Status of AMS2-TRD Simulation Studies

Th. Kirn, F. Raupach, Th. Siedenburg
I. Phys. Institute RWTH Aachen

October, 18th 1999

RWTH PhysicsAC-I

Status of AMS2-TRD Simulation Studies

GEANT 3.21 + TR-generation/absorption:

(Cherry Phys. Rev. D 10 (1974) 3594, implemented by V. Saveliev)

- Aachen-AMS2-TRD-design fully implemented

- AMS2-SRD, -TOF, -Tracker, -Magnet material positioned for GEANT tracking

- e^+, p^+, γ (E_{prim}= 5 - 100 GeV), isotropic incidence within tracker acceptance

Analysis for e^+-signal and p^+-background

- select events with single "good" track

  $\rightarrow$ e^+-efficiency
  $\rightarrow$ p^+-rejection

  for different varied cut-parameters (E_{CUT}, H_{CUT})

Track Finding and Selection

Hit: total straw energy deposit $E_{DEP} > 0.1$keV

First track fit: Error weighed linear regression based on mean layer coordinates from all hits in TRD

Second track fit: Linear regression based on 10 hits with smallest residual with respect to 1st fit

Inner road: all hits within $\pm\frac{3}{2}$ pitch of 2^{nd} track fit

Outer road: remaining hits within $\pm\frac{13}{2}$ pitch

N_I: number of hits in inner road

N_O: number of hits in outer road

N_L: number of layers with a hit in inner road

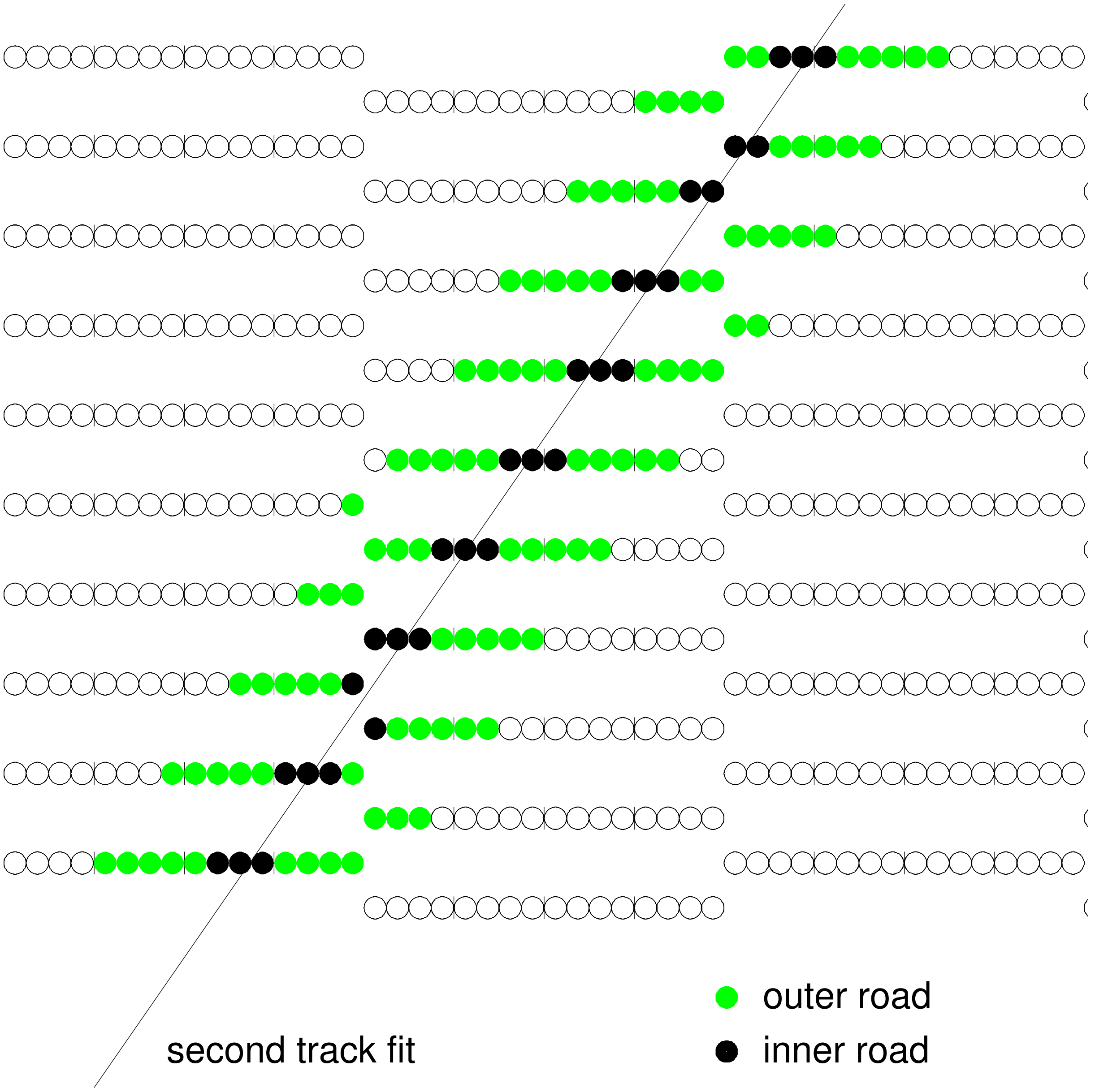
N_{MB}: number of lower 3 layers with a hit in outer road

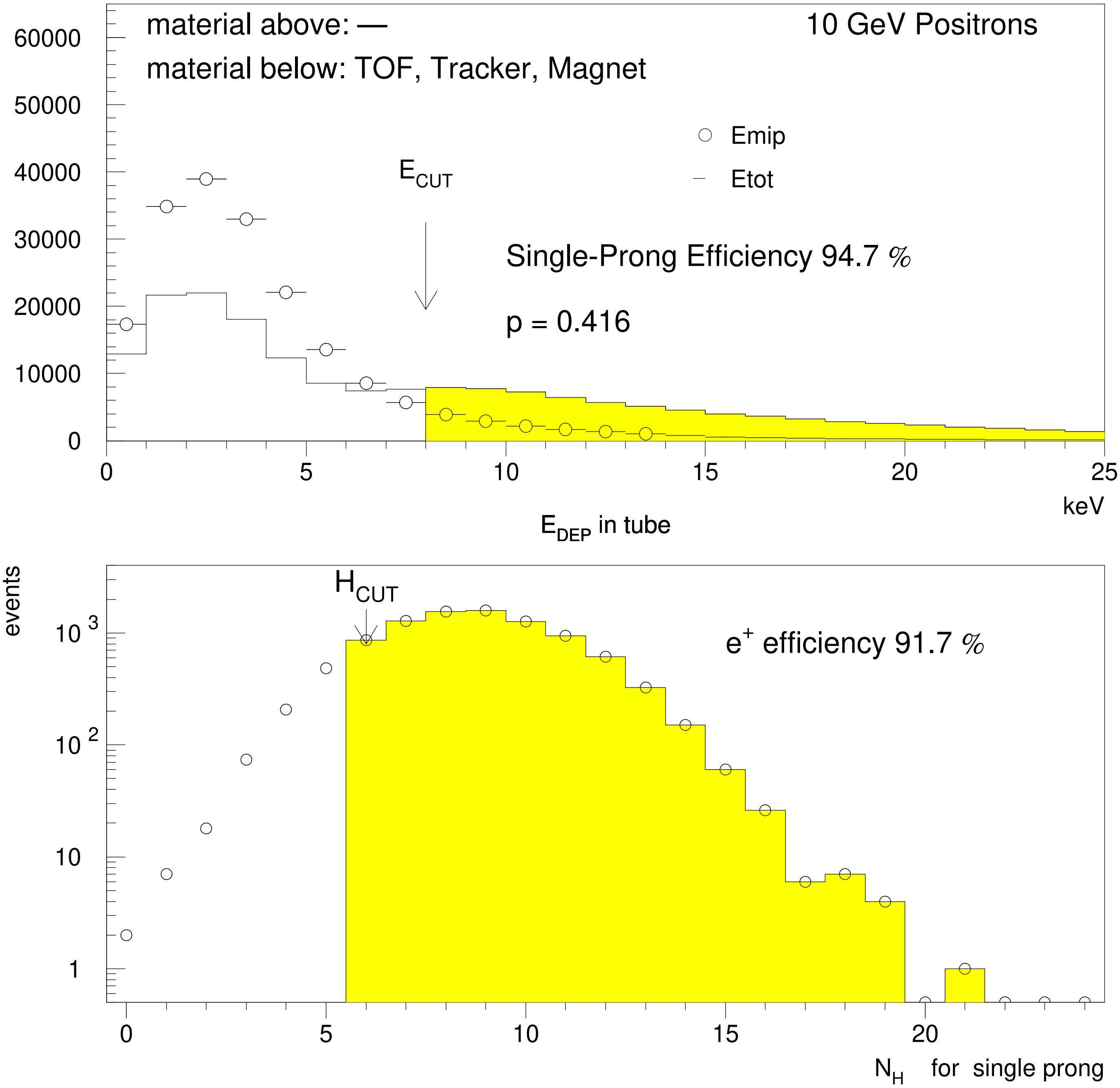
Single Prong: $N_I \geq 10$ & $N_I \geq N_O$ & $N_{MB} < 2$

N_H: number of hits in inner road with $E_{DEP} \geq E_{CUT}$

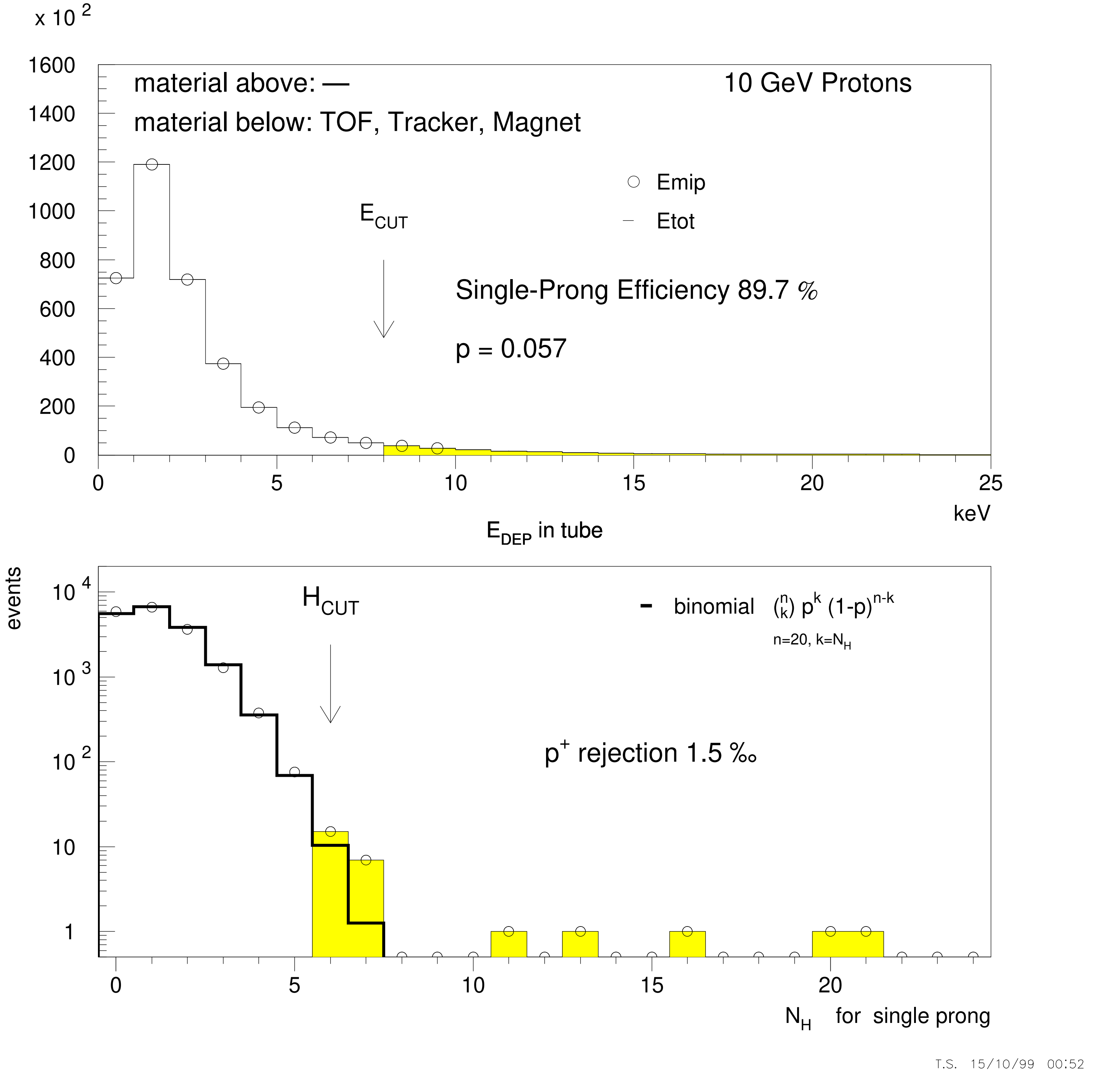
Eventselection: single prong with $N_H \geq H_{CUT}$

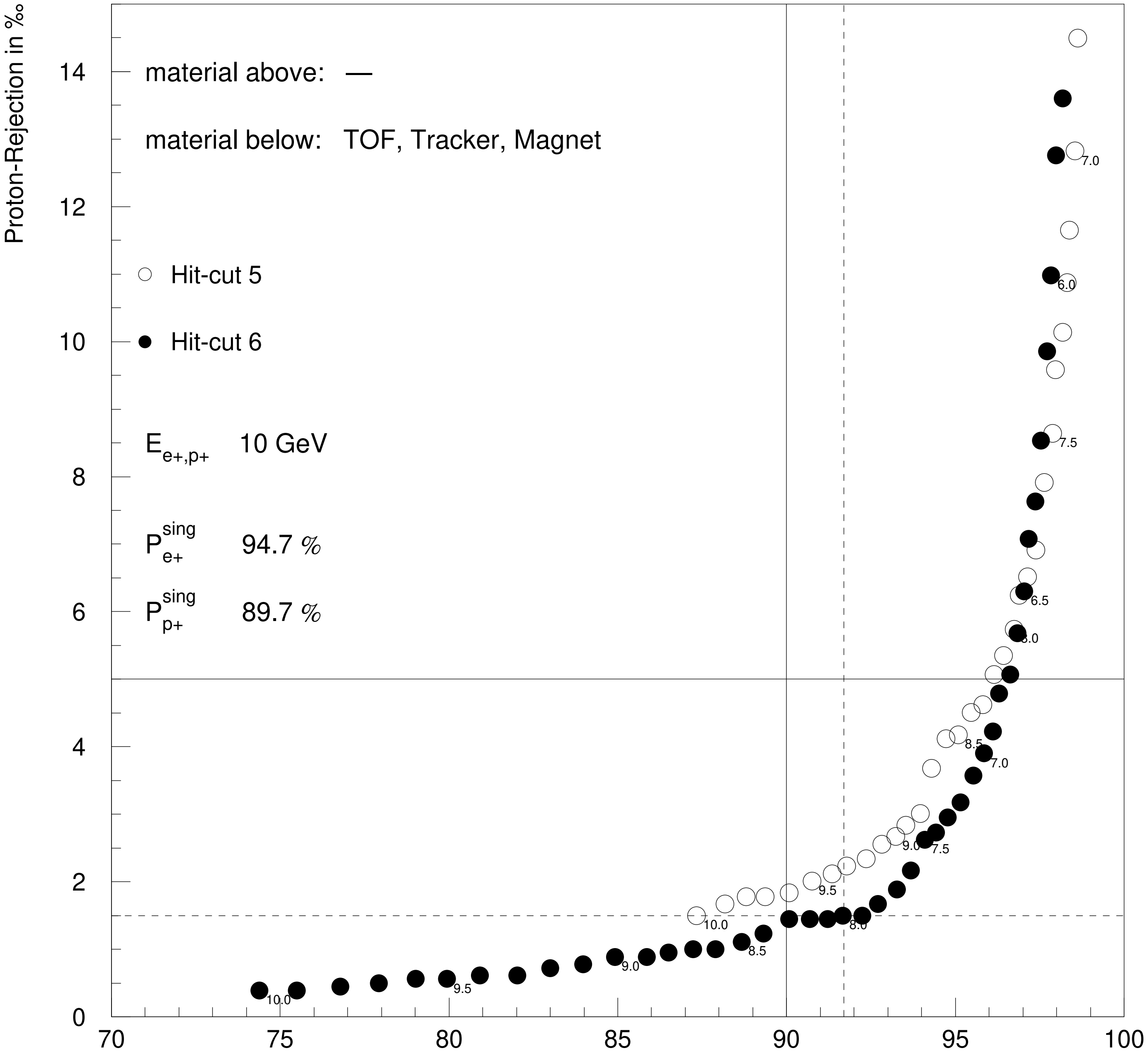
Track Finding: Road Definition





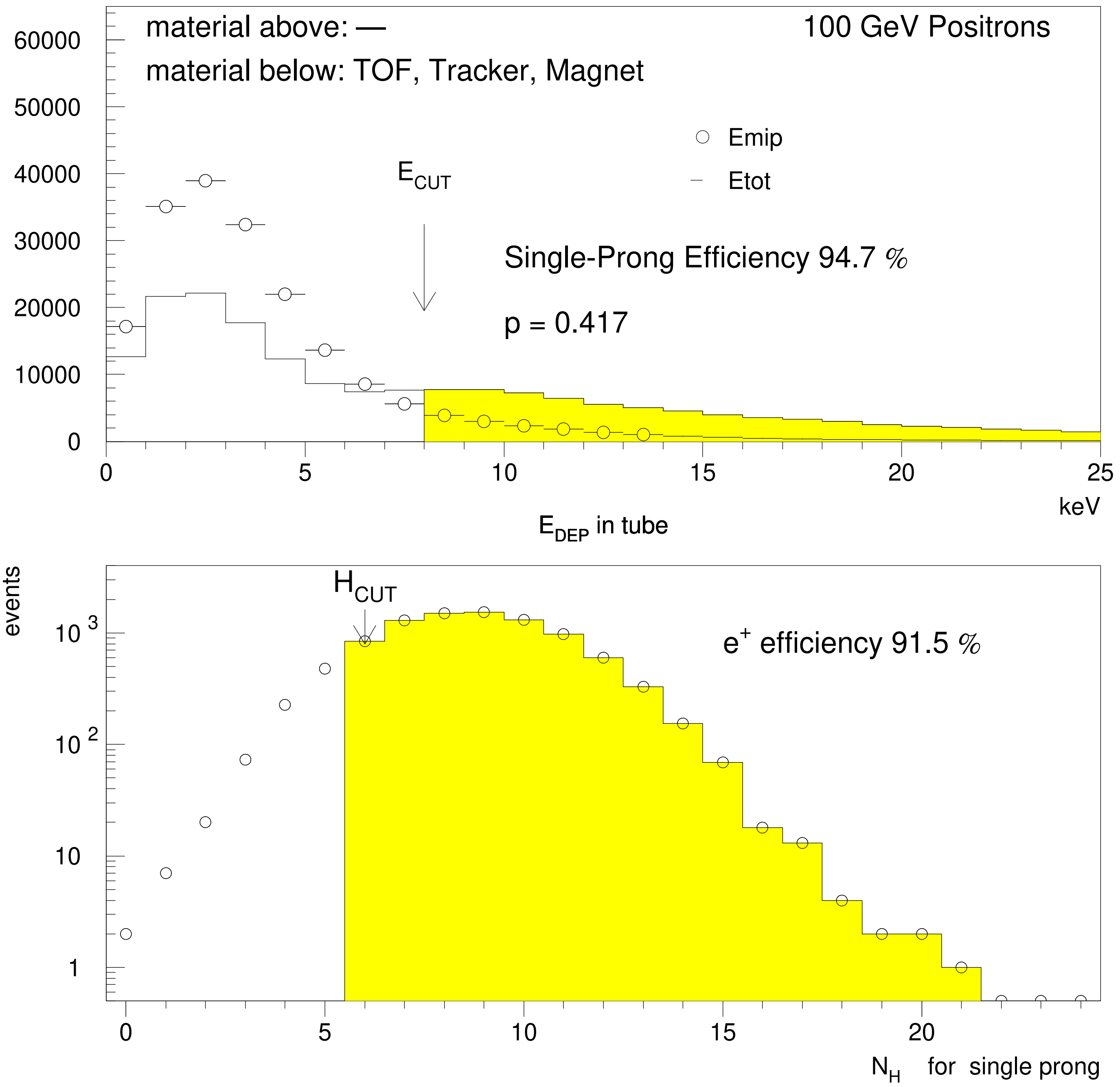
T.S. 15/10/99 00:53


x 10 2
material above: —
material below: TOF, Tracker, Magnet
10 GeV Protons
Emip
Etot
E_CUT
Single-Prong Efficiency 89.7 %
p = 0.057
keV
E_DEP in tube
events
H_CUT
binomial (n k) p^k (1-p)^(n-k)
n=20, k=N_H
p+ rejection 1.5 ‰
N_H for single prong
T.S. 15/10/99 00:52

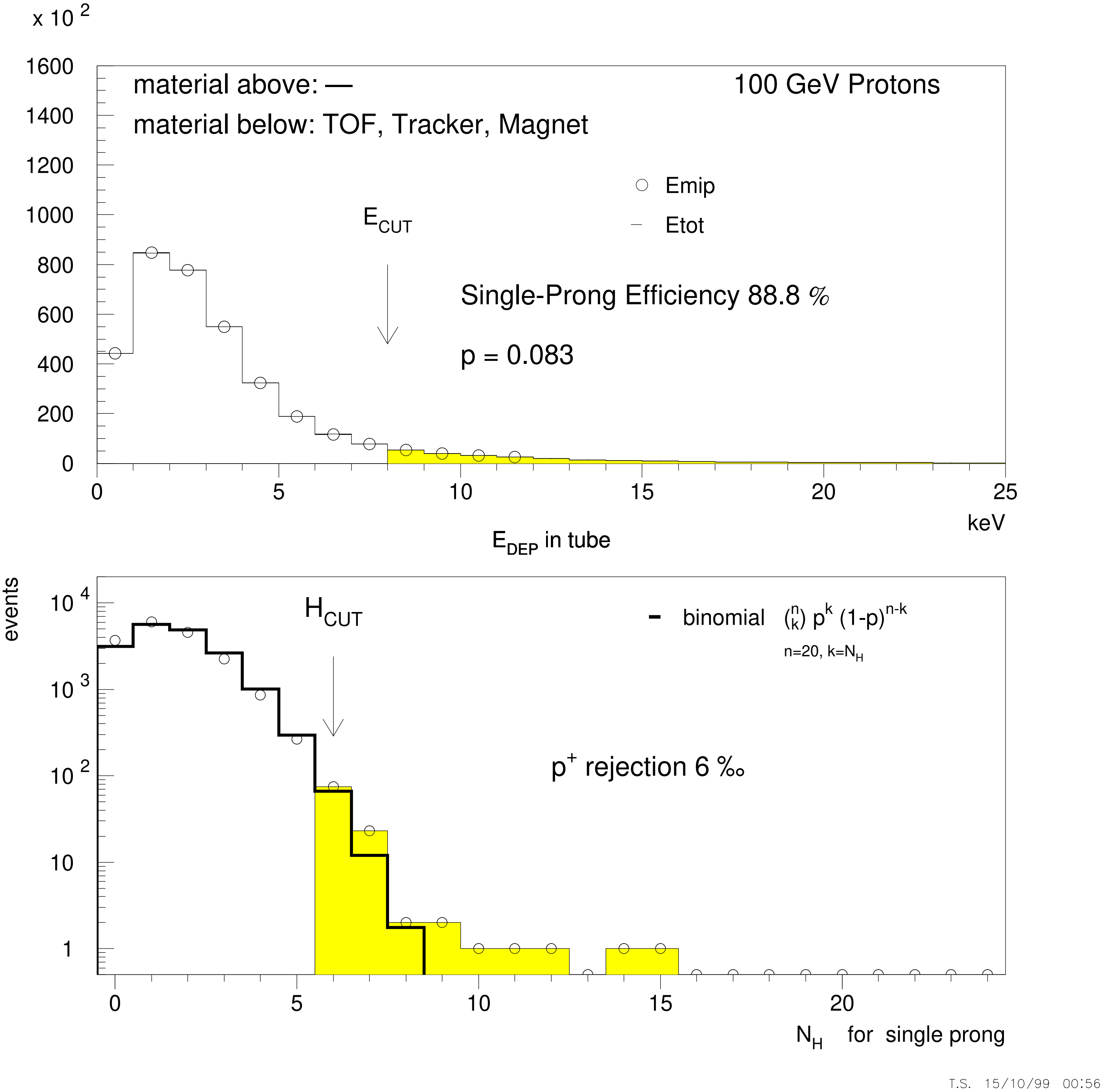


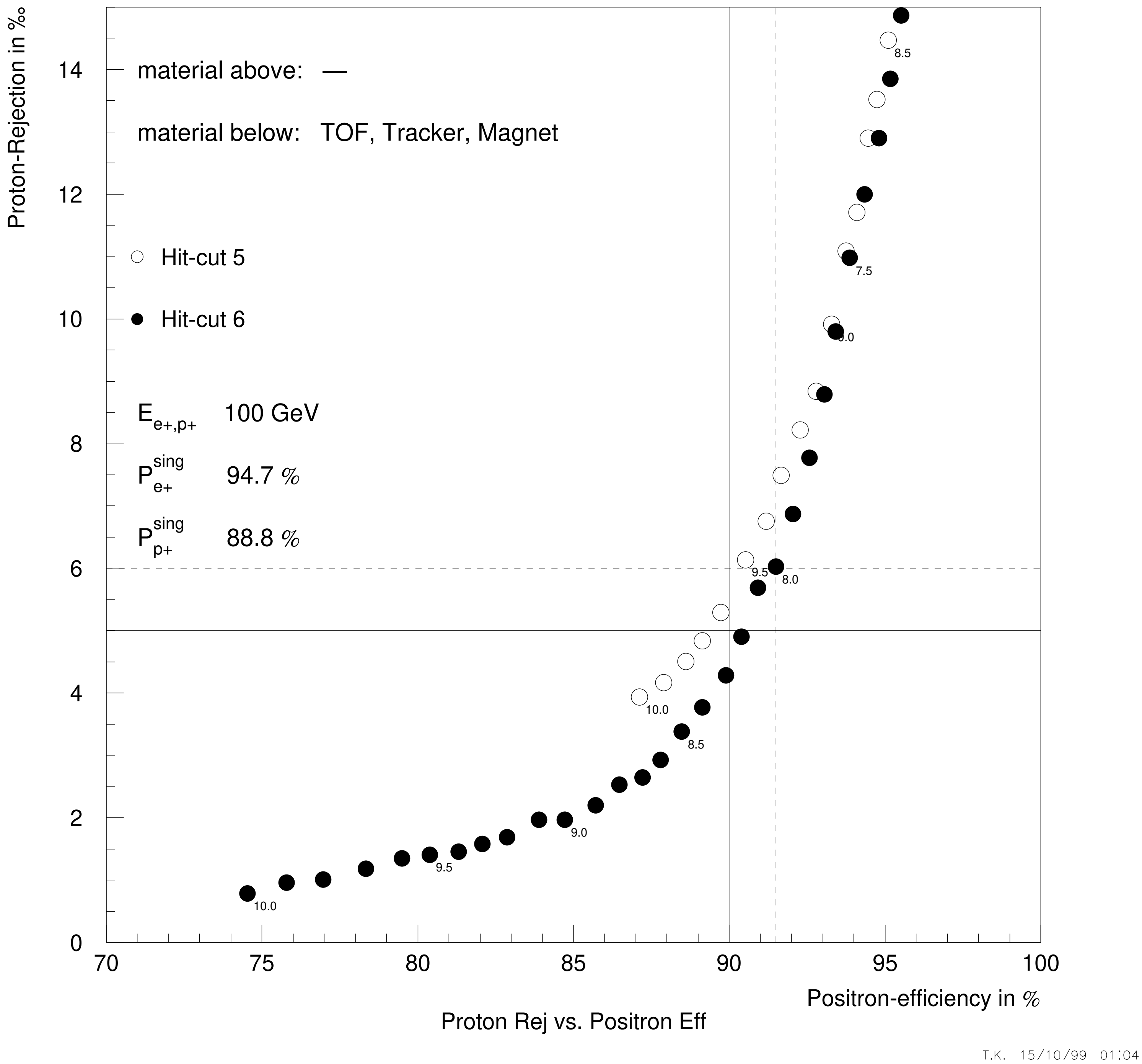
Proton Rej vs. Positron Eff

T.K. 15/10/99 00:57

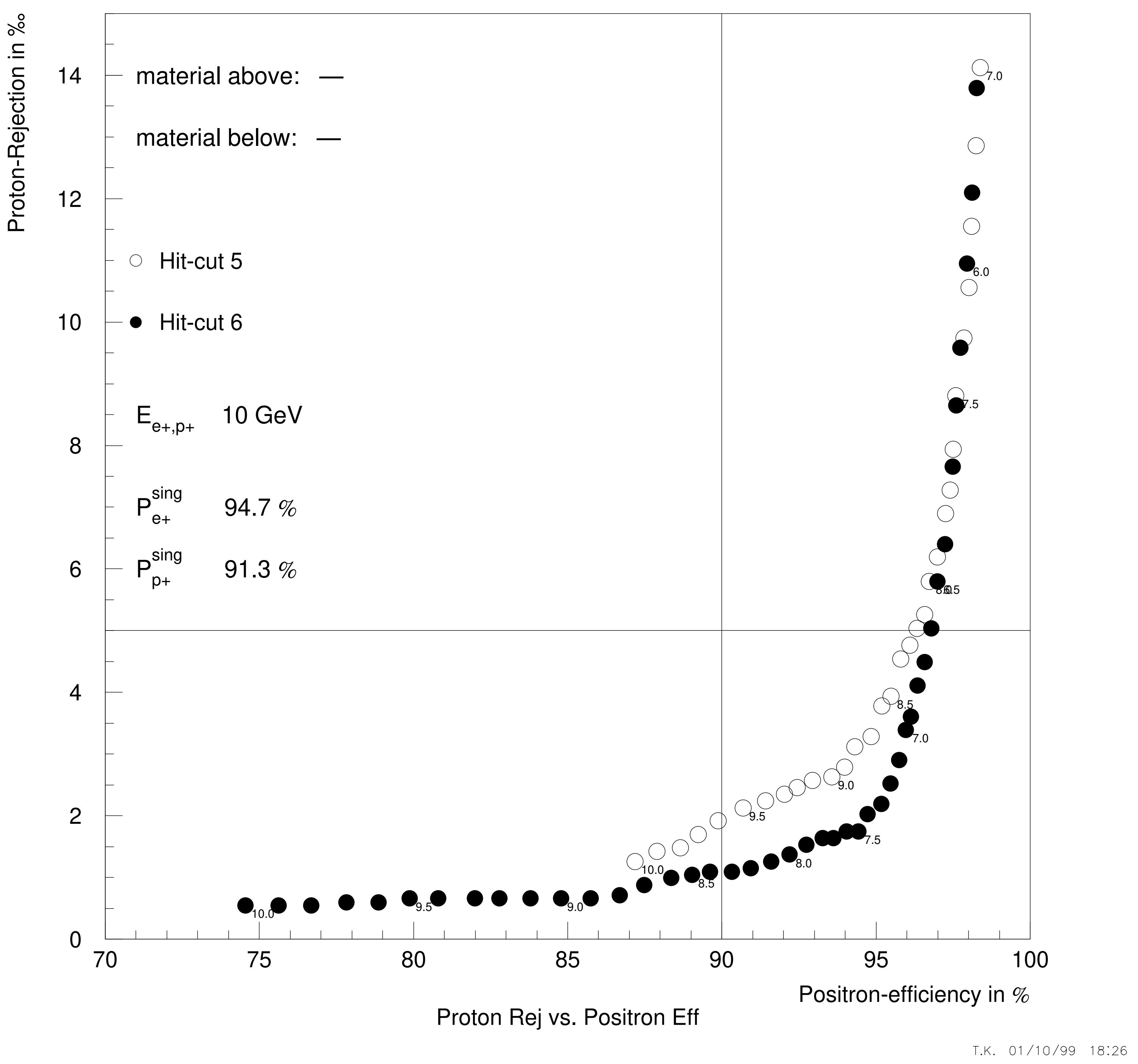


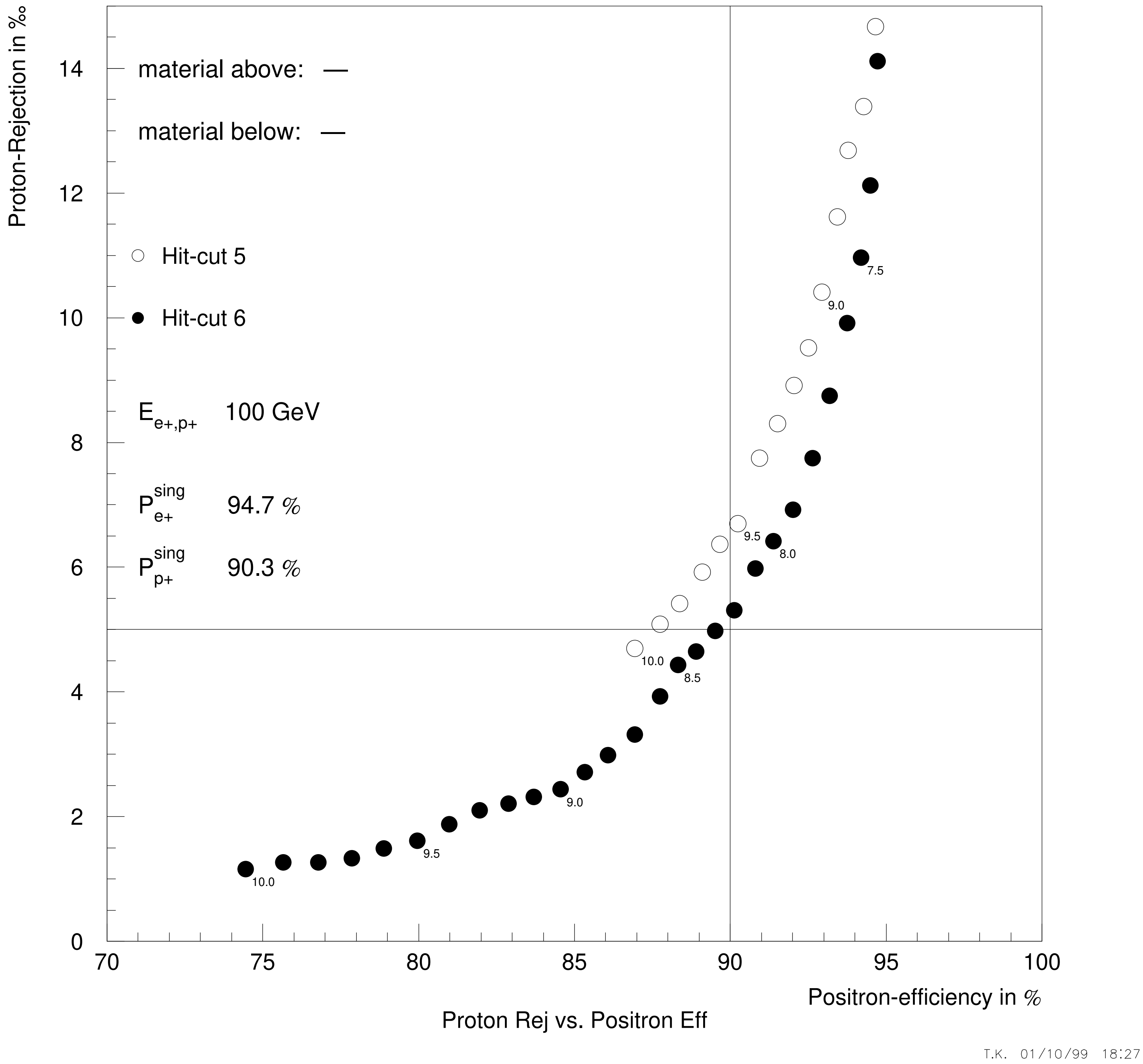
T.S. 15/10/99 00:54


x 10 2
material above: —
material below: TOF, Tracker, Magnet
100 GeV Protons
Emip
Etot
E_CUT
Single-Prong Efficiency 88.8 %
p = 0.083
keV
E_DEP in tube
events
H_CUT
binomial (n k) p^k (1-p)^n-k
n=20, k=N_H
p+ rejection 6 ‰
N_H for single prong
T.S. 15/10/99 00:56

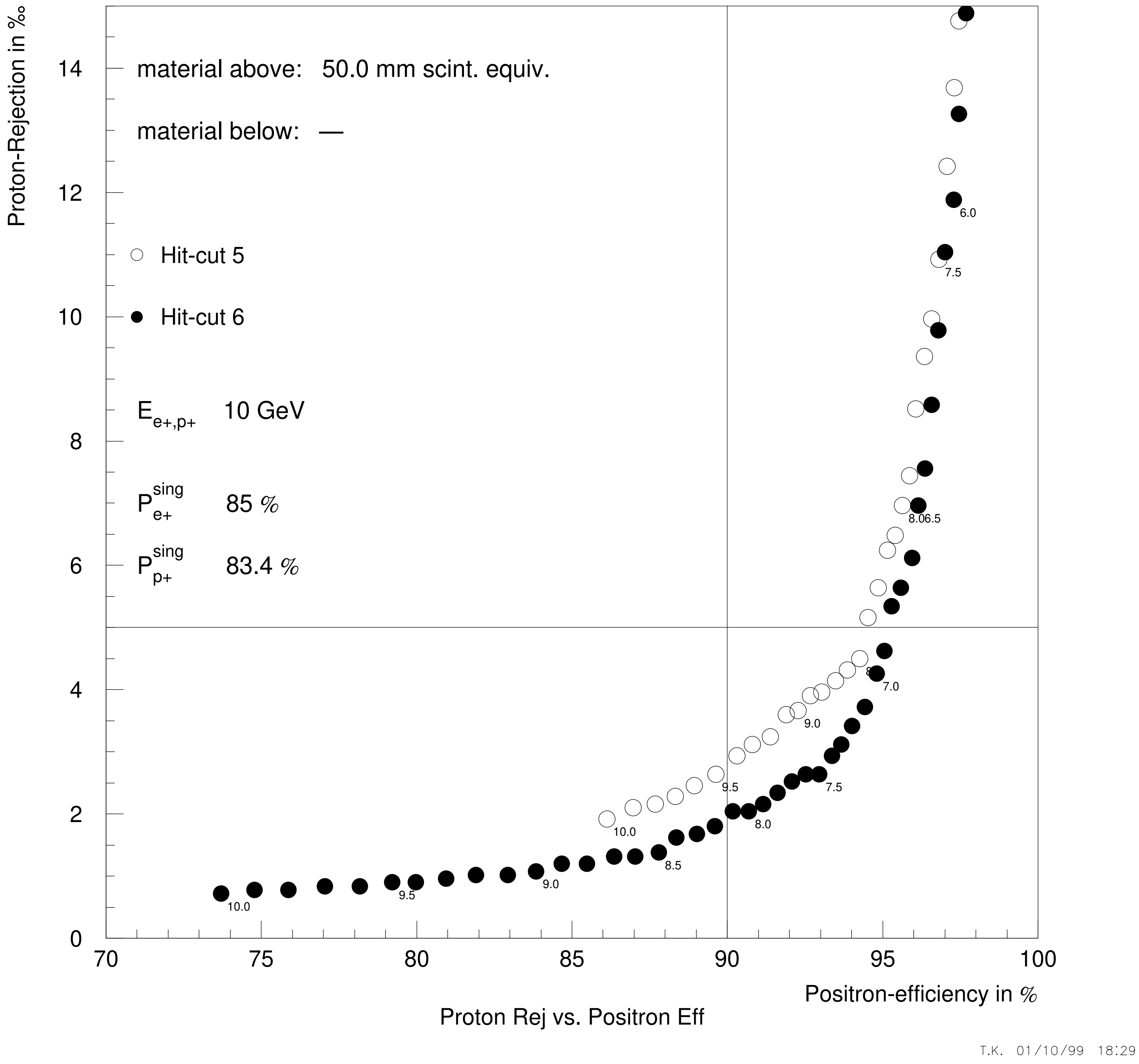


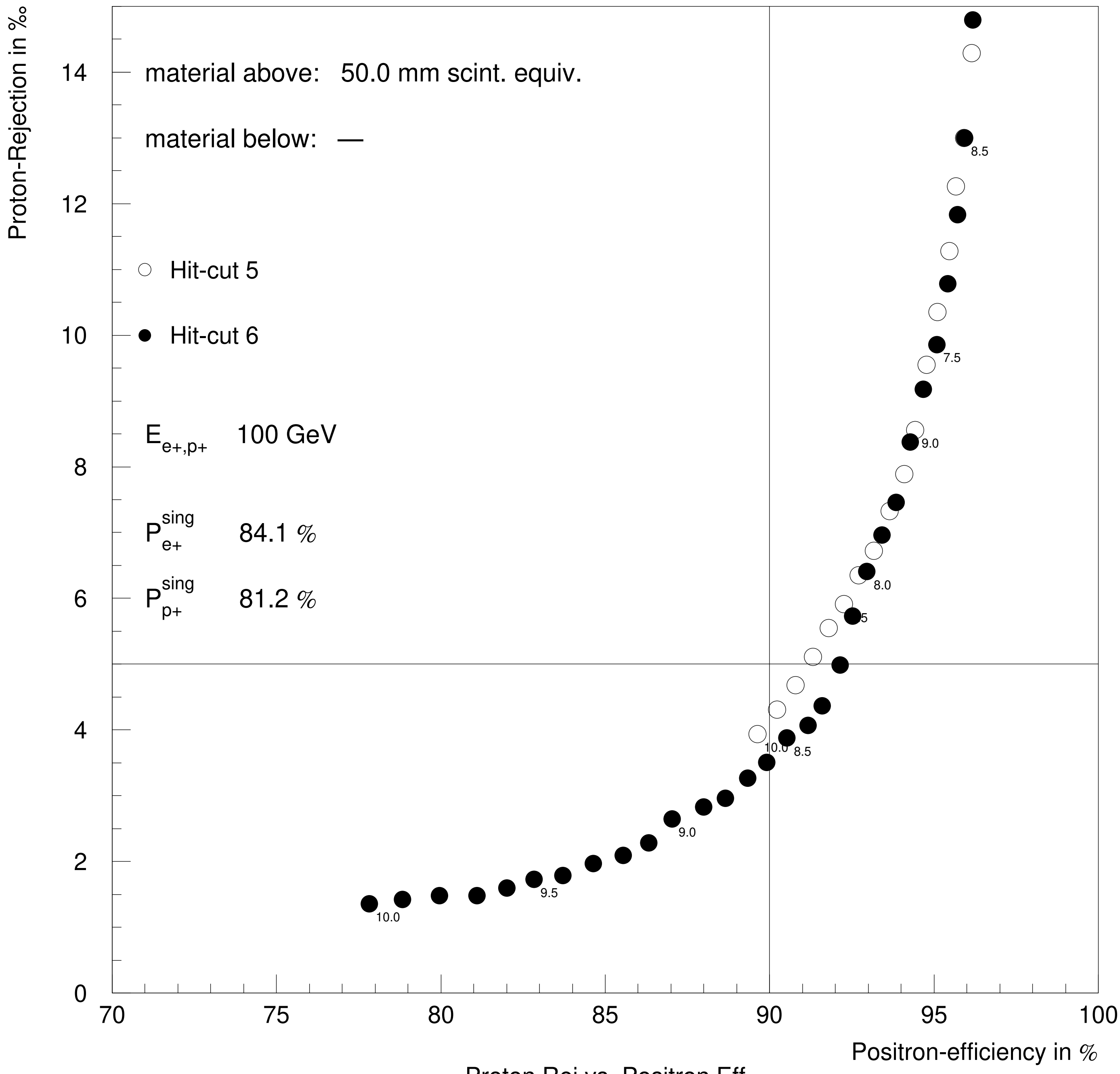
Proton-Rejection in ‰
material above: —
material below: TOF, Tracker, Magnet
Hit-cut 5
Hit-cut 6
E e+,p+ 100 GeV
P sing e+ 94.7 %
P sing p+ 88.8 %
Positron-efficiency in %
Proton Rej vs. Positron Eff
T.K. 15/10/99 01:04


Proton-Rejection in ‰
material above: —
material below: —
Hit-cut 5
Hit-cut 6
E e+,p+ 10 GeV
P sing e+ 94.7 %
P sing p+ 91.3 %
Positron-efficiency in %
Proton Rej vs. Positron Eff
T.K. 01/10/99 18:26



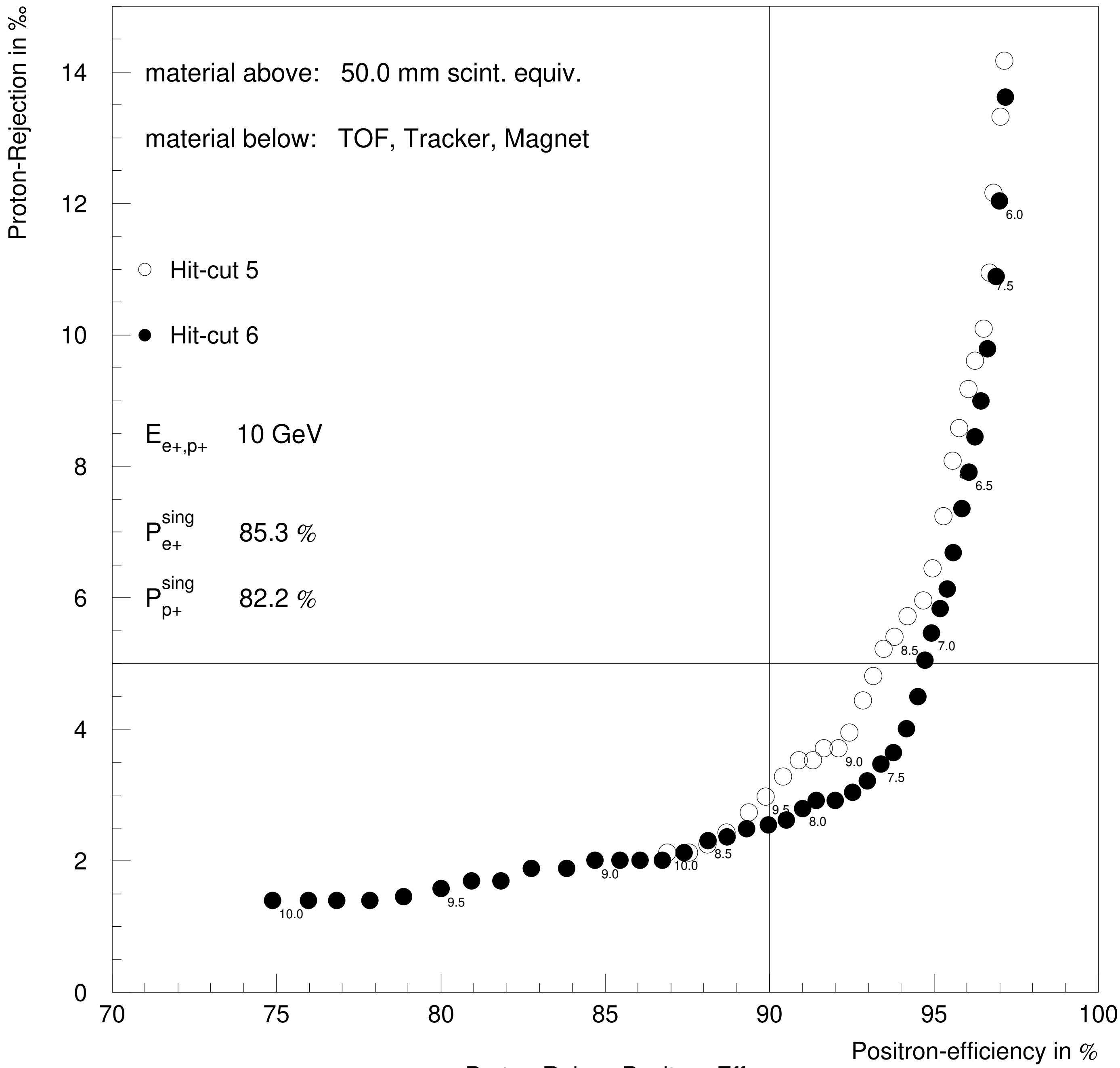
Proton-Rejection in ‰
material above: —
material below: —
Hit-cut 5
Hit-cut 6
E e+,p+ 100 GeV
P sing e+ 94.7 %
P sing p+ 90.3 %
10.0
9.5
9.0
8.5
8.0
7.5
Positron-efficiency in %
Proton Rej vs. Positron Eff
T.K. 01/10/99 18:27


material above: 50.0 mm scint. equiv.
material below: —
Hit-cut 5
Hit-cut 6
$E_{e+,p+}$ 10 GeV
P^{sing}_{e+} 85 %
P^{sing}_{p+} 83.4 %
Proton-Rejection in ‰
Positron-efficiency in %
Proton Rej vs. Positron Eff
T.K. 01/10/99 18:29



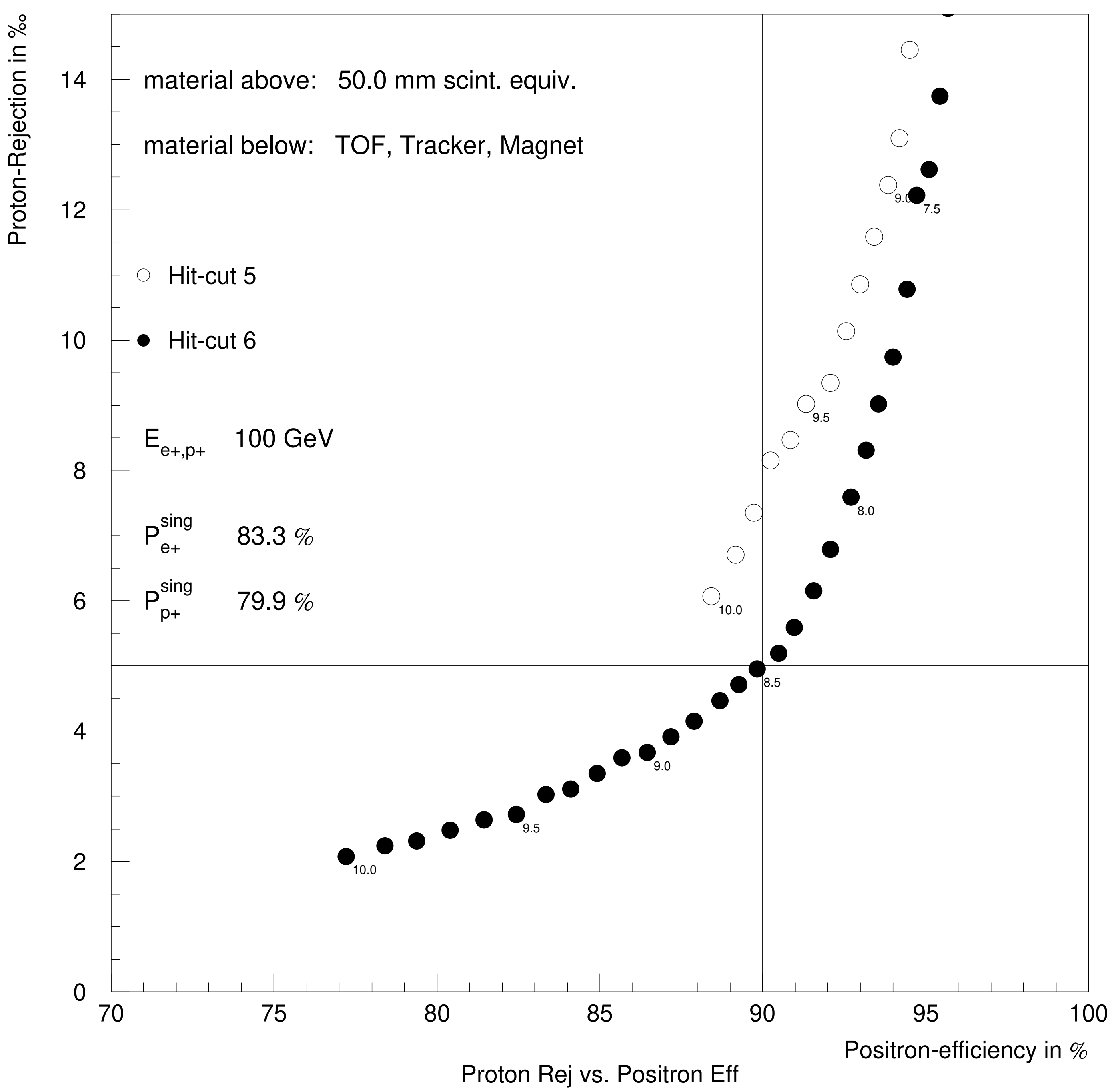
Proton Rej vs. Positron Eff

T.K. 01/10/99 18:30

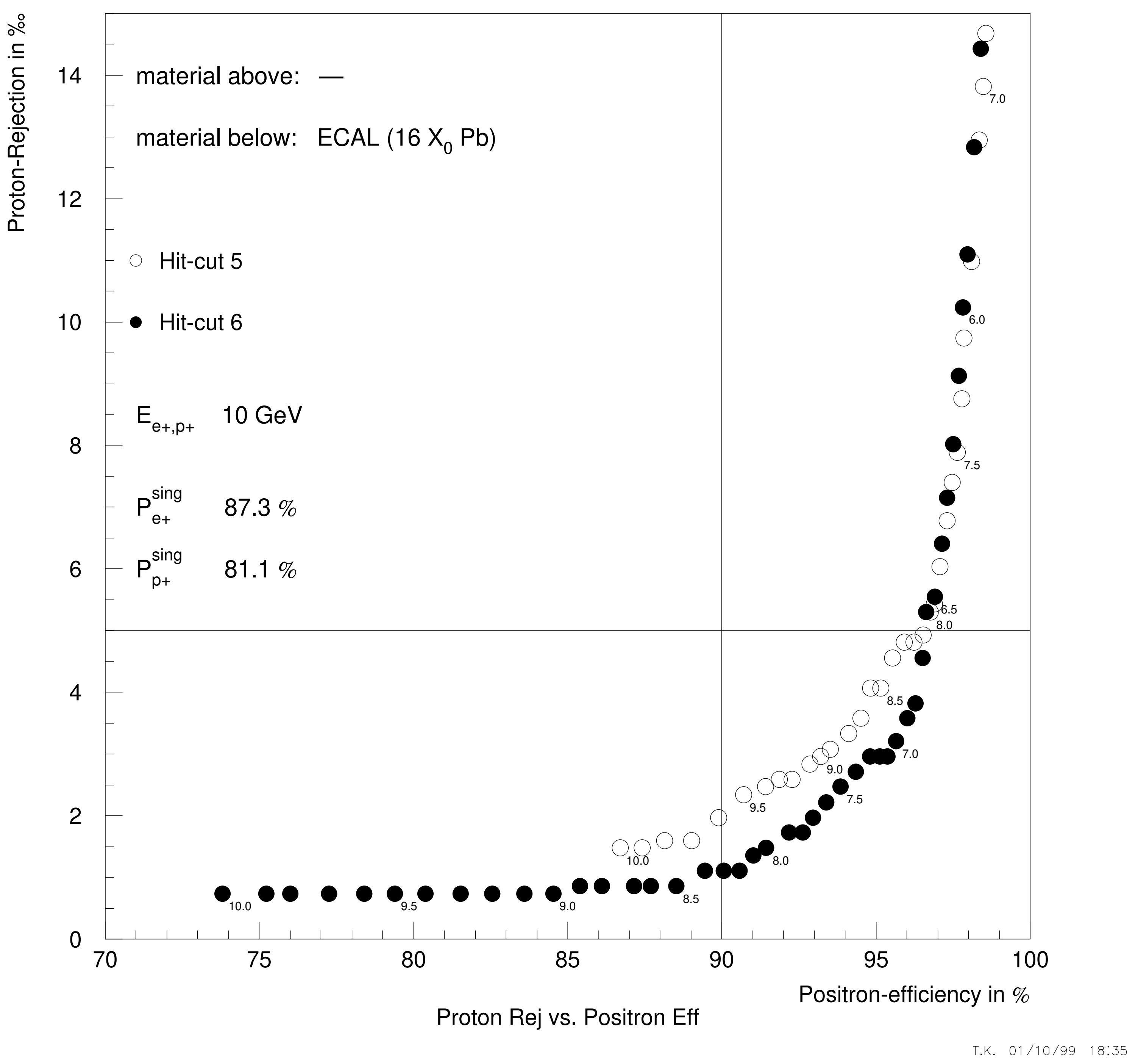


Proton Rej vs. Positron Eff

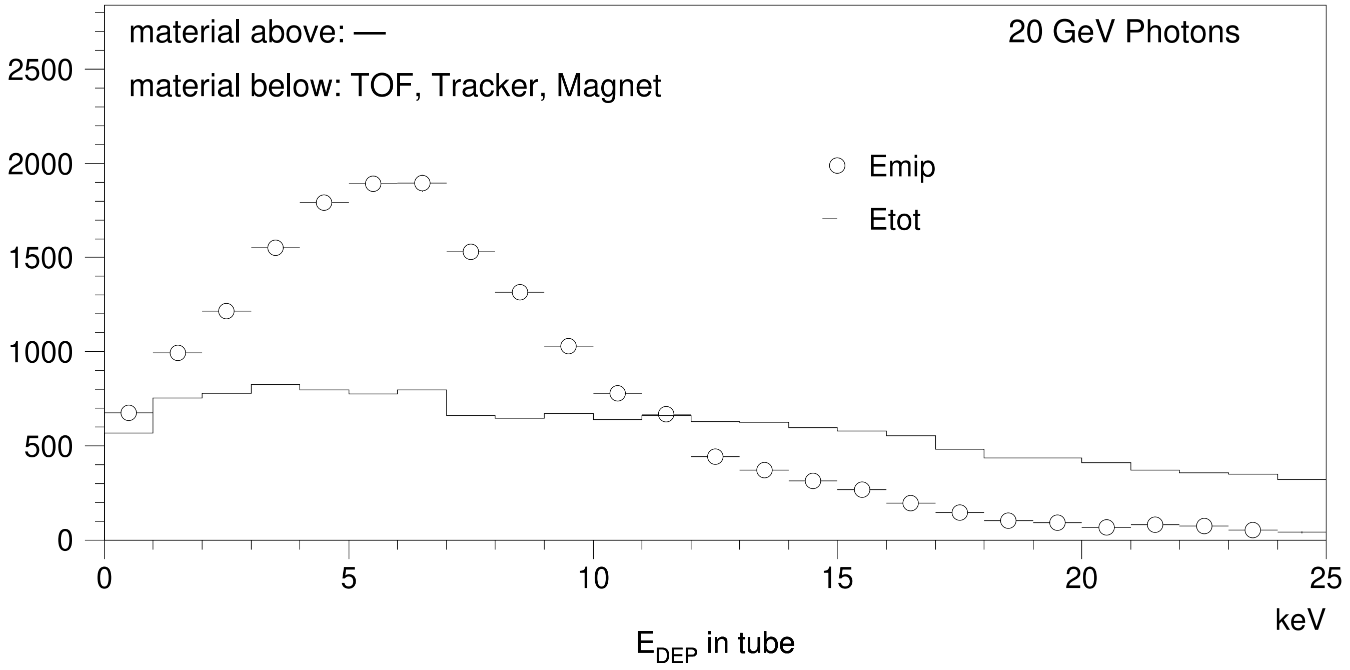
T.K. 01/10/99 18:31

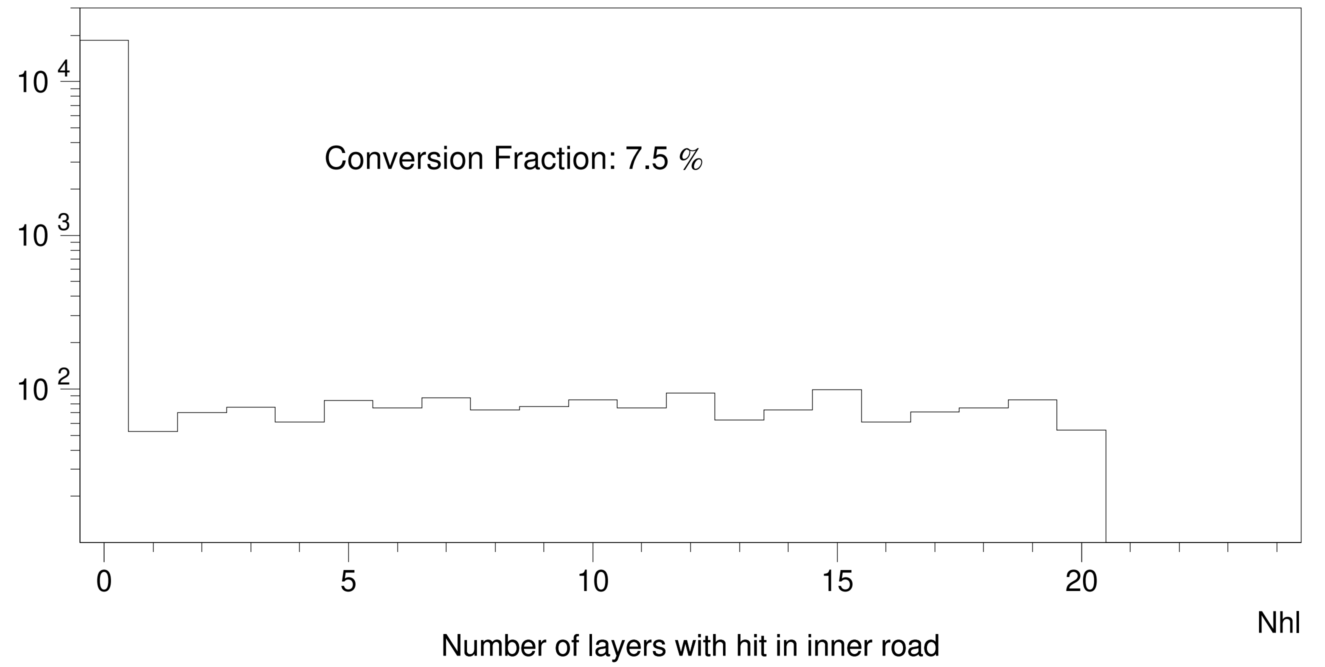


T.K. 01/10/99 18:31


material above: —
material below: ECAL (16 X_0 Pb)
Hit-cut 5
Hit-cut 6
$E_{e+,p+}$ 10 GeV
P^{sing}_{e+} 87.3 %
P^{sing}_{p+} 81.1 %
Proton-Rejection in ‰
Positron-efficiency in %
Proton Rej vs. Positron Eff
T.K. 01/10/99 18:35

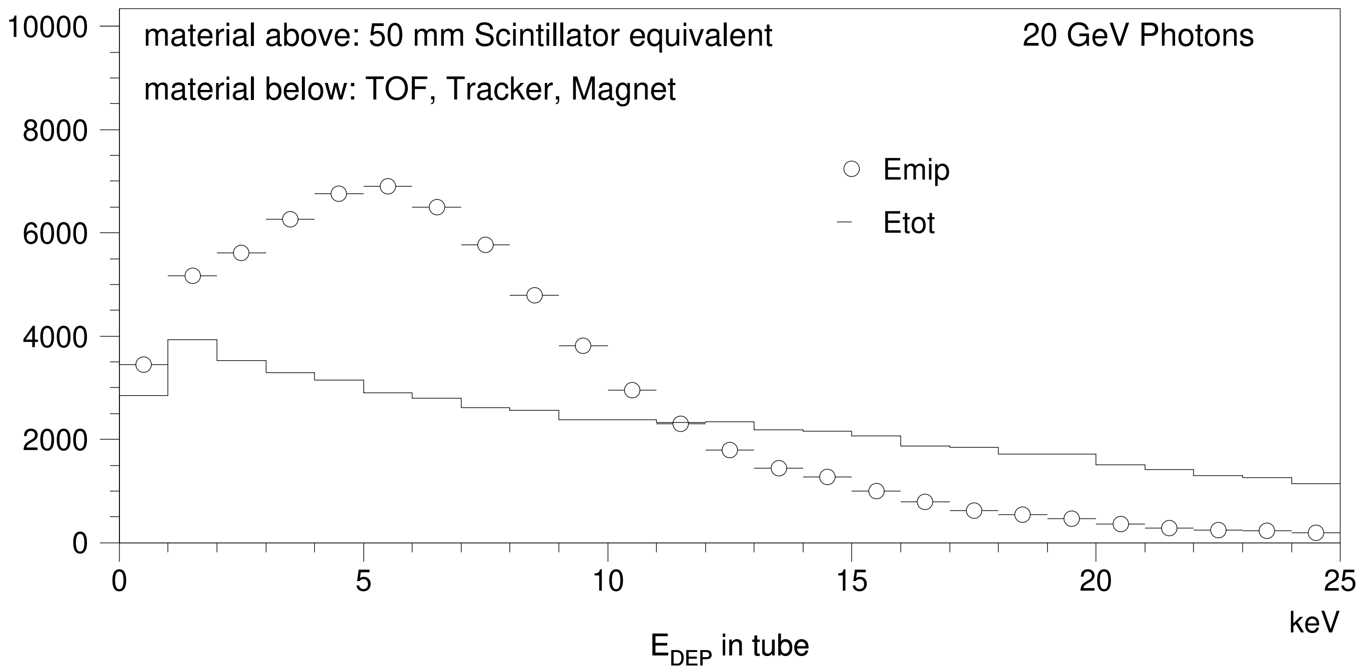
gamma-conversion study

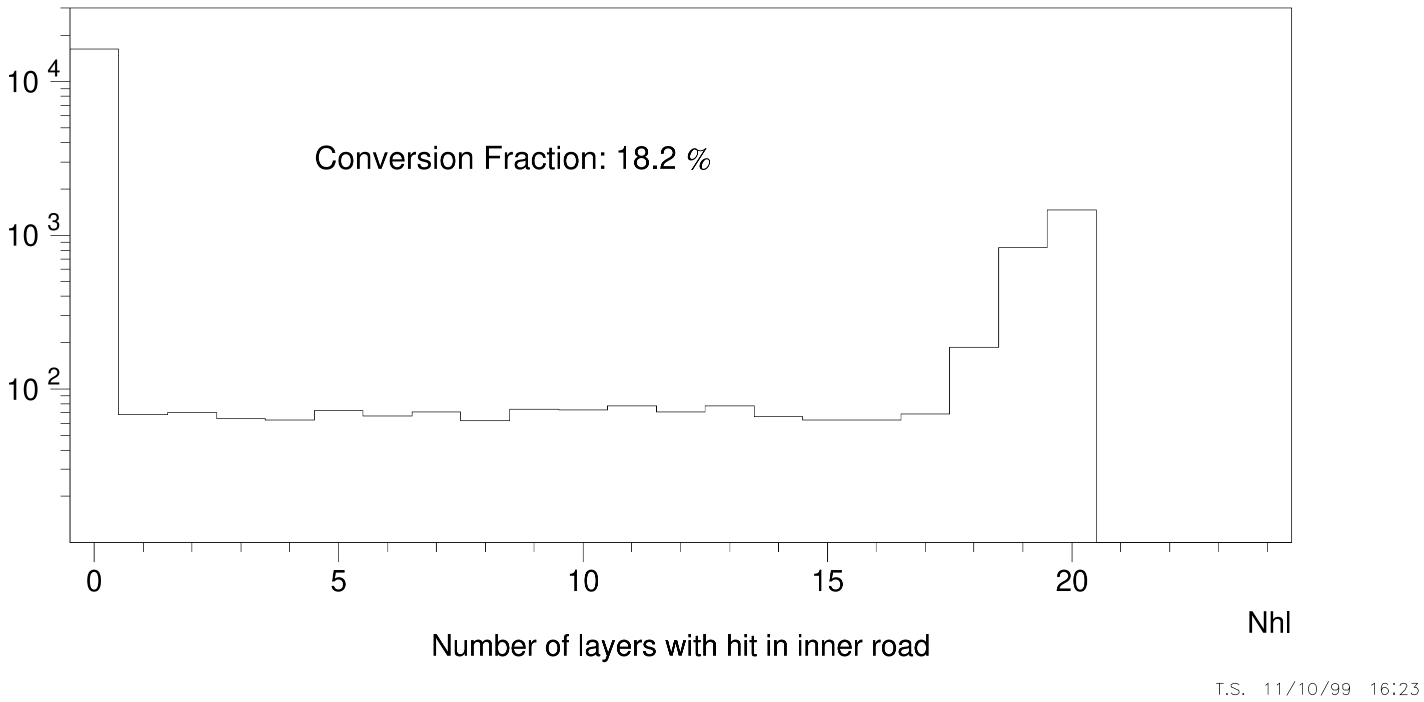




T.S. 11/10/99 16:18

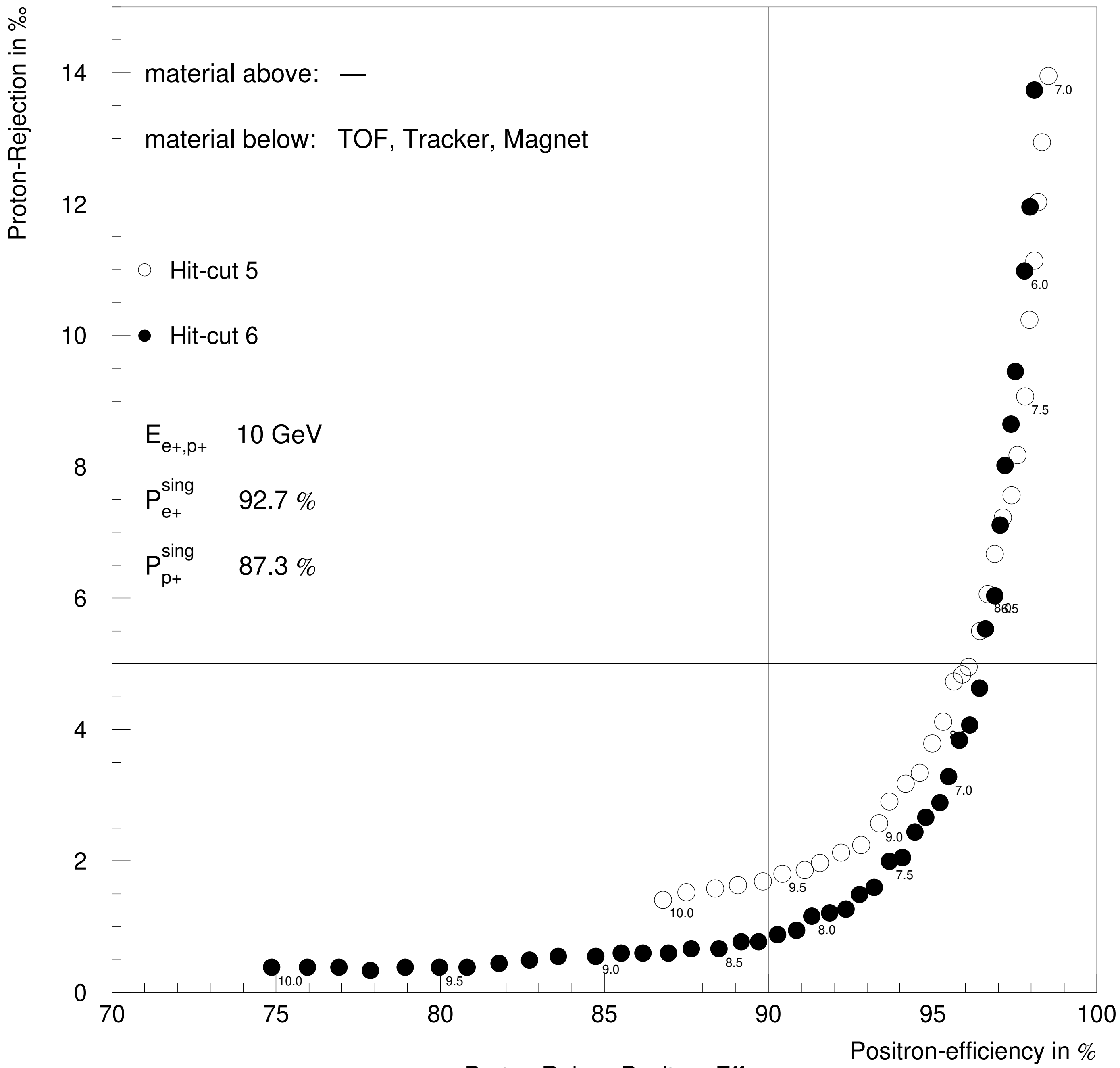
gamma-conversion study





20 layers

10 GeV 23mm Rad 20 Lay SRD 0 MC-generator

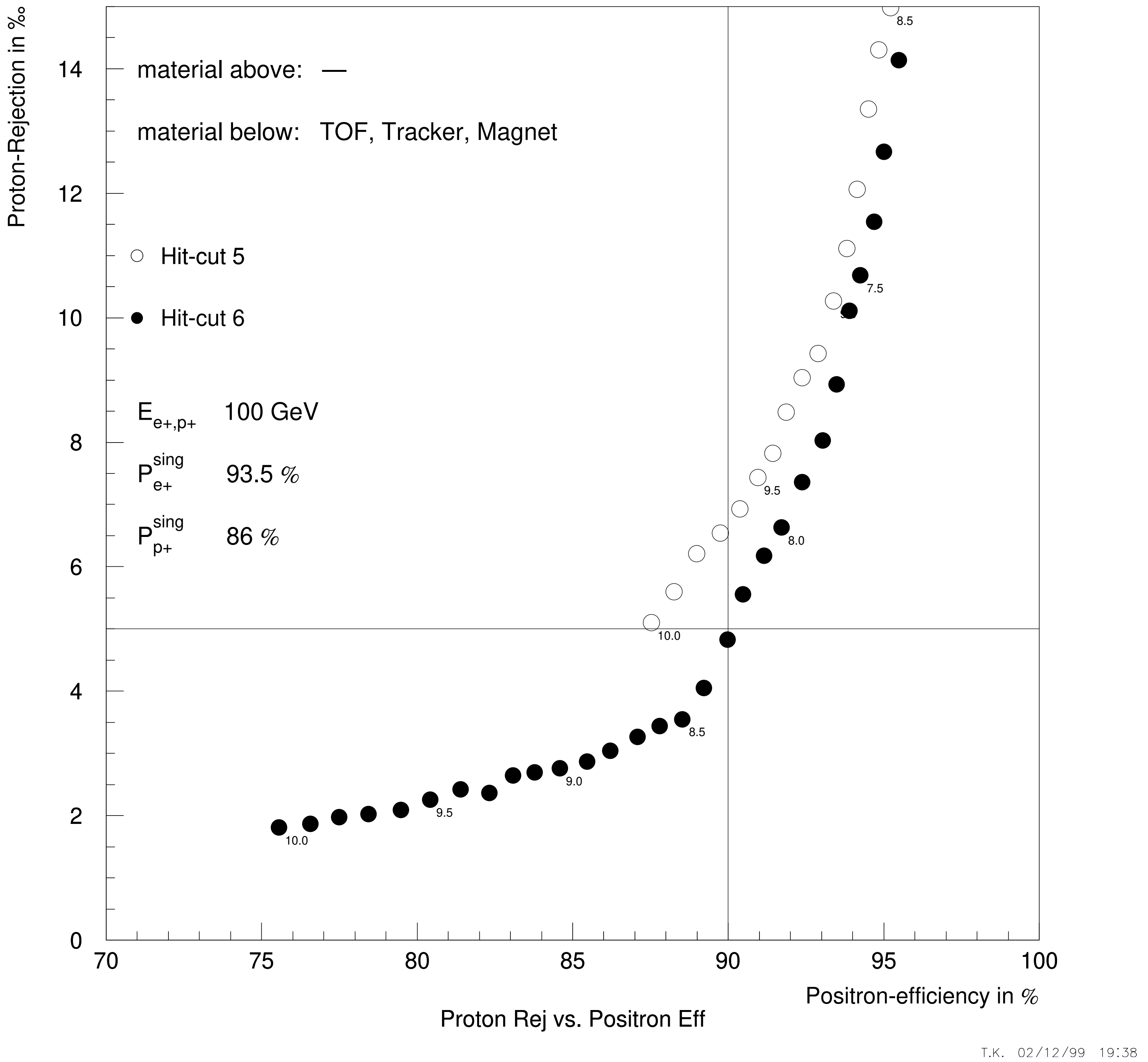


Proton Rej vs. Positron Eff

T.K. 02/12/99 19:37

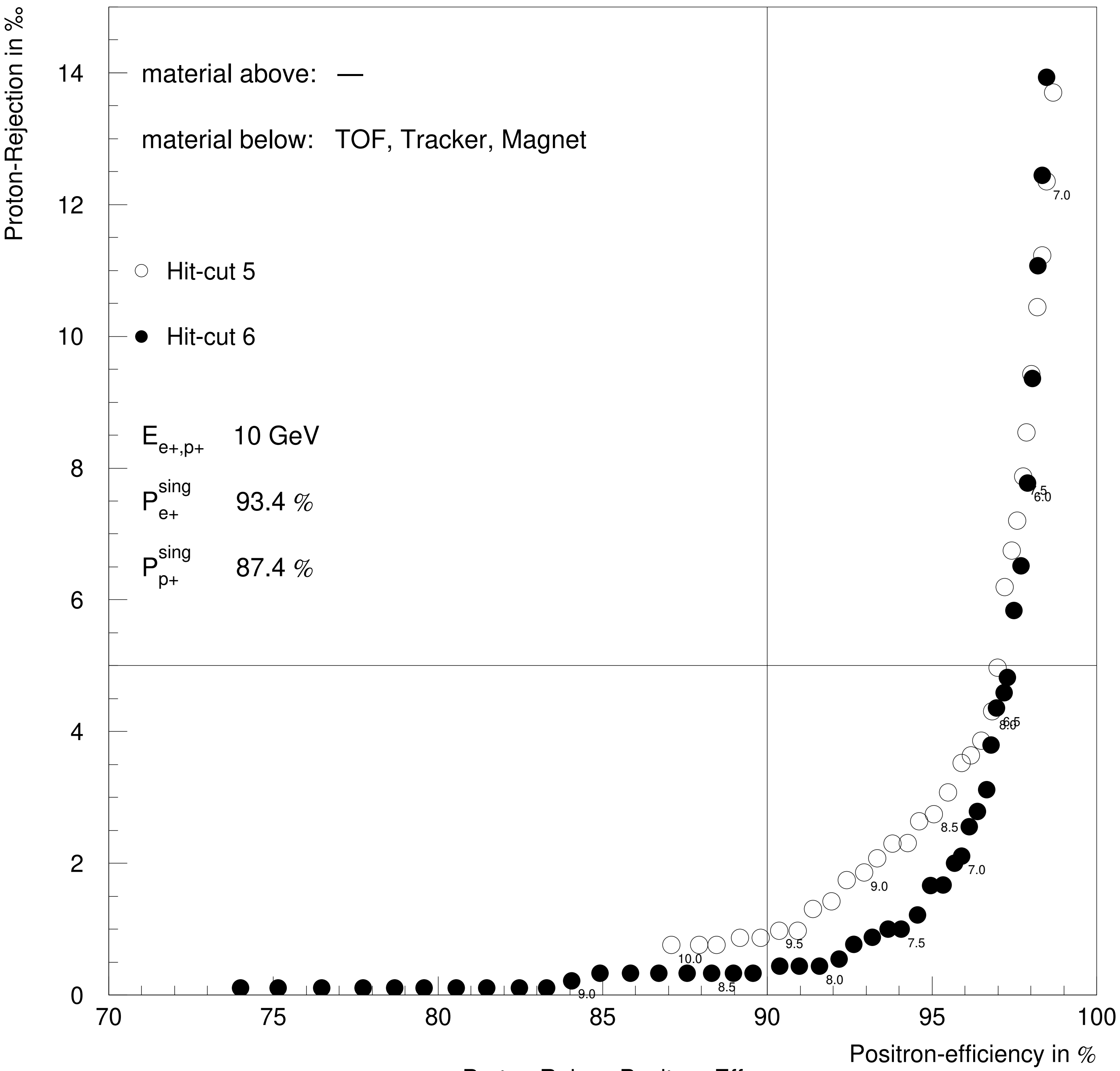
20 layers

100 GeV 23mm Rad 20 Lay SRD 0 MC-generator



3,4 17,18 crossed

10 GeV 23mm Rad 20 Lay SRD 0 MC-generator Xsd

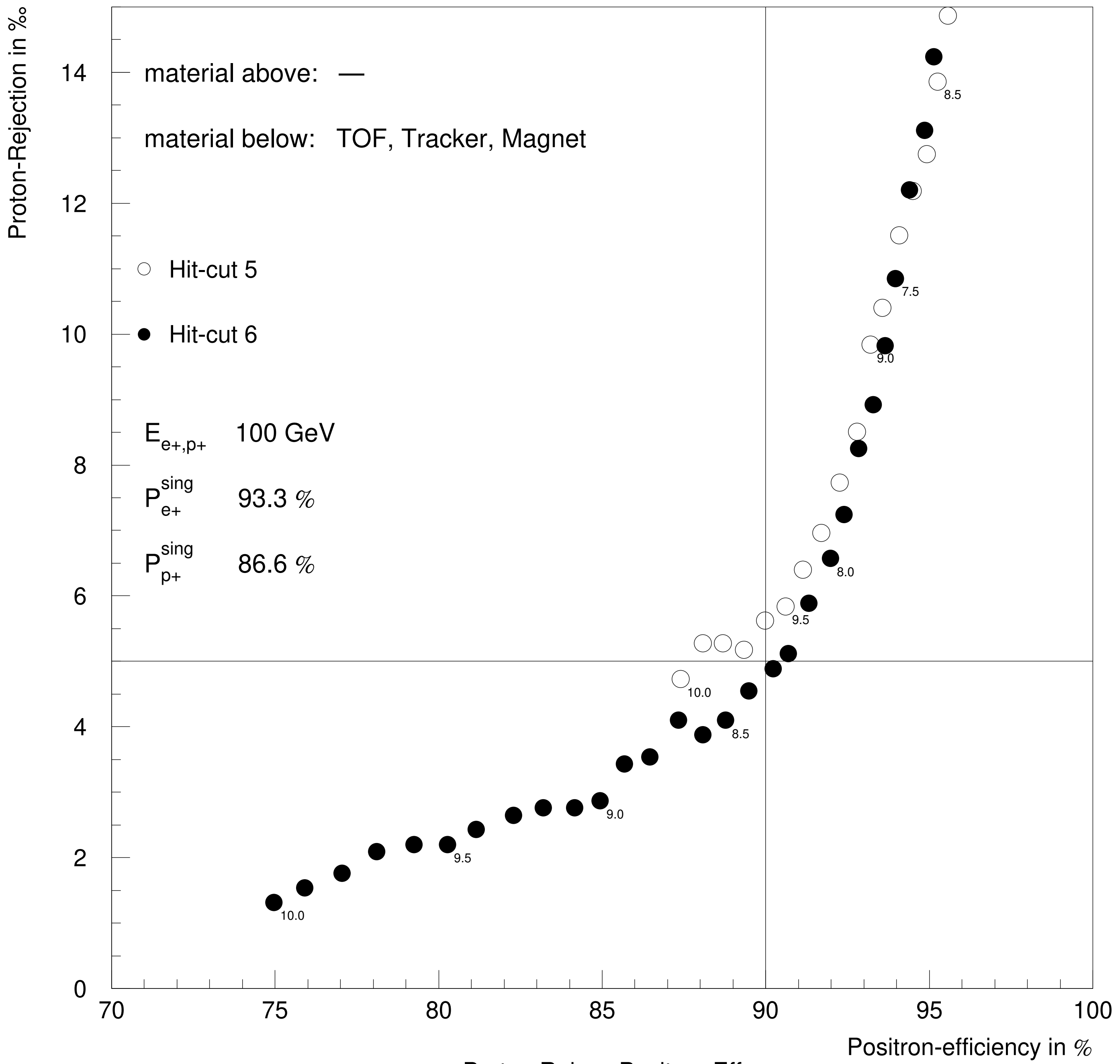


Proton Rej vs. Positron Eff

T.K. 02/12/99 19:37

3,4 17,18 crossed

100 GeV 23mm Rad 20 Lay SRD 0 MC-generator Xsd

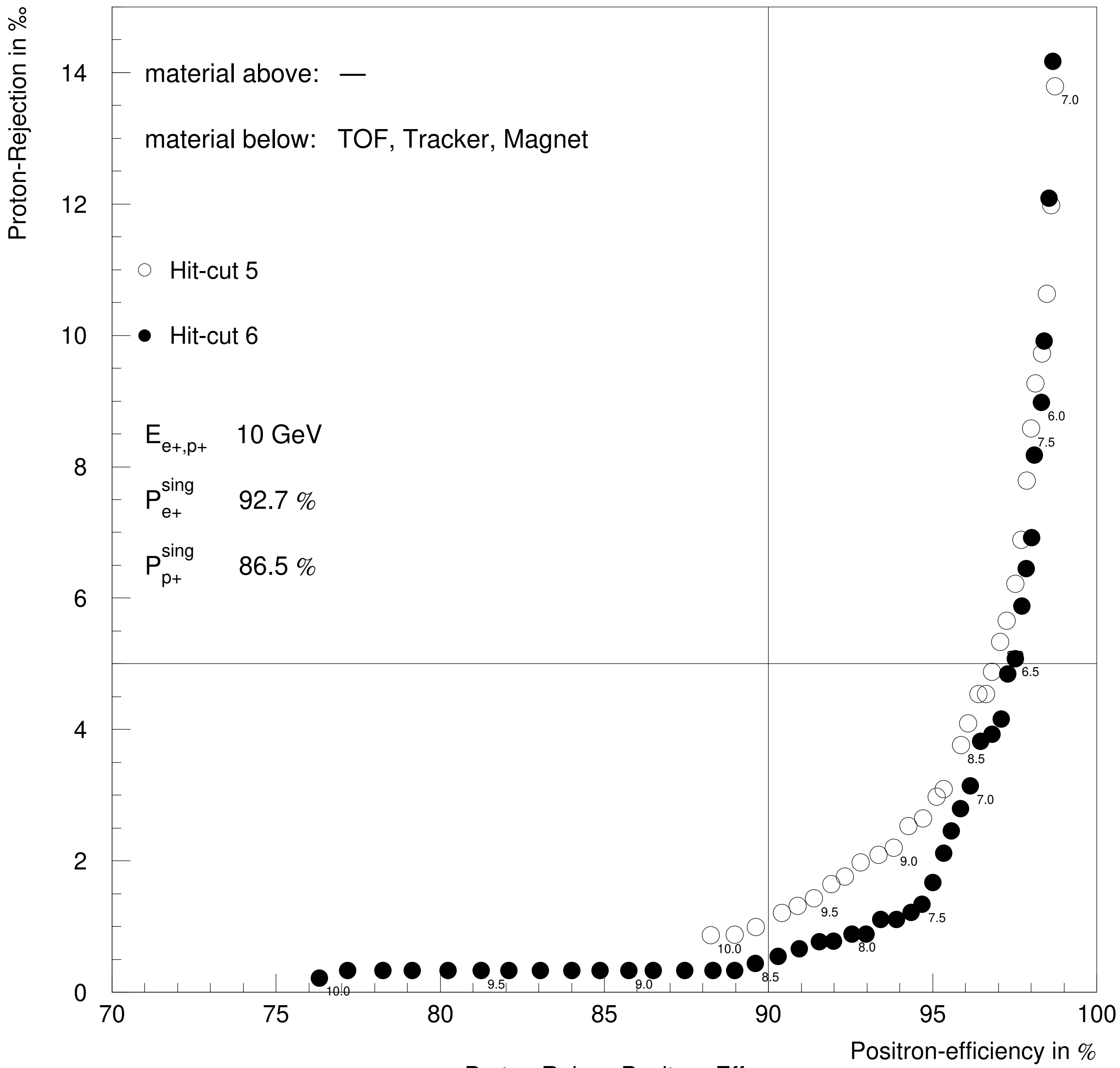


Proton Rej vs. Positron Eff

T.K. 02/12/99 19:38

3,4 17,18 crossed + 4 x 10mm Rad

10 GeV 23mm Rad 20 Lay SRD 0 MC-generator Xsd

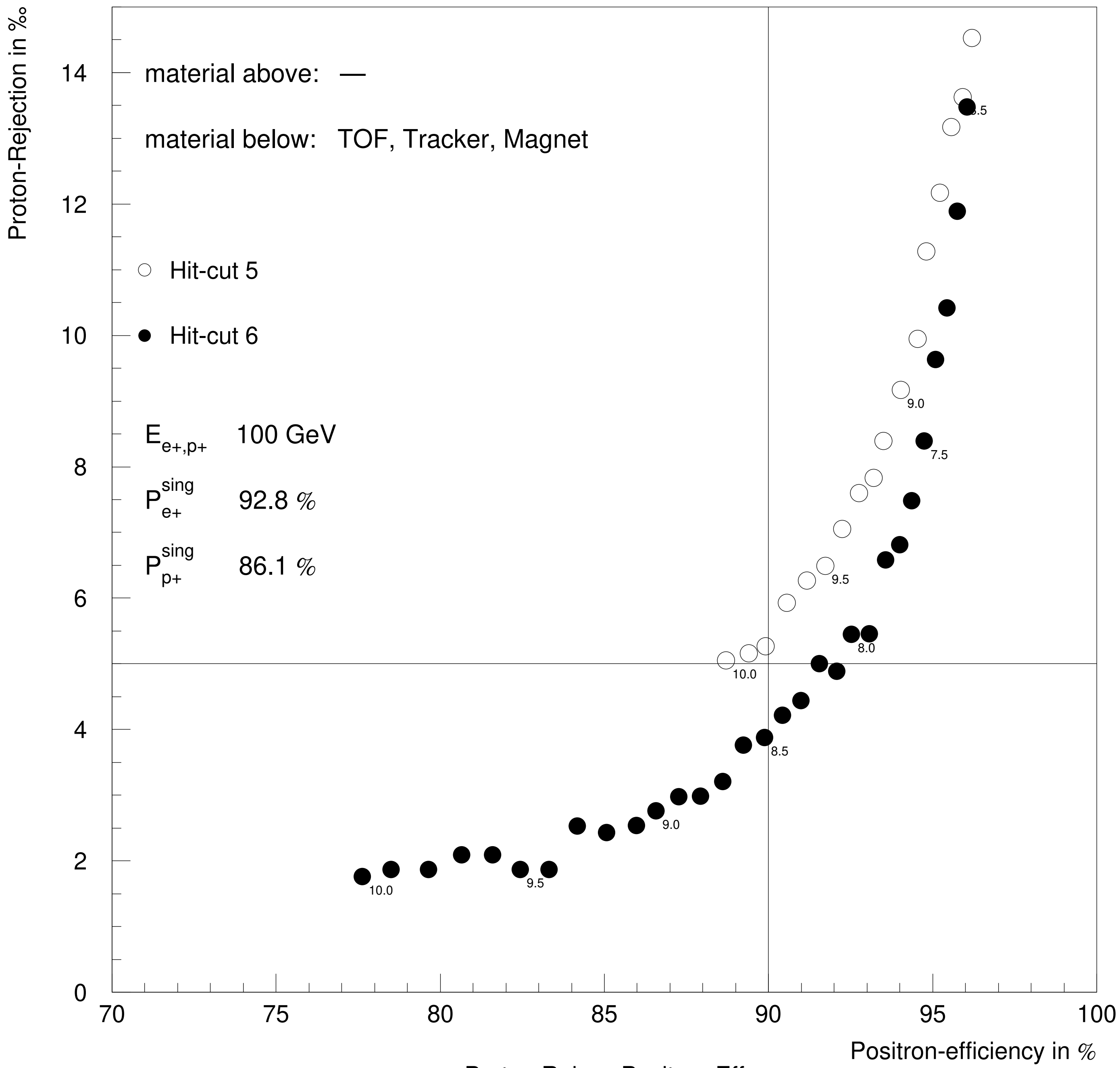


Proton Rej vs. Positron Eff

T.K. 02/12/99 19:37

3,4 17,18 crossed + 4 x 10mm Rad

100 GeV 23mm Rad 20 Lay SRD 0 MC-generator Xsd



Proton Rej vs. Positron Eff

T.K. 02/12/99 19:38