eFLASH_radiotherapy and exp_microdosimetry examples: status and recent developments

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eFLASH_radiotherapy

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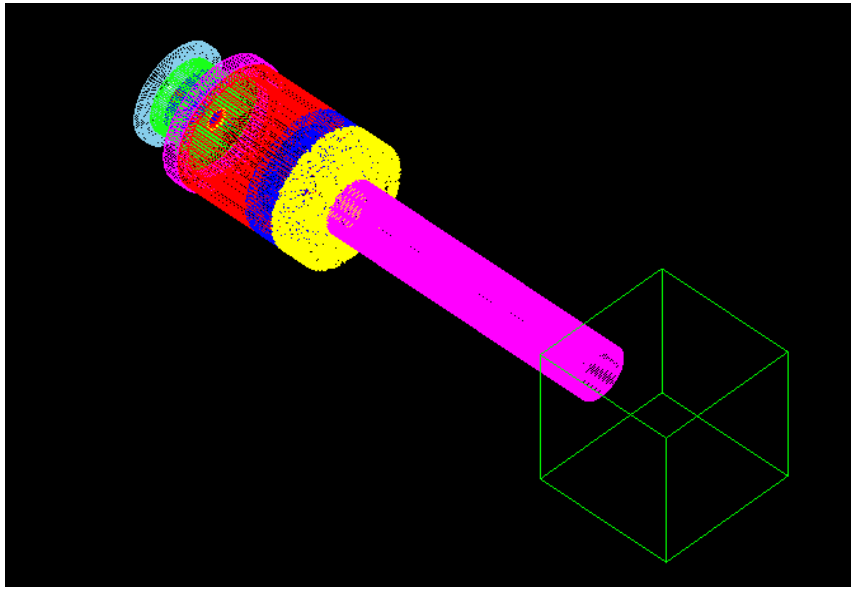
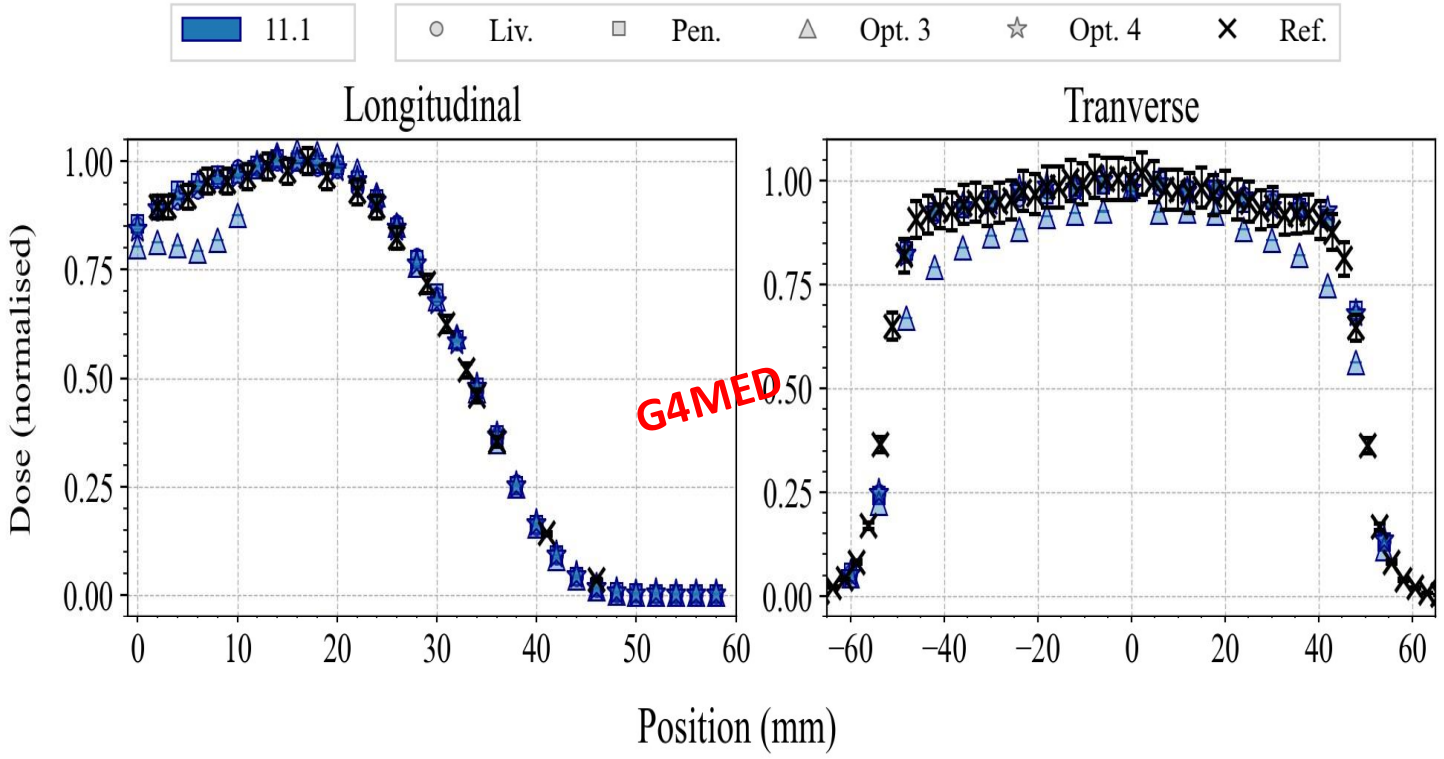
Included in Nov 2022 Geant4 release

- The ElectronFLASH LINAC installed at the Centro Pisano for FLASH Radiotherapy CPRF by following the manufacturing specifications provided by Sordina Iort Technologies S.p.A
- Simulation of a water phantom and detectors placed within the phantom to predict dose distributions and scattering





Geant4 EM Standard Physics Option 3: *RangeFactor* in Geant4 11.1 is 0.03.

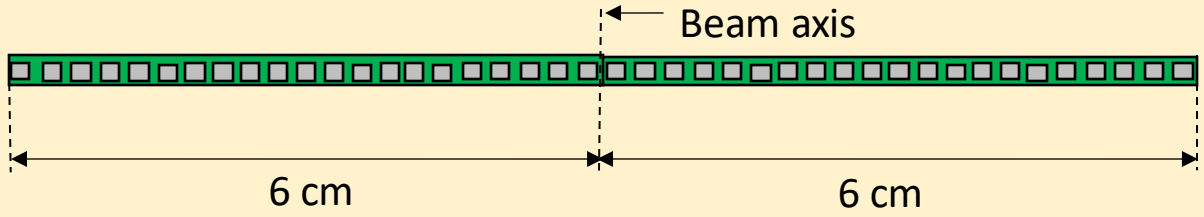
eFLASH_radiotherapy: new developments

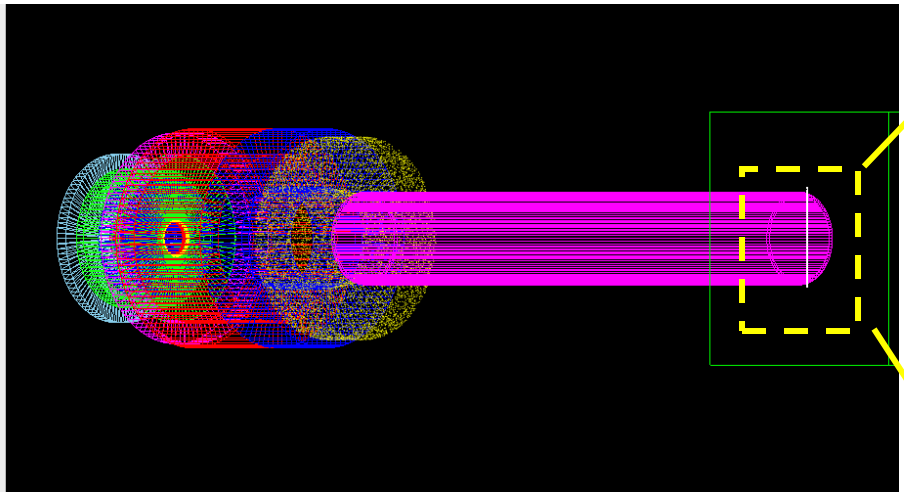
R4I Research for Innovation

INFN CATANIA Istituto Nazionale di Fisica Nucleare Sezione di Catania

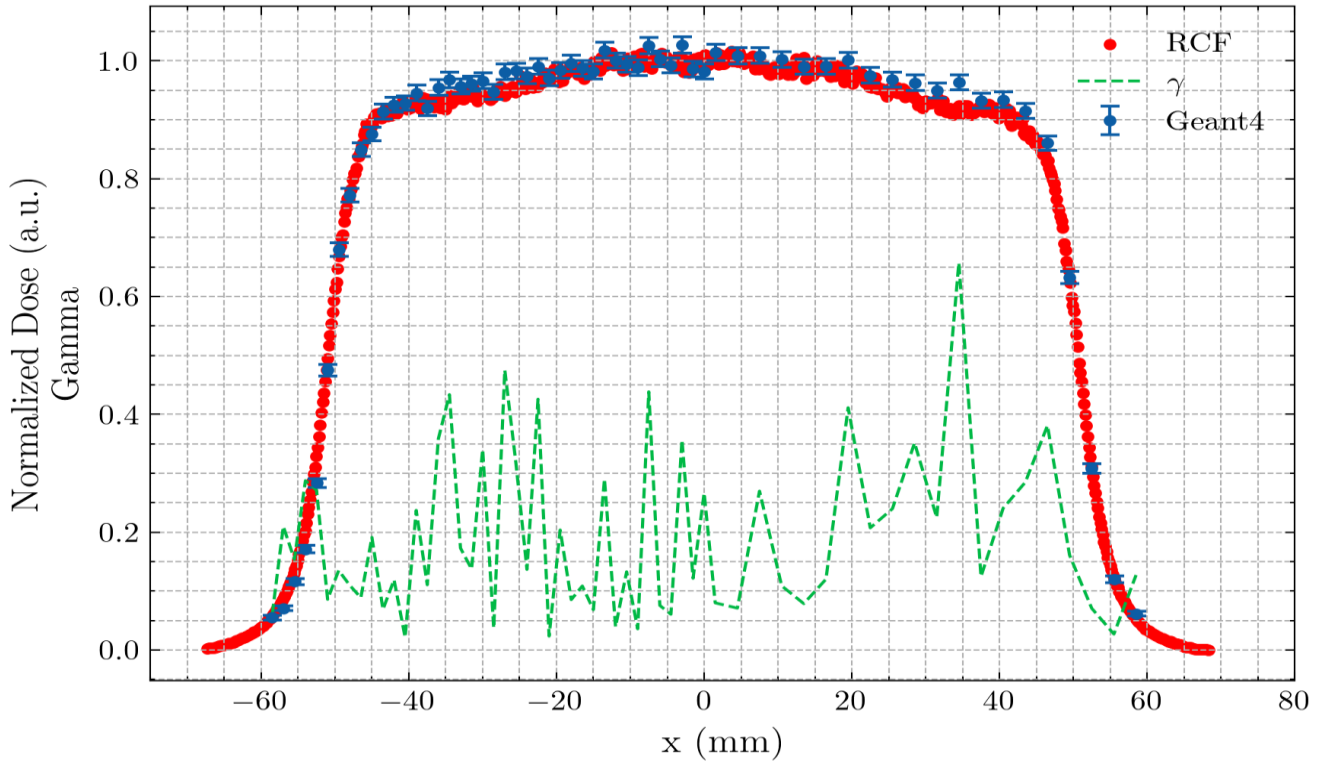
DREAM

Silicon carbide array **D**etecto**R** for dose profil**E** me**A**sure**M**ents at FLASH regimes





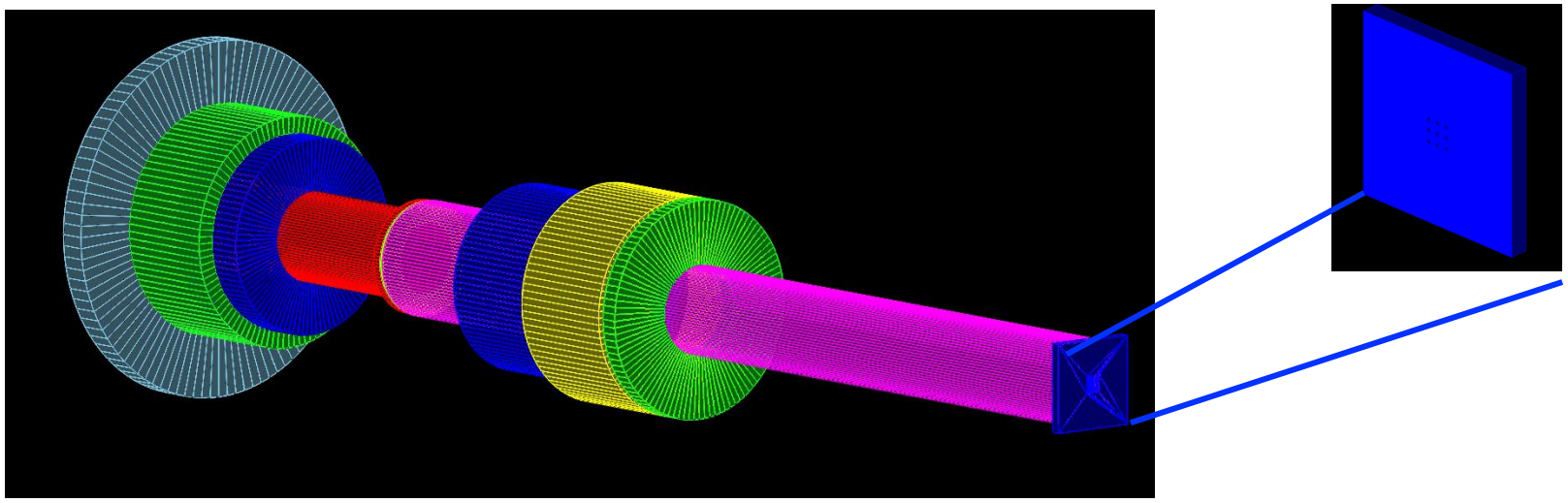
Master degree Thesis Said Ahmed

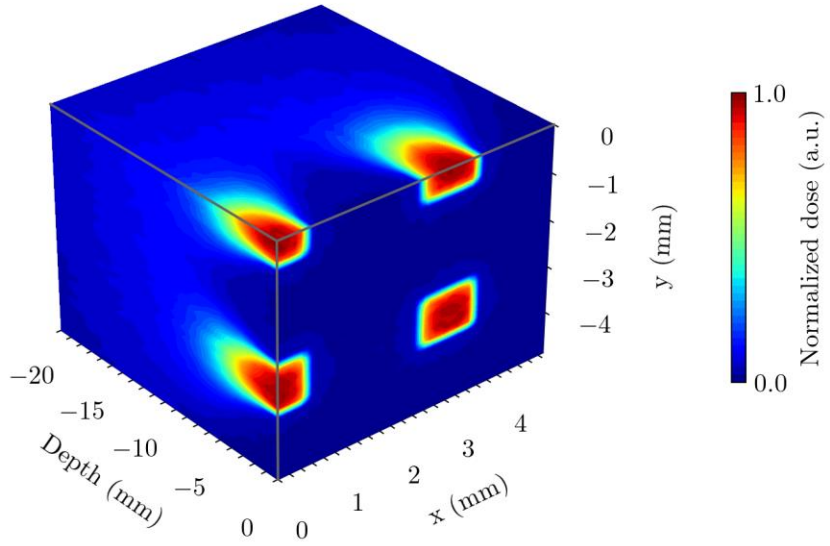


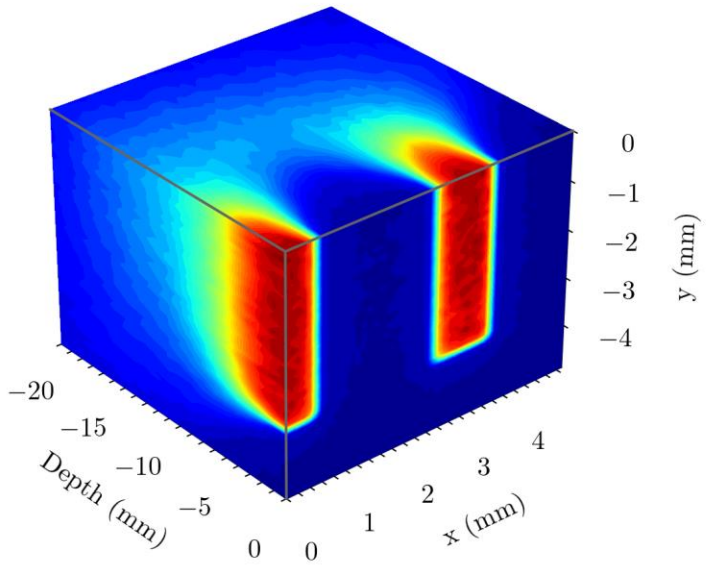
eFLASH_radiotherapy: new developments

Minibeam collimators implementation

MIRO
Minibeam Radiotherapy







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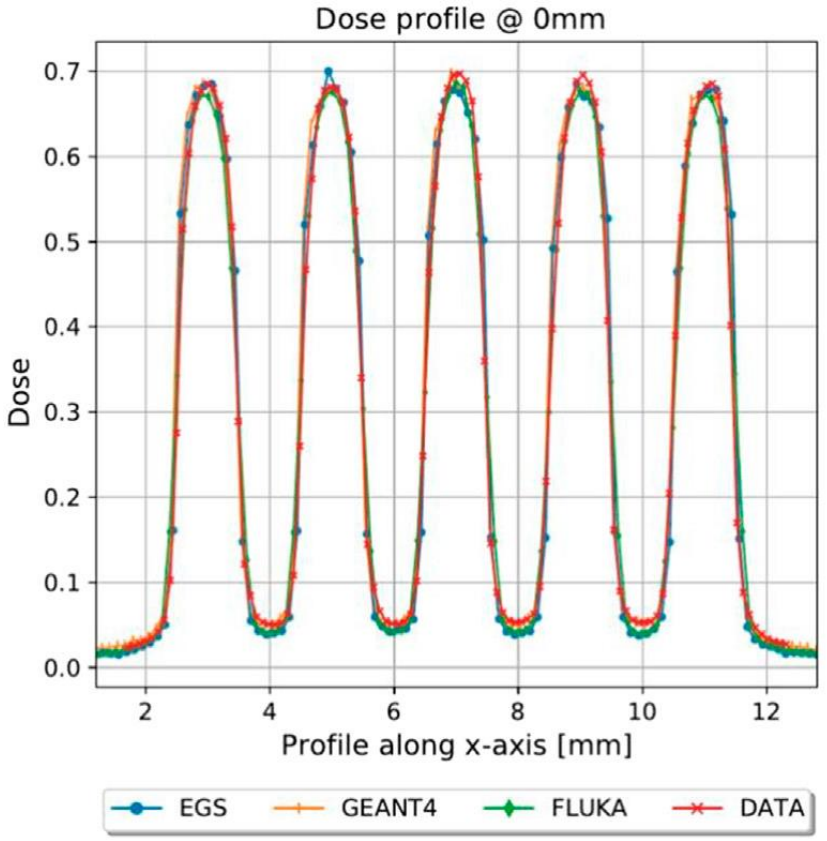
Comparison with different **Monte Carlo** codes and experimental data



J. Pensavalle et al.,Frontiers Physics
10.3389/fphy.2023.1269495

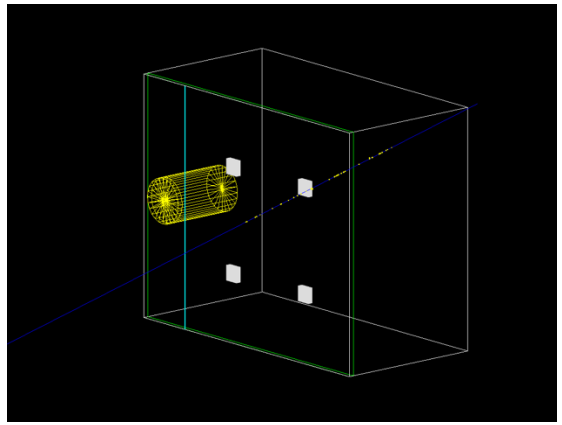
exp_microdosimetry

Current authors: G. Milluzzo and F. Romano (INFN Catania, Italy)

CENTRE FOR MEDICAL RADIATION PHYSICS

INFN CATANIA Istituto Nazionale di Fisica Nucleare Sezione di Catania

(ex radioprotection)



GEOMETRY

- Semplified diamond microdosimeter
- The microdiamond detector (TorVergata)
- Bridge silicon microdosimeters
- Diamond telescope
- **SiC microdosimeter**
- **Mini TEPC**

FUNCTIONALITIES

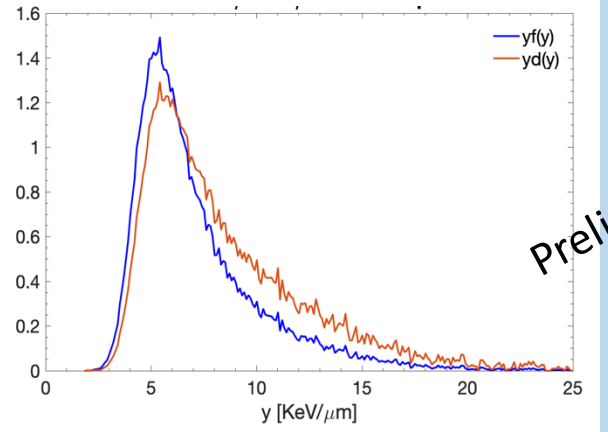
- Sensitive detector to retrieve the energy deposited spectra
- Macro commands to switch from one microdosimeter to the other
- Python script to convert the energy deposited spectra in microdosimetric spectra and data analysis

NEW DEVELOPMENTS

Silicon Carbide microdosimeter

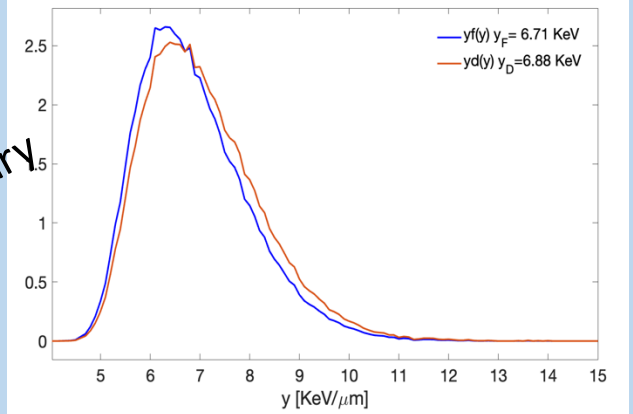
Optimization design through the MC simulations

20 MeV protons, 100x100 um^2/2 um



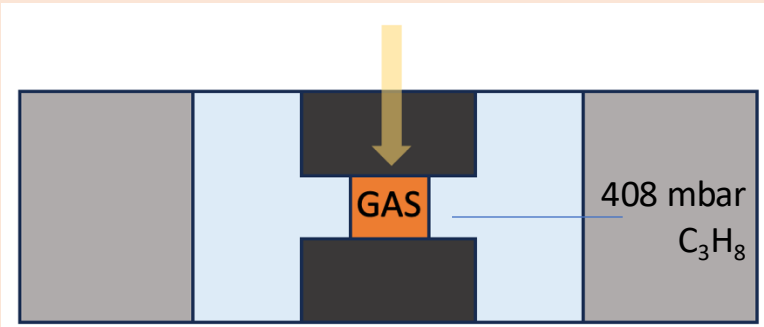
Preliminary

20 MeV protons, 100x100 um^2/22 um



Tissue Equivalent proportional counter (TEPC)

Semplified version of the TEPC developed at Laboratori Nazionali di Legnaro (INFN)



Summary and next release

eFLASH_radiotherapy

New Geometry

- Silicon carbide array for lateral dose distribution computation added
- Collimators for minibeams

✓ **Next Geant4 release**

New functionalities

- Sensitive detectors for each SiC detector to retrieve dose, ene dep, kinetic energy, secondary particles etc…
- Messengers to easily modify the geometry

In progress, maybe first version

exp_microdosimetry

New Geometry

- SiC microdosimeter added in the geometry

✓ **Next Geant4 release**

- TEPC implementation still in progress, collaboration with INFN LNL- first semplied version

In progress, maybe first version

Thank you