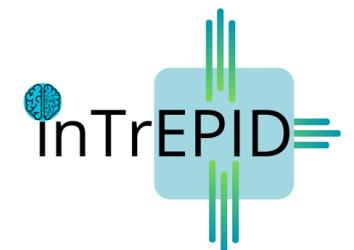


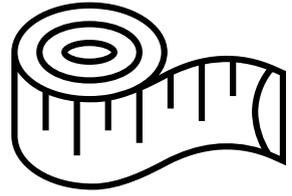
Update 07/10/2025

Validazione finale della distribuzione di dose
portale

e

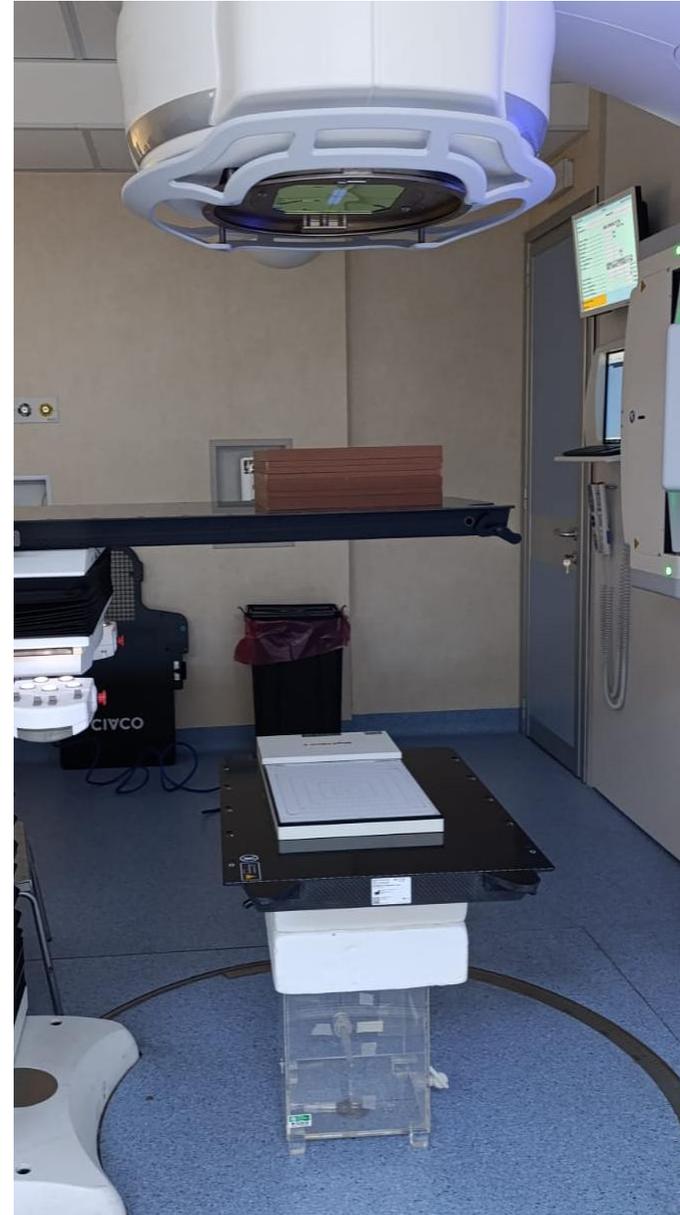
applicazione U-net per QA pre trattamento

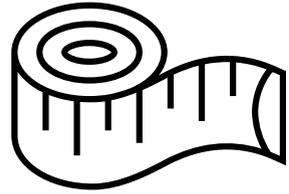




Validazione TPS

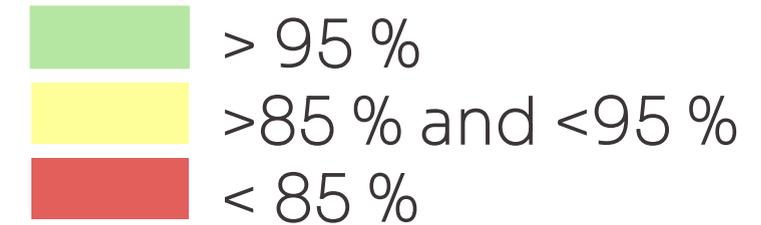
- Per validare le simulazione con il TPS
- Misure di dose 2D con **pellicole radiocromiche** e matrice 2D di diodi (Mapcheck2)
 - Misure puntuali con la **camera a ionizzazione Farmer**





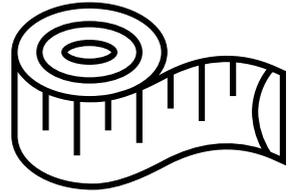
Validazione TPS

Pellicole radiocromiche



Phantom	Field cm ²	MU	Gamma 5%/1.5mm 20% thr. Global
Anthropomorphic	2x10	300	98.63
Modular heterogeneous	5x5	200	95.66
Solid water with lung insertion	Circular 2	400	95.36
10 cm of solid water	2x2	200	100

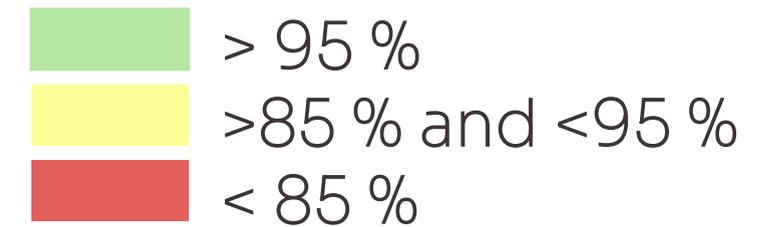
Confronto con il gamma:
5%/1.5mm e 20% threshold
(Pellicole sono molto accurate in
risoluzione, più complessa la
questione per la dose)



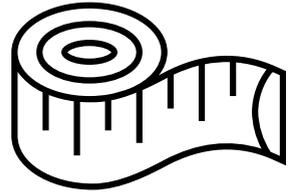
Validazione TPS

Mapcheck2

Phantom	Field cm ²	MU	Gamma 3%/3mm 10% thr. Local	Gamma 2%/2mm 10% thr. Global
Anthropomorphic	2x2	300	100	97.3
Anthropomorphic	2x10	300	99.3	92.8
Anthropomorphic	10x10	300	98.9	90.4
Modular heterogeneous	5x5	200	92.5	83.3
Modular heterogeneous	10x10	100	95.3	86.3
Modular heterogeneous	Circular	200	90.7	81.1
Modular heterogeneous	Elliptical	200	89	80.7
Solid water with lung insertion	Circular 1	400	100	97.6
Solid water with lung insertion	Elliptical	400	97.2	80.9
Solid water with lung insertion	Circular 2	400	99.5	94.4
10 cm of solid water	2x2	200	100	100
10 cm of solid water	2x10	200	100	99.3
10 cm of solid water	10x10	100	98.9	93.8
10 cm of solid water	5x5	200	99.4	98.3



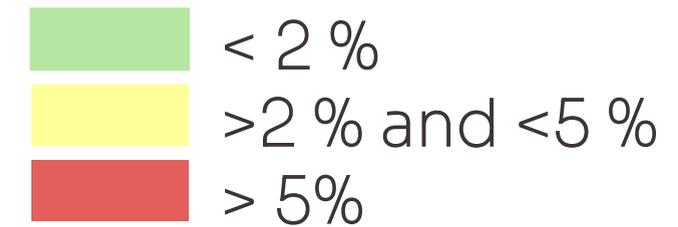
Confronto con il gamma:
 3%/3mm locale e 2%/2mm
 globale con 10% threshold



Validazione TPS

Camera a ionizzazione Farmer

Phantom	Field cm ²	MU	Deviation %
Anthropomorphic	2x2	300	0.8 ± 0.6
Anthropomorphic	2x10	300	0.8 ± 0.6
Anthropomorphic	10x10	300	2.9 ± 0.7
Modular heterogeneous	5x5	200	0.3 ± 0.5
Modular heterogeneous	10x10	100	0.5 ± 0.3
Modular heterogeneous	Circular	200	2.7 ± 0.6
Modular heterogeneous	Elliptical	200	1.9 ± 0.6
Solid water with lung insertion	Circular 1	400	3 ± 2
Solid water with lung insertion	Elliptical	400	2 ± 2
10 cm of solid water	2x2	200	2.7 ± 0.6
10 cm of solid water	2x10	200	2.6 ± 0.6
10 cm of solid water	10x10	100	1.7 ± 0.4
10 cm of solid water	5x5	200	2.2 ± 0.7

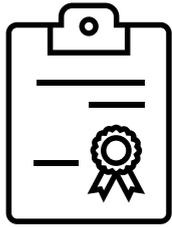


Confronto con scarto %:

$$\frac{|D_{mis} - D_{TPS}|}{D_{mis}}$$

Stima dell'errore con:

- Deviazione standard sulla misura ripetuta
- Errore camera (1%)
- Errore sistematico sull'altezza



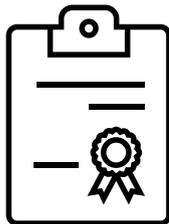
QA pre-trattamento

Idea di utilizzo del modello U-net allenato per la verifica della corretta erogazione del piano pre-trattamento del paziente

EPIBEAM (Dosisoft) è software commerciale usato al Careggi per fare questa verifica sulle immagini EPID

Con la nostra rete con il calcolo sarebbe più veloce e meno laborioso

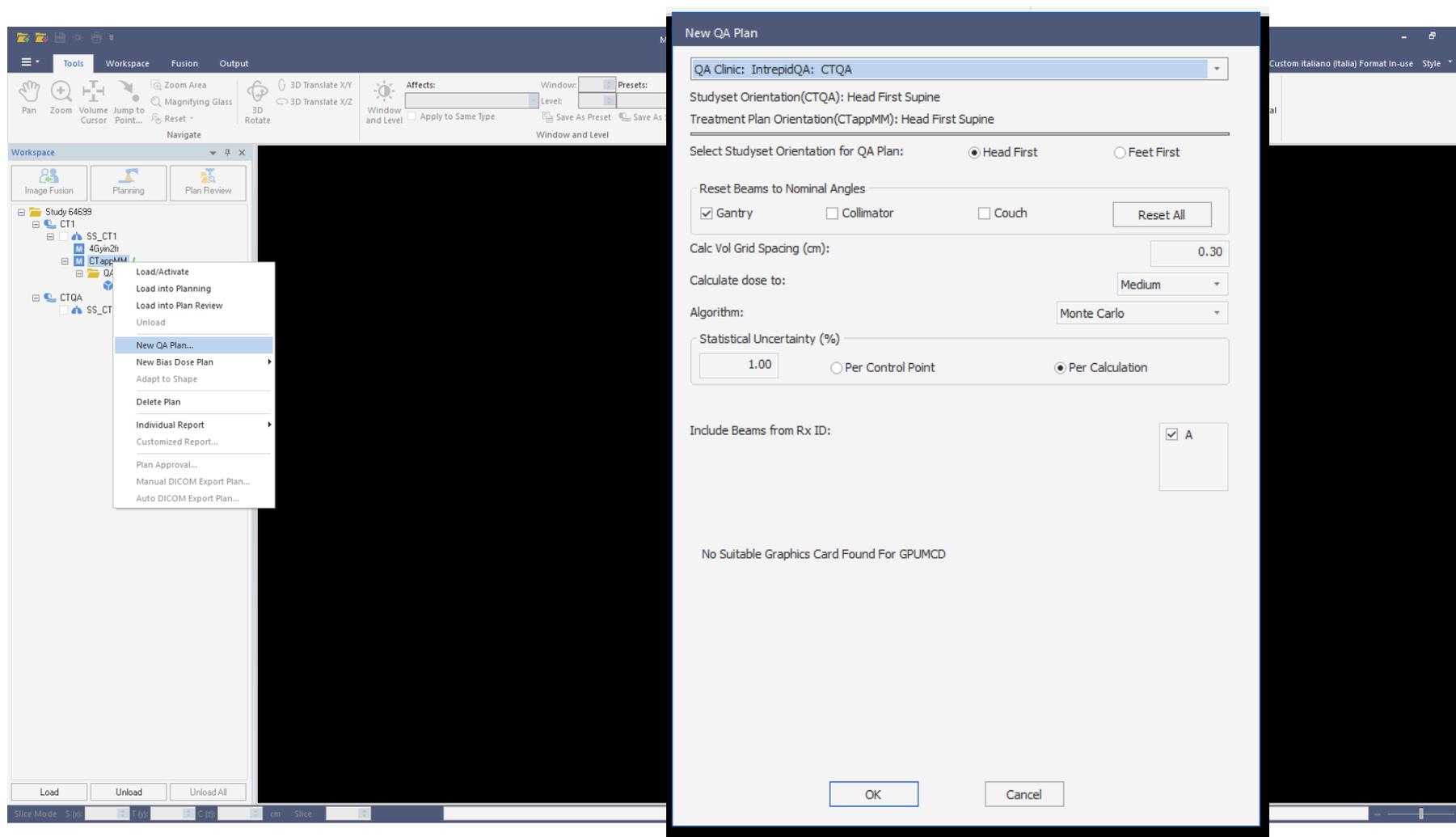
Alcuni step da fare per il calcolo nel TPS

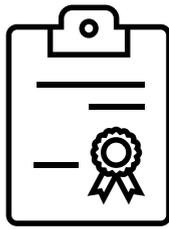


QA pre-trattamento

Step per ottenere la distribuzione della dose portale

1) Dal piano del paziente in Monaco creare il piano QA con gantry fisso a 0



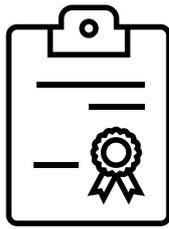


QA pre-trattamento

Step per ottenere la distribuzione della dose portale
2) Come fantoccio importo IntrepidQA contenente un fantoccio di acqua forzato ad aria e le strutture dell'epid simulato come nel dataset

The screenshot displays the Monaco treatment planning software interface. The main workspace shows a CT scan of the IntrepidQA phantom with a radiation therapy plan overlaid. The plan includes a target volume (UL) and a structure (EPID). The DVH plot shows the dose distribution for the EPID structure. The structures table at the bottom lists the following structures:

Name	Color	Visible	Lock	Volume (cm ³)	Type	Force ED	Fill ED	Relative ED	Show 2D Outlines	2D Transparency	3D/BEV Transparency
EPID	Yellow	Checked	Unchecked	6335.376	Internal	Checked	Unchecked	1.000	Checked	Slider	Slider
EPID_guidaPos	Grey	Checked	Checked	112303.351	External	Checked	Checked	0.010	Checked	Slider	Slider
esternoSlab 10cm	Brown	Checked	Unchecked	9030.452	Internal	Checked	Unchecked	0.010	Checked	Slider	Slider



QA pre-trattamento

Step per ottenere la distribuzione della dose portale

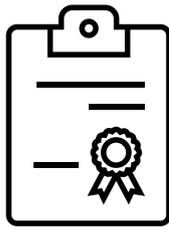
3) Calcolo della dose ed estrazione della dose nel piano dell'epid

The screenshot displays the Monaco treatment planning software interface. The main workspace shows a 3D view of the patient's anatomy with a dose distribution overlaid. A Total Volume DVH (Dose-Volume Histogram) is visible in the top right, showing the distribution of dose across the volume. The interface includes various toolbars and panels, such as the 'Tools' panel, 'Workspace' panel, and 'Structure Visibility' panel.

Two dialog boxes are open over the main interface:

- Calculation Properties**: This dialog box is used to configure calculation settings. It includes options for Grid Spacing (cm), Calculate Dose Deposition to, Force entire patient to be treated as water, Store and display dose in couch structures, Algorithm Settings (Monte Carlo Photon), and Statistical Uncertainty (%).
- Dose Plane Output**: This dialog box is used to configure the output of the dose plane calculation. It includes options for Transverse, Sagittal, and Coronal planes, and a table of output parameters.

ID	X (cm)	Y (cm)	Z (cm)	Description	Total Dose (Gy)	Mean Dose (Gy)	Min Dose (Gy)	Max Dose (Gy)
I1	0.00	0.00	0.00	iso	0.434	0.438	0.404	0.491
I2	0.00	0.00	-60.60	misura	0.671	0.676	0.637	0.719



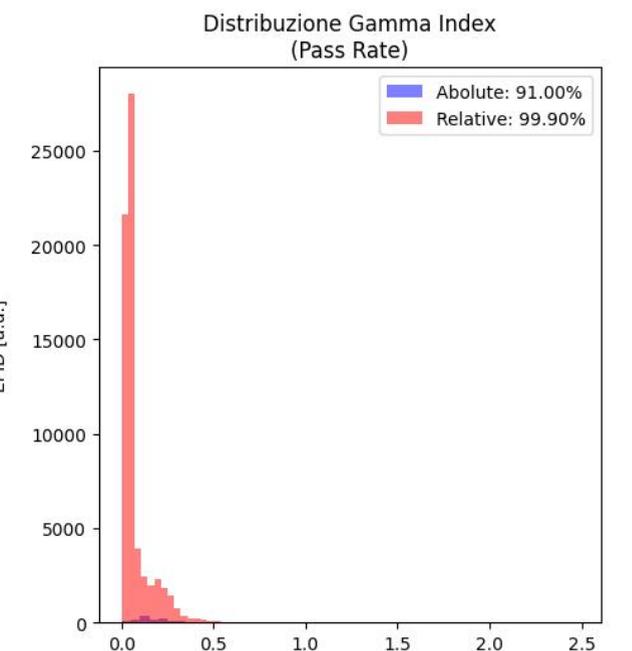
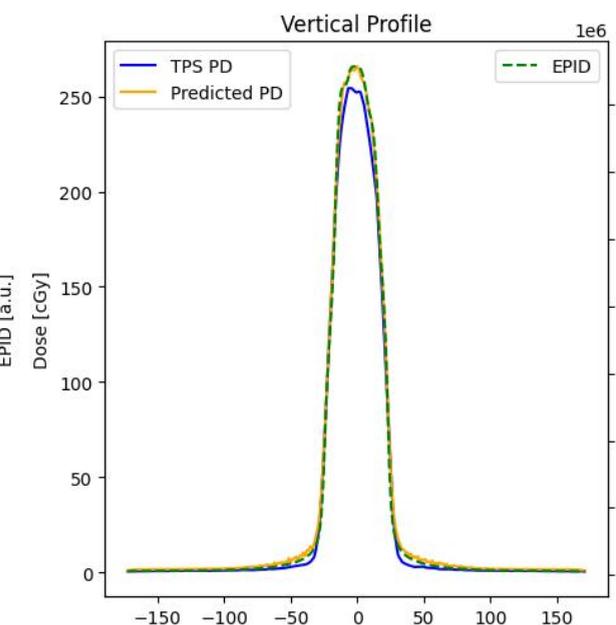
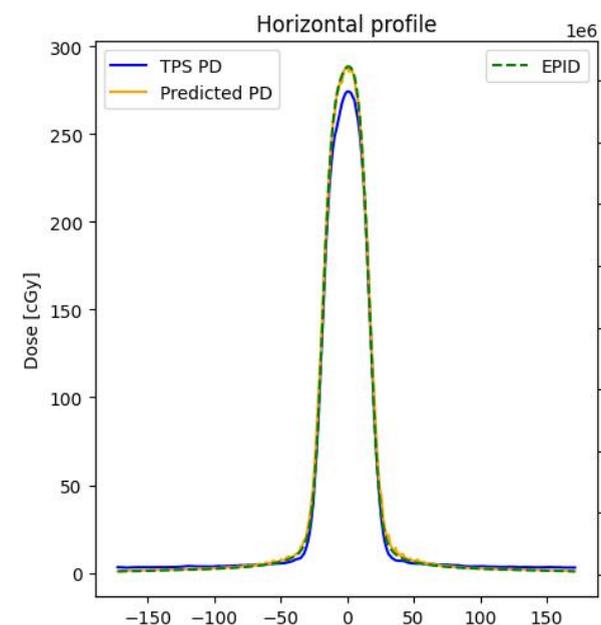
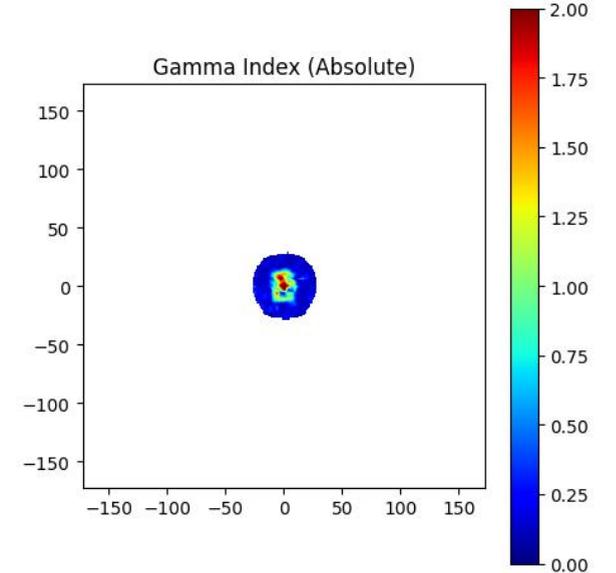
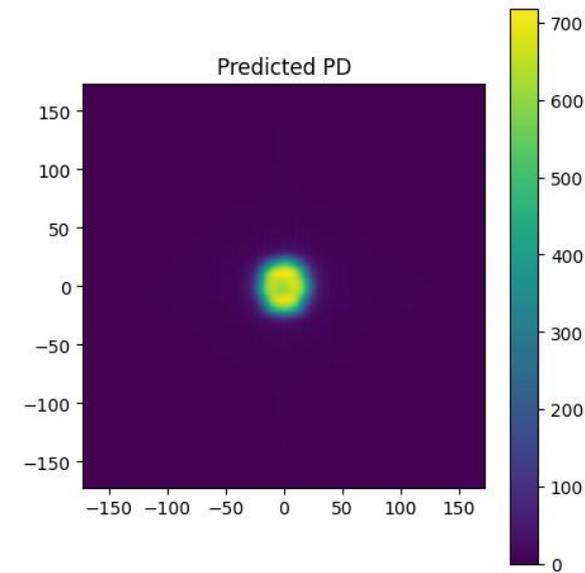
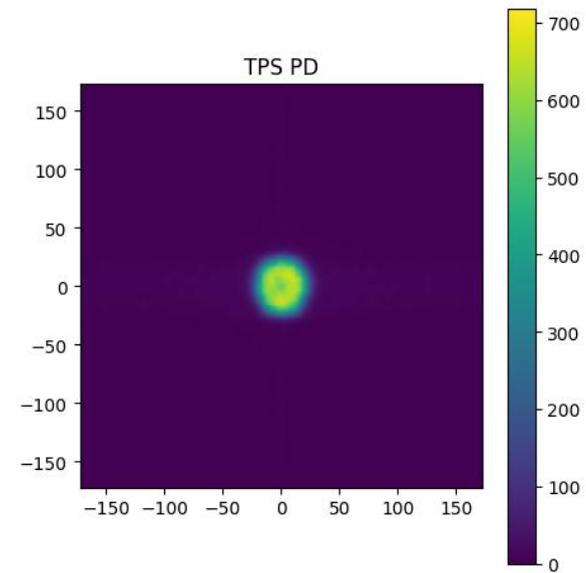
QA pre-trattamento

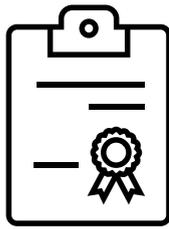
Prove e primi risultati

Prova con un piano effettuato su un fantoccio, poi ricalcolato in aria con gantry a 0°

→ Gamma 3%/3mm globale sia assoluto che relativo per la valutazione

91 % assoluto
99.9 % relativo





QA pre-trattamento

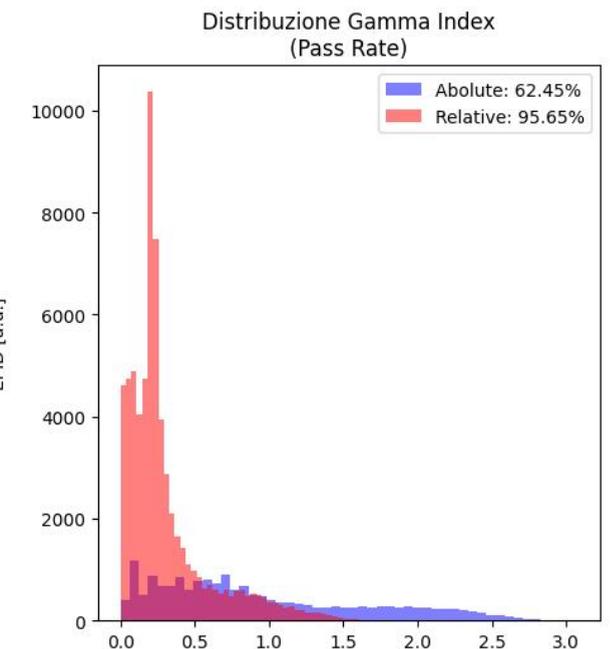
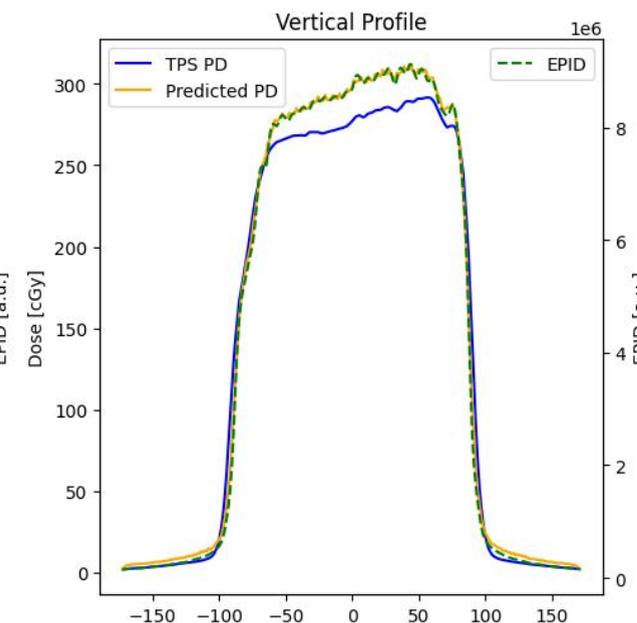
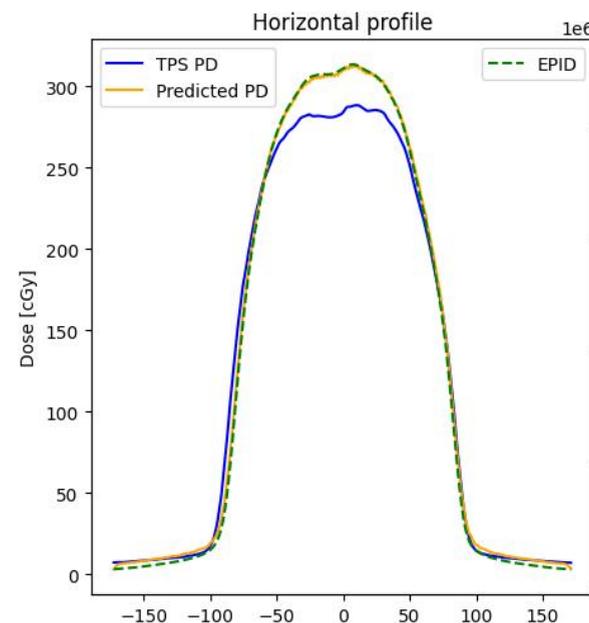
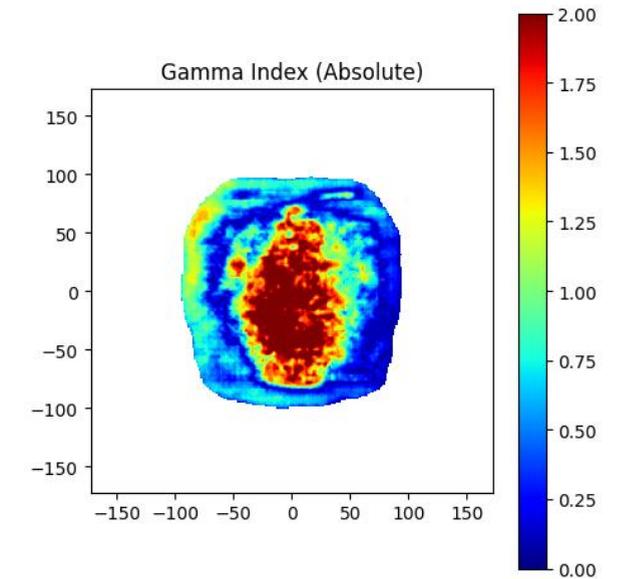
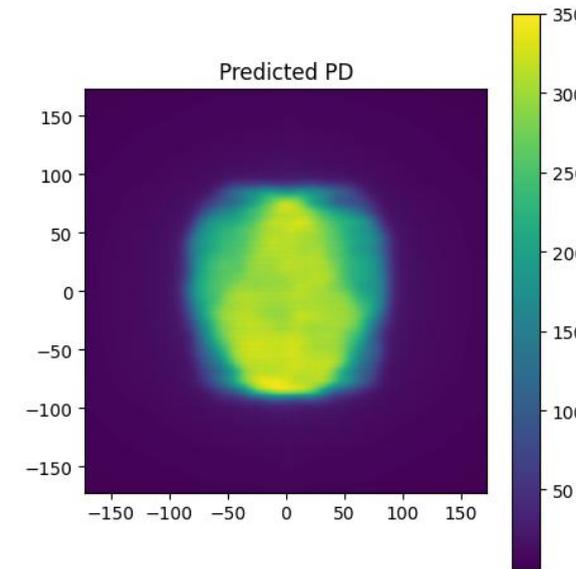
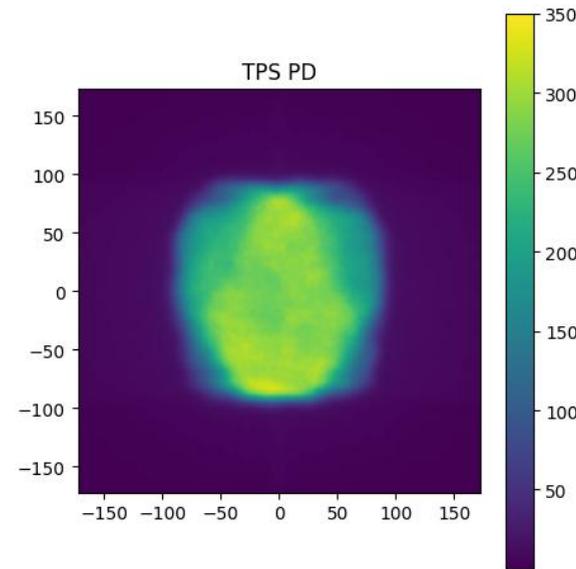
Prove e primi risultati

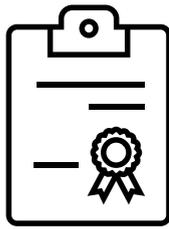
Prova con un piano paziente, poi ricalcolato in aria a 0°

→ Gamma 3%/3mm globale sia assoluto che relativo per la valutazione

62.45% assoluto

95.65% relativo





QA pre-trattamento

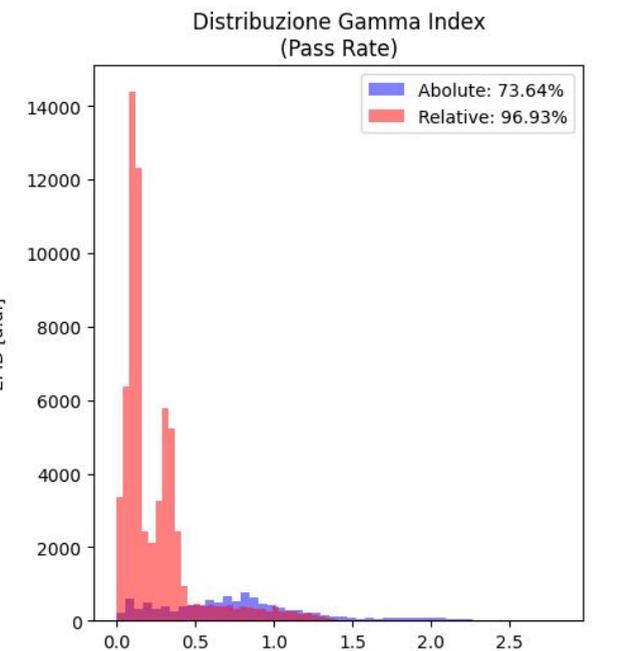
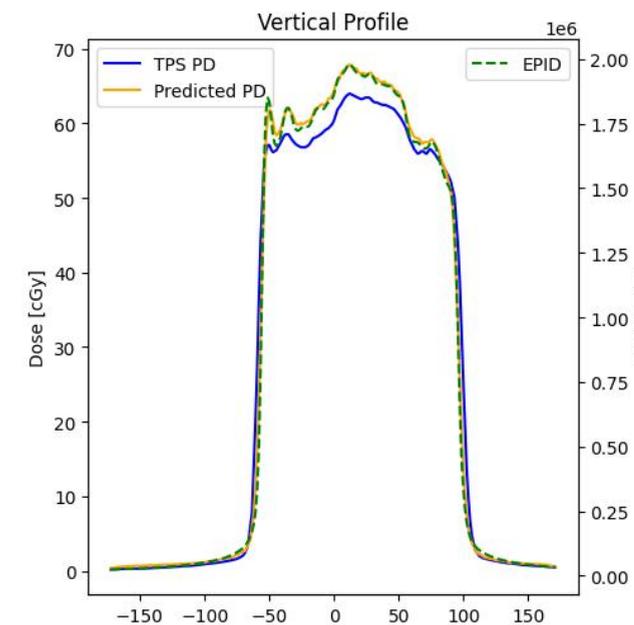
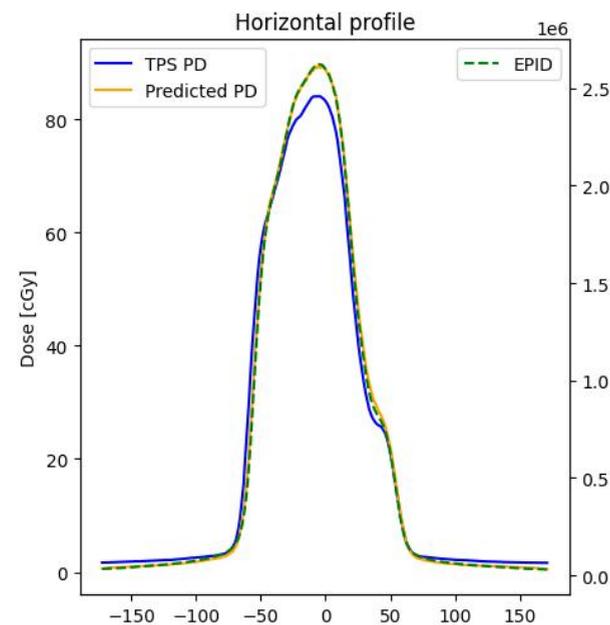
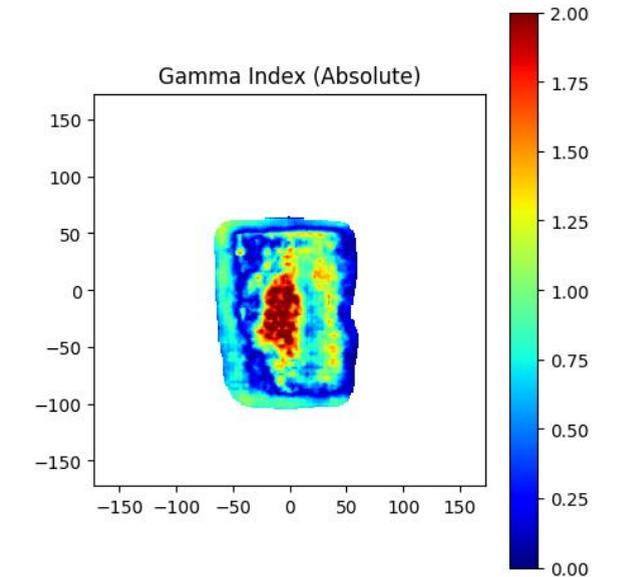
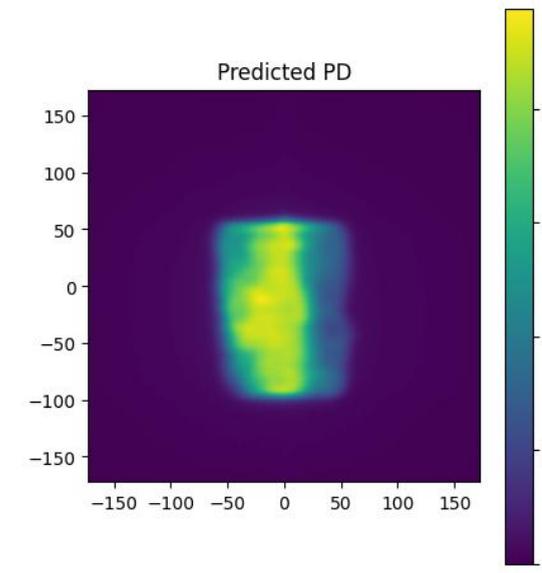
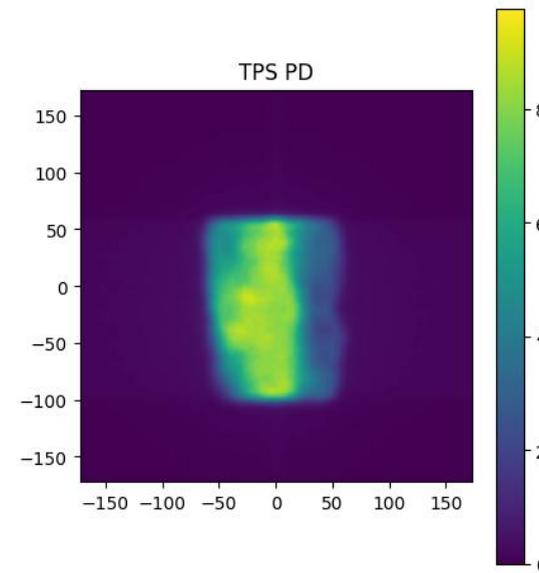
Prove e primi risultati

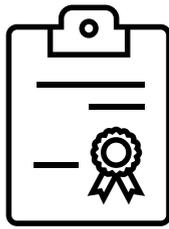
Prova con un piano paziente, poi ricalcolato in aria a 0°

→ Gamma 3%/3mm globale sia assoluto che relativo per la valutazione

73.64% assoluto

96.93% relativo





QA pre-trattamento

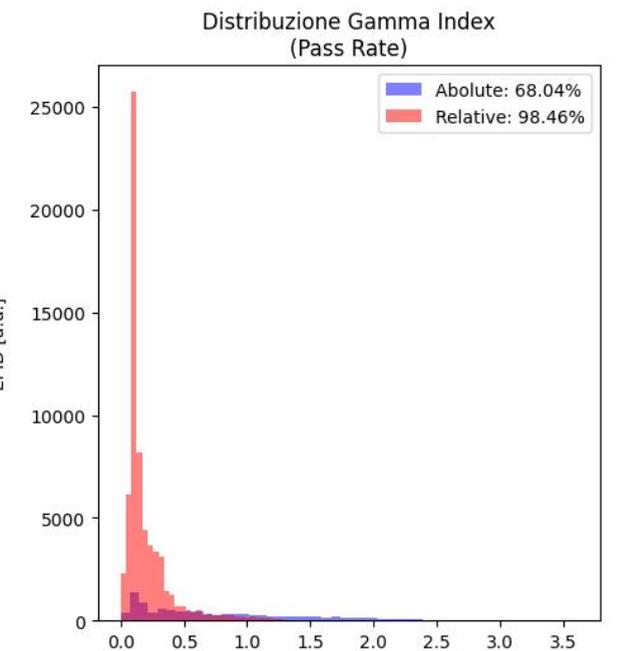
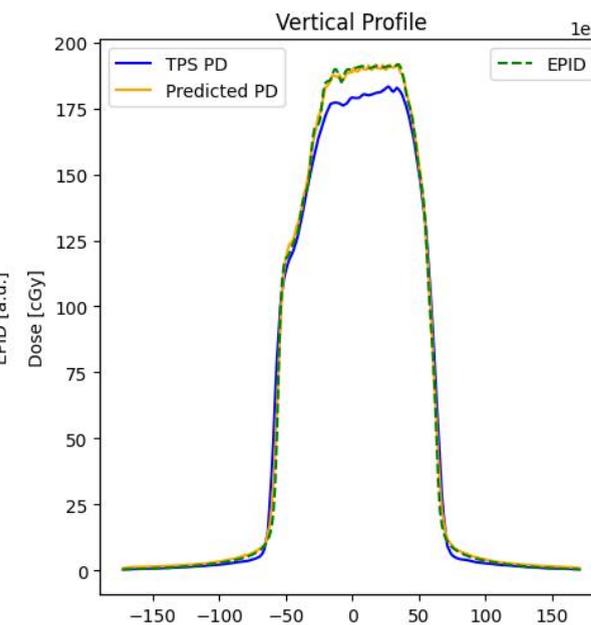
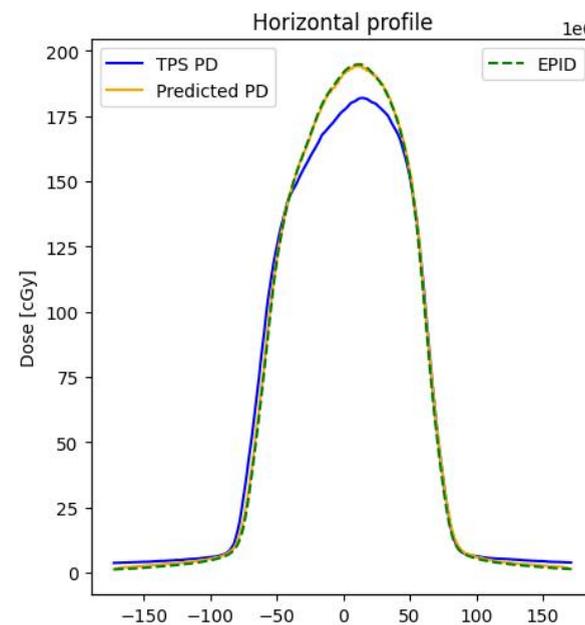
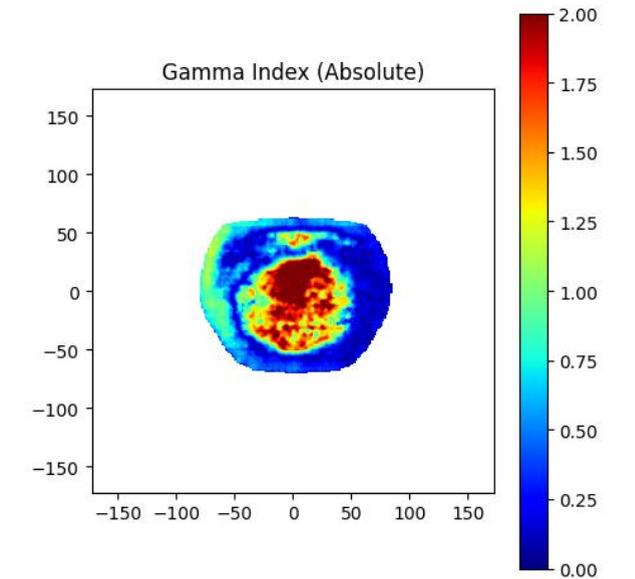
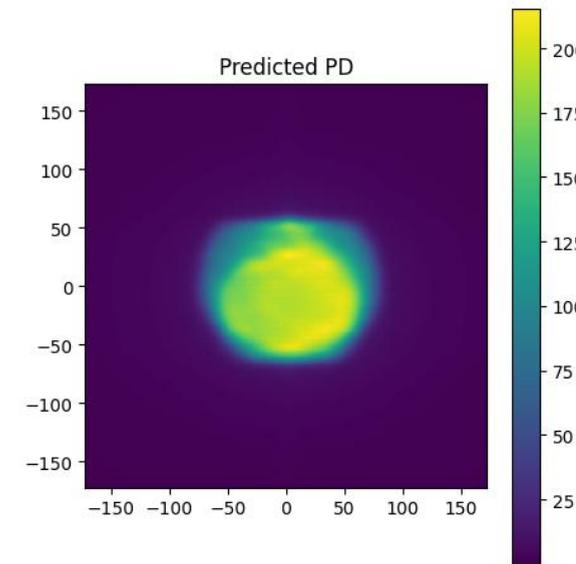
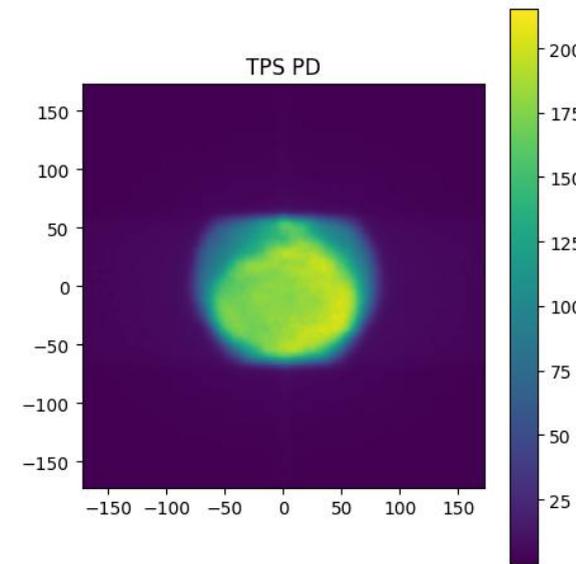
Prove e primi risultati

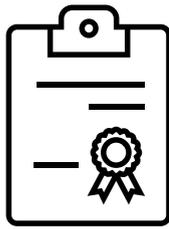
Prova con un piano paziente, poi ricalcolato in aria a 0°

→ Gamma 3%/3mm globale sia assoluto che relativo per la valutazione

68.04% assoluto

98.46% relativo





QA pre-trattamento

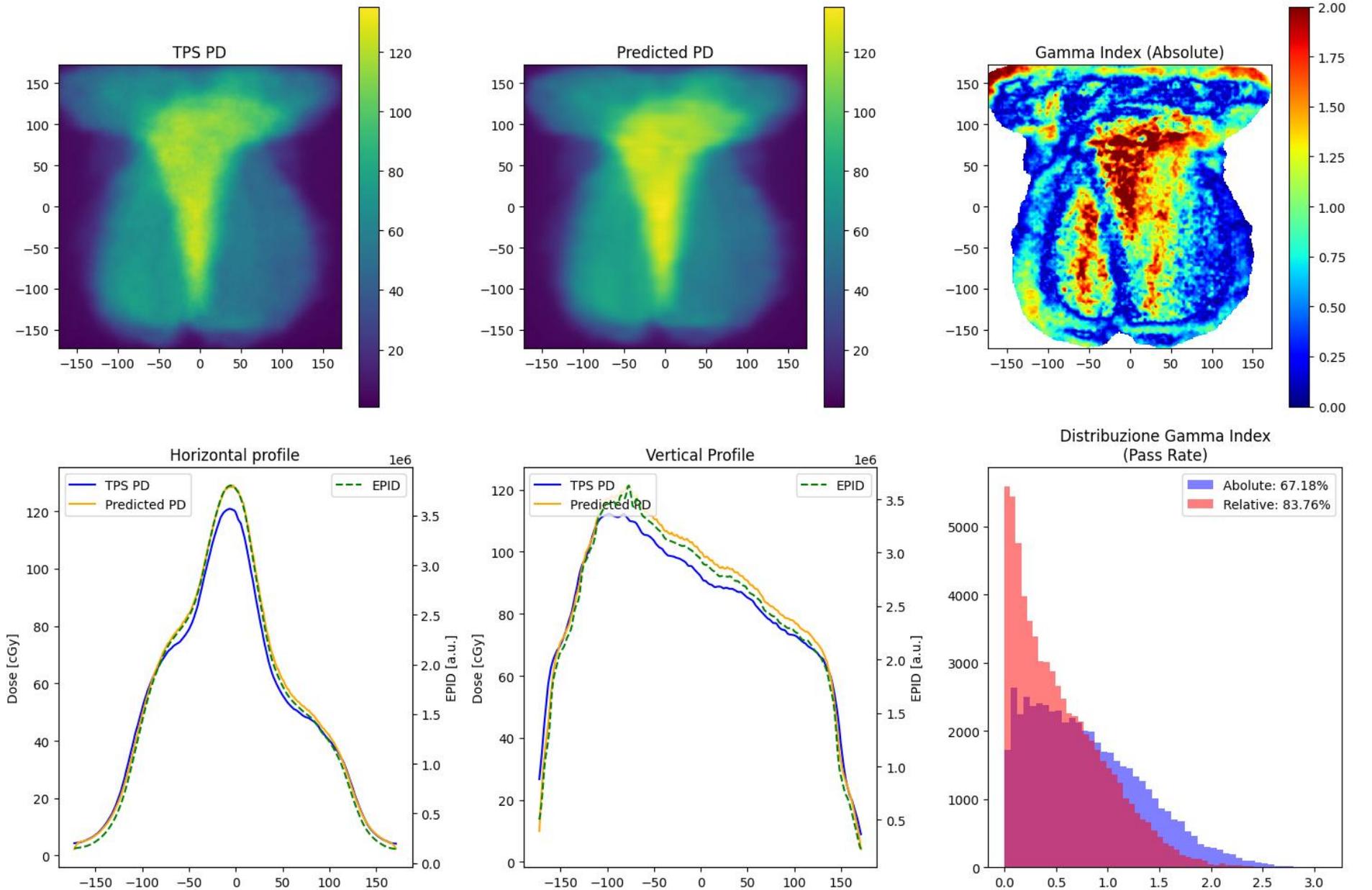
Prove e primi risultati

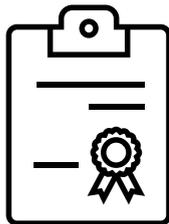
Prova con un piano paziente,
poi ricalcolato in aria a 0°

→ Gamma 3%/3mm globale
sia assoluto che relativo per
la valutazione

67.18% assoluto

83.76% relativo



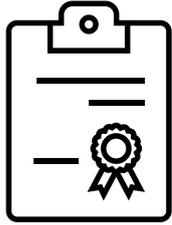


QA pre-trattamento

Prove e primi risultati

Tabella riassuntiva e confronto se irraggiamento al versa HD 4 o al versa HD 2

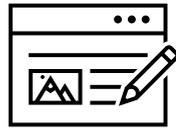
Plan	VHD2		VHD4	
	Gamma 3%/3mm 10% thr. Absolute Global	Gamma 3%/3mm 10% thr. Relative Global	Gamma 3%/3mm 10% thr. Absolute Global	Gamma 3%/3mm 10% thr. Relative Global
QA Plan 1 - 122174	57.39%	96.15%	62.45%	95.65%
QA Plan 2 - 124607	59.97%	98.65%	73.64%	96.93%
QA Plan 3 - 124629	61.43%	99.31%	68.04%	98.46%
QA Plan 4 - 124674	56.78%	84.38%	67.18%	83.73%
QA Plan 5 - Lung injury	-	-	91%	99.90%



QA pre-trattamento

Ho 18 dosi portali con le corrispettive immagini EPID + 15 dosi portali a cui manca la corrispondente EPID (da fare)

Possibile riallenamento della rete per ottenere risultati migliori



Australia -IUPSEM 2025



Presentazione del Lavoro al congresso mondiale fisica medica e ingegneria biomedica

16:22 B. ...

<

Development and validation of a robust dataset using commercial TPS and dose measurements devices for deep learning in transit dosimetry

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Speakers

Miss Carlotta Mozzi
Student in medical physics specialization
- University of Florence

