

Localization of uranium-bearing particles in soil samples from the Fukushima restriction zone

福島県の制限区域で採取された環境試料中のウラン含有粒子の局在

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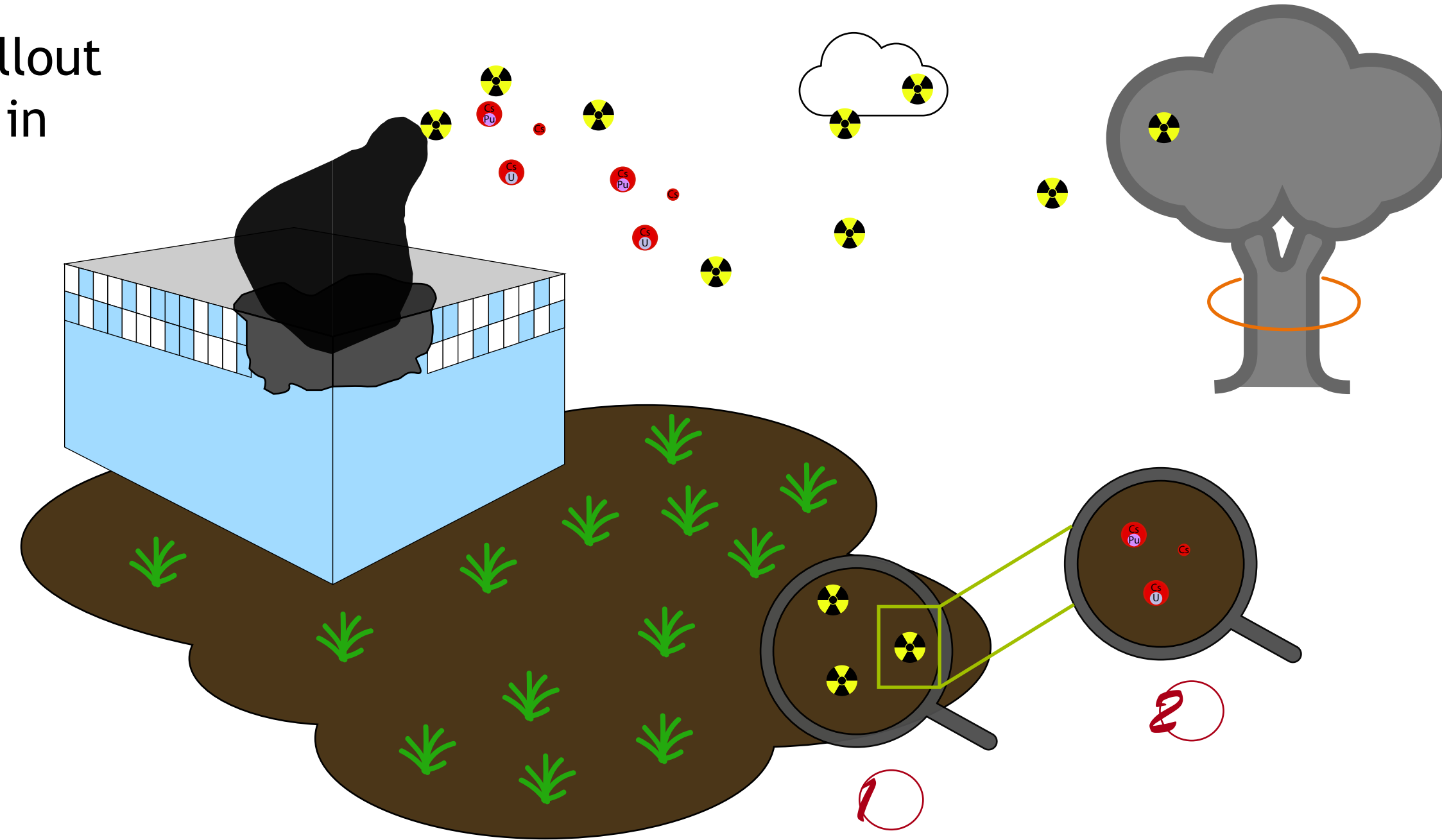
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1. Introduction

- ① Japanese soils were tagged with radioactive fallout originating from the global fallout (bomb tests in 1960s) and Fukushima fallout.

- ② Particle localization and characterization (elemental and isotopic composition) give us information on their formation process and their origin (reactor 1, 2, 3)



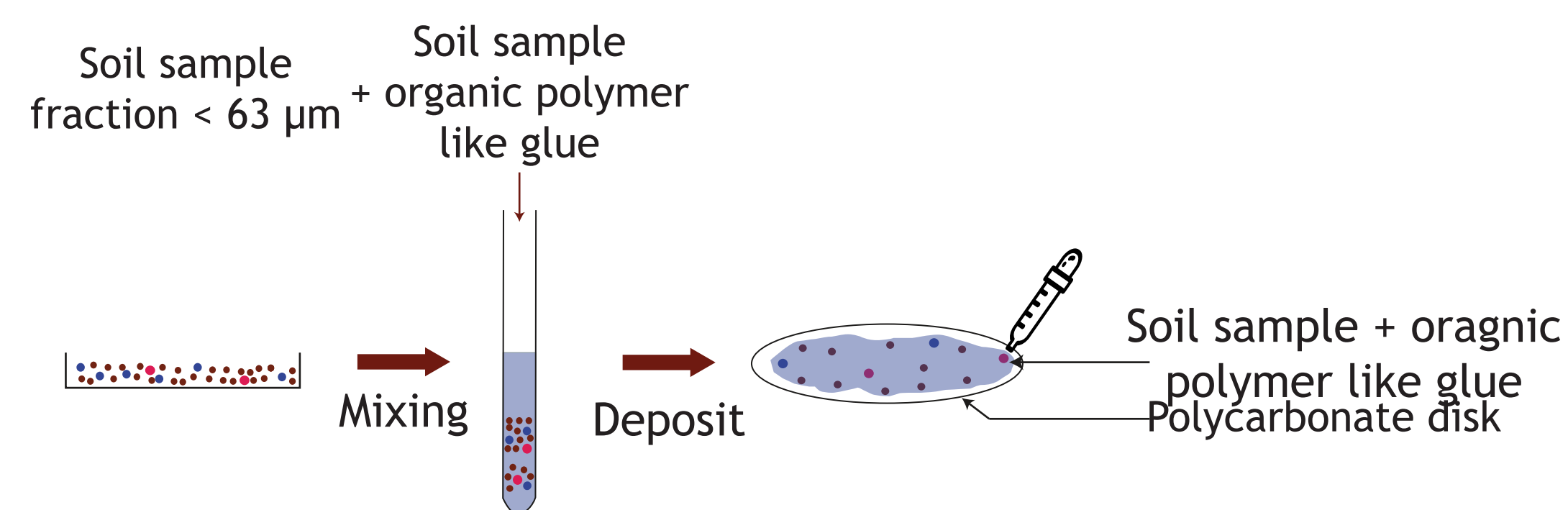
? How to locate uranium-bearing particles ?

Uranium emitted alpha particles during decay.

Uranium 235 fission induced by thermal neutrons divides the nucleus into two fragments.

2. Methods/Results

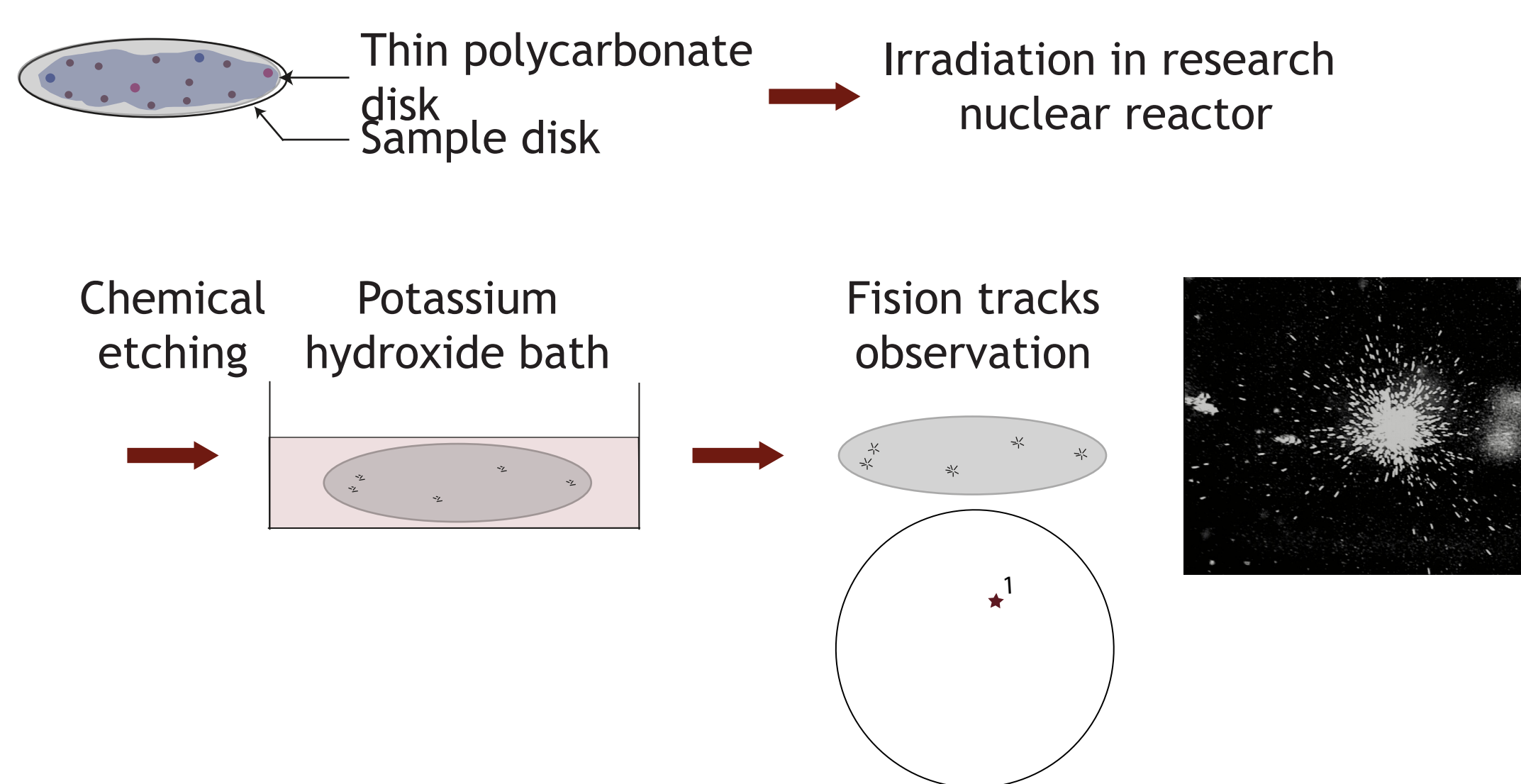
Soil sample



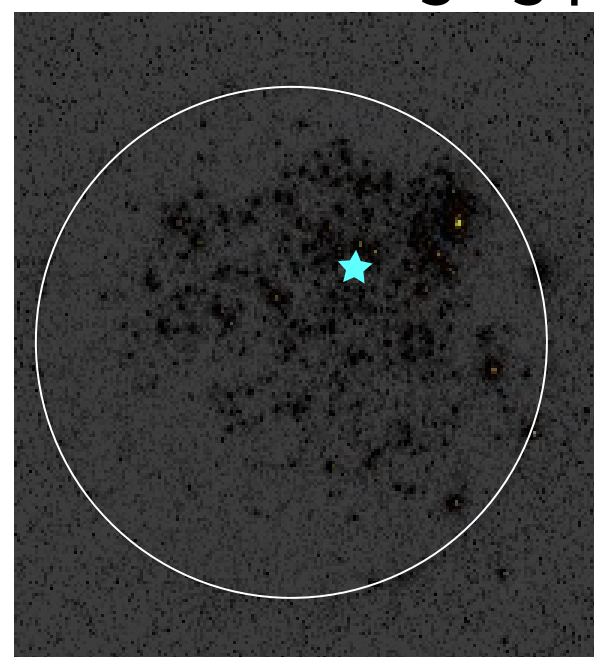
Localization methods

Localization principles:

Fission tracks
(reference method for locating fissile products)
Fission fragments create structural defect.

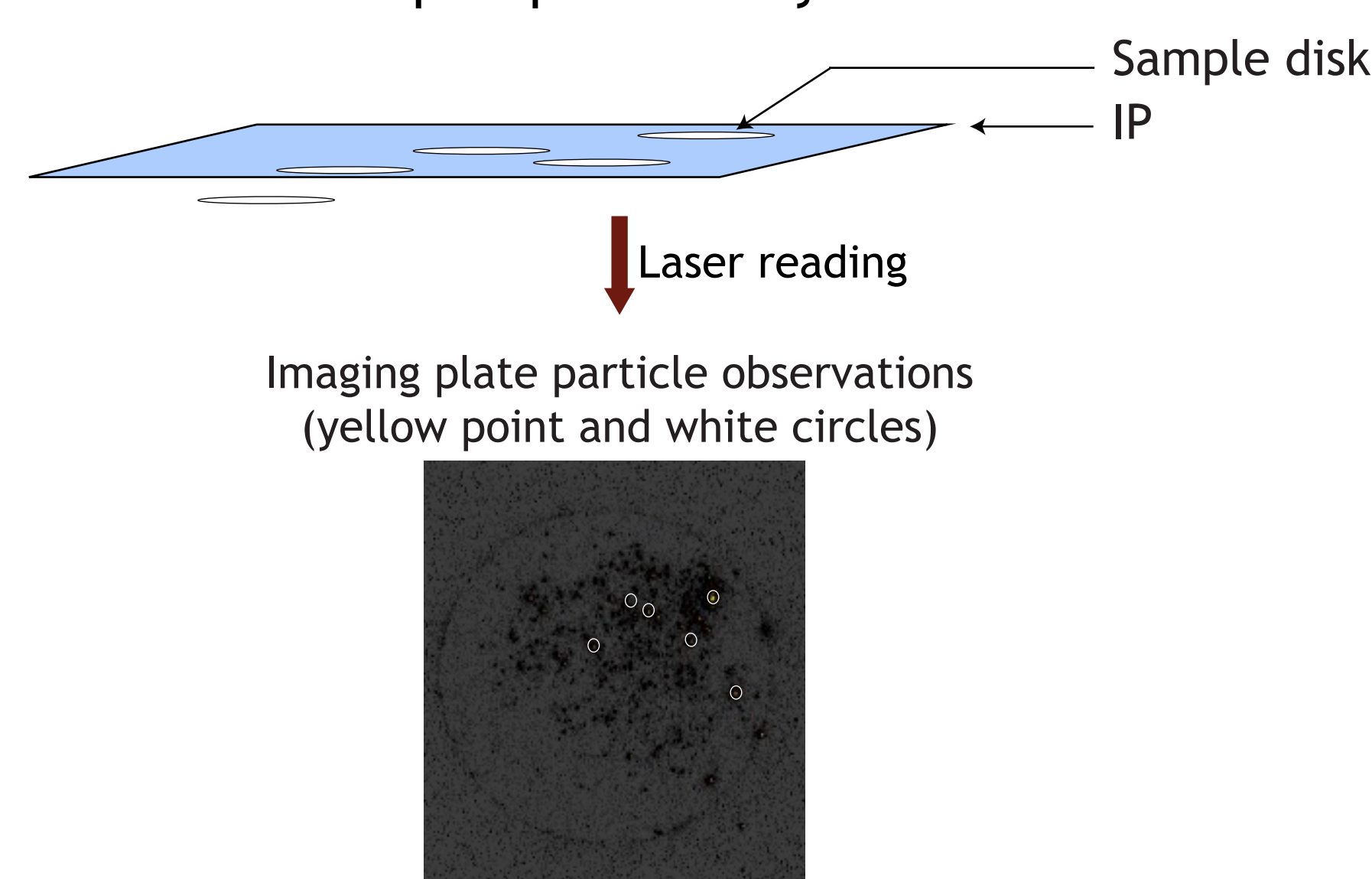


Method comparisons: Fission tracks/Imaging plate

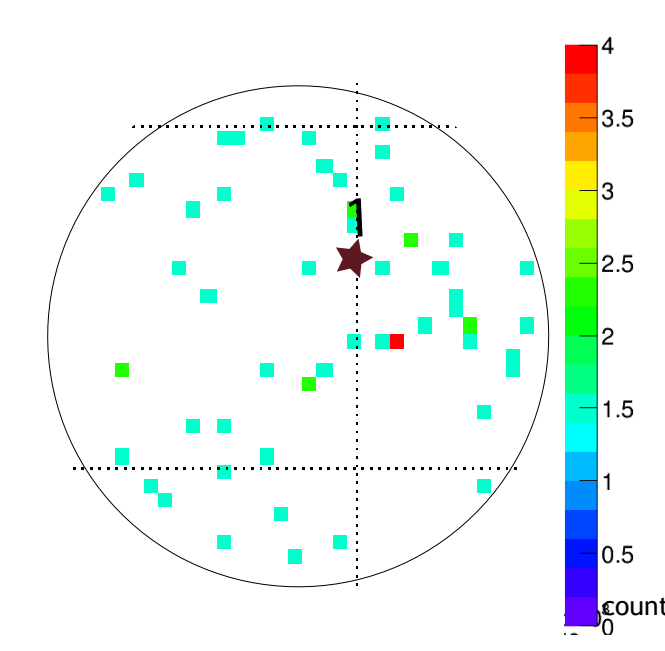


→ No correspondence between both methods
Hypothesis:
→ Analytical background due to cesium

Imaging plate (IP)
Interaction between alpha particle and an active phosphorous layer



Fission tracks/BeaQuant

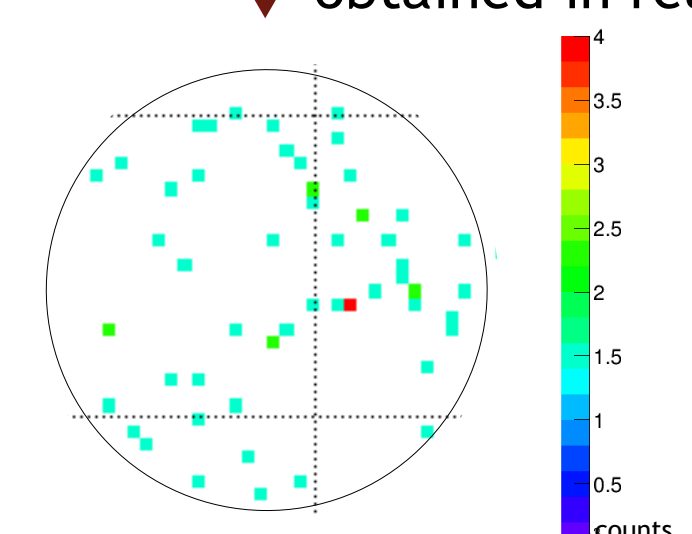


→ No correspondence between both methods
Hypothesis:
→ Alpha emissions under detection limit

Real time alpha autoradiography
(BeaQuant®)
Alpha particles interact with the gas detector.



Numeric results obtained in real time



3. Conclusions

- ✓ Fission tracks method is the most efficient technique to detect and locate actinide-bearing particles originating in soil sample from the Fukushima restriction zone.

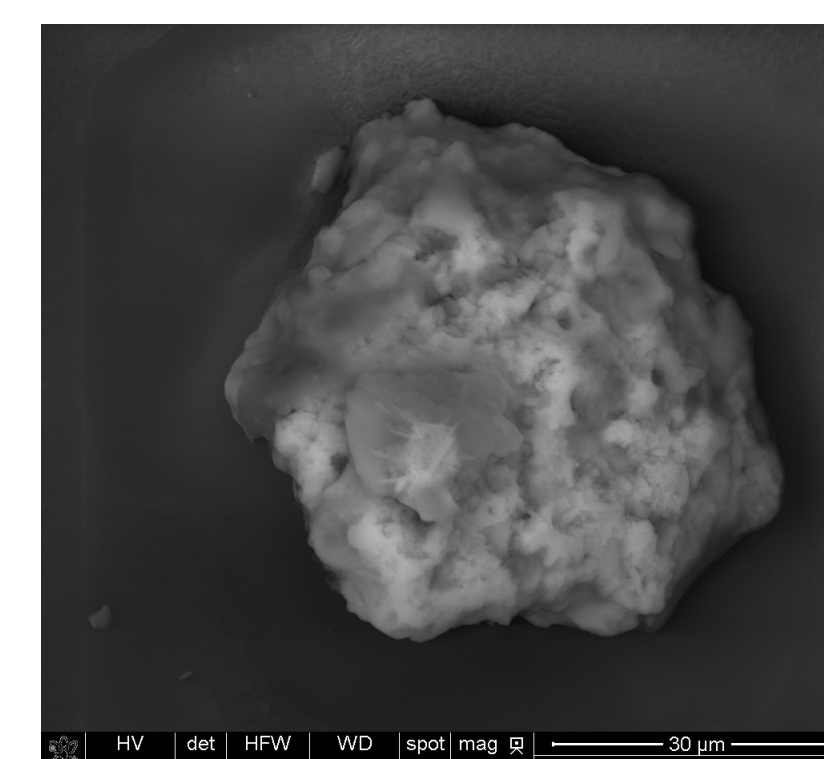
→ However, it does not allow to discriminate between natural and anthropogenic uranium-bearing particles. It would be interesting to couple it with imaging plate.

- ✓ In the future it would be interesting to improve other methods for alpha detection.

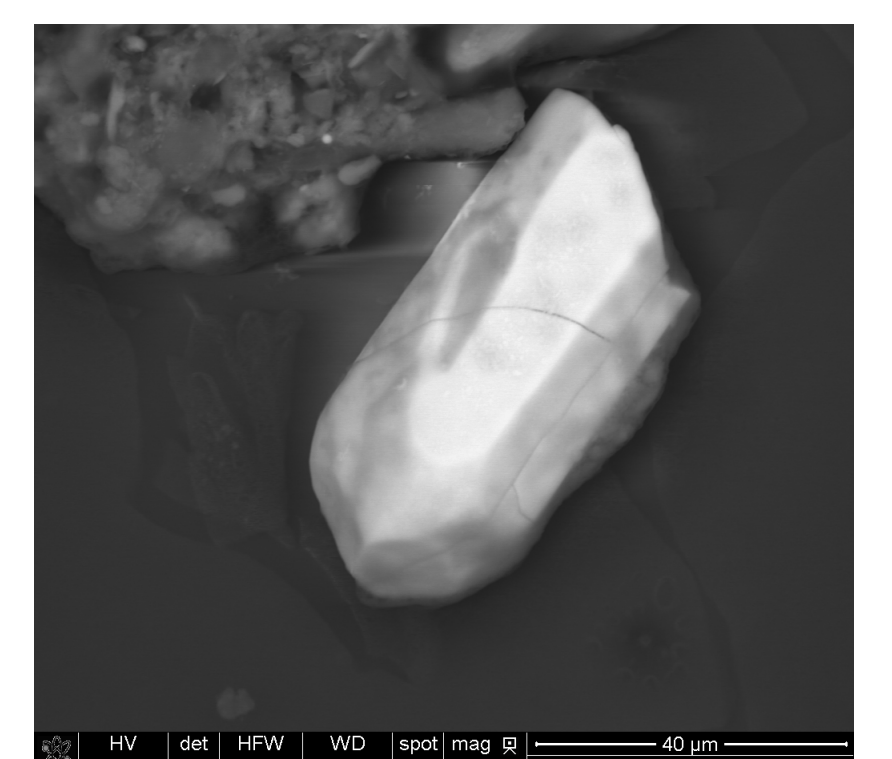
Next steps:

- ✓ Isolation and characterization of particles to determine their origin and to improve our understanding of their formation processes within the reactors and anticipate their fate in the environment.

Electronic images of 2 uranium-bearing particles found in the soil sample



Potential anthropogenic uranium-bearing particle. Presence of Ti, Fe, Si, etc... and uranium in low concentrations.



Natural uranium-bearing particle
It is a zircon mineral composed of Zr, U, Th and other light elements