AFROSCREEN project

Overview, progress and challenges

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AFD Agence Française de Développement
République Française Liberté Égalité Fraternité
anrs Maladies infectieuses émergentes Inserm
IRD Institut de Recherche pour le Développement France
Institut Pasteur

Background
Why monitor SARS-CoV-2 variants?

Certain mutations can affect the properties of the virus and influence:

- its transmissibility, its spread
- its replication speed
- the clinical presentation of the disease
- its ability to bypass our immune system
- the efficiency of
  - vaccines
  - medication
  - diagnostic tools
  - social and public health measures

Background
Sequencing: a key public health tool

nature medicine

Correspondence | Published: 07 April 2021

Africa needs more genome sequencing to tackle new variants of SARS-CoV-2

Akaninyene Otu, Emmanuel Agogo & Bassey Ebenso

World Health Organization
REGIONAL OFFICE FOR Africa

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WHO Africa / Scaling up genomic sequencing in Africa

Scaling up genomic sequencing in Africa

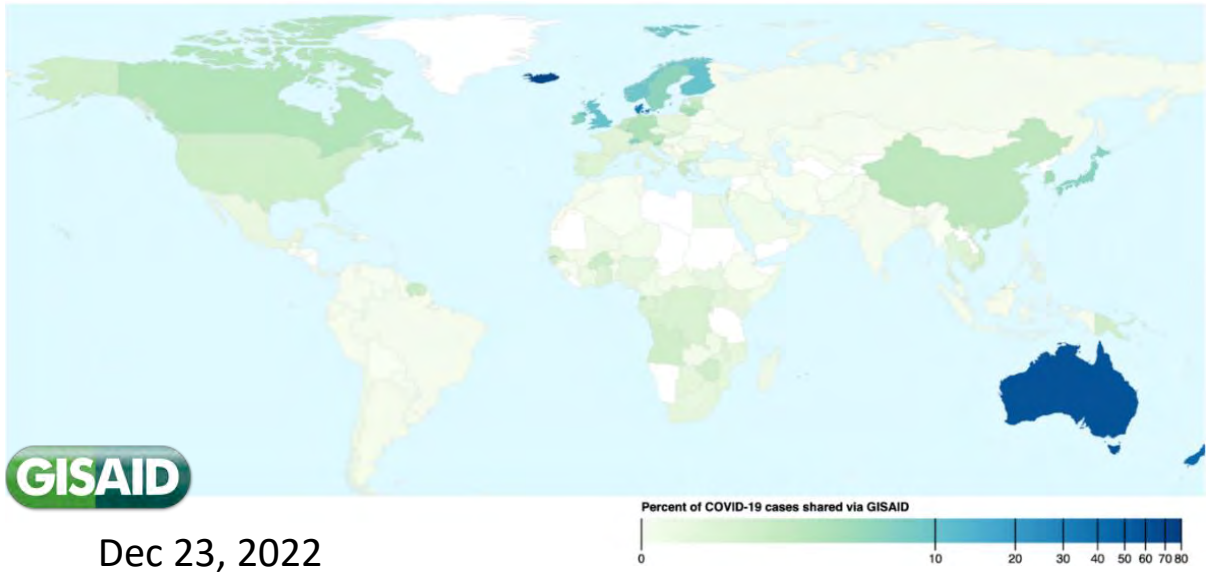
30 September 2021

Brazzaville – COVID-19 has had a catastrophic impact on lives and livelihoods. But it has also spurred impactful scientific research that gave the world a vaccine in record time and thrust genomic sequencing at the centre of pandemic response.

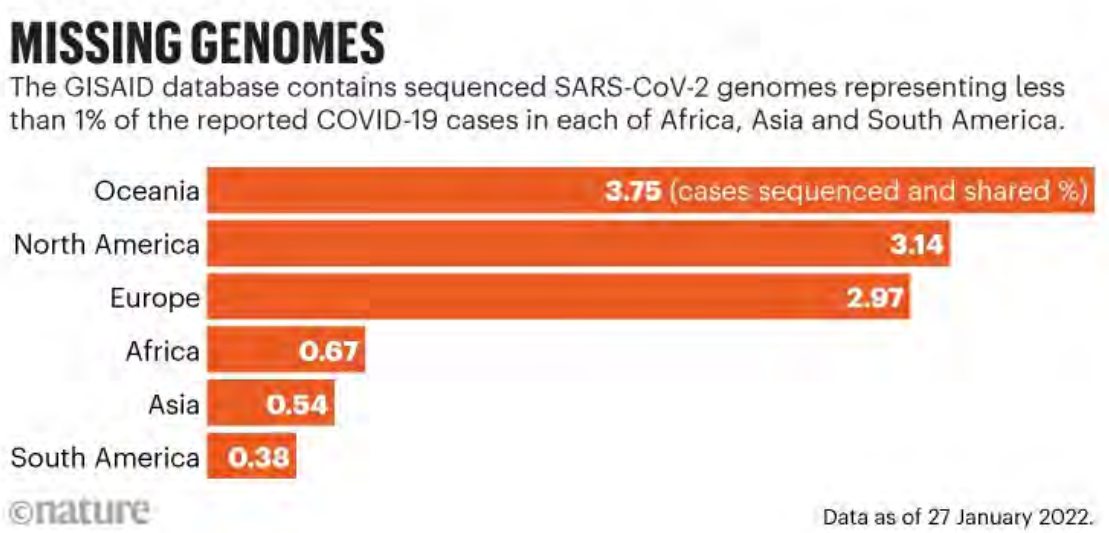
The world rapidly identified the virus that causes COVID-19 and developed diagnostic tests and other response tools thanks to genomic sequencing, which remains crucial in monitoring the evolution of COVID-19 and identifying variants of concern.

In Africa, World Health Organization (WHO) is working with countries to scale up pathogen surveillance through genome sequencing to detect and respond effectively to COVID-19 variants. In 2020, WHO and the Africa Centre for Disease Control and Preventionestablished a COVID-19 sequencing laboratory network in Africa which has to date produced over 43 000 sequencing

Background – **Sequencing worldwide**



Dec 23, 2022



- **Worldwide: 14 157 528 sequence** entries shared via GISAID
- **Africa: 144 516** (1,5% of total COVID-19 cases reported on the continent)

Overview – **The AFROSCREEN project**

AFROSCREEN

10 M€

24 months

(July 2021 – July 2023)

AFD
AGENCE FRANÇAISE DE DÉVELOPPEMENT

Consortium

anrs MALADIES INFECTIEUSES EMERGENTES Inserm

PASTEUR NETWORK

IRD Institut de Recherche pour le Développement FRANCE

& African Partners

25 Laboratories, reference centers and partners

Objective

Respond to surveillance needs for SARS-CoV-2 and emerging pathogens

13 countries

Benin, Burkina Faso, Cameroon, Central African Republic, Democratic Republic of Congo, Ghana, Madagascar, Mali, Niger, Republic of Côte d'Ivoire, Republic of Guinea, Senegal and Togo

Coordination

- WHO/PCG for the implementation of the Global Genomic Surveillance Strategy
- ACDC/PGI
- WHO/AFRO, Dakar Emergency Hub, regional program to strengthen genomic surveillance
- Team Europe Initiative (IEE) with Africa on sustainable health security using a One Health approach
- HERA, Intelligence Gathering, Analysis and Innovation Unit

Overview – **Objectives**

AFROSCREEN

General Objectives

Sequencing capacity strengthening in laboratories within 13 African countries for surveillance of SARS-CoV-2 and other emerging pathogens

Monitor the evolution of SARS-CoV-2 and other emerging pathogens integrating into each country's national system

Specific Objectives

To train, equip and reinforce sequencing capacities or screening PCR in partner laboratories

To detect emerging variants and follow their spreading dynamics in populations

To alert rapidly health authorities and the international community in case of emergence of a variant of interest

To investigate epidemiological characteristics of SARS-CoV-2 variants of interest in Africa

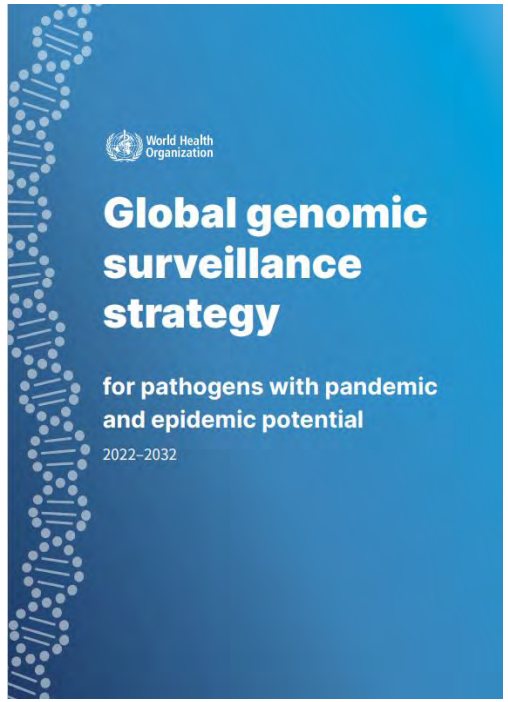
To improve the response to the COVID-19 crisis and **to prepare** countries to respond to future emerging pathogens on the African continent

Public Health Objective

Use of data from sequencing and epidemiological investigations by the authorities → **Public Health Measures**

Overview
In line with WHO recommandations

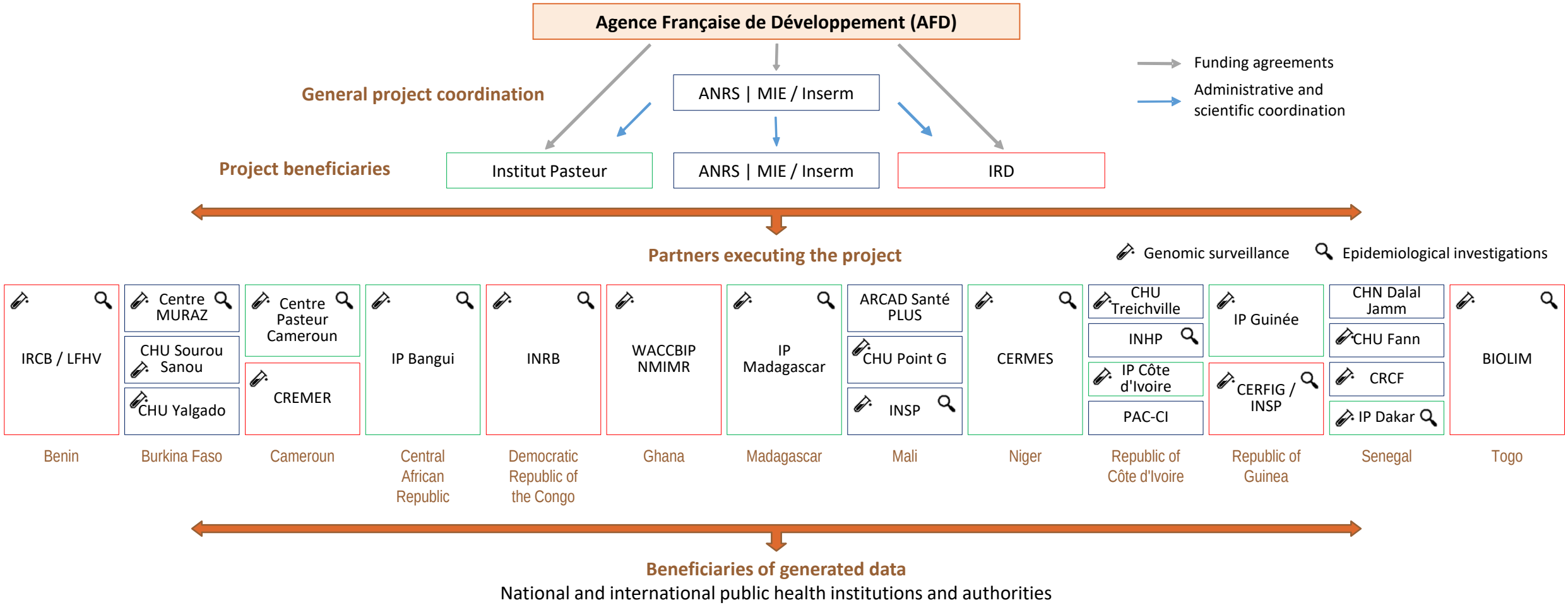
Genomic surveillance is transforming public health action by providing a deeper understanding of pathogens, their evolution and circulation



The goal of the Strategy is that genomic surveillance for pathogens with pandemic and epidemic potential is strengthened and scaled for quality, timely and appropriate public health actions within local to global surveillance systems

The AFROSCREEN project is contributing to the effort WHO is calling for “to **bring the benefits of genomics to everyone in an effective, ethical, and equitable manner**”

Overview – **Organization and Coordination**



Overview – **Capacities of 21 laboratories**

- Before AFROSCREEN / through other projects
- Right now, thanks to AFROSCREEN
- Planned, thanks to AFROSCREEN

* equipment and reagents

Country	Structure	Screening PCR *		Sequencing *		Sequencing training
		Before	AFROSCREEN	Before	AFROSCREEN	AFROSCREEN
Benin	IRCB / LFHV	Yes	Yes	-	iSeq100	2 month training for 2 people at TransVIHMI (IRD) + Bioinformatics
Burkina Faso	Centre Muraz	No	Yes	MinION	MiniSeq	3-week training for 2 people at CHU MONDOR
	CHU Yalgado	No	Yes	-		
	CHU Sourou Sanou	No	Yes	MinION		
Cameroun	CP Cameroun	No	Yes	MinION + NextSeq 500	iSeq100	*10-day Illumina training and 1-week on-site NGS MinION training*
	CREMER	No	Yes	iSeq100		3-month training for 2 people at TransVIHMI (IRD) + Bioinformatics + Continuous monitoring by on-site missions
Central African Republic	IP Bangui	No	Yes	MinION		2-month Illumina training at the CIBU of the Institut Pasteur
Democratic Republic of the Congo	INRB	No	Yes	MiSeq + iSeq100 + MinION		Training in remote bioinformatics analyzes
Ghana	WACCBIP/ NMRI	No	Yes	MiSeq + NextSeq550 + MinION		Fully trained in sequencing before the project
Madagascar	IP Madagascar	No	Yes	iSeq100 + MinION	MinION + Illumina	
Mali	CHU Point G	No	Yes	-		
	INSP	No	Yes	MinION + *NextSeq550*	MiniSeq	3-week training for 2 people at CHU MONDOR
Niger	CERMES	No	Yes	MinION	iSeq100	2-month Illumina training at the Biomics platform of the Institut Pasteur (Jan.-Mar. 2023)
Republic of Côte d'Ivoire	IP Côte d'Ivoire	No	Yes	NextSeq550 + MinION		
	CHU Treichville	No	Yes	-		
Republic of Guinea	CERFIG / INSP	No	Yes	iSeq100		2-week training for 2 people on site
	IP Guinea	No	Yes	MinION	iSeq100	*1-month MinION training at the CIBU of the Institut Pasteur*
Senegal	IP Dakar	Yes	Yes	NextSeq550 + Miseq (2) + iSeq100 (2) + MinION (8)	NovaSeq6000 (350k€/900k€)	Fully trained in sequencing before the project
	CHU Fann	No	Yes	-	iSeq100	3-week training for 2 people at CHU MONDOR
	CHU Dalal-Jamm	No	Yes	-		
Togo	BIOLIM	No	Yes	-	iSeq100	2-month training for 1 person at TransVIHMI (IRD) + 2-week training for 2 people on site + Bioinformatics

AFROSCREEN in action

- **Equipment and reagents + training**
- **Active sentinel epidemiological surveillance** in Benin, Burkina Faso, Cameroon, Madagascar, Central African Republic, Republic of Côte d'Ivoire, Republic of Guinea, Democratic Republic of the Congo and Senegal
- **Implementation of the variant surveillance system** in Burkina Faso
- **Active family epidemiological investigations** in Madagascar
- Reagents for the detection (diagnostic PCR) and characterization (sequencing) of **other priority viruses**
- **Number of screening PCRs performed: 7,015**
- **Number of sequences deposited in international public databases: >7,000**

- Number of webinars: 2
- Number of laboratory training sessions: 23
- Number of clusters investigated: 1

AFROSCREEN in action – Viruses other than SARS-CoV-2

The project has started providing the reagents for the detection (diagnostic PCR) and characterization (sequencing) of the priority viruses in the different countries:

- The Pasteur Institute of Madagascar has set up mpox diagnostic PCR and is sequencing the Rift Valley fever virus (RVFV)
- The Institut Pasteur in Côte d'Ivoire has extended activities to dengue fever and mpox
- The Pasteur Center in Cameroon participated in an investigation in the Center region around cases of mpox and is drafting a research protocol for a study on mpox in the region
- The Institut Pasteur in Dakar participated in the investigation of cases of Crimean Congo hemorrhagic fever
- CERMES tested six samples for suspected viral hepatitis E, three of which were confirmed positive
- The Institut Pasteur in Guinea has set up diagnostic PCRs and started sequencing for measles. It tested two samples for suspicion of mpox. Monitors entero-transmissible and zoonotic viruses from pig feces samples in Conakry and in wastewater. It is in the process of characterizing by sequencing the hepatitis E virus (HEV) circulating in Guinea
- The INRB (DRC) has obtained around thirty complete genomes of mpox

Challenges

- Delays in supplying equipment, reagents and consumables due to
  - lack of responsiveness from Illumina
  - non availability from suppliers
  - high prices and low quality from local suppliers/distributors
  - complex and slow administrative procedures and customs exemption procedures
- Local (and occasional?) difficulties in sharing sequencing results (on GISAID)

Perspectives

- Capacity of national institutions to respond to epidemic emergences in the countries of the network
- Availability of sequencing platforms for One Health applications
- Availability of sequencing platforms for research projects (wildlife, domestic fauna, wastewater, etc.)
- Need to strengthen the coordination of efforts and communication between implementing partners in terms of laboratory capacity building for genomic surveillance in West African countries
- Need for funding for the continuation of the project to ensure the sustainability of activities

Acknowledgments

Benin (Abomey-Calavi, Cotonou)
- Benin Clinical Research Institute (IRCB) and Benin Viral Haemorrhagic Fever Laboratory (LFHV)

Burkina Faso (Bobo-Dioulasso, Ouagadougou)
- MURAZ Centre
- National Institute of Public Health (INSP)
- Souro Sanou University Hospital Virology Laboratory
- Yalgado University Hospital Virology Laboratory

Cameroon (Yaoundé)
- Centre for Research on Emerging and Re-Emerging Diseases (CREMER)
- Centre Pasteur Cameroon

Côte d'Ivoire (Abidjan)
- National Institute of Public Hygiene (INHP)
- Institut Pasteur Côte d'Ivoire
- Treichville University Hospital Virology and Bacteriology Laboratory
- ANRS Côte d'Ivoire Co-operation Programme (PAC-CI)

Ghana (Accra)
- West African Centre for Cell Biology of Infectious Pathogens (WACCBIP)
- Noguchi Memorial Institute for Medical Research (NMIMR)

Guinea (Conakry)
- Centre for Research and Training in Infectious Diseases in Guinea (CERFIG)
- National Institute of Public Health (INSP)
- Institut Pasteur Guinea

Madagascar (Antananarivo)
- Institut Pasteur Madagascar

Mali (Bamako)
- ARCAD SANTE PLUS
- National Institute of Public Health (INSP)
- Point G University Hospital Virology Laboratory

Niger (Niamey)
- Centre for Medical and Health Research (CERMES)

Central African Republic (Bangui)
- Institut Pasteur Bangui

Democratic Republic of the Congo (Kinshasa)
- National Institute of Biomedical Research (INRB)

Senegal (Dakar)
- Fann Centre for Research and Training in Clinical Care (CRCF)
- Institut Pasteur de Dakar
- Dalal Jamm National University Hospital Virology Laboratory
- Fann University Hospital Virology and Bacteriology Laboratory

Togo (Lomé)
- Molecular Biology and Immunology Laboratory (BIOLIM)
- National HIV-IST Reference Centre

Thank you for your attention

www.afroscreen.org

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