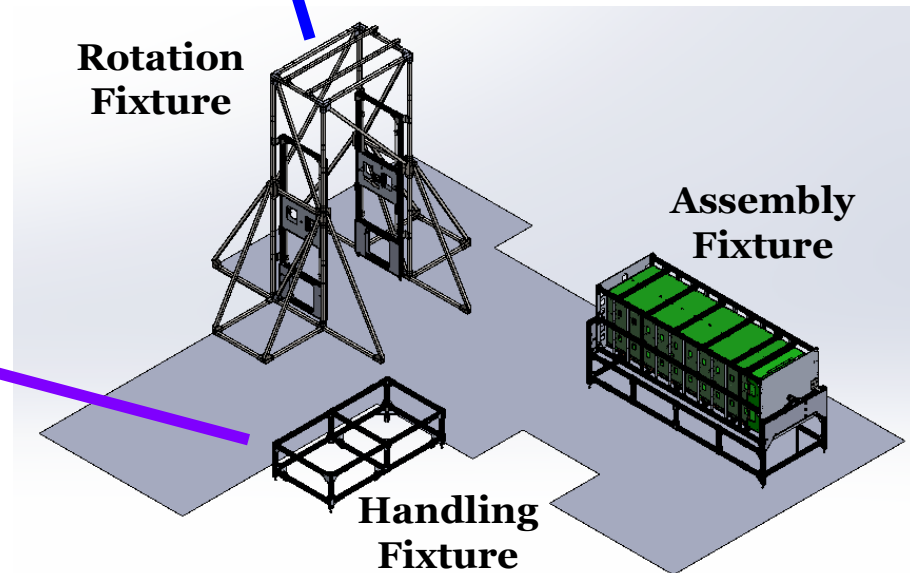
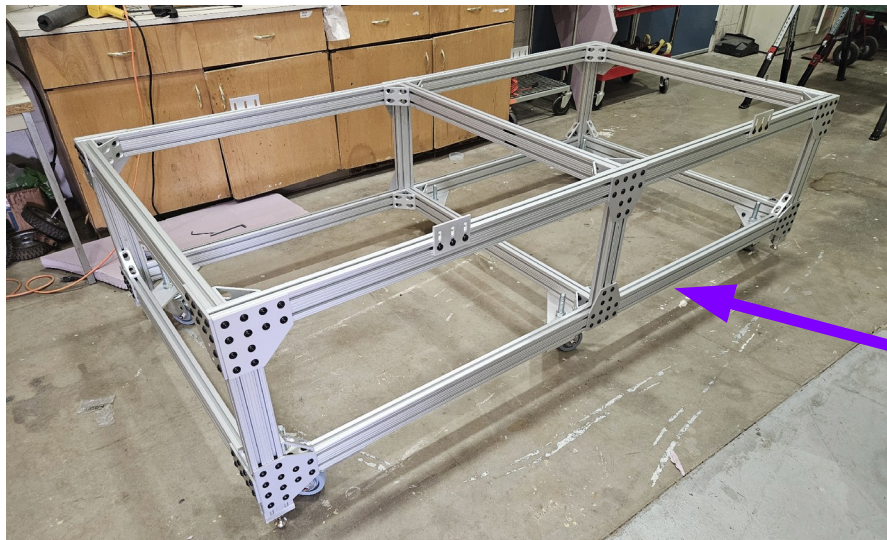
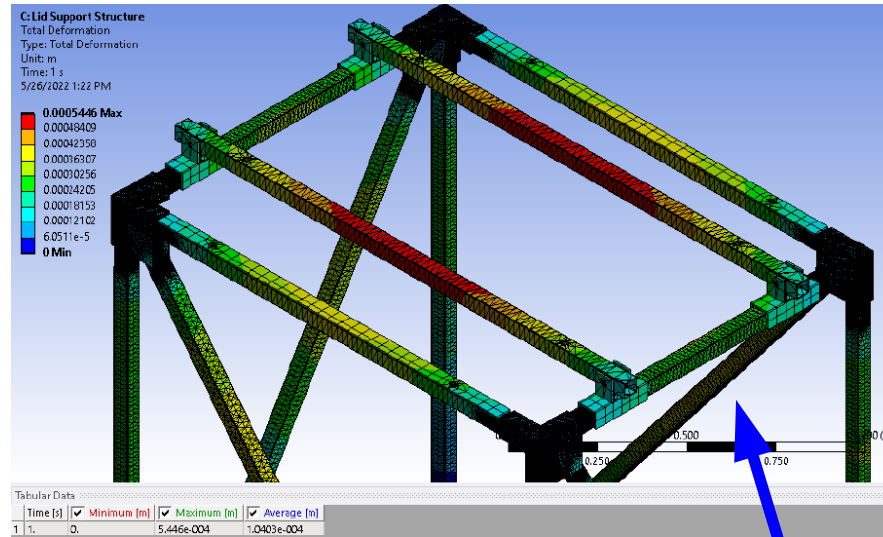


ND-LAr TPC Module Assembly and Testing Update

Michael Mooney
Colorado State University

DUNE ND-LAr Management Meeting
April 3rd, 2024

- ◆ Brief update on ND-LAr TPC Module Assembly and Testing (“A&T”) work today, focusing on recent activities and schedule toward FSD
- ◆ Most recent focus has been construction and testing of fixtures (handling fixture, assembly fixture, rotation fixture) prior to delivery to University of Bern
- ◆ Many thanks to Andrew Lambert who visited us twice (March 18-19, March 25-26) to help with local activities!



Fixture Construction/Testing





Fixture Construction/Testing

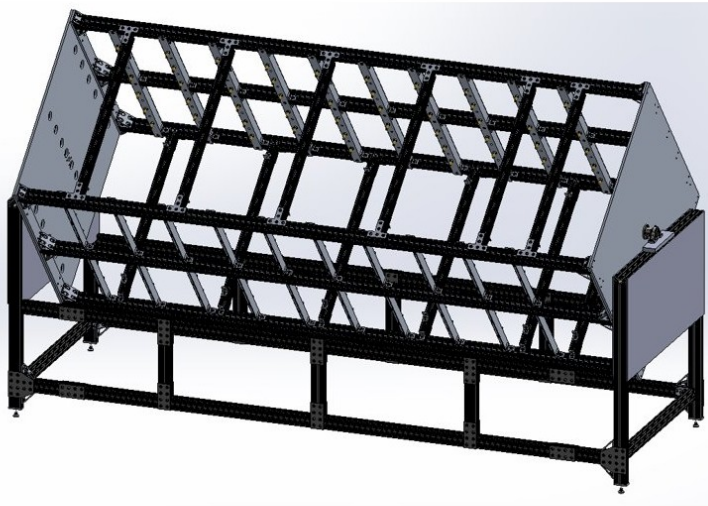


- ◆ Construction and testing of handling/assembly fixtures using TPC mock-up – **finished**
- ◆ Powder coat steel, finish G10 assembly for rotation fixture – ongoing, should **finish by end of this week**
- ◆ Testing of rotation fixture using TPC mock-up – to be done **end of this week or early next week**
 - Andrew Lambert may visit CSU again for this
- ◆ Ship fixtures to Bern (after building shipping crates) – to be done **sometime next week**
- ◆ Jay Jablonski will travel to Bern for week or two to help with FSD assembly test – **end of April or early May** (whenever University of Bern is ready)

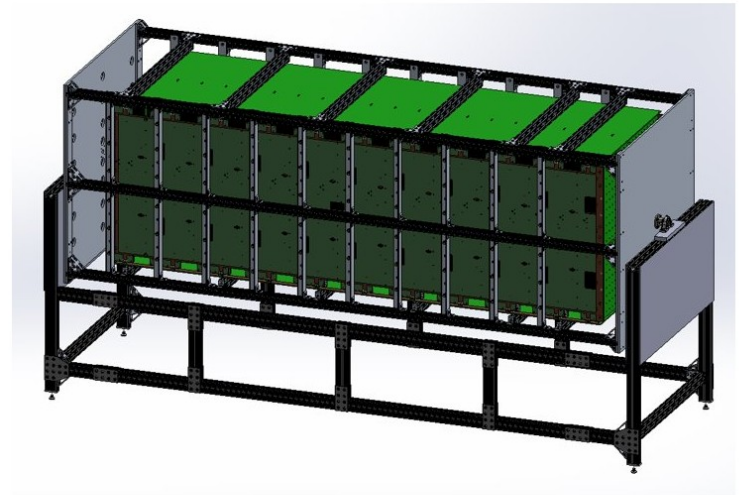
- ◆ CAD for fixtures (Jay Jablonski): **done**
- ◆ Finite element analysis for rotation fixture including lid support stress/strain (Zach Rautio): documentation to be finished **within next two weeks**
- ◆ Assembly procedures (Jay Jablonski, Andrew Lambert): documentation to be done **after assembly test at University of Bern**

BACKUP SLIDES

- ◆ TPC Module Assembly and Testing (“A&T”) for ND-LAr involves:
 - Assembly of 35 ND-LAr modules (+ spares)
 - Full-module QC for 35 ND-LAr modules (+ spares)
 - QA for above activities in preceding small, large-scale prototypes
- ◆ Includes assembly/testing plans and procedures, assembly fixtures, and associated QA
 - For 2x2, FSD, and MATF; support role during I&I
- ◆ Production for TPC Module A&T will occur at MATF (Module Assembly and Testing Facility) at Fermilab IERC (Integrated Engineering Research Center): **starting in 2026, finishing in 2028**



Assembly Fixture



Assembly Fixture with Assembled TPC



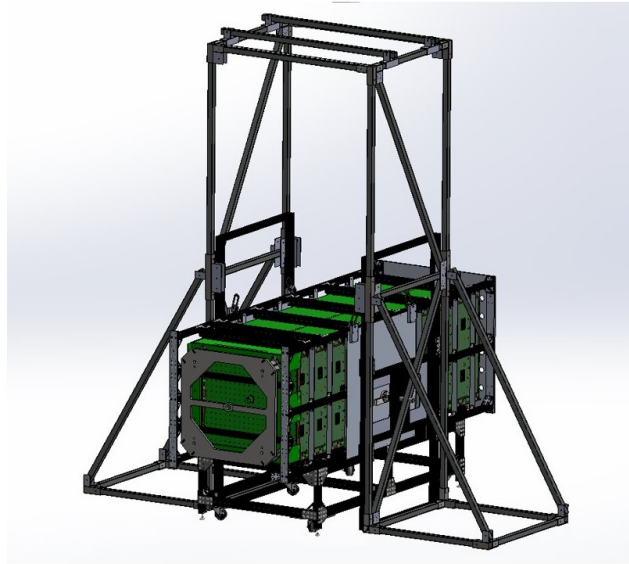
Handling Fixture



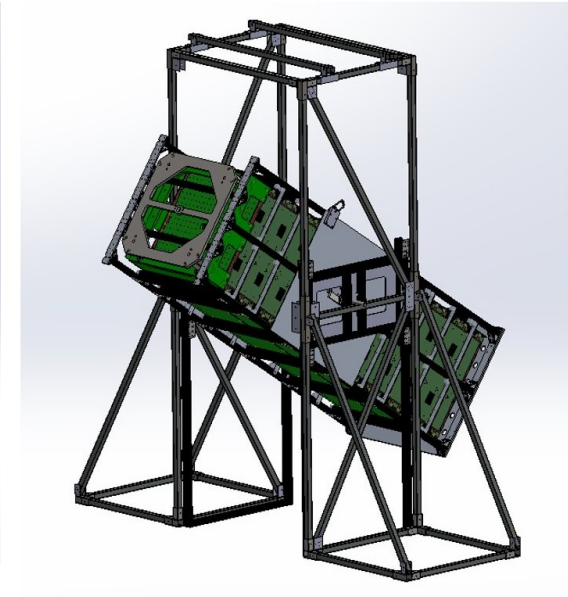
Handling Fixture with TPC



Lid Support Structure

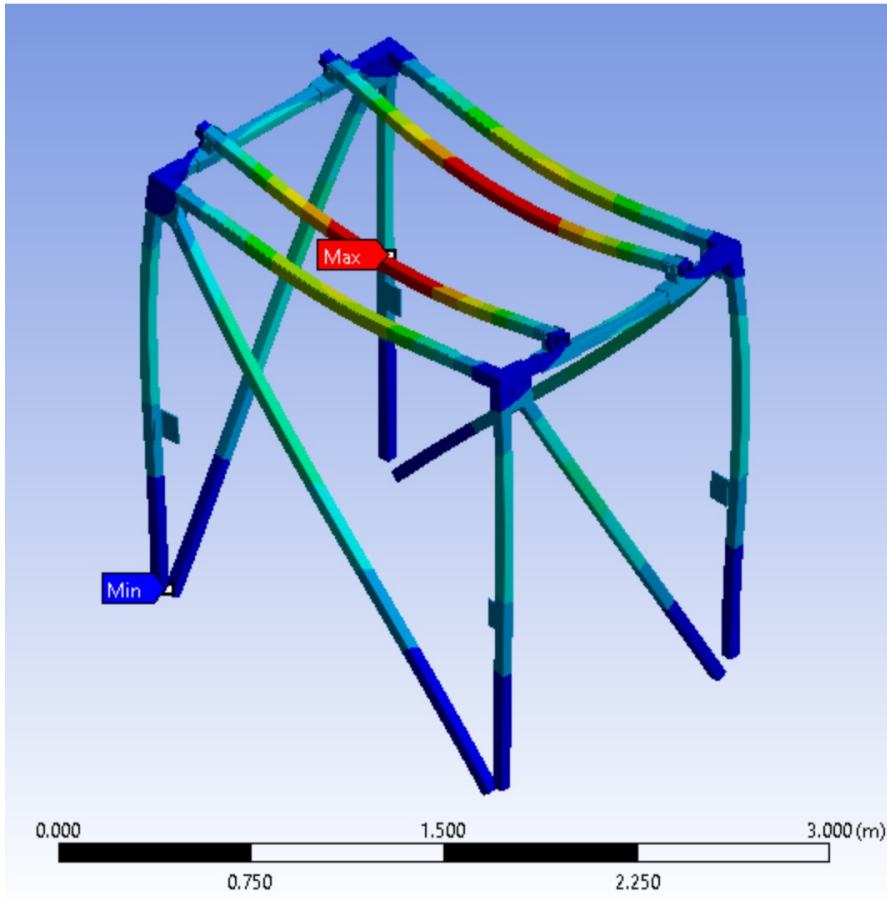


Lid Support Structure-TPC Integrated

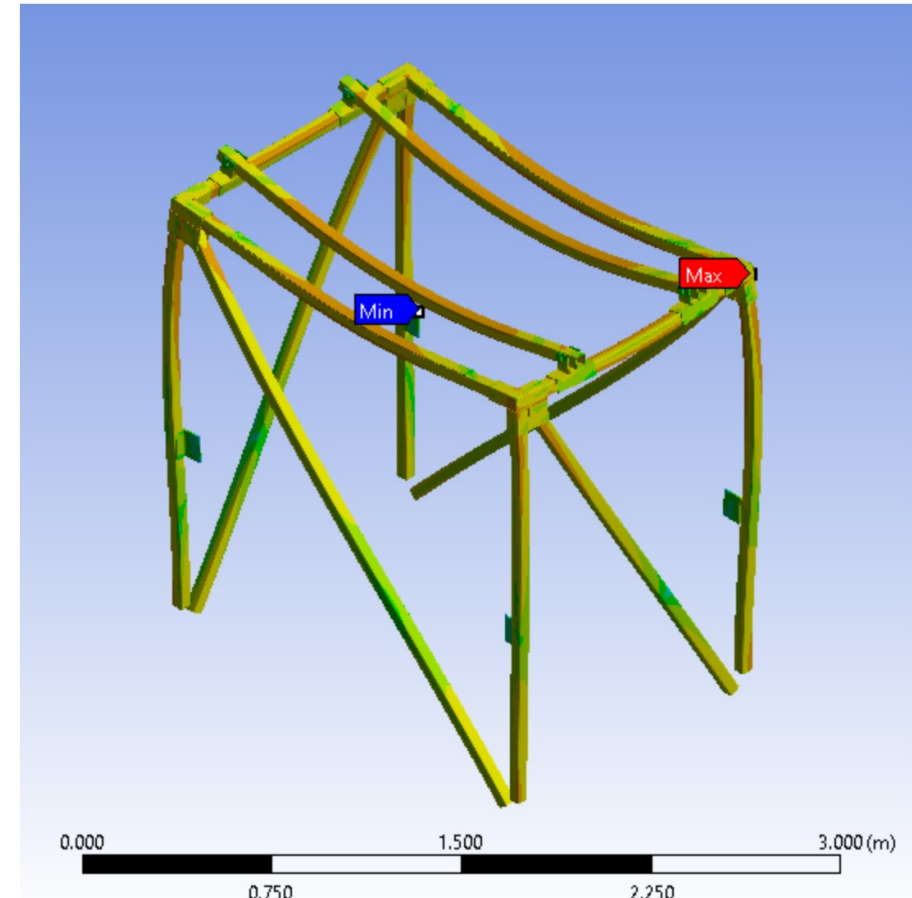


Lid Support Structure-TPC Rotation

Deformation Plot



Stress Plot



Documentation Progress

| ITEM NO. | PART NUMBER | DESCRIPTION | QTY. |
|----------|------------------------|---------------------------------|------|
| 1 | Base Weldment - cf1 | Outrigger Swivel Joint | 2 |
| 2 | Base Weldment - cf2 | Outrigger Swivel Joint - Mirror | 2 |
| 3 | Base Weldment - cf3 | Base Interior Corner Joint | 2 |
| 4 | Base Weldment - cf4 | Base interior corner - mirror | 2 |
| 5 | 6527K38 - 2 x 125 tube | 35.75 | 6 |
| 6 | 6527K38 - 2 x 125 tube | 44.75" | 4 |
| 7 | 6527K38 - 2 x 125 tube | 93" | 4 |
| 8 | 6527K38 - 2 x 125 tube | 74.5 - Slide Mate | 8 |
| 9 | 6527K38 - 2 x 125 tube | 40.75" - Miter | 2 |
| 10 | 6527K38 - 2 x 125 tube | 83.86" | 4 |
| 11 | 6527K38 - 2 x 125 tube | 73.88" - Miter | 2 |
| 12 | 6527K38 - 2 x 125 tube | 101.875" | 2 |
| 13 | 6527K38 - 2 x 125 tube | 76.625 - FEA | 2 |
| 14 | Beam Interface - cf1 | Default | 2 |
| 15 | Beam Interface - cf2 | Default - Mirror | 2 |
| 16 | Bearing Slide Weldment | FEA<As Machined> | 4 |
| 17 | Top Corner - R2 | Default<As Machined> | 4 |
| 18 | Lid Interface Strip | FEA | 2 |
| 19 | Top Corner - R2 - FEA | Default | 4 |

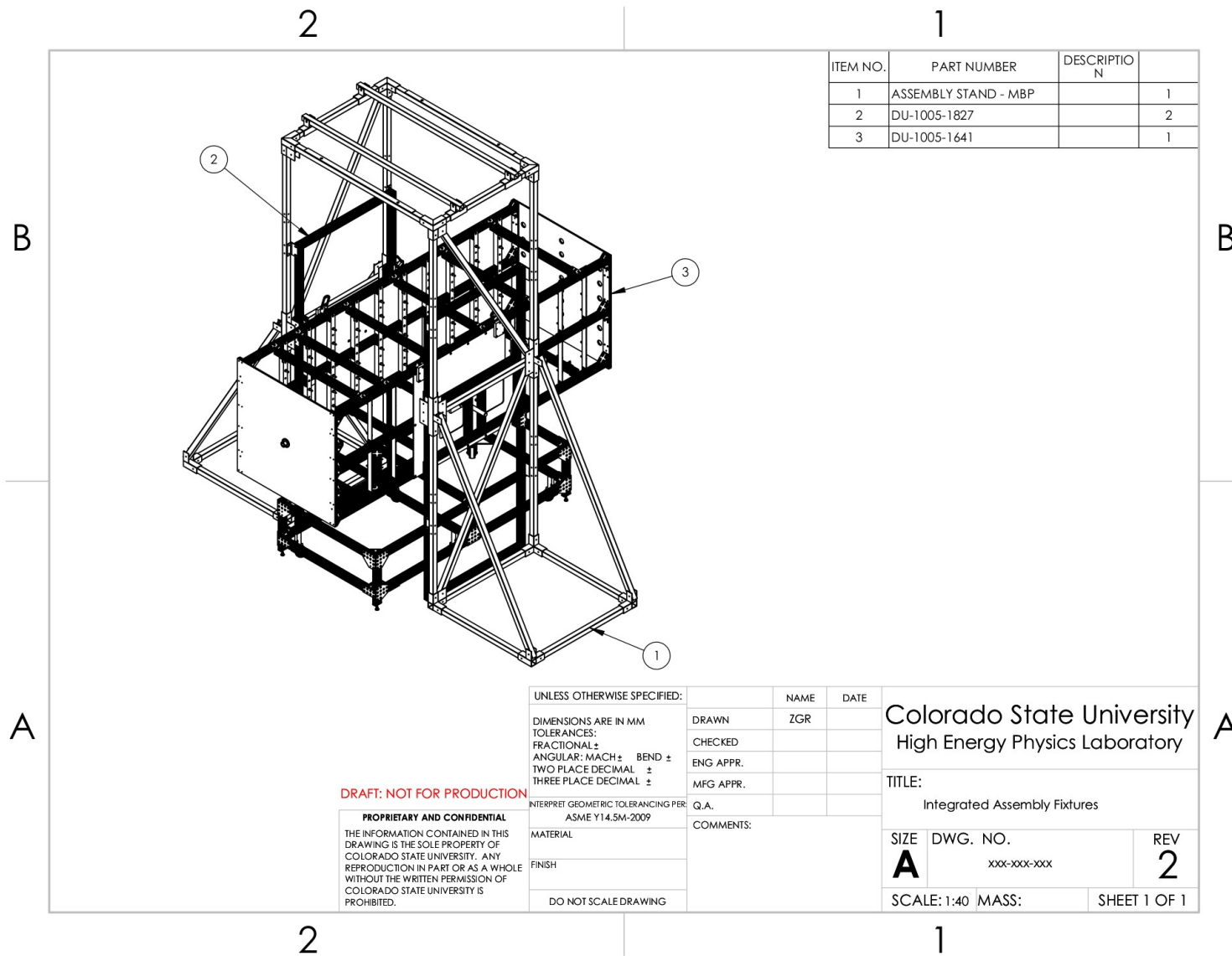
| | | | |
|--|--|---|------------|
| UNLESS OTHERWISE SPECIFIED: | | NAME | DATE |
| DIMENSIONS ARE IN MM | | DRAWN | ZGR |
| TOLERANCES: | | CHECKED | |
| FRACTIONAL: ± | | ENG APPR. | |
| ANGULAR: MACH ± BEND ±2° | | MFG APPR. | |
| ONE PLACE DECIMAL ±0.5 | | Q.A. | |
| TWO PLACE DECIMAL ±0.25 | | COMMENTS: | |
| INTERPRET GEOMETRIC TOLERANCING PER ASME Y14.5M-2009 | | Colorado State University High Energy Physics Laboratory | |
| MATERIAL | | TITLE: | |
| BOM ITEM # | | Assembly Stand - MBP FEA - NEW LID - OVERSIZED | |
| DO NOT SCALE DRAWING | | SIZE | REV |
| | | A DWG. NO. | 2.0 |
| | | SCALE: 1:40 MASS:(lb):676.12 SHEET 19 OF 19 | |

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Documentation Progress



| ITEM NO. | PART NUMBER | DESCRIPTION | |
|----------|----------------------|-------------|---|
| 1 | ASSEMBLY STAND - MBP | | 1 |
| 2 | DU-1005-1827 | | 2 |
| 3 | DU-1005-1641 | | 1 |

| | | |
|--|-----------|------|
| UNLESS OTHERWISE SPECIFIED: | NAME | DATE |
| DIMENSIONS ARE IN MM | ZGR | |
| TOLERANCES: | | |
| FRACTIONAL ± | DRAWN | |
| ANGULAR: MACH ± BEND ± | CHECKED | |
| TWO PLACE DECIMAL ± | ENG APPR. | |
| THREE PLACE DECIMAL ± | MFG APPR. | |
| INTERPRET GEOMETRIC TOLERANCING PER ASME Y14.5M-2009 | Q.A. | |
| MATERIAL | COMMENTS: | |
| FINISH | | |
| DO NOT SCALE DRAWING | | |

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Colorado State University
 High Energy Physics Laboratory

TITLE:
 Integrated Assembly Fixtures

| | | |
|-------------|-------------|--------------|
| SIZE | DWG. NO. | REV |
| A | xxx-xxx-xxx | 2 |
| SCALE: 1:40 | MASS: | SHEET 1 OF 1 |