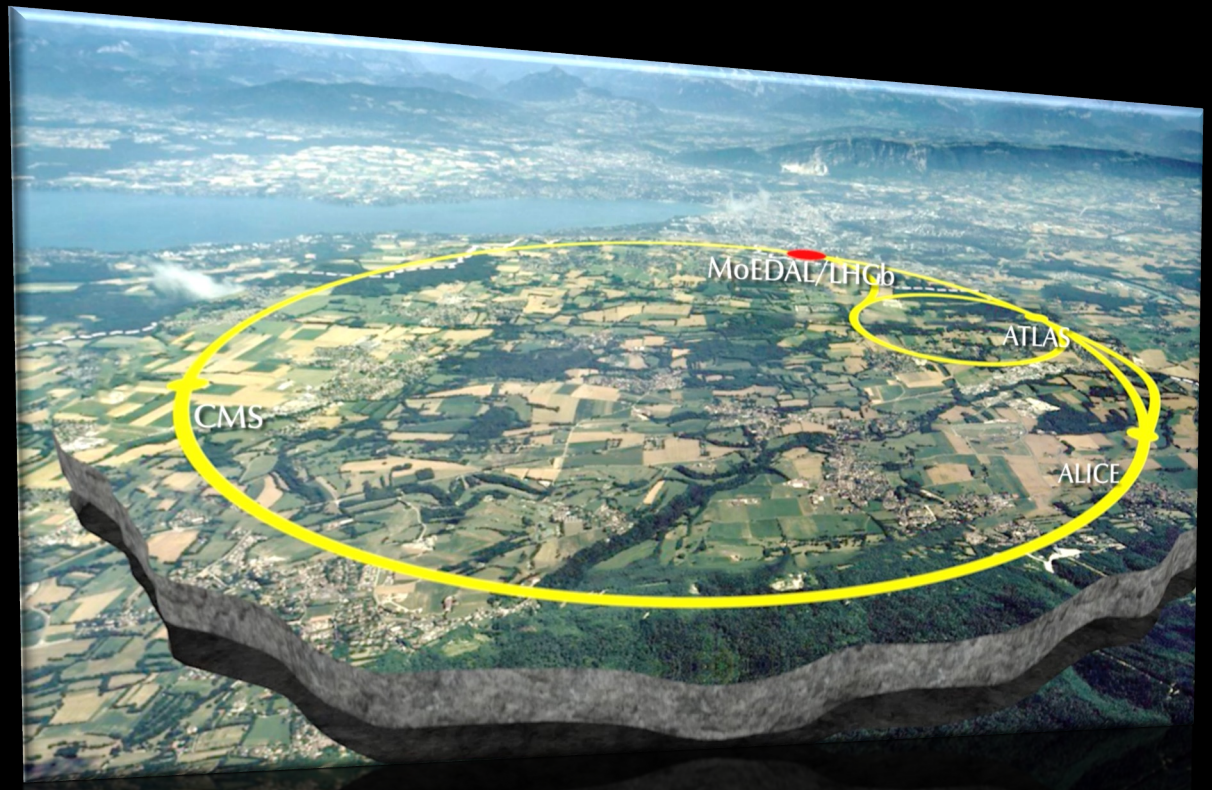
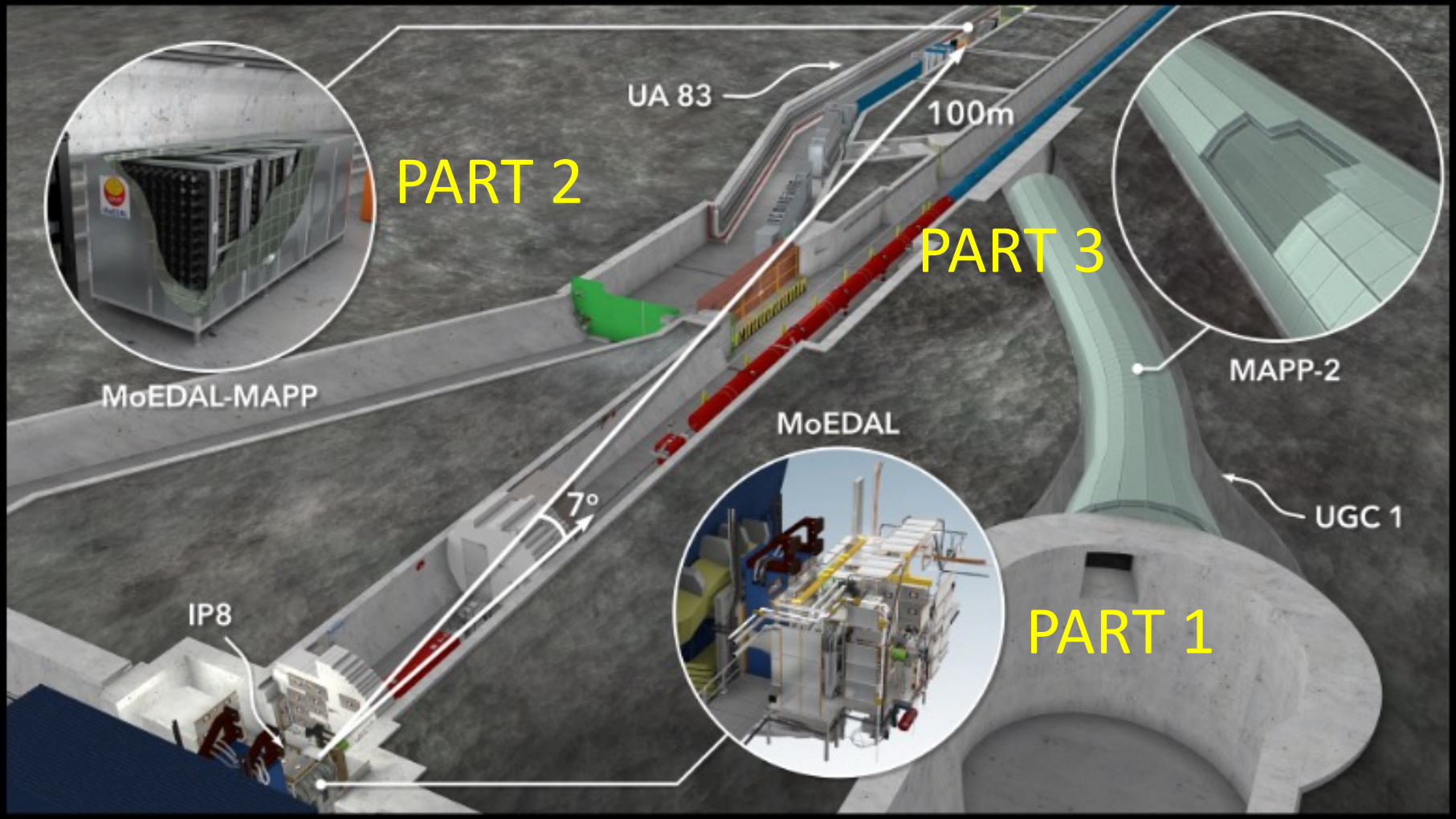
Installation of MoEDAL-MAPP at LHC's Run3 - A Progress Report



Mitch Baker, Paul Davis, James L. Pinfold, Richard Soluk
For the MoEDAL-MAPP Experiment

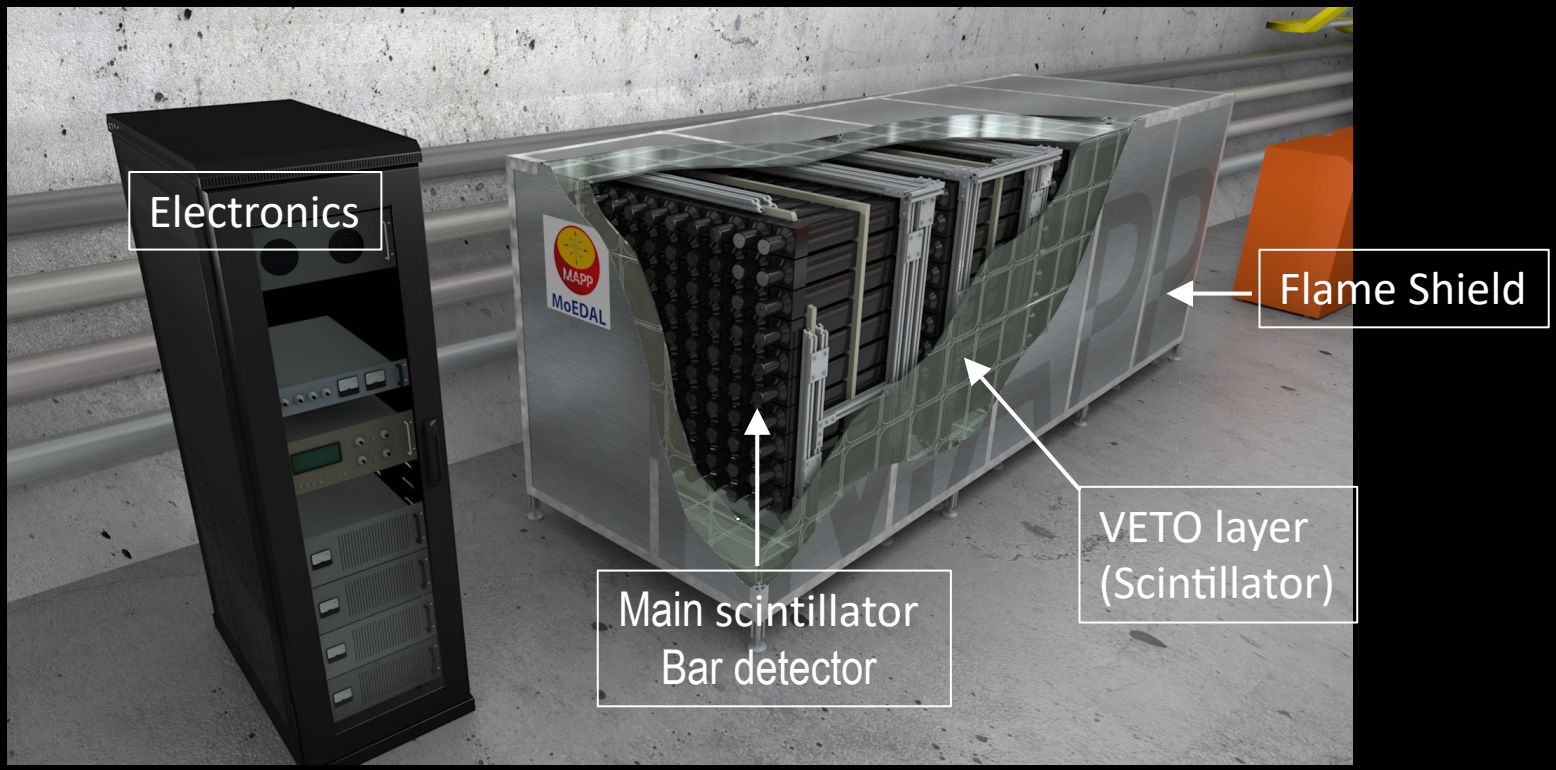
MENU


PART 2
UA 83
100m
PART 3
MoEDAL-MAPP
MAPP-2
MoEDAL
7°
UGC 1
IP8
PART 1

MoEDAL-MAPP is Taking Data

- *MoEDAL-MAPP is taking data albeit at much reduced luminosity due to LHCb status.*
- *However, we expect to take data at full luminosity in the upcoming heavy ion run in September 2023*
- *MoEDAL will be removed for repairs to LHCB's VELO region at the beginning of the YETS – it will be reinstalled for running in 2024.*

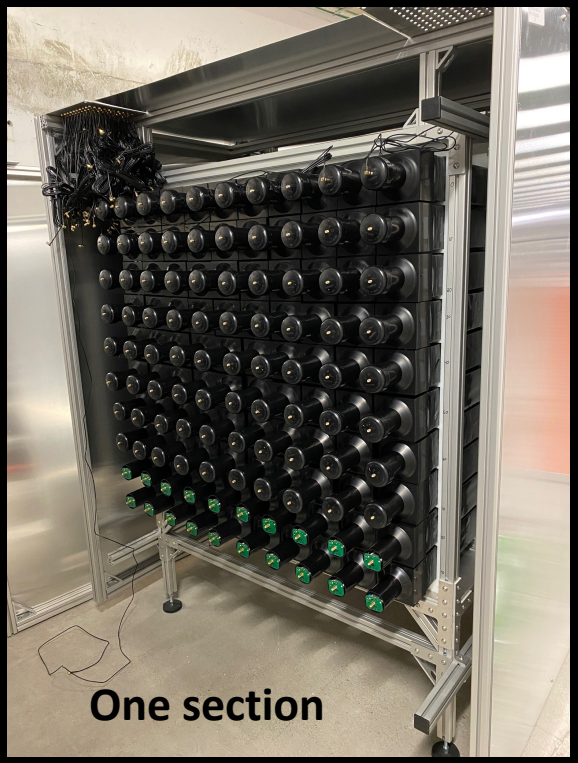
Status of the MAPP-1 Installation



- *The unexpected shutdown on Jul 17th due to the magnet quench and subsequent helium leak in triplet magnets near point 8 gave us time to advance the installation of MAPP-1*

Work completed in July 2023

MoEDAL with flame shield


One section

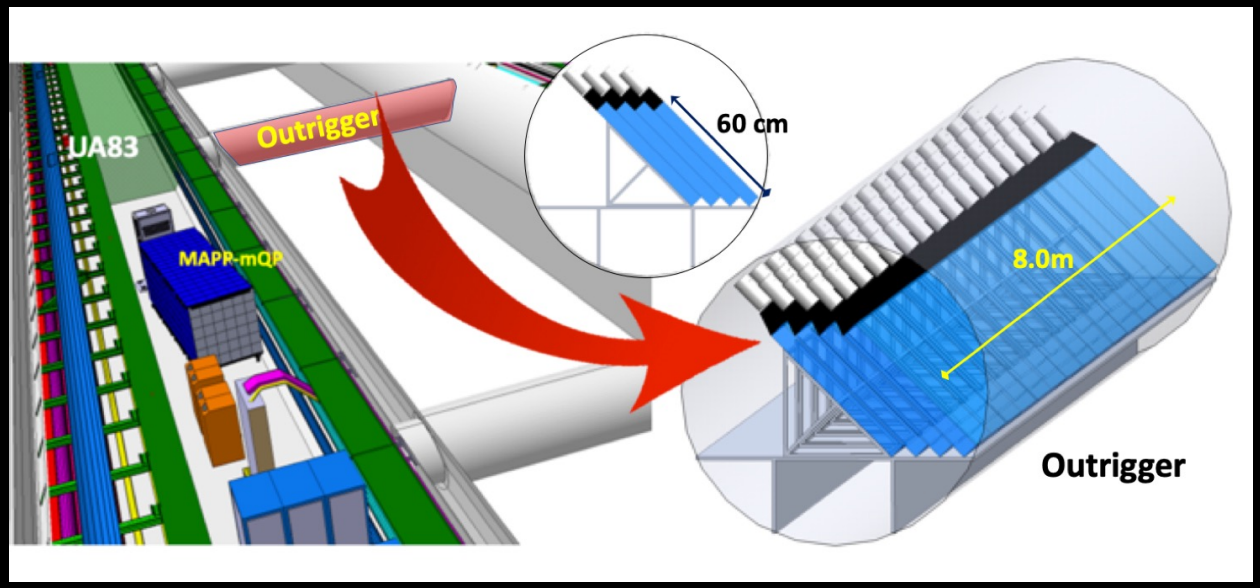
- *All scintillator bars loaded into detector*
- *All cabling completed*
- *Flame shield completed*
- *One section (100 bars) connected to PMT+HV PS & made light tight*
- *Section movement system tested*

A Movie – from the Safety Cam

MAPP-What Still Needs to Be Done

- *We need to test the 100 PMTs that were provided late due to failure of HZ Photonics supplier -*
  - *The testing to be performed in October 2023*
- *Frontend board design completed but due to the availability of parts the design was revisited –*
  - *We expect to have the boards by mid November 2023*
  - *However, ADCs and FPGAs have been ordered and will arrive by the end of September*
- *The electronics will be installed for the complete detector in the upcoming YETs.*
- *The detector will be commissioned using Cosmic rays after the electronics is installed – ready for data taking in 2024.*

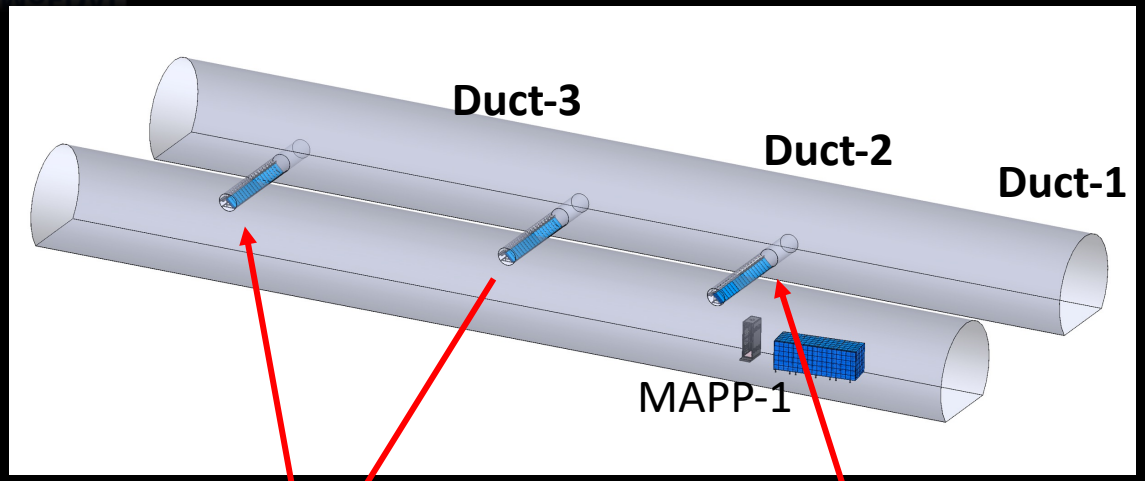
The MAPP-1 Outrigger

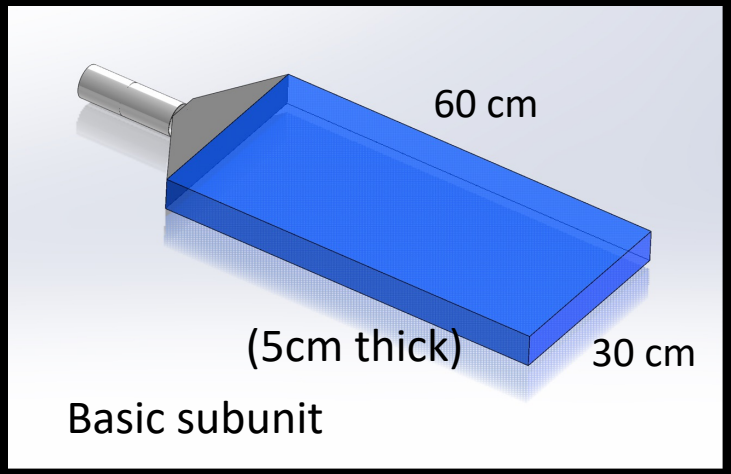


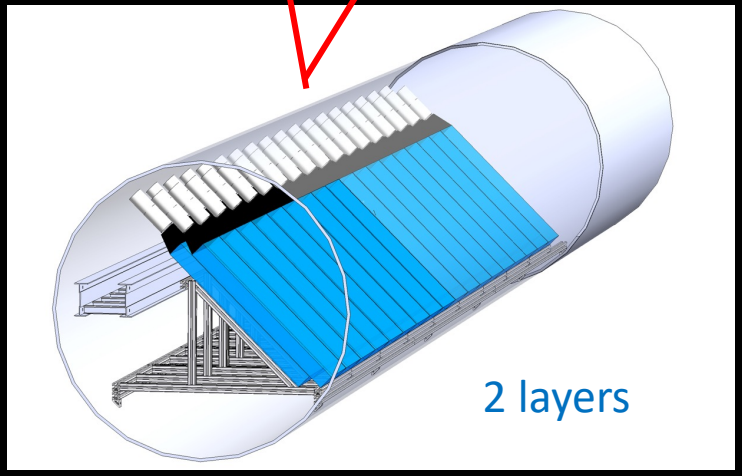
Outrigger for a canoe

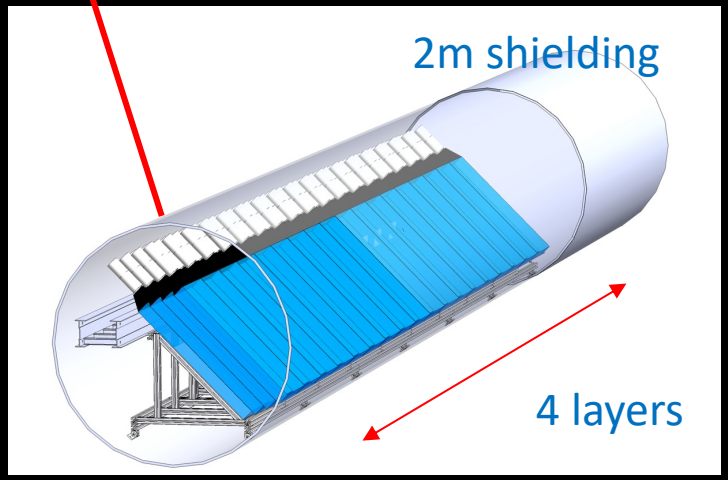
- *Two important developments since last report:*
  - *The Alabama group received funding for the Outrigger 4 outrigger layers + PMTs from NSF – the decision was late and unexpected*
  - *Discussions on the 2m of concrete shielding with CERN led by Francois Butin required further consideration of shielding design involving the CERN group in charge of assessment of beam induced radiation.*

The New Outrigger Redesign





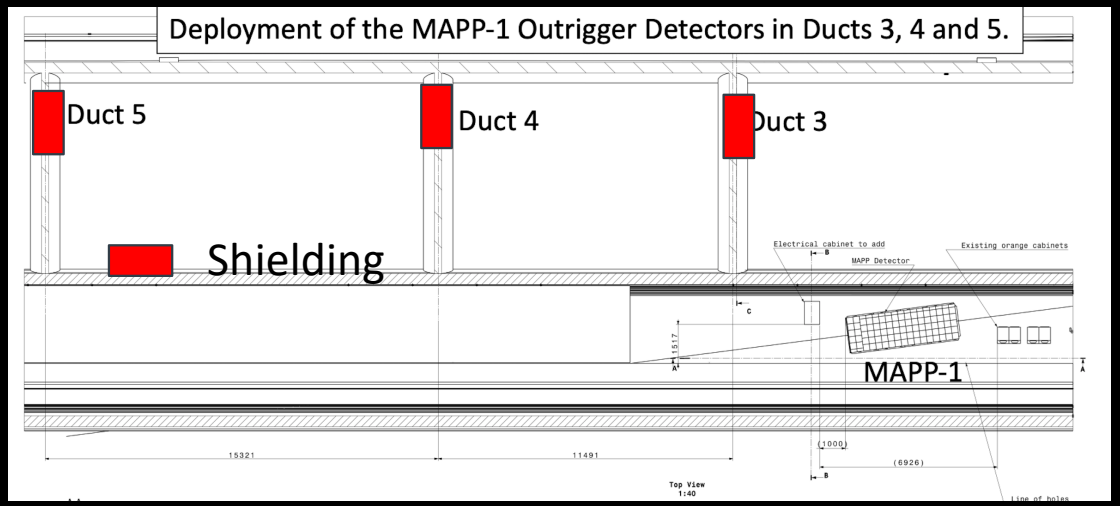


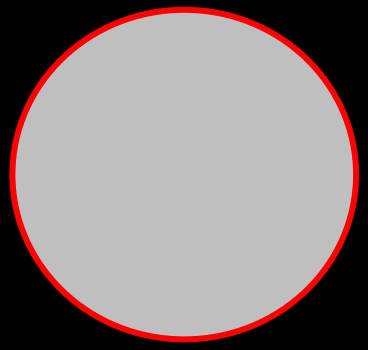


Each layer is 6m long containing 20 scintillator slabs.

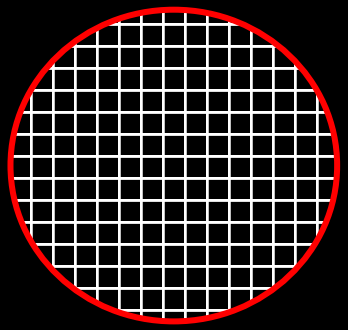
- *Due to the Alabama contribution can now double the number of basic units deployed allowing us to instrument the 2nd and 3rd ducts*

The Outrigger Shielding

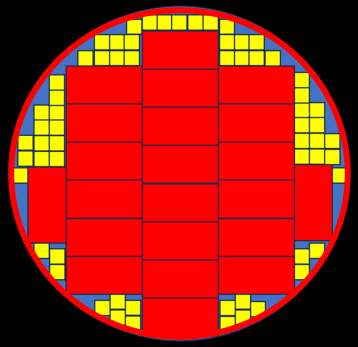




A) Fill with concrete



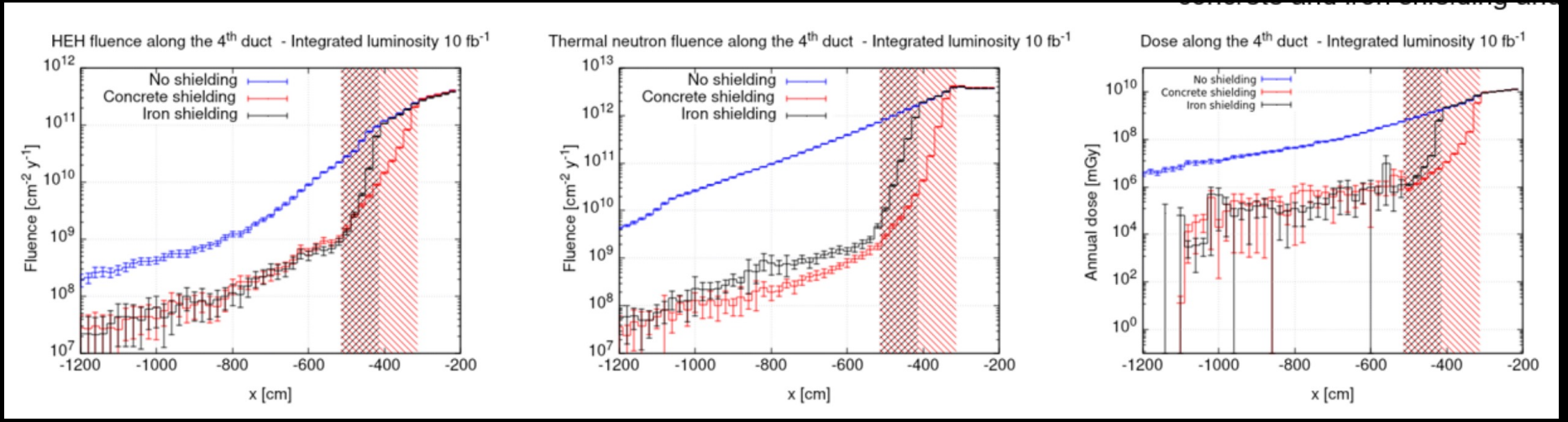
B) Fill with iron bar
(4cm x 4cm x 100 cm bars)



C) Fill with shielding
and iron bars

- *Option (A) rejected by beam-line group; Option (B) iron bar fill is costly (56.5 kCHF); Option (C) a mix of shielding blocks + iron is 24 kCHF*

New Beam Background Simulations



- *A new simulation was performed by Alessia Ciccotelli of the CERN group responsible for understanding beam induced radiation backgrounds for the all-iron solution.*
  - *A complete fill of iron compared 1m in depth was used and compared with 2m of concrete solution we showed previously.*
  - *Because we cannot completely fill with iron without gaps the commendation is to use 2m of mixed iron + concrete block.*

Plans for Outrigger Installation

- *Plan for the installation of the Outrigger in 2 phases:*
  - *PHASE-1 - in the upcoming YETS install 4 planes of scintillator slabs in Duct-1*
  - *PHASE-2 - in the YETS starting in 2024 install an additional 4 panes in Duct-2 (2 planes) and Duct-3 (2 planes)*
- *PHASE-1 requirements*
  - *The machine needed to complete the machining of the scintillator blocks is under order and due to be delivered in October*
  - *The PMTs are in hand. The electronics and calibration are the same as that used in the MAPP detector, to be ordered in October 2023.*
  - *Installation of the shielding for Duct-1 will take place in Nov.-Dec. 2023*
  - *Installation of the scintillator slabs is foreseen for February- March 2024.*
- *PHASE-2 requirements*
  - *Awaiting delivery details of Alabama PMTs and scintillator*
  - *Work on preparing slabs, etc. for Phase-2 will take place at Alabama in 2024*
  - *Installation of shielding in Duct-2 and Duct-3 in the 2024 YETs*
  - *Installation to take place in the YETS 2024/25.*

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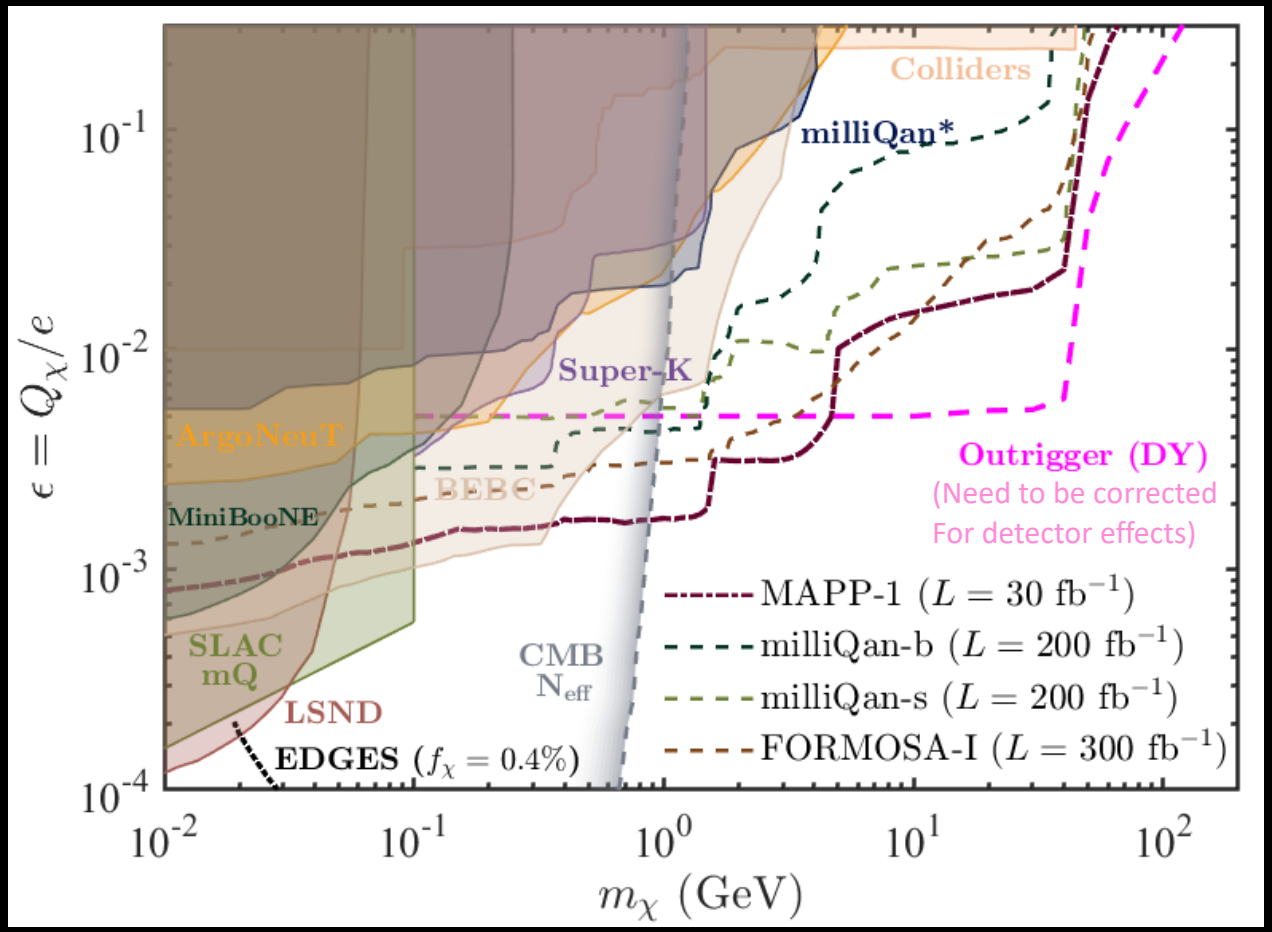
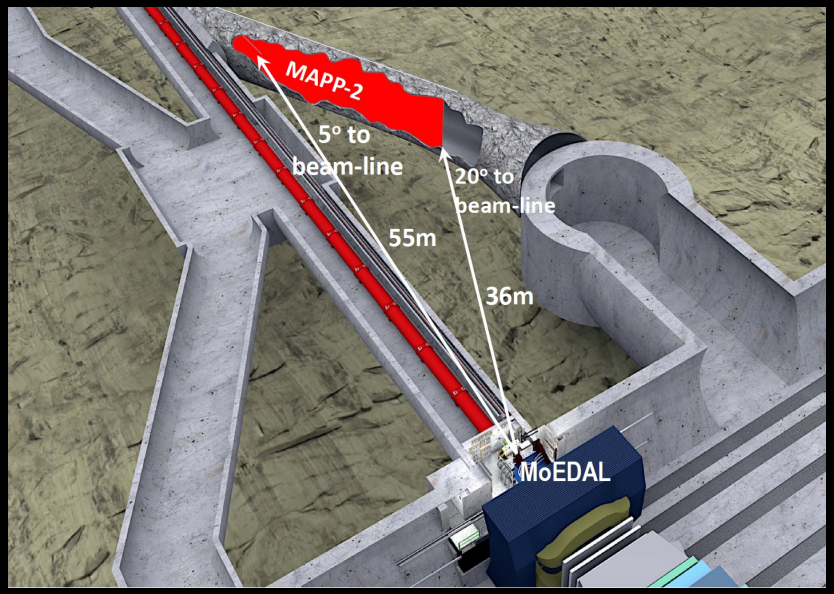
Technical Report for Outrigger Detector to be circulated in October

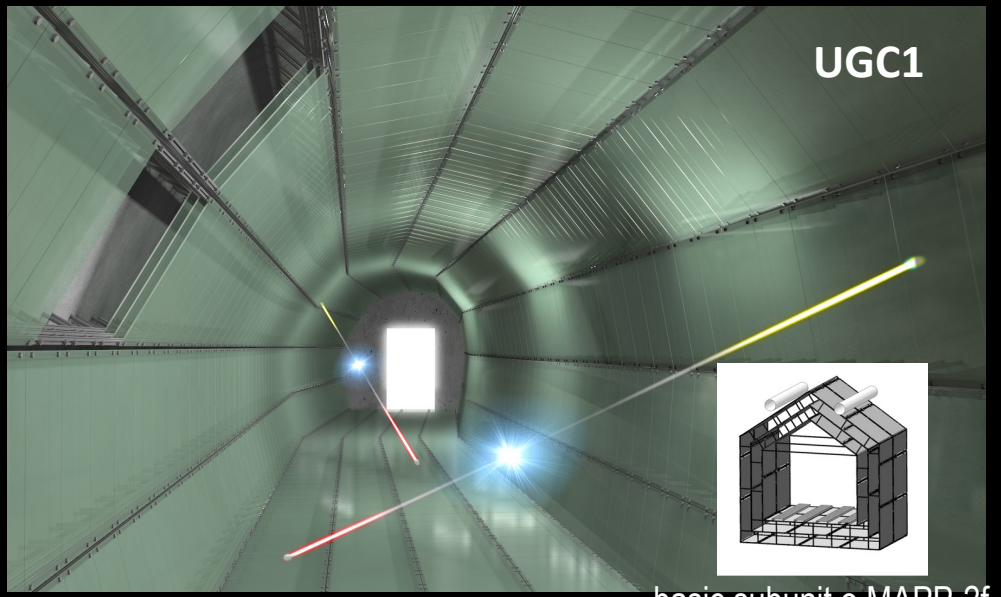
Physics Studies for MAPP-1



- *Run-3 sensitivity for MAPP-1 for DY production of mCP-pairs Including modelling for all known detector effects*
- *A paper presenting these studies is due out before Christmas.*

LoI for MAPP-2 for HL-LHC





basic subunit o MAPP-2f

- *The MAPP-2 detector would fill the UGC1 gallery adjacent to LHCb*
  - *The UGC1 gallery would be prepared during LS3 prior to HL-LHC*
  - *The tracking detectors would form 3 or 4 hermetic containers - one within the other – lining the walls of UGC1*
- *MAPP-2 ~1200 m^3 of instrumented decay volume. Estimated technical Costs of MAPP-2 ~$3-4 M including 0.5K of civil engineering already determined*
- ***LoI will be presented to the LHCC referees for consideration in December 2023.first iteration of document provided a month before***