

Alert system

Motivazione

Motivation:

- 2D alert framework that takes as reference a TPS prediction (which is safer than using a day1 reference)
- Possibly in real time

Goal of study (work by Rossana Lanzalotti and Emmanuel Uwitonze)

- perform a systematic comparison of some commonly applied alert metrics in 2D in-vivo EPID dosimetry, evaluating their efficacy for the detection of errors

Metrics:

- the gamma-index
- dose difference related metrics

Measurements:

Using EPID measurements performed with several types of phantoms and ad-hoc introduced errors,

- Setup errors
 - Translations
 - Rotations
- Anatomical changes
- Errors in delivered monitoring unit

Metrics

- **Gamma-index**

- Visual inspection of 2D gamma-index distributions
- Overall value: gamma PR
- Freedom in
 - Tolerance criteria
 - Threshold
 - Local/global

$$PR = \frac{\sum_{v,pass} \Gamma_v^{pass}}{\sum_{v,tot} \Gamma_v^{valid}}$$

- **Dose difference related metrics**

- Visual inspection of 2D difference
- Visual inspection of horizontal and vertical dose profiles
- Some overall value... there seem to be **many** and definitions are not 100% clear
 - Relative (with respect to what? max ? Prescribed? Fixed value?), Absolute (mean absolute error)

$$\Delta D_1 = 100\% \times \frac{1}{N_{v \in T}} \sum_{v \in T} \frac{|D_e - D_r|}{D_r^{max}}$$

$$\Delta D_2 = 100\% \times \frac{1}{N_{v \in T}} \sum_{v \in T} \frac{|D_e - D_r|}{D_r}$$

$$\Sigma_{r,e} = 100\% \times \sqrt{\frac{\sum_{v \in T} (D_e - D_r)^2}{N_{v \in T}}}$$

Input appreciated (can discuss later or offline)

→ Quale usate di solito?

Measurements

CIRS centro, 0R115 rectangular 1x15

Posizione [cm]	Angolo	MU
0	0	100
0	0	105
0	0	110

CIRS centro, 0GF3, 10x10

Posizione [cm]	Angolo	MU
0	0	100
0	0	105
0	0	110

CIRS centro, 0GF2, 5x 5

Posizione [cm]	Angolo	MU
0	0	100
0	1	100
0	2	100
0	5	100

CIRS centro, 0R115, rectangular 1x 15

Posizione [cm]	Angolo	MU
0	0	100
0.2	0	100
0.3	0	100
0.5	0	100

CIRS centro, 0GF3, 10 x 10

Posizione [cm]	Angolo	MU
0	0	100
0.2	0	100
0.3	0	100
0.5	0	100

6s10, yf3, 10x 10, phantom 10 cm

acqua solida			
Spessori aggiuntivi [mm]	Posizione [cm]	Angolo	MU
0	0	0	100
2	0	0	100
3	0	0	100
5	0	0	100

For now:
reference is the
orange measurement

Error in MU: visual inspection, 10 x 10 cm²

Emmanuel

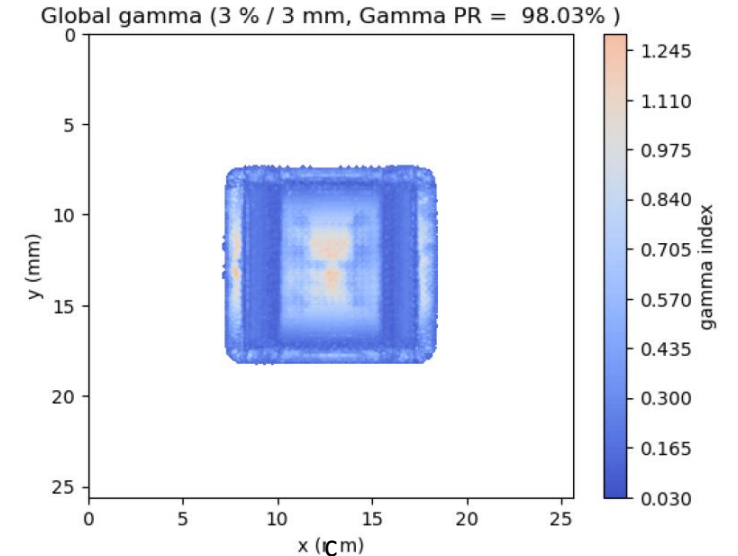
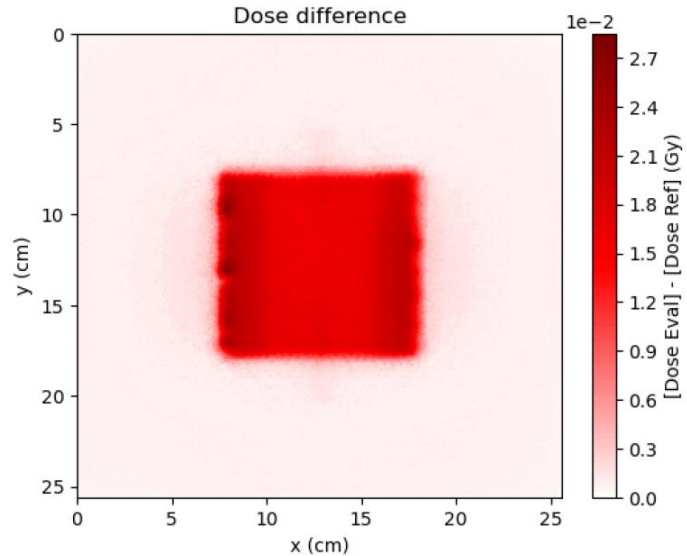
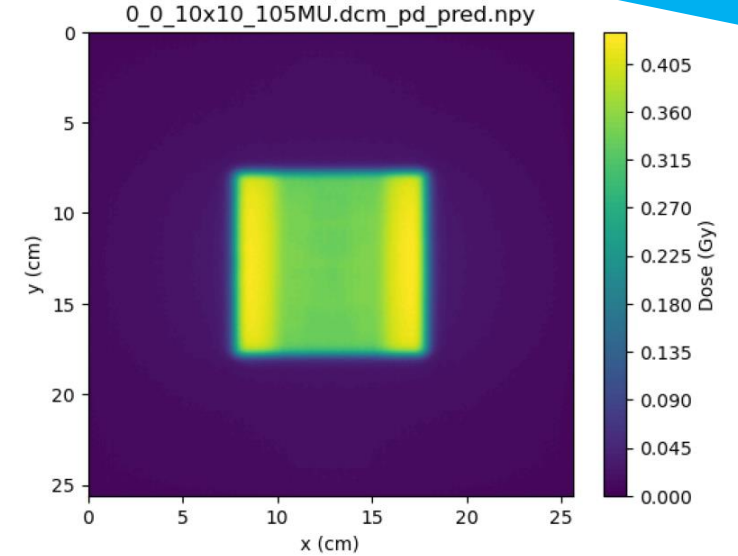
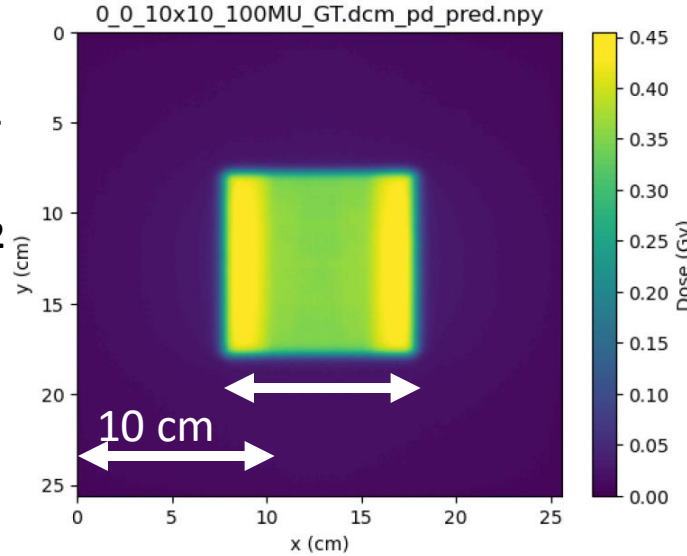
Reference: CIRS, 100 MU, 10 x 10 cm²

Compare with: CIRS, 105 MU, 10 x 10 cm²

Global gamma
10% threshold
3%/3 mm



Question: campo di 10x10 cm²
→ 14 x 14 cm² EPID?



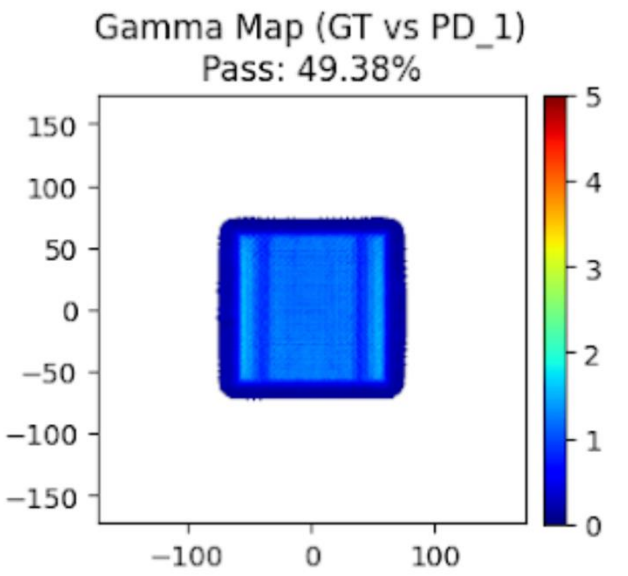
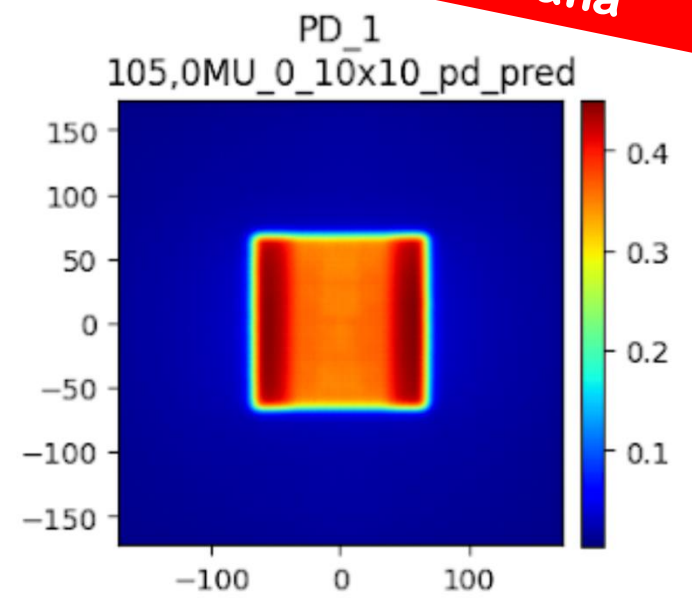
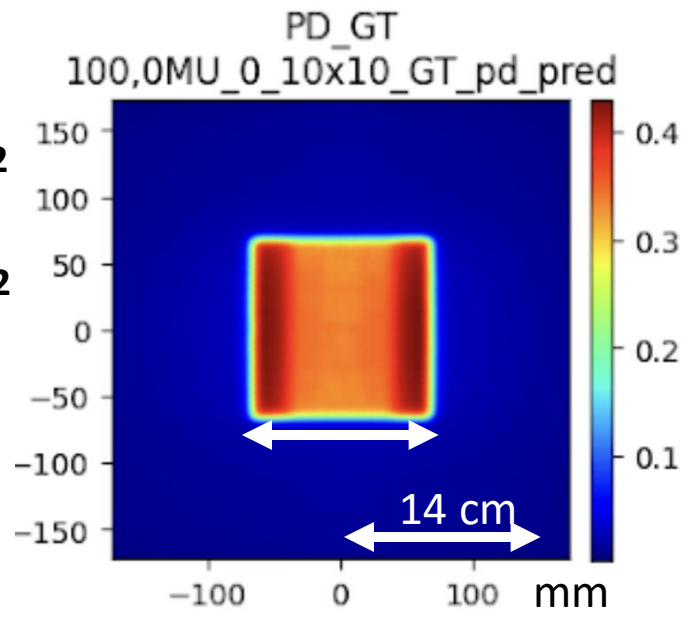
Error in MU: visual inspection, 10 x 10 cm²

Rossana

Reference: CIRS, 100 MU, 10 x 10 cm²

Compare with: CIRS, 105 MU, 10 x 10 cm²

Global gamma
10% threshold
3%/3 mm



First exercises up and running!
Cross check both codes and
check disagreement (rescaling? voxel size?)

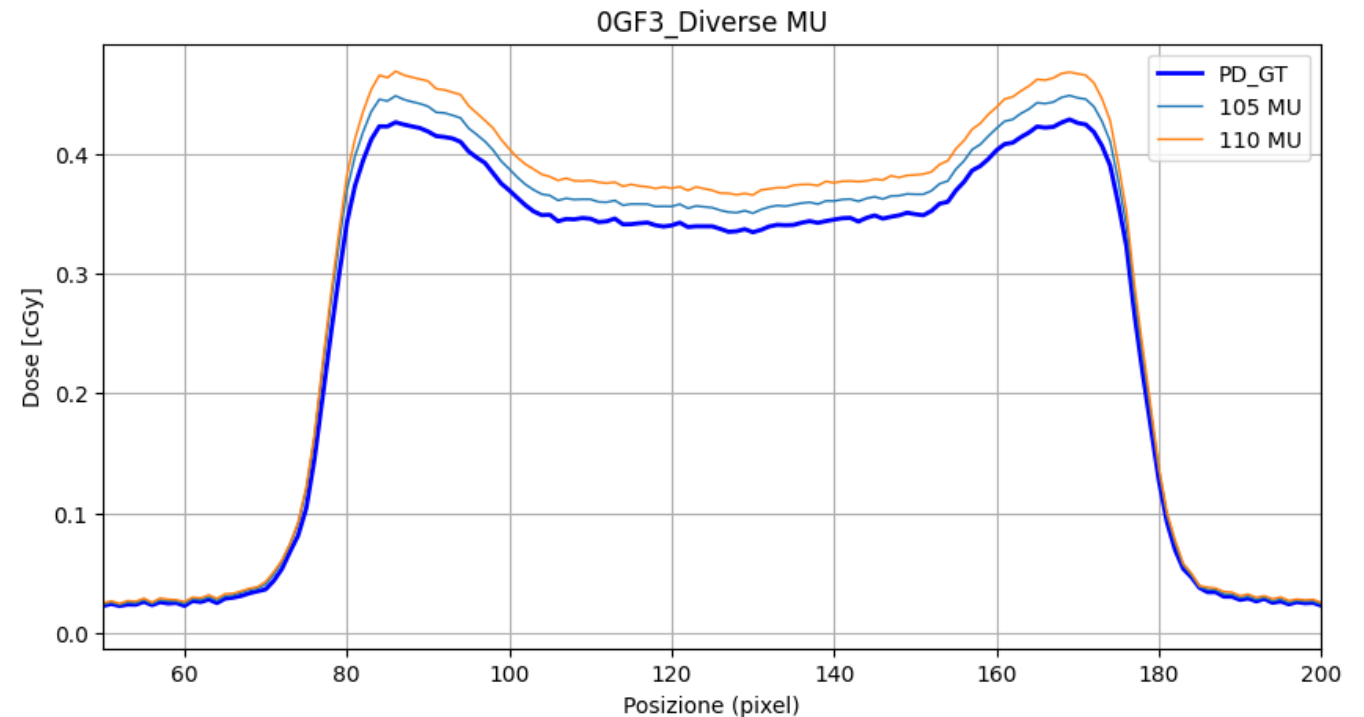
Error in MU: visual inspection, 10 x 10 cm²

Rossana

Reference: CIRS, 100 MU, 10 x 10 cm²

Compare with: CIRS, 105 MU, 10 x 10 cm²

Compare with: CIRS, 110 MU, 10 x 10 cm²



Error in MU: visual inspection, 10 x 10 cm²

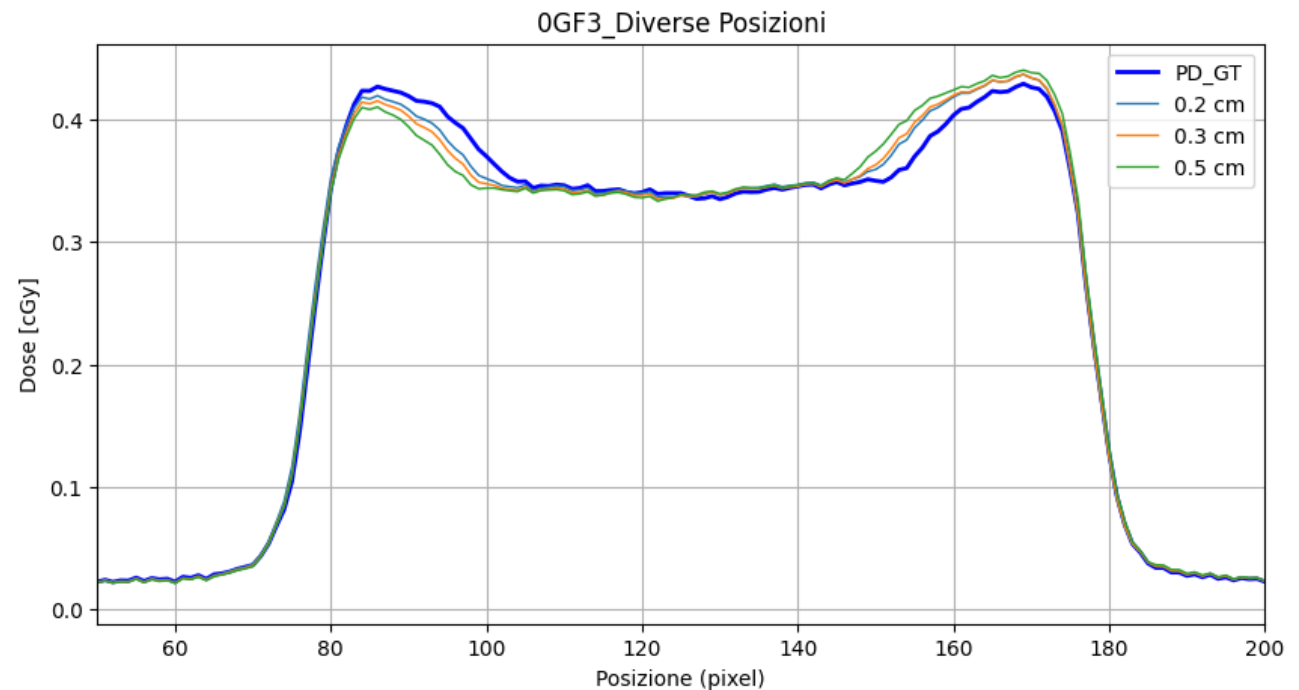
Rossana

Reference: CIRS, 100 MU, 0 mm, 10 x 10 cm²

Compare with: CIRS, 100 MU, 2 mm, 10 x 10 cm²

Compare with: CIRS, 100 MU, 3 mm, 10 x 10 cm²

Compare with: CIRS, 100 MU, 5 mm, 10 x 10 cm²



Plans

Results not agreeing completely

- Dimensions
- Free parameters, threshold?

Next steps:

- Make results solid
- Consolidate work on these 6 series
- Change the reference (TPS prediction for default situation)
- Test also EPID vs EPID?

- Analyze new series