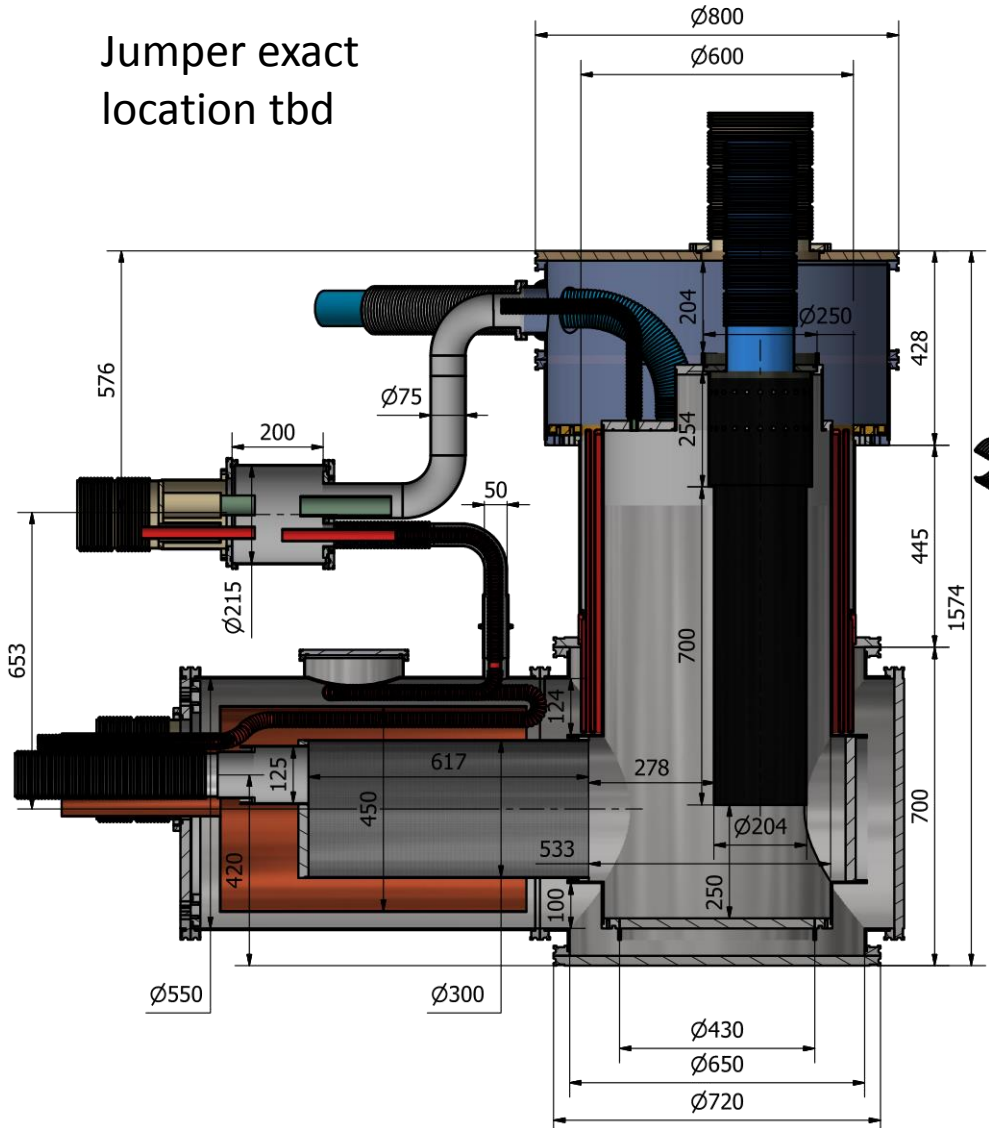
Present design



Y. Yang

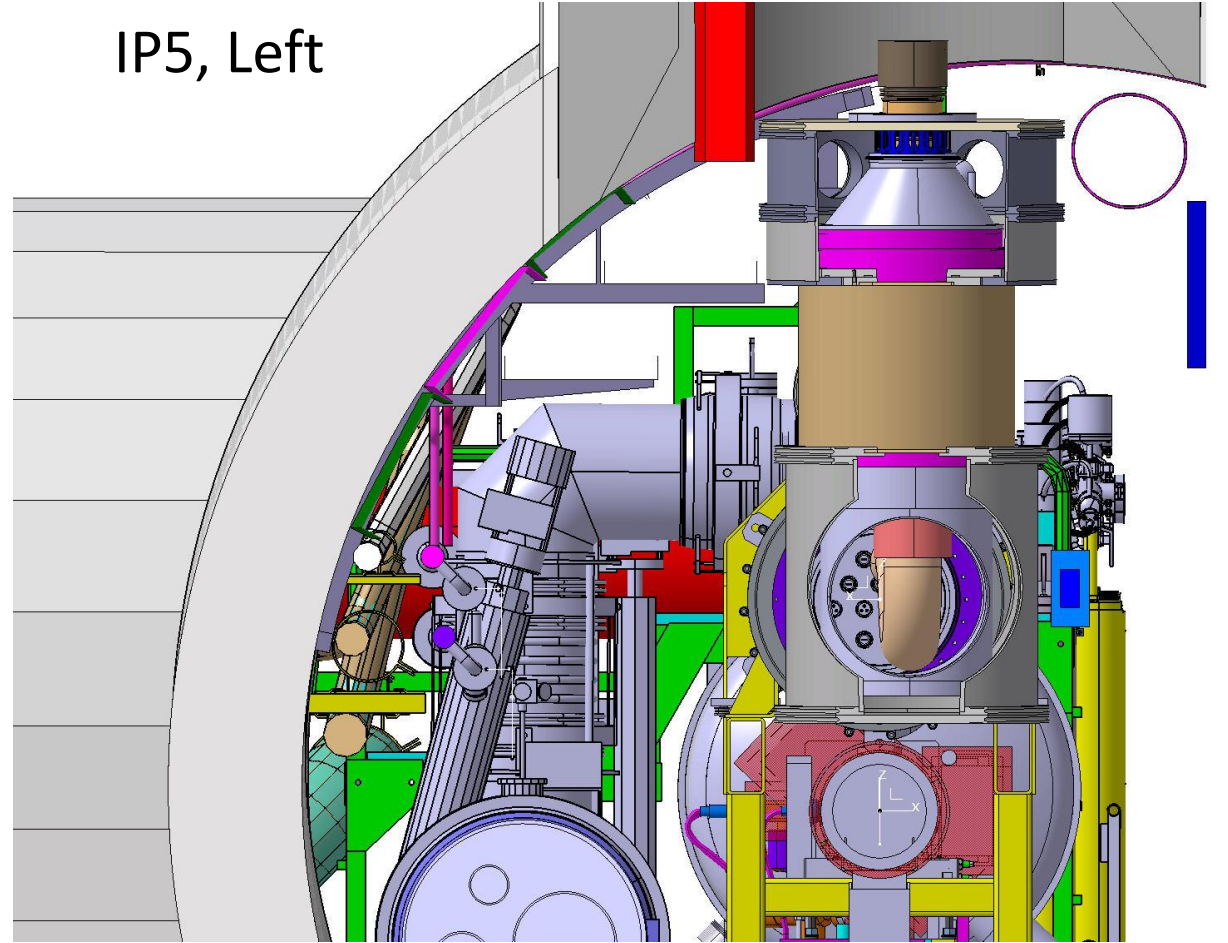
Present design

Jumper exact location tbd



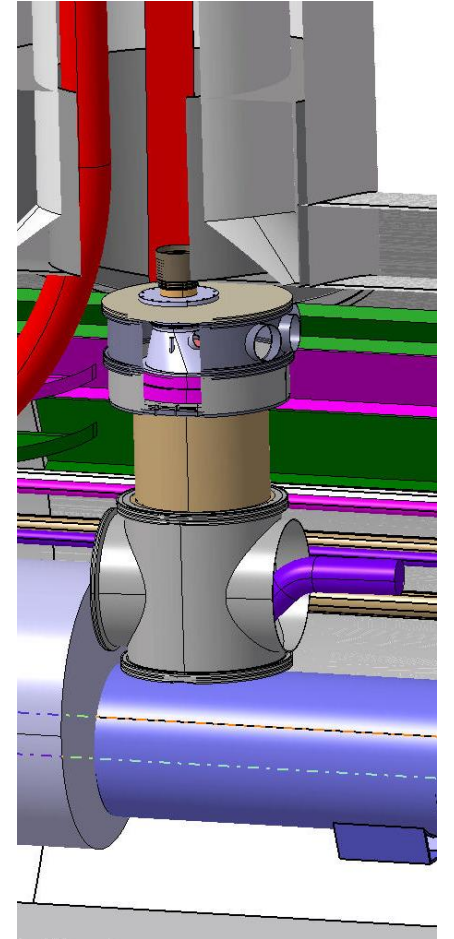
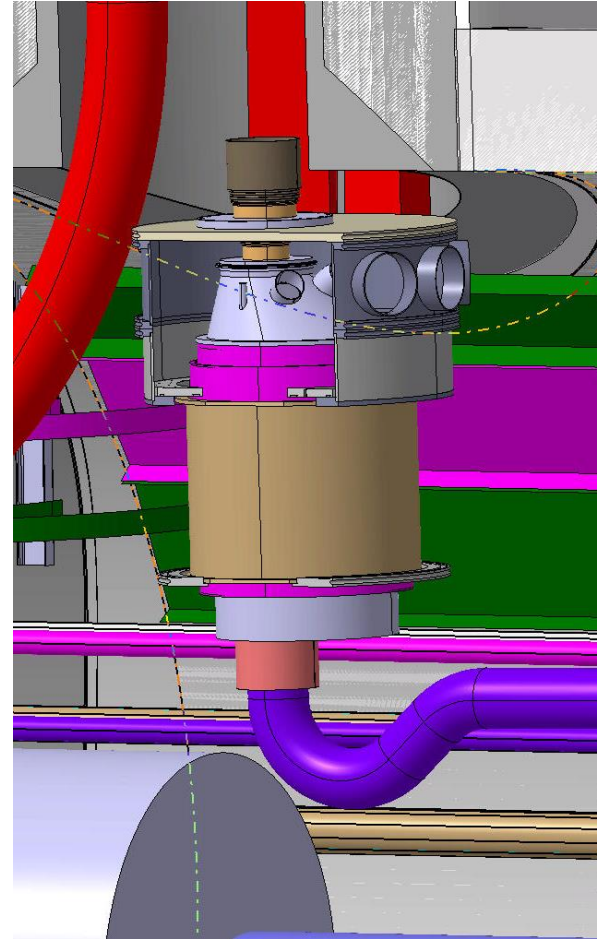
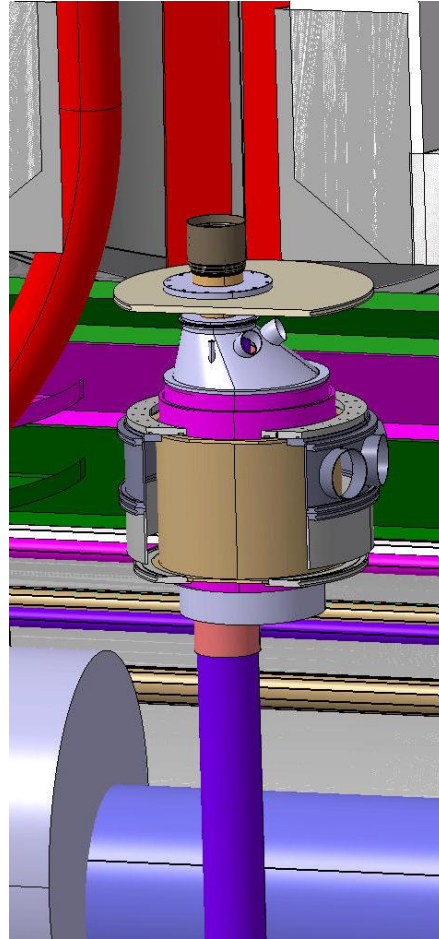
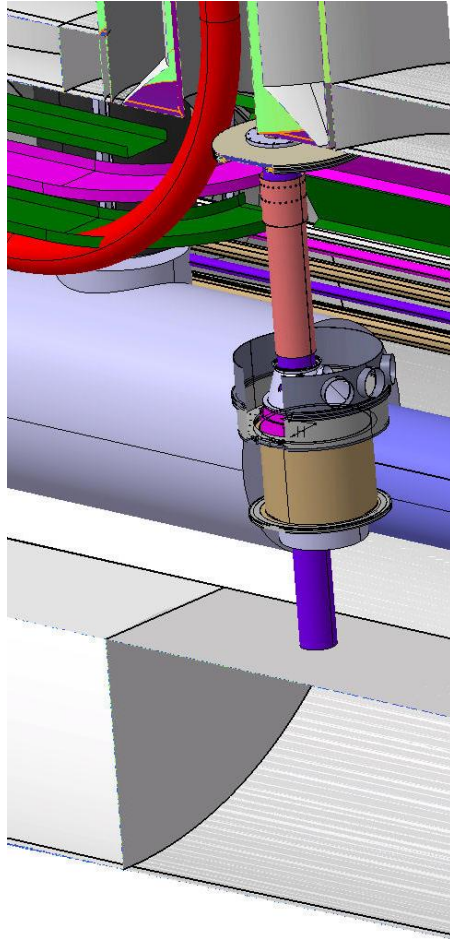
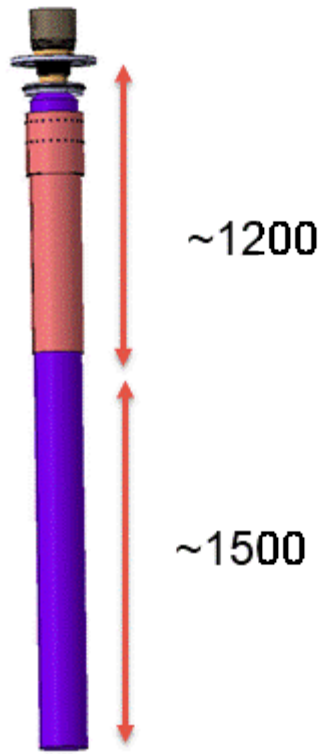
Y. Yang

IP5, Left



R. Betemps, WP6a Integration Meeting, 11/12/2018

Integration at IP5 Left



ASSEMBLY IN LHC TUNNEL

HL-LHC DISTRIBUTION FEEDBOX (DFX) PROTOTYPE/SPARE

Abstract

This document describes the conceptual steps for assembling the DFX in the LHC tunnel and integration with the interfaces.

TRACEABILITY

Prepared by: Y. Yang, W Bailey and R Betemps

Date: 2018-12-10

Verified by: V. Parma, Y. Leclercq, ***

Date: 2018-**-**

Approved by: A. Ballarino [WP6a Leader], ***

Date: 2018-**-**

Distribution:

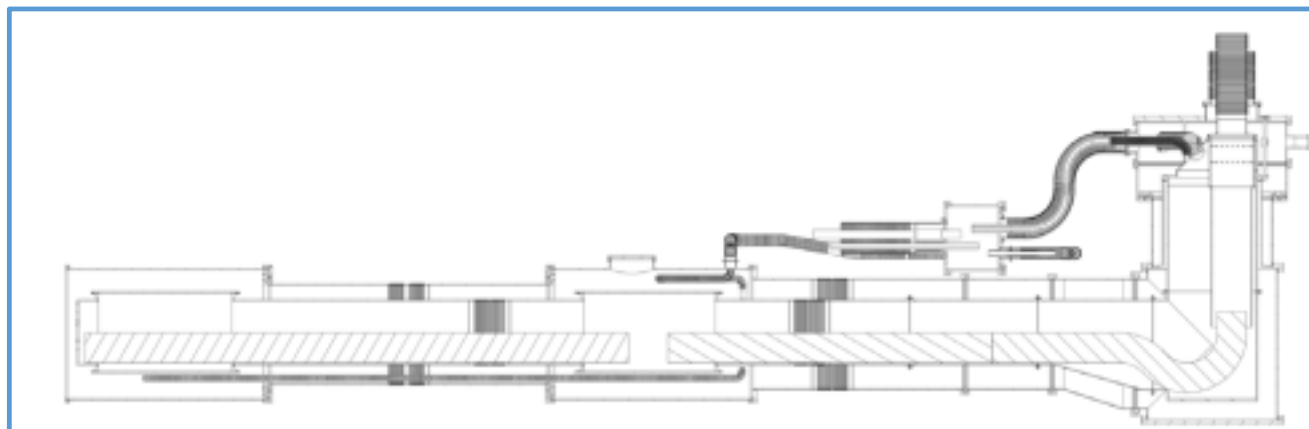
Rev. No.	Date	Description of Changes (major changes only, minor changes in EDMS)
X.0	2018-12-10	First version

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1 INTRODUCTION

A prototype low temperature distribution feedbox (DFX) cryomodule, to be designed and built by University of Southampton, is a hardware deliverable to CERN as a part of the HL-LHC-UK project jointly funded by STFC and CERN. The prototype will be used for the cold powering system test and eventually serves as a spare for the series. This document elaborates at a conceptual level the procedures of DFX installation and integration in the LHC tunnel.



Some recent studies

- Increased **volume of LHe** to assure proper control of LHe level
- Integrated **positive slope** in the LHe horizontal cold mass
- Verified **space constraints for *in-situ* welding** (and ***in-situ* cutting**)
- Verified/discussed **interfaces with cryo-system**
- Proposed **Heat Exchanger with He gas** (in addition to electrical heater)
- Defined **baseline for vacuum barriers**
- Discussed and implemented length for **MgB₂ to Nb-Ti splices** (700 mm), length for **control of LHe level** (250 mm), length for **bending Nb-Ti cables** (250 mm)
- Working on **detailed integration procedure** – in the tunnel – as well as **transport requirements**
- Defined **instrumentation requirements and routing** – document in preparation

To be defined

- Interface with λ - plate (CERN supply)
- Exact location of λ -plate (and possibility of moving it toward the shaft – for reducing the length of the Nb-Ti cables)

Ready for conceptual design review by end of January 2019