



Metal Detecting Search Coils



Metal Detector Search Coil 101

by **Lee Wiese**
March 1, 2008
Update: Sept. 2013
Update: May 15, 2016
Update: Feb. 24, 2021
<http://www.mdhtalk.org>

Metal Detecting Search Coils

Shape & Windings



Search Coil

A circular (or other shaped) plastic housing containing single or multiple transmit and receive windings (wire coils) in a specific configuration.

Metal Detecting Search Coils

Names & Differences



Metal Detecting
Search Coil Class

A Search Coil Can be Called

- Antenna
- Coil
- Head
- Loop
- Spider Coil

Differences Between Search Coils

- Configuration (**Concentric, Widescan or Doubt “D”, Mono**)
- Shape (**Circular, Elliptical, Open Web or Spider**)
- Size (**4 to 18 + inches**)

Metal Detecting Search Coils

Coil Types

Metal Detecting
Search Coil Class

Search Coils Types



Concentric coil uses two separate coils of wire, a Transmit & a Receive coil, one inside the other.



Widescan coil or (DD) uses two Transmit & two Receive D-shaped coils of wire that are placed back to back.



Mono coil uses one coil of wire for both the Transmit and Receive function.

Note: Printed Spiral Search Coil is made only by Tesoro for use with pulse induction circuitry. It offers good sensitivity to a broader range of target sizes and improved sensitivity to less conductive targets such as fine gold chains.

Note: Big Foot Coil is becoming very popular with competition hunters; also called the "figure eight" loop. This coil is very efficient for fast searching. The search area of this narrow 18 inch rectangular coil is nearly the entire coil.

Note: Mono Coils are for MPS technology detectors (SD & GP Series), Eric Foster's High End PI Detectors



Metal Detecting Search Coils



Concentric Search Coils

Circular, Elliptical and Spider



4 inch

5.3 inch

7 inch

8 inch

9.5 inch

11 inch

9 x 12 inch

12 inch

Widescan (DD) - Double "D" Search Coils

Circular, Elliptical



4 x 6 inch

8 inch

6 x 10 inch

10.5 inch

12 inch

14 inch

18 inch

Metal Detecting Search Coils

Construction & Operation



Search Coil Construction

- **Transmitter Coil** - The outer coil acts as the transmit antenna
- **Receiver Coil** - This inner coil loop acts as the receiver antenna

Search Coil Operation

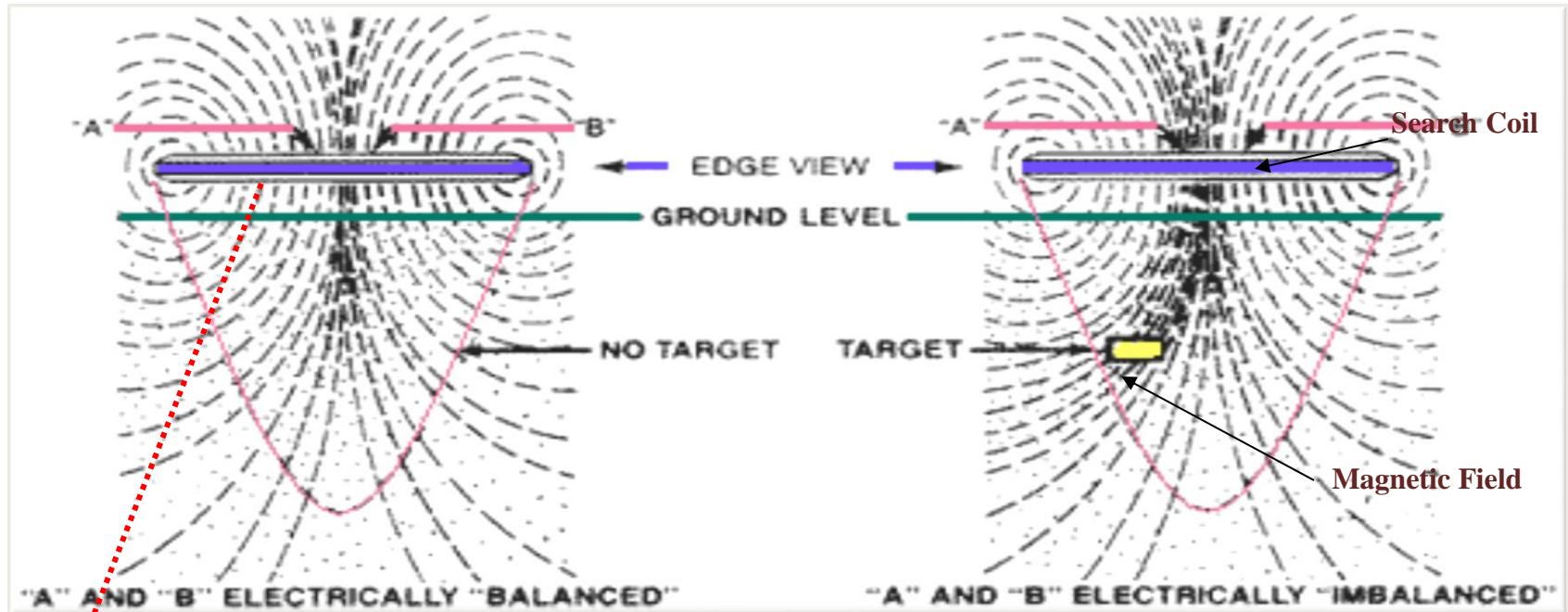
- The Detector's Electronics control an oscillator (an electric circuit capable of switching on and off very quickly determined by the Detectors Operating Frequency). This signal is directed to the search coil producing an electromagnetic field in the transmitter search coil.
- If the search coil is resting on the ground, the field it generates will extend outwards and downwards to a *depth roughly equal to the diameter of the coil for coin size targets.* When the coil's magnetic field detects an alteration in the magnetic field, the control electronics produce a corresponding change in the detectors speaker tone or on the detectors display.
- This change tells us that we have detected a buried metallic object.

Metal Detecting Search Coils

Field Patterns

Metal Detecting
Search Coil Class

Search Coil Magnetic Field Pattern



Balanced Fields

Unbalanced Fields

Note: *Coil Height Above the Ground*, The Higher the Coil the Less Ground Magnetic Penetration

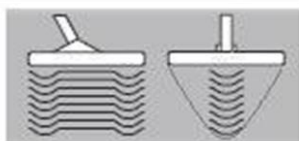
Metal Detecting Search Coils

Scan Patterns



Search Coil Scan Pattern

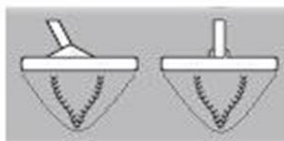
Widescan (DD)



Side

Front

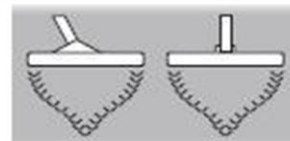
Concentric



Side

Front

Mono



Side

Front

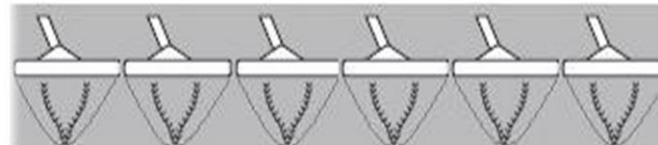
Pattern View:

Ground Covered While Sweeping



Widescan (DD)

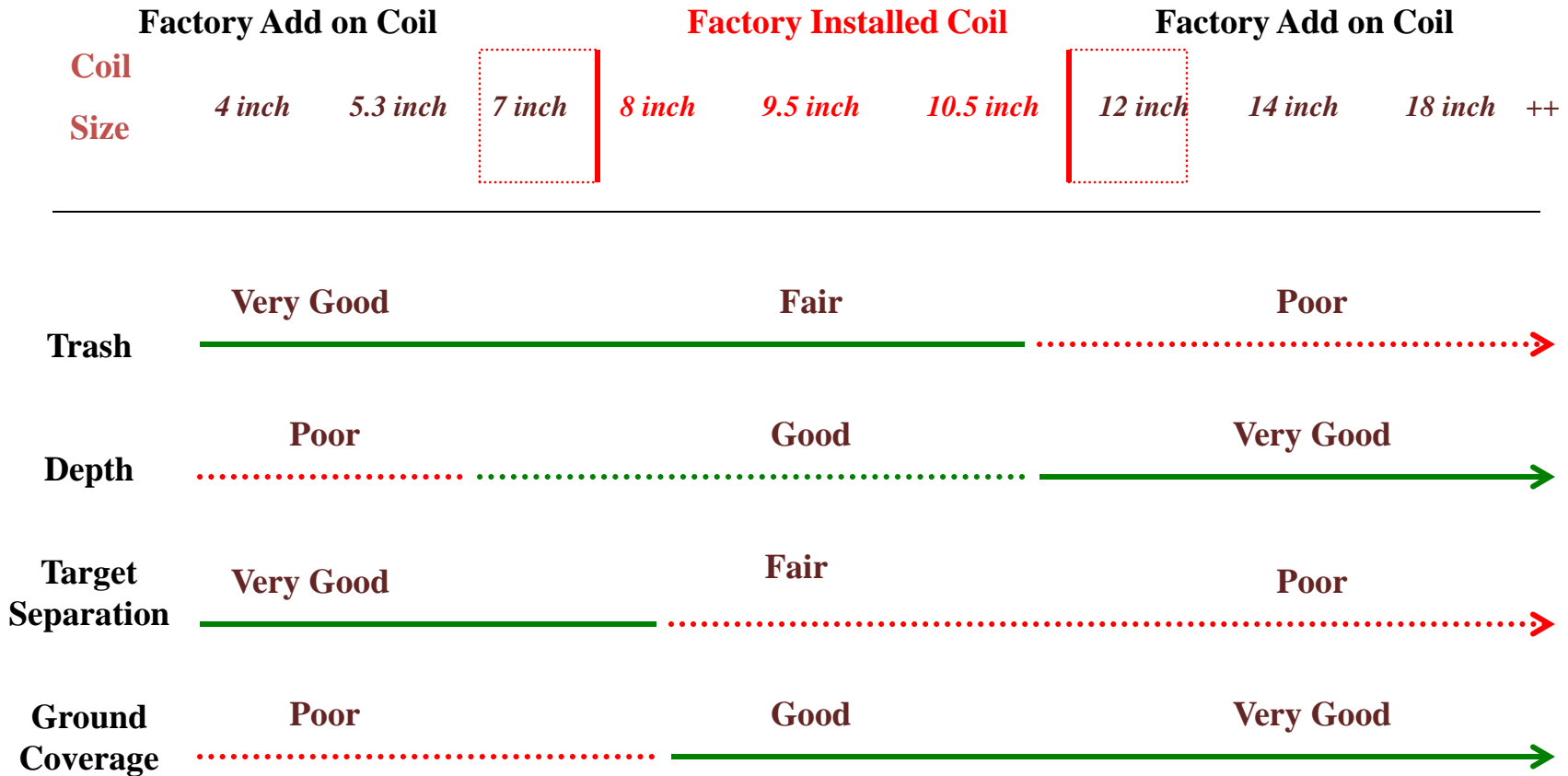
Ground Covered While Sweeping



Concentric

Metal Detecting Search Coils

Coil Size



Metal Detecting Search Coils

Comparison



Search Coil Comparison

	Concentric Coil	DD Coil	++ Mono Coil
Noise Factor:	Noise in Mineralized soils	Less Less	Good
Ground Coverage:	Fair	Very GoodVery Good	Good
Sweep Profile:	Half Overlap	Little Overlap . Little Overlap	Half Overlap
Sensitivity:	Greater	Less Less	Greater
Operating Mode:**	All Modes	All Mode All Modes	All Metal
Pin Pointing:	Center	Toe / HeelToe / Heel	Center
Pin Point Difficulty:	Easiest	HardHard	Easiest
Coil Penetration Profile:	Cone Shape	Chisel Shape ...Chisel Shape	Cone
Number of Windings:	Two	FourFour	One
Ground Balancing:	Good	SuperiorSuperior	Difficult

** **Operating Mode** = Discrimination and All Metal

++ **Mono Coils** are for MPS technology detectors (SD & GP Series), Eric Foster's High End PI Detectors

Metal Detecting Search Coils

Coil Depth



Metal Detecting
Search Coil Class

Detector / Search Coil *Depth*:

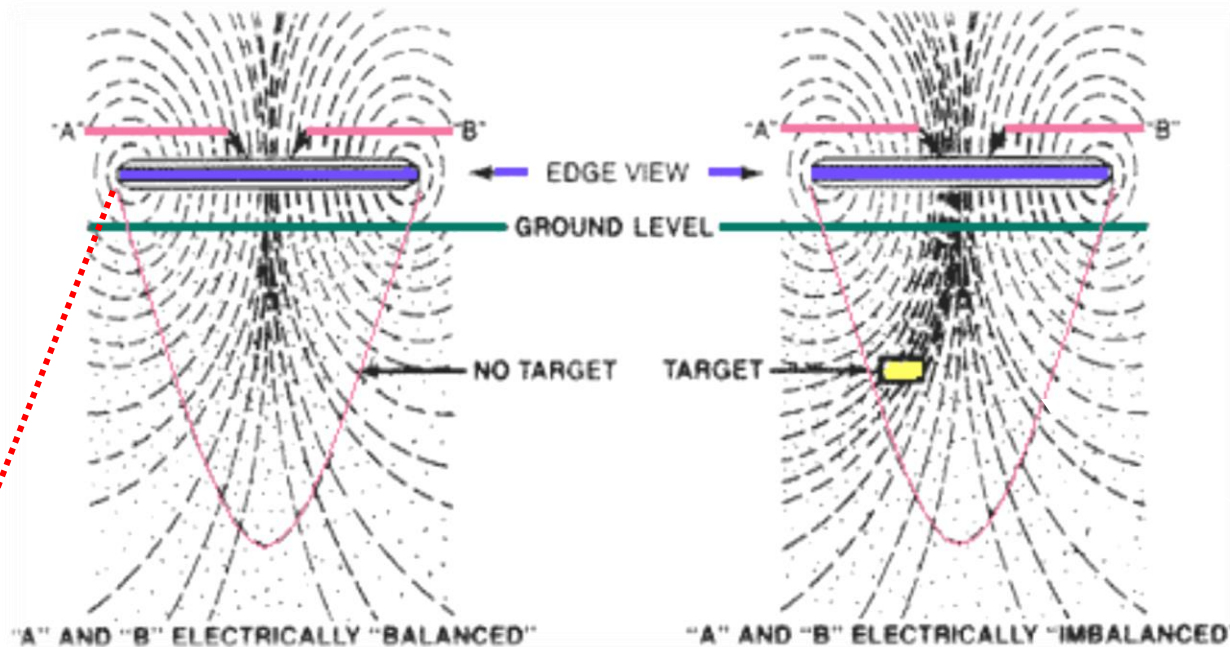
- *Depth* is Dependant on **Soil Conditions - Mineralization , Moisture, Trash**
- *Depth* is Dependant on **Target Material - Type, Position, Size, Shape**
- *Depth* is Dependant on the **Detector & Adjustments – ie: All Metal vs. Discrimination, etc**
- *Depth* is Dependant on **Operator Usage and Swing – Coil Level, Height, Speed**
- *Depth* is Dependant on the **Coil - Configuration, Shape, Size**
- *Depth* is Dependant on the **Magnetic Field Penetration into the Ground**

Metal Detecting Search Coils

Once Again

Metal Detecting
Search Coil Class

Search Coil Magnetic Field Pattern



Search Coil

Magnetic Field

Balanced Fields

Unbalanced Fields

Note: *Coil Height Above the Ground*, The Higher the Coil the Less Ground Magnetic Penetration

Metal Detecting Search Coils

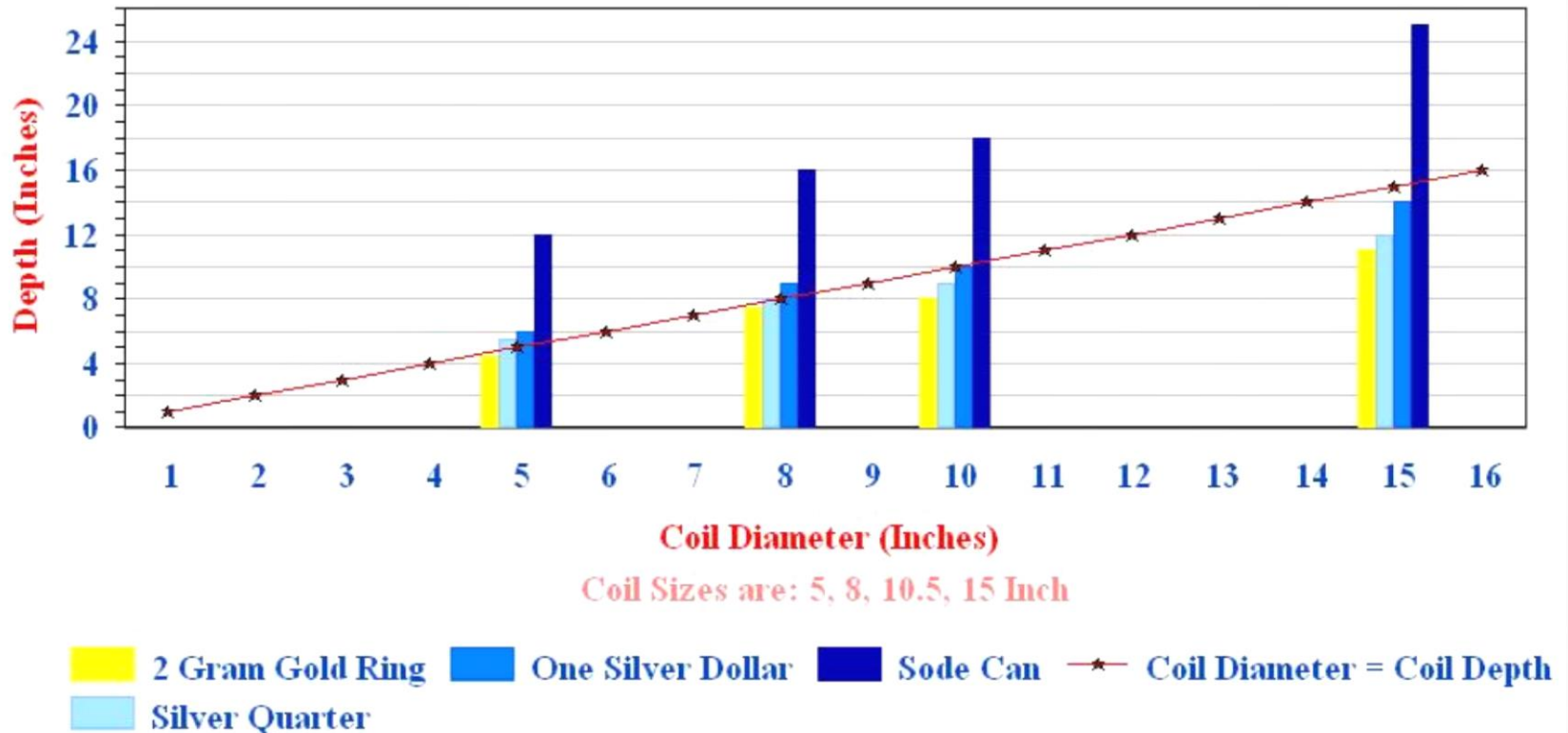
Air Test



DD Coils Used for Air Test are: **5", 8", 10.5", 15"**

Detector Adjustments Held Constant for all Coils Sizes

Major Brand Detector Coil Depth Air Test



Metal Detecting Search Coils

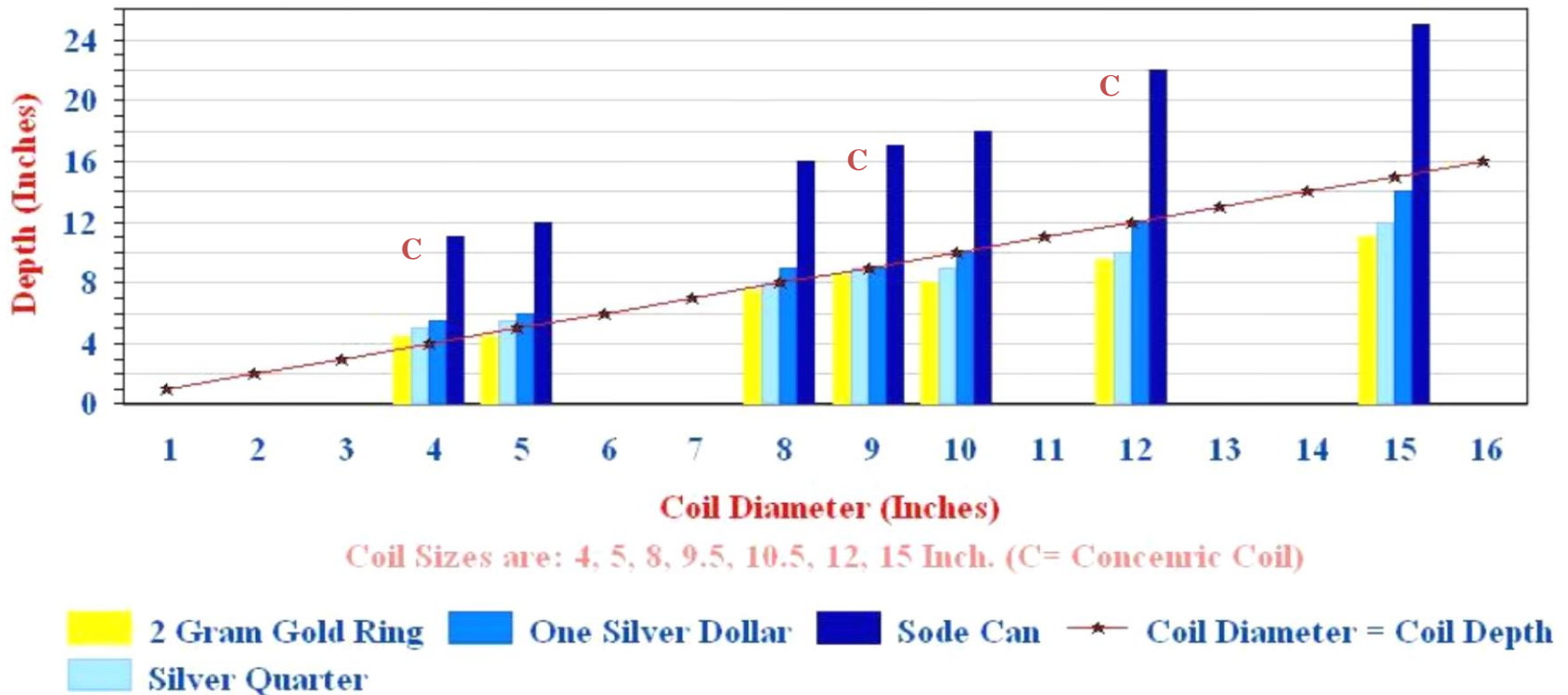
DD Coils Used for Air Test are: 5", 8", 10.5", 15"

Concentric Used for Air Test are: 4", 9.5", 12"

Detector Adjustments Held Constant for all Coils Sizes

Metal Detecting
Search Coil Class

Major Brand Detector Coil Depth Air Test



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To Recap



- ***Depth* is Dependant on Soil Conditions - Mineralization , Moisture, Trash**
- ***Depth* is Dependant on Target Material - Type, Position, Size, Shape**
- ***Depth* is Dependant on the Detector & Adjustments – ie: All Metal vs. Discrimination, etc**
- ***Depth* is Dependant on Operator Usage and Swing - Coil Level, Height, Speed**
- ***Depth* is Dependant on the Coil - Configuration, Shape, Size**
- ***Depth* is Dependant on the Magnetic Field Penetration into the Ground**

Metal Detecting Search Coils

End



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