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GLOSSARY FOR CDFII TECHNICAL DESIGN REPORT (Chapters 1, 2 and 12)

A

α_S - The strong coupling constant.

ADC - Analog-to-Digital Converter.

ASD - Amplitude Shaper Discriminator.

B

b^{-1} as unit of data - 1/(barn), where the barn is a unit of area; 1 barn $= 10^{-24} cm^2$. When data is expressed in units of b^{-1}, the quantity given is actually $\int Ldt$, where L is the luminosity . The total number of events, N , in the data is then given by $N = (\int Ldt) \times \sigma$, where σ is the cross section of the interaction.

Bag parameters - Parameters involved in the Bag Theory of hadrons, in which quarks are considered to be contained in a spherical "box" potential, or bag.

Baryon - Hadrons with a multiple of 1/2 spin.

Boson - An integral spin particle.

b-tagging - Identification of events involving the b-quark, usually by one of the three following methods; 1. Finding a secondary vertex; The identification of the track of a particle which begins the distance corresponding to the b's lifetime away from the original interaction site. 2. Identifying leptons from b-decay. 3. Identifying a single displaced track.

C

Charginos - The Supersymmetric Fermion partners to charged Higgs and W bosons which mediate the weak interaction.

Chiral coupling - Chiral refers to the "handedness" of the particle. Left handed (polarized) particles may have different coupling with right handed particles than with other left handed particles.

(quark) Compositness - the possibility that quarks are composed of even smaller particles.

CL - Confidence Level

Color-octet vector meson - Color is the strong “charge”. Octet refers to the group structure which transforms under SU(3) like an octet. Vector means spin 1. A meson is an integral spin hadron; a linear combination of quark-antiquark pairs.

Converted Photon - An e^+ or e^- resulting from the decay of a photon into such a pair.

D

DAQ bandwidth - DAQ is the Data Aquisition system. Bandwidth is the number of bytes per second which can be written to the magnetic tape.

Drell-Yan Process - The annihilation of a quark-antiquark pair to form a photon, which can decay to like charged electron and muon.

E

η - pseudo-rapidity; η = -ln(tan(θ/2)), where θ is the azimuthal angle.

F

FCNC decay - Flavor Changing Neutral Current decay. The interaction current has neutral charge (photon) while, for example, a b-quark is converted to a c-quark (they have the same charge) by the decay. This has never been observed.

Fermion - A particle with a multiple of 1/2 spin.

Fiducial Region - Region of the detector in which there are no cracks or support structures which can result in measurements which are not faithful to reality.

G

Gauge Bosons - The mediators of the weak interaction.

(First) Generation - Many particles are grouped in “generations”; The top and bottom quarks are referred to as the first “generation”.

Gluinos - Supersymmetric Fermion partners to the gluon boson which mediates the strong interaction.

Gluon - A boson which mediates the strong interaction.

H

Hadron - Particles which interact through the strong interaction.

Hadronizing - Bare, or isolated, quarks have never been observed and it is believed that a quark cannot exist in isolation but must hadronically decay.

Hard - High momentum.

I

Inclusive Jet - An interaction producing a jet but not exclusively; data is not rejected if the jet is accompanied by other jets or products.

Invariant Mass Spectrum - The Lorentz Invariant mass spectrum.

J

Jet -"spray" of particles caused by decay of a quark.

K

$\Delta\kappa_\lambda$ - A means of parameterizing anomalous couplings.

L

$\Lambda^{+/-}$ - The lepton-quark compositness scale. It is the energy needed to give a small enough wavelength in order to observe whether leptons and quarks are composed of smaller particles.

λ - A means of parameterizing anomalous couplings.

Left W - Left-hand circularly polarized relative to the momentum direction.

Lepton - Particles which interact through the weak interaction.

Lepto-quarks - Theorized composite particles which have properties of both quarks and leptons which are the two "fundamental" types of particles in the Standard Model.

Longitudinal W - Non-circularly polarized spin.

Luminosity - A property of the accelerator which relates the event rate to the event cross section; $N = L \times \sigma$. It depends on the revolution frequency and bunch spacing.

M

Meson - Integral spin hadrons.

MSSM - Minimal Supersymmetric Standard Model.

Multiplexing - A switching technique by which data groups are rapidly regrouped and redistributed.

P

Parton Distribution Functions - Partons are the constituents of strongly interacting particles; quarks and gluons. The Distribution functions describe the distribution of momentum of a particle among its constituent partons.

Partial Width - The total width of a particle is one over its lifetime. The partial width of a certain decay is the branching ratio for that decay times the total width.

Penguin decays - Feynman diagram which is allegedly similar to a penguin in its shape.

Proportional Mode - In a gaseous charged particle detector, the particle is detected by the ionization of the gas. In proportional mode the gas amplification factor is constant (due to choice of appropriate voltage) and the signal strength is then proportional to the amount of ionization produced.

Q

q - generic symbol for a quark.

Q^2 - Square of the difference in the rebound momentum of the particles.

QIE - Charge Current Encoding. A fast ADC chip invented by Bill Foster at Fermilab.

R

Resummation effects - Summing up higher order backgrounds.

S

Self-tagging - An event or particle which has some characteristic which allows identification of whether the particle contained a b or an $\bar{b}$ at the time of its creation.

Sequential c-quark - A charm quark resulting from the decay of a b-quark.

Shower Centroid - A shower is the interaction of a particle and the subsequent interactions which result from the products of the initial interaction, producing an avalanche effect. Showers are used in a Photomultiplier Tube (PMT) to find the energy of particles. The centroid is the center of the shower.

$\sin^2(\theta_W{}^{eff})$ - Both the photon and Z-boson can be written as a linear combination of a neutral B-meson and a neutral W-boson. The relationship takes the form of a rotation, with the coefficients being sines and cosines of θ_W. The eff just means effective or as observed.

S/N - Signal to Noise Ratio.

Soft - Low Momentum.

Stand alone segment - In contrast to previous inner silicon vertex detector placement, the new larger number of such detectors allows reconstruction of tracks in the inner region without reference to data from the outer detectors.

Stereo wires - In addition to parallel wires in the particle detectors, which allow detection of position in the transverse plane, "stereo" wires are placed at an angle to the parallel wires, thereby allowing reconstruction of position in three dimensions.

Stiff - High Momentum (same as "hard").

Stop quarks - The Supersymmetric partner of the top quark; not yet observed.

(limited) Streamer Mode - In a gaseous charged particle detector, the voltage is set so that the passage of the particle causes just enough ionization to create a small spark.

Stub - "Stubs" are the individual short tracks that a particle leaves in each detector it crosses. The entire trajectory of the particle is reconstructed from the stubs.

T

TDC - Time to Digital Converter.

Top condensate - A Boson "soup" made of top pairs.

U

$< u >$ (p. 2-27) - A proton consists of two u-quarks and a d. At high momentum, energy can be converted into an up - anti-up pair, so that the total number of ups or downs in a proton is actually not fixed, but can vary as long as the total charge is 1. The momentum of each of the quarks must add up at all times to the total momentum of the proton, but in general will have some distribution within the proton (Parton distribution functions). The average fraction of the momentum per u is denoted $< u >$.

(non-)Universal top interactions - The top coupling may not be universal; it might couple differently with a bottom than with a charm.

Υ(4S) - Υ is a bound state of a b and $\bar{b}$ quark. 4S refers to the 4S state of the Υ.

V

V+A term in top decay - Vector and Axial-Vector interactions.

Vector Bosons - The $W^{+/-}$ and Z^0 bosons which mediate the electro-weak interaction.

Vertex detection - technique for the identification of events involving b-quark, as described under "b-tagging".

VME based board - VME is the international standard used in HEP electronics.

Y

y_W - y is the rapidity; the rapidity of a W boson.

Z

Z pole - The propagator for a Z meson depends on $[p^2 - m^2]^{-1}$ so that it diverges for momentum equal to the mass. This momentum is the Z-pole.

Zero strength (WWZ) coupling (p. 2-32) - Zero strength means that there is no coupling. If the coupling were non-zero we would actually expected to see more events since then the destructive interference predicted between WWZ and WWγ in the Standard Model would no longer apply and the lack of cancellation would result in an increase of events.