Fast Proton Radiography

http://www.et-gw.eu/

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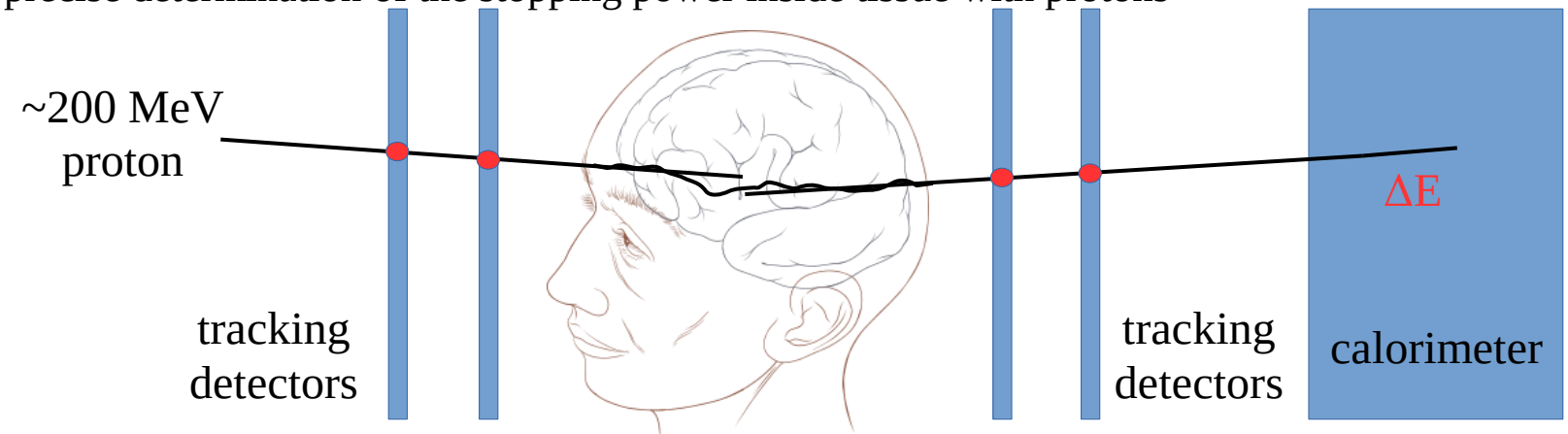
Proton therapy and radiography

- Proton Therapy
  - cancer treatment not affecting healthy tissue (using Bragg peak)
  - two centers (Delft and Groningen) under construction in NL
  - first patient treatment this year
- Issues
  - indirect determination of the proton stopping power via CT scan
    → large safety margin in healthy tissue around tumor needed
  - movement of tissue during the treatment plan
- Proton Radiography
  - high proton energy, Bragg peak inside a calorimeter outside body
  - direct and precise determination of the stopping power inside tissue with protons



Goal

Medical imaging which is

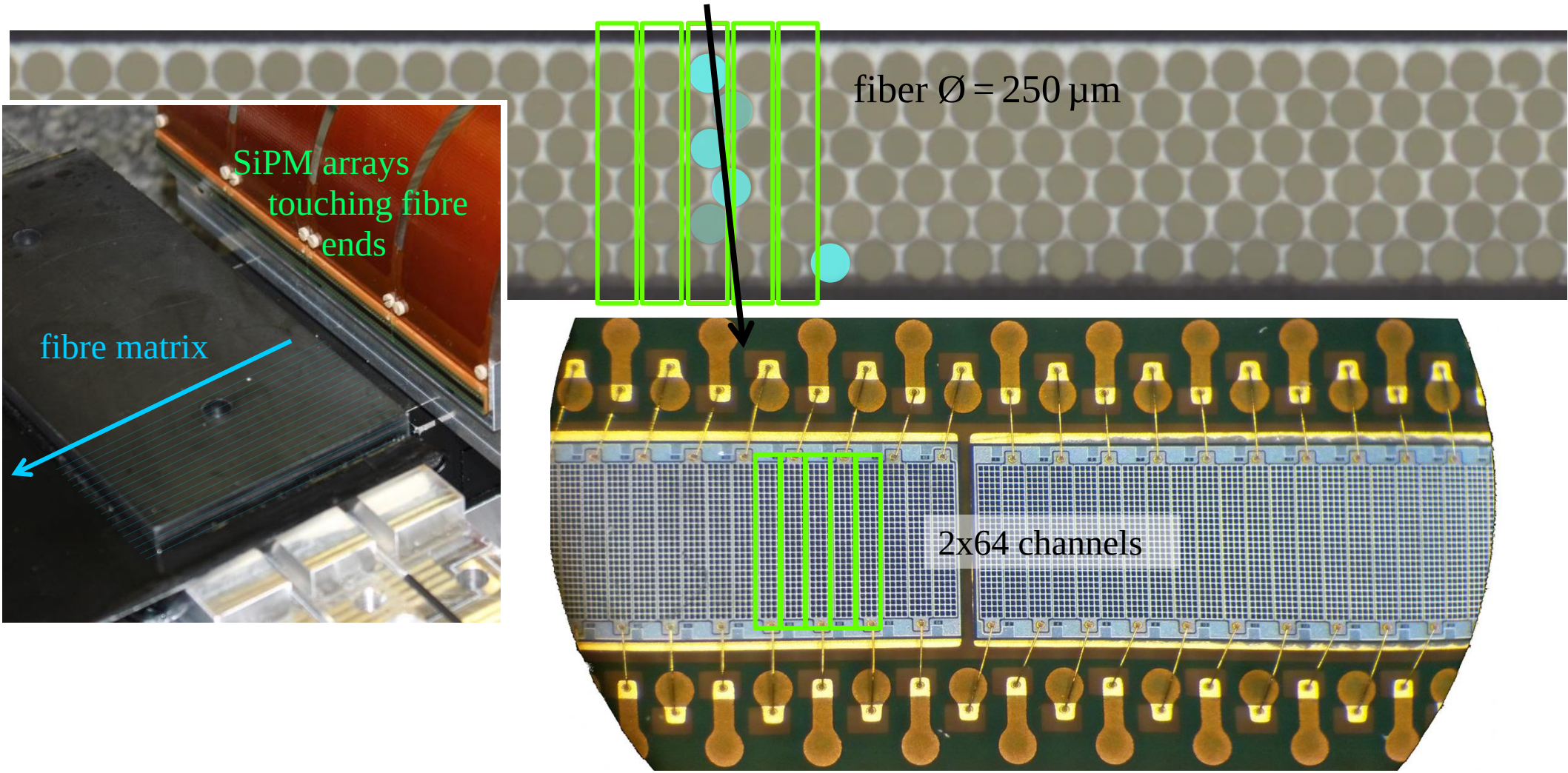
- fast
  - no disturbances from tissue movement between treatment sessions
  - efficient and convenient for patient and doctor
- accurate
  - better tissue image in units of proton stopping power
  - smaller dose in healthy tissue
- safe
  - low dose from high energy protons
  - new image prior to every treatment

How?

- envisaged collaboration
  - HEP institutes: CERN, Nikhef, Heidelberg, RWTH Aachen
  - proton therapy centers: PTC Delft, GPTC Groningen, HIT Heidelberg

- novel technology
  - Scintillating fiber tracker
  - Silicon photomultiplier readout
  - ultra fast 40 MHz readout → 5 minutes per scan

SciFi



- staggered layers of 250 µm thin double-clad scintillating fibres (Kuraray SCSF-78MJ)
- read out by SiPM arrays covering the
- decay time of scintillator 1.8 ns
- material budget of 6 fiber layers 0.5% X_0