Scripting and Automation for Efficient and Effective Chart Checks in a Pinnacle/Mosaïq Environment

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What?  
Why?  
How?  

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Sim → TPS Import → MD Contours → Plan → Plan Check → R&V Upload → MD Review

Physicist sees the plan for the first time
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What do we check?

- Check orders and simulation note and verify against treatment planning images (e.g. immobilizers, compression, jaw position, PET/CT)
- Verify image orientation (supine or prone only)
- Check volumes (e.g. expansions/crops, target dose labeling vs. prescription)
- Verify necessity and accuracy of density/material overrides
- Verify patient support structure location
- Verify patient support structure accuracy
- Check DVH scorecard against prescription note
- Verify correct CT-density table used
- Verify treated area is immobilized
- Check CT field of view and extent (e.g. no patient cut-off)
- Verify correct application of bolus
- Verify appropriate location of isocenter relative to target
- If multi-arc, ensure number of isocenters to be used
- Verify same isocenter used for all beams
- Verify same isocenter used for all beams
- Verify patient support structure location
- Verify accurate application of bolus
- Check appropriate location of isocenter relative to target
- Check beam energy
- Verify 6 MV used for VMAT beams
- Check beam energies (including latitudinal, anteroposterior)
- Verify correct isocenter and dose calculation point
- Verify same isocenter and dose calculation point
- Verify correct isocenter and dose calculation point
- Verify correct isocenter and dose calculation point
- Verify homogeneity correction
Are we **adding** or **replacing** a check?

![Diagram](https://example.com/image.png)

**FMEA: RPN = O · S · D**

- **O** – Occurrence
- **S** – Severity
- **D** – Detectability (lack of)

<table>
<thead>
<tr>
<th>Issue</th>
<th>Impact</th>
<th>Severity</th>
<th>Source</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
When Dosimetrist had more time to plan, they asked for more pre-checks

![Graph showing correlation between Days to Tx and % of Pre-Checks Requested](source: https://doi.org/10.1016/j.prro.2022.05.011)

**Pre-check Helper — Pinnacle**

<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Image Site</td>
<td>Ready</td>
<td>All CT images ready with no issues</td>
<td>Green</td>
</tr>
<tr>
<td>Patient Name and ID</td>
<td>Ready</td>
<td>All patient details correct</td>
<td>Green</td>
</tr>
<tr>
<td>Dose Calculation</td>
<td>Ready</td>
<td>Calculations correct</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Planning</td>
<td>Ready</td>
<td>Planning complete and ready</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Setup</td>
<td>Ready</td>
<td>Setup complete and ready</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Verification</td>
<td>Ready</td>
<td>All verification checks complete</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Execution</td>
<td>Ready</td>
<td>Execution complete and ready</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Follow-up</td>
<td>Ready</td>
<td>Follow-up complete and ready</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Report</td>
<td>Ready</td>
<td>Report complete and ready</td>
<td>Green</td>
</tr>
<tr>
<td>Treatment Summary</td>
<td>Ready</td>
<td>Summary complete and ready</td>
<td>Green</td>
</tr>
</tbody>
</table>

**Pre-check Helper — RayStation**

![RayStation Pre-Check Helper interface](source: https://doi.org/10.1016/j.prro.2022.05.011)
Some Thought on Automation

Easy to Run

Show the current values and expected values when possible
Use colors to draw attention to problem areas

Interpretable Results

While automation holds great promise for improving the efficiency and effectiveness of plan and chart review, it is important to be aware of its limitations. If it is not properly implemented or tested it could lead to errors being systematically unidentified.

— TG 275
“What gets measured gets managed.”

— Peter Drucker
What do you check?

- Check orders and simulation note and verify against treatment planning images (e.g., immobilization, compression, breath hold, etc.)
- Verify treatment planning image perfection (right patient, right field)
- Verify simulation (e.g., immobilization, compression, etc.)
- Verify immobilization (e.g., immobilization, compression, etc.)
- Verify immobilization accuracy (right target, right patient, etc.)
- Verify image orientation (supine or prone only)
- Check volumes (e.g., expansions/crops, target dose labeling vs. prescription)
- Verify necessity and accuracy of density/material overrides
- Verify patient support structure location
- Verify patient support structure accuracy
- Check DVH scorecard against prescription note
- Verify correct CT-density table used
- Verify treated area is immobilized
- Check CT field of view and extent (e.g., no patient cut-off)
- Verify correct outside-patient air threshold
- Verify localization point matches tattooed isocenter
- Verify accurate application of bolus
- Check appropriate location of isocenter relative to target
- If multiple targets, ensure number of isocenters is correct
- Verify same isocenter used for all beams
- Verify same isocenter used for all beams
- Evaluate possibility of collision
- Verify correct isocenter and dose calculation point
- Check for appropriate beam entering point
- Verify correct CT-density table used for VMAT beams
- Check naming convention (including laterality, anatomical)
- Verify partial area are used on correct side
- Verify are characteristics are correct
- Verify target area moves away from patient's head
- Verify appropriate collimator angles for VMAT beams
- Check beam path coverage
- Verify correct dose grid resolution
- Verify dose engine
- Verify homogeneity correction

Auto-naming contours based on TG-263 guidelines
Checklists!

Plan Check Scripts as Checklist

Plan Check Scripts as Checklist
Just Take the First Step

Acknowledgment

Thank You!