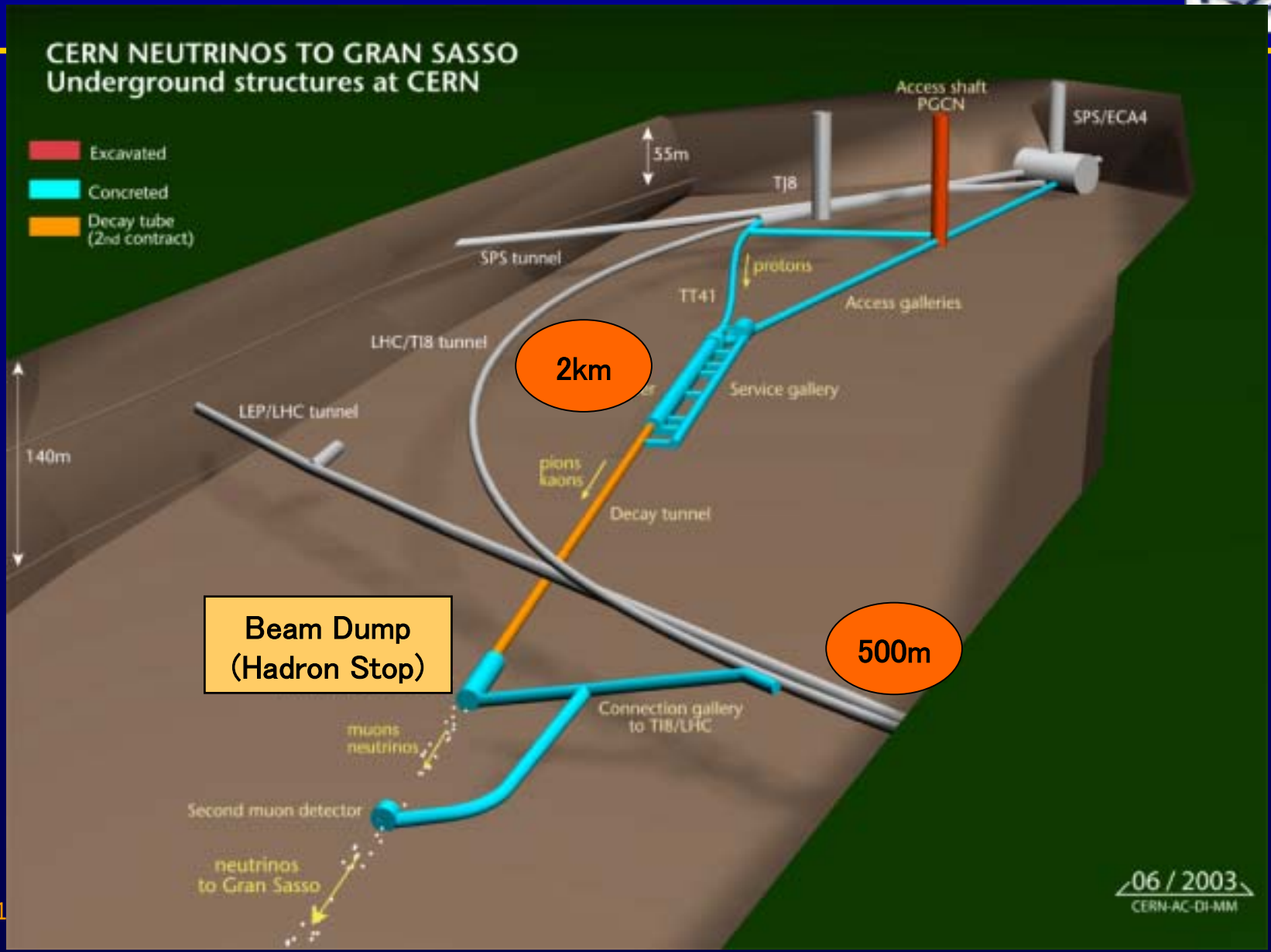
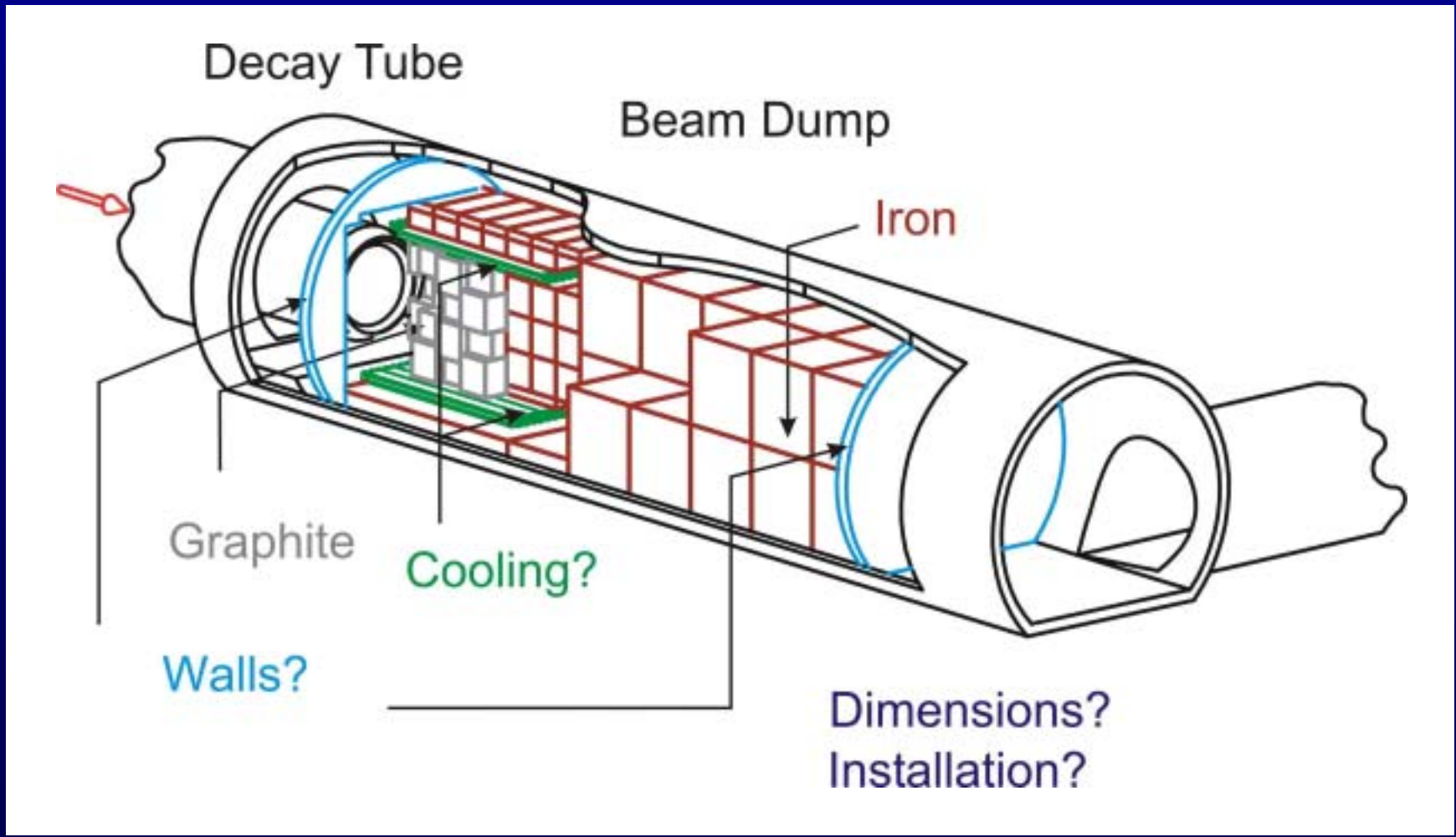
Beam Dump & Cooling

- Introduction
  (Location, Access & Driving Parameter)
- Components
  (Graphite, Iron, Aluminium)
- Cooling System
- Layout
- Installation

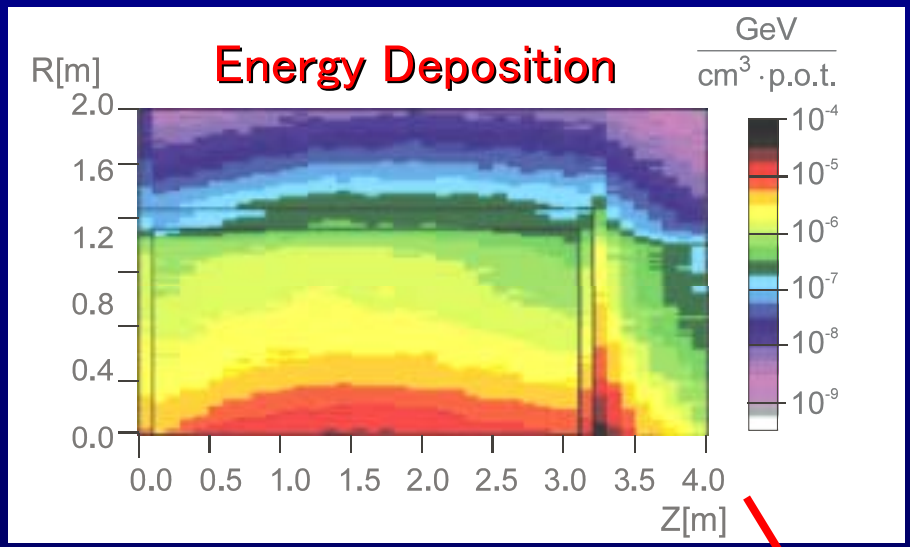
Location & Access



First Design



Driving Parameter



Choice Materials

Graphite, Iron, Aluminium,

Constraints:

Aluminium: T < 150°C

Graphite: T < 400°C …

Thermal FE-Calculations

For ultimate load case*, model with air gaps**:

Need for

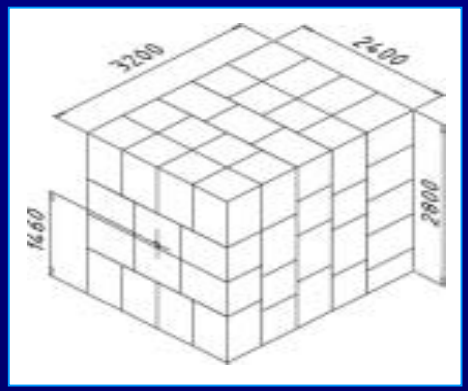
2 cooling plates of 50kW each

* 13.8 x10^{19} p.o.t./yr

**4/2/0.5mm gaps

Graphite & Iron

Graphite core



graphite
Thermal conductivity:~160 W/(mK)
Tolerances: ± 0.5 mm
Good surface quality

Iron dump

cast iron
~400 blocks = ~1825 tons
Mostly recuperated (WANF)

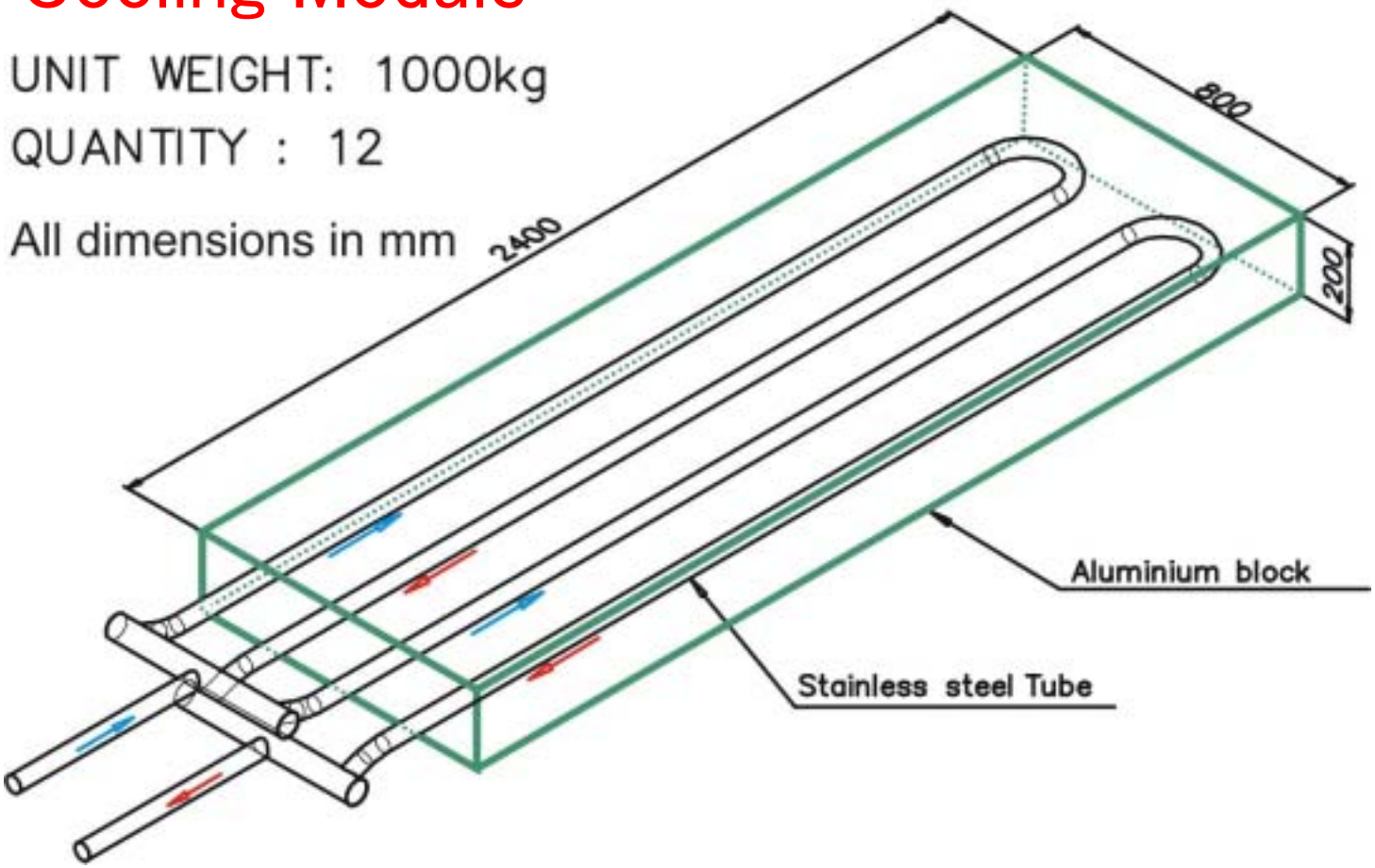
Cooling System

Cooling Module

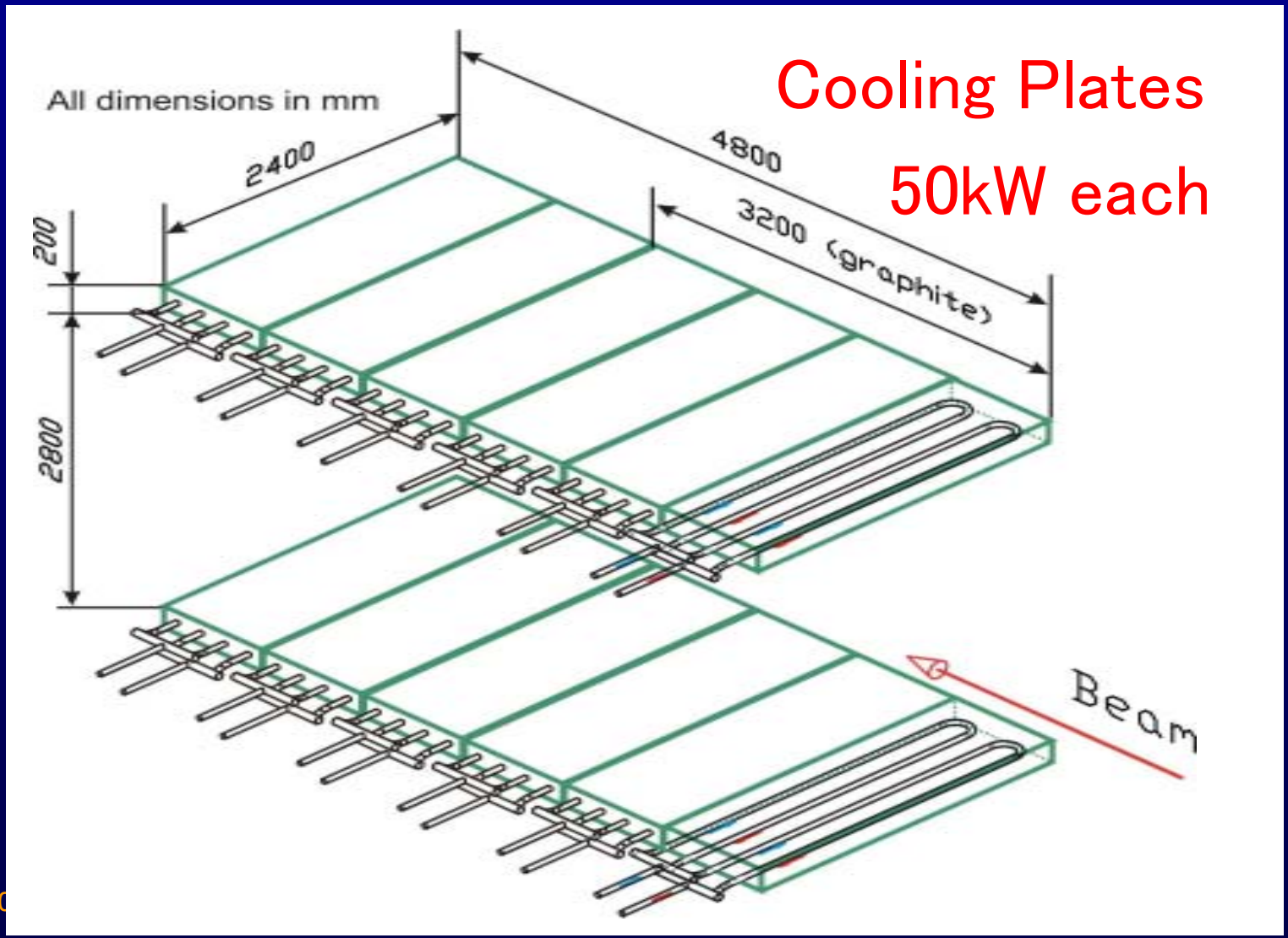
UNIT WEIGHT: 1000kg

QUANTITY : 12

All dimensions in mm



Cooling System



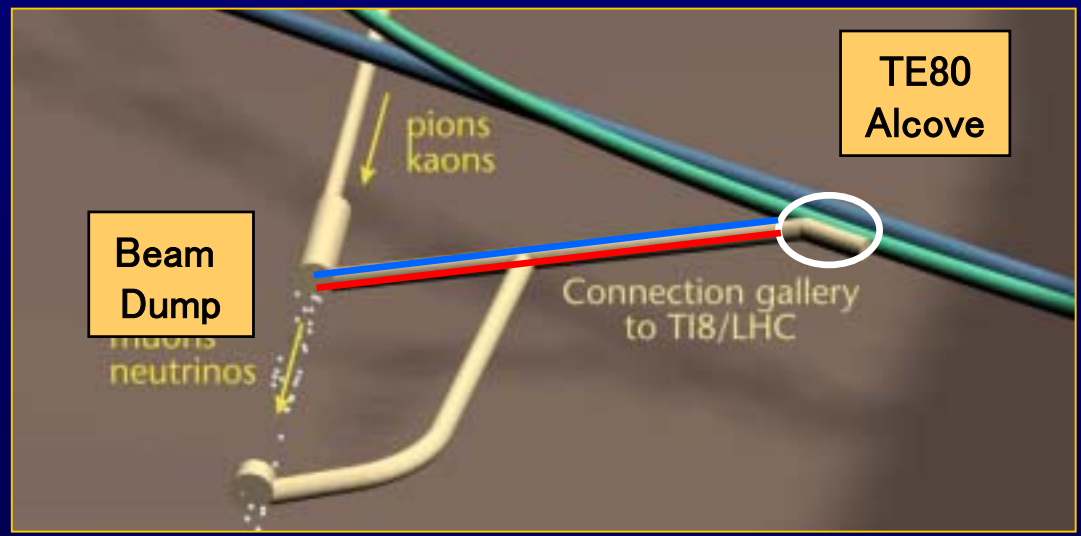
Cooling Plates

50kW each

Cooling System

Primary Heat Exchanger:

Easy access,
Regular maintenance



Cooling System

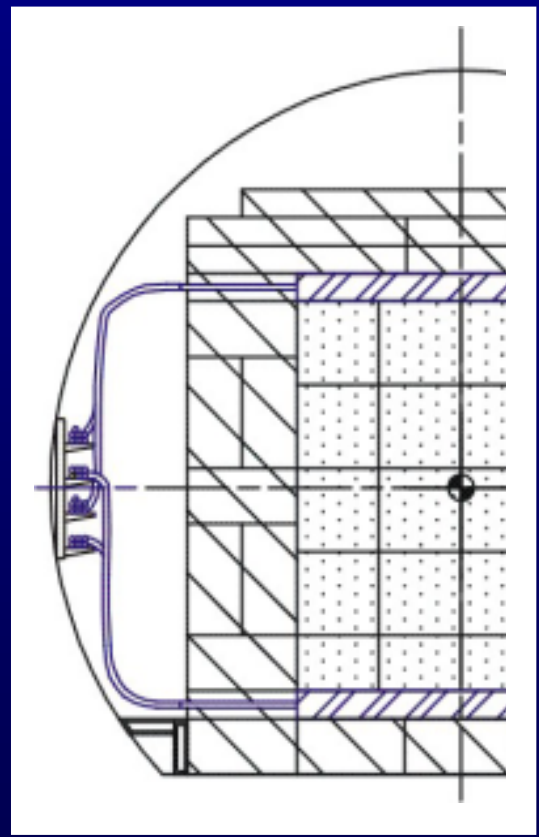
Connections to TE80 (Heat Exchanger)

- Lateral connections → Accessibility
- 2x6 independent circuits → Reliability
- Flexible tubes (metallic) in Beam Dump

  → Work in the tunnel minimized

  → Absorption of vibrations,

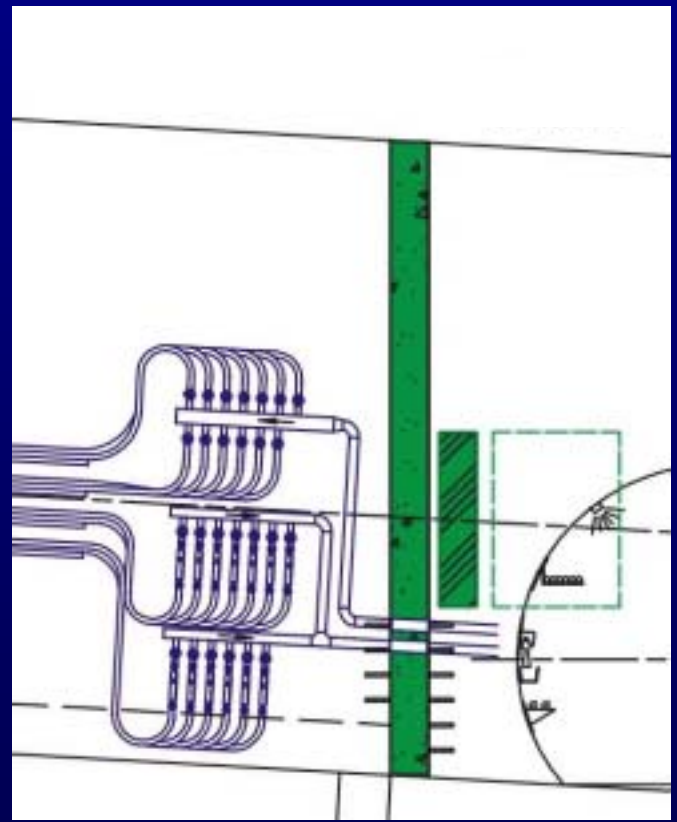
  thermal dilations
- Purely metallic connections
- 2 tubes to TE80



Cooling System

Manifold: Valves & Flow-meters Operation

- Monitoring of circuit (TE80)
- If pressure drop
  - → Signal detected (TE80)
  - → As soon as access possible:
    Visual inspection of
    flow indicators in Beam Dump
    to locate faulty circuit
  - → Close circuit
- Repair
  (when/if access Beam Dump possible)

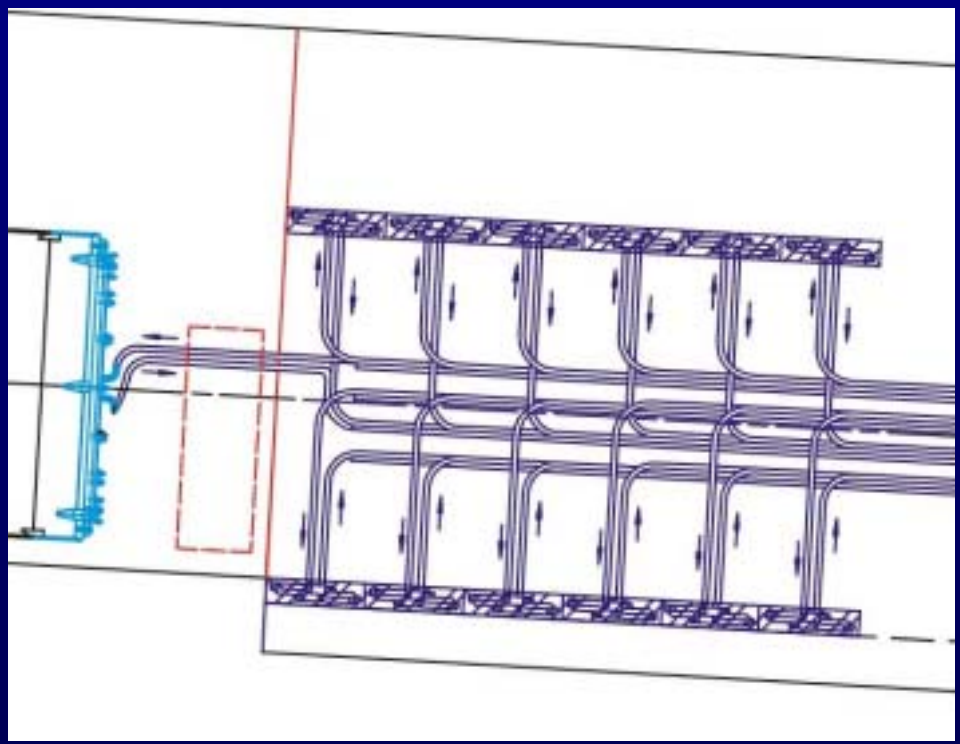


Cooling System

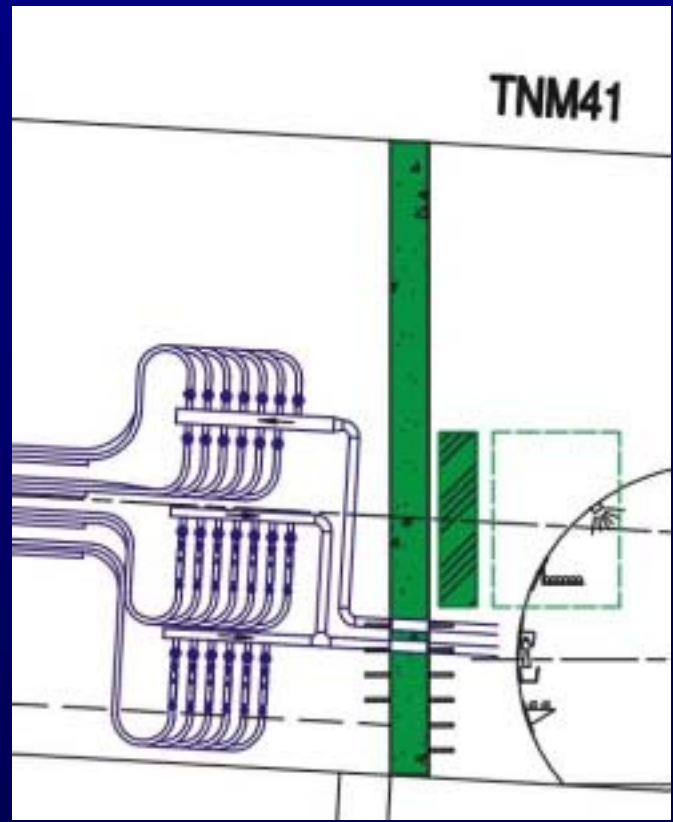
12 Aluminum Cooling Modules

26 Manual Valves,
13 Visual Flow Meters

2 Flexible Tubes from Exit Window



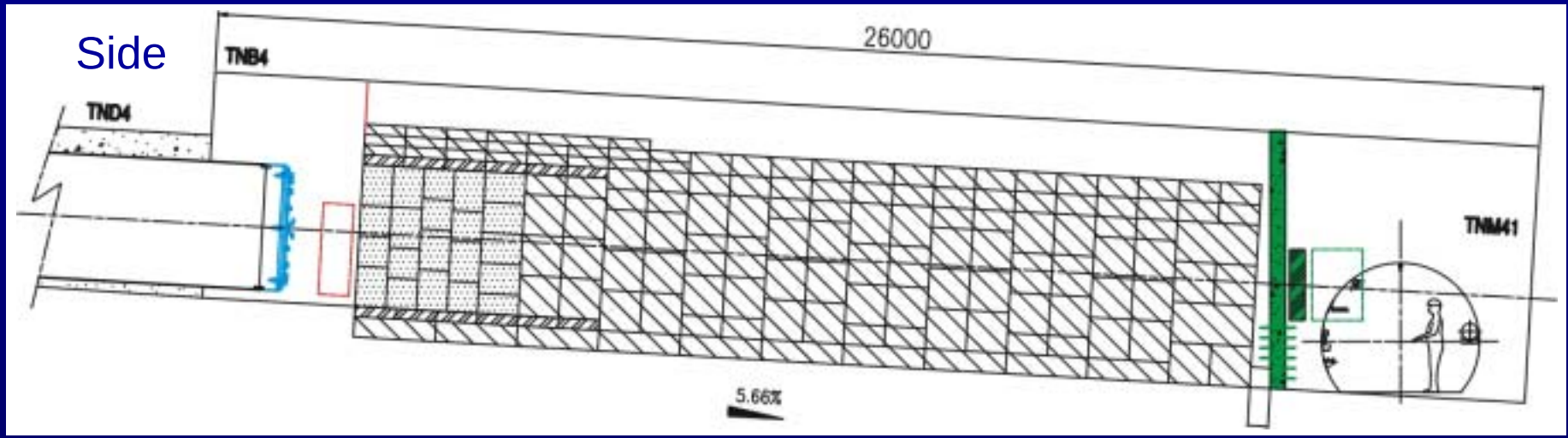
26 Flexible Tubes

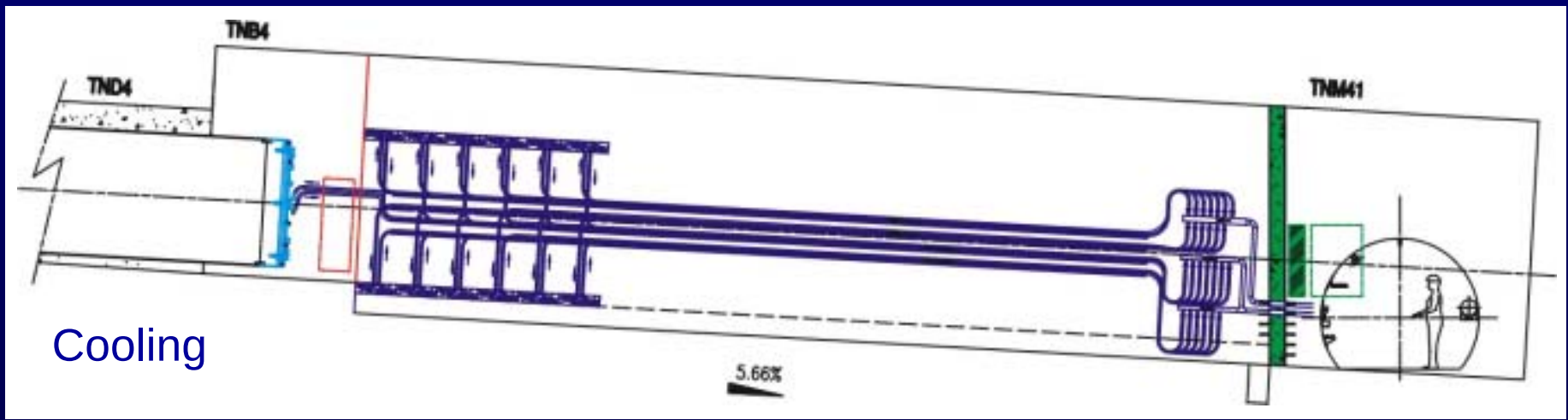


2 Tubes to TE80

Layout

Side

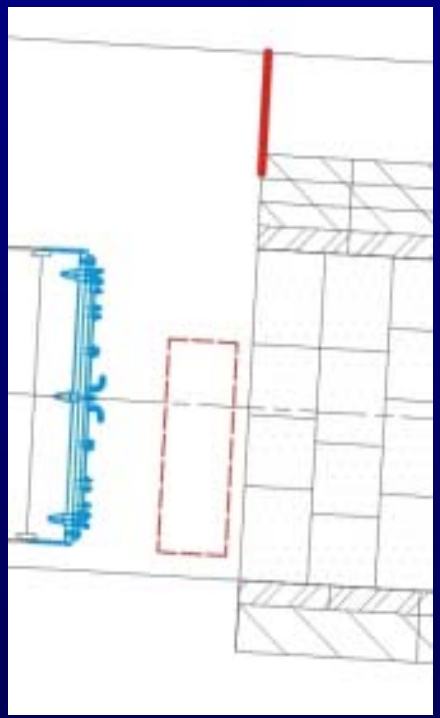




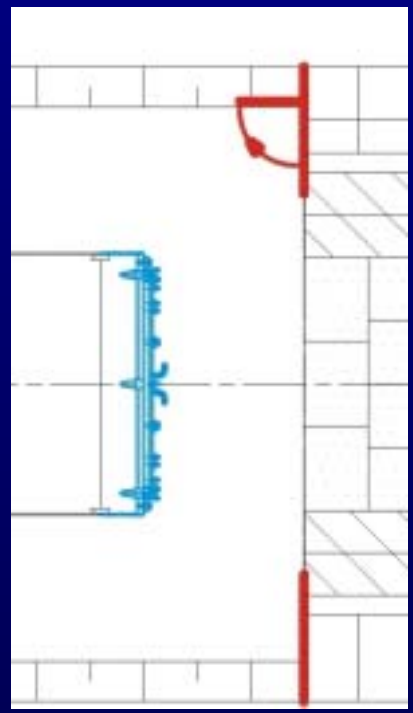
Cooling

Upstream Wall

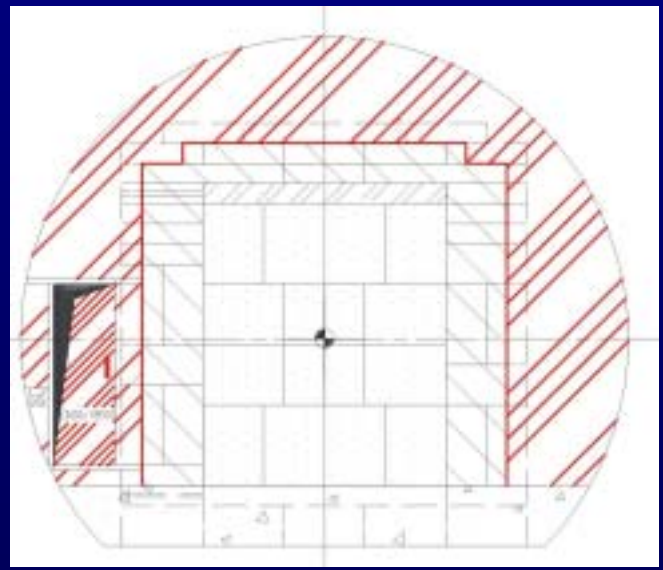
Air separation & Door → 1mm stainless steel sheet



Side



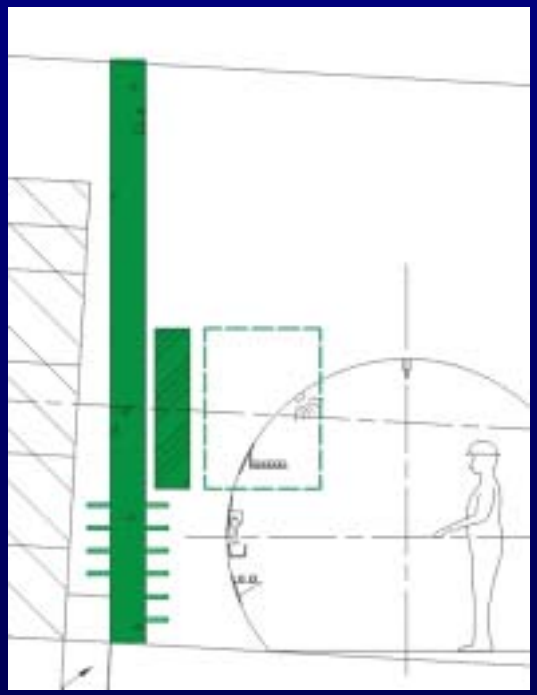
Top



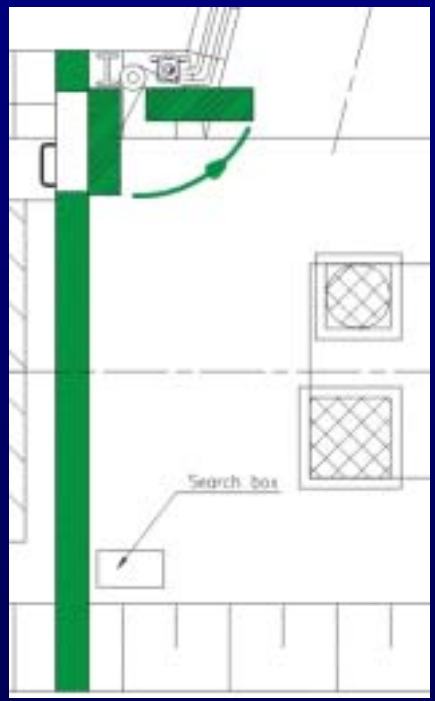
Front

Downstream Wall

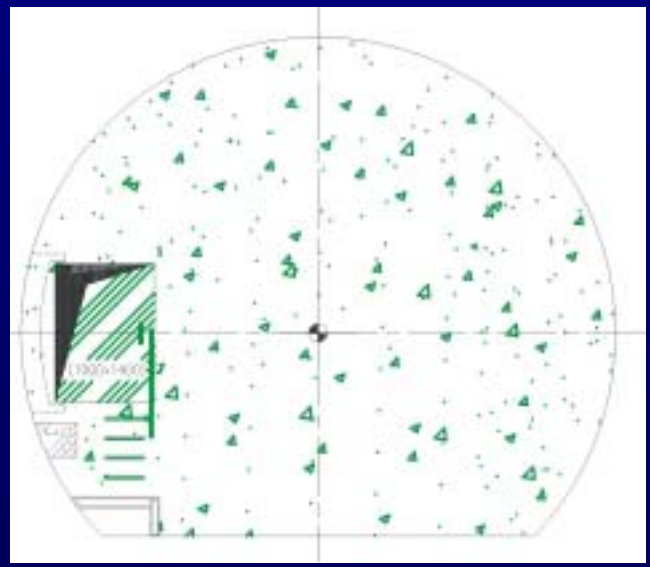
Air separation, Radioprotection & Door→ 300mm concrete wall



Side



Top

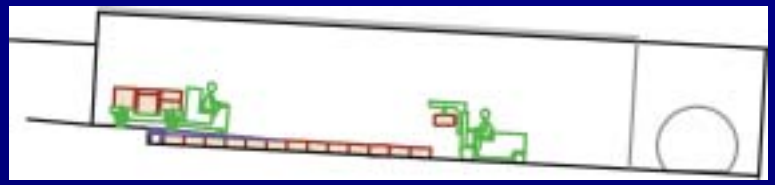


Front

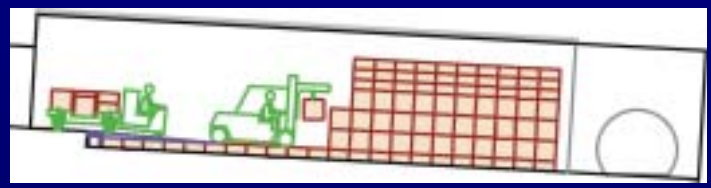

1875 tons, ~500 blocks
Installed between
15/07 - 01/09/2003

Installation

- Installation Sequence



Phase 1: Preparation & Iron “floor”



Phase 2: Iron Blocks

Phase 3: Iron and Aluminium (1,2)

Phase 4: Graphite (1-5), Aluminium (3-6) and Iron

Installation

Installation

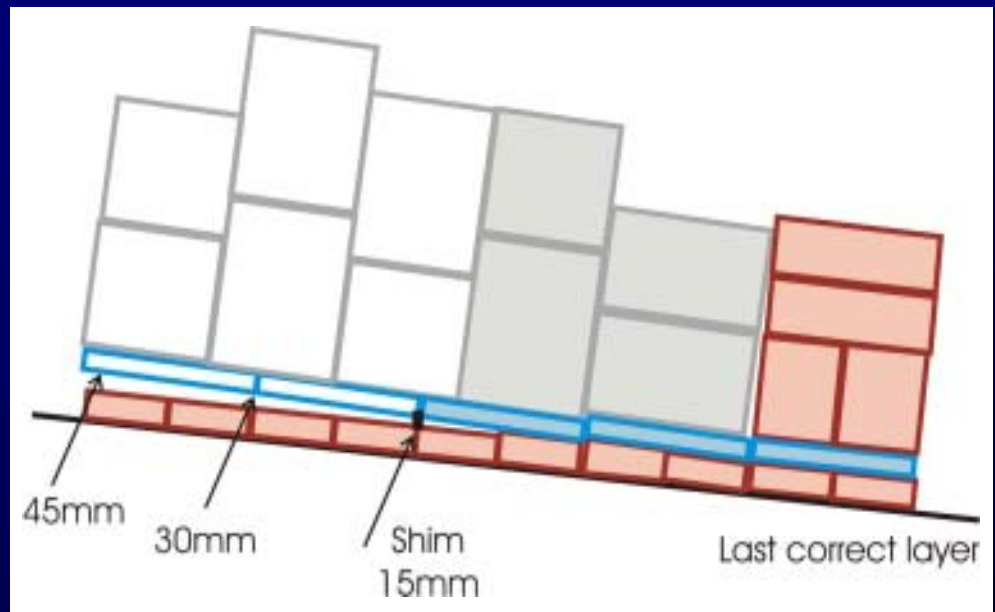
Problem (encountered during phase 4)

Observed:

Shims!

Measured:

Slope of Aluminium blocks (3,4) ~7.5%
(tunnel=5.6%)



Installation

Solution

1. Measure topology of iron “floor”
2. Calculate shim thicknesses to simulate “good slope”
3. Place shims
4. Place aluminium modules until smooth surface at 5.7%

(extra time needed: ~3 days)

Installation