Baseplates and Hg System Handling

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MERIT Hg System Safety Review

CERN

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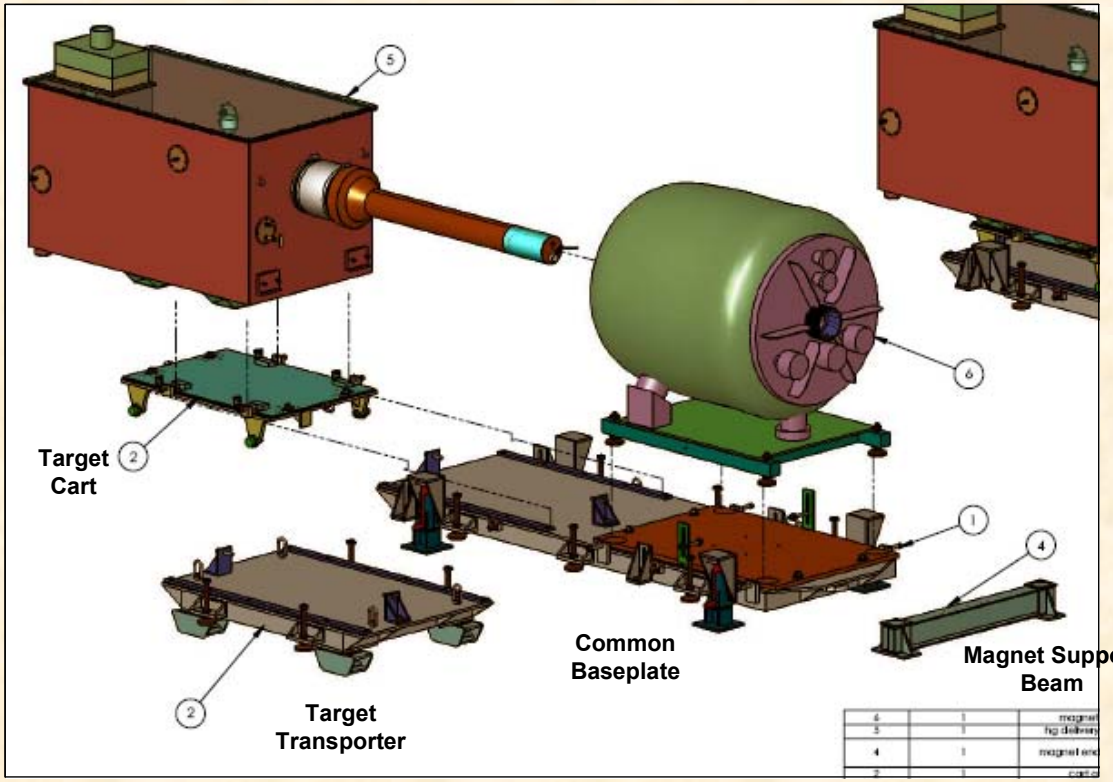
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Outline

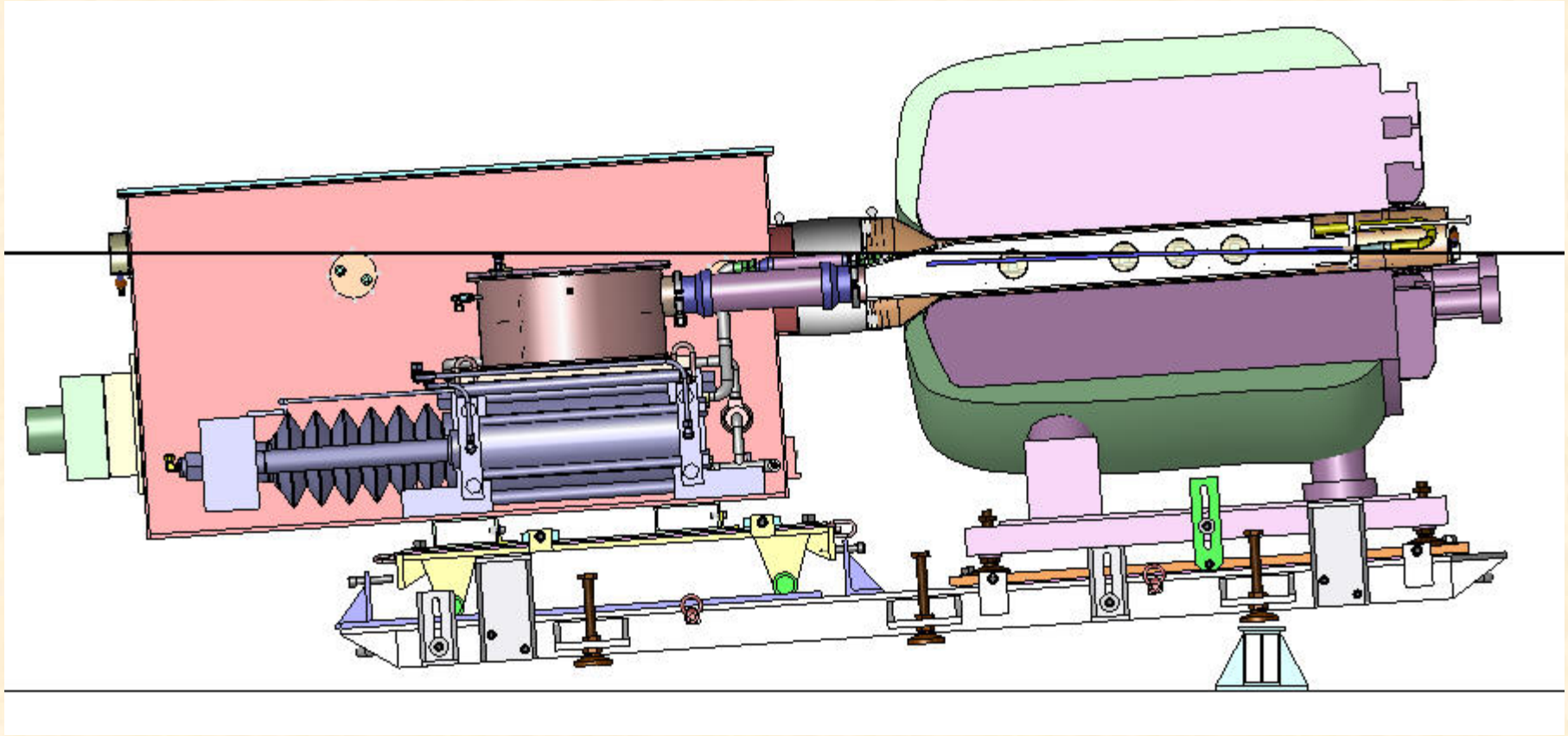
- **Baseplate descriptions**
- **Design overview**
- **Handling and installation**

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**

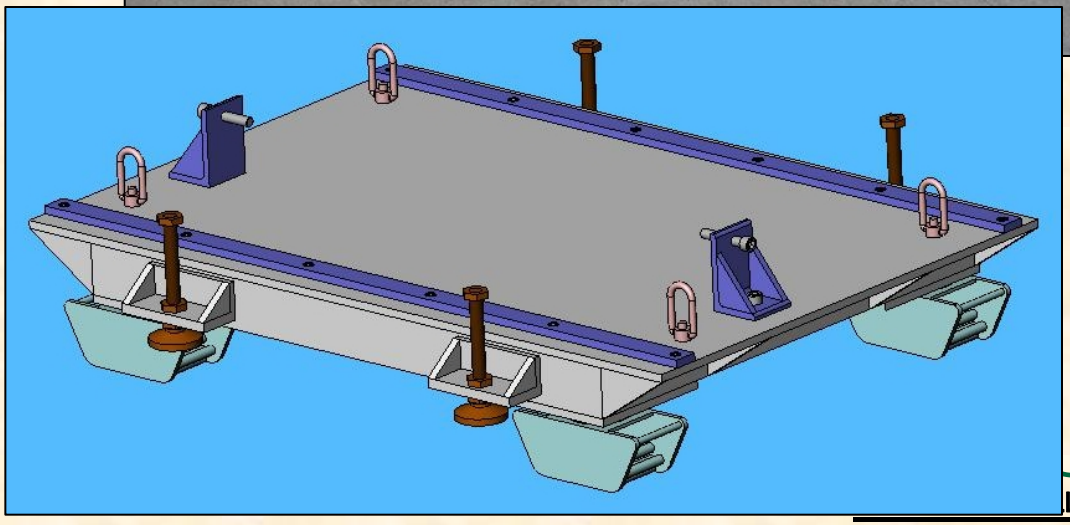


MERIT Equipment



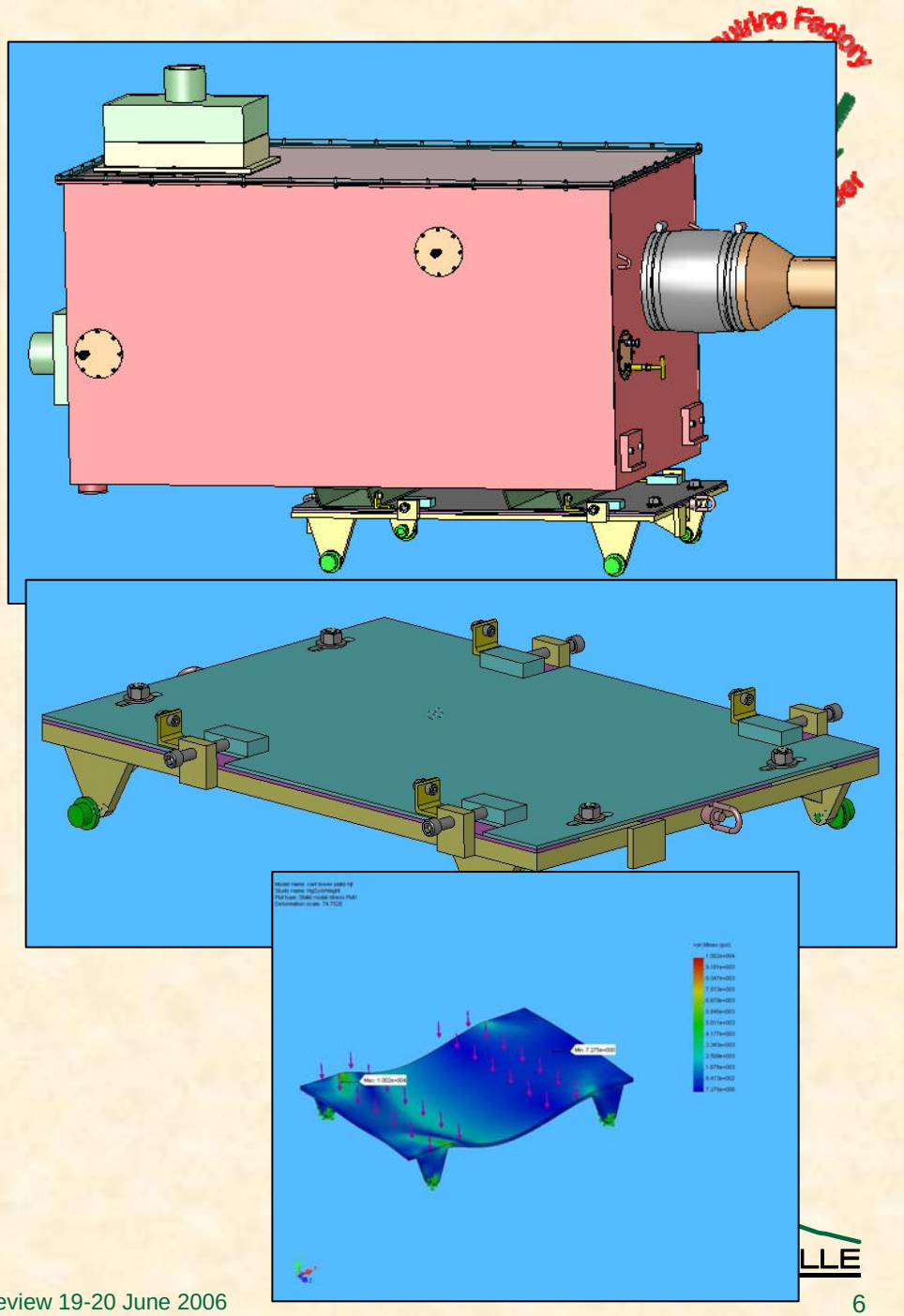
Target Transporter

- 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**

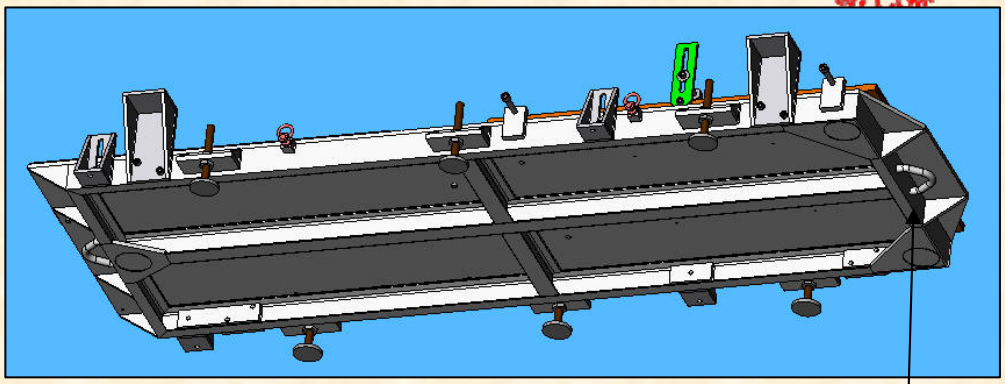


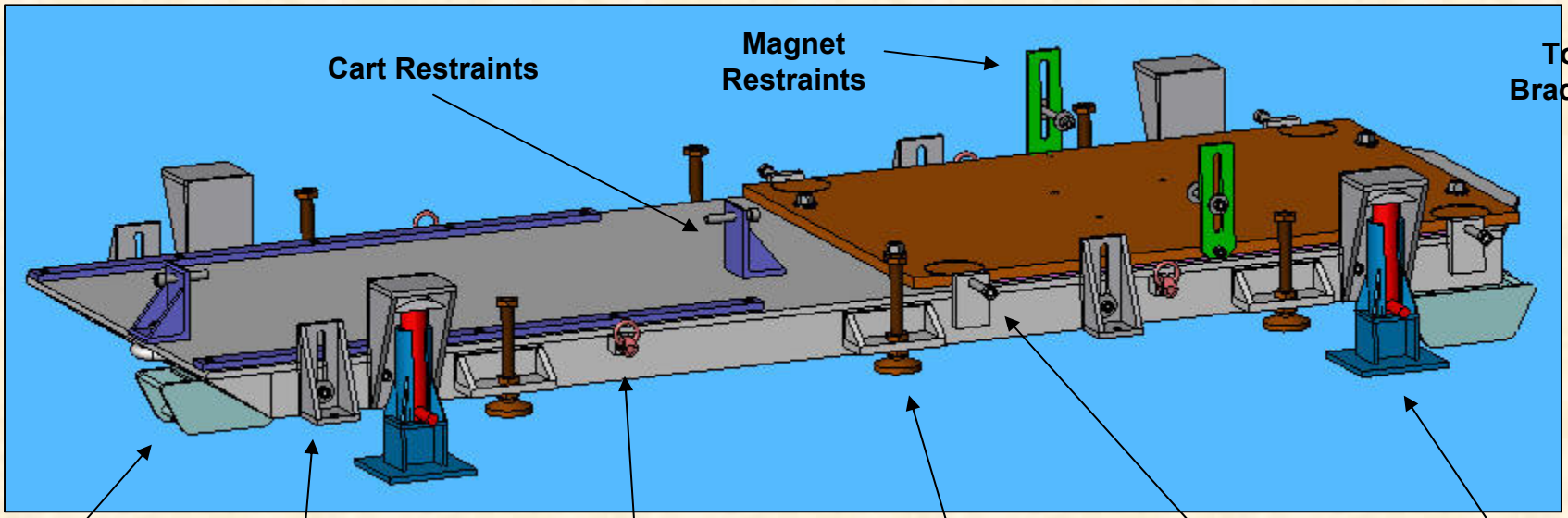
Hydraulic System Power Unit

- **Has built-in lift points for 4-point spreader**

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**



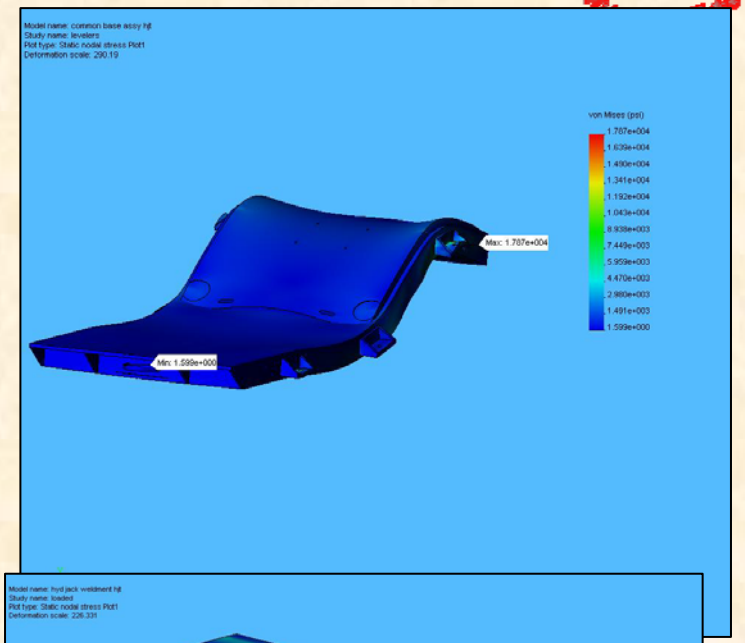


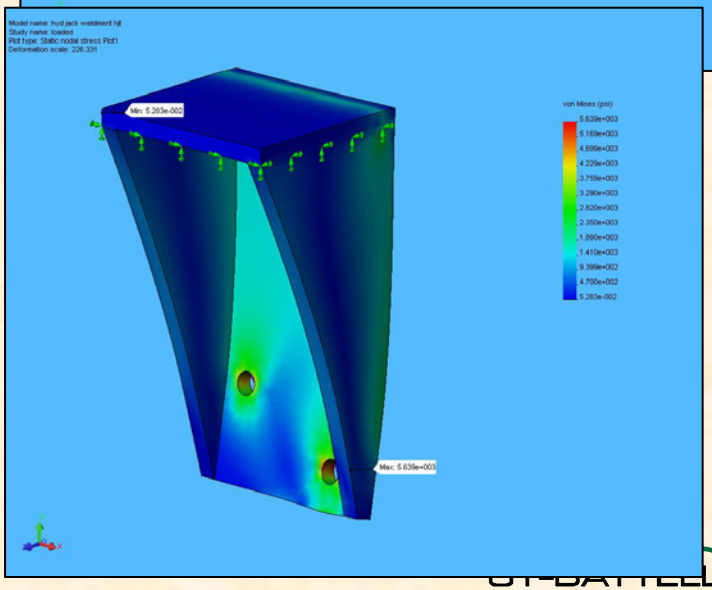
Baseplate Design Constraints & Requirements

- **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 <u>unloaded</u> baseplate**

Common Baseplate Analyses

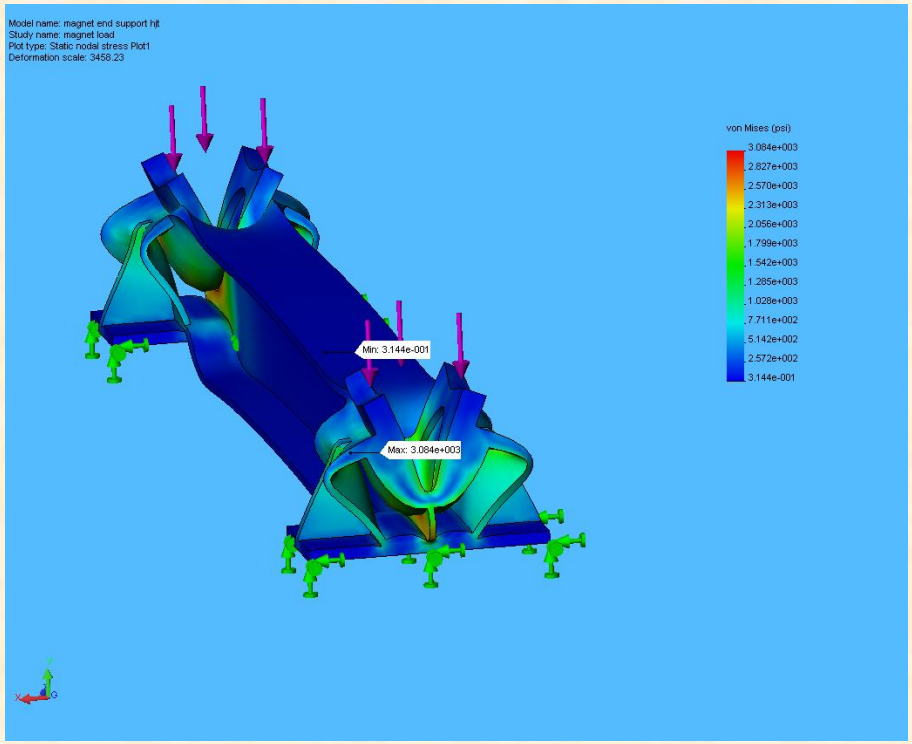
- **Multiple finite-element studies performed to simulate various loading scenarios**
  - **Transport rollers**
  - **Lifting brackets**
  - **Hoisting**
  - **Leveling feet**
- **Results showed adequate design in all loading conditions simulated**
- **Additional manual calculations performed on specific 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**

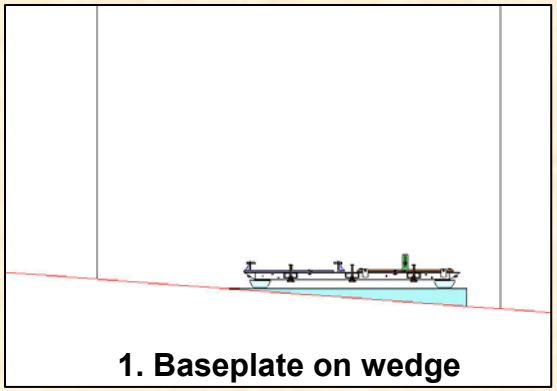


Components & Estimated Weights

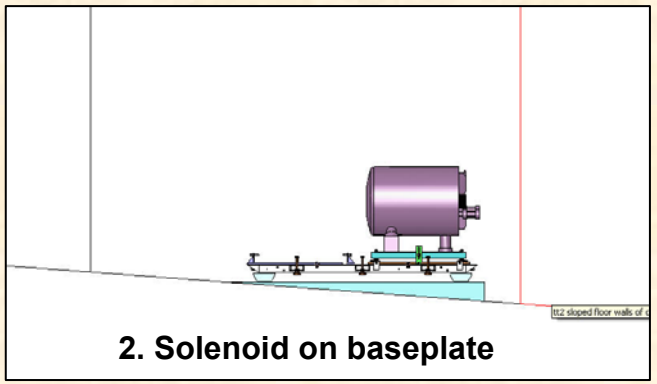
	Approximate Dimensions Centimeters (inches)	**Est. Weight** Kilograms (pounds)
MERIT (fully assembled)	406x119x165 (160x47x65)	7250 (16000)
Primary Containment	356x81x74 (140x32x29)	860 (1900)
Secondary Containment	396x107x135 (155x42x53)	680 (1500)
Base Support Structure	320x127x30 (126x50x12)	360 (800)
Target Cart	117x84x20 (46x33x8)	80 (175)
Target Transporter	157x119x30 (62x47x12)	160 (350)
Magnet Beam Support	127x25x18 (50x10x7)	14 (30)
Hydraulic Cart (w/o oil)	172x102x152 (68x40x60)	1000 (2200)
Hydraulic Fluid Drum	61dia x 97tall (24dia x 38tall)	230 (500)
Mercury Flask	15dia x 30 tall(6dia x 12tall)	34 (76)
Solenoid	1800x940x1250 (708x370x490)	5440 (12000)

Proposed Method to Lower Equipment into TT2

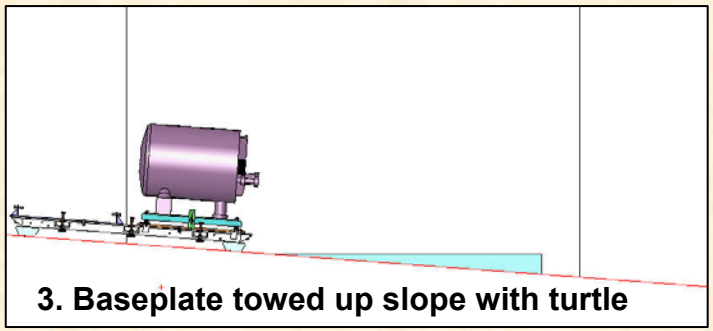
- **Target transporter and common baseplate not designed to be hoisted while supporting other equipment**
- **Requires wedge to provide horizontal landing site**
- **Hg system follows same basic process, except placed on transporter**



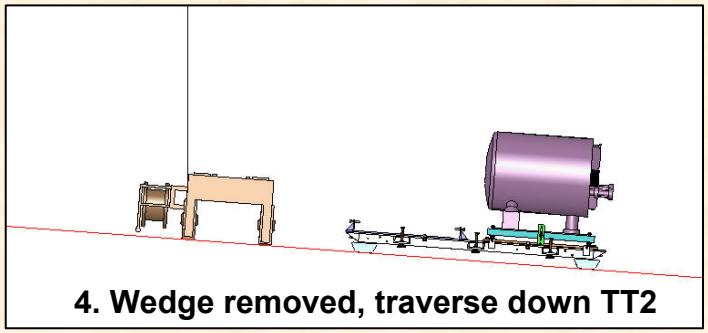
1. Baseplate on wedge



2. Solenoid on baseplate



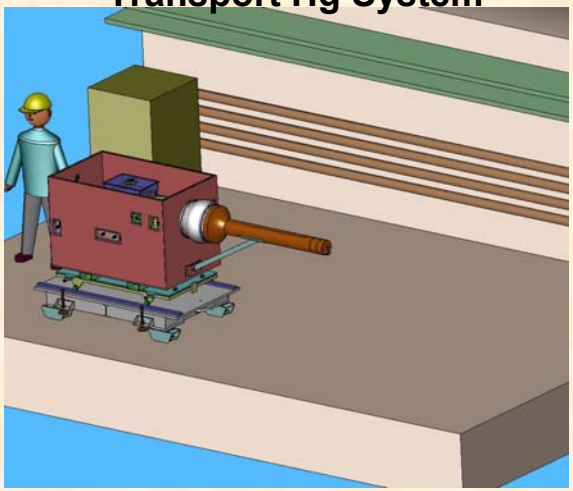
3. Baseplate towed up slope with turtle



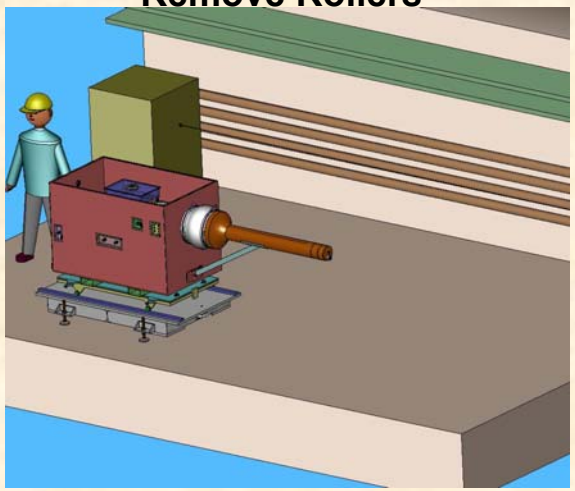
4. Wedge removed, traverse down TT2

Installation Sequence Part 1

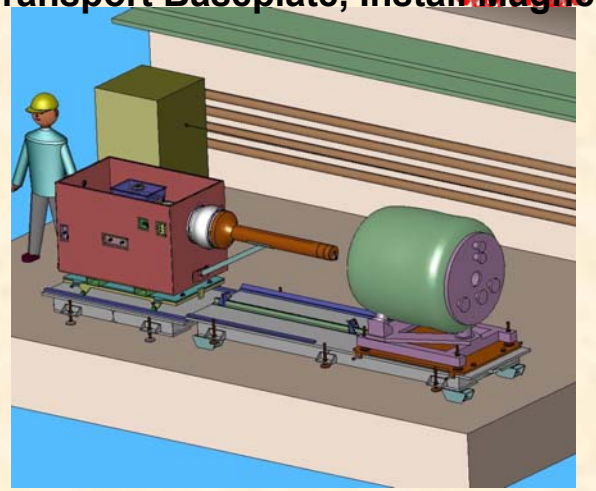
Transport Hg System

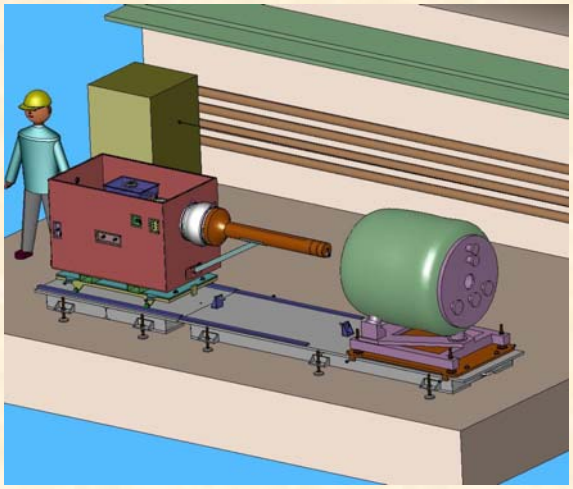


Remove Rollers

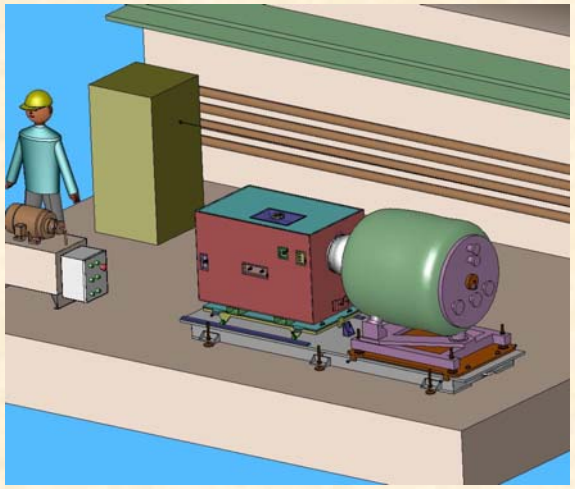


Transport Baseplate, Install Magnet

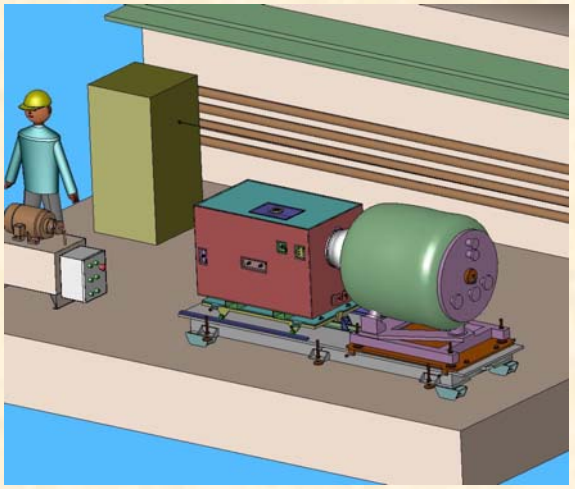




Remove Rollers, Level Magnet



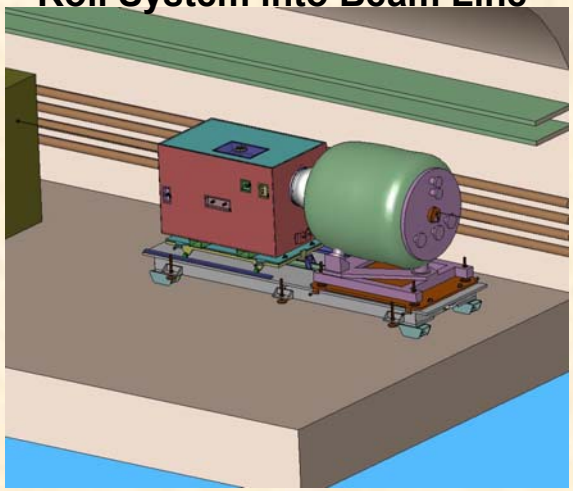
Roll Hg System into Magnet



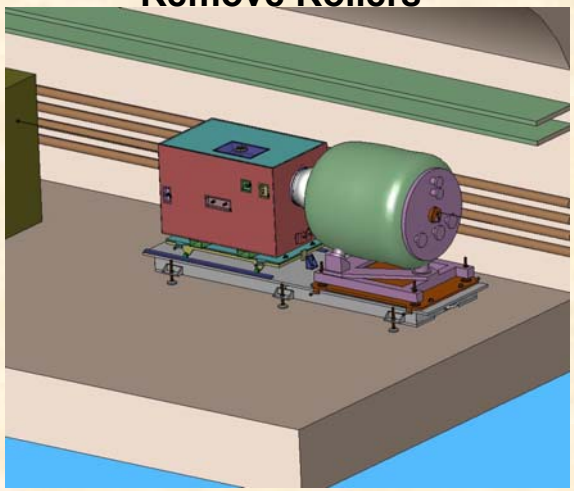
Add Rollers

Installation Sequence Part 2

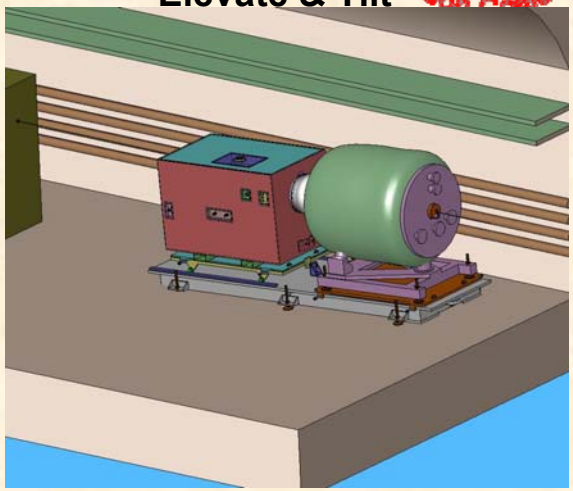
Roll System into Beam Line



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**