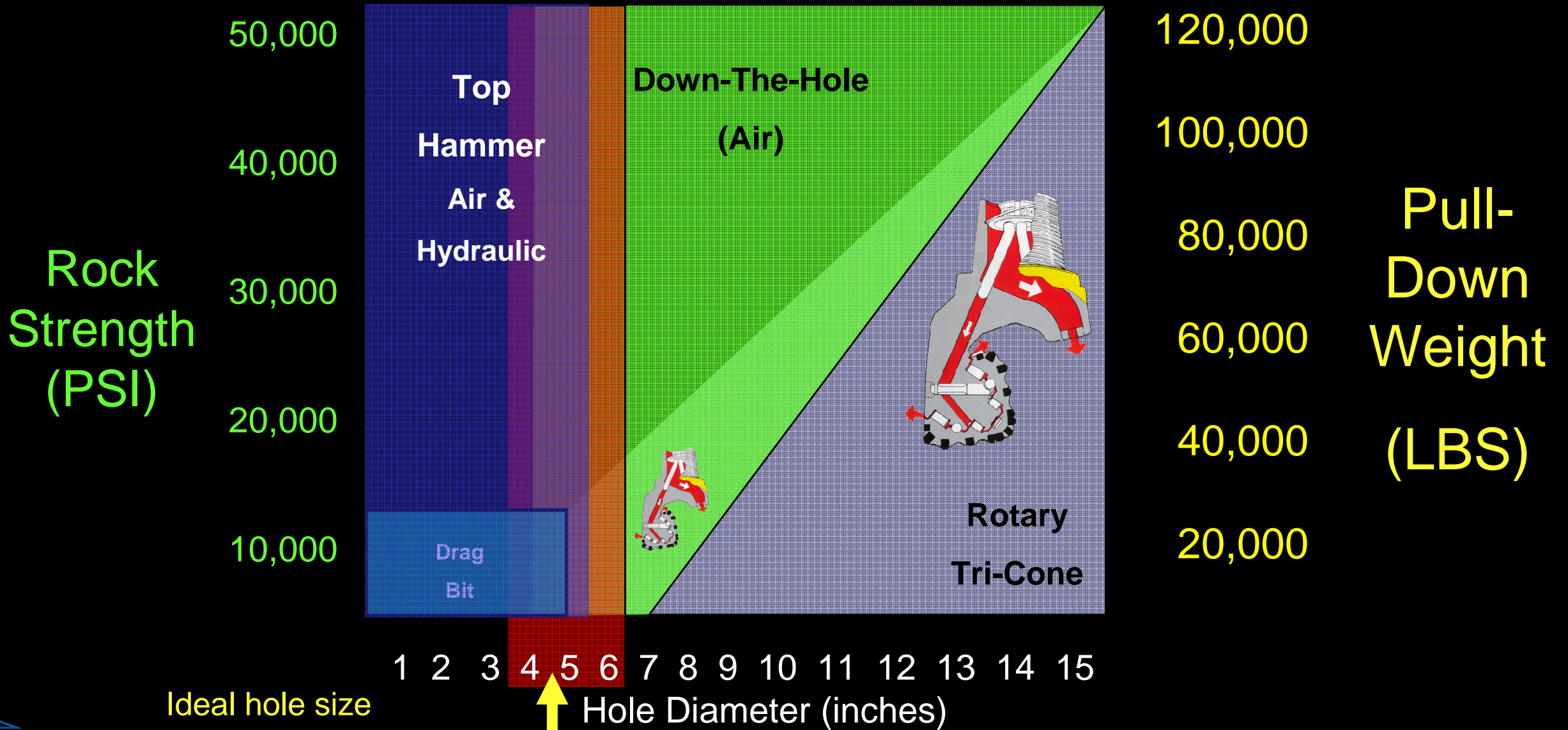


* Hole Diameter

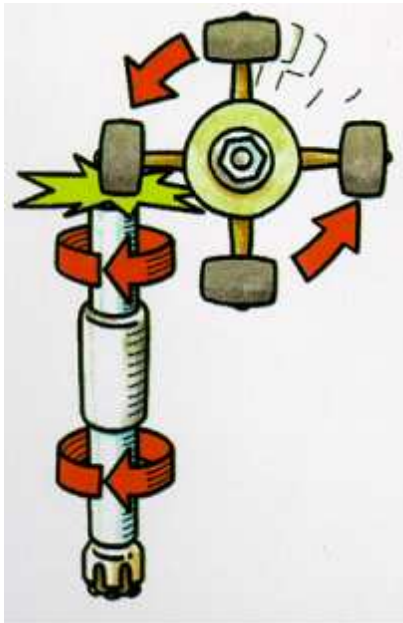


Ideal hole size for Quarries:

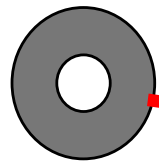
Drilling Domains

Drill String Elements

Top - Hammer

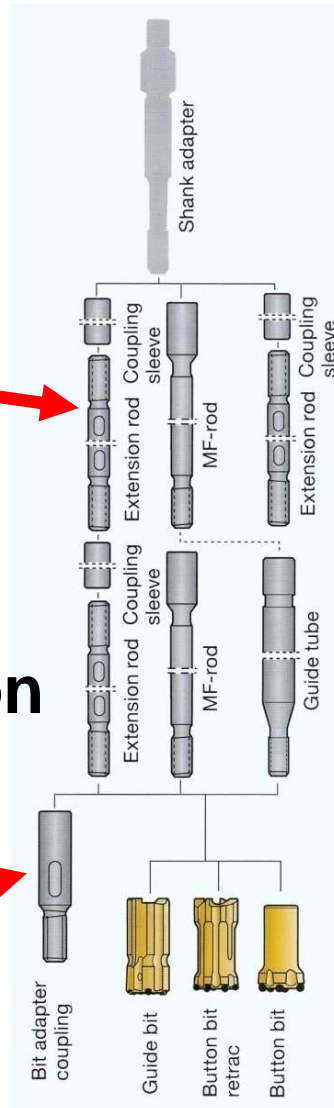
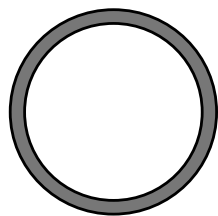


Drill Rod

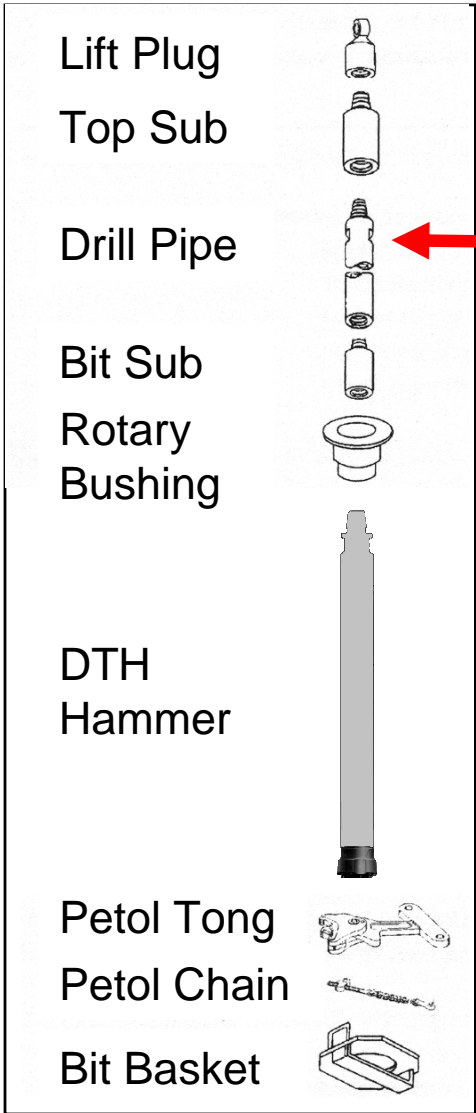


X-Section

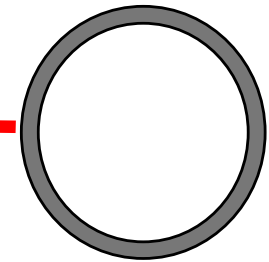
Percussion Pipe



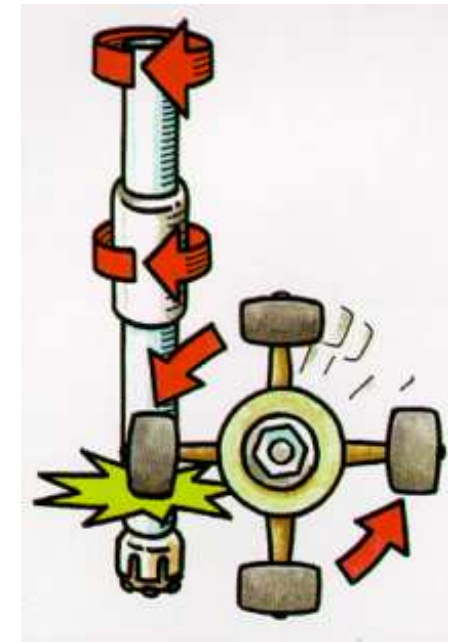
DTH - Rotary



Drill Pipe

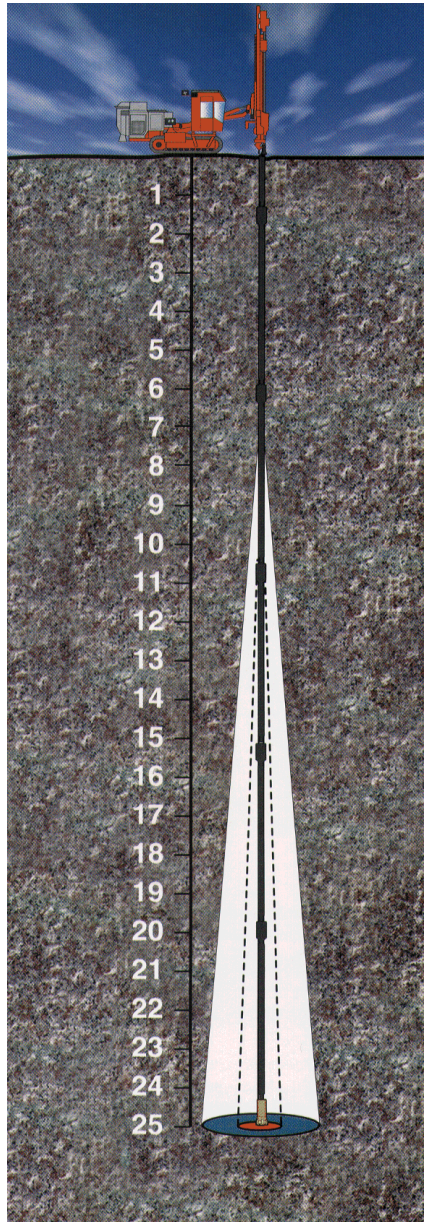


X-Section



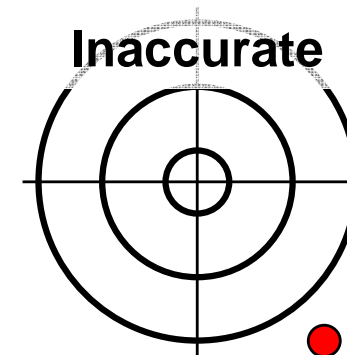
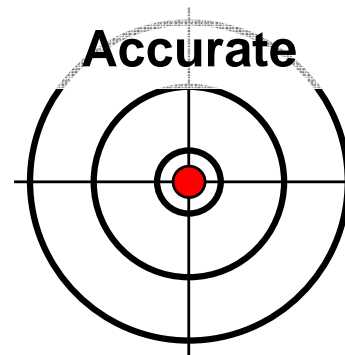
* Hole Accuracy/Precision

What is it?



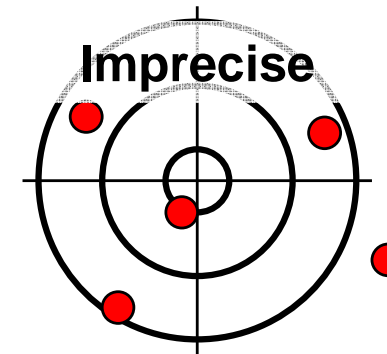
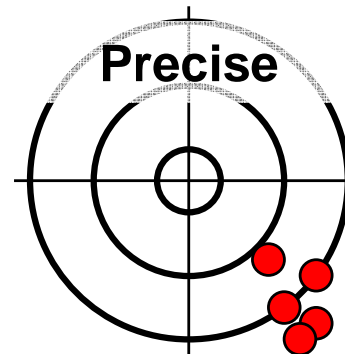
● Accuracy

✓ How close to the target the drilled result is:



● Precision

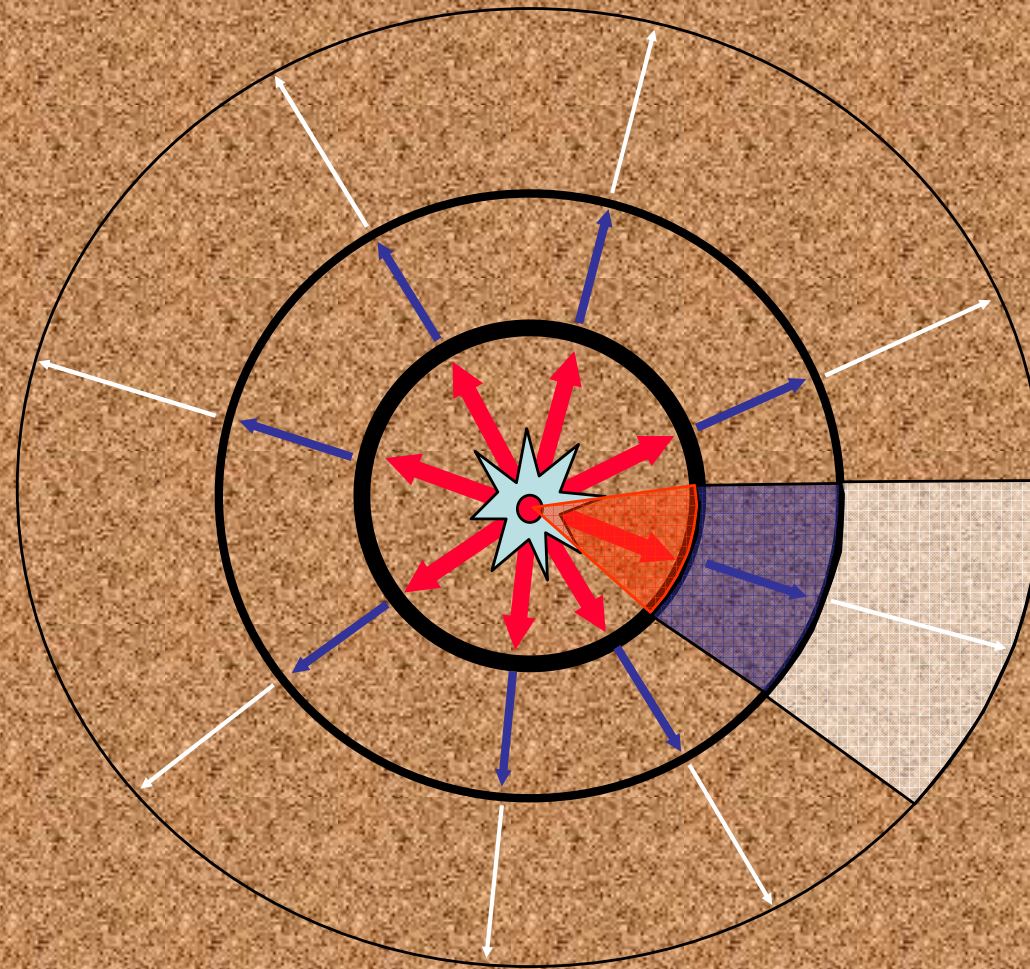
✓ How close/consistent the drilled result is:



Energy Force Vector Distribution

Lower Bench

Upper Bench

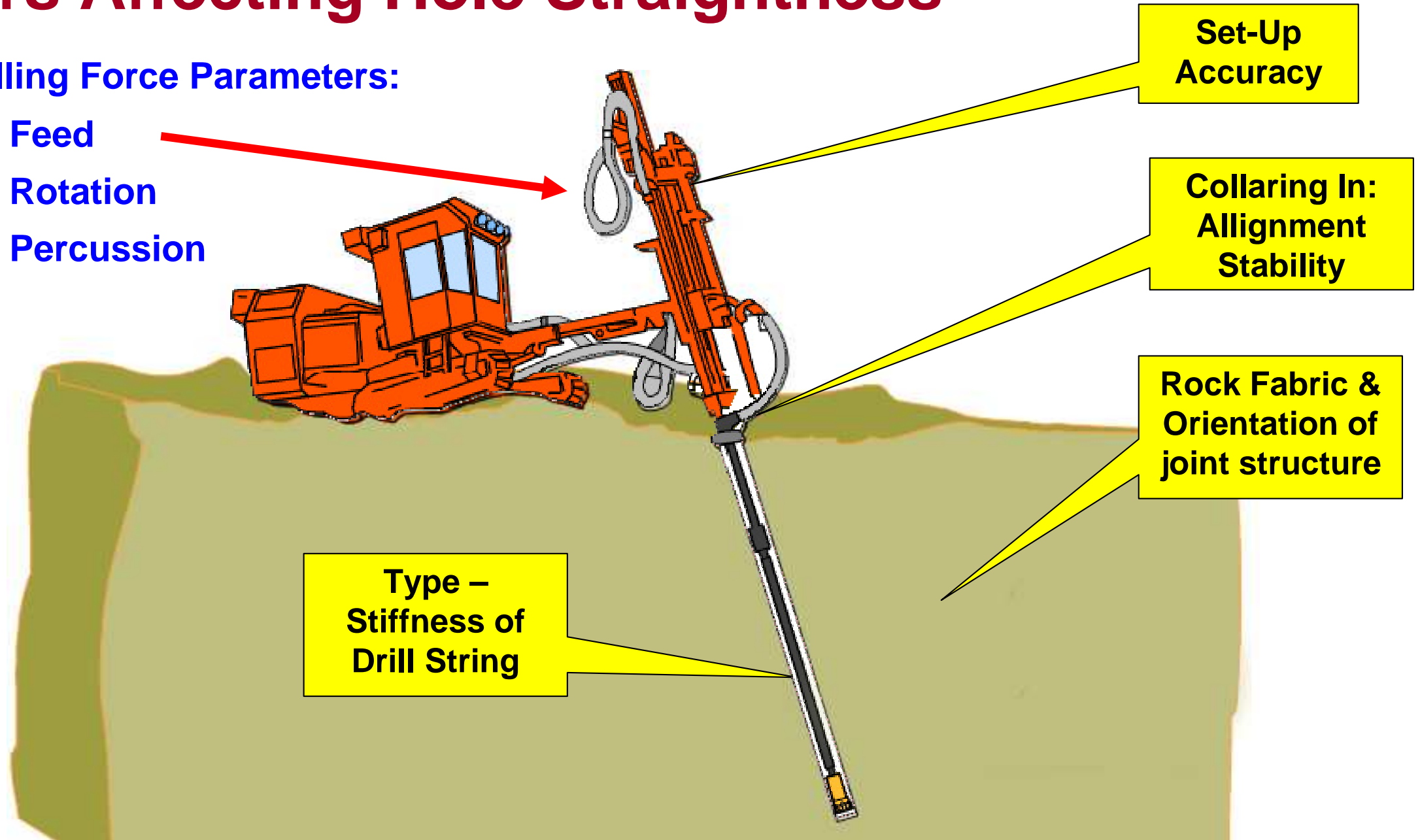


Plan View

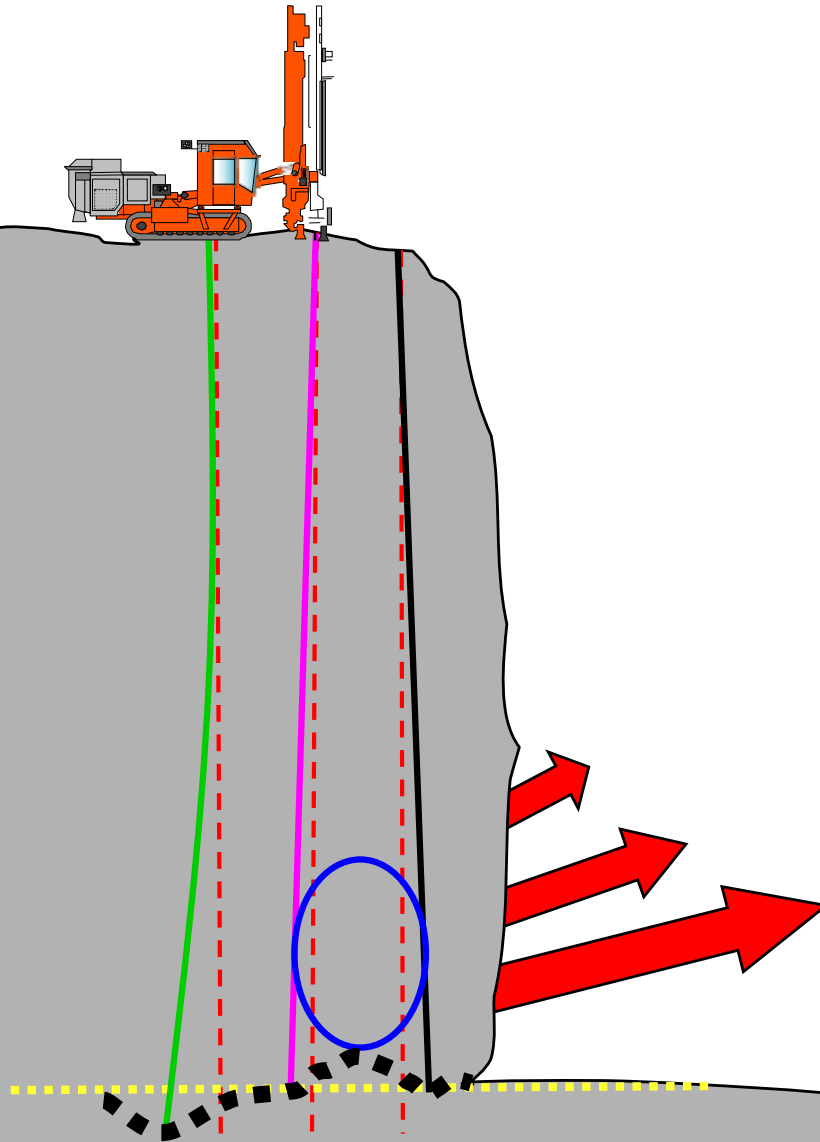
Factors Affecting Hole Straightness

Drilling Force Parameters:

- Feed
- Rotation
- Percussion



Accuracy & Precision



Inclination error

Collaring error

Hole depth error

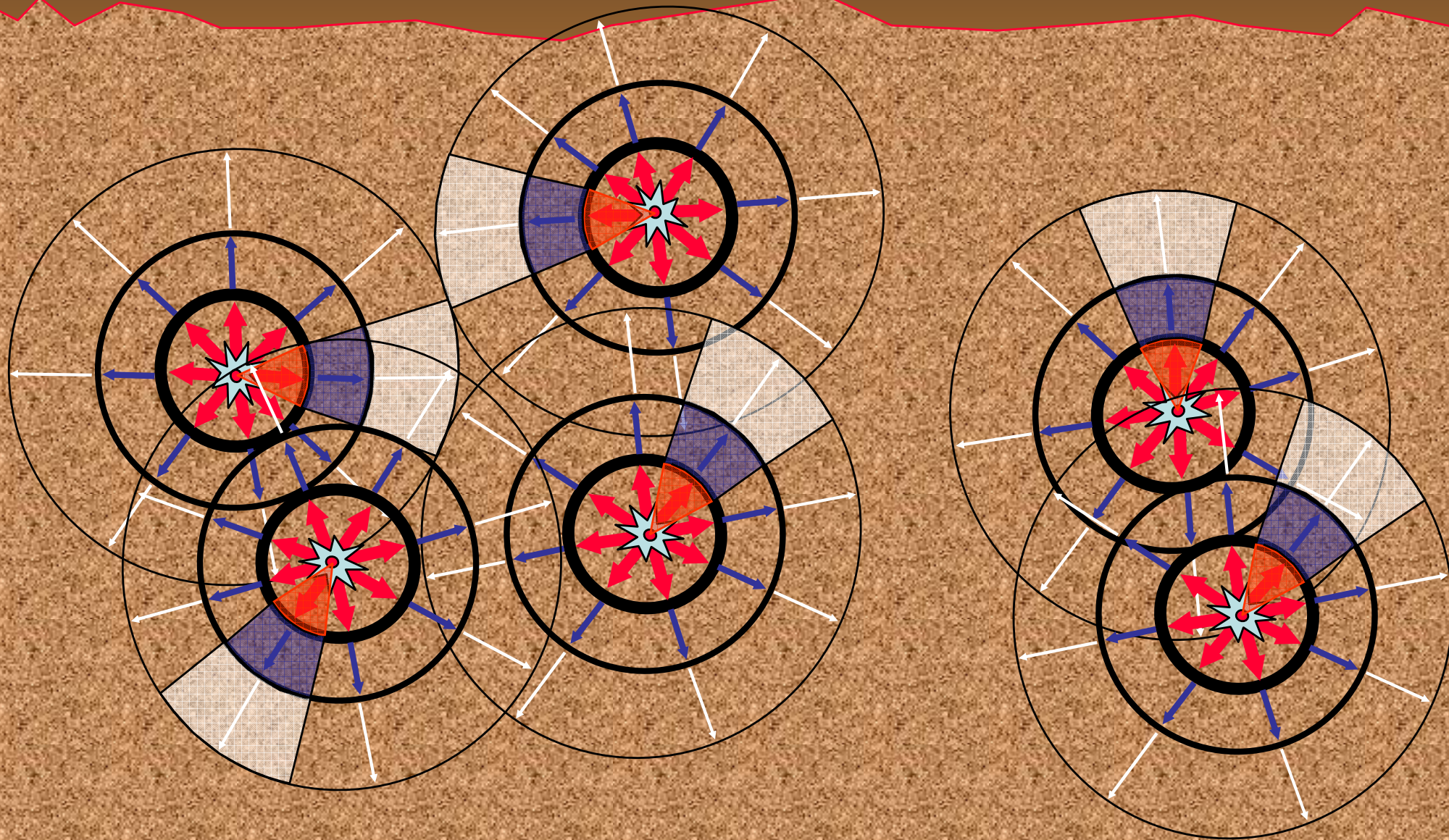
Deflection

Fly Rock

Oversize

Over – Under break

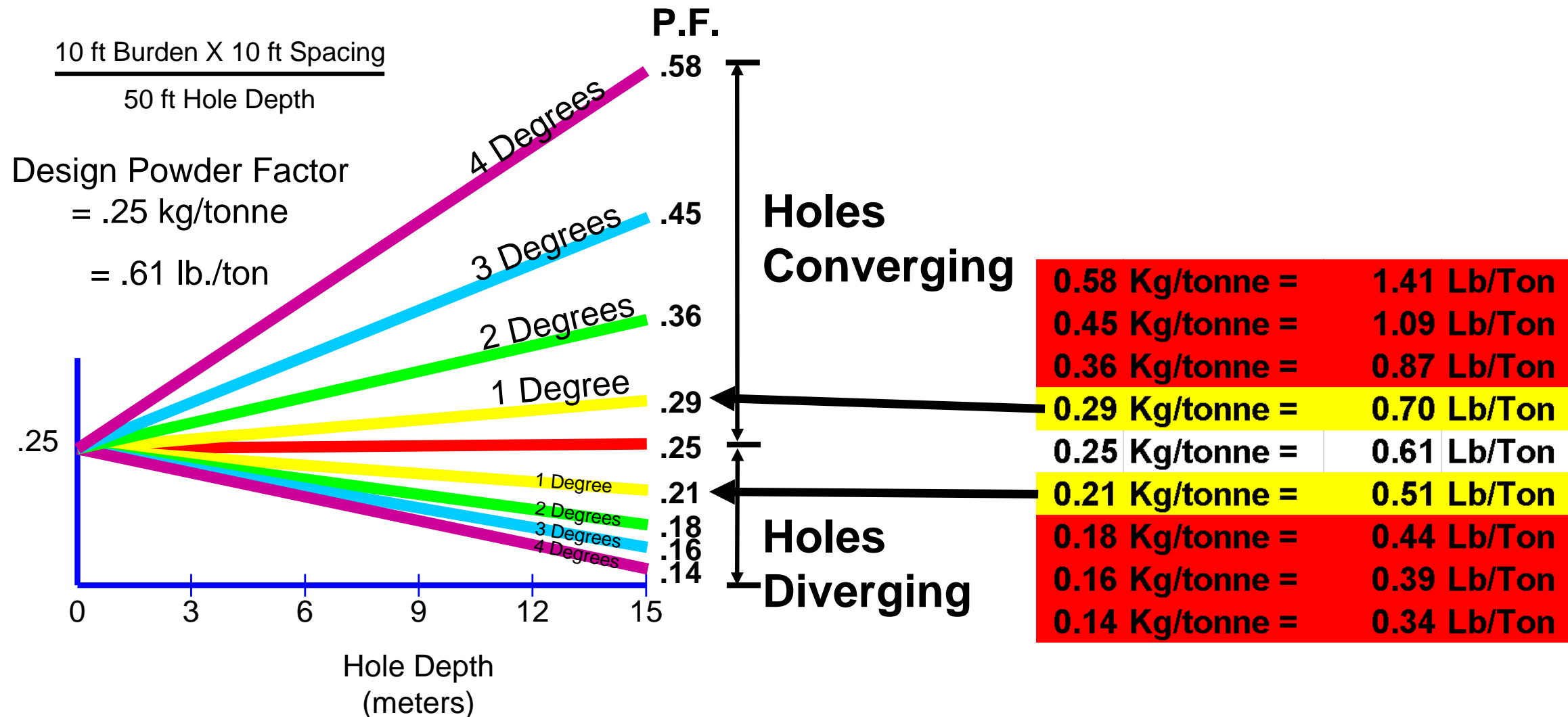
Inaccuracy compounded with imprecision causes uneven energy distribution, inefficiency, lower safety and minimal return on investment.



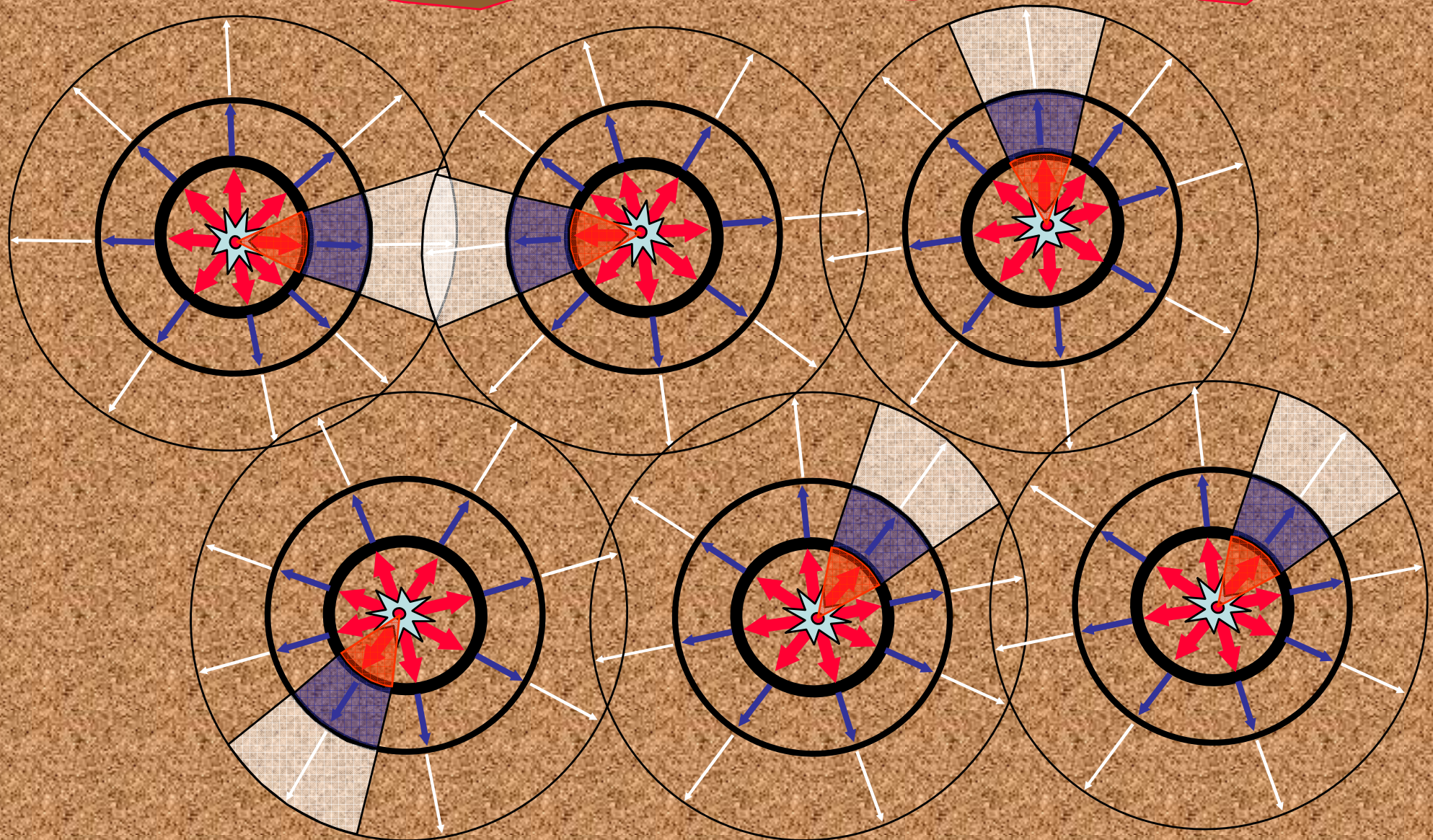
Effective Powder Factor

As Affected By Hole Accuracy

Maximum Variation in Powder Factor with Drilling Deviation



Accuracy and precision deliver uniform energy distribution and give the blast design a chance to deliver maximum performance for the money invested.



Explosive Section

Explosives

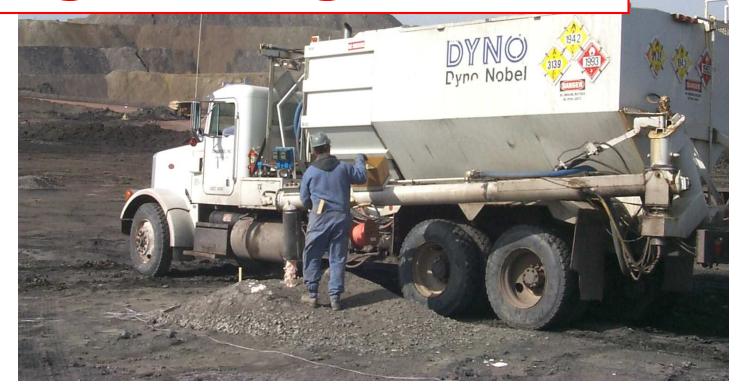
Play a role in:
Right Energy
Right Place
Right Time



Commercial Explosives

- Main Explosive Charge
 - Packaged
 - Bulk
- Dry Blend ANFO and Emulsion / Augerable
- Wet Blend ANFO and Emulsion / Augerable
- Pumpable Emulsion and ANFO Blend
- Pumpable Emulsion

Exactly the Right Energy for the main explosive is that which is sufficient to break the rock geology at the operation. The product that offers the most flexibility to meet changing conditions and requires minimum blast design changes.



Commercial Explosives

- Explosive component of the primer assembly
 - High explosive – 1.1D
 - Dynamite
 - Emulsion Explosive
 - Cast Booster

Exactly the Right Energy for priming is a cast booster.

Exactly the Right Place for the primer is near to the bottom of the blast hole preferably at floor level and near to the top of the explosive column. You should consider using a primer for every 20 ft column of explosive. Where hard rock zones are present it is best to position a primer in this area.



Commercial Explosives

Initiation Systems

- Electric Detonators
 - Pyrotechnic Delay
- Nonelectric Detonators
 - Pyrotechnic Delay
- **Electronic Detonators**
 - Programmable
 - Accurate and Precise

The tool to provide Exactly the Right Time for delivery of the Right Energy is a programmable, accurate and precise Electronic Detonator System.



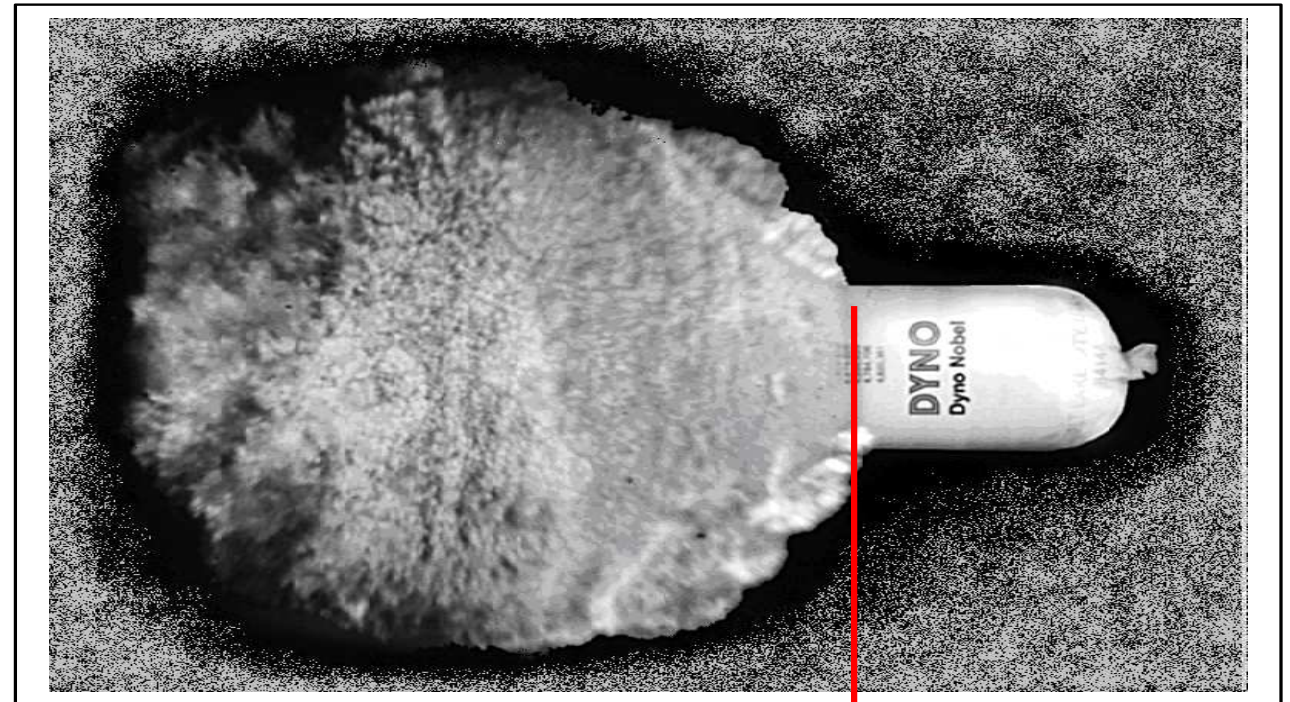
Important Explosive Properties

- Composition
 - Water Resistance
- Density (g/cc)
- Critical Diameter (inch)
- Energy (kcal)
- Velocity of Detonation (ft/sec)
- Detonation Pressure (psi)
- After Blast Fumes
 - NO_x / CO

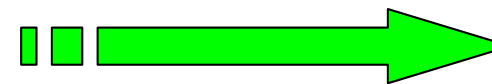


Important Explosive Properties

- Load Factor – Lbs/ft
- Energy
- Detonation Velocity
- Detonation Pressure



VELOCITY OF SHOCK
FRONT



= DETONATION
VELOCITY

Blasting Section

As Chemical Crusher, Drill and Blast targets extend one step further than the old norm.

- **Normal Drill and Blast**

- Zero Harm
- Full Regulatory Compliance
- Controlled boundaries of blast / excavation
- Uniform Breakage
- Easy to dig, load, haul, dump and feed.

- **New Normal - Chemical Crusher**

- Control and Influence rock particle size distribution.

Basic Drill and Blast Principles Still Apply.

- When explosives are detonated they release the chemical energy stored within them.
- All that energy will go somewhere:
 - into breaking and fragmenting the rock
 - into moving and heaving the rock
 - into ground vibration
 - into air overpressure and heat

Basic Drill and Blast Principles Still Apply.

- To do efficient work in rock, explosives need to be confined in drill hole. Without the drill hole, explosives would not be a practical tool for the quarry industry.
- In a correctly designed blast, accurately placed drill holes put the right quantity of explosive energy in the right place!
- In a correctly designed blast, an accurate and precise explosive initiation system applies the right quantity of explosive energy at the right time!

