Clinical Indications for Online Adaptive Particle Therapy: From Anatomical Correction to New Treatment Strategies

Main aim

Online adaptive particle therapy is still an emerging approach. Because it requires substantial additional resources, the field needs a clear clinical rationale: which patients, indications, or treatment strategies justify the extra complexity, and what new opportunities become possible only when adaptation is available at the treatment unit?

It is therefore essential to define which clinical scenarios and treatment concepts may truly benefit from online workflows, so that the field can prioritise those areas where the additional resources is most likely to translate into meaningful clinical benefit.

The value of online adaptive particle therapy should not be assessed only by asking whether adaptation improves plan quality on a given treatment day. Its broader value may be that it changes what can be safely attempted in particle therapy: simulation-free or direct-to-unit pathways, reduced margins, safer hypofractionation, adaptive dose escalation or de-escalation, response-guided treatment, and future biological personalisation.

This workshop will focus on identifying where online adaptive particle therapy matters clinically, where it may enable new treatment strategies, and which use cases should be prioritised

Breakout groups

Group 1

Clinical indications for anatomical correction / plan recovery

Main question:
In which clinical situations is online adaptive particle therapy justified because anatomical changes create a clinically relevant risk of target underdosage or OAR overdosage?

Suggested topics:

- Head and neck anatomical changes
- Skull base / CNS cases with critical OAR proximity
- Thoracic or abdominal density changes
- Pelvic anatomy changes
- Re-irradiation with narrow therapeutic windows

- Triggered versus daily online adaptation
- Required evidence and endpoints

Expected output:
A ranked list of clinical indications where online adaptive particle therapy is justified as plan recovery or anatomical correction.

Group 2

Clinical indications beyond anatomical correction

Main question:
Which new treatment strategies become possible only, or more safely, when online adaptation is available at the treatment unit?

Suggested topics:

- Simulation-free or direct-to-unit workflows
- Reduced margins
- Safer hypofractionation
- Adaptive dose escalation or de-escalation
- Response-adaptive or PULSAR-like treatment
- Biological, functional, LET/RBE-guided adaptation
- Cost, resources, workflow, and QA implications

Expected output:
A ranked list of treatment concepts where online adaptive particle therapy may enable new clinical strategies beyond plan correction.

Final expected workshop output

By the end of the workshop, participants should have defined:

1. **Priority clinical indications** for online adaptive particle therapy as anatomical correction.
2. **Priority treatment concepts** where online adaptation may enable new strategies.