Flexray Project Plan

Real-time Spectral X-ray CT Scanning

August 5, 2016

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Objective

Our joint ambition

develop

- Image Reconstruction techniques
- Detector technology (hardware & software)
- Adaptive scanning techniques

that jointly maximize the information obtained from a scan for a given dose level

Making the most out of each photon

From meeting d.d. April 22, 2016

Objective

Key functions of the lab

- Developing novel proof-of-concepts for combining advanced scanning and computation
- Developing hardware and algorithms for spectral CT
- Establishing and fostering collaborations with a broad range of experimental imaging groups
- Demonstrating state-of-the-art capabilities to commercial and academic partners

From meeting d.d. April 22, 2016

A phased approach

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- Phase 1
  - Realize Flexray setup @ CWI
  - Obtain first proof-of-principle results
- Phase 2
  - Perform demonstrations to show unique features of Flexray system
  - Improve performance and user experience
- Phase 3
  - leverage Flexray to establish new collaborations
  - Valorization of results

Next Steps Phase 1

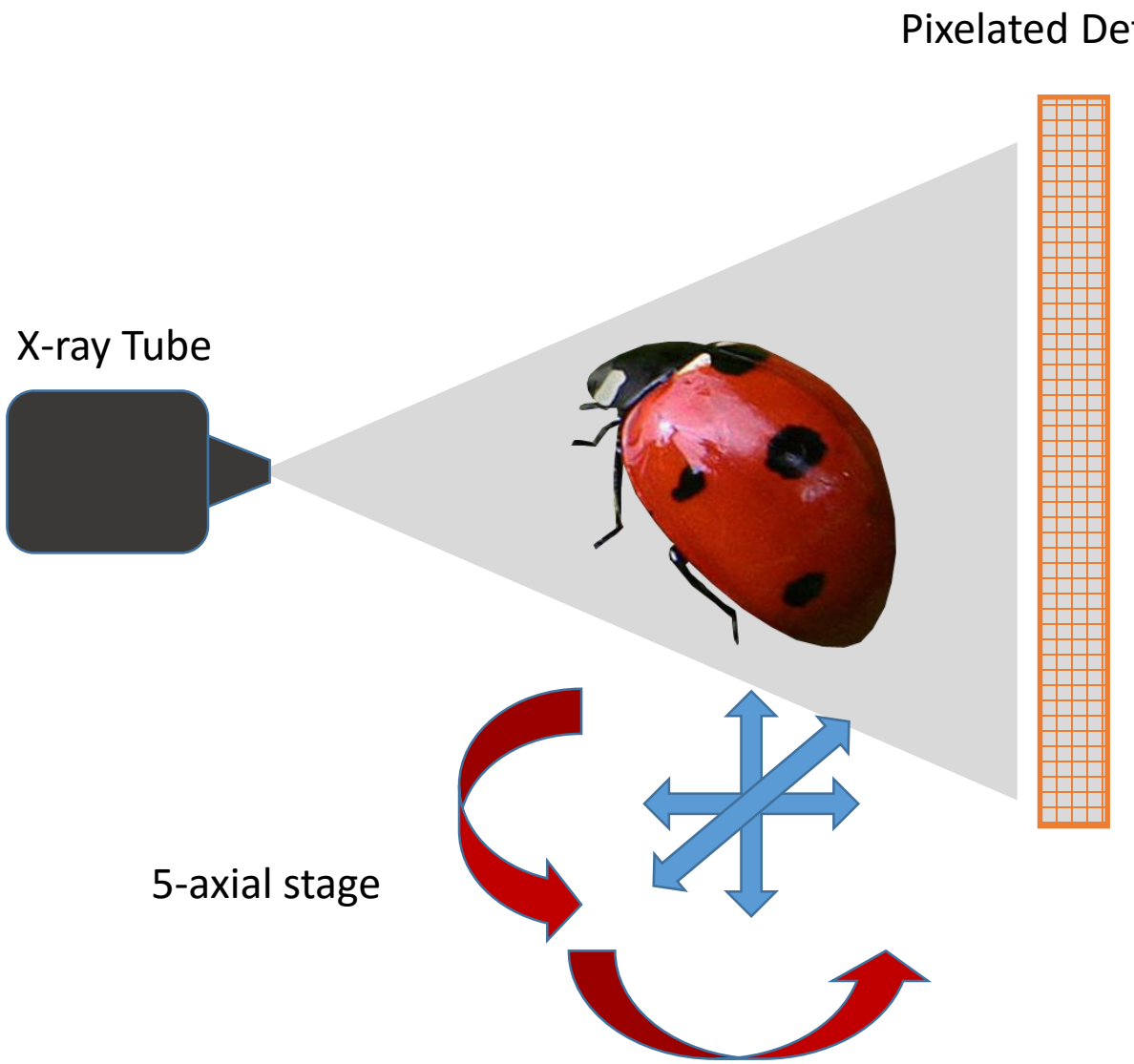
I. CT Scanning Lab @ CWI
   a) Design v1.0 by XRE (specifications)
   b) Built & test v1.0 (budget & planning)
   c) Integrate Mpx3 detector
   d) Run first measurements
   e) Grand Opening!

II. Proof-of-principle for Real-time Spectral X-ray CT Scanning
   a) First CT scans by Alex Kostenko (CWI) together with ASI
   b) Define interfaces for data handling
   c) Develop data connection between ASI/Nikhef setup & CWI CT reconstruction platform
   d) Show case of Flexray project

Basic system breakdown

- Hardware (mechanical)
- Electronics
- Software

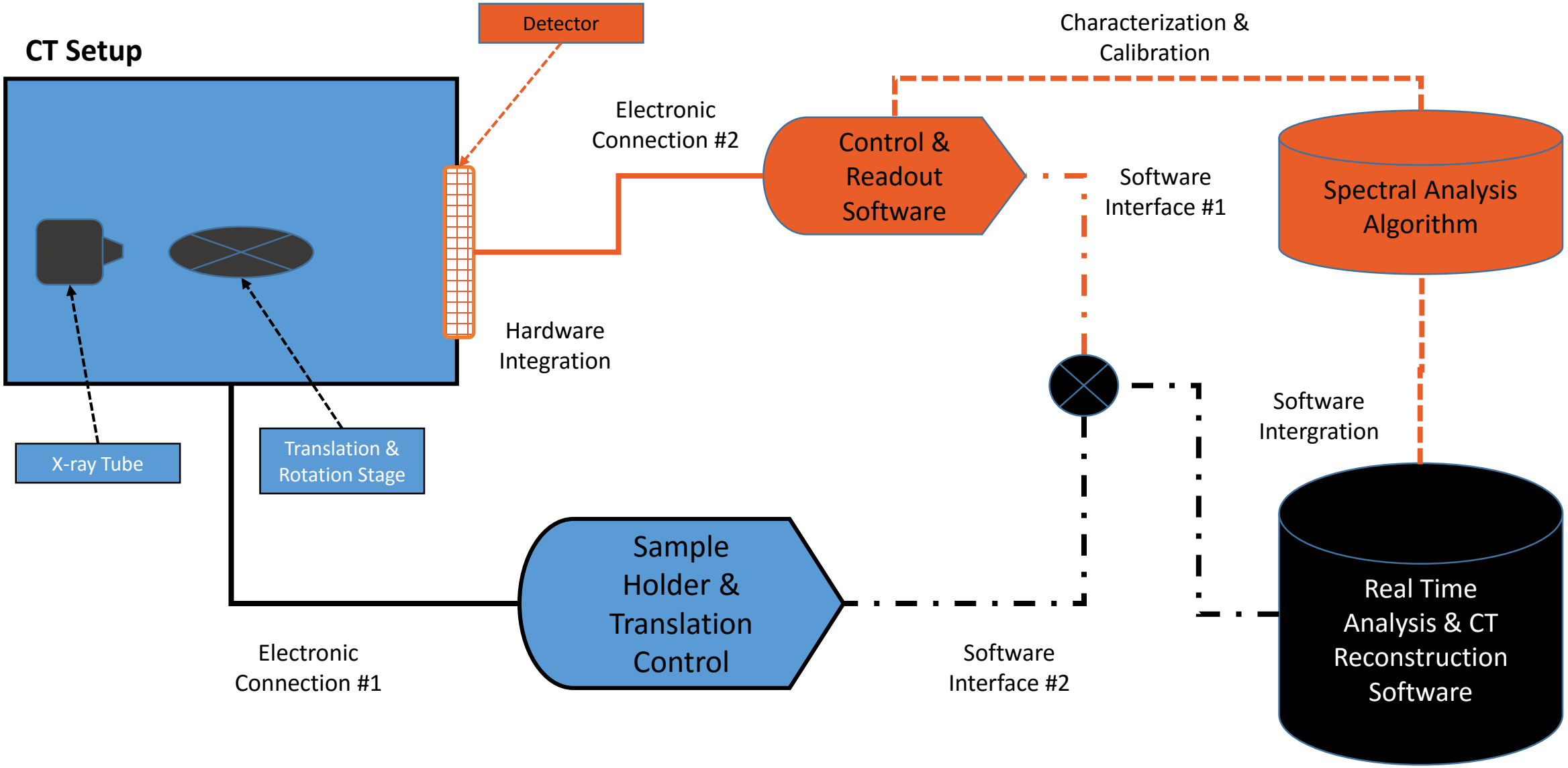
X-ray CT setup



2D Images & CT Reconstruction

Real-time & Spectral

Schematic overview



Components

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- **Hardware**
  - Radiation safe setup compliant with regulatory requirements: max energy?
  - X-ray Tube from 3rd party vendor: kVp energy & focal point?
  - Translation & Rotation Components: accuracy?
  - Flatpanel / Amorphous Silicon Pixel Detector: high speed vs large area?
  - Medipix3 Hybrid Pixelated Detector: n x 512 x 512 pixels with Silicon and GaAs/CdTe?
- **Electronics**
  - Control Electronics for tube & sample holder
  - Safety interlocks
- **Software**
  - Remote control tube & sample holder: fully automated?
  - ASI/Nikhef readout & control software platform: integration into Flexray setup
  - Develop and integrate material resolving algorithm into CWI reconstruction SW
  - Integration and optimization of Real time Spectral X-ray CT
  - End-User GUI: a single dashboard for desktop control

Roles & Responsibilities

CWI: Overall Project Mgmt & End-user

- Facility infrastructure
- Setup specifications
- Software Integration
- End-to-end test of ***integrated*** Flexray setup

XRE: Hardware Production & System Integrator

- Design & Production:
  - Design and procurement
  - Hardware Integration of “basic” X-ray setup to allow CT scans
  - Electronic Connection #1 and Software Interface #2
- System test:
  - End-to-end test of ***stand alone*** Flexray setup

Nikhef: Integration & Applications

- Support ASI on Mpx3 camera
- Electronic Connection #3 and Software Interface #3
- Standalone Spectral X-ray CT imaging (“color images”)
- Proof op principle for (medical) applications

ASI: Delivery and integration of Mpx3 Detector

- Production
  - Medipix3 camera
  - Electronic Connection #3 and Software Interface #3
- System test:
  - Standalone Spectral X-ray CT imaging (“color images”)
  - Detector integration with Flexray setup

Preliminary (ambitious) Schedule Phase 1

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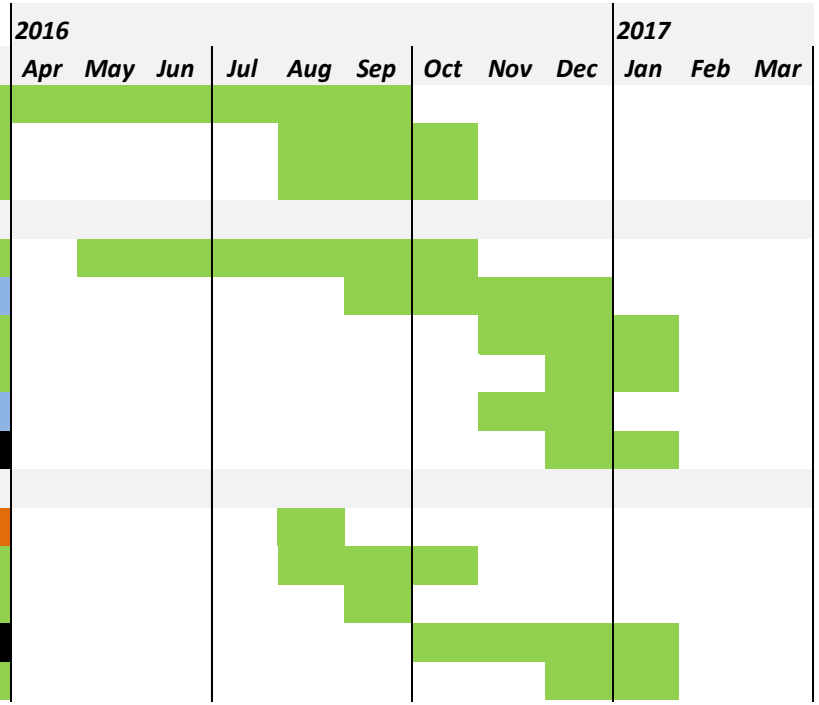
8-Aug-16

Flexray Project Planning (v1)

WP	Task	Description	Lead	Support
WP1		**Scoping**		
	T 1.1	High level planning	Consortium	
	T 1.2	Collaboration LOI/NDA/Agreement		
	T 1.3	Flexray setup specifications		
WP2		**Flexray X-ray CT System Design & Built**		
	T 2.1	Flexray Setup design	XRE	Cons
	T 2.2	Procurement	XRE	XRE
	T 2.3	Built & test hardware	XRE	Cons
	T 2.4	First Measurements with Flatpanel	XRE	Cons
	T 2.5	Integrate Mpx3	ASI	XRE
	T 2.6	First Measurements with Mpx3	ASI	Nikhef
WP3		**Integration DAQ with Reconstruction Platform**		
	T 3.1	First measurements at ASI setup	CWI	ASI
	T 3.2	Define SW Interfaces between DAQ & Recon Platform	CWI	Cons
	T 3.3	Agree on planning for software integration	Cons	Cons
	T 3.4	Integrate with CWI DAQ & Reconstruction platform	CWI	Nikhef
	T 3.5	Proof of Principle Measurements with Flexray Setup	Cons	Cons



Phase 2 – Q1 & Q2 2017

Perform demonstrations & improve performance and user experience to show unique features of Flexray system.