LHC LUMINOSITY PROJECT

Test Beam Results for the

Ionisation Chamber Detector

M. Placidi

on behalf of the **CERN-LBNL Collaboration Project**

for the **LHC Luminosity Monitoring and Optimisation**

Who & What

- **The CERN–LBNL LHC Luminosity Project**

  J.F. Beche, M.T. Burks, P.S. Datte,

  J.E. Millaud, V.J. Riot, W.C. Turner

  P.F. Manfredi, L. Ratti, V. Speziali, V. Re

  M. Haguenauer, M. Placidi, H. Schmickler

- **Contents**

  Historical & Concepts

  Purposes of Tests

  Simulations

  Results from Run 2000

  Plans for Run 2001

Concepts and Developments

(W.C. Turner / LBNL)

- **Instrument TAN (TAS) Absorbers at LHC High Luminosity IPs**

  TAN only : $\Rightarrow$ Luminosity

  TAN and TAS : $\Rightarrow$ Luminosity + Crossing Angle + IP Position

- **@ TAN: Detect Flux of Neutral particles from IPs**

  @ TAS: Detect Flux of Charged particles

- **Detector(s)**

  Ionisation Chamber / LBNL project

  CdTe Solid state / SL-BI project

Prototype Detector Tests

- **Simulate Electro-magnetic Showers**

  initiated by **Neutrals in TAN**

- **Modular Fe Absorber on H4 SPS 450 GeV p-Beam**

  Prototype IC @ Shower Maximum

- **Test Detector Sensitivity and Speed**

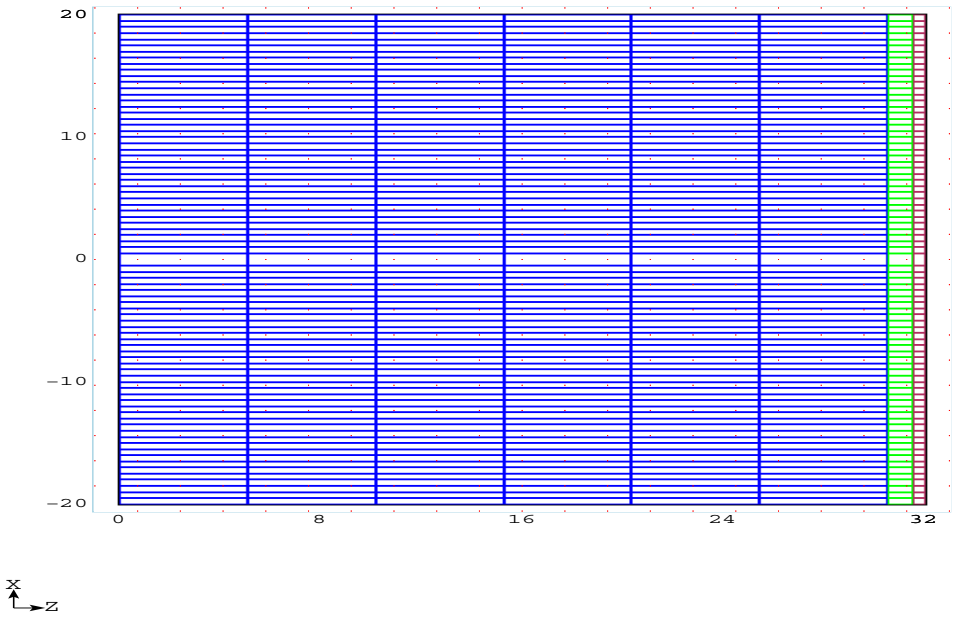
  Compare Detector Performance to Design

  Compare absorber yield with **Monte Carlo simulations**

MARS Simulations for H4 Tests / 1

- **Shower development** simulated as a function of **absorber material/thickness** to **locate shower maxima**.

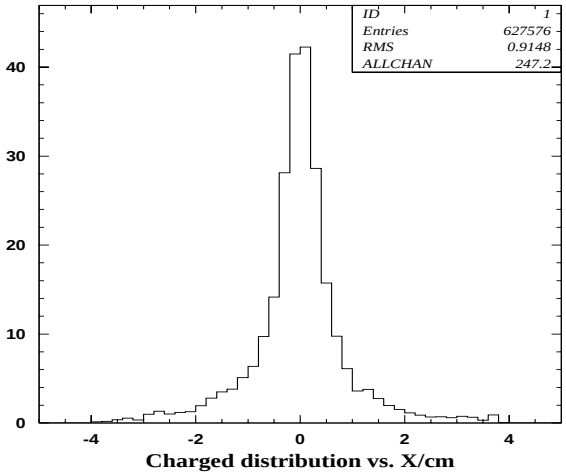
Schematic side-view of Cu/Fe/W/Ar radiator model

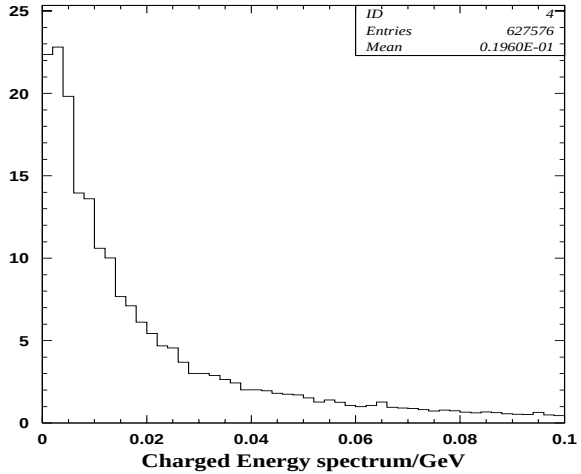


- Incoming 450 GeV proton beam enters the left side along the **z**-coordinate and at **x**, **y**=0.
- Tungsten slice after **Copper/Iron radiator** displaced along **z** for γ **best re-conversion efficiency**.
- Argon slice simulates the IC detector.

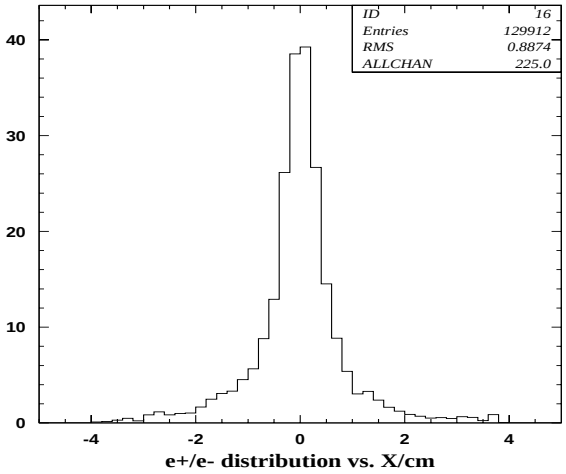
Shower particles @ detector

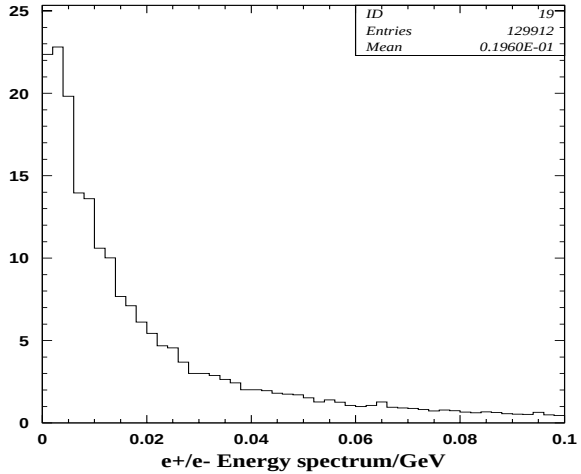
All-charged transverse distributions and energy spectra





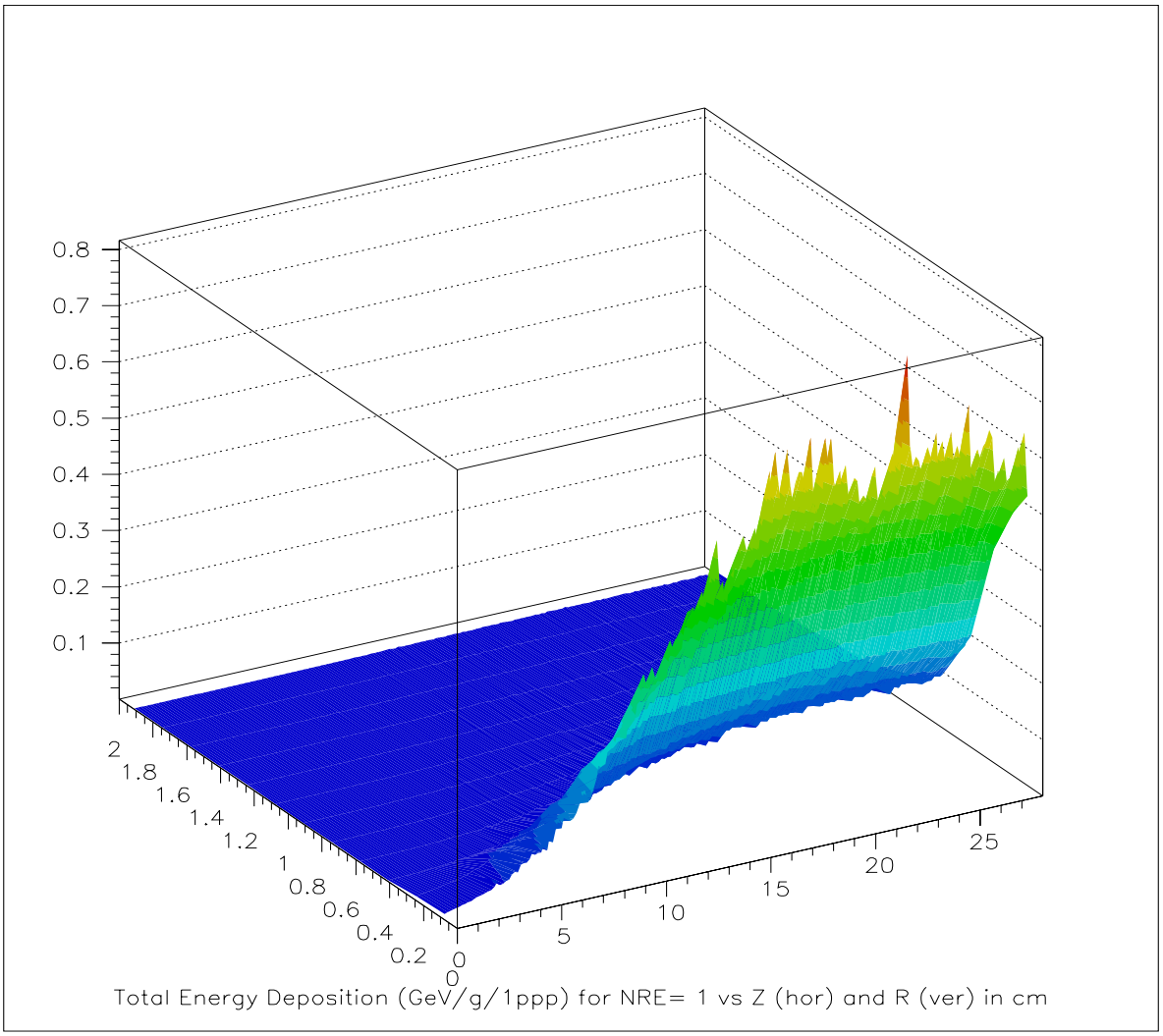
$e^+ e^-$ transverse distributions and energy spectra





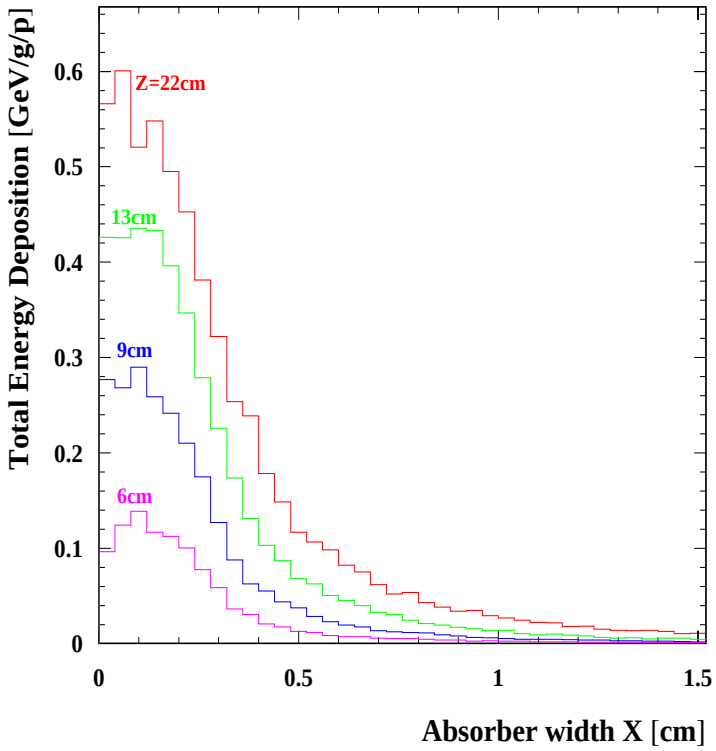
Energy Deposition / 1

Total Energy Deposition in a 28cm long Fe absorber



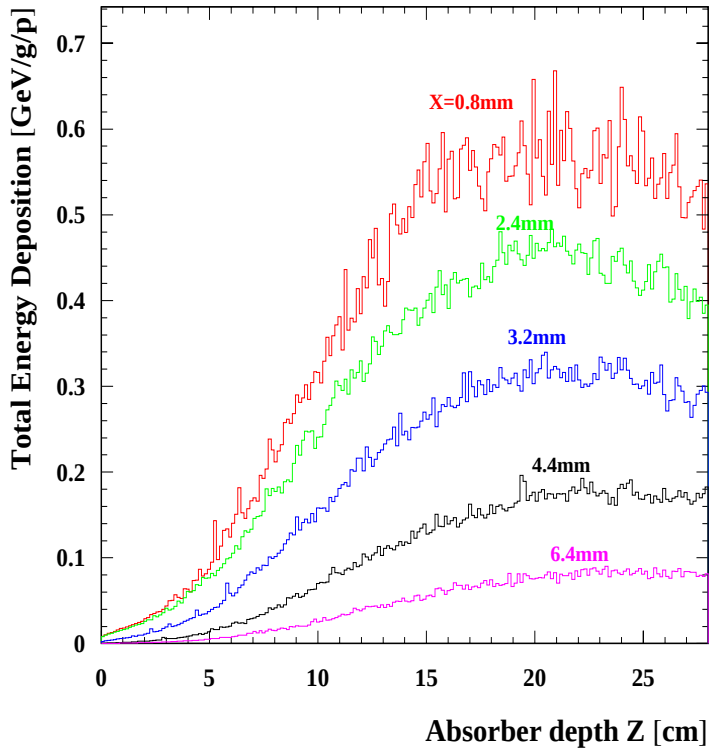
Energy Deposition / 2

Radial shower development at different depths Z



Most shower confined in $\mathbf{X = \pm 0.5}$ cm

Longitudinal shower development at different radii X



Shower Max. predicted at $\mathbf{Z \sim 21}$ cm

Summary

- **Prototype IC proved fasibility to detect hadronic/em showers initiated by 450 GeV protons**

- **Linear dependence of signal amplitude with Ar/N_2 Gas pressure was demonstrated**

- **Position of shower maximum agreed with MARS simulations**

- **Improvements are required to:**
  eliminate capacitive coupling
  reduce pulse width from ~ 175 ns to design 25 ns.

/tex/talks/BI/biday12_00.ps