FP420 Tracking Stations
CERN Meeting
Mar 2006

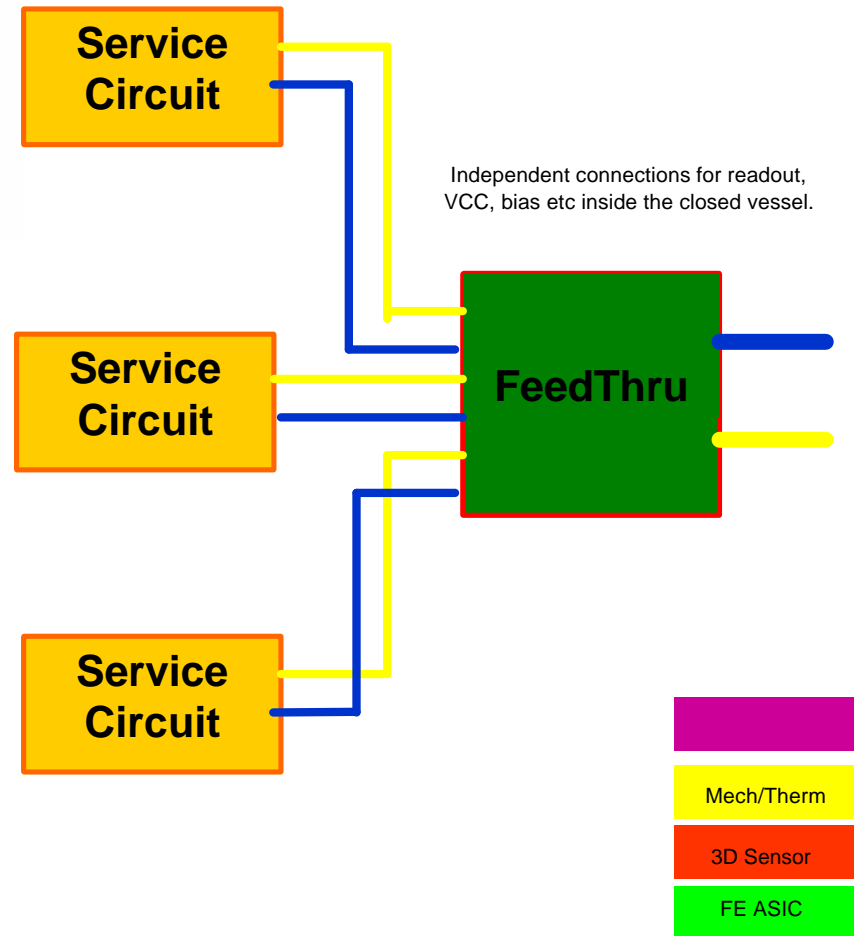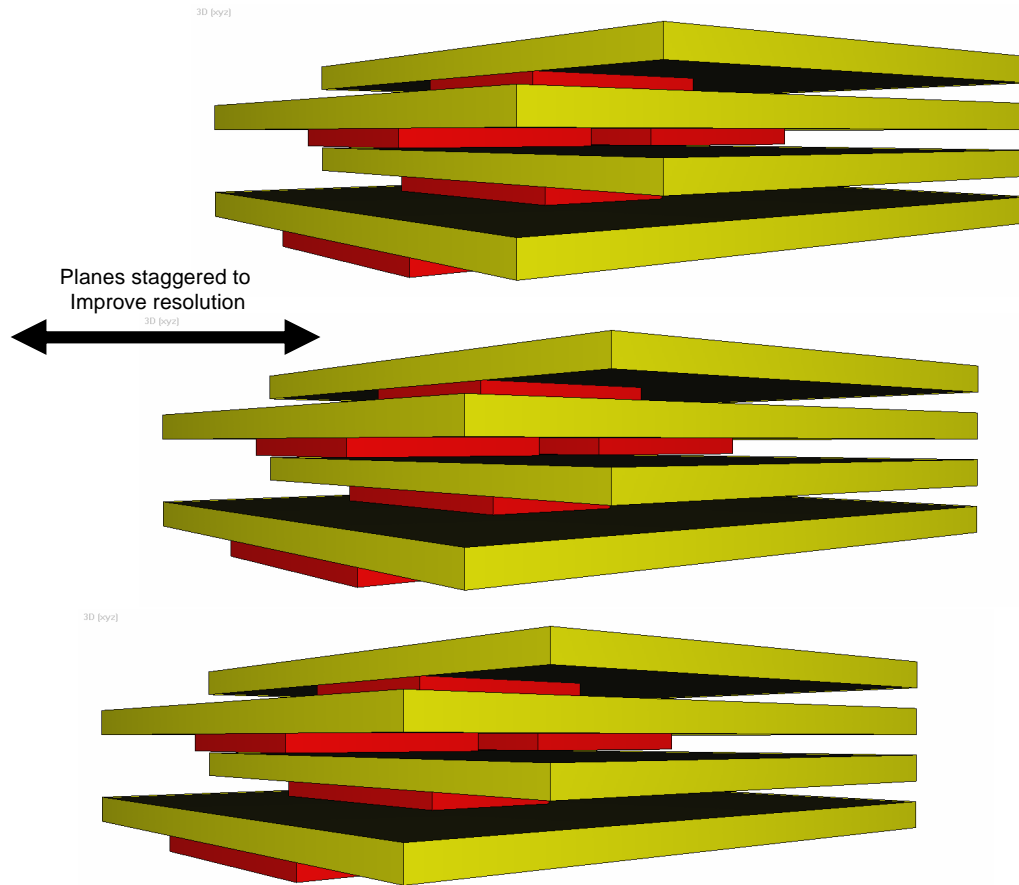# Overview

3D [xyz]

Tunnel | IP

In-Tunnel
Infrastructure

Detector Blade

Detector Hub

Feedthrough
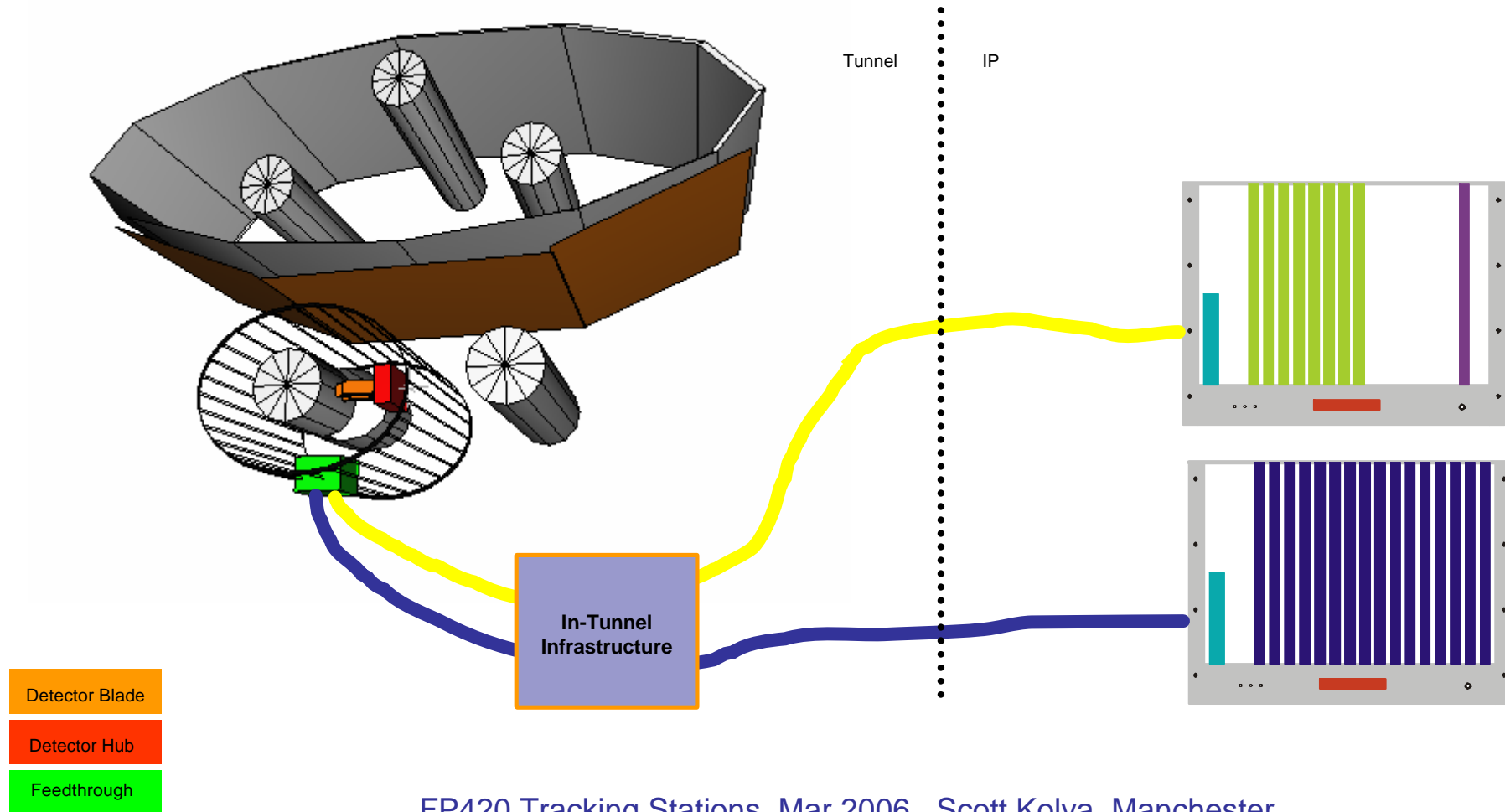
Breakdown of responsibilities for tracking detectors….

Mech Control

Etc.

LV

HV

Slow Control

Turin & Louvain
+ Henning Larsen
(rad hard LV supplies
for Alice)

Detector

Detector

Detector

Patch Panel

Opto Board

Brunel & Manchester +MSSL (UCL)
(0.25 SY Engineering Effort)

For CMS

Antwerp

For Atlas and testbeam

Manchester
+ UCL, CAMBRIDGE
(ATLAS SCT Readout/Trigger)

Back of Crate Card

Front Card

ROD

TX

RX

SLink

T2 Buffer/ROS
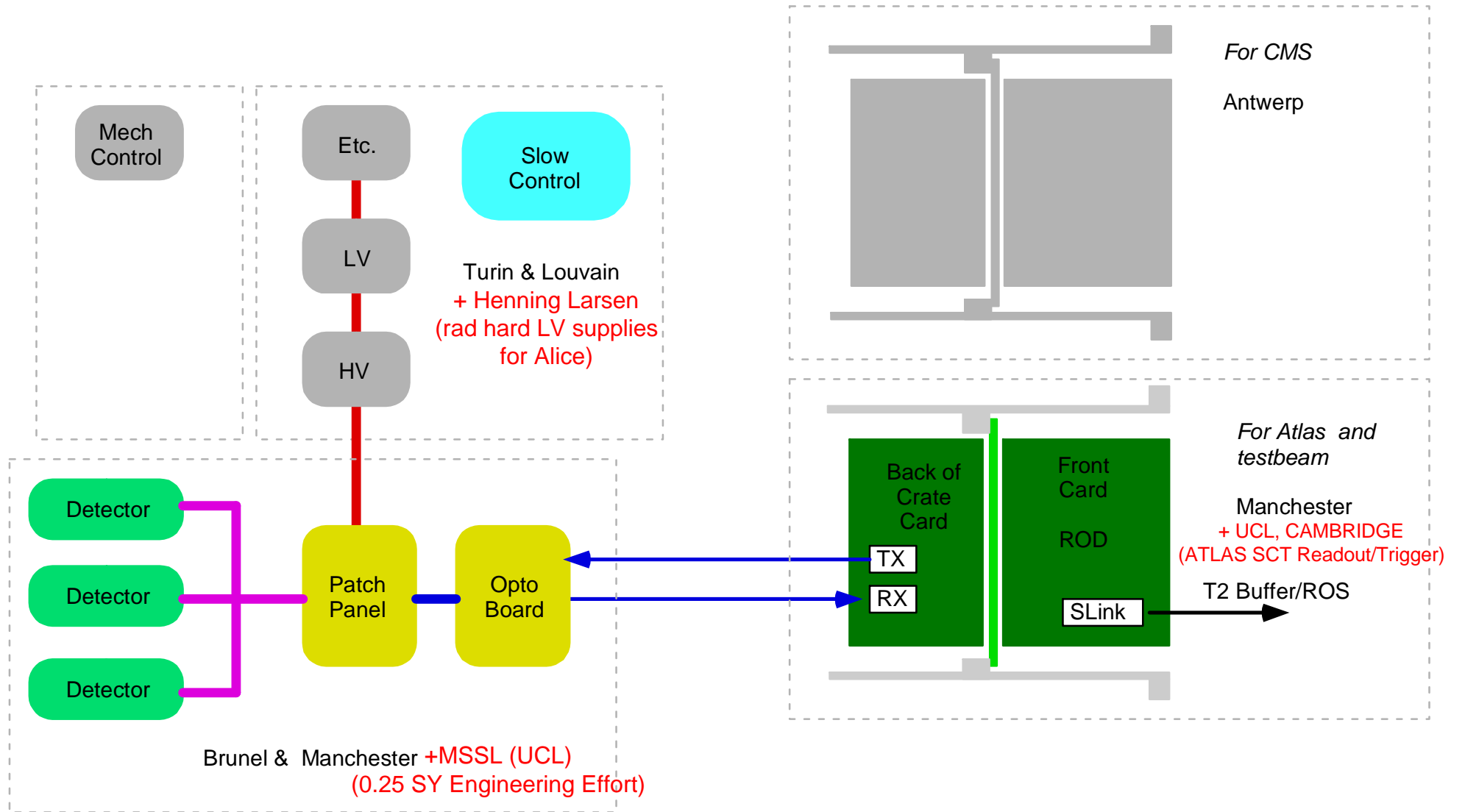
Detector Station built from a number of superlayers

Planes staggered to
Improve resolution

Service Circuit

Service Circuit

Service Circuit

FeedThru

Independent connections for readout,
VCC, bias etc inside the closed vessel.

Mech/Therm

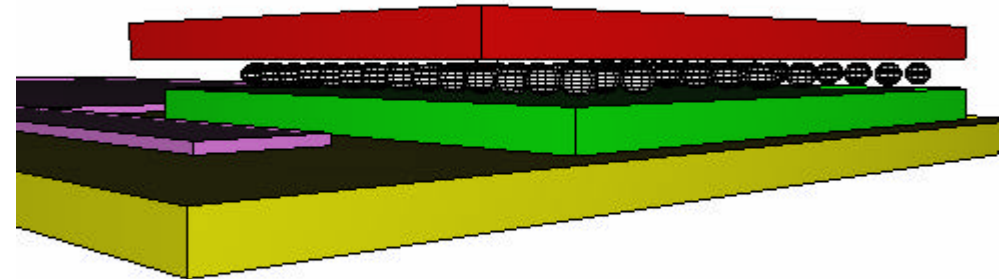3D Sensor

FE ASIC

Detector Blades (example)

3-D sensor bump bonded to FE ASIC. FE ASIC bonded to support (ceramic, carbon-carbon, etc) that provides heat path. Electrical connections wire bonded to eg Kapton/Polyimide flexible loom.

3D [xyz]
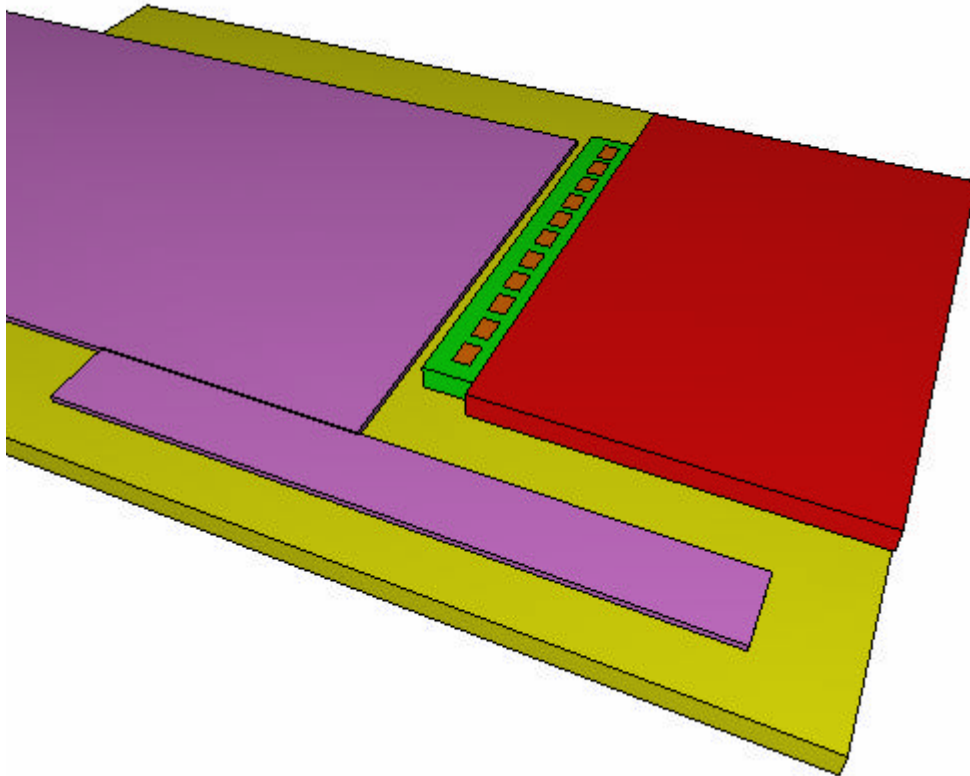
3D [xyz]

|	
Kapton	
Mech/Therm	
3D Sensor	
FE ASIC	

Detector 'Superlayer', the basic building block

Two (logical) layers, both orientations. Superlayers share upstream control ASIC and other connections.

Usually about 6mm of material per superlayer (worst case may be ~10mm) Depth 12mm
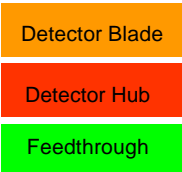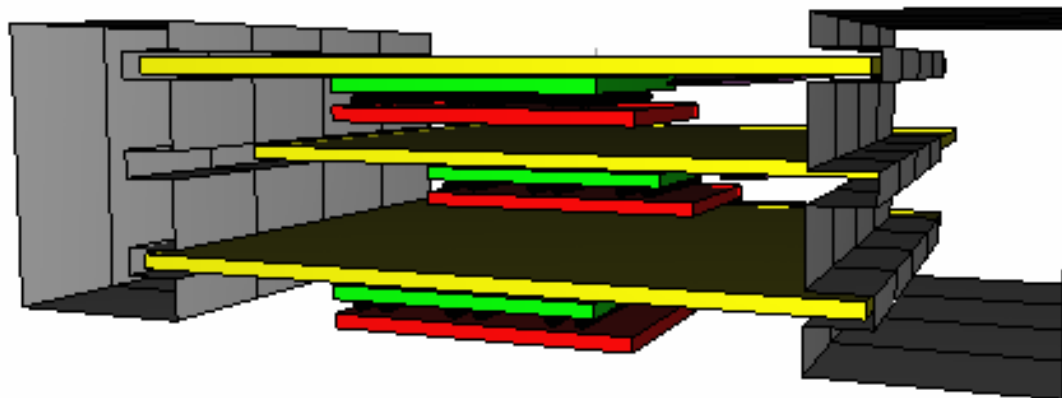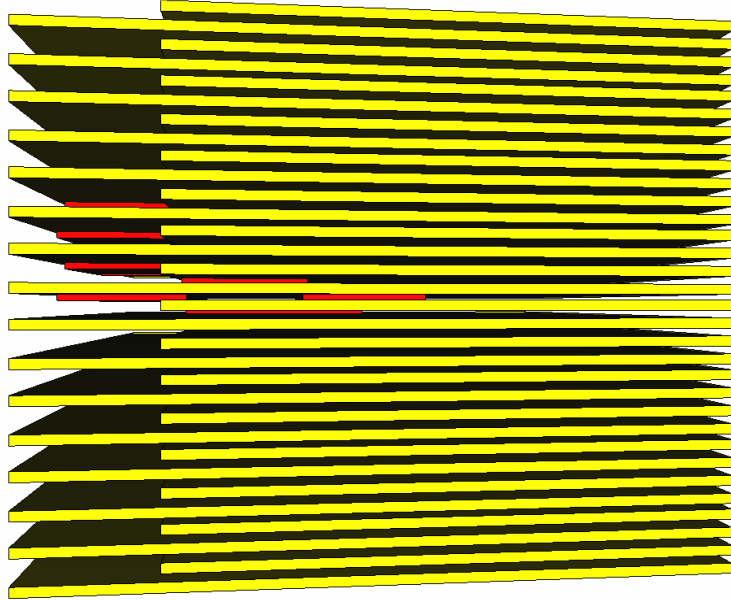Power - typically less than ~5W

3D [xyz]

Kapton

Mech/Therm

3D Sensor

FE ASIC

3D [xyz]

Detector Blade	
Detector Hub	
Feedthrough	
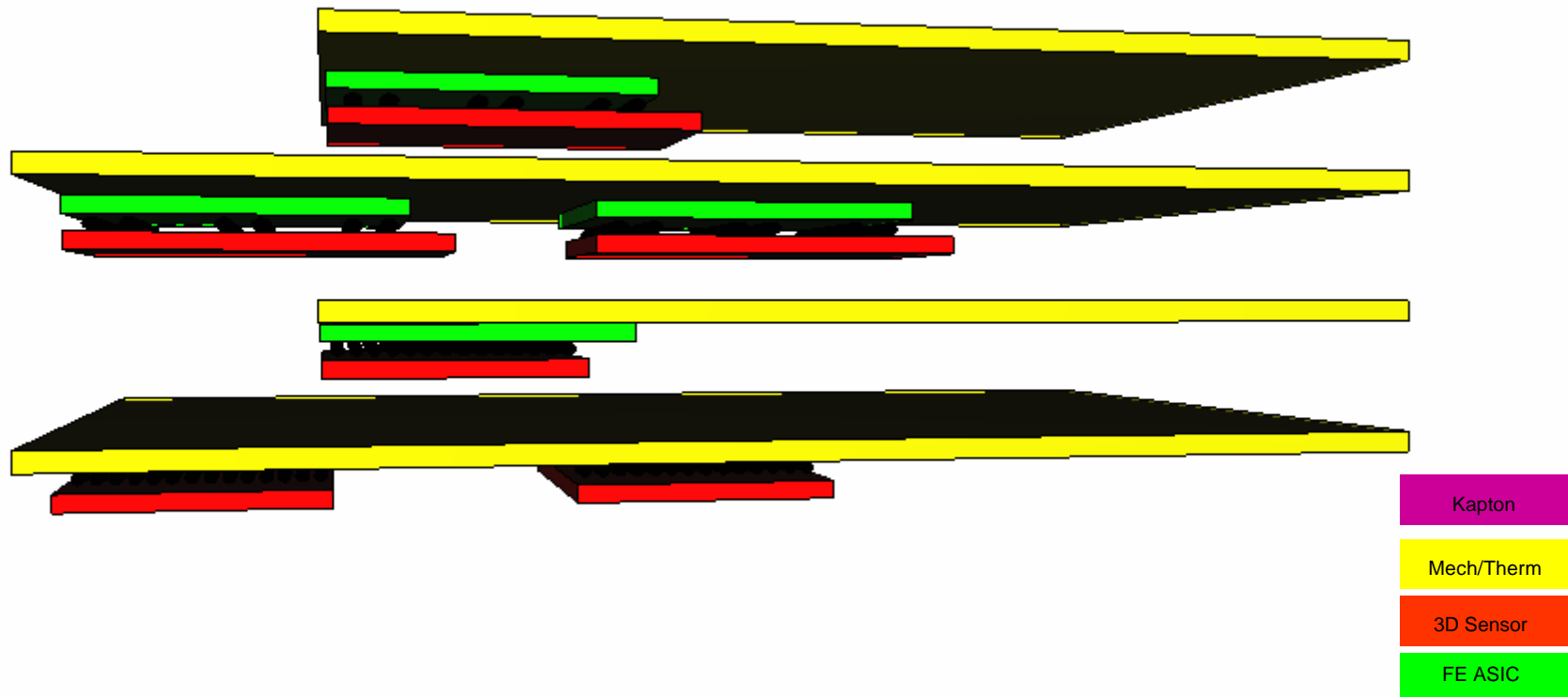
Detector Station (example) … stack of superlayers

3D [xyz]

	Depth	Material	Power
5 Superlayers 10 layers 20 blades	~60mm	30-50 mm	~25W
6 Superlayers 12 layers 24 blades	~72mm	36-60 mm	~30W
8 Superlayers 16 layers 32 blades	~96mm	48-80 mm	~40W

Resources…

✍ Funding:

As part of the UK bid to the PPRP we requested resources to develop the design of the tracking detector station, under 'Work Package 3'. The budget was 225K (15K Travel, 75K equipment, 2.5SY). This is/will be approved.
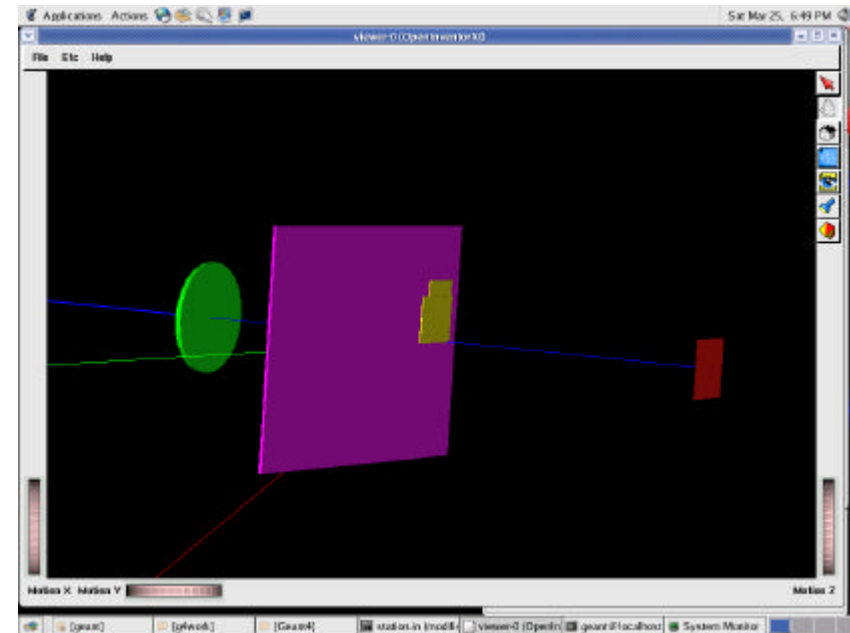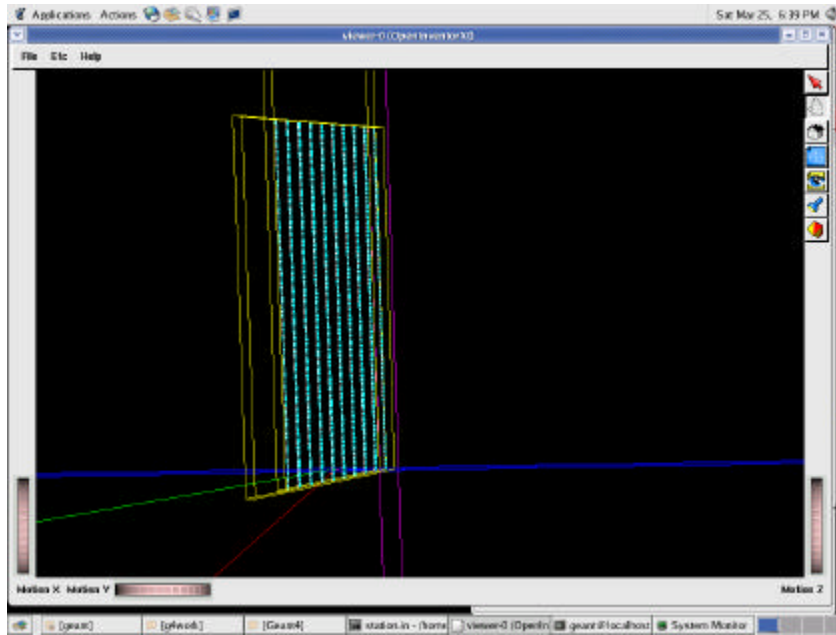
We are working up to placing orders for readout infrastructure and a wedge bonder. (Advice most welcome).

Modelling….

? **Geant for material/design studies:**
We want to have some local ability to work through consequences of material/layout choices.

? **Thermal Modelling:**
This is critical, thermal stresses determine mechanical accuracy, detector handling, etc.
We have experience at Manchester with FlexPDE (Atlas Silicon modelling)
We may want to use ANSYS with our default Mechanical CAD, AutoDesk Designer Pro
May consider buying I-DEAS for compatability with MSSL
MSSL are well placed to work on the thermal modelling.

Plans….

Electrical Prototype

Mechanical/Thermal Prototype

Full Prototype

Summer (end!)

XMAS
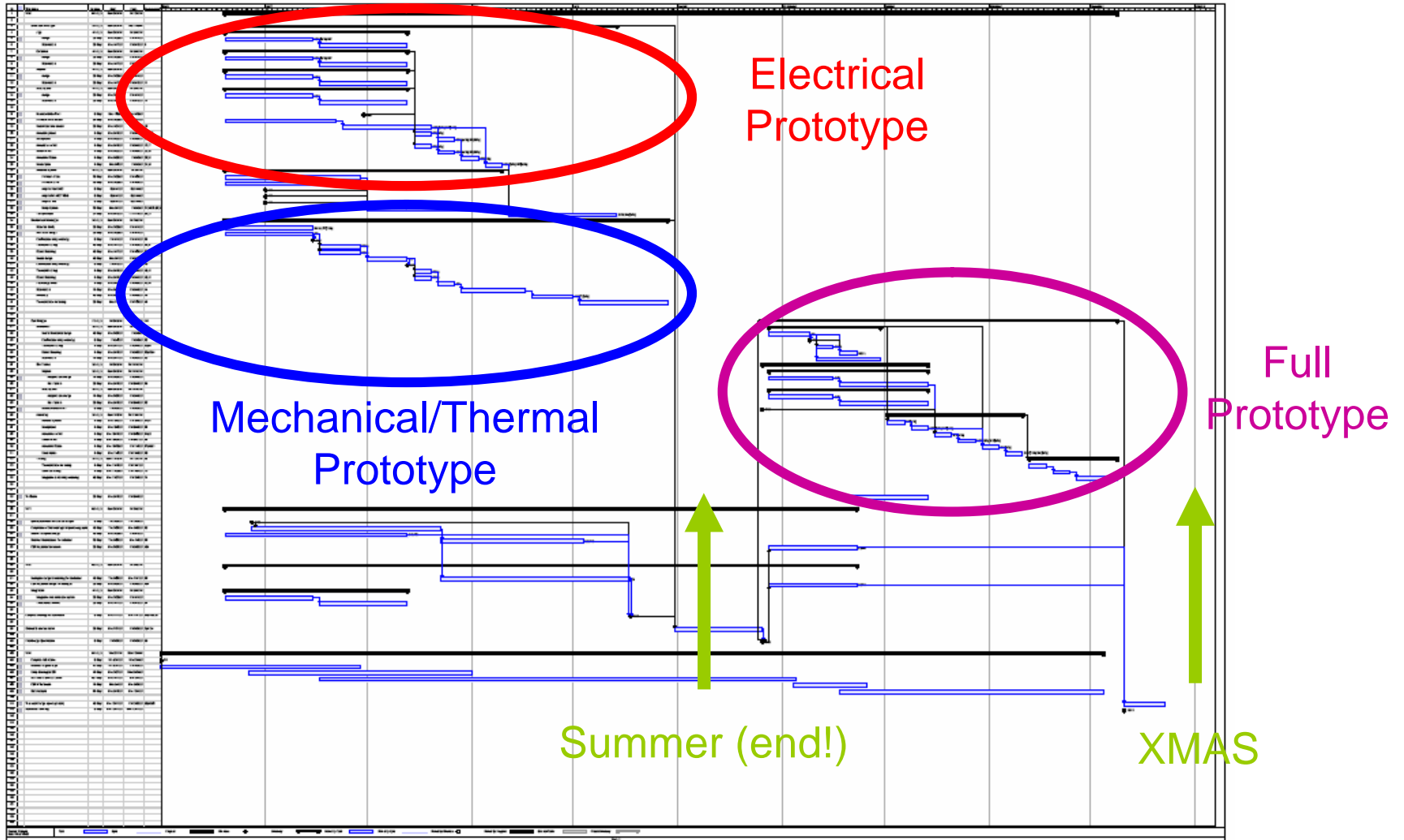
Milestones….

- **LABS** (Apr)
  The Manchester HEP group has had it's office and lab space refurbished at a cost of 1.3 Million. Being handed over now, 'finished' date not certain, but 'soon'.

- **Fix the sensor design** (Apr)
  This has a major impact on the design of the detector station.
  Hope to fix this at a workshop at Stanford in April.

- **Obtain samples of bonded sensors** (Apr)

- **Establish a readout testbench** (May)

- **Commission bonding station** (by June)

- **Develop/Test Electrical prototype** (Sept)

- **Develop/Test Mechanical Prototype** (Sept)

- **Testbeam** (Sept)
  No reason why we shouldn't test the electrical prototype if ready

- **Final design constraints specified** (Sept)

- **Final Prototype** (Dec)