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Tracking and alignment monitoring histograms in offline DQ

The full detailed list of histograms with options for the alignment at https://lbhistogramdb.cern.ch/OfflineDataQuality/OfflineDataQuality/ALIGNMENT/ for the tracking at https://lbhistogramdb.cern.ch/OfflineDataQuality//OfflineDataQuality//OfflineDataQuality/TRACKING/

Mailing list to be used for any data quality issues about tracking and alignment: lhcb-track_align-dataquality@cernNOSPAMPLEASE.ch

Alignment pages

- page 00: Primary Vertex
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    - Brunel/Track/TrackVertexMonitor/NumBackTracksPerPV_Mean
    - Brunel/Track/TrackVertexMonitor/NumLongTracksPerPV
    - Brunel/Track/TrackVertexMonitor/NumLongTracksPerPV_Mean
    - Brunel/Track/TrackVertexMonitor/NumPrimaryVertices
    - Brunel/Track/TrackVertexMonitor/NumPrimaryVertices_Mean
    - Brunel/Track/TrackVertexMonitor/NumTracksPerPV
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  Number of primary vertices per event, number of (all, long, backward) tracks per PV and PV fit Chi2/DoF with trends
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    - Brunel/Track/TrackVertexMonitor/PV y position_Mean
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  Primary Vertex position with trends
- page 02: VELO 2-half alignment
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    - Brunel/Track/TrackVertexMonitor/PV forward-backward delta y
    - Brunel/Track/TrackVertexMonitor/PV forward-backward delta z
    - Brunel/Track/TrackVertexMonitor/PV left-right delta x
    - Brunel/Track/TrackVertexMonitor/PV left-right delta
    - Brunel/Track/TrackVertexMonitor/PV left-right delta z

  Primary Vertex position (x, y, z)

    - difference between fit with only forward and backward tracks
    - difference between fit with only left and right tracks

  The PV Delta_x and Delta_y should be well centered in 0. For any deviation of the mean bigger than 5 micron take note of the run and make sure it does not get worse. If the mean is off by more than 10 micron inform the VELO experts with an ELOG entry. For more than 20 micron contact the experts immediately
- page 03: OT alignment
    - Brunel/OT/OTHitEfficiencyMonitor/Module4/effvsdist
    - Brunel/OT/OTTrackMonitor/avtimeres
    - Brunel/OT/OTTrackMonitor/station1/drifttime
    - Brunel/OT/OTTrackMonitor/station1/residualgood

Drift time spectrum: see OT page 1

Hit efficiency vs distance (to wire), should be centered at 0, with a flat top and steep edges at about +/- 2.5 mm
Average time residual: centered at 0 (t0 calibration), sensitive to changes of the LHCb clock offset. The left tail is slightly larger than the right tail (because the drift time is determined by the earliest hit on the straw).

- page 04: RICH HPD
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  - Brunel/RICH/RichAlignMoniR2Gas/dThetavphiRecSide0
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- page 05: VELO overlap residuals
  - BrunelDaVinci/Track/TrackVeloOverlapMonitor/overlapResidualPhi
  - BrunelDaVinci/Track/TrackVeloOverlapMonitor/overlapResidualR
  - BrunelDaVinci/Track/TrackVeloOverlapMonitor/residualAPhi
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- page 06: IT overlap residuals
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  - Brunel/Track/TrackITOverlapMonitor/ITBottomTrack/IT1ASideBox/hitres
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  Residuals for hits (on track) in the IT1 overlap regions
- page 07: TT overlap residuals
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  - Brunel/Track/TTTrackMonitor/TTbV/Overlap residual
  - Brunel/Track/TTTrackMonitor/TTbX/Overlap residual

  TT overlap residuals by layer
- page 08/09: M1 track match A/C-side
  - Brunel/Track/TrackMuonMatchMonitor/resX_ASide_M1R1
  - Brunel/Track/TrackMuonMatchMonitor/resX_ASide_M1R2
  - Brunel/Track/TrackMuonMatchMonitor/resX_ASide_M1R3
  - Brunel/Track/TrackMuonMatchMonitor/resX_ASide_M1R4
  - Brunel/Track/TrackMuonMatchMonitor/resY_ASide_M1R1
  - Brunel/Track/TrackMuonMatchMonitor/resY_ASide_M1R2
  - Brunel/Track/TrackMuonMatchMonitor/resY_ASide_M1R3
  - Brunel/Track/TrackMuonMatchMonitor/resY_ASide_M1R4
  - Brunel/Track/TrackMuonMatchMonitor/resX_CSide_M1R1
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  - Brunel/Track/TrackMuonMatchMonitor/resY_CSide_M1R1
  - Brunel/Track/TrackMuonMatchMonitor/resY_CSide_M1R2
  - Brunel/Track/TrackMuonMatchMonitor/resY_CSide_M1R3
  - Brunel/Track/TrackMuonMatchMonitor/resY_CSide_M1R4

  Residuals between extrapolated tracks and muon hits

Centered at 0, width around the pad size (10/25, 20/50, 40/100, 80/200)
first shoulder (+/- 2 * pad size) should be symmetric
The background slope is due to the angular distribution of the tracks.
The difference between the central peak and the secondary peaks and/or the background depend on the track sample, that means that a difference would not necessarily indicate a problem

- page 10: Ecal-track match
  - Brunel/Track/TrackEcalMatchMonitor/E over P (inner)
  - Brunel/Track/TrackEcalMatchMonitor/E over P (middle)
  - Brunel/Track/TrackEcalMatchMonitor/E over P (outer)
  - Brunel/Track/TrackEcalMatchMonitor/dxVsTx
  - Brunel/Track/TrackEcalMatchMonitor/dxVsX
  - Brunel/Track/TrackEcalMatchMonitor/dyVsTy

  Ecal energy / momentum in the 3 region of the detector (inner, middle, outer)

  Y residual (distance between a long track and the center position of the pad) vs ty
  Y residual (distance between a long track and the center position of the pad) vs tx
  Y residual (distance between a long track and the center position of the pad) vs x position of the cluster
- page 11/12: Ecal-track match A/C side
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (inner A-side)
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (middle A-side)
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (outer A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (inner A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (middle A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (outer A-side)
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (inner C-side)
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (middle C-side)
  - Brunel/Track/TrackEcalMatchMonitor/xEcal - xTRK (outer C-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (inner C-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (middle C-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yTRK (outer C-side)

  Extrapolation of each long track to Ecal and evaluate the distance in x and y with each Ecal cluster.

  The plots show the distribution for the 3 region of the detector (inner, middle, outer) for A side in page 11 and for C side in page 12
- page 13: Ecal-VELO match
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (inner A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (inner C-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (middle A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (middle C-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (outer A-side)
  - Brunel/Track/TrackEcalMatchMonitor/yEcal - yVELO (outer C-side)

  Extrapolation of only velo segment to Ecal and evaluate the distance in only y with each Ecal cluster.

Tracking pages

- page 1: Long track
  - Brunel/Track/TrackMonitor/Long/125
  - Brunel/Track/TrackMonitor/Long/126
  - Brunel/Track/TrackMonitor/Long/2
  - Brunel/Track/TrackMonitor/Long/6
  - Brunel/Track/TrackMonitor/Long/7

  Global track fit parameters
- page 2: Long track hit multiplicity

- Brunel/Track/TrackMonitor/Long/101
- Brunel/Track/TrackMonitor/Long/110
- Brunel/Track/TrackMonitor/Long/111
- Brunel/Track/TrackMonitor/Long/112
- Brunel/Track/TrackMonitor/Long/114
- Brunel/Track/TrackMonitor/Long/115

Number of hits of each type on a track

- page 3: Long track chisquares
  - Brunel/Track/TrackMonitor/Long/3
  - Brunel/Track/TrackMonitor/Long/chi2PerDofDownstream
  - Brunel/Track/TrackMonitor/Long/chi2PerDofMatch
  - Brunel/Track/TrackMonitor/Long/chi2PerDofVelo
  - Brunel/Track/TrackMonitor/Long/numiter

Track Chi2 distributions for long tracks

(Chi2/DoF)_match = (Chi2 - Chi2_Velo - Chi2_T) / (NDoF - NDoF_Velo - NDoF_T)
T and Velo Chi2/DoF distributions have shorter tails, The match part dominates the overall Chi2.

- page 4: residuals
  - Brunel/Track/TrackMonitor/Long/ITResidual
  - Brunel/Track/TrackMonitor/Long/OTResidual
  - Brunel/Track/TrackMonitor/Long/TTResidual
  - Brunel/Track/TrackMonitor/Long/VeloPhiResidual
  - Brunel/Track/TrackMonitor/Long/VeloRResidua

RMS-unbiased residuals

- page 5: V0 and DiMuon masses
  - Brunel/Track/TrackDiMuonMonitor/chi2prob
  - Brunel/Track/TrackDiMuonMonitor/massJPsi
  - Brunel/Track/TrackV0Monitor/DownstreamDownstream/pipimass
  - Brunel/Track/TrackV0Monitor/DownstreamDownstream/pipmass
  - Brunel/Track/TrackV0Monitor/DownstreamDownstream/ppimass
  - Brunel/Track/TrackV0Monitor/LongLong/pipimass
  - Brunel/Track/TrackV0Monitor/LongLong/pipmass
  - Brunel/Track/TrackV0Monitor/LongLong/ppimass

pi+pi- (Ks peak), p-pi+ and p+pi- (Delta peak) mass from long-long (top) and downstream-downstream (middle) track pairs
Bottom: J/psi mass peak from mu+mu- track pairs, with track chi2 probability for these tracks

- page 6: Multiplicity and type
  - Brunel/Track/TrackMonitor/1
  - Brunel/Track/TrackMonitor/2

Number of tracks per event (Rec/Track/Best), and distribution of track types

- page 7: Massive two-prongs
  - Brunel/Track/TrackVertexMonitor/twoprong IP chi2 per dof
  - Brunel/Track/TrackVertexMonitor/twoprong decaylength significance
  - Brunel/Track/TrackVertexMonitor/twoprong doca
  - Brunel/Track/TrackVertexMonitor/twoprong doca pull
  - Brunel/Track/TrackVertexMonitor/twoprong doca vs phi
  - Brunel/Track/TrackVertexMonitor/twoprong mass (GeV)

Massive two-prong: highest-PT good long track in the event with the good long track that gives the highest invariant mass

- page 8: Fast IP in X and Y (biased)
  - Brunel/Track/TrackVertexMonitor/track IP X
  - Brunel/Track/TrackVertexMonitor/track IP X vs eta
  - Brunel/Track/TrackVertexMonitor/track IP X vs phi
  - Brunel/Track/TrackVertexMonitor/track IP Y

    - Brunel/Track/TrackVertexMonitor/track IP Y vs eta
    - Brunel/Track/TrackVertexMonitor/track IP Y vs phi

  Biased IP to PV for good long tracks in events with 1 PV
- page 9: Highest-PT track fast IP in X and Y
    - Brunel/Track/TrackVertexMonitor/fast track IP X
    - Brunel/Track/TrackVertexMonitor/fast track IP X vs eta
    - Brunel/Track/TrackVertexMonitor/fast track IP X vs phi
    - Brunel/Track/TrackVertexMonitor/fast track IP Y
    - Brunel/Track/TrackVertexMonitor/fast track IP Y vs eta
    - Brunel/Track/TrackVertexMonitor/fast track IP Y vs phi

  Unbiased IP to PV distributions for the highest-PT good long track in events with 1 PV

  IP X vs Eta and IP Y vs Eta: differences of less than 5 micron (0.005) are no problem

-- WouterHulsbergen - 09-Oct-2009

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