4th Concept

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C. Gatto, F. Grancagnolo (at Valencia)

~1/3 Asian, ~1/3 American, ~1/3 European

Mostly orthogonal to other three concepts

Basic design principle: only four basic, powerful systems, each as simple as possible. Obviate any need for tail-catchers, pre-showers detectors, end-cap chambers, or silicon blankets to augment performance of main detector.

- Pixel Vertex (PX) 20-micron pixels (like Fermilab/SiD thin pixel)
- TPC (like GLD or LDC) with "gaseous club sandwich"
- Triple-readout fiber calorimeter: scintillation/Cerenkov/neutron (new)
- Muon dual-solenoid iron-free geometry (new), cluster counting (new)

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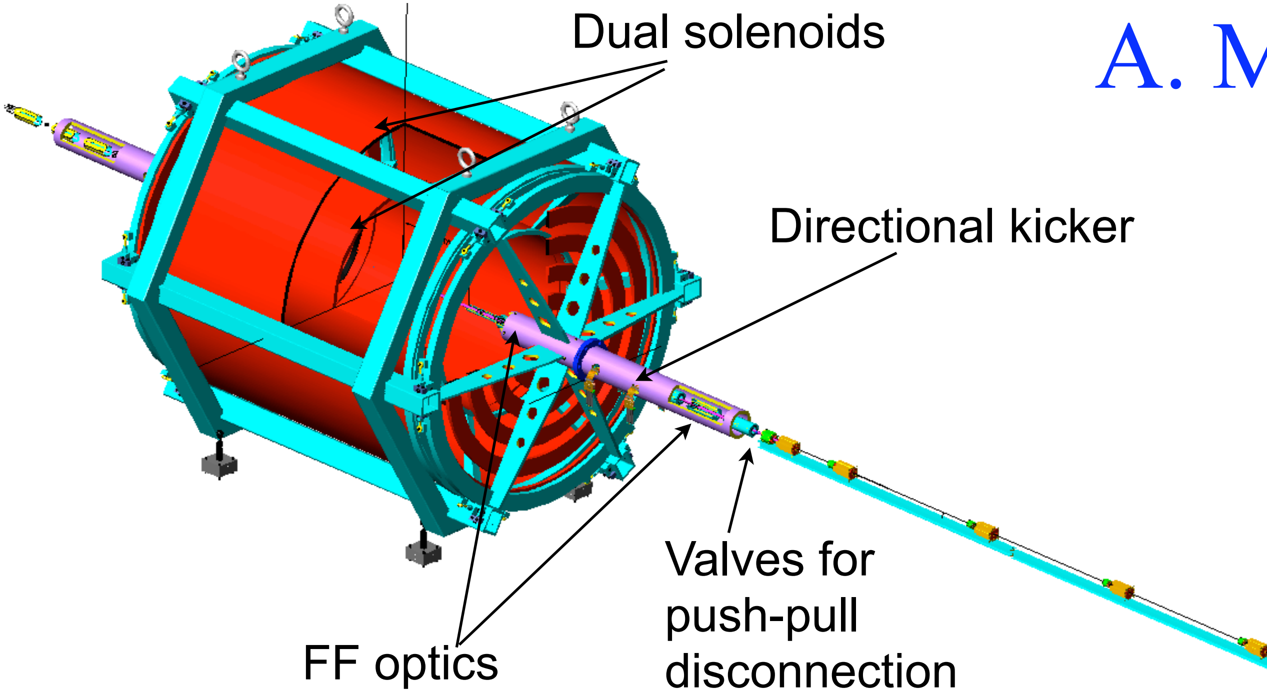
4th talks at Valencia Workshop

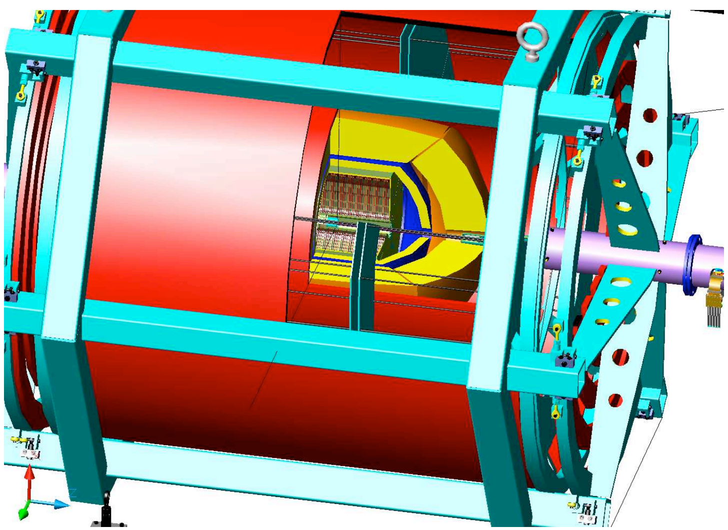
- Alexander Mikhailichenko , Cornell LNS, machine-detector interface, push-pull, B-field configuration
- Aldo Penzo, INFN Trieste, dual readout calorimetry and its extensions
- Franco Grancagnolo, INFN Lecce, muon spectrometer
- Corrado Gatto, INFN Lecce, ILCroot simulation and analysis of 4th Concept

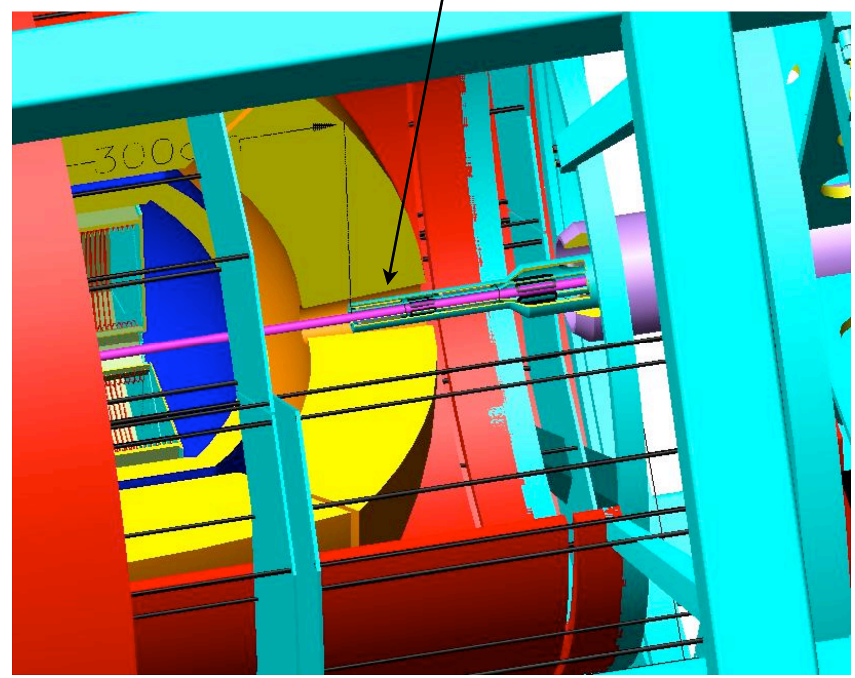
A. Mikhailichenko



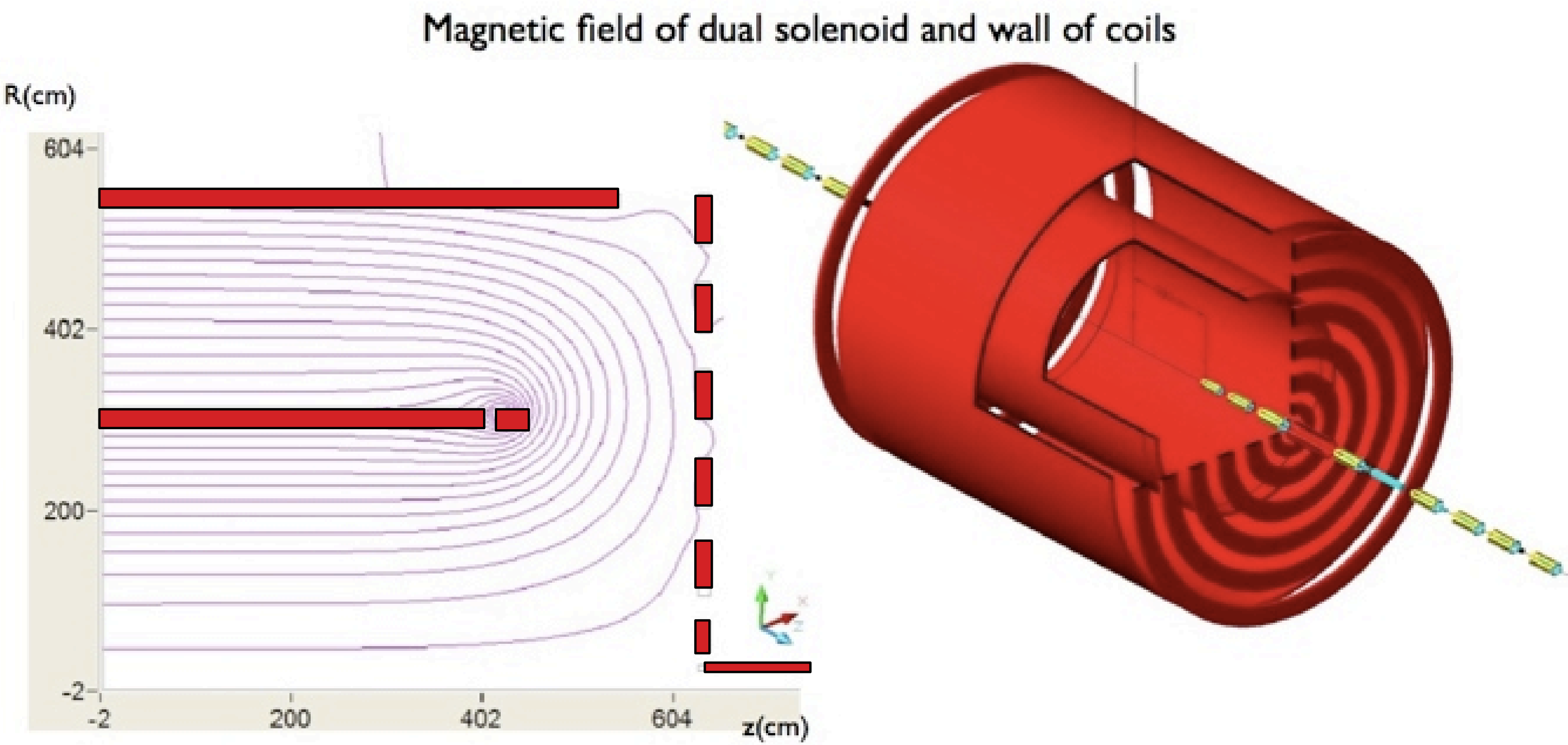
Final focus optics, mounted inside a cylinder attached to the detector by consoles.

This reduces influence of ground motion.

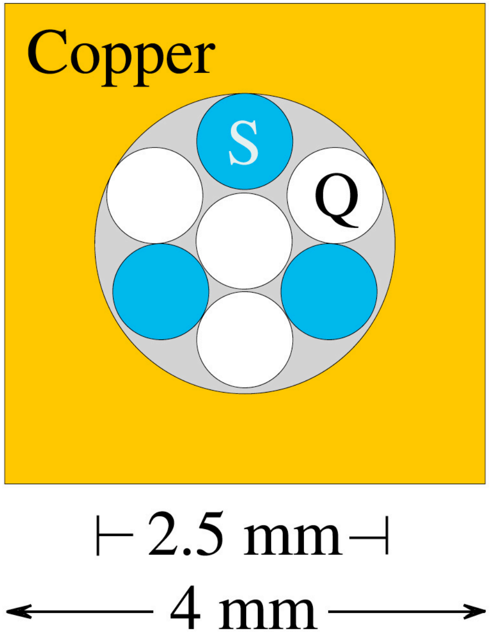




New magnetic field, new ``wall of coils'', iron-free:
many benefits to muon detection and MDI,
Alexander Mikhailichenko design

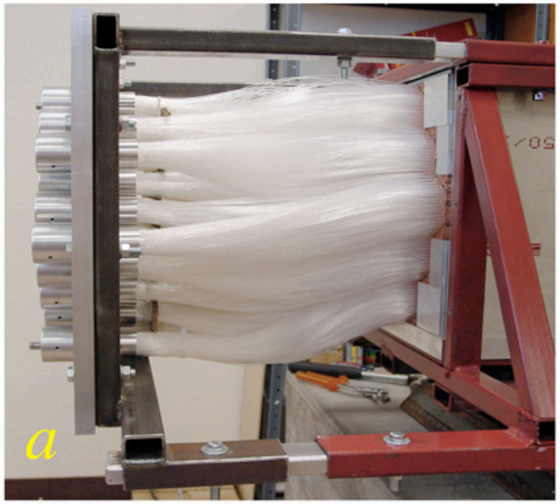


Aldo Penzo: DREAM module: simple, robust, not intended to be "best" at anything, just test dual-readout principle

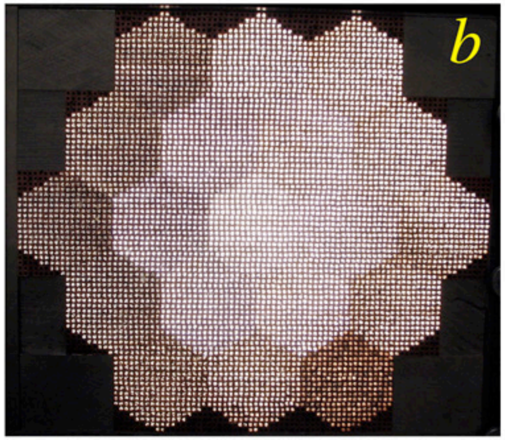


Unit cell

Back end of 2-meter deep module



Physical channel structure



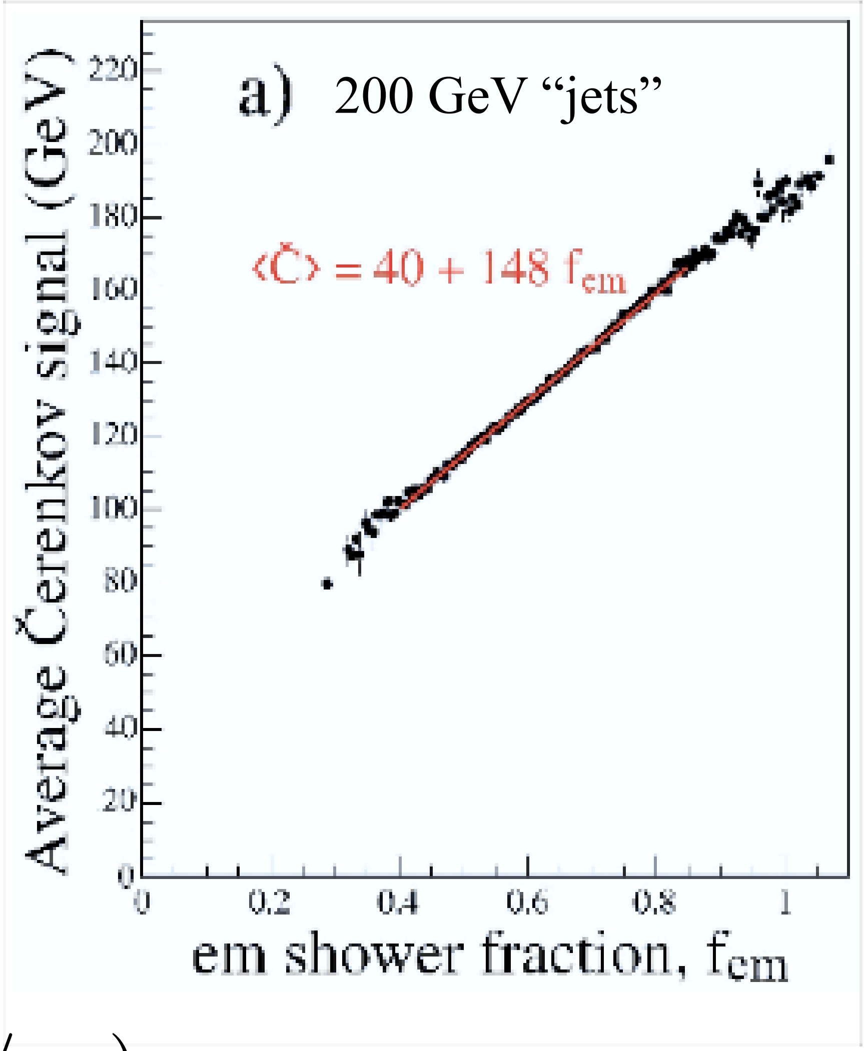
Downstream end of DREAM module, showing HV and signal connectors

Dual-Readout: Measure every shower twice - in scintillation light and in Cerenkov light.

$$(e/h)_C = \eta_C \approx 5$$
$$(e/h)_S = \eta_S \approx 1.4$$

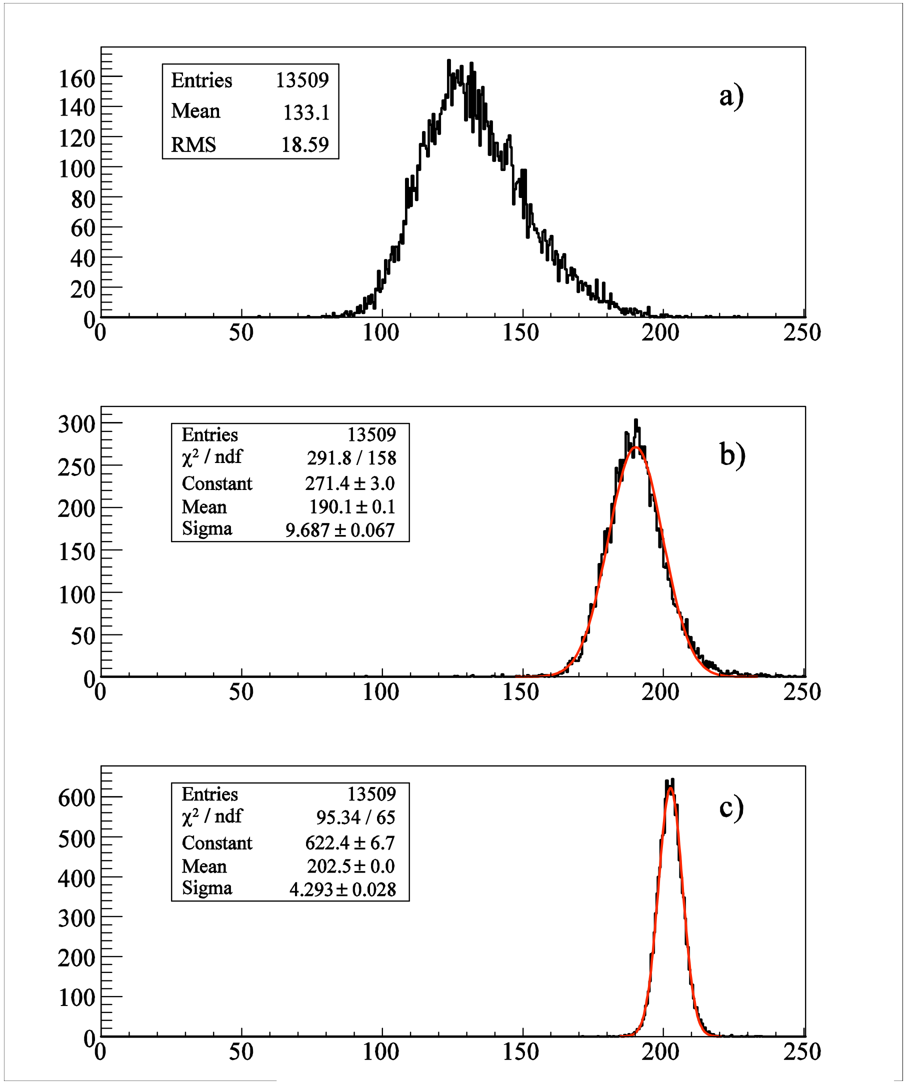
$$C = [f_{em} + (1 - f_{em})/\eta_C]E$$
$$S = [f_{em} + (1 - f_{em})/\eta_S]E$$

$$\rightarrow C/E = 1/\eta_C + f_{em}(1 - 1/\eta_C)$$



Data NIM A537 (2005) 537.

DREAM data 200 GeV π^-: Energy response



Scintillating fibers

Scint + Cerenkov

$f_{EM} \propto (C/E_{shower} - 1/\eta_C)$

(4% leakage fluctuations)

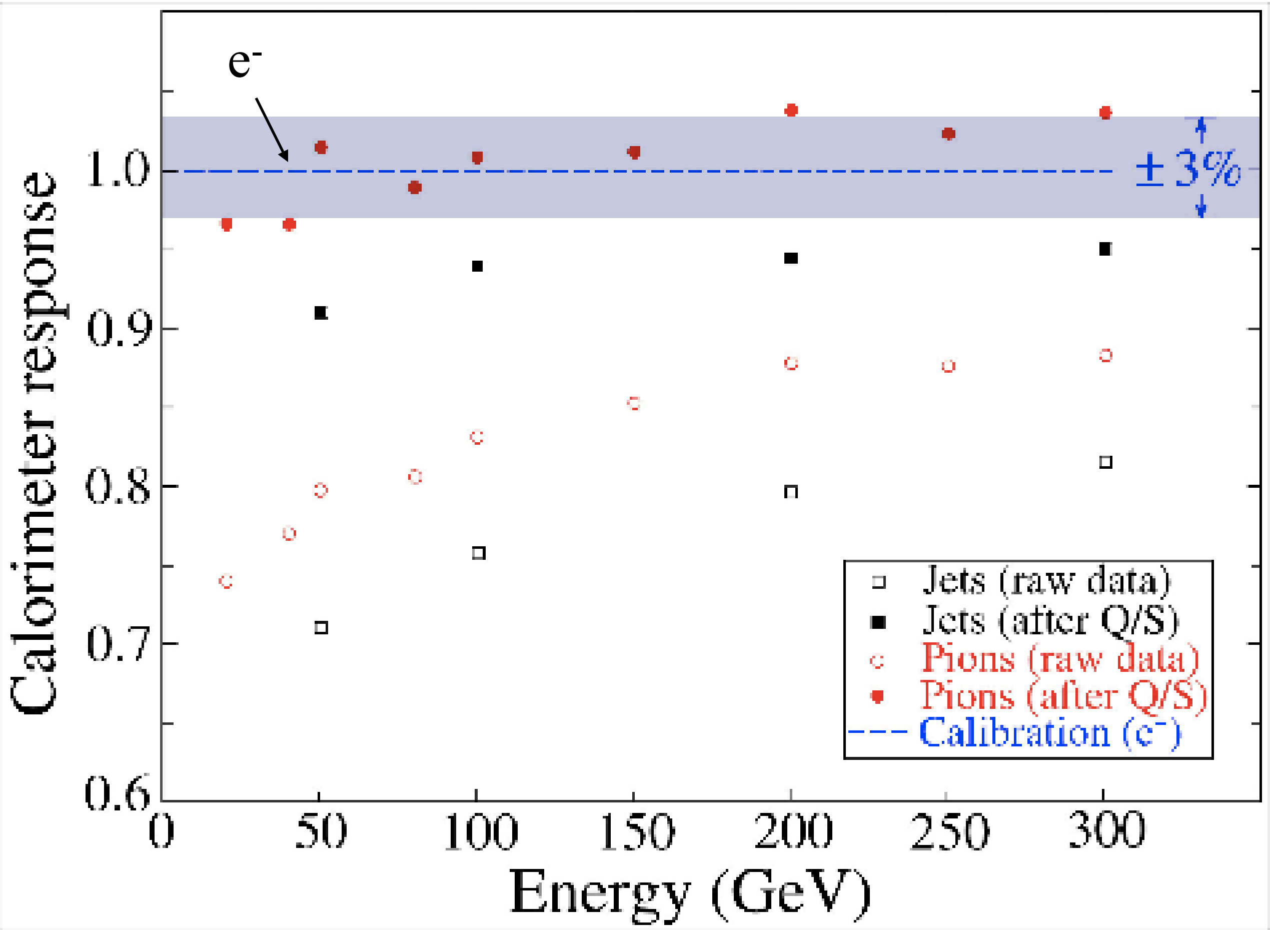
Scint + Cerenkov

$f_{EM} \propto (C/E_{beam} - 1/\eta_C)$

(suppresses leakage)

Data NIM A537 (2005) 537.

More important than good Gaussian response: DREAM module calibrated with 40 GeV e^- into the centers of each tower responds linearly to π^- and "jets" from 20 to 300 GeV.



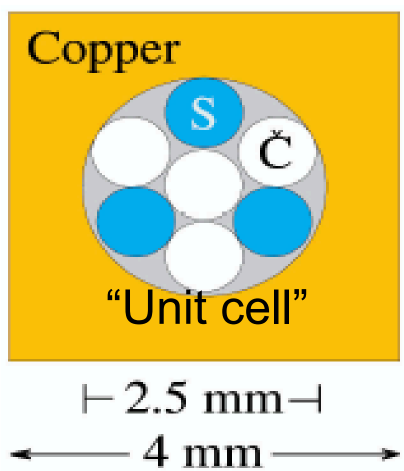
Hadronic linearity may be the most important achievement of dual-readout calorimetry.

Data NIM A537 (2005) 537.

DREAM module

3 scintillating fibers

4 Cerenkov fibers



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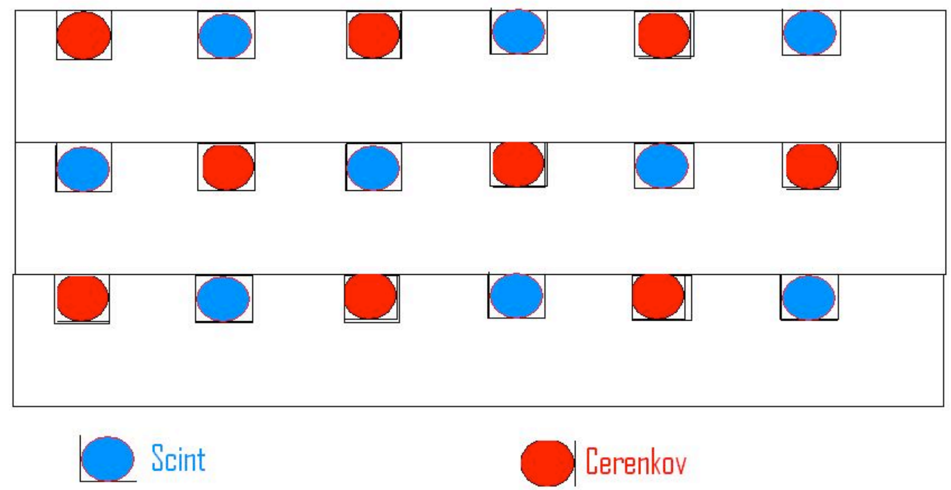
ILC-type module

2mm Pb or brass plates;
fibers every 2 mm

(Removes correlated fiber hits)



Binding energy loss fluctuations: next largest hadronic shower fluctuation after EM fraction, correlated with MeV neutrons

(1) Measure MeV neutrons by time.

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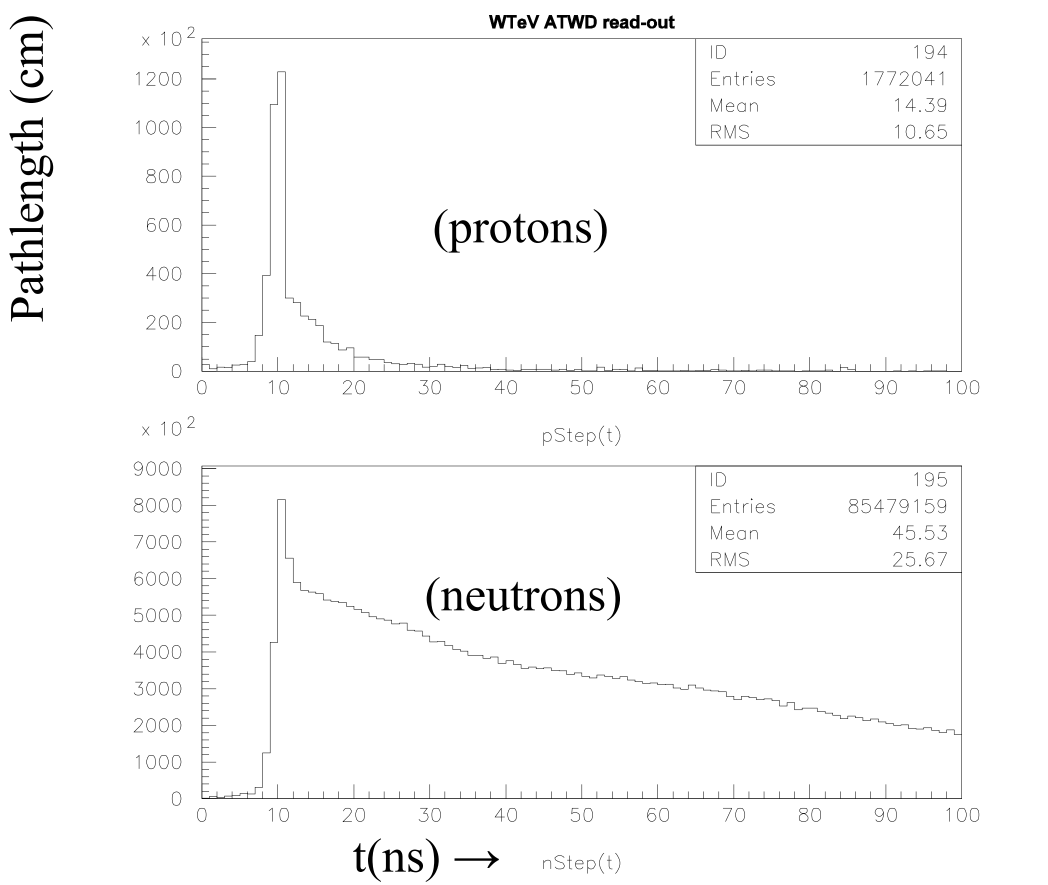

Velocity of MeV neutrons is ~ 0.05 c

(1) Scintillation light from np→np scatters comes late; and,

(2) neutrons fill a larger volume
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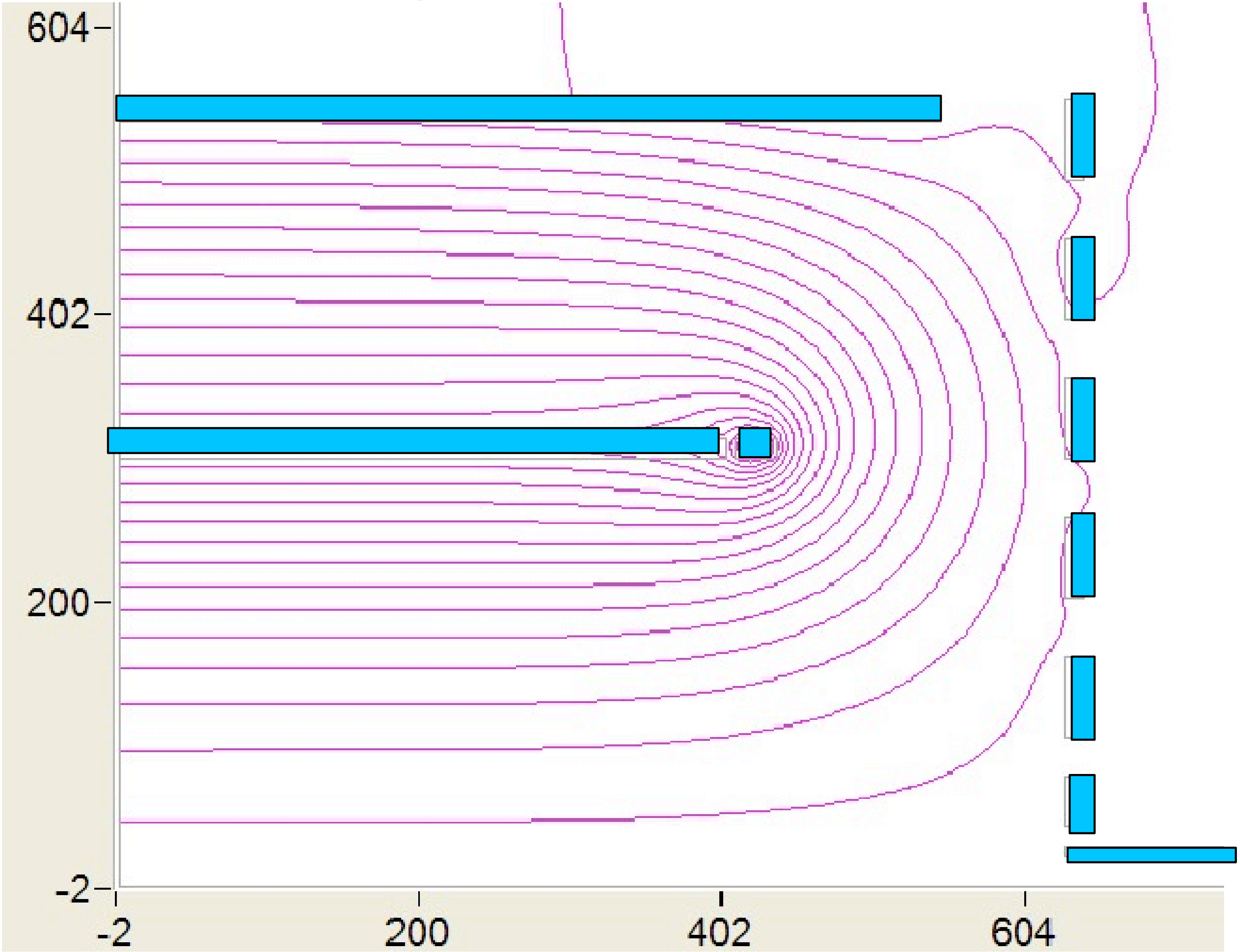
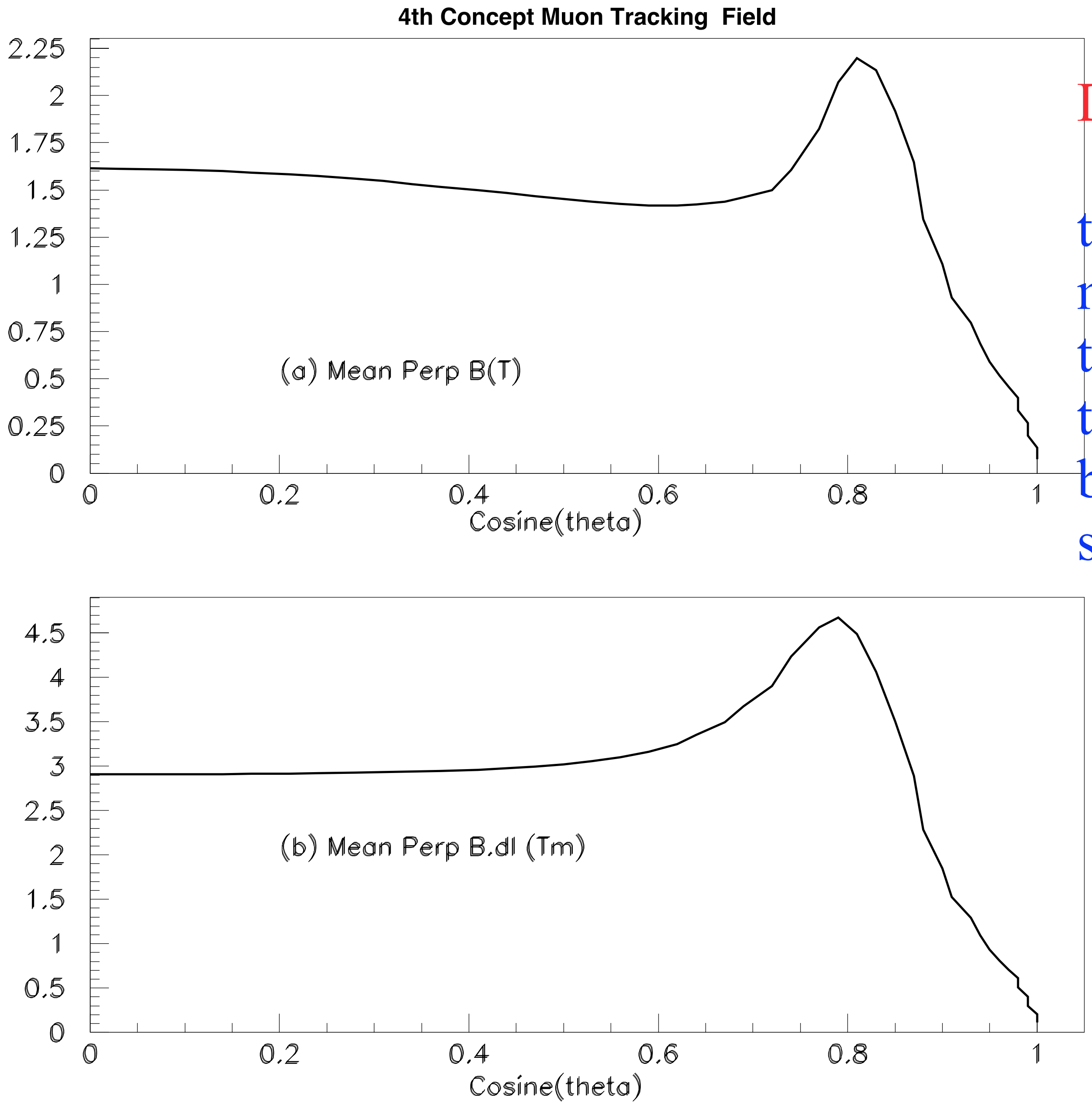
Franco Grancagnolo: Muon spectrometer





Dual solenoid

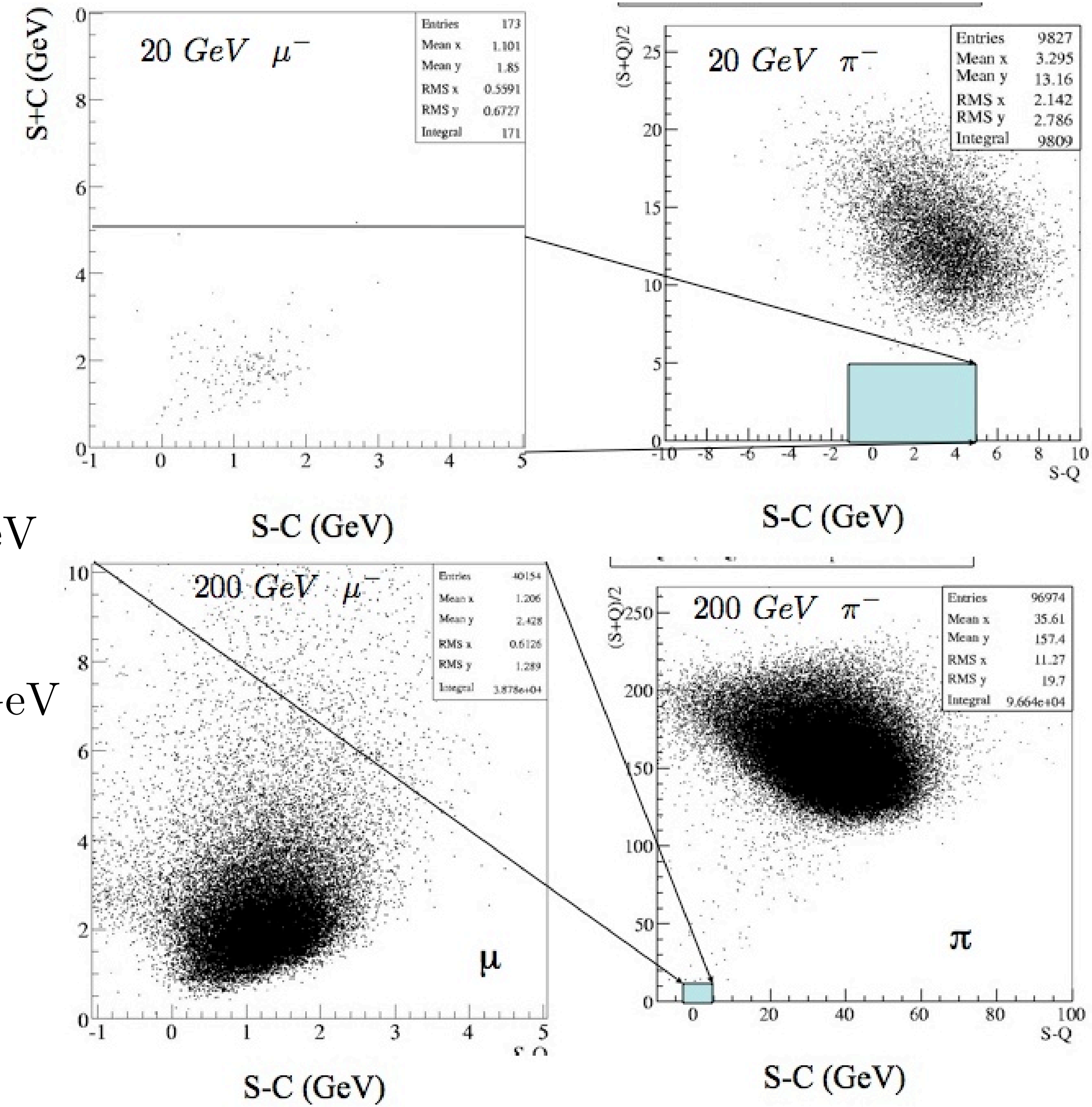
tracking along muon trajectories in the annulus between solenoids

Dual readout of muons in DREAM module

$\pi^{\pm}$ rejection:

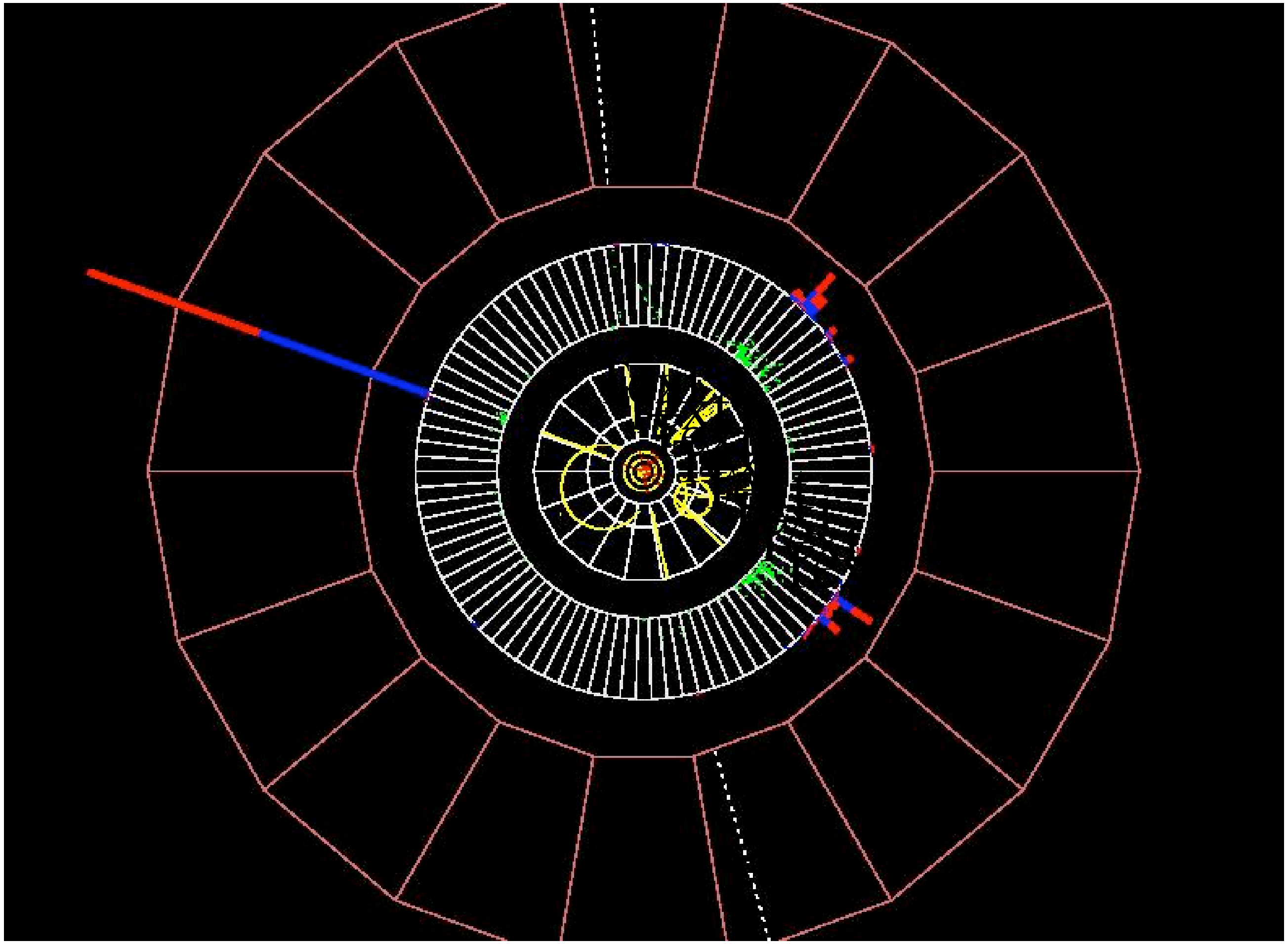
10^{-3} at 20 GeV

10^{-4} at 200 GeV



Corrado Gatto: ILCroot

$$e^+e^- \rightarrow H^0 Z^0 \rightarrow W^+W^-\mu^+\mu^- \rightarrow jj \;\; e^-\nu \;\; \mu^+\mu^-$$



Illustrates all the detectors of 4th Concept … particle ID "obvious"