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Novel medical imaging technologies for disease diagnosis and treatment

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New clinical approaches for disease diagnosis, treatment and monitoring will rely on the ability of simultaneously obtaining anatomical, functional and biological information. Medical imaging technologies in combination with targeted contrast agents play a key role in delivering with ever increasing temporal and spatial resolution structural and functional information about conditions and pathologies in cardiology, oncology and neurology fields among others. This presentation will review the clinical motivations and physics challenges in on-going developments of new medical imaging techniques and the associated contrast agents. Examples to be discussed are:

- The enrichment of computer tomography with spectral sensitivity for the diagnosis of vulnerable sclerotic plaque.
- Time of flight positron emission tomography for improved resolution in metabolic characterization of pathologies.
- Magnetic particle imaging -a novel imaging modality based on in-vivo measurement of the local concentration of iron oxide nano-particles - for blood perfusion measurement with better sensitivity, spatial resolution and 3D real time acquisition.
- Focused ultrasound for therapy delivery.