Transport of the CLIC Modules and Elements

CLIC Workshop October 2007

Two Beam Hardware and Integration Working Group

Keith Kershaw (CERN)

Contents

- Introduction - Transport system integration into design
- Example of LHC cryodipole installation
- Some lessons learned from LHC – application to CLIC integration

Introduction - Transport system integration into design

- Main concern for today's meeting is transport in the tunnel
- Key items to transport
    1) Modules, module supports
    2) Transfer line /roof elements
    3) Injection rings, loops
    4) Turnaround elements
    5) Drive beam dump

approx 50,000 items with declared weights of max 2 tonnes to be installed within two year period (logistics!)

Don't forget racks, cables, cooling and ventilation, supports…

Need to consider all phases:

- Delivery of components
- Assembly
- Test
- Storage (LHC experience –this will be needed)
- Transfer to shaft (road transport)
- **Lowering (crane or lift ?)**
- **Loading underground**
- **Transport along tunnel (co activities)**
- **Unloading / Transfer onto supports (time constraints)**
- **Removal for repair**

Difficulties for LHC cryodipole tunnel transport / installation

- Space
  - Laterally during transport and unloading
  - Underneath when placing on supports
  - Transport and installation blocks tunnel
- Overlapping interconnects (horizontal transfer)
- Fragility (cold feet)
- Proximity of support and lifting points
- Precise positioning needed to put on jacks
- One lowering shaft for whole ring

Difficulties for LHC cryodipole tunnel transport / installation

Implications

- Separate transport, unloading and transfer equipment
- Complex (prototype) very compact equipment
- Shocklog monitoring of each magnet
- Approx 2hours to unload
- Complicated logistics

LHC Cryodipole installation sequence

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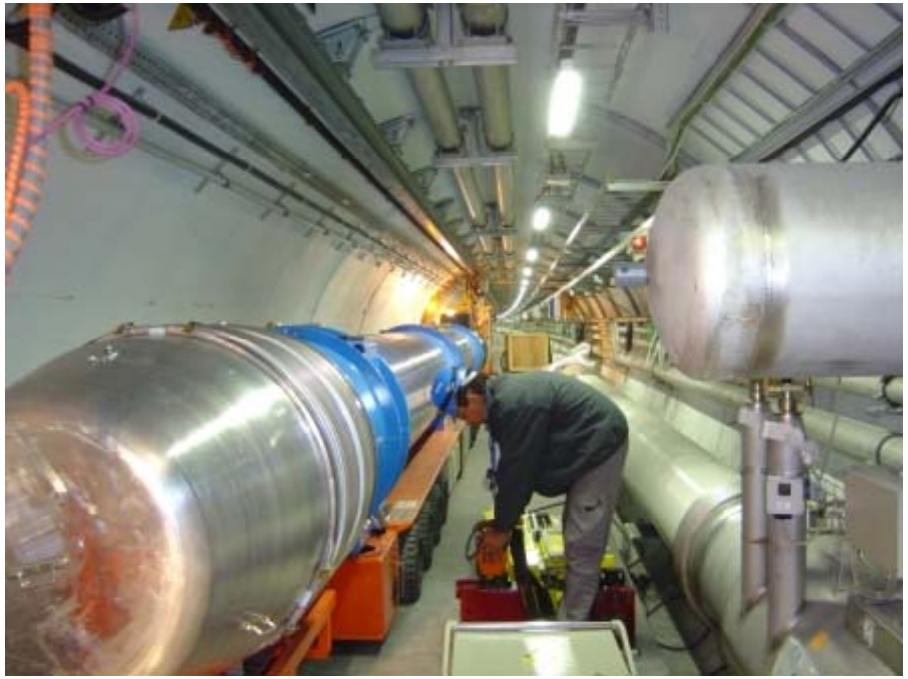

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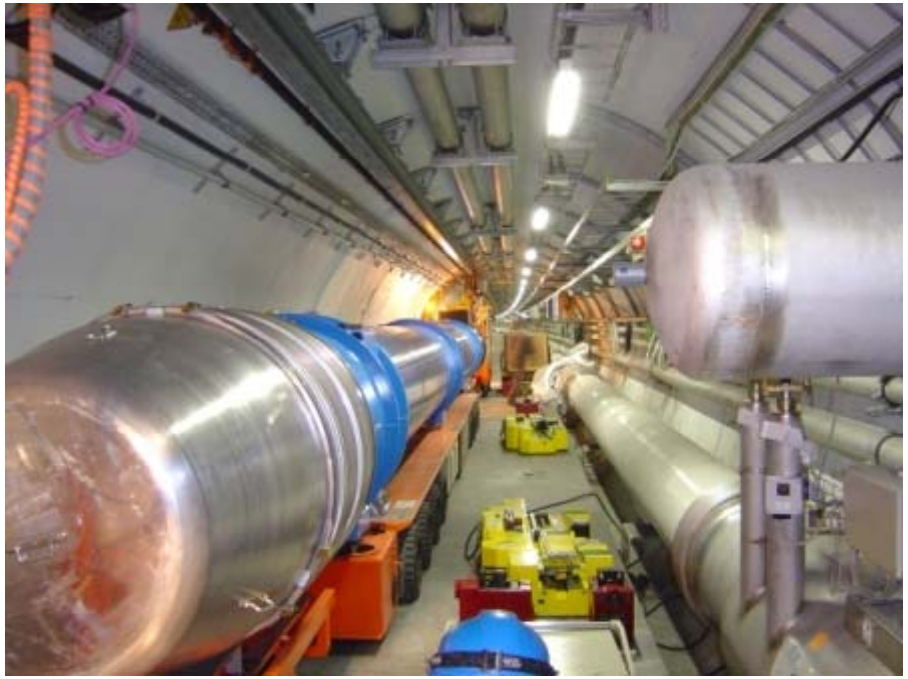
Lift magnet



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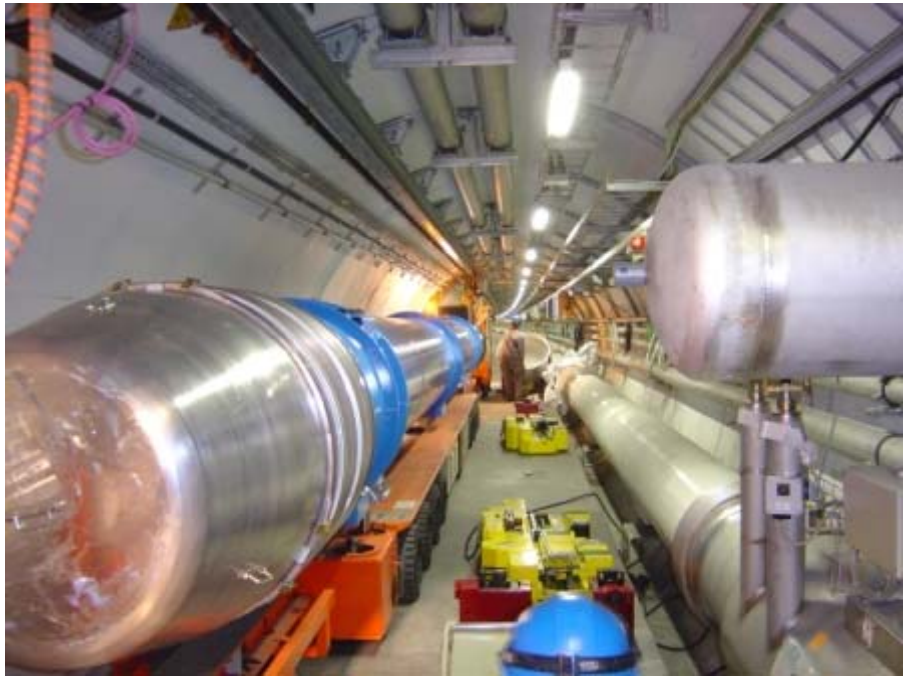

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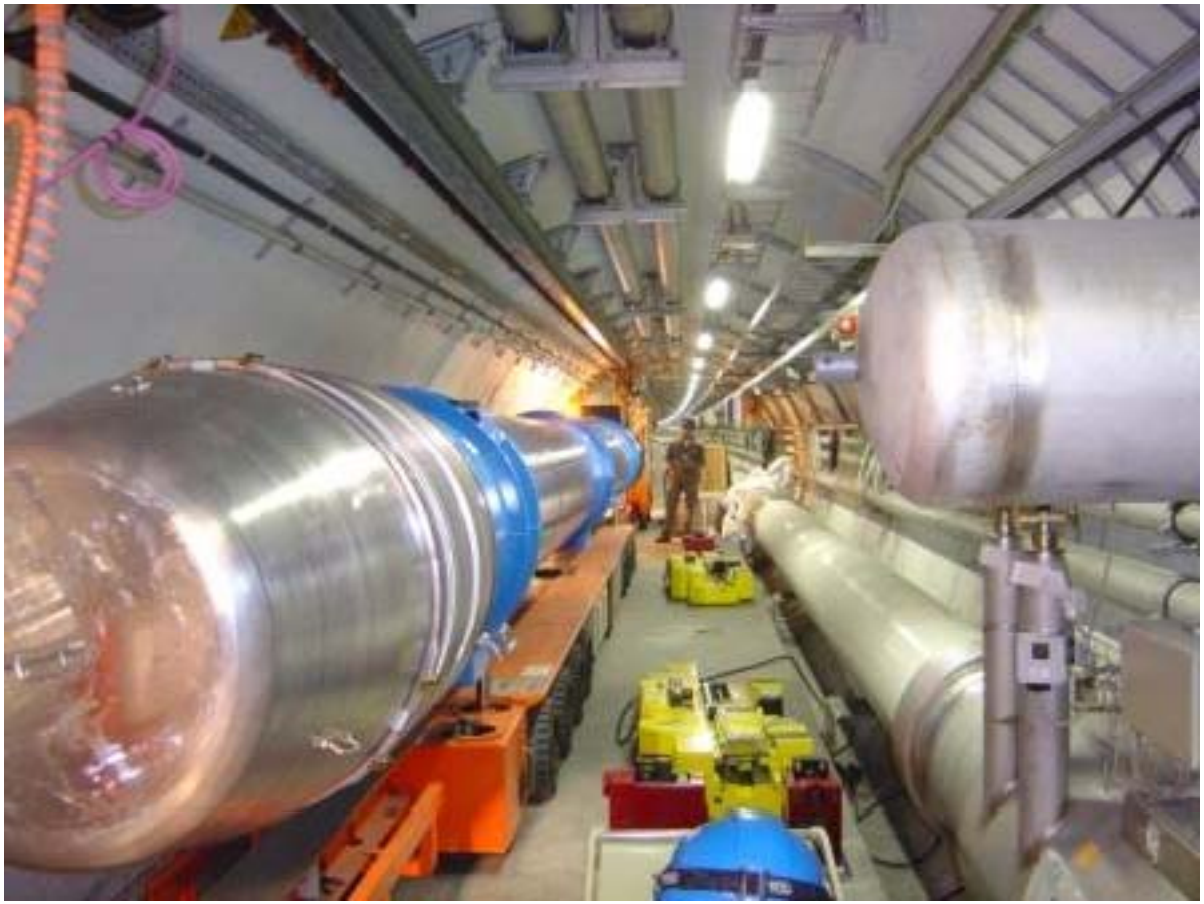

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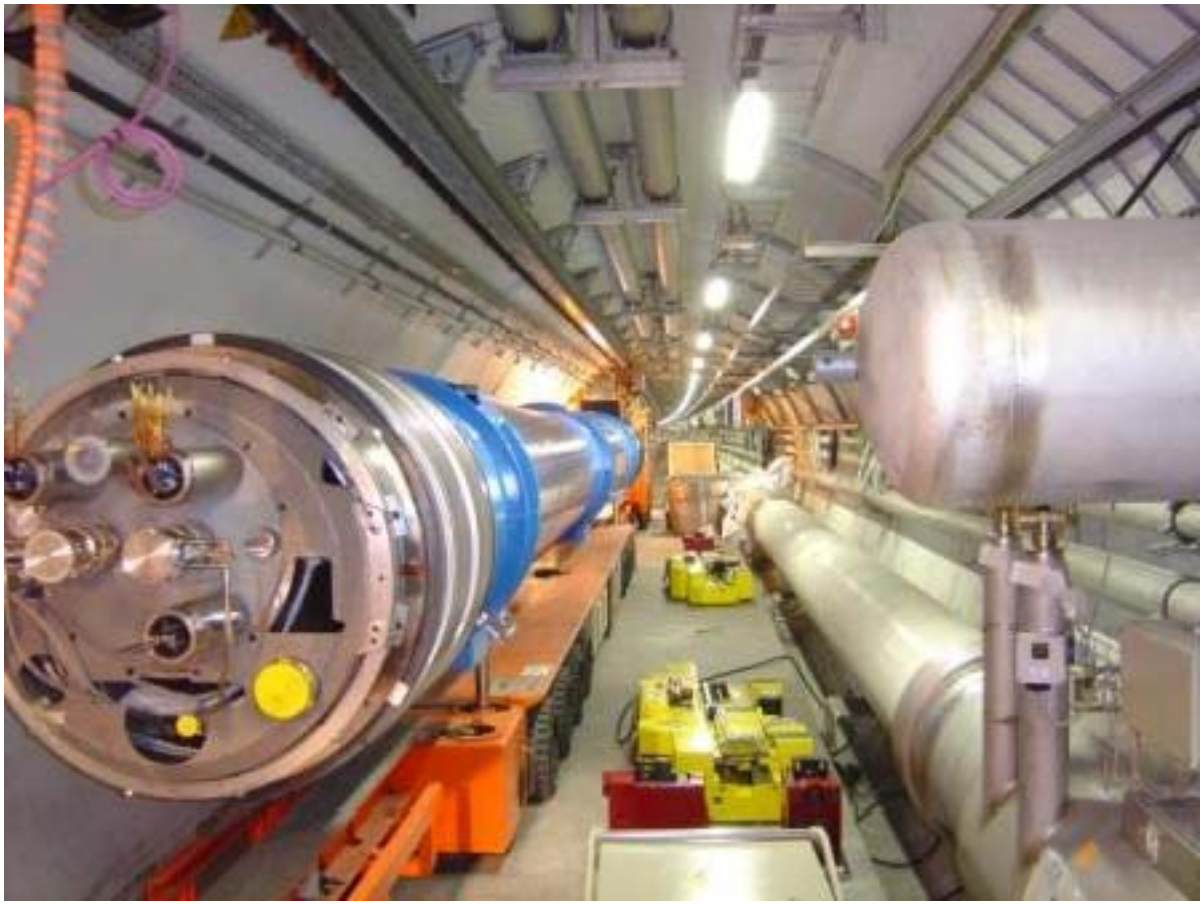

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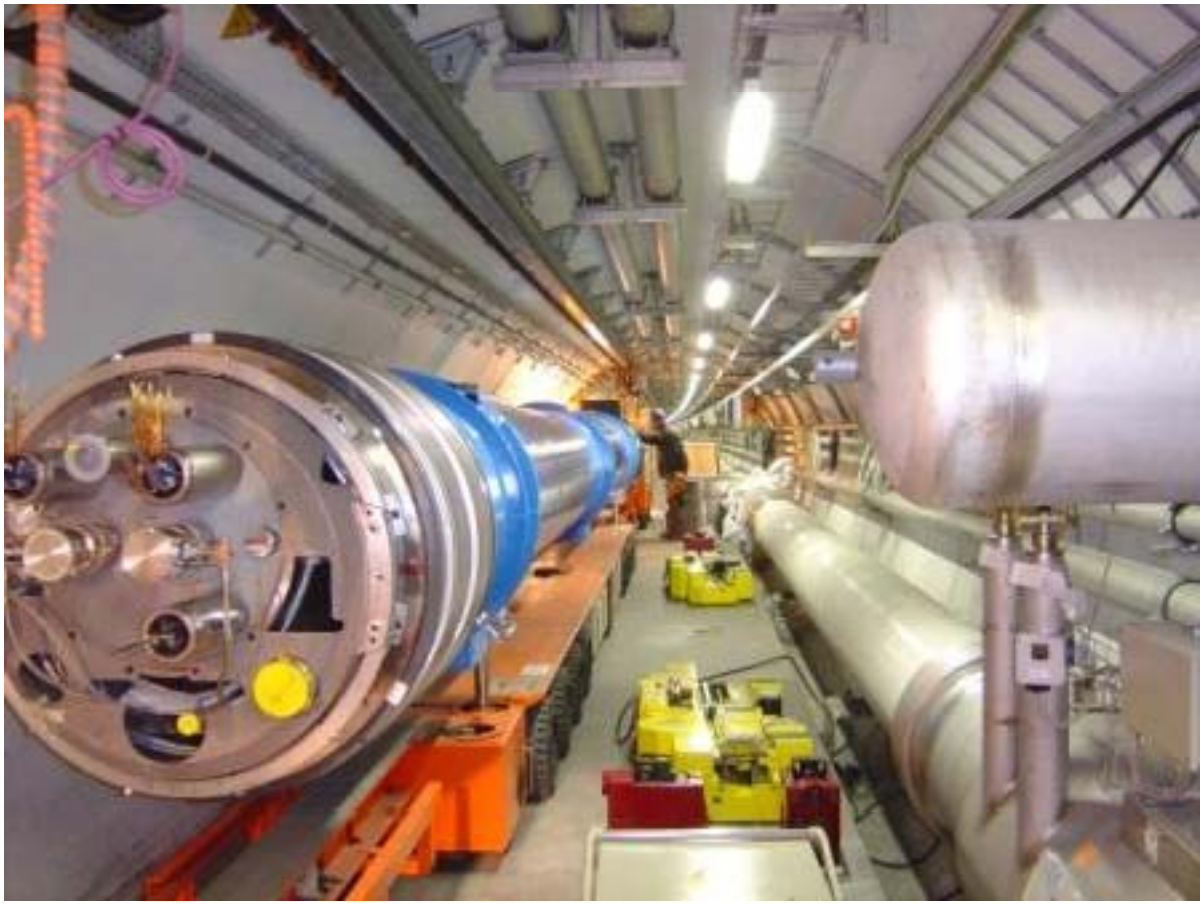

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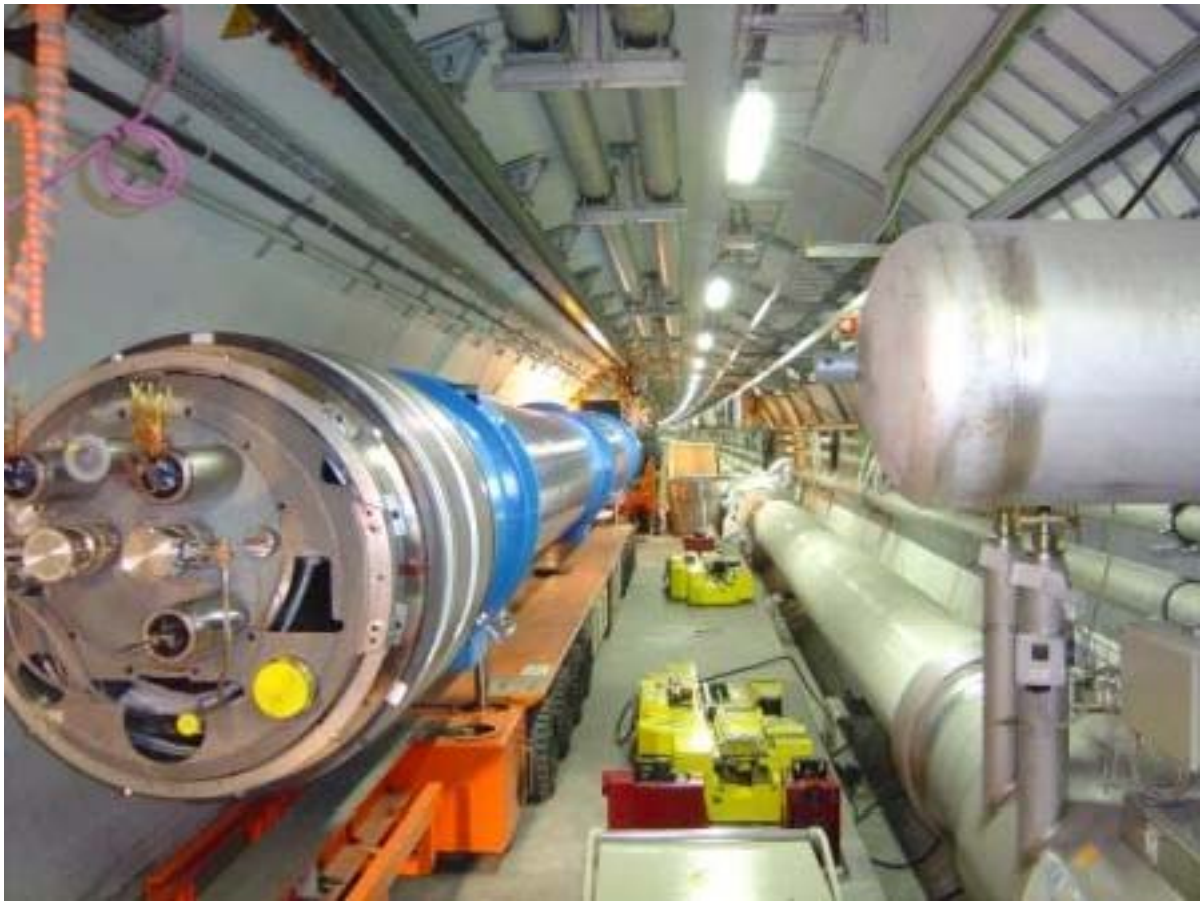

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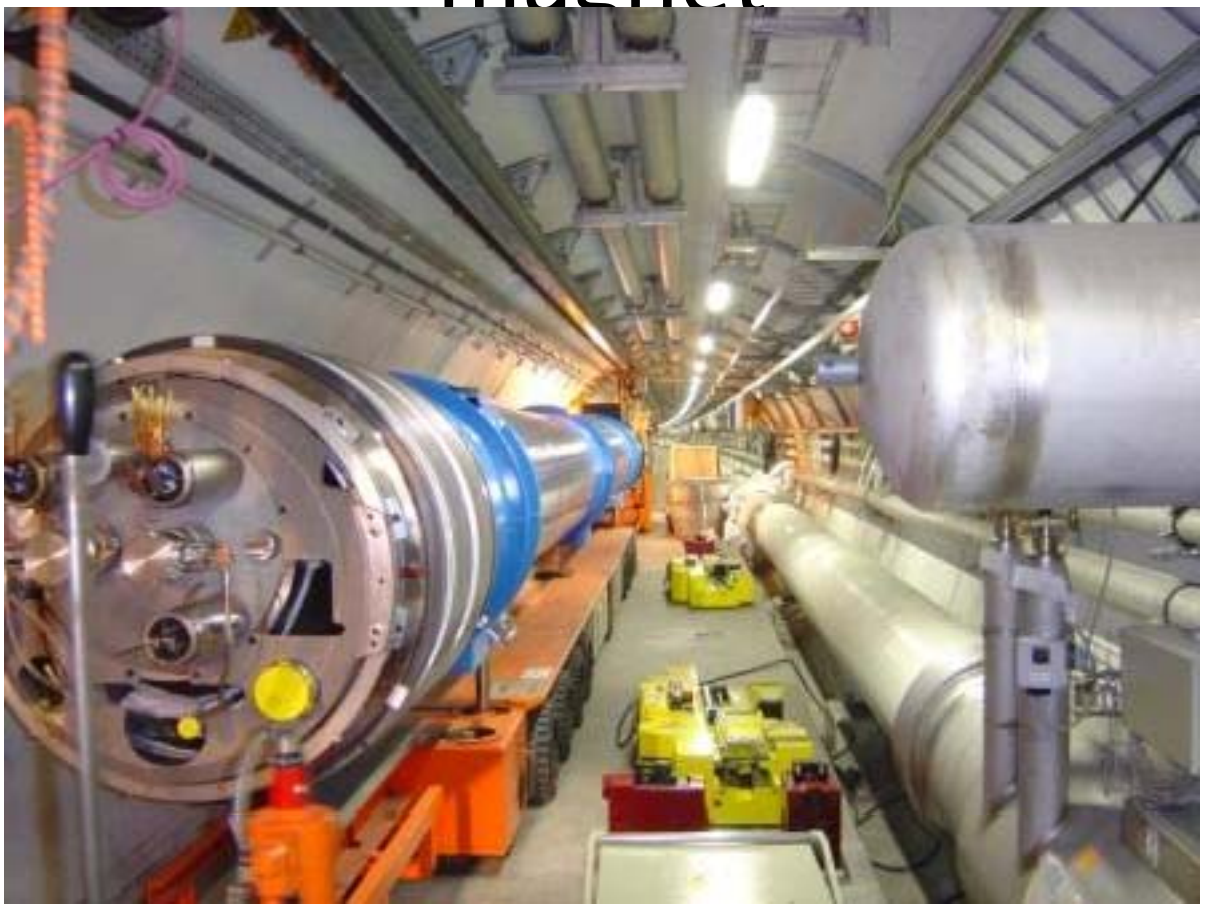
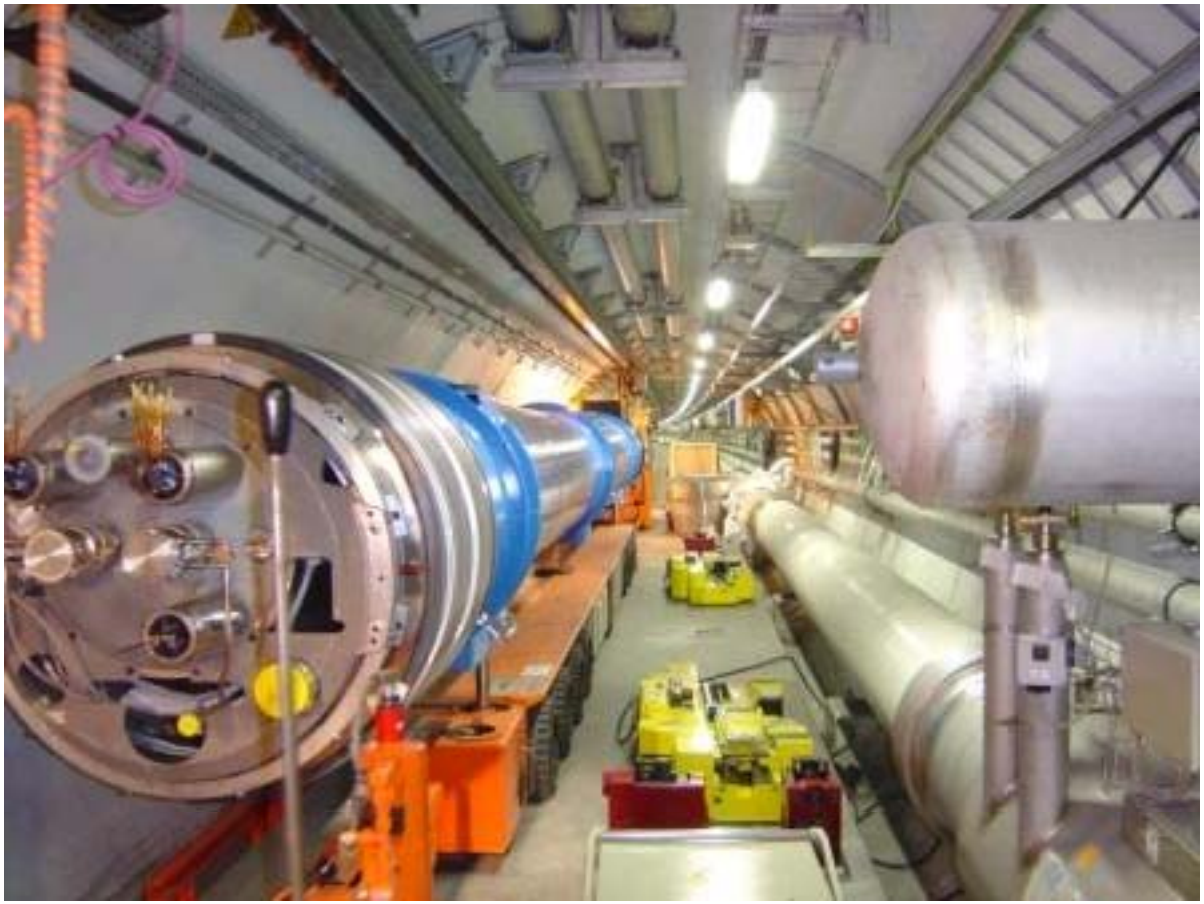
Roll unloading equipment under magnet





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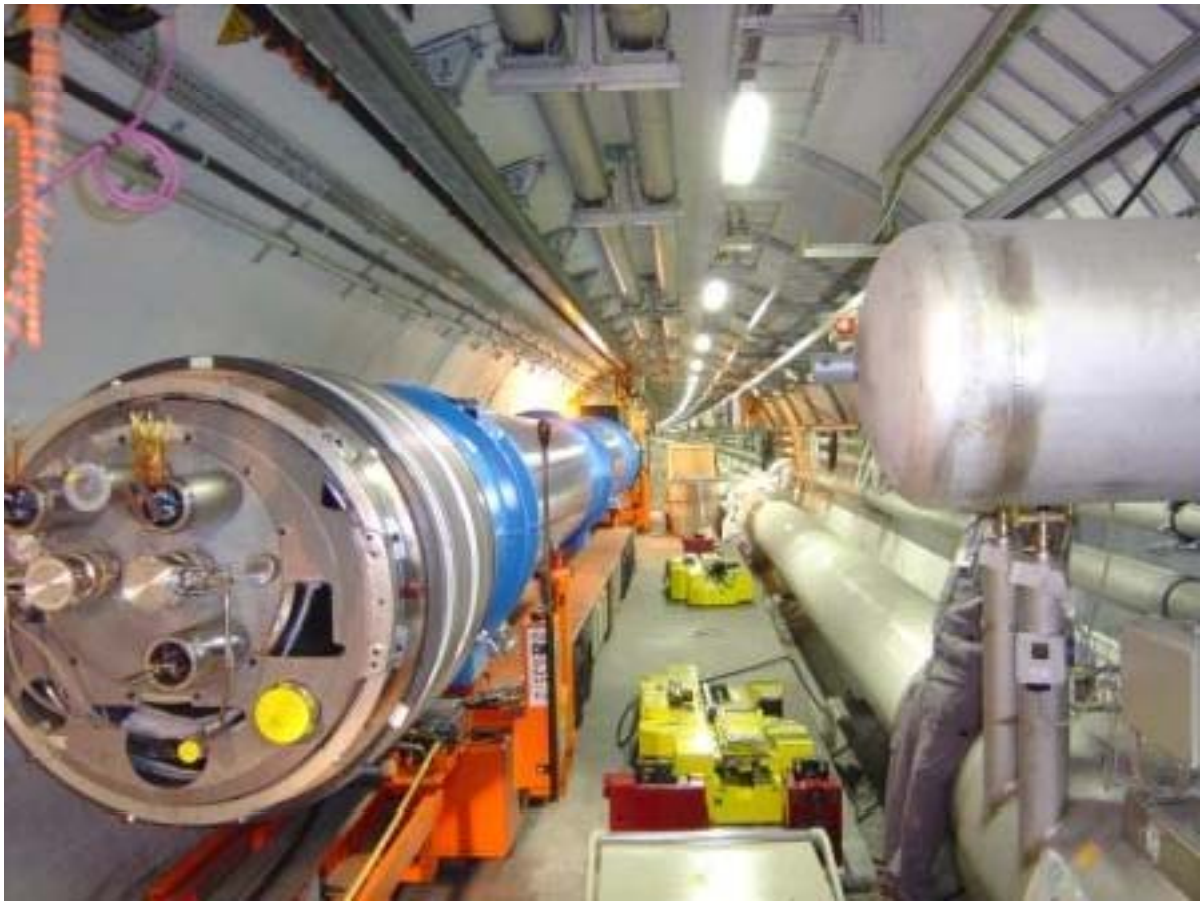

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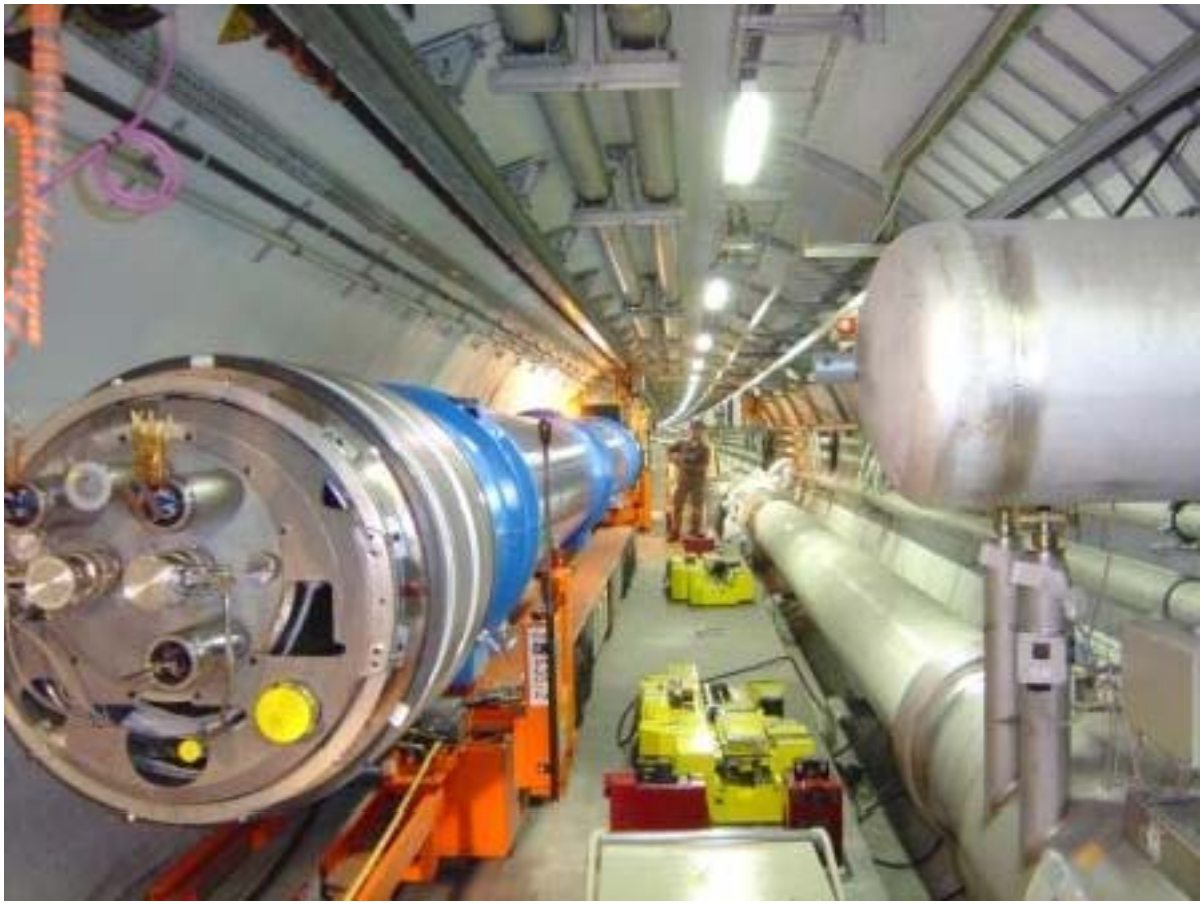

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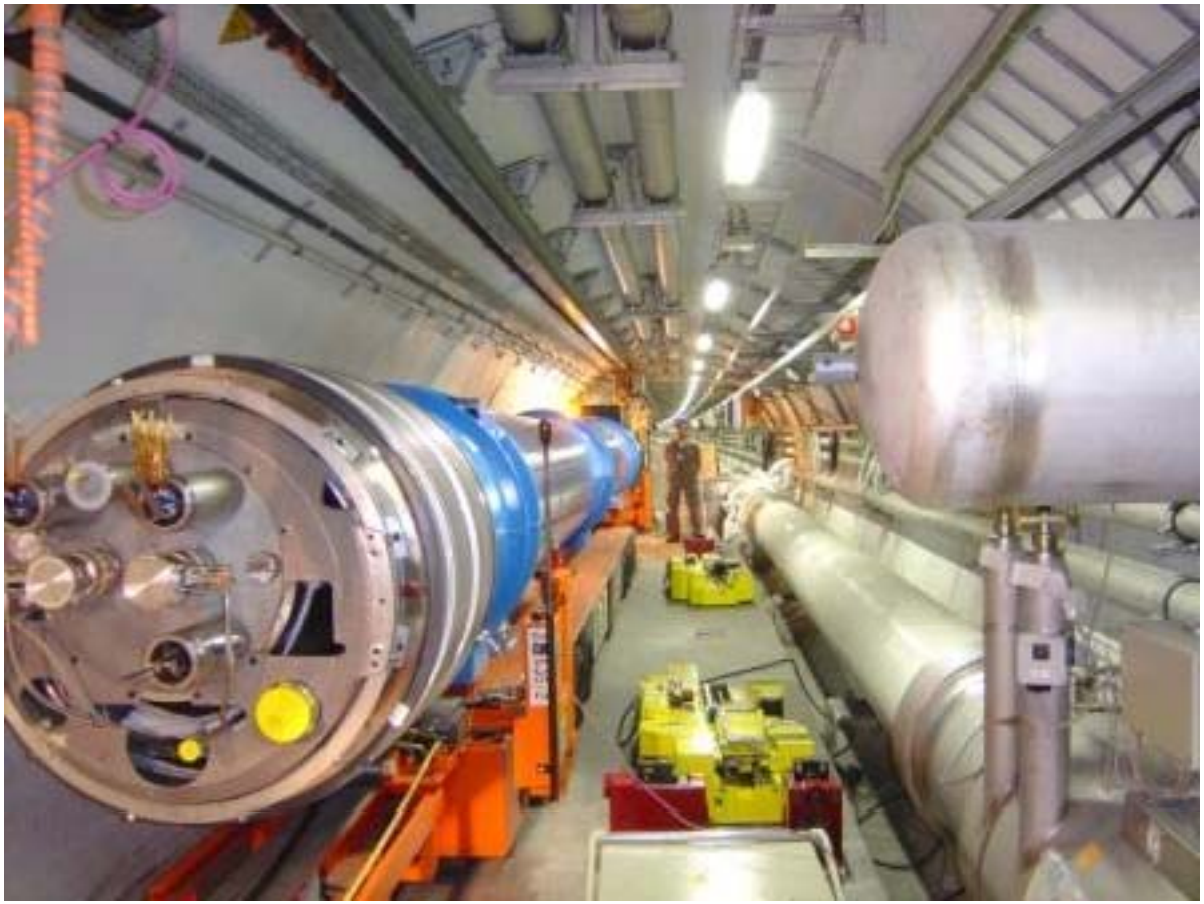

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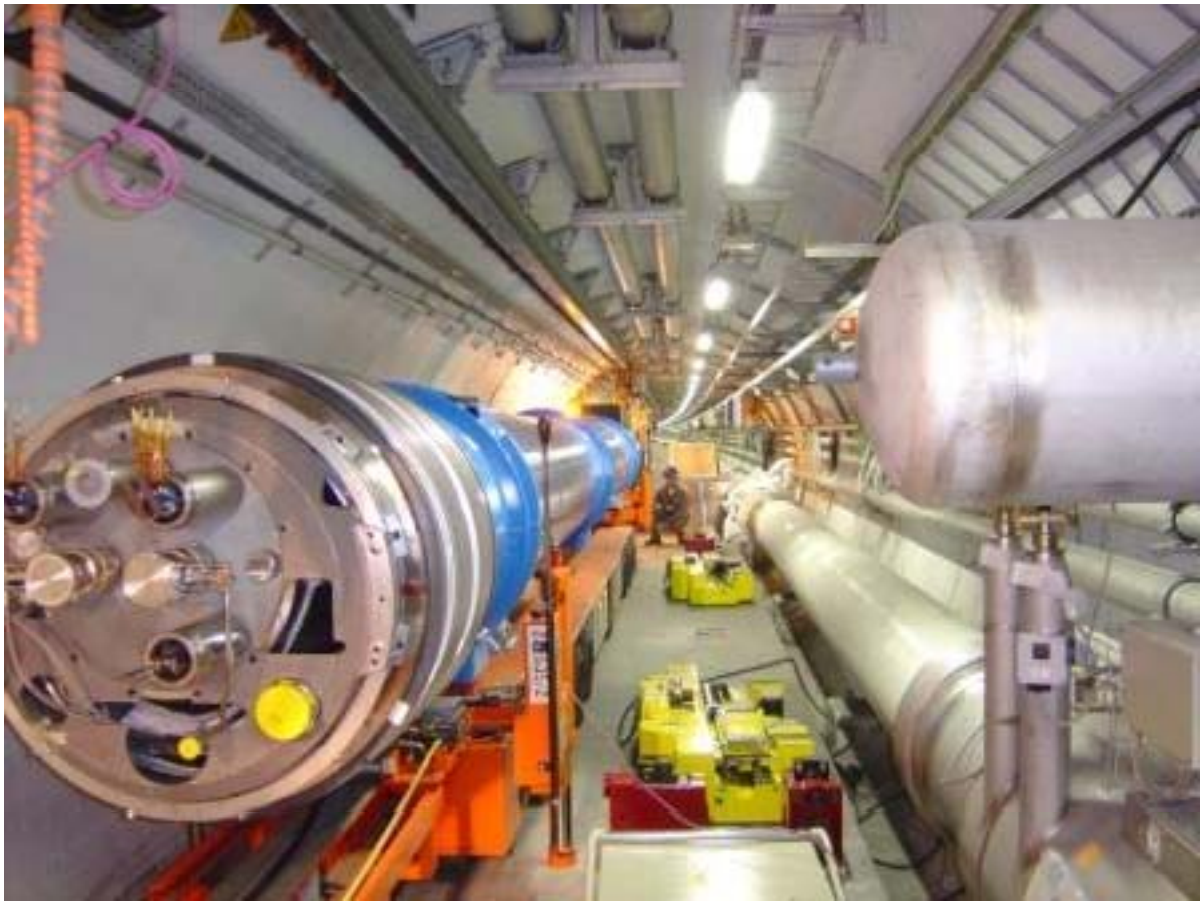

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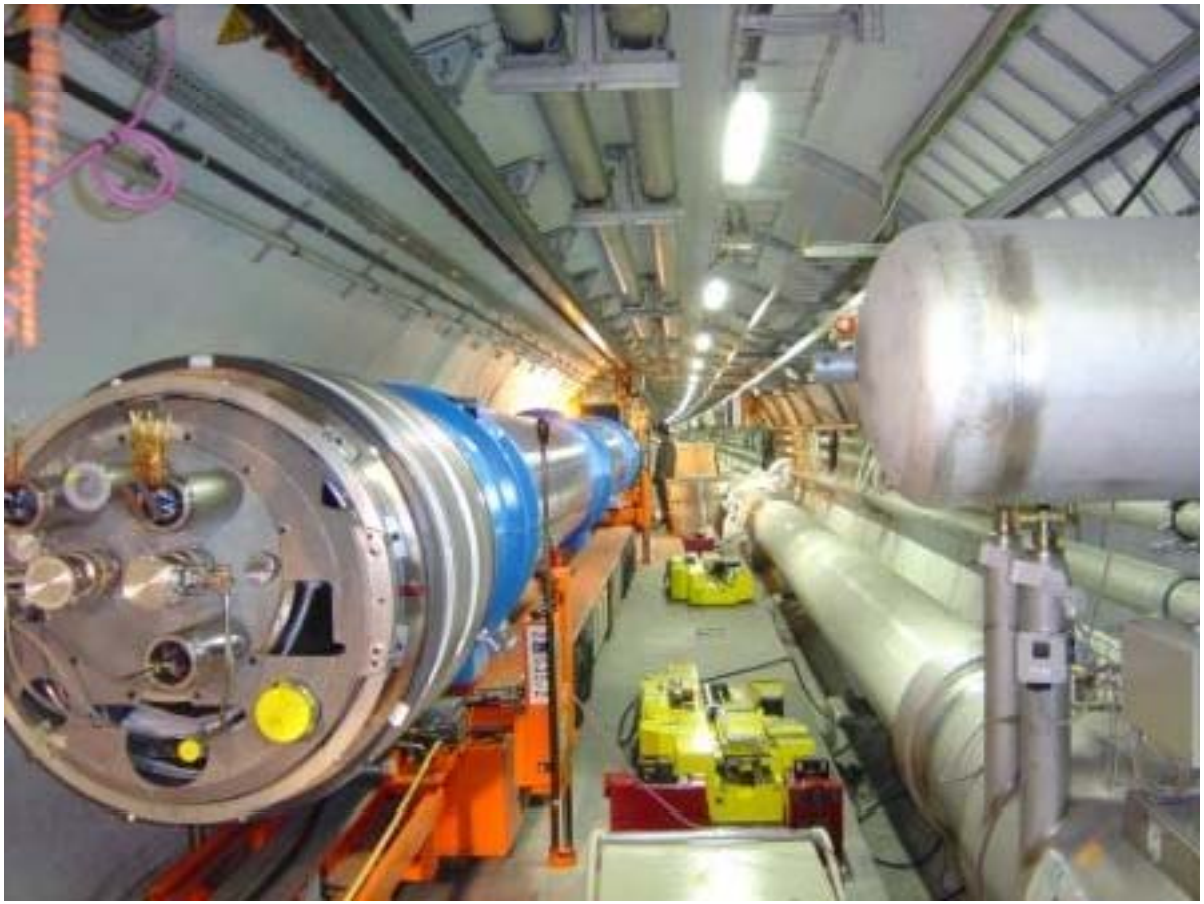

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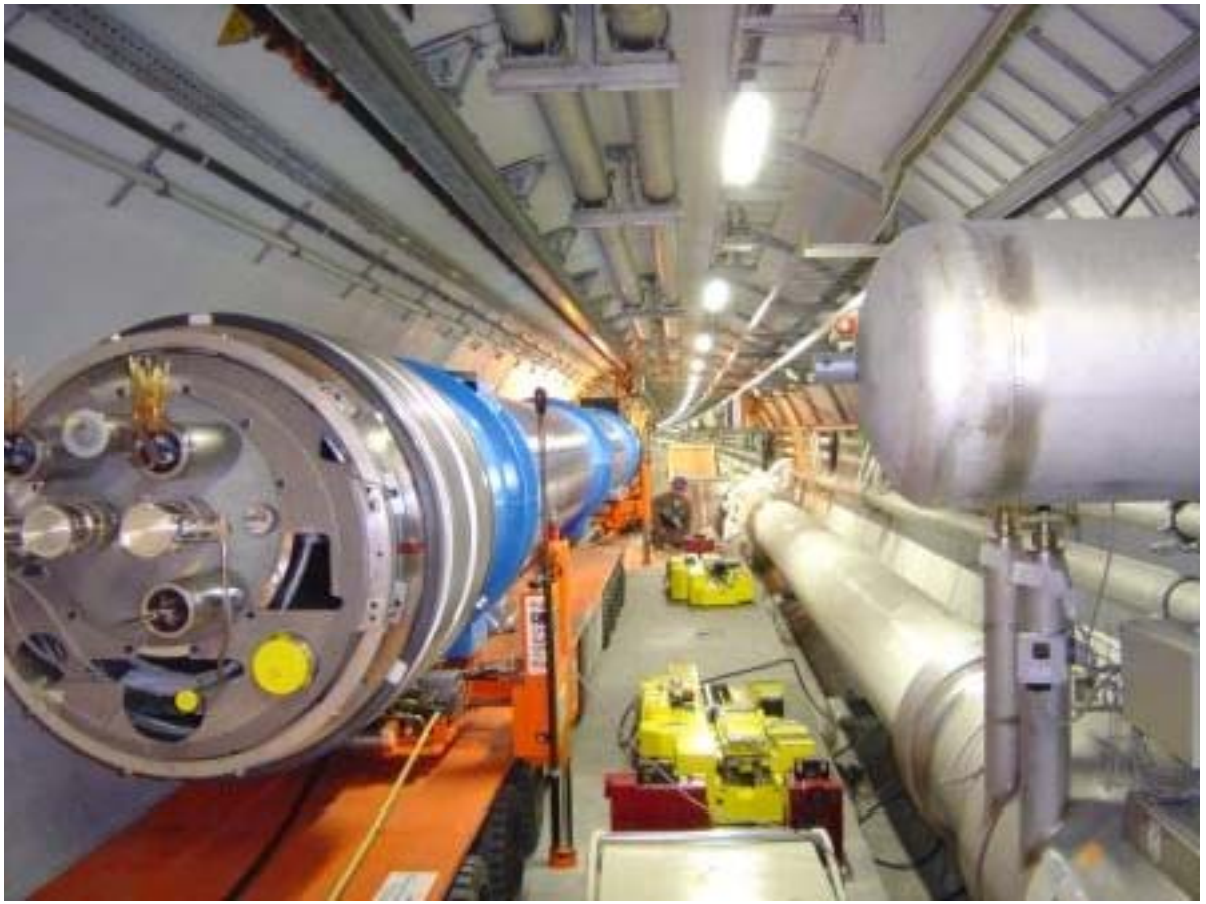
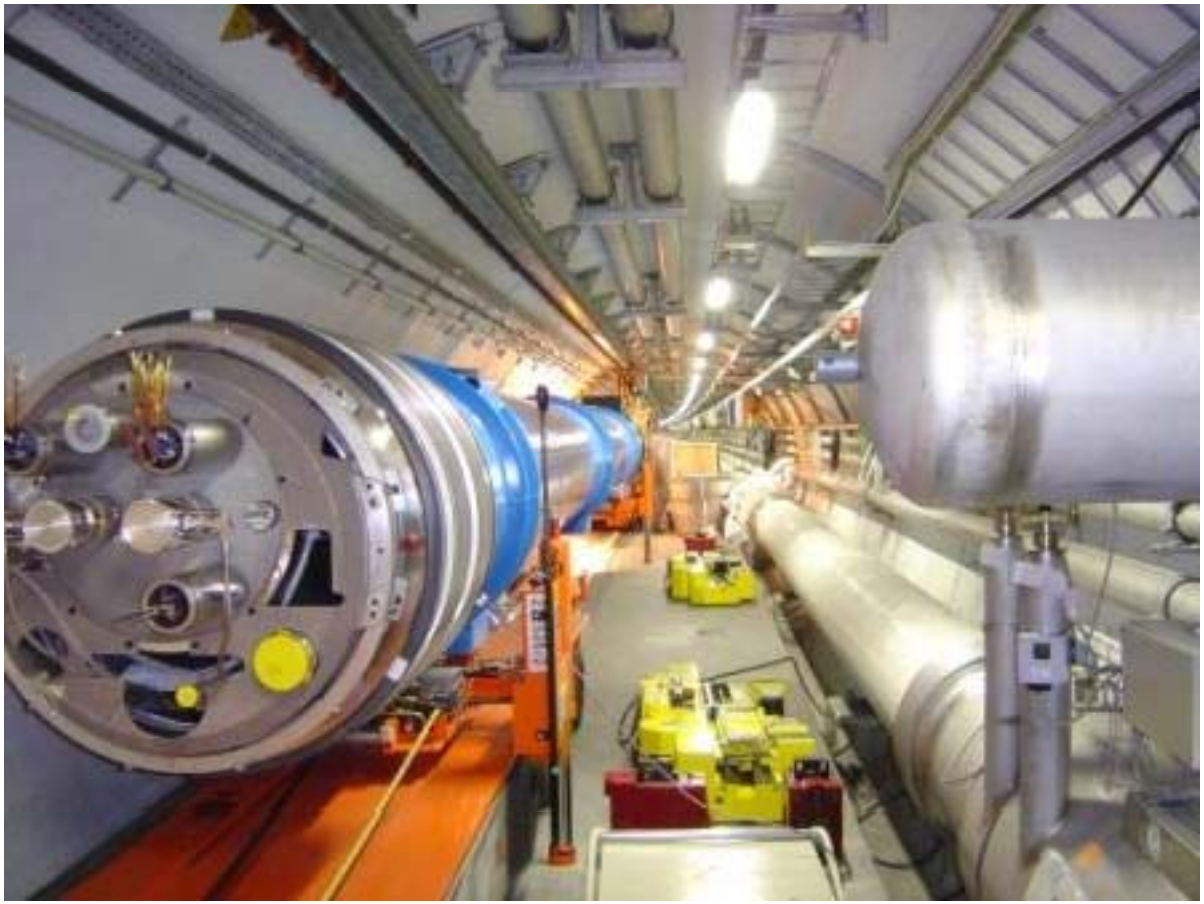
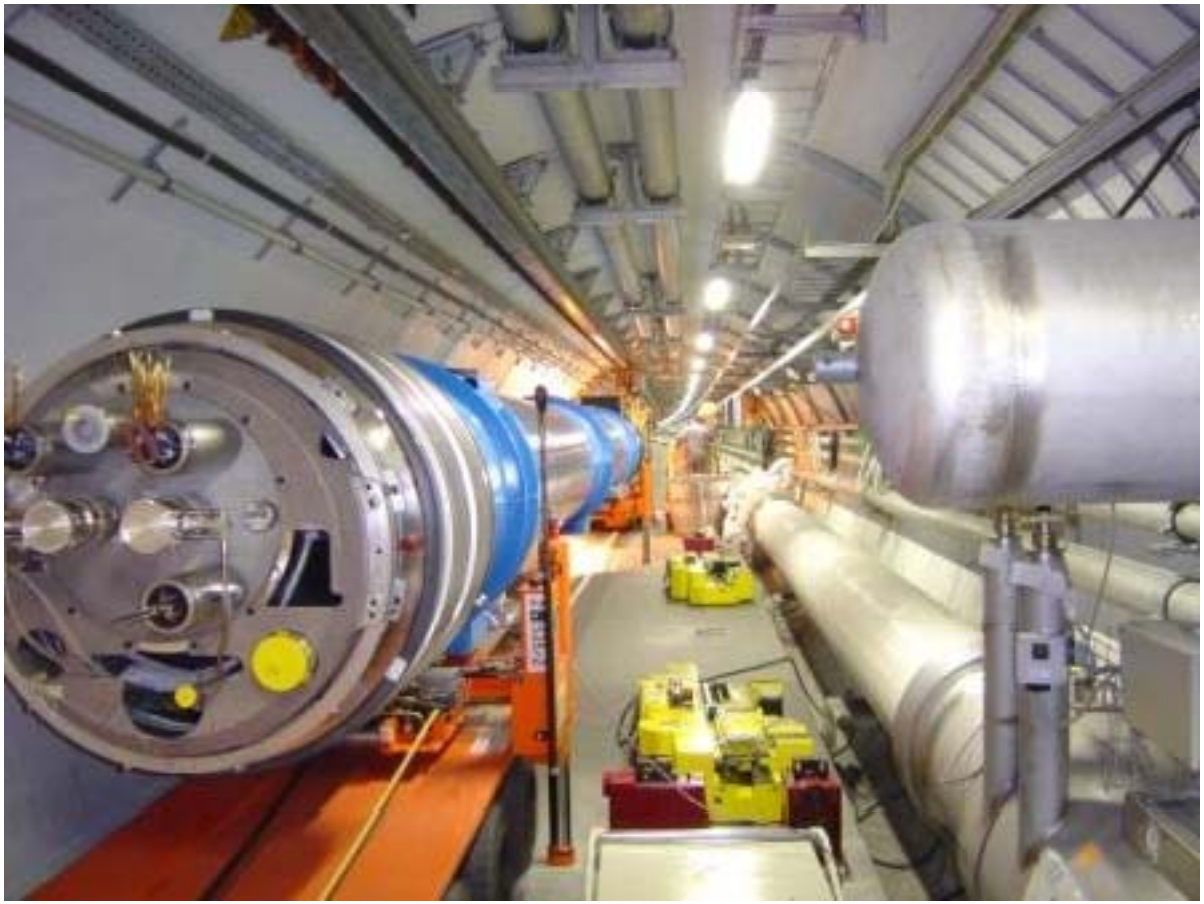
Lift magnet



Withdraw trailer





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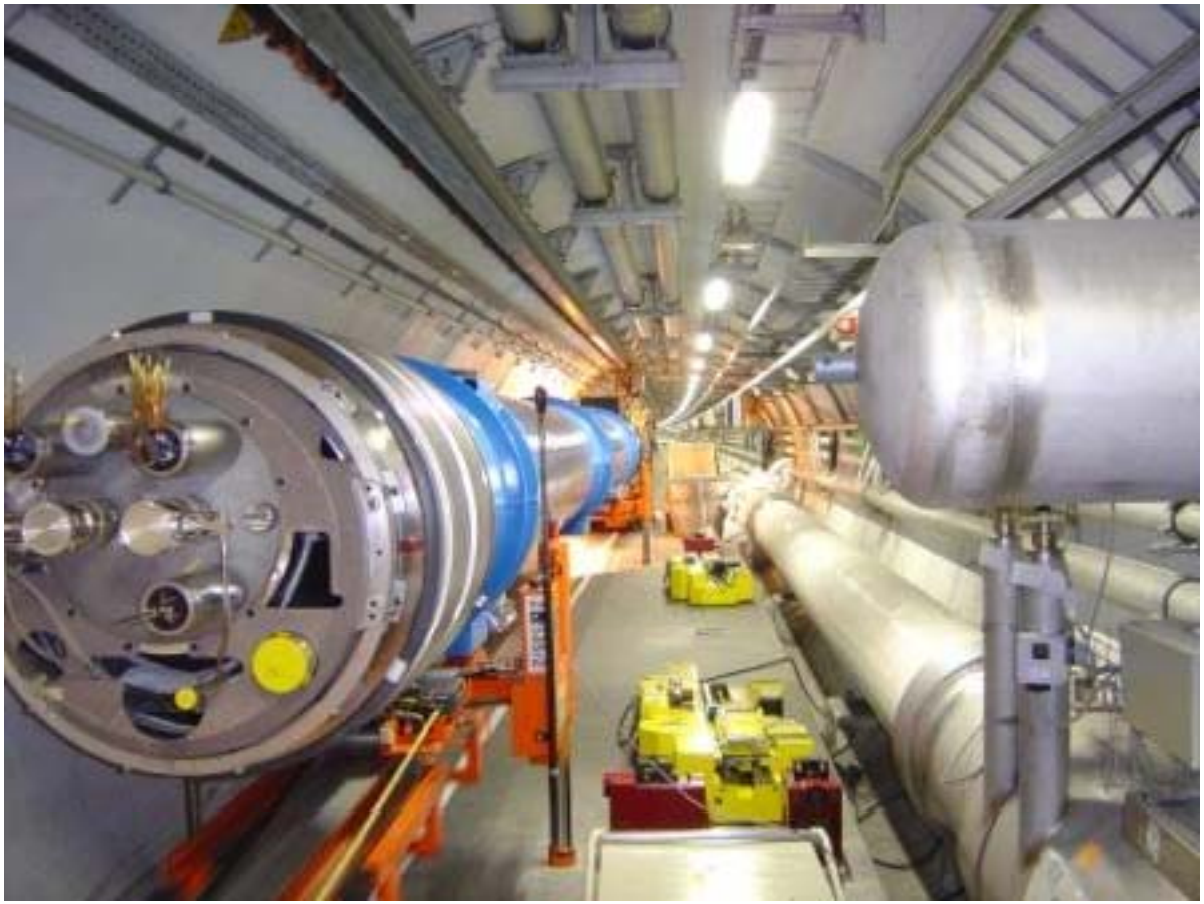

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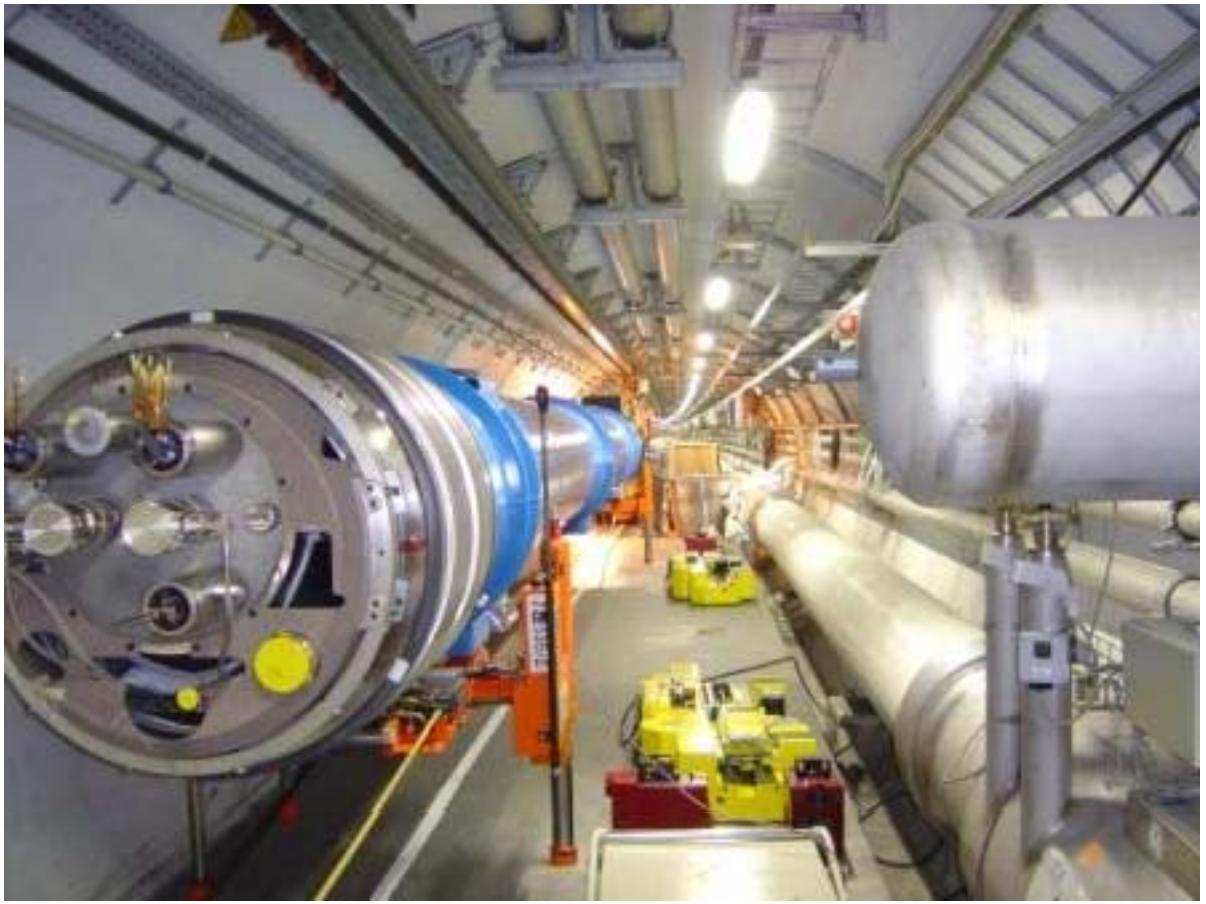
Lower magnet



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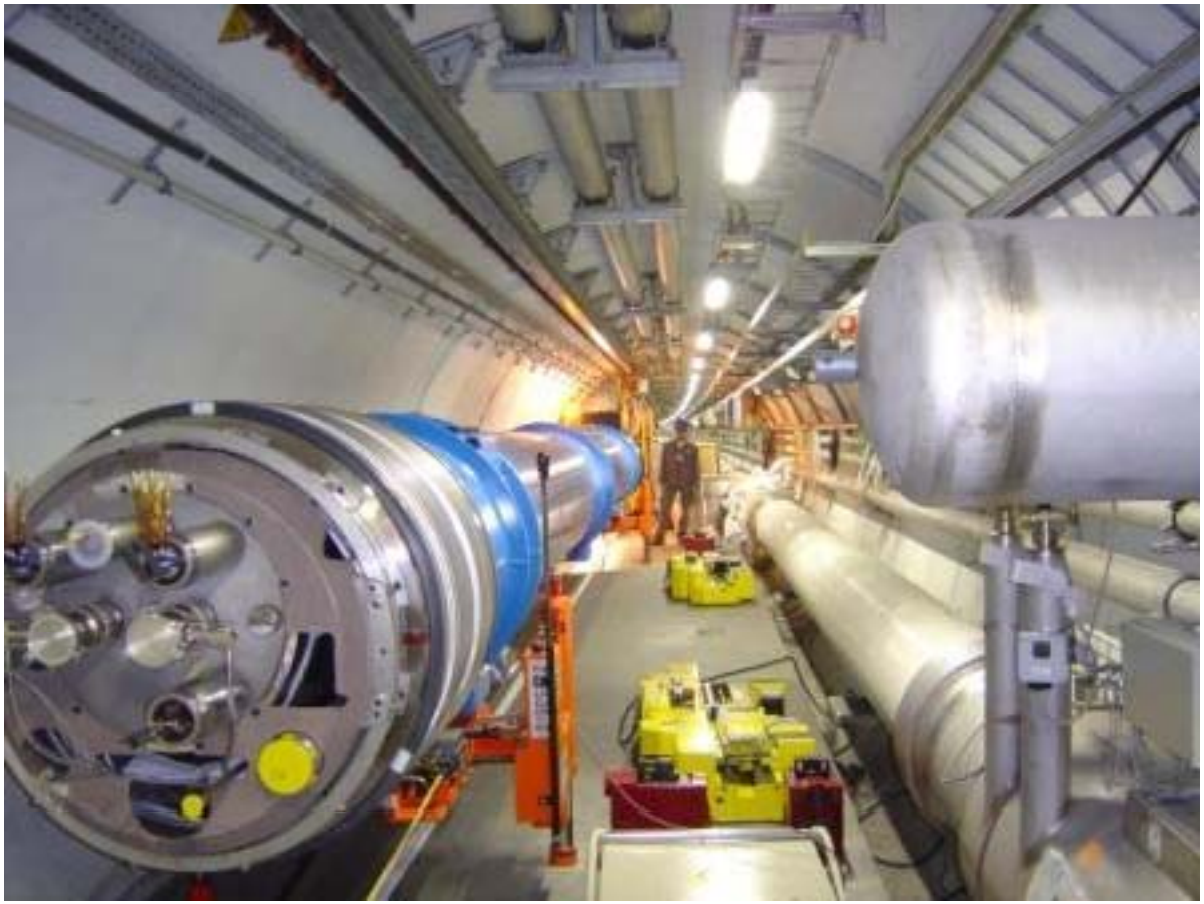

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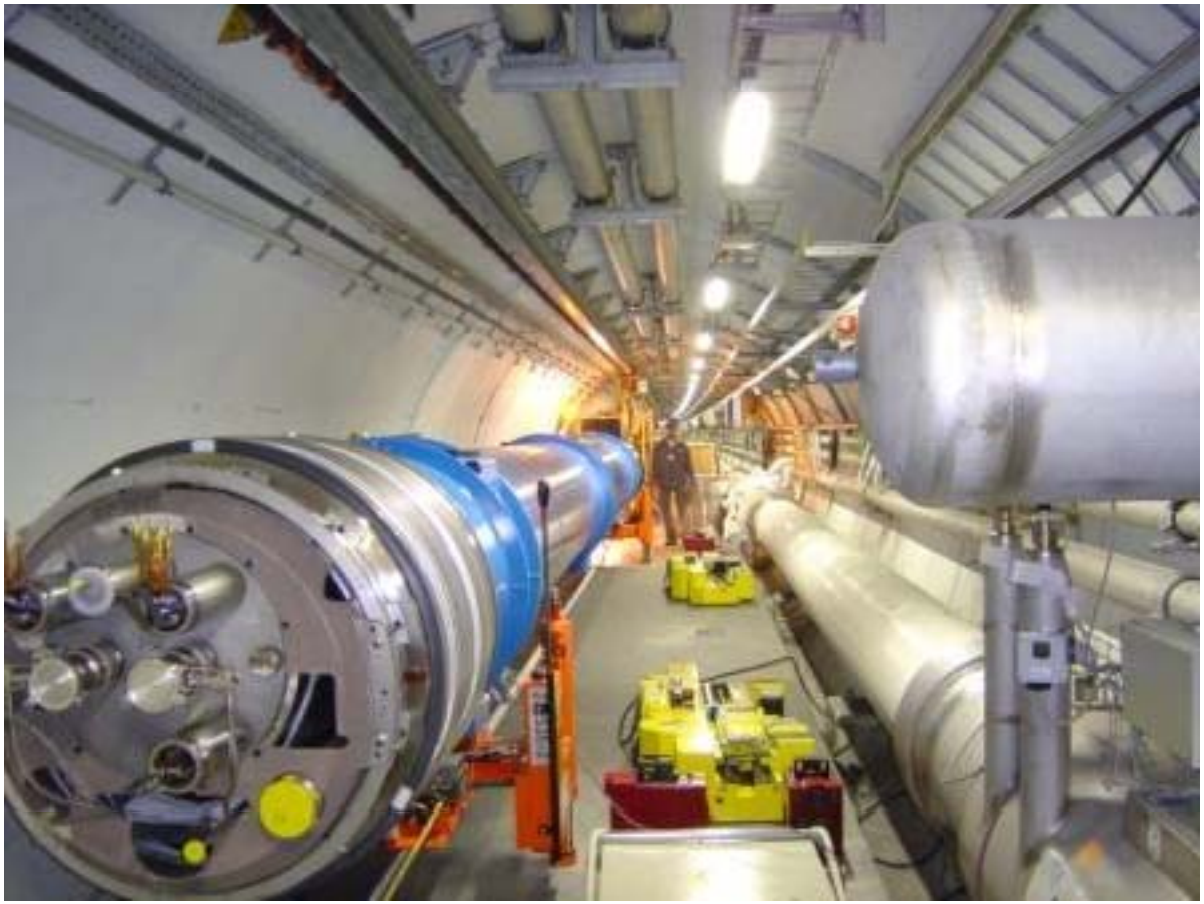

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Install transfer tables

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Withdraw unloading equipment

Measure positions

Transfer onto supports

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Re-connect convoy

Go to get the next one

LHC Collimator transport and installation – trailer-crane

Prepare to unload

Transfer onto supports (conical guides)

LEP monorail (guidance and power from overhead rail)

Information needed for transport

- Dimensions
- Weight
- Support points
- Lift points
- Maximum accelerations (and frequencies)
- Number to be transported and installed
- Support interfaces
- Interconnection details
- Position in tunnel cross section and space around
- Time available for transport and installation

Integration issues

- Space for transport , unloading and transfer
  - With guidance error margin
  - Allow co-activity (passage next to transport zone)
- Space for power rail
- Space for loading lowered items
- Consider logistics (parking and passing places)
- Integration should include space for removal

Transport integration into design

Try to integrate transport and handling design issues into equipment and infrastructure design at an early stage.

Any questions?