

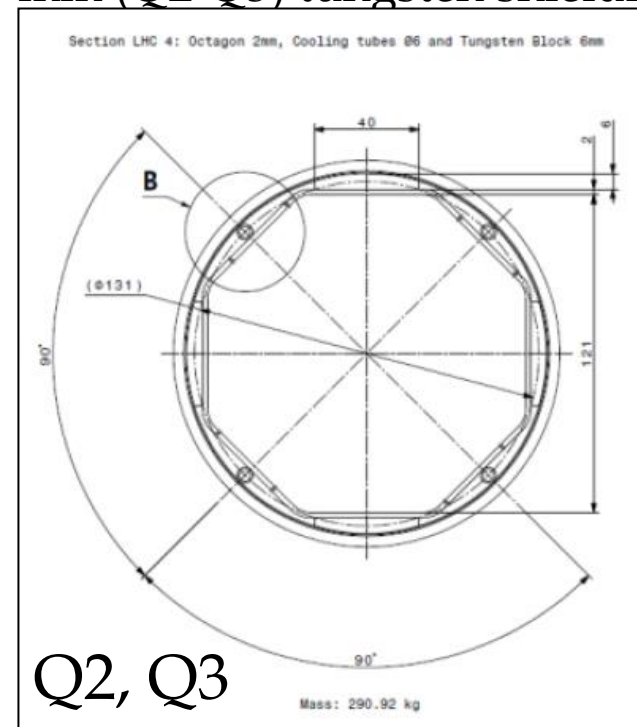
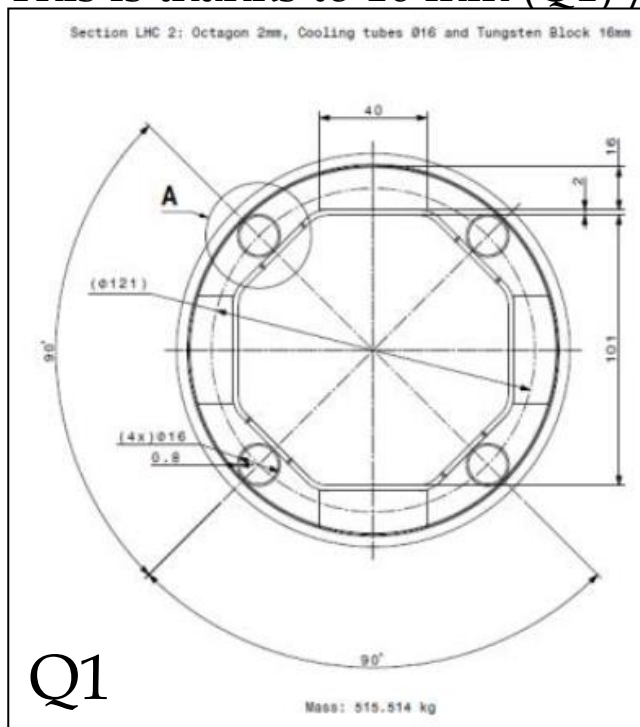


CRITICAL ISSUES AND DESIDERATA FOR BEAM SCREEN IN THE HL LHC

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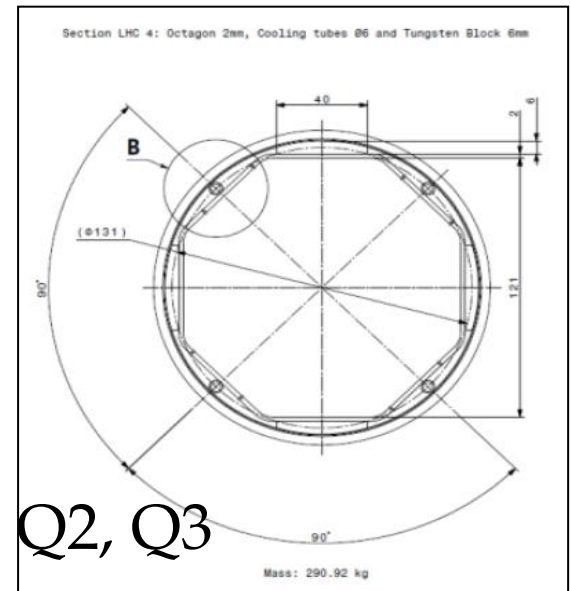
Acknowledgements:
V. Baglin, P. Ferracin, R. Kersevan, R. Van Weelderen

- Beam screen is one of the key elements of the HL LHC design
 - It allows reducing the heat loads and the radiation damage to the same level of the LHC ($\sim 4 \text{ mW/cm}^2$, $\sim 40 \text{ MGy}$) [L. Esposito, F. Cerutti, E. Todesco, PAC 2013 <http://cds.cern.ch/record/1636133/files/CERN-ACC-2013-0283.pdf>]
 - This is thanks to 16 mm (Q1) / 6 mm (Q2-Q3) tungsten shielding



- First issue: cooling
 - The heat load is of the order of 700 W – to remove heat we need thick «capillary» tubes
 - Design, dimensions, to be finalized – do we have enough space for the tube in the Q2-Q3? How is the topology ?
 - Temperature of the beam screen to be defined, compatible with vacuum

- A baseline should be defined asap in collaboration with cooling colleagues
 - Tentative deadline: April



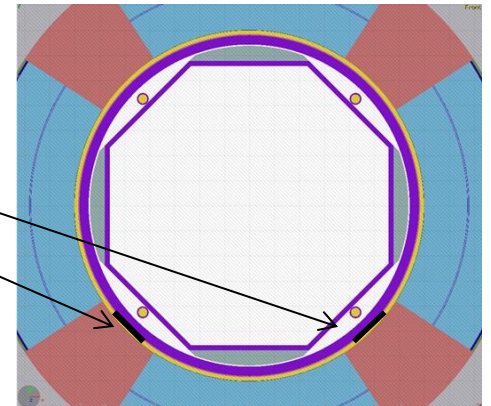


BEAM SCREEN ASSEMBLY

- Second issue: beam screen assembly
 - How to fix the tungsten shielding on the the copper beam screen
How to fix the capillaries
 - How to center the beam screen in the cold bore
 - Check compatibility with inner coating necessary to kill electron cloud
 - Check magnetic properties – this object is very close and can strongly perturb the magnetic field of the triplet

- A baseline should be defined asap
 - Tentative deadline: June

- Third issue: beam screen assembly in the magnet
 - The weight of the beam screen is considerable (~ 40 kg/m in Q1)
 - First brainstorming done on 28 January 2014 WP3 meeting [P. Ferracin, M. Juchno, R. Kersevan]
(<https://espace.cern.ch/HiLumi/WP3/SitePages/Minutes%20and%20Presentations.aspx>)
 - Magnet assembled without cold bore
 - Beam screen inserted in the cold bore
 - Cold bore and beam screen inserted in the magnet
 - Sliding on supports placed on coil poles
- A prototype should be launched soon
 - Tentative deadline
 - June 2014 end of drawings
 - End 2014 manufactured piece, 8-m-long
 - Beginning 2015 assembly





BEAM SCREEN ASSEMBLY IN THE MAGNET

- Fourth issue: tolerance analysis
 - Aperture is precious and costs money and performance
 - Estimate of fabrication and assembly tolerances
 - How to reduce them? Work is ongoing [\[see talk by C. Garion\]](#)
- Tentative deadline:
 - First estimates already available
 - In parallel with prototyping, reliable final estimates by the end of the year



CONCLUSIONS

- There are several critical issues in the design of the beam screen, and its compatibility with triplet assembly, cooling, ...
 - Conceptual design still to be finalized
 - We should have it completed very soon (by mid 2014)
 - Prototype should be launched soon after ending conceptual design
 - Assembly test and check of tolerances

- This is an essential part of HL LHC



STATUS AND PLAN FROM R. KERSEVAN, JANUARY 2014

Engineering

1. - Modify BS design with 6mm W shielding (Q2->D1), to accommodate bigger capillaries
TBD
2. - Repeat magnetic/mechanical stress calculations with new BS profiles **TBD**
3. - Visit/discussion with Plansee (25 Nov 2013) **DONE**
 - Define brazing parameters of W shielding on BS (same, plus CERN advice) **UNDER STUDY**
 - Prototype brazing and validate (LN₂ thermal shock, heat conduction tests,...) **TBD**
 - Launch 1m-long prototype of low-toleranced ID cold-bore (CB) with 304L SS BS, to study manufacturing issues **STARTED, but resources at MME are SCARCE**
4. Launch 8m-long prototype with high-precision CB, and real P506 BS **Same as previous**
5. Procure P506 BS material of proper thickness (co-laminated Cu and SS, Böhler)
6. Cold-test 8m-long prototype?...
7. - Measure magnetic permeability at low-temperature
8. - Develop BS insertion tool and installation sequence for BS and CB (H vs V)
9. - Develop design of BS for magnets D1 and beyond
10. Collaborate with BI group on development of shielded BPMs (**waiting for input from R. Jones' trapped-modes simulations**)
11. Develop installation sequence of shielded BS inside cold-bore tube: vertical insertion?



STATUS AND PLAN FROM R. KERSEVAN, JANUARY 2014

Vacuum R&D

1. Coldex experiment at SPS (desorption/e-cloud at low temperatures)
STARTED
2. Study of equilibrium isotherms for relevant gases (**TBD, PhD/Fellow to be recruited**)
3. *Development of amorphous-C coating configuration (hollow cathode x4?)* (**under study**)
4. Material characterization
5. Integration of electrode for suppression of e-cloud (**collaboration with ASTeC Daresbury initiated**)
6. Finalize vacuum layout (including other, non-triplet, areas)
7. Write/detail Work Package **TBD**

... the logical consequence is that more resources are needed, and will be identified and allocated within the VSC group.