Monitoring and replanning strategy in Aarhus
• Training of RTT’s started in summer 2016.
  – Training in recognise soft tissue (uterus, cervix, rectum and bladder)

• First adaptive cervix patient in September 2016

• The patients follow a drinking protocol.

• RTT’s monitor whether uterus and/or cervix is inside PTV45

• Flow chart describe actions to be taken.
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Daily on-line CBCT check of the cervix and uterus position by the RTTs

Registration on bone → On board daily couch correction

PTV 45

- Uterus outside in ≥3 fractions
- Cervix outside in 1 fraction

Re-check by a phycisist within 24 hours

Sort out the reason for the problem. Can it be solved at the linac, e.g. focus on bladder- and rectal filling

- Estimated dose ≥40Gy for uterus
- Estimated dose <40Gy for uterus
- Estimated dose <40Gy for cervix once

Enlarge match_PTV to 40Gy isodos curve around the top of uterus and approved by a gynae RT specialist
Consult a gynae RT specialist; consider re-contouring and re-planning
Allow cervix to be outside one more time, but do NOT change match_PTV

The fraction of the day is delivered
Monitoring – target coverage

- The first 23 patients (not hysterectomies) are evaluated.
- 93.5% of 538 CBCT’s were correctly evaluated by the RTT’s according to target coverage.
- On 31/538 CBCT’s the RTT’s were in doubt.
  - One patient was, after one week, decided to be evaluated only offline because of bad image quality.
- On 4/538 CBCT’s the target coverage were evaluated to be ok, but uterus or cervix was marginally outside PTV45.
Monitoring – bladder and rectum

- RTT’s give on a daily base feedback to the patients about bladder and rectum filling.

- 10/30 patients changed their drinking schema.
  - 3 wait longer, 1 wait shorter, 3 drink more, 5 drink less

- Faster action when bladder or rectum have an inappropriate filling
Replanning

7 patients were re-planned because of insufficient target coverage.

- The top of uterus tip outside PTV45
  - 5 patients
    - Dose gain when re planning – less than 2Gy.

- LR-CTV in vagina move outside PTV45
  - 2 patients
    - Dose gain are relatively large, because cervix can move out of the treated area in caudal direction.
Uterus tips outside

If not replanned: Uterus top: 40Gy
Replanned: Uterus top: 41.2Gy
Uterus tips outside

If not replanned:  Uterus top: 38.9Gy  
Replanned:  Uterus top: 39.1Gy
If not replanned: Uterus top: 38.8 Gy
Replanned: Uterus top: 40.1 Gy
Uterus tips outside

If not replanned: Uterus top: 39Gy
Replanned: Uterus top: 40.7Gy
Uterus tips outside

If not replanned: Uterus top: 41.9Gy
Replanned: Uterus top: 42.0Gy
If not replanned: LR-CTV (vagina): 41.4Gy
Replanned: LR-CTV (vagina): 42.4Gy
If not replanned: LR-CTV (vagina): 25.1Gy
Replanned: LR-CTV (vagina): 37.8Gy
Filling and uterus/cervix outside

- **Rectum filling**

- **Bladder filling**

![Bar charts showing filling vs. uterus/cervix outside and overall cohort for small, medium, and large categories.](chart.png)
Conclusion

- No critical under dose of uterus even without re-planning.
  - From 0.2Gy to 1.7Gy gain and no one below 38.8Gy

- Caudal margin important because of big dose gradient
  - Gain of 12.7Gy on LR-CTV The reason for the problem was probably a big bladder and an air bobble in rectum at the time of CT-scan.

- No patients where HR-CTV is outside PTV45.

- More often rectum then bladder causes problems.
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Thanks for your attention