

Process Example – Technical Coordinator Office + Compliance office

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Outline

- *Background*
- *Compliance Office*
- *Technical Coordinator member*
- *Process Example*

Giuseppe Gallo - Background

- Mechanical Engineer with 10+ years of experience in mechanical design at FNAL
 - Roles in the Technical Coord Office/ Integration Project Office - part of JPO system engineering team (current assignment)
 - Member of the Compliance Office (current assignment)
 - Lead engineer of Mu2e Tracker (current assignment)
 - Lead engineer of DESI barrel, cage and lens rotating mechanism (earlier assignment)
- Master degree in Mechanical Engineering (PISA-ITALY)

Compliance Office

Section - LBNF/DUNE structures and structural components

- Members : O. Beltramello (Ldr. - CERN), G.Gallo (FNAL) and M.Zimbru (CERN)
- Scope :
 1. Applicable rules and regulation and European and US norms equivalency
 2. Equipment safety compliance checks and validation
 3. Equipment sign off process

In addition

- Provide assistance to the consortium leaders on the applicable standards
 - Provide guidance to the consortiums on the structural engineering file from the structural design phase through the fabrication, assembly, installation and commissioning process.
 - Require internal interface documents for consortium with multiple groups or when needed.
- Key documents :
 - Validation of the LBNF/DUNE structures and structural components for equipment and detectors EDMS #2172998

See O. Beltramello's talk for details.

Compliance Office

Validation form EDMS #2172998

1. Introduction and purpose
2. Analysis Plan – provide the list of the minimum requirements to be communicate and to be approved by the Compliance Office prior to commence the detailed structural analysis
3. Structural Engineering File – contains the required list of documentation to demonstrate the compliance with applicable standards and safety principles
4. Annex 1 – List of US and European standards applicable for DUNE/LBNF project
5. Annex 2 – Standard equivalency

See O. Beltramello's talk for details.

Role within the Technical Coordinator member

G.Gallo roles:

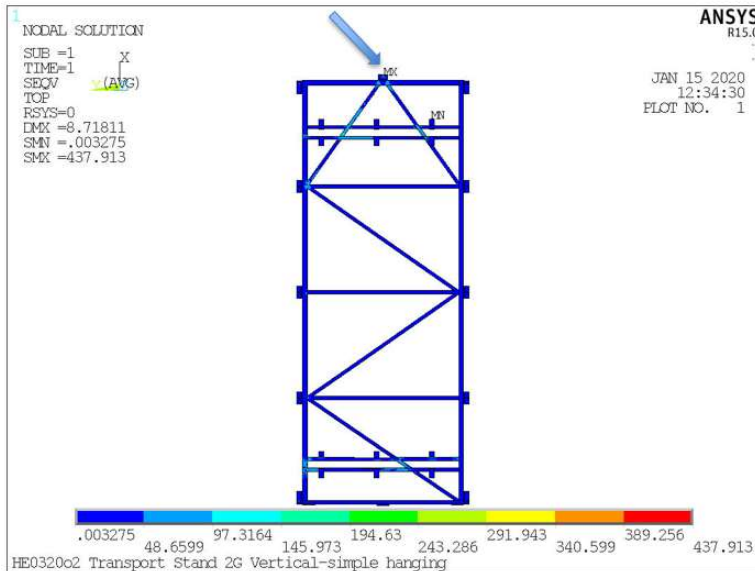
- Inform consortium about compliance office
- Review consortiums engineering files
- Assist consortiums technical leaders on addressing raised concerns
- Communicate technical documents status and concerns to DUNE Technical and Resource Coordinators (E. James) specially when impacts on costs and schedules are significant

Technical Coordinator – Example (APA shipping frame FEA analysis)

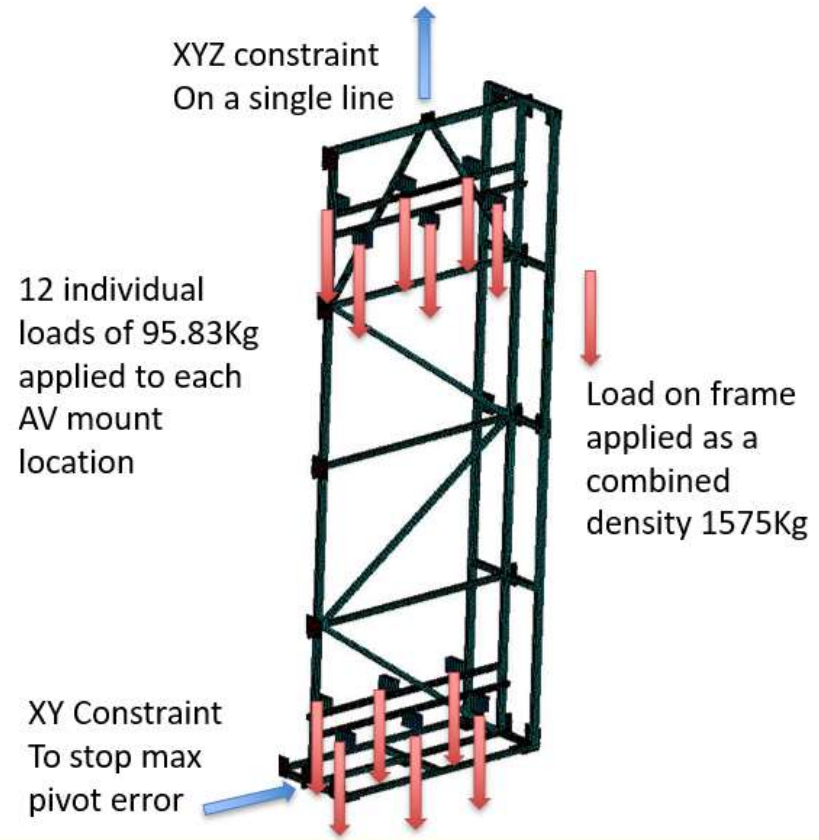
FEA

- FEA performed in ANSYS (classic)
- Using shell elements (SHELL 281 and SOLID185)
 - Care in ANSYS classic needed I direction of elements (thickness direction) and alignment of nodes
- Would like to thank Ang Lee and Guiseppe for their invaluable input.
- Just one load case performed on the 'critical lift'
 - Single hook lift down the shaft

Stresses map



Loads and constraints



APA Shipping frame FEA

By courtesy of P. Sutcliffe

Process Example – APA shipping frame analysis plan

Step 1: Compliance Office generated a memorandum (through iterations with APA consortium – team work)

EDMS No.:2093094
Date: 20.01.2020

MEMORANDUM (DRAFT)

A/To : A. Marchionni, C. Touramanis
De/From : O. Beltramello, G. Gallo
Cc : M. Nessi, E. James, M. Andrews, S. Kettell, P. Weber, J-L Grenard, M. Zimbru
Objet/Subject : APA Shipping Frame - Compliance Office preliminary requirements

The aim of this memorandum is to clarify the preliminary requirements from the Compliance Office (CO) in order to assess and ultimately validate the APA shipping frame.

The APA shipping frame is considered in its integrality as a Lifting Device based on the definitions of ASME B30-20-2013 section 20-0.2 or EN13155 paragraph 3.11.

*US standard
(as CO & TC member)*

The applicable standards for Design, Fabrication, and Quality Control are for the APA frame built, assembled and used in the US are:

ASME B30.20-2013 for below-the-hook lifting devices

ASME BTH-1-2017 (Design of Below-the-Hook Lifting Devices)

ANSI/AISC 360 (Specification for Structural Steel Buildings – American Institute of Steel Construction)

Structural Welding Codes: ANSI/AWS D14.1 and ASME BTH-1.

EN1090 (all applicable parts)- Execution of steel and aluminium structures.

*US/EN standard
(as TC member)*

Process Example – APA shipping frame analysis plan

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Nevertheless, the European standards below can be considered equivalent to the US standards mentioned above.

Directive machine - 2006/42/CE

EN 13155:2003 +A2: 2009: Cranes – Safety – Non-fixed Load Lifting Attachments

EN 1993 - EUROCODE 3 (all applicable parts): Design of steel structures

EN1090 (all applicable parts)- Execution of steel and aluminium structures.

Based on experience, we recommend to use the US standards or to make sure that the transportation company will accept both standards.

- DOE 10 CFR851 – Work Safety and Health Program

- DOE Standard DOE-STD-1090- 2011 – Hoisting and Rigging

DOE standard (as CO member)

Lifting classification and Lifting device load test factors (1.25xWL -ASor 1.5xWL are under discussion

- Below the Hook Lifting device - Design Category A lifting equipment, Service Class 0 as defined in ASME BTH-1 Chapter 2, Table 2-3-1 and Appendix B.2.1 Table B-3-1 and ASME B30.20 section 20-0.4.

US standard (as CO & TC member)

SF = 2.0 (overall structure against YTS)

SF = 2.4 (connections such as weld joints, bolts, lifting attachments etc.)

Any deviation from the standards shall be documented and communicated and to the CO who will assess the request and inform the LBNF/ DUNE ESH manager when required for his approval.

All the engineering design, fabrication, QC and documentation process has to follow the document “Validation of the DUNE/LBNF structures and mechanical components for equipment and detectors - EDMS #2172998”.

(as CO member)

Process Example – APA shipping frame analysis plan

Step 1: Compliance Office generated a memorandum (through iterations with consortium – team work)

In order to prepare the Preliminary design review – “60 % review “of the APA shipping frame design, the following points are expected from the CO, at least 3 weeks in advance:

- The site of fabrication of the APA shipping frame, the number of items has to be provided.
- Material and lifting equipment
- Mass budget (with contingencies)
- Main load cases (with justification)
- Intended use: i.e. the different steps of use should be described for example unloading from a truck, transfer from horizontal position to the vertical position to lower in the Ross Shaft, reverse operation...) and a logistics scheme of the APA transport frame should be provided.
- All operational requirements:
At least the specification of the maximum displacements of the supporting points of the APA chambers should be provided.
- Structural analysis for the worst load cases
- Stability analysis

*Preliminary Design review –
60 % review
(as CO member)*

Process Example – APA shipping frame analysis plan

Step 1: Compliance Office generated a memorandum (through iterations with consortium – team work)

- Risk assessment
- Proposed execution classes (EN 1090), proposed of a QC plan and expected delivery documents.
- Expected testing campaign for the APA frame (welds checks, load tests in the different handling configurations with the expected overload factor, functional tests of the different possible handling configurations at nominal load...).
- Expected schedule of the project (main milestones: reviews, fabrication, tests, etc..)

The APA frame lead engineer has to be communicated to the CO, he will take responsibility of the design, fabrication, QC and documentation of the lifting device.

Any change in the responsibility, in the schedule, in the project technical plans has to be communicated to the CO.

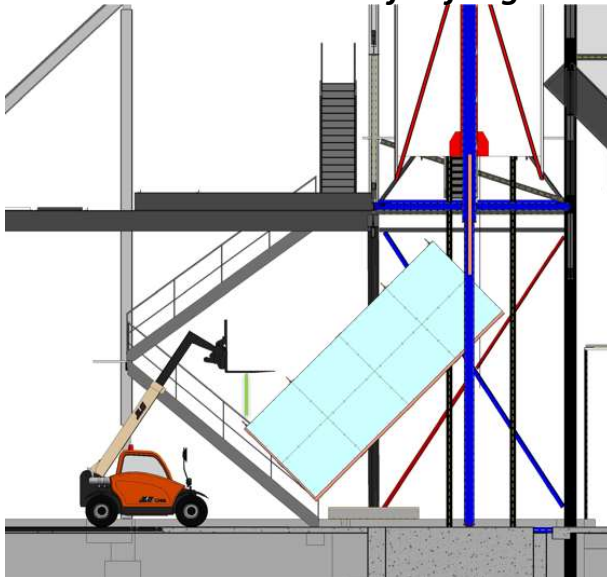
The interaction between the Project and the CO has to be channelled via the APA Frame lead engineer.

*Preliminary Design review –
60 % review
(as CO member)*

Process Example – APA shipping frame analysis plan

Step 2. - Compliance Office – guidance on the first draft of the analysis plan for **the 60% review** based on the Validation Form EDMS #2172998:

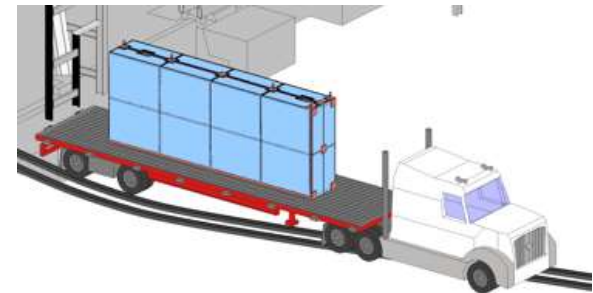
1 – Ross Shaft Lifting



2 – Hoist Ring mounting features



**3 – Transportation Loads
(based on MIL-STD-810H)**



Working with A. Marchionni, J. Freitag, J-L Grenard, T. Jones as CO & RO member

Process Example – APA shipping frame analysis plan

Step 3. – Compliance Office – Review and sign-off the APA analysis plan for the PDR (60% review). *(work in progress)*

Step 4. – Compliance Office and Technical Coordinator Office – Technical assistance during the engineering analysis for the PDR

Step 5. – Approve engineering report for the Review Office

Step 6. – Rework on analysis plan and engineering analysis for the FDR

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Step 7. - see Olga's talk for the complete process flow.

Tips & Learned Lesson

1. Work as team on the analysis plan and provide a top-down engineering evaluation on all load cases.
2. Share technical design inputs on DOE/EN/US structural design standards with consortium technical leaders prior design reviews
3. Provide guidance on weekly basis in preparation of engineering files to follow a unique format to speed-up review process
4. Build-up a friendly and technical work team to assist all consortiums.



THANKS