



Interactive radiotherapy planning for IMRT

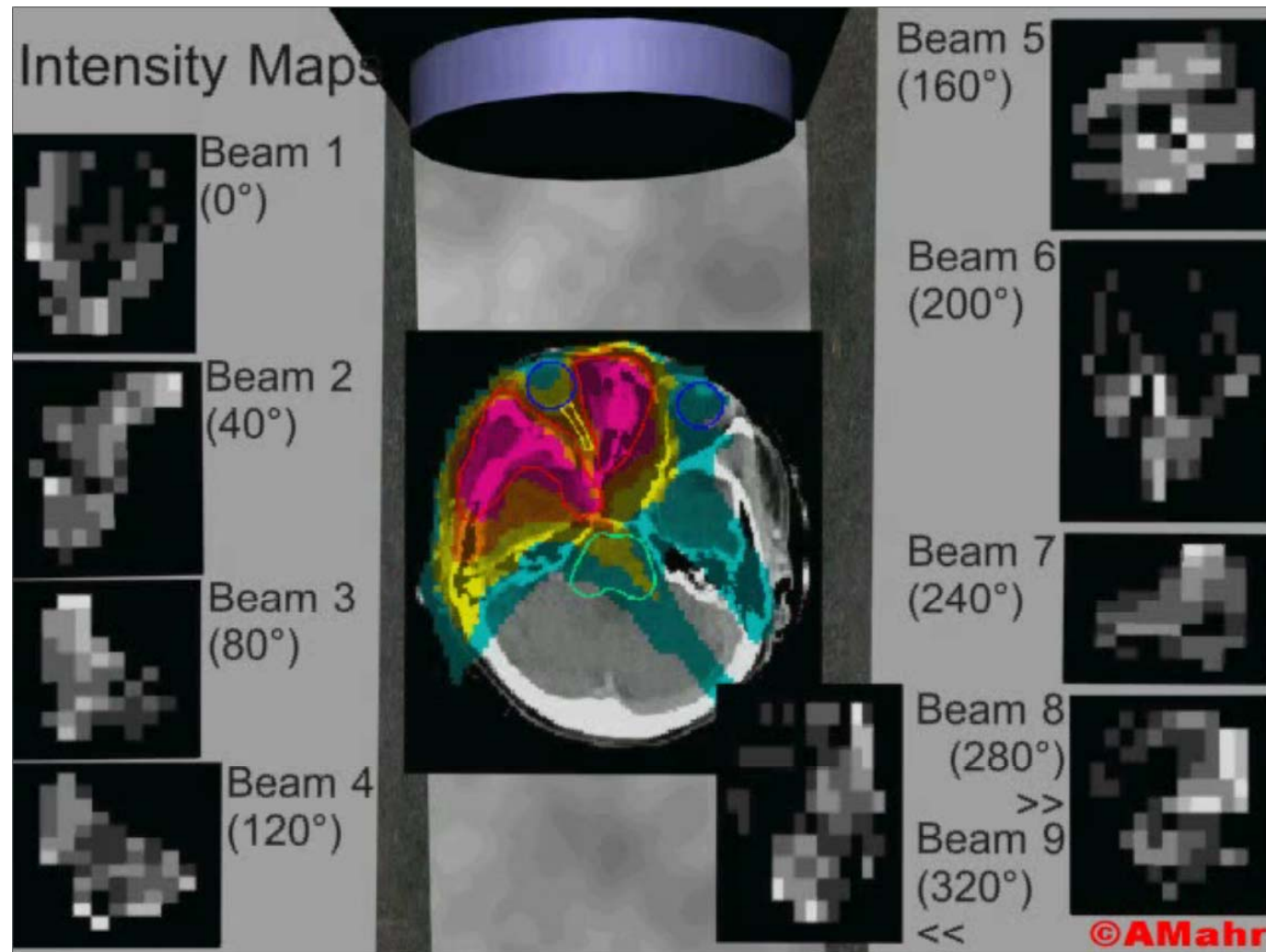
Christian Thieke

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dkfz.

DEUTSCHES
KREBSFORSCHUNGSZENTRUM
IN DER HELMHOLTZ-GEMEINSCHAFT

IMRT and inverse planning



The inverse planning problem

Maximizing the target dose and minimizing OAR dose are contradictory goals

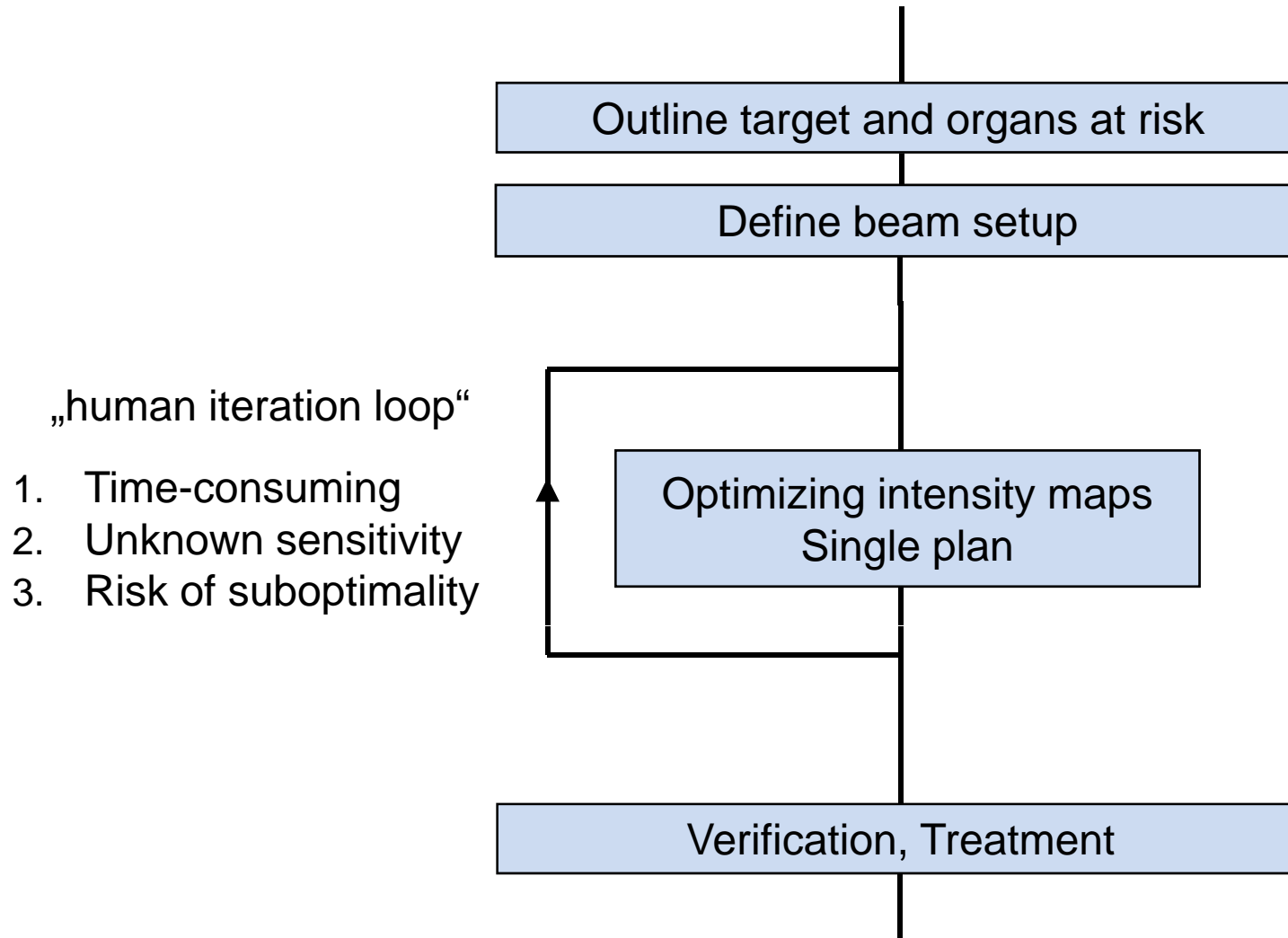
⇒ no global optimum

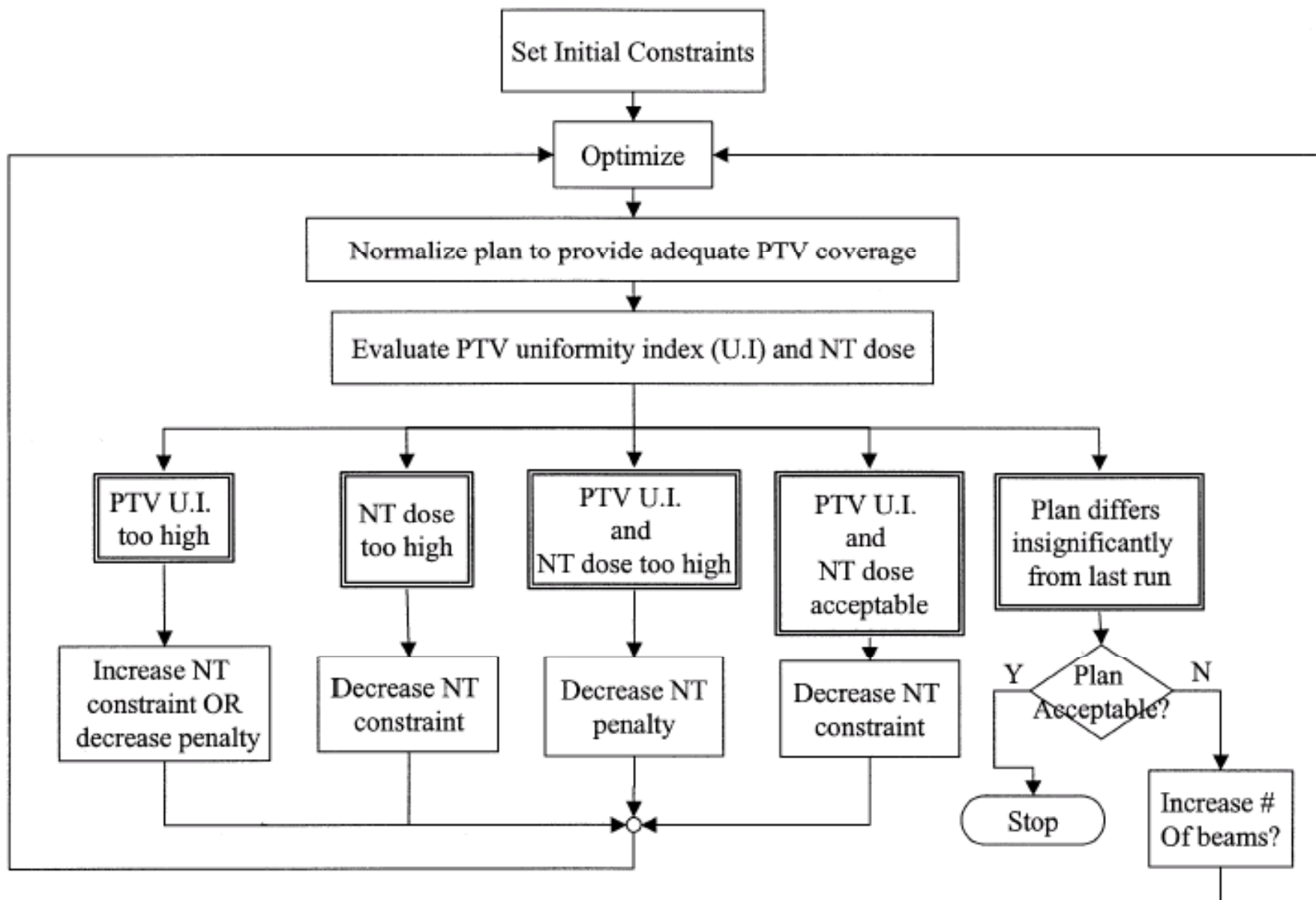
(i.e. 100% target dose and 0% everywhere else)

⇒ every plan is a compromise

⇒ inverse planning is a *multicriterial optimization problem*

Inverse planning in IMRT

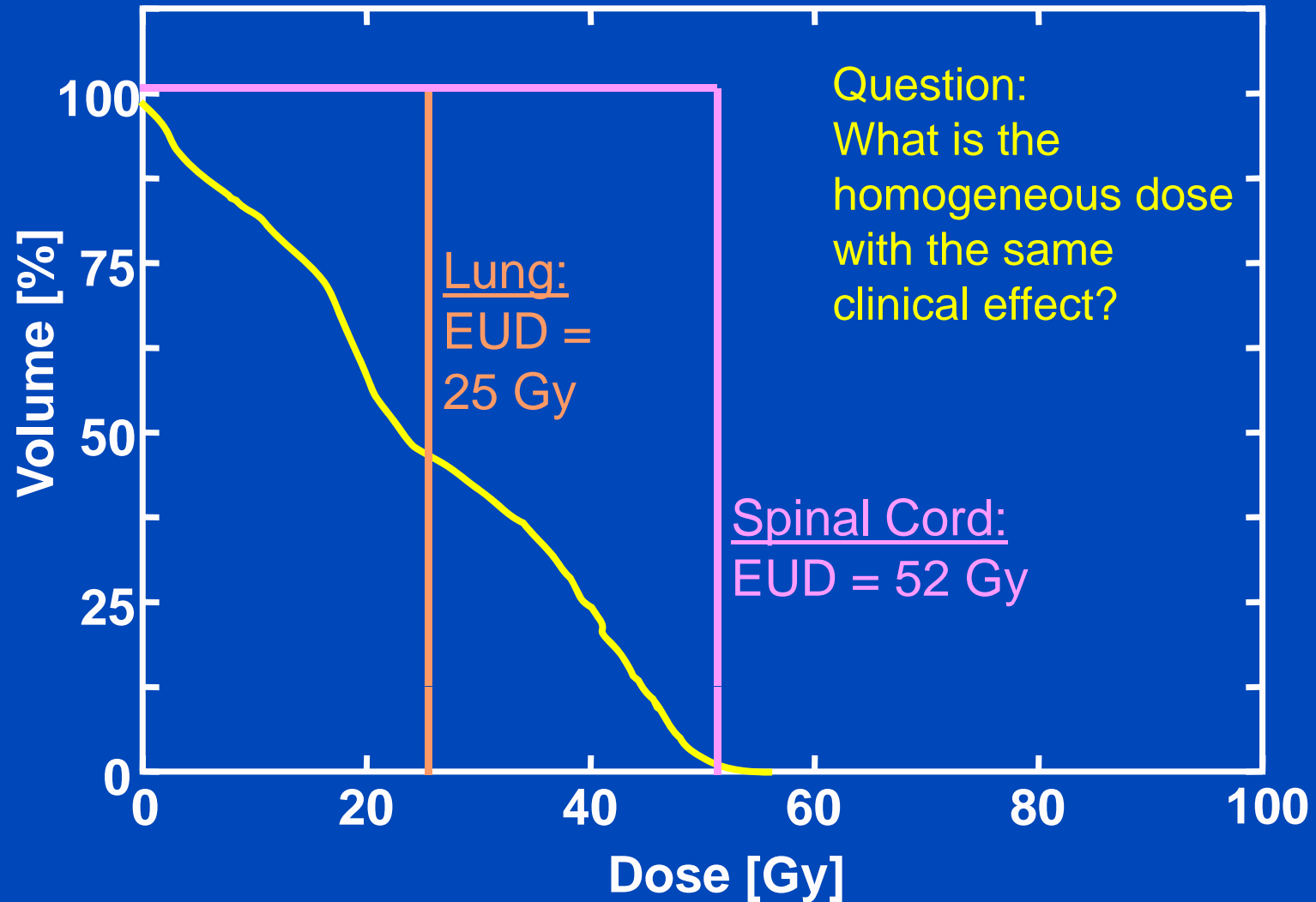




M. Hunt *et al.*, IJROBP 54 (2002) 953–962

Biological objective functions

Equivalent uniform dose (EUD)



Biological objective functions

NTCP = Normal tissue complication probability in %,
monotone function of EUD

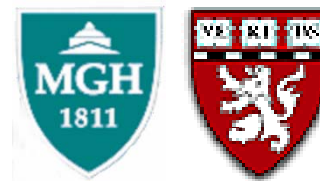
TCP = Tumor control probability in %

Interactive multicriteria planning

**MIRA: Multicriteria
Interactive
Radiotherapy
Assistant**



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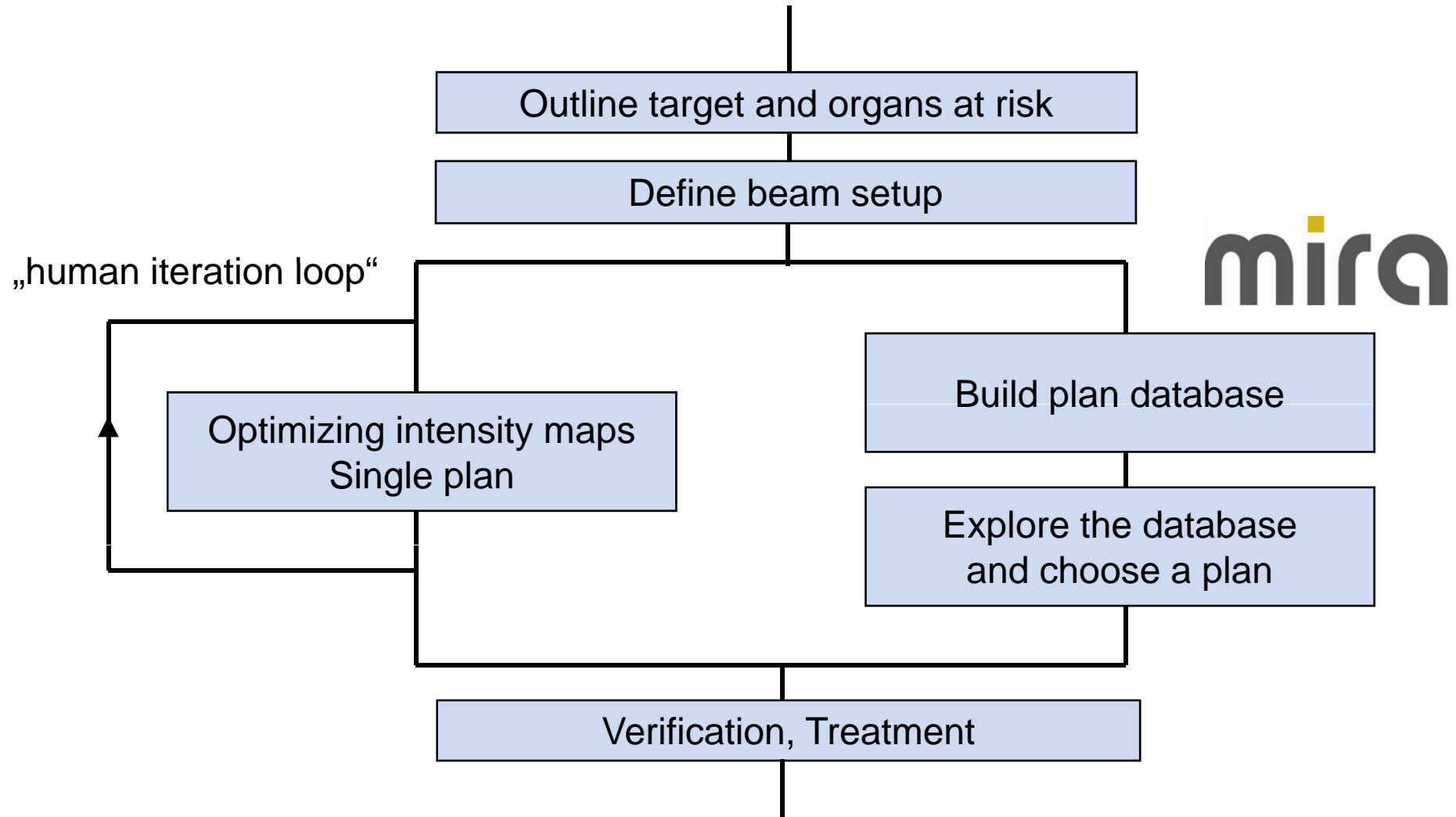


Boston



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Inverse planning in IMRT



Multicriterial setting

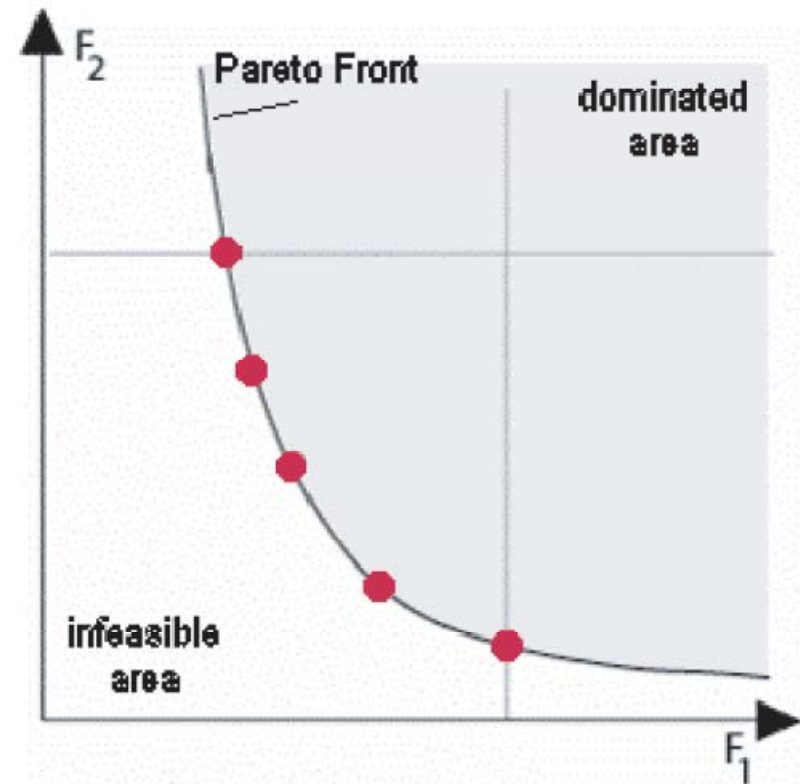
$$\vec{F} = (F_1, F_2, \dots)$$

Pareto optimal:

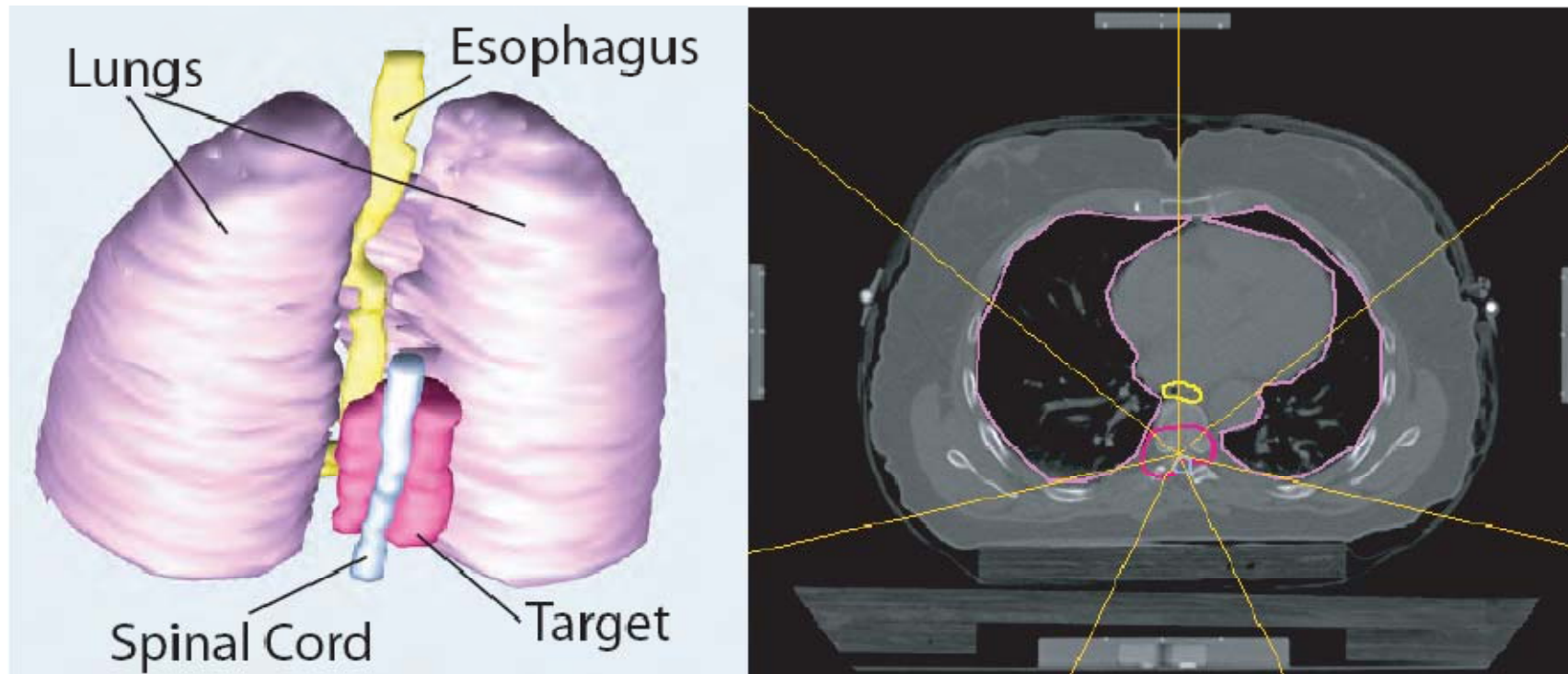
A solution that cannot be improved in one criterion without worsening at least one other criterion

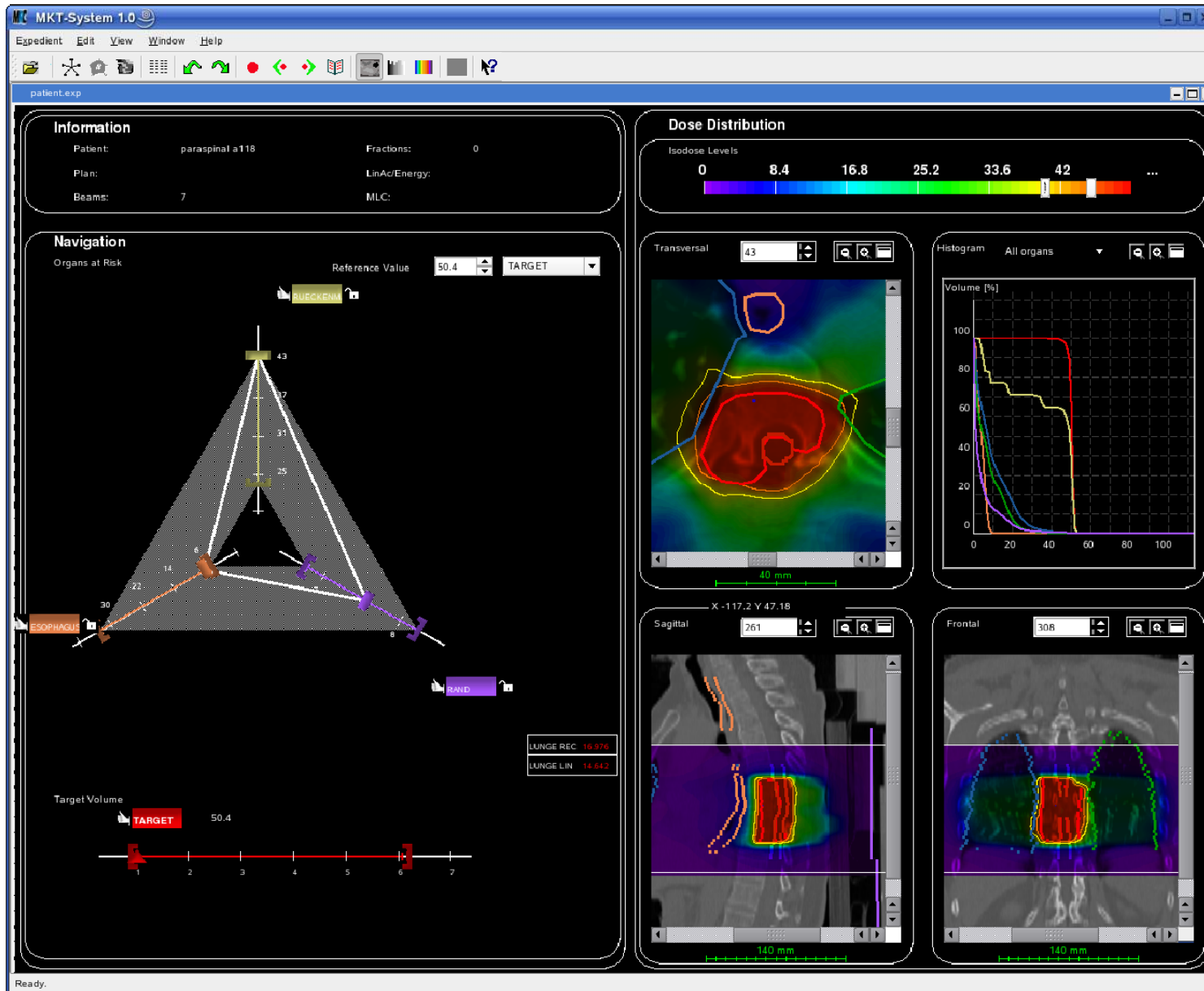
Pareto front:

Set of Pareto optimal solutions



Clinical case: Paraspinal meningioma





Conclusion

- inverse planning for IMRT is a multicriterial problem
- current systems produce single plans
- database of Pareto-optimal plans is more appropriate
- planning process will become interactive
- MIRA is the first prototype of a new generation of IMRT planning tools

<http://www.project-mira.org>

Welcome to MIRA - Windows Internet Explorer

http://www.project-mira.org

Welcome to MIRA

Multicriteria Interactive Radiotherapy Assistant

mira

Multicriteria
Interactive
Radiotherapy
Assistant

Radiotherapy

- *Radiotherapy (RT)*: main therapy form in oncology aside surgery and chemotherapy
- *Planning goals*: destroy tumor cells with high doses, spare healthy tissue to reduce risk of complications
- *Modalities*: mostly high energetic photons, less frequently electrons, protons, heavy ions
- *Photon IMRT*: intensity modulation on photon beams to form complex shaped dose distributions
- *Optimization*: effective way to compute treatment plan in spite of many intensity values on beams

Which data does MIRA need?

What does MIRA offer?

How does MIRA work?

Where can I get MIRA from?

Who works on MIRA?

Further questions about MIRA?

open

Fertig

Internet 100%