Baseplates and Hg System Handling

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MERIT Hg System Safety Review

CERN

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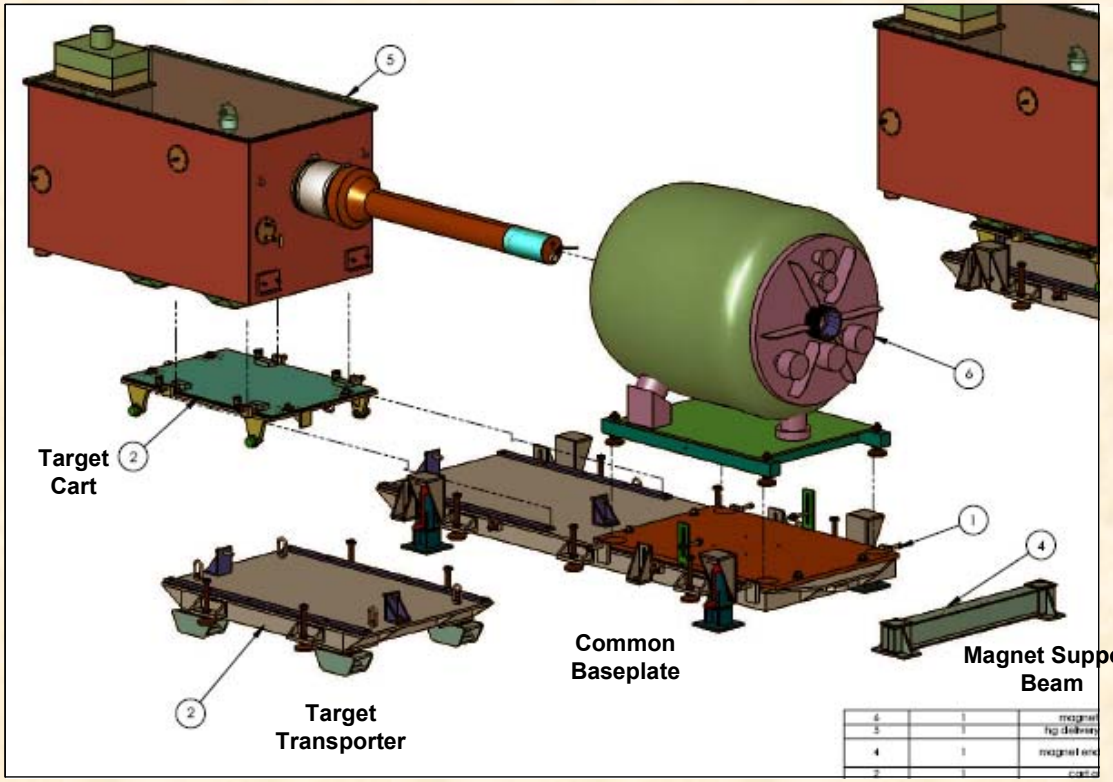
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Outline

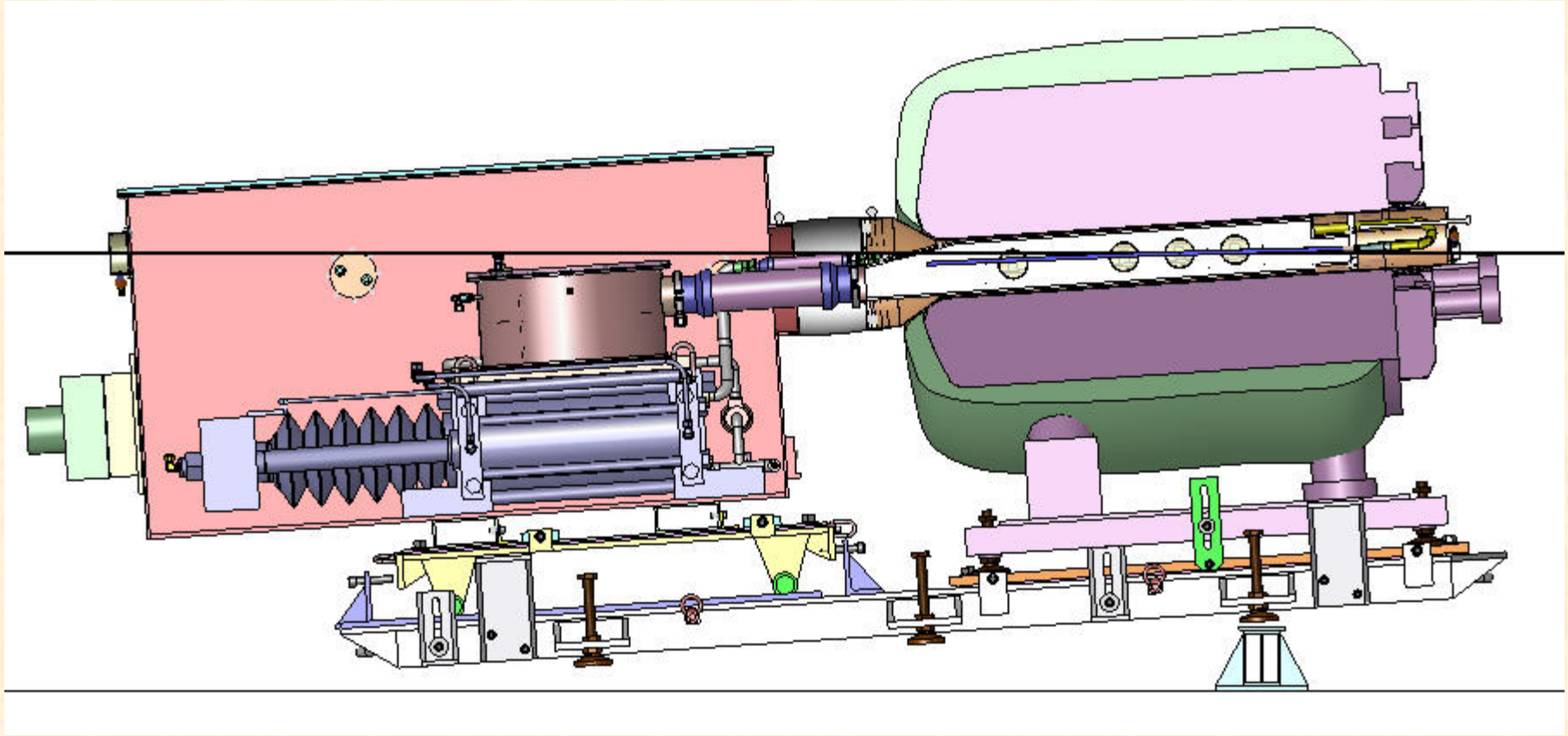
- **Baseplate descriptions**
- **Design overview**
- **Handling and installation**

Baseplates

- **Purpose – provide mobility, alignment, and structural support for experiment components**
  - **Experiment requires magnet tilt of 3.8° and elevation ~ 50cm**
- **Four structures**
  - **Common baseplate**
  - **Target transporter**
  - **Target cart**
  - **Magnet support beam**
- **Primarily fabricated from AL6061-T6**

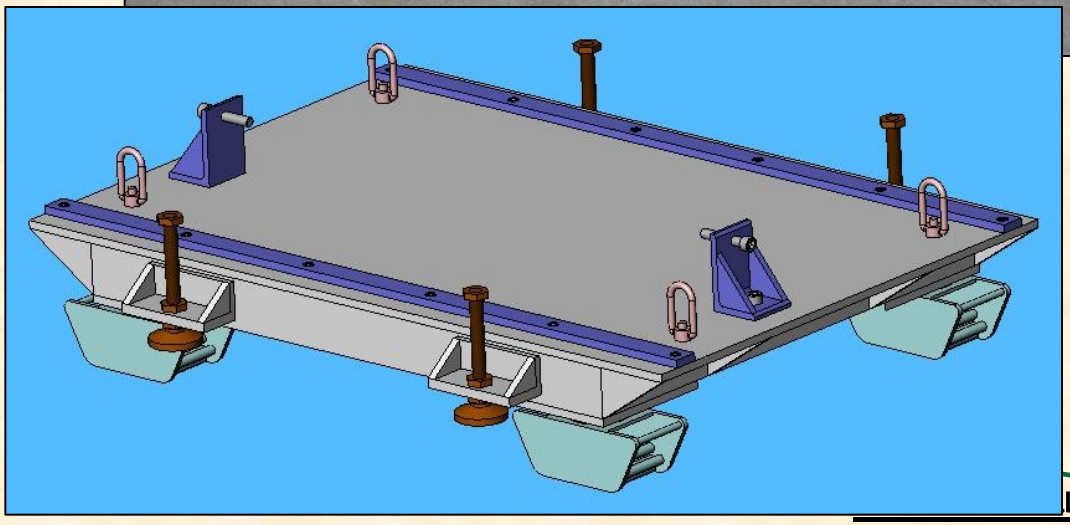


MERIT Equipment



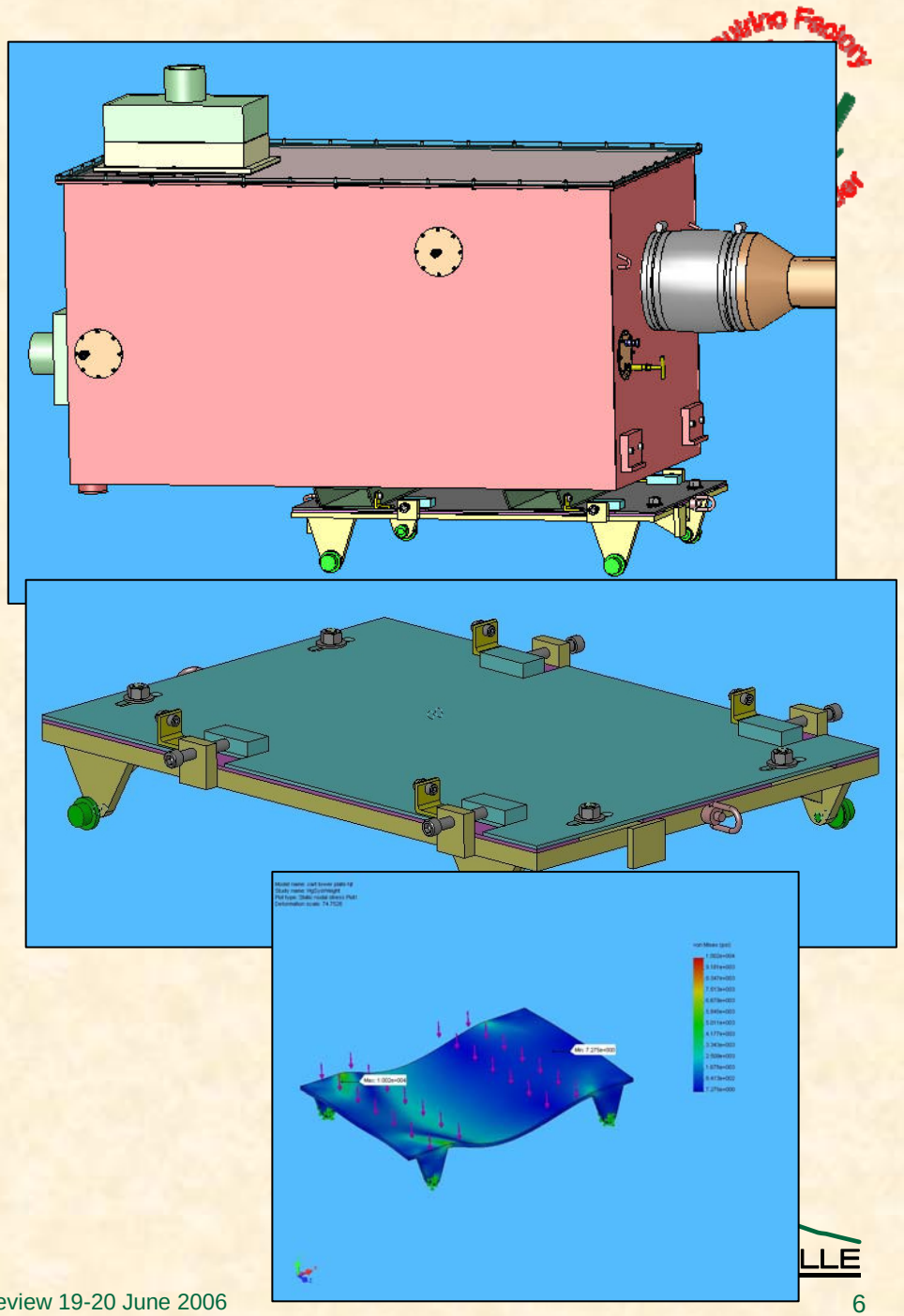
Target Transporter

- Transports target cart and Hg system inside tunnel using rollers
- Rails for target cart wheels
- Jack brackets prevent rolling
- Swivel hoist rings for lifting & cart tie-down
- Structure shares common baseplate design but is shorter & carries smaller load, so no separate analysis performed



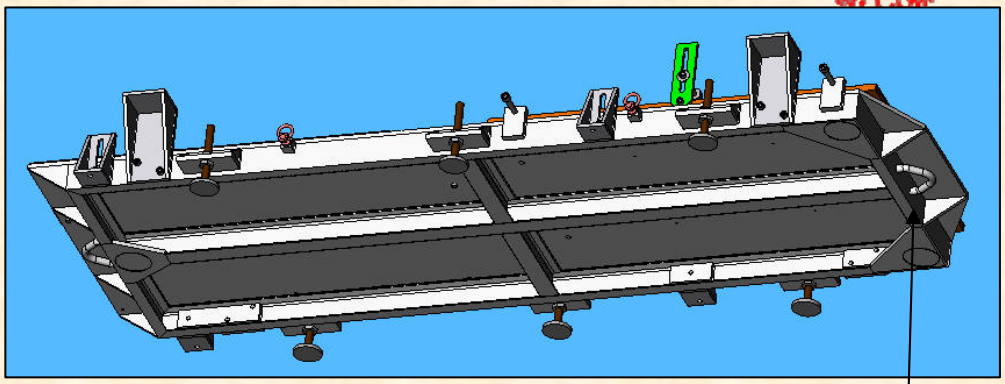
Target Cart

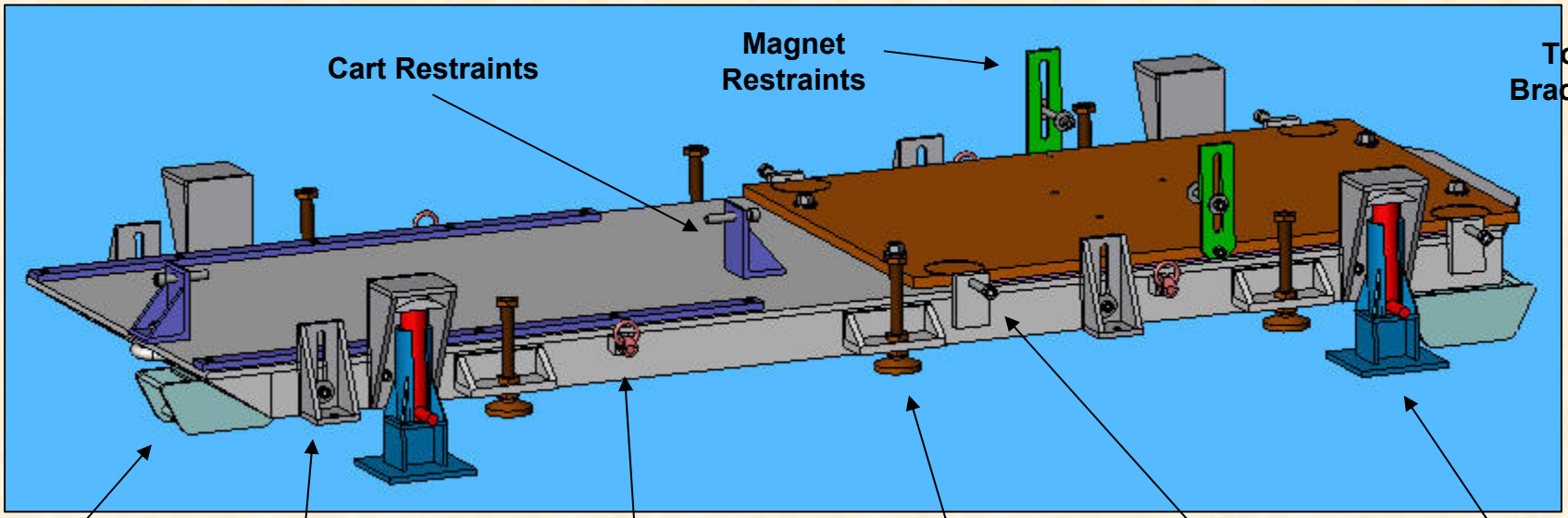
- **Supports Hg system during all phases of experiment**
- **Rollers allow transfer from transporter to common base during integration with magnet**
- **Provides lateral movement of Hg system to maintain alignment with solenoid**
- **Structural analysis performed – Appendix E**



Common Baseplate

- **Supports solenoid and Hg system during experiment**
- **Solenoid mobility platform during installation**
- **Rollers used to grossly align solenoid to beam**
- **Provides minor lateral movement of solenoid for alignment to beam**



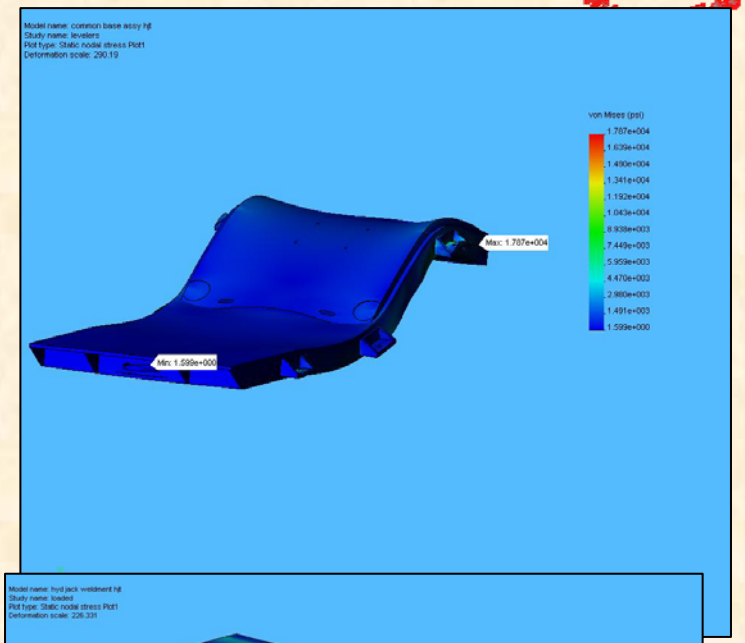


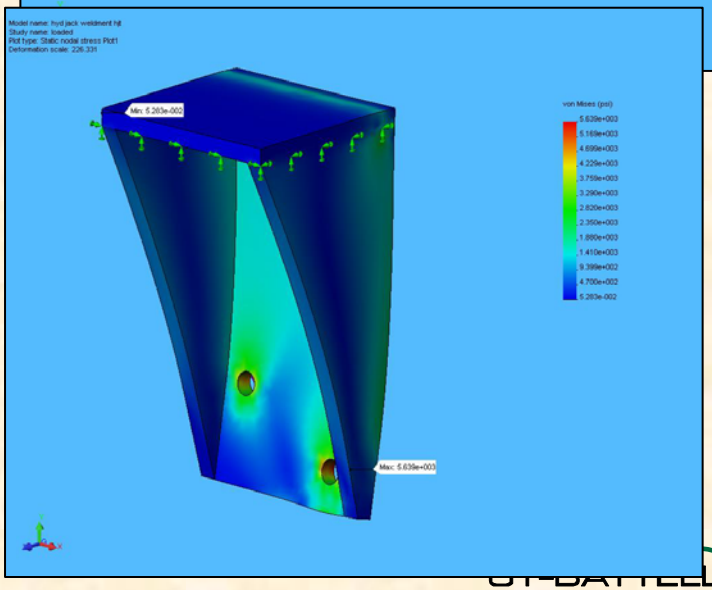
Baseplate Design Constraints & Requirements

- **Total supported weight**
  - **Solenoid: 5500 kg (12000 lbs)**
  - **Hg System with 23liter Hg: 1800 kg (4000 lbs)**
  - **Baseplate: 450 kg (1000 lbs)**
  - **Movement requires lateral force of 3.8kN (850 lbs) (μ_s = 0.05 per roller vendor)**
- **Maximum width of 1.3m (51") to meet CERN facility constraints**
- **Fabrication material to be non-magnetic (chose AL 6061-T6)**
- **Must have lifting provisions for unloaded baseplate**

Common Baseplate Analyses

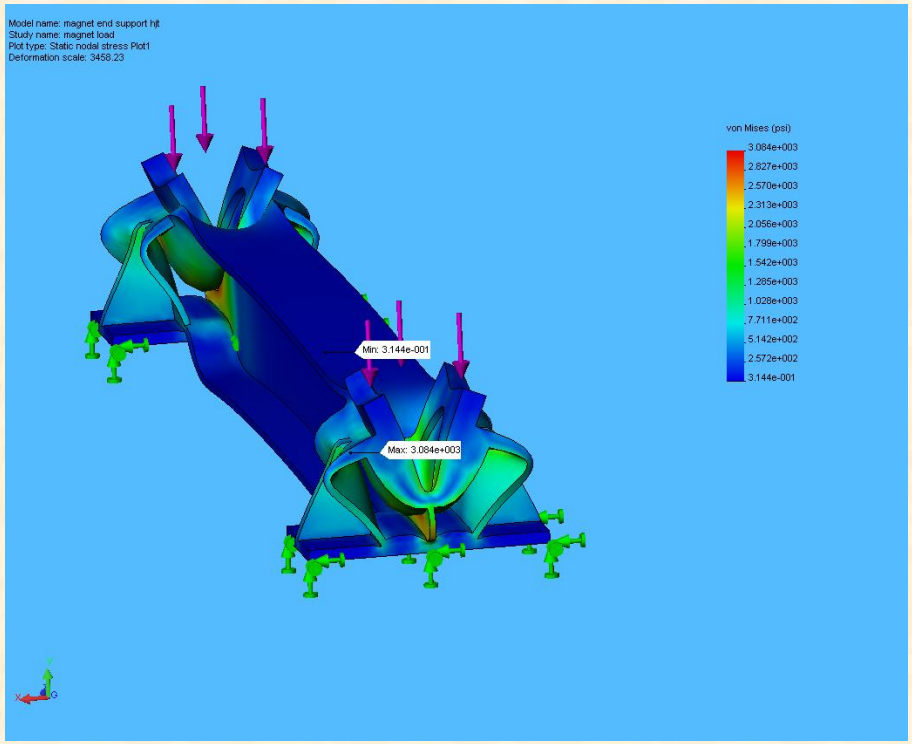
- **Multiple finite-element studies performed to simulate various loading scenarios**
  - **Transport rollers**
  - **Lifting brackets**
  - **Hoisting**
  - **Leveling feet**
- **Results showed adequate design in all loading conditions simulated**
- **Additional manual calculations performed on specific critical baseplate components**
  - **Baseplate lifting point welds**
  - **Hydraulic jacking bracket welds**
  - **Hg cart restraint brackets**
- **Included in Appendix E**





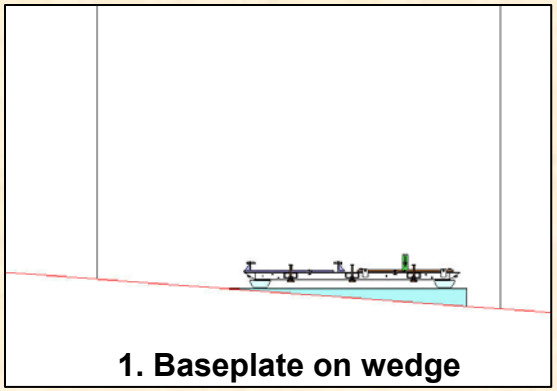
Magnet Support Beam

- **Elevating solenoid into beam line will put leveling jack near its limit of travel, affecting stability & limiting height adjustment**
- **Beam is used as spacer to allow more adjustability with leveling jack**
- **Material: AL6061**

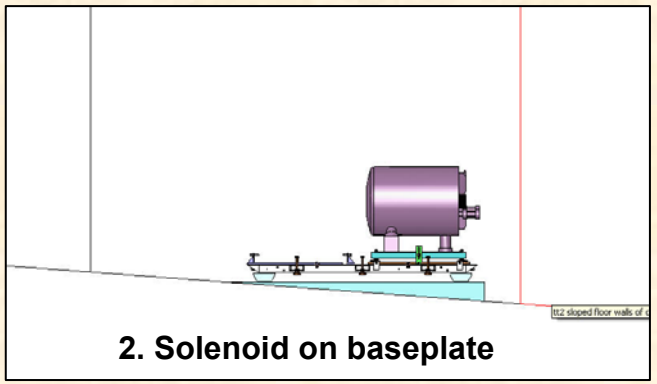


Proposed Method to Lower Equipment into TT2

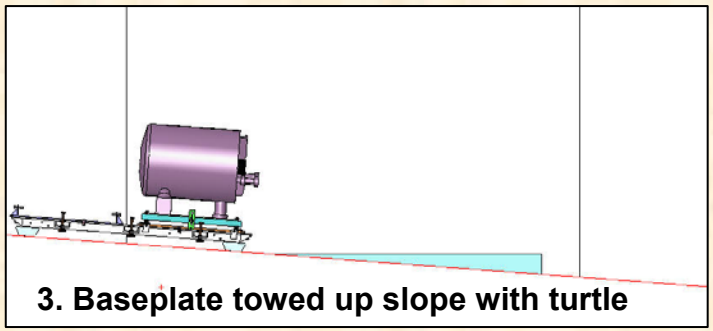
- **Target transporter and common baseplate not designed to be hoisted while supporting other equipment**
- **Requires wedge to provide horizontal landing site**
- **Hg system follows same basic process, except placed on transporter**



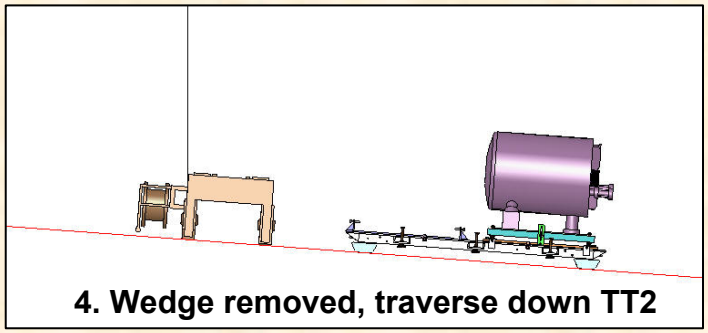
1. Baseplate on wedge



2. Solenoid on baseplate



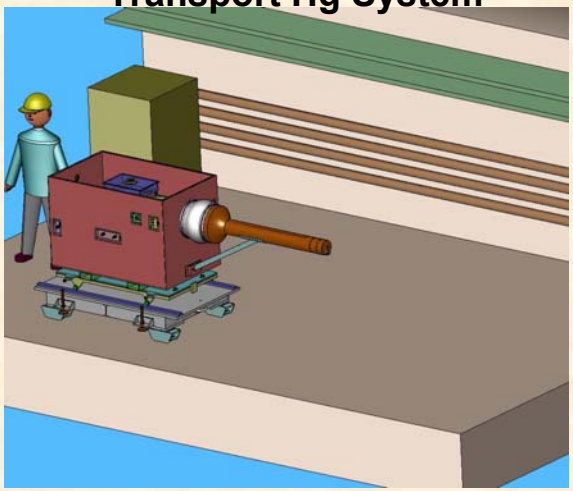
3. Baseplate towed up slope with turtle



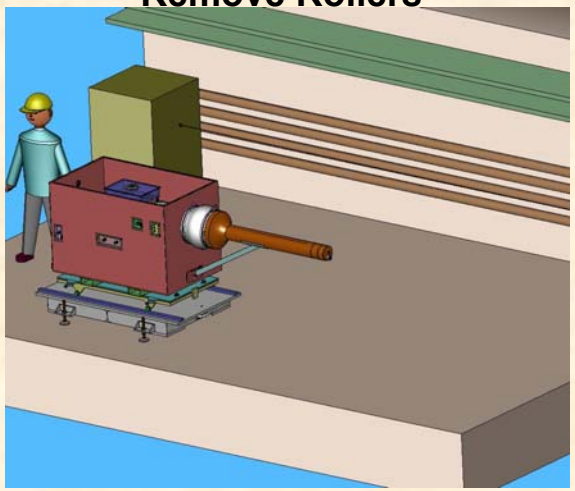
4. Wedge removed, traverse down TT2

Installation Sequence Part 1

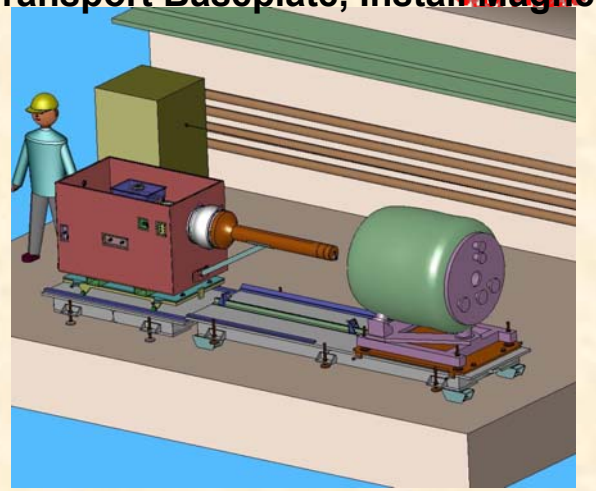
Transport Hg System

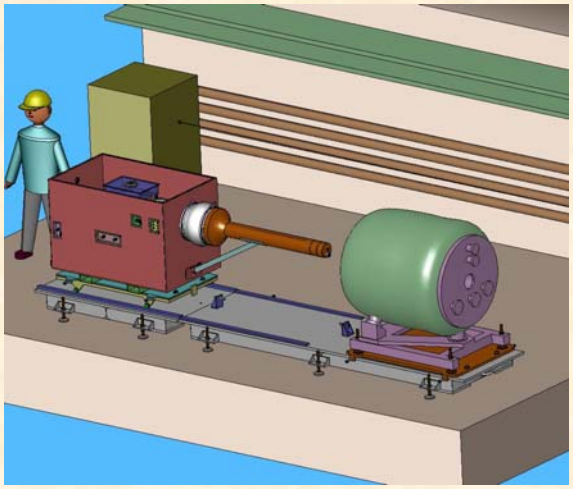


Remove Rollers

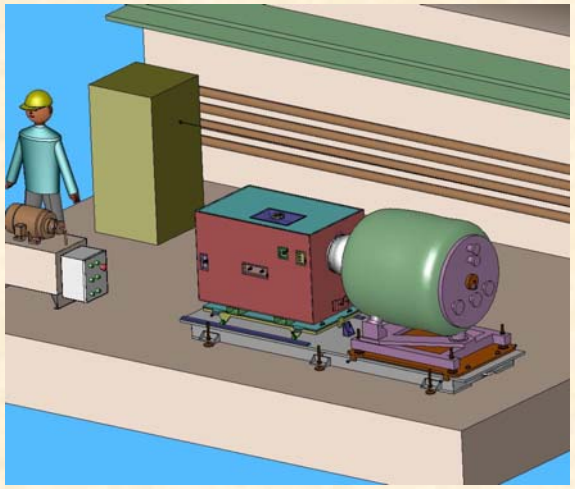


Transport Baseplate, Install Magnet

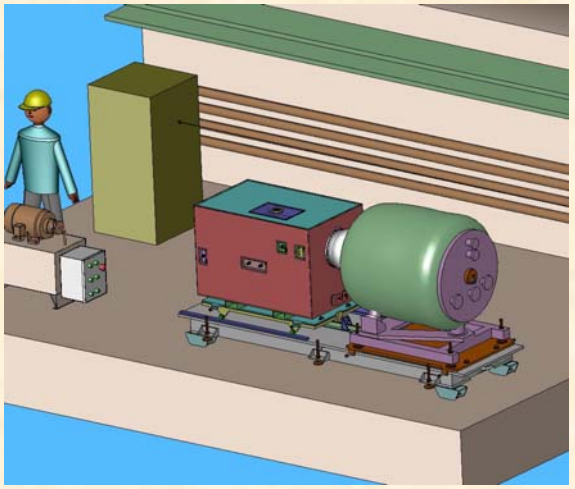




Remove Rollers, Level Magnet



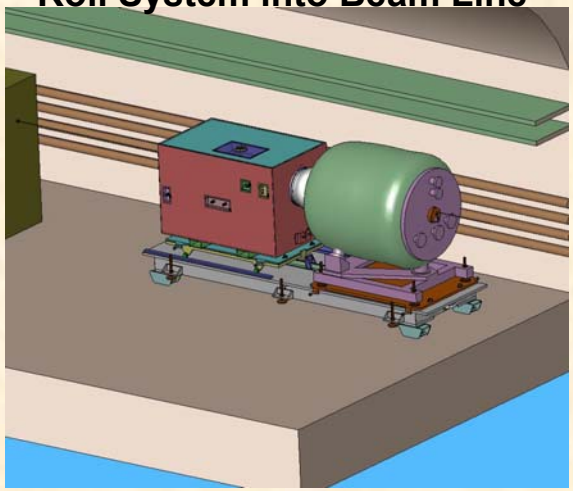
Roll Hg System into Magnet



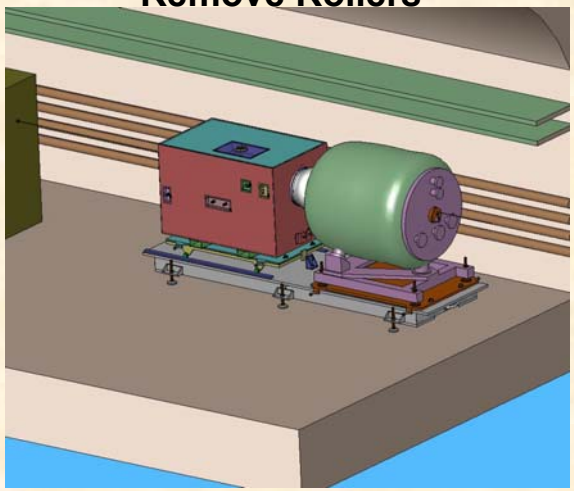
Add Rollers

Installation Sequence Part 2

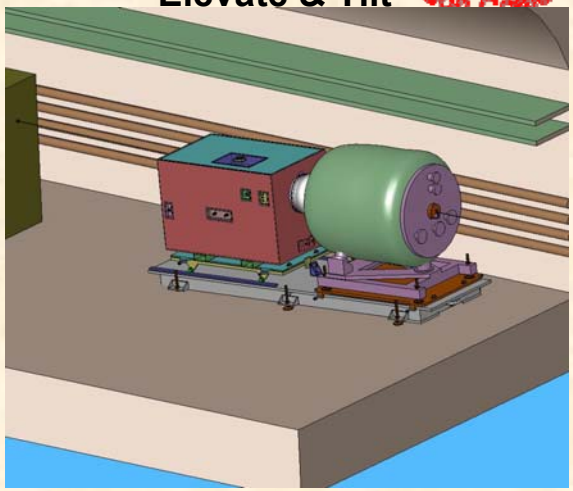
Roll System into Beam Line



Remove Rollers



Elevate & Tilt



- **Baseplate & magnet may go in beam line prior to Hg system insertion**
  - **Align magnet axis to beam (common vertical plane)**
  - **Hg system in position for transfer**
  - **Insert Hg system**
  - **Elevate and tilt to final alignment**

Conclusions

- **Baseplate structures custom-designed for MERIT experiment**
- **Provides mobility, support, and alignment functions**
- **Includes features for handling and lifting**
- **Numerous structural analyses performed**
- **Method proposed for equipment installation into TT2A**
  - **Rigging equipment (straps, chokers, etc) to be provided by CERN**
  - **Final installation procedure determined by CERN Transport**