ATLAS Plans for LS2

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With Thanks to the many people who provided input

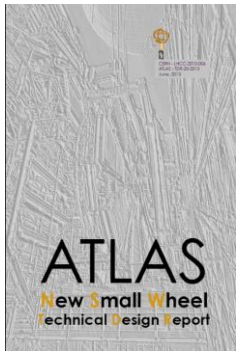
LS2 DAYS

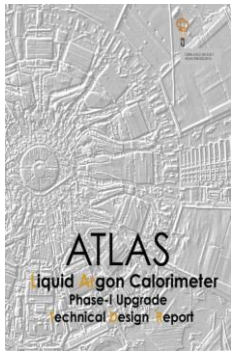
29-30 SEPTEMBER 2015

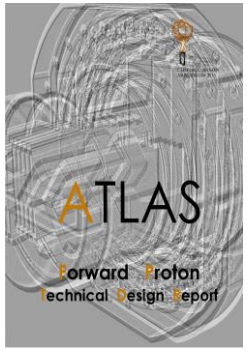
http://indico.cern.ch/event/436424/

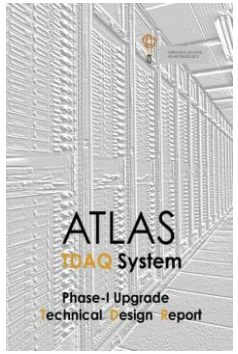
Outline

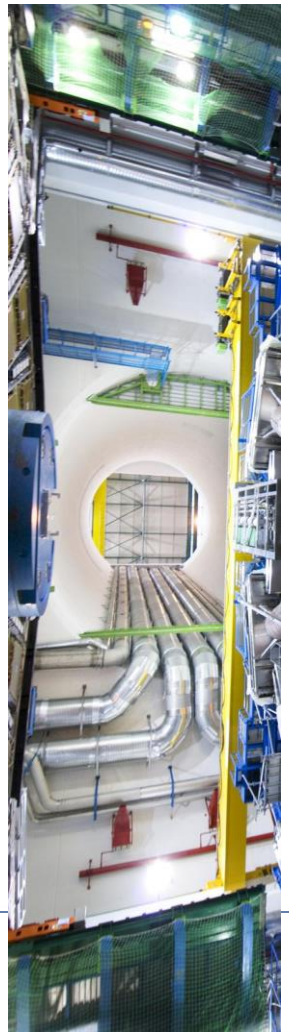
- ATLAS Phase1 Upgrades
  - AFP in 2016 and 2017
  - New Small Whell
  - Calorimeter Trigger Electronics
  - BIS7/8 installation
  - BMG Installation in EYETS
  - FTK (not in this talk)
  - TDAQ (not in this talk)
- Infrastructures
  - Electrical services
  - Cooling and Ventilation
  - Transports and cranes

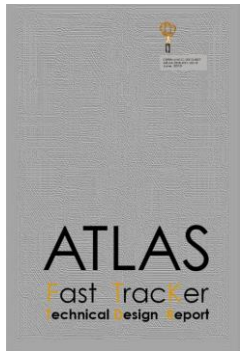






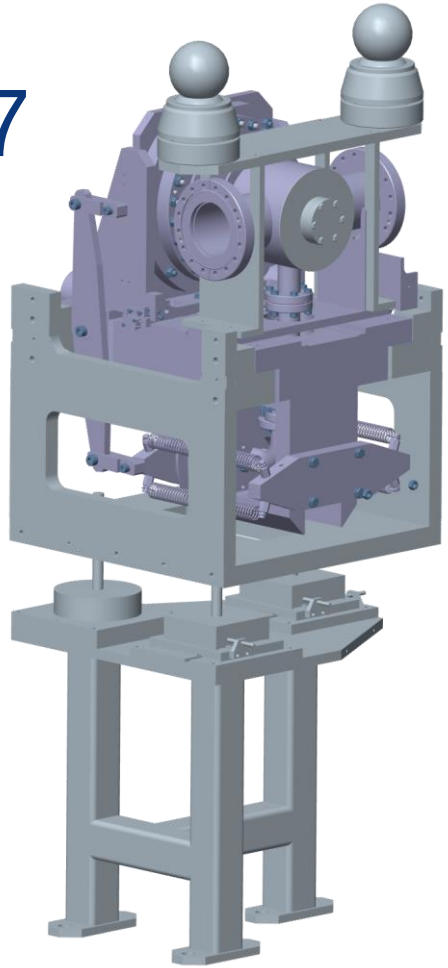






AFP installation 2016 and 2017

- AFP is made a double arm detector
  - In 2015 only one arm has been funded to be installed during this year YETS
- Each detector consists of 2 Stations containing Roman Pots placed at 205 and 217 mt from IP



AFP installation in YETS 2015-16

- 2016- Aim to install two stations of ARM on C6R1 (Jura side of IP), second ARM in 2017
- ECR for installation in 2016 work approved in LMC-232
  - Integration in tunnel in collaboration with EN-MEF
  - Drilling of holes for the AFP supports should start during YETS
  - Installation of the stations hopefully by the end of the YETS after commissioning of equipment on surface
  - Modify Exterior vacuum chamber between Q5 and Q6
    - 2 VPI
    - 2 BLM, 1-2 BPM
  - 2 Roman pot stations: 205 m, 217 m from Point 1
    - secondary vacuum
    - air cooling

AFP installation in YETS 2015-16

- 2016- Install cables for trigger in the service tunnel for both arms
  - After discussion with surveyors agreed to install this year both sides not to duplicate the dismounting of the surveyors equipment
  - This work will entail the passage of the cable from the LHC tunnel to the surveyors gallery
  - Need to check tightness of sealing after installation
  - Cable installation will be done in collaboration with EN-MEF (Gianluca Canale)
- 2016- Install cables for services from Stations to US15 (not yet clear if services form both ARM will be installed in 2016)
  - This work will be done in collaboration with EN-MEF
  - The cabling from US15 to USA15 (in the UX15 cavern) can be done by ATLAS team
- Install patch panels/crates/racks at 205 m, 217 m, and 212 m
- Controls, Vacuum and motorization of the roman pots done in collaboration with PH-DT
  - commissioning of motorization, interlocks, and detectors

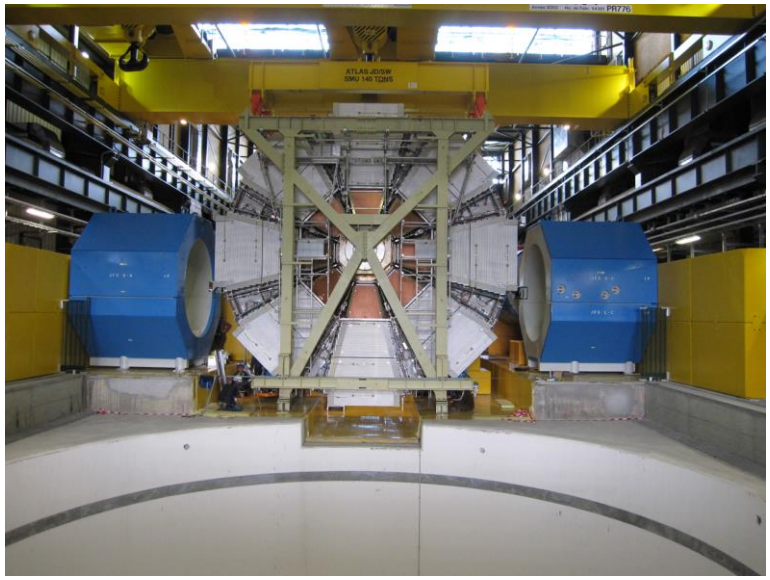
AFP installation in EYETS 2016-17

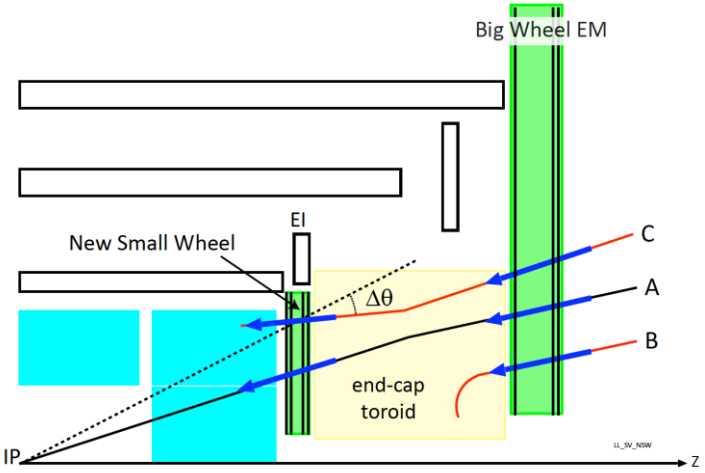
- 2017- second ARM in C6L1
  - Modify Exterior vacuum chamber between Q5 and Q6
    - 2 VPI
    - 2 BLM, 1-2 BPM
  - 2 Roman pot stations: 205 m, 217 m from Point 1
    - secondary vacuum
    - air cooling
  - Install remaining cables from station in C6L1 to US15
    - Cable installation will be done in collaboration with EN-MEF(Gianluca Canale)
    - The cabling from US15 to USA15 can be done by ATLAS team

The New Small Wheel

- Replace the present first measuring station of the forward muon spectrometer with New Small Wheel (NSW)
- The NSW will allow to:
  - Improve the LVL1 muon trigger capabilities
  - Cope with Rate limitation of the present detectors

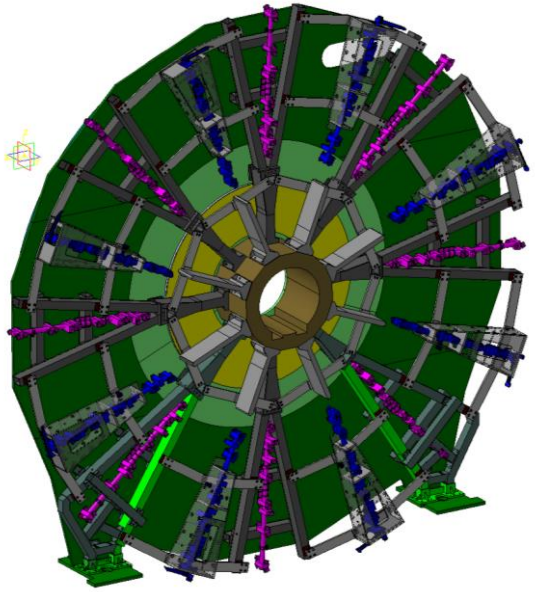
Small wheel on surface in 2013

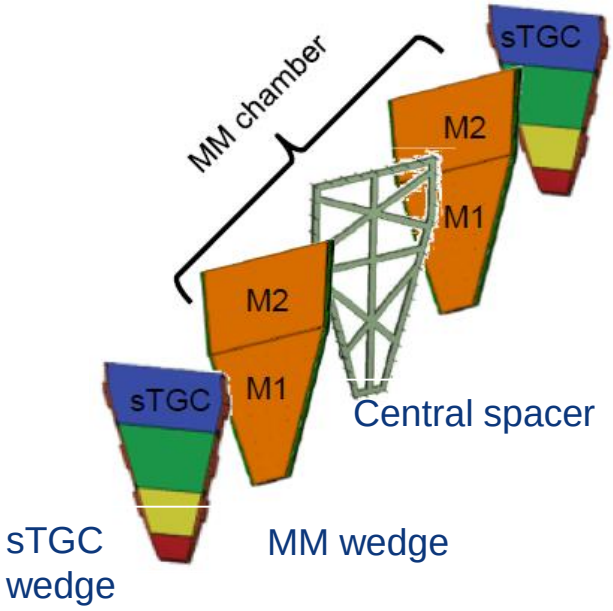




The New Small Wheel

- Main components to be produced and integrated
  - New JDs and Sector support structures:
    - Heavy and big Objects (10 mt hight ,100 Tons)
  - 32 MICROMEGAS (MM) Sectors
  - 32 sTGC Sectors
  - Integration of MM and sTGG in 32 Sectors





NSW Assembly and integration

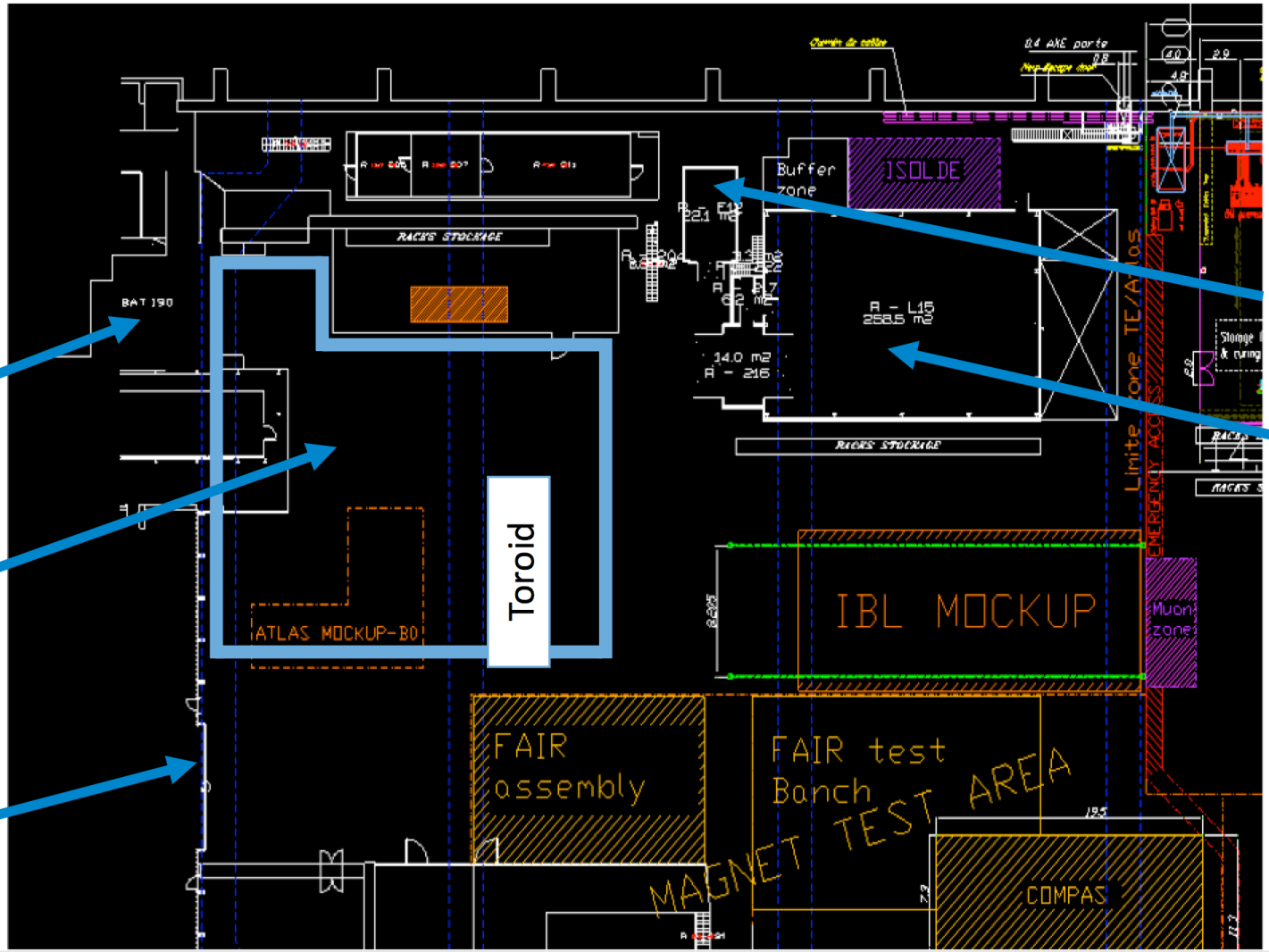
- NSW commissioning, assembly and integration will take place in buildings 899 (BB5), 180 and 191.
- BB5:
  - MicroMegas quadruplet reception, storage, testing
  - Central spacer assembly and integration into wedges
  - These activities will be carried out by personnel from the involved institutes, including operation of the 2 overhead cranes in BB5 R-001.
- Support from CERN transport services is needed for:
  - transporting completed wedges from BB5 to 180/191 (32 in total)
  - transporting quadruplet packages between BB5 and GIF++,
    - 1 transport in each direction about every 2 weeks starting from second half of 2016 to end 2017.

NSW Assembly and integration

- Bld 180:
  - sTGC wedge assembly in the 180 ATLAS clean room and tested in the gas room close to clean room.
    - Refurbishment of the Gas Detection system needed for flammable gas
  - Handling of quadruplets during wedge assembly will be done by personnel from involved institutes.
  - Wedges will be stored (in Bld 180) on wheels

- Support from CERN transport services is needed for:
  - Reception of quadruplets from the institutes (unloading, shipment is by container)
  - Transporting quadruplet packages between 180 and GIF++

BLD 180 layout



B190

Proposed area of use for wedges and sectors

Entrance

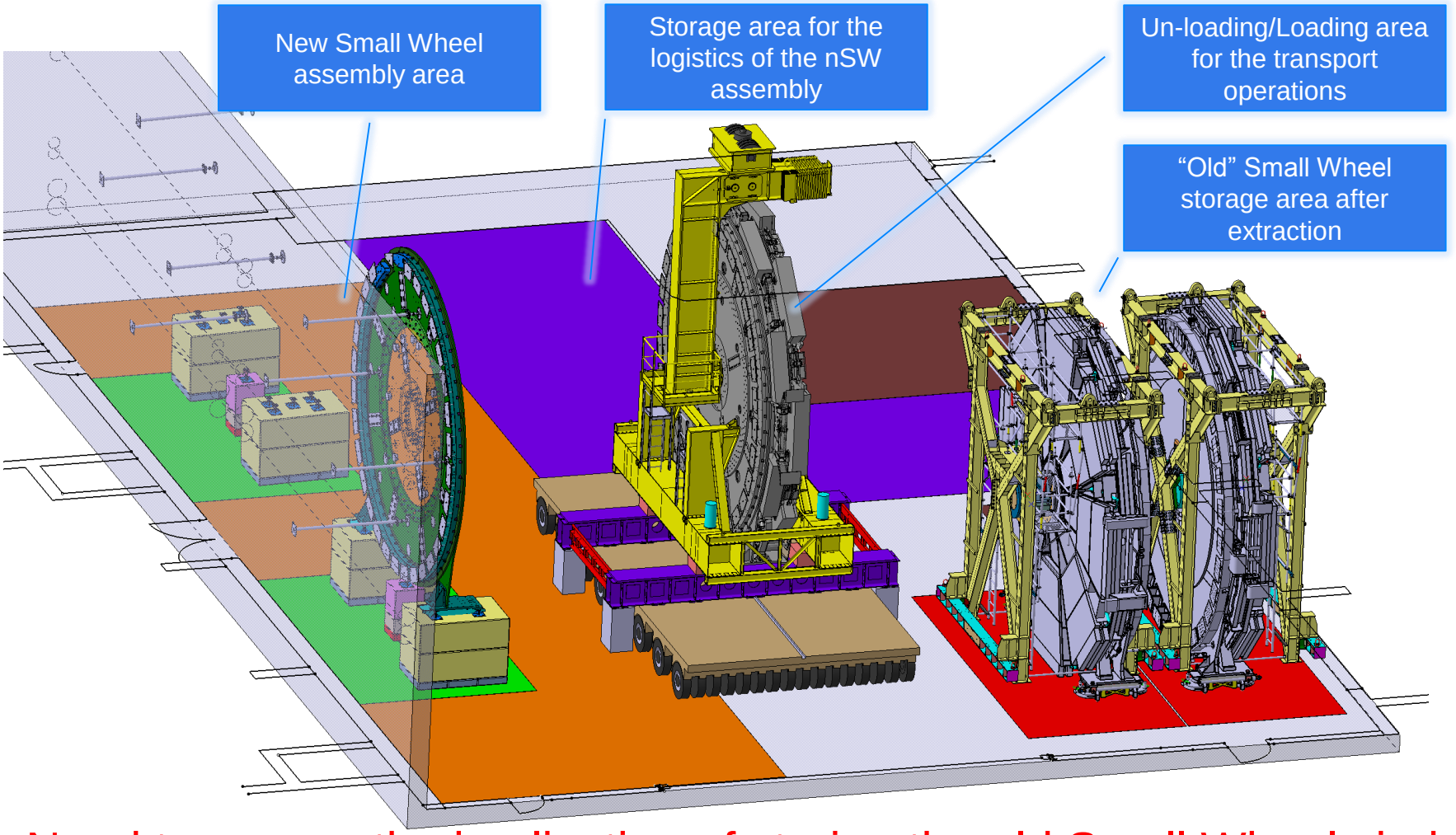
sTGC Gas Testing Room

sTGC Clean Area

NSW Assembly and integration

- 180 continued:
  - Moving of completed sTGC wedges from 180 to 191 can either be:
    - Via an internal passage through 190 (NSW preferred solution, but currently disfavoured by PH space management)
    - By truck from 180 to 191 via the outside.
  - For the second scenario, crane (main 180 bridge crane) and transport support is needed starting from Q3/Q4 2017.
- 191:
  - Assembly of the NSW JD, structure, plug/hub + shielding plus mounting of MM and sTGC wedges/sectors.
  - Activities will start ~Q2 2017 and be continuous for 2 years.
- Handling (crane) support will be needed
  - 2 crane drivers

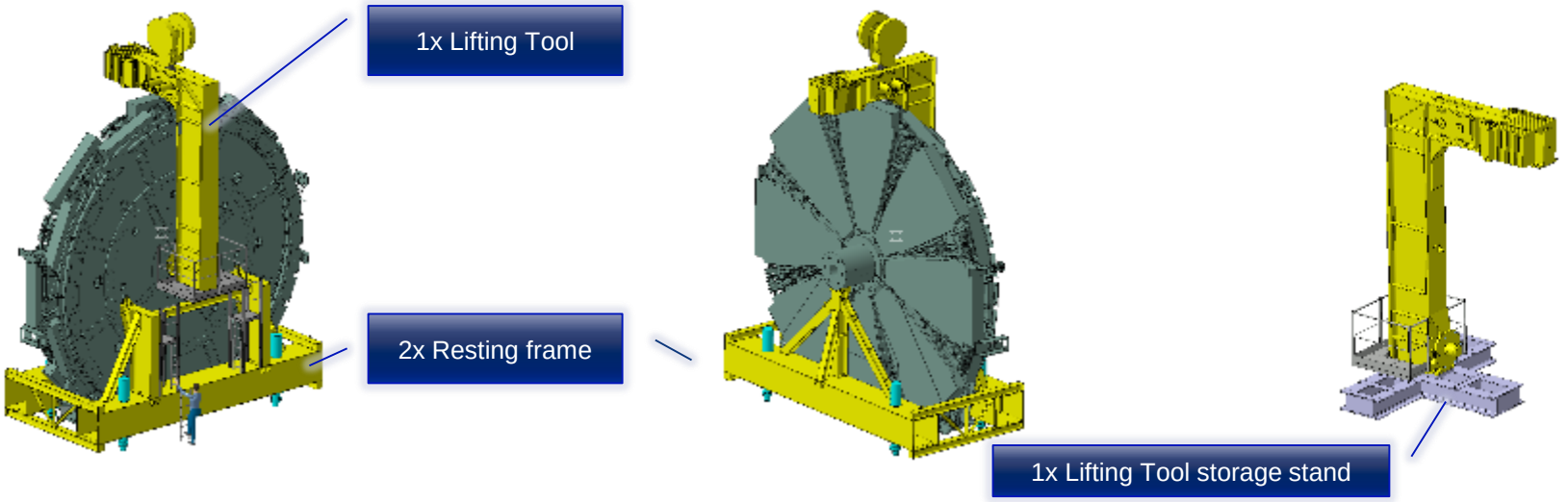
Layout of Bld191



- Need to assess the implication of storing the old Small Wheels in bld 191 in terms of radiation protection (RSO and RP)

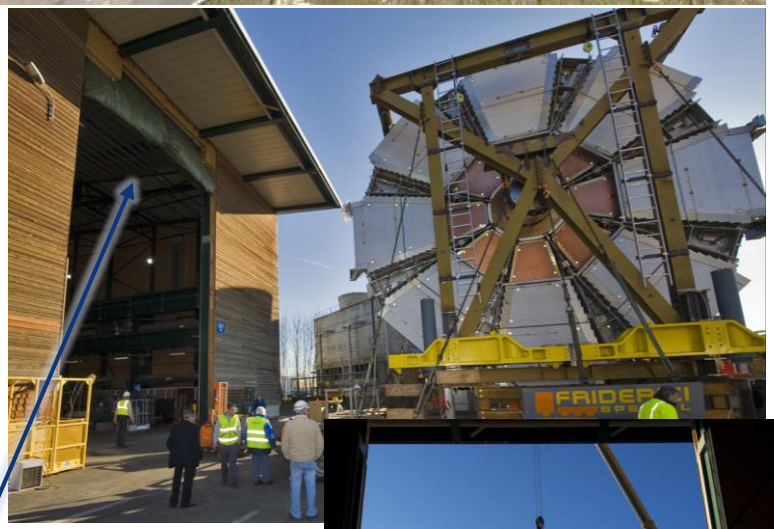
The New Small Wheel : tooling

- To ease and speed up the handling operation of the NSWs, new lifting tooling have been designed.
- The fabrication of these tooling will be sub-contracted via EN-MME-FS services. Fabrication is foreseen for 2016-2017



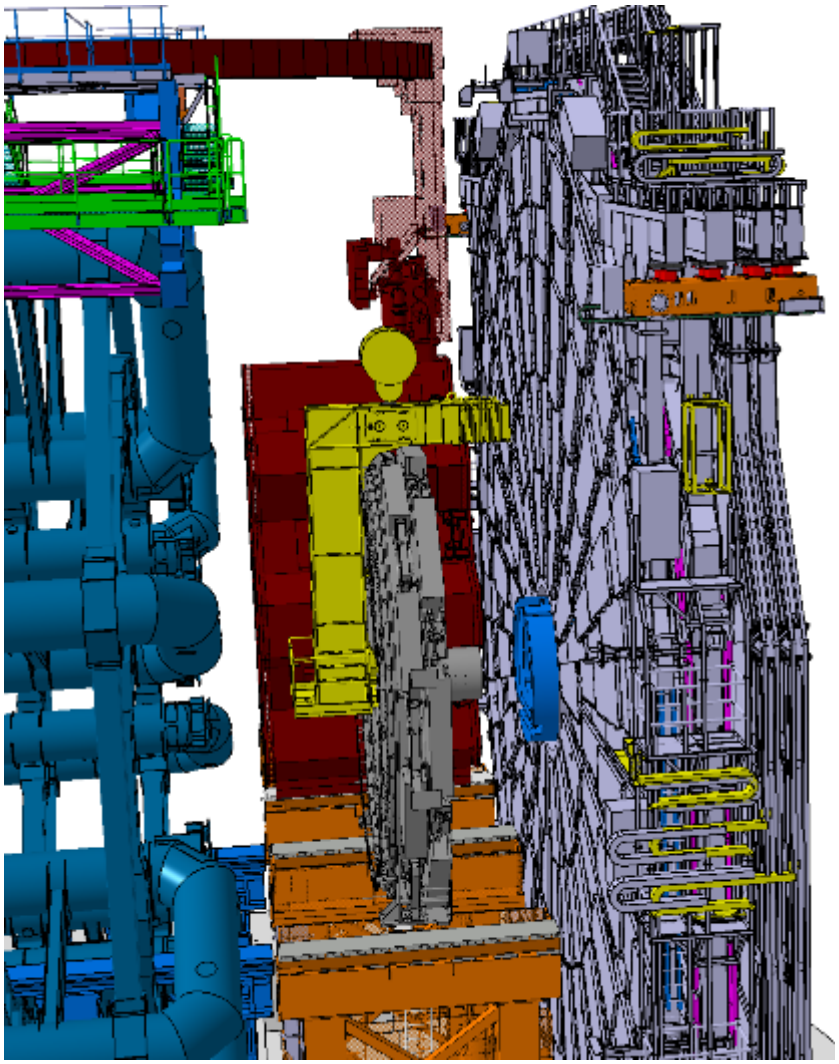
The New Small Wheel

- Transport
  - Transport of very large (10m hight), heavy (120T) and delicate objects
    - Small Wheels from SX1 to bld 191
      - 2 special transports (with double trailer)
    - NSWs from bld 191 to SX1
      - 2 special transports (with double trailer)
      - The timing of these operations will be very different for Side C (beginning 2019) and Side A (beginning 2020)
      - Requirements on transports (acceleration, angle, vibration) and environmental factors (temperature)
      - Passage through new tram line toward St Genis will have to be handle with TPG and Police Cantonale.
      - For each of this transport the CERN mobile crane is required at point1 to remove the protection cover in front of the SX1 and to dismount the panel above the door



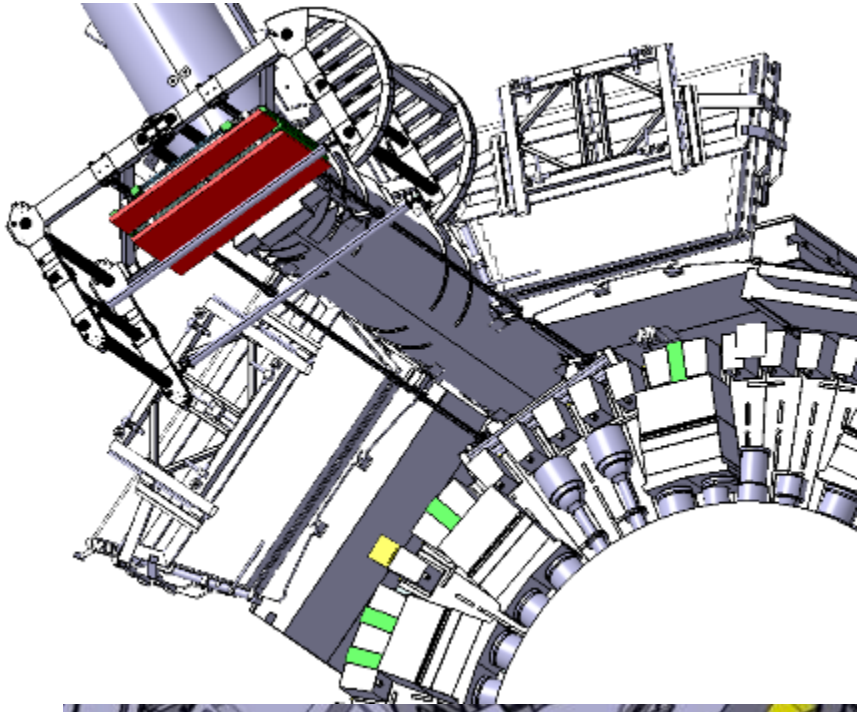
The New Small Wheel

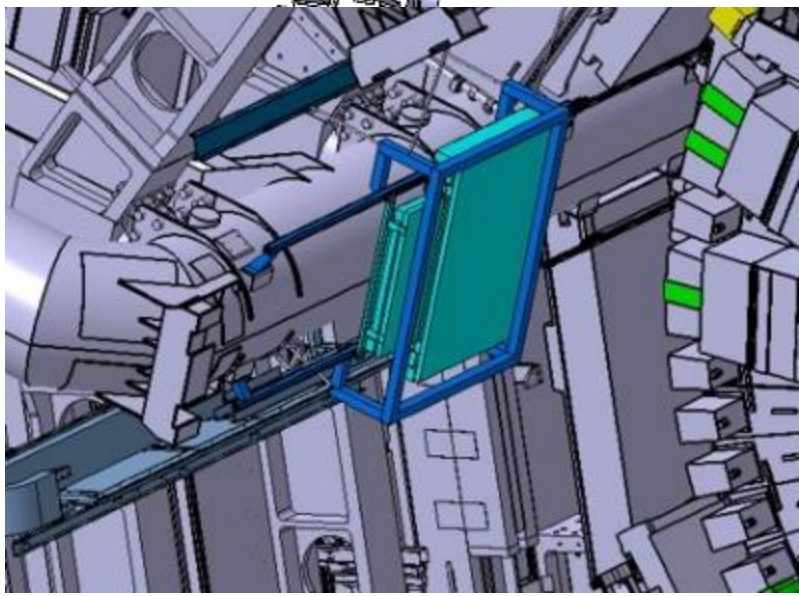
- Final Deployment in UX15
  - Use of 140T crane
  - nSW will be left in vertical position on the truck
  - Access to the lifting tool thanks to the Palazzani cherry pick-up placed on US15 side



BIS7/8 installation

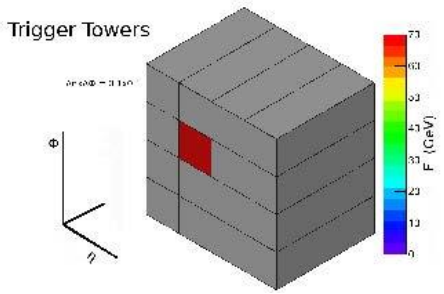
- Replace the present BIS7/8 MDT chambers with new sMDT and RPC chambers to enhance Muon LVL1 trigger and rate capabilities
  - Installation of 16 stations
  - These activities will be carried out by personnel from the involved institutes, including operation of the 2 overhead cranes in BB5 R-001.
  - Transports
    - 16 transports from point1 to BB5 for BIS7 & BIS8 removal
    - 16 transports from BB5 to Pt1 for new BIS7&8 installation
- Very challenging installation
  - Will be done with ATLAS resources and crane drivers available for ATLAS during LS2, (about 2 days operation per chamber in cavern)

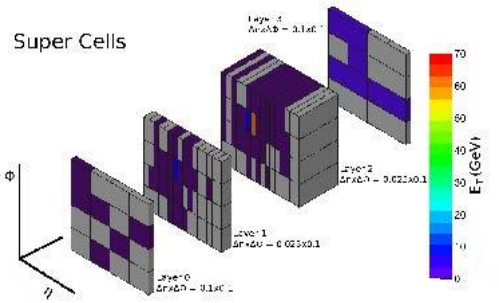


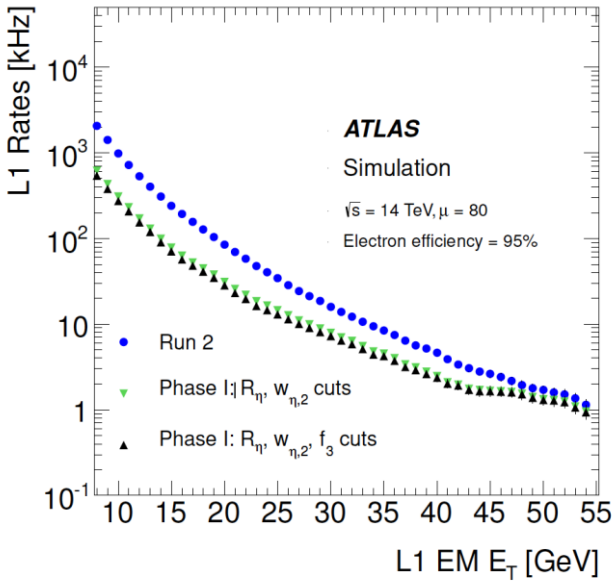


LAr Electronics replacement

- LAr trigger electronics will be changed to enhance the granularity available at LVL1
- Will allow to control the electron and photon trigger rates at high luminosity

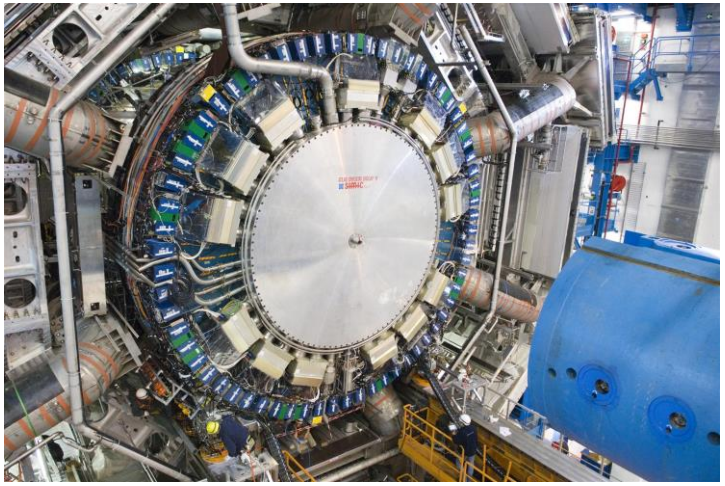






LAr Electronics replacement

- Access to the LAr Electronics crate
  - Need of scaffolding as long as possible all along the LS2 period
  - Scaffolding is done by ATLAS-TC
  - Electronics Installation will be ATLAS-LAr resources
  - New Optical fibers to be ordered (ATLAS-LAr) and laid (ATLAS-TC), including modifications to Cable chains
    - Should investigate the possibility of common purchases with other systems/experiment



Infrastructures: Electrical installations (2015-16)

- Upgrade of EOD8/15A UPS sub-switchboard in USA15
  - Adding new output breakers
  - Power cabling in collaboration with EN-EL
  - Update of monitoring/remote control by EN-EL-CO
  - Tentatively scheduled for YETS 2015
- Refurbishment of six secondary switchboards EXD2/1DX … EXD7/1DX supplying racks in TDAQ room in SDX1
  - Replacement of internal parts for higher current rating (with un-wiring and re-wiring after) by EN-EL
  - No change of power cabling
  - No change of monitoring/remote control
  - Tentatively scheduled for YETS 2015
- Refurbishment of two primary switchboards EXD1/15X and EXD2/15X supplying all electronic equipment in Atlas detector cavern UX15
  - Replacement (with refurbishment in the meantime) of power drawers by EN-EL
  - No change of power cabling
  - Change of monitoring/remote control by EN-EL-CO
  - Tentatively scheduled for YETS 2015

Infrastructures: Electrical installations (LS2)

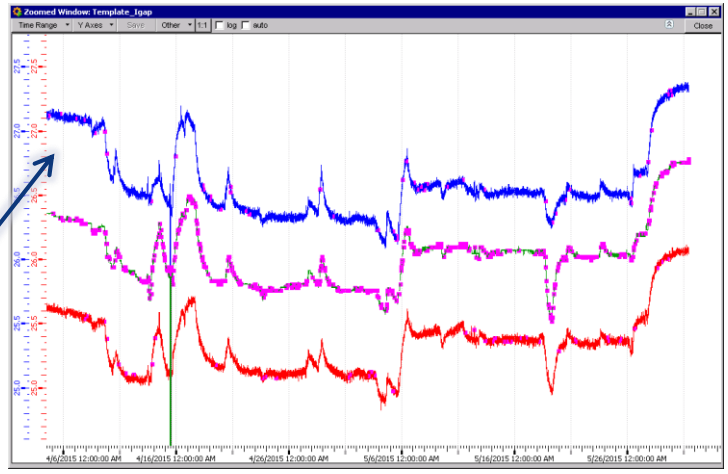
- Upgrade from 1.5 MVA to 2.0 MVA of broad coverage UPS in SX1 supplying all electronic racks in USA15 racks and all equipment in UX15
  - New UPS module to be connected to three existing ones; batteries block to be extended
  - Power cabling by EN-EL
  - No change of monitoring/remote control
  - Tentatively scheduled for LS2
- Consolidation of central UPS distribution in USA15
  - Relocation of primary EOD1/15A switchboard supplying UPS power to equipment in USA15; fabrication and installation of three (one-per-floor) homogeneous sub-switchboards
  - Power cabling in collaboration with EN-EL
  - Update of monitoring/remote control by EN-EL-CO
  - Tentatively scheduled for LS2

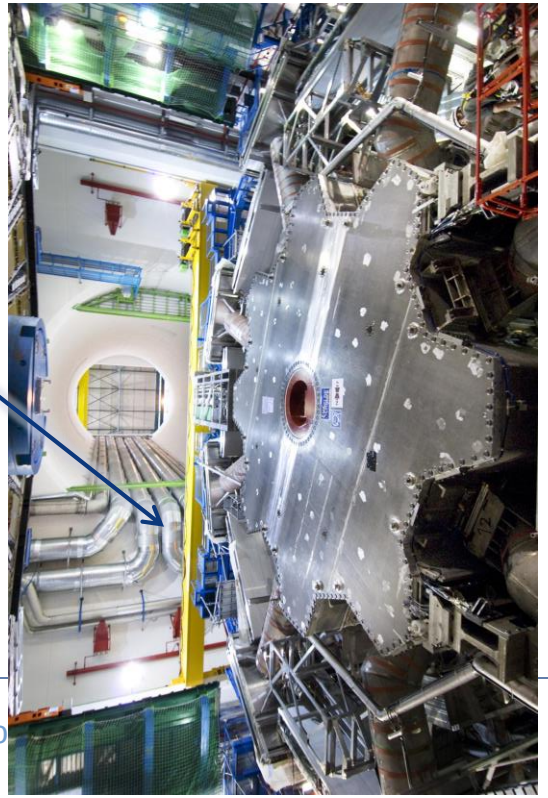
DSS Update

- Renovation of DSS PLCs under discussion
  - 7 racks underground and on surface
  - 2 redundant PLC
- ATLAS resources will be used to refurbish the racks and the relative cabling
- Participation of EN-ICE would be required for updating the PLC software.

Cooling and Ventilation

- EN-CV plans to renew the Ventilation control system
- ATLAS aims to reduce temperature gradients in the cavern to lower the temperature on top RPC stations
  - Refurbishment of the Cooling distribution during LS2
  - Heavy works on the UX15 Ducts
  - Work in collaboration with EN-CV
- CV aims at the deployment of an automatic system to change the mode of ventilation during access
  - Take into account the request of minimizing pressure jumps for TRT





Need in transport and crane operators: Summary

On top of usual activities, specific needs are identified for NSW integration in the period 2016-2019

- Transport of 32 chambers from BB5 to B180 : 1 every 2 weeks starting from 2nd half of 2016 to end 2017.
- Transport of sTGC wedges from 180 to 191 (x32)
- JD shielding & NSW at B191 : 2 crane drivers (part time) from end-2016 to mid-2019

During LS2 :

- 6 persons during 2 months at the opening period (beginning of LS2)
- 3 persons in between the opening and closing periods
- 6 persons during 2 months at the closing period (end of LS2)

Survey: Summary

1- Usual activities related to every YETS or Shutdown

- Measurement of the network (2 times over LS2)
- Stability of ground (about 3 times over LS2)
- Stability of TX1STF
- Maintenance of HLS system
- **Detector position measurement when they are back to RUN position**
- Lar stability at the very end of LS2

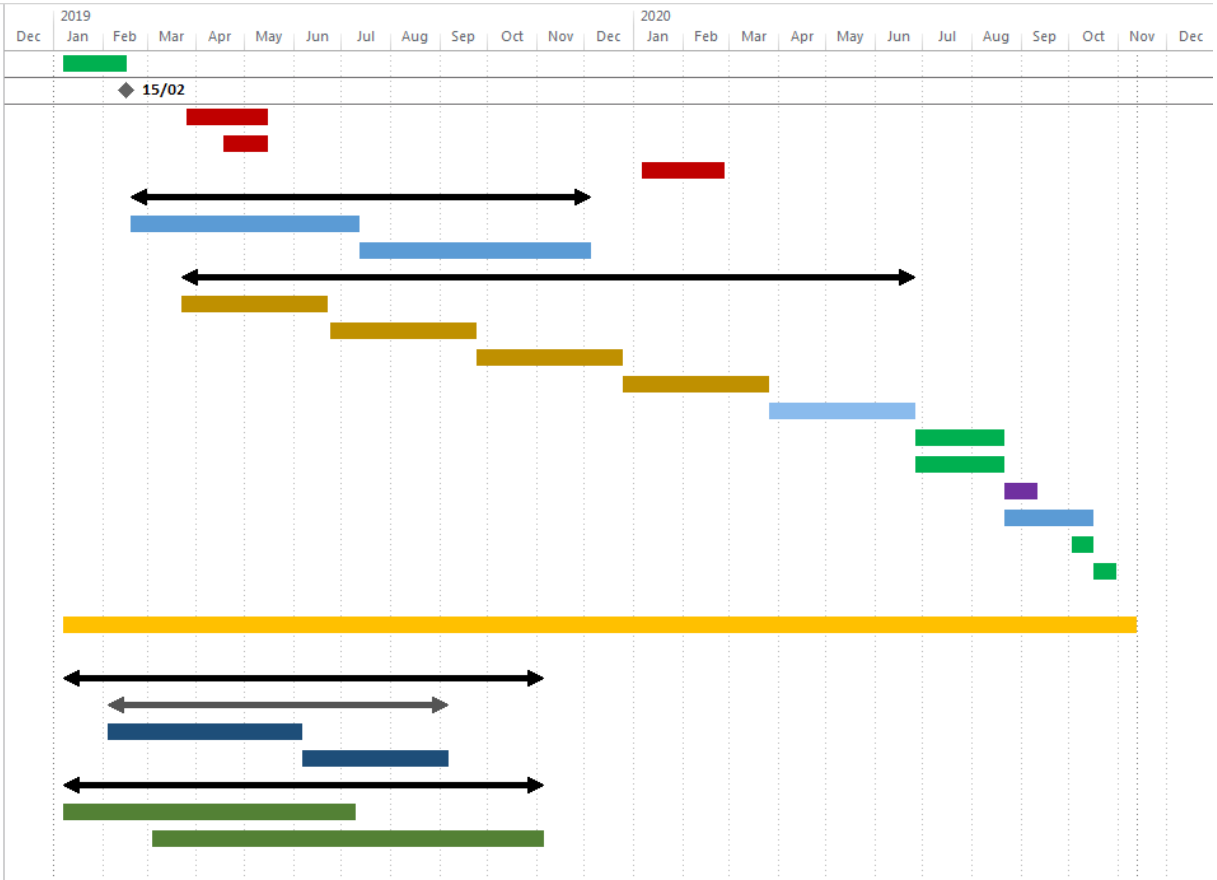
2- Survey related to new detectors

- During NSW construction : measure of spacer frame + measure of assembled sector (2017-2018)
- NJD measurement (2017)
- NSW measurement at B191 after integration, 2nd semester 2018 and 1st semester 2019
- BIS 7/8 measurement after installation, during LS2, expected before fall 2019

LS2 Schedule

Schedule will still grow up with infrastructure upgrade and maintenance.
Main drivers are the sign off “NSW ready for installation” and the LAr electronics replacement.
ATLAS activities are fully consistent with the duration of LS2.

Task Name	Duration	Start
Opening (semi-large on C side)	6 wks	07/01/2019
SW-C at surface in RBZ	0 days	15/02/2019
nSW-C installation	**37.5 days**	**25/03/2019**
nSW-A to surface	**20 days**	**17/04/2019**
nSW-A installation	**37.5 days**	**06/01/2020**
BIS 7/8	**208 days**	**18/02/2019**
Side C	**104 days**	**18/02/2019**
Side A	**104 days**	**12/07/2019**
Liquid Argon	**330 days**	**22/03/2019**
Barrel C electronics	3 mons	22/03/2019
End Cap C electronics	3 mons	24/06/2019
Barrel A electronics	3 mons	24/09/2019
End Cap A electronics	3 mons	25/12/2019
Commissioning	3 mons	26/03/2020
Closing Barrel - Side A	8 wks	26/06/2020
Closing Barrel - Side C	8 wks	26/06/2020
Beam pipe bakeout	3 wks	21/08/2020
Muons Forward	**40 days**	**21/08/2020**
Closing Forward - side C	2 wks	02/10/2020
Closing Forward - side A	2 wks	16/10/2020
TDAQ upgrade	22 mons	07/01/2019
Infrastructure	**216 days**	**07/01/2019**
Electrical upgrades & maintenance	**154 days**	**04/02/2019**
UPS upgrade (1.5 MVA to 2MVA)	4 mons	04/02/2019
Consolidation of central UPS distribution	3 mons	06/06/2019
Cooling & ventilation	**216 days**	**07/01/2019**
Cooling plant control system	6 mons	07/01/2019
Distribution of UX15 ventilation	8 mons	04/03/2019



Conclusions

- Large range of activities for ATLAS from now to the end of LS2
  - The main “customers” for CERN services are:
    - AFP during YETS (2015-16) and EYETS
    - NSW during all the period from 2016 to end of LS2
    - Infrastructure works mainly on distribution of electrical power and ventilation distribution
    - Survey activities will be concentrated on the YETS/EYETS with the addition of the survey activities related to the integration of the NSW
- Thanks to
  - M. Raymond, R. Vuillerment, G.Spigo, S. Zimmermann, M. Aleksa, M. Rijssenbeek, W. Iwanski, C. Amelung, L. Hervas….

NSW: Services

- Gas systems
- sTGC will re-use the 2 TGC gas racks in UX15.
  - The gas racks need to be modified extending the number of channels, including corresponding controls
- MicroMegas will re-use the 2 gas racks in UX15 used by CSCs in SW and possibly the MDT Gas racks
  - The gas racks may/will need modifications
  - Actual rack modifications can take place only from the start of LS2
  - Support needed from PH-DT gas section

Cooling

- Both MicroMegas and sTGC on-detector electronics needs to be water cooled.
- Water cooling shall be provided from the Muon cooling stations side A and side C.
- The present CSC cooling loops (2 per side) can be re-used for this but will/may require flow and pressure adjustments.
- It may be needed to provide 2 additional cooling loops per side, depending on conclusions from flow/power analysis.
- Additional cooling pipes from the 2 cooling stations to the SW patch panel have already been installed at the start of LS1.
- Discussions with the detector cooling group have started and will be continued over the next months.

Electricity

- USA15 rack layout for the NSW has not been completed yet.
- It is planned to use racks currently assigned to CSC, which may require adaption from vertical to horizontal cooling, in particular in connection with ATCA crate equipment.
- For the new trigger hardware additional rack space will likely be needed, and racks commissioned.

- For the power system, use of primary power generators in US15 is one option currently being considered, which would require providing and commissioning additional racks there including cooling.