MoEDAL-MAPP Progress Report – Stressing LHCb Related Issues

Update on the MoEDAL TP

November 17th , 2020

James Pinfold & Richard Soluk

for

The MoEDAL Collaboration

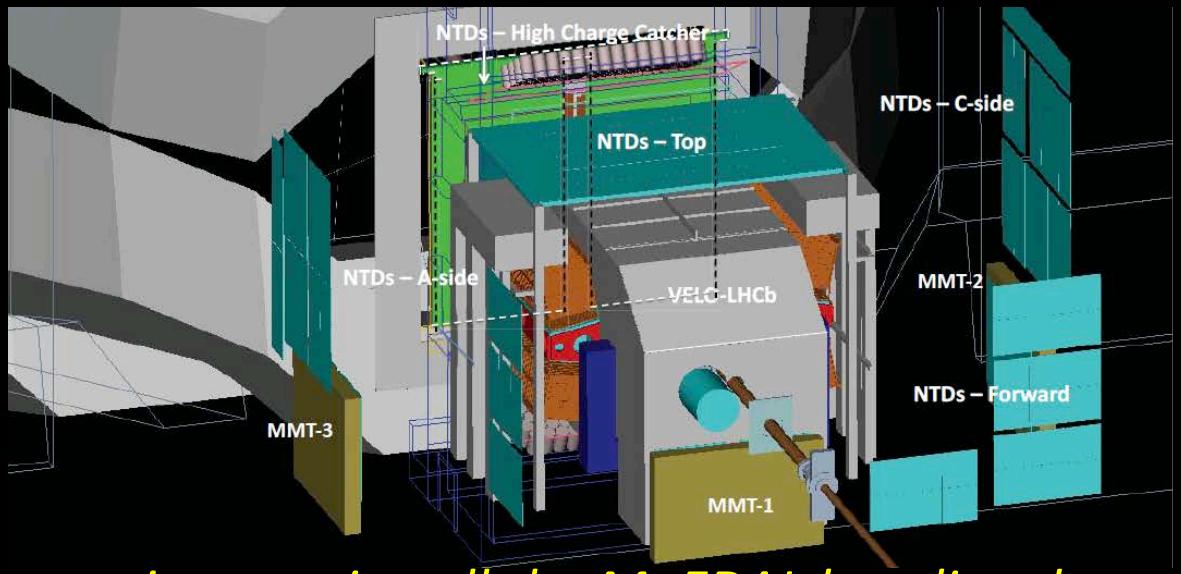
MENU

- *Introduction*
- *Phase 1 Installation of MoEDAL Baseline Detector*
  - *The HCC detector*
- *Machine requirements*
  - *Plans for acquiring the LHC BST clock*
- *The UGC1 Gallery*
  - *Beam backgrounds*
  - *Installation issues*
  - *Safety*
  - *Environment*
- *Manpower and Manning for Installation and Operation*
- *Interactions with the EP Safety Group*
- *The MoEDAL-MAPP MoU for Run-3*
- *Concluding remarks*

Introduction

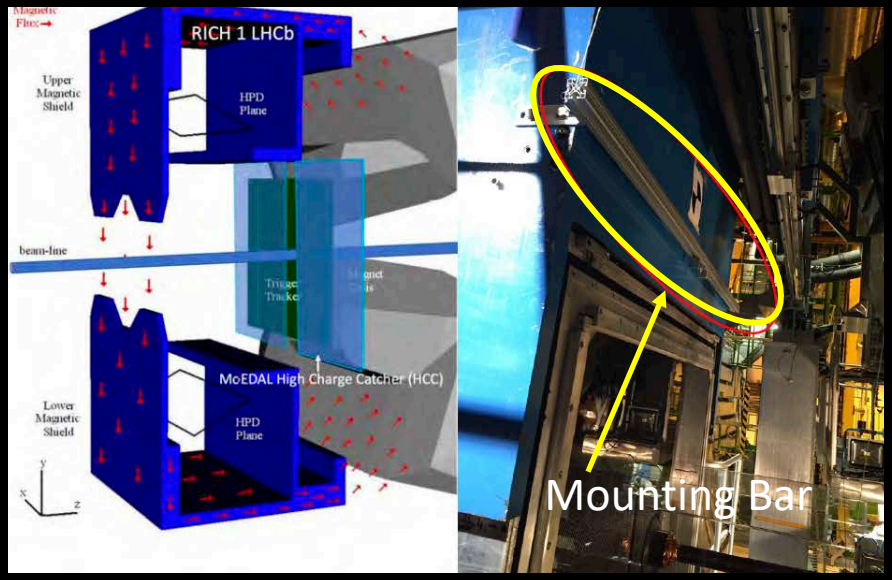
- *The MoEDAL baseline detector is ready for reinstallation*
- *The construction of MAPP Phase-1 (MAPP-mQP) is proceeding according to schedule*
- *Since the last report, we have presented to*
  - *The TREX (Tunnel Region Experiments) meeting (30th September)*
  - *The LMC (LHC Machine Committee) meeting (28th of October)*
- *We received our first questions from the EP Safety Group on 10/ 15*
  - *We have submitted a document on November 15th in response that is circulated with this talk*
  - *We submitted extra questions to the CERN safety group on November 8th*
- *The MoEDAL CB voted on October 22nd to submit a new MoU for MoEDAL-MAPP in Run-3*
- *We are preparing an updated version of the TDR + a document detailing how we meet LHCb requirements + a new MoU for LHC Phase-1*

The MoEDAL Baseline Detector



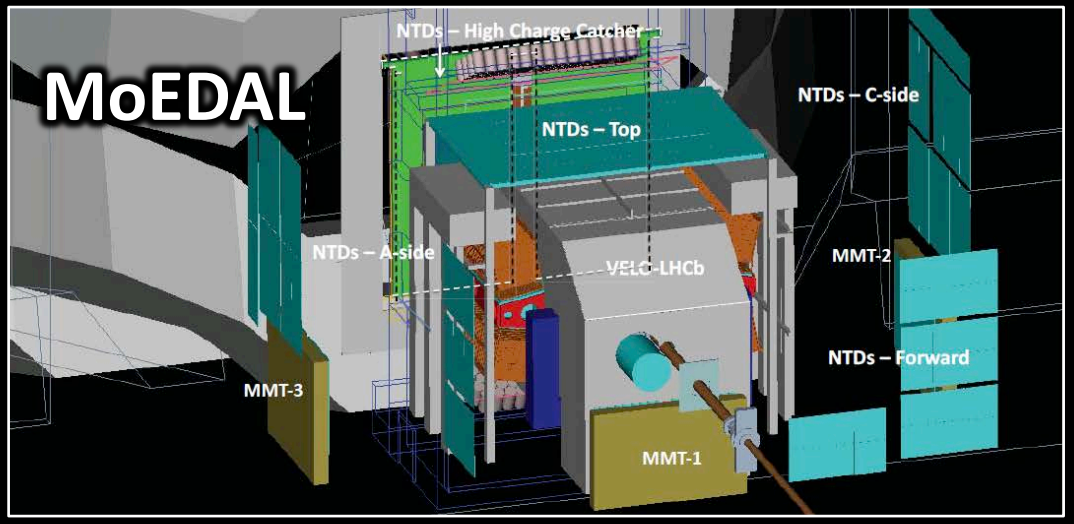
- *We are requesting to reinstall the MoEDAL baseline detector for Run-3*
- *There were 4 independent subdetectors:*
  - *Nuclear Track Detectors (NTDs) consisting of stacks of plastic*
  - *Magnetic Monopole Trappers (MMTs) composed of aluminum bars*
  - *TimePix which are active silicon particle detectors*
  - *High Charge Catcher (HCC) a thin low mass NTD*
- *We believe the passive MoEDAL detector can be reconfigured to accommodate LHCbs upgraded VELO detector*
- *One issue that has been identified by LHCb is MoEDAL's HCC …*

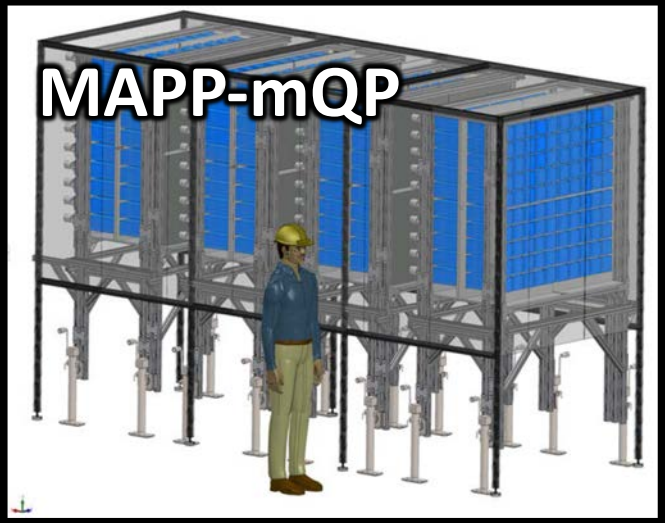
The HCC Detector for Run-3



- *MoEDAL's High Charge Catcher (HCC) detector was deployed within the LHCB's acceptance throughout Run-2*
  - *The HCC < 1mm thick and contributes 0.15% RL (45cm of dry air)*
- *LHCb asked us to repeat studies of physics effect of HCC, with their upgraded detector*
- *Thus, we will shelve our request to reinstall the HCC until the working parameters of LHCb's upgraded tracking system have been established using Run-3 data*

Access to the LHC BST Clock (1)

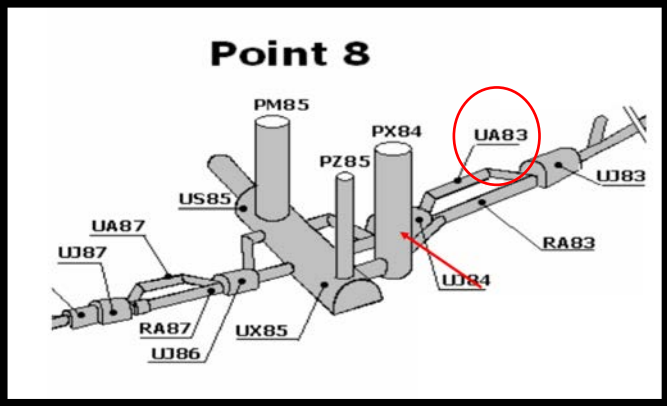


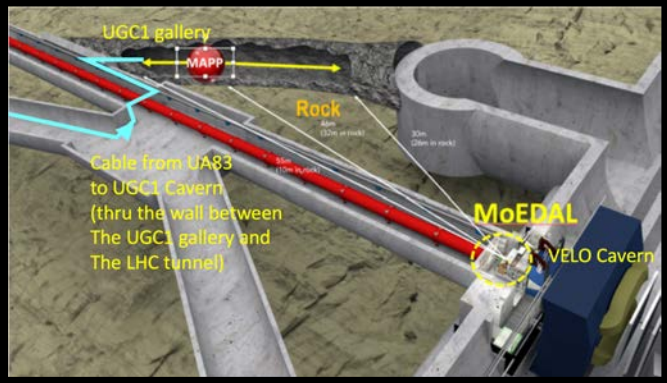


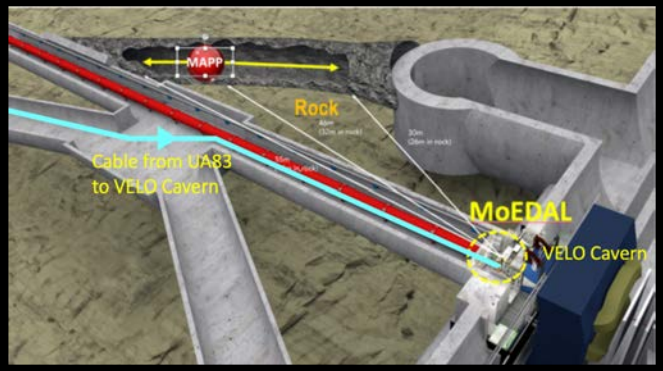
- *We need the LHC BST clock at two locations: the UGC1 gallery (MAPP-mQP) and the VELO cavern (MoEDAL's TMPX sub-detector))*
- *The discussion on obtaining the LHC clock with the LHCb expert Federico Alessio are ongoing but delayed by Covid-19, main results:*
  - *No spare fibres carrying beam clock information from LHCb underground (UG)*
  - *However it is feasible to split (6) fibres carrying the LHC clock signal to LHCb at the surface and then for MoEDAL-MAPP to lay them from the surface to UG*
  - *<u>If plan is agreed by LHCb, all costs and manpower provided by MoEDAL-MAPP</u>*

Access to the LHC BST Clock (2)

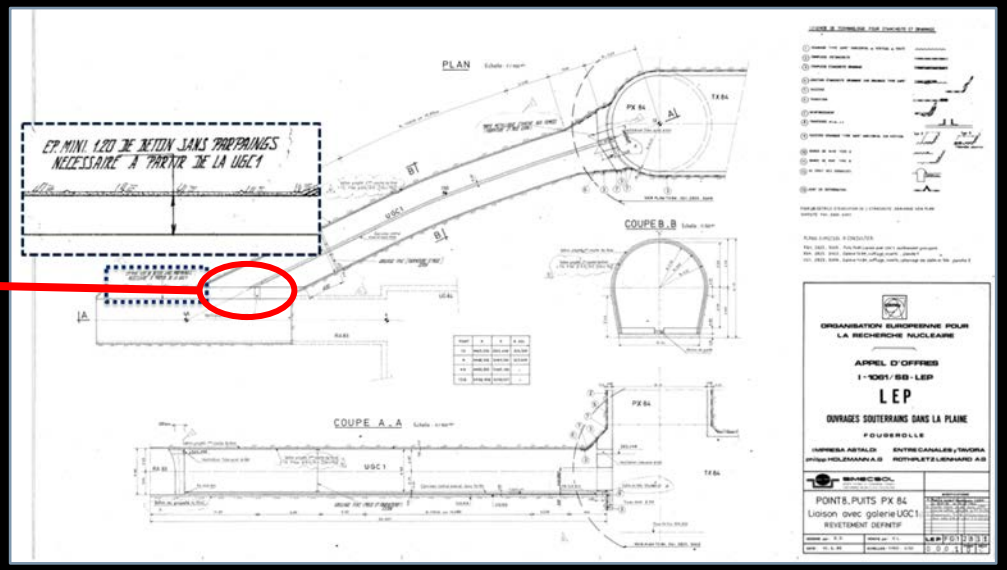
- *Our second approach to accessing the BST clock is to acquire it underground from the LHC machine "directly"*
- *After discussions with Tom Levens (CERN Beams Department, BE) and Johannes Troller (CERN, EN-EL-FC) there are spare fibres that we could, in principle, access in UA83 and then carry to MoEDAL and MAPP-mQP*
- *Discussions are still in process but so far this approach to obtaining the clock looks positive at present.*
- *<u>This approach would not require LHCb resources/interaction, except for liaison.</u>*





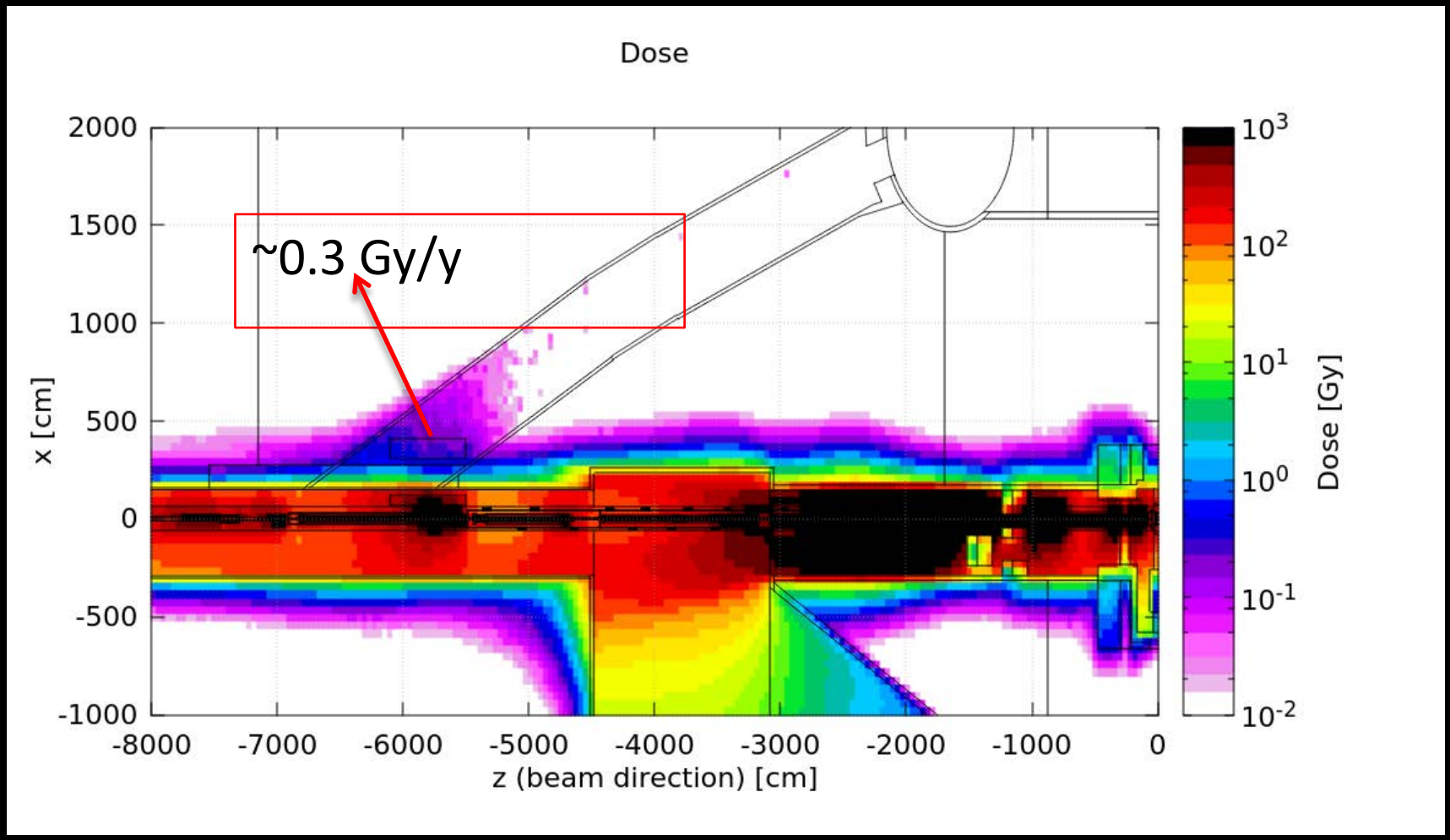


UGC1 – Beam Backgrounds (1)



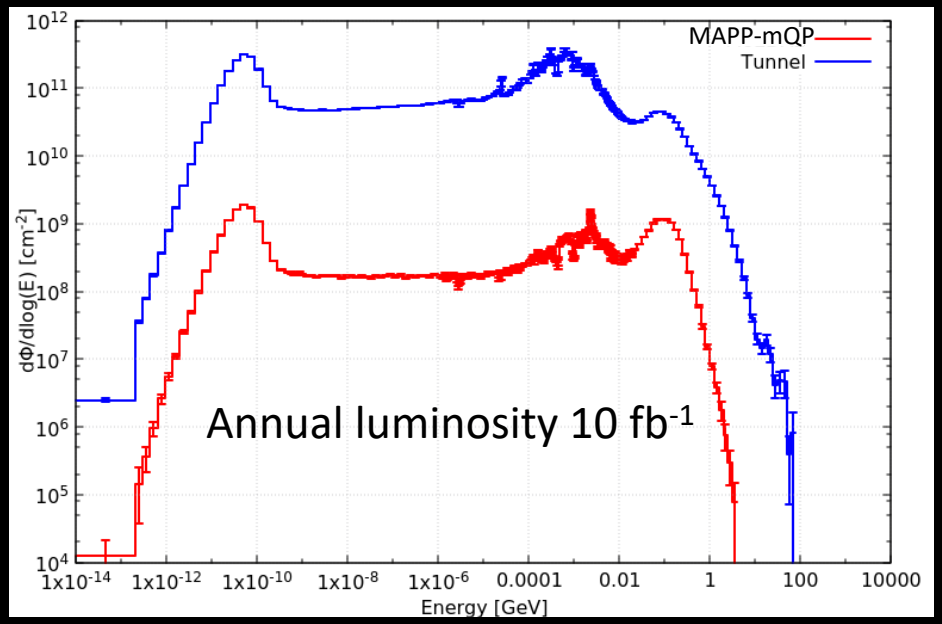
- *Francesco Cerutti and Alessia Ciccotelli of the Beam-Machine Interaction section of the CERN Engineering Department are performing FLUKA studies of beam related background in the UGC1 gallery*
  - *They have established that the thickness of the wall between UGC1 and the LHC tunnel is 1.2m thick – obviating the need for additional shielding*
- *The Good News - we do not need the extra shielding previously requested*
- *Radiation backgrounds are relatively low with no radiation related show stoppers.*

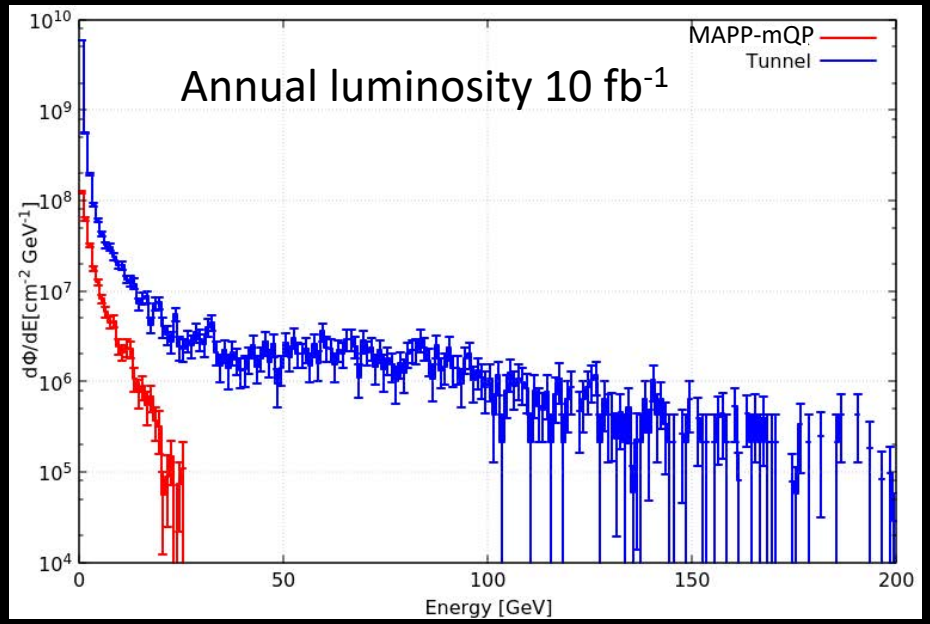
UGC1 – Beam Backgrounds (2)



- *Our SEU error correction system can easily handle the expected SEU rates*
  - *Nevertheless we will move readout electronics seberal metres towards the open end of the UGC1 gallery to reduce the beam backgrounds by a factor of 100 or more.*

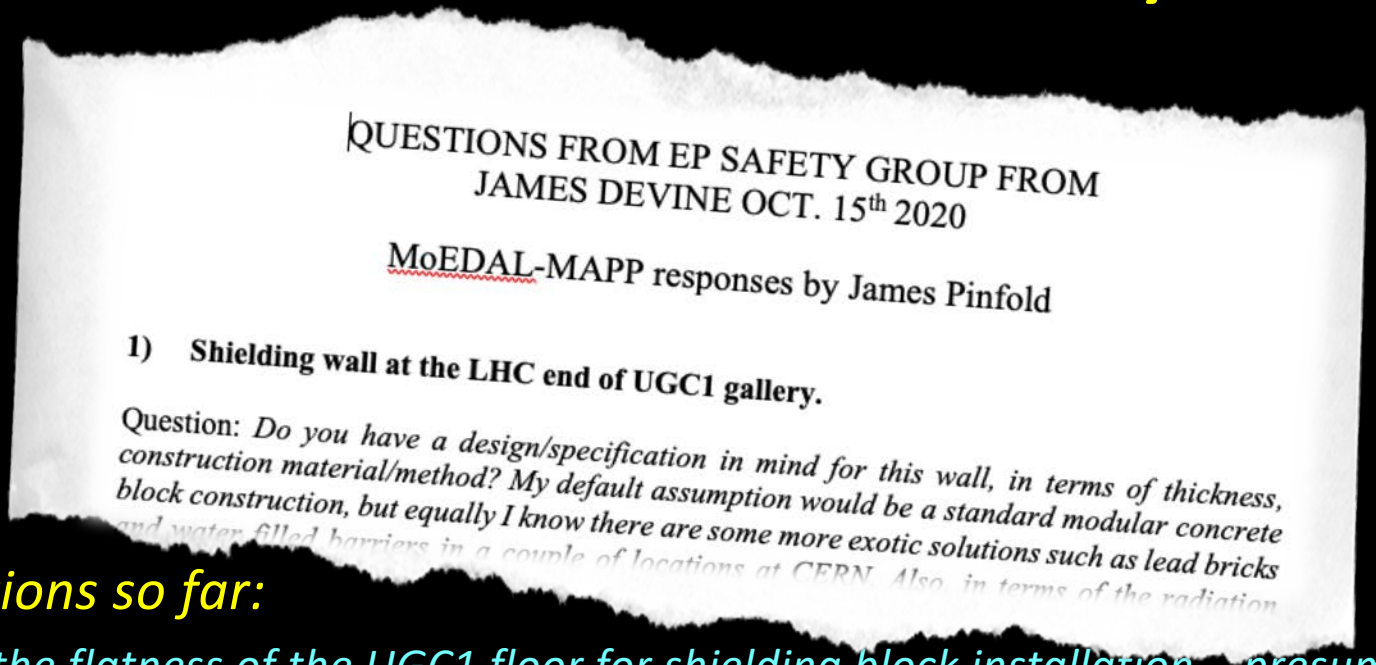
UGC1 – Beam Backgrounds (3)





- *Physics backgrounds from beam related neutrons and muons are quite manageable*
- *The EM component of the beam background which is much more computing intensive is still being simulated.*

Interactions with EP Safety Group



QUESTIONS FROM EP SAFETY GROUP FROM JAMES DEVINE OCT. 15th 2020

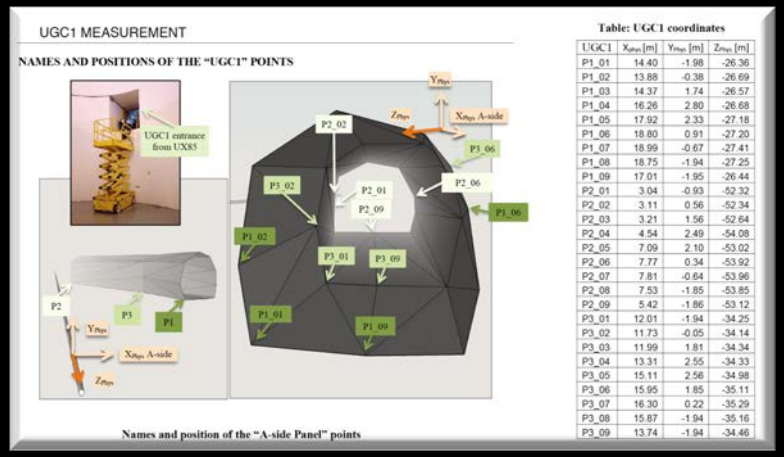
MoEDAL-MAPP responses by James Pinfold

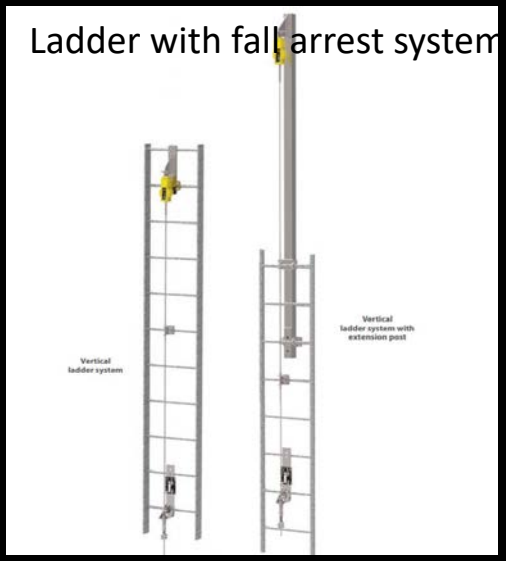
1) Shielding wall at the LHC end of UGC1 gallery.

Question: *Do you have a design/specification in mind for this wall, in terms of thickness, construction material/method? My default assumption would be a standard modular concrete block construction, but equally I know there are some more exotic solutions such as lead bricks and water filled barriers in a couple of locations at CERN. Also, in terms of the radiation*

- *Questions so far:*
  - *On the flatness of the UGC1 floor for shielding block installation – presumably flatness is not a problem now that shielding is no longer required*
  - *On the mass of the mu-metal B-field/flame shield - this turned out to be due to a typo in a previous version of the TDR*
  - *On the ventilation of the UGC1 gallery – we are involved in a small design study to install a ventilation duct in the tunnel.*
- *Questions we have asked the safety group, pending reply:*
  - *Is a ladder with a fall arrest system acceptable for emergency access to UGC1?*
  - *Can we use a lockable gate over the UGC1 gallery entrance which if locked signals no safety patrol needed?*

Installation in the UGC1 Gallery





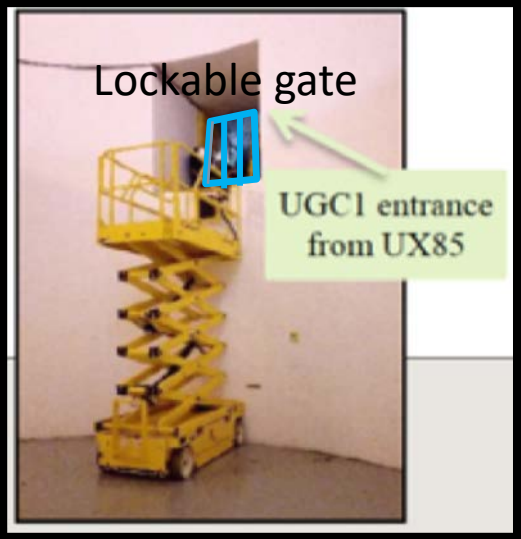
- *Access to the UGC1 gallery:*
  - *MoEDAL-MAPP will provide a scissor-lift/cherry picker operated by trained MoEDAL-MAPP personnel to access the UGC1 gallery during LSs Shutdowns*
  - *During Technical Stops (TSs)we will not use lifting devices that have to be craned underground to avoid pressure changes from the opening of the shaft*
- *To access UGC1 during a TS we will use a (hired) mini scissor-lift that can be taken underground using the lift*
  - *We have asked the CERN Safety Group for their ruling on the installation of a ladder (with a fall arrest system) to allow quick access to the UGC1 gallery for safety reasons*
- *MoEDAL-MAPP will arrange for 4 more 13 amp circuits to be installed in the UGC1 gallery – except for liaison this will not involve LHCb personnel*

The UGC1 Gallery Environment

- *The EP Safety Group had two stipulations on the UGC1 gallery:*
  1. *The floor must be surfaced flat **if shielding block need to be moved through the gallery** to reinforce the wall at the LHC tunnel interface*
  2. *A ventilation system must be provided for the tunnel that changes the air a few times an hour*
- *Point 1 - is no longer relevant as we no longer need extra shielding*
- *Point 2- we are designing, with CERN group, a simple ventilation system*
- *This addresses LHCb questions on the UGC1 environment so far*

Safety in the UGC1 Gallery

- *A question from the LHCb is to do with the safety check for the UGC1 gallery after a TS/LS*
- *Our solution to this problem has been submitted to EP Safety for approval:*
  - *After a LS/TS our on site GLIMOS or deputy GLIMOS will patrol the tunnel and then close the UG1 gallery using a lockable gate.*
  - *If no access is made by MoEDAL-MAPP to the UGC1 gallery in a LS or TS the gate will remain locked and thus will not need to be checked.*

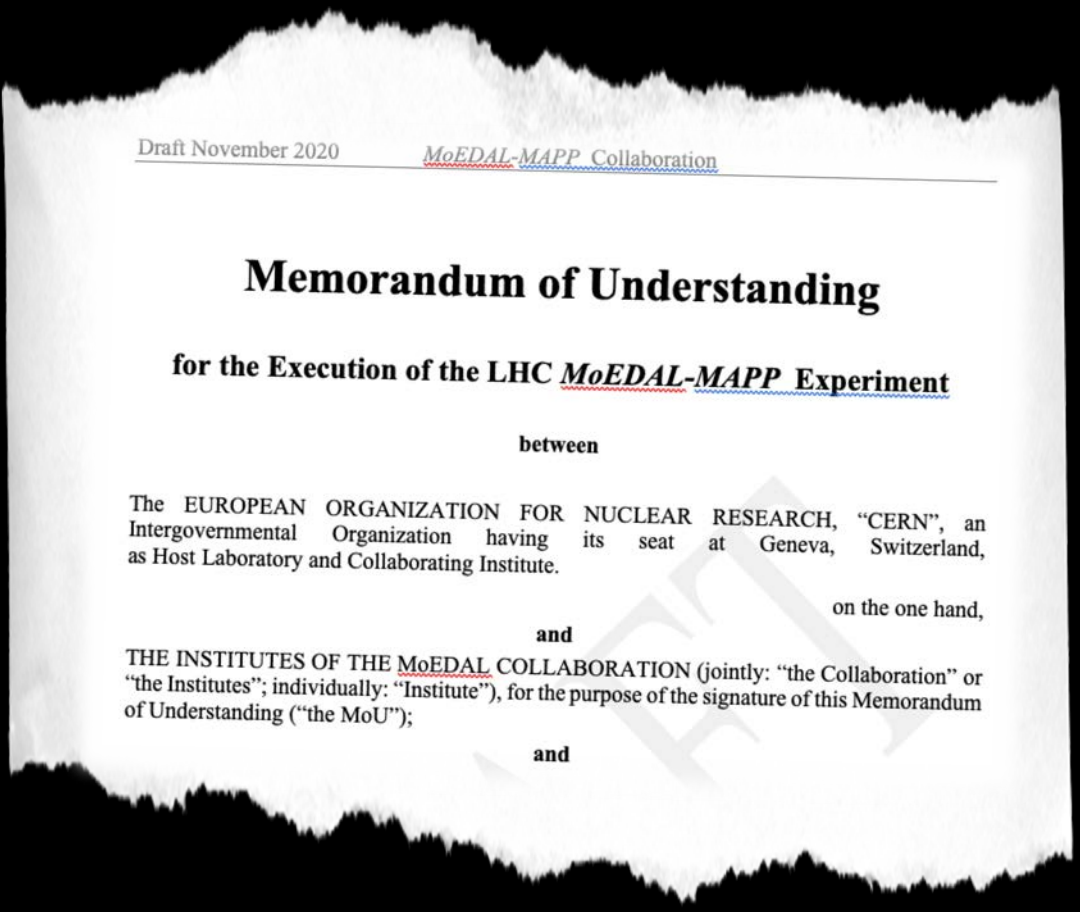


MoEDAL-MAPP Organization for Construction, Installation + M&O

- *PROJECT MANAGERS:*
  - *Richard Soluk (MoEDAL-MAPP Technical Coordinator)*
  - *James Pinfold (MoEDAL-MAPP Spokesperson)*
  - *Chief Engineer (Mitchel Baker, Major Resources Support, NSERC)*
  - *Chief Electronics Eng. (Paul Davis, Major Resources Support, NSERC)*
  - *GLIMOS (James Pinfold)*
- *INSTALLATION: Both Project Managers (above) & fulltime people (below) will be present at CERN over the installation and testing-in-place period*
- *FULLTIME CERN BASED PERSONNEL – resident in the CERN area*
  - *Albert de Roeck (Overall management, physics, coordination with LHCb etc)*
  - *Daniel Lacarrere* (Coordinates Run-3 IP8 surface activities with LHCb)*
  - *MoEDAL RA , Assistant GLIMOS, safety, etc coordination with LHCb)*
  - *Veronique Wedlake - Administrator of MoEDAL-MAPP activities*
  - *Senior MoEDAL member (eg J. Pinfold, for year 1 of RUN-3, GLIMOS, Spokes)*

* Daniel Lacarrere was a CERN employee now to be be paid by the UofA in Canada

An MoU for RUN-3 MoEDAL-MAPP



Draft November 2020 *MoEDAL-MAPP* Collaboration

Memorandum of Understanding

for the Execution of the LHC *MoEDAL-MAPP* Experiment

between

The EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, "CERN", an Intergovernmental Organization having its seat at Geneva, Switzerland, as Host Laboratory and Collaborating Institute.

on the one hand,

and

THE INSTITUTES OF THE MoEDAL COLLABORATION (jointly: "the Collaboration" or "the Institutes"; individually: "Institute"), for the purpose of the signature of this Memorandum of Understanding ("the MoU");

and

- *The MoEDAL Collaboration Board approved the preparation of a MoEDAL-MAPP MoU for data taking during Run-3 on October 22nd*
- *We expect to submit a draft for approval before Christmas.*

Concluding Remarks

- *The main milestones of the construction and installation of the Phase-1 MoEDAL-Baseline detector are as follows:*
  - *The Baseline MoEDAL detector is ready to reinstall*
  - *The MAPP phase-1 detector (MAPP-mQP) construction is underway according to schedule to be finished by May 2021;*
  - *All detectors will be assembled and tested with cosmics by late summer 2021*
- *Main detector installation could start in the summer/fall of 2021, but installation dates cannot be finalized without knowing LHCb's schedule*
- *We have been contacted Eckhard Elsen about the preparation of a an MOU for the MoEDAL-MAPP experiment at Run-3 - which is now in preparation.*