

Beam Halo in data: update

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Outline

- Checks on run 142130:
 - which is the effect of the different selection cuts?
 - which is the effect of the HitFilter and TrakRefitter?
- Check of the event and track rates in the sample Run2010A-TkAlBeamHalo-v4

The Data Samples

- Run 142130:
 - /store/data/Run2010A/Cosmics/ALCARECO/v4/000/142/130/9693689A-3A9E-DF11-A3DE-0030487CD7C0.root
 - 14,542 events
 - 140,258 tracks
- Run 142130, only events with $1 \leq n\text{Tracks} \leq 4$
 - rfio:/castor/cern.ch/user/p/parenti/ALCARECO/nTrk_1_4/skim_RUN142130.root
 - 5,836 evts
 - 9,166 tracks
- Data sample: Run2010A-TkAlBeamHalo-v4
 - 846,034 events

“Standard” Track Selection - 1

- Number of selected tracks (no track selection yet), run 142130:
 - all events, all tracks in the ALCARECO 140,258
 - all events with $1 \leq n_{\text{Tracks}} \leq 4$, all tracks 9,166
 - after TrackRefitterBHM* TrackerTrackHitFilter* ctfWithMaterialTracks* AlignmentTrackSelector* TrackRefitterBHM sequence 2,111
- ... applying the selection cuts in sequence:
 - $n_{\text{Hit}} \geq 8$ 1,931
 - $n_{\text{HitsPerSubDet.inENDCAP}} \geq 1$ 639
 - $p \geq 2.5$ 571
 - $n_{\text{LostHits}} \leq 2$ 567
 - $n_{\text{HitDiffEndcaps}} \leq 2$ 402
 - $\chi^2_n \leq 10$. 402

“Standard” Track Selection - 2

- The biggest reduction in track number is given by:
 - $1 \leq n_{\text{Tracks}} \leq 4$: factor 15 (from 140,258 to 9,166 tracks)
 - TrackHitFilter, TrackRefitter: factor 4 (from 9,166 to 2,111 tracks)
 - number of hits: factor 3 (from 2,111 to 639 track)
- All the other cuts give a reduction factor of 1.6 (from 639 to 402 tracks)

Check 1

- Check 1: check the effect of $1 \leq n\text{Tracks} \leq 4$ cut on selected tracks
 - Data sample: run 142130
 - 456 tracks after the “standard” track selection, when no $1 \leq n\text{Tracks} \leq 4$ selection is applied
 - The reduction is only 12% on the selected tracks (it was a factor 15 reduction on non-selected tracks!)

Check 2

- Check 2: check the effect of TrackHitFilter, TrackRefitter on selected tracks (on run 142130)
- Number of selected tracks running a track analyzer on the ALCARECO (*in italic: running TrackHitFilter, TrackRefitter*)
 - all events with $1 \leq n_{\text{Tracks}} \leq 4$ 9,166
 - $\&\& n_{\text{Hit}} \geq 8$ 3,026 1931
 - $\&\& n_{\text{HitsPerSubDet.inENDCAP}} \text{plus/minus} \geq 1$ 883 639
 - $\&\& p \geq 2.5$ 672 571 (-18%)
 - $\&\& n_{\text{LostHits}} \leq 2$ 658 567 (-14%)
 - $\&\& n_{\text{HitDiffEndcaps}} \leq 2$ 503 402 (-20%)
 - $\&\& \chi^2_n \leq 10.$ 493 402 (-18%)
- ~20% of “good tracks” rejected (it was a factor 4 on non-selected tracks!)

Check 3

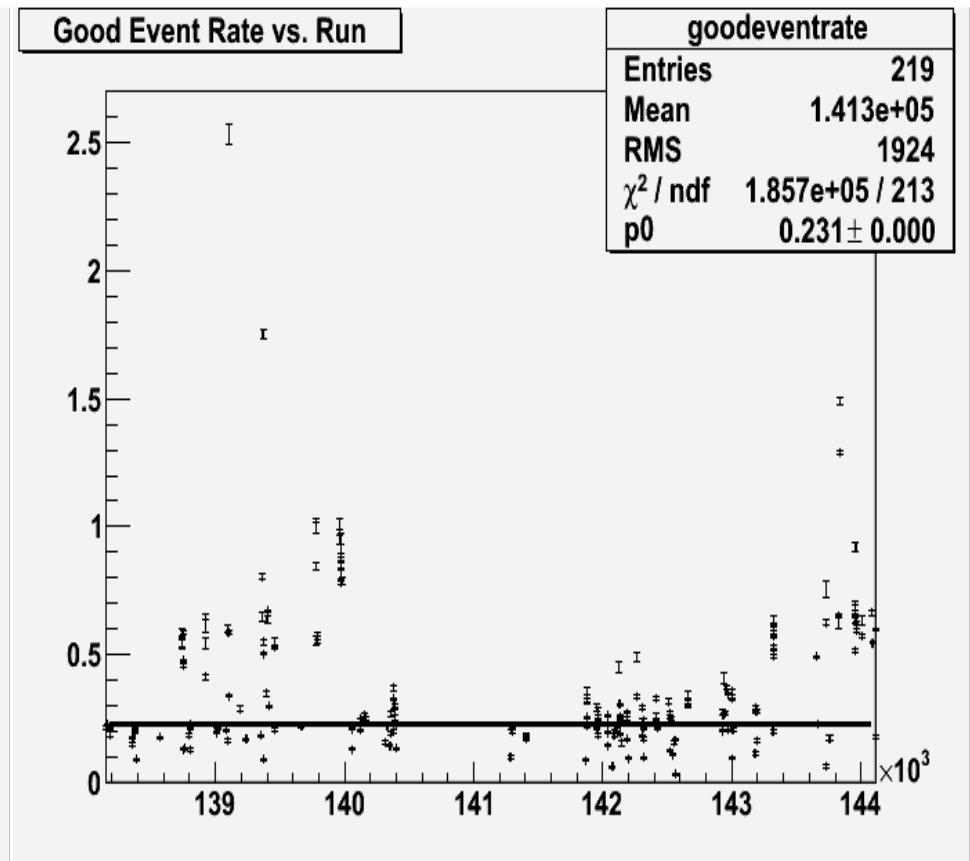
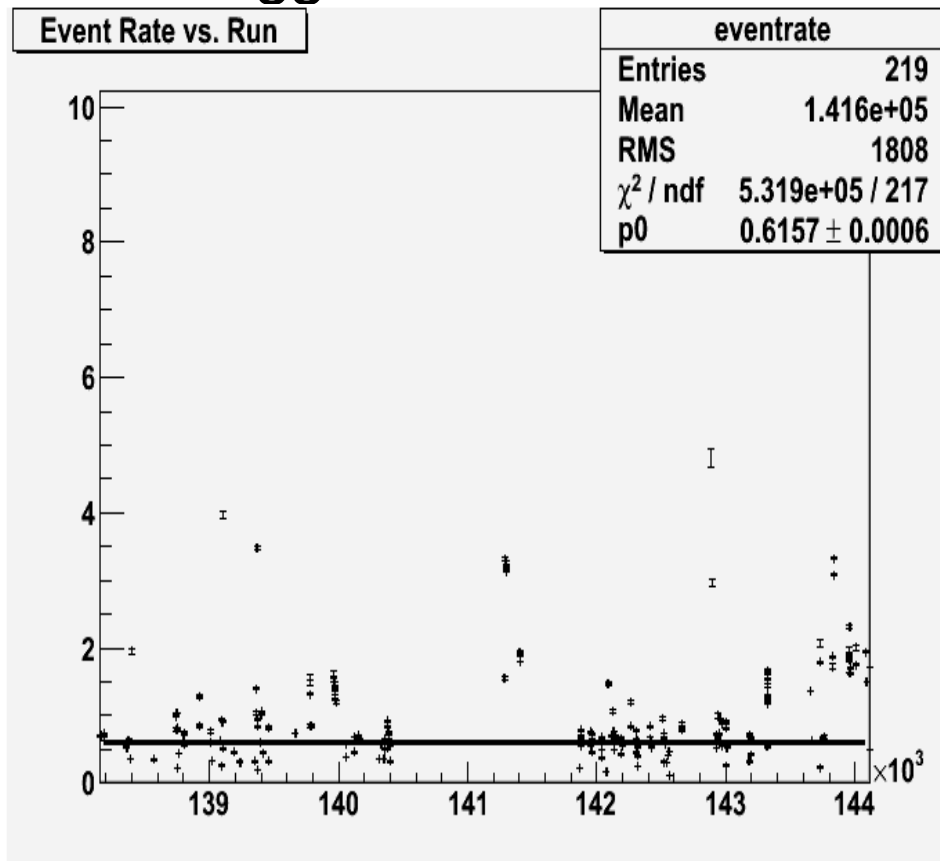
- Check 3: Comparison of the two sequences in millePedeMonitor
 - AlignmentTrackSelector* TrackRefitterBHM
 - TrackRefitterBHM* TrackerTrackHitFilter* ctfWithMaterialTracks* AlignmentTrackSelector* TrackRefitterBHM
- Data sample: Run2010A-TkAlBeamHalo-v4 (846034 events)
- Number of selected tracks:
 - 54962 with the first sequence,
 - 50343 with the second one (TrackHitFilter, TrackRefitter)
- 8% of “good tracks” are rejected by the second sequence

Check 4

- nHit and nHitsPerSubDet.inENDCAPplus/minus cuts cannot be released
- Check 4: check the effect of a softer pMin cut
 - all events with $1 \leq nTracks \leq 4$ 9,166
 - && nHit ≥ 8 1,931
 - && nHitsPerSubDet.inENDCAPplus/minus ≥ 1 639
 - && p ≥ 0.5 622
 - && p ≥ 1.0 613
 - && p ≥ 1.5 599
 - && p ≥ 2.0 584
 - && p ≥ 2.5 571
- Small effect on the statistics

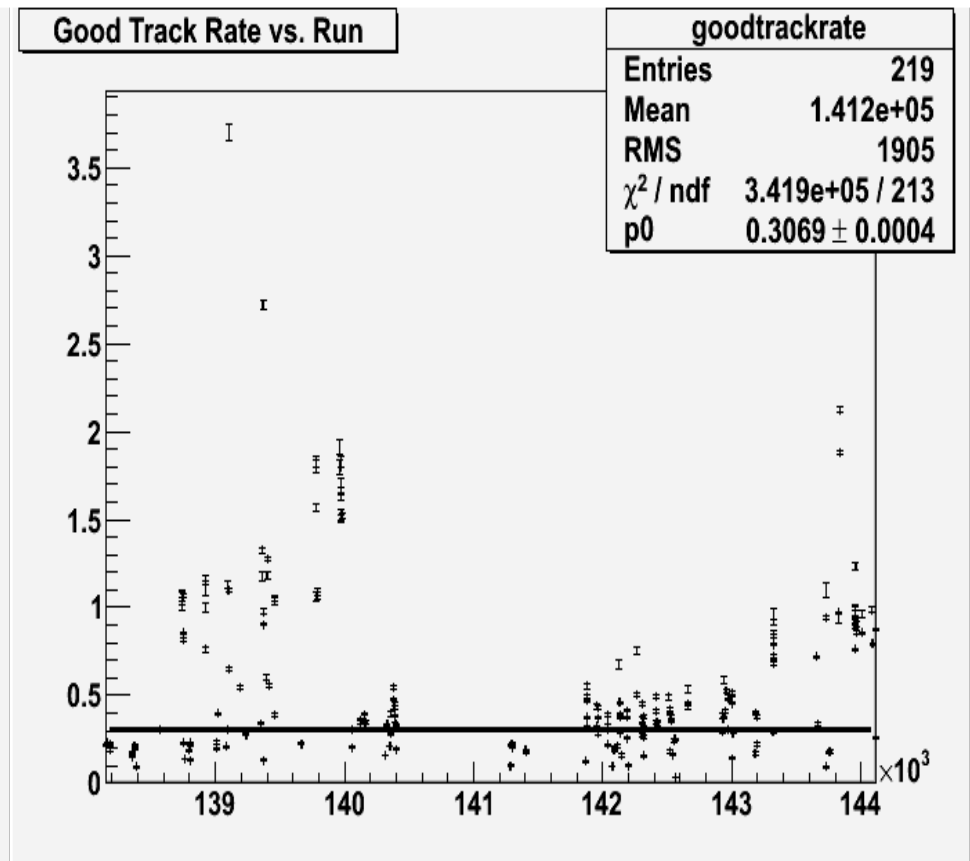
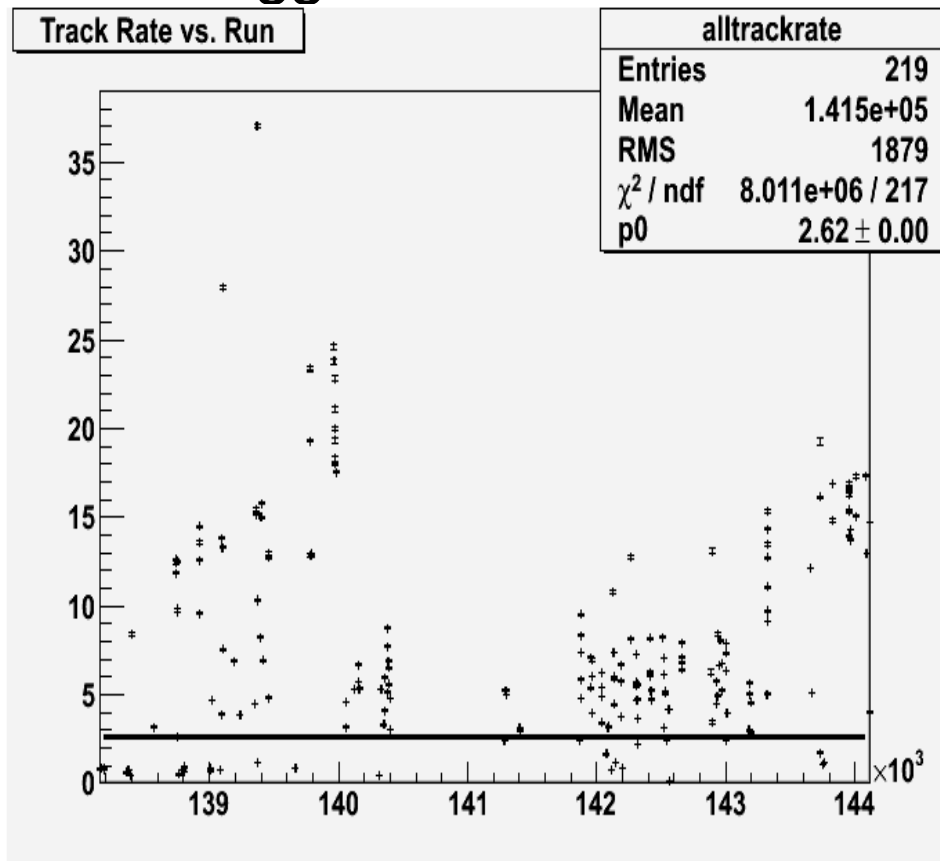
Event rates

- Data set: Run2010A-TkAlBeamHalo-v4
- Good event means: event with at least one selected track
- No trigger selection



Track rates

- Data set: Run2010A-TkAlBeamHalo-v4
- Good track: track surviving the selection cuts (see next page)
- No trigger selection

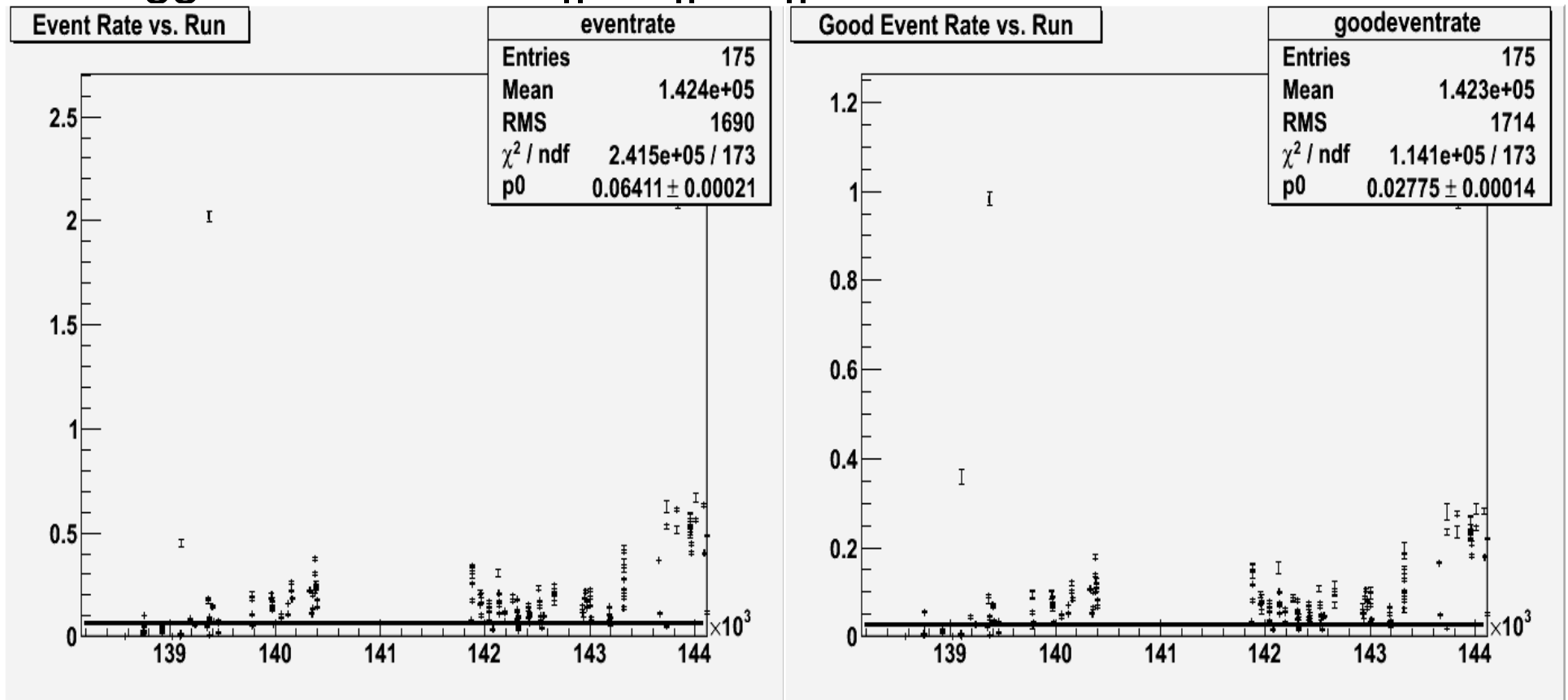


Track selection cuts

- $n_{\text{HitMin}} = 8$
- $n_{\text{HitsPerSubDet.inENDCAPplus}} = 1$
- $n_{\text{HitsPerSubDet.inENDCAPminus}} = 1$
- $p_{\text{Min}} = 2.5$
- $n_{\text{LostHitMax}} = 2$
- $\text{maxDiffHitEndcaps} = 3$
- $\text{chi2nMax} = 20.$

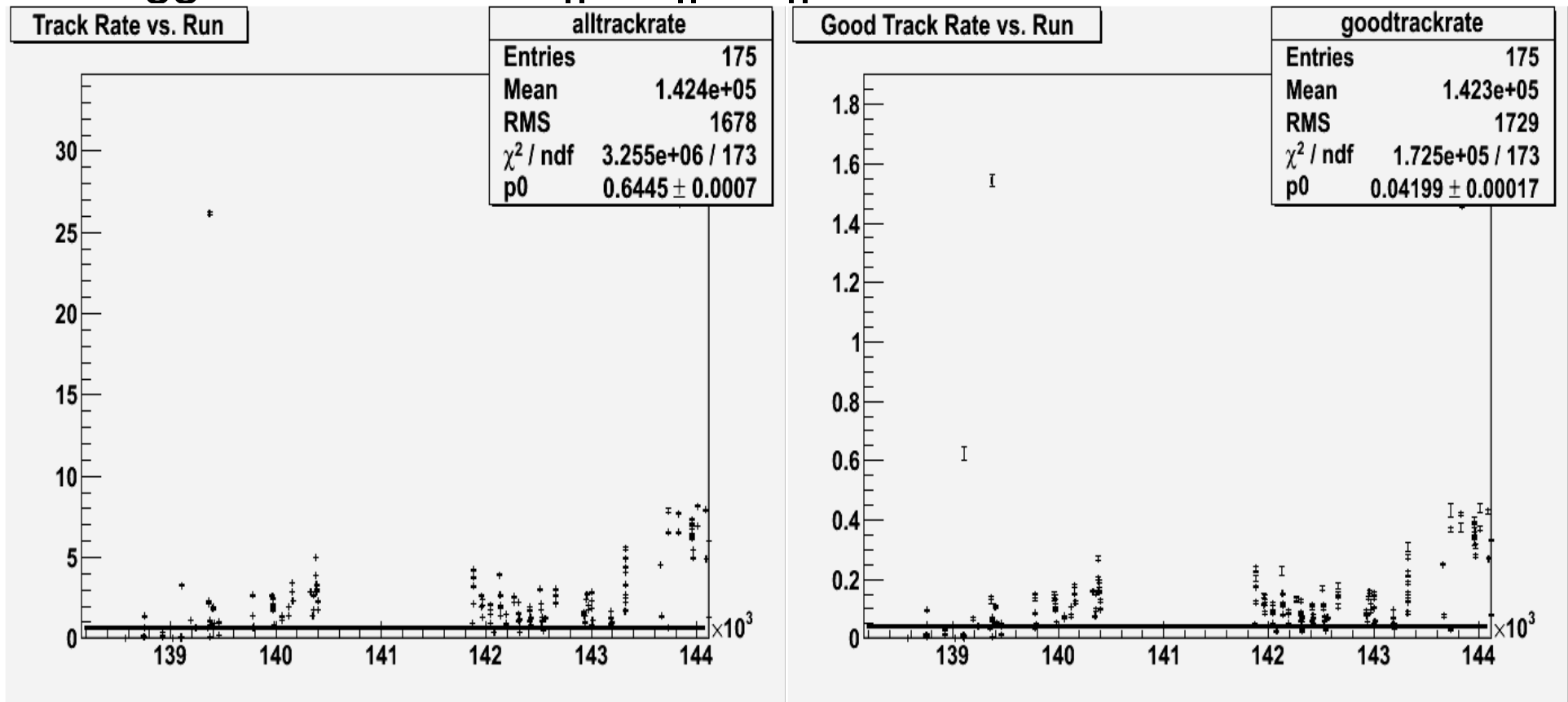
Event rates

- Data set: Run2010A-TkAlBeamHalo-v4
- Good event means: event with at least one selected track
- Trigger selection: 36 || 37 || 38 || 39



Track rates

- Data set: Run2010A-TkAlBeamHalo-v4
- Good track: track surviving the selection cuts
- Trigger selection: 36 || 37 || 38 || 39



Comparison of the average rates

	no Trg	L1:36 37 38 39
• Event rate (Hz)	0.62	0.064
• “Good” event rate (Hz)	0.23	0.028
• Track rate (Hz)	2.62	0.64
• “Good” track rate (Hz)	0.31	0.042

Conclusion

- The $1 \leq n_{\text{Tracks}} \leq 4$ cut, and TrackHitFilter, TrackRefitter are reducing the number of input tracks by a factor 66... but the factor is much smaller on “good tracks”.
- Also the effect of momentum cut is not very large... most of the tracks are already rejected by the hits' cuts.
- Event/track rates:
 - thanks to Justyna for the code!
 - “good” event rate: 0.23 Hz (0.028 after trigger selection)
 - “good” track rate: 0.31 Hz (0.042 after trigger selection)
- To do: re-run the trigger and check why there is a big reduction in “good” track rate