# WP 4 “cLFV experiments”

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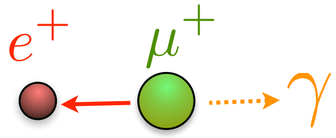
# Content

- The latest news from
  - The MEGII experiment at PSI
  - The Mu3e experiment at PSI
  - The Mu2e experiment at Fermilab

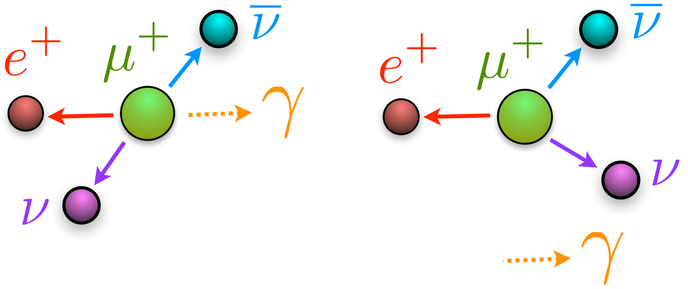
# The MEGII experiment

- Best upper limit on the BR ($\mu^+ \rightarrow e^+ \gamma$) set by the MEG experiment (**$4.2\ 10^{-13}$** @90% C.L.)
- Searching for $\mu^+ \rightarrow e^+ \gamma$ with a sensitivity of ~ **$6\ 10^{-14}$**
- Five observables **($E_\gamma$, $E_e$, $t_{e\gamma}$, $\vartheta_{e\gamma}$, $\phi_{e\gamma}$)** to identify $\mu^+ \rightarrow e^+ \gamma$ events

Signature




Backgrounds



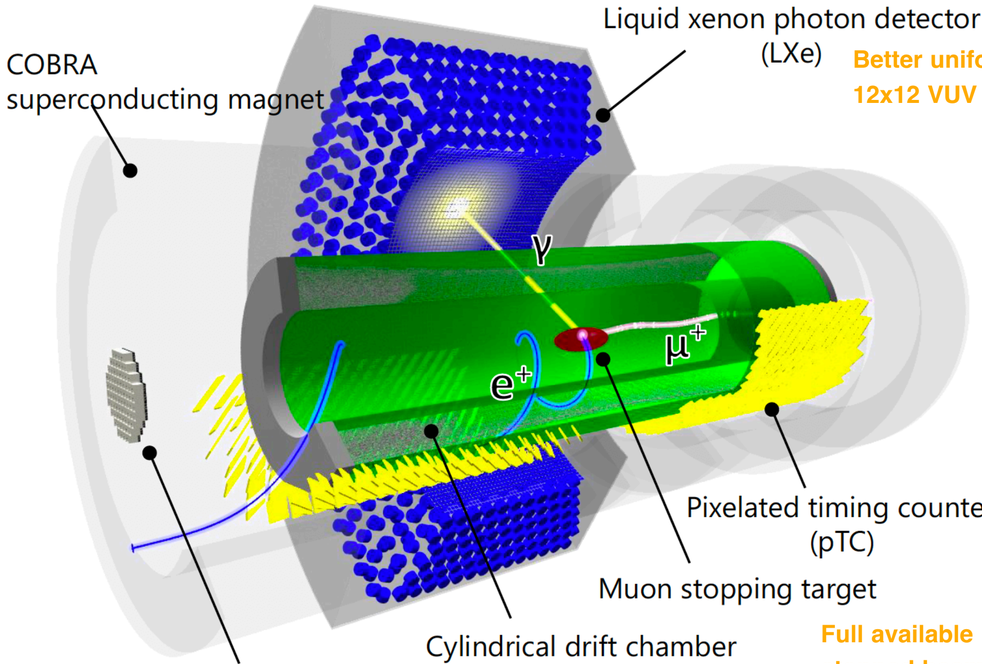

New electronics:
Wavedream

**~9000 channels at 5GSPS**

**x2 Resolution everywhere**

Updated and new Calibration methods

**Quasi mono-chromatic positron beam**




**x2 Beam Intensity**

# Latest news and currents status

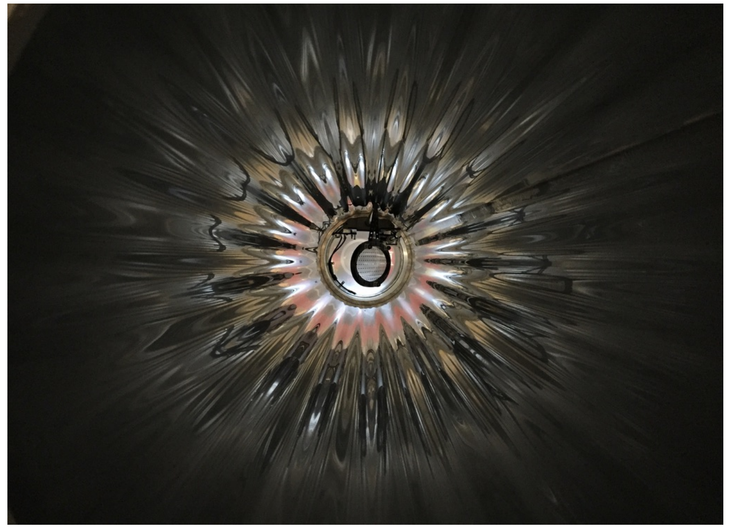
Key points:

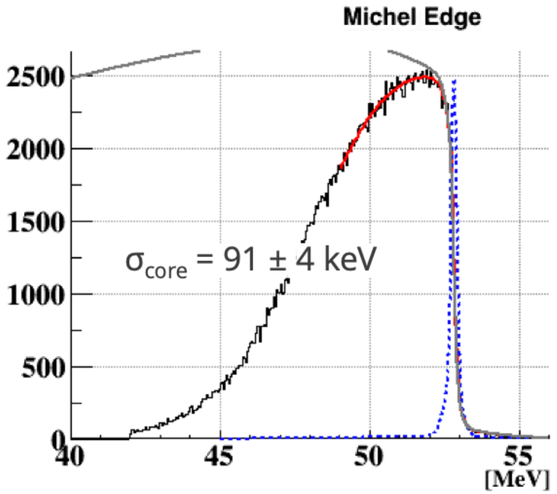
- **Run2021 very successful**
- Electronics fully installed and tested with all sub-detectors and calibration tools
- All calibration and physics trigger configurations released
- Assessed performances of each sub-detectors in the final MEG II conditions
- Collected data at different beam intensities
- Dedicated RMD at reduced beam intensity as proof-of-principle of the experiment quality
- **Physics run started at the end of September 2021**
- …with the COVID19 outbreak ongoing

Outlook:

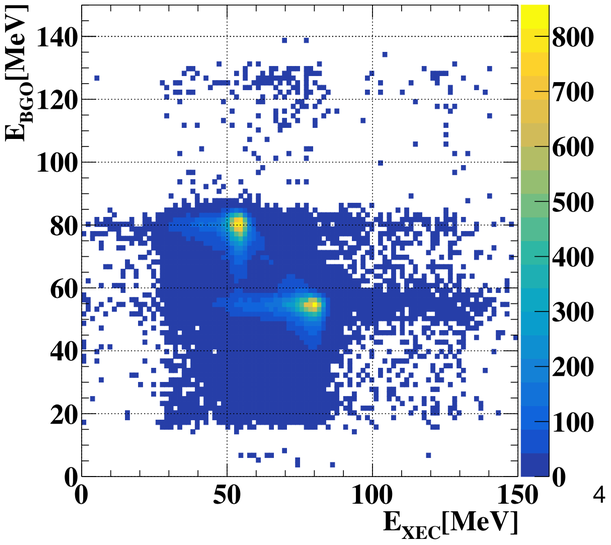
- **MEGII beam time 2022 just started (June 7th)**
- MEG sensitivity expected to be **surpassed by the Run 2022**

MEGII **fully** installed!





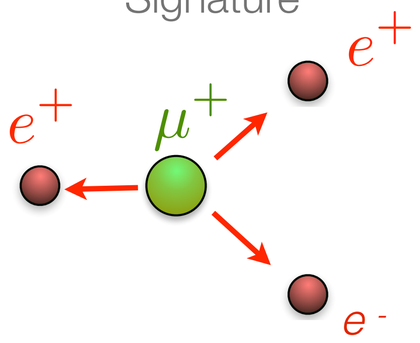

Data from the **first** Physics Run2021



# The Mu3e experiment

- The Mu3e experiment aims to search for $\mu^+ \rightarrow e^+ e^+ e^-$ with a sensitivity of $\sim 10^{-15}$ (Phase I) up to down $\sim 10^{-16}$ (Phase II). Previous upper limit BR($\mu^+ \rightarrow e^+ e^+ e^-$) $\leq 1 \times 10^{-12}$ @90 C.L. by SINDRUM experiment)
- Observables ($E_e$, $t_e$, vertex) to characterize $\mu \rightarrow$ eee events

Signature

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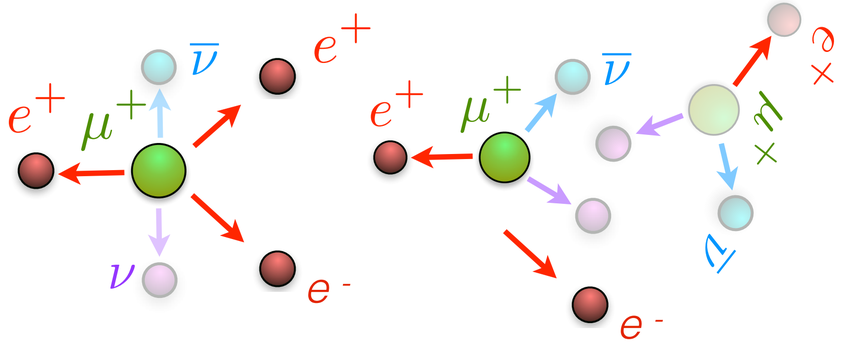
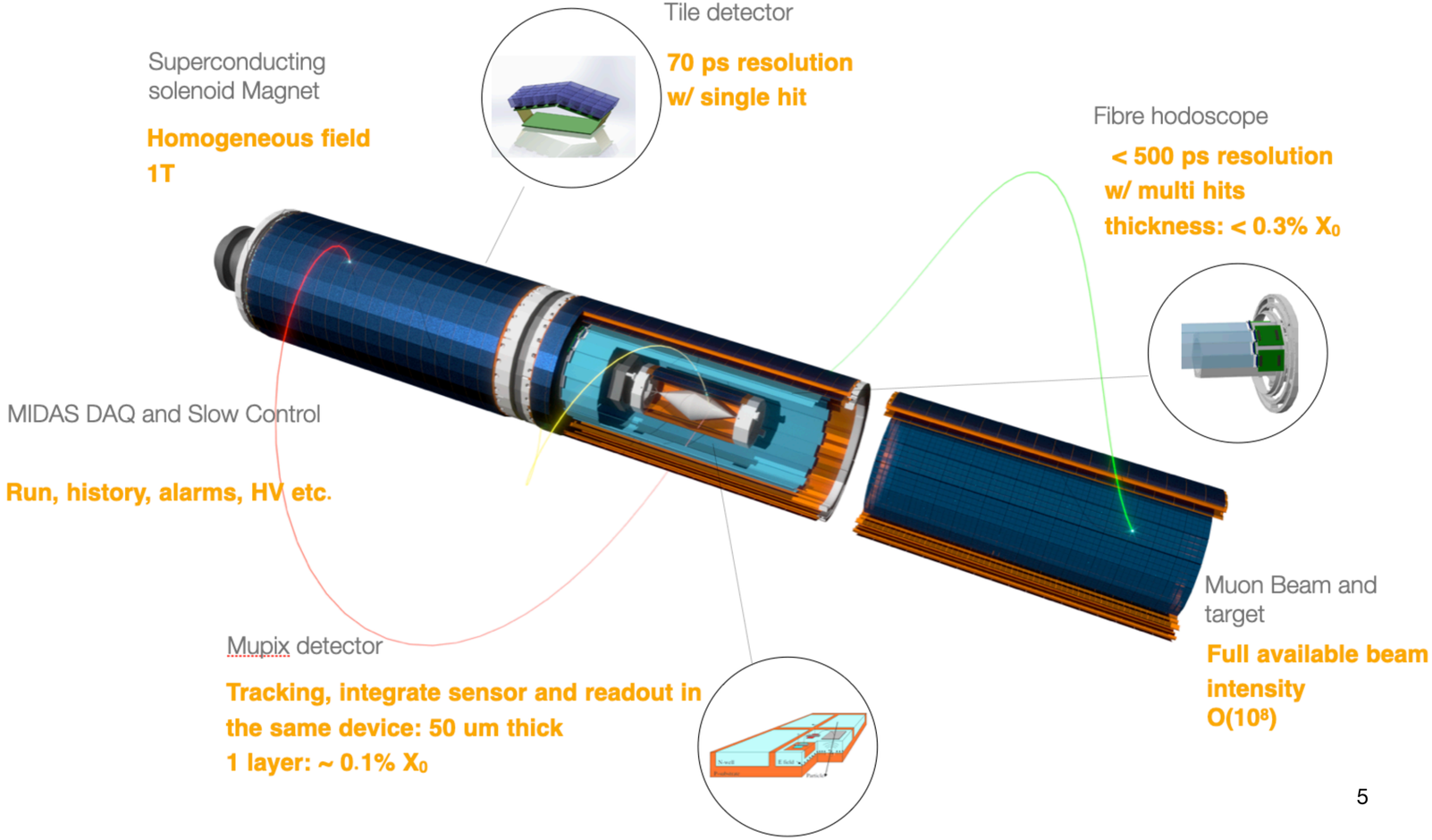


# Latest news and currents status

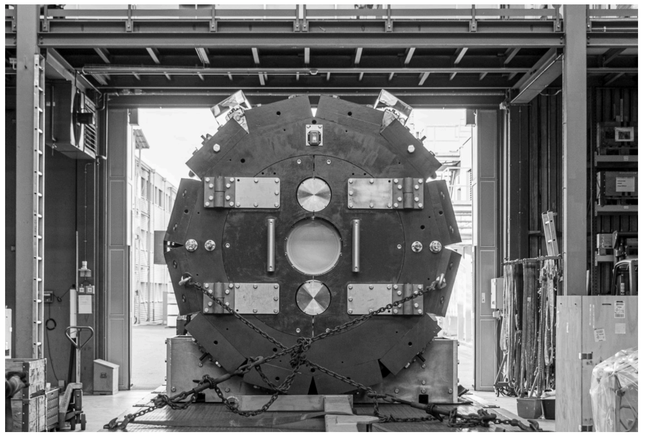
Key points:

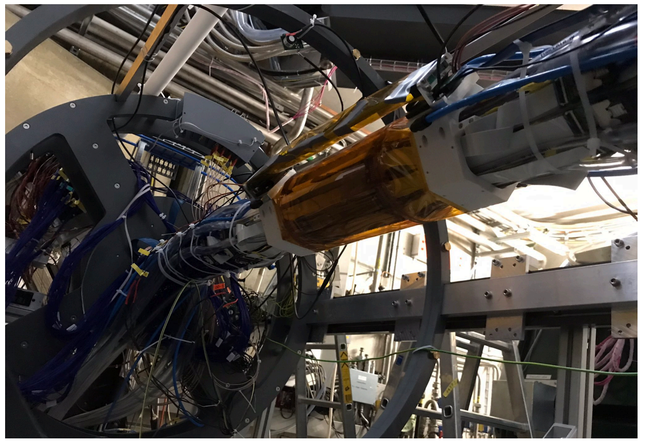
- **First integration Run 2021**
- Inner MuPix layer
- SciFi ribbons
- Sub-detector services

- **Full beam line commissioning 2022**
- Very successful: TDR promised values **matched!**
  - **2.49e10$^{8}$ mu/s @2.4 mA** (at the collimator): The highest beam rate in pie5 at the collimator
  - **1.02e10$^{8}$ mu/s @2.4 mA** (Mu3e magnet): Several beam configurations studied, some of them connected with possible Mu3e magnetic field intensity optimisation

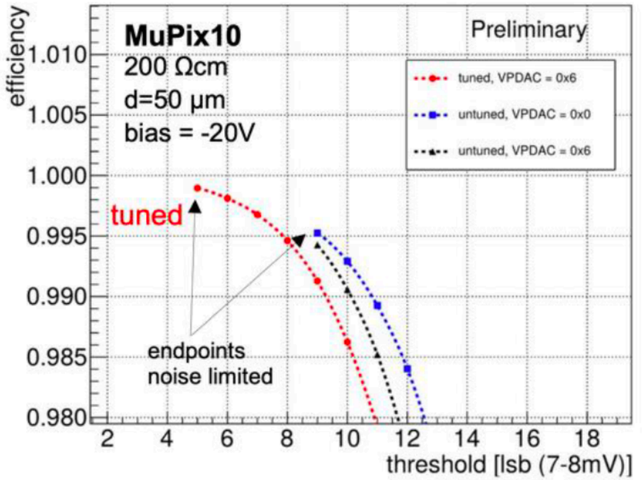
Outlook:

- Cosmic Ray Run ongoing outside the experimental area with all sub-detector services
- MuPix mass production: ongoing
- Complete integration run: 2023
- Engineering run: 2024
- First physics run: 2025

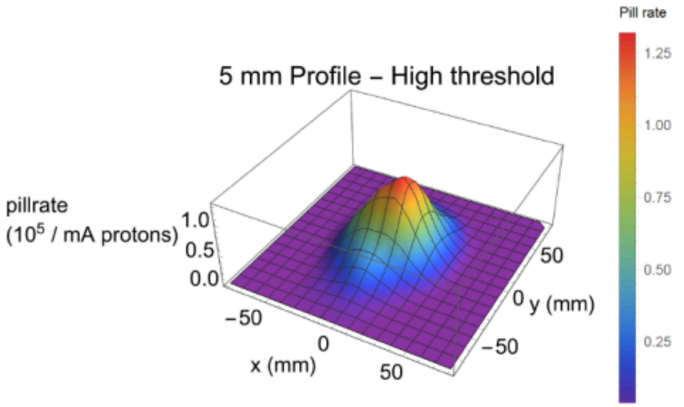




Test beam **2021**



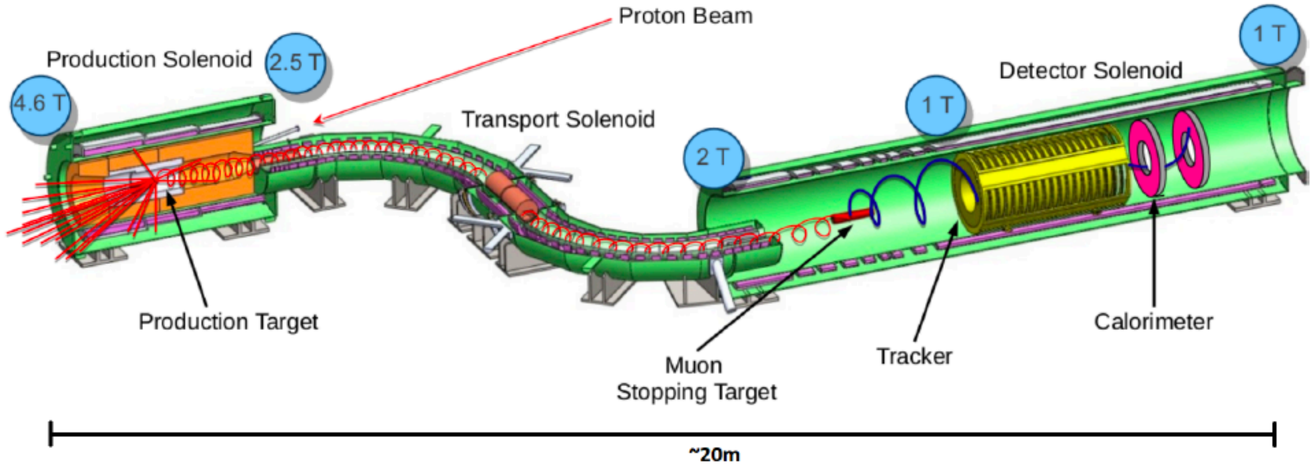

Beam commissioning **2022**




2.49e10$^{8}$ mu/s @2.4 mA

# The Mu2e experiment

- The Mu2e experiment will search for the muon-to-e conversion in nuclei with a sensitivity R(90% CL) < 8e10$^{-17}$ process in Al and improve on this limit by four orders of magnitude

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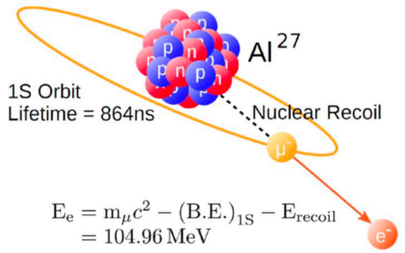
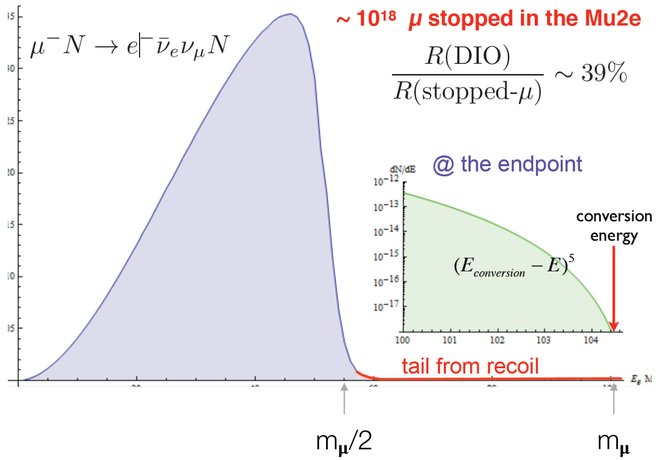
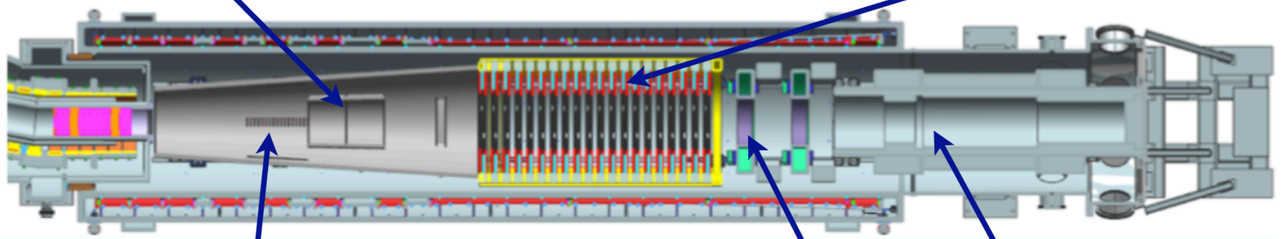



- *Proton absorber:*
  - ❖ made of high-density polyethylene
  - ❖ designed in order to reduce proton flux on the tracker and minimize energy loss
- *Tracker:*
  - ❖ ~20k straw tubes arranged in planes on stations, the tracker has 18 stations
  - ❖ Expected momentum resolution < 200 keV/c



- *Targets:*
  - ❖ 34 Al foils; Aluminum was selected mainly for the muon lifetime in capture events (**864 ns**) that matches nicely the need of prompt separation in the Mu2e beam structure.
- *Calorimeter:*
  - ❖ 2 disks composed of undoped CsI crystals
- *Muon beam stop:*
  - ❖ made of several cylinders of different materials: stainless steel and polyethylene

# Latest news and currents status

Key points:

- Solenoids:
  - **All coils for PS and TS are fabricated**
  - Cold mass fabricated for TS
  - Everything else under construction
- Targets
  - **production and stopping targets assembled**
- Tracker
  - All straws produced
  - 167 / 216 panels produced
  - 16 / 36 planes are built
  - Cosmic ray tests with a single plane
- Calorimeter
  - All crystals, SiPMs, and FEEs produced all mechanical parts in hand to build the first disk
- Cosmic Veto
  - 2200 / 2700 di-counters produced
  - 67 / 83 modules produced
  - Cosmic ray tests underway at Wideband

Outlook:

- **Detector commissioning: 2024**
- Data taking: 2025-2026