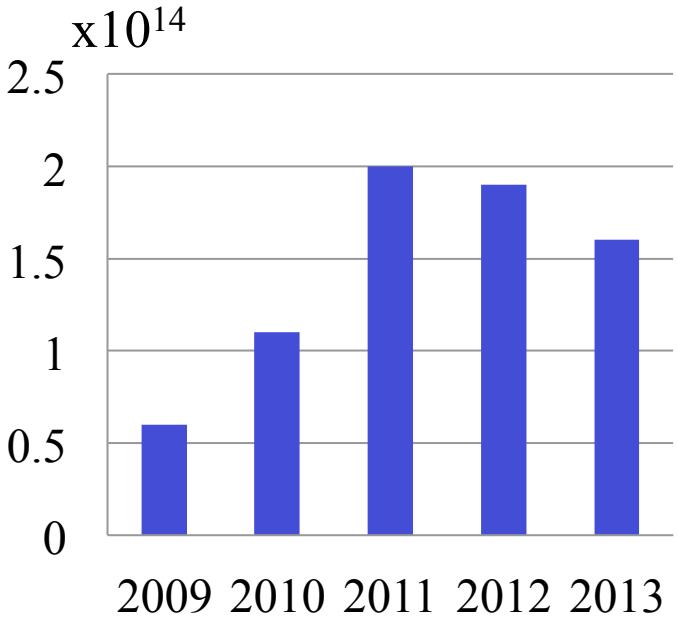
Esperimento MEG: stato e richieste

D. Nicolò
(per conto del gruppo MEG-Pisa)
Pisa, 3 Luglio 2015

Sommario

- Analisi run I (resp. F. Cei)
  - nuovi tool e sistematici
  - articoli in produzione
- Apparati
  - CDCH (resp. M. Grassi)
    - mock-up
    - finale
    - software ricostruzione
  - trigger (resp. L. Galli)
    - prototype tests
    - engineering run and final production
- Agenda
- Richieste 2016

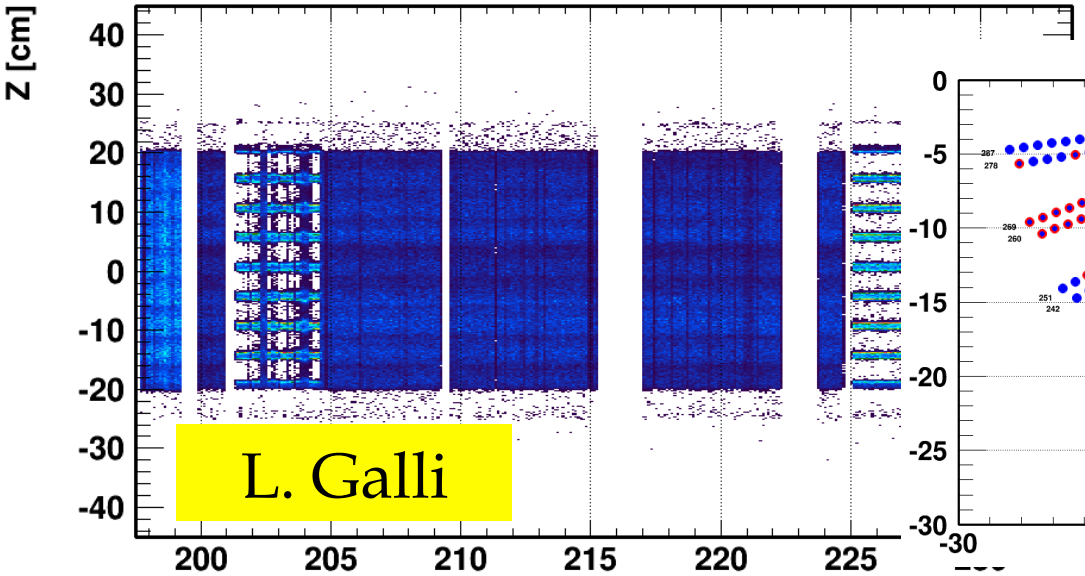
Run fase I

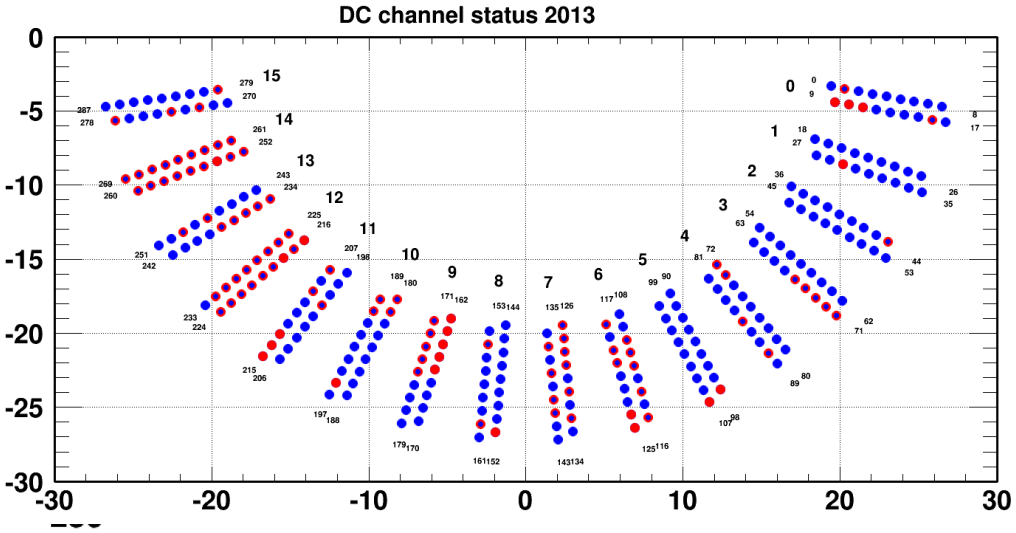

x10^14
2.5
2
1.5
1
0.5
0
2009 2010 2011 2012 2013


Where We Will Be
6×10^-14
500
×10 Sensitivity
375
250
Where We Are
Upgraded MEG
5×10^-13
125
2.4×10^-12
2008
2010
2012+2013
2017
k factor
(×10^11)
0

Stato analisi dati

- In corso (termine Settembre)
  - Identificazione di eventi da
    - annichilazione in volo di positroni ➔ reiezione fondo γ
    - tracce di positroni a grande dip angle ("missing turn tracks") ➔ efficienza
  - Nuova misura mappa del campo magnetico
  - correzione per catodi erratici (rilevante per il Run2013)

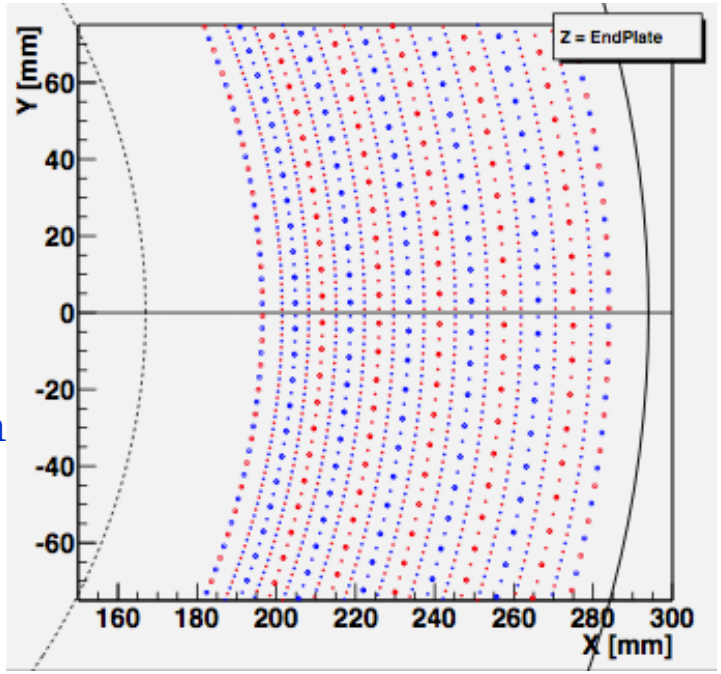




➔ # of cells with bad pad(s) / # of cells with good wires: 87 / 267 ≈ 33%

Nuovo tracker, obiettivi

- Funzionalità ad alto rate
  - fino a 1×10^8 μ/s
- Stabilità
  - garantita per radiazione integrata fino a 3C/y
- Material budget
  - Lunghezza di traccia < 1.7×10^{-3} X_0
- Prestazioni
  - Risoluzione singolo hit, vista radiale ~ 100 μm
  - Risoluzione impulso ~ 150 keV
  - Risoluzione angolare ~5 mrad
  - Efficienza combinata DCH-TC > 80%



- Lettura con WFD ad alta banda (~1GHz)
  - Capacita`di isolare i singoli cluster di ionizzazione (λ~7 mm)
  - Soppressione del pile-up (in particolare per i fili interni)

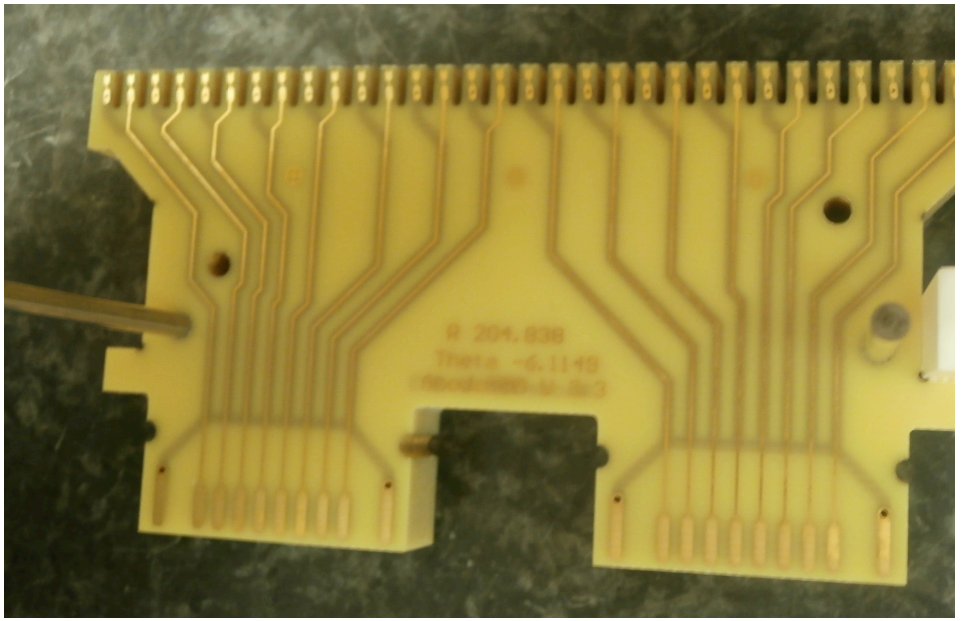
Tracker, divisione tasks

- Pisa
  - Wire PCB production
  - Final EndPlates
  - Mechanical support and integration
- Lecce
  - Wires
  - Wiring machine
  - FE electronics
- Roma
  - Gas system and monitor chamber
  - HV system
  - Wire strength measurement
- PSI
  - Inner foil
  - Integration

M. Grassi

Tracker, wirePCB

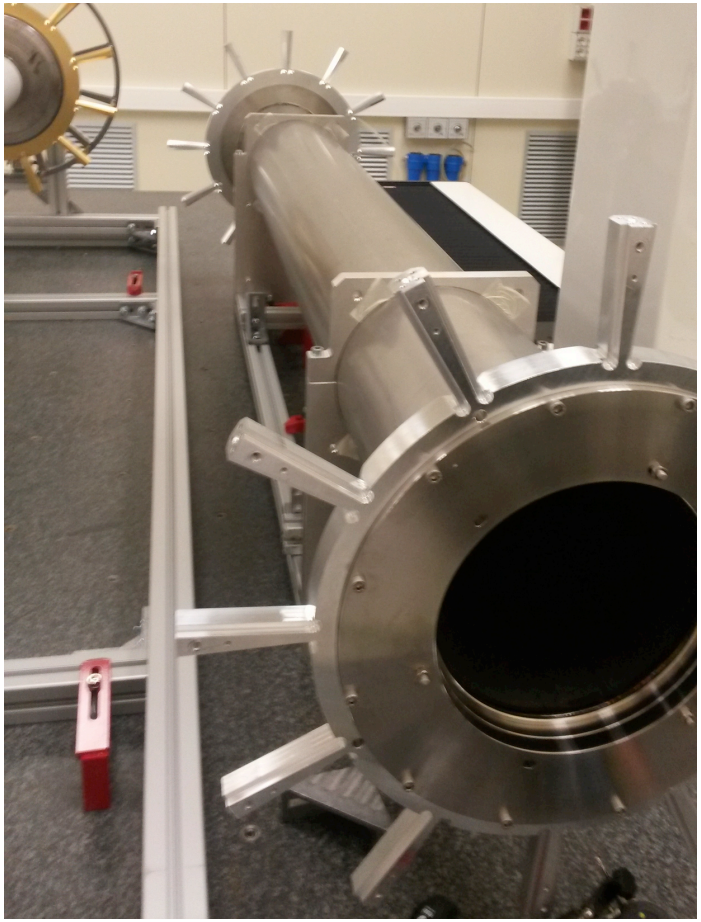
- Adequate reproducibility
- Clear cuts



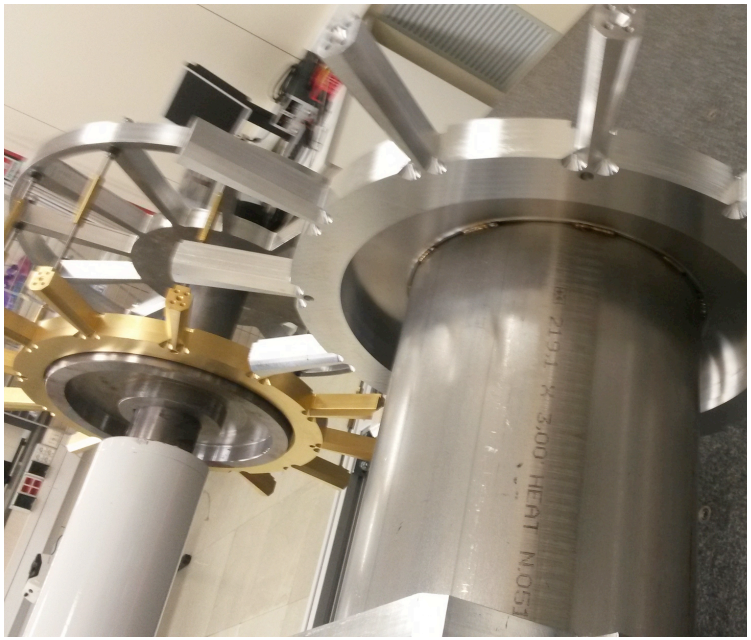
Problem

- Residual metallization on edges and holes
- Problem in production sequence
- Solved and new production in progress ➔ completed

Tracker, the mock-up



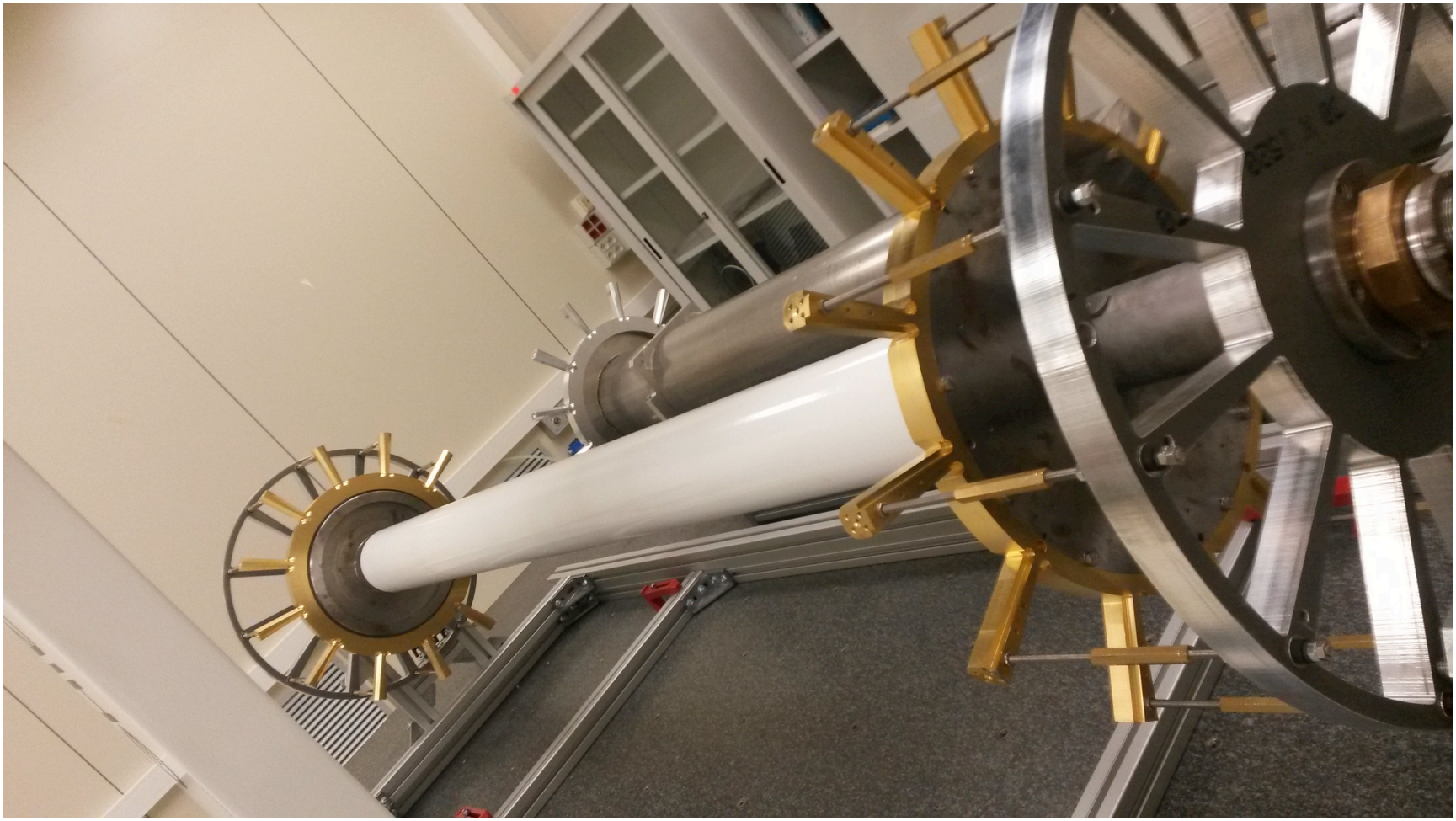
- copia della camera finale
- solo un settore
- supporti prodotti ed adattati agli end-plates
- da trasferire al PSI entro fine mese per test con l'insertion system



Full CDCH, end plates

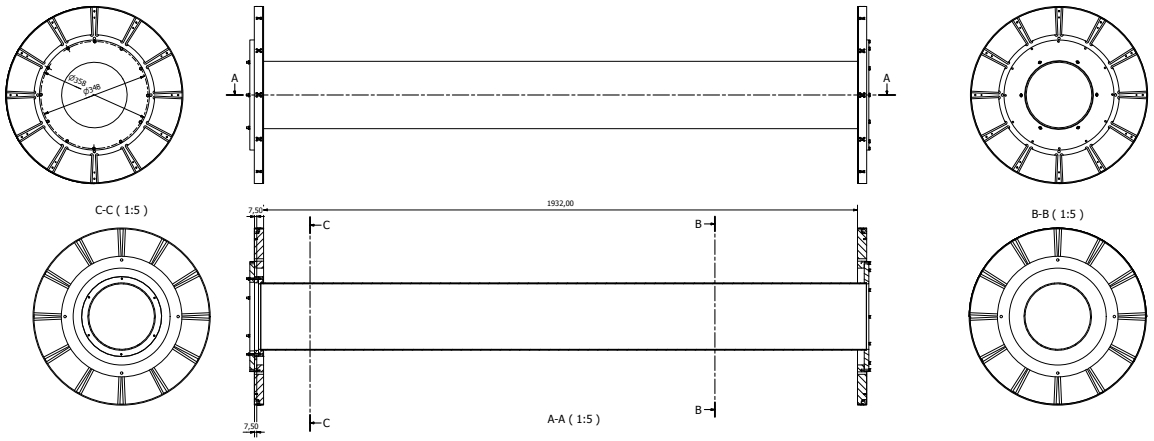
- Completed
- Initial survey done
  - Concentricity: better than 14 um
  - Roundness: max-min ~40 um
  - Best – Nominal : 30 um
  - Planarity: within 30 um

Tracker, assembly



Full CDCH, support structure

- Contractor Loson SRL
  - Molds already produced OK
  - Material procured OK
  - First set expected by end of April OK
  - Reference structure provided by INFN Pisa in production at VCS OK



  - Corbon fiber cutting and drilling second in progress
  - Structural tests begin of June
  - Wire mount on mockup end of june
  - Delivery at PSI for mylar foil insertion and insertion device begin of july

Support structure, final set

- Make an other couple of endplates (Pisa) september
- Production of the final set of carbon fiber support (Loson) september
- Mount of the final reference structure October
- Corbon fiber cutting and drilling second end of October

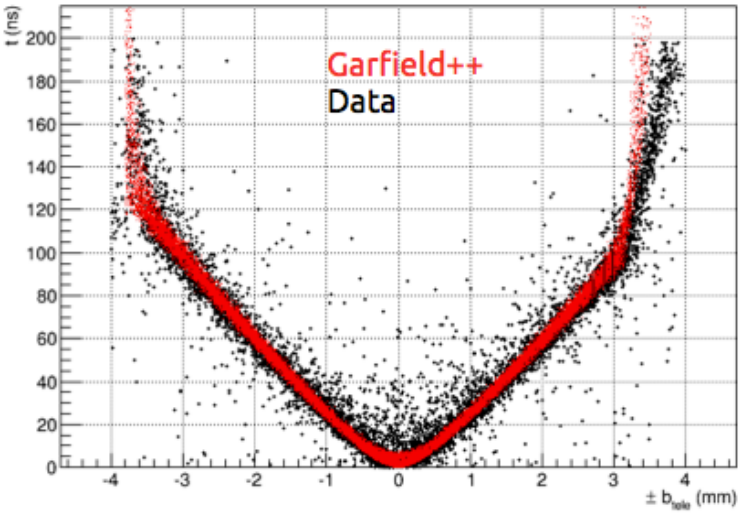
- Mounting on the chamber Winter 2016

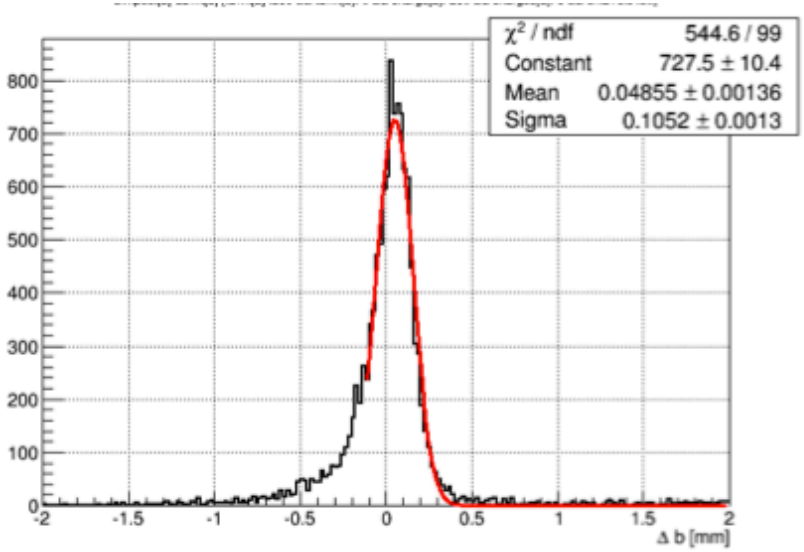
Risoluzioni singolo hit attese

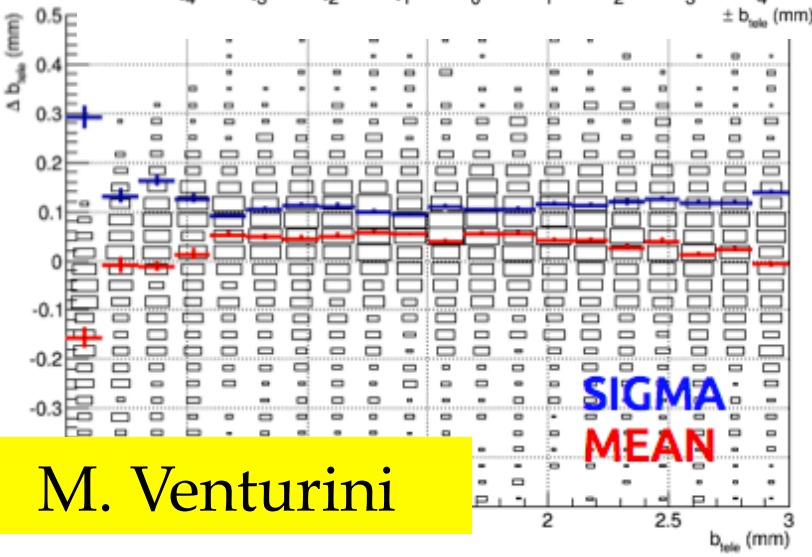
- Drift time vs r
  - Validazione Garfield++
- misure ottenute con cosmici sotto telescopio
- Risoluzione singolo hit

  $\sigma \sim 100\ \mu m$

  con taglio su χ^2 tracce





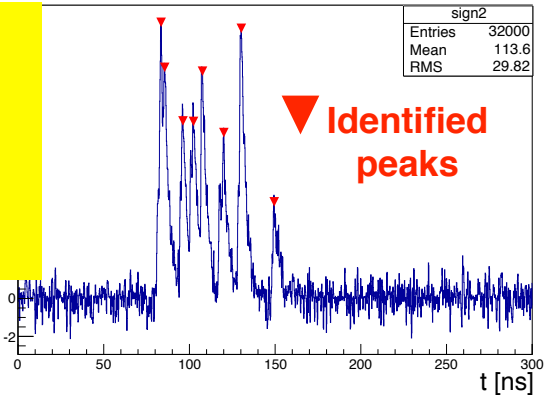


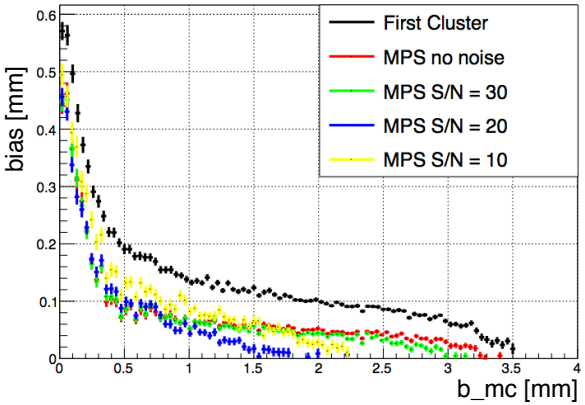
M. Venturini

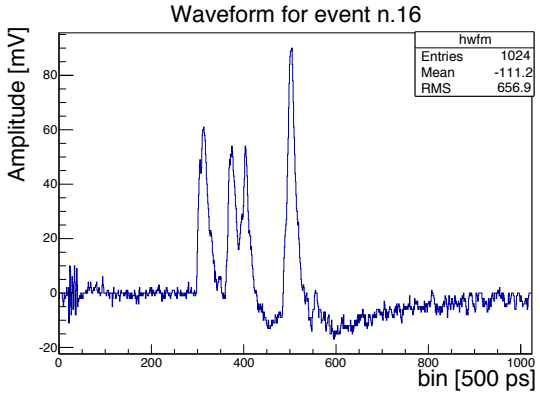
Cluster timing

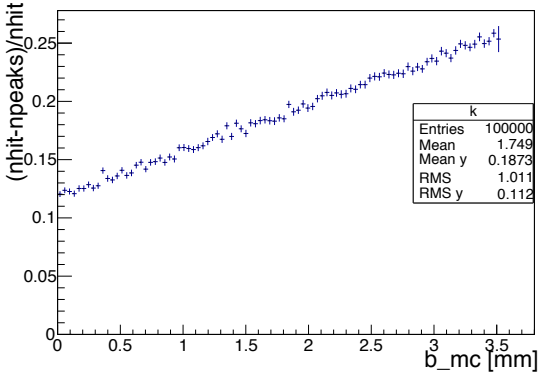
A waveform simulation with realistic noise conditions, combined with a refined version of the ROOT TSpectrum class, shows that we can reconstruct clusters with an efficiency $\simeq 80\%$ without spoiling the algorithm performance:

D'Onofrio tesi di laurea (sup. G. Signorelli)









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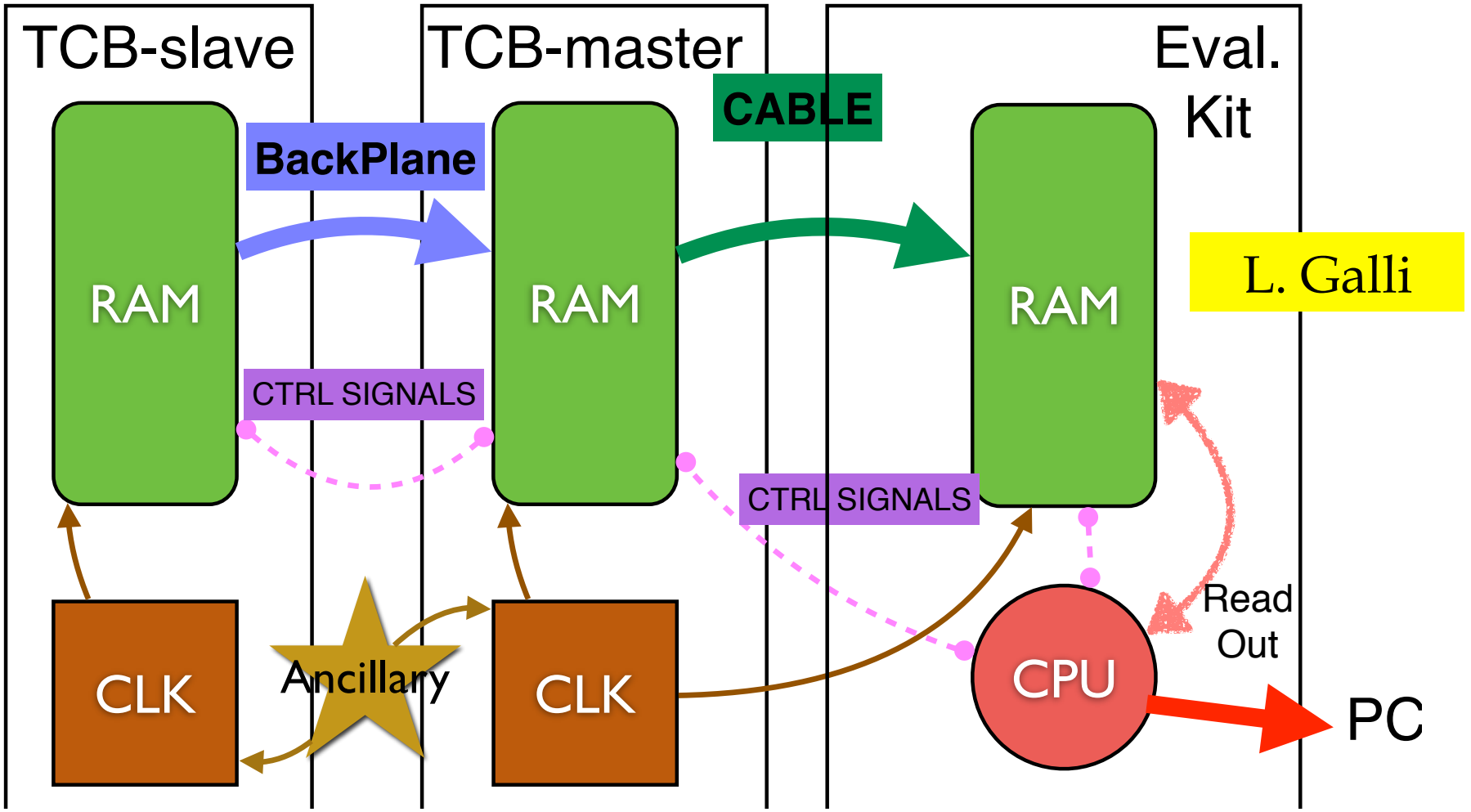
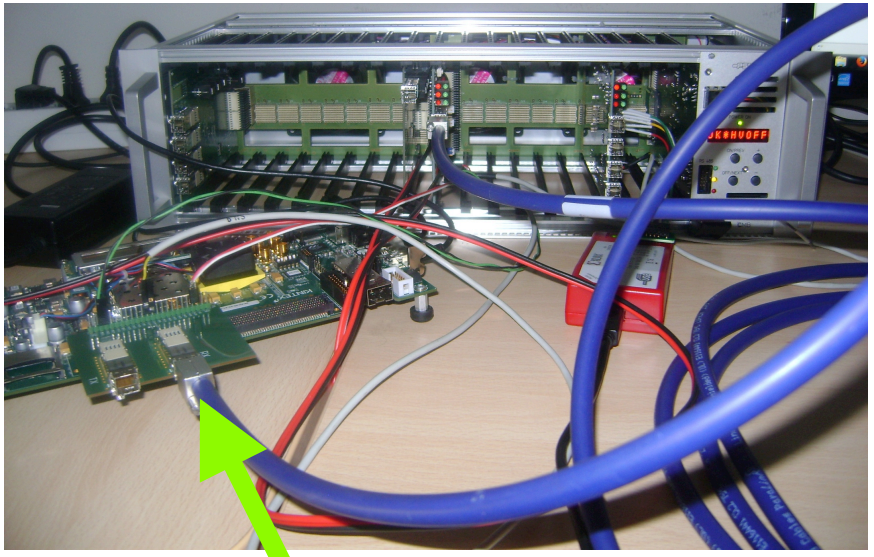
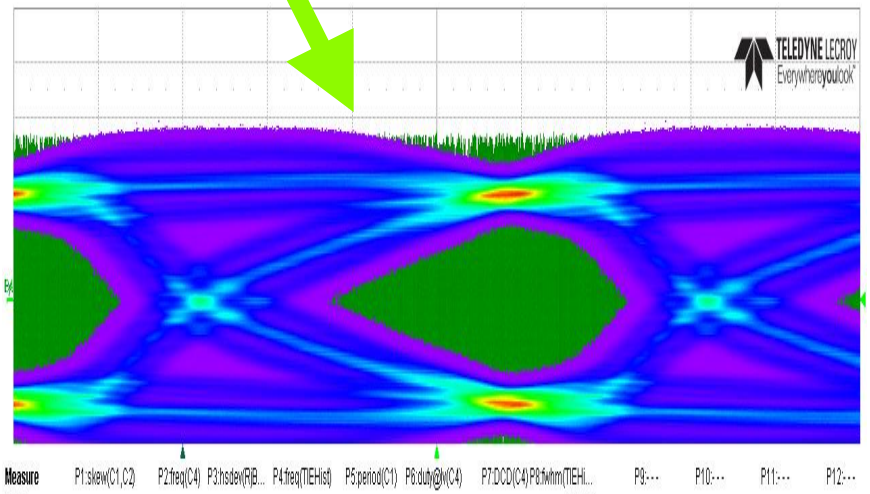
Trigger, prototype test scheme



Trigger, test results

- Signal quality in serial connection with eye diagram
  - *extracted after the 5 meters of MEG II transmission cables*
  - *BER < 10^{-11}*
    - limited by a small reflections in signals
    - this is a sanity check (and a nice picture for a talk at a conference)
      - *we already checked the performance with previous tests*





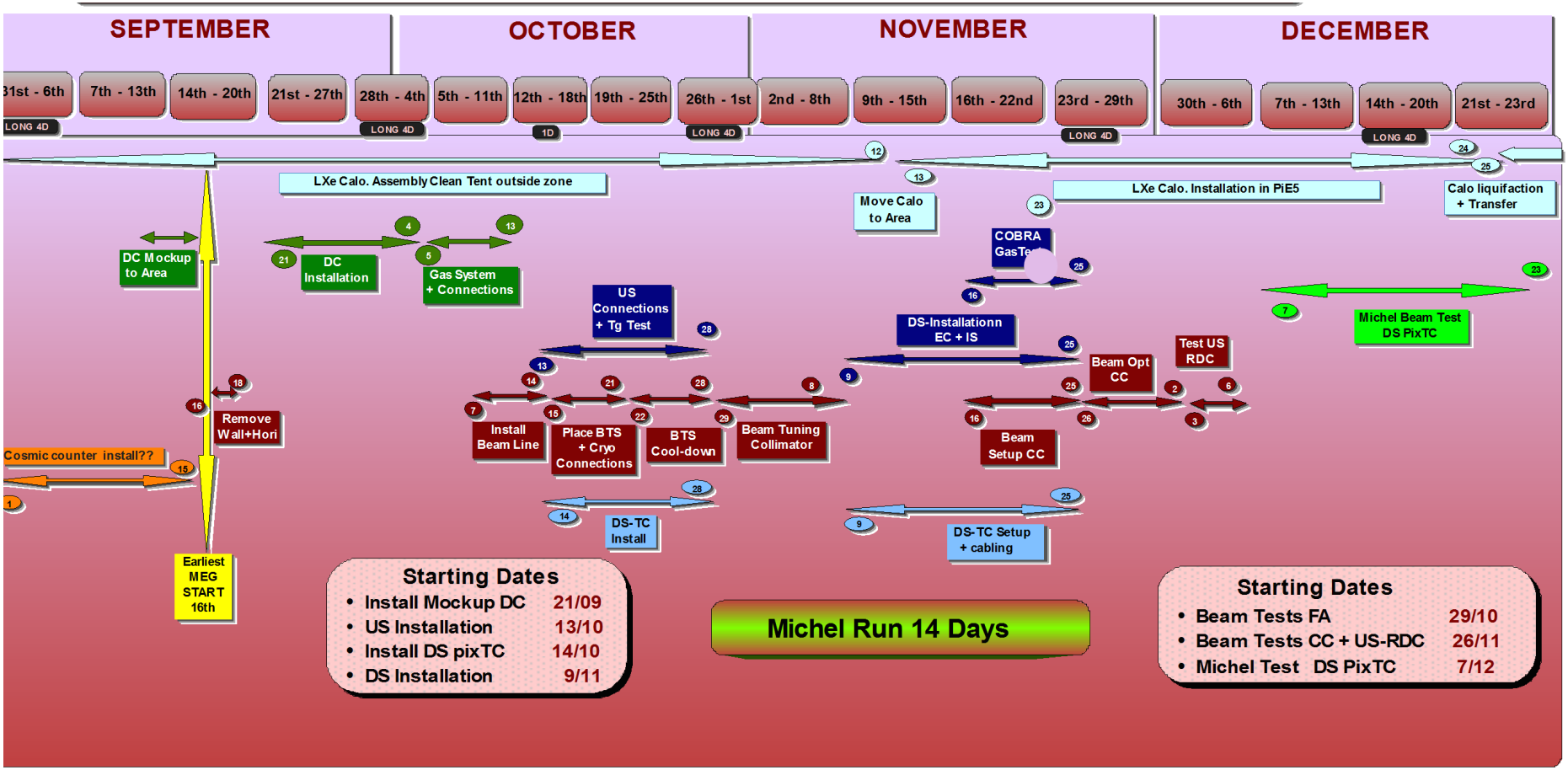
Towards the engineering run

- We foresee two scenarios
  - *in either scenario*
    - the 16 WDB are synchronised and share the trigger and control signals
    - the TCB is in the game
      - *from simple to complex selections*
- Scenario 1: DCB in the game (main roadmap)
  - *read out by DCB*
    - ~ complete system test
- Scenario 2: DCB out from the game (backup)
  - *WDB individually read out through ethernet*
    - software event building needed
    - not a complete test for the TDAQ
      - *but in any case a big step to the final set up*

Towards final production

- Connections to DCB
  - *probably possible with TCBs*
- SPI protocol
  - *load firmware to SPI memory from remote*
  - *access the FPGA from remote for single word access*
    - to be done in collaboration with Stefan
- In principle we will complete the tests and be ready for production before the end of the year
  - *do we want to skip a complete test with WDBs and DCB?*

Installation, engineering run



Composizione gruppo

	2015	2016
A. Baldini	0.7	0.7
C. Bemporad	0	0
F. Cei	0.7	0.7
L. Galli	1	1
M. Grassi	0.7	0.65
D. Nicolo`	0.7	0.65
G. Signorelli	0.3	0.3
F. Tenchini	1	
M. Venturini	1	1
F. Morsani	0.2	0.2
F. Raffaelli	0.7	0.5
Totale (FTE)	7.0	5.7

Laureandi: A. D'Onofrio (laur. 3/6/15), M. Chiappini

Richieste 2016, supporto

- Camera
  - prog. meccanica (Raffaelli) 0.5 fte
  - disegno mecc. (Bianucci) 0.3 fte
  - tecn. mecc. 0.3 fte
  - alte tecnologie (Petragnani) 1 fte
  - montaggio elettronica 0.5 fte

- Trigger
  - prog. elettronica (Morsani) 0.2 fte
  - dis. CAD + prog. FPGA (Minuti?) 0.2 fte

Richieste 2016, fondi

- Costr. App.
  - Trigger (prod. circuiti, montaggio componenti) 20 k€
    (rinvio al 2016)
- Missioni
  - Estero (5 meeting analisi+costruzione) 5 k€/fte 30 k€
    installazione camera 3 m.u. x 5 k€ 15 k€
    test DAQ-trigger +installazione 3 m.u. x 5 k€ 15 k€
  - Italia (6 " " ") 4.5 k€/fte 27 k€
  - Metabolismo 1.5 k€/fte 9 k€

  tot. 96 k€
- Trasporti (inclusi oneri doganali)
  - Camera (thermo., ammortizzato)+ schede trigger 10 k€

Richieste 2016, fondi(2)

- Consumi
  - Manutenzione straordinaria CW 50 k€
  - Camera
    - assemblaggio+servicing (Pisa) 10 k€
    - manutenzione camere pulite 3 k€
    - gas 5 k€
    - materiale per montaggio ed integrazione (PSI) 20 k€
  - tot. 76 k€