Delivering a conformable dose distribution for advanced stages of cervical cancer using a hybrid gynecological applicator

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How did we get to hybrid gyn applicators?

- Early LDR Gyn case with Radium in the 1920s
- First HDR in the 1980s
- First CT/MR applicator 1998
- Now MR based, fused with CT/PET volume implants

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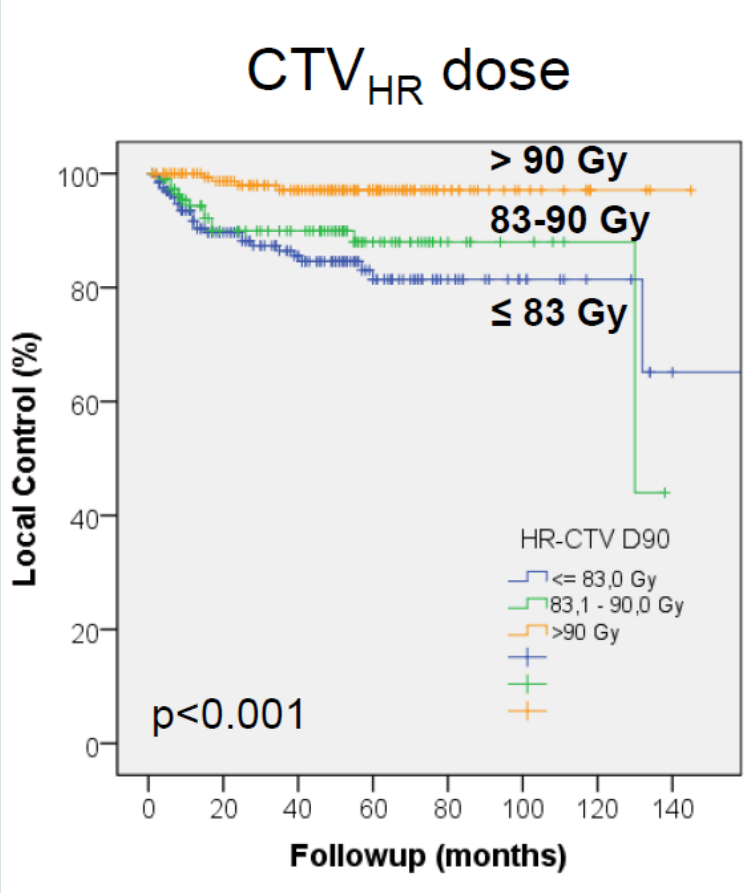
Embrace clinical data and resulting recommendations



Tanderup et al. Radiother Oncol. 2016 Sep;120(3):441-446.

Results of EMBRACE Study reflected in ICRU

- Established dose response curve
- Planning aim > 90 Gy
- Dose < 85 Gy results in sub-optimal local control

EMBRACE II

- Guide for the future of IGBAT

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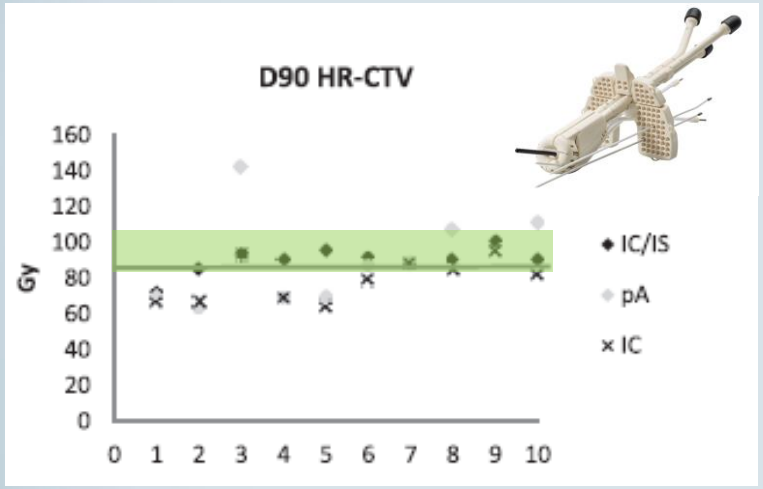
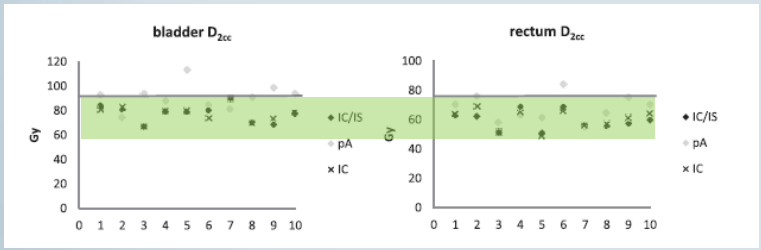
Disclaimer: Clinical evidence does not reflect Elekta products.

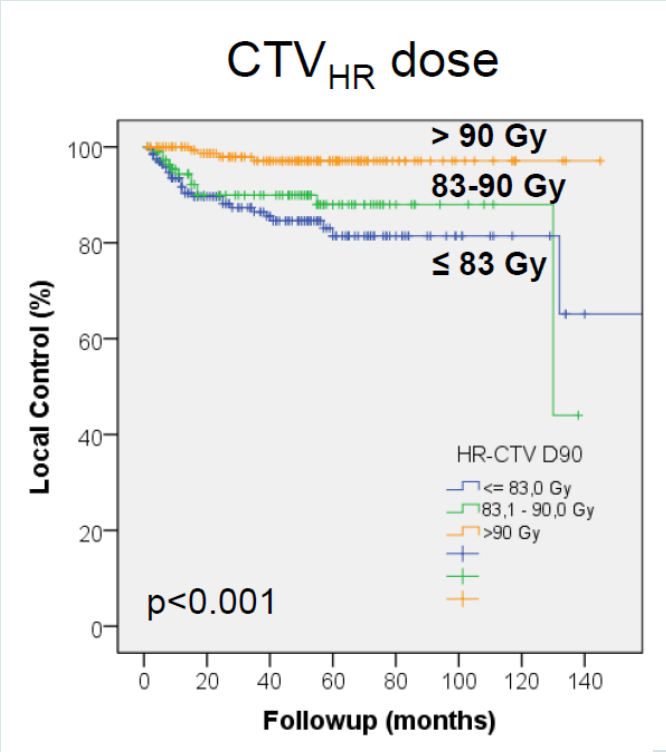
Venezia in clinical setting

Elekta Ir-192 User/Venezia[1]





Dose/Volume Response curve EMBRACE[2]



10 patients between FIGO IIB–FIGO IVB[1]

Venezia consistently met ICRU guidelines across all stages

Potentially better clinical outcome

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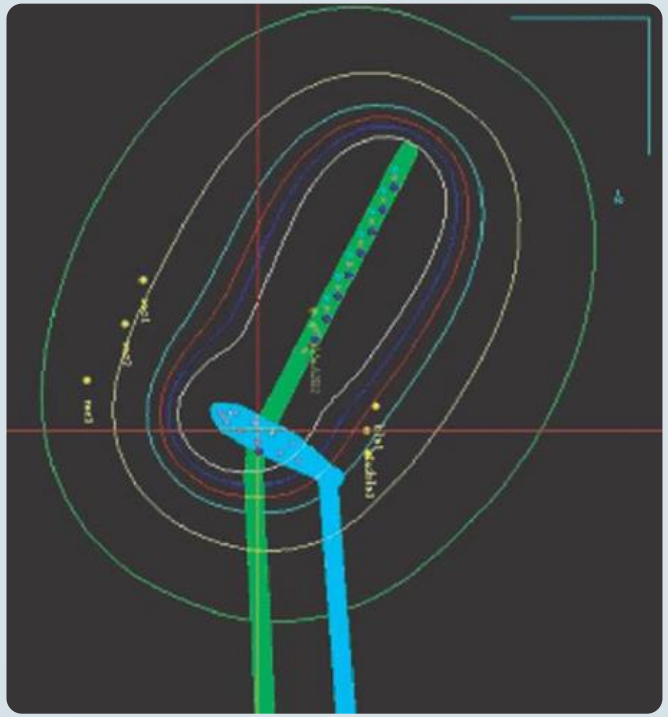
[1] Walter et al. Combined intracavitary and interstitial brachytherapy for cervical cancer using the novel hybrid applicator Venezia: Clinical feasibility and initial results. 2018 Brachytherapy 17:775-81.

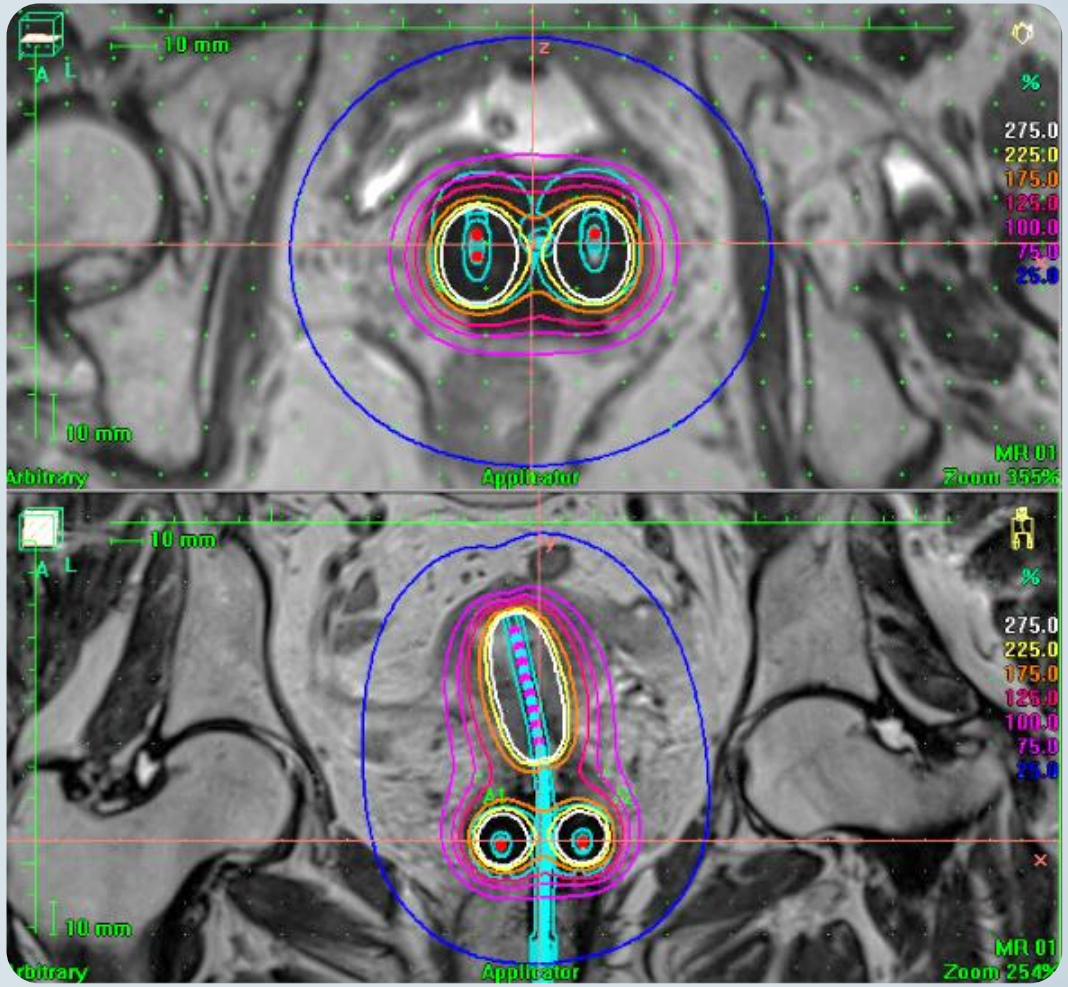
[2] Tanderup et al. Effect of tumor dose, volume and overall treatment time on local control after radiochemotherapy including MRI guided brachytherapy of locally advanced cervical cancer. Radiother Oncol. 2016;120(3):441–46.

How did we get to hybrid gyn applicators?

Transition from LDR to HDR

- Optimization of dwell times
- Shorter treatment times





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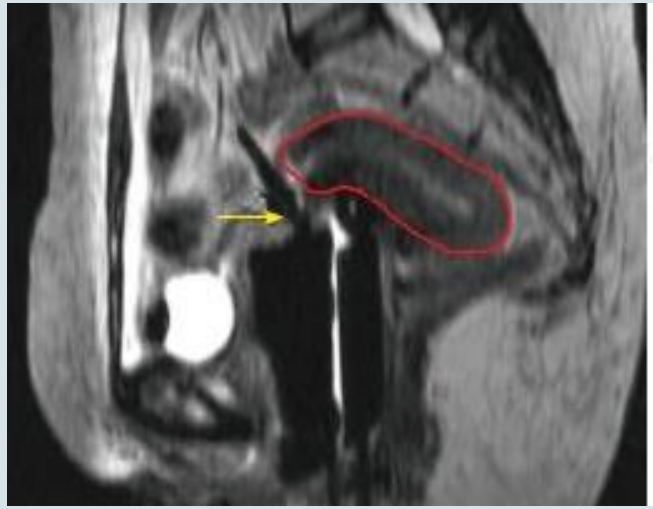
How did we get to hybrid gyn applicators?

Transition from x-ray to MR

- Visualizing the applicator
- Visualizing the soft tissues and applicator



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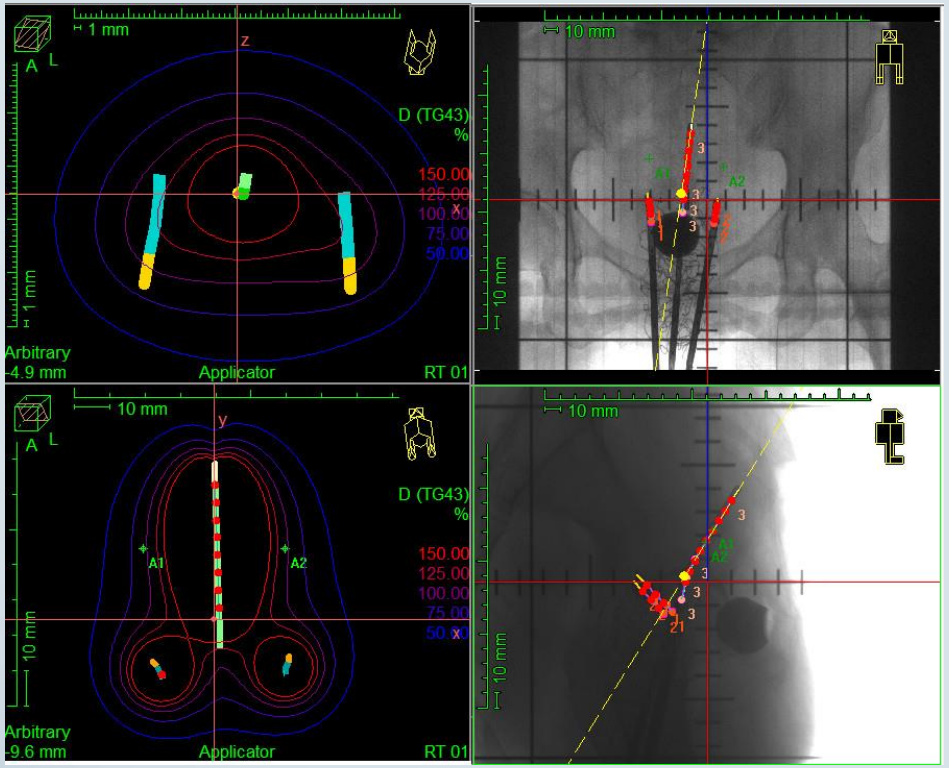
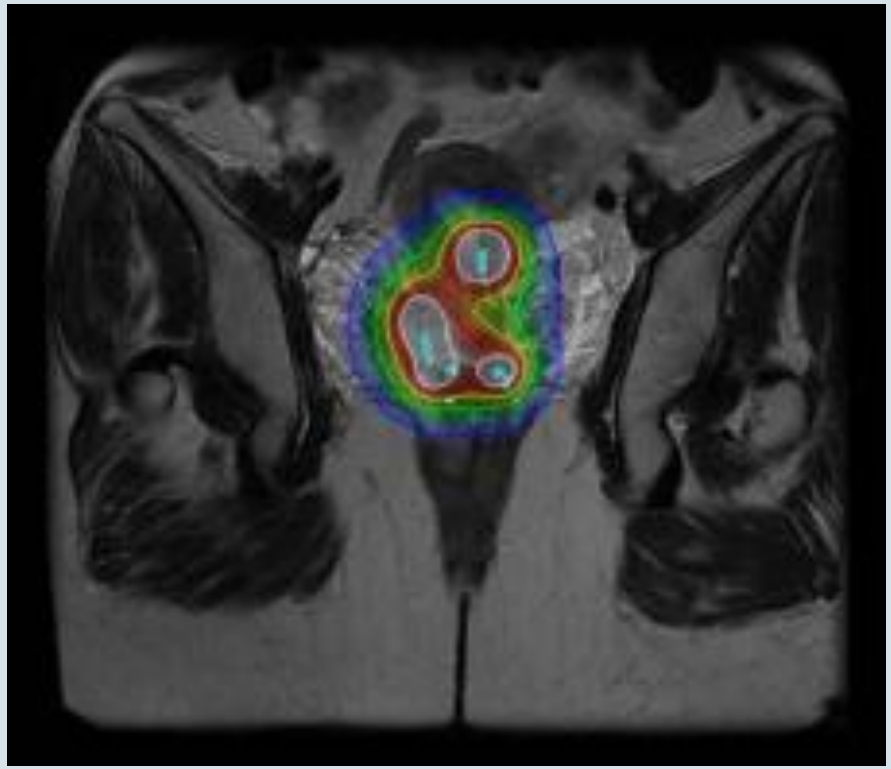
How did we get to hybrid gyn applicators?

Transition from point to volume optimization

- Adjust dose to tumor volume based upon soft tissue imaging

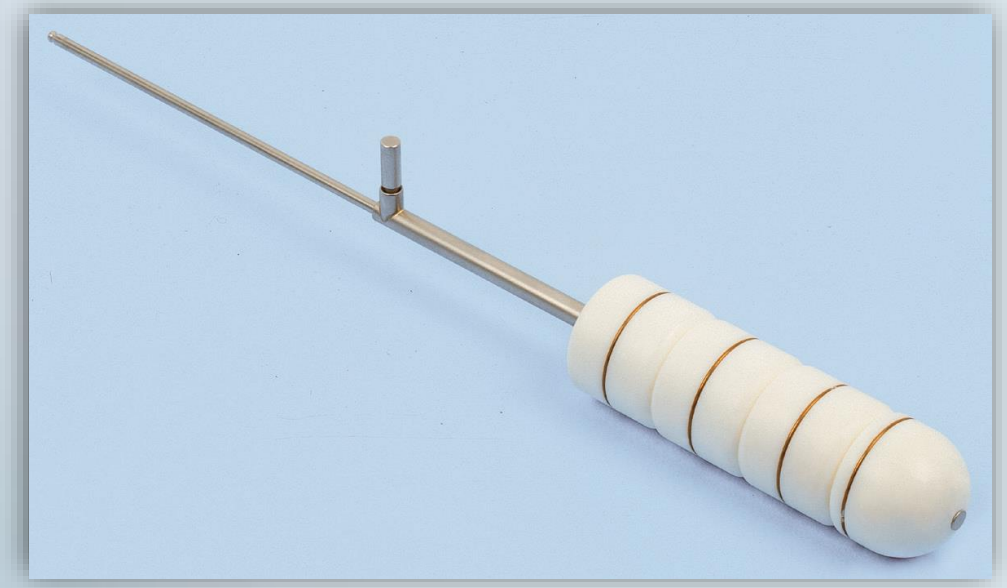




How the use of MR changed applicator design

Changes in materials—from metal to MR safe materials

- MR safe—PPSU materials
- Difference applicator strength



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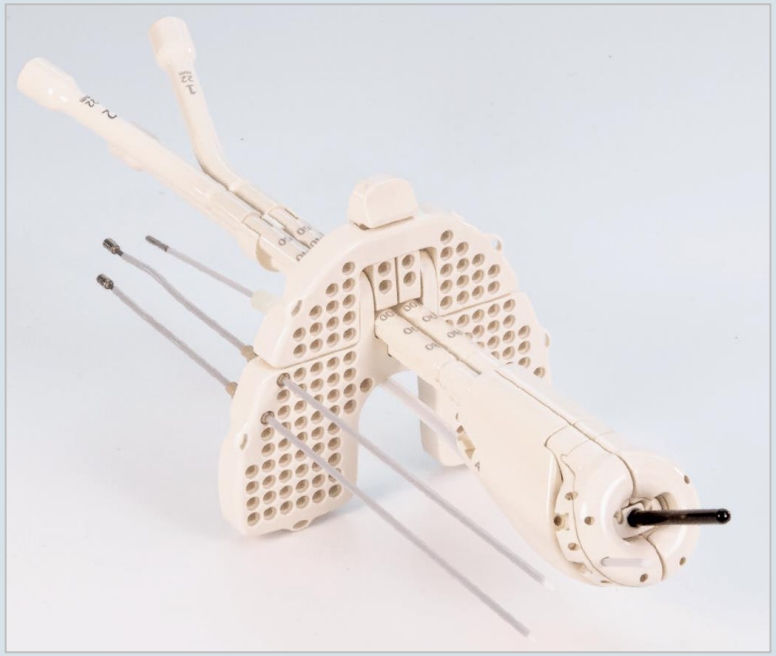
How the use of MR changed applicator design

Changes in materials—from metal to MR safe materials

- Different ways of fixating parts
- Requires physician training / different markers
- Designs evolved to more user-friendly designs



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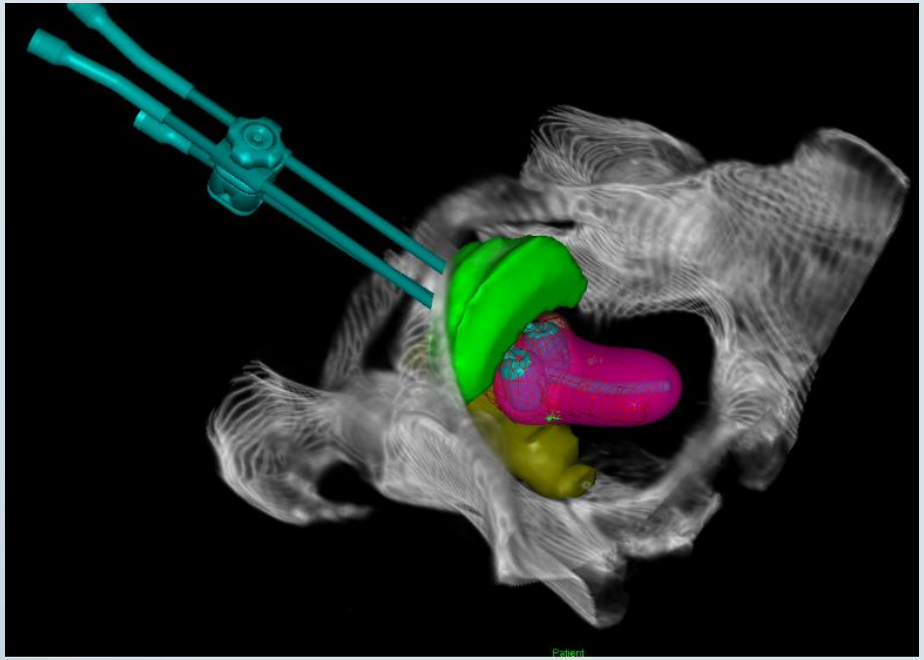
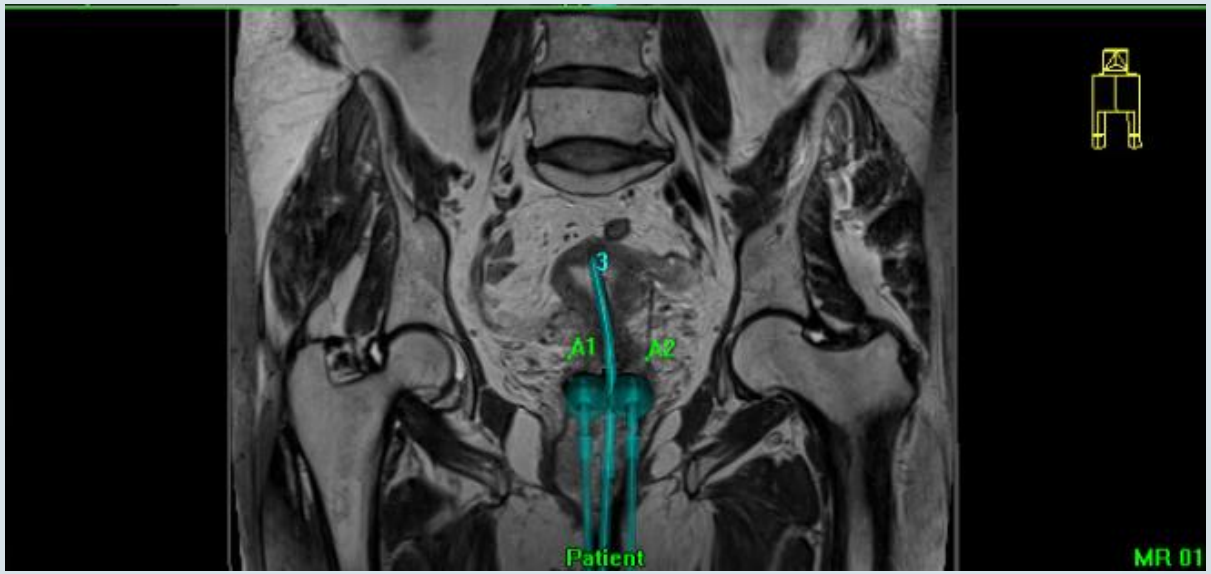
How the use of MR changed applicator design

Impact on treatment planning

- Image fusion—CT and MR
- Applicator modeling





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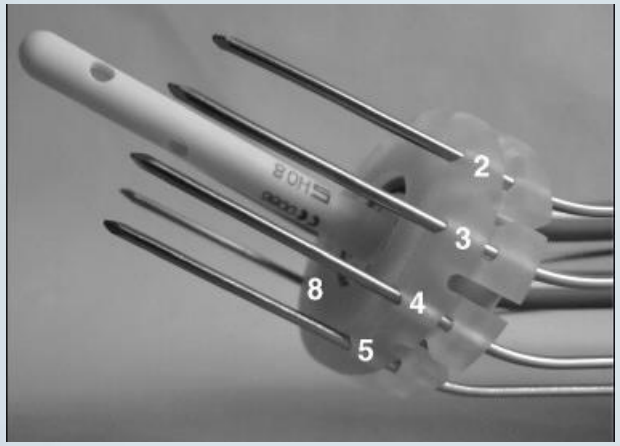
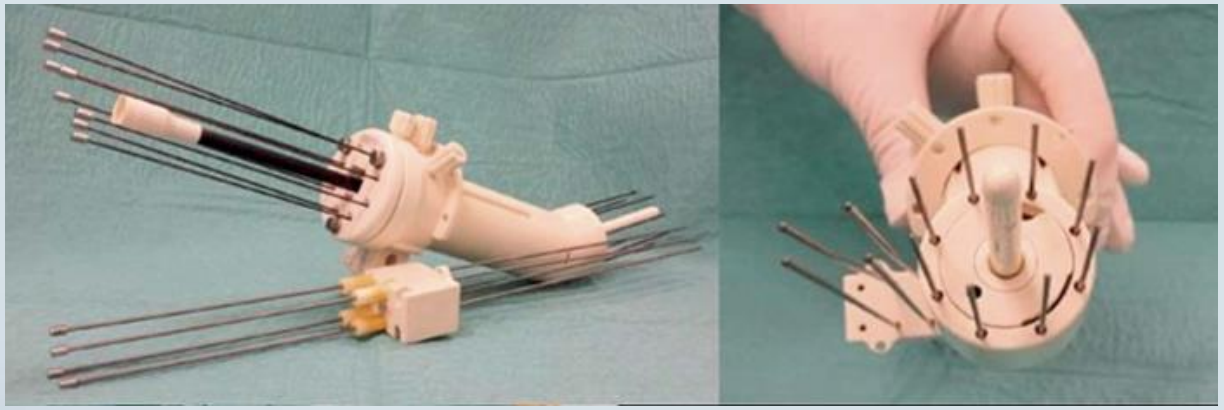
The evolution of hybrid applicators

- From customer designed applicators to latest commercial design





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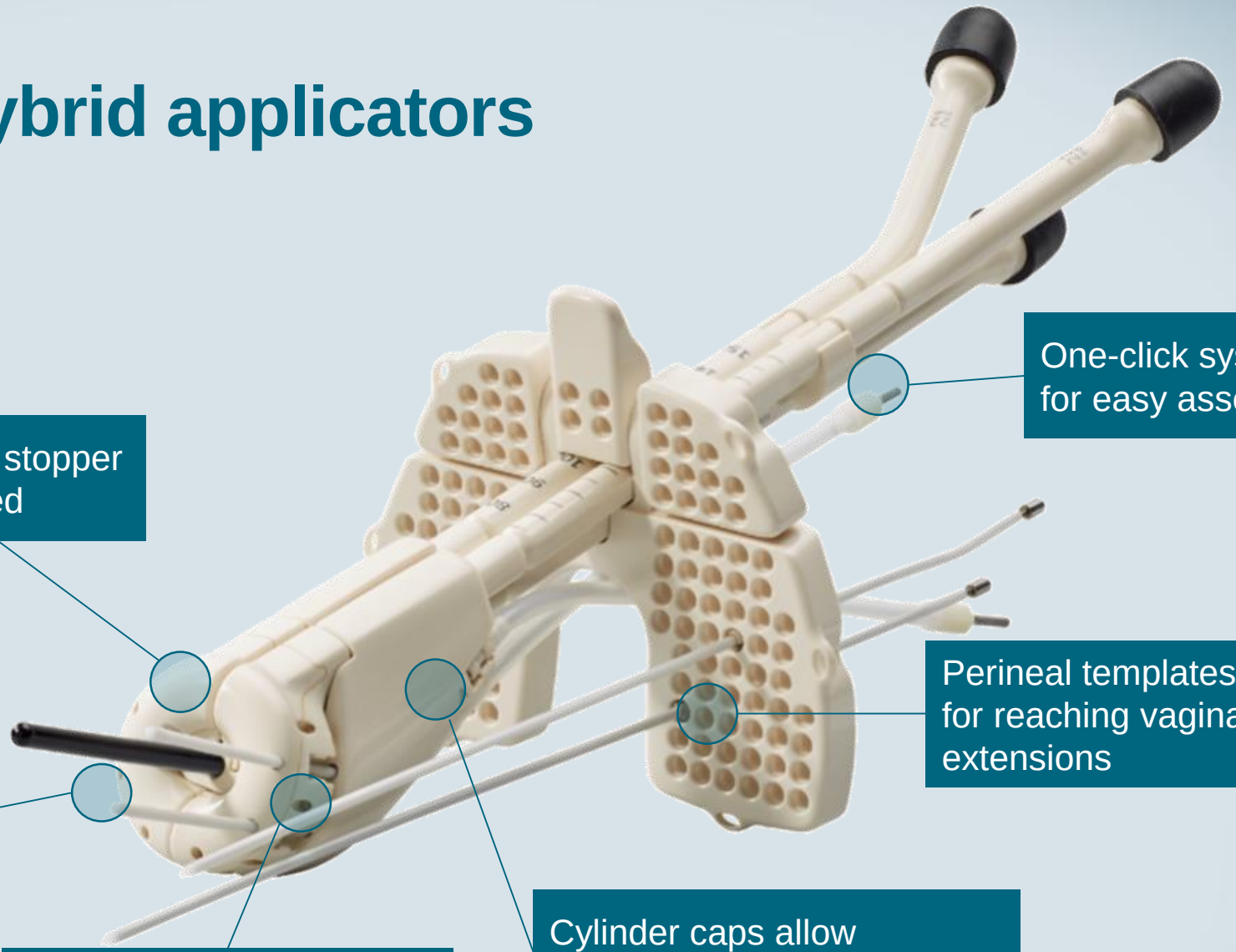
The evolution of hybrid applicators

The Venezia™ applicator



One-click system for easy assembly

Cervical stopper integrated

Perineal templates for reaching vaginal extensions

Two lunar-shaped ovoids that when clicked together form a ring

Cylinder caps allow treatment of the vaginal wall

Ovoid holes allow parallel and oblique needles to reach the parametrium

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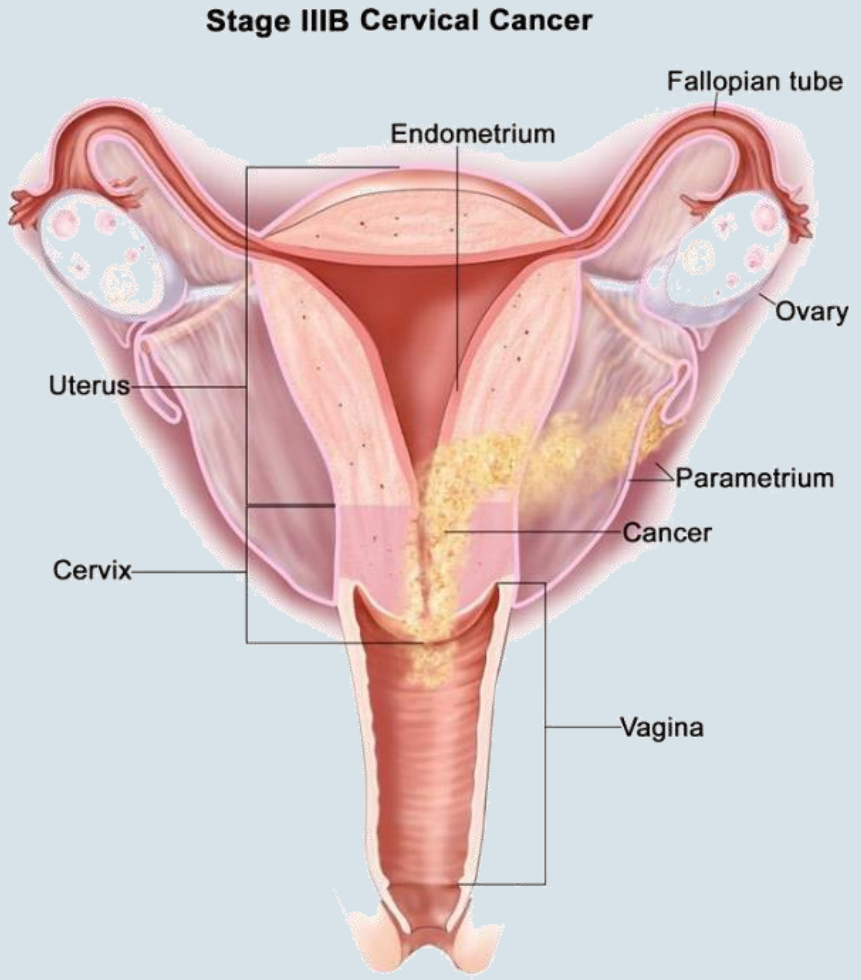
The evolution of hybrid applicators

Expanding clinical capabilities

Reach the cervix, parametrium and vaginal extensions with one applicator

Deliver optimal dose to target, sparing OAR

Use for various patient groups (stage IB, IIA/B, IIIA/B and IVA)



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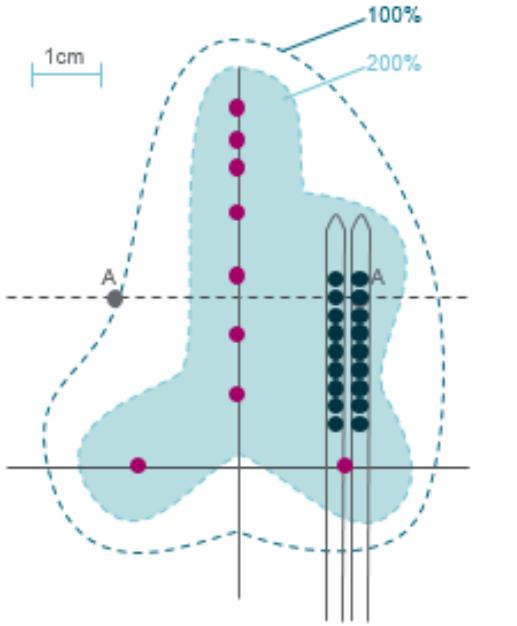
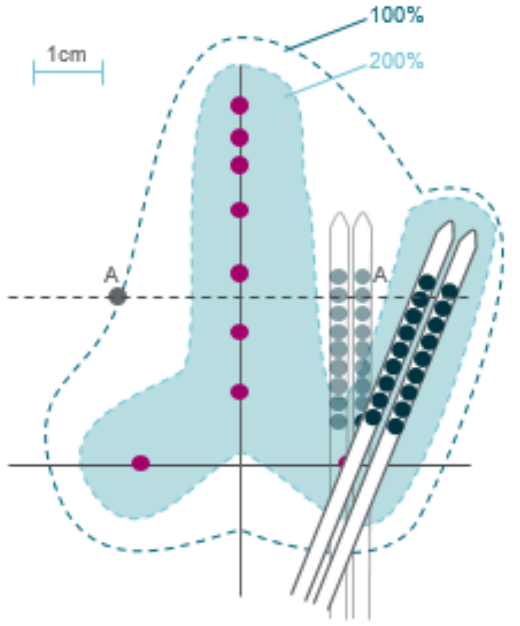
Hybrid part of the applicator



With parallel needles



With parallel and oblique needles

Parallel, oblique and template needles

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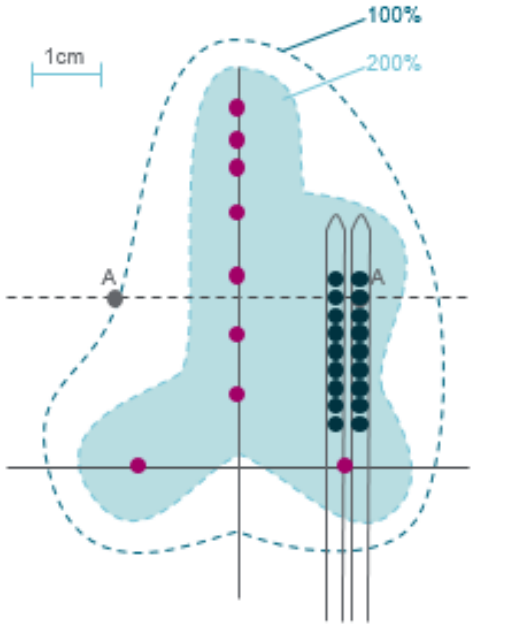
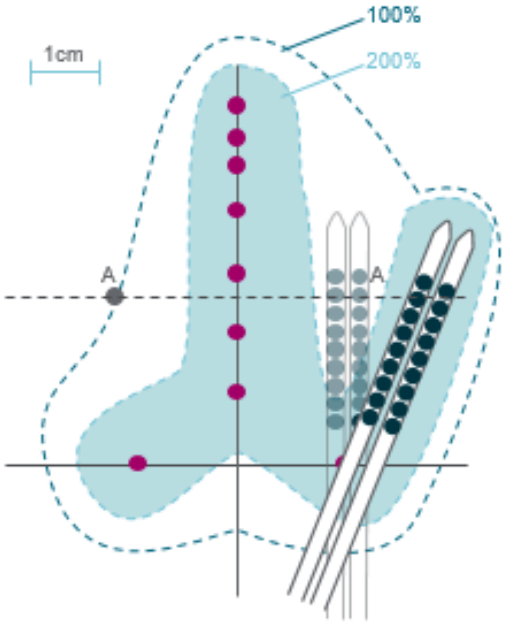
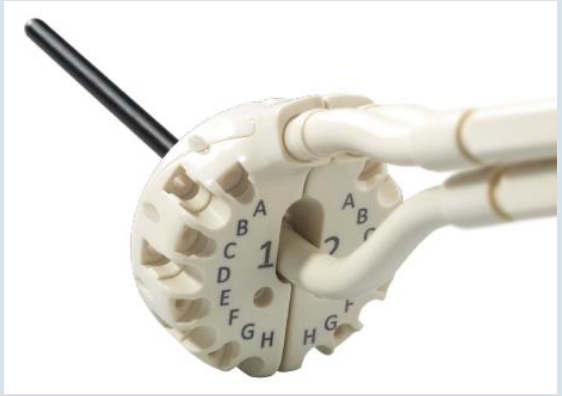
Hybrid part of the applicator



With parallel needles



With parallel and oblique needles



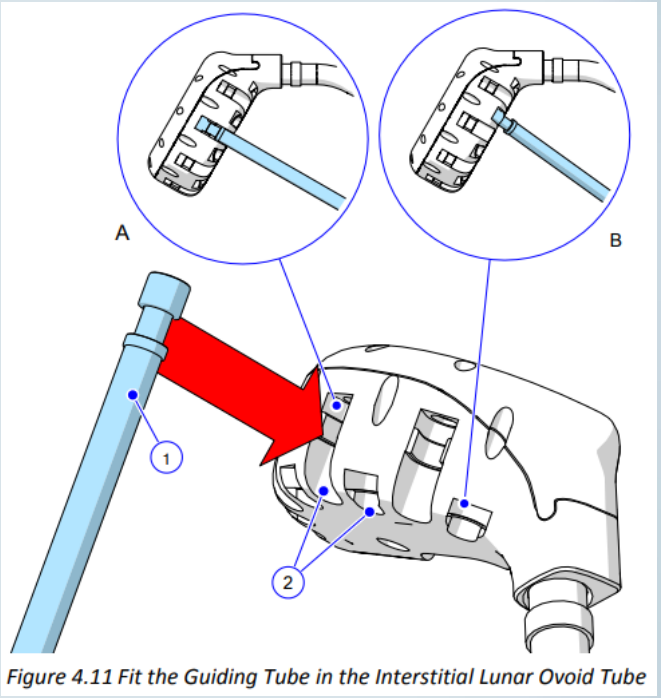


Figure 4.11 Fit the Guiding Tube in the Interstitial Lunar Ovoid Tube

Parallel, oblique and template needles

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Hybrid part of the applicator

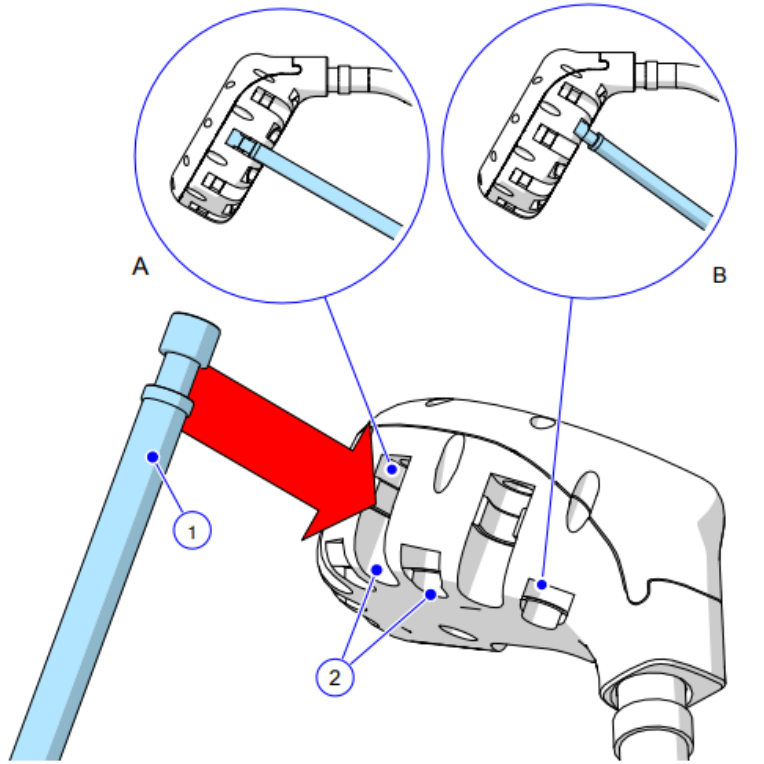

Figure 4.11 Fit the Guiding Tube in the Interstitial Lunar Ovoid Tube

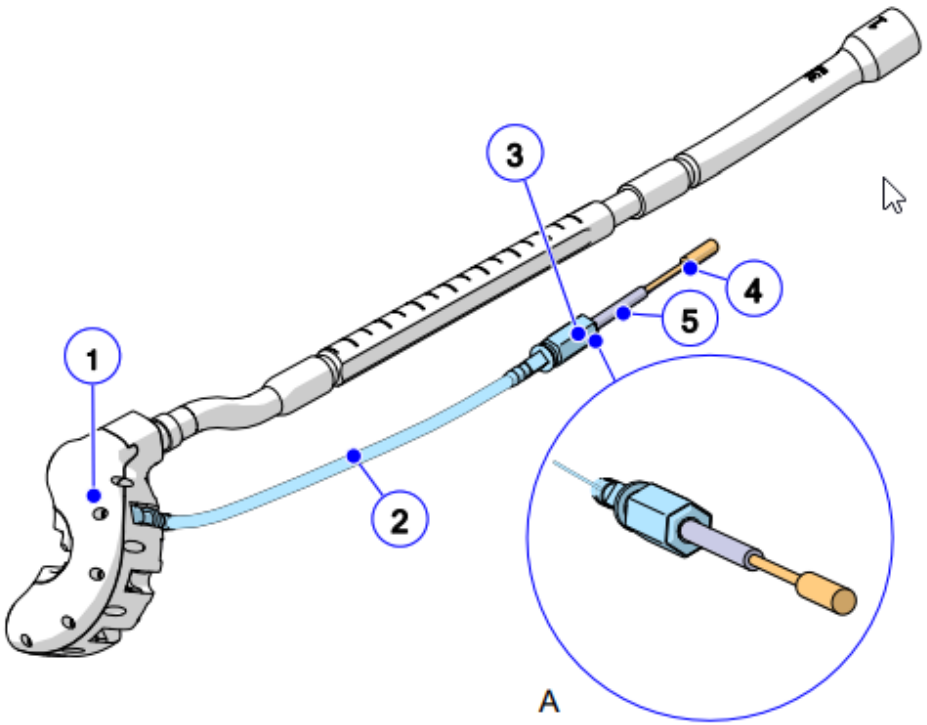

Figure 4.12 ProGuide Needle with obturator in the Guiding Tube

Guide tubes allow insertion of the needles with flexible titanium obturators

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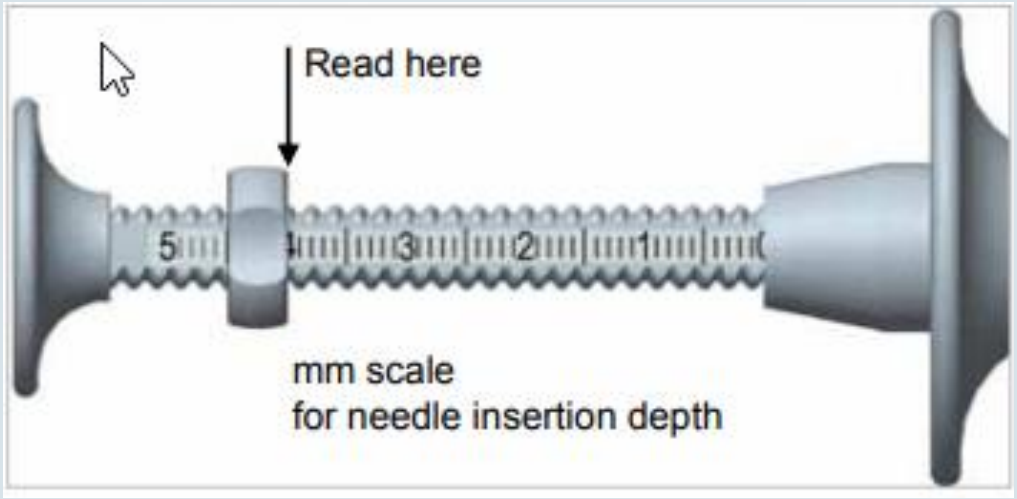
Hybrid part of the applicator



Precise depth of needles with insertion tool

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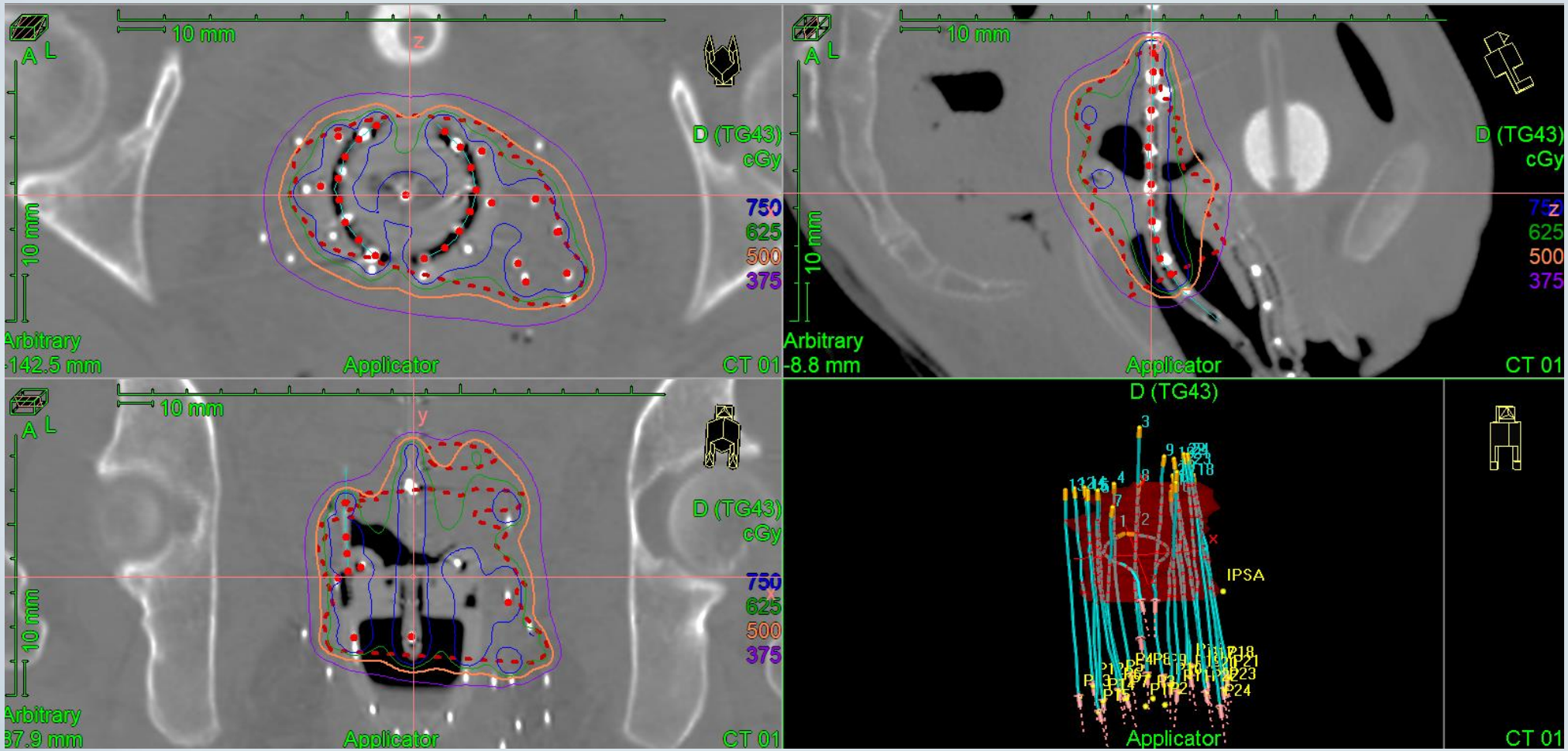
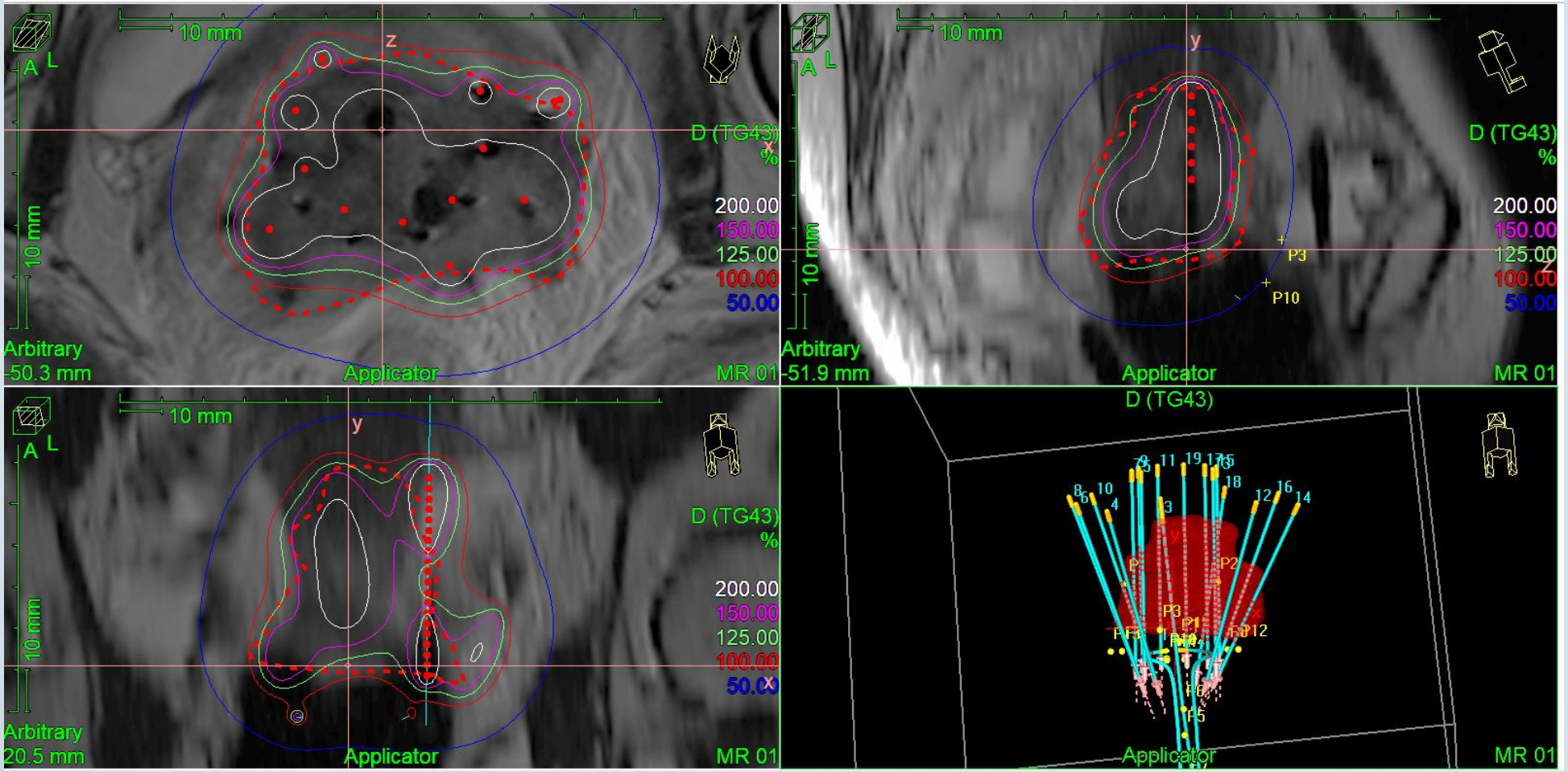
Clinical examples of hybrid applicator cases



Clinical examples of hybrid applicator cases

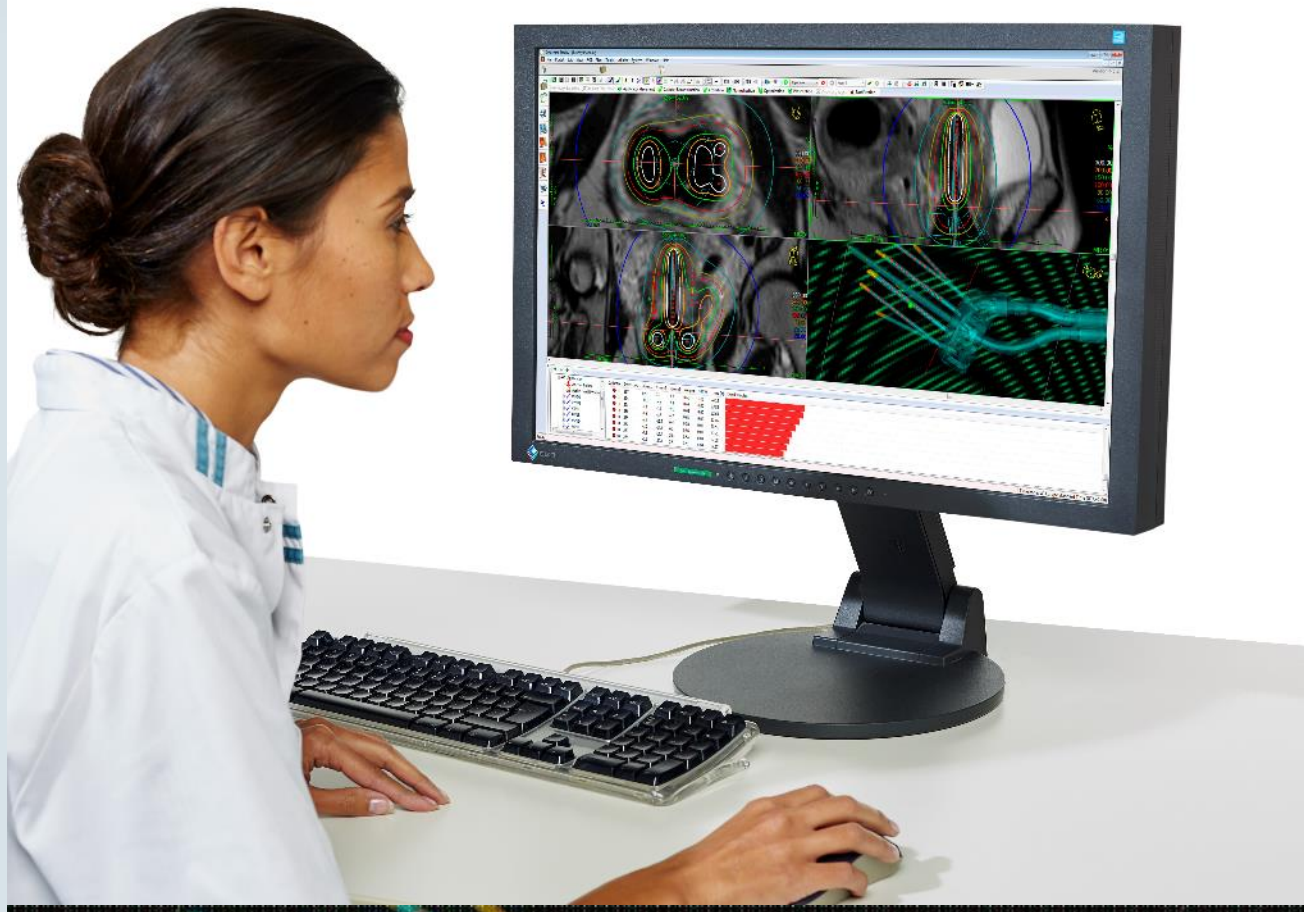


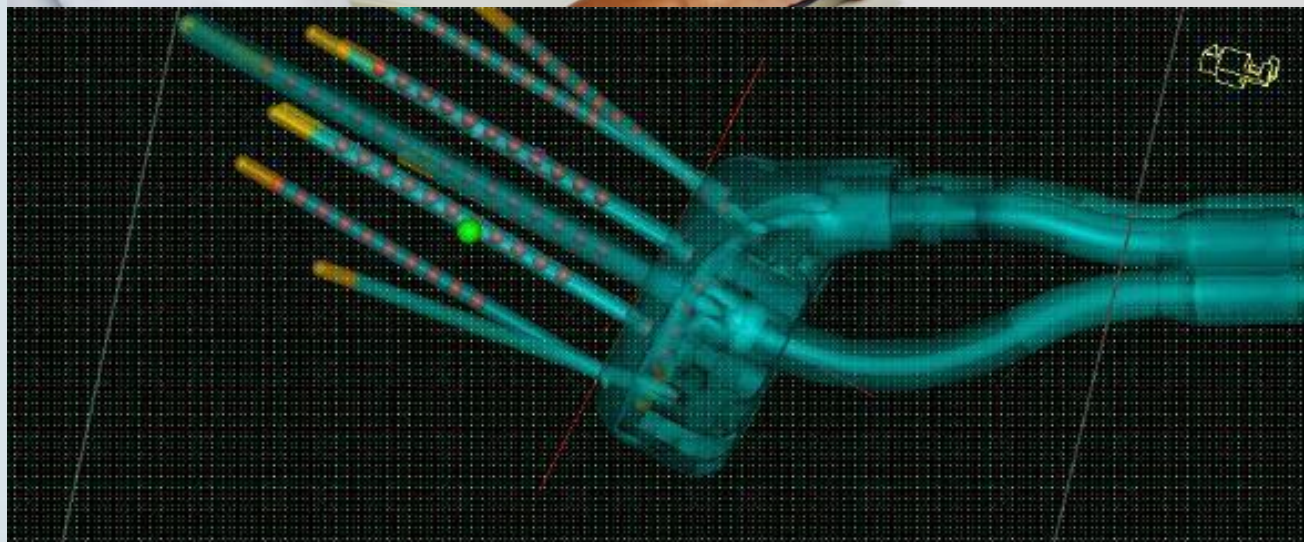
What it means for Physics

Treatment Planning

Applicator Modeling and Implant in Oncentra® Brachy treatment planning allows for fast reconstruction of the applicator

Standard length flexible needles can be reconstructed in different ways with the use of CT markers





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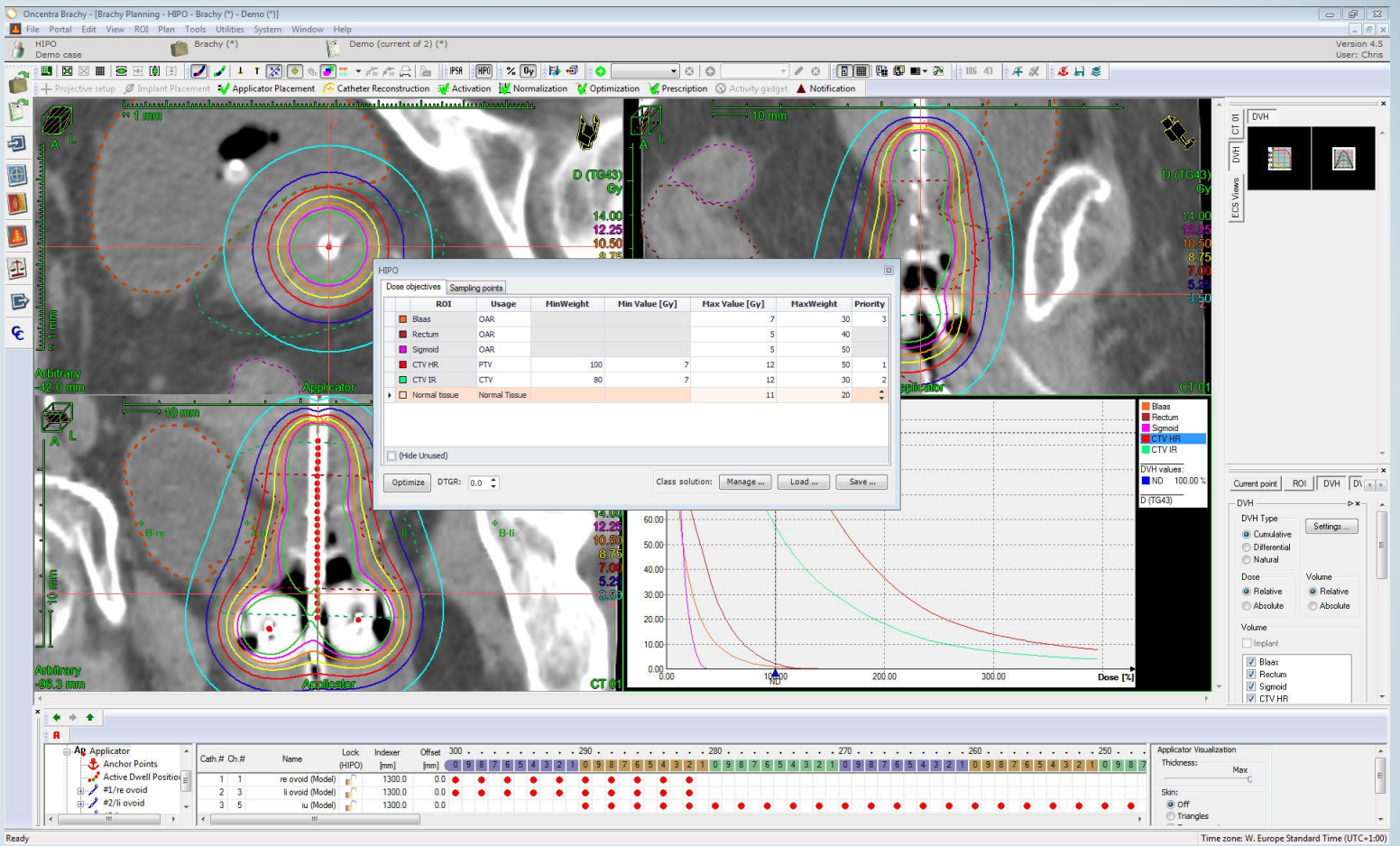
What it means for Physics

Treatment Planning

HIPO optimization

- Complex dose optimization in significantly reduced time
- Physics has more control on the parameters of the optimization
- Individual catheters can be locked during the optimization to maintain the dose in that area of the plan.



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What it means for Physics

QA

- Regular pre-treatment QA
- Standard length needles and our absolute metric source positioning system reduce the physics workload and verification steps.
- Use the labels to identify the individual flexible needles

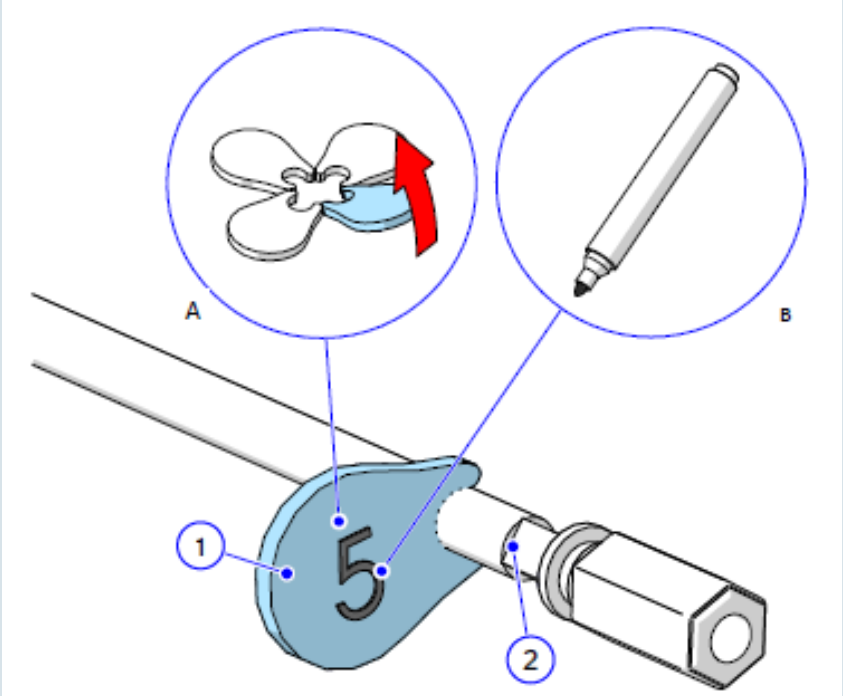

Figure 4.17 Needle identification with Number Tags

Conclusions

- The Embrace studies showed the need for a high dose (> 90 Gy)
- The Walter study[1] showed that a combination of intracavitary and interstitial is the best combination to achieve the required dose
- The Advanced Gynecological Applicator provides this combined with the use in MR
- The placement of interstitial needles using guide tubes and the insertion tool reduces the complexity
- Applicator modeling and HIPO optimization reduce planning time needed

The AGA applicator Delivering a conformable dose distribution for advanced stages of cervical cancer

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[1] Walter, et al. Combined intracavitary and interstitial brachytherapy for cervical cancer using the novel hybrid applicator Venezia: Clinical feasibility and initial results. Brachytherapy 2018;17:775-81.

Questions