

Focusing Block (FBLOCK) **initial optical design**

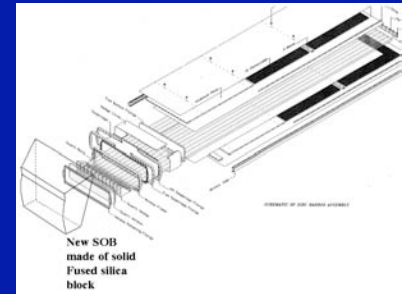
J. Va'vra, SLAC

Events since the last SuperB meeting

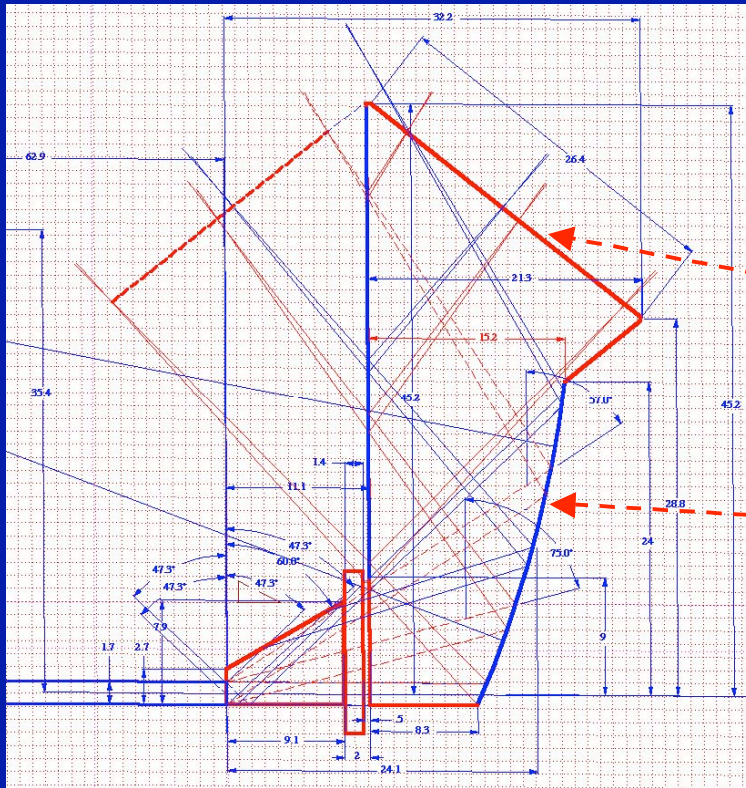
- We did not get the LDRD money from the lab, however, the letter from Persis said that if SuperB is approved, we should come back and try again.
- Finish preliminary design of the Focusing Block (FBLOCK), and write a SLAC-PUB-13763 with details.
- Started Massimo on the design of the mechanical support. Discussions what is the best way to support is under way.
- Helped Dough to start the MC simulation. This is progressing very well.
- Tweak details of the FBLOCK design so we can go for preliminary quotes. (Comments from Blair, Richard Boyce (eng.), Reggie (machinist), Matt.)
- Started a process to get preliminary quotes: involve 7 companies.
- Discussions with Matt how to make the optical coupling between the FBLOCK to the bar box window.

FBLOCK design #3

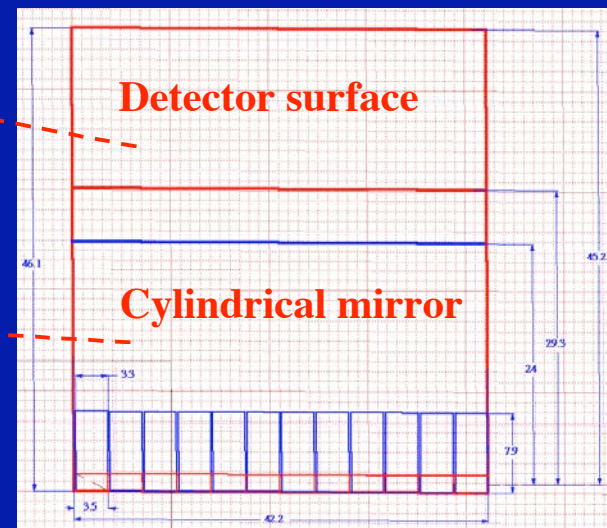
J.V., SLAC-PUB-13763



Side view:



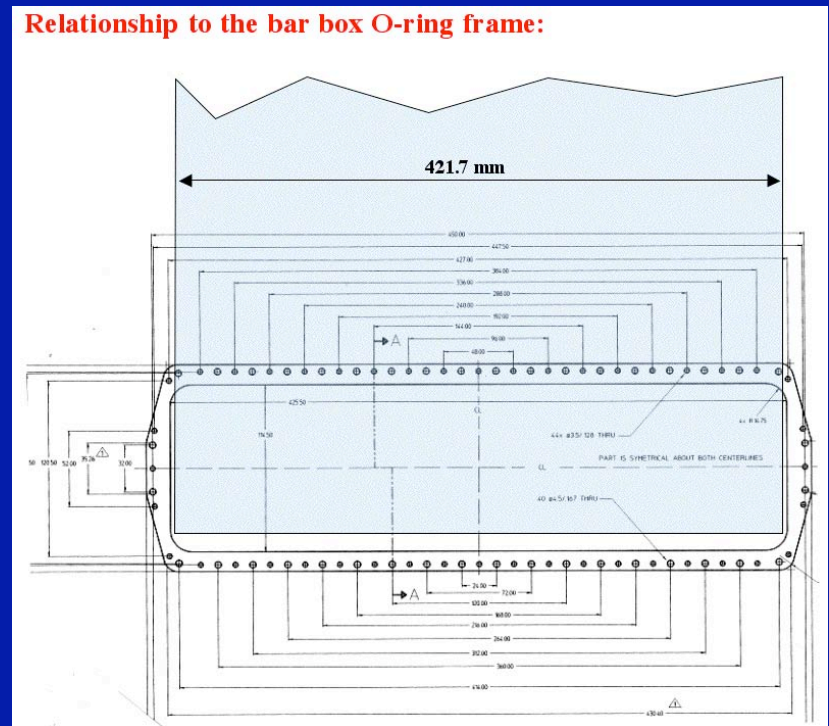
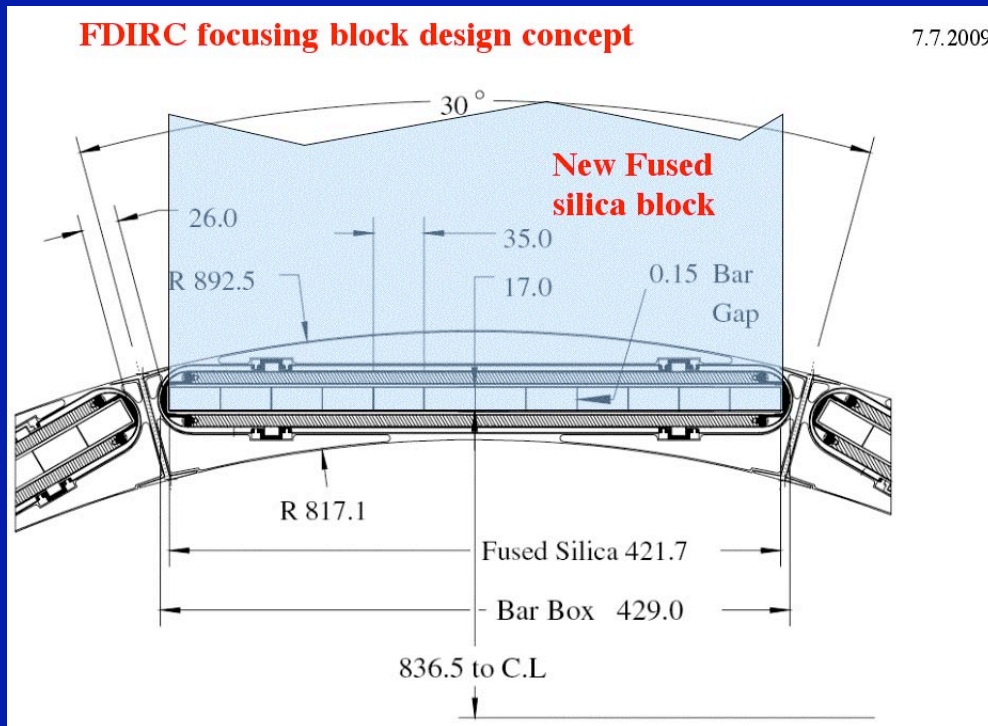
Back view:



- Design FBLOCK using manual ray tracing, i.e., the same way as FDIRC prototype.
- Verify it with a computer ray tracing, and later with a Geant 4 MC.
- Focal plane is formed as a focus of two parallel rays coming off the bar without bouncing off the wedge included surfaces.

Focusing blocks and bar boxes

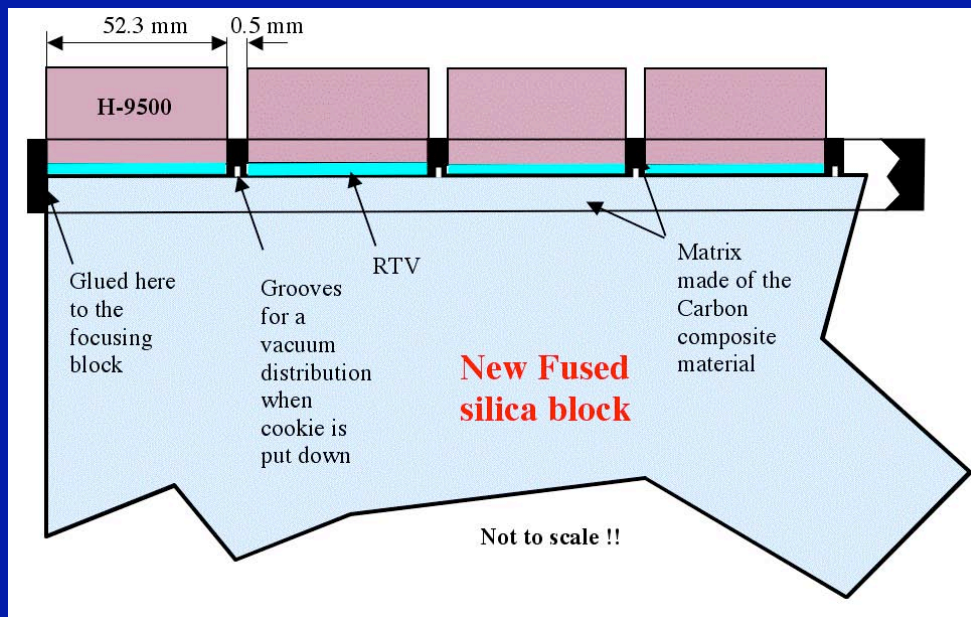
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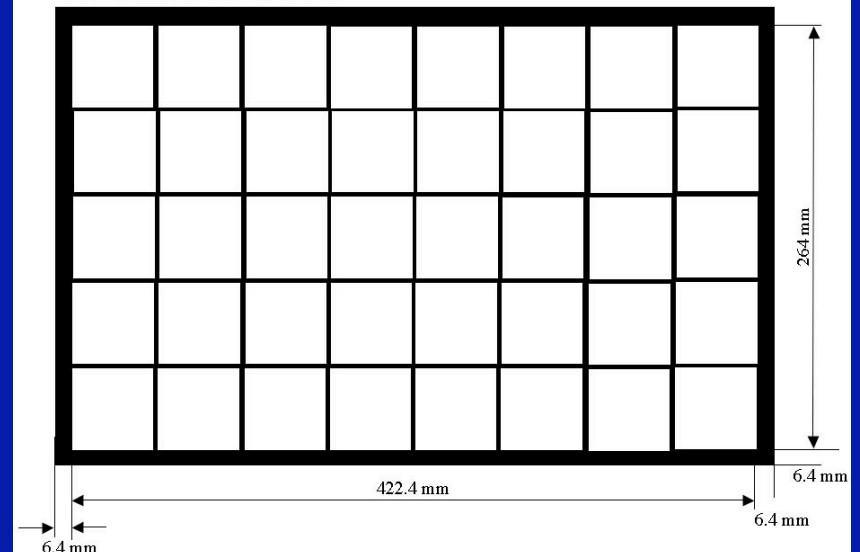
- The width is defined by a nominal width of bars.
- Bottom, face and side of the Focusing block should be aligned with bars to ~ 0.25 mrad.

Detectors on the focal plane

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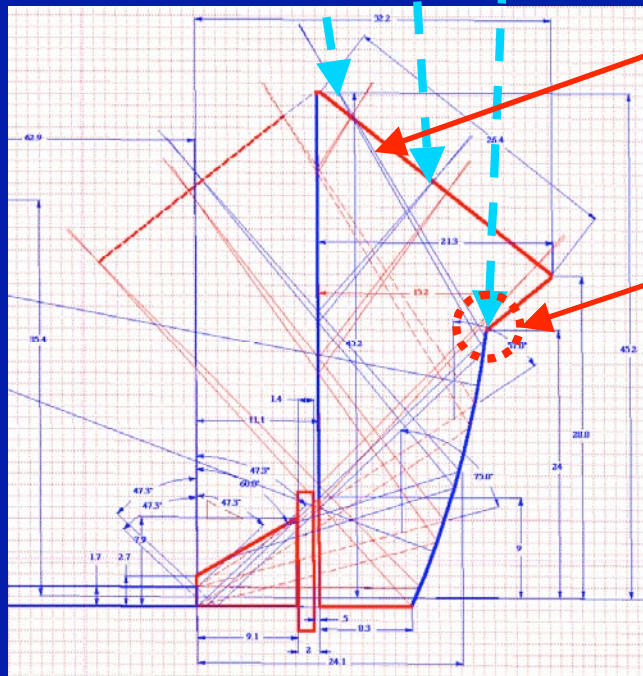
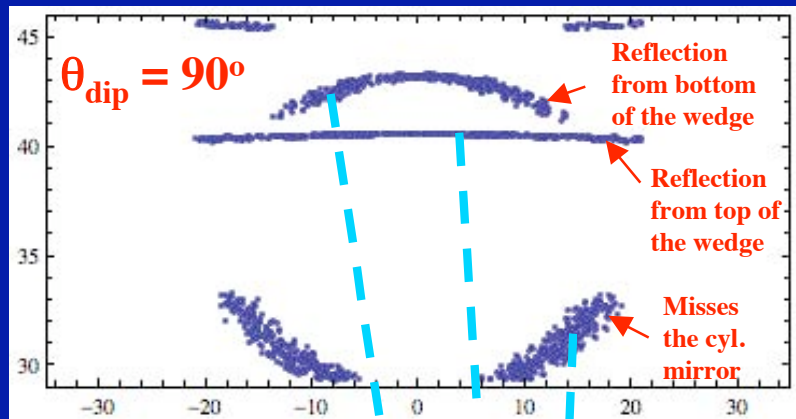


Carbon composite matrix attached to the Focusing Block:
(this will locate the detectors in place)



- **40 detectors per one FBLOCK (5 x 8 matrix of H-8500's)**
- **RTV optical contact. This needs a lot of testing.**
- **The holding frame must be made of an insulator (info from Hamamatsu).**

Still some tweaking to do

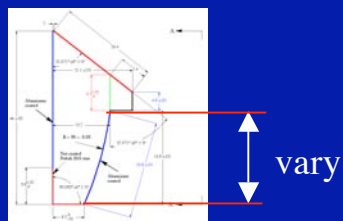
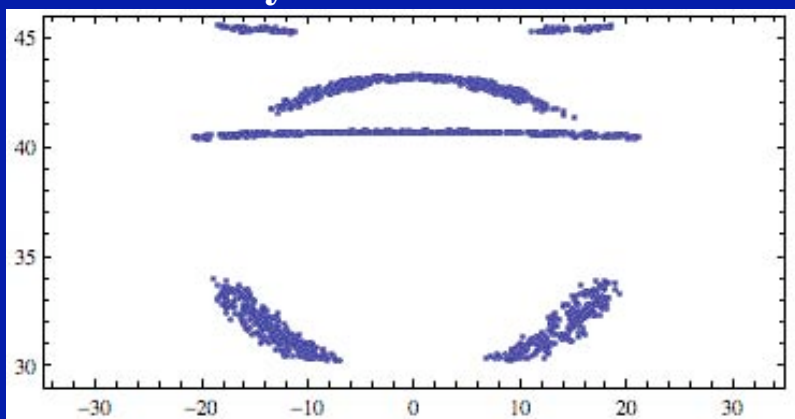


Two contradictory requirements:

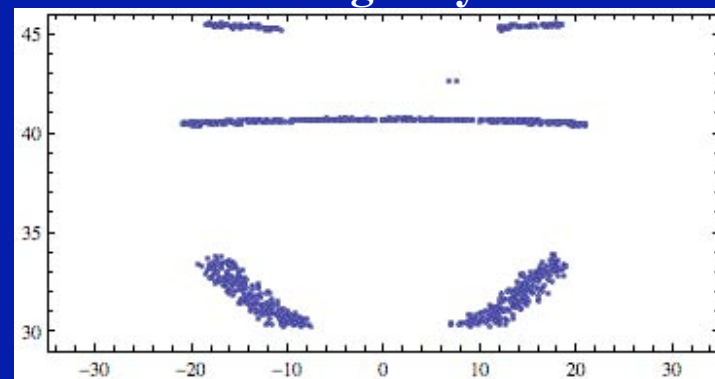
- We do not want to get rays coming to the focal plane at very steep angle as it invites reflections, which will in turn cause late hits - this would require to shorten the extent of the cylindrical mirror.
 - On the other hand, this will increase a piece of ring, which is only partially focused, coming from a region near the very end of the cylindrical mirror - this would require to extend the cylindrical mirror.
- => Want to do a bit more tweaking...**

Example of study still to do: vary height of the cylindrical mirror

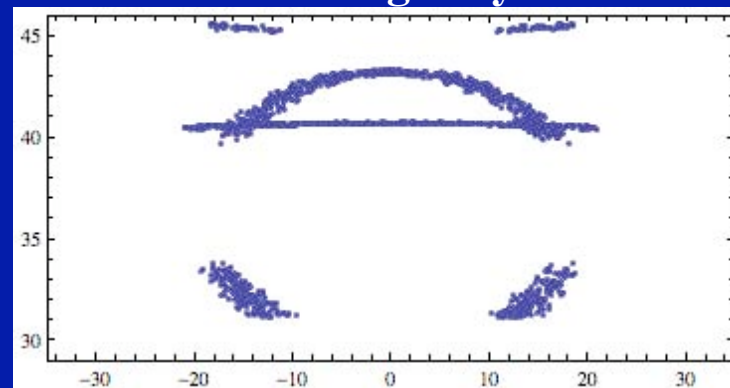
Nominal cylindrical mirror size:



Reduce its height by 2.5 cm:



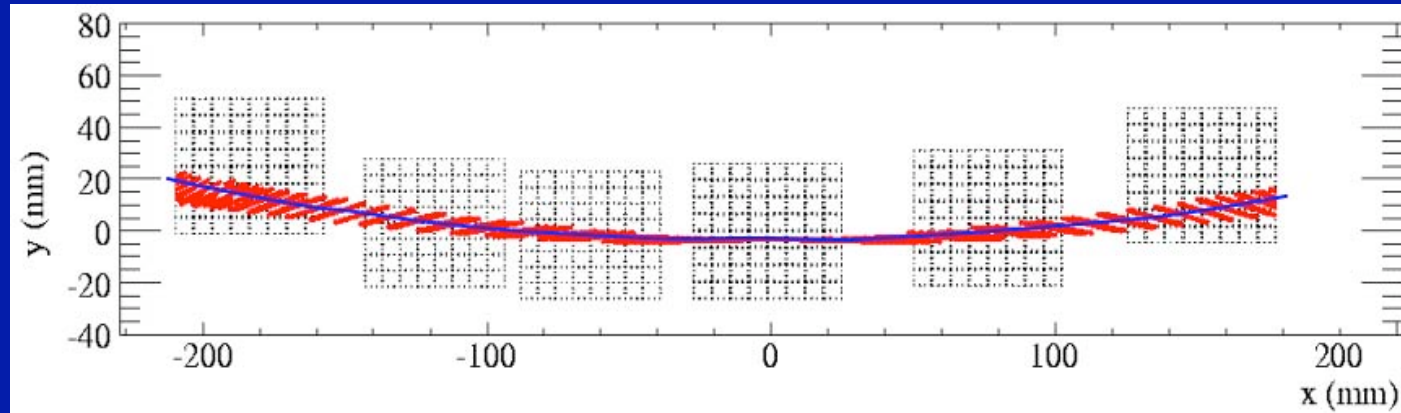
Increase its height by 2.5 cm:



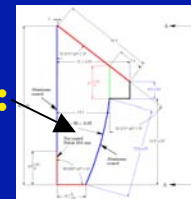
- This needs to be studied systematically.

Do we want to have FBLOCK sides reflecting ?

FDIRC prototype true ring image if we would have an infinite resolution:

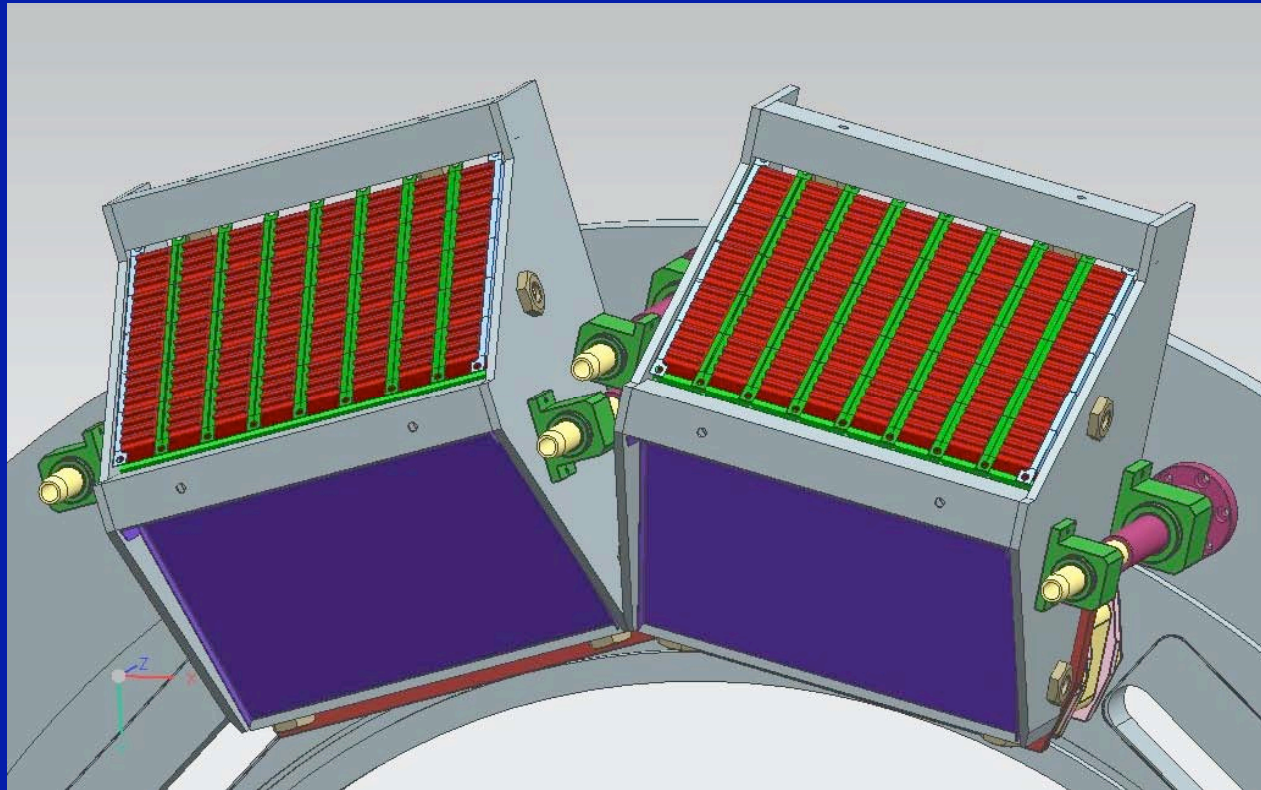


- **Kaleidoscopic wiggles in the image come from the bar rectangular bar structure. It is present even without the spherical mirror => it is present in Babar DIRC. Its broadening effect was neglected so far.**
- **Contribution from this effect to $\sigma_{\theta c} \sim 0 - 9$ mrad, with ~ 9 mrad near the wing and ~ 0 mrad near the center of the ring, based on FDIRC prototype studies.**
- **Do we care about the second or even the third bounces between reflective sides of the FBLOCK ? They increase the complexity of the pattern, and correspond to extreme sides of the ring where the resolution is generally worse.**
- **It also might be good to have more area with the non-reflecting surfaces to prevent an “accumulation” of late unwanted photon background bouncing around for too long.**
- **For example, we could polish only lower part of FBLOCK sides:**



3D drawings of the mechanical support

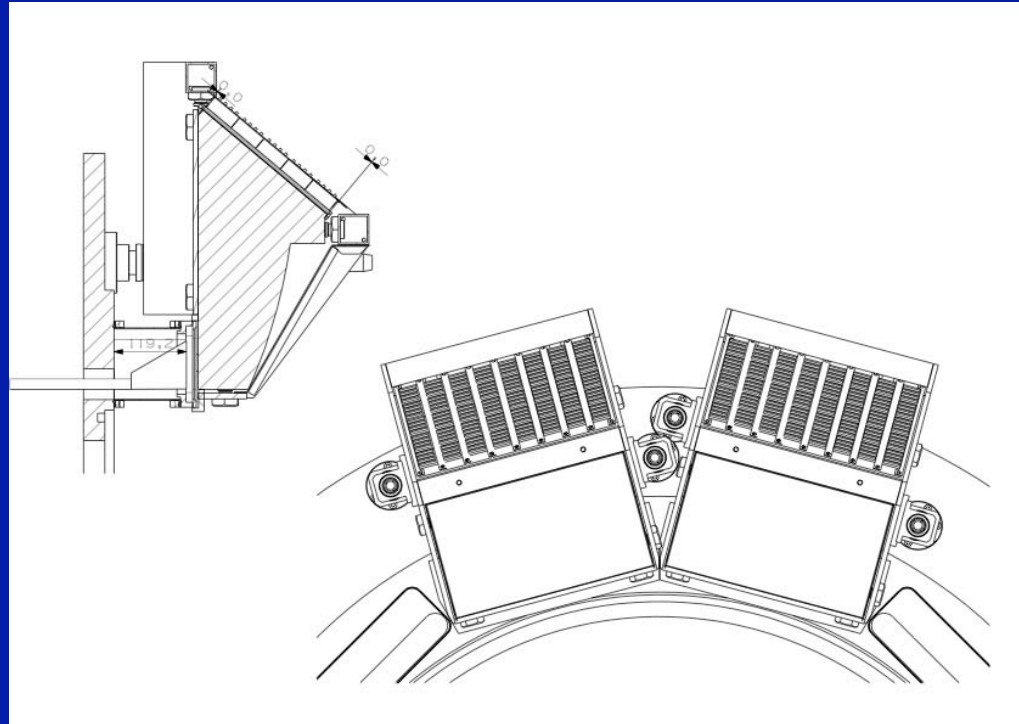
Massimo Benettoni



- Many details need to be understood, but it is a good start.
- Bottom, face and side of the FBLOCK should be aligned with bars to ~ 0.25 mrad. The support **MUST** be reproducible around the azimuth.

2D views of the mechanical support

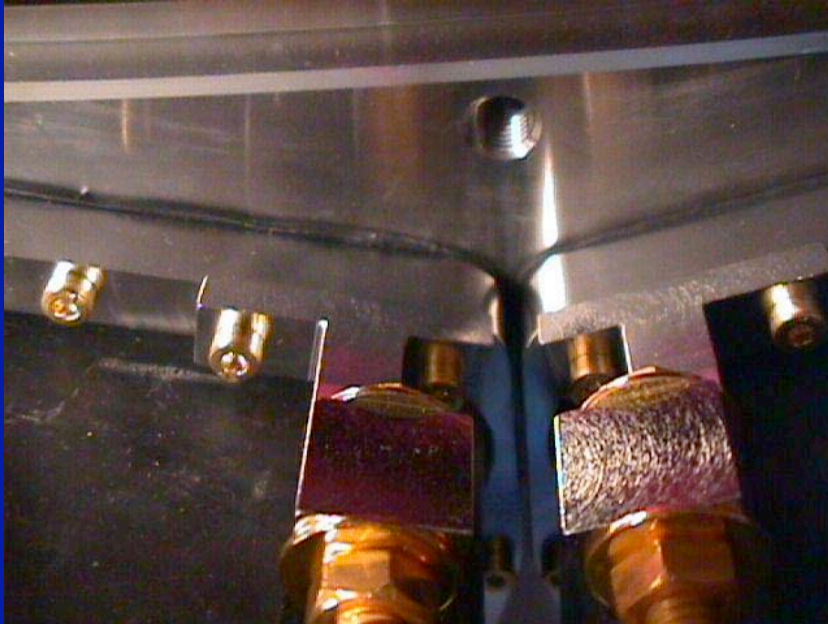
Massimo Benettoni



- **An example of detail:**

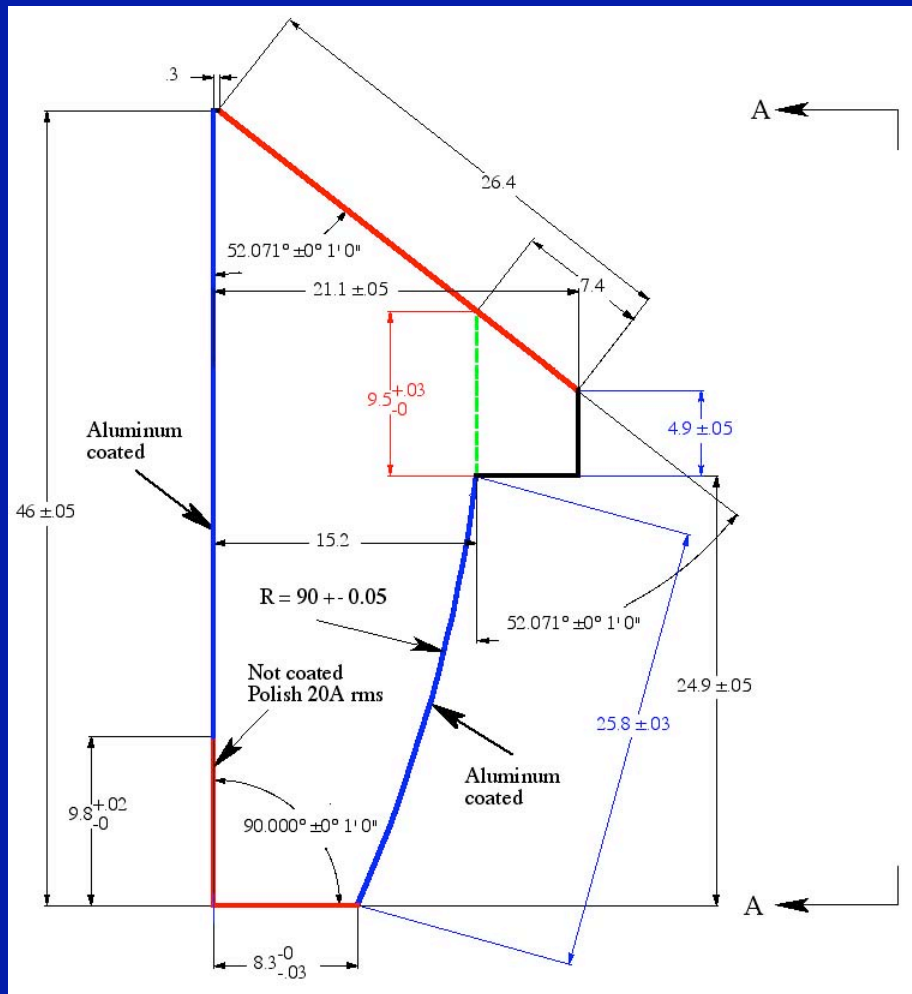
- How do we glue FBLOCK to window ? Do we have enough room for it ?
- How do we take it apart ?

Reality of real bar boxes



- **May need to reverse bolts to reduce the gap size.**

Going for preliminary quotes to get a feel for the cost and a difficulty to make it



- Contacted **seven** companies, **two** rejected the bid, **five** are considering it presently.
- So far, the companies involved in discussions want to make it out of two parts. The green line suggests the split. This is also “convenient” from the gluing point of view.
- There are other possible ways to split it, which we would invoke if the price is too high.
- The bid is considered by Zygo, Carl Zeiss, Ariel, Optimax, and Pacific Coast Optics at the moment.
- United Lens declined to bid because of a curved surface. For Harold Johnson Optical Labs the piece is too big.

Plans for the next steps

- **Tweak the geometry some more both in the G4 MC simulation and the Mathematica-based ray tracing program (What fraction of sides should be reflecting ? Where should cylindrical mirror end ? ...).**
- **Went for preliminary quotes to know the cost and difficulty to make it.**
- **Further work on understanding how to couple the FBLOCK to the bar box optically. This may include some RTV gluing tests to see what is possible. This may influence the FBLOCK design also, as well as the FBOX (need enough room for hands to do the RTV job in situ).**
- **Understand dimensions and tolerances.**
- **More work on a design of the mechanical support.**
- **May have to do some measurements of the radiation hardness, transmission, etc.**