B02: ニュートリノ精密測定にむけた原子核乾板開発

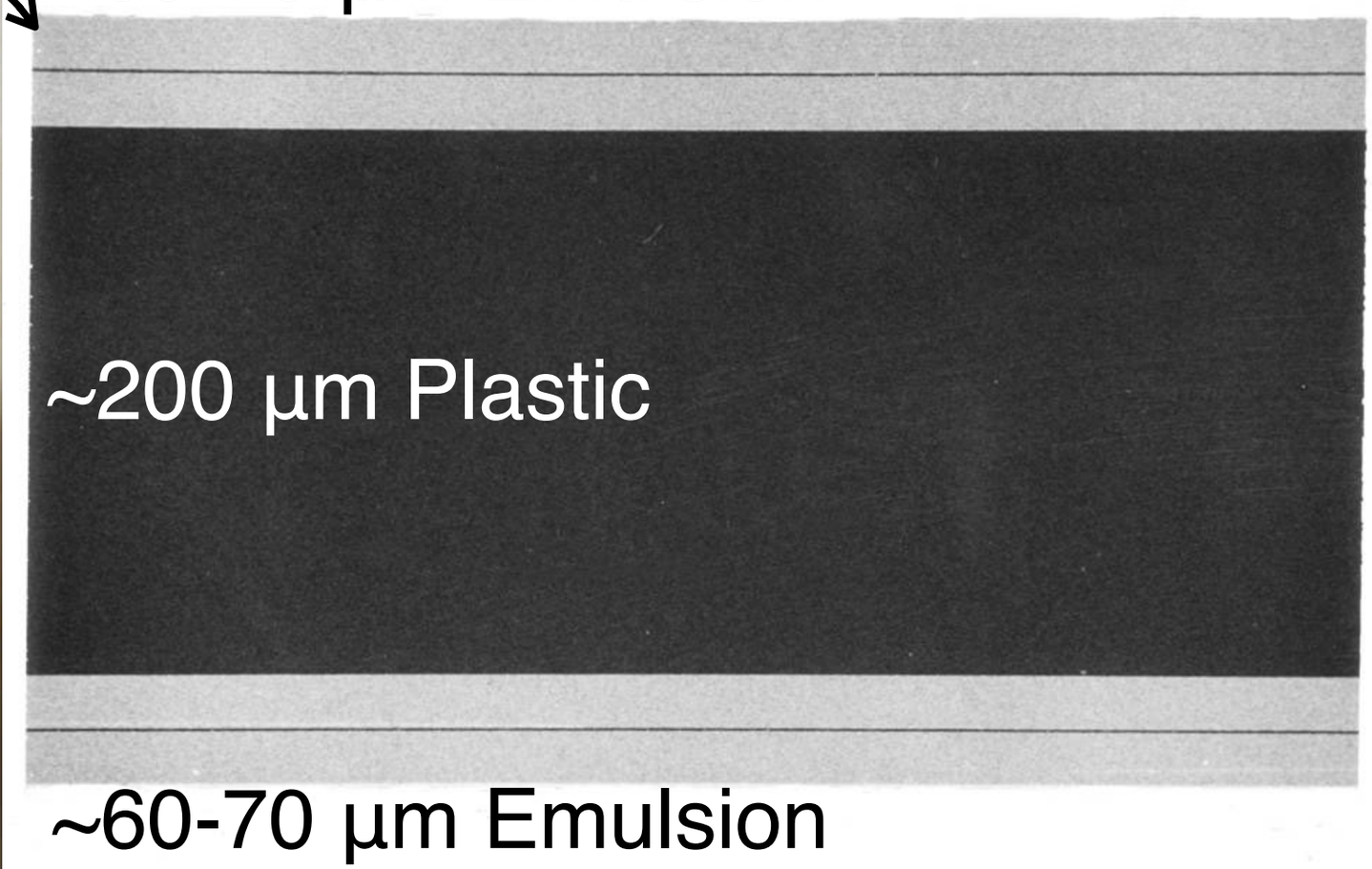
Status of Emulsion Production Facility

Hiroki Rokujo (Nagoya)

Why do we use emulsion?
A: One and Only Vertex detector

Cross section
(Electron microscopic view)

ν , had., e^{+-}, Nucl.



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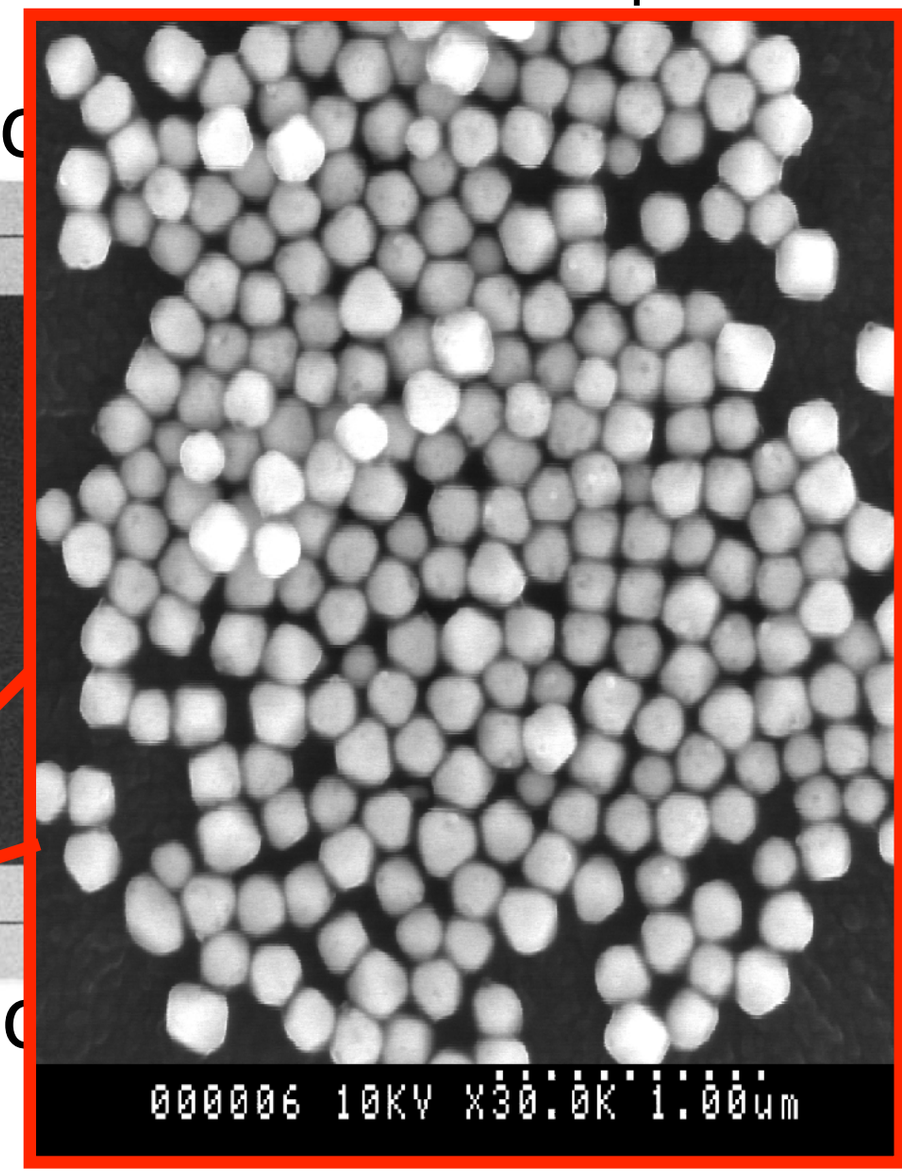
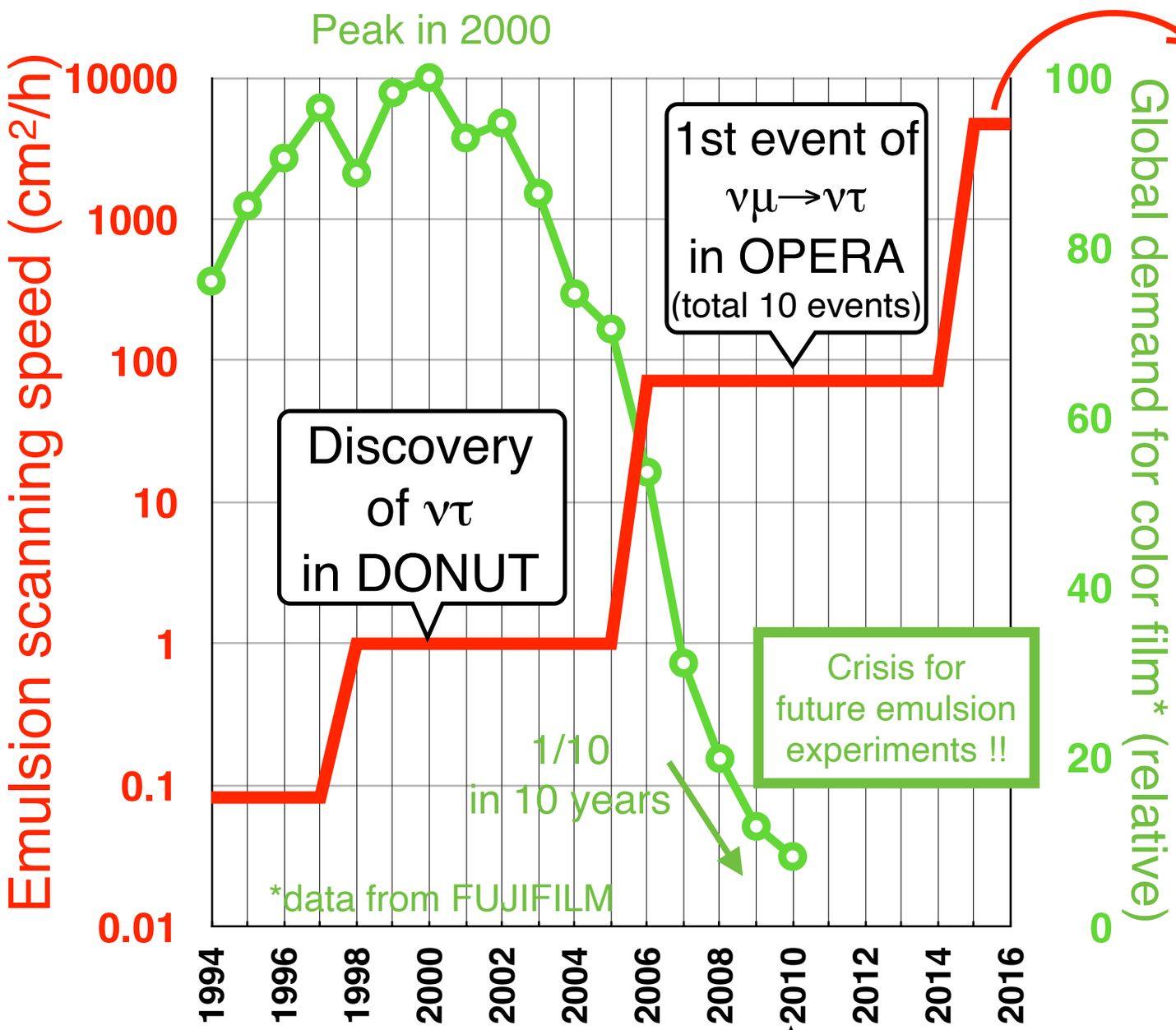


0.2 µm-diameter AgBr crystals in gelatine function as 3-D position censors.

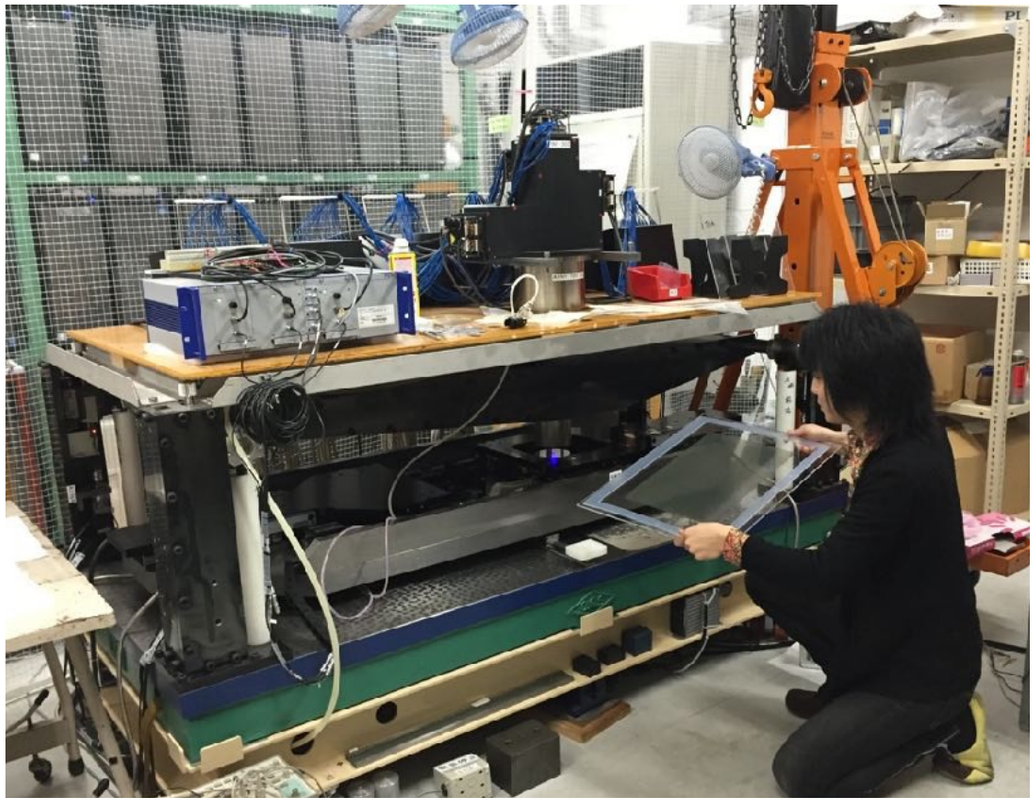
Intrinsic resolution: ~ 50 nm

Evolution of Emulsion Scanning Speed

and Decline of Photographic Film Industry



Current system "HTS" 5000 cm²/h



→New system "HTS-II" (developing) will be 25000 cm²/h (x5 faster)

We started the development and supply of Nuclear Emulsion itself in our laboratory (2010–)

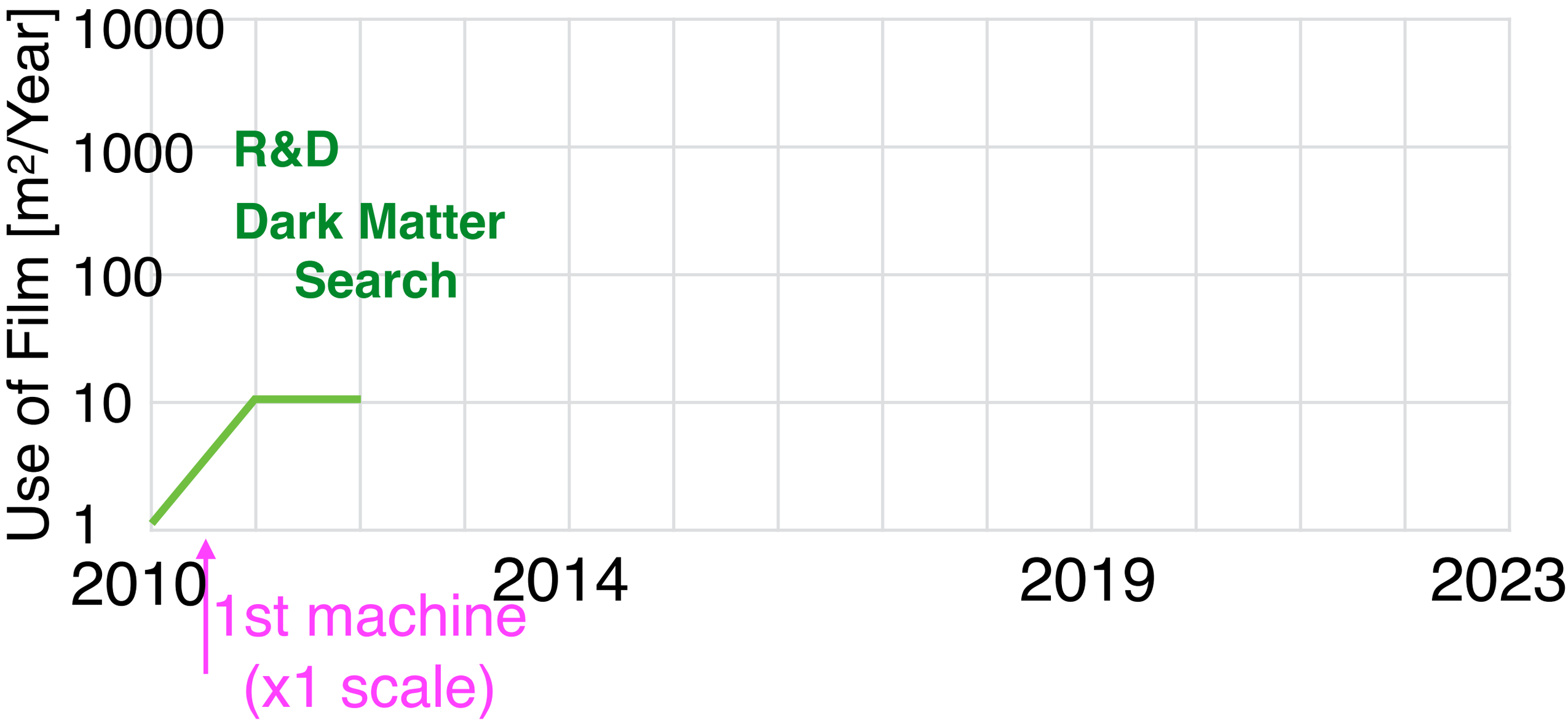
In 2010, Introduction of Emulsion Gel Production System

名古屋大学
NAGOYA UNIVERSITY

in cooperation with former members of Fuji Film

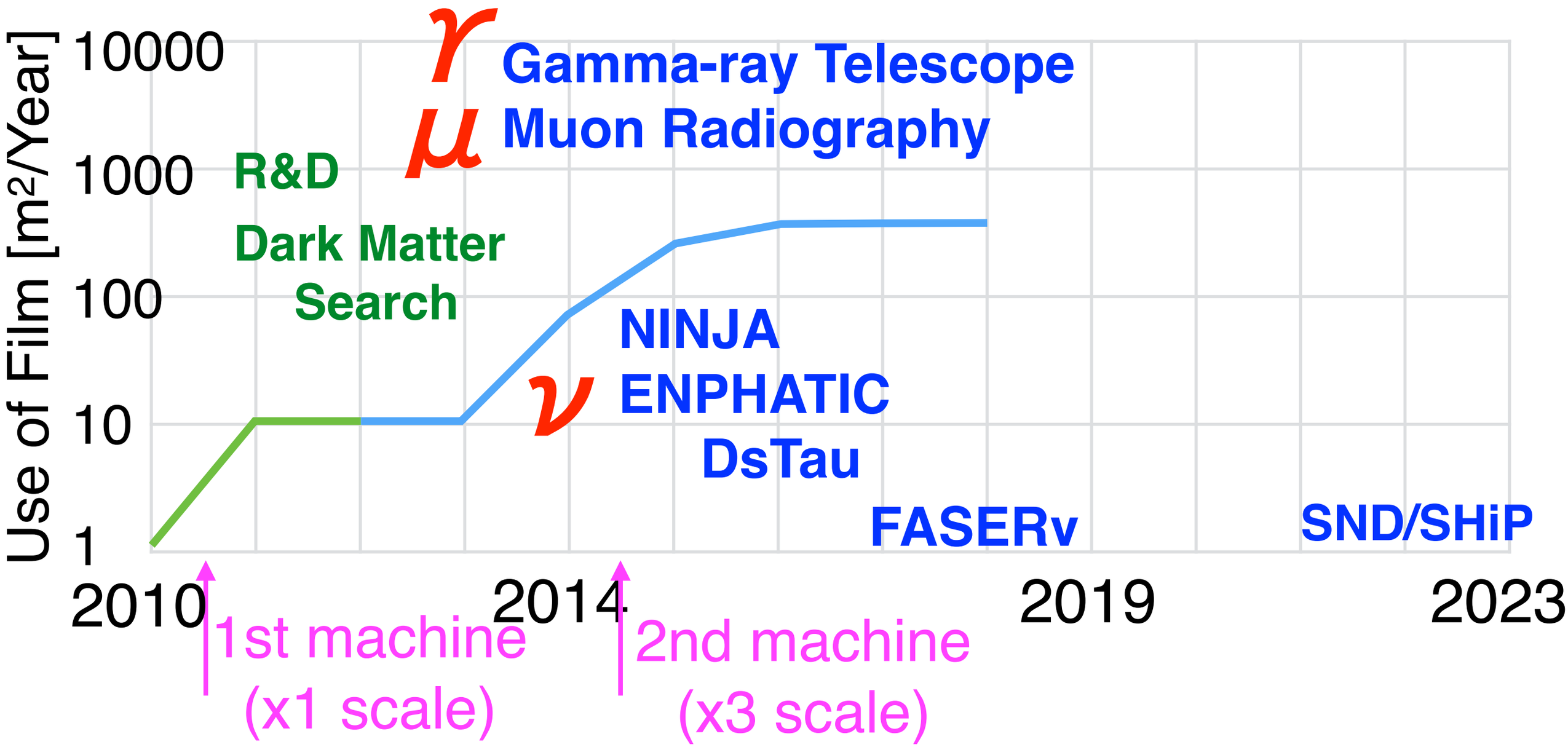
we developed and evaluated self-controlled nuclear emulsion for each purpose of experiments.

the Use of NAGOYA Emulsions



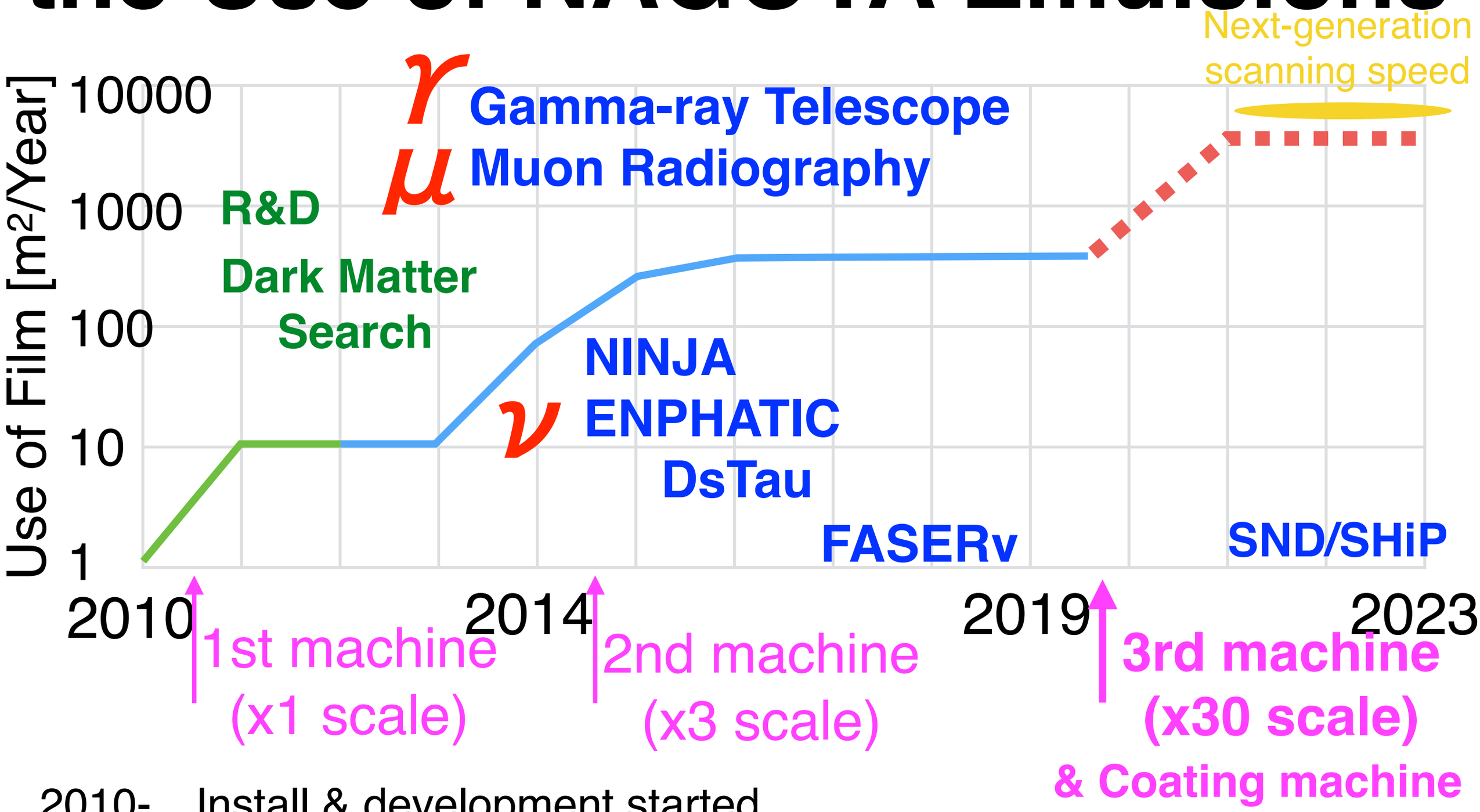
2010- Install & development started

the Use of NAGOYA Emulsions



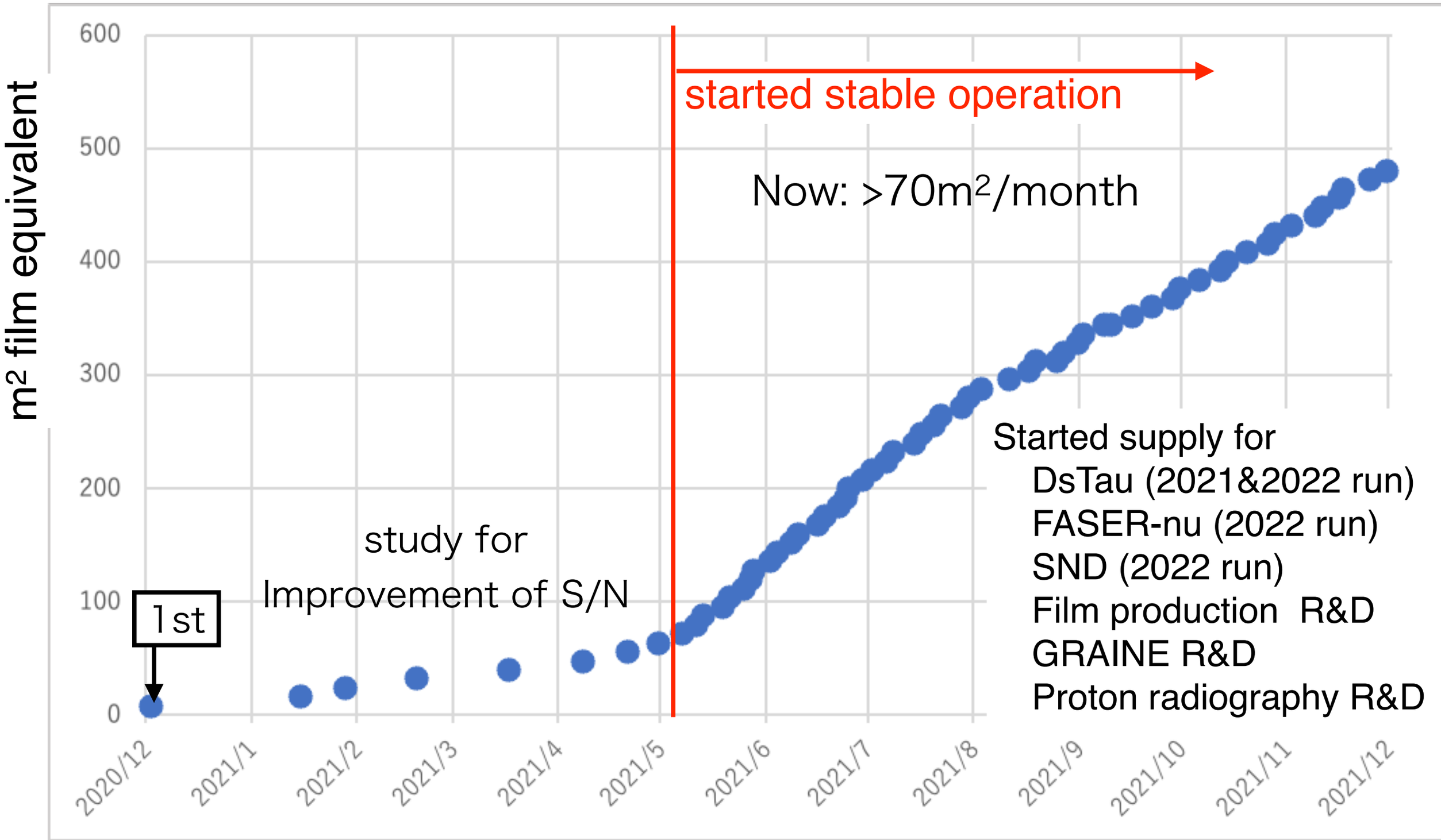
2010- Install & development started
2013- Supplied self-controlled films to real experiments.
2014- New projects launched. Successfully achieved good results.

the Use of NAGOYA Emulsions

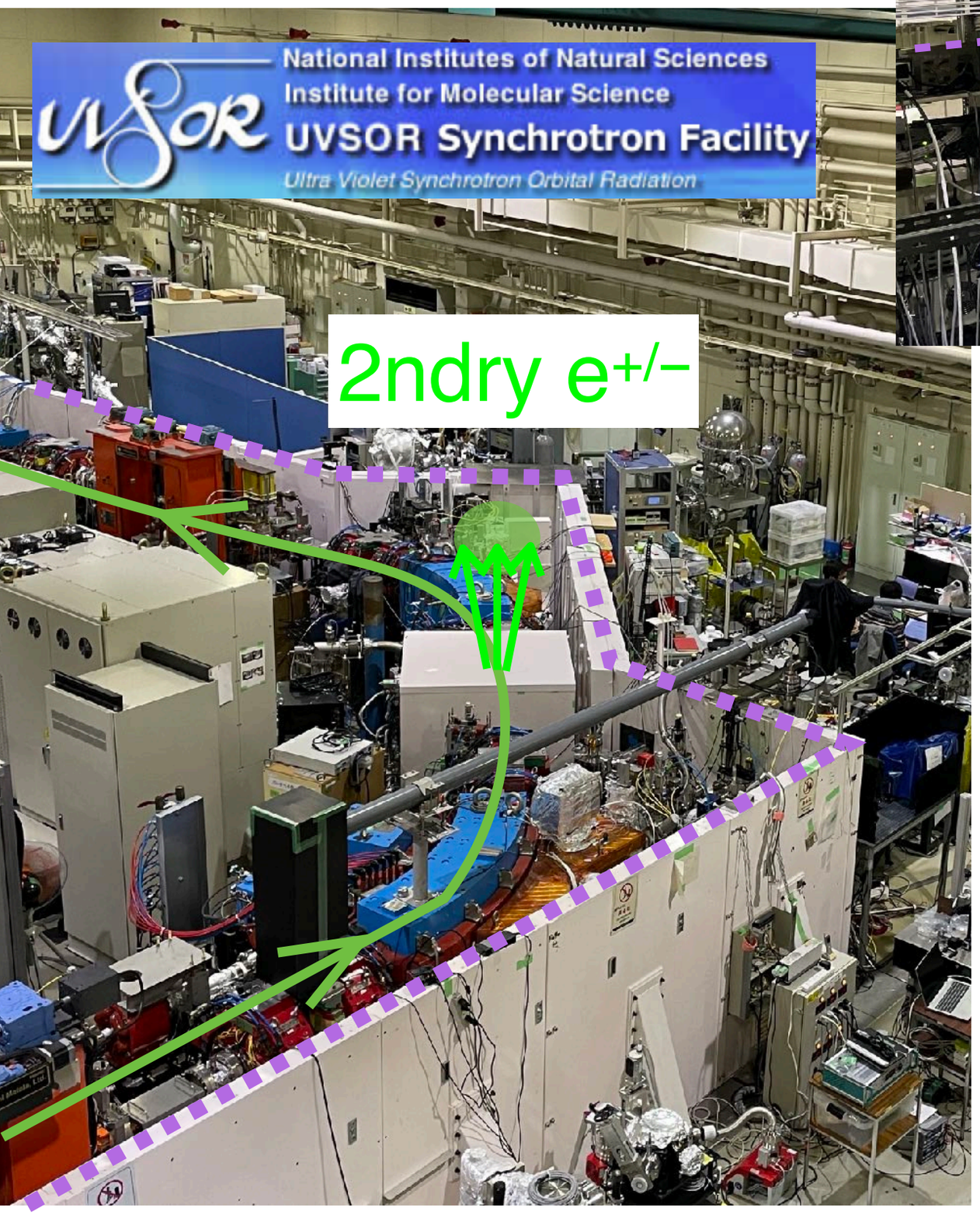


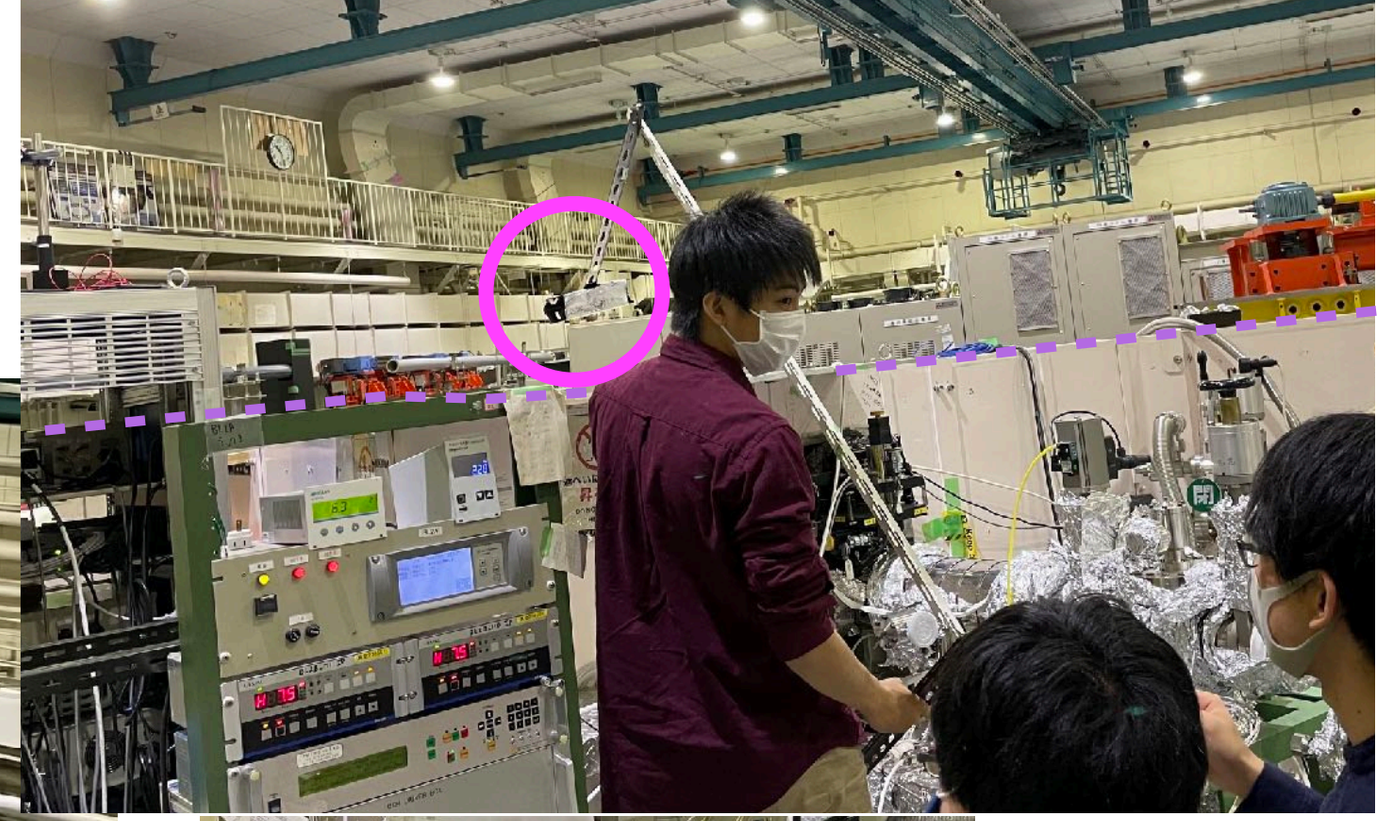
2010- Install & development started
2013- Supplied self-controlled films to real experiments.
2014- New projects launched. Successfully achieved good results.
2019- All projects plan to expand the scale of experiment

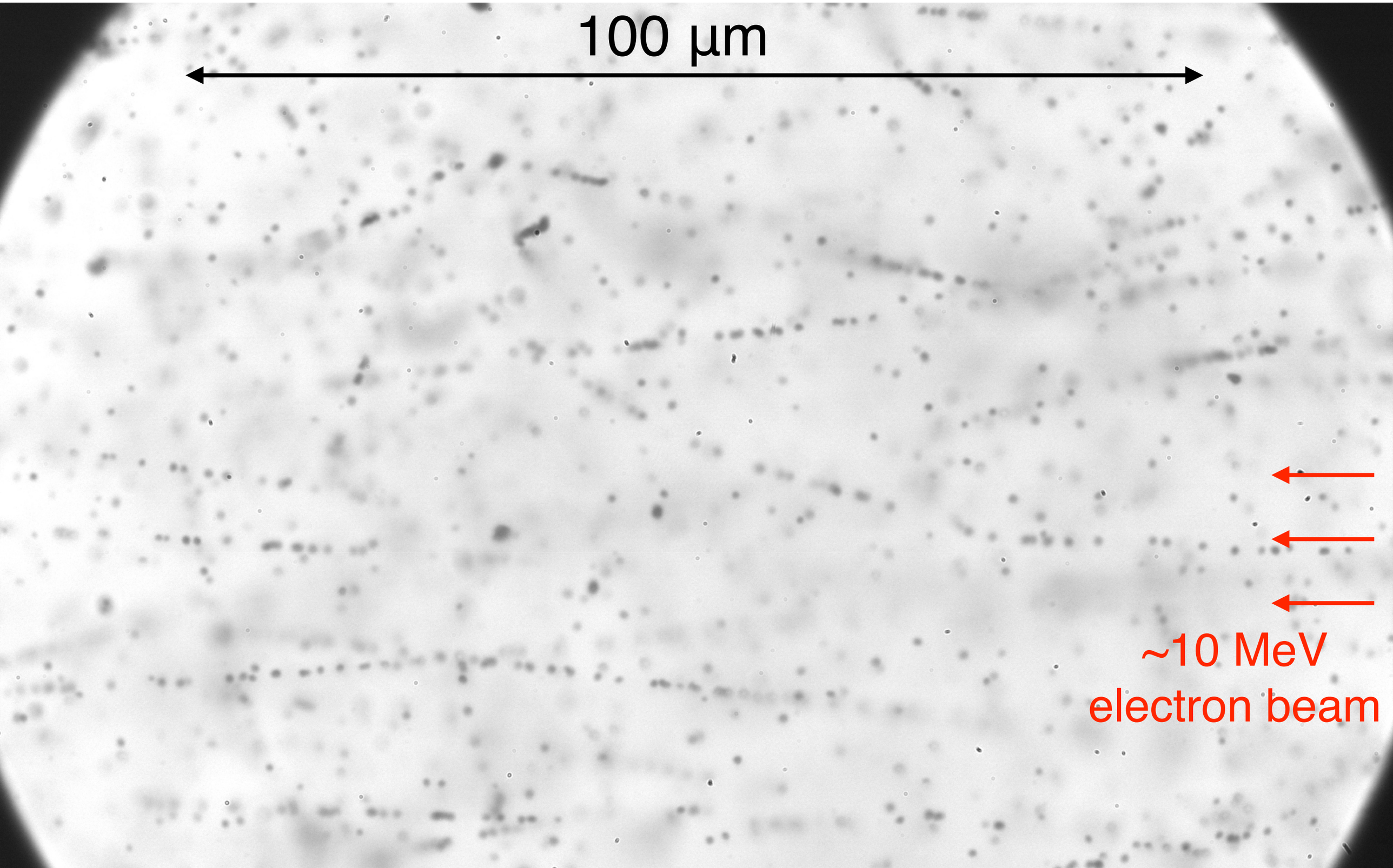
Started stable operation of gel production in the new facility



Evaluation of Sensitivity



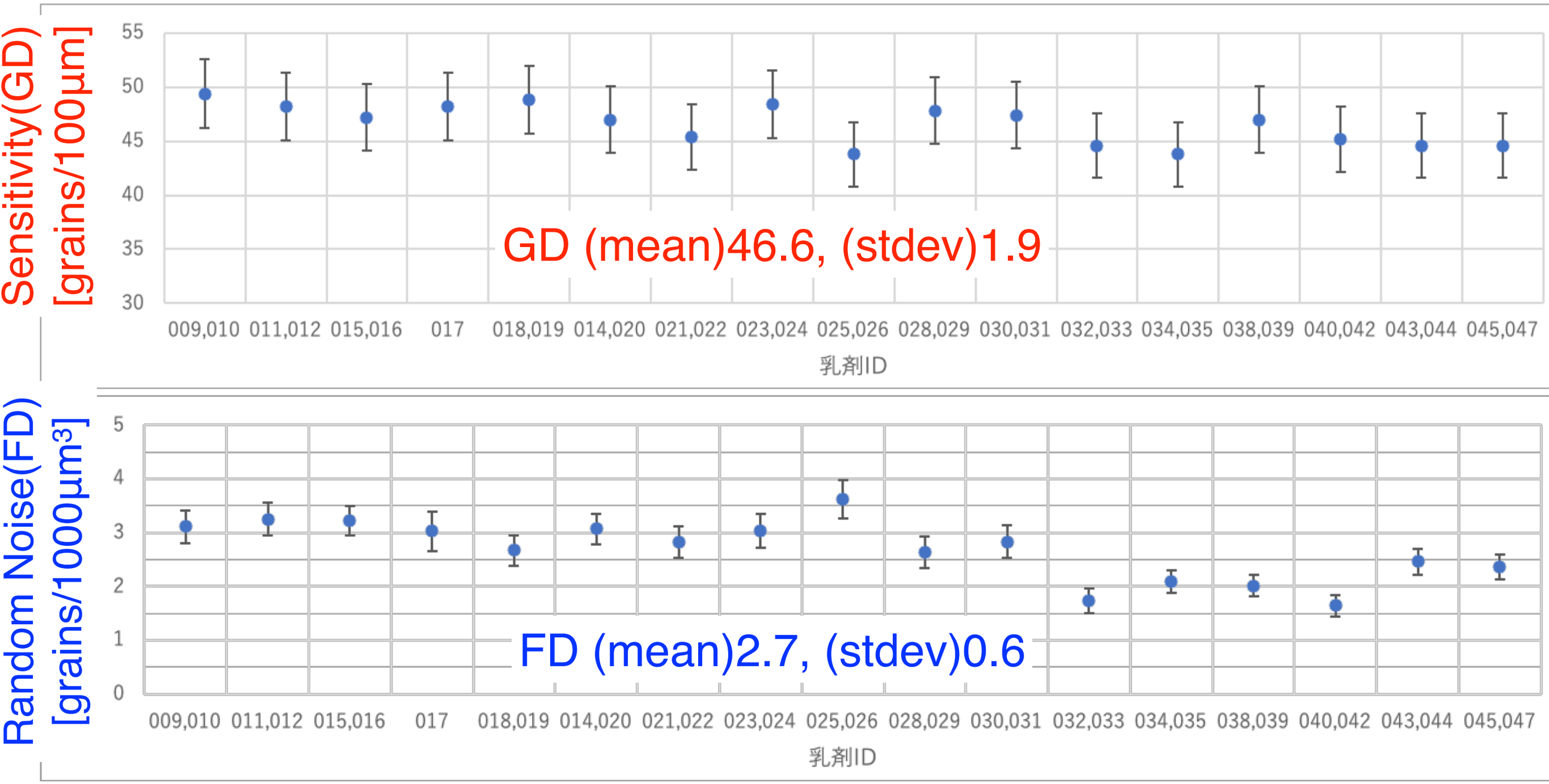




Sensitivity: Grain Density (signal grain per 100µm)

Noise: Fog Density (random noise per 1000µm^3)

Performance of Emulsion Gel produced in the new facility



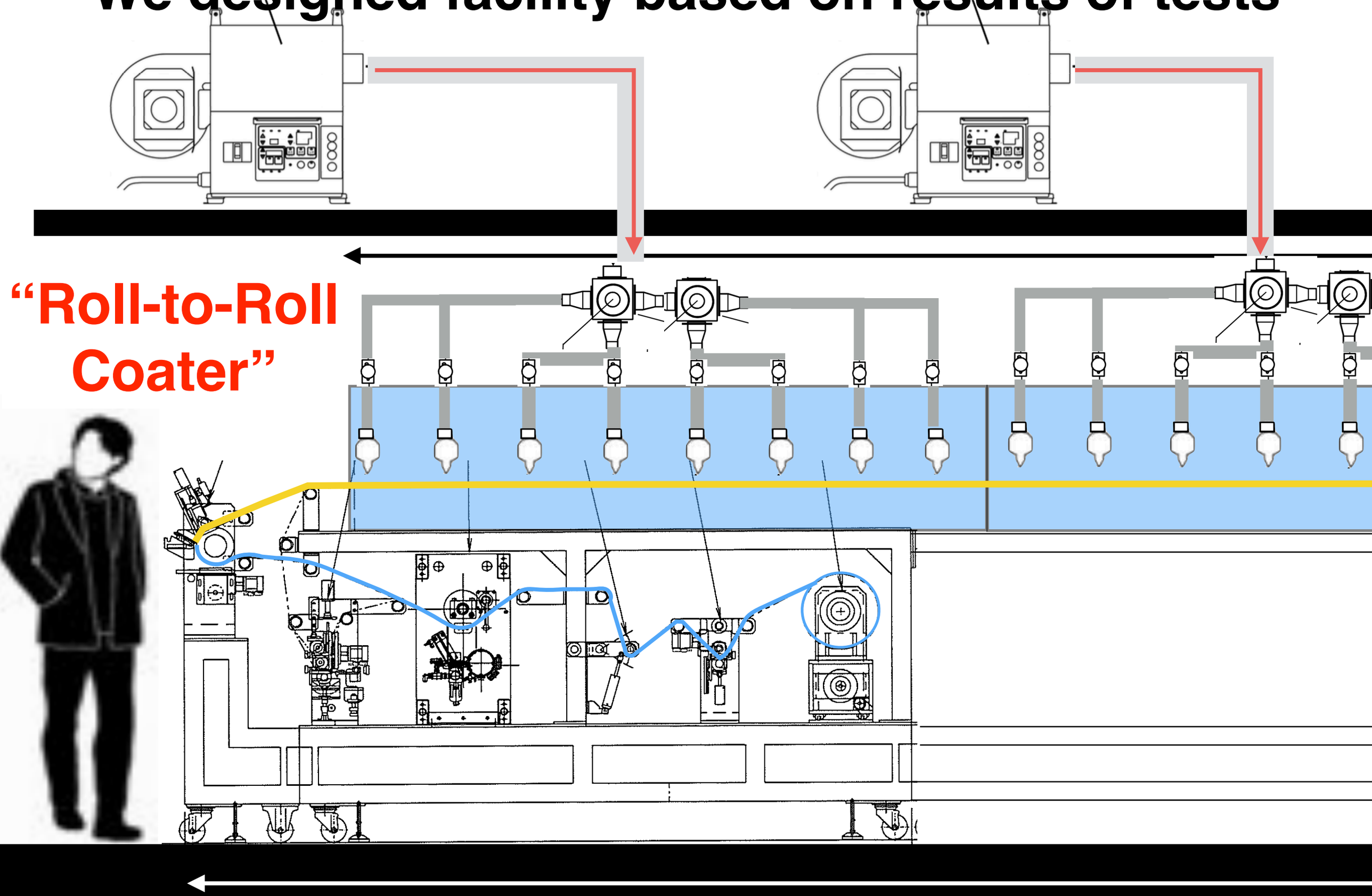
Upgrade of Film Production

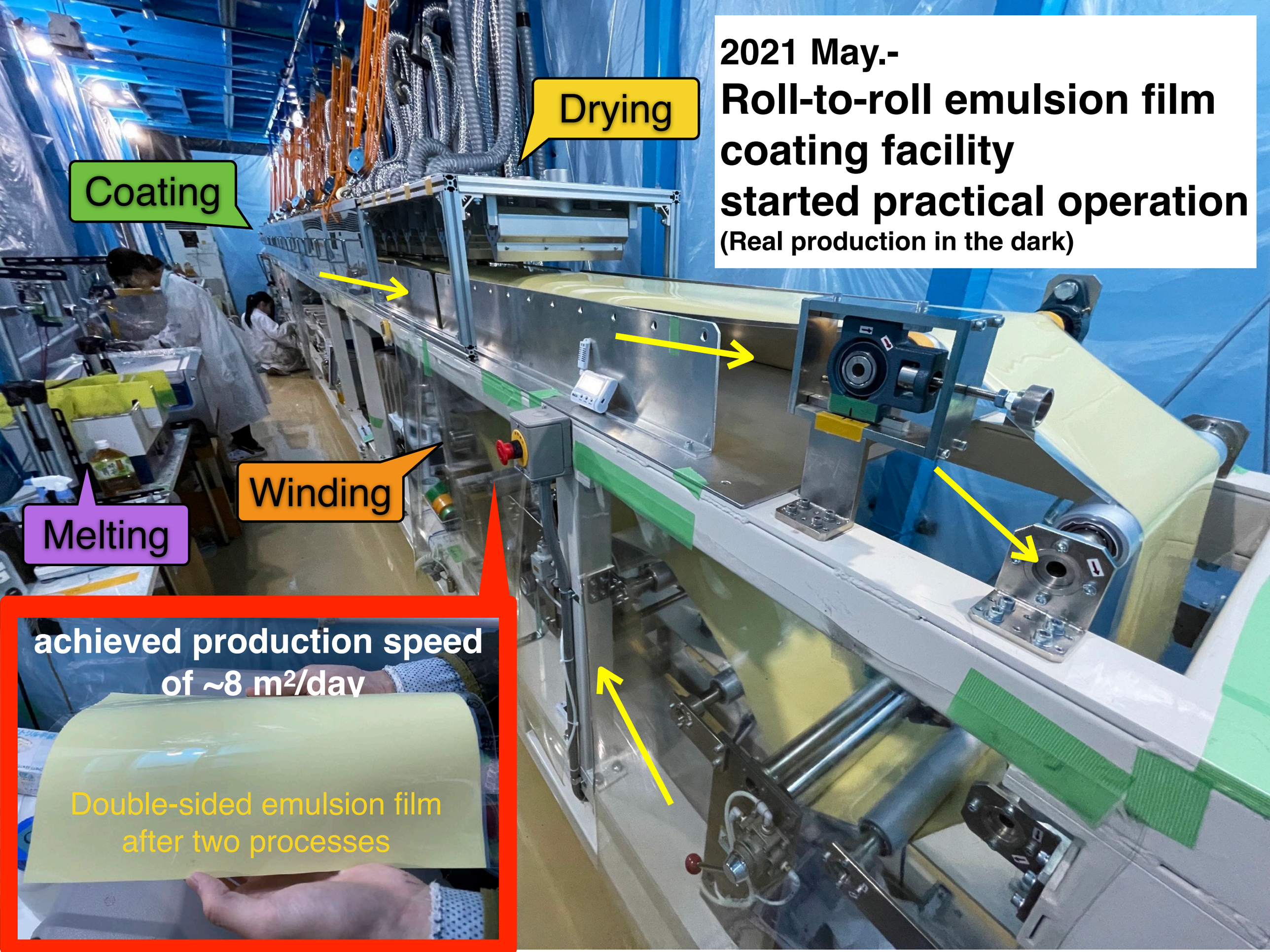
Conventional method (手塗り)

Development of Automatic Coat Method

- Knife Coater Method-

We designed facility based on results of tests



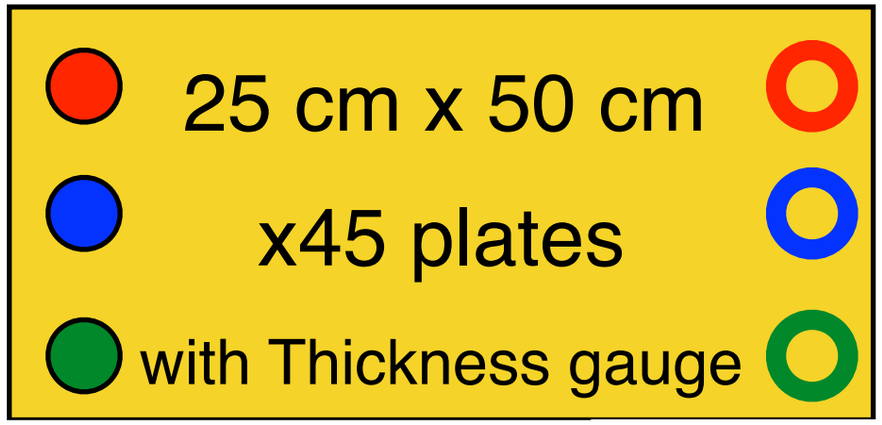

2021 May.-
Roll-to-roll emulsion film coating facility started practical operation
(Real production in the dark)
Drying
Coating
Winding
Melting
achieved production speed of ~8 m²/day
Double-sided emulsion film after two processes

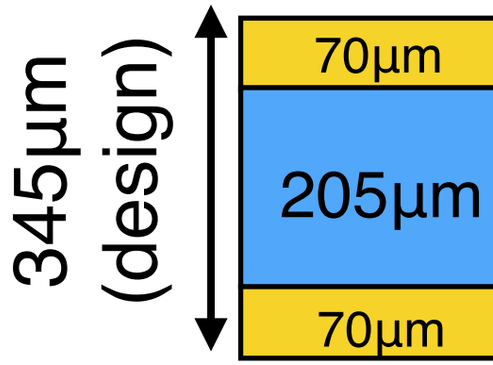
Atm. γ rays & Cosmic rays Observation Rehearsal (GRAINE team)

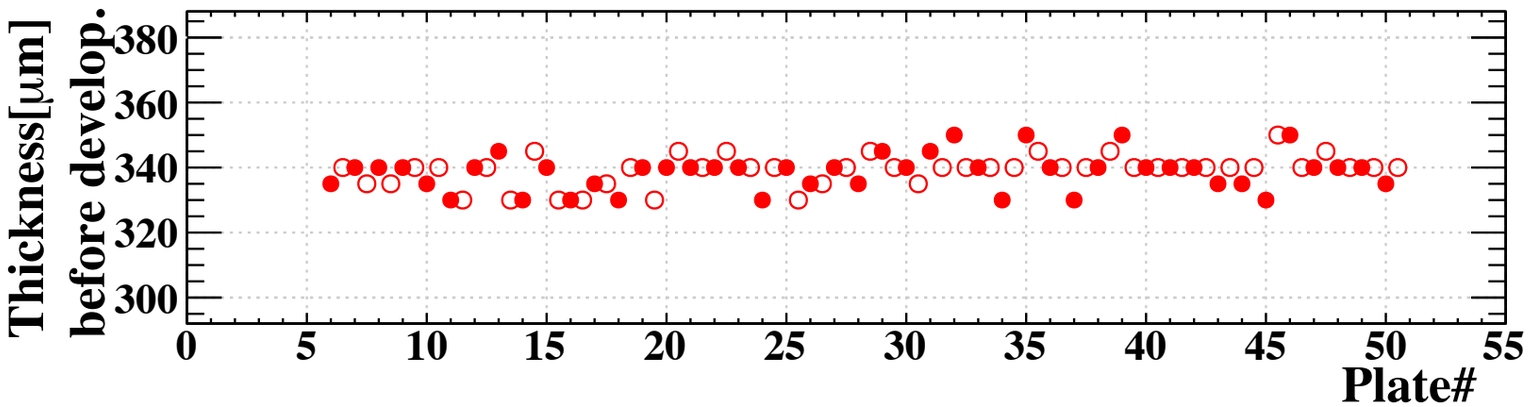
Production, preparation, observation, development, analysis etc.
towards the next experiment

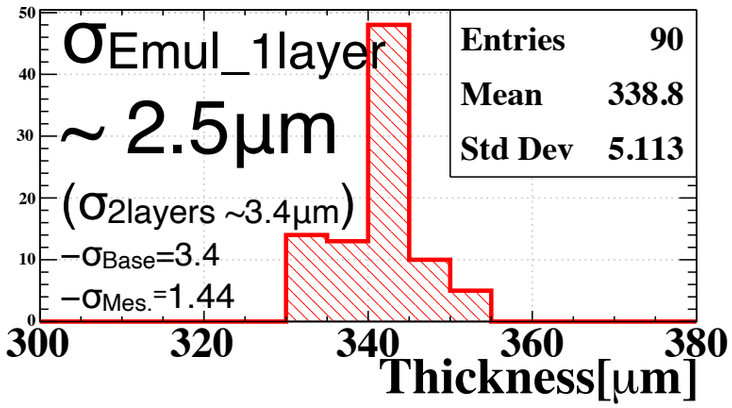
understand overall performance of current film and problem
→feedback to production

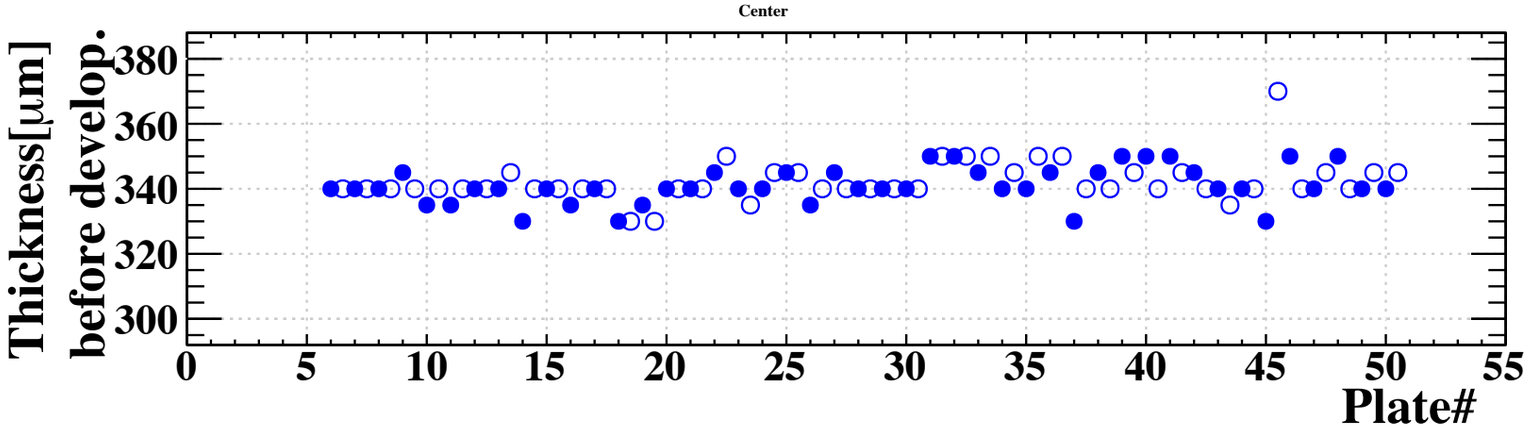
Thickness Measurement

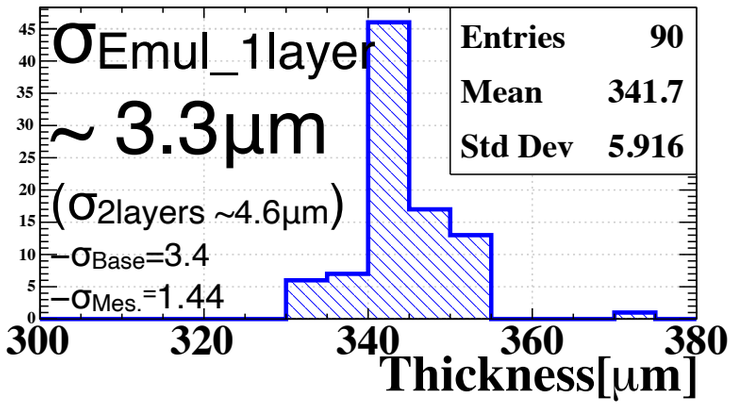


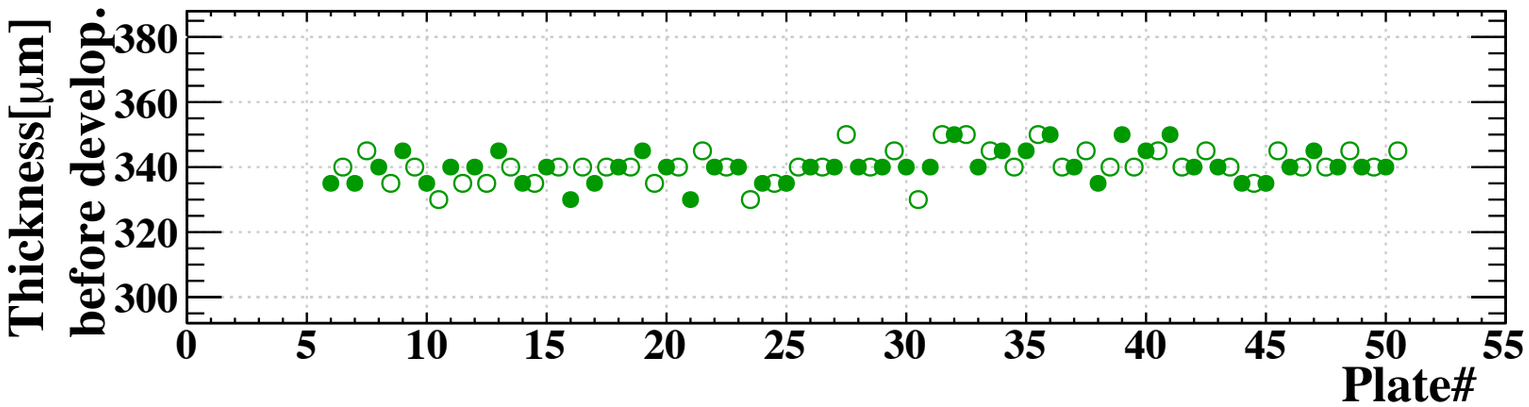


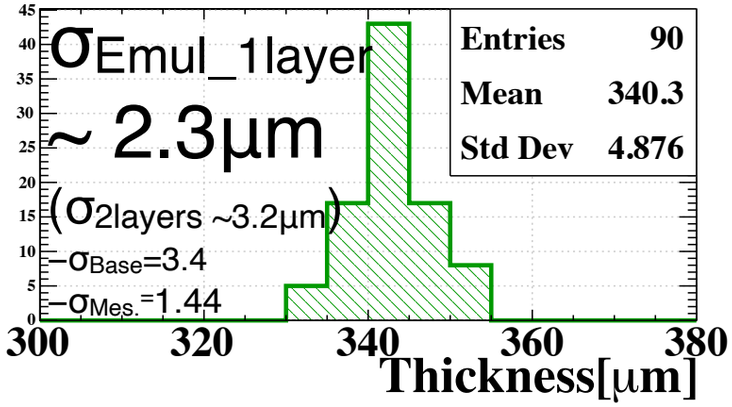




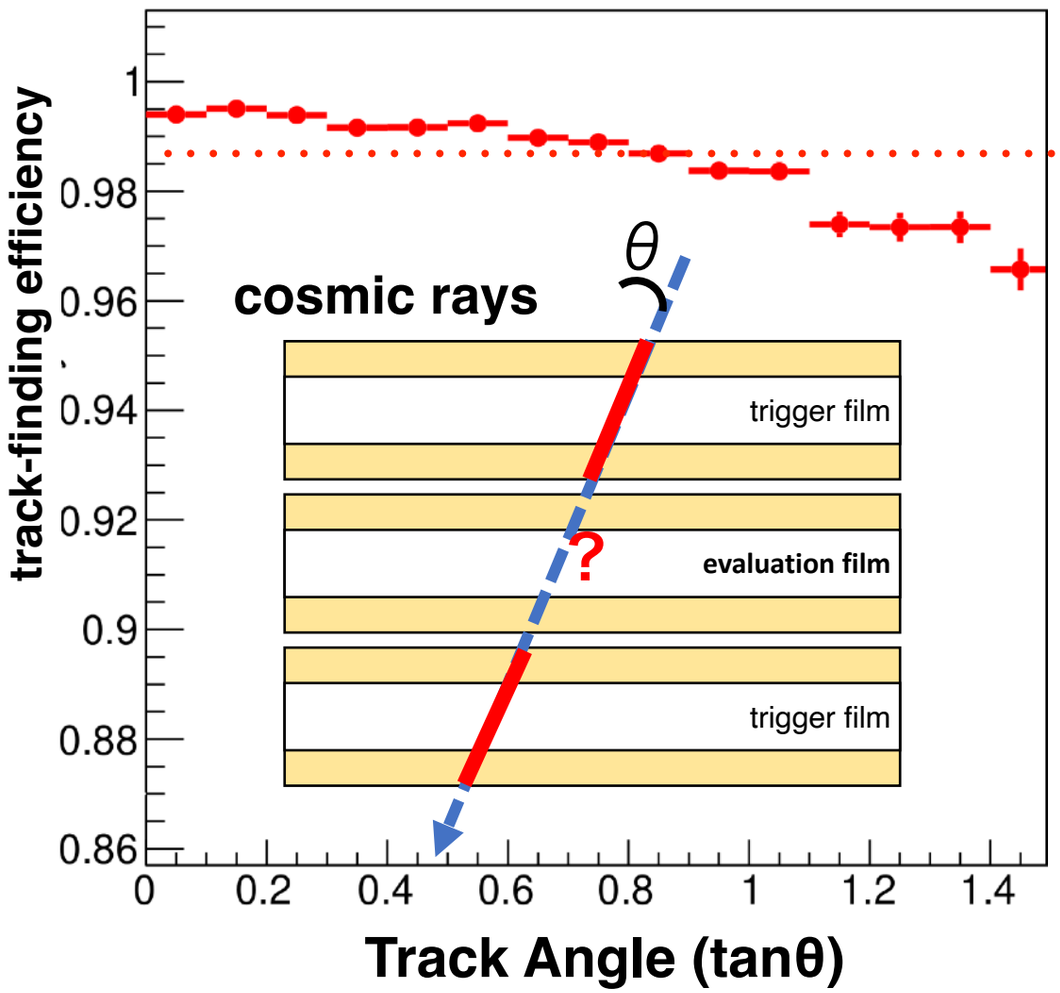


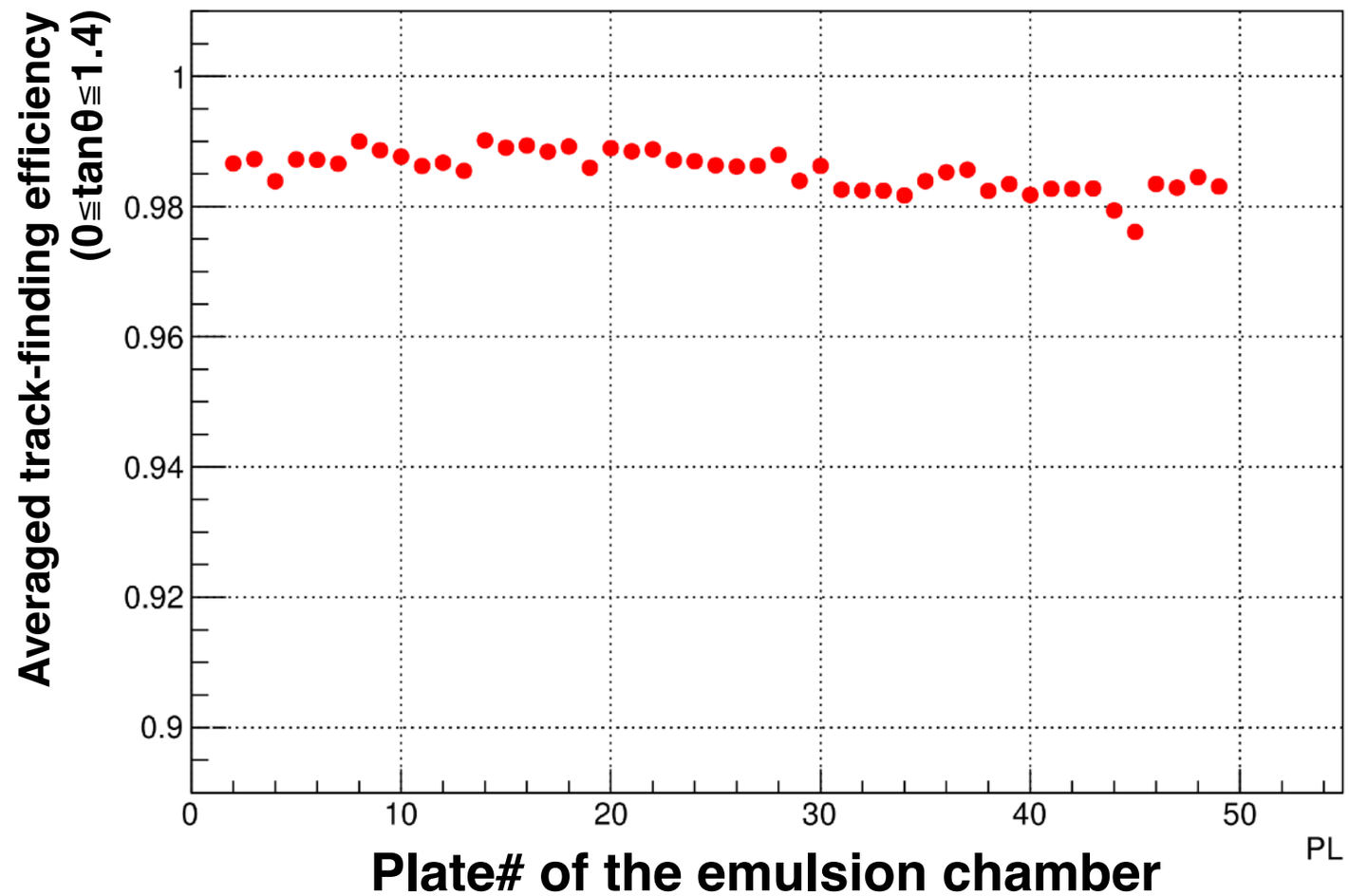






Evaluation of R-to-R Film with Scanning Data





Confirmed the sufficient track-finding efficiency(>96%) and position/angle accuracy in the wide range of track angle in the whole chamber.
Event reconstruction analysis is ongoing.

Summary & Plans

- The Use of NAGOYA emulsion is increasing. But production capacity was limited (200-300 m^2/year)
- **The new emulsion facilities (gel & coat) are operating from 2021.**
- We started the supply to the experiments conducted in 2021-2022.
  - DsTau-2021/2022run ~100+100 m^2
  - FASERv-2022 ~150 m^2
  - SND-2022 ~60 m^2
  - GRAINE 2023 ~600 m^2
  - MuonRadiography ~100 m^2
  - NINJA 2023 ~500 m^2
- Emulsion Experiments enter to the next stage !
- Stay tuned for results of our experiments !