



Workflow Box: Using autocontouring in a truly automated way

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Mirada Workflow Box



First released under 510(k) in 2013

Workflows:

- Atlas-based autocontouring
- DIR-based recontouring
- Rule-based routing
- User workflows
- Deep learning-based autocontouring

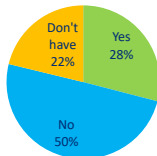
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How ubiquitous is autocontouring?

First clinical system: 2008

Does your institution use an auto-contouring system?



Polling conducted at AAMD 2017 NCS

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Why isn't autocontouring used?

1.) Poor workflow integration

"I don't want another box to go to"

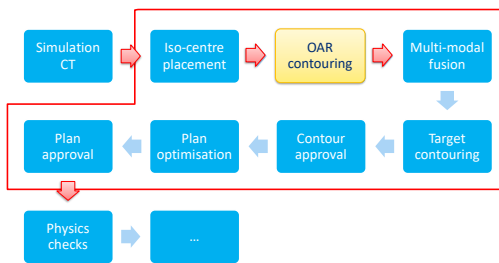
2.) Poor performance

"It's faster to start from scratch"

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Solutions to poor integration



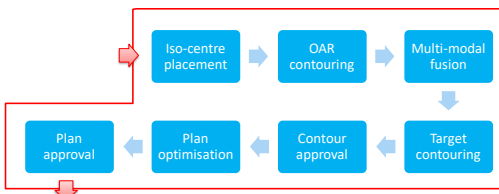
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Single vendor solutions

Good for the customer

✓ Less integration effort



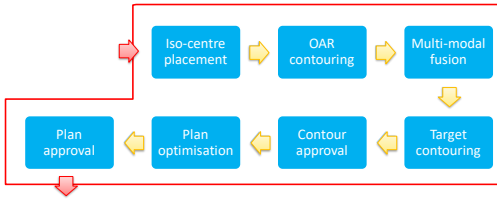
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Single vendor solutions

Great for the vendor

- ✓ Less integration effort
- ✓ Minimal effort integrating according to standards



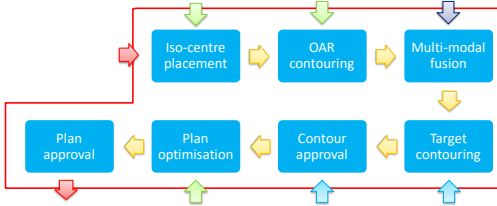
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Single vendor solutions

Great for the vendor

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Single vendor solutions

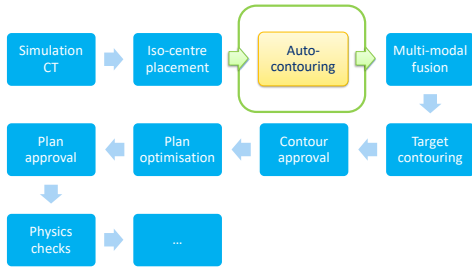
Great for the vendor

- ✓ Less integration effort
- ✓ Minimal effort integrating according to standards
- ✓ Hard to displace / Vendor ownership of the customer

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Solutions to poor performance



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User-centric Automation Philosophy

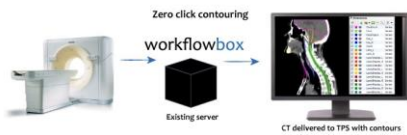


- Identify smallest logical workflow component
- Define standard interfaces - where needed
- Allow seamless replacement of components with best-in-class to achieve better automation.

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Workflow Box integration approach



- Autocontouring as a component
- Automated DICOM transfer
 - CT
 - RTSS
- Works with any TPS / contouring workstation
- Invisible to the user, negligible workflow impact

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Why isn't autocontouring used?

~~1.) Poor workflow integration~~

~~"I don't want another box to go to"~~

2.) Poor performance

"It's faster to start from scratch"

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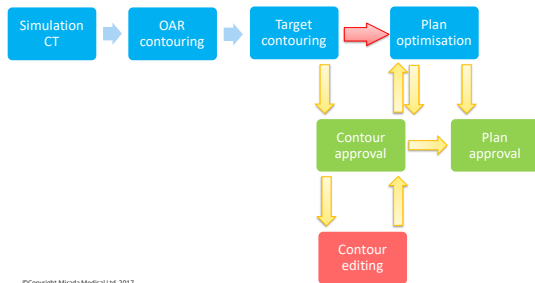
How automated is autocontouring?

Reference	Anatomy	No. of Patients	No. of Atlases	Time saved (mins)	Time saved (%)
Teguh, David N., et al. "Clinical validation of atlas-based auto-segmentation of multiple target volumes and normal tissue (swallowing/mastication) structures in the head and neck." <i>International Journal of Radiation Oncology Biology Physics</i> 81.4 (2011): 950-957.	H&N	12	10	114	63
Young, Amy V., et al. "Atlas-based segmentation improves consistency and decreases time required for contouring postoperative endometrial cancer nodal volumes." <i>International Journal of Radiation Oncology Biology Physics</i> 79.2 (2011): 943-947.	Edometrial	10	15	9	26
Gambacorta, Maria Antonietta, et al. "Clinical validation of atlas-based auto-segmentation of pelvic volumes and normal tissue in rectal tumors using auto-segmentation computed systems." <i>Acta Oncologica</i> 52.8 (2013): 1676-1681.	Rectal	10	4	13	34
Haver, Jeremiah, et al. "Technology assessment of automated atlas based segmentation in prostate bed contouring." <i>Radiation Oncology</i> 6.1 (2011): 110.	Prostate	5	75	3	24
Liu, A., et al. "Atlas-based segmentation in prostate IMRT: Timesavings in the clinical workflow." <i>International Journal of Radiation Oncology Biology Physics</i> 72.1 (2008): 5328-5329.	Prostate	10	97	12	45
Granberg, Christoffer. "Clinical evaluation of atlas based segmentation for radiotherapy of prostate tumours." (2011).	Prostate	10	15	10	26
Larsnick, K. A., et al. "The utility of atlas-assisted segmentation in the male pelvis is dependent on the interobserver agreement of the structures segmented." <i>The British journal of radiology</i> 87.1043 (2014): 20140299.	Prostate	11	8	10	40
Walker, Gary V., et al. "Prospective randomized double-blind study of atlas-based organ-at-risk auto-segmentation-assisted radiation planning in head and neck cancer." <i>Radiotherapy and Oncology</i> 112.3 (2014): 321-326.	Head and Neck	40	-	9	30

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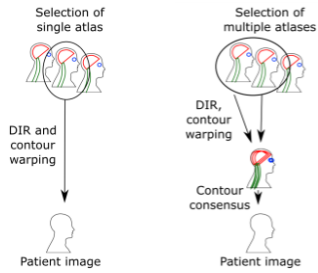
Automation requires robustness



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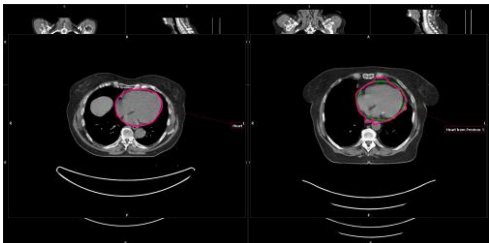
Atlas-based autocontouring



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Limitation of atlas-based autocontouring

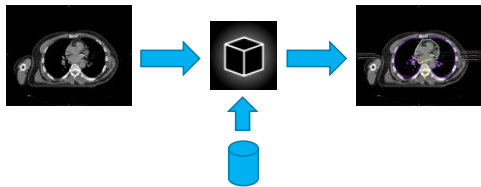


Atlas contouring tries to map image appearance to a different image's appearance
Atlas contouring isn't mapping anatomy

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Improving atlas-based autocontouring



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