ILC Vertex Detector Mechanical Studies

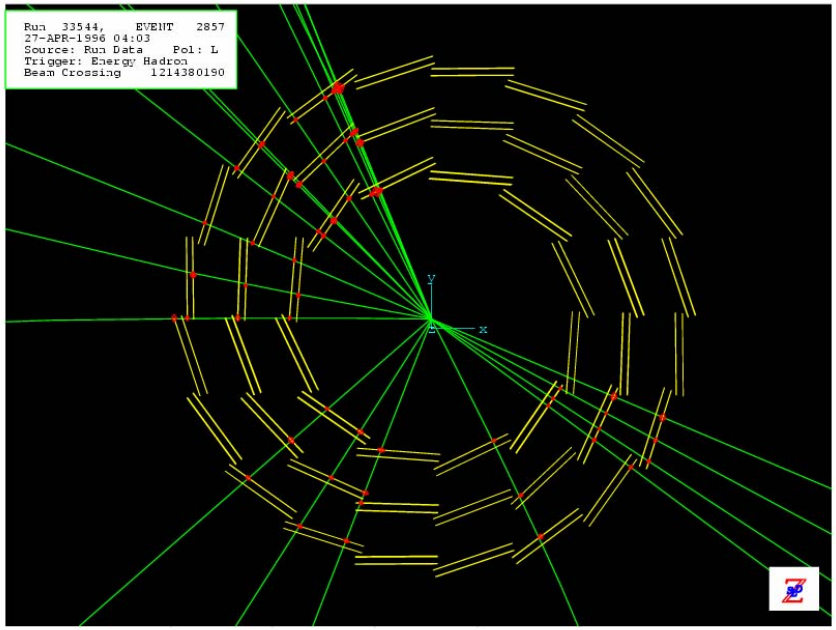
Erik Johnson
On behalf of the LCFI collaboration
STFC, Rutherford Appleton Laboratory

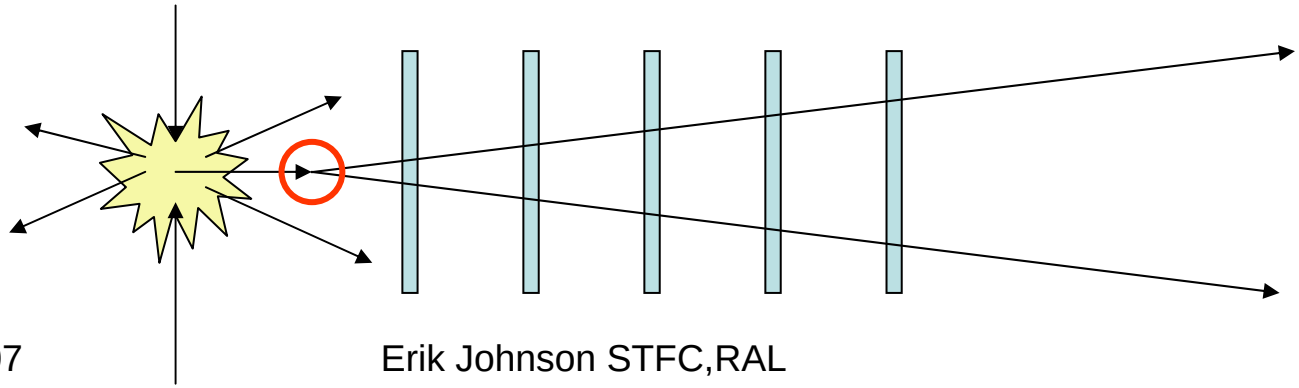
Outline

- Approaches to building a vertex detector
- Resource available
- Future plans

Approach for Building a Vertex Detector

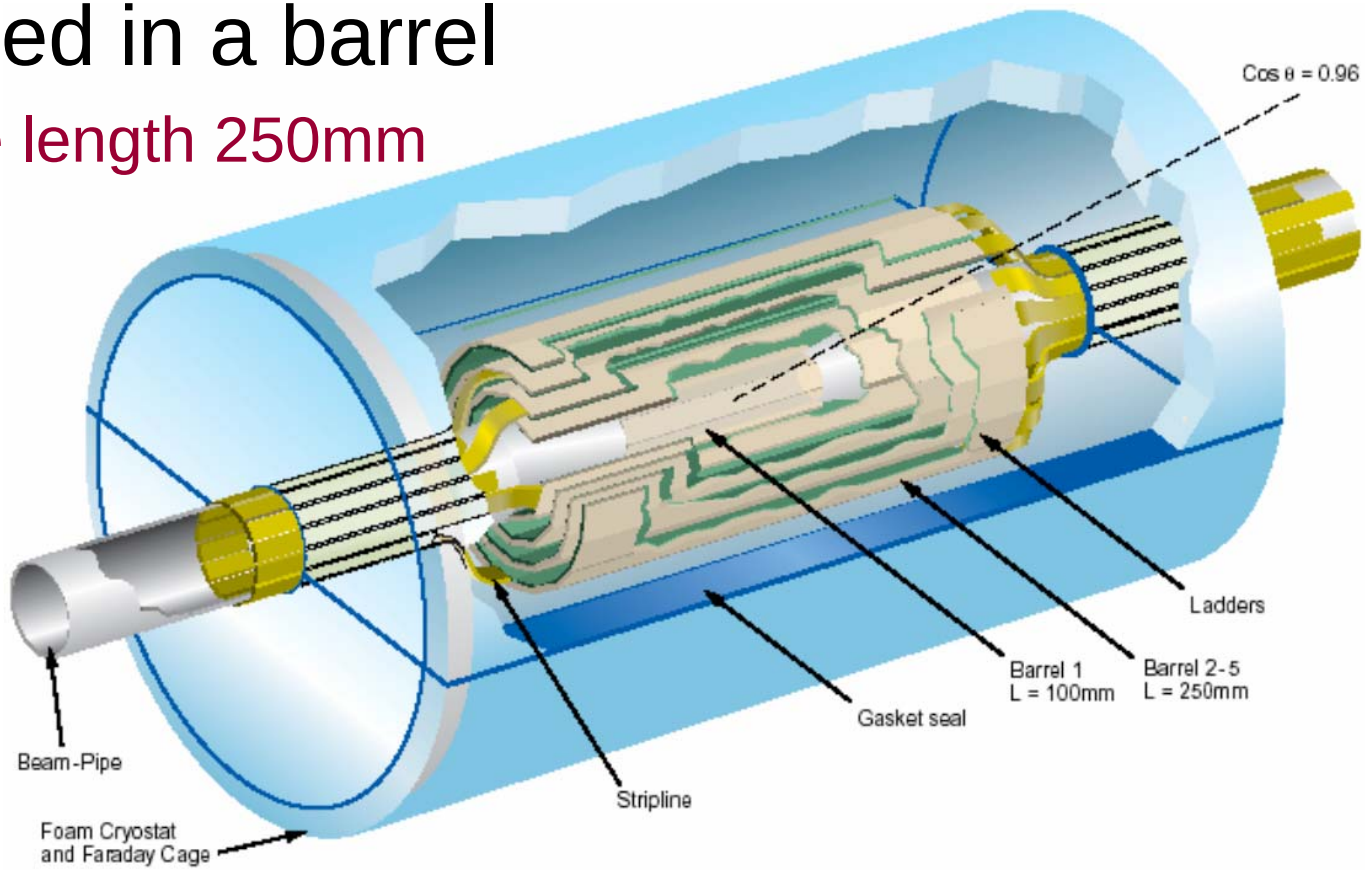
- Close to interaction point
- Long lever arm
- Low mass
  - cooling
- Robust
- Uniformity within a layer



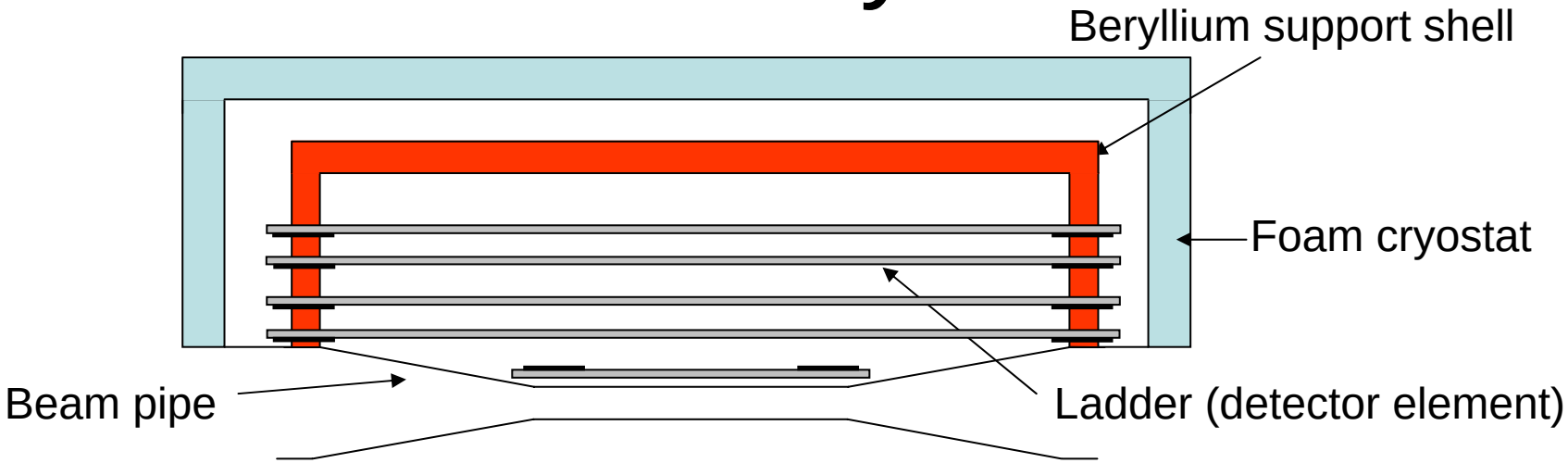


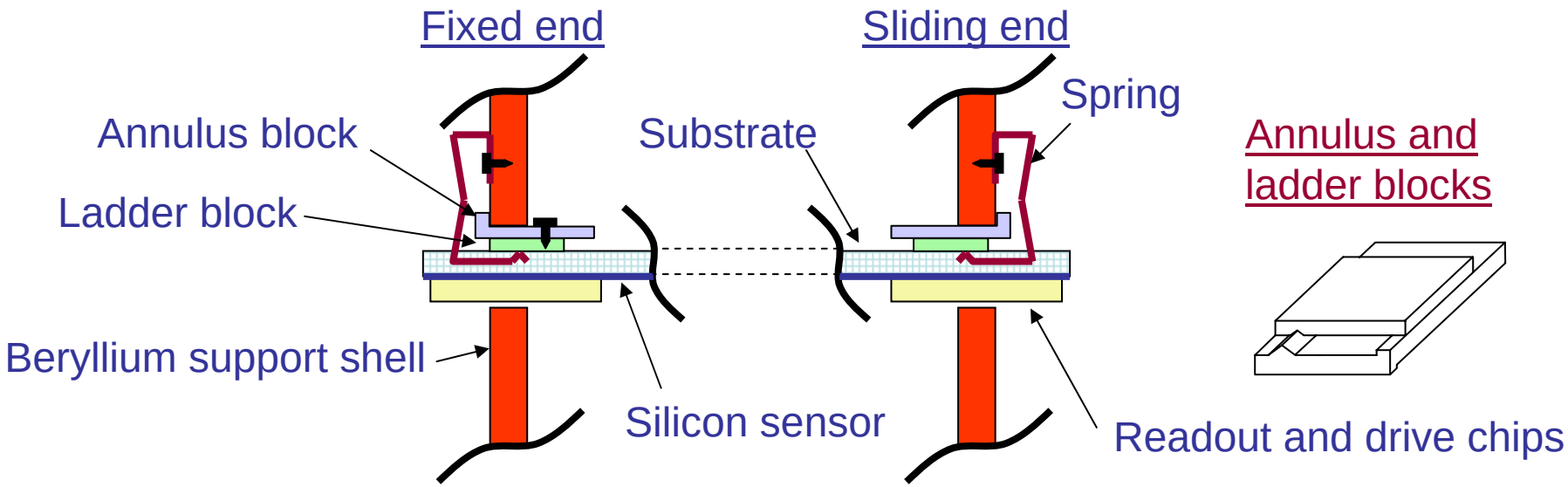
LCFI Baseline Design

- Individual long ladders
- Arranged in a barrel
  - Active length 250mm



Barrel Layout

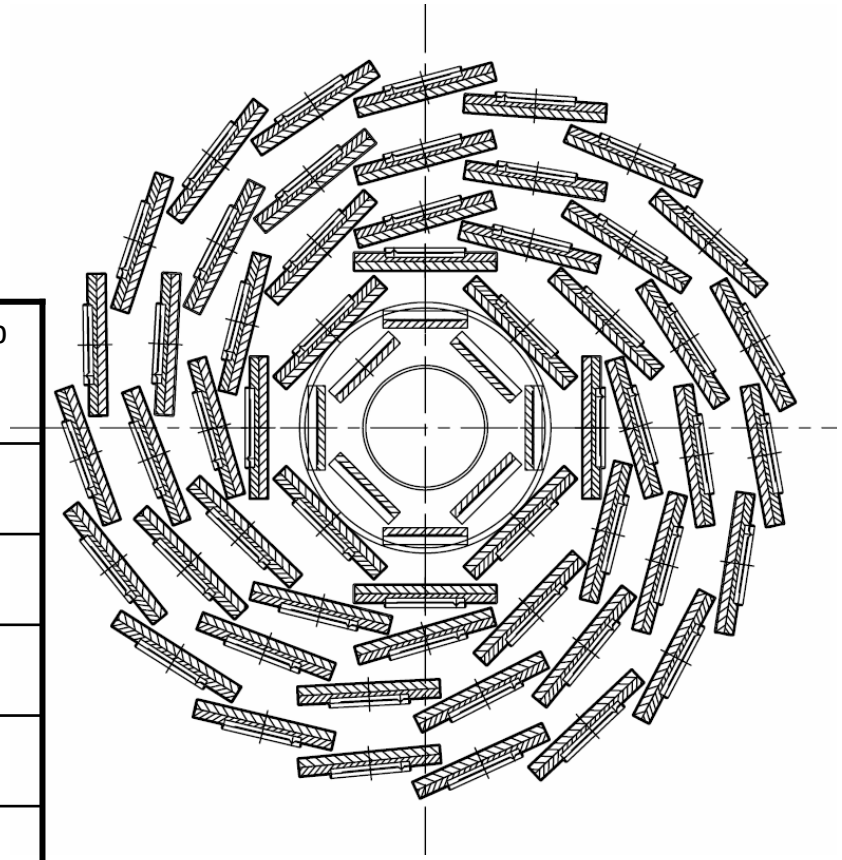




Barrel Layout

- Looking at:
  - the radius of the layers
  - width of elements
  - tilt angle

Layer no	No of Ladders	Radius (mm)	Active length (mm)	Active width (mm)	Tilt angle	Overlap (mm)
1	8	15(19)	100	13	0	0
2	8	26(28.5)	250	22	0	0.42
3	12	37	250	22	15	1.3
4	15	48	250	22	15	0.86
5	19	60	250	22	15	1.2

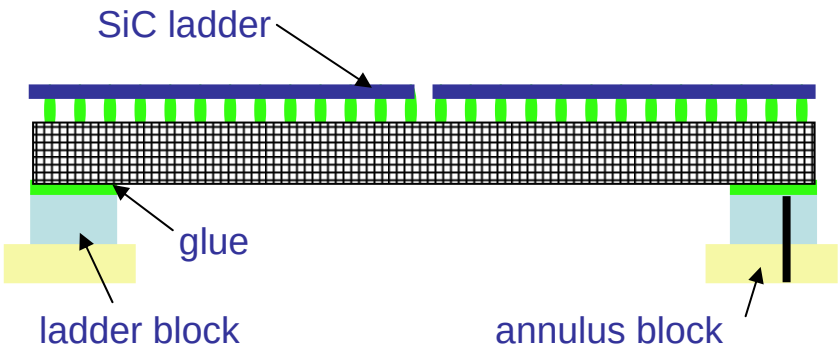


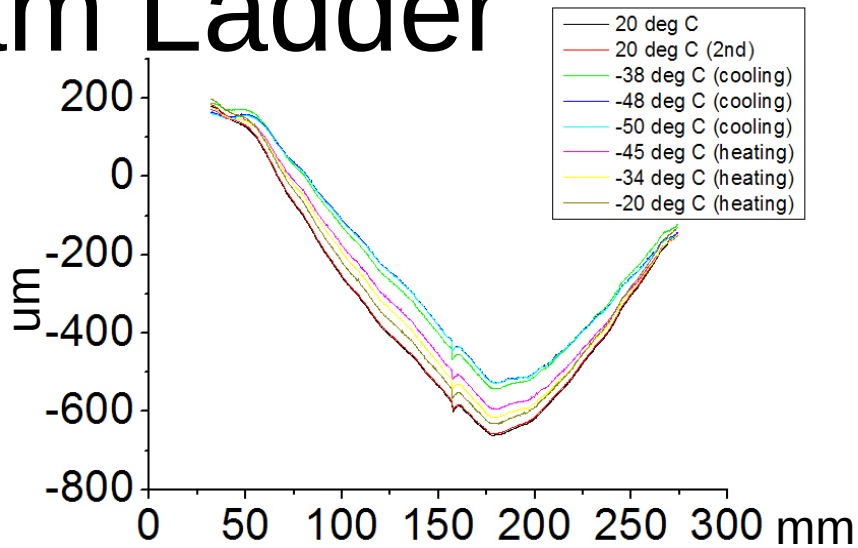
Ladder Developments

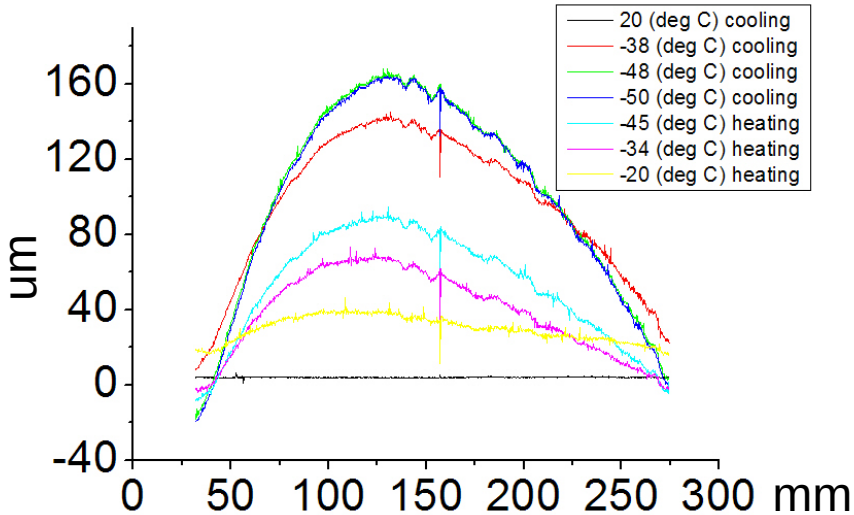
- Foams – + low mass
  - take up space
- Prototypes of ladders
  - SiC (silicon carbide foam)
  - RVC (reticulated vitreous carbon foam)
- Some success with both
- Problems with procuring thin silicon
- Have new supplier of thin silicon – Aptek Industries Inc

SiC Foam Ladder

- 20 um thick silicon
- 1.5 mm thick SiC foam
  - 8% relative density
- Silicone adhesive pads
  - 1mm diameter 200 microns high on ~5mm pitch
- ~0.14% X_0

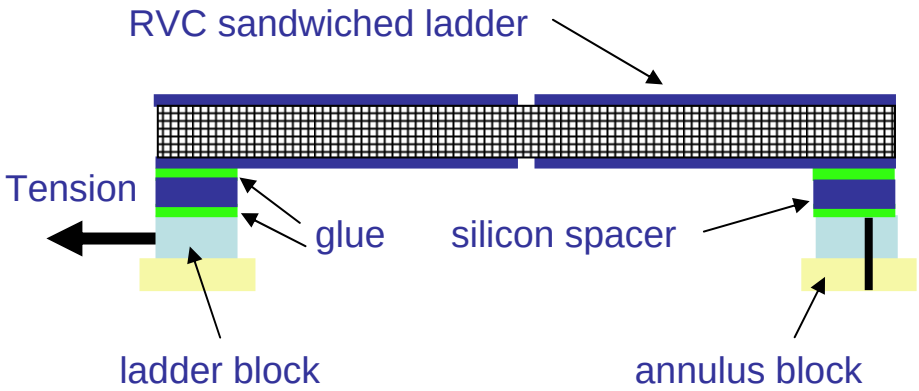


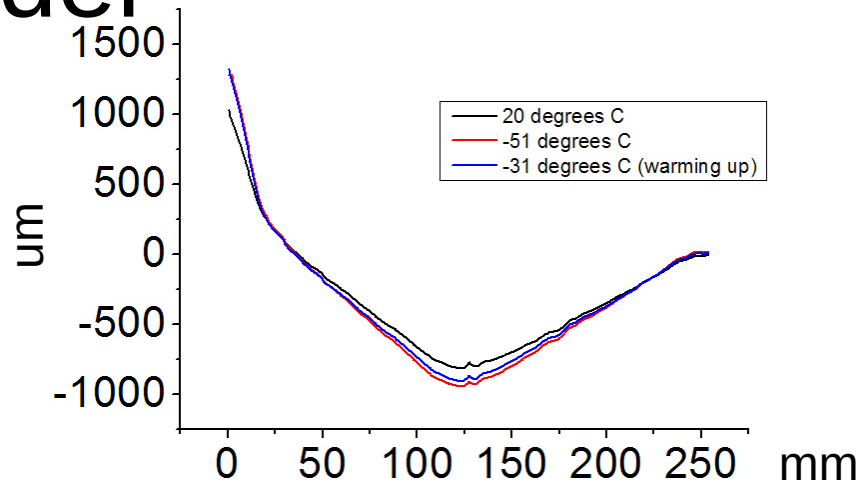


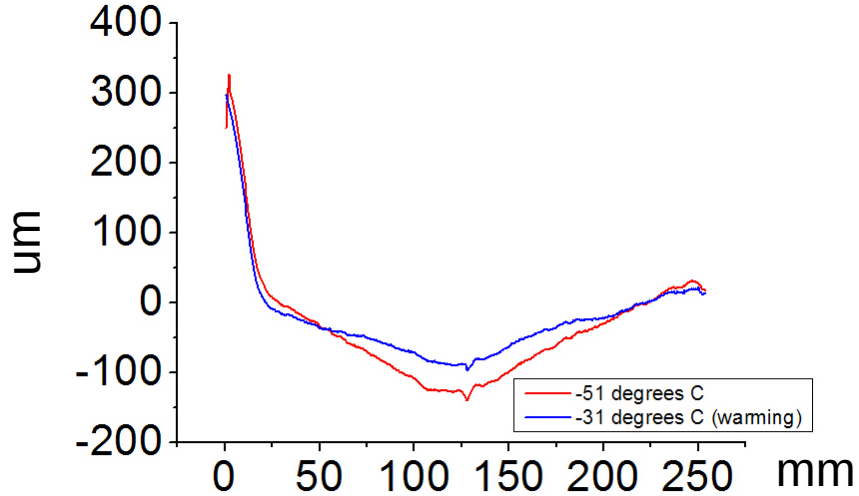


RVC Foam/Silicon Sandwich Ladder

- 20 micron thick silicon
- 1.5 mm thick RVC foam
  - 3% relative density
- Silicone adhesive pads
  - on ~5mm pitch
- Tension ~1.5 N
- ~0.08% X_0

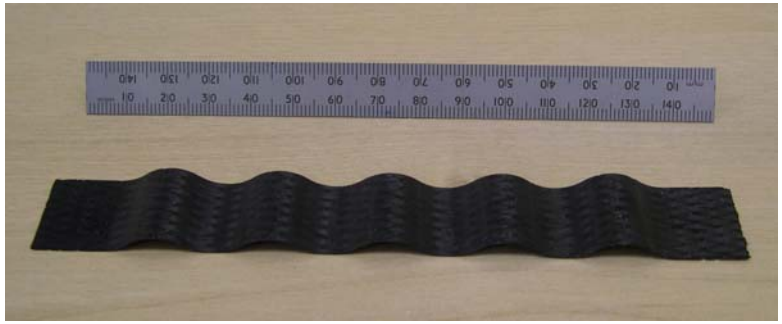




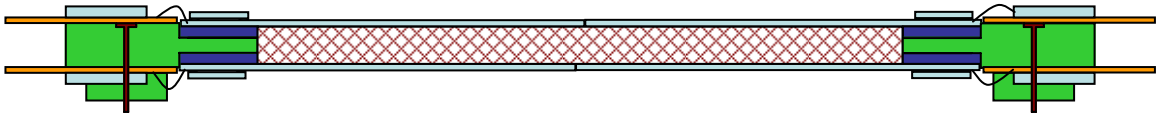


Possible Alternatives

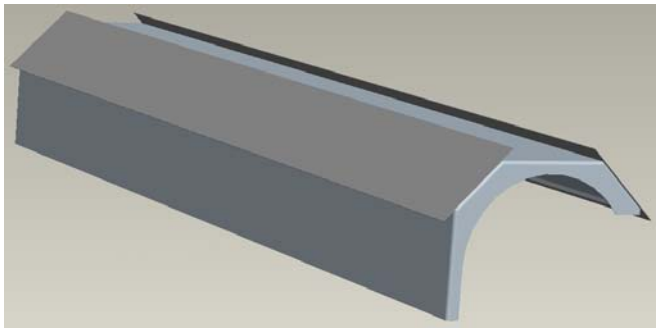
- Carbon fibre substrates



- Double sided detectors – reduce number of layers

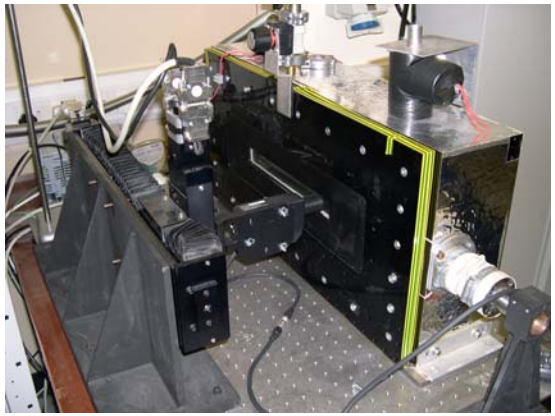


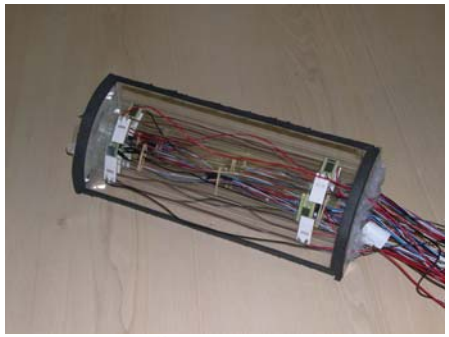
- Use a Carbon fibre shell for one or more layers

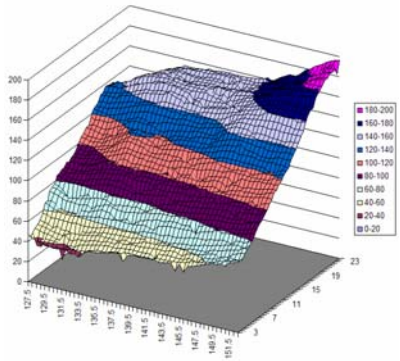


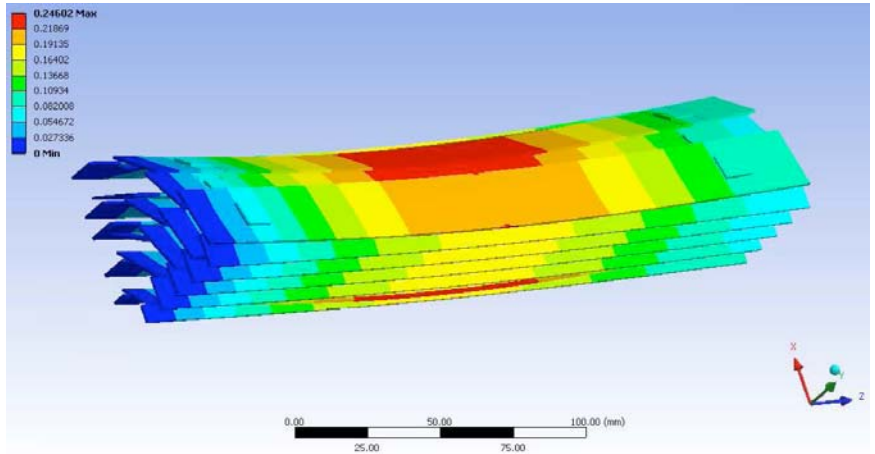
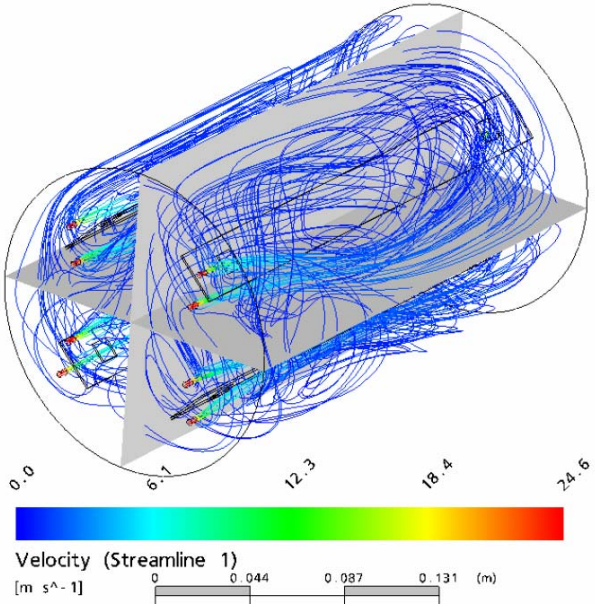
Resources Available

- Lab tools:
  - Cold survey cryostat with high precision laser micrometer
  - Glue robot
  - Cooling test stand







Future Plans

- Continue prototyping foam ladders
- Build and test carbon fibre shell
- Computer simulations
  - FEA and CFD