ADEPT Cancer Imager
(ADEPT: agent-derived early photon tomography)

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Discovering unique therapies that treat an individual's cancer based on the specific genetic abnormalities of that person's tumor.
Every *part* of a cancer can be unique

**Objective:** Develop an imaging system capable of mapping cancer variability in 3D (volume)
ADEPT Cancer Imager Applications

• Clinical:
  Surgically Removed Tissue
  – Map variability to guide therapy
  – Cancer staging by 3D imaging of tumor draining lymph node

• Preclinical:
  Cancer in Live Animal
  – All cancer drugs go through animal testing
  – Ensure animal model matches human
  – Correlate variability and drug resistance
Roadmap to achieving objective

Optical imaging system capable of mapping cancer variability at the cellular level

1. Accurately measure the concentration of cancer-specific molecules

2. Sufficiently high spatial resolution in three dimensions
1. **Accuracy in measurement of cancer molecules**

**Paired-Agent Molecular Imaging**

- **Cancer Targeted Imaging Agent**
- **“Paired” Non-Targeted Imaging Agent**

**Corrected Image** Shows Location of Cancer

Tichauer et al., *Nature Medicine*, 2014
2. Sufficiently high spatial resolution

Clear Object

Laser

Scattering Object (Like Tissue)

Laser
6 Faculty, 5 Postdoctoral Fellows, 30 Graduate Students, > $1 million/yr in federal grants

ADEPT
Cancer Imager

Medical Imaging
Inverse Problems
Jovan Brankov, PhD
ECE

Molecular Imaging
Optical Engineering
Ken Tichauer, PhD
BME

Cancer Biology
Drug Development
Raju Mehta, PhD
Biology

Hardware Control
Signal Processing
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Animal Models of Cancer
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MEDICAL IMAGING RESEARCH CENTER

NAYAR PRIZE
ILLINOIS INSTITUTE OF TECHNOLOGY

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web.ilt.edu/nayar-prize
Deliverables (Year 1)

Construct, characterize and validate the ADEPT Cancer Imager

- *cellular levels of sensitivity*
- *spatial resolution of < 100 microns*
Goal: prolong survival and improve quality of life for cancer patients by:

1) Chemotherapy remains largely trial and error

- Carry out precision medicine by “fingerprinting” an individual’s cancer

2) Metastasis (the spread of cancer to other organs) is not diagnosed early enough

- Detect single cancer cells in surgically removed cancer-draining lymph nodes

3) The connection between drug resistance and cancer variability is unknown and animal models generally fail to mimic the variability of cancer in humans

- Help identify new effective drugs designed to handle disease variability