WP9: QRL Dismantling – Activated Waste

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QRL Modifications for HL-LHC

HL-LHC: QRL modifications at P1 and P5:

- 4 Long Straight Sections (LSS) → 680 m of QRL in total
- 70 QRL sub-assemblies in total

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Mass = 1300kg to 2200kg
Length = 6.6m to 8.4m

Mass = 1200kg to 2000kg
Length = 6m to 12.3m

Mass = 1000kg to 1600kg
Length = 4m to 8.7m

16 x Service Modules (SM)

Mass = 1300kg to 2200kg
Length = 6.6m to 8.4m

50 x Pipe elements (PE)

Mass = 1200kg to 2000kg
Length = 6m to 12.3m

4 x Return Modules (RM)

Mass = 1000kg to 1600kg
Length = 4m to 8.7m
QRL Materials and Activation

FLUKA simulation for QRL undertaken by RP (Angelo Infantino).
- Activation: above CERN clearance limits.
- Dose rate: on average < 10 µSv/h.

FLUKA simulation based on standard material properties and stainless-steel vacuum jacket:
- Cobalt content not considered. We intend to verify actual content by testing QRL spare parts.
- Pipe elements have carbon steel vacuum jacket. Further analysis will be requested to understand impact.

Thermal shields: Aluminium

Vacuum jacket:
- Pipe Elements → Carbon Steel
- Service Modules → Stainless Steel
- Return Modules → Stainless Steel

Headers: Stainless Steel
QRL Dismantling – Radioactive Waste

- ‘Moved’ sub-assemblies (HL-LHC total = 12) will be reinstalled in a new position.
- All other sub-assemblies (HL-LHC total = 58) will be substituted by new equipment.

QRL sub-assemblies

- To be moved: ~ 20 ton.
- Waiting area to be defined
- Undergraduate is preferred
- On surface if re-work required

Possible spares
- Up to ~ 10 ton.
- Storage procedure depends on sub-assemblies' activation

To be replaced
- 90 to 100 ton.
- Preliminary RP considerations: non-reused parts to be treated as radioactive waste
- Discard as is
- Sort by material, discard
- Cut in pieces, discard
- Compact before discarding
Conclusions

- Sub-assembly dimensions and mass are confirmed.
- Preliminary estimate of activation is available:
  - Further studies to confirm effect of Co and carbon steel vacuum jacket.
- Radioactive waste:
  - Estimated mass is available.
  - Spare strategy is under study.
  - Disposal strategy and storage location to be defined.