

# Reconstructions from sparse data sets

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in collaboration with



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## **Eigenor Corporation**

## **Background:**

- founded in 2004
- computational science & inversion mathematics
- owned by employees and investors

## Focus:

- scientific & mathematical software
- computed tomography solutions
- weather-radar signal processing







## Setup:

- bulky objects require a powerful X-ray machine
- we used LINAC in out measurements
- measurements take a long time to complete

## **Solution:**

- reduce the number of projections
- use advanced reconstruction technique (PSIG)



## **Reconstruction Methods**

## FDK (FBP)

- direct reconstruction technique
- restricted geometry
- light-weight computation

## SART

- algebraic reconstruction technique
- flexible geometry
- average-weight computation

## PSIG

- statistical inversion based method
- flexible geometry
- heavy-weight computation
- includes a noise model
- includes prior information



## **Statistical Inversion Method**

Noise Model:  $m = Ax + \varepsilon$ 













## **Statistical Inversion Method**

**Bayes' Theorem:** 

 $P(x|m) \sim P(m|x) P(x)$ 





#### thyratron tube





#### petrol engine

#### solid-fuel rocket







#### thyratron & detector

petrol engine



## **Results: Petrol Engine**





## **Results: Petrol Engine**





## **Results: Solid-fuel Rocket**





## **Results: Solid-fuel Rocket**





#### **PSIG gives superior starting point for automatic segmentation**





## **Summary:**

- three LINAC measurements
- three reconstruction methods: FDK, SART, PSIG
- PSIG: best results from sparse-angle data
- increased throughput of powerful X-ray machine
- joint work together with NCBJ
- CT system is commercially available



## The End

# Thank you!

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