TOF700 MC Efficiency

Lalyo Kovachev

MC TOF700 Particle Identification

GEM tracks from tracking group (reconstructed MC SIGEM **tracks**)

DCH1 and **DCH1+2 tracks** from **DCH** group (reconstructed MC **tracks**)

DCH1 denotes **all tracks** reconstructed by the **DCH1** chamber and **DCH1+2** is the part of reconstructed tracks which have been matched to the **DCH2 tracks**.

“Good” GEM tracks are extrapolated to the **DCH1** z-position and sorted by cut selection. Each **GEM track** can enter in combination only with a single **DCH track** (the closest one in terms of distance)

“Good” GEM+DCH tracks are extrapolated to the **TOF700** planes and matched against the **TOF700** hits with terms of distance

Criteria and Notations

“Good” GEM tracks – those which pass cut selection.
TrueOverAllHitsRatio >= 0.7

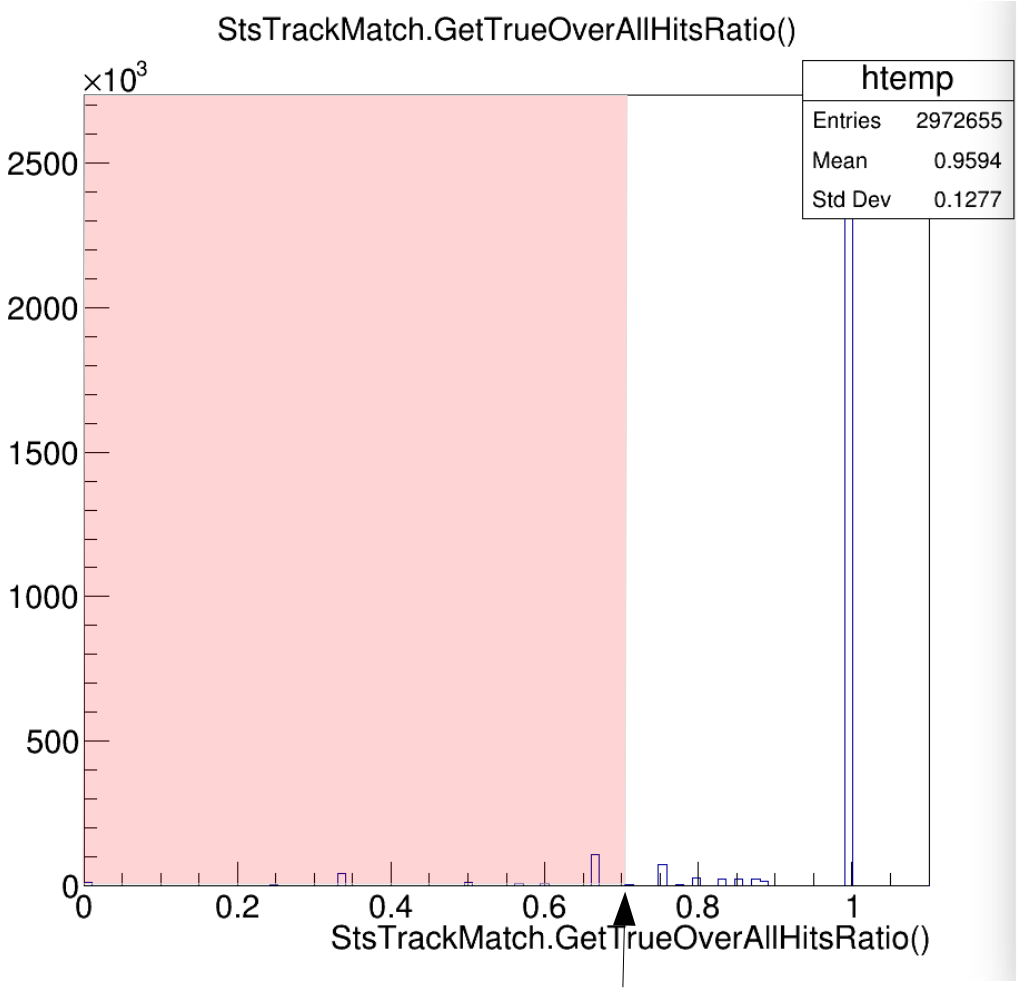
Yuri Petuhkov data cut

```
if (nGemHits < 6  ||
gemX < -140 || gemX > 240 ||
gemY < -40 || gemY > 200 ||
gemTx < -0.5 || gemTx > 1.0 ||
gemTy < -0.1 || gemTy > 0.5 ||
Xpv   < -3.5  || Xpv   > 4.0 ||
Ypv   < -1.0  || Ypv > 6.0 ||
Qp == 0.0  ||   1.0/TMath::Abs(Qp) > 15.0 || 1.0/TMath::Abs(Qp) < 0.15 ||
gemZ < 500)  continue;
```

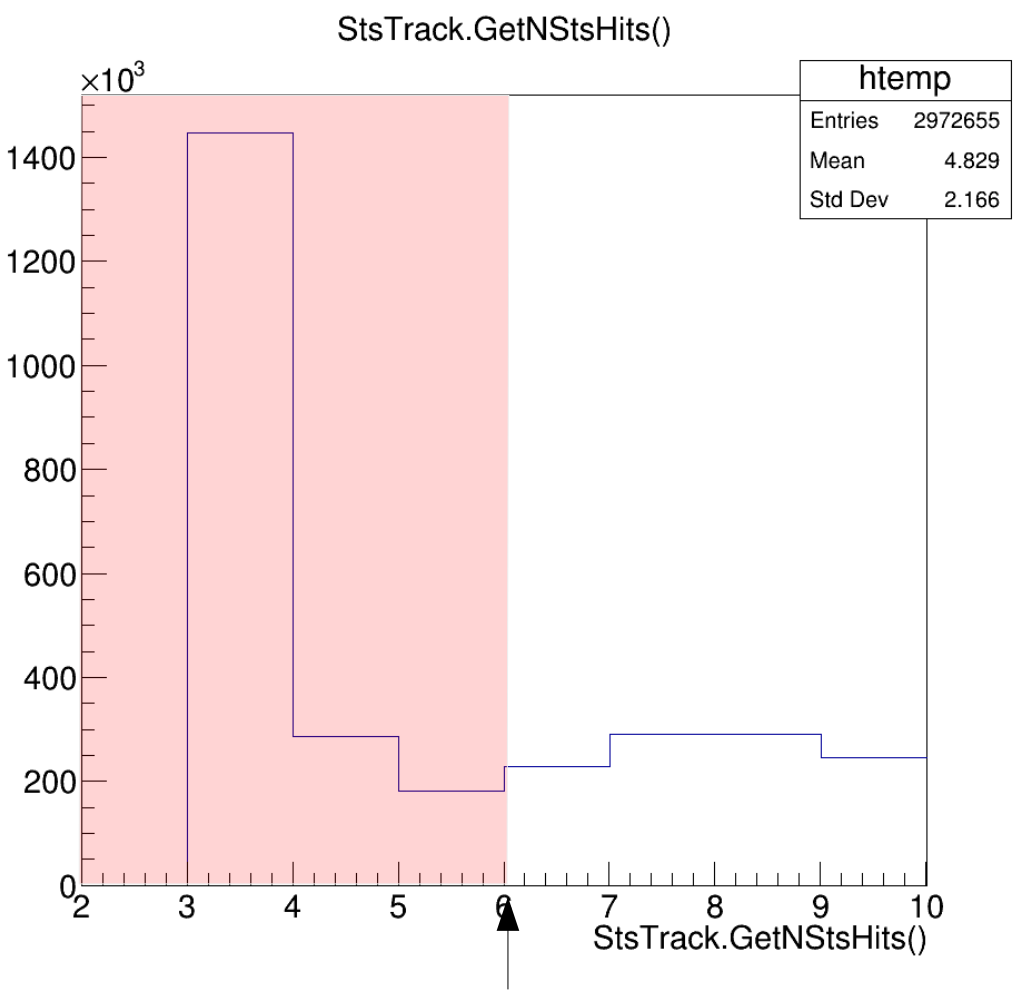
Matching criteria:
“Good” GEM+DCH tracks – those which pass cut selection.
Abs(Dx)<2 and Abs(Dy)<1 cm

“Good” GEM+DCH tracks+TOF700 hits matching criteria:
track and hit pairs are sorted in a multimap by minimum distance, unique pairs are selected **MAX distance cut ~7 cm**

“Good” Gem Tracks



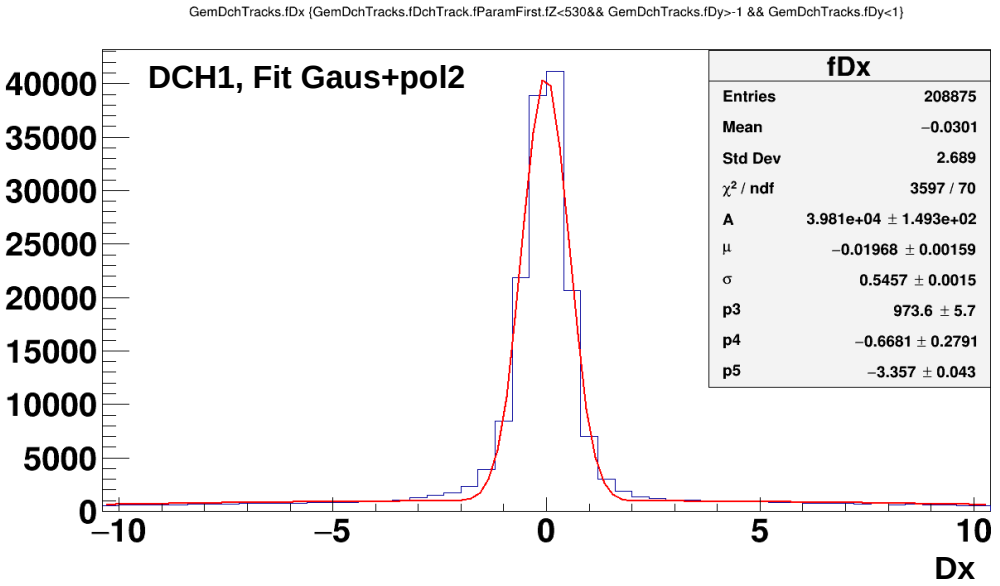
TrueOverAllHitsRatio >= 0.7

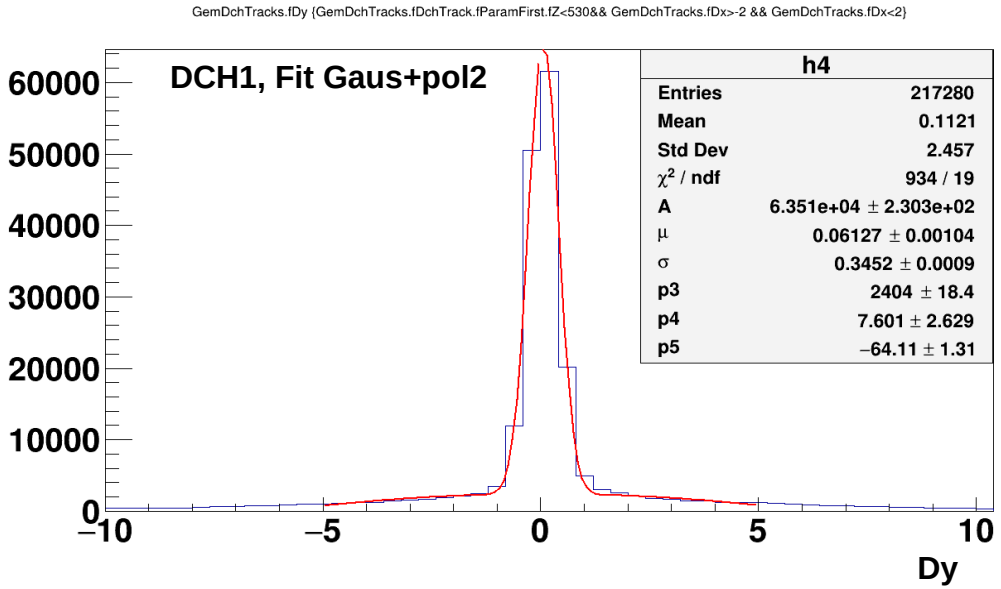


Minimum 6 SIGEM hits

“Good” GEM tracks are 35.17% of all GEM tracks

GEM-DCH1 Matching Criteria





Function: Gaus + pol2

Dx-peak is situated in interval of ±2cm

Dy-peak is between ±1cm

Dx σ ~ 0.54

Dy σ ~ 0.34

Matching criteria: **Abs(Dx)<2 and Abs(Dy)<1 cm**

Notations

$N_{\text{gem trs}}$ GEM tracks (reconstructed MC gem tracks)

$N_{\text{good gem trs}}$ ”Good” GEM tracks (those which pass cut selection)

$N_{\text{dch trs}}$ **DHC** tracks (reconstructed MC DCH1 tracks)

$N_{\text{w. all dch tr}}$ GEM tracks with a least 1 **DCH1** track

$N_{\text{w. dch tr}}$ ”Good” GEM tracks a least 1 **DCH1** track

$N_{\text{matched trs}}$ GEM tracks extrap. to **DCH1** and **matched** to **DCH1** tracks

$N_{\text{true matched trs}}$ GEM tracks mathched to **DCH1** tracks and belong to the **same MC track (id)**

DCH1 Efficiency

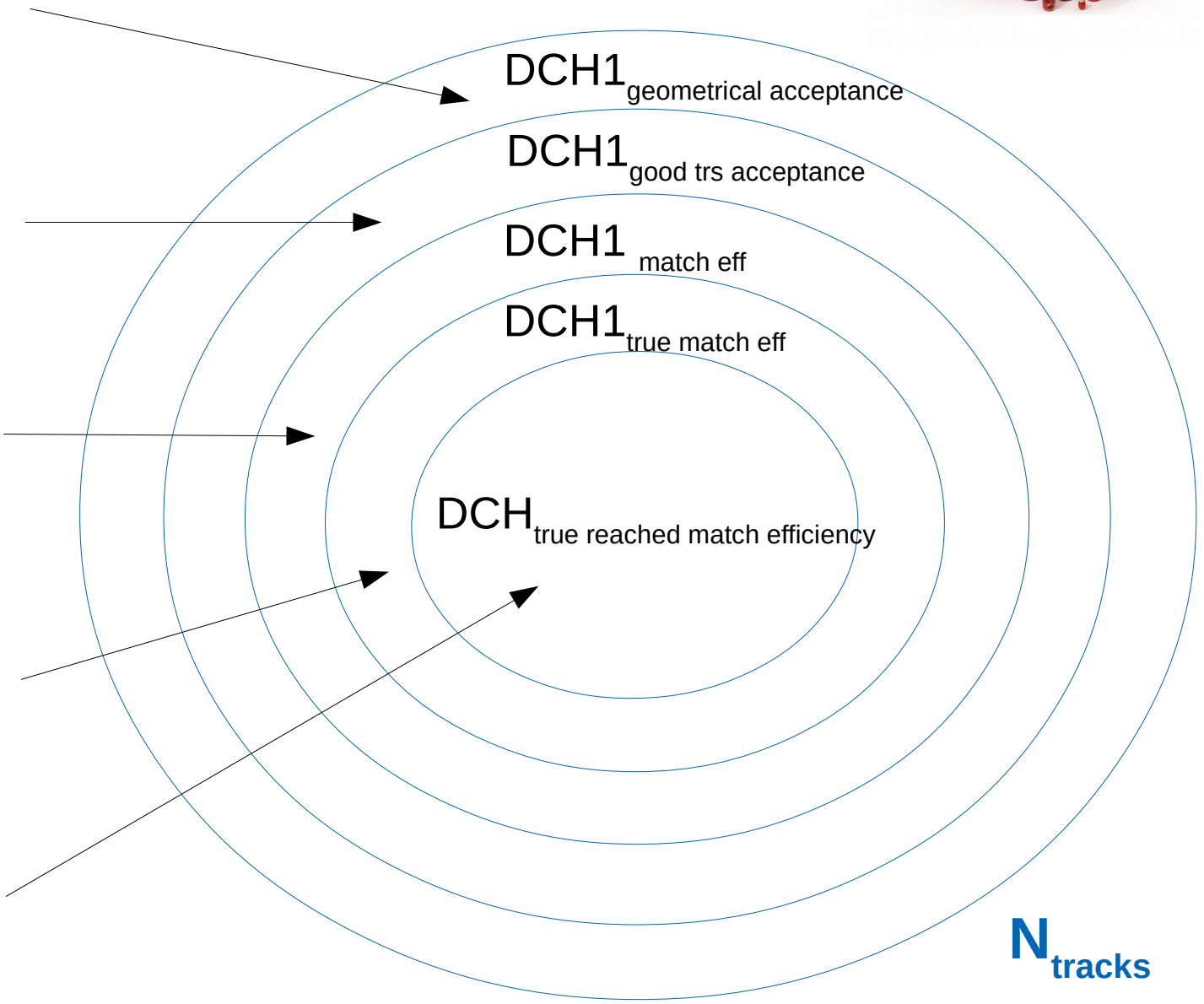
$$E_{geom\,acc} = \frac{N_{w.\,all\,dch\,tracks}}{N_{gem\,tracks}}$$

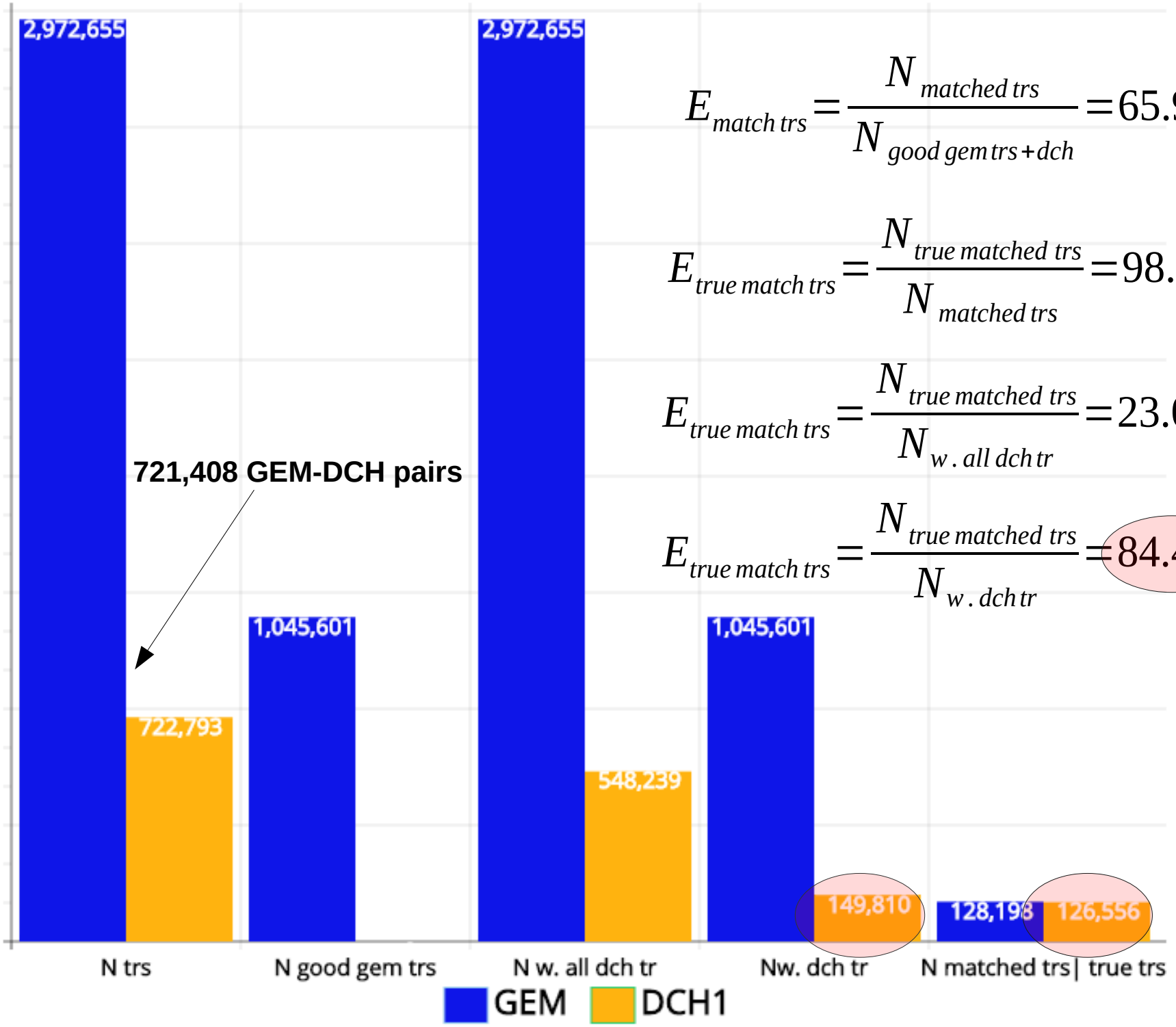
$$E_{goodtrs\,acc} = \frac{N_{w.\,dch\,tracks}}{N_{w.\,all\,dch\,tracks}}$$

$$E_{match\,trs} = \frac{N_{matched\,trs}}{N_{good\,gem\,trs+dch}}$$

$$E_{true\,match\,trs} = \frac{N_{true\,matched\,trs}}{N_{matched\,trs}}$$

$$E_{true\,match} = \frac{N_{true\,matched\,trs}}{N_{???}}$$





$$E_{match\ trs} = \frac{N_{matched\ trs}}{N_{good\ gem\ trs+dch}} = 65.9\,\%$$

$$E_{true\ match\ trs} = \frac{N_{true\ matched\ trs}}{N_{matched\ trs}} = 98.7\,\%$$

$$E_{true\ match\ trs} = \frac{N_{true\ matched\ trs}}{N_{w.\ all\ dch\ tr}} = 23.08\,\%$$

$$E_{true\ match\ trs} = \frac{N_{true\ matched\ trs}}{N_{w.\ dch\ tr}} = 84.4\,\%$$

Notations

$N_{\text{gem trs}}$ GEM tracks (reconstructed MC gem tracks)

$N_{\text{w. tof points}}$ GEM tracks with a least 1 MC **point** in TOF700

$N_{\text{w. all tof hit}}$ GEM tracks with a least 1 **hit** TOF700

$N_{\text{w. tof hit}}$ ”Good” GEM tracks with a least 1 **hit** TOF700

$N_{\text{good trs}}$ GEM+DCH tracks extrap. to TOF700 and passed cut

$N_{\text{matched trs}}$ GEM tracks extrap. to TOF700 and **matched** to hits

$N_{\text{true matched trs}}$ GEM tracks mathched to TOF700 hits and belong to the **same MC track (id)**

TOF700 Efficiency

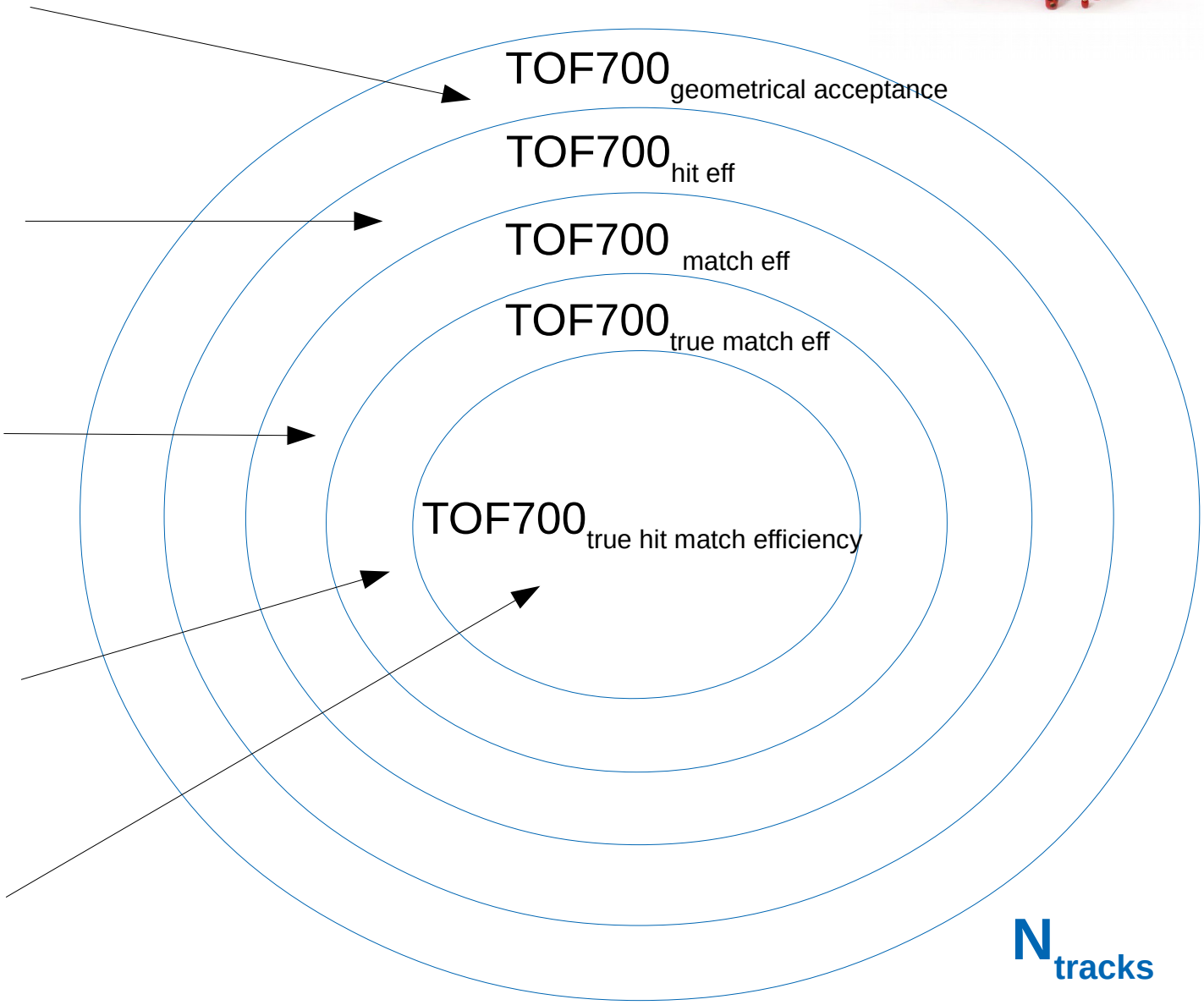
$$E_{geom\,acc} = \frac{N_{w.\,tof\ points}}{N_{gem\,tracks}}$$

$$E_{hit} = \frac{N_{w.\,tof\ hit}}{N_{w.\,tof\ points}}$$

$$E_{match\,trs} = \frac{N_{matched\ trs}}{N_{good\,trs}}$$

$$E_{true\,match\,trs} = \frac{N_{true\,matched\,trs}}{N_{good\,trs}}$$

$$E_{true\,hit\,match} = \frac{N_{true\,matched\,trs}}{N_{???}}$$



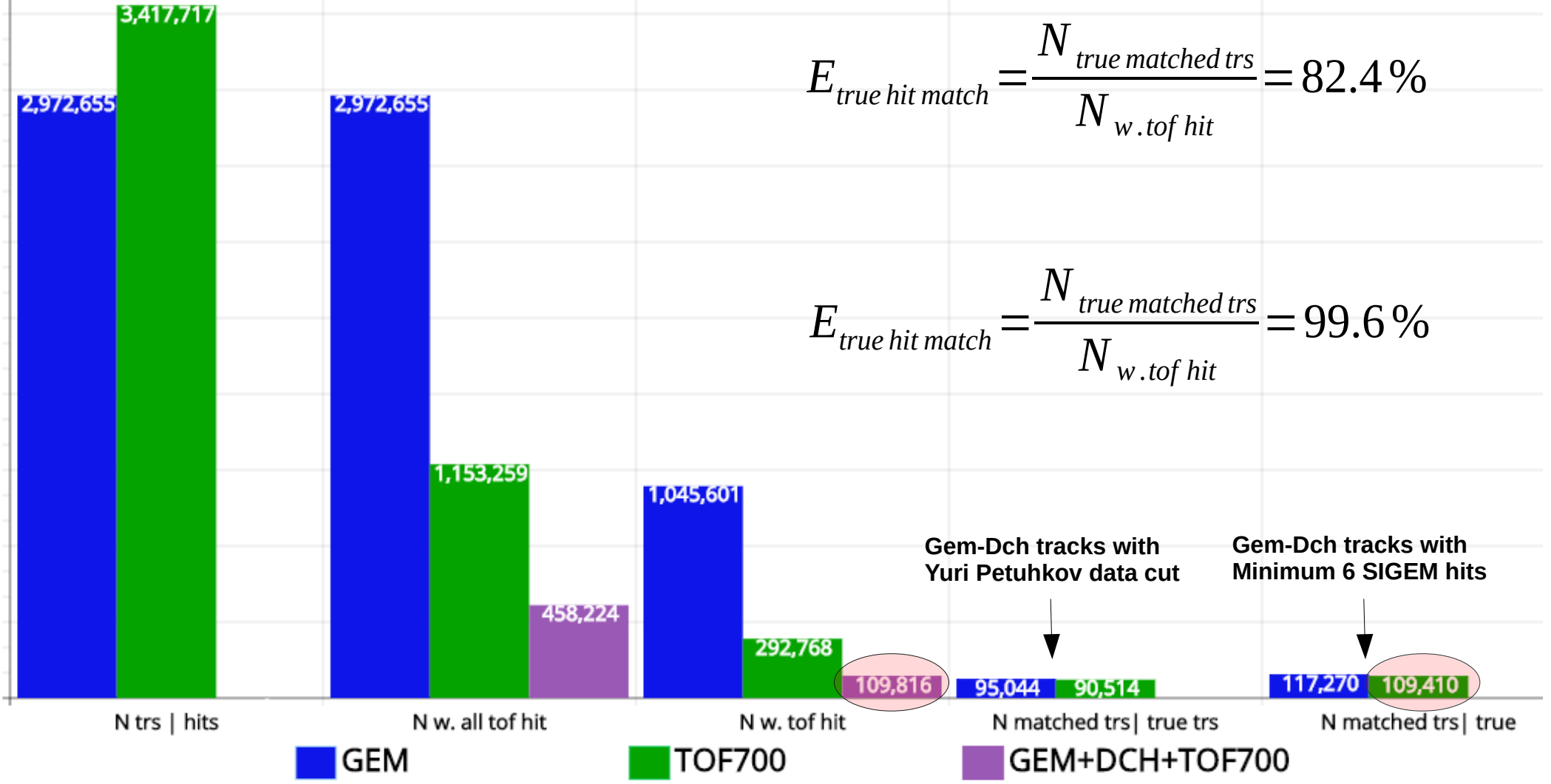
$$E_{match\ trs} = \frac{N_{matched\ trs}}{N_{good\ trs}} = 76.8\,\%$$

$$E_{true\ match\ trs} = \frac{N_{true\ matched\ trs}}{N_{good\ trs}} = 95.2\,\%$$

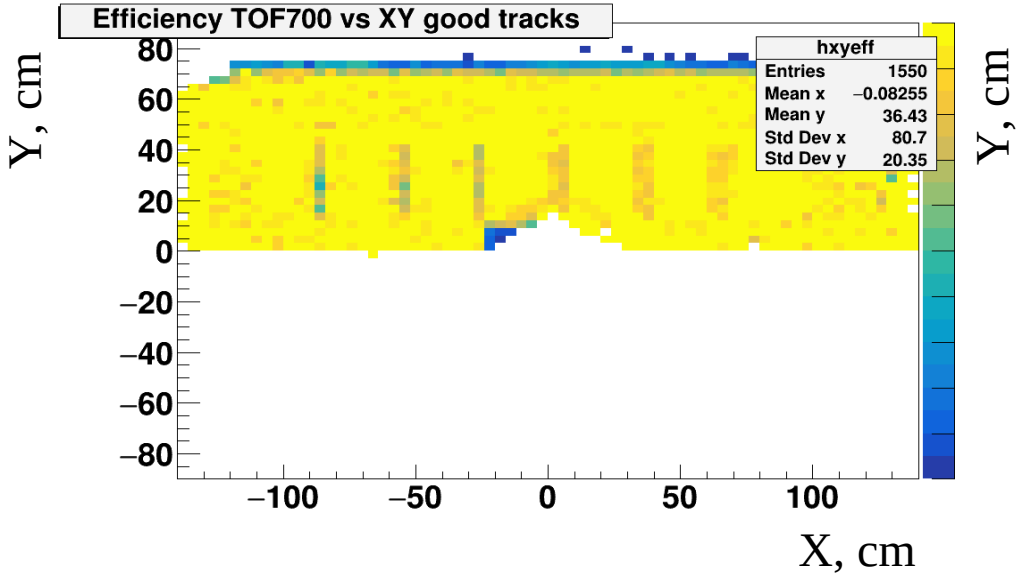
$$E_{true\ hit\ match} = \frac{N_{true\ matched\ trs}}{N_{w.\ all\ tof\ hit}} = 21.8\,\%$$

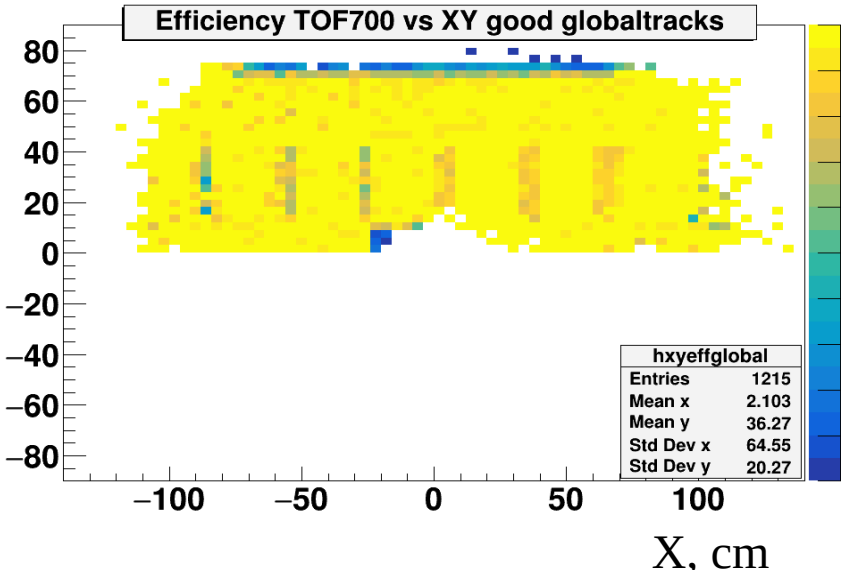
$$E_{true\ hit\ match} = \frac{N_{true\ matched\ trs}}{N_{w.\ tof\ hit}} = 82.4\,\%$$

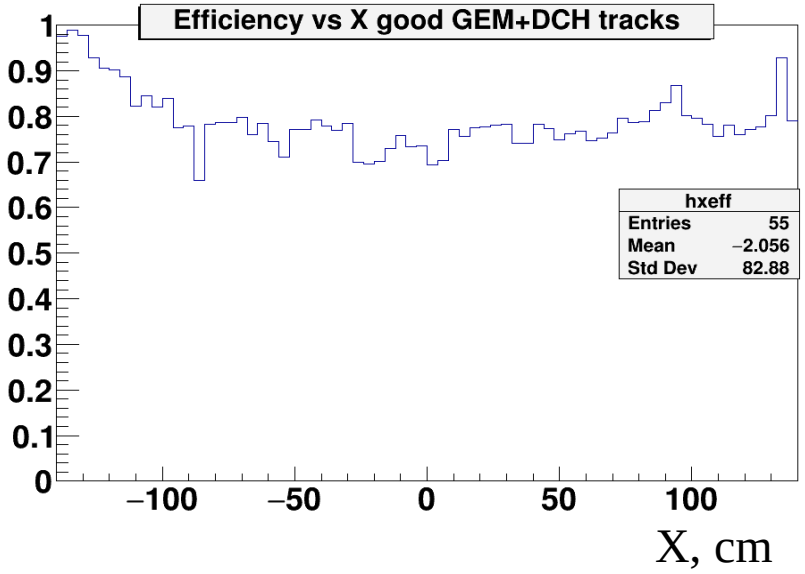
$$E_{true\ hit\ match} = \frac{N_{true\ matched\ trs}}{N_{w.\ tof\ hit}} = 99.6\,\%$$

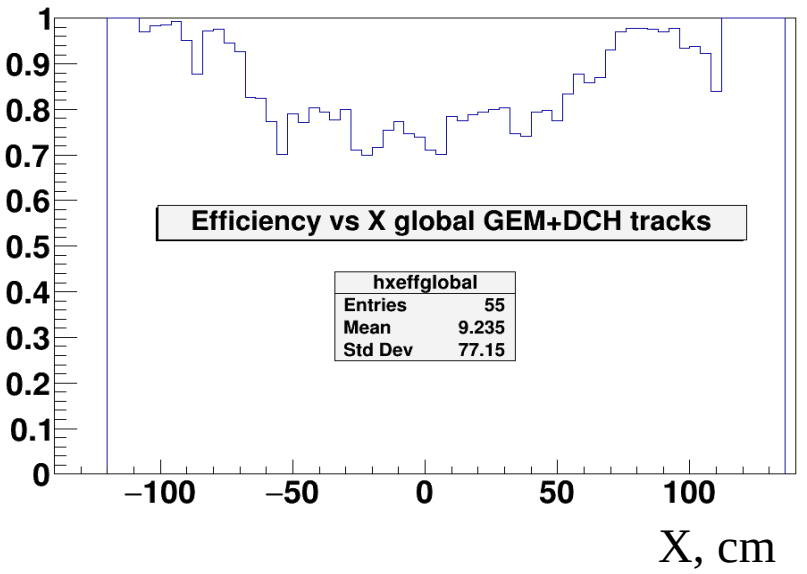


TOF700 Efficiency vs XY









Efficiency is good enough. Small edge effect.