

# ***ColonCa – Medical Background***

✓ **3. Most common Ca**

✓ 2

✓ 1

✓ S

ad

✓ c

**Only complete in 85 – 90%**

**Misses 10 – 20% of all Ca**

**Perforation (1:1500)**

**Only part of the of the  
colonic visualized**

**T:**

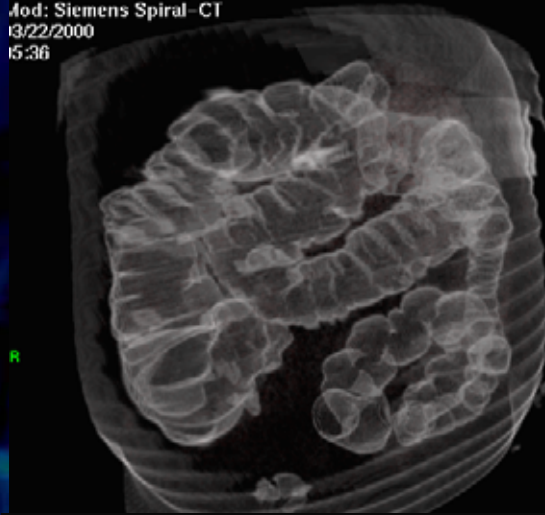
# ***3D Visualization of the Colon:***

- ✓ **CT Pneumocolon**
- ✓ **„Interactive Slicing“**
- ✓ **„Fly through“ (CT-colonoscopy)**
- ✓ **Virt. Dissection**

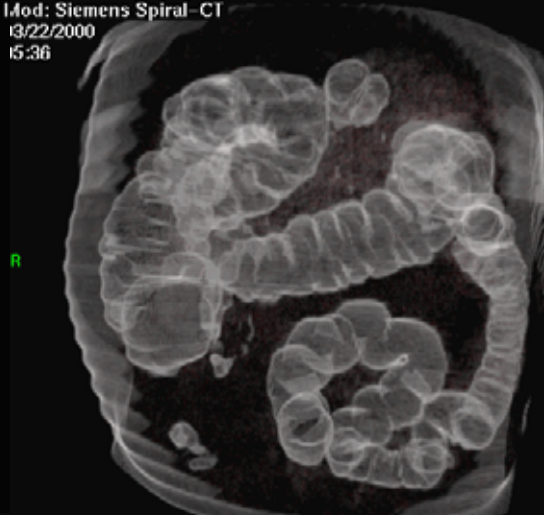


# „CT Pneumocolon“

Mod: CT-Colography  
Mod: Siemens Spiral-CT  
13/22/2000  
15:36



Mod: CT-Colography  
Mod: Siemens Spiral-CT  
13/22/2000  
15:36

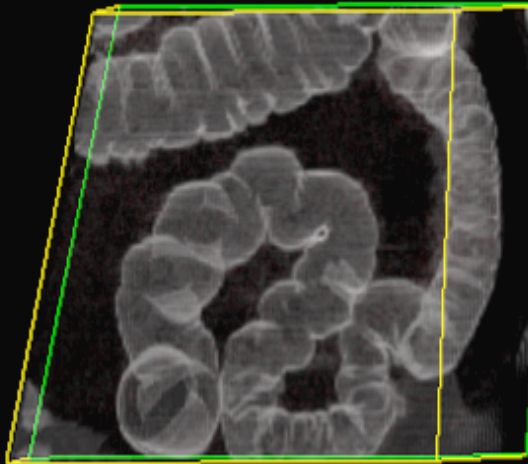


SERIES 500  
IMAGE 1-Colography  
1: 0.00 mmens Spiral-CT  
0

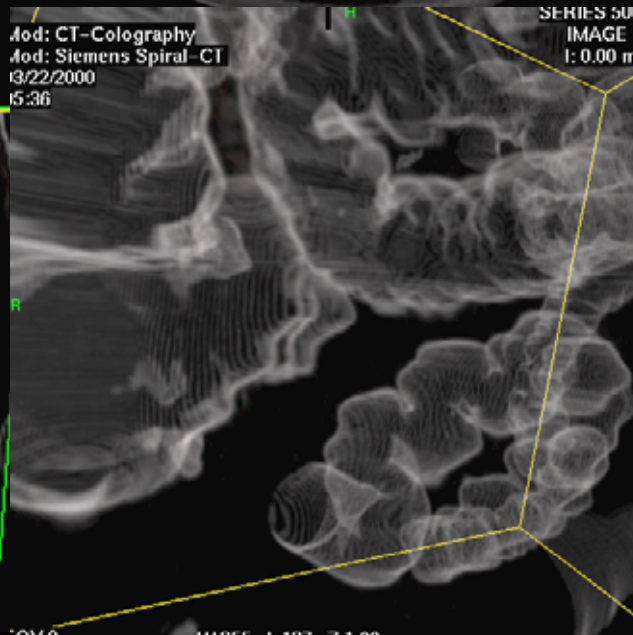


SERIES 500  
IMAGE 1  
1: 0.00 mm

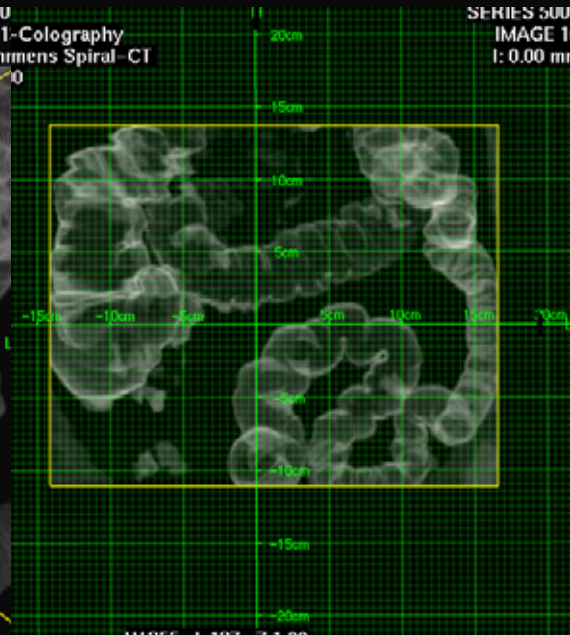
Mod: CT-Colography  
Mod: Siemens Spiral-CT  
13/22/2000  
15:36



SERIES 500  
IMAGE 1-Colography  
1: 0.00 mmens Spiral-CT  
0



SERIES 500  
IMAGE 1  
1: 0.00 mm



FOV 0 W 945 L 197 Z 1.00

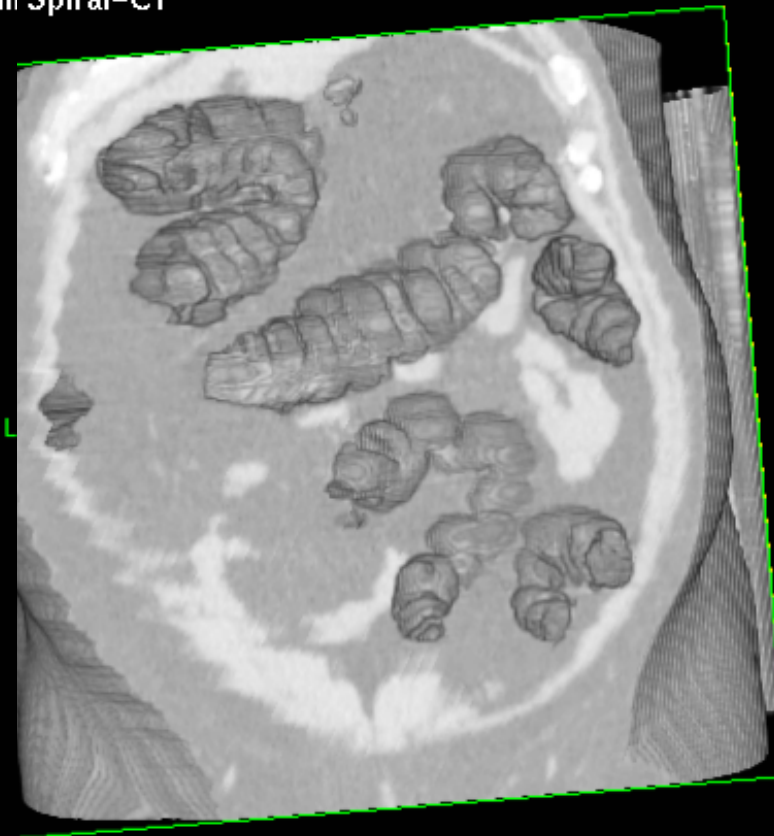
W 945 L 197 Z 1.00

# „Interactive Slicing“

Mod: CT-Colography  
Mod: Siemens Spiral-CT  
13/22/2000  
15:36

SERIES 5001  
IMAGE 1:graphy  
I: 0.00 mm Spiral-CT

SERIES 5001  
IMAGE 1:

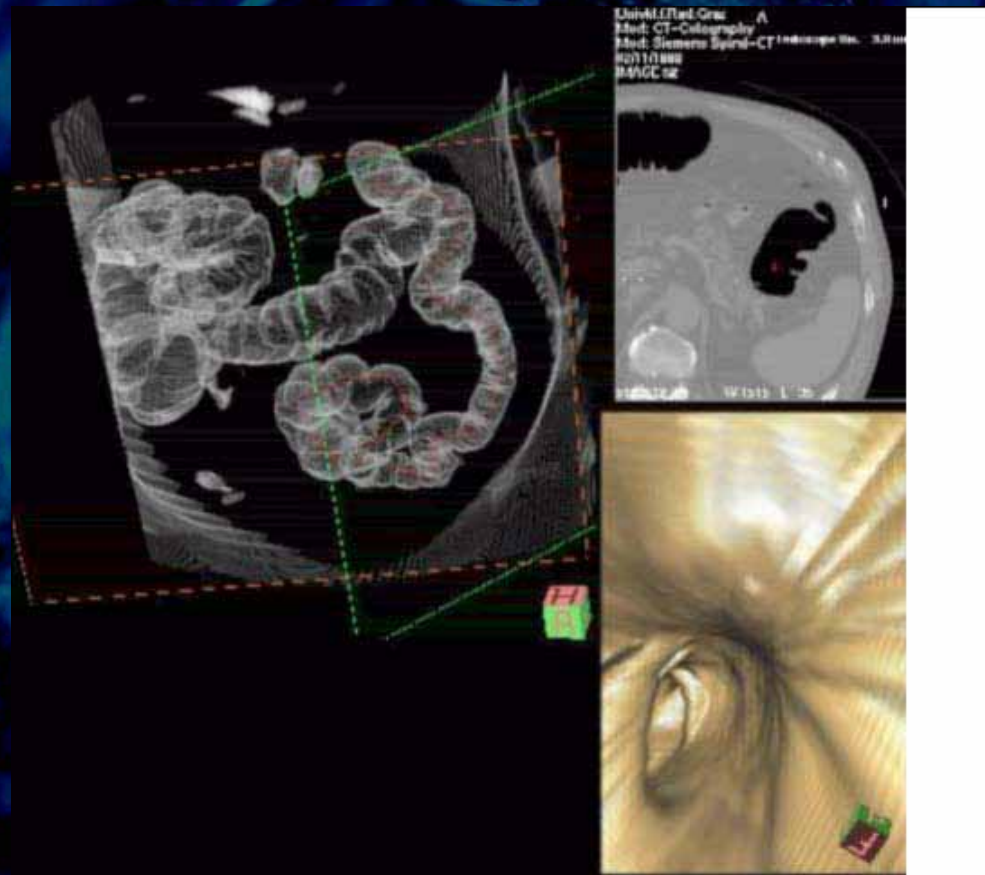


FOV 0

WI 255 I 127 Z 1.00

WI 255 I 127 Z 1.00

# *„Fly Through“*



colon\_beispiel.m1v

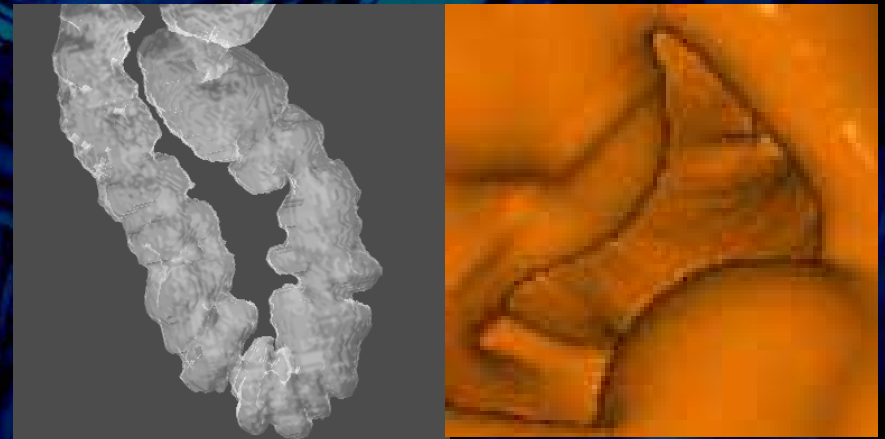
## ***Problems - General:***

### **☑ Post processing of cross sectional data:**

- time consuming
- hardware intensive (expensive!)
- specialized staff necessary

# ***Problems - CT colonoscopy***

- ✓ **Path planning for automated „fly through“ complicated and even operator dependent**
- ✓ **Endoscopic view display just a small proportion of the colonic surface -> Ante and - retrograde views necessary**



# ***What do you wanna have for CT - colonoscopy?***

- Inspection of total colonic surface**
- Fast tool**
- Minimal interaction**
- No operator influence**
- Easy and quick to report**
- (Hardware independent)**

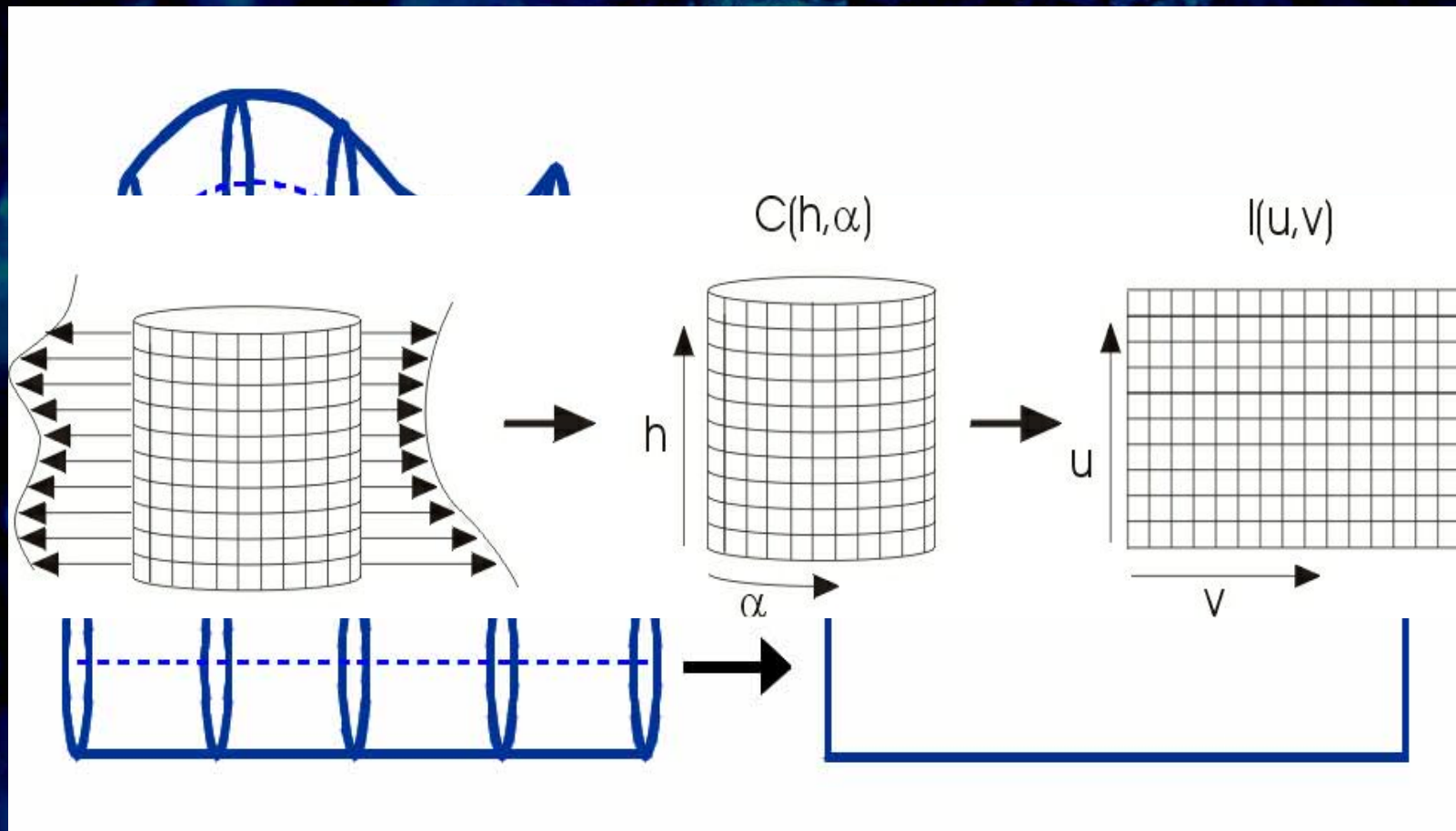


# ***„Virtual dissection“***

- ✓ **Stretch the colon and cut it along its longitudinal axis similar to the pathologist's table**



# *„Virtual dissection“*



# ***„Virtual dissection“*** ***- How to do?***

- Data aquisition**
- Segmentation - Fuzzy connected**
- Extraction of the centerline  
(Skeletonisation - Thining)**
- Calculation of the cross sections**
- „Remapping“ to 2D**

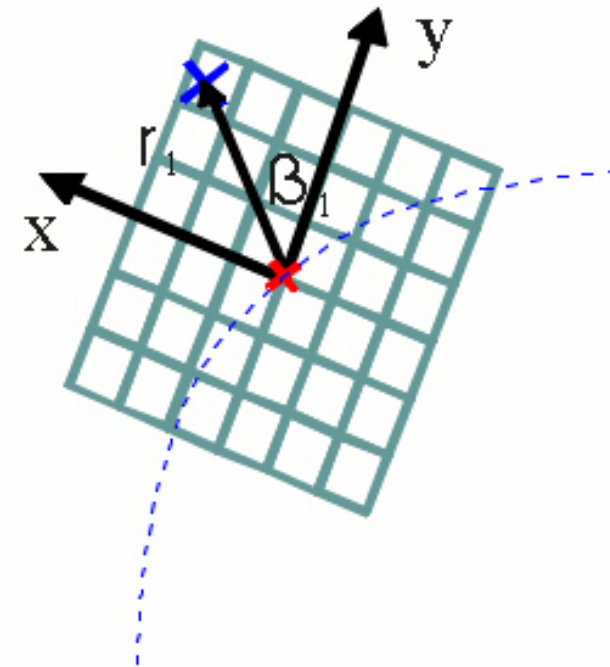
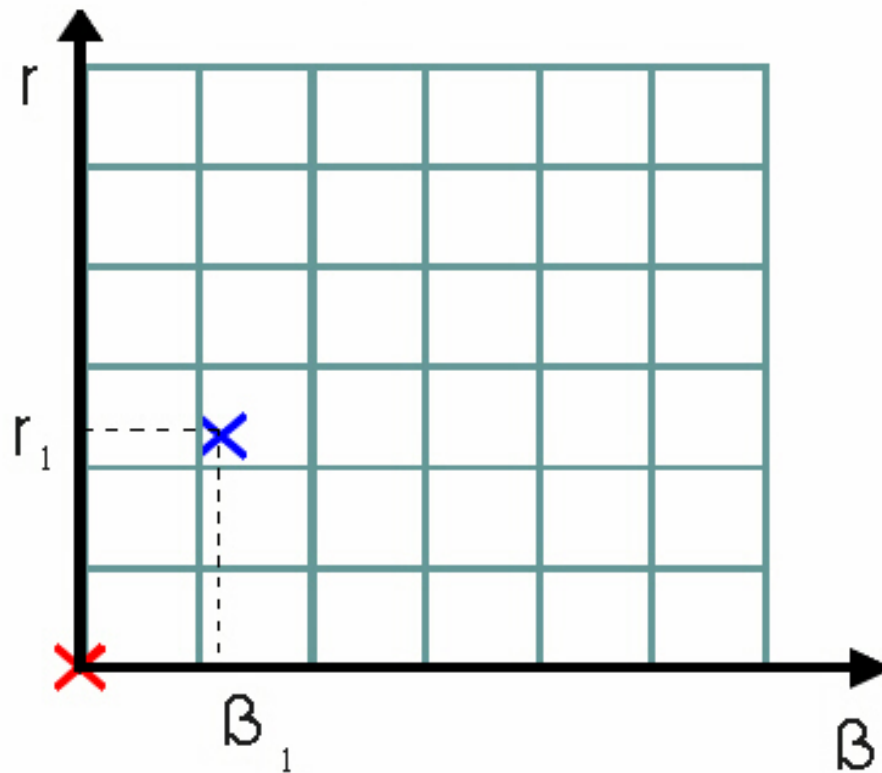
# ***Virt.Diss. - Data Aquisition***

## **MRDCT**

- Slice thickness 2.5mm
- Reconstruction: 1.25mm slice thickness, increment 0.5 - 1.0mm (~600-700 images)



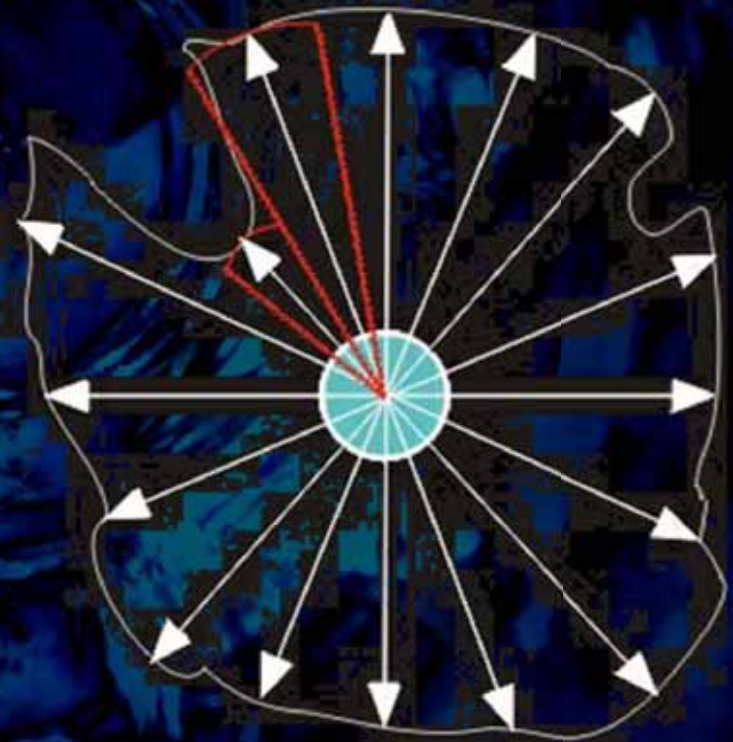
# ***Virt.Diss. - Cross sections***



# ***Virt.Diss. - Remapping***

## **Constant Angle Sampling**

- No distortion in the y direction but adds area distortion.
- Can miss objects.
- No sense of "size".
- The surface is not sampled uniformly



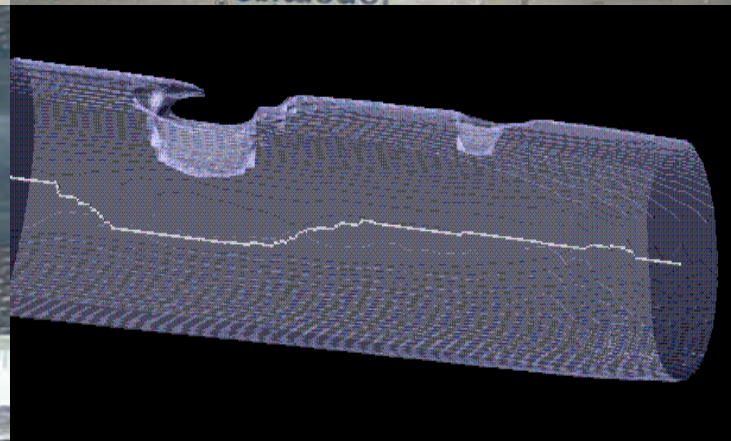
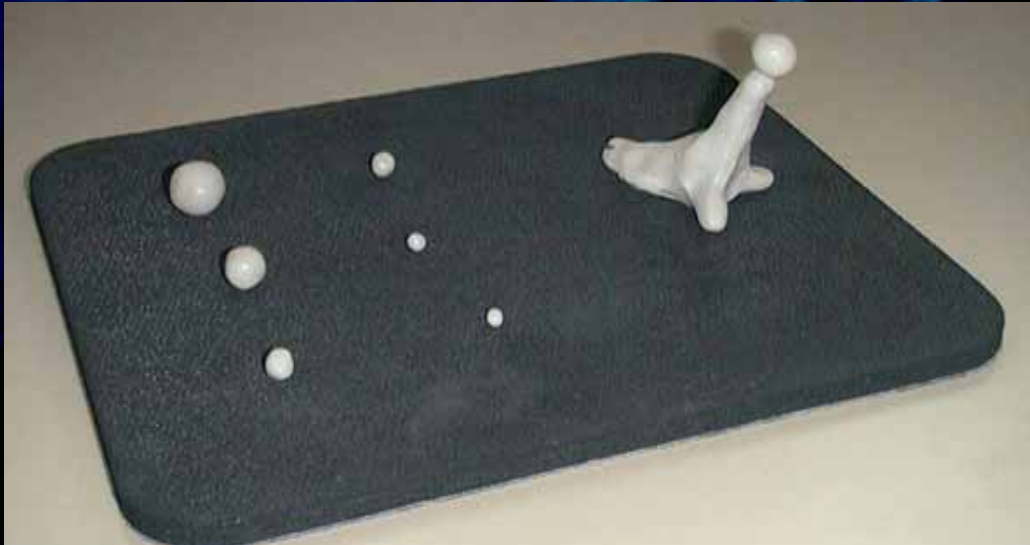
# ***Virt.Diss. - Remapping***

## **✓ Perimeter Sampling**

- Surface Sampled uniformly.
- No missing elements. If sample step small enough.
- Area Preservation.
- Deformation in the y direction-  
Shrinking
- Deformation increasing with  
distance to the vertical center line.

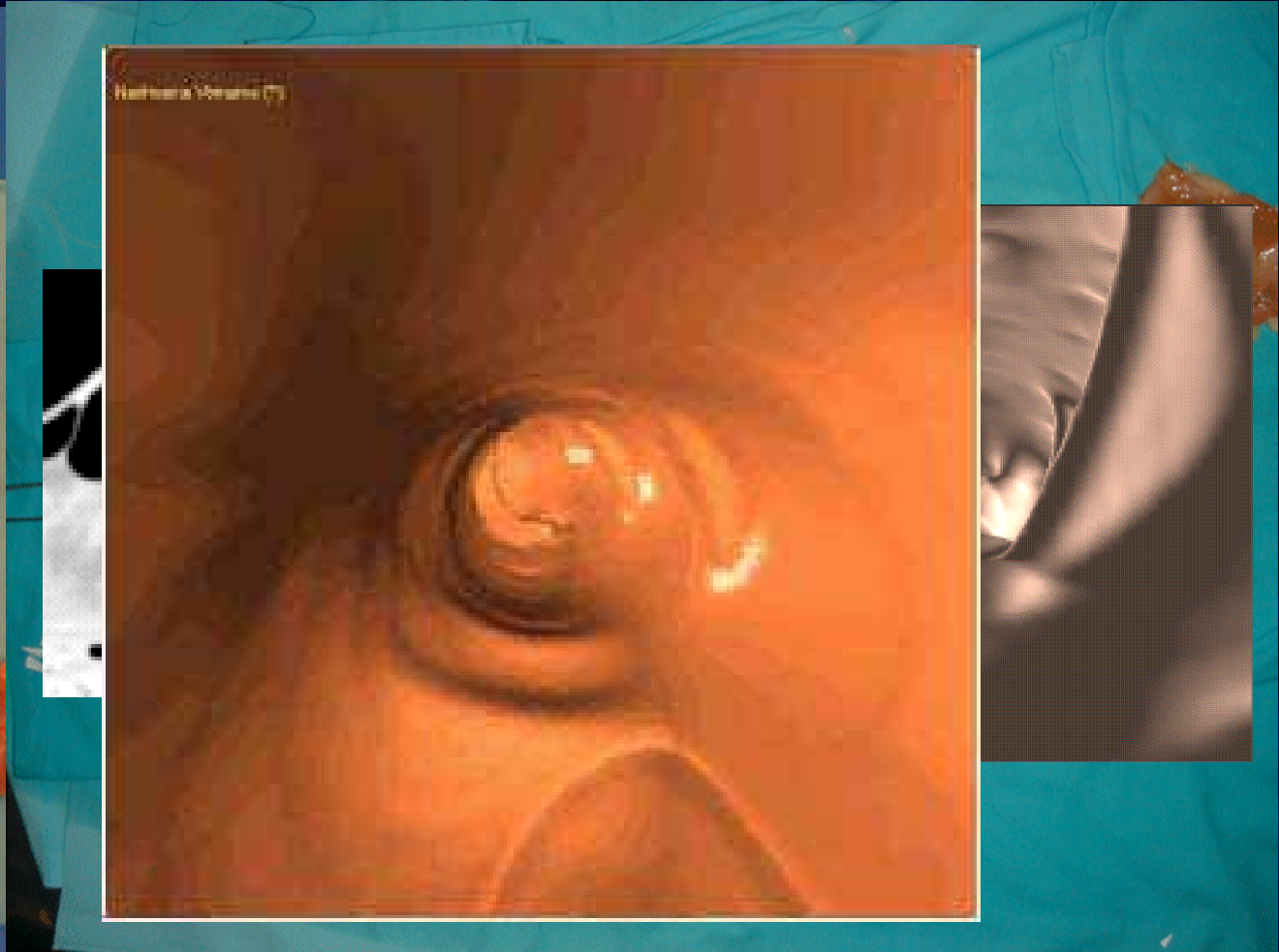
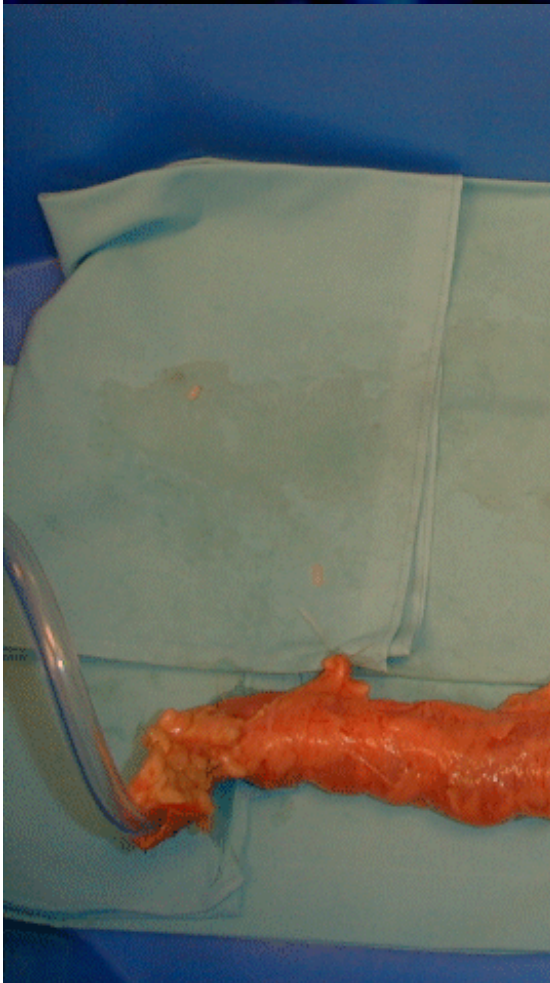


# *Phantoms - Technical*

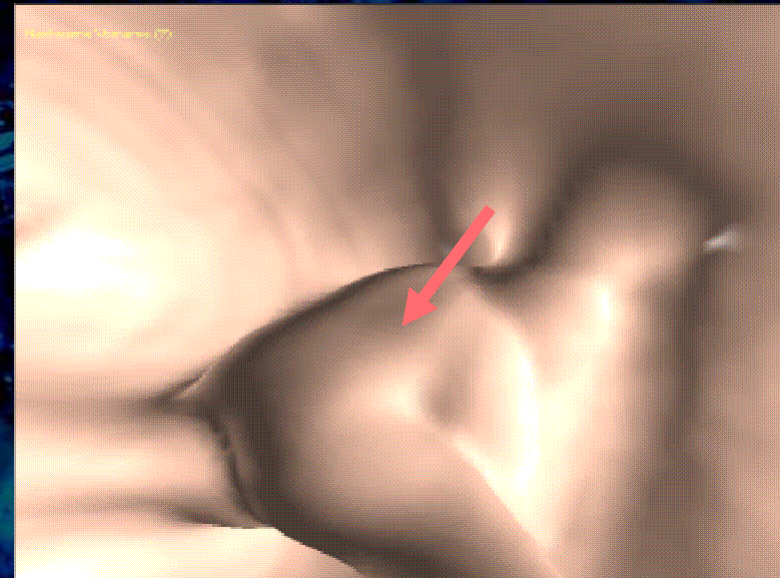
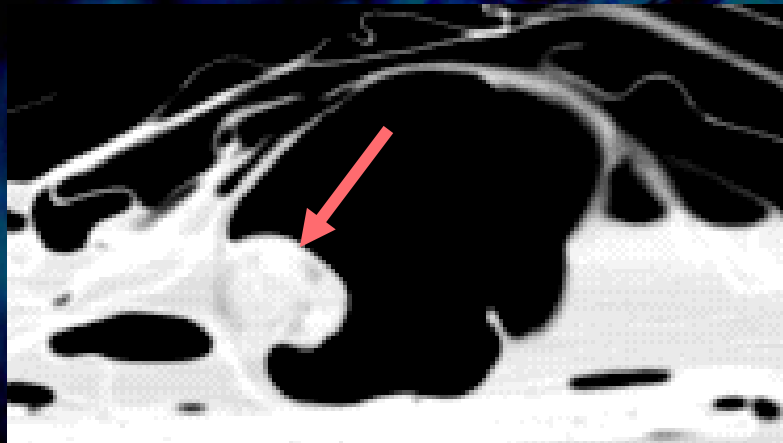




# ***Phantoms - Cadaveric***



# *Phantoms - Cadaveric Artific. Polyps (n=13)*



Filename:

image.691

Table Position:

-506.09

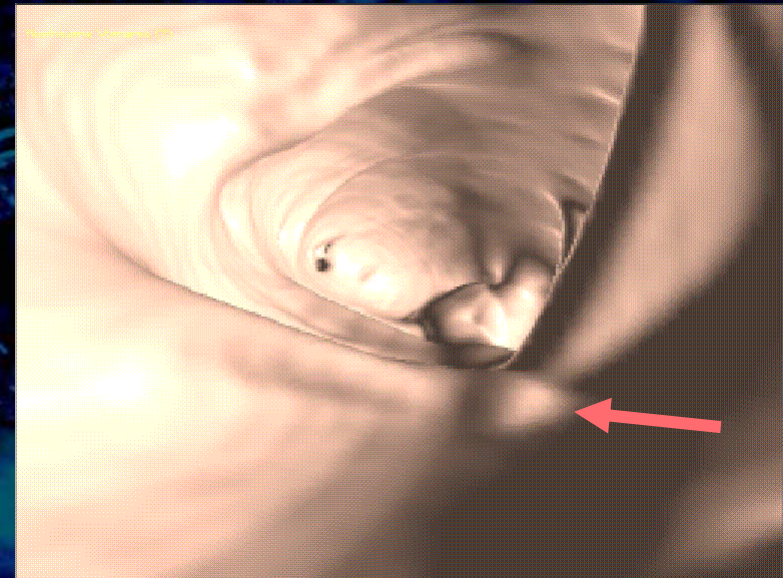
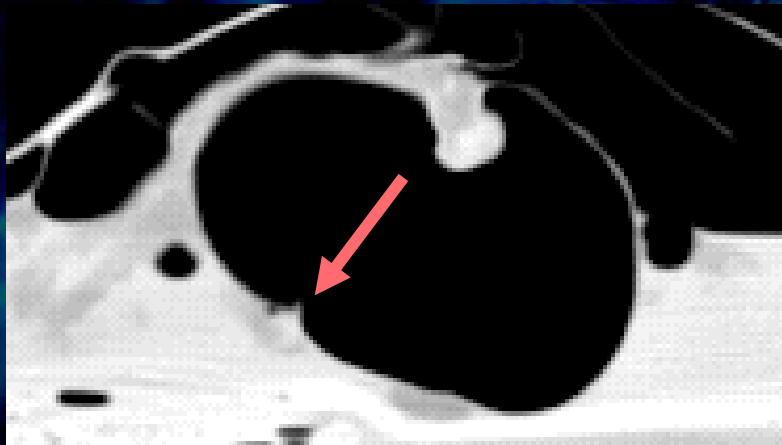
Size(Trans, Cor, Sag):

12.9 \* 15 \* 11.4

Protrusion(Trans, Sag, Cor):

13.8 \* 13.8 \* 11.2

# *Phantoms - Cadaveric Artific. Polyps (n=13)*



Filename:

image.580

Table Position:

-450.09

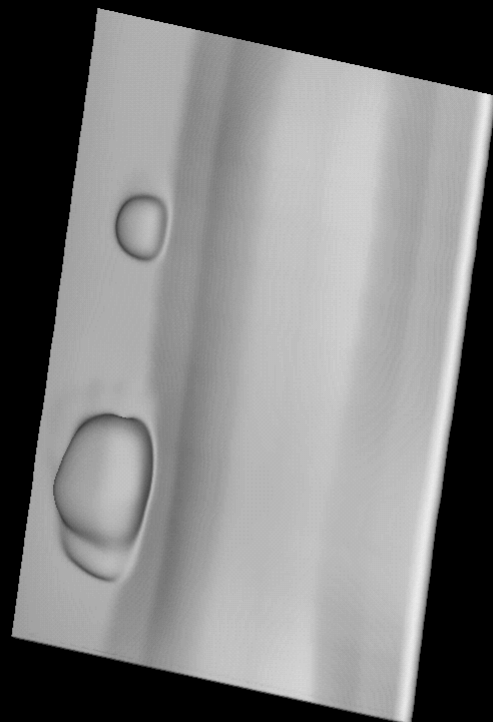
Size(Trans, Cor, Sag):

6.8 \* 4.8 \* 3.6

Protrusion(Trans, Sag, Cor):

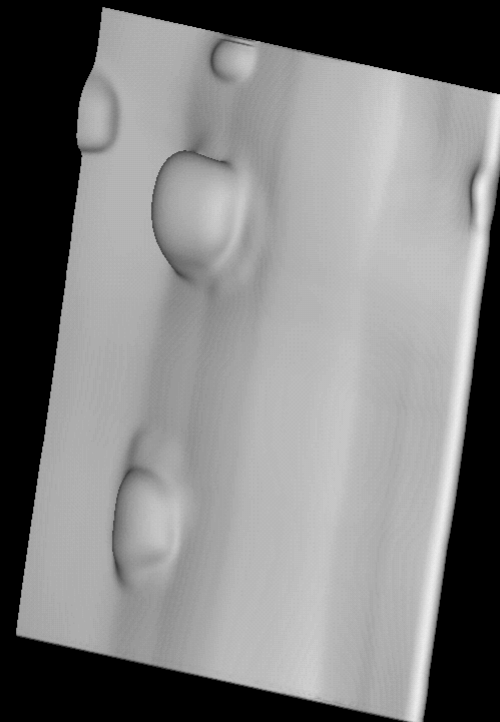
2.6 \* 1.6 \* 0

# *Results - Techn. Phantom*



Name: COLON PHANTOM  
Birthday:  
Study Date: 20000413  
Files: image.001-image.136  
Nr. of Slices: 136

Univ Klinik, Graz  
Div. of Diq. Inf.  
and Image Proc.

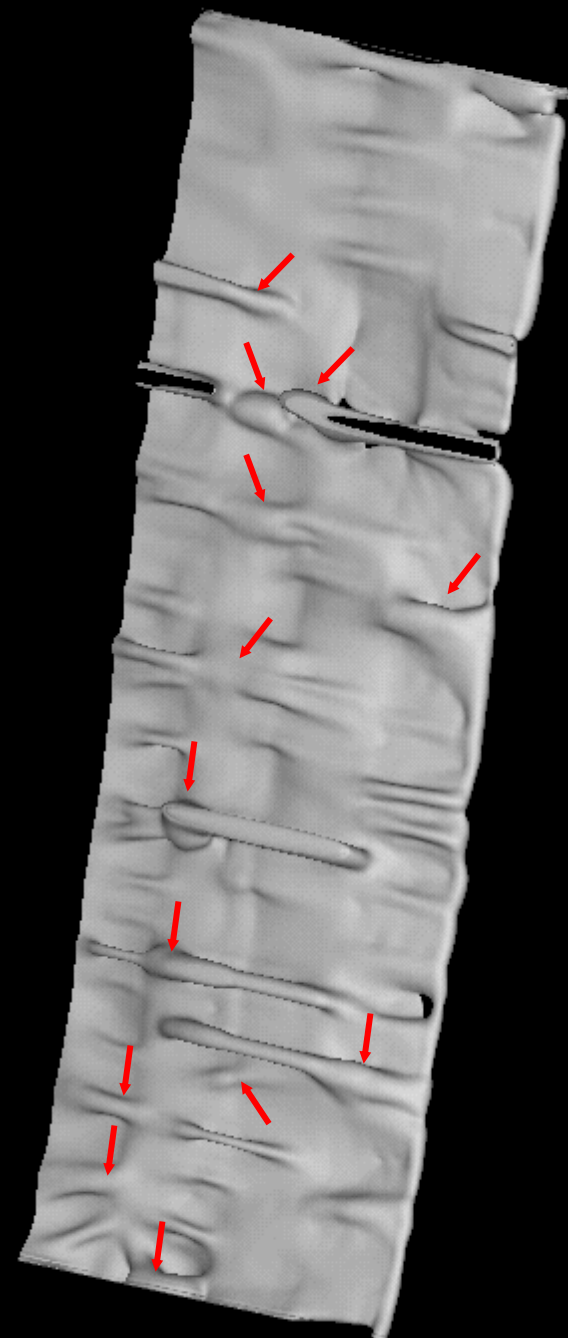


Name: COLON PHANTOM  
Birthday:  
Study Date: 20000413  
Files: image.001-image.136  
Nr. of Slices: 136

Univ Klinik, Graz  
Div. of Diq. Inf.  
and Image Proc.

# *Results - Cadaveric Phantom*

Name: COLON VIRTUELL  
Birthday: 20000406  
Study Date: 20000406  
Files: image.002-image.740  
Nr. of Slices: 370

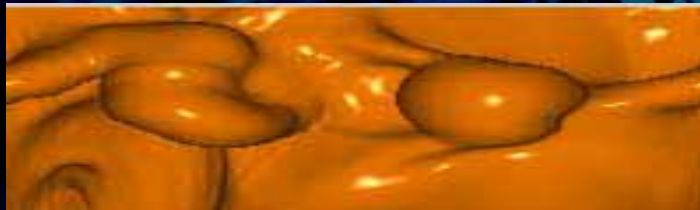
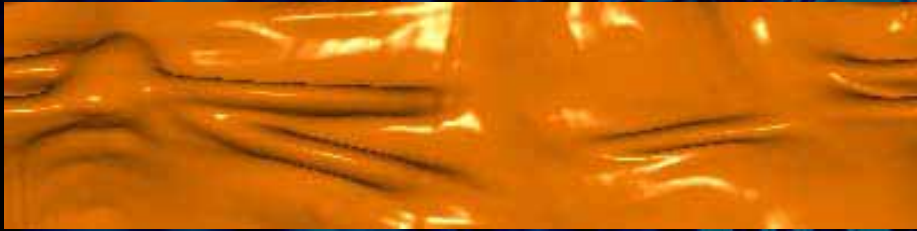


***Results -  
Cadaveric  
Phantom***

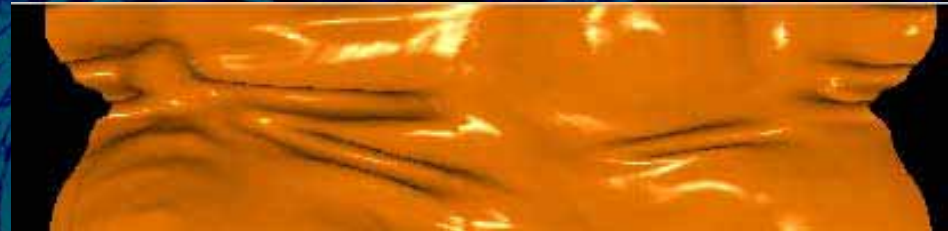


# *Results - Cadaveric Phantom*

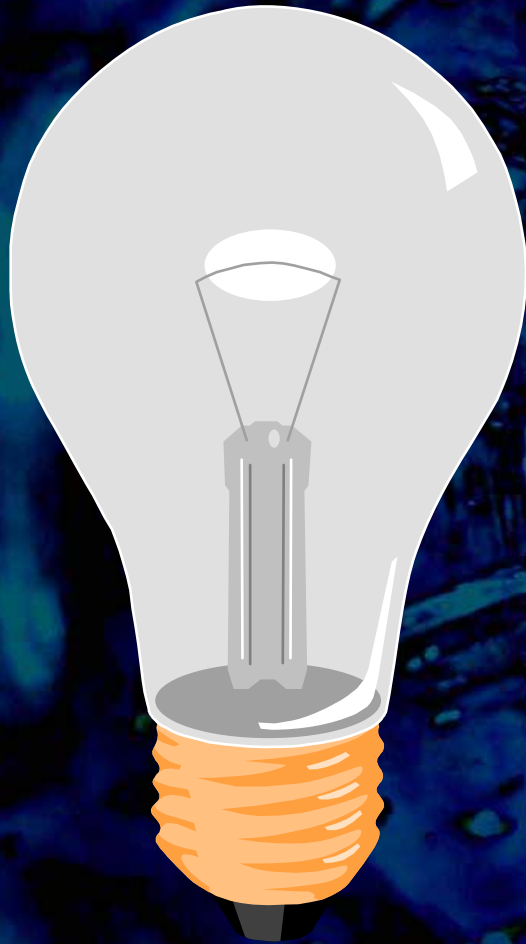
Constant Angle Sampling



Perimeter Sampling



# ***Results - Cadaveric Phantom***



## **✓ Polyps appear**

- as bumps
- as asymmetric broadening of folds

## **✓ Time:**

- Operator 10min
- Total time: 2h



# ***Results - Diverticulitis***



## ***Results - Medical Evaluation***

### **☑ 2 Observer, 13 Polyps:**

- Sensitivity:  $12/13 = 92.3\%$
- Interob. Agreement:  $11/13 = 84.6\%$
- Pos.pred.Value: 75-80%

### **☑ Each Observer overlooked 1 Polyp:**

- 3.9 \* 5.0mm
- 3.5 \* 2.5mm

## ***Conclusion VirtDiss***

- ✓ Virt. Dissection of the Colon seems to be possible within a reasonable timeframe**
- ✓ Operator interaction minimal (<10min), total time about 2h**
- ✓ Graz environment platform independent**
- ✓ Easy to report, performance excellent**
- ✓ Clinical experience until now limited**

# *Outlook*

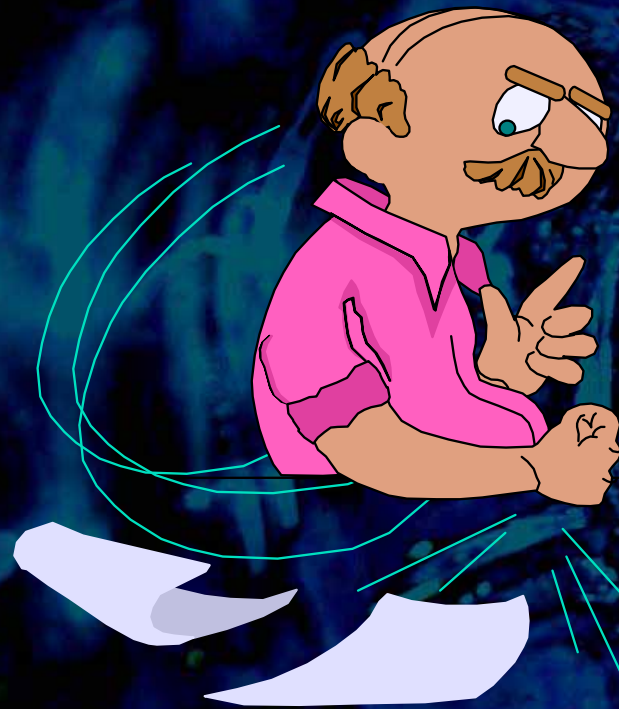
Using the depth map enhance the image using image processing.

Contour detection.

Curvature detection.



# *Outlook*



- ✓ „Troubelshhooting Tool“
- ✓ „Fecal Tagging“ – for easier patient preparation

