



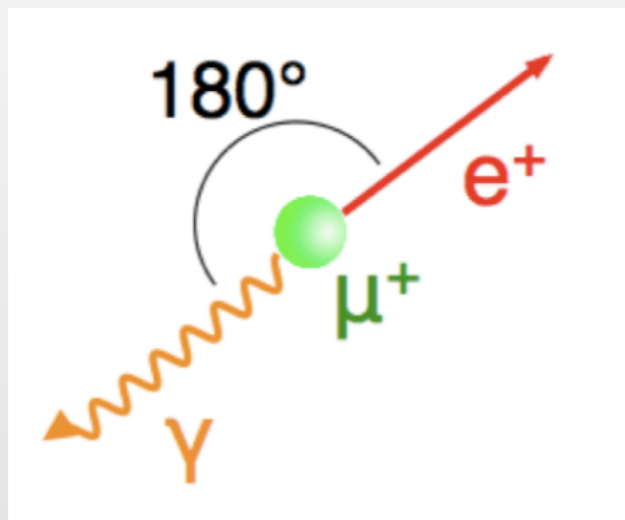
# MEG II

CdS Preventivi 2021  
15/07/2020

M. De Gerone

# $\mu \rightarrow e \gamma$

## Signal

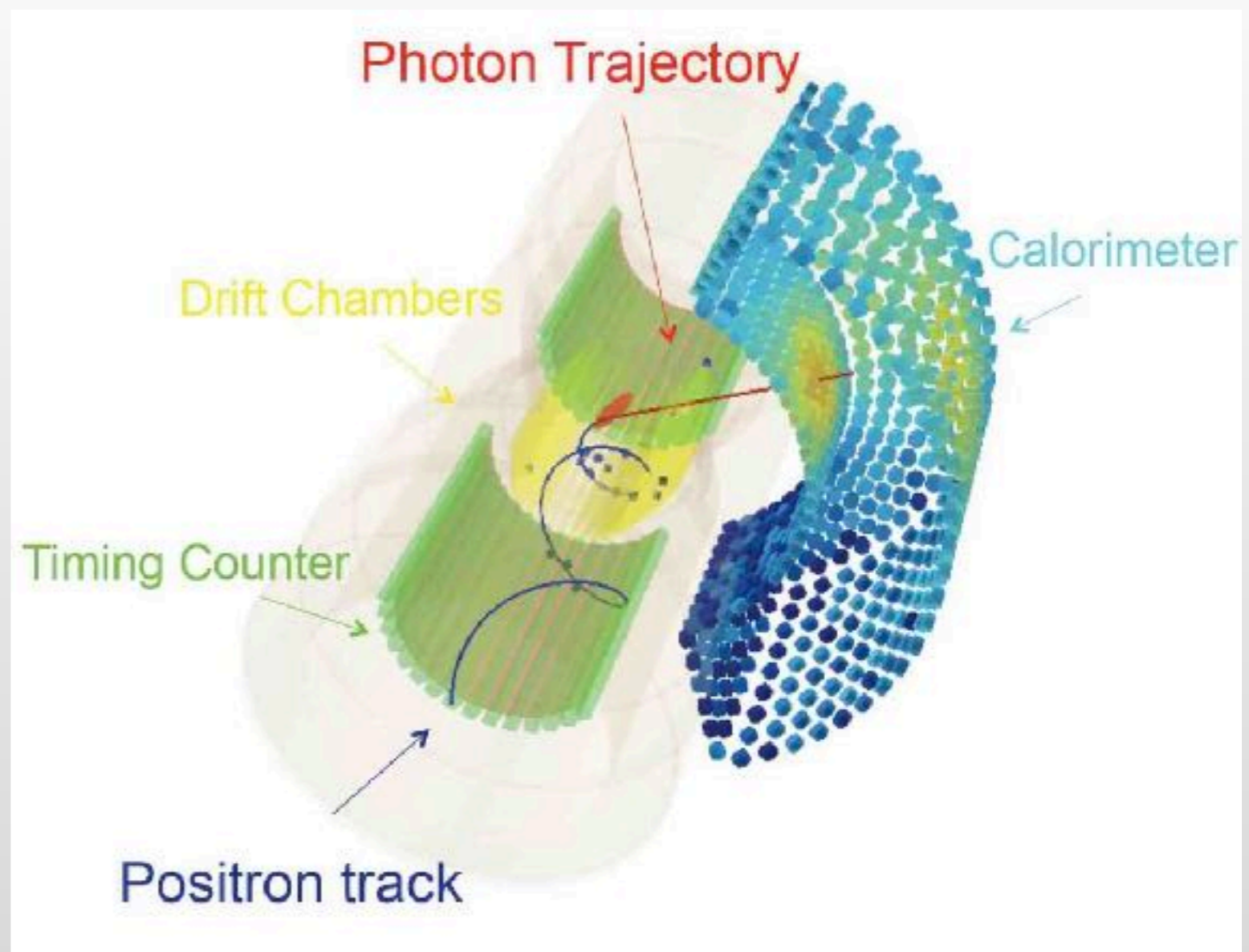


2 bodies final state

$$E_\gamma = E_e = \frac{m_\mu}{2} = 52.8 \text{ MeV}$$

$$\Delta t_{e\gamma} = 0$$

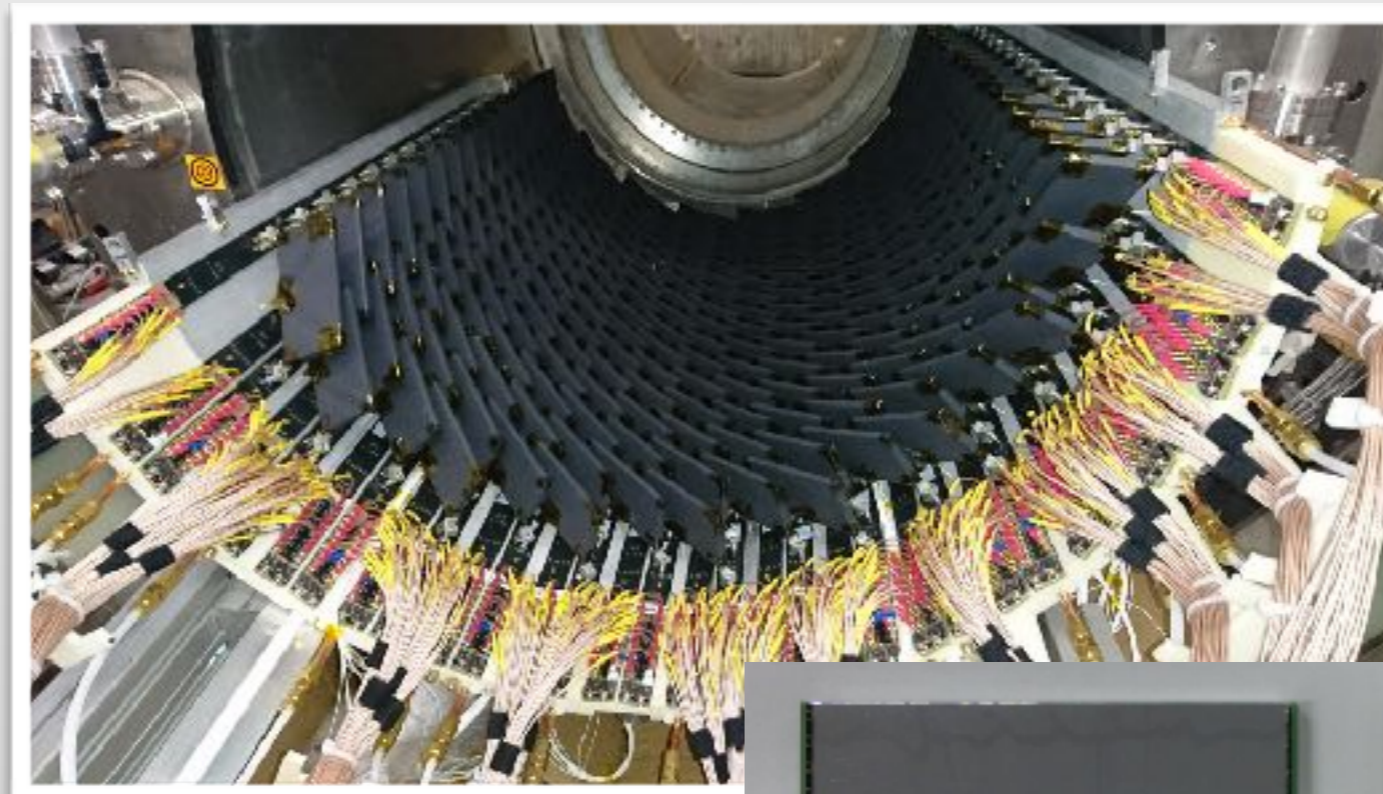
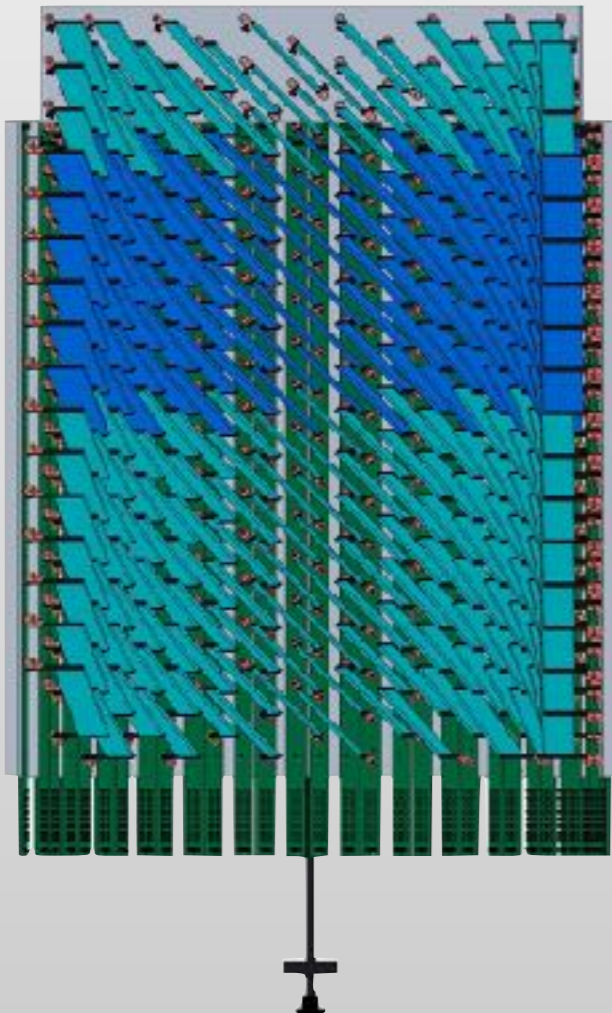
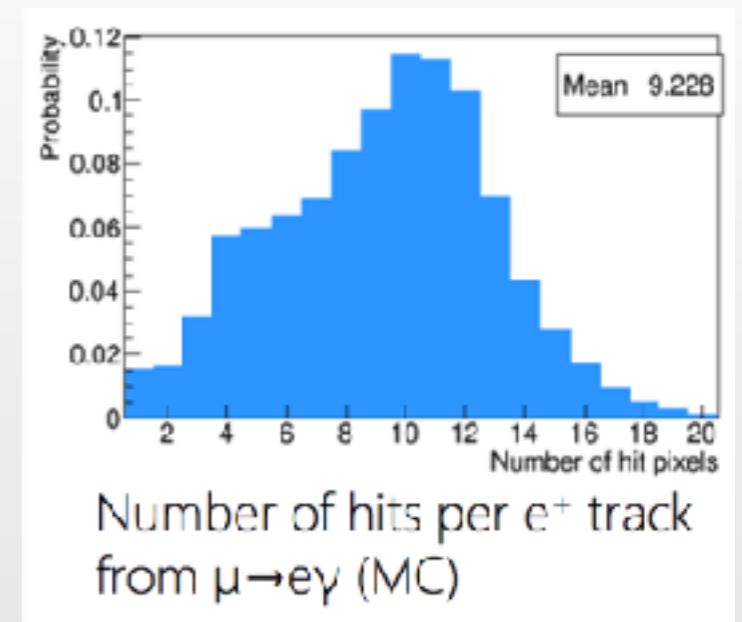
$$\theta_{e\gamma} = \phi_{e\gamma} = 180^\circ$$



- **Lepton flavour violating decay.**
- **Final MEG result (2013):  $\text{BR}(\mu \rightarrow e \gamma) < 4.2 \cdot 10^{-13}$  @90% C.L.**
- **Starting from 2013, all detectors were upgraded  $\rightarrow$  MEG II**

# The MEG II Timing Counter

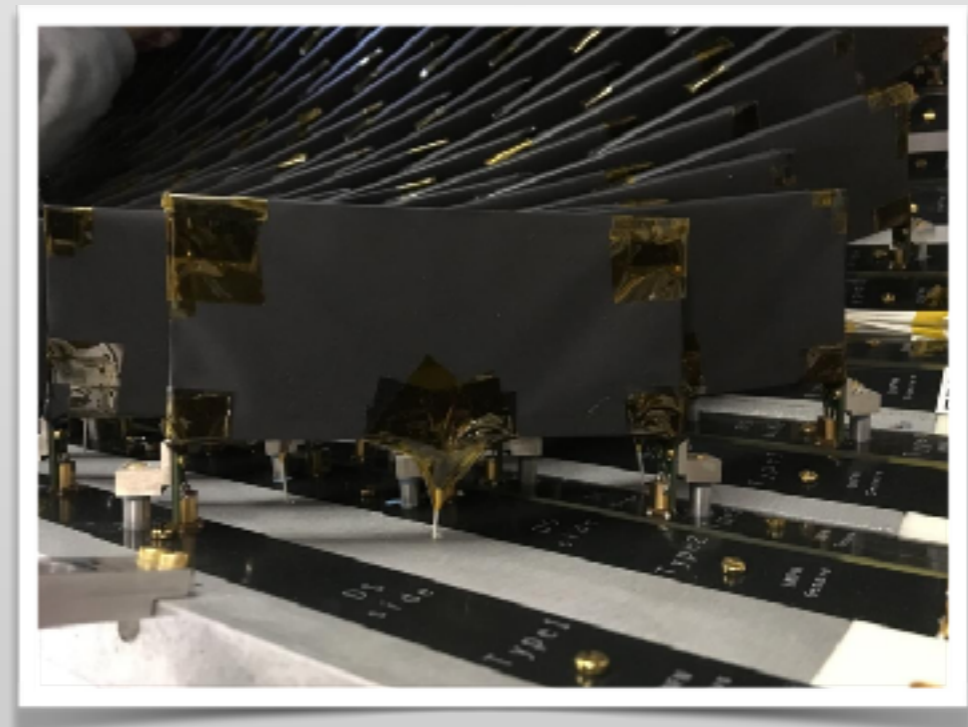
- A new pixelated detector with  $\sigma(t_{e^+}) \sim 40$  ps.
- Exploit multi-hits time resolution.
- 2 detector x 256 pixels each (symmetric down/up-stream the target).
- Optimized pixel sizes (50 or 40 mm tall) for better  $e^+$  trajectories interception.
- Low budget material along  $e^+$  tracks.



# Calibration system

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- A **laser source with an optical splitter system allows light injection** simultaneously on each pixel.
- **Laser power and system temperature are continuously monitored** in order to guarantee the best stability.
- Laser and optical splitter system are connected by means of 4 x 10m long fibers.
- Connection in splitter box are made in such way to be able to recover different length fibers allowing an easy handling
- Splitter box is placed very closed to the TC detector (just below the COBRA edge)
- **A fundamental calibration tool for inter-pixel calibration, detector stability, DAQ check** etc...



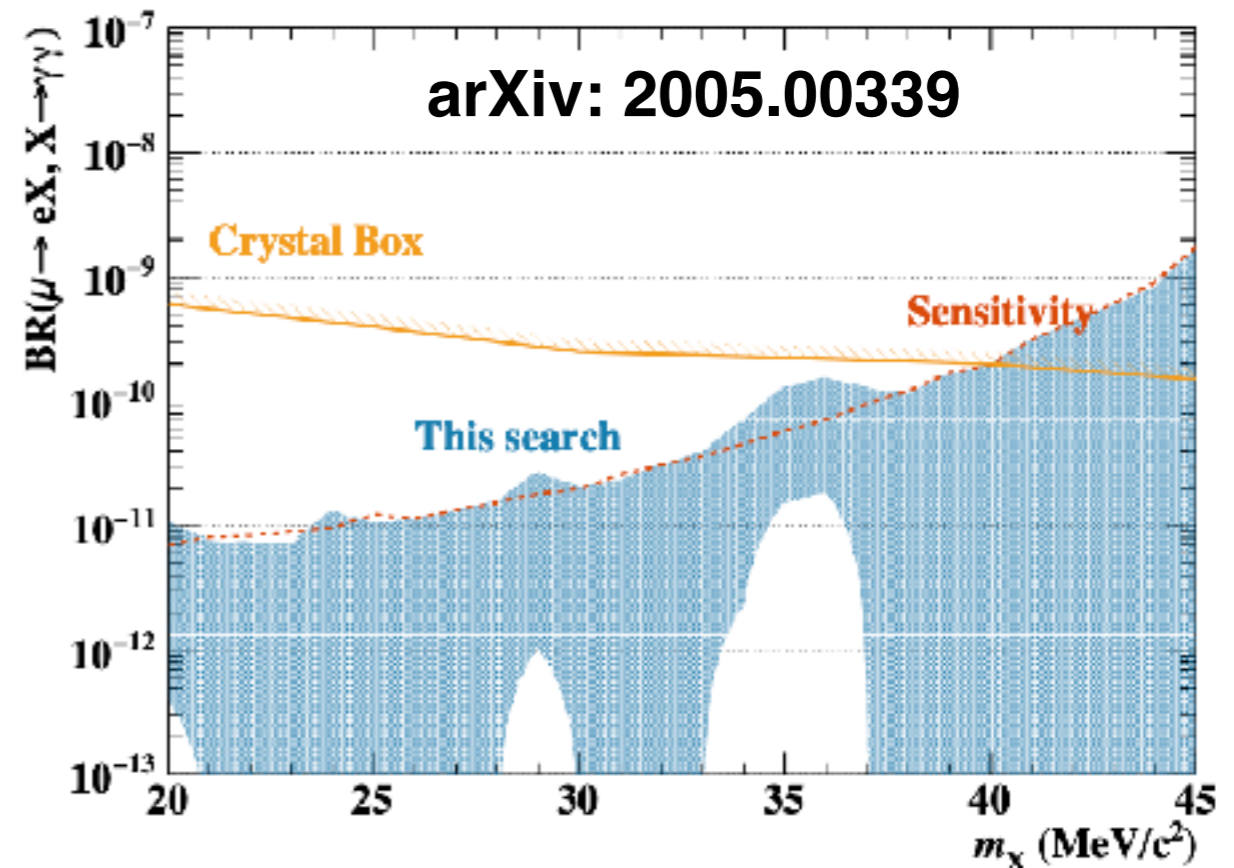
# Genova responsibilities

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- The Genova group has been responsible of the Timing Counter detector since MEG, and has been in charge for the development of TC upgrade in MEG II (shared with Uni. Tokyo).
- The new detector was fully designed in Genova; main structure, electronic boards, all mechanic stuff produced in Genova.
- Currently Genova group is responsible for detector maintenance and operation at PSI and calibration tools.

# Activities during last year

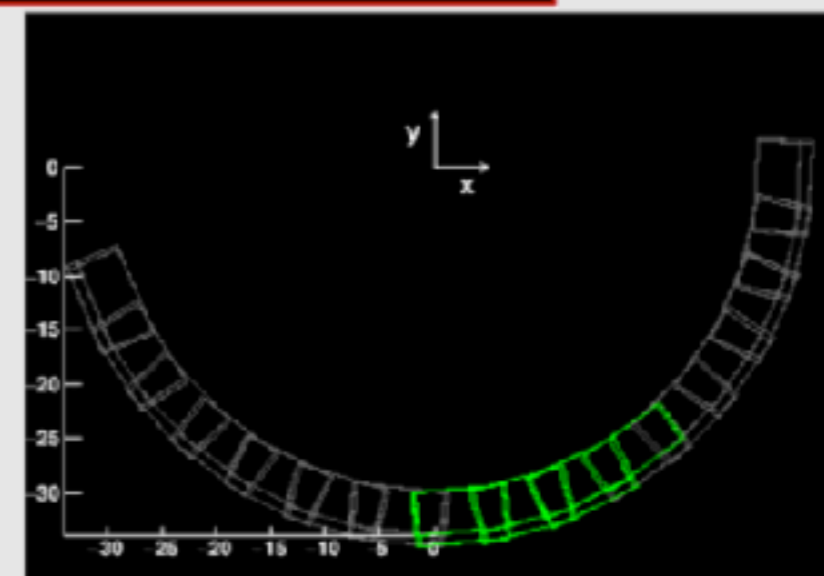
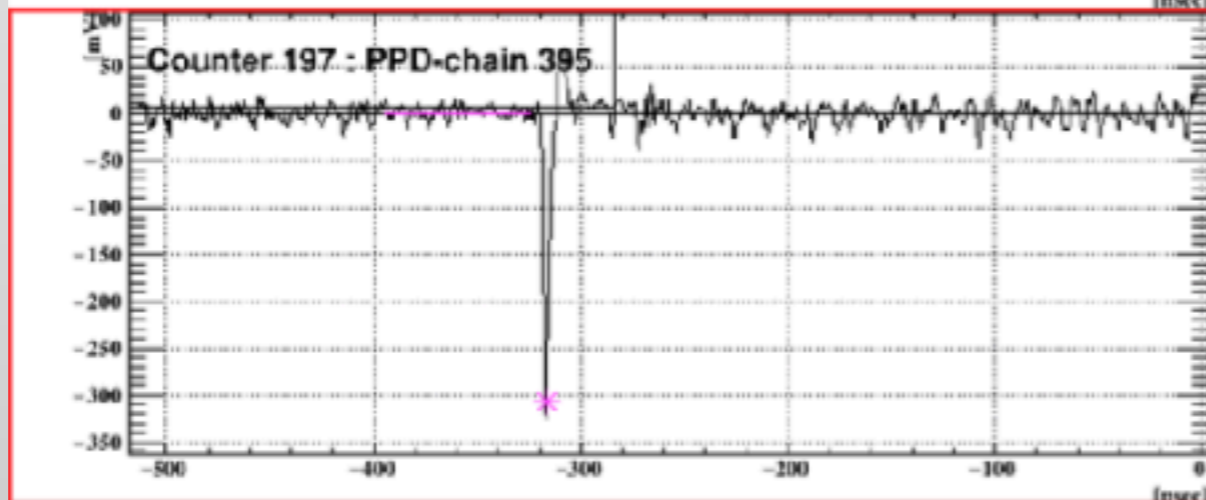
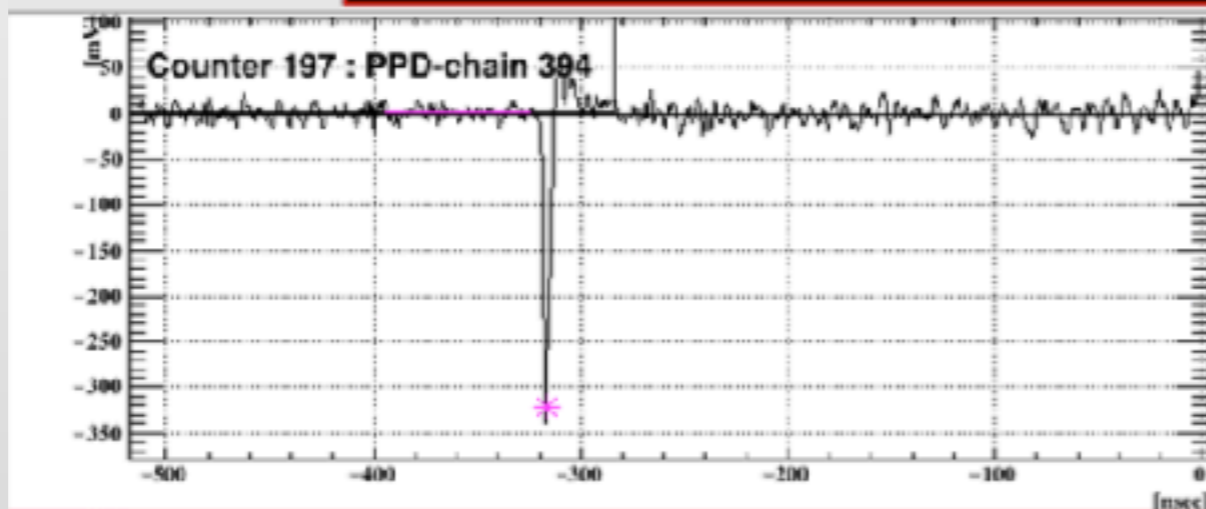
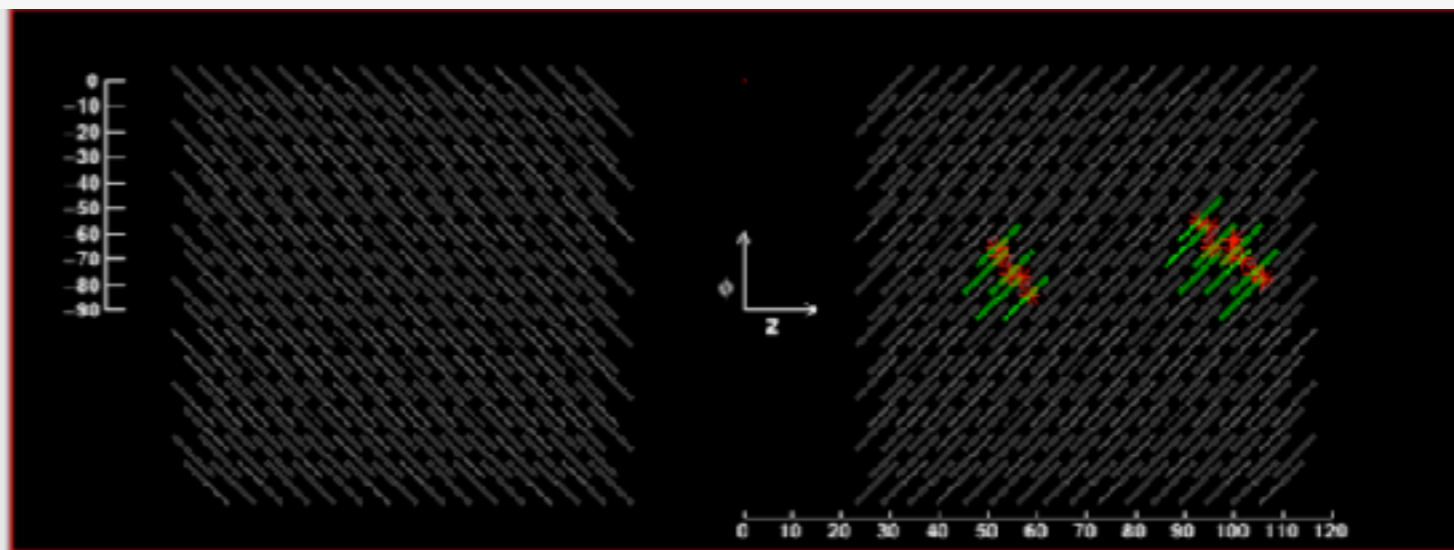
- Analysis of MEG data set looking for LFV muon decay mediated by a new light particle:
  - $\mu \rightarrow eX, X \rightarrow \gamma\gamma$
  - Improve branching ratio upper limit in the mass range from 20 to 40 MeV



- Detector standard maintenance (few pixels and fibers replacement)
- Extensive studies of Timing Counter performances with muon and lab data:
  - Timing resolution in final MEG II conditions
  - Studies on calibration system
  - Radiation damage on SiPM and correlation with timing resolution.

# Engineering run analysis

**Nice Michel tracks clearly visible!**



Pixel number with hit  
#197, 214, 198, 199, 215, 216, 231, 87, 72, 88, 182, 70, 71,  
0

Rec track  MC hit  MC track  only e+  
MCTrack indices to be displayed (eg. type 0,12,13 below and press Enter key)

# Engineering run analysis

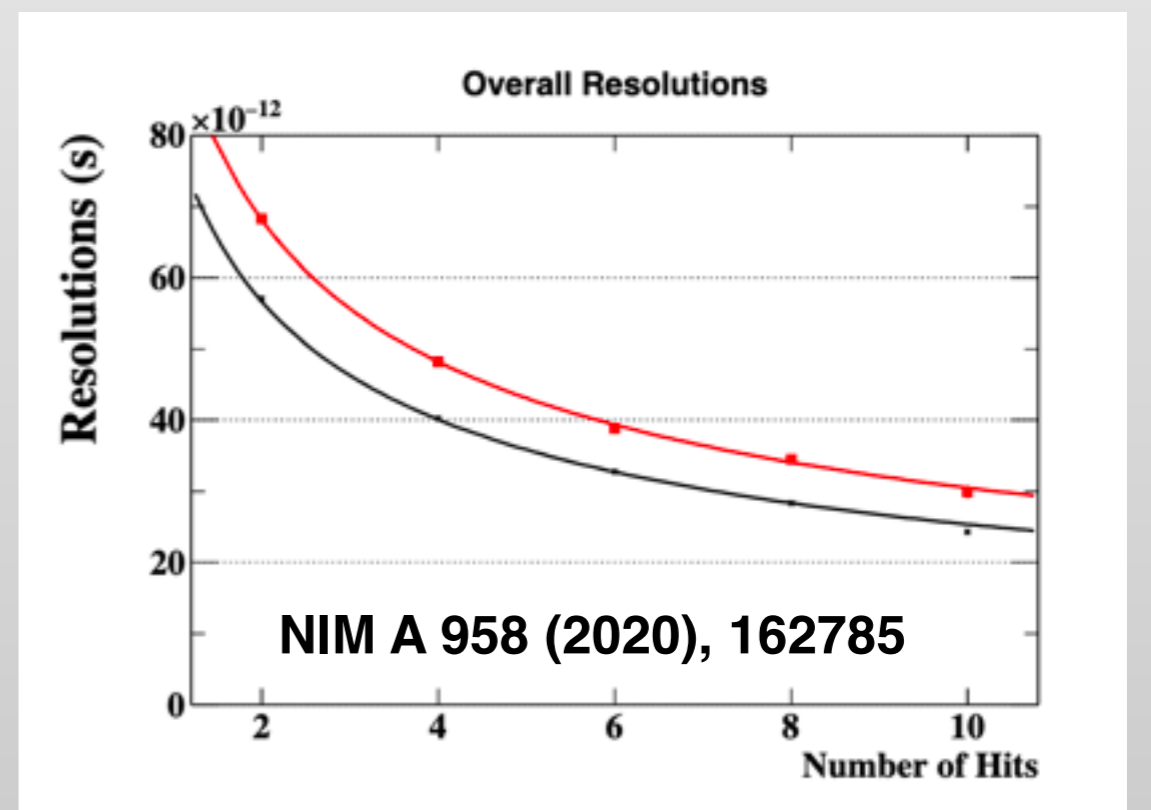
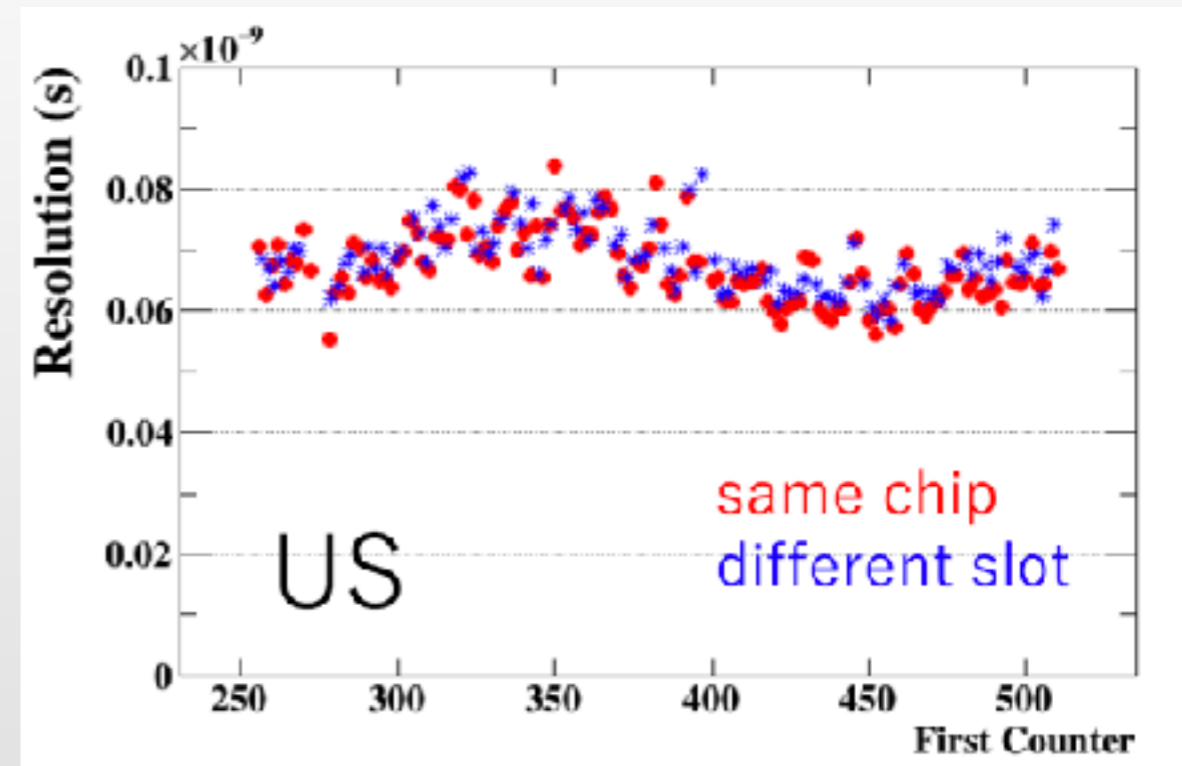
Check of the double hits resolution (2 adjacent counters):

pixels on same DRS chip:  $\sigma (T_{i+1} - T_i)/2$

pixels on different DRS chip:  $\sigma (T_{i-15} - T_i)/2$

We did not see any strong influence from electronic jitter now. Single pixel resolutions stay in the range 60 - 80 ps as expected from lab tests.

Resolution as a function of the number of hit pixels follows  $1/\sqrt{N}$  behavior - considering  $\langle N \rangle \sim 8$  average detector resolution is estimated to be  $\sim 37$ ps





# what's new in MEG II since last year

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- Not so much...
- The Timing Counter has been largely tested in last years and it is ready to take data in MEG II framework.
- Calibration tools (i.e. laser system) are completed, installed and properly working.
- Some delays in other detectors move forward our DAQ schedule
- (Another) engineering run was foreseen for fall 2020 but not clear wether we will be able to take data or not this year due to pandemic.

# Anagrafica e servizi

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|               |     |
|---------------|-----|
| De Gerone     | 0.5 |
| Gallucci      | 0.1 |
| Giovannini    | 0.7 |
| Grosso        | 0.7 |
|               |     |
| Totale FTE    | 2.0 |
|               |     |
| A. Bevilacqua |     |
| F. Siccardi   |     |

Richieste ai servizi:

- ~ 2 m.u. pro. mec.
- ~ 2 m.u. officina meccanica

Richieste a bassa priorità legate a piccoli interventi di manutenzione sul detector che si possono rendere necessari durante le , implementazione del sistema di raffreddamento.