SVT Mechanical Support and Strip Sensors

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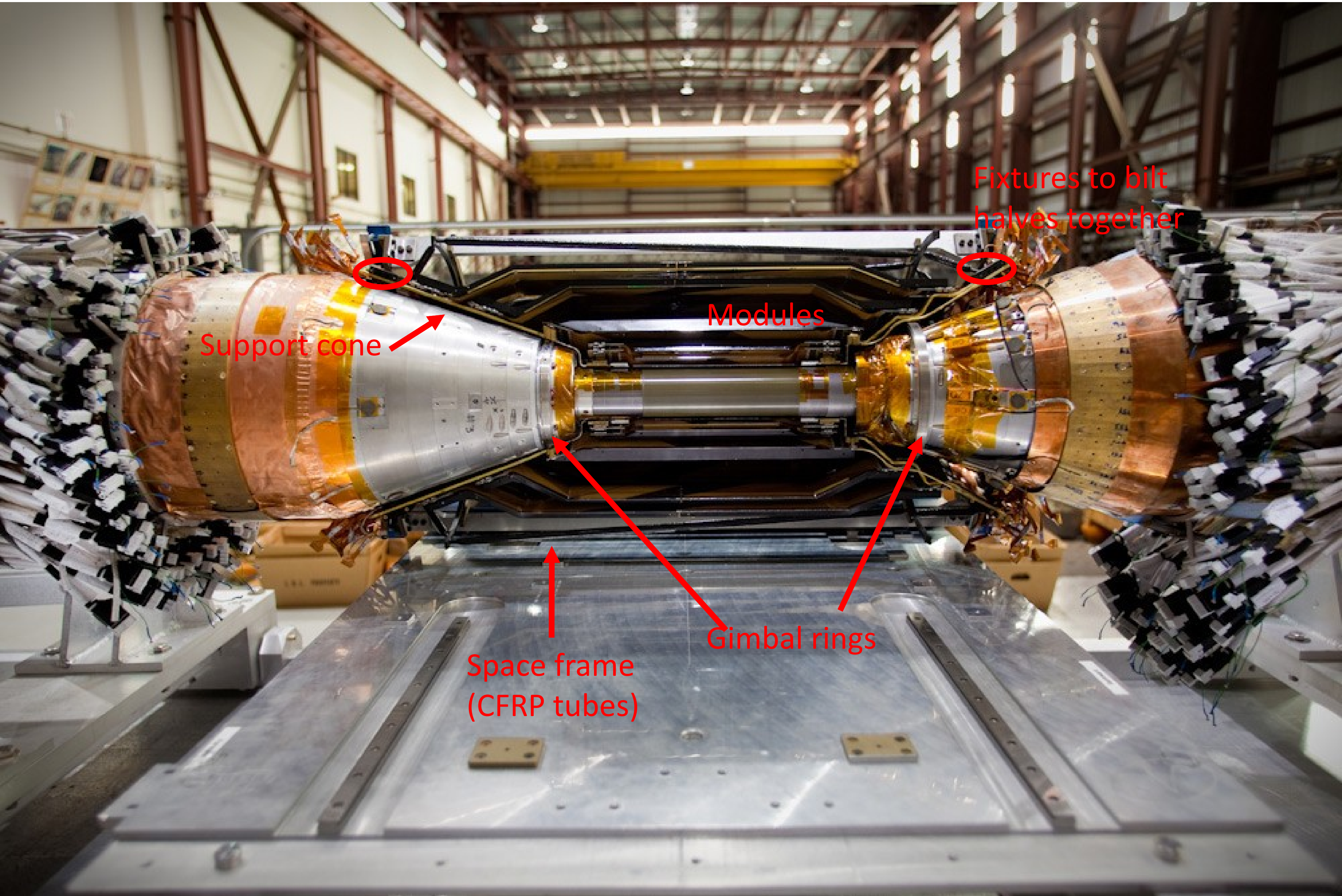
Outline

- A Brief reminder BaBar SVT
- Mechanics:
  - Tungsten shield and support scheme
  - L0 support structure
  - Outer layer support structure
  - Activities/open areas
- Strip sensors

BaBar SVT

- Double sided silicon strip detector:
  - one side measures r, ϕ, other measures z.
  - 5 layers
  - Clamshell construction
  - Asymmetric design: boost at BaBar: $\beta\gamma$=0.56.
  - Support superstructure:
    - End cones constrained by space outer frame
    - Modules mounted onto cones
    - End of module hybrid requires cooling (cones)
    - Mounted onto cyrostat via gimbal rings
    - Fits within the BaBar DCH for a cantilever support method for cyrostat.
    - RF shield lines structure to shield strips from noise.

BaBar SVT


Fixtures to bilt halves together
Modules
Support cone
Gimbal rings
Space frame (CFRP tubes)

SuperB

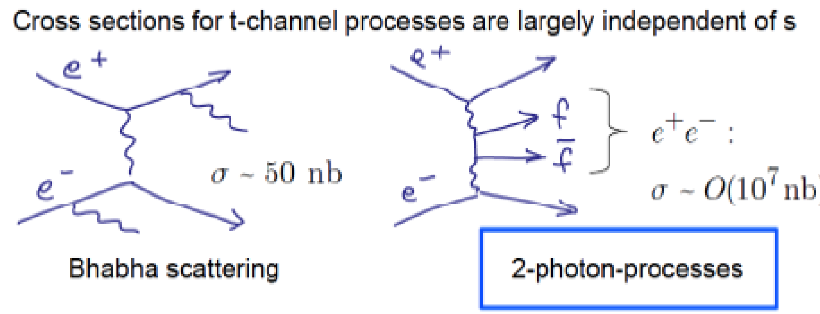
- L0 needs to be accommodated.
  - Support off of beam pipe
    - Design scheme available for striplets and pixel options.

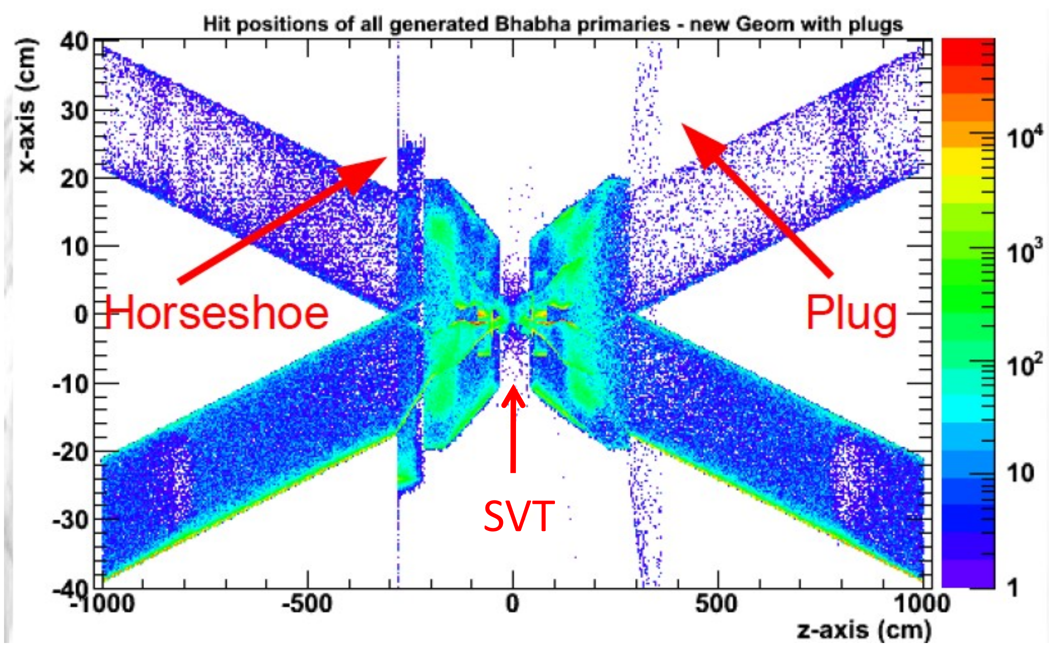
- L1-5 support:
  - symmetric (boost = 0.24)
    - 300mrad is active area for sensors
    - Expect to have 20mm clearance below this for services
  - support off of gimbal rings mounted to tungsten shield

- Whole structure (SVT/sheield/cryostat) removable
  - Need to maintain fast access to L0 for maintenance/replacement
  - Mechanical scheme outlined, need to work on detail

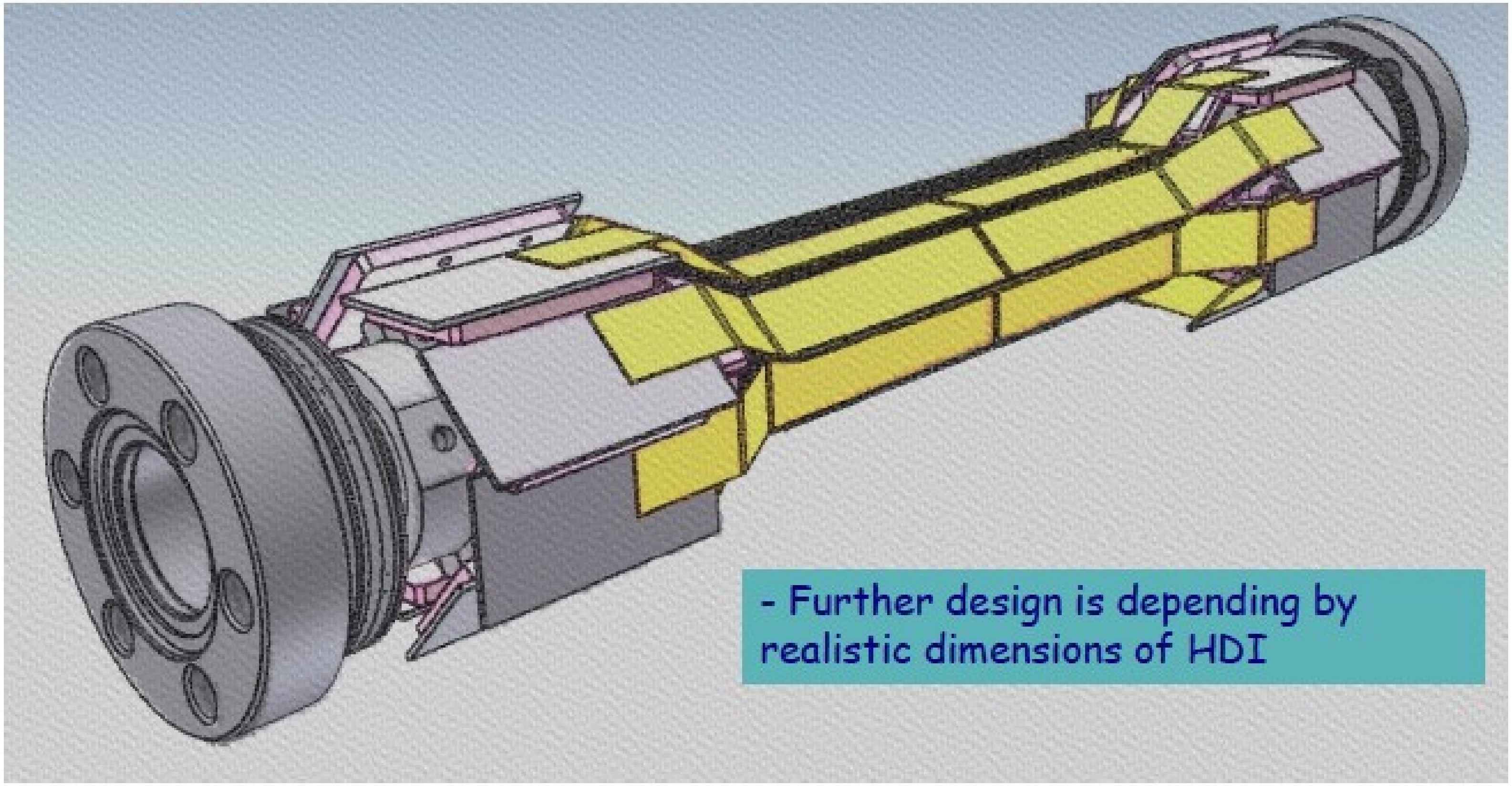
γγ & Bhabha backgrounds

- Simulation work on understanding impact of Bhabhas & two-photon pairs backgrounds ongoing.
  - These are dominant background contributions
  - Iterate with shielding designs near interaction region



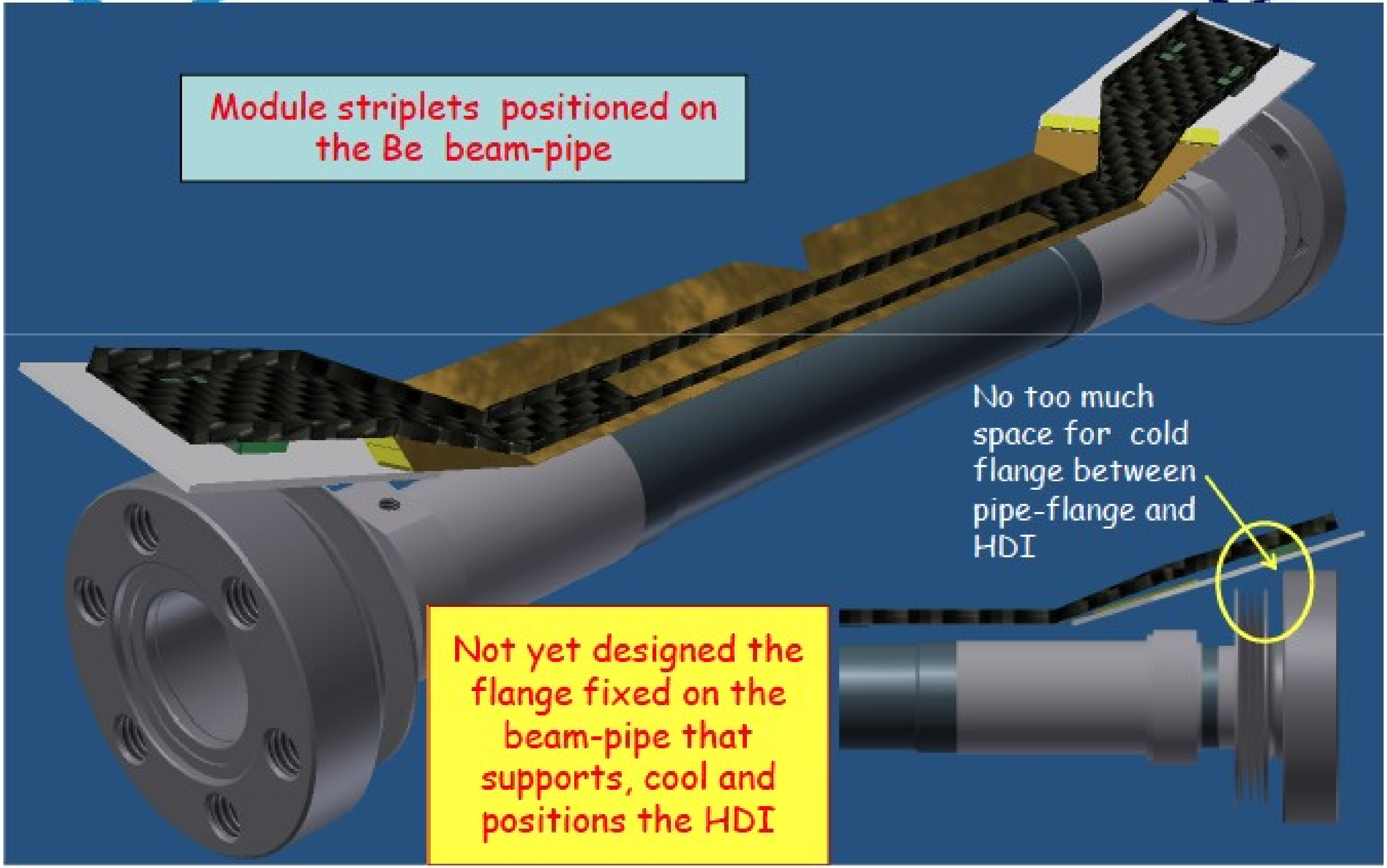


L0 on Beam Pipe



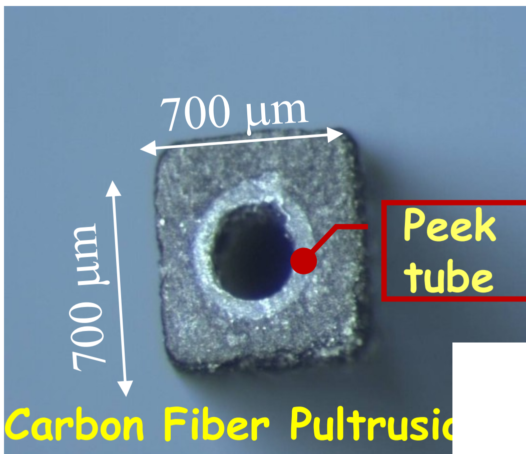
- Further design is depending by realistic dimensions of HDI

Module Striplets

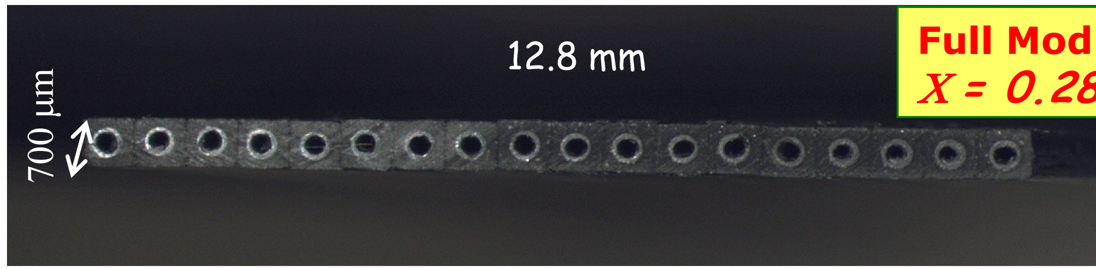


Light pixel module support & cooling

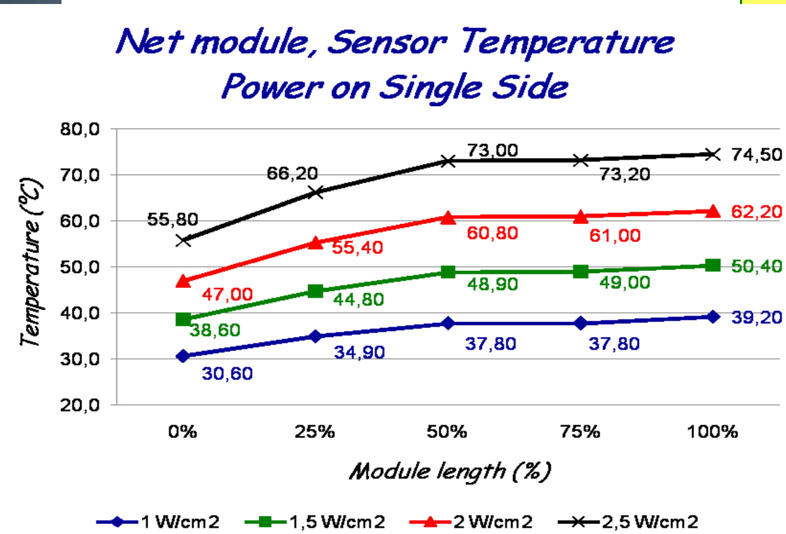
- Light support with integrated cooling needed for pixel module: P~2W/cm^2
- Carbon Fiber support with microchannel for coolant fluid developed in Pisa:
  - Total support/cooling material = 0.28 % X_0 full module, 0.15% X_0 net module
- Thermo-hydraulic measurements in TFD Lab: results within specs



Full module supports with microchannels glued toghether



Full Module
$X = 0.28\%\ X_0$



Net Module
= 0.15% X_0

Cones and space frame

- Cones will be symmetric
  - 300 mrad sensitive area
  - +20mm gap between sensors and tungsten shield for services, cones and support modules.
  - Provide support to the detector once mounted onto gimbal rings.

- Space frame provides rigidity for SVT while mounting.
  - CFRP tube webs to provide support while mounting.

- Whole system will be made in 5 layer half shells

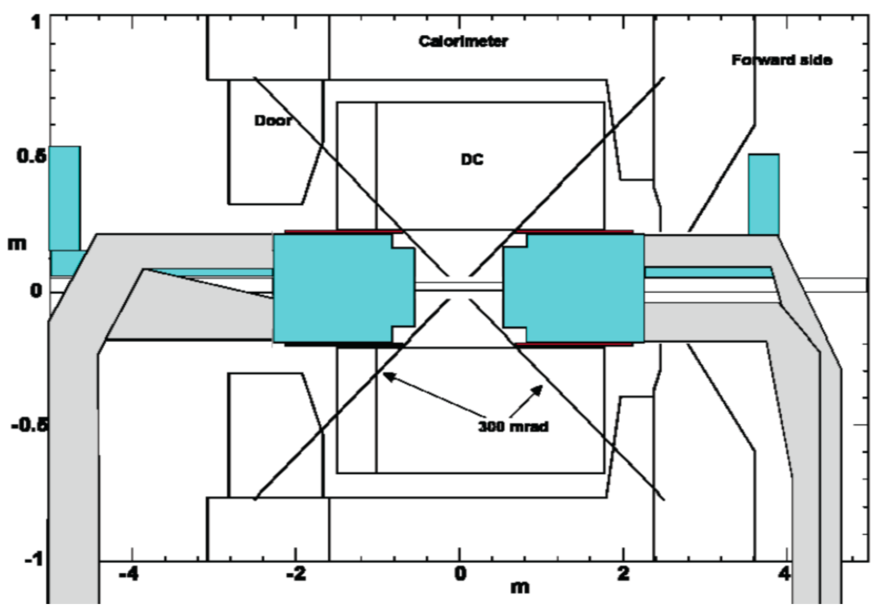
- Work started at QMUL using HEFCE funded effort.

L1-5 Modules

- Two types of modules:
  - L1, L2, L3 straight modules
  - L4, L5 lampshell modules
- Assembly procedure: construct half modules
  - wire bond sensors together
  - mount kapton bus cable
  - affix to module support frame (lampshade trapezoid sections need to be bent down to fit support frame).
- Glue half modules together prior to mounting on support cones.
- ~500 half modules to assemble for the SVT.
- Pisa will be a module assembly site. SuperB wants to identify a second site, aim to do this in the UK @ RAL.

Fast extraction system

- Aim:
  - Access SVT/permanent magnets in the IR within a few days.
  - Central cryostat/magnet SVT supported off of the same object.
  - Modifications/repairs on the innermost detector/accelerator components will be relatively quick to perform.



Remove vacuum pipe in drift regions near IR.

Move ends of detector out of the way.

Slide cryostat support on rail (with tungsten shield and SVT).

Set up temporary clean room to replace L0 if damaged.

2-3 week turn around.

Strip sensors

- BaBar used 300μm double sided strip sensors made by Micron semiconductor.
  - 6 types of sensors (6 sets of masks, 6 geometries required)

- Need to design and fabricate a thinner version of these sensors.
  - Need to identify team to design masks.
  - Will require QA at production site.
  - Each sensor will need to be validated at a lab post-production in order to validate manufacturer specs and ensure only high quality sensors are used in modules.
  - Semi-automatic probe stations available in Pisa, RAL, QM for this purpose. Additional sites would be welcome.

Strip sensors

- Micron produced BaBar sensors
- Pisa had someone on site for the whole time responsible for initial QA.
- All sensors were re-qualified after shipping back to Italy. In particular:
  - Tested characteristics as a function of time (noticed some modules suffered from performance drift).
  - Tested inter-strip cross talk.
  - Only the best sensors were then used in module construction.
- Expect that we will use a similar modus operandi for SuperB.
  - Want to establish 2 module production sites, so logical to assume distributed sensor testing. Would want to have standard candles to cross-calibrate different testing sites.
  - Assume that RAL will be 2nd module assembly site.

Conclusions

- Open areas
  - Concept for fast removal of detector needs detailed engineering study.
  - Layout of IR needs to be finalised: magnets / cryostat / beam pipe
  - Tungsten shield has to be designed (support cones mount to this)
  - Strip sensor module design (sensors + structure) open
- Work started on
  - Cones and space frame (HEFCE funded people at QM)
- Covered
  - L0 support (Pisa)
- Remember:
  - Need to maintain close (international) collaboration between machine and detector groups.

CONTACTS: UK SVT effort: Adrian Bevan (QM) and Fergus Wilson (RAL)
Global SVT project leader: Giuliana Rizzo (Pisa)