Development of a Transparent Photon Detector for the Online Monitoring of IMRT Beams

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TraDeRa

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Summary

I. Context : the need of an online 2D detector

II. TraDeRa : Transparent Detector for Radiotherapy

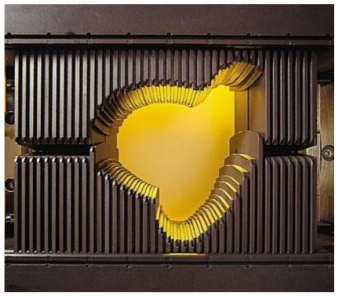
III. Measurements
   a) Electronic stability
   b) Real-time measurement

IV. Conclusions & perspectives

I. Context

- Problem of the increasing complexity of external radiotherapy techniques, as IMRT and rotational IMRT :

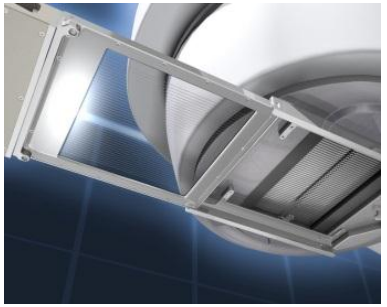
  - *Mu et al. 2008* : showed that 1 mm error on leaf positions can induce dosimetric changes until 10 %.



  - Compulsory *in vivo* dosimetry *(Inca 2008)* : which devices?

1D detectors

2D detectors after the patient



2D detectors before the patient

I. Context

- Problem of the increasing complexity of external radiotherapy techniques, as IMRT and rotational IMRT :

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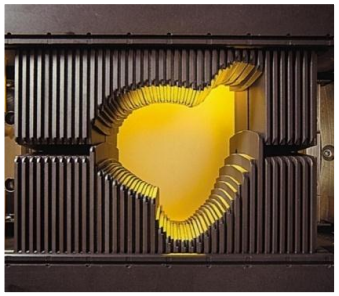
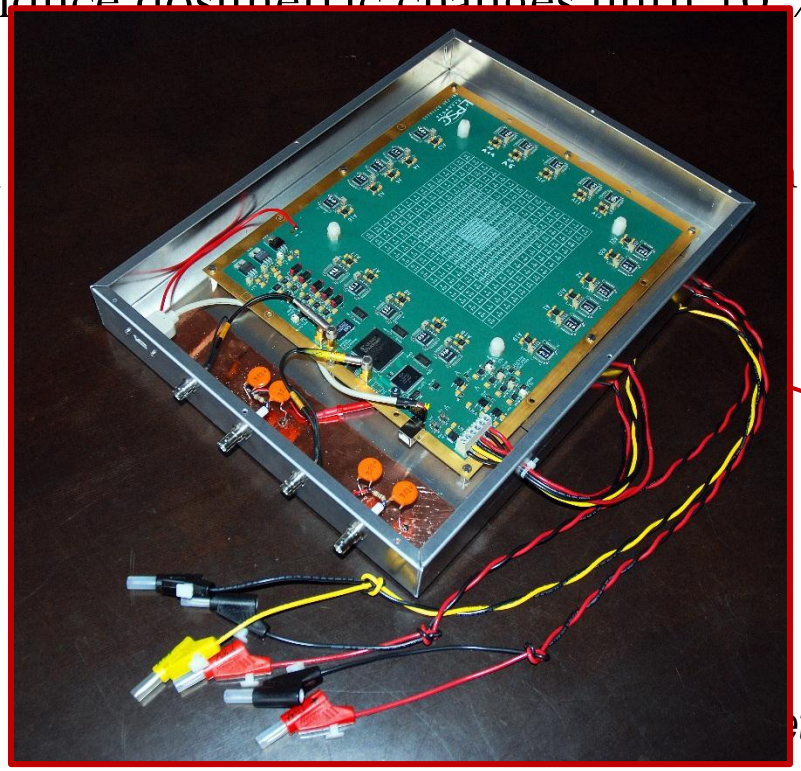
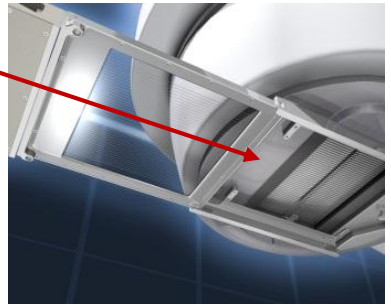


  - Compulsory *in* devices?

1D detectors

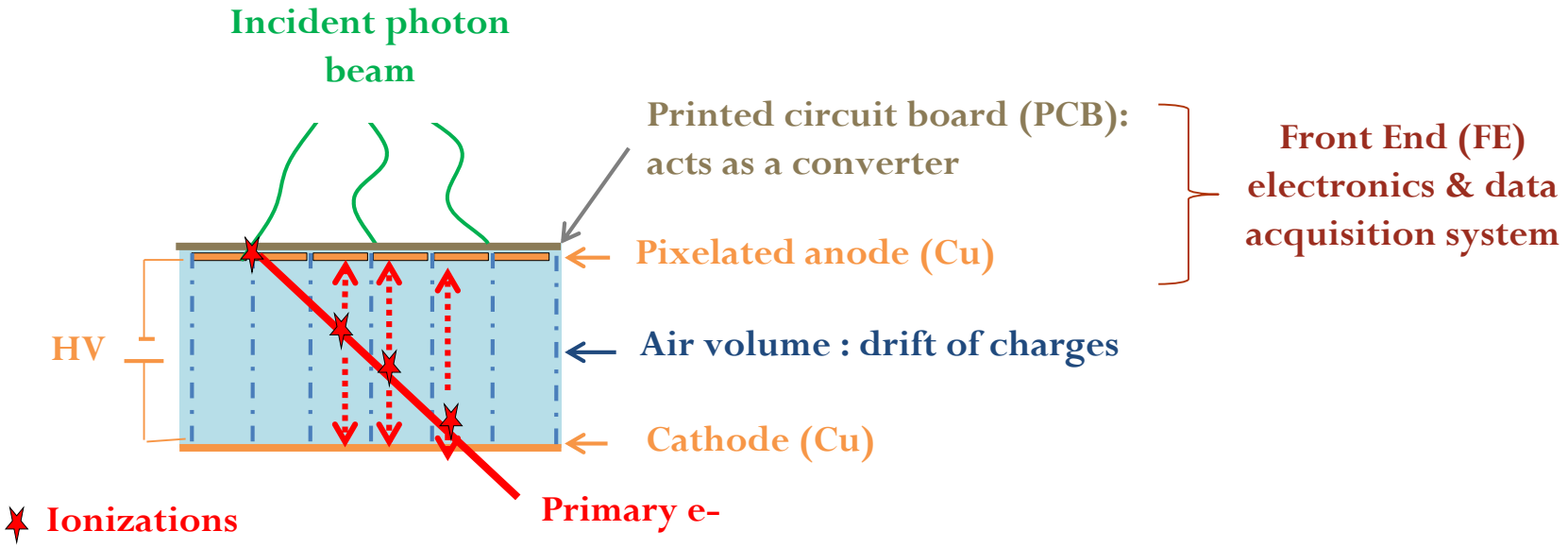




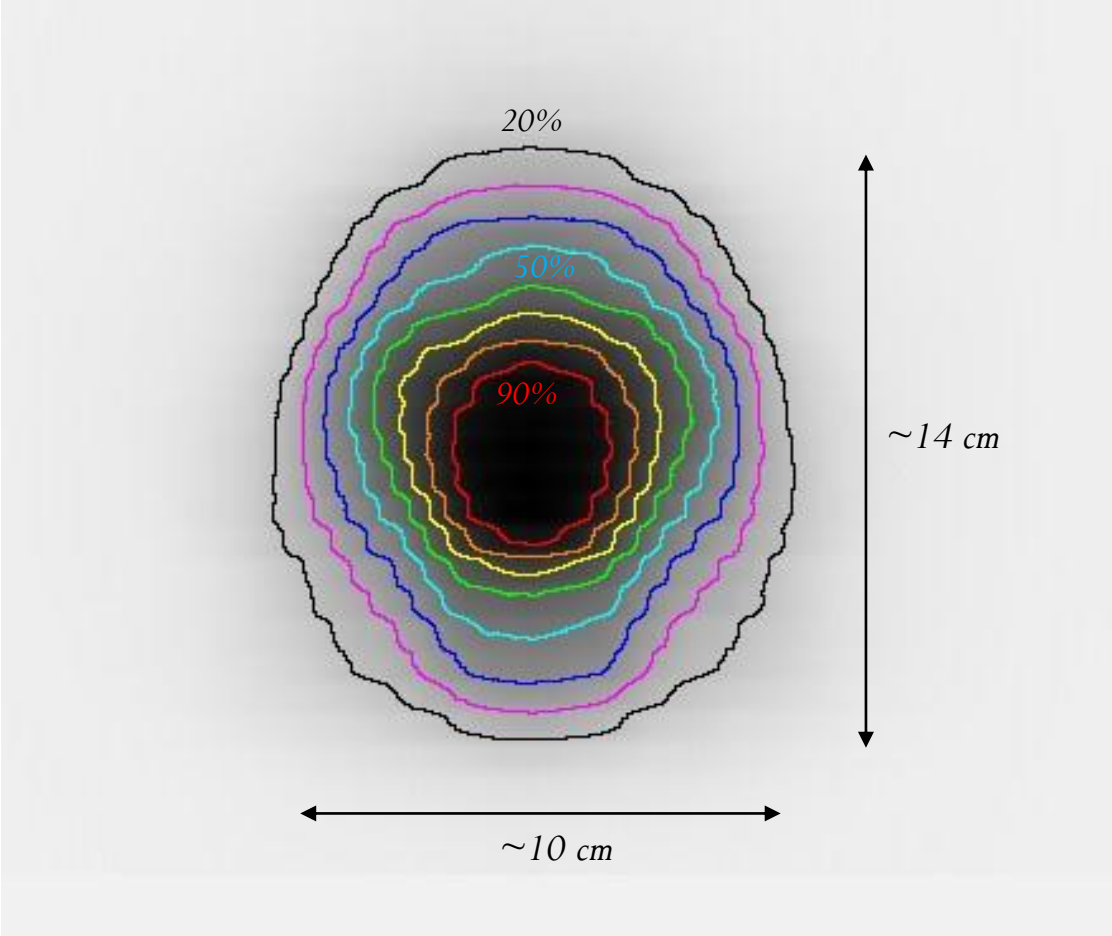
etectors before the patient

II. TraDeRa

- **Principle** : pixelated matrix of ionization chambers



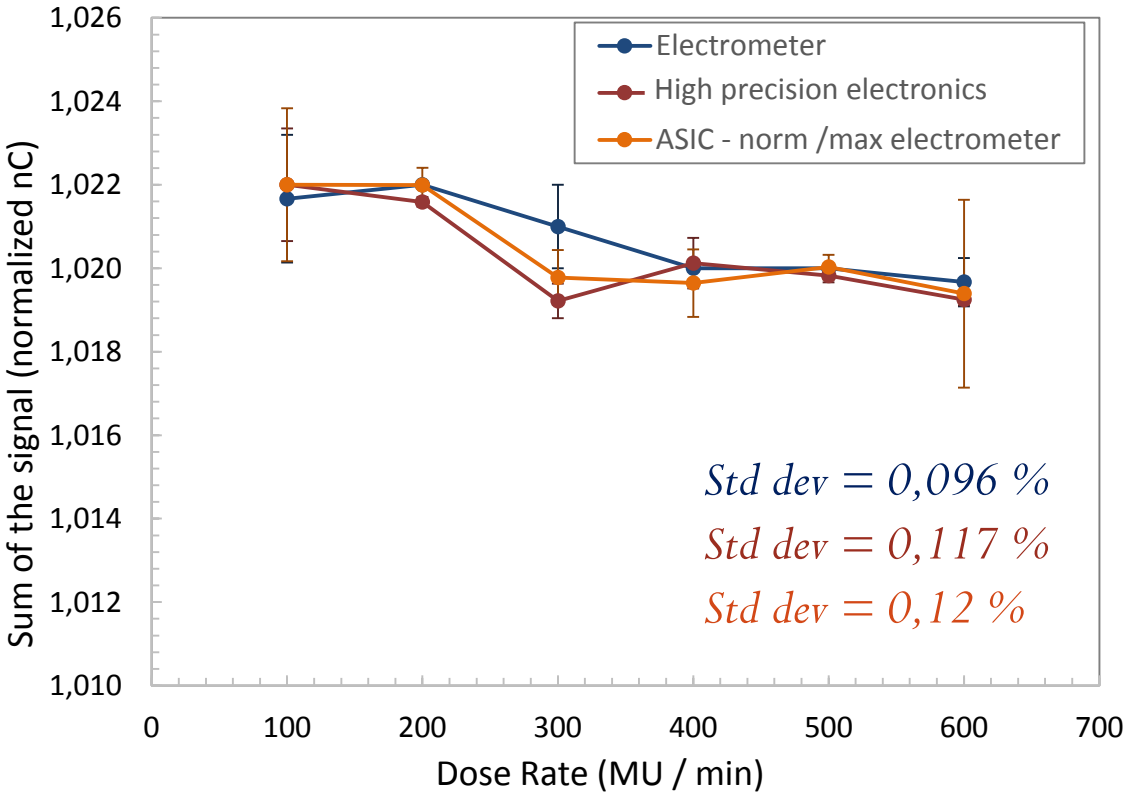
II. TraDeRa

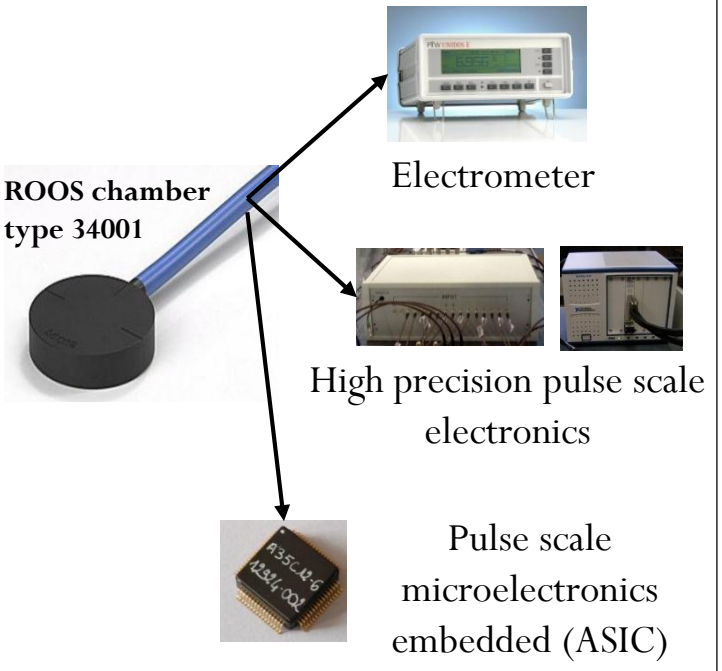


Accumulation of EPID data of IMRT treatments from CHUG : 200 patients, 20 locations

III. Measurements

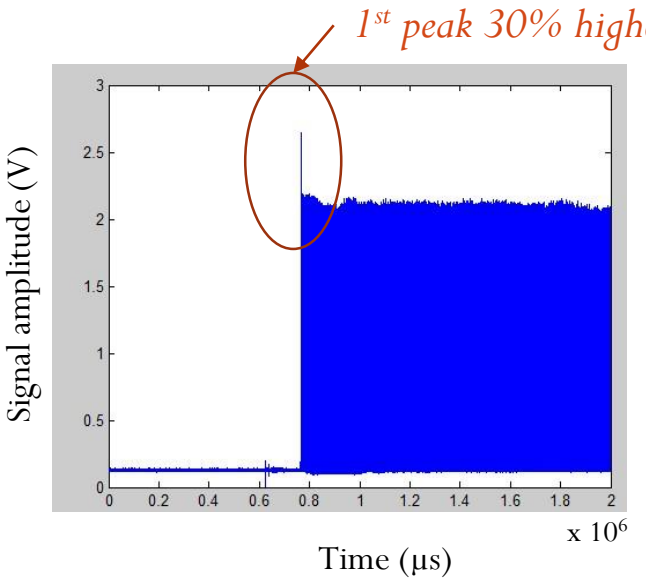
- Comparison of different acquisition systems with an ionization chamber *(6 MV, 100MU)* :



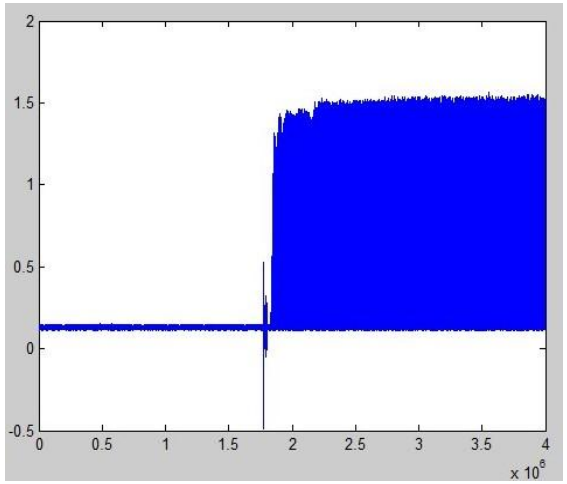


III. Measurements

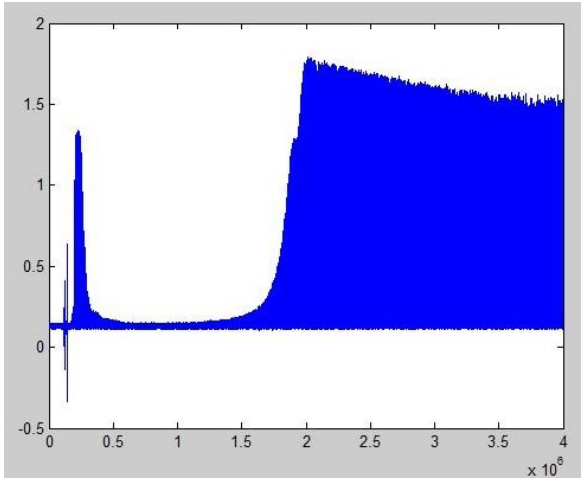
- Pulse scale precision revealing various behavior of accelerators :
  example of starting irradiations (6 MV) :



Clinac 600 (Varian)
@ 300 UM/min



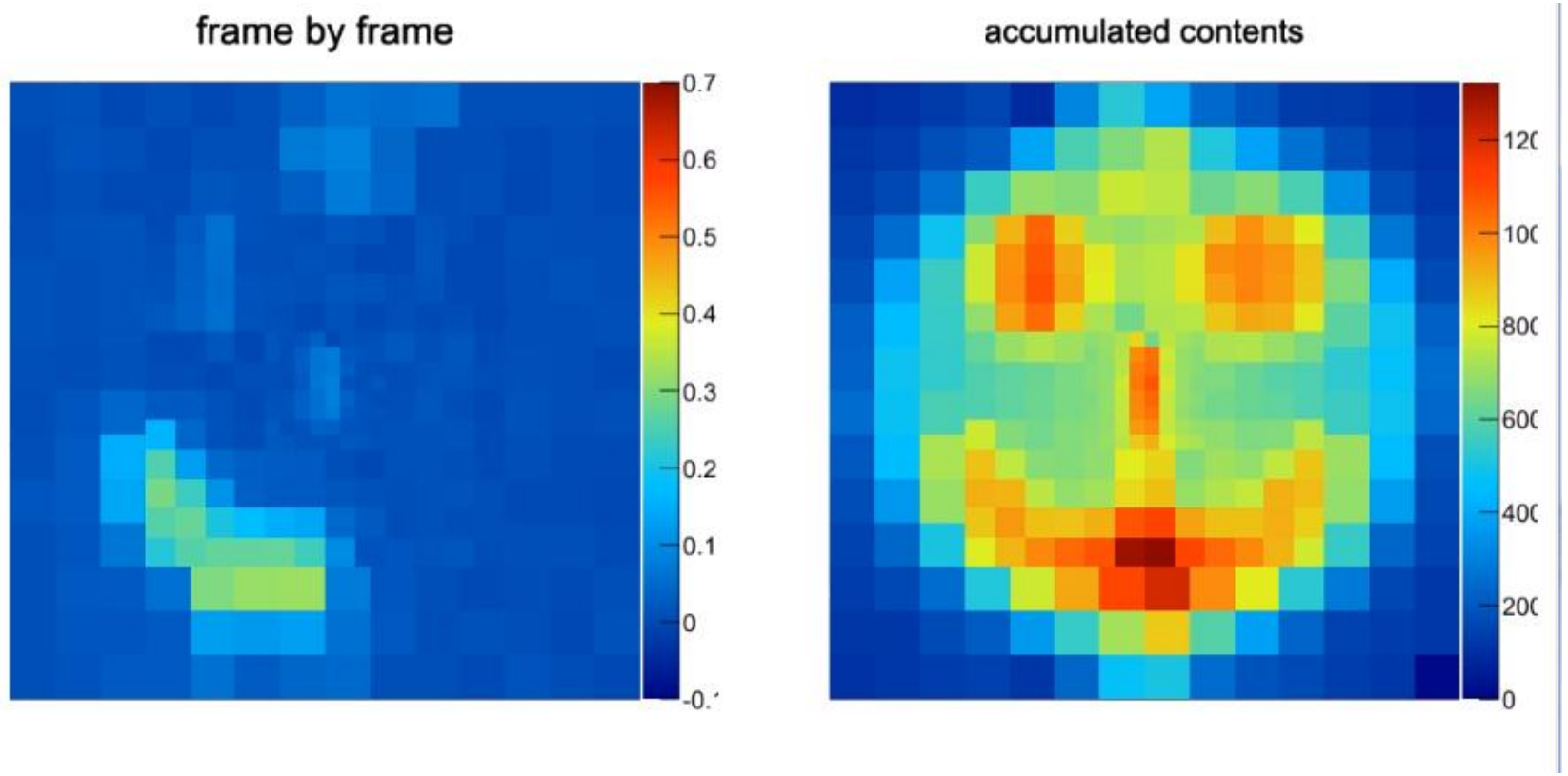
Clinac 2100 (Varian)
@ 300 UM/min



Clinac 2100 with a cough
@ 300 UM/min

III. Measurements

- TraDeRa real-time acquisition at CHU of Grenoble : 6 MV beam, dynamic treatment



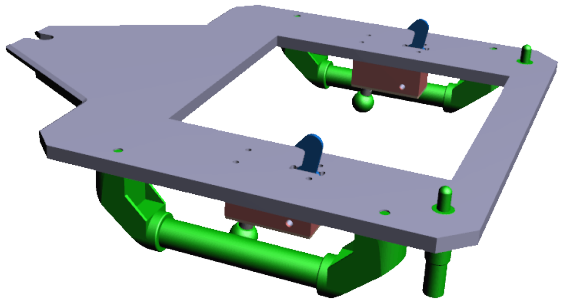
IV. Conclusions

- TraDeRa already shows promising results :
  - Micro FE electronics are stable under various treatment beams and even for high dose rate and long irradiations.

  - Real-time 2D measurements at the pulse scale already working.
  - Two patents *(FR N° 11/53254 & FR N° 13/54339)*

IV. Perspectives

- Final prototype, cover 40x40cm² with 1600 channels :
  - PENELOPE simulations : influence of TraDeRa on the photon beam & contribution of contamination electrons from the head.
  - Dosimetry calibration with Gafchromics© films and water phantom measurements.
  - TraDeRa embedded on accelerator's head.



- ESRF : proposal for high dose rate synchrotron beam monitoring.

TraDeRa

Thank you for your attention

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