



# HYBRID DETECTOR FOR MICRODOSIMETRY: HDM

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**Marta Missiaggia**

E. Pierobon, M. Castelluzzo, A. Perinelli, F. Cordoni,  
M. Centis Vignali, C. Manea, G. Borghi, V. E. Bellinzona, E. Scifoni,  
F. Tommasino, V. Monaco, L. Ricci, M. Boscardin, C. La Tessa

# HDM: The Basis

## Basic quantity

Lineal energy  $y$  =  
energy deposited  
over the TEPC **mean  
chord length (mcl)**

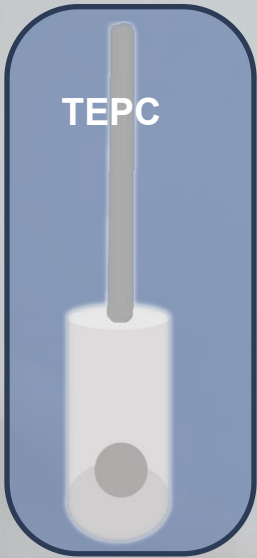


$$\text{mcl} = \frac{2}{3} * d$$



Frequency spectra of  $y$  and other  
standard microdosimetric quantities  
are measured to characterize the  
radiation field quality

# HDM: The Idea

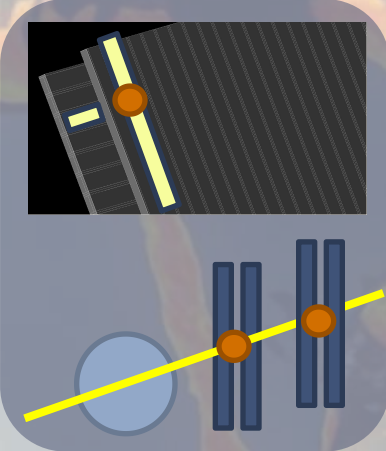


Energy deposition of all particles traversing the TEPC

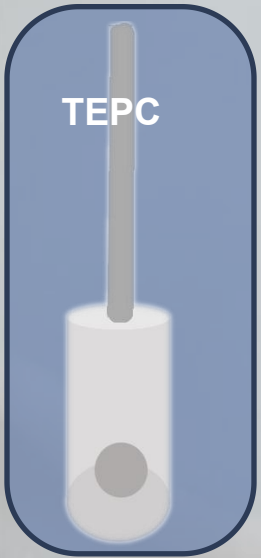
$$= \overset{\text{NEW}}{y_T} = \frac{\epsilon}{rtl}$$

Real track length of particles (with 4 layers of LGADs)

# HDM: The Idea



Energy deposition of all particles traversing the TEPC



**NEW**

$y_T$

=

$\epsilon$


$rtl$




improved spatial resolution

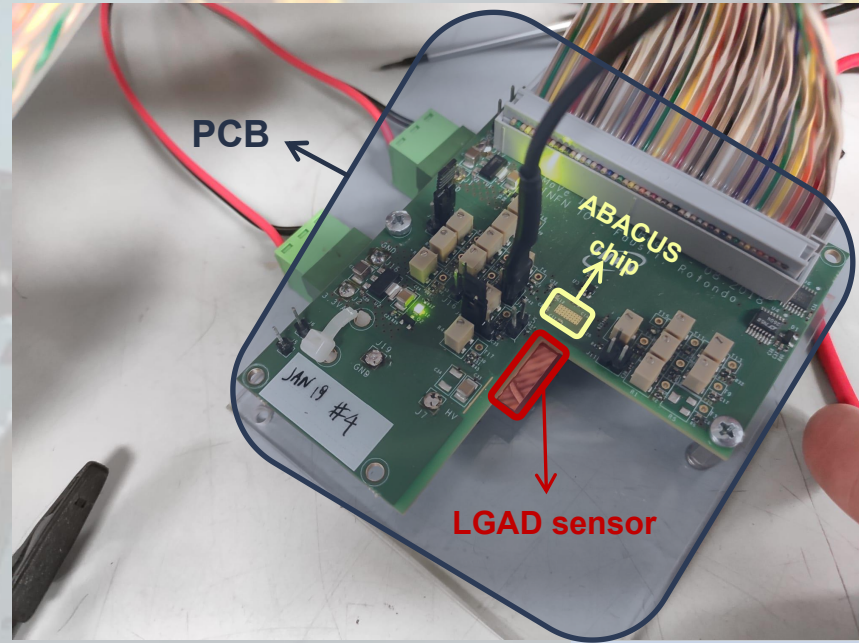
Real track length of particles (with 4 layers of LGADs)

## HDM: The Status

■ The LGADs have been produced and characterized at  (Trento)

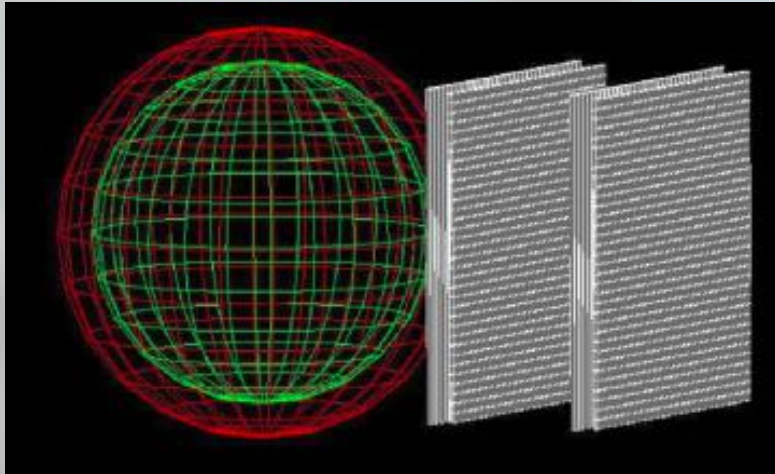
FONDAZIONE  
BRUNO KESSLER

■ The **read-out chip** ABACUS and the **PCB** have been developed at *University and INFN of Turin*   
-> updated versions are coming soon



## HDM: The Status

Missiaggia, M., et al. "*A novel hybrid microdosimeter for radiation field characterization based on TEPC detector and LGADs tracker: a feasibility study.*"  
Accepted for publication on *Frontiers in Physics* (2020)



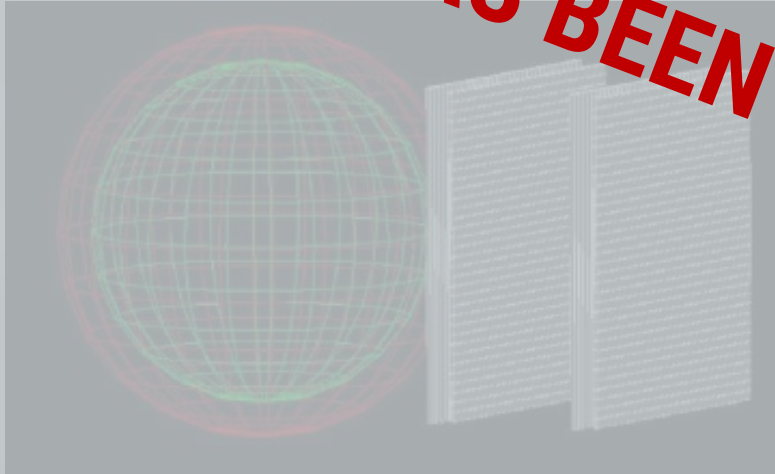
- ▀ for  $^1\text{H}$  and  $^{12}\text{C}$  beams
- ▀ for different LGAD strips configurations



## HDM: The Status

Missiaggia, M., et al. "A novel hybrid microdosimeter for radiation field characterization based on TFPC detector and LGADs tracker: a feasibility study." Accepted for publication on Frontiers in Physics (2020)

**HDM FEASIBILITY  
HAS BEEN DEMONSTRATED**

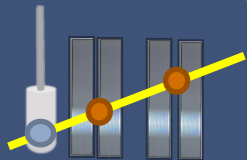


**More accurate radiation field  
quality  
for a more effective  
radiobiological damage  
estimation**





## HDM Idea



**More  
advanced  
tracking  
algorithm via  
ML techniques**

**HDM  
Feasibility  
study** (via MC  
simulations)

**LGADs  
production  
at**   
FONDAZIONE  
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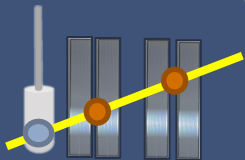
**HDM  
read-out chip  
ABACUS  
and PCB**



Istituto Nazionale di Fisica Nucleare  
SEZIONE DI TORINO



## HDM Idea



**More advanced tracking algorithm via ML techniques**

## HDM Feasibility study (via MC simulations)



**HDM characterization with protons!**

## HDM Readout system FPGA-based



## HDM read-out chip ABACUS and PCB



## LGADs production at

**New radiobiological microdosimetric model that exploits information given by HDM**



***THANK YOU  
FOR YOUR  
ATTENTION***