NH_3 and GHG emissions from maize cultivation for silage on a sandy-loam soil fertilized with three different slurries.

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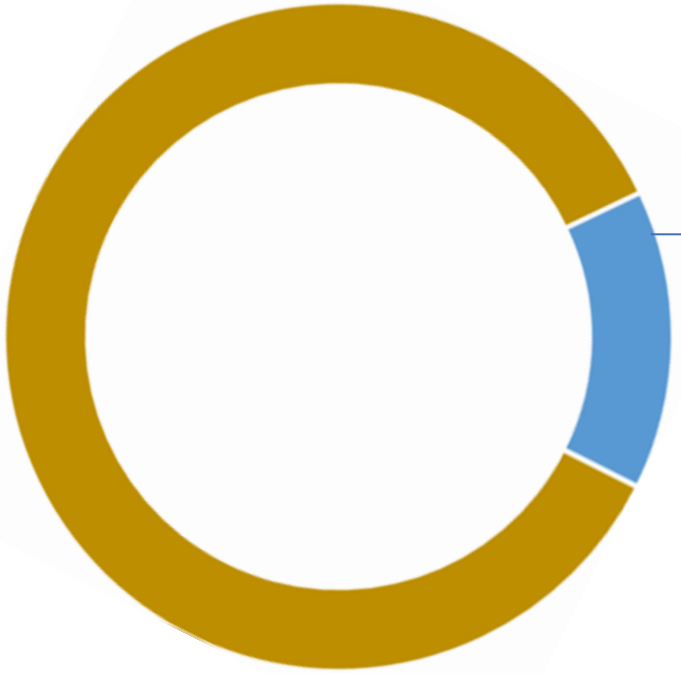
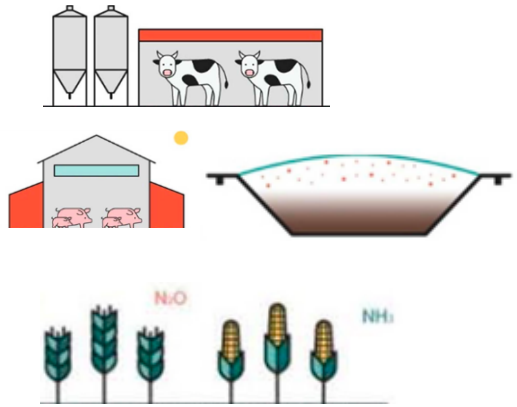
Global GHG emissions from Livestock



14.5% from livestock

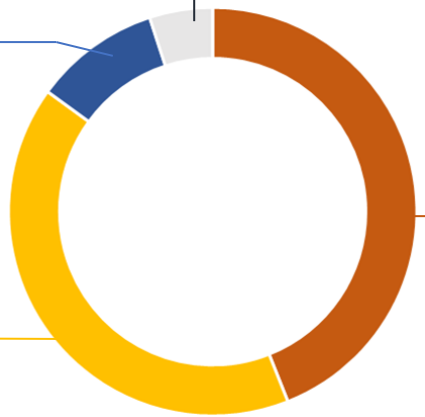


Energy consumption

Manure management

Enteric fermentation

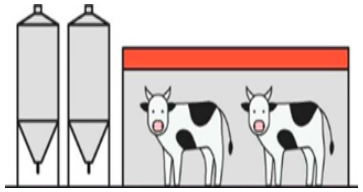
Feed production



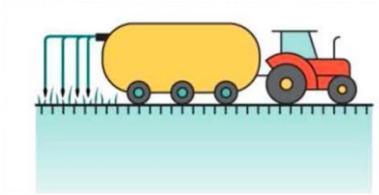
Global Ammonia emissions from Livestock

Anthropogenic NH_3 emissions from agriculture

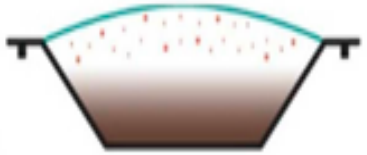
80.4 %



30.5 %



20.7 %



29.2%

- ✓ Indirect source of N_2O
- ✓ Eutrophication
- ✓ Soil acidification
- ✓ PM formation

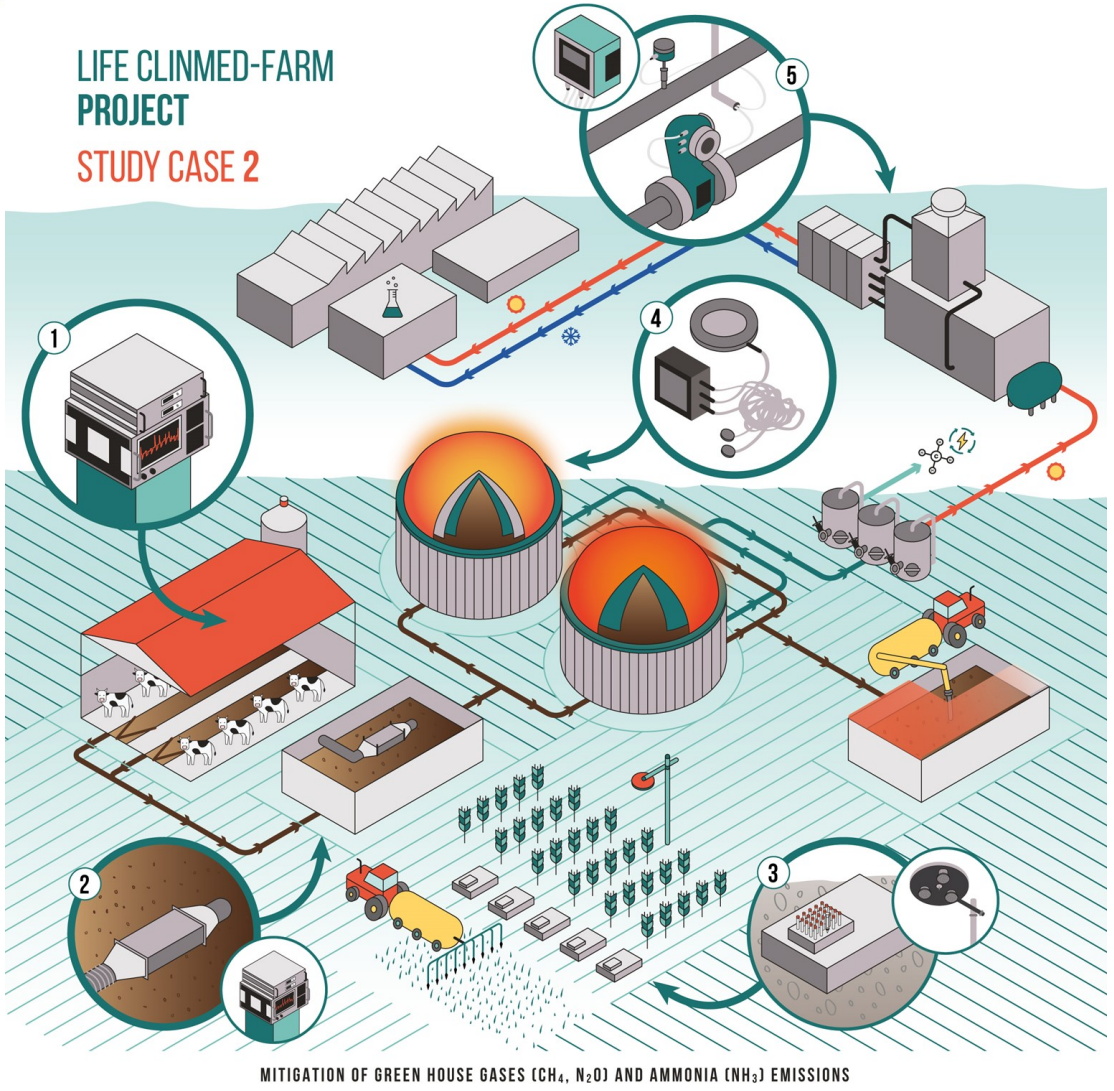
The situation in Italy

- ✓ Italian livestock activity is concentrated in the Northern Italy zone
- ✓ Massive manure production
- ✓ Direct injection of liquid slurry is compulsory in this area

It can reduce NH_3 emissions by 90% compared to traditional splash plate

It could increase GHG emissions from the soil

The project CLINMED-FARM *(Towards a Mediterranean Climate Neutral Farm model)* – LIFE20 CCM/ES/001751)



- Reduction of the environmental impact of the system
- Improvement of the energetic performance of the system
- Two study cases
  - Pig production
  - Cattle production
- Comparison of a base line and a project scenario (improved with the adoption of technical solutions)

Objectives

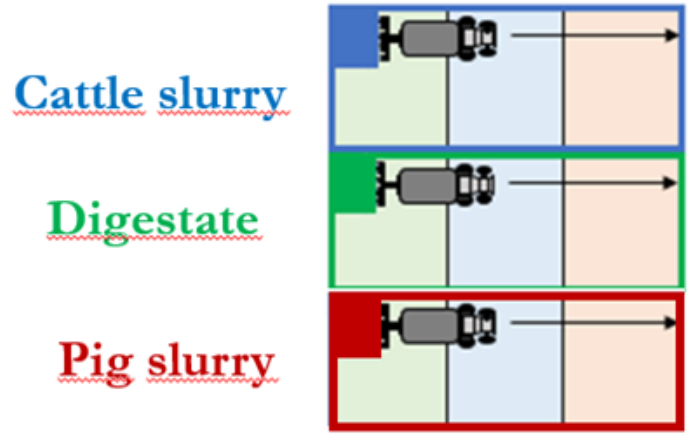
Measurement of the Base Line Scenario of the slurry spreading phase – Italian SC

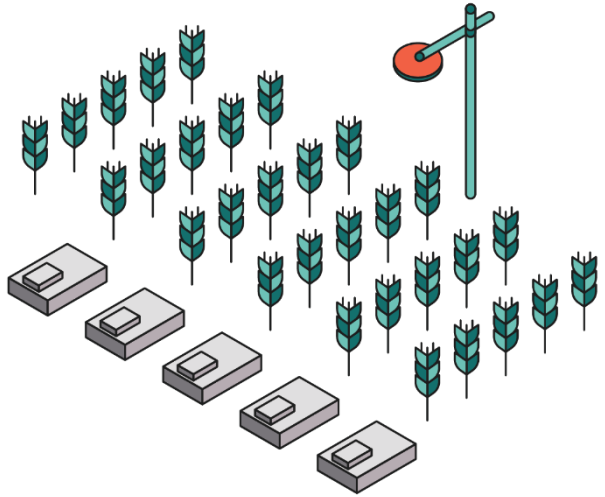
Assessment and quantification of the environmental impact of different slurry types application

The experiment was performed in a typical Po Valley dairy farm

Experimental design

- One type of soil (sandy-loam)
- 3 slurry types
  - Cattle slurry (**CAT**)
  - Cattle Digestate (**DIG**)
  - Pig slurry (**PIG**)
- Slurry injection before maize seeding → 280 kg N ha^{-1}
- Experiment repeated for 2 consecutive years





Evaluated parameters - NH_3 emissions

Micrometeorological method

↓

Backward Stochastic Lagrangian Model

↓

ALPHA samplers coupled with Windtrax

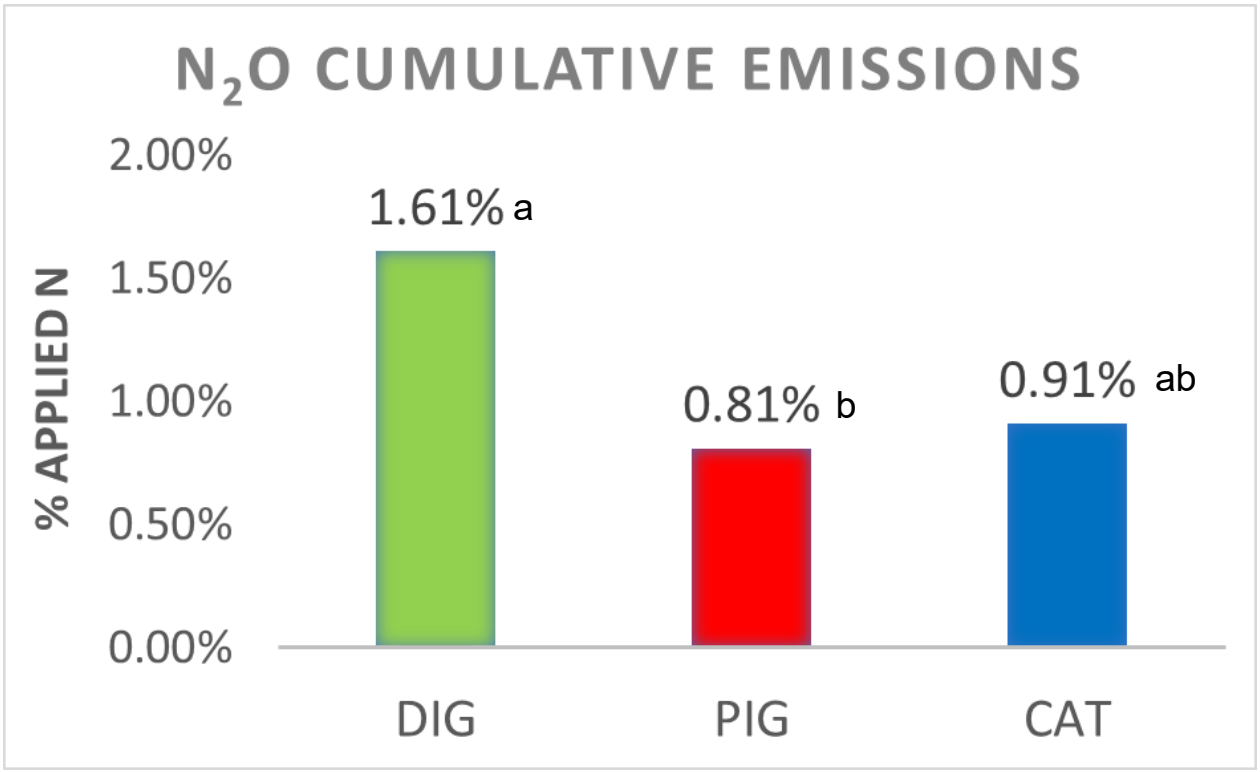
Fluxes were monitored for 4 days after slurry spreading

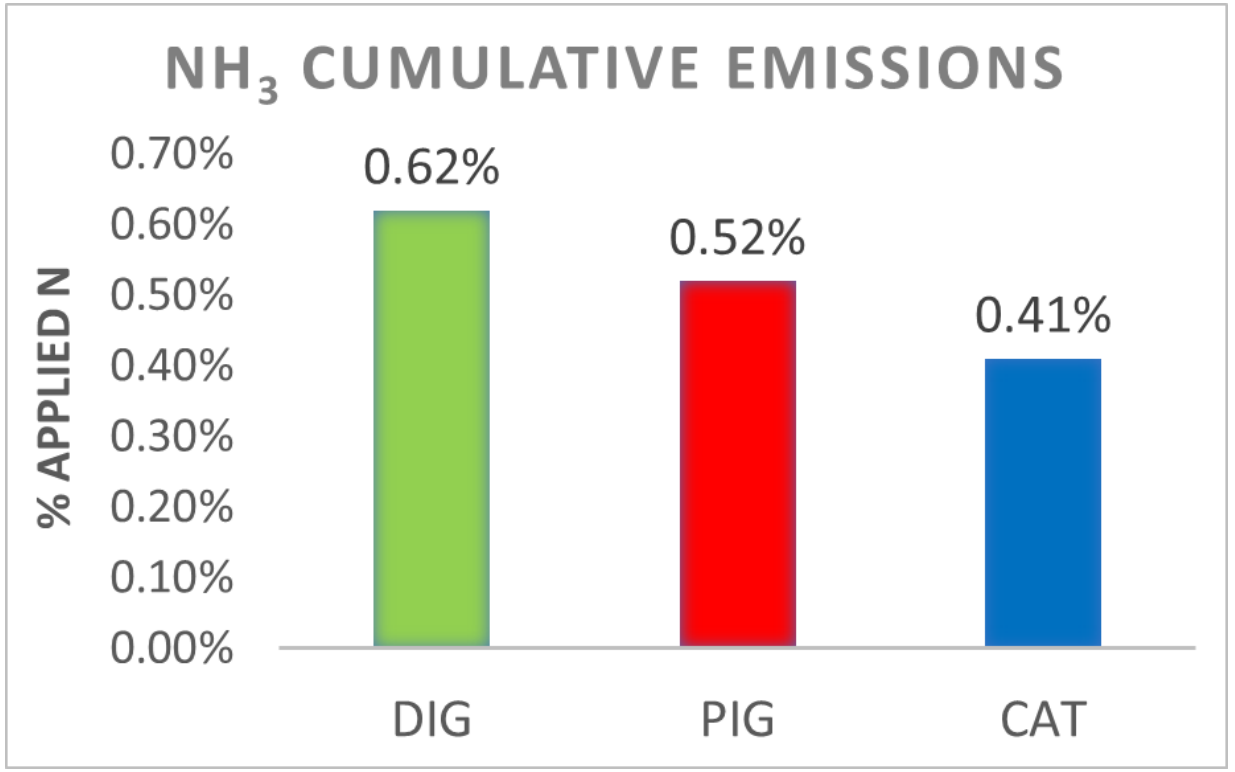
Detailed view of the ALPHA samplers and the sonic anemometer used to determine NH_3 fluxes from the plots

Evaluated parameters - GHG emissions

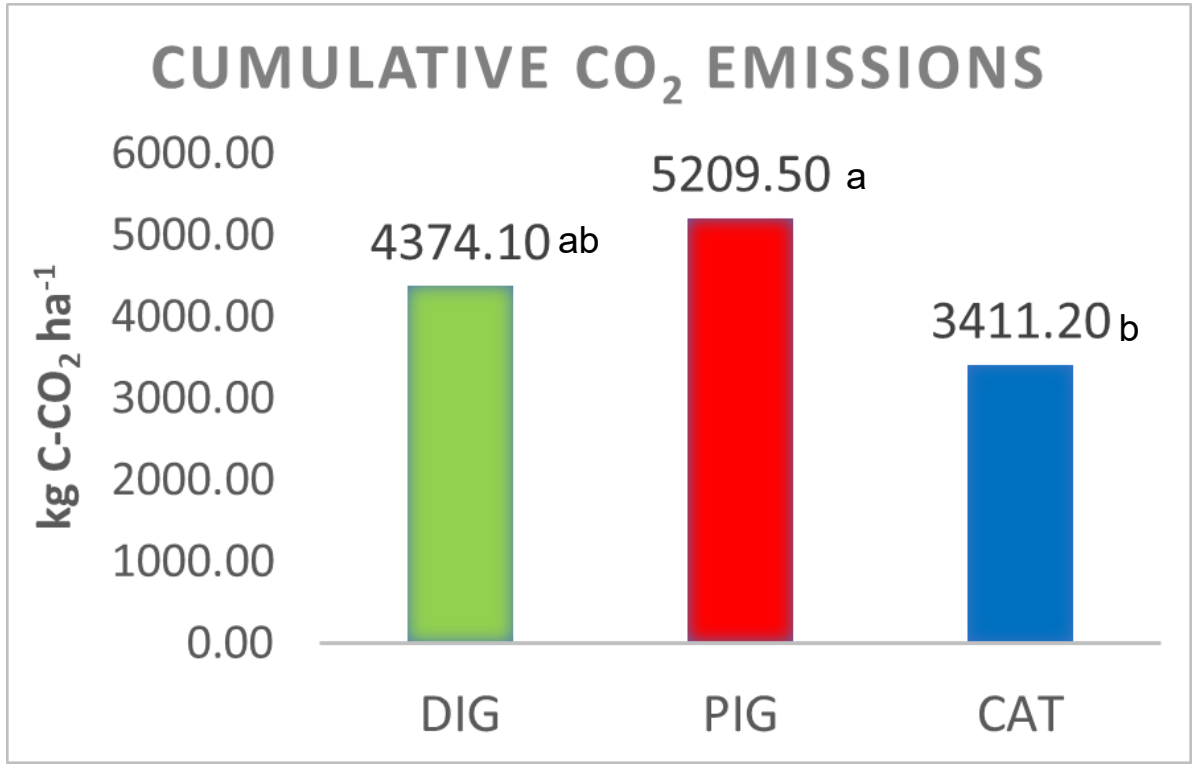
- Closed static chambers method coupled with gas chromatograph
- CO_2 – CH_4 – N_2O
- Twice or Once a week, for the whole growing season

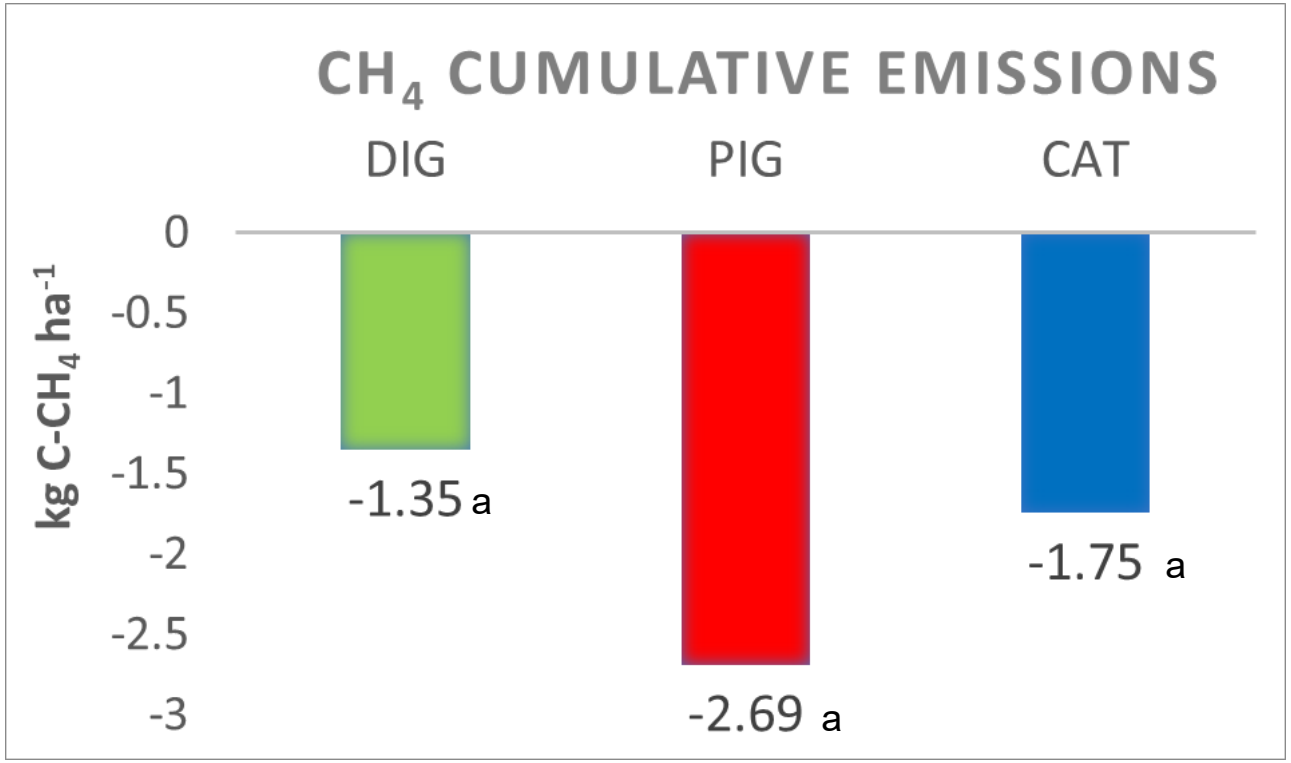
Results – N_2O and NH_3 emissions





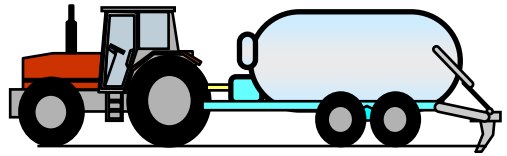
Results – CO_2 and CH_4 emissions





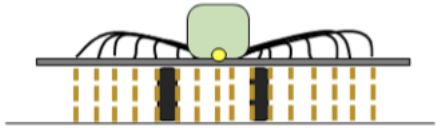
Conclusions

- On average, slurry injection determined very low NH_3 emissions.
- On average, N_2O emissions from all the slurries were consistent, around 1% of total N content.
- Emissions from digestate were the highest



Within the LIFE CLINMED FARM project, innovative technologies and strategies are being evaluated:
- Slurry acidification in combination with band spreading
- Nitrification inhibitors in combination with direct injection

Simultaneous incorporation



Band Spreading

- **Acidification**
- **Nitrification inhibitors**
- **Crop rotation systems**

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