The Effect of Truncation on Very Small Cardiac SPECT Camera Systems

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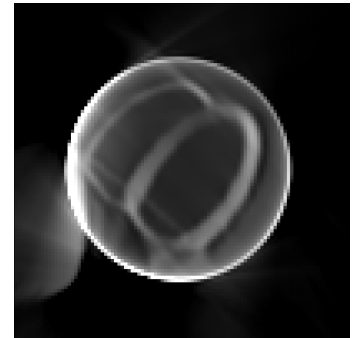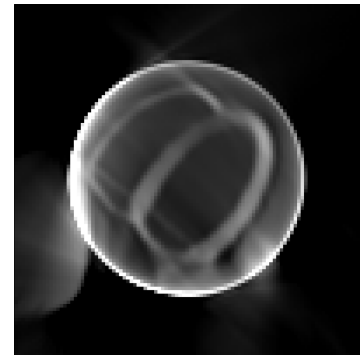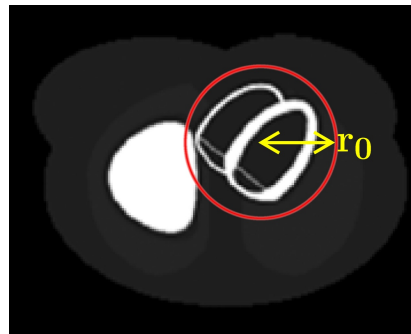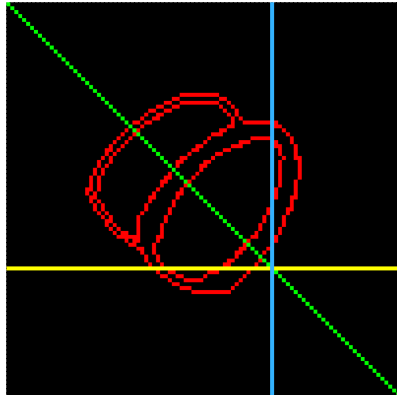
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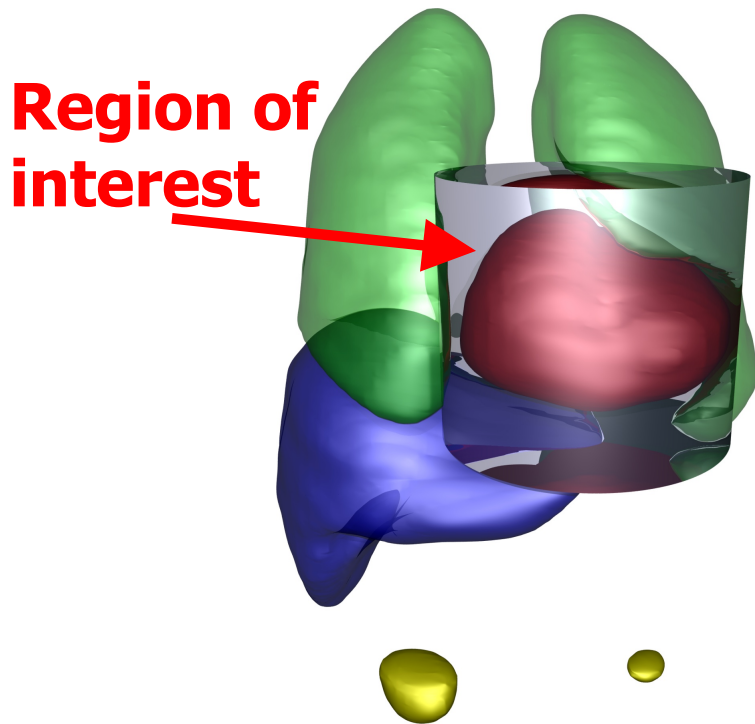
Overview

1. **Truncation in cardiac SPECT imaging**
2. **Methods of simulation and reconstruction**
3. **Effect of the Truncation**
4. **Effect of the small hot structure**
5. **Conclusion**

Truncation in cardiac SPECT imaging

- ## Why Truncation occurs

Region of interest

SRC : NCAT phantom

SNM San Diego 2006

Truncation in Cardiac SPECT Imaging

- **Goal of the study:**
  - **Visualize** artifacts due to the truncation
  - **Quantify** the error caused on the heart wall
  - **Understand** the effect of the attenuation on the artifacts
  - **Simulate** the effect of an unexpected hot structure.

Method of Simulation and Reconstruction
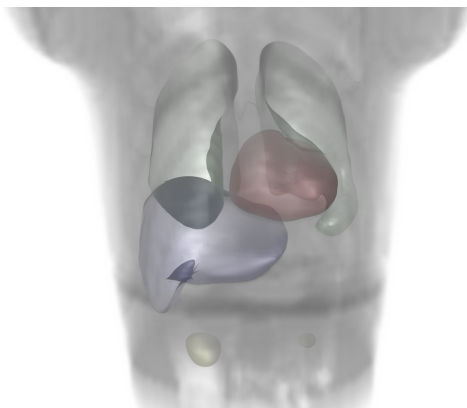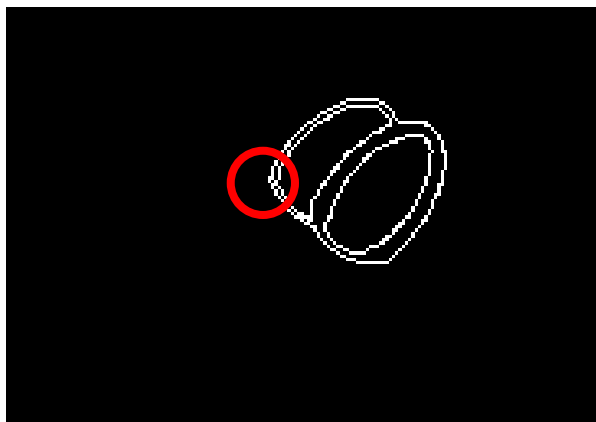
- **Simulation data**
  - Activity
    - 2D transversal slice of the MCAT phantom.
    - The heart wall is close to the liver.
  - Attenuation
    - Can take **attenuation** in account but **does not correct** for it
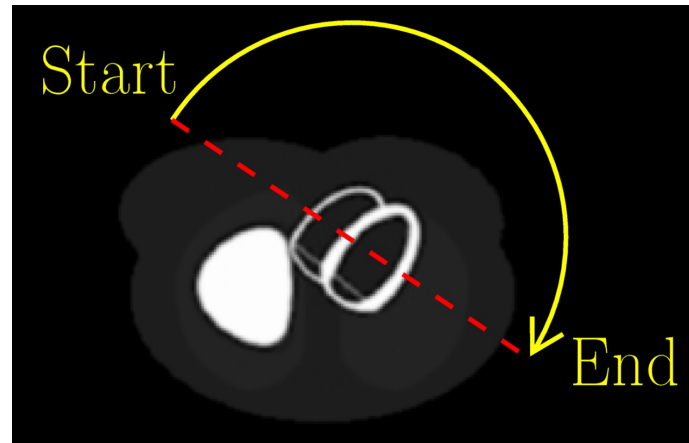
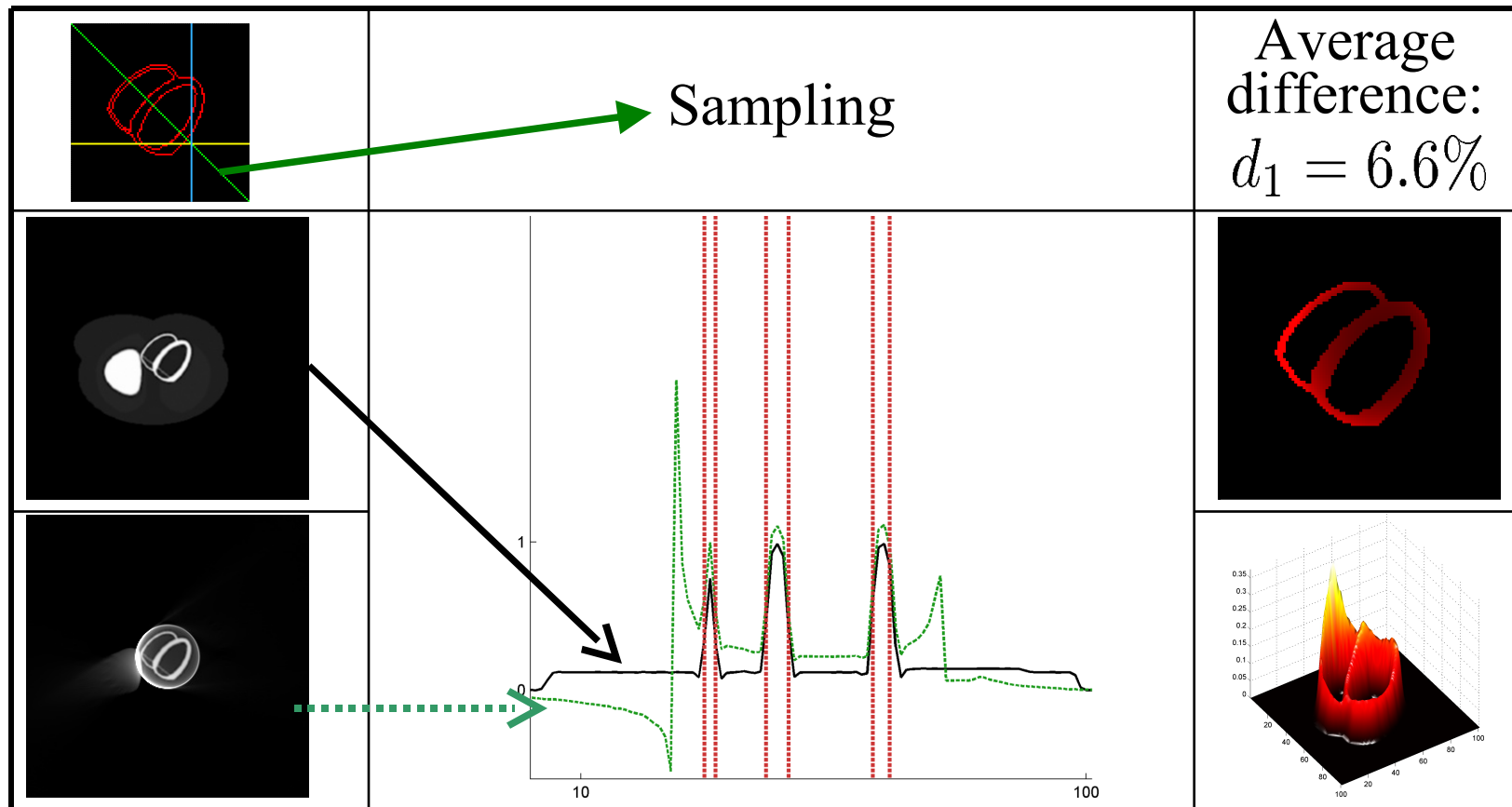**Attenuation map for 140keV photons in tissue**

0.15 /cm

Method of Simulation and Reconstruction

- **Projection and Back-Projection Method**
  - Sampling :
    - Angle span **180º**
    - Start at **45º Right Anterior Oblique**
    - 400 projections to **avoid other artifacts**
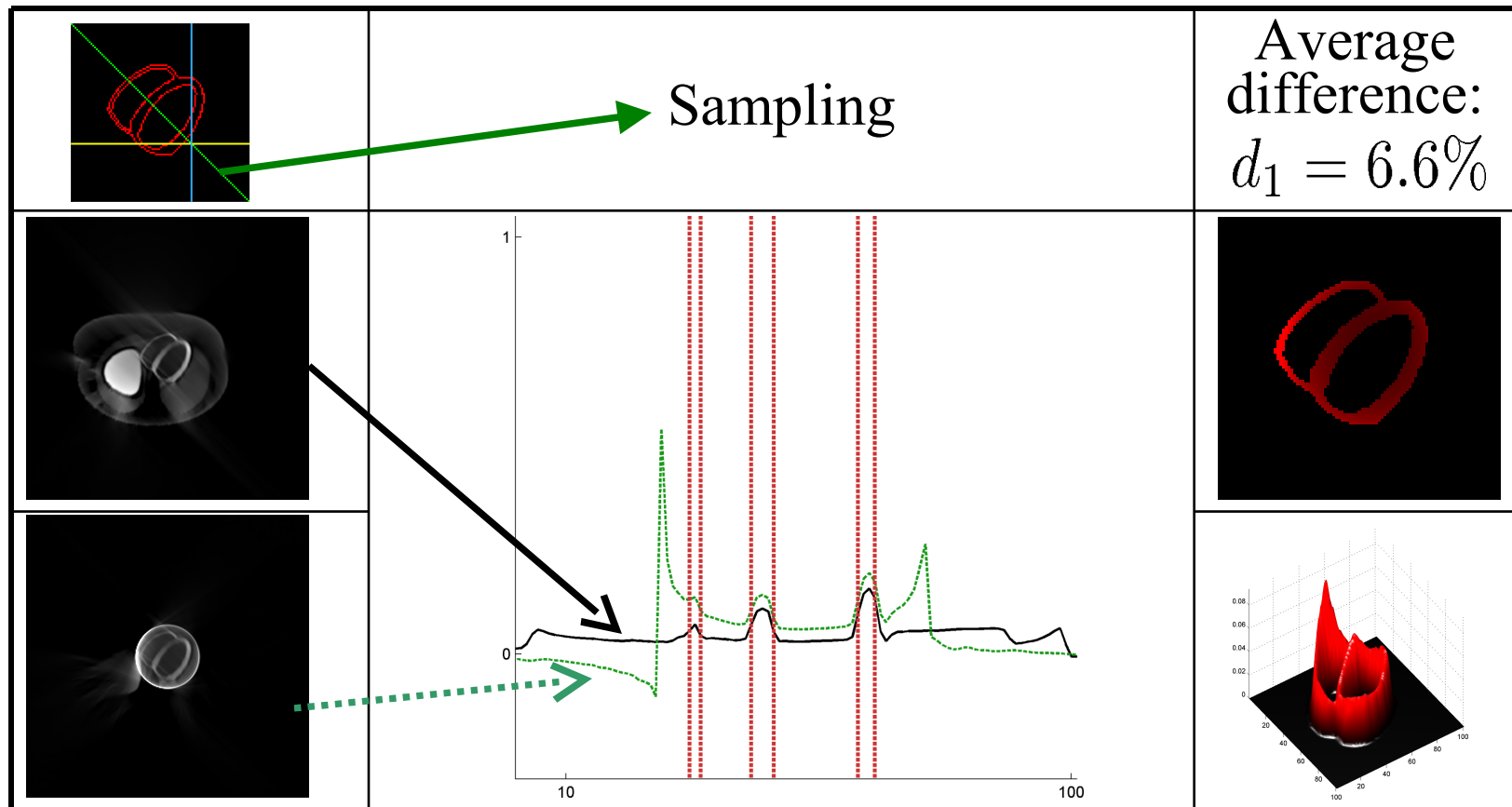   - **Filtered Back-projection** is used for the reconstruction

Effect of the Truncation

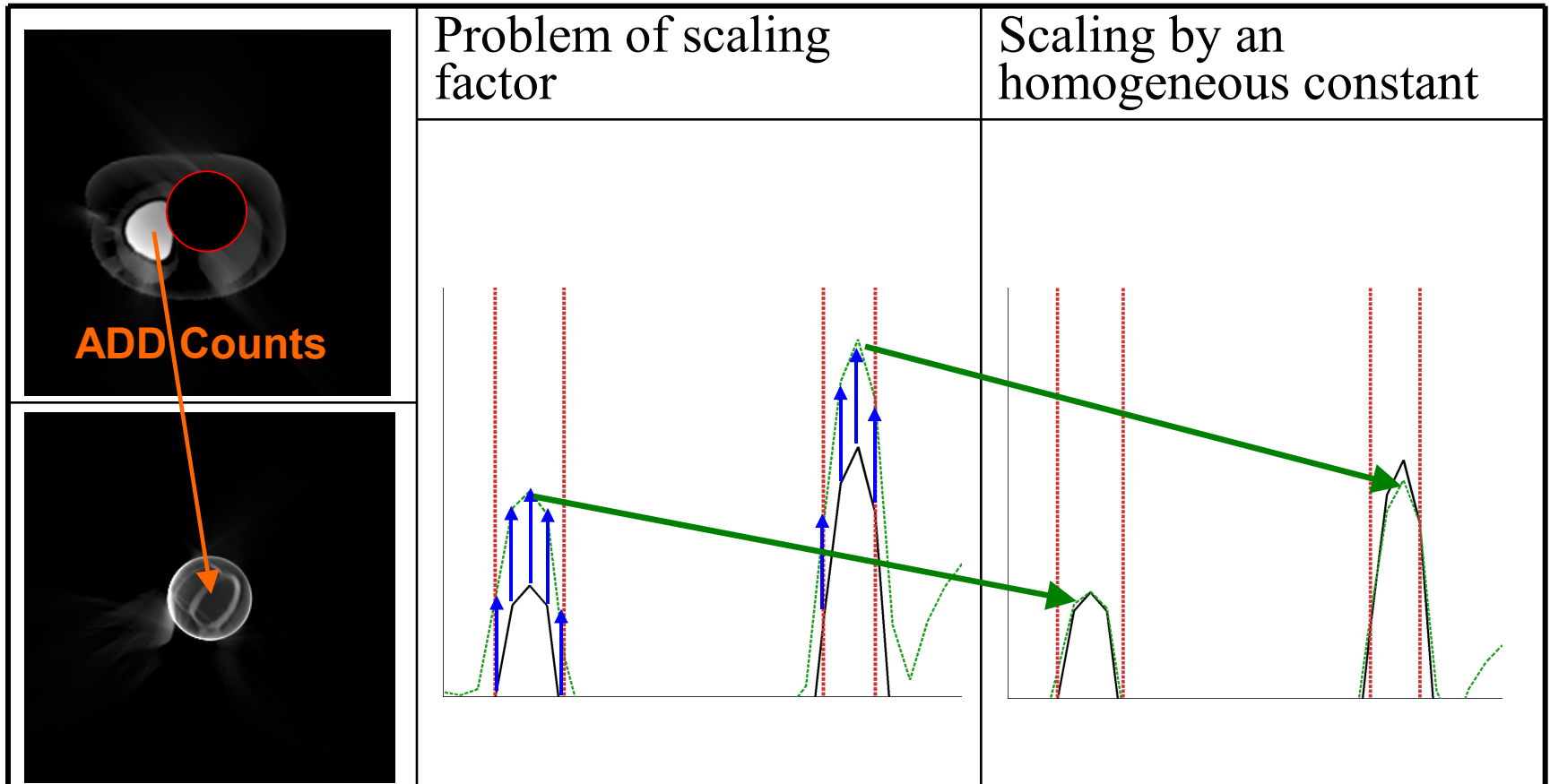- **Results <u>without</u> attenuation in the projection**

Sampling

Average difference:
$$d_1 = 6.6\%$$

Effect of the Truncation

- **Results <u>with</u> attenuation in the projection**

Sampling
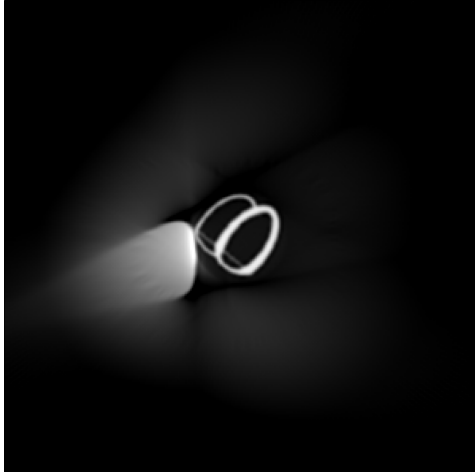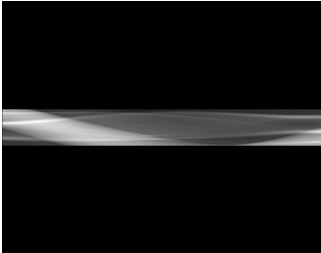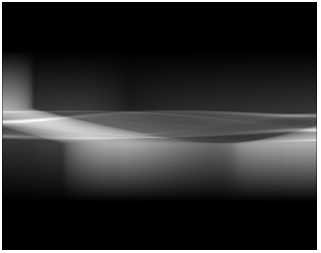
Average difference:
$$d_1 = 6.6\%$$

Effect of the Truncation

- **Truncation changes the <u>DC component</u>**

	Problem of scaling factor	Scaling by an homogeneous constant
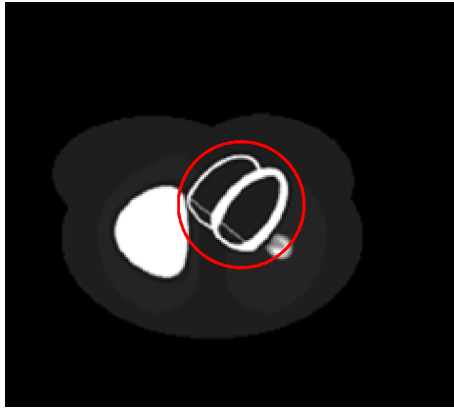
Effect of the Truncation

- **Elimination of the ring effect**

	Original Truncated data	After Sinogram interpolation
Reconstruction		
Sinogram		

Effect of the small hot spot

- ## **Placement of the structure**

Activity Map	Attenuation Map	Truncation
	Hot ball : 0.175 /cm	

Effect of the Truncation

- **Results <u>with</u> attenuation in the projection**

Sampling

Maximal difference:
$$d_{max} \leq 4\%$$

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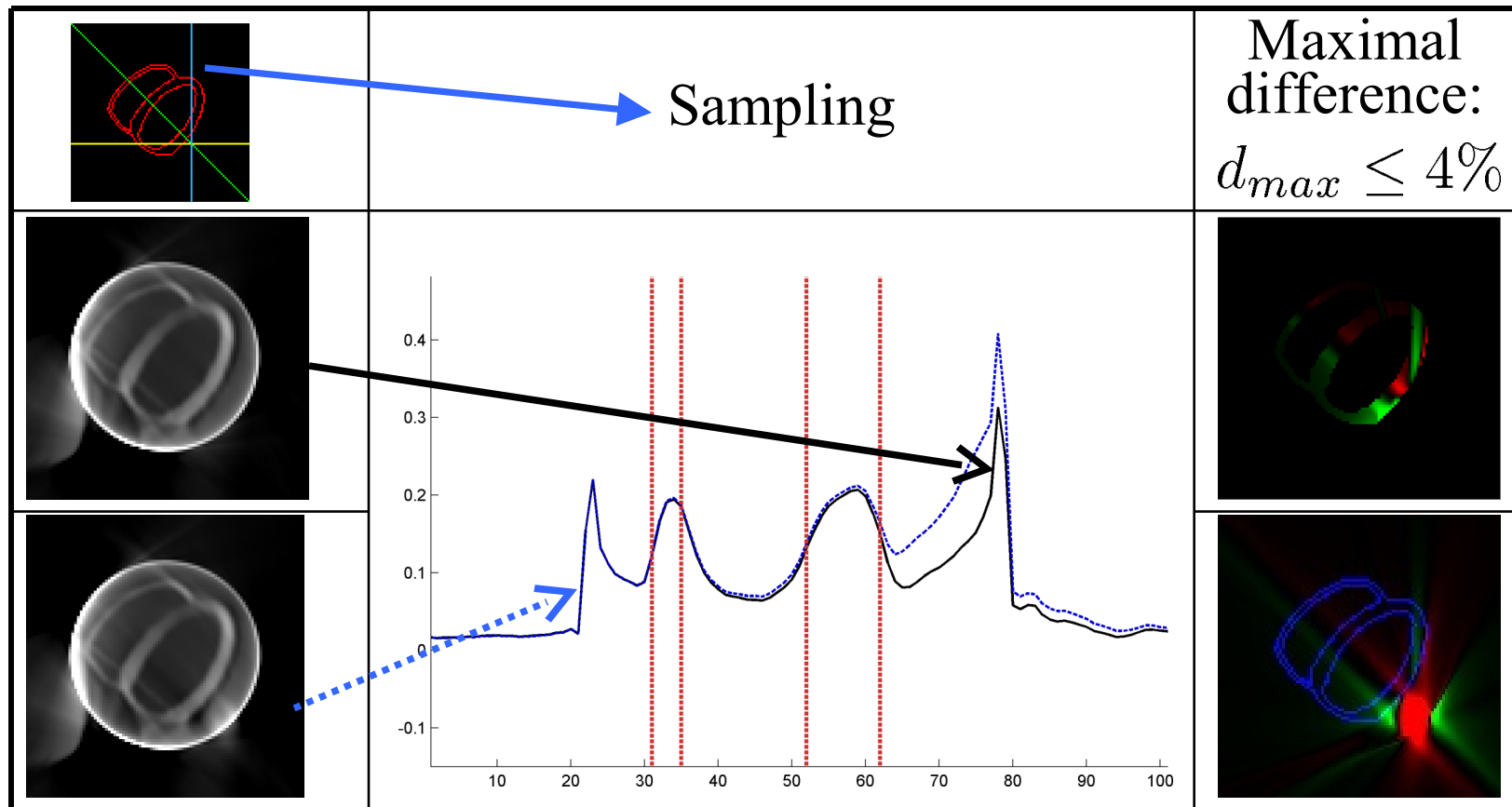
Conclusion

- **Effect of truncation and attenuation is a complex problem**
- **Artifacts caused by the truncation alone should have small impact on the diagnostic**
- **A scaling factor is the most important effect (and the ring effect can be decreased)**
- **The hot structure is not big enough to induce a problem from the truncation**