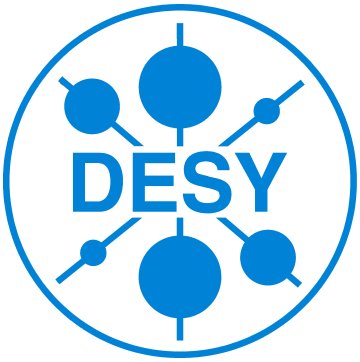

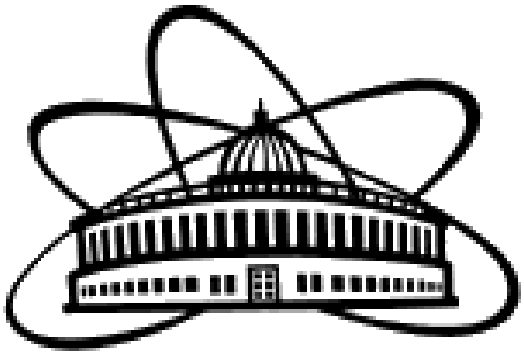

STATUS OF THE FORWARD CHAMBER SIMULATION AND RECONSTRUCTION (STRAW OPTION)

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DESY-Zeuthen, Germany

Alexander BEL'KOV and Irina POLENKEVICH

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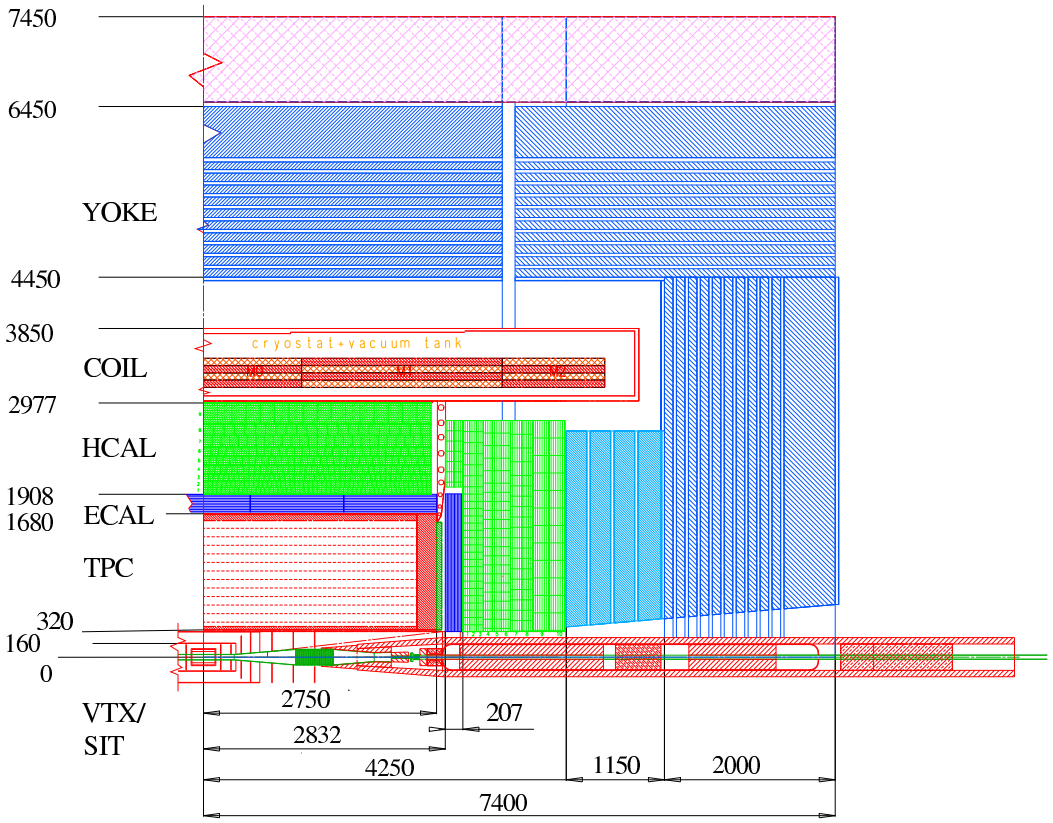
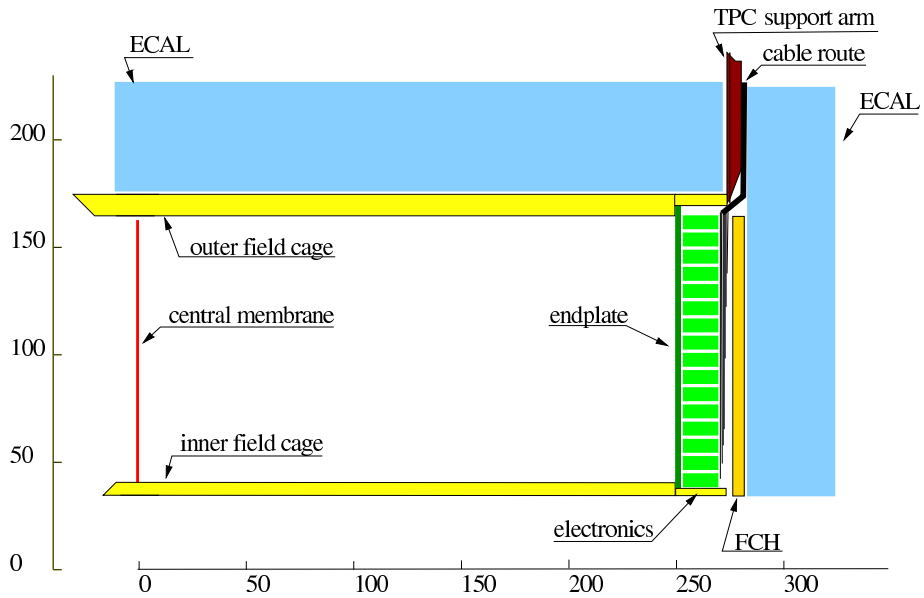
Second Workshop of the ECFA Study
"Physics & Detectors for a Linear Cillider"
Durham, UK, Sep 1-4, 2004

FORWARD CHAMBERS OF THE TESLA DETECTOR

- View of one quadrant of the TESLA Detector (dimentions are in mm)



- General layout of one quarter of the central tracking



- **Main mechanical parameters of the FCH for the**

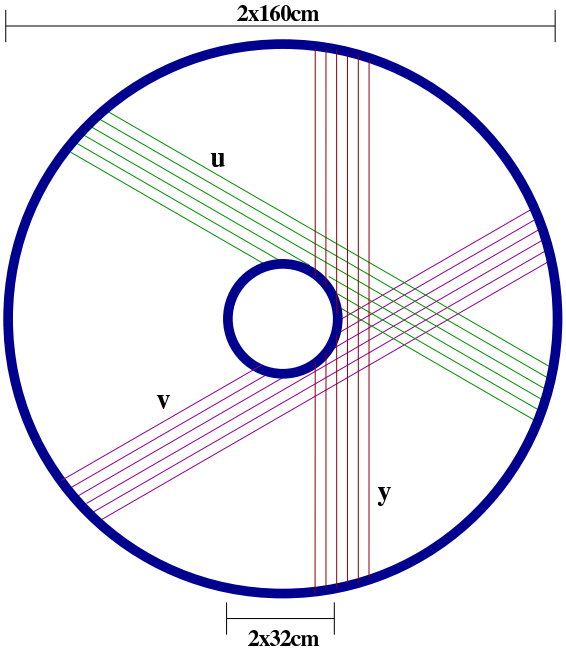
Radii of superlayer	320 mm inner, 1590 outer
Number of stereo planes	6 with stereo angles $0^o, 60^o, 120^o, 0^o, 60^o, 120^o$
Depth	$z = \pm(2730 \text{ to } 2800)$ mm

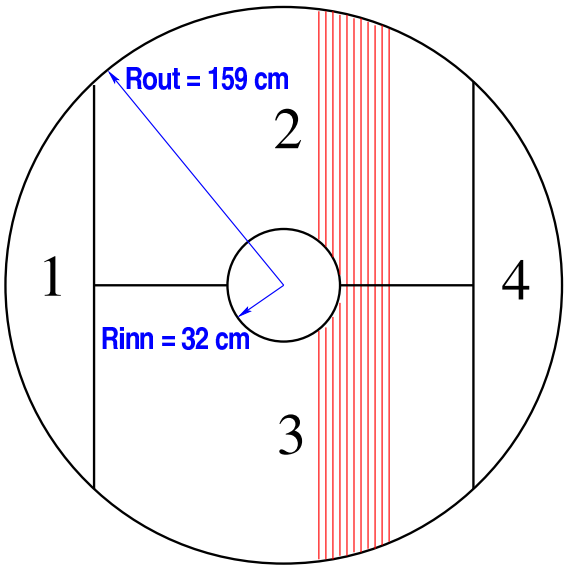
Each stereo plane is built up from two layers of straw which are shifted with respect to each other by one half of the distance between neighbouring wires

- **Mechanical and physical characteristics of Straw tube**

Tube diameter	5 mm
Capton thickness	50 μm
Wire diameter	50 μm
Wire support thicknes	5 mm
Distance between wire supports	500 mm
Endcap length	10 mm

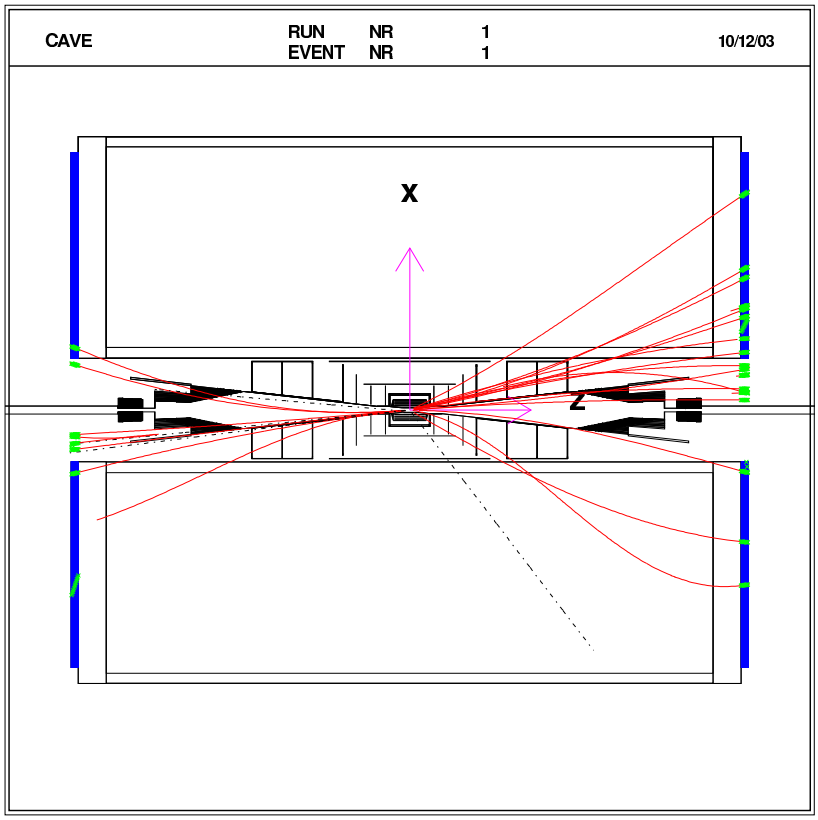
- **Orientation of the FCH wires & superlayer sectioning**



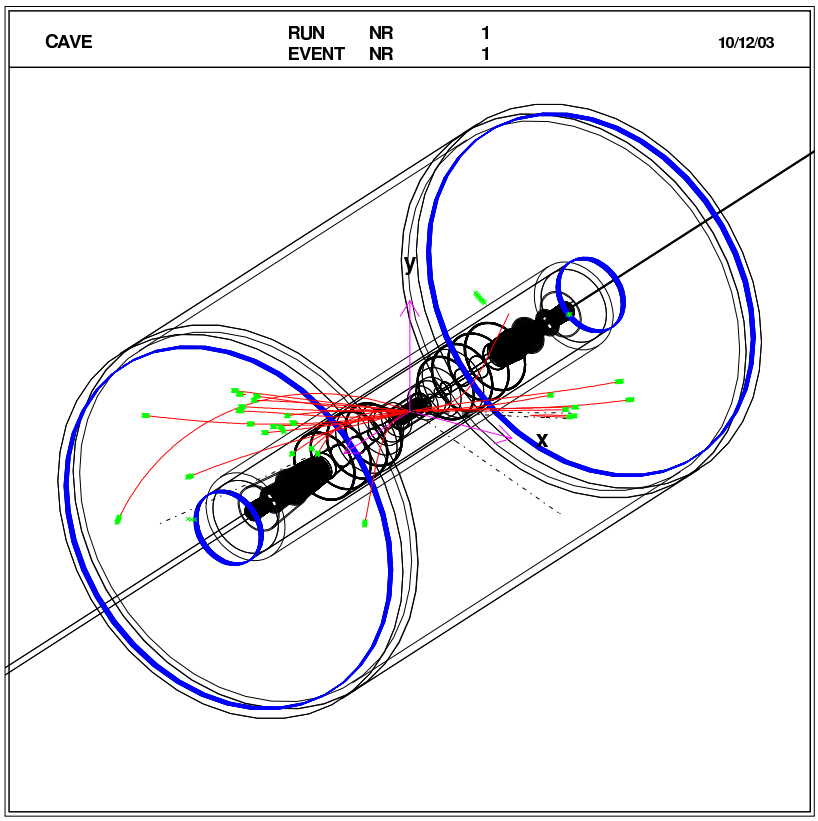


BRAHMS events

- **XZ-progection of event in the TESLA detector**



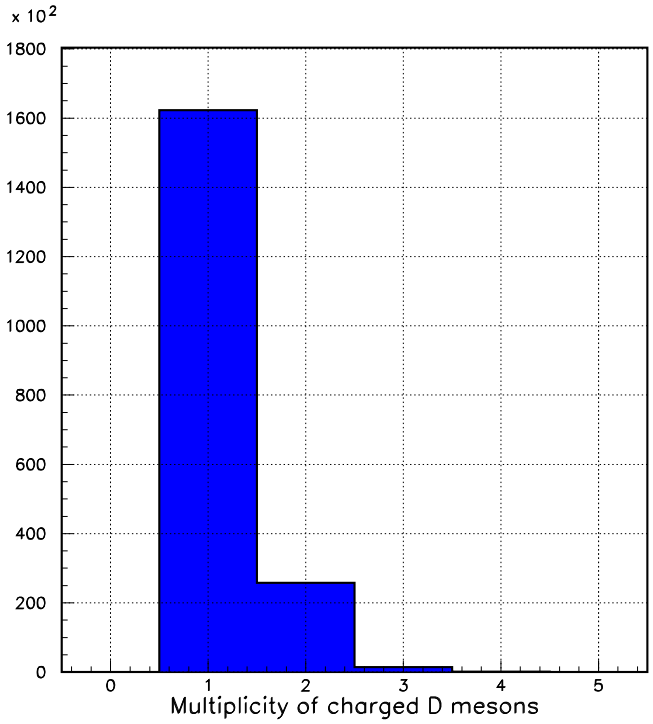
- **3D view of event in the TESLA detector**

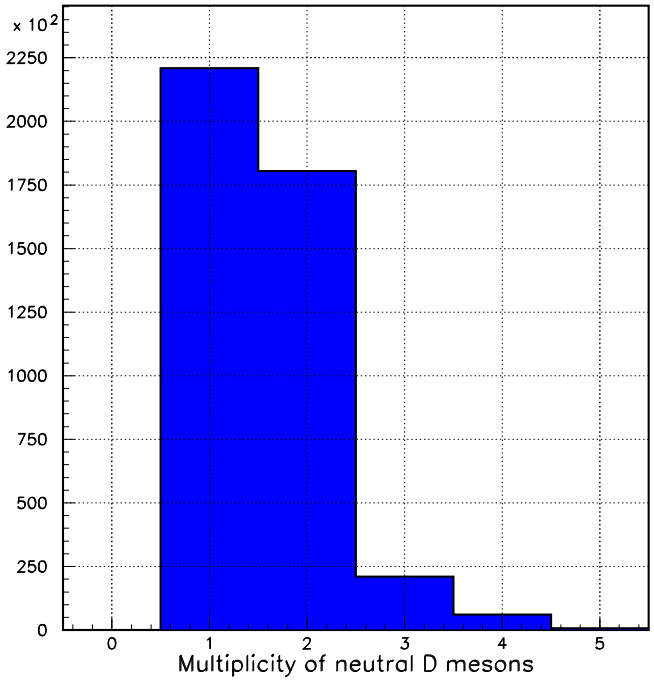


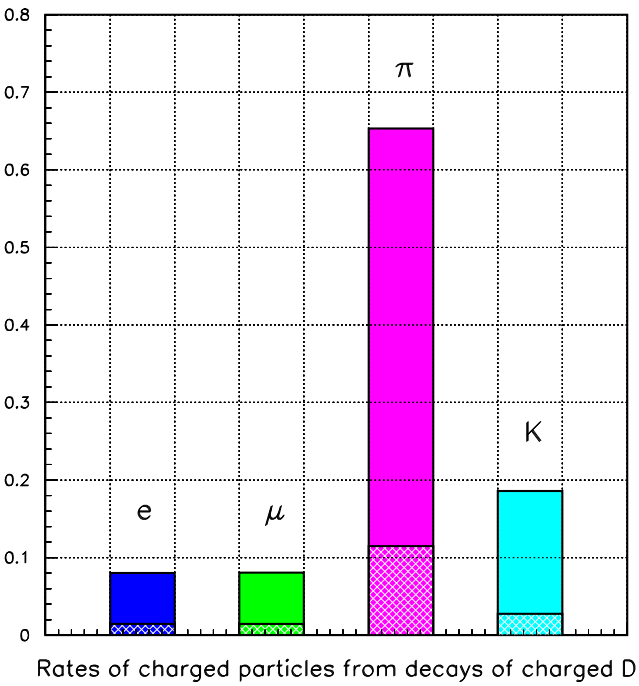
CHARACTERISTICS OF THE $c\bar{c}$ EVENTS

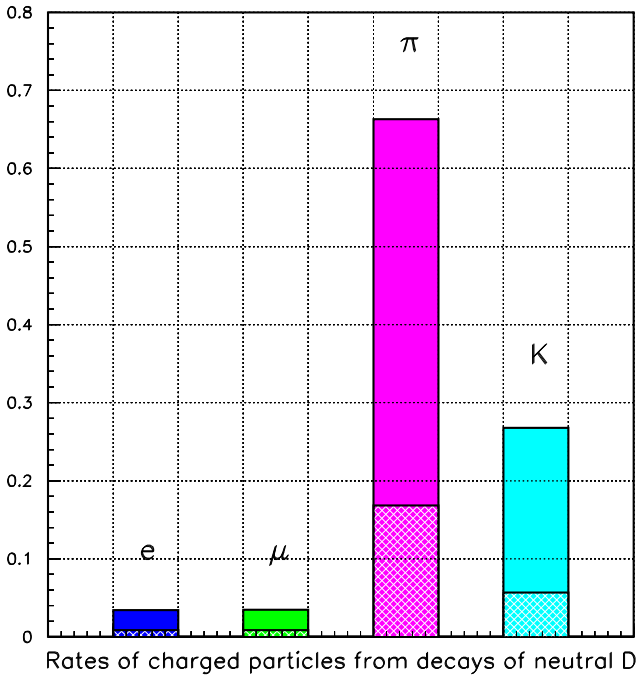
- $c\bar{c}$ **events simulated by PYTHIA have been used for the FCH performance studies**

- D**-meson production and decays** *(dark colours – all particles, light colours – particles reached to FCH)*

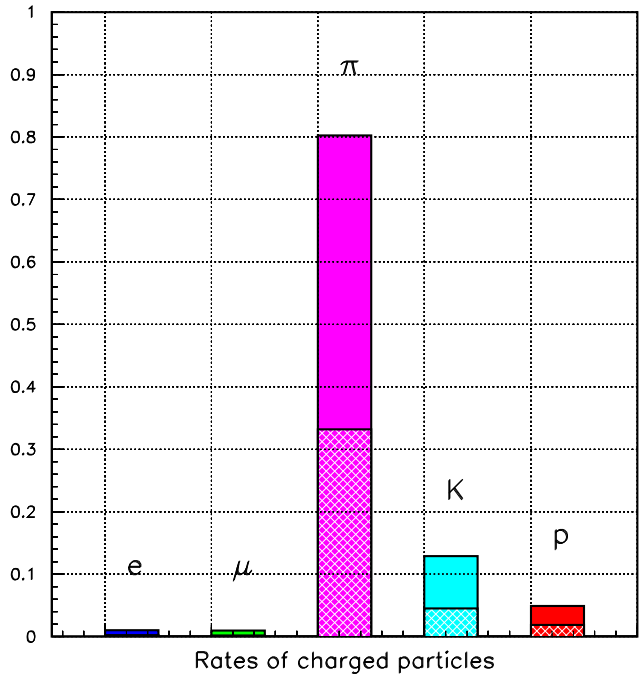


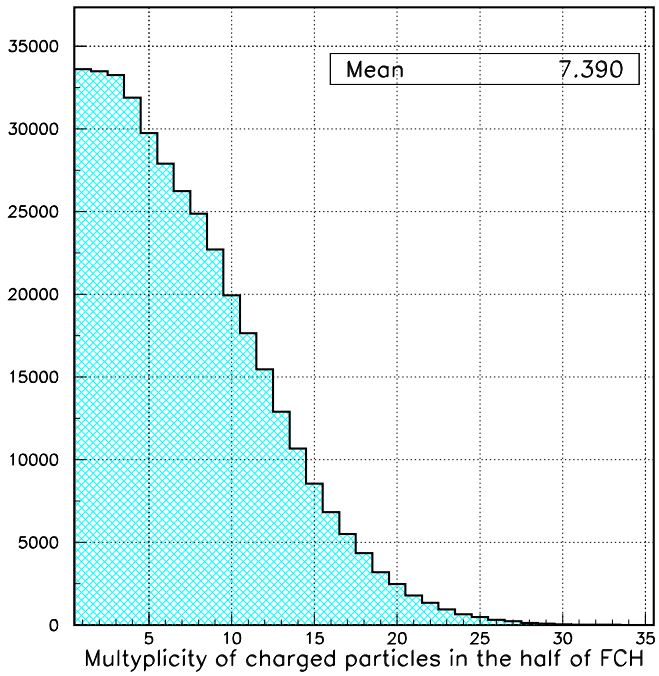




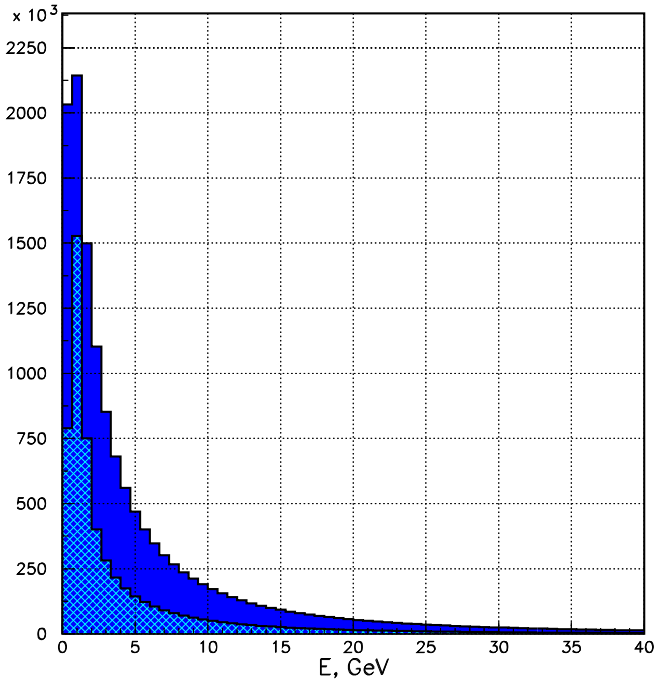


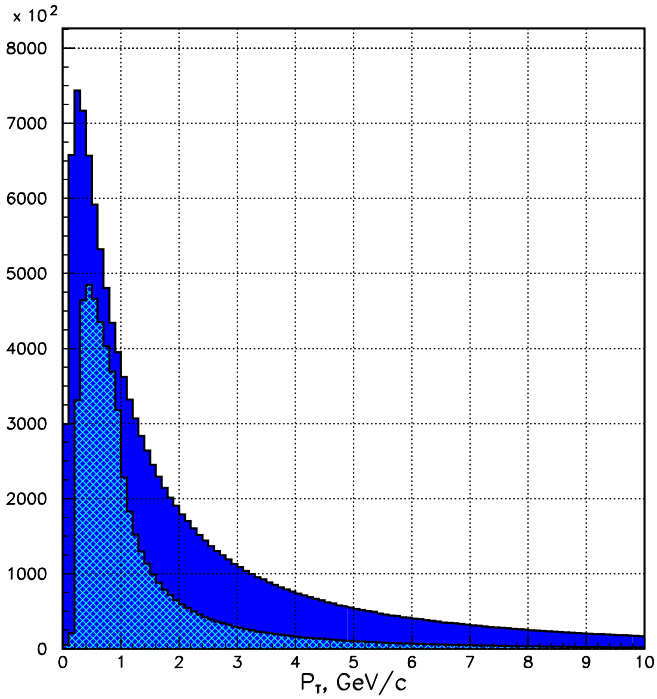
- **Total rates and multiplicity of charged particles**





- **Energy and P_T distributions for charged particles from $c\bar{c}$ events** *(dark colours – all particles, light colours – particles reached to FCH)*





TRACK RECONSTRUCTION ALGORITHM

- All possible pairs of hits in neighbouring wires of different single layers of straw in each stereo plane are found and stored:

$$\overbrace{(u_1, u_2)}^{0^\circ}\ \overbrace{(u_3, u_4)}^{60^\circ}\ \overbrace{(u_5, u_6)}^{120^\circ}\ \overbrace{(u_7, u_8)}^{0^\circ}\ \overbrace{(u_9, u_{10})}^{60^\circ}\ \overbrace{(u_{11}, u_{12})}^{120^\circ}$$

  u_i – hit coordinate measured in the rotated UV-axis frame of the i-th single layer of straw (each stereo plane consists of two single layers)

- Only the pairs of hits which can be assigned to the same track projection by least-squares-method extrapolation from one stereo plane to another one with the same stereo angle are selected and stored:

$$\overbrace{(u_1, u_2)(u_7, u_8)}^{0^\circ}\ \overbrace{(u_3, u_4)(u_9, u_{10})}^{60^\circ}\ \overbrace{(u_5, u_6)(u_{11}, u_{12})}^{120^\circ}$$

  (the left/right ambiguity is resolved at this step)

- **The combinations of hits belonging to those projections in stereo planes which can be assigned to the same track are selected according to the requirements:**

$$u_1 - u_3 + u_5 \leq \Delta \;\; \& \;\; u_2 - u_4 + u_6 \leq \Delta$$

$$\& \;\; u_7 - u_9 + u_{11} \leq \Delta \;\; \& \;\; u_8 - u_{10} + u_{12} \leq \Delta$$

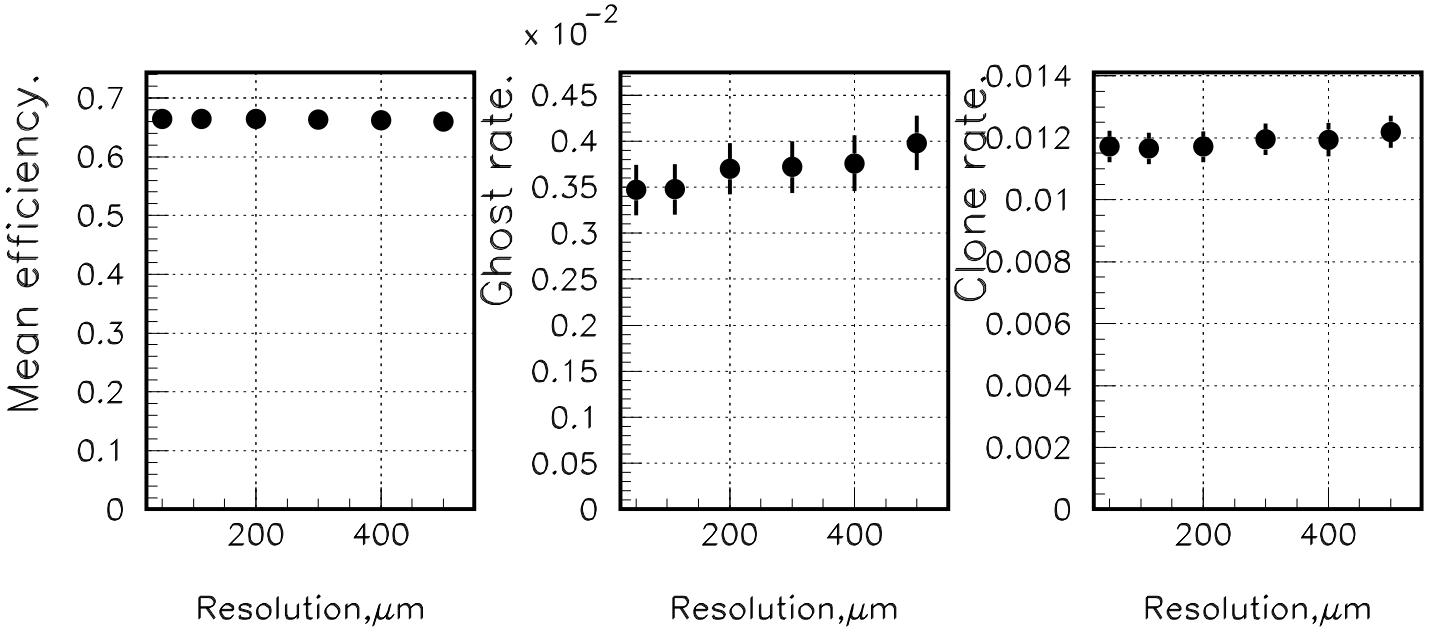
  Δ **– tuning parameter of algorithm**

- **Each combination of selected 12 hits in 6 stereoplanes is fitted by straight line and stored in the array odered according to the value of** χ^2
- **Only those combinations of 12 hits with minimal** χ^2 **and not more than 2 repeated hits are finally treated as track candidates**

TRACK RECONSTRUCTION IN THE FCH

- The track reconstruction in the FCH has been studied by MC method for various drift-tube space resolution, wire efficiency, and wire-noise level
- Homogeneous wire noise was generated according to the fixed value of the wire-noise probability
- Mean efficiency, ghost & clone rates vrs drift-tube space resolution:

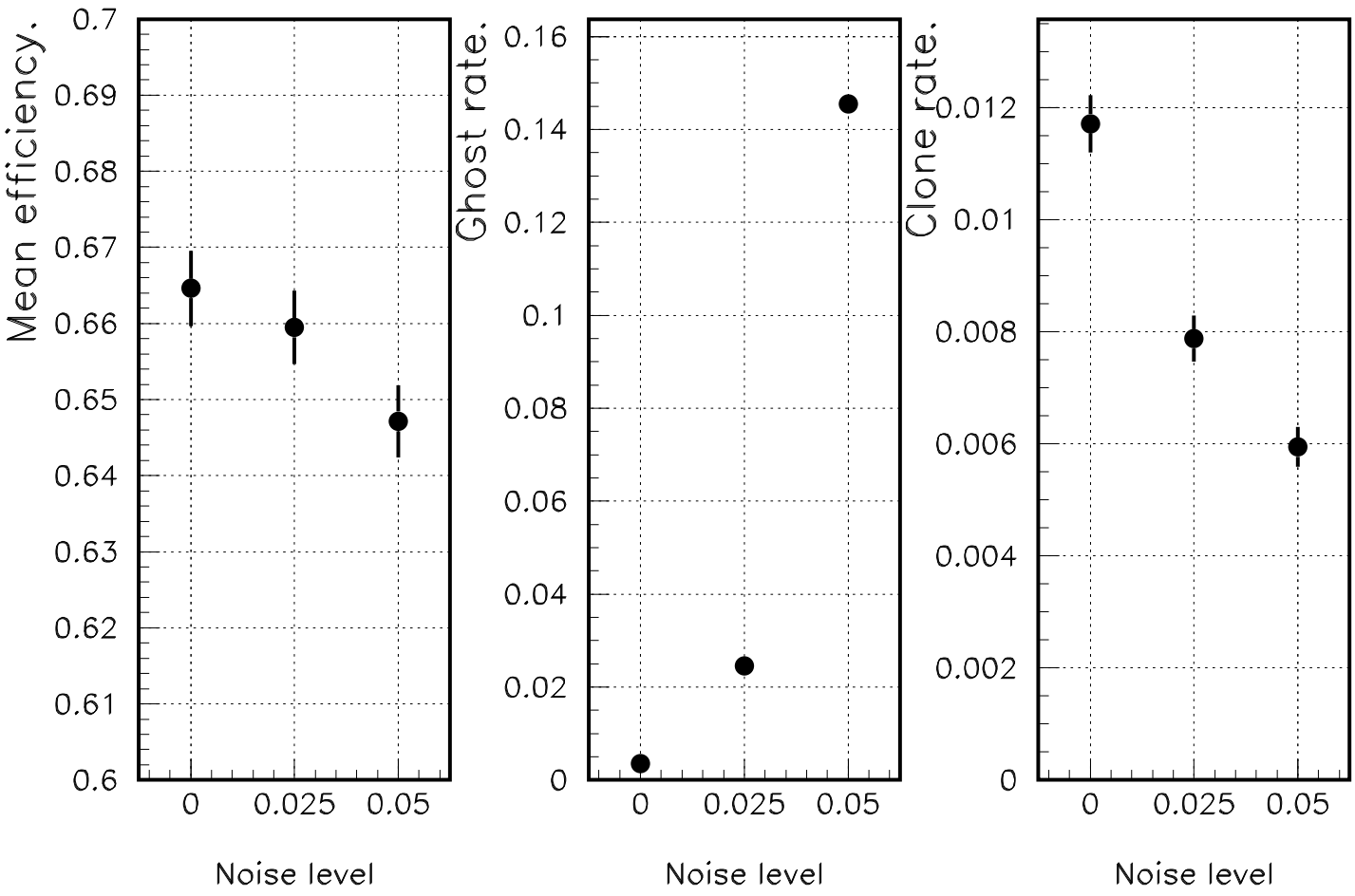
Wire efficiency $= 100\%$
Wire-noise probability $= 0\%$



⇓

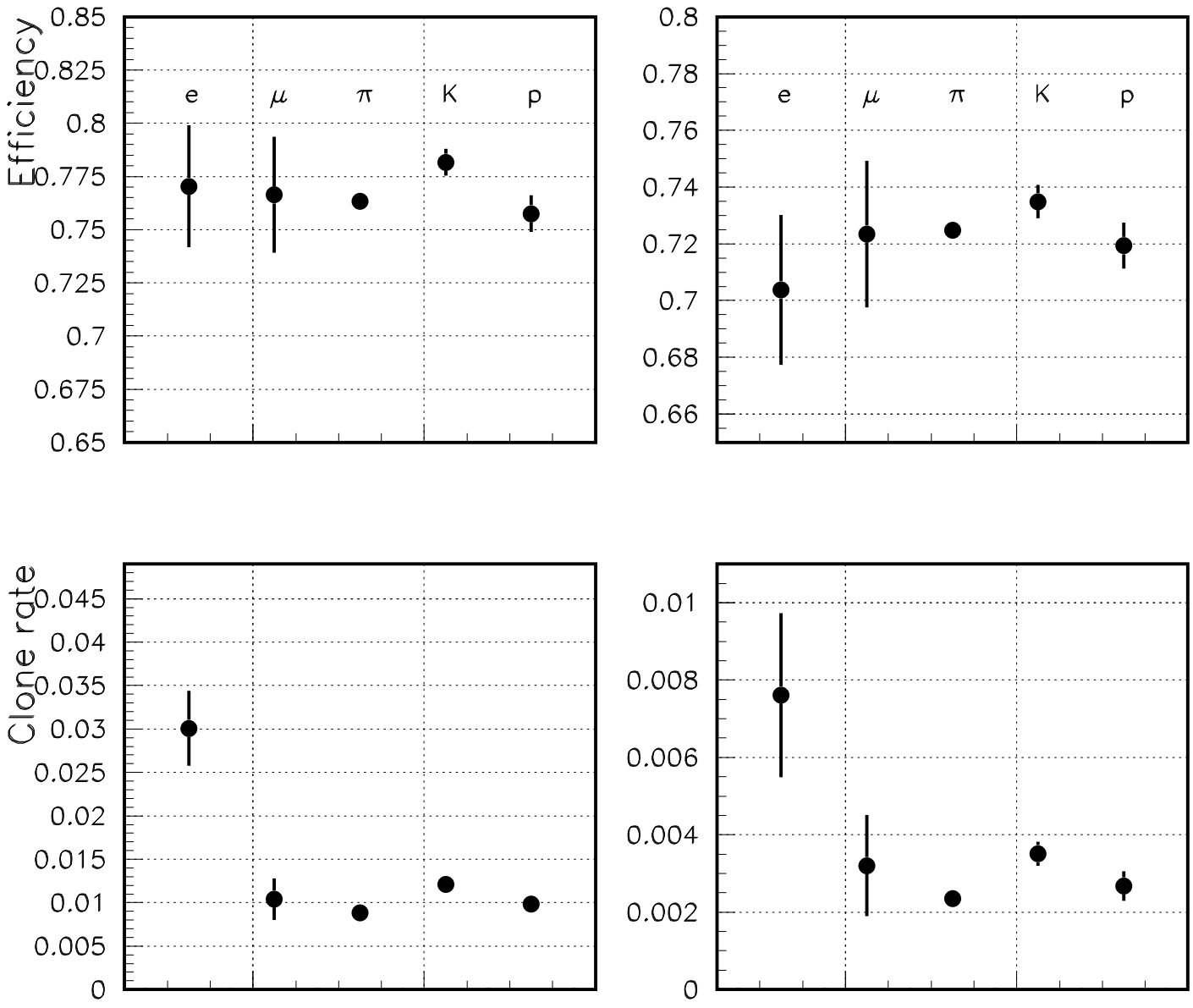
Small dependence on the drift-tube space resolution

- **Mean efficiency, ghost & clone rates for various wire noise level** *(wire efficiency = 100%)*



Drift-tube space resolution = 50 μm

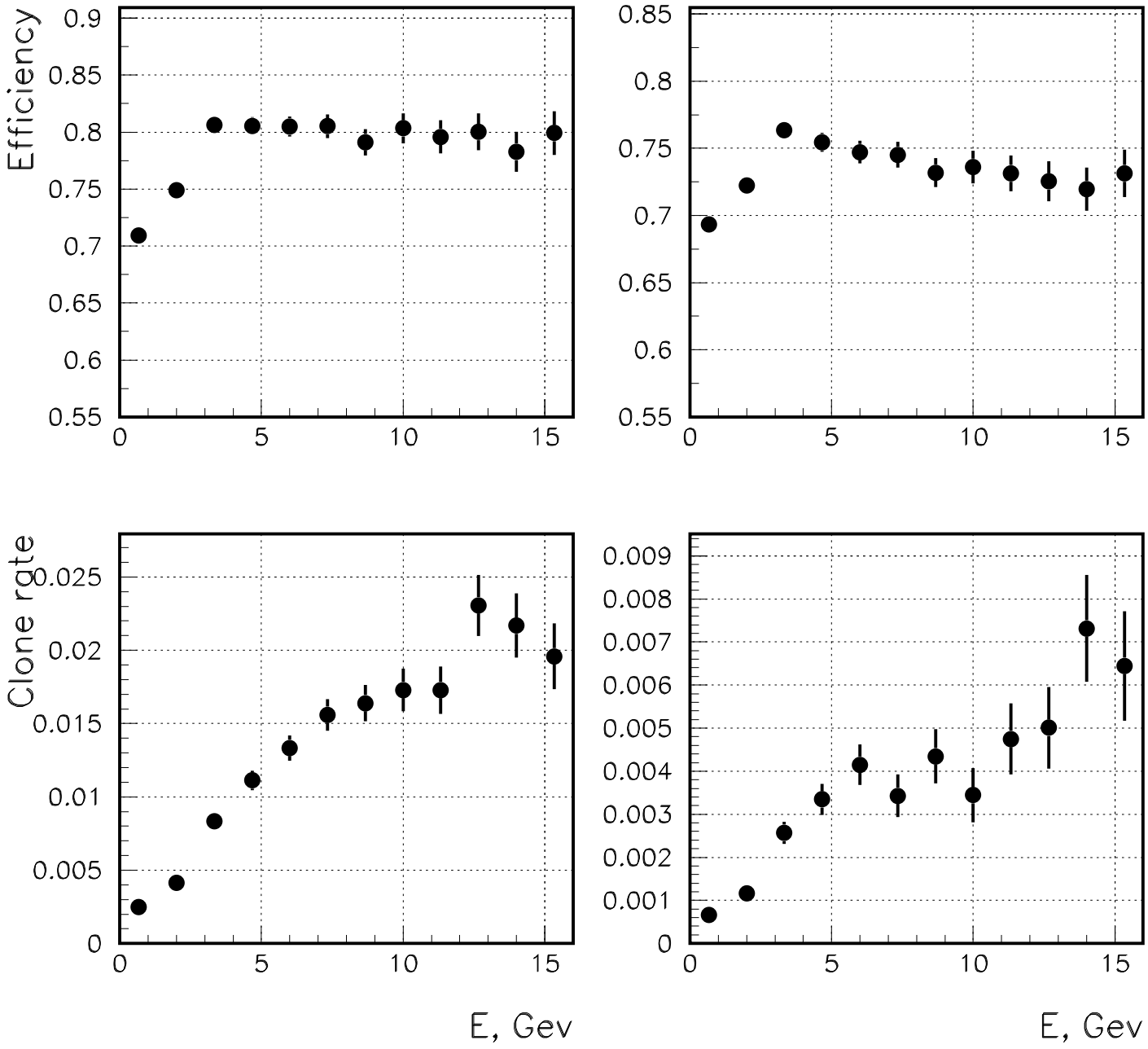
- **Mean efficiency & clone rate for different types of particles** *(wire efficiency = 100%)*



Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

- **Mean efficiency & clone rate vrs track energy**
  (wire efficiency = 100%)

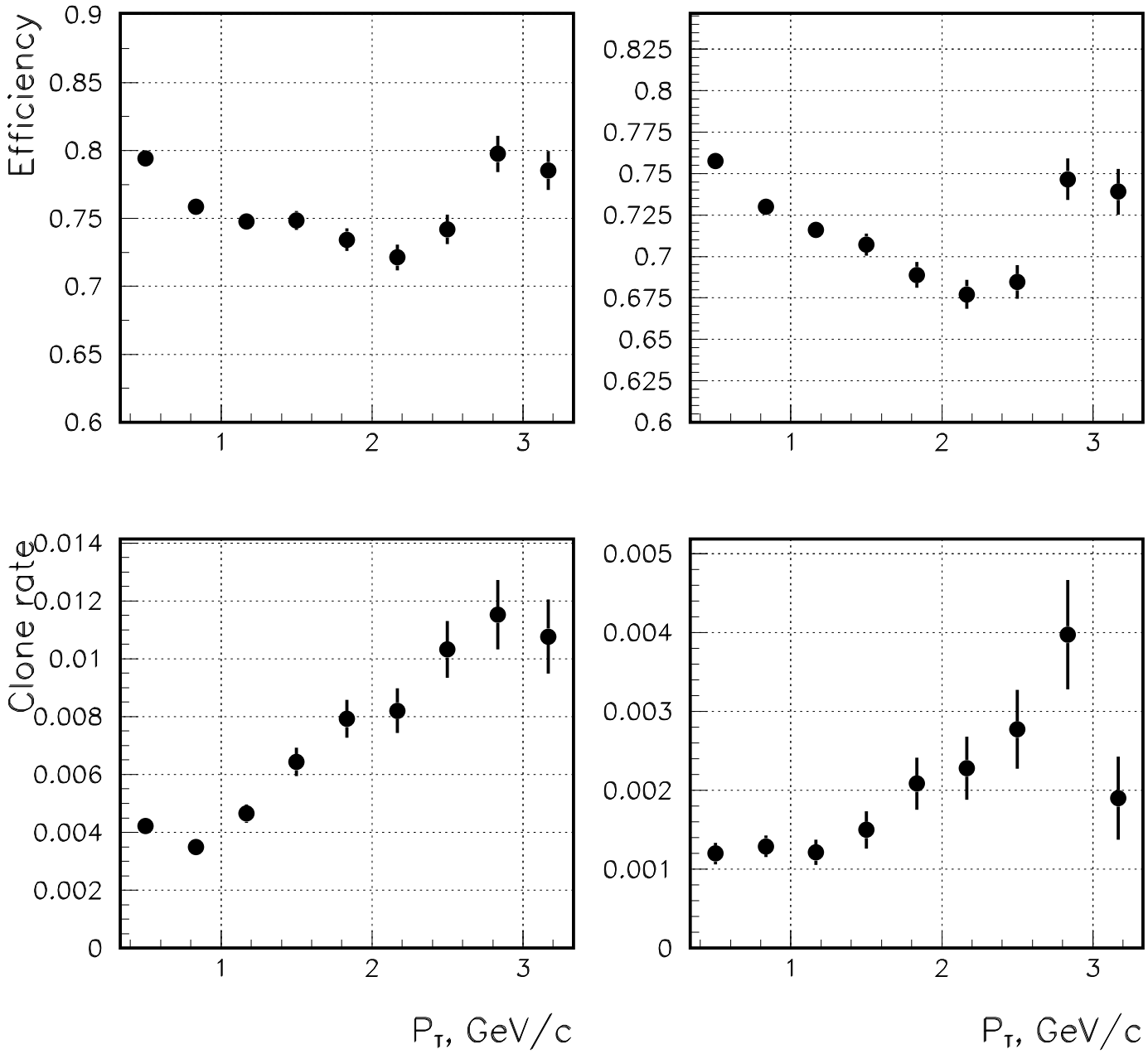


Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

- **Mean efficiency & clone rate vrs track P_T**

  (wire efficiency = 100%)

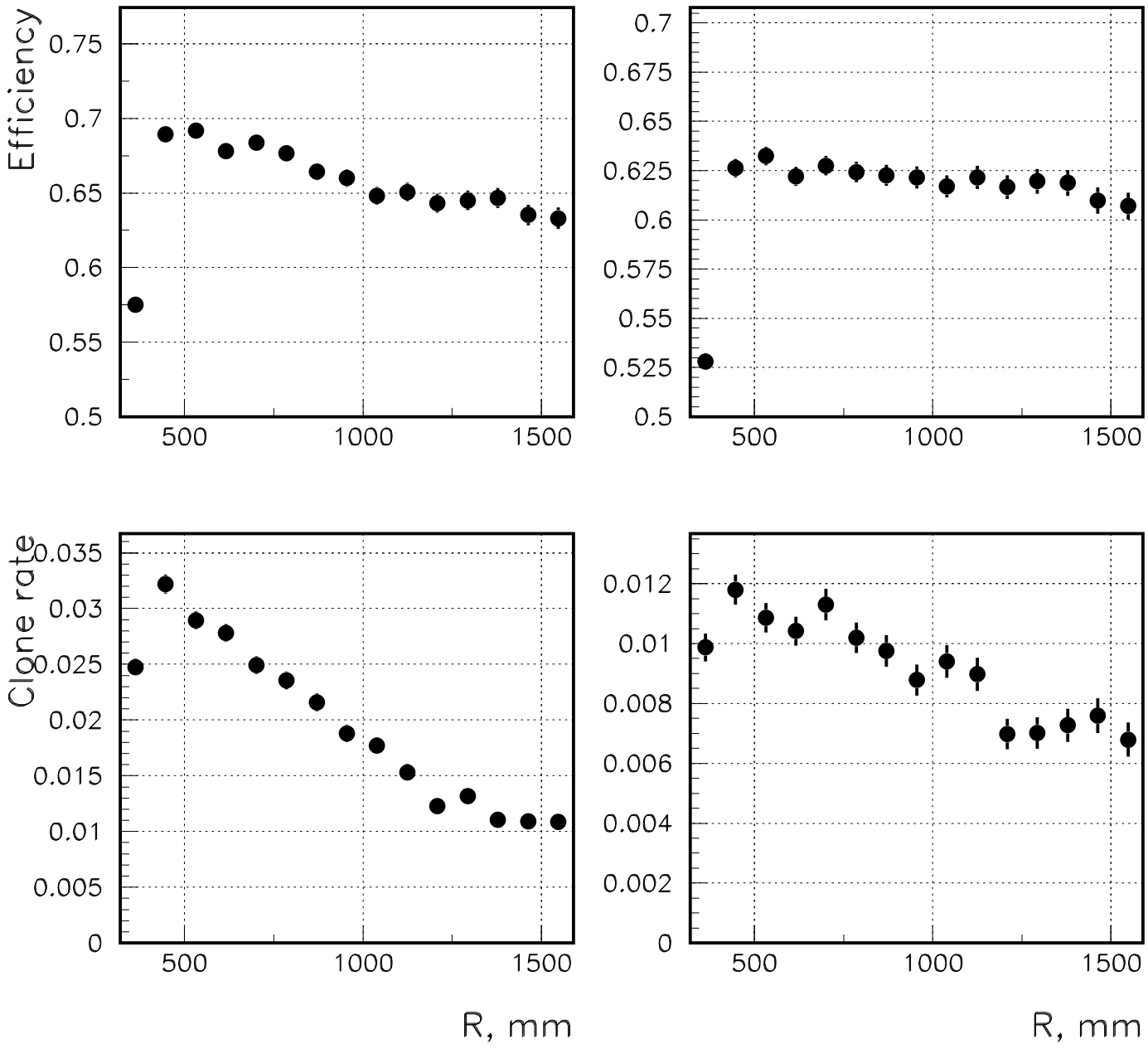


Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

- **Mean efficiency & clone rate vrs radius** R

(wire efficiency = 100%)

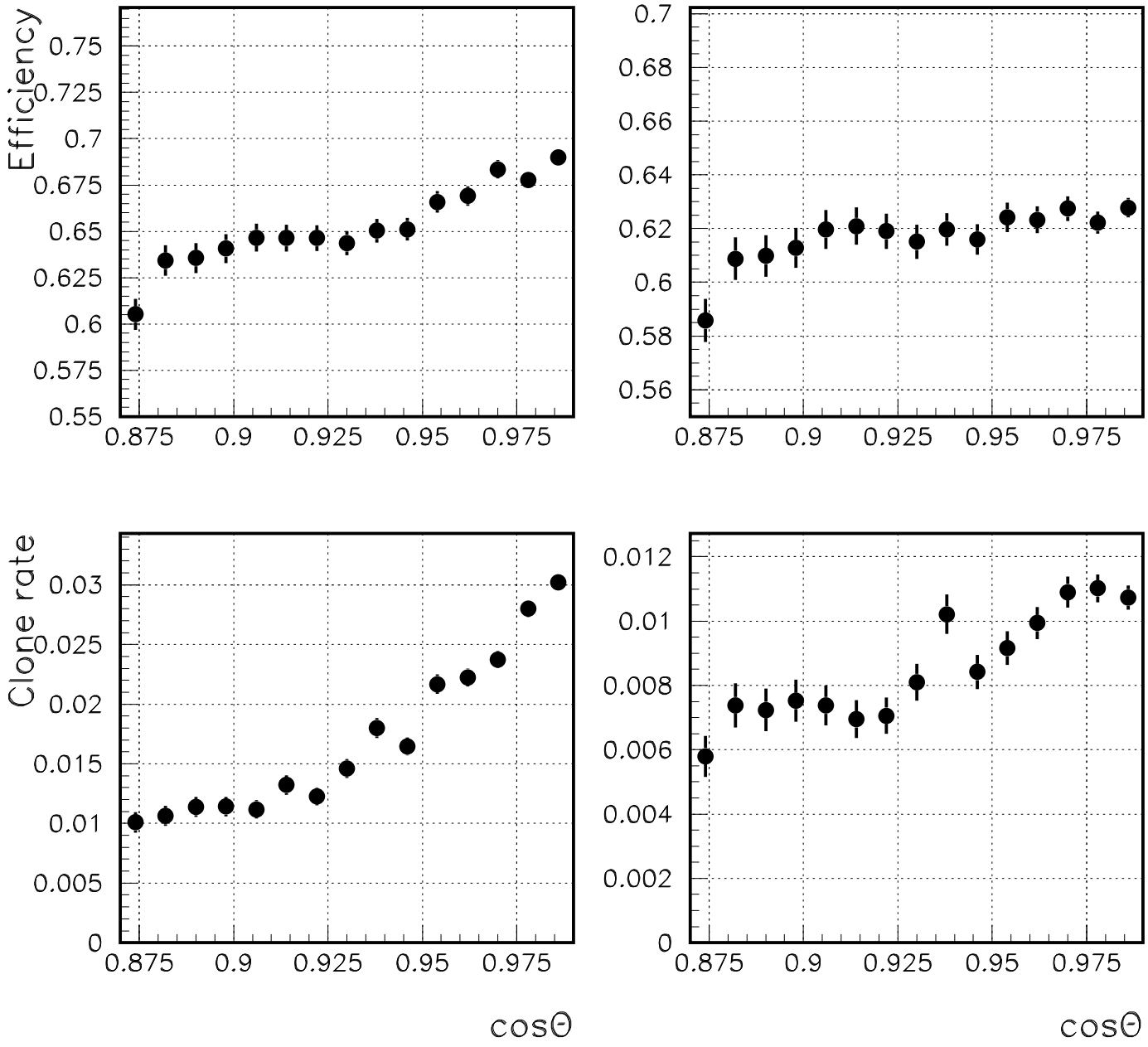


Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

- **Mean efficiency & clone rate vrs** $\cos\Theta$

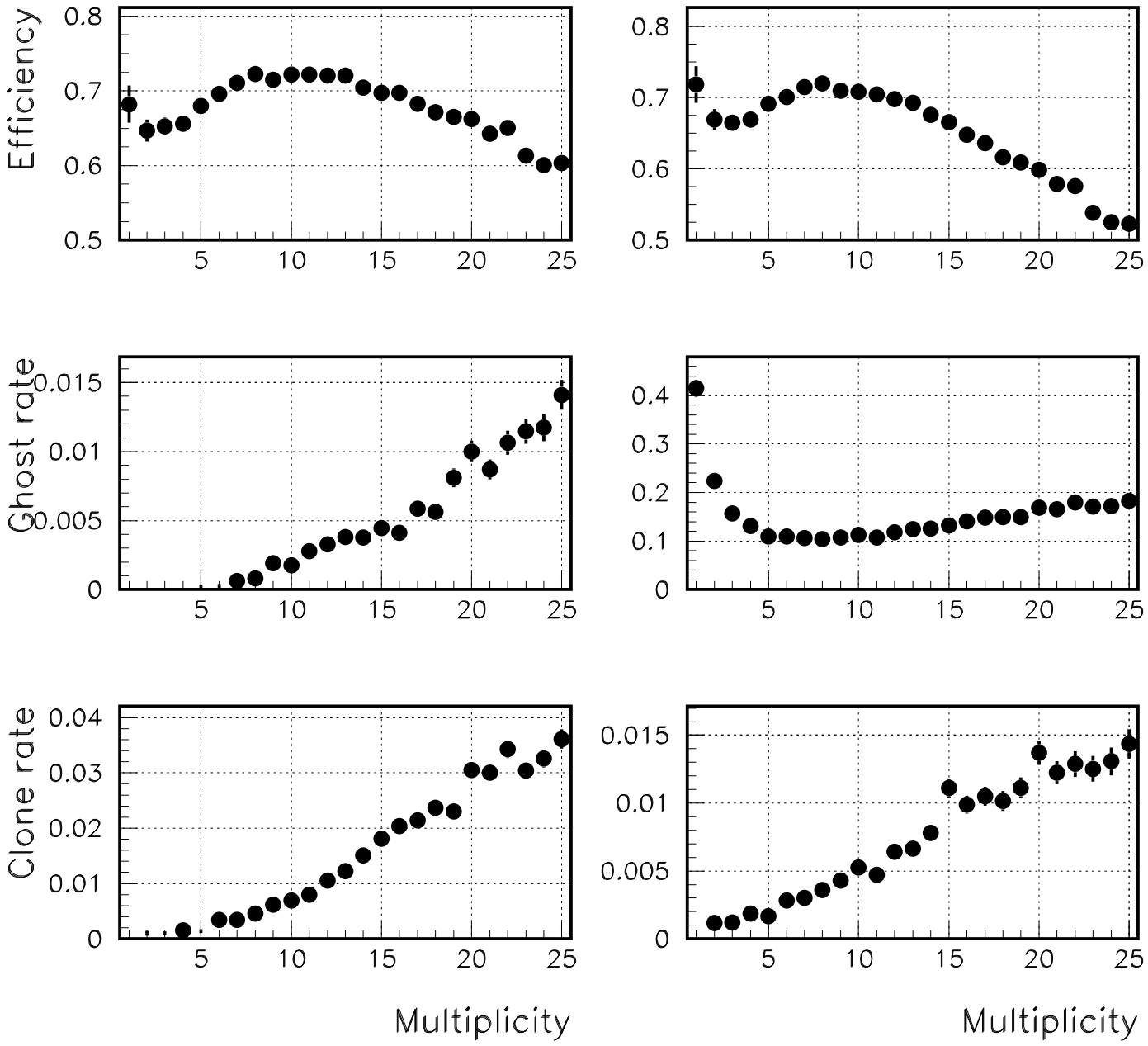
(wire efficiency = 100%)



Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

- **Mean efficiency, ghost & clone rates vrs track multiplicity** *(wire efficiency = 100%)*



Wire noise = 0% **Wire noise = 5%**

Drift-tube space resolution = 50 μm

FURTHER WORKING PLANS

- To complete the MC studies of the current reconstruction algorithm for nonzero wire inefficiency
- Further improvement of the existing hit-tracing algorithm for the track reconstruction in the FCH: to use softer selection requirements instead of too strong requirements which have been used in present studies
- Integration of the Htr routines (Hough-transform algorithm) into the BRAHMS, tuning parameters of new algorithm, and track reconstruction

Switch to studies of the Silicon option of the FCH