

TOFGoodMatch cut for event preselection

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Analysed data: ISS.B584/2ecal2 stream

Total runs: 20,382

Total events: 182,915,850

Cuts from file select_4.C

TOFGoodMatch cut → revised

1. **protons** selected using TRD-S likelihood and positive rigidity:
 $lk_{ep} > 0.8 \ \&\& \ lk_{pHe} > 0.25 \ \&\& \ R > 0$

2. **electrons** selected using TRD-S likelihood, ECAL BDT and negative rigidity:
 $lk_{ep} < 0.54 \ \&\& \ lk_{eHe} < 0.55 \ \&\& \ BDT \ (90\% \ eff.) \ \&\& \ R < 0$

TOFGoodMatch cut (revised)



```
bool TOFGoodMatch(AMSEventR *pev, TrTrackR *this_track){
    if ( !pev || !this_track ) return false;

    bool goodlayer[4] = { false, false, false, false };
    float LONGCUT[4][10]={18.5,15.9,14.1,13.9,14.6,13.3,14.3,17.2,0.,0.,
                          22.,12.,12.2,15.9,12.2,17.6,11.4,20.9,0.,0.,
                          6.8,10.4,10.5,12.,10.6,10.7,11.1,10.1,10.9,14.6,
                          16.6,13.4,11.6,11.2,12.6,10.3,12.6,17.8,0.,0.}; // cm (~100% efficiency cut on tof-track longitudinal coord.)
    float TRANCUT[4][10]={11.5,6.6,6.4,6.8,6.7,6.6,6.7,11.3,0.,0.,
                          13.6,7.1,6.5,6.7,6.6,6.7,6.6,13.8,0.,0.,
                          10.8,6.4,6.7,6.4,6.9,6.6,6.9,6.3,6.9,10.8,
                          14.8,6.6,6.4,6.4,6.3,6.5,6.5,13.7,0.,0.}; // cm (~100% efficiency cut on toftrack transverse coord.)

    double tlen;
    AMSPoint tofpnt;
    AMSDir tofdir;
    int longit[4]={0,1,1,0};
    int tranit[4]={1,0,0,1};
    double dlong,dtran;
    bool goodmatch[4]={false,false,false,false};

    // track match with cluster and check status
    int id=this_track->ITrTrackPar(1,3,1);
    int ilay=0;
    bool good_c = false;

    if(pev->NToFCluster()>0){
        for (int icl=0; icl<pev->NToFCluster(); icl++) {
            tof_cl = pev->pToFCluster(icl);
            if (tof_cl>0) { // cluster exists
                good_c=true;
                int layer=tof_cl->Layer-1;
                int bar=tof_cl->Bar-1;
                // check cluster status
                for (int i = 7; i < 13; ++i) if (((tof_cl->Status >> i) & 1) == 1) good_c = false;
                if (((tof_cl->Status >> 2) & 1) == 1) good_c = false;
                if (((tof_cl->Status >> 4) & 1) == 1) good_c = false;
                if (good_c) goodlayer[layer] = true;
                // check track match with TOF beta clusters
                tlen=this_track->Interpolate(tof_cl->Coo[2],tofpnt,tofdir,id);
                dlong=tof_cl->Coo[longit[layer]]-tofpnt[longit[layer]];
                dtran=tof_cl->Coo[tranit[layer]]-tofpnt[tranit[layer]];
                if(fabs(dlong)<LONGCUT[layer][bar] &&
                    fabs(dtran)<TRANCUT[layer][bar]) goodmatch[layer]=true;
            }
        }
        for (int i=0; i<4; i++) if(goodmatch[i] && goodlayer[i]) ilay++;
    }
    return (ilay==3 || ilay==4);
}
```

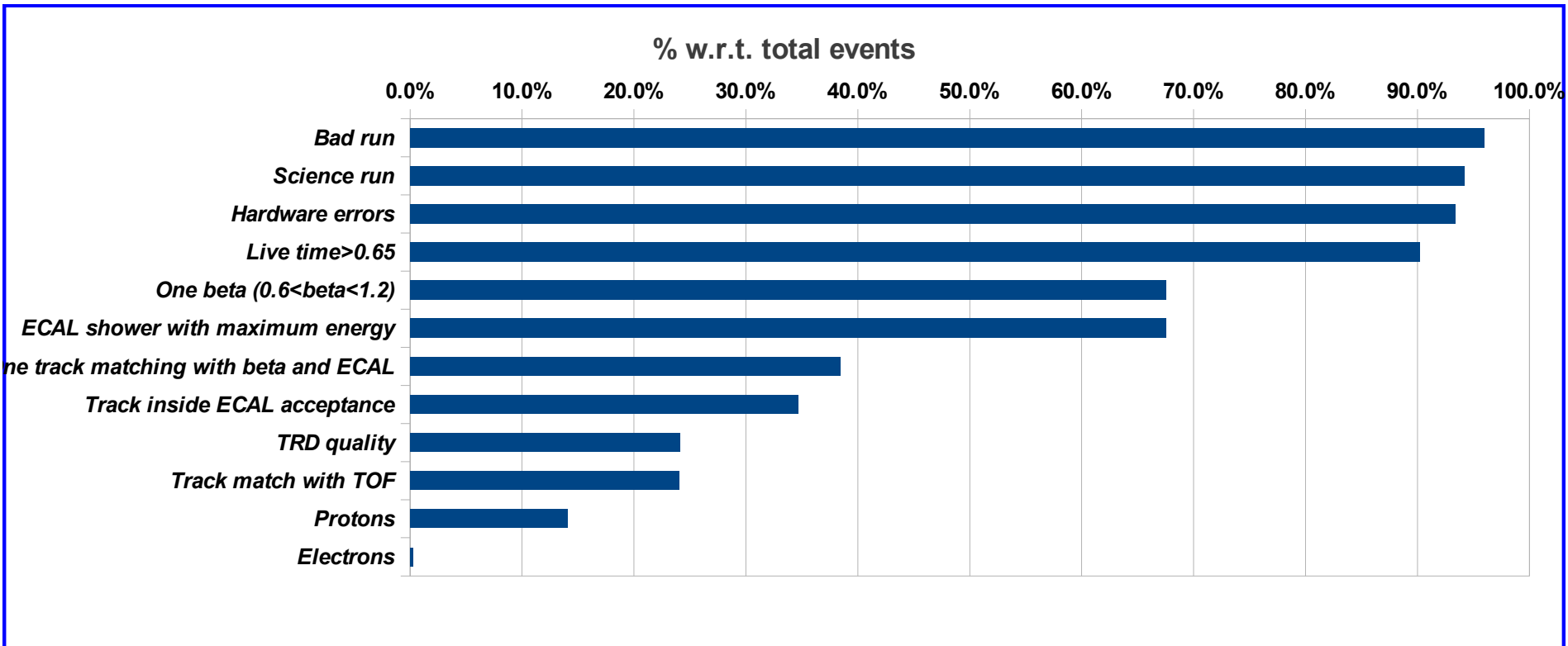
inputs: event and tracker track

Refit with Inner Tracker only

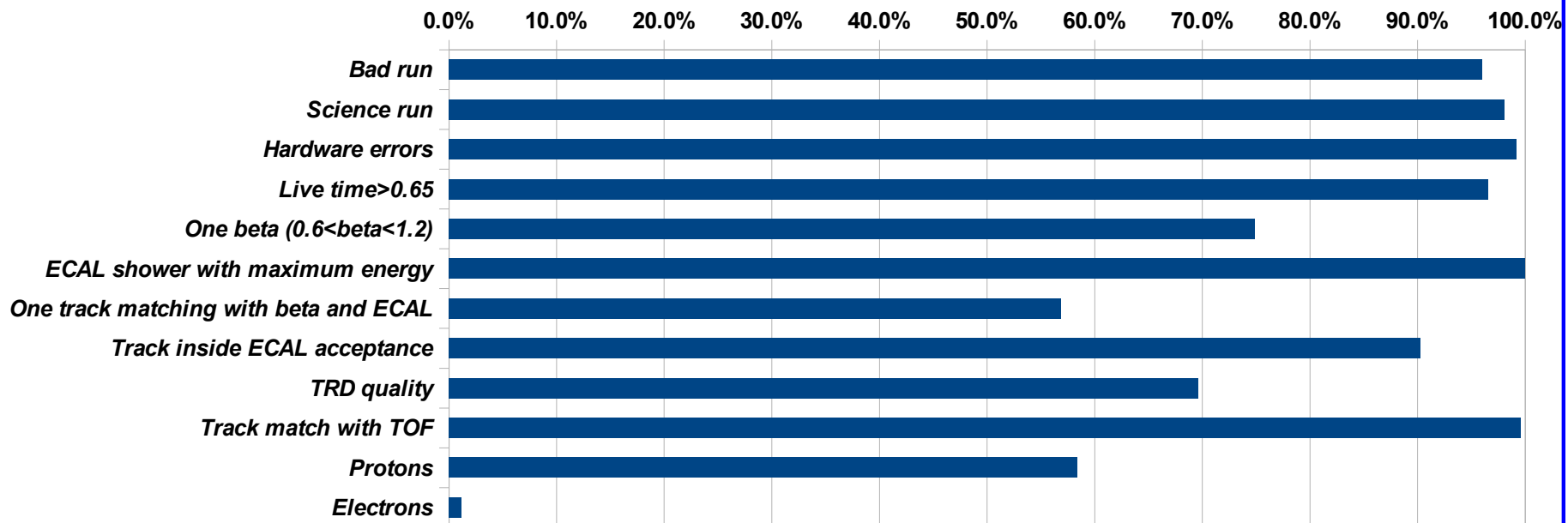
TOF clusters from event

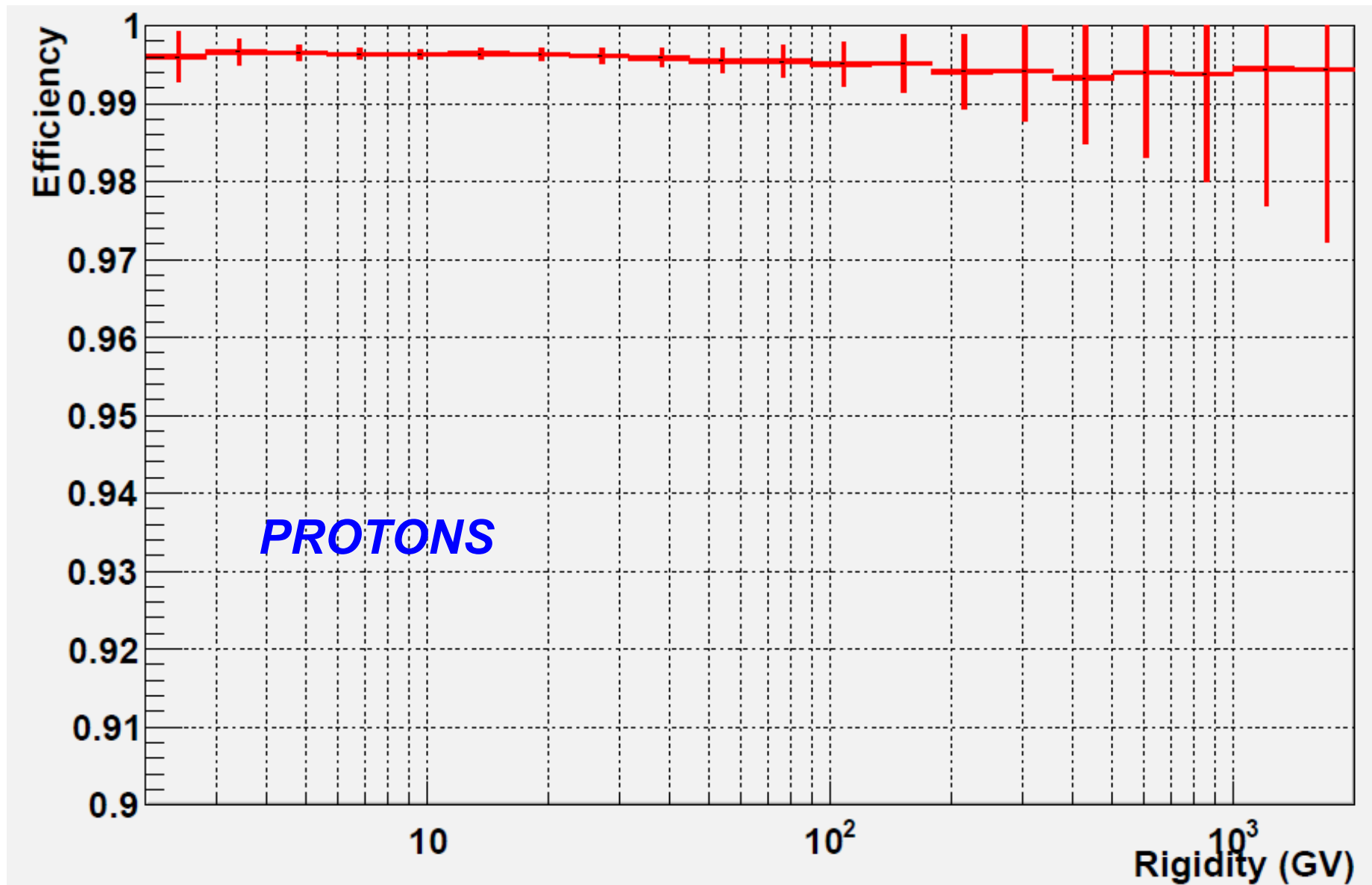
Total events: 182,915,850

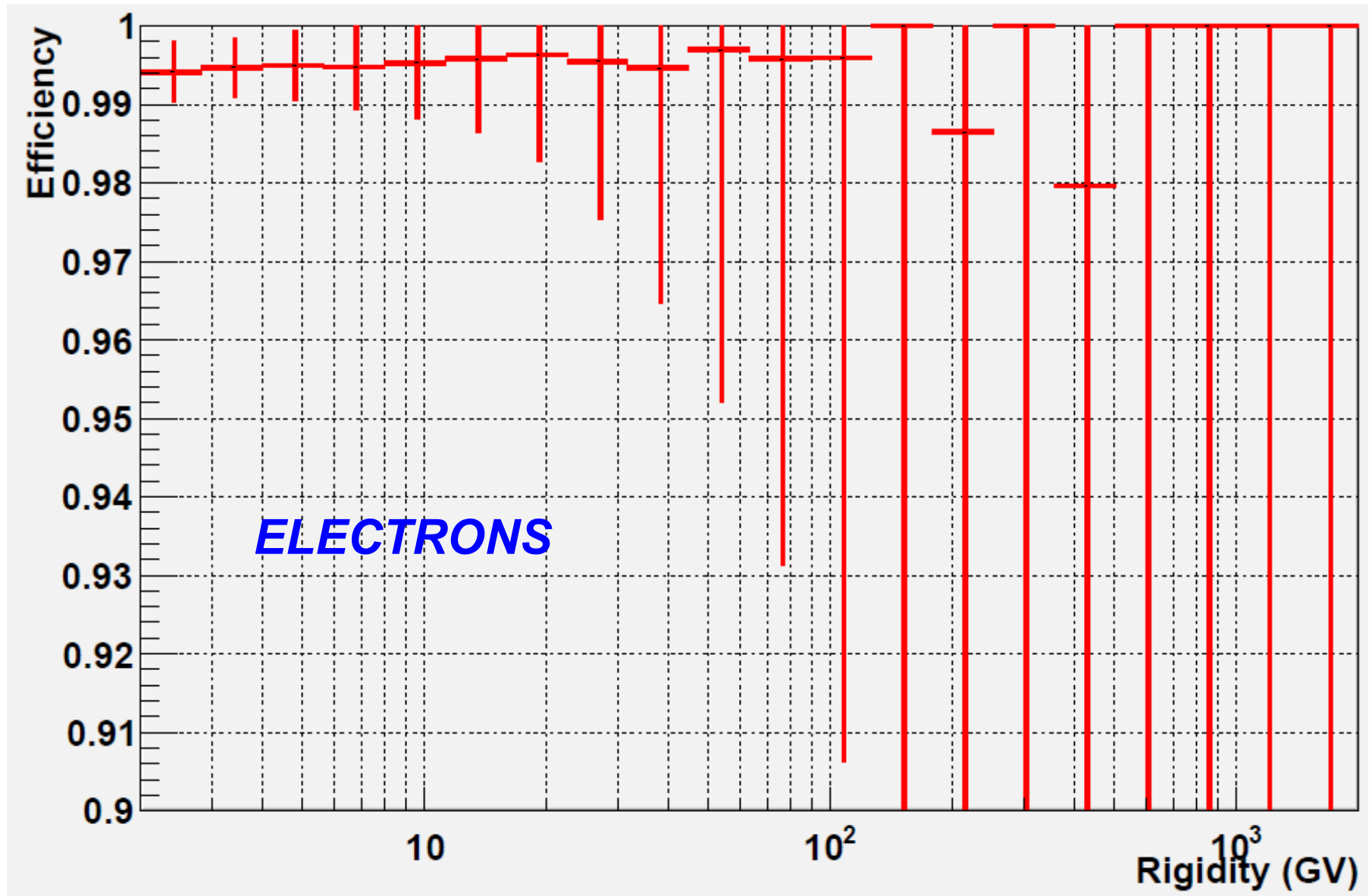
cut	# events	% w.r.t. previous cut	% w.r.t. total events
<i>Bad run</i>	175,623,550	96.0%	96.0%
<i>Science run</i>	172,288,004	98.1%	94.2%
<i>Hardware errors</i>	170,874,814	99.2%	93.4%
<i>Live time>0.65</i>	164,985,607	96.6%	90.2%
<i>One beta (0.6<beta<1.2)</i>	123,519,394	74.9%	67.5%
<i>ECAL shower with maximum energy</i>	123,509,253	100.0%	67.5%
<i>One track matching with beta and ECAL</i>	70,286,818	56.9%	38.4%
<i>Track inside ECAL acceptance</i>	63,444,574	90.3%	34.7%
<i>TRD cuts</i>	44,155,320	69.6%	24.1%
<i>Track match with TOF</i>	43,982,757	99.6%	24.0%
<i>Protons</i>	25,791,911	58.4%	14.1%
<i>Electrons</i>	515,032	1.2%	0.3%



% w.r.t. previous cut







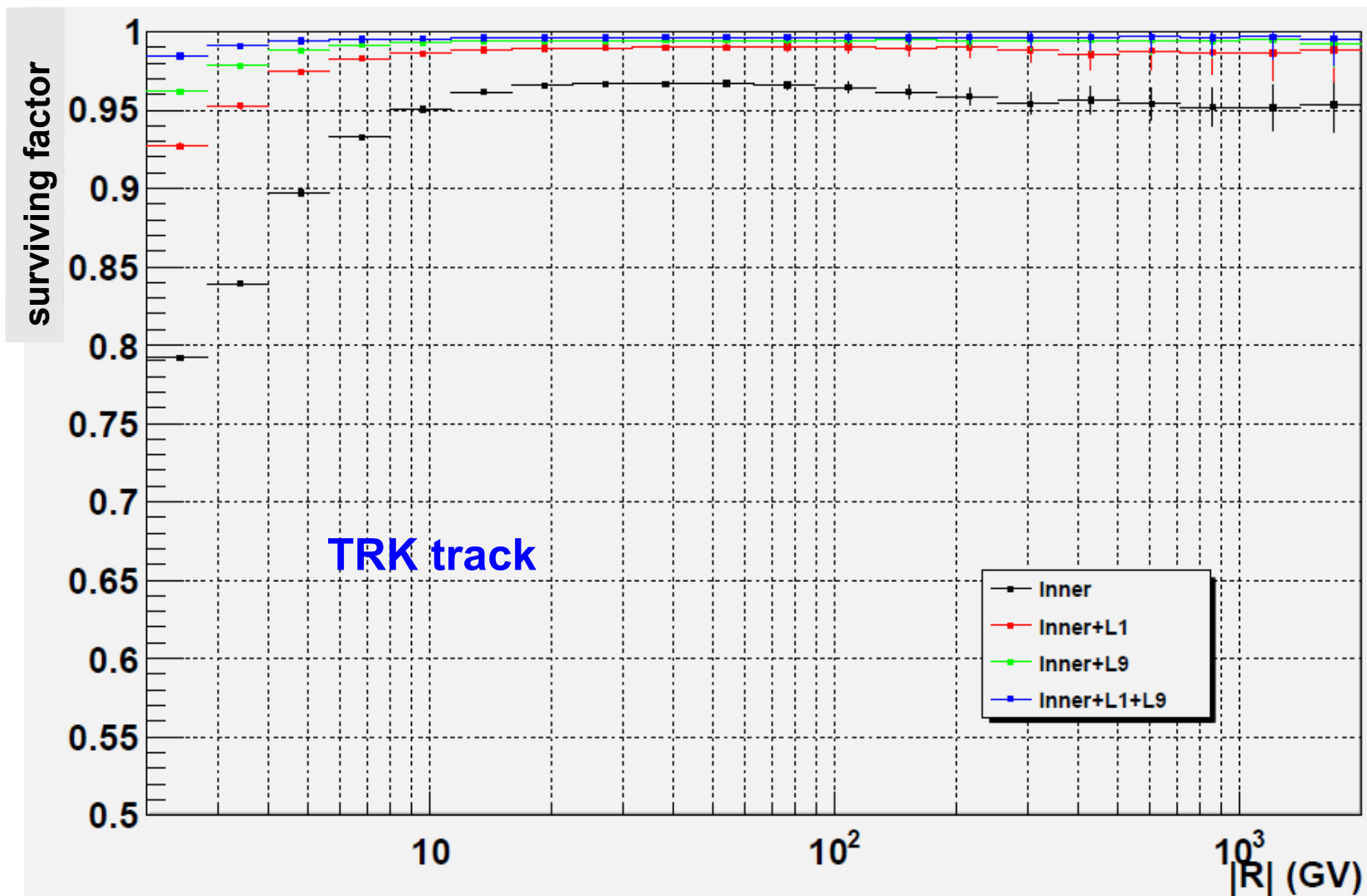
Study of TOFGoodMatch cut with respect to number of Tracker tracks.

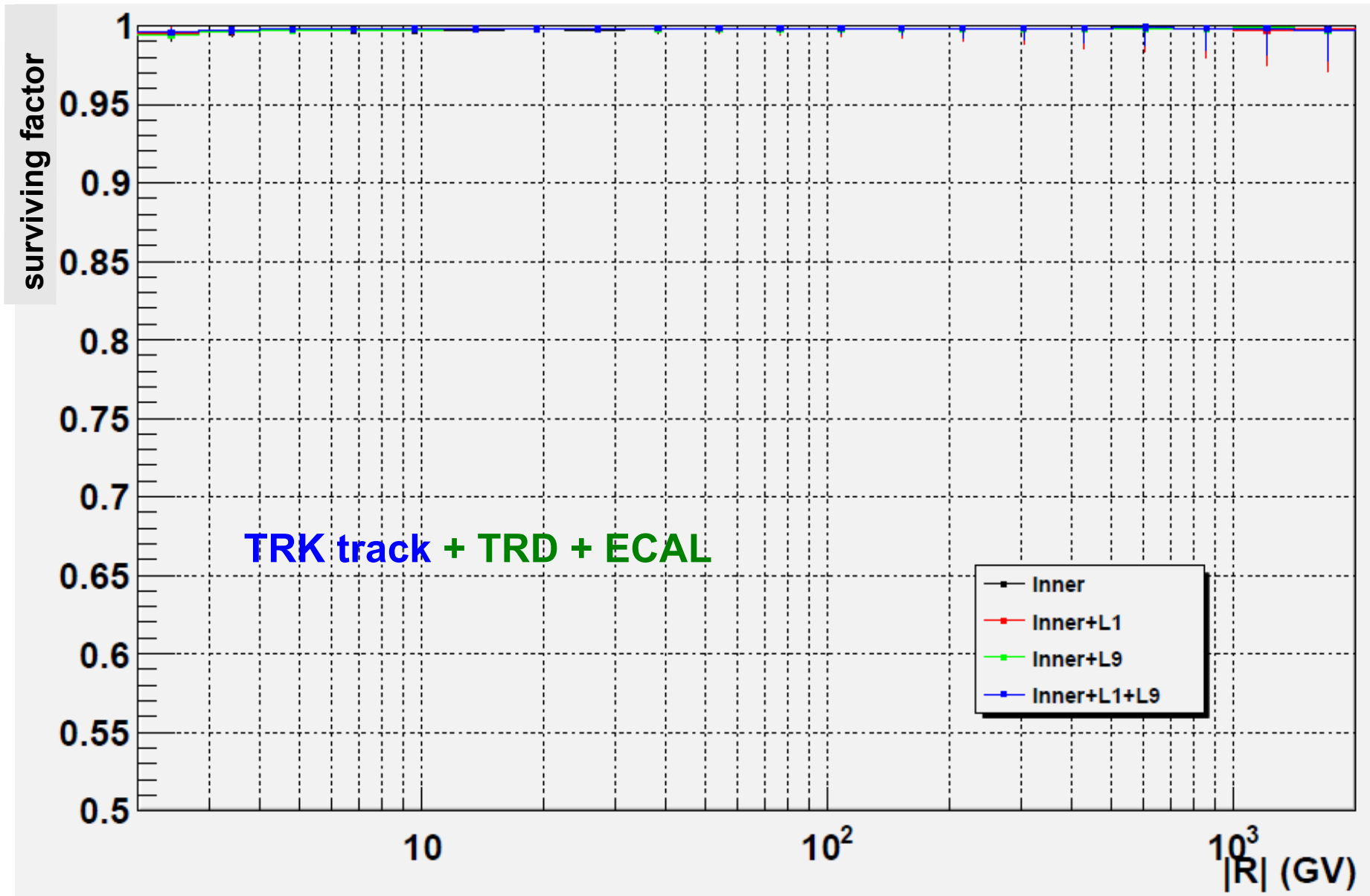
$$\text{surviving factor} = \#(\text{tracks after TOF cut})/\#\text{tracks}$$

The surviving factor due to TOF cut is computed before and after the selection cuts:

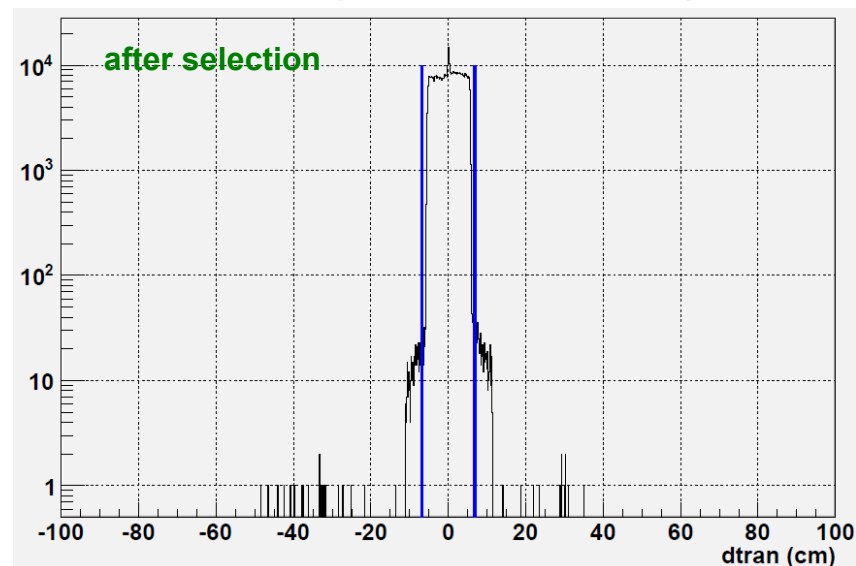
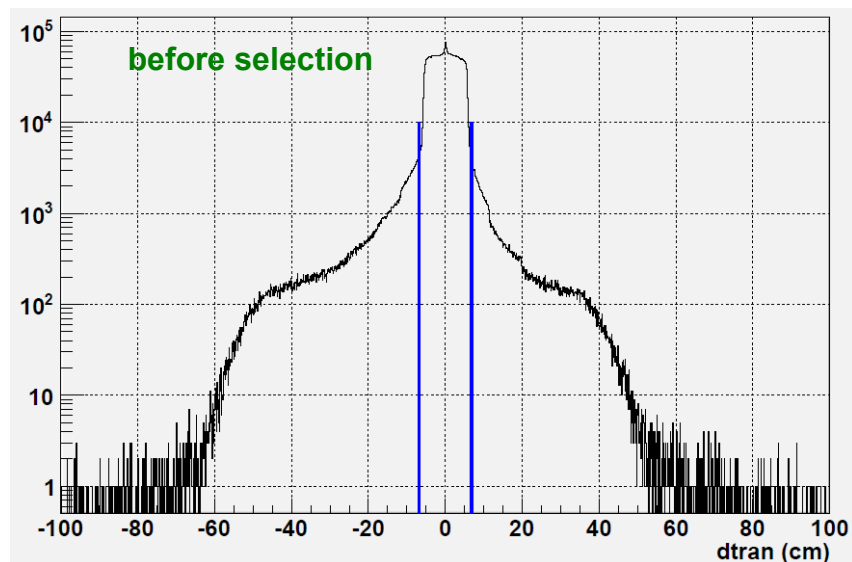
- 1) good Tracker track ($\text{Chi}^2_Y < 10$)
 \leq TOFGoodMatch cut (surviving factor)
- 2) good Tracker track + TRD match + ECAL match
 \leq TOFGoodMatch cut (surviving factor)

Surviving factor due to TOFGoodMatch cut with respect to number of tracker tracks

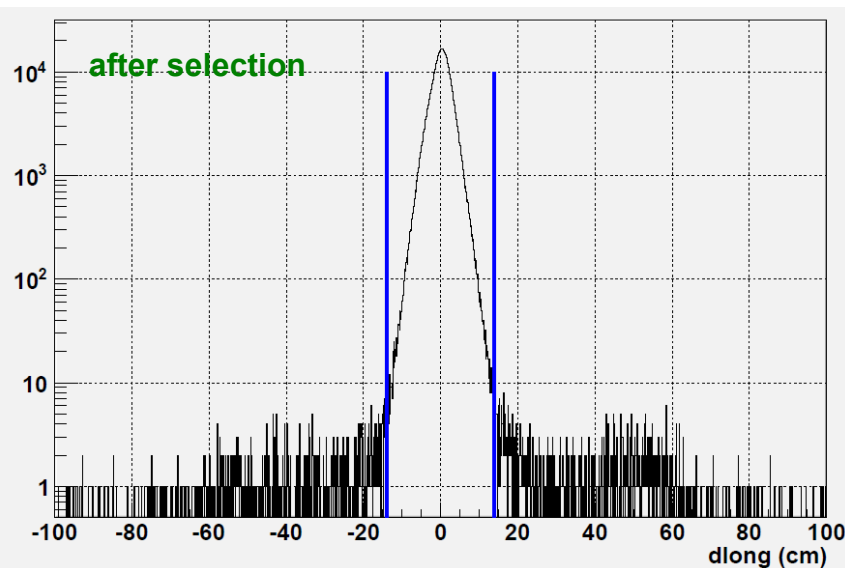
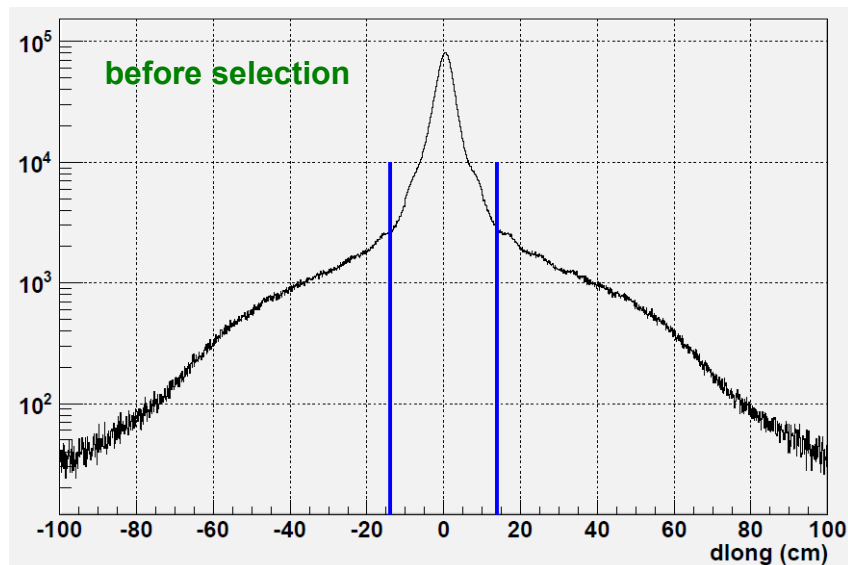




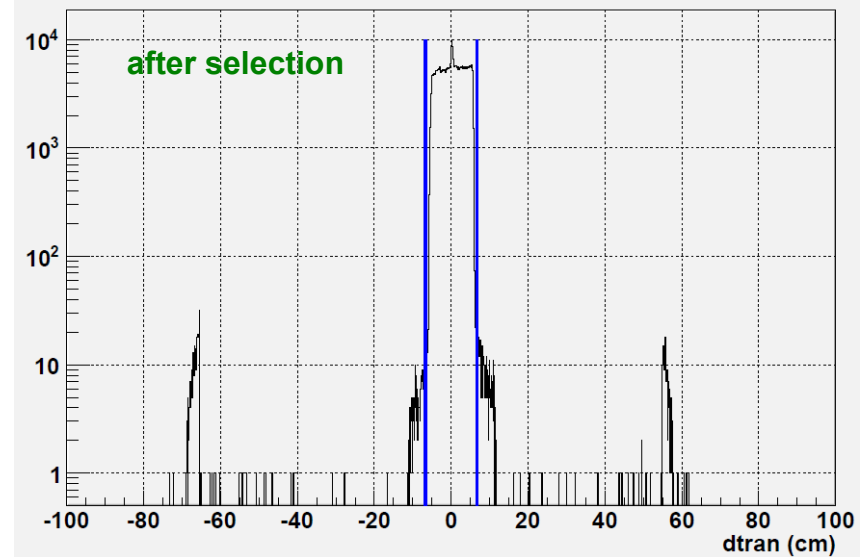
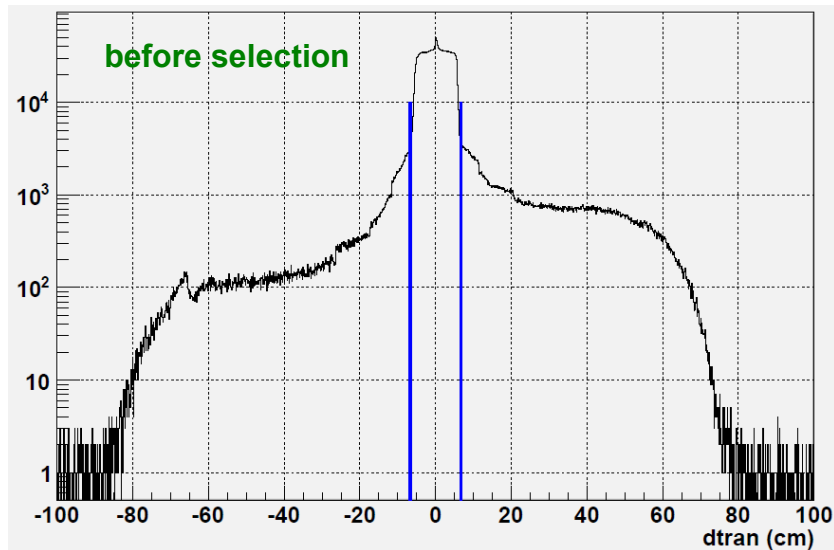
Transversal coordinate difference (counter 104)



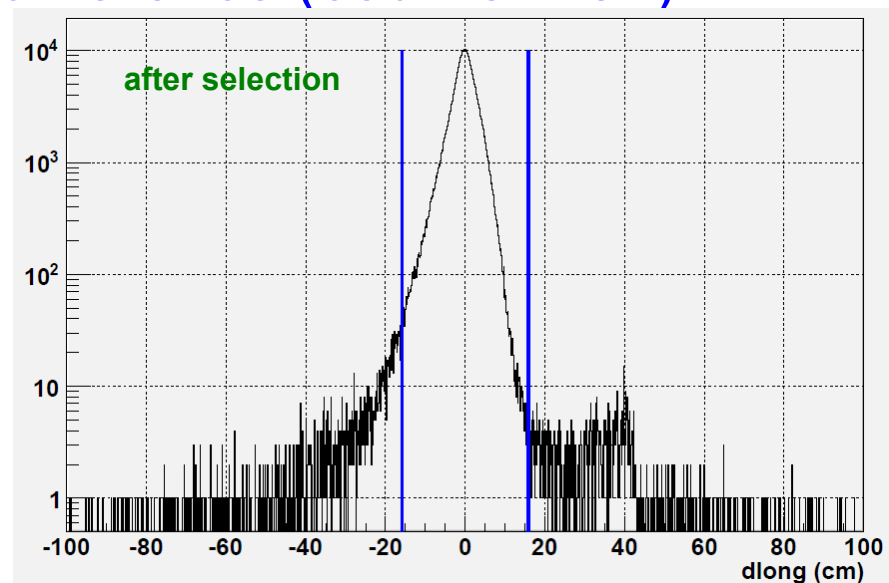
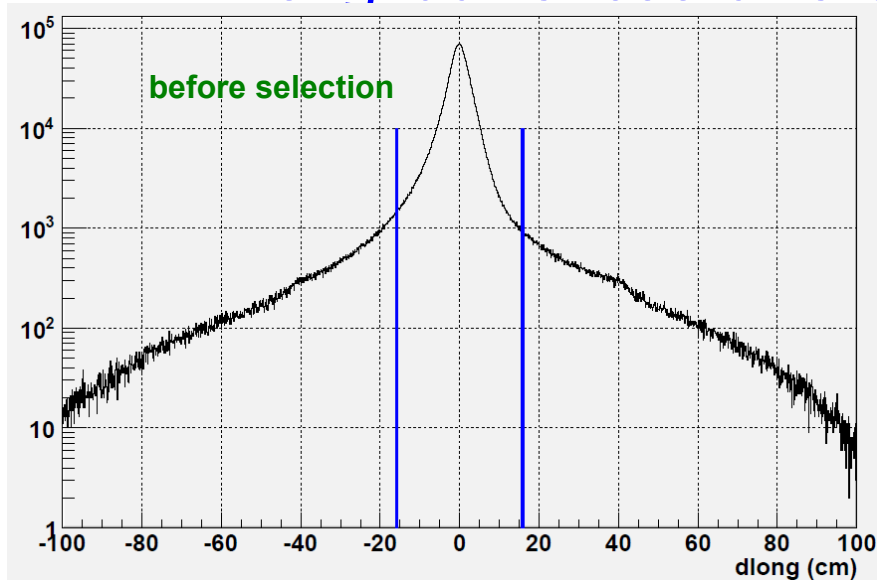
Longitudinal coordinate difference



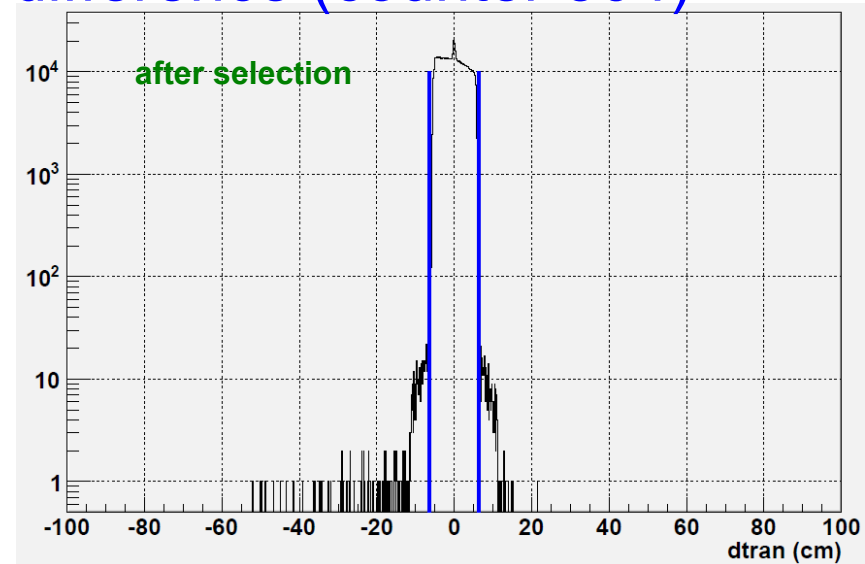
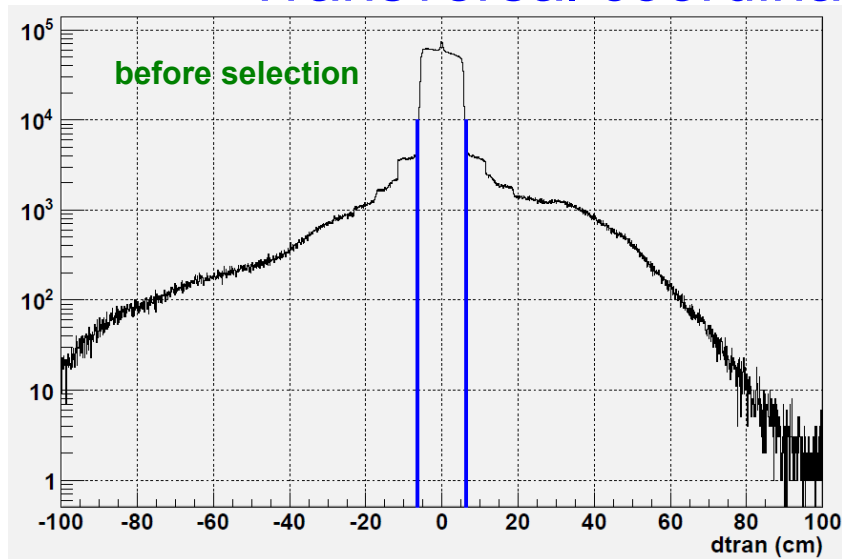
Transversal coordinate difference (counter 204)



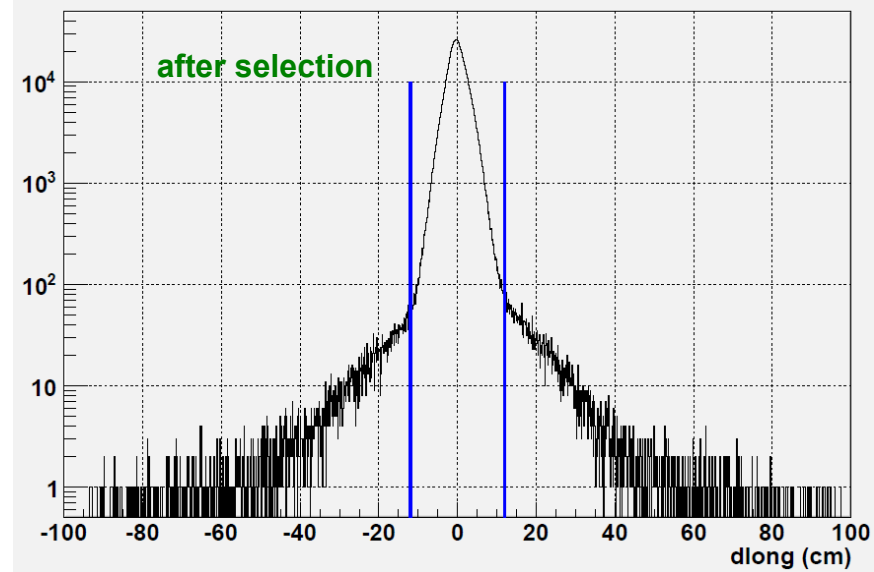
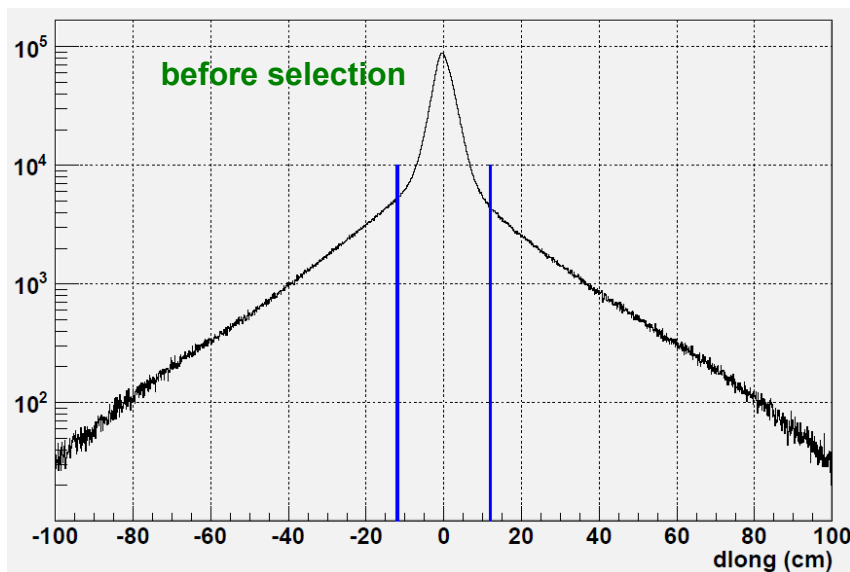
Longitudinal coordinate difference (counter 204)



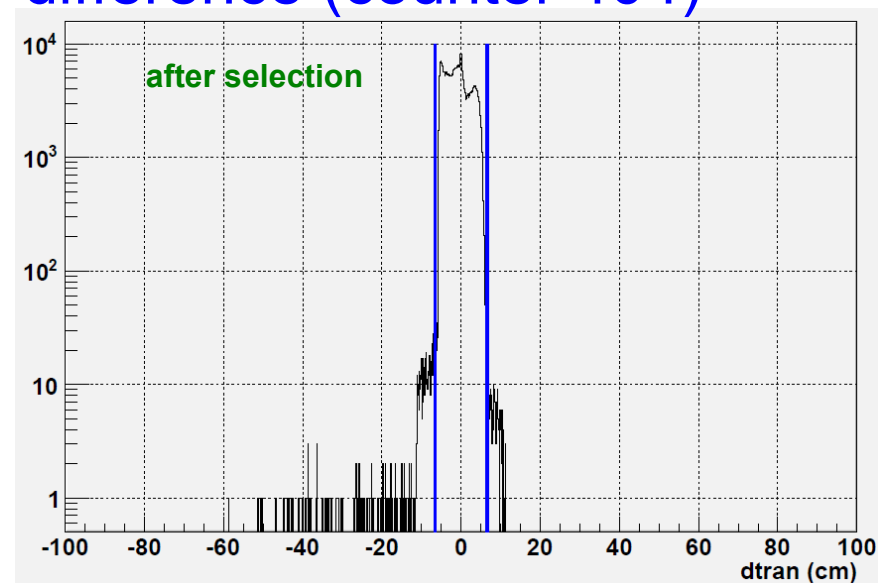
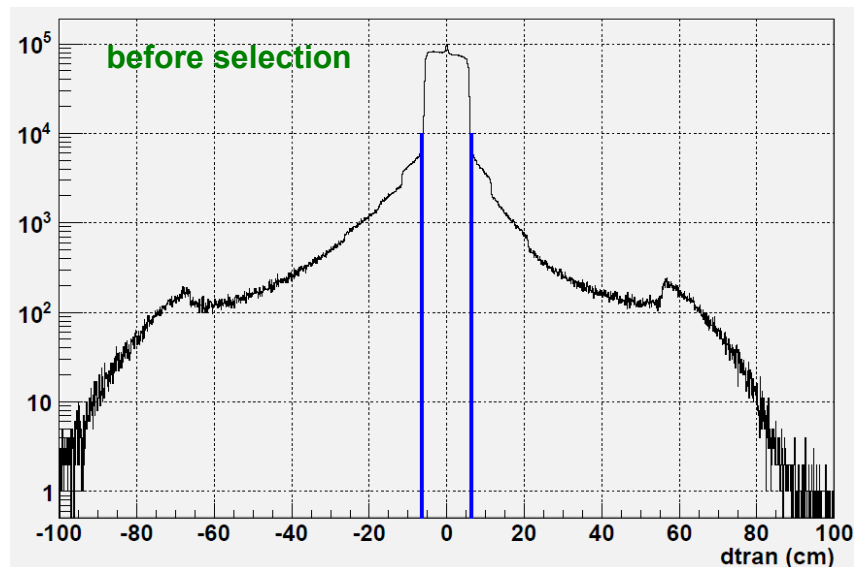
Transversal coordinate difference (counter 304)



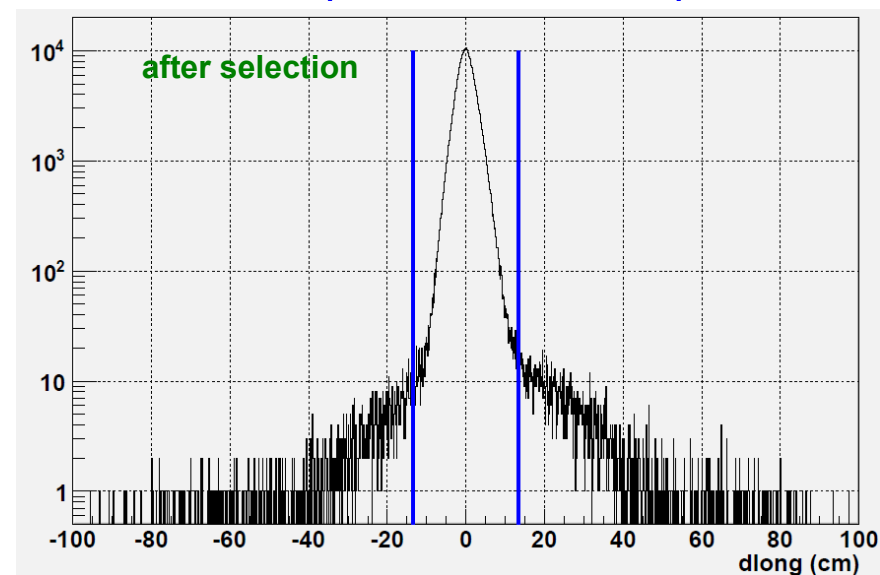
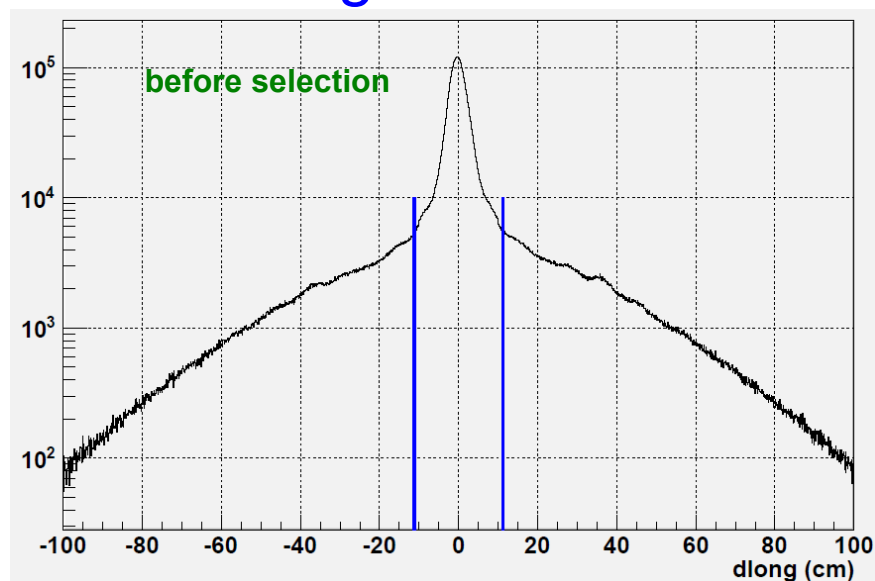
Longitudinal coordinate difference (counter 304)



Transversal coordinate difference (counter 404)



Longitudinal coordinate difference (counter 404)



Surviving factor due to TOFGoodMatch is 99.5% if the cut is applied as last cut in the event pre-selection.

TOF cut can improve the background reduction also if the cut is applied after the TRD and ECAL match.



Back-up slides

