



What do we have to transport/install?

In Linac tunnel (XTL) after the floor is installed:

- Floor plates
- Cable trays
- Water/Air/Helium pipes
- Cables
- Mounts for modules (240)
- Modules (4 + 116)
- Waveguide distribution (4 + 116)
- Mounts for string connection box (22)
- String connection box (11)
- Mounts for String end box (4)
- String end box (4)
- Mounts nc. Magnets
- Nc. Magnets
- Beam pipes
- Klystrons (29)
- Pulse Transformer (29)
- Matching network (29)
- Wave guide interface (29)
- Electronic racks (a lot)
- Rack shielding (a lot)
- Different small parts
- **And the forgotten things!**



What do we have to transport/install?

In the Undulator/Photon tunnels (XTDn):

- Cable trays
- Water/Air pipes
- Cables
- Undulators (119)
- Supports in-between Undulators (~119)
- Magnets/monitors etc. in-between Undulators
- Nc. Magnets
- Supports for Nc. Magnets
- Beam pipes
- Electronic racks
- Dumps
- Shielding
- Support for photon optics
- Photon optics
- Different small parts

What is missing?



How to transport and install all this?

1. Standard Vehicles

- Fork lift
- Tractors with trailers or wheels attached to the components
- **BUT space is limited.**
- How to get the (heavy) load from the walk way to the final position in a controlled way?
- Especially if this needs to be done very accurately and/or very often or "fast".

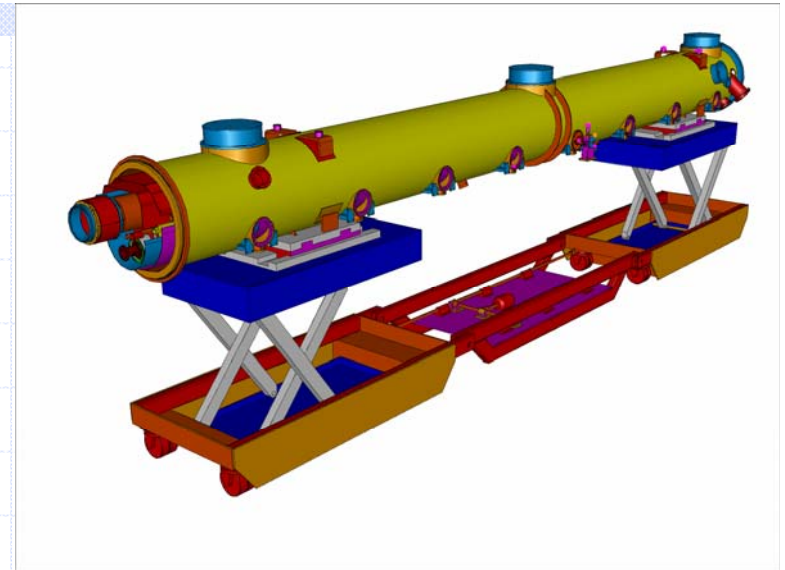
2. Special vehicles

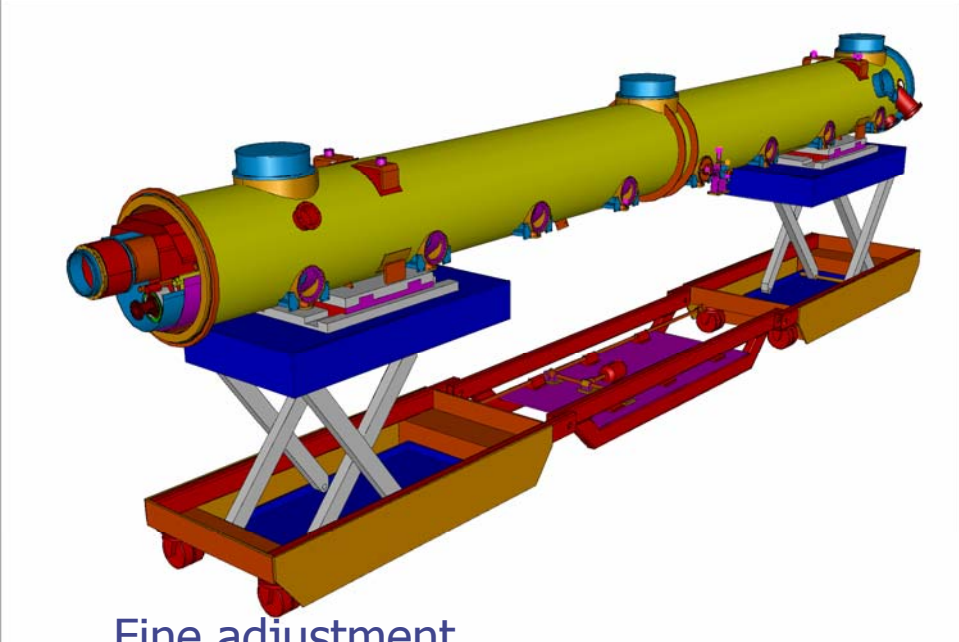
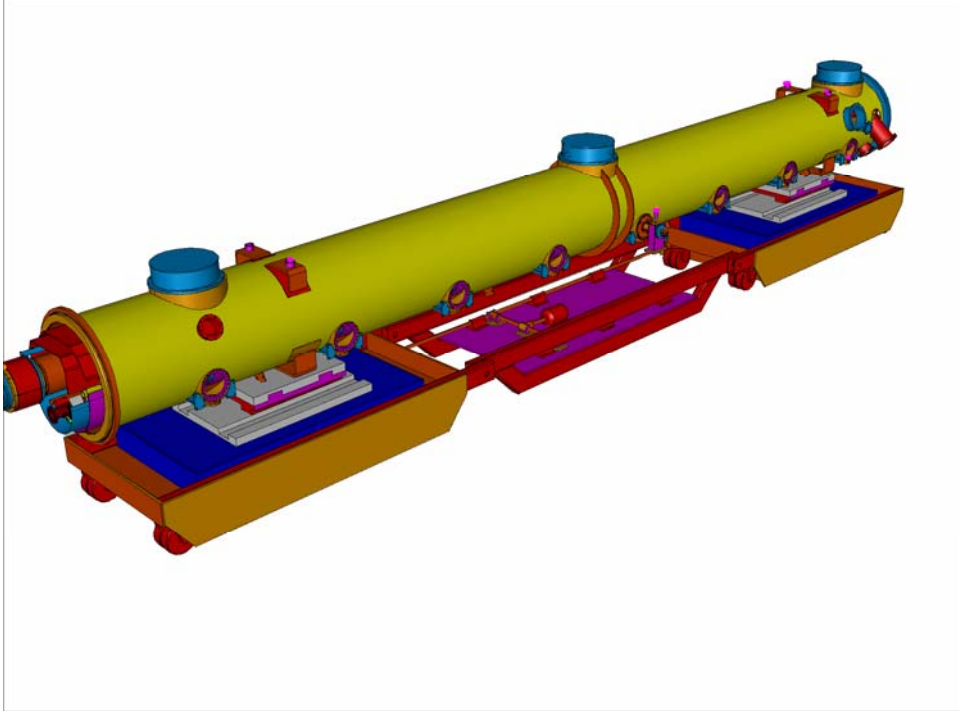
- A lot of possibilities!
- Nearly everybody has ideas and feeling about it.
- **We developed a first concept, then we look at CERN, talked to possible vendors, revisited the concept and wrote a specification.**

Module transport system

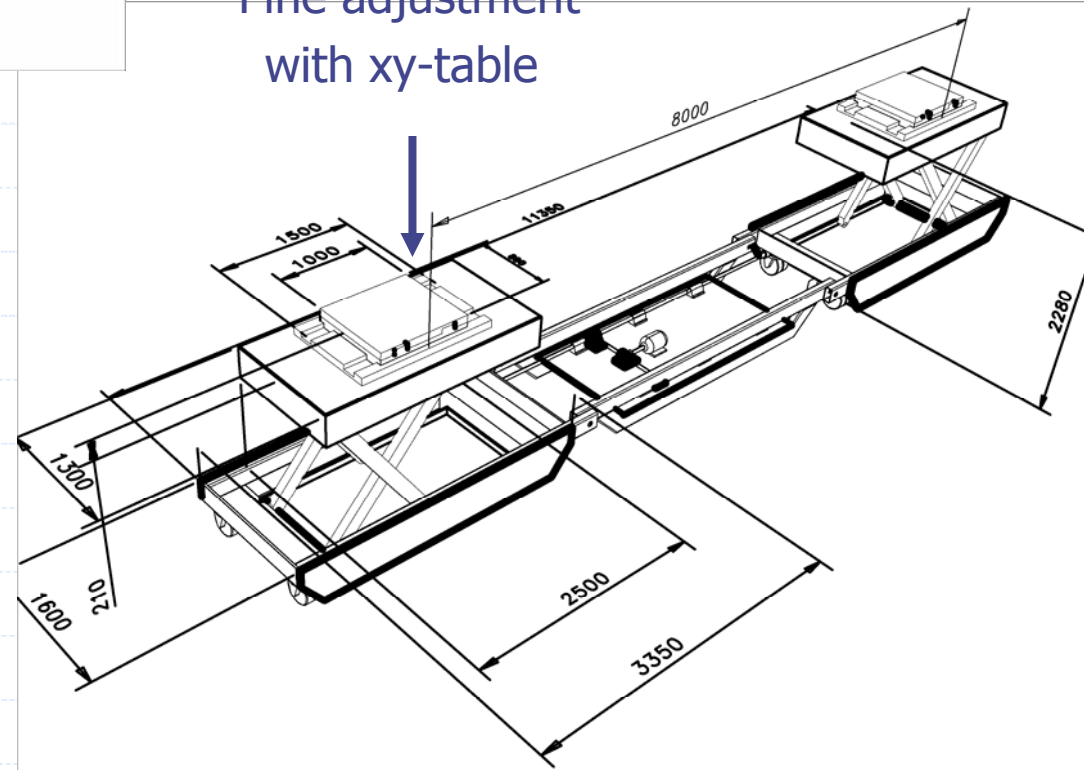
We started with then biggest component.
Suggestion/assumptions:

- ◆ Vehicle does transport and installation (like the HERA tram, the "dwarslöper" or the "boogies" at CERN)
- ◆ To lift 10t about 1m scissor lift tables are the only reasonable compact solution ($\geq 2,5\text{m} \times 1\text{m} \times 41\text{cm}$ (h)).
(Pure hydraulic cylinder can not take transverse forces!)
- ◆ There is no space to lift the module in the walk way position and 'roll' it over to the installation position!
- ➔ Vehicle transports the module to the installation place, turns its wheels by 90° and moves under the final position and lifts it up.
- ➔ Holes in the floor plates are not allowed at the wheel positions!
- ➔ To exchange a module later on the installation below has to be dismantle. In the worst case this will be a hole RF-station or other complicated stuff!





Fine adjustment
with xy-table



Module transport system (0.Version)

At CERN

"Mafis" (LHC cryo magnet vehicles)

- Operator unit
- + Short trailer
- + Operator unit



Long trailer



Long sc. Magnets

L: 16.3m; weight: 34t



At CERN

"Mafis" (LHC cryo magnet vehicles)

- ◆ "Only" transport
 - Unloading with "unloading equipment"
 - Installation with "transfer equipment set"
- ◆ Small cross section (h: 50cm; w: 1m; long)
- ◆ Hydraulic motors
- ◆ Overhead power rail/ No batteries
- ◆ Optical guidance (white line) (SLOW; Main trouble maker; but very flexible)
- ◆ Hydraulic suspension
- ◆ Trailer is less rigid than the magnet



At CERN “Boogies” (transfer line vehicles)

- ◆ Transport and installation
(Small lifting capacity with added compressed air cushions)
- ◆ Compact (h: 55cm; w/l: 1m)
- ◆ 9t load capacity each
- ◆ Up to four boogies can be coupled together
- ◆ Overhead power rail + Backup battery (~4h)
- ◆ Optical guidance
- ◆ NO suspension!



Boogie concept

- ◆ Electric motors
 - “It is hard to maintain hydraulic system over 20 year”
- ◆ Three wheels
 - Two driven and steered (3,5t)
 - One castor (2t)
 - Can move sideways

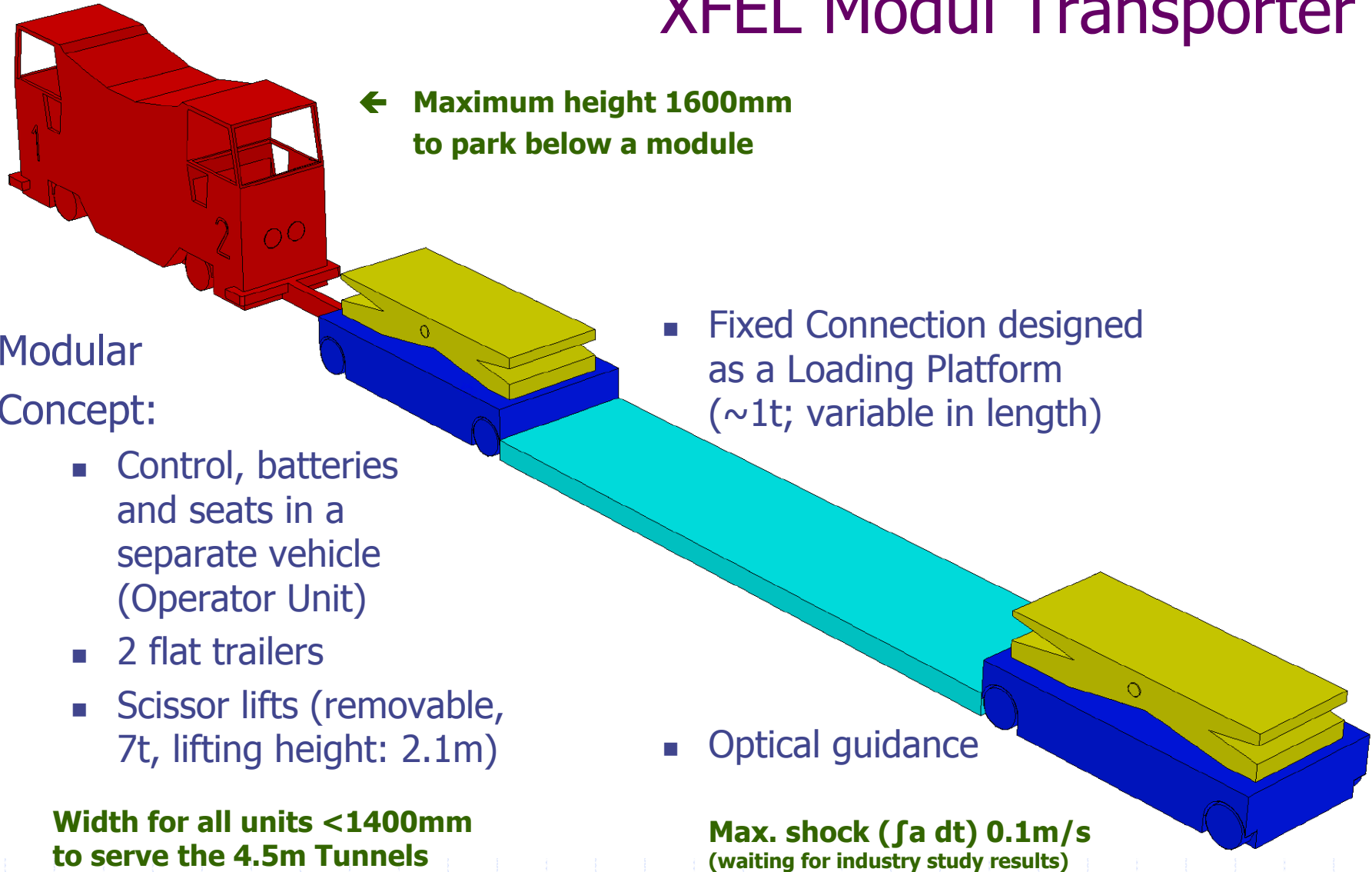


Boogie concept

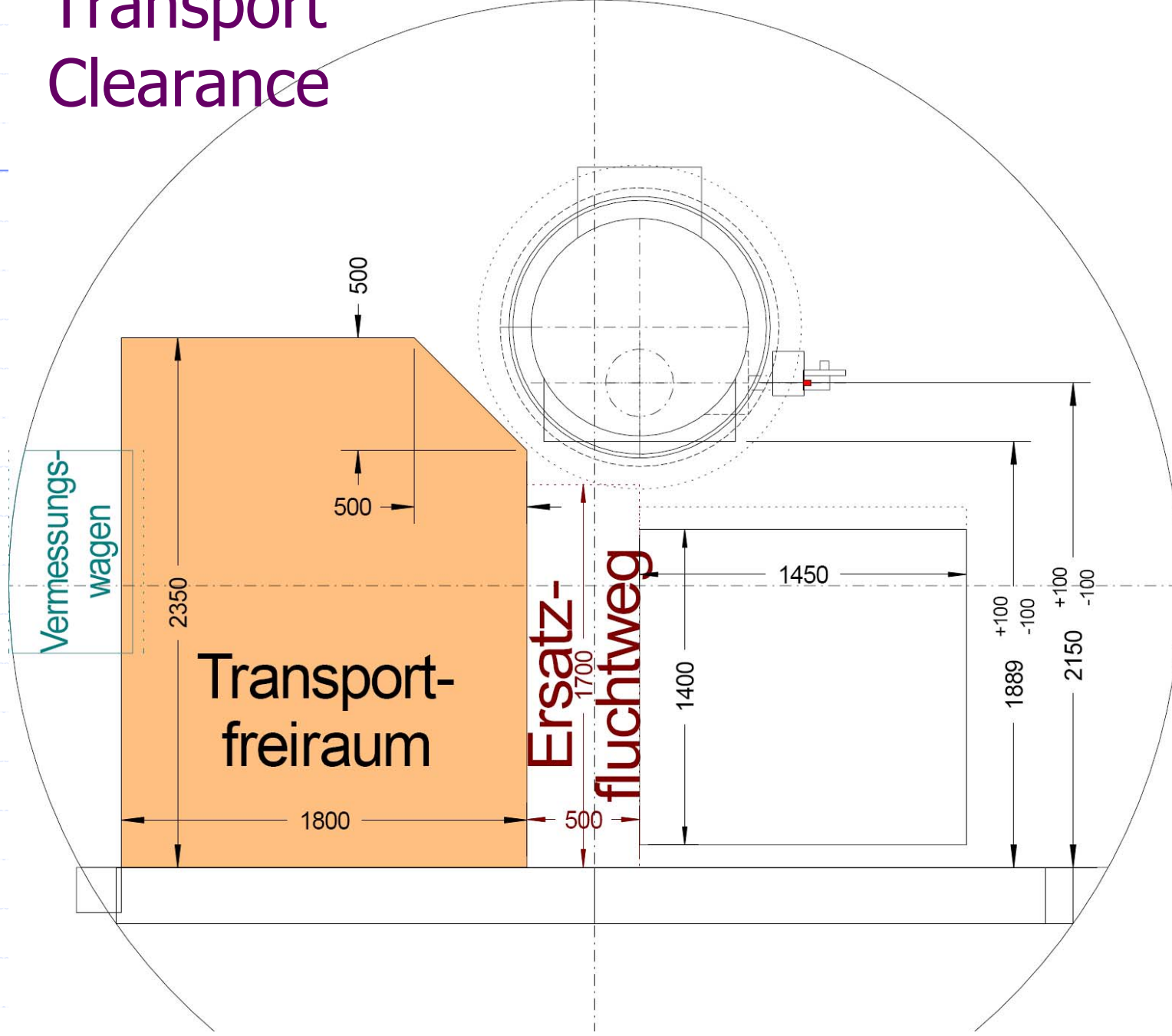
- ◆ Operator unit with batteries and control system (l: 4,5m; w: 0.95m)
- ◆ Crane can be added



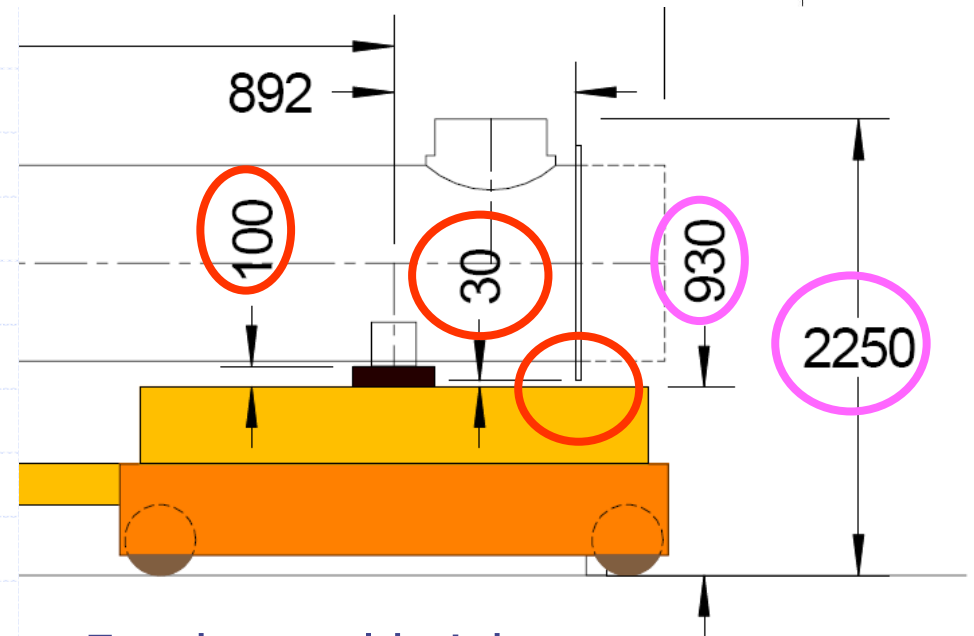
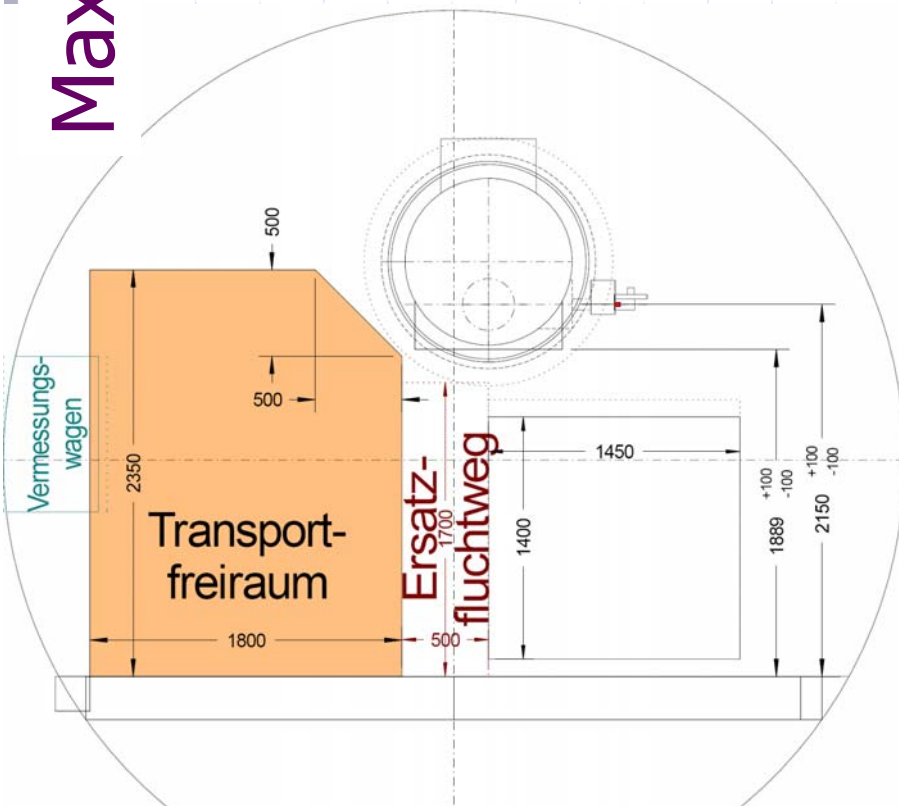
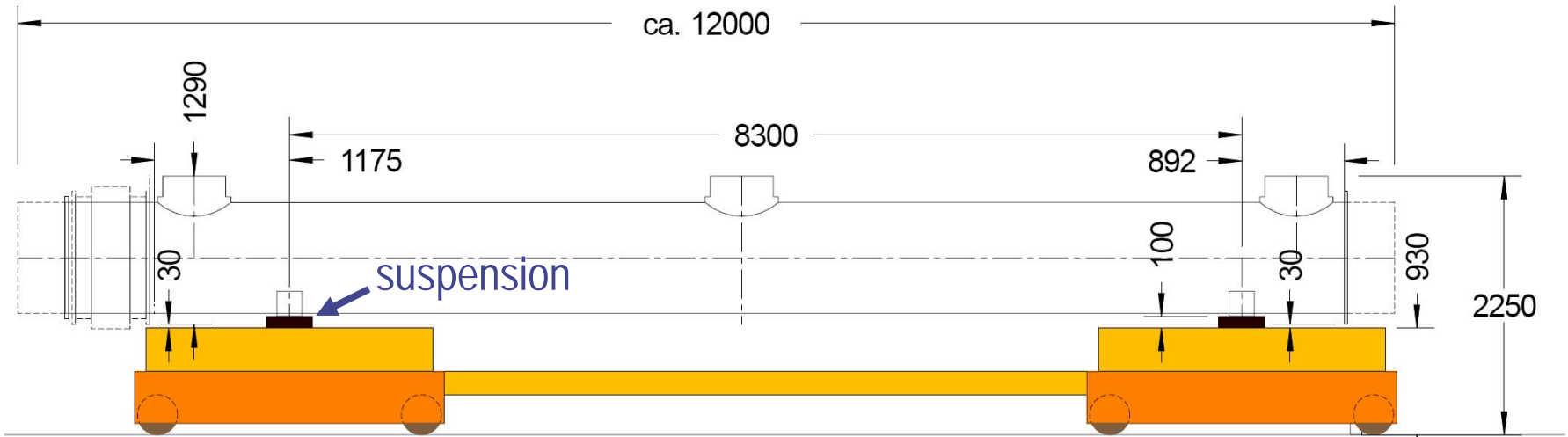
XFEL Modul Transporter



Transport Clearance

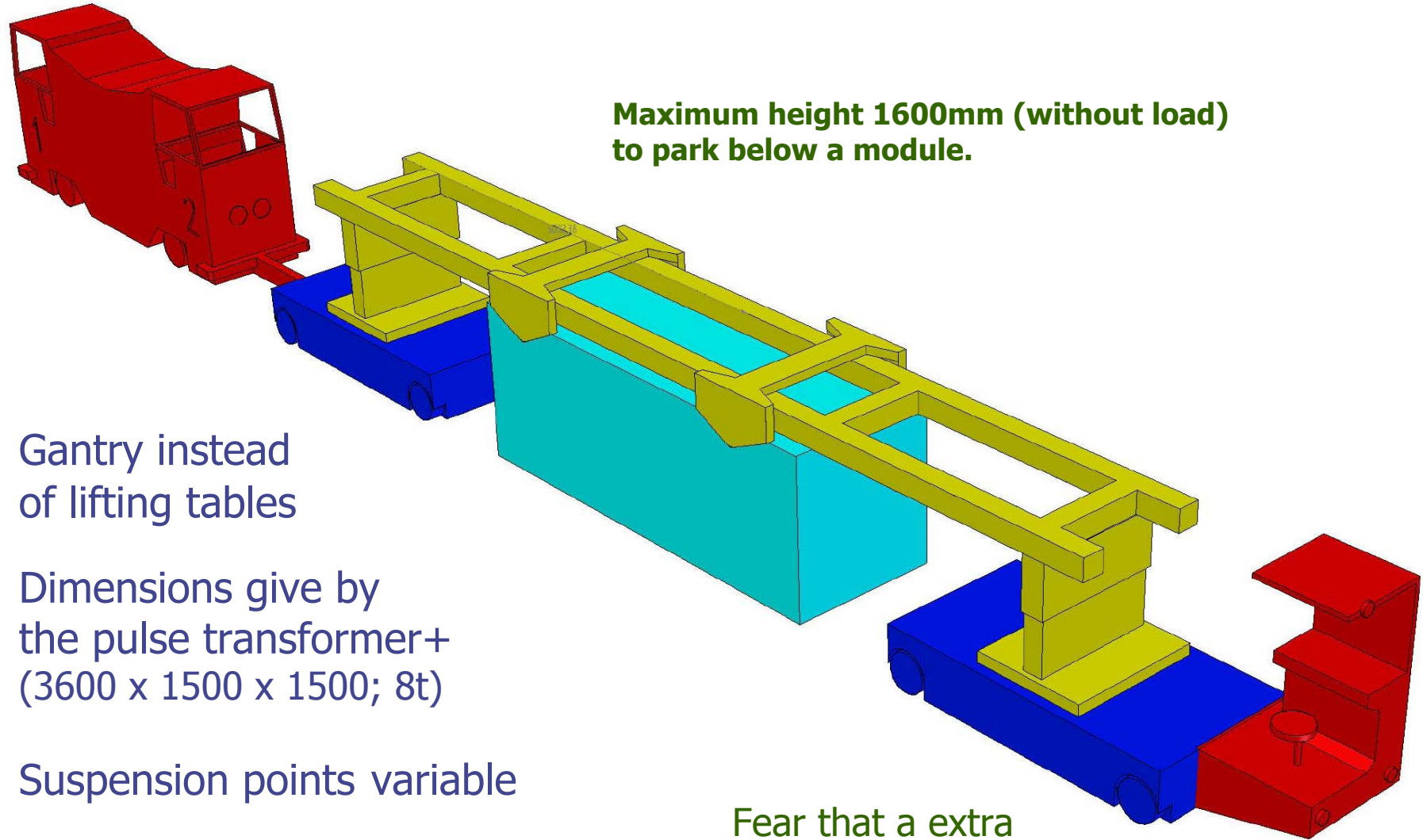


Maximum Height



For the total height
+50mm allowed!

Container Transporter



**Maximum height 1600mm (without load)
to park below a module.**

Gantry instead
of lifting tables

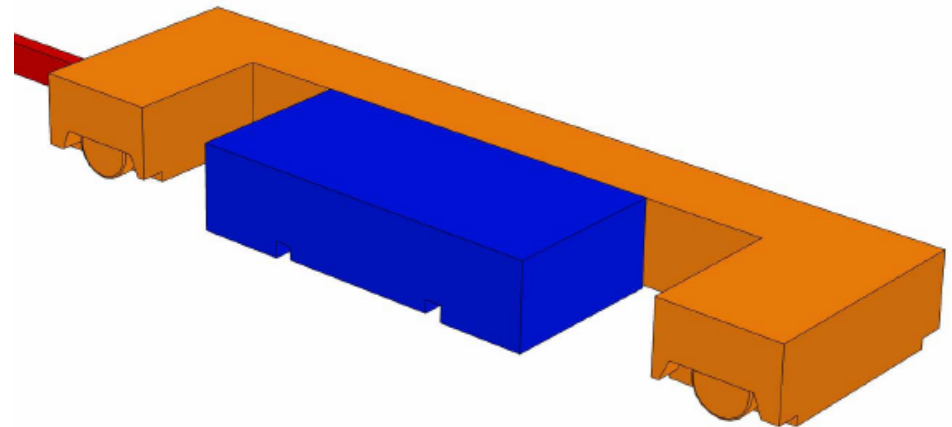
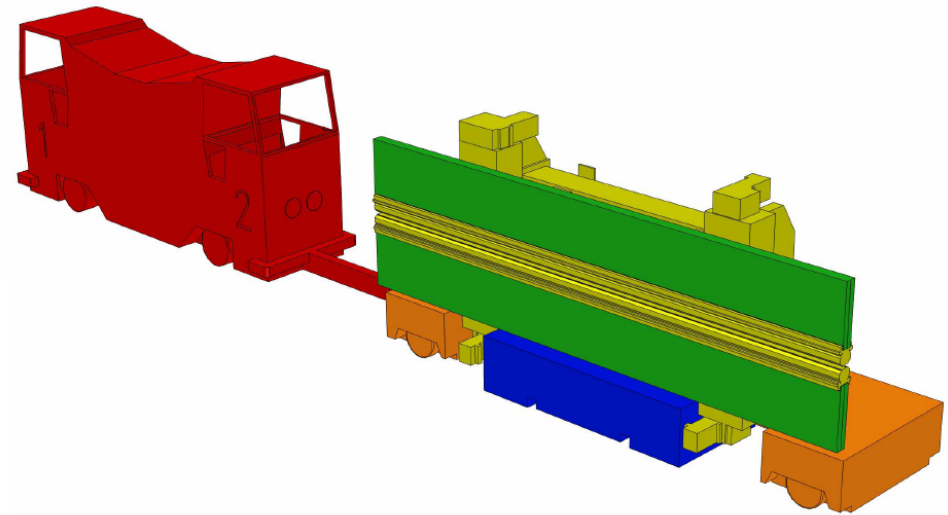
Dimensions give by
the pulse transformer+
(3600 x 1500 x 1500; 8t)

Suspension points variable

Fear that a extra
rear seat is needed!

Undulator Trailer

- ◆ Supplied and controlled by the operator unit
- ◆ Wheels for transport
- ◆ Air cushions in unloading device (in blue)
- ◆ Design included
- ◆ Construction optional



Summary

- ◆ Need 1. vehicle for the mock-up tunnel
- ◆ Concept has been revised and is ready
- ◆ Call for tender has been published yesterday
 - Order can be place in spring 2007
 - Last changes can be feed in before design
 - Delivery Fall 2007

Order with Options

2 Lieferumfang

2.1 Erstbestellung

Die Erstbestellung umfasst:

- 1 Steuer/Energiefahrzeug
- 2 Plattformwagen mit Hubtischen
- 1 längenveränderliche Verbindungsplattform
- 1 kurzer Verbindungsträger
- 1 15m Verlängerungskabel für die Verbindung vom Steuer/Energiefahrzeug zum Plattformwagen
- 1 Lastbrücke
- Konstruktion eines Undulatortransportwagen mit Abladeeinrichtung inklusive der Vorbereitung der Steuerung und falls nötig des Steuer-/Energiefahrzeugs
- Wartung der Fahrzeuge
- Optional: 1 Rückwärtiger Fahrerplatz
- Optional: Herstellung eines Undulatortransportwagen mit Abladeeinrichtung
- Optional: Ausführung der Fahrzeugsteuerung mit Siemens SPS-S7-300 oder mit einer SPS gleichwertiger Art
- Optional: Induktive statt optischer Spurführung

Der Preis soll in die verschiedenen Einheiten des Fahrzeuges aufgegliedert werden. Auch die Wartung soll als separate Position aufgeführt werden.

2.2 Nachbestellungsoption

Die Nachbestellung einzelner **Einheiten** oder eines kompletten Fahrzeuges soll möglich sein. Dabei sollen mögliche Änderungswünsche aus den Erfahrungen durch die Erprobung des Fahrzeuges im Testtunnel berücksichtigt werden.



Technische - Spezifikation

Projekt: XFEL

Komponente: Tunnelfahrzeug

Datum: 28.9.2006

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Very detailed to allow „Nebenangebote“