



# *Advances in emulsion-based (ECC) detectors data analysis and reconstruction techniques*

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- **Nuclear emulsions are actively used now as a high-precision tracking detector thanks to its unique submicron spatial resolution**
- **Two major problems of the emulsion detector are:**
  - difficulty to read-out information – solved now with fast automated scanning systems development
  - no time-stamp – all tracks collected during the emulsion life superimposes. Practical solution of this problem is in multy-patterns matching helping to extract the interesting set of tracking information.
- **Main applications of the emulsion detectors:**
  - neutrino physics (OPERA)
  - cosmic rays (suitable to balloons)
  - Muon Radiography
  - Dark Matter (WIMP) research
- ECC – “Emulsion Cloud Chambers” is the most popular detectors configuration and allow to get a high absorber mass typical for calorimeters keeping tracking resolution significantly better then in any other tracking detector

# Reconstruction on the emulsions data

Starting from the 3-d space segment (microtrack) the reconstruction process in ECC pass the following steps: alignment, long tracks reconstruction, vertex reconstruction and event analysis. Tracking and vertexing are similar to ones used in other 3-d vertex detectors. Alignment is the procedure specific for the emulsions and consists in the search of the matched tracks patterns in the consecutive emulsion plates. Without the time stamp the patterns matching is the only way to separate tracks accumulated after the detector assembling from transportation tracks and from other background types.

**With ECC it is possible to obtain precise and quite complete physics information about the reconstructed event:**

- Precise event topology reconstruction with submicron accuracy including short decays and kinks research
- Particles identification using  $dE/dX$  and multiple scattering information
- Particles momentum reconstruction using the Multiple Coulomb Scattering
- Electromagnetic showers reconstruction