WP8 Collider-Experiment Interface

HL-LHC Vacuum Meeting - CERN
WP8 Input for the vac specifications

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…for the WP8 (H. Burkhardt, A. Ball, B. Di Girolamo)

Systems related to vacuum

- ATLAS/P1 & CMS/P5
  - **Experiment** vacuum pipe
  - **TAS** & **TAN** on either side

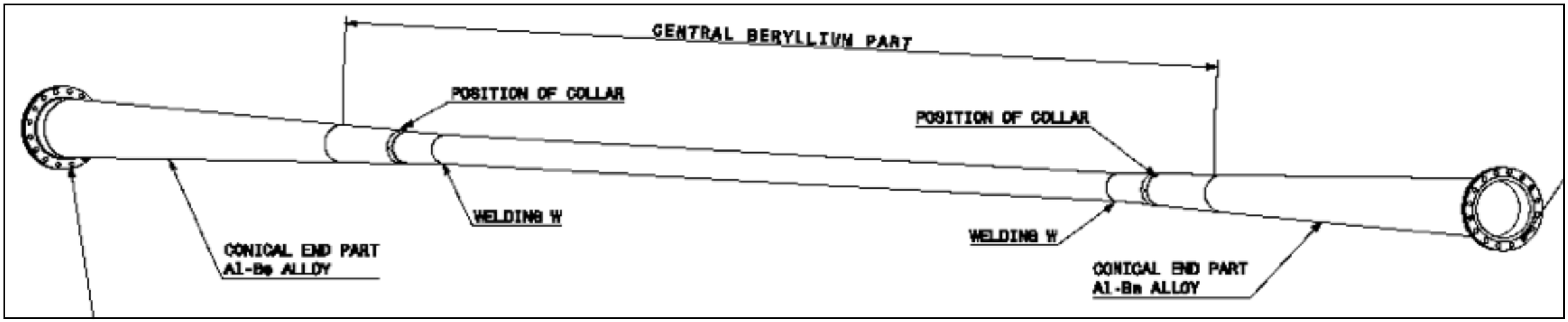
- LHCb/P8
  - **Experiment** vacuum pipe
  - Possibly : **TAN** on either side, **TAS** only on the left side (if needed - tbc)

- ALICE/P2:
  - Experiment vacuum pipe ⇐ no modifications foreseen for HL-LHC (tbc)

- **Key issues:**
  - aperture for vacuum pipes - tbd by optics studies (WP2) and experimental requirements for background & machine protection
  - engineering to consider energy deposition and handling due to activation

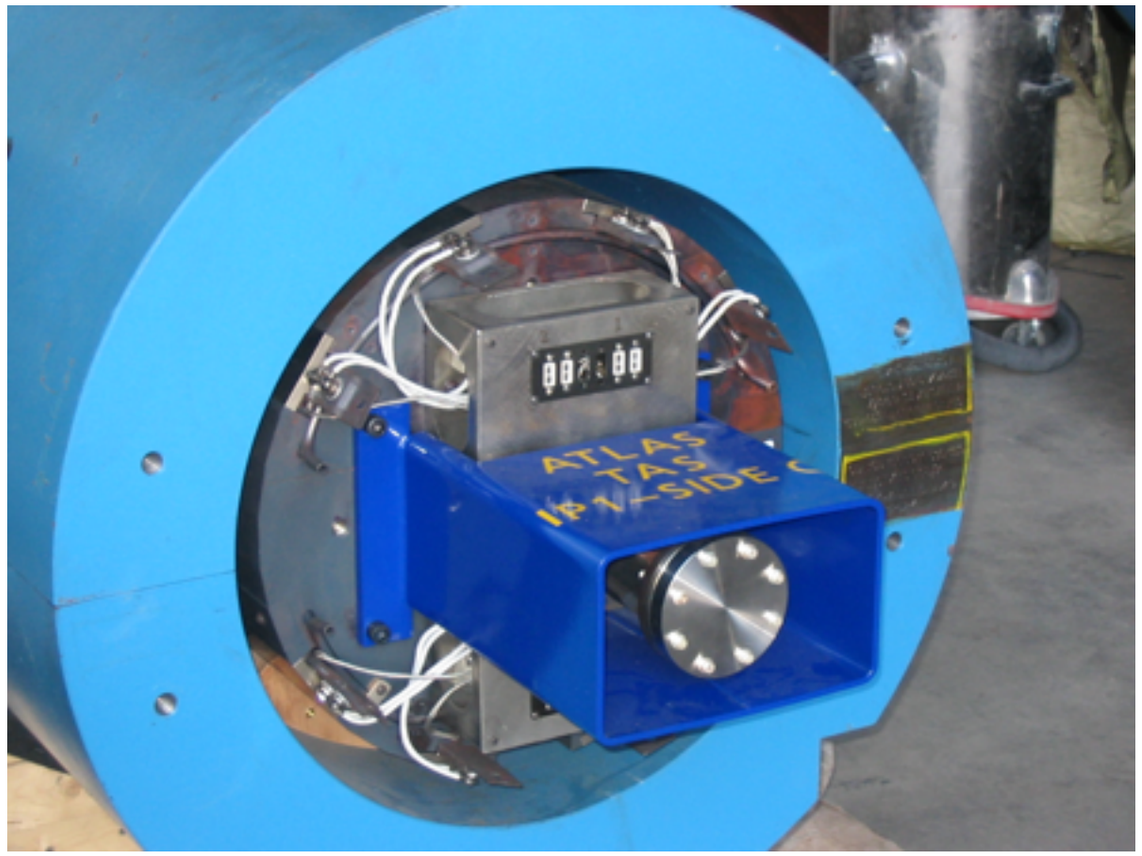
HL-Experiments (IP1 & IP5)

- Experimental beam pipes
  - already changed at LS1
    - radius reduced to 21.7 mm for CMS and 23.5 mm for ATLAS
  - experience as of Run-2
    - with the inner detector layers
    - handling procedures



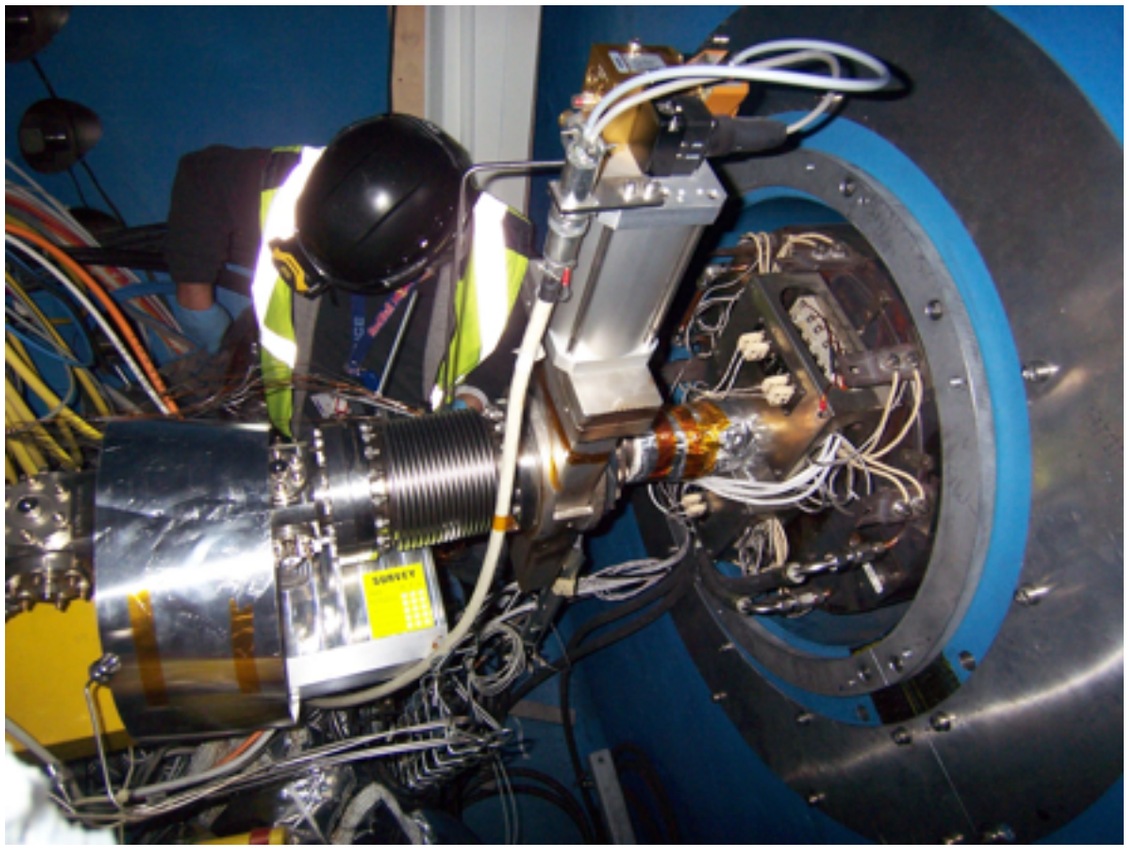
HL-Experiments (IP1 & IP5) - TAS

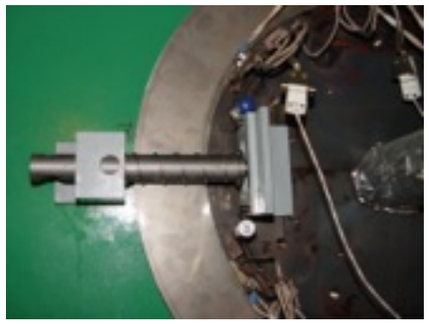
- new design is required for HL-LHC operation
  - increased aperture, energy deposition
- Specifications (present):
  - Cu block, 1.8m long, 250mm OR, 17mm IR
  - Designed to absorb a heat load of **220W** at the LHC design luminosity (10^{34} $cm^{-2}s^{-1}$), which averaged over a fill (~8-10h) is reduced to **130W**
    - air cooling considered sufficient, switch to water cooling for ultimate (2.5 10^{34} $cm^{-2}s^{-1}$) luminosity operation
    - however since we had to isolate the experimental caverns for the He accident case, this is probably no valid and we may have to activate the water cooling already from Run-2
- mechanical tolerances on the vacuum chamber geometry : ±0.5mm in radius,
  - this is in fact the aperture limiter !!
- …and assembly to the Cu block
  - to transfer the alignment and heat load

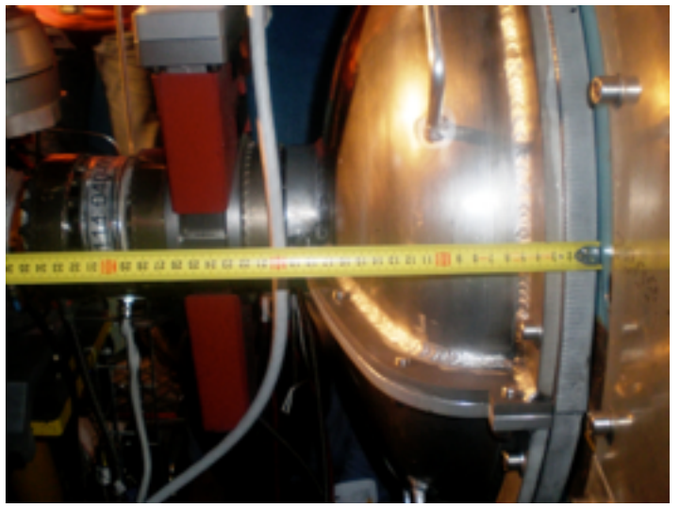


HL-Experiments (IP1 & IP5) - TAS

- New TAS design considerations
  - increased aperture to 30 mm (?)
    - the TAS must be the aperture limiter at all cases, i.e. mask the exp. beam pipe radius
  - improved alignment (mechanics & procedure)
  - energy deposition and cooling requirements
  - must maintain the He separation between tunnel and exp. caverns
  - address handling issues (including removal of present TAS)
  - similar requirements for the vacuum chamber geometry and mechanics as today
  - mechanical stop for longitudinal movement
    - transverse movements ±10 mm
    - with possibility to readjust up to ±30(20)mm
  - easy disconnect vacuum flanges from either side (experiment & machine) - remote?
  - integration in the TAS-Q1 region







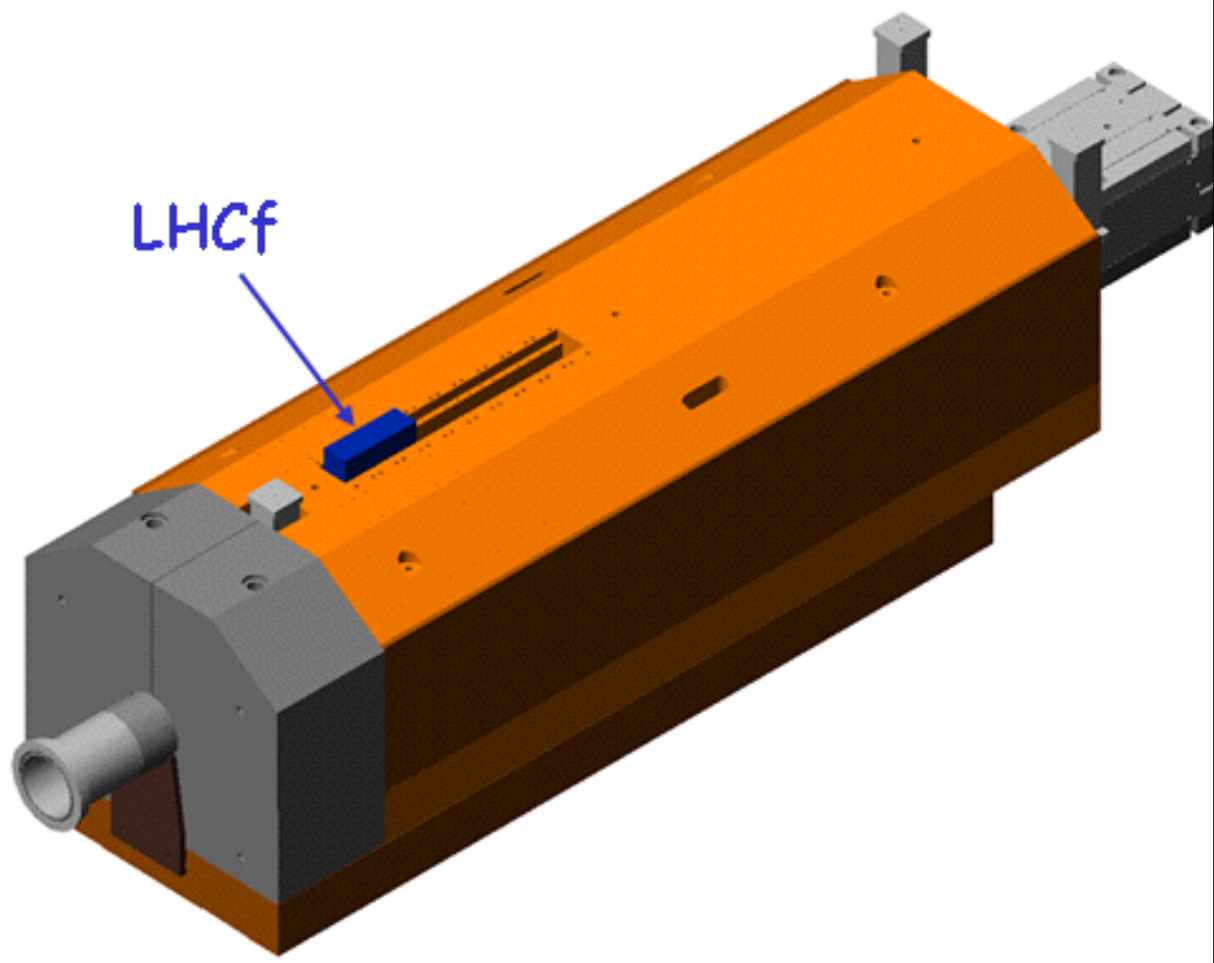
HL-Experiments (IP1 & IP5) - TAS

- Request from both experiments to investigate:

1. the possibility of handling the TAS from the tunnel side instead from the experiment
   - will be studied within WP8
   - if a solution is found, will have a minimum impact on vacuum configuration in the tripplet/TAS region but major on the running of the services (cabling, disconnects, etc.)
2. the possibility to replace already the present TAS with a new one during LS2
   - use an insert to maintain the present aperture until LS3
     - would have to be removed together with the vacuum pipe because of the flanges
       - corresponding to ~20-40% of the total mass of the TAS

HL-Experiments (IP1 & IP5) - TAN

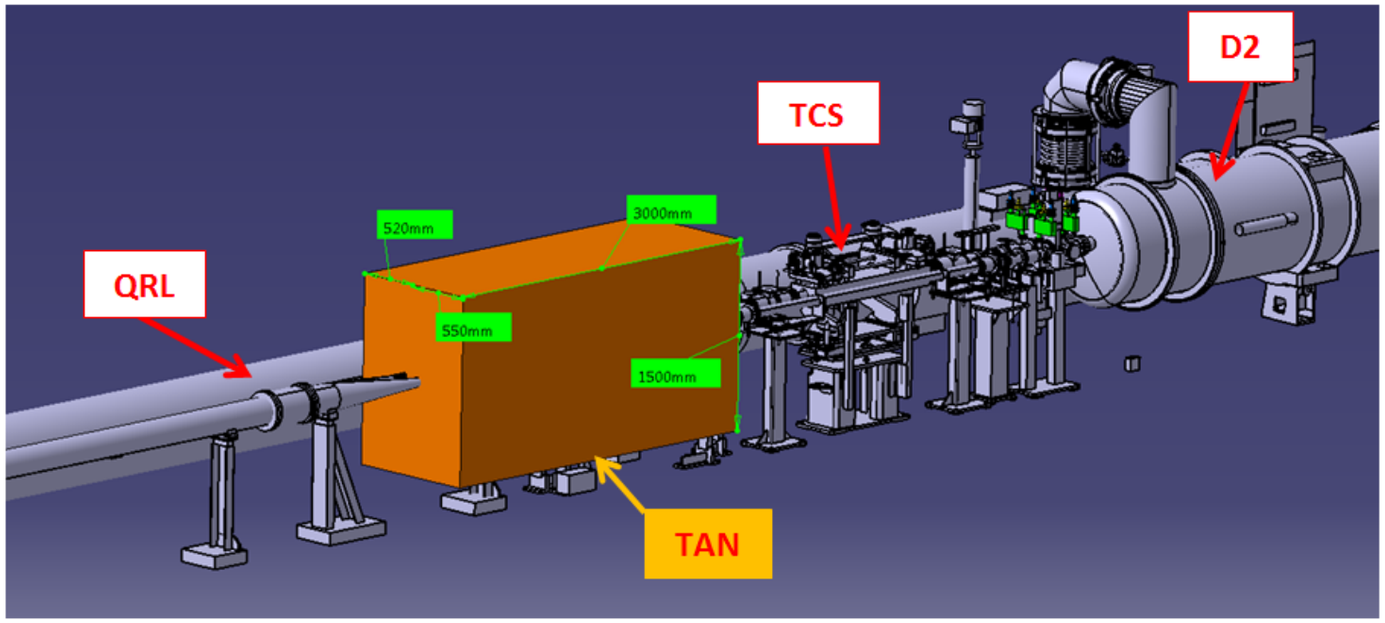
- For HL-LHC need to displace the existing TAN by ~13 m towards IP (tbc)
- Similar design, but different geometry
  - increased beam x-ing angle
  - larger beam apertures
  - handling issues for installation and more importantly dismantling!
- Increased energy deposition
  - 200 W to 1000 W
  - air or water cooling ?
- Do we need to foresee a slot for experiments and/or beam instrumentation?
  - need to address handling issues, must be done remotely!
- Vacuum chamber:
  - exact shape and parameters to define by the beam optics
  - geometrical constraints as present TAN
  - fast disconnect flanges on front side



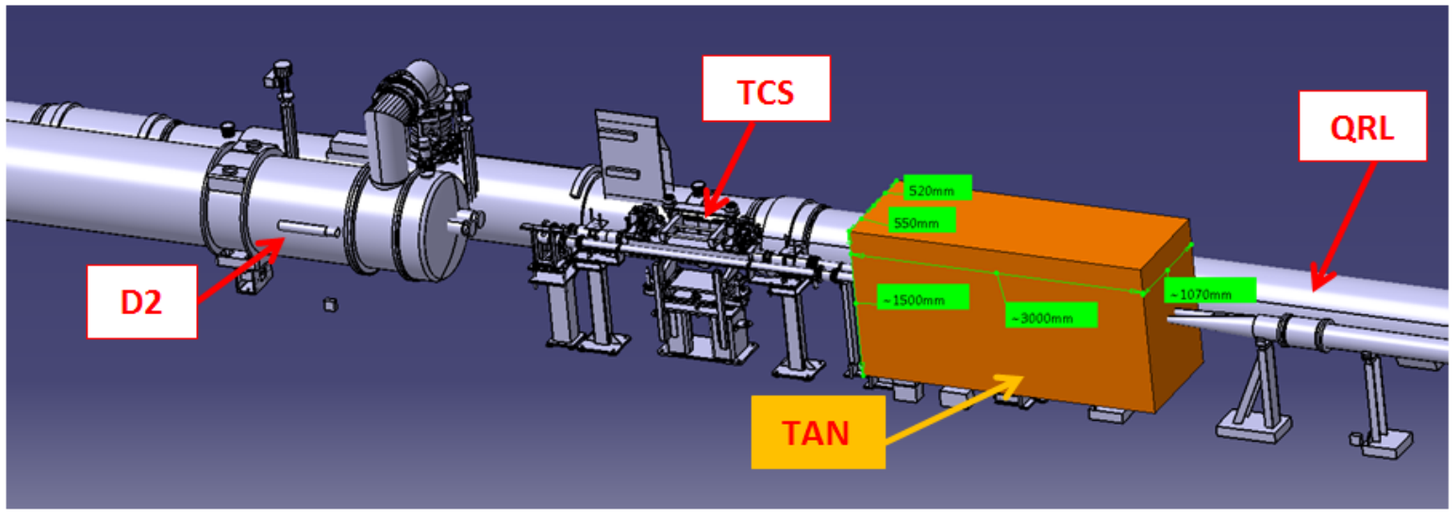
LHCb - Experiments (IP8)

- Investigate TAS & TAN installation for LHCb/IP8
  - https://edms.cern.ch/document/1331944/1
  - TAN Left & Right possible
  - TAS only possible on Left side

    not required for energy deposition, WP10
- Determine angular coverage and aperture needs (WP2)
- To be followed by integration and engineering



2. Point 8 Right (8R) general view. Dimension future TAN



2. Point 8 Left (8L) general view. Dimension future TAN

- Similar design as for IP1/IP5

Status - WP8

- Continue the follow-up of the beam optics and parameters

- Start engineering studies for the TAS and the other elements
  - special attention to optimised handling and interventions

- Common effort with all experiments and accelerator