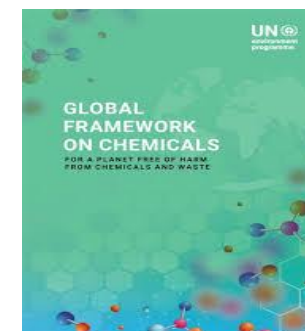


## CWFPF ROUNDTABLE MEETING

# *Biological Metal Recovery from E-Waste and Industrial Residues*

**Dr. KwaDwo Konadu Ansah Antwi**

CEO/Co-founder, BioMetallica Pte Ltd, (Singapore / Hong Kong)



# BIO METALLICA

## CHEMICALS AND WASTE FINANCING PARTNERSHIP FACILITY (CWFPF)

### ROUND TABLE MEETING

#### “Biological Metal Recovery from E-Waste and Industrial Residues”



# Precious Metals Powers our Modern Life

## Consumption in 2024

Platinum

Palladium

Rhodium

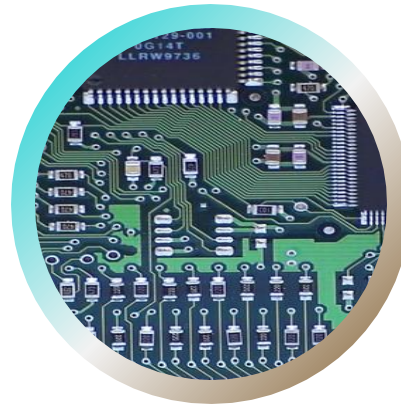
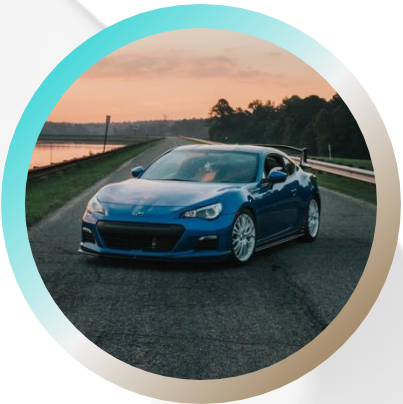
Gold

Silver

1.1 million kilos

5.1 million kilos

36 million kilos



An aerial photograph of a large-scale open-pit mine. The mine is characterized by deep, terraced rock walls that show distinct horizontal layers of different rock types. Several winding roads are visible, snaking through the various levels of the mine. In the foreground, a road curves sharply to the left. Further down, another road is visible with a few small vehicles. The sky above is blue with scattered white clouds. A semi-transparent green rectangular box is overlaid on the left side of the image, containing white text.

~70% of the global supply  
of precious metals

# Problems caused by Mining

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3.5% of Global  
Energy Use



90% of water stress  
and biodiversity  
decline



Global avg. lead  
time of 16 years

# Recycling Technologies

## Pyrometallurgy



- High energy cost
- Hazardous gaseous
- Mature technology

## Hydrometallurgy



- Toxic chemicals and additives
- Secondary liquid waste
- Mature technology

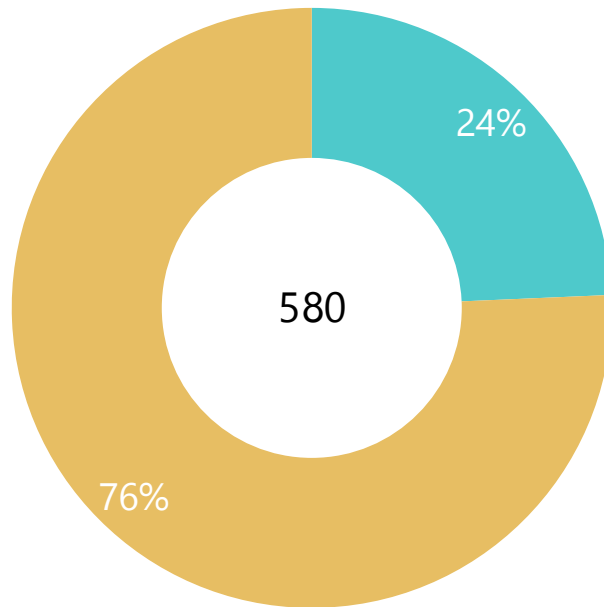
435 Mt/yr  
Toxic  
Wastewater

4.35 kt/yr  
Heavy Metal  
Waste

85 Mt CO<sub>2</sub>e  
Green House  
Gasses(GHGs)

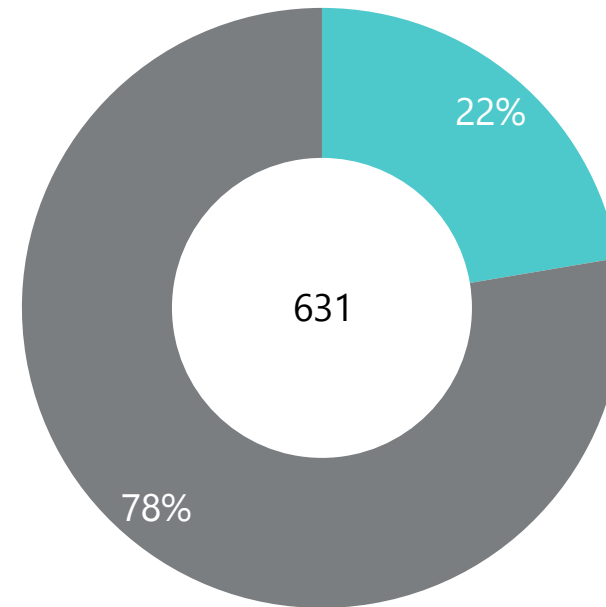
# Platinum Group Metals (PGMs)

Supply in 2024 (tonnes)



■ Recycled  
■ Mined

Recycling in 2024 (tonnes)



■ Open Loop Recycling  
■ Closed Loop Recycling



# E-waste in 2023

71 billion kgs generated  
only 20% recycled  
\$24 billion lost to landfill



E-waste: 200 – 3500g/ton of critical metals

10x to 100x



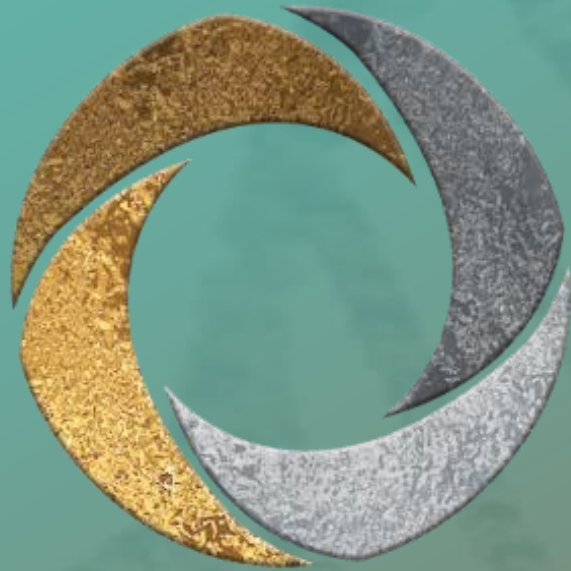
Primary ore: 5 -10g/ton of metals

A large, conical pile of scrap metal, primarily consisting of rusted metal pipes and fittings, dominates the center of the image. The pile is situated outdoors on a dirt and gravel surface with some sparse green weeds. In the background, a clear blue sky with scattered white clouds is visible. To the right, a white truck is partially visible behind a blue metal gate. A semi-transparent teal rectangular box is overlaid on the center of the image, containing white text.

**20 billion kgs**  
in 2023

A Black man with short, dark hair is shown from the chest up, wearing a dark jacket. He is looking down towards a large, intense fire that is consuming a pile of debris on the ground. The fire is bright orange and yellow, with thick black smoke rising from it. The man's expression is somber and contemplative. The background is a dark, paved surface, possibly a street or a parking lot. The overall mood is one of despair and hopelessness.

**Why do  
I care?**



# Our **Solution**

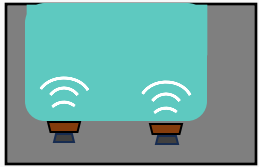
Sustainable metal recycling  
using synthetic biology



E-WASTES

# An end-to-end, mid-stream solution within the recycling value chain

1

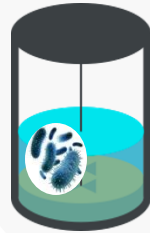


## Feedstock Pretreatment

Ultrasonication to remove non-target metals

Patented

2

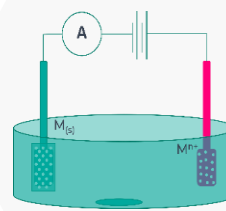


Patented

## Metal Bioleaching

Ionic metal state via oxidation

3



## Metal Reduction

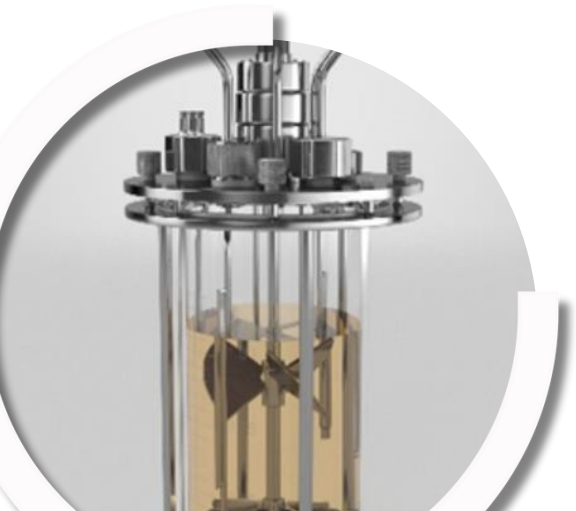
Convert to metallic state

Patented

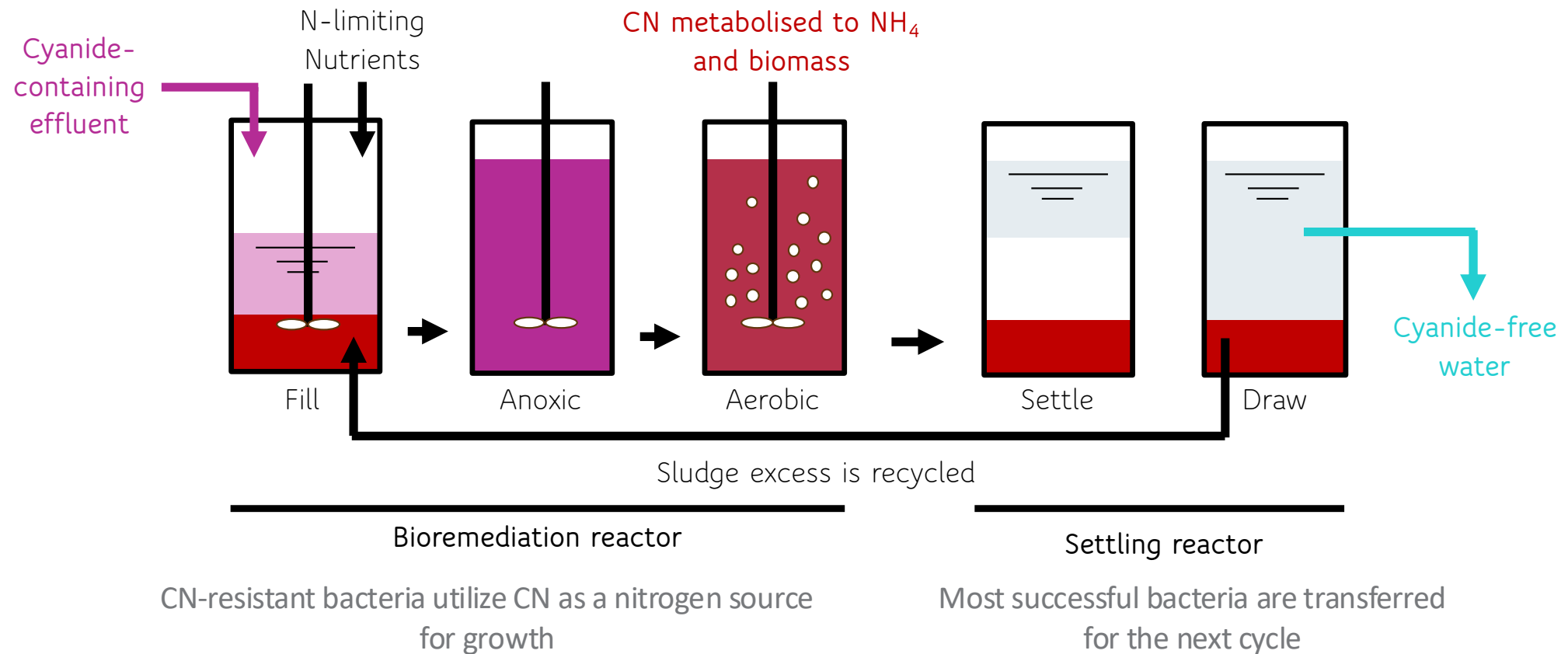
4

## Cyanide recovery & Destruction

Biocatalytic breakdown of cyanide effluent and regeneration

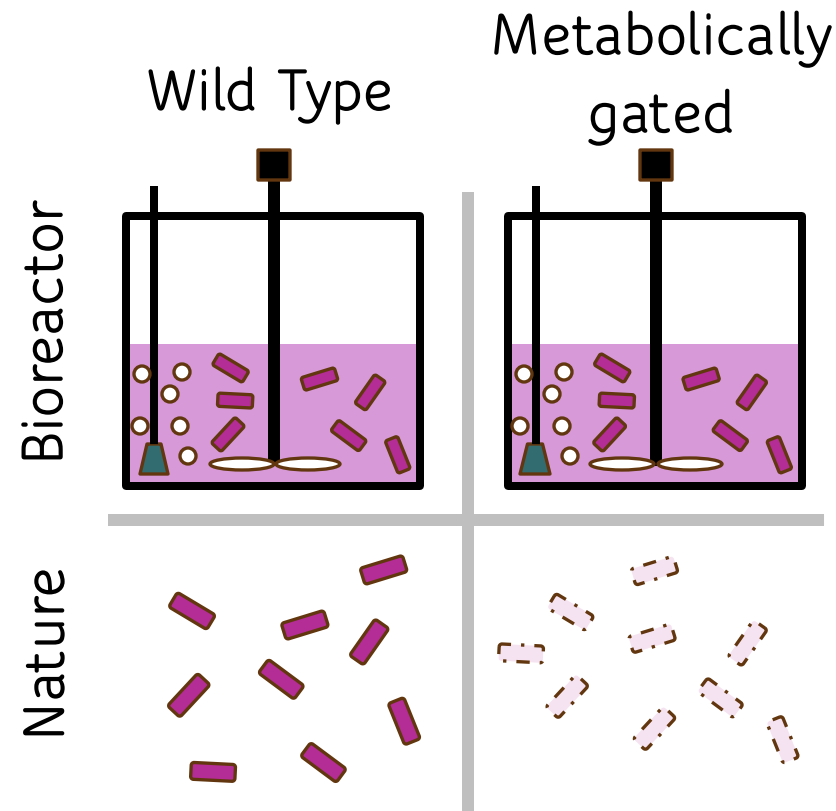


# Continuously self-improving bioremediation



# Safe handling of Engineered bacteria

Wild type bacteria capable of producing DAP (diaminopimelate) can survive on it's own



DAP deficient mutants cannot survive outside the bioreactor when DAP is not provided

# Value Proposition

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**3x**

Cheaper  
vs. today's tech



**6x**

Energy  
Efficiency



**90%**

Reduced  
Chemical Usage



**Safe**

Sewer-safe  
Discharge

# Market Opportunity and GTM Strategy



## Total Available Market

US \$54B growing at 10% CAGR  
is the estimated value of the Global  
Precious Metal Recycling market in  
2024

## Growth Drivers



Industrial  
Demand



Regulatory  
Pressure

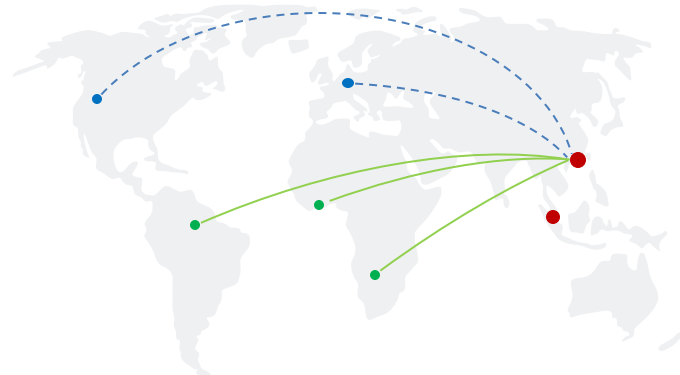


Supply  
Constraints

BioMetallica is launching operations in Hong Kong and  
Singapore, where market opportunity is ~US \$100M in revenue

## Scaling and Expansion

- Phase 1: **Launch in Asia-Pacific** (SG, HK and PH with pilot units)
- Phase 2: **Expand into Europe and SEA** (via partnerships and licensing)
- Phase 3: **Enter resource-rich regions** (Africa, Latam with modular units for mine tailings and urban mining)



# Business Model

## Equipment-as-a-Service (EaaS)

**40%** Service charges on metal sales  
(**5** year service agreement)

+

Recurring Revenue:  
Annual Service and Management Fee  
Consumables and Hardware

## Direct Sale of Mobile Recycling Unit (MRUs)

Unit Sales:  
**\$700k** per unit

+

Recurring Revenue:  
**20%** Service charges on metal sales  
Annual Service and Management Fee  
Consumables and Hardware

# Competitive Analysis

|                              |  |  |   |    |    |    |
|------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Room Temperature             |  |  |                                                                                     |                                                                                       |                                                                                       |    |
| Eco-Friendly Micro-Organisms |  |  |                                                                                     |    |    |    |
| Diverse Range of Feedstock   |                                                                                   |                                                                                   |                                                                                     |                                                                                       |   |   |
| Metal Agnostic               |                                                                                   |                                                                                   |  |  |  |  |

## BioMetallica's Edge

-  **Diverse Feedstock:** Recovers PGMs, gold, silver, and cobalt from various waste streams.
-  **Field-Deployable RaaS:** On-site recycling reduces costs and transport related emissions.
-  **Integrated Innovative Technology:** Real-time monitoring and analysis and near-zero toxic secondary waste.

WHERE WE ARE

# Traction

2025 2026 - 2027

Revenue Stream:

## Research Contracts

1 Paid Pilot: Projected Revenue:

**\$500k**



# Commercial Roadmap



# Team



**Kwadwo "Joe"  
Ansah-Antwi, PhD**

**CEO & Founder**

PhD, Elect & Com. Engineering & Management of Technology, NUS

- Founder/Ex-CEO Hessner Technologies, HK
- Top 10 Most Promising Entrepreneur 2024



**Wesley  
Loftie-Eaton, PhD**

**CSO**

PhD, Molecular Microbiology, University of Stellenbosch, SA

- 5 patents granted
- 7+ years leading R&D in enzyme engineering and synthetic biology



**Elizabeth  
Loennborn, MSc**

**COO**

M.Sc. Biotechnology, Johns Hopkins University, USA

- Specialist in commercialization and strategic partnerships.
- Climate-driven deep tech evangelist



**Hugo  
G. Schmidt, PhD**

**Principal Scientist**

PhD, Systems Biology, Cambridge, UK

- Former WuXi Biologics Subject Matter Expert
- Former consultant for USD 20 million booming startup

# Team



**Suresh  
Govindarajan, PhD**

**Principal Scientist**

PhD, Physics, VIT University, India

- Co-Founder of TuSense, Singapore
- Passionate and Experienced Materials Scientist



**James  
Kohagen, MSc**

**Lead Engineer**

M.Sc. Sustainable Mining & Remediation, TU Bergakademie Freiberg, Germany

- Former lead biohydrometallurgist
- Former Helmholtz Engineer



**Filippo  
Colagrande, MSc**

**Founder Associate**

Double Master in Eviron Tech and Aero Eng; UK

- BCG Consultant with 4+ years of experience;
- Experience in M&A, Technology Commercialization, Venture Building and GtM Strategy

# ADVISORY TEAM



**Sam Chow**

**Business Dev Advisor**

- Professional Chartered Account
- President, Star Metal Recall Sdn Bhd, Malaysia



**Douglas Abrams**

**Investor Relations Advisor**

- CEO of EXpara Pte Ltd
- NUS Business School



**Prof Jason Lam**

**Principal Consultant**

School of Environment and Energy, CityU HK



**Rajeev Kumar**

**Business Dev Advisor**

- MBA, Delhi University
- BSc in Chem and Industrial Engineering
- Independent Consultant



**Prof Yew Wen Shan**

**Scientific Advisor**

- Associate Professor, NUS, Singapore
- HoD Department of Biochemistry



**Prof Eveliina Repo**

**Scientific Advisor**

- Full Professor (Tenured)
- LUT School of Engineering Science Lappeenranta, Finland.

# Past Funding

Raised \$1M



香港城市大學  
City University of Hong Kong



The Heritage Group  
ACCELERATOR



NUS  
National University  
of Singapore



SUSV

Enterprise  
Singapore

# Seed Funding

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## Scaling Operations

2 Modular Recycling Units

40%

30%

## Product Engineering

IoT enabled & Remote Access

Control/Monitoring

30%

## Field Deployments

Singapore, Hong Kong & Philippines

We're seeking

**\$5M**

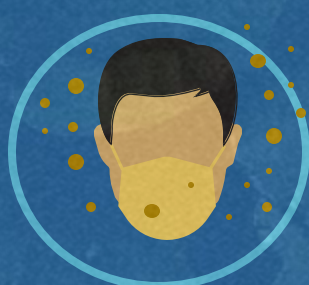
# Financial Projections



## TRACTION

- Revenue grows from \$0.5M in 2025 to \$38.1M in 2030
- EBITDA turn positive in 2027, (\$100k)
- Positive Net Income achieved in 2028, (\$1.8M, 15% margin)
- EBITDA margin improves to 36% by 2030
- Net Income margin similarly grows to 24%

# BIO METALLICA



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