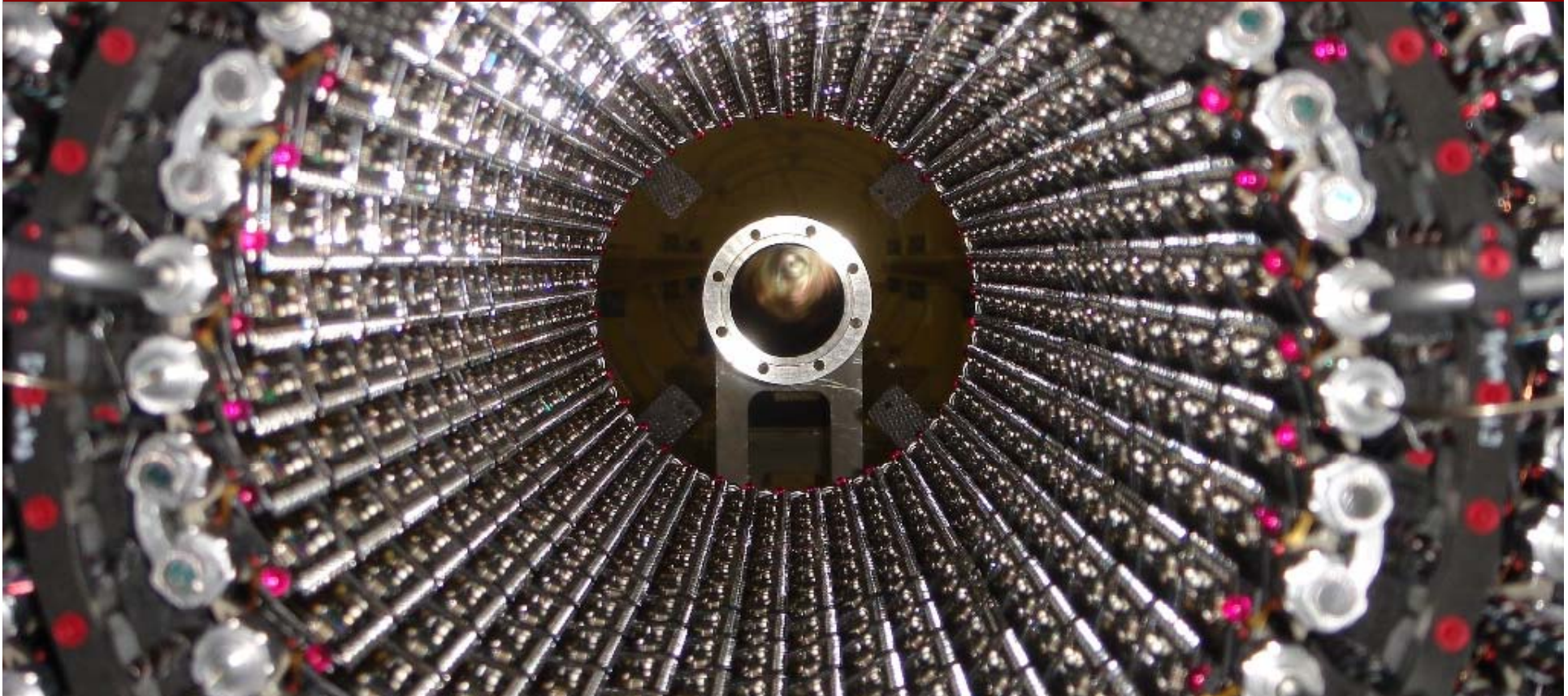


Upgrade Strategy for the Experimental Vacuum Systems



Ray Veness / CERN-AT-VAC

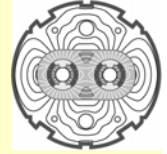
With thanks to R.Assmann, O.Bruning, R.Ostojic, E.Tsesmelis

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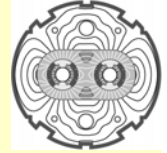
Beampipe Upgrade Strategy -
R.Veness



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Introduction

0 Background

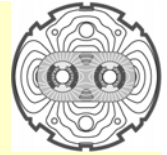
- 0 Baseline LHC experimental beampipe project started in 1993
- 0 Last system commissioned in Sept. '08

0 Why do we need this talk?

- 0 Designs 'frozen' 2000-2003, but with plans for consolidation
 - 0 Some requests for work from the experiments were not possible due to manpower limitations
 - 0 Some technology was shown to be unreliable without further development, and downgraded for later installation
- 0 Machine and experimental upgrade plans advancing quickly
 - 0 Need a definition of the central beampipe radius for ATLAS and CMS PIXELS
 - 0 Impact of phase- I triplet upgrade on ATLAS and CMS needs to be analysed
- 0 Missing some mandates to continue
 - 0 Baseline project is now complete and in 'operation-shutdown' mode
 - 0 Financial basis of upgrades needs renewing
 - 0 Technical scope, priorities and responsibility need updating



Organisation for the Baseline Systems



O Structure

- O 'LHC Experimental Beampipes' working group, active 1993-2004 reporting to LEMIC and then LHC Technical Committee reviewed from conceptual design to construction
- O Design reviews and TDRs with experiments and machines closed the final designs

O Scope

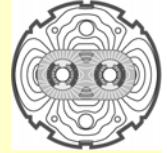
- O Layouts and designs of chambers, supports and interfaces inside 4 LHC caverns, plus TOTEM Roman Pots
- O Chamber geometries, machine and experimental physics requirements (aperture, impedance, RF, vacuum, background), follow-up of R&D

O Resources

- O All installed hardware funded by relevant experiment
- O R&D, design, assembly, test, installation and management funded from a 'work package' given to AT-VAC in 2001
- O Staff assigned to project by AT-VAC and other groups, design office and additional industrial support paid from AT work package



Current Work Programme for Beam Vacuum Consolidation and Upgrade



o Consolidation

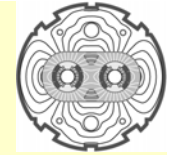
- o ATLAS: Replace stainless VA (&VT) steel chambers and bellows with aluminium for background and ALARA reasons
- o LHCb: Replace defective UX85/3 beryllium chamber, optimise UX85/2 supports, replace stainless steel bellows with aluminium
- o CMS: Re-evaluate forward vacuum chamber supports and gas injection system operation for magnetic fields

o Upgrades

- o Machine insertion upgrade: New forward chambers in ATLAS and CMS, new TAS and/or TAS chambers, new VAX region (TAS-Q1)
- o ATLAS: New (insertable) B-layer, tracker upgrade (beryllium) beampipe
- o CMS Tracker upgrade (beryllium) beampipe,
- o New materials and manufacturing methods for transparent chambers
- o FP420-type forward physics moving beampipes
- o Phase - II upgrade concepts



Apertures for Next Generation Beampipes



○ History

- ATLAS requested a smaller beampipe diameter in $Z \pm 3.5\text{m}$ for B-layer and PIXEL upgrades
- Presentation to ATLAS tracker upgrade workshop in 2006 based on aperture requirement at injection (which was the limit for the current beampipe radius)
- A number of open questions remained to be answered, (eg, future optics and collimation) with final value expected some time after machine start-up

○ Information required from ATLAS and CMS

- Formal statement needed on range of β^* in IR's 1 and 5 required for physics
 - TOTEM or other high β^* optics required after phase - I triplet upgrade?
- Latest information on structural stability of experimental caverns

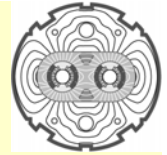
○ Next steps

- Calculate baseline aperture of beampipe in cavern, taking into account new information on triplet and collimation
- Make detailed simulations based on beam loss, background and machine protection before agreeing final value

○ Need a forum for advancing this in a structured way



Proposed Organisation for Upgrades



○ Re-activate ‘LHC Experimental Beampipes’ (LEB) Group

- Mandate for consolidation and upgrade (phase I and II) of vacuum sectors from Q1 to Q1, plus new forward physics experiments
- Vacuum chambers, support systems and interfaces with experiments and machine
- Constraints from experiments and machine, geometry, technology, project management

○ Membership

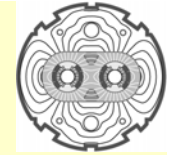
- 1 member (TC or nominated) per experiment, representation from concerned machine groups, plus safety
- Reporting to ?

○ Urgent topics for discussion

- Definition of upgrade aperture in ATLAS and CMS
- Follow-up on consolidation projects, and scheduling



Conclusions and Issues



○ Baseline vacuum systems

- The design and follow-up of the currently installed systems was via a VAC-led working group called LEB. This worked well!

○ Current situation

- There are a large number of requests for consolidation and upgrade activities
- The financial basis, priorities and resourcing for these activities are not clearly defined

○ Proposed actions

- The LEB working group should be re-activated with an updated mandate and membership
- A budget for consolidation and upgrade of experimental vacuum should be agreed between the research and accelerator sectors, along with an associated resource plan