Unlocking the Potential: Exploring the limitations and uses of Gamma-Density data for improved Mineral Resource Estimation

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Introduction to Me

Grew up in **Tom Price**

Started out with **Hamersley Iron**

Studied Geophysics at **Curtin**

Continued with **Rio Tinto** Iron Ore and Technology & Innovation

Moved to **Fortescue** in 2019

Currently studying Masters Data Science through **UNSW**

Overview

Why even estimate density?

Options for Estimation

Gamma-density as a solution product

Limitations and rectifications

Conclusion

Questions

Why should we care more about the **density** in Resource Estimation models?

- An orebody is defined by material of a given **grade** and tonnage [**volume**/geological interpretation x **density**]

- Current industry standard under-resources **density** determination

- Improved understanding on the spatial variability of the **density** within the orebody improves the grade-tonnage predictions

Options for Estimating **density**

- Depending on the **quantity** and **quality** of density data available we can:
  SCRIPT a density into the model, OR
  ESTIMATE the density directly into each block

- Current Industry standard:
  - drill diamond core;
  - obtain bulk density measurements; and
  - script values into domains.

- **How can we collect sufficient data to directly estimate?**

Gamma-Density: the silver bullet?

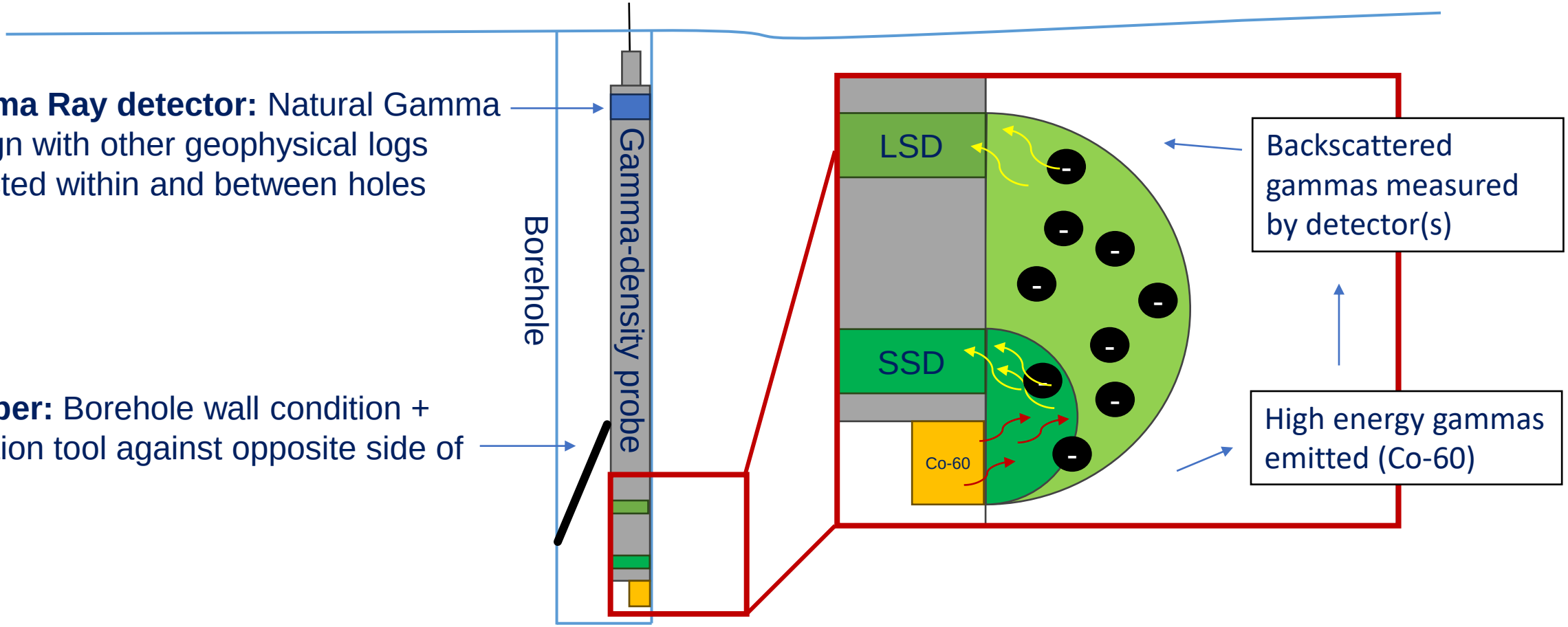
- A robust, repeatable, relatively cost-effective means to collect locally measured representation of density.

- Known **limitations** that *can* be accounted for.

What is **Gamma-Density**?

Gamma Ray detector: Natural Gamma to align with other geophysical logs collected within and between holes

Caliper: Borehole wall condition + position tool against opposite side of hole



Number of backscattered gammas is **inversely proportional** to the **electron density** of the material.
The higher the count, the lower the electron density.
Within the tools module a formula **converts the counts to a density** equivalent (g/cc) value

Addressing the **Limitations**

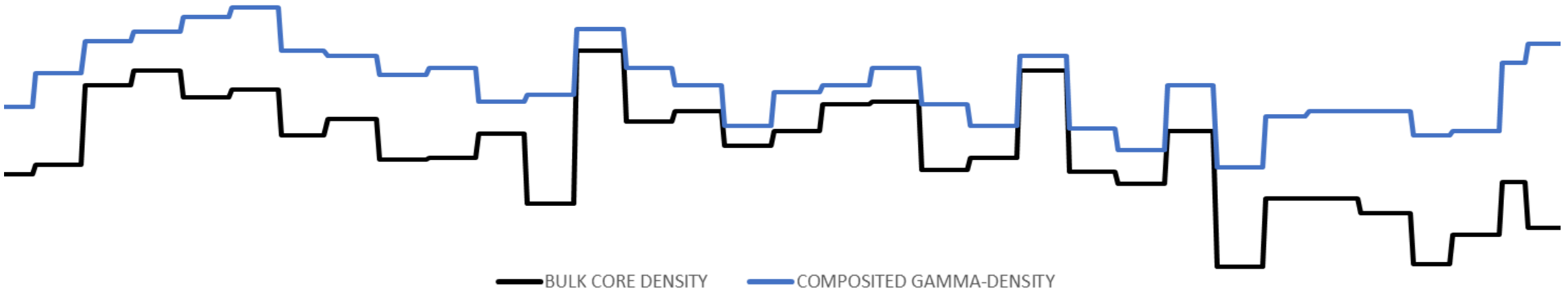
- **Decay** of energy source
  - Calibration Blocks Vs Master Holes
- Borehole **wall conditions**
  - Tool selection (single point vs dual receiver)
  - Geometric/Rugosity Correction (Roy Hill 2019)
- Electron Density **=/=** Bulk density
  - Assay Correction (to be trialled)

Addressing the **Limitations**

- **Moisture (?)**

  Moisture correction – Use Borehole Magnetic Resonance (BMR) data

  Diamond core TWIN programs



Conclusion: why it **is** worth it.

- A locally acquired density for direct estimation improves spatial tonnage variations in same space as GRADE variations

- Better spatial tonnage predictions can lead to:
  - De-risking mine plans
  - More accurate strip ratios
  - Improved Fleet selection
  - Increased accuracy in bench turnover rate
  - Stockpile/product build conformance
  - Optimisation of Ore Body
  - Improved reconciliations

‘Knowledge is worth nothing, if not shared’ ~ attributed to numerous French philosophers (ChatGPT3.5)

Questions?