

EP-DT Group Meeting Engineering Office

Andrea Catinaccio

CERN, November 1st 2016



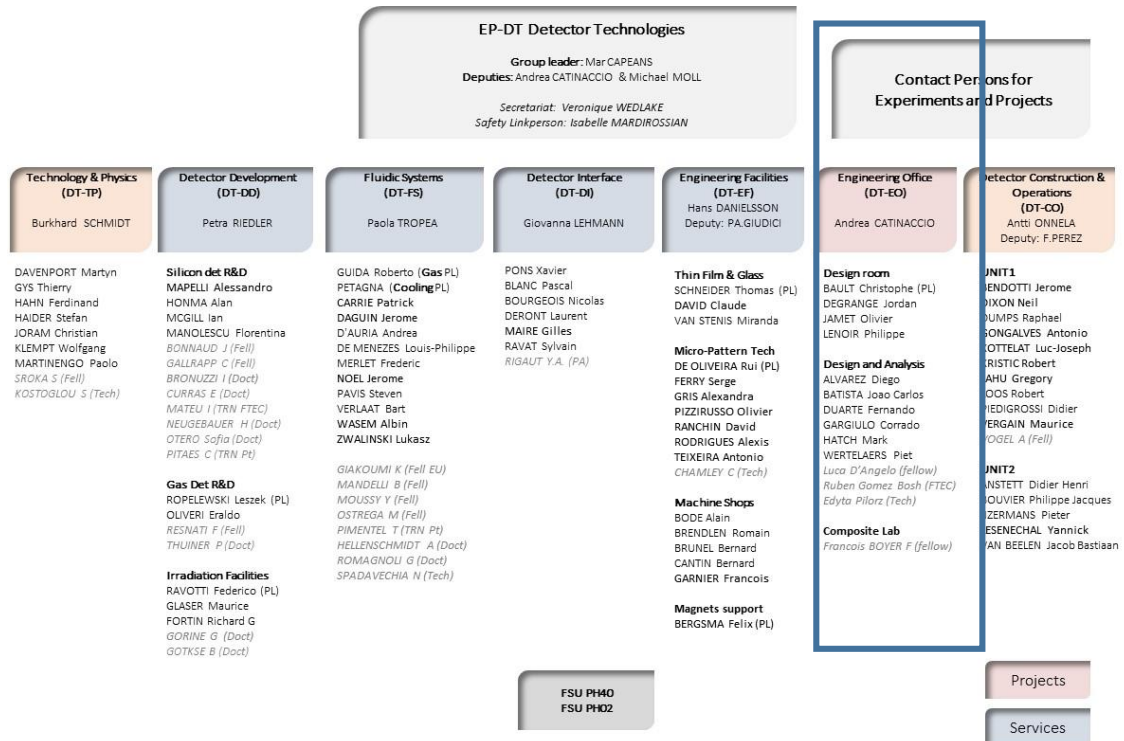
Introduction

New project challenges have driven:

- developments in technical infrastructures
- growth in technical skills
- partial increase of resources.

In the next slides:

- Some info about the section & new personnel
- Update on technologies and technical infrastructures
- Some examples of key projects (new and running)
- Conclusions



Engineering Office (EO) Section Mandate and Team

Mandate

To provide design & engineering expertise for the group's projects:

17 Members

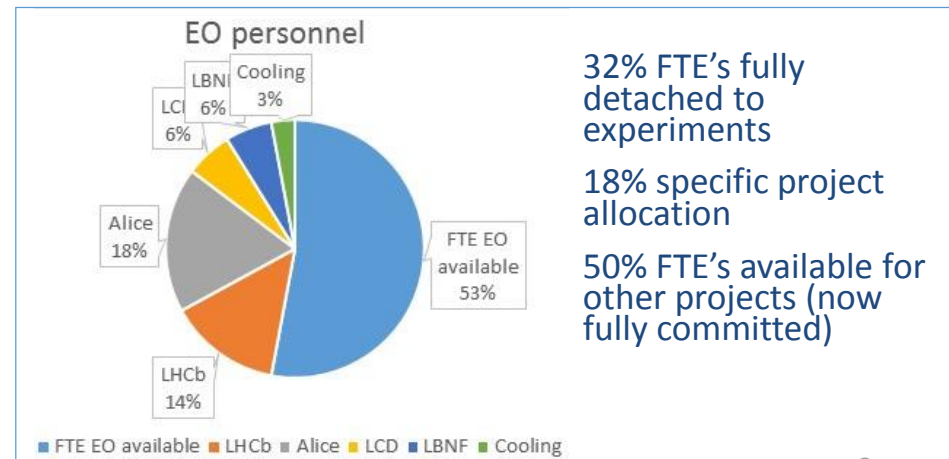
11 Staff members
2 new Fellows
3 new Tech Students
1 new FTEC

Members profile:
13 engineers
4 designers

Query: Status Code All (except Externals) and Ancestor Unit EP-DT-EO

Name	First Name	Primary Nationality	Office 1	Organic Unit	Status Co
ALVAREZ FEITO	Diego	ES	25-R-028	EP-DT-EO	STAF
ANGELETTI	Massimo	IT	70-R-007	EP-DT-EO	TECH
BATISTA LOPES	Joao Carlos	PT	25-R-028	EP-DT-EO	STAF
BAULT	Christophe Daniel	FR	25-R-028	EP-DT-EO	STAF
BOYER	Francois	FR	25-R-004	EP-DT-EO	FELL
CATINACCIO	Andrea	IT	25-R-020	EP-DT-EO	STAF
D'ANGELO	Luca	IT	25-R-028	EP-DT-EO	FELL
DEGRANGE	Jordan	FR	25-R-028	EP-DT-EO	STAF
DUARTE RAMOS	Fernando Manuel	PT	25-R-004	EP-DT-EO	STAF
GARGIULO	Corrado	IT	25-R-014	EP-DT-EO	STAF
GOMEZ BOSCH	Ruben	ES	25-R-028	EP-DT-EO	TRNE
HATCH	Mark	GB	58-1-013	EP-DT-EO	STAF
JAMET	Olivier	FR	3862-2-015	EP-DT-EO	STAF
LENOIR	Philippe	BE	25-R-028	EP-DT-EO	STAF
PELLIZZARI	Andrea	IT	22-R-017	EP-DT-EO	TECH
PIJORZ	Edyta Maria	PL	25-R-028	EP-DT-EO	TECH
WERTELAERS	Piet	BE	25-R-018	EP-DT-EO	STAF

Consolidating future manpower with Department:
2 designer and 1eng. x Composite Lab



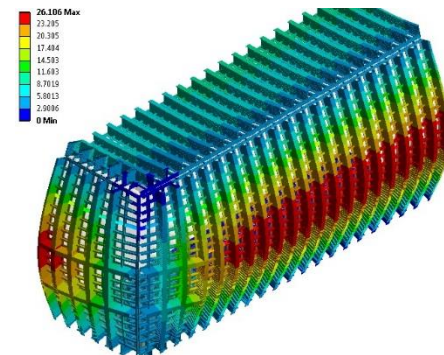
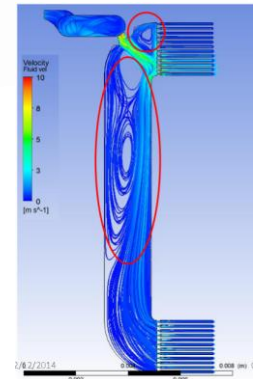
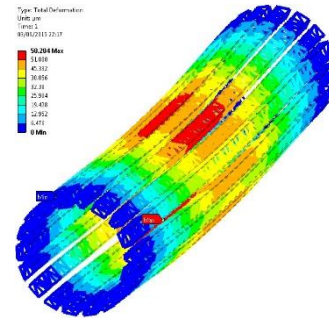
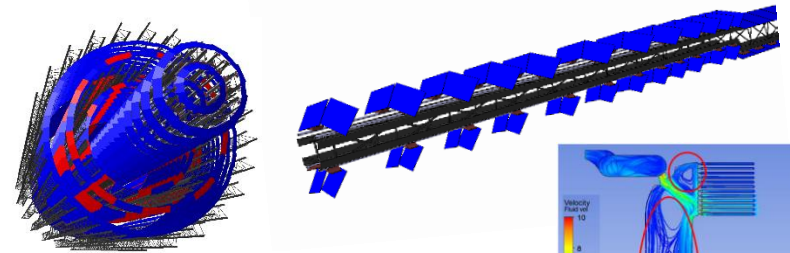
Section EP-DT-EO

Competencies & Infrastructure

Wide range of disciplines in mechanical engineering

The core competencies of the section comprise:

- **Design** studies, 3D modelling and drafting
- **Engineering simulation** for structural and thermal analyses, composites, fluid-dynamics, multi-physics and structural verifications according to relevant standards and codes
- **Integration** studies of detectors
- The section covers as well activities of:
 - **Composite Material** prototyping and manufacturing
 - **Project Engineering**, manufacturing support and follow-up, relations with external suppliers, installation and first commissioning.



EP-DT-EO Technical Infrastructure

EP-DT Composite Lab



*Composite training
(More than 40 people trained to the prepreg technology)*

- Established in 2014: lab fully operational
- Upgrading of equipment well advanced
- All main experiments as customers
- WS on composites @ Berkeley and @ CERN (2017)
- Contacts with KT and the Swiss Space Center for a possible partnership



Production Room



New autoclave 2.5m x 1m



*RTM process
developed with DT-CO*



New compacting table

Semi-clean Room Building 153



Composite laboratory location

Characterization Room



Manual polish system



Optical microscope



Chemical dissolution bench

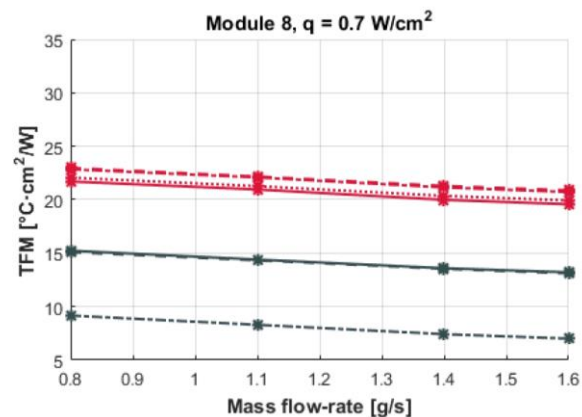
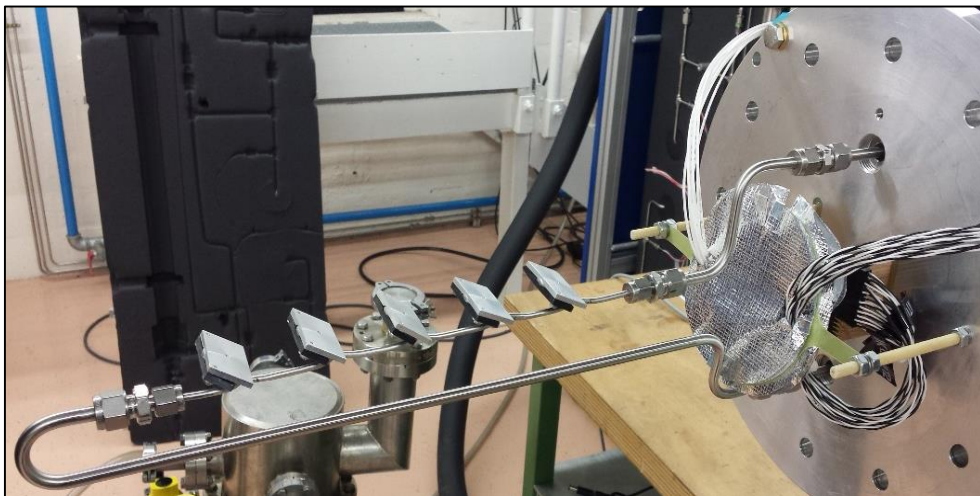


NEW Tensile Testing Machine

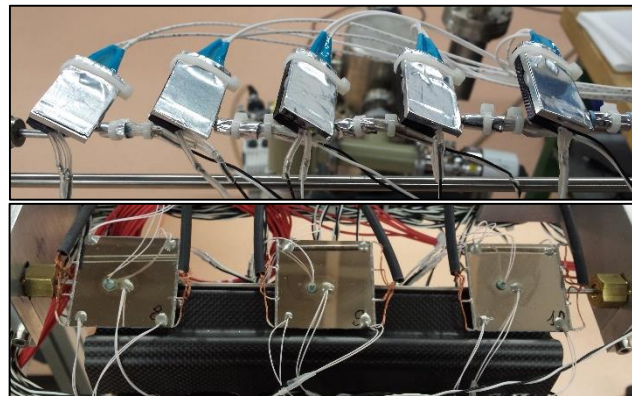
EP-DT-EO Technical Infrastructure

EP-DT Thermal Setup

- Vacuum vessel setup to provide thermal characterization of advanced materials for detectors



- Equipped with Ciller and/or CO2 system
- Prototyping measurements
 - Reference material samples
 - Characterisation of material interfaces
 - Test for Atlas Pixel SLIM v3.0 and v2.0
 - A simple SS sample with 5 loops was tested. Results show no relevant issues.
 - A realistic Ti sample is to be tested after the setup upgrade.

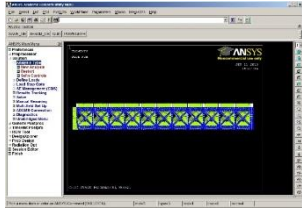


Main Engineering Tools (EO)

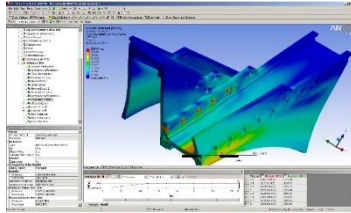
A wide range of tools (12) available for CAD, FEA and analytical calculations.

New CAD/CAM software selected with EN (main workshop) x DT-EF and CO

ANSYS Classic and APDL programming



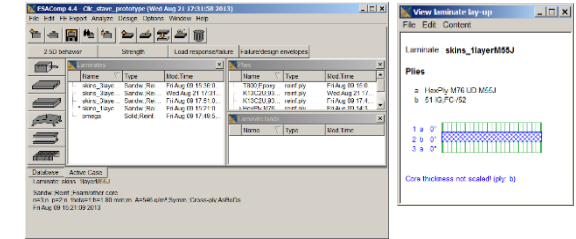
ANSYS Workbench



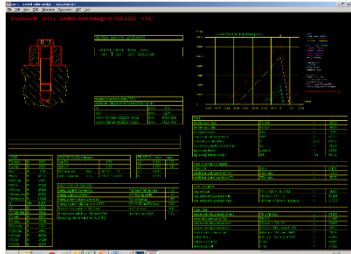
Scia Engineer Structures



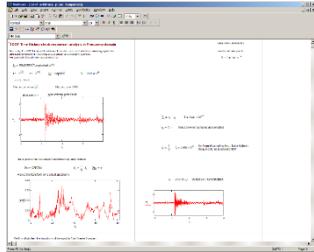
Composites EsaComp



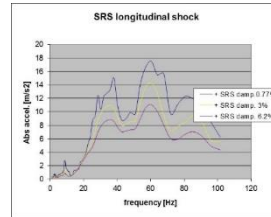
EXAGON assemblies



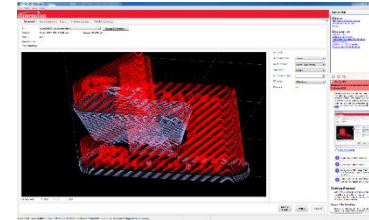
Analytical Mathcad library



Vibration SRS software



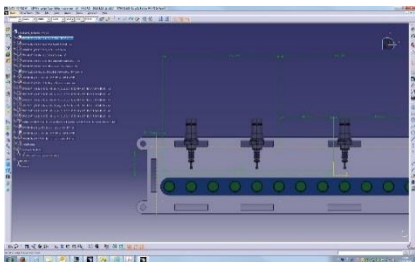
Catalyst for 3D printer
Dimension Elite



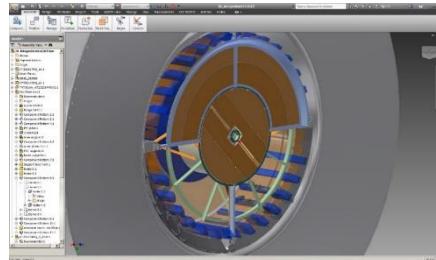
WorkNC CAD/CAM



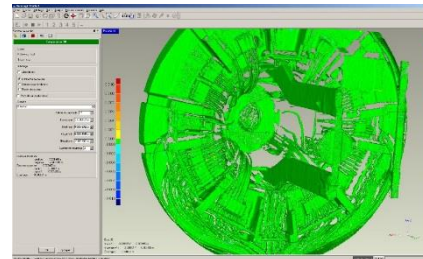
CATIA V5 - 3D modeling
and Smarteam



Autodesk Inventor
3D modeling



Geomagic laser scan
reconstruction



Web - EDMS and \ldfs EO libraries

CERN Accelerating science Signed in as: catinacc Sign out Directory

PH DT Engineering Office

Home DM&PD **Software** Structural mechanics Composites & bonding Thermal & fluids C&I Materials Detectors

GO TO

1 Metals

- 1.1 Sheeting and profiles
- 1.2 Piping
- 1.3 Wiring
- 1.4 Plating, shielding & windows
- 1.5 Fasteners
- 1.6 Welding, soldering & brazing

2 Ceramics

- 2.1 Glasses
- 2.2 Plating and shielding

Materials

View What links here

To add and modify materials in this database follow this [procedure](#).

1 Metals

Composite lab in EDMS

- Stock of raw materials (pregreg, foams ...)
- Production of the different pieces
- Safety files

<https://ph-dep-dt-eo.web.cern.ch/>

Mathcad section library

ANSYS model library

CERN Accelerating science

EDMS Home Favourites Inbox

Navigator

1523064 v.2 Released CERN Internal

Inventaire matières premières by FRANCOIS B

Composite lab

- Procedures & templates
 - 1450919 (v.1) Template Fiche de suivi pièce co
 - 1418623 (v.1) Life and control of prepeg
- Equipment inventory
- Production
 - CMS
 - CLIC
 - ATLAS
 - LHCb
 - ALICE
 - 1481197 (v.1) Protocole fabrication slave comp
 - 1693224 (v.3) VRTM Process Video
 - 1698508 (v.1) PROCEDURE FOR THE FABRI
- Planning Equipment
 - 1604174 (v.2) Planning Oven
- Safety files
 - 1499243 (v.2) Description Lab

Info

Description:

Details

Local administrators: [List of Administrators](#)

Context: PH-DT-EO CERN-VIEW
PH-DT-EO context for documents to be users

Associated Links:

This page <https://edms.cern.ch/document/1523064>

Files

Add Delete Download all

Name
Stock_raw_material_Room_153.docx

Page 1 of 1

More info

Sub Documents Used In Approval & Comments

Engineering & Equipment Data Management Service (EDMS)

<https://edms.cern.ch/nav/P:CERN-0000089058:VO/P:CERN-0000089058:VO/TAB3>

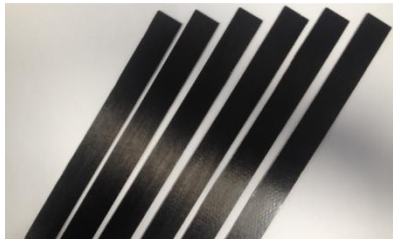
EP-DT-EO some examples of key projects and technologies in 2016

Among about 30 projects / activities (non exhaustive list) followed each year.

EO projects with Composites

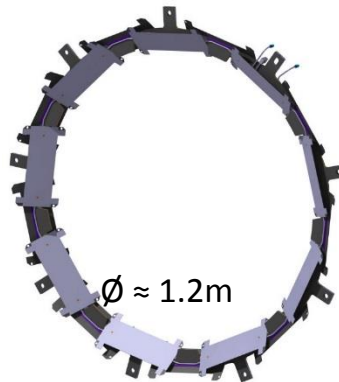
Activities since the beginning of the year

- The composite lab is now prototyping and producing final CFRP components for most of CERN Experiments

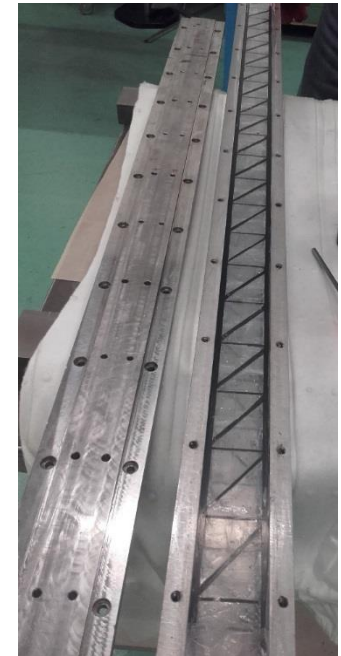


Stave prototype for CLIC experiment

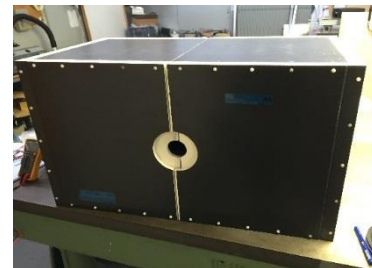
Production of ring prototypes for CMS tracker phase 2



Production of Shell longeron prototypes for ATLAS phase 2 pixel upgrade (SLIM)



Production of Truss longeron prototypes for ATLAS phase 2 pixel upgrade (SLIM)



UT Box prototype for LHCb experiment



Tracker outer prototype for CLIC experiment



MICROMEAS
Carbon vacuum table (DT-CO)



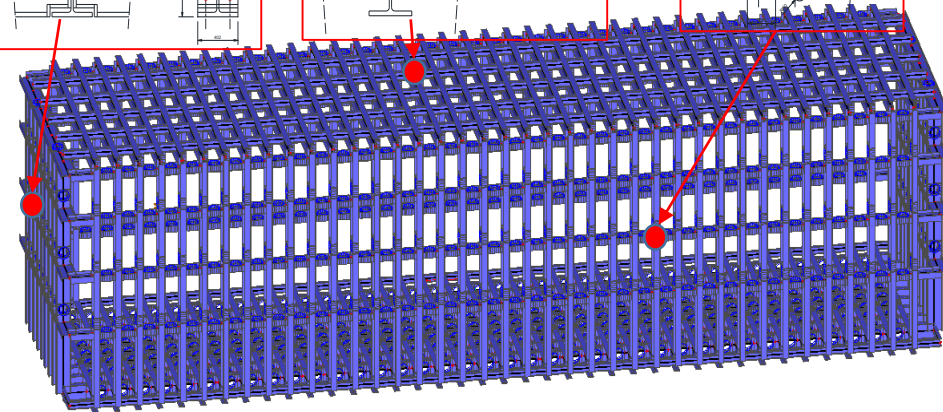
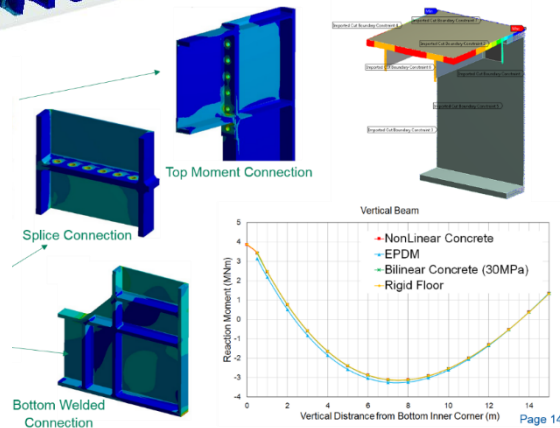
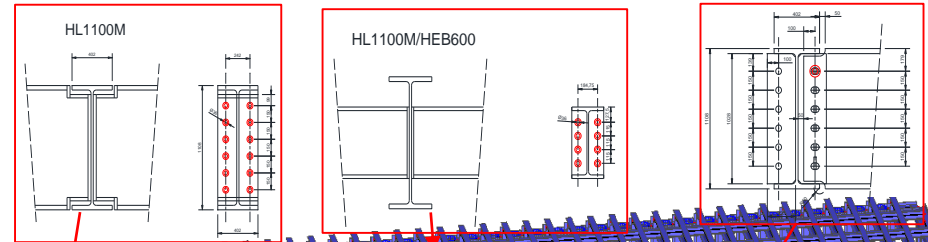
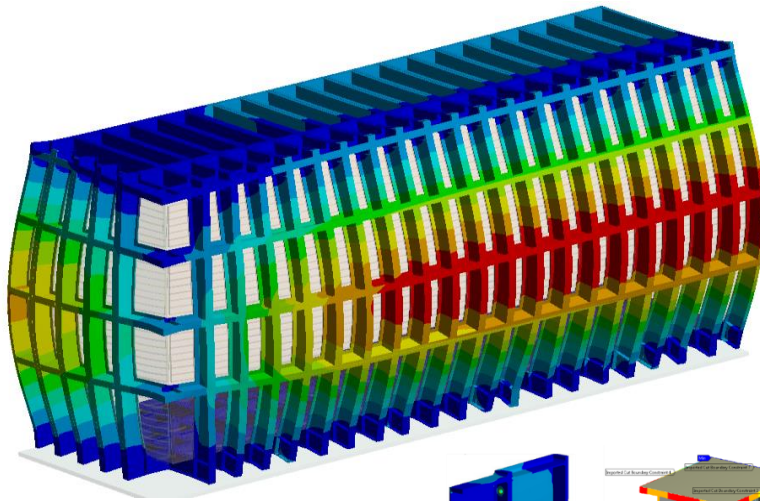
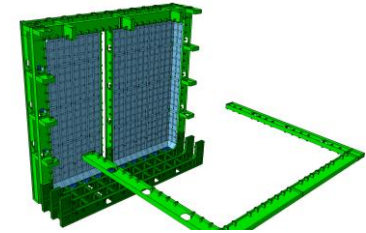
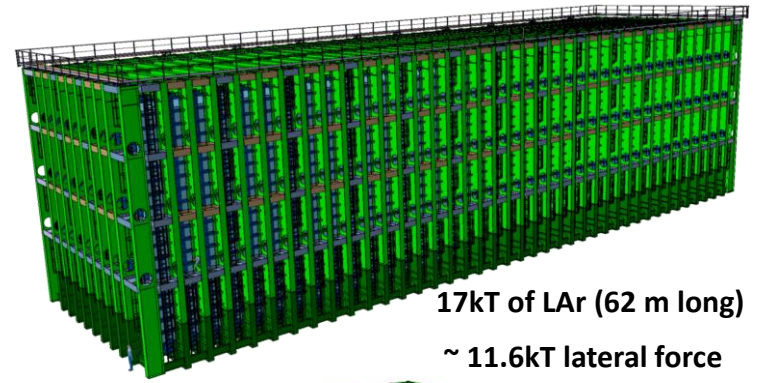
Carbon plates produced for CMS (module 2S and PS)



Support for AIDA¹⁰ calorimeter

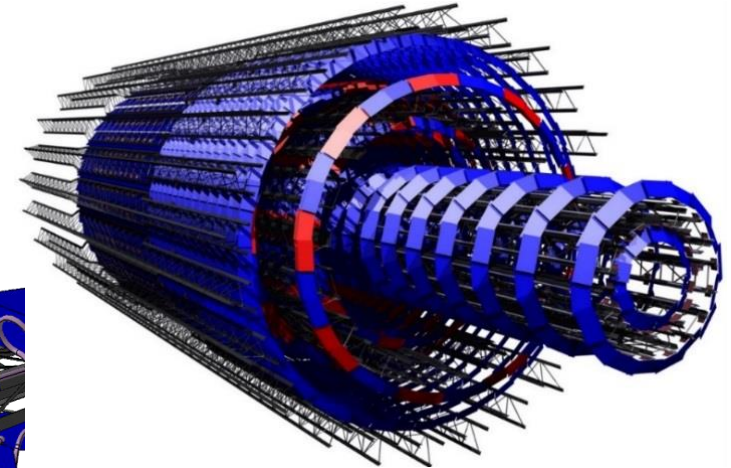
EO Neutrino LBNF

- 3D CAD models
- Assembly process and tooling
- Structural design (EC3 / SCIA, Analytical)
- FEA Warm Vessel, Bolted/Welded Connections (Sub-modelling), Floor support conditions.

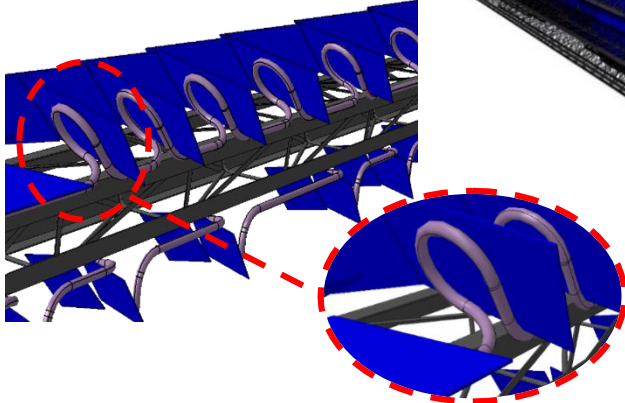


ATLAS Pixel Phase 2 Upgrade: SLIM Project

- Design, optimisation & prototyping of CFRP support structures (Truss girder)
- Development of aggressive solutions for cooling tilted silicon modules

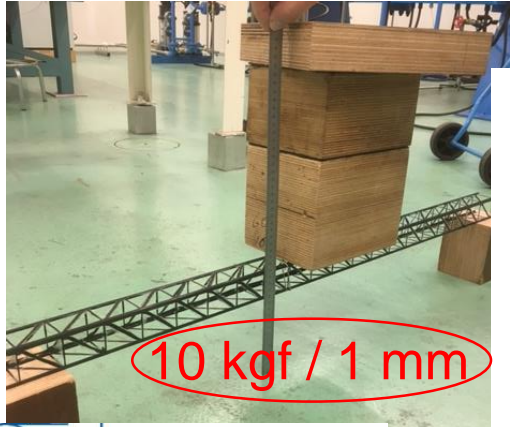
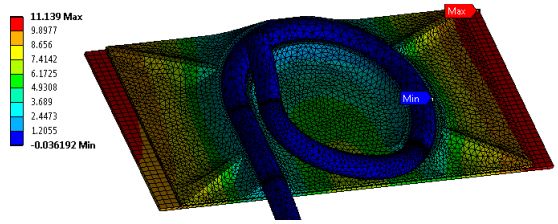


~ 40g/m

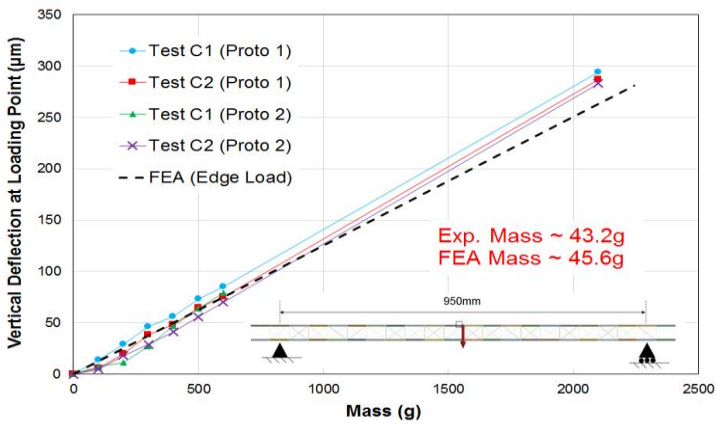


“Looping” pipe concept

Conductive TFM



10 kgf / 1 mm



0.36g (porous graphite)

EO other Projects

Other examples of running projects/ activities (non exhaustive list):

CMS :

- Upgrade TOB, TIB
- Upgrade High granularity Si Calorimeter
- CMS HGCal wafer probe station setup

Alice

- ITS upgrade
- ITS, TPC, installation LS2
- TC integration

LHCb

- upgrade (SciFi tracker), UT detector
- TC integration, infrastructure design and calculations

NA62

- GTK integration and micro-cooling
- Straw detector (post installation support)

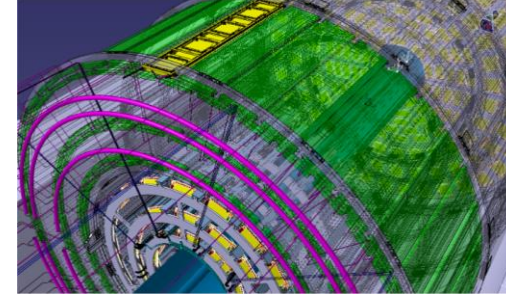
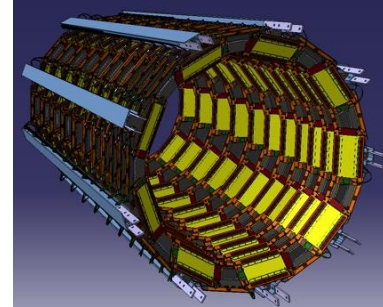
LCD:

- CLICdp Vertex, Integration studies HCAL, ILC collaboration
- Outer tracker support structure prototype
- Testbeam telescope

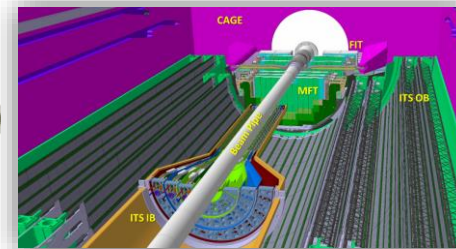
Support to the Cooling Project (EP-DT-FS)

Support Catia / Smarteam

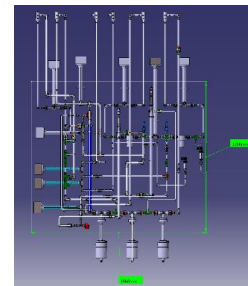
Micro-fabrication and micro-scint design support



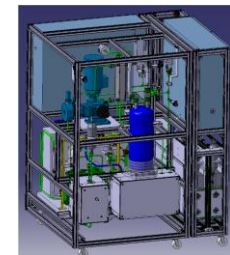
Integration: CMS OUTER TRACKER PHASE 2 UPGRADE



Alice ITS staves production, Beam pipe production, TC integration



Junction Box for LHCb detectors: UT & Velo



Operation Lucasz Plant modelling

EP-DT-EO 2016 Objectives and Conclusions

- Objectives presented at the beginning of the year have been largely achieved (DTCM with management on 14.1.2016).
- This thanks to the expertise and commitment of all the team members.
- Several examples have been provided here on:
 - Key technologies.
 - Discipline retention – synergies.
 - Multitasking, balance of resources.
 - Complementary areas of expertise (Composites, Thermal materials)
- Projects for 2017 are very challenging.
- Existing DT Resources will need to be internally re-allocated.
- Resource consolidation by the Department will be the key for the present and future success of EO.

Thank You

EP-DT-EO 2016 Objectives and achievement examples

Results of Objectives presented at the DTCM with management on 14.1.2016

- **Stay at the forefront of key technologies:**
- Some examples: recent development in CFRP, thermal material characterization - WS on composites @ Berkely and @CERN 2017 - contributing to Forum on Detector Mechanics - KT developments on micro heat pipes, Swiss space center - New facilities developed - New challenges in projects as Pixel and Neutrino large structures.
- **Continue to develop a Reservoir of technical expertise – discipline retention – synergies across projects:**
- Some examples: Training in CFRP provided - synergies with Alice and CMS in composite development- procurement and sharing of raw material - development and sharing of engineering database. Selection and procurement of new CAD/CAM system (WorkNC) for EF and CO.
- **Respond efficiently to large multitasking, balance of resources:**
- Some examples: dynamic allocation of designers and engineers for Neutrino, ITK Pixel, Cooling, Support for CFRP developments, 3D printed parts - New Students, Fellows, FTEC and Trainees (5 young trainees this year) x projects.
- **Develop further complementary areas of expertise (Composites, CFD):**
- Some examples: design and calculations of large metallic structures, composites (see above), advanced thermal materials, on CO2 on-detector cooling

EP-DT Detector Technologies

Group leader: Mar CAPEANS
Deputies: Andrea CATINACCIO & Michael MOLL

*Secretariat: Veronique WEDLAKE
Safety Linkperson: Isabelle MARDIROSIAN*

Contact Persons for Experiments and Projects

Technology & Physics (DT-TP)

Burkhard SCHMIDT

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GYS Thierry
HAHN Ferdinand
HAIDER Stefan
JORAM Christian
KLEMPF Wolfgang
MARTINENGO Paolo
SROKA S (Fell)
KOSTOGLIOUS (Tech)

Detector Development (DT-DD)

Petra RIEDLER

Silicon det R&D
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HONMA Alan
MCGILL Ian
MANOLESCU Florentina
BONNAUD J (Fell)
GALLRAPP C (Fell)
BRONUZZI I (Doct)
CURRAS E (Doct)
MATEU I (TRN FTEC)
NEUGEBAUER H (Doct)
OTERO Sofia (Doct)
PITAES C (TRN Pt)

Gas Det R&D
ROPELEWSKI Leszek (PL)
OLIVERI Eraldo
RESNATI F (Fell)
THUINER P (Doct)

Irradiation Facilities
RAVOTTI Federico (PL)
GLASER Maurice
FORTIN Richard G
GORINE G (Doct)
GOTKSE B (Doct)

Fluidic Systems (DT-FS)

Paola TROPEA

GUIDA Roberto (**Gas** PL)
PETAGNA (**Cooling** PL)
CARRIE Patrick
DAGUIN Jerome
D'AURIA Andrea
DE MENEZES Louis-Philippe
MERLET Frederic
NOEL Jerome
PAVIS Steven
VERLAAT Bart
WASEM Albin
ZWALINSKI Lukasz

GIAKOUMI K (Fell EU)
MANDELLI B (Fell)
MOUSSY Y (Fell)
OSTREGA M (Fell)
PIMENTEL T (TRN Pt)
HELLENESCHMIDT A (Doct)
ROMAGNOLI G (Doct)
SPADAVECHIA N (Tech)

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PONS Xavier
BLANC Pascal
BOURGEOIS Nicolas
DERONT Laurent
MAIRE Gilles
RAVAT Sylvain
RIGAUT Y.A. (PA)

Engineering Facilities (DT-EF)

Hans DANIELSSON
Deputy: PA.GIUDICI

Thin Film & Glass

SCHNEIDER Thomas (PL)
DAVID Claude
VAN STENIS Miranda

Micro-Pattern Tech

DE OLIVEIRA Rui (PL)
FERRY Serge
GRIS Alexandra
PIZZIRUSSO Olivier
RANCHIN David
RODRIGUES Alexis
TEIXEIRA Antonio
CHAMLEY C (Tech)

Machine Shops

BODE Alain
BRENDLEN Romain
BRUNEL Bernard
CANTIN Bernard
GARNIER Francois

Magnets support

BERGSMA Felix (PL)

FSU PH40
FSU PH02

Engineering Office (DT-EO)

Andrea CATINACCIO

Design room

BAULT Christophe (PL)
DEGRANGE Jordan
JAMET Olivier
LENOIR Philippe

Design and Analysis

ALVAREZ Diego
BATISTA Joao Carlos
DUARTE Fernando
GARGIULO Corrado
HATCH Mark
WERTELAERS Piet
Luca D'Angelo (fellow)
Ruben Gomez Bosh (FTEC)
Edyta Pilorz (Tech)

Composite Lab

Francois BOYER F (fellow)

Detector Construction & Operations (DT-CO)

Antti ONNELA
Deputy: F.PEREZ

UNIT1

BENDOTTI Jerome
DIXON Neil
DUMPS Raphael
GONGALVES Antonio
KOTTELAT Luc-Joseph
KRISTIC Robert
LAHU Gregory
LOOS Robert
PIEDIGROSSI Didier
VERGAIN Maurice
VOGELA A (Fell)

UNIT2

ANSTETT Didier Henri
BOUVIER Philippe Jacques
IJZERMANS Pieter
LESENECHAL Yannick
VAN BEELEN Jacob Bastiaan

Projects

Services

EP-DT-EO Current Projects

More than 30 projects / activities (non exhaustive list):

Atlas

- Upgrade ITk Pixel, Pixel structures and thermal R&D
- Jig for bonding module onto flex
- Micromegas design x production

CMS :

- Upgrade TOB, TIB
- Upgrade High granularity Si Calorimeter
- CMS HGCal wafer probe station setup

Alice

- ITS upgrade
- ITS, TPC, installation LS2
- TC integration

LHCb

- upgrade (SciFi tracker), UT detector
- TC integration, infrastructure design and calculations

NA62

- GTK integration and micro-cooling
- Straw detector

Neutrino LBNF:

- Structural engineering and final design review (Andrea, Joao, Piet, Christophe, Luca) 2.5 FTE's plus 1 fellow from July . Ongoing.

LCD:

- CLICdp Vertex, Integration studies HCAL, ILC collaboration
- Outer tracker support structure prototype
- Testbeam telescope

Support to the Cooling Project (EP-DT-FS)

Micro-fabrication and micro-scint design support
FEA support and design studies
3D printing, Catia user support

EP-DT-EO Current Projects

More than 30 projects / activities (non exhaustive list):

Composite lab

- Tools and infrastructures
- Prototype activities

Thermal Testing Setup

Engineering database

- Structure implementation
- Populating DB

R&D

- Composite materials
- Thermal management materials
- FEA methods: creep, CZM, fracture mechanics, XFEM, Ansys-Catia bi-directional associative connection, FEA model integration
- 3D printing technologies (Christophe)