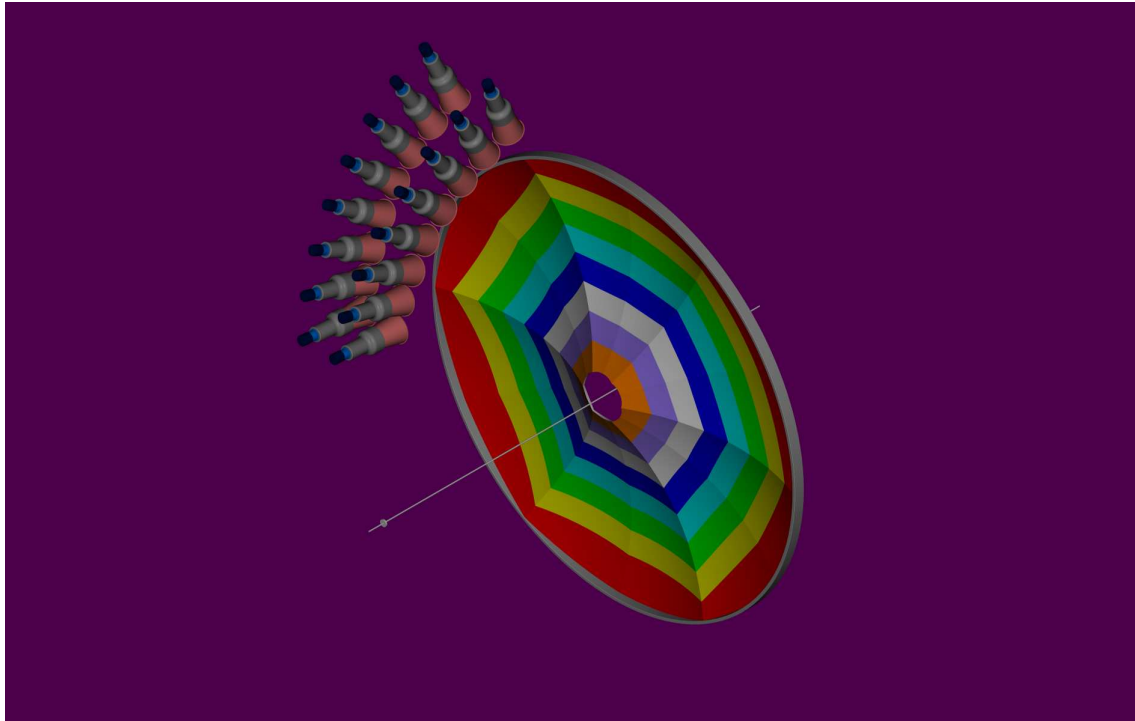


High Threshold Cherenkov Counter for CLAS12



Youri Sharabian

CLAS12 Upgrade Workshop, Feb 2-3, 2007

MAIN REQUIREMENTS

- High electron detection efficiency, low background
- Capability to run at luminosity : $L \gtrsim 10^{35} / \text{cm}^2 \times \text{sec}$
- Acceptance : $5^\circ \lesssim \theta \lesssim 35^\circ$ and $\Delta\phi = 2\pi$
- Lightweight : Total Thickness $\lesssim 200 \text{mg}/\text{cm}^2$ within working acceptance
- Reliability

HTCC for CLAS12

Requirement	Solution
High electron detection efficiency	Development of technology providing highest finish of mirror surfaces at low cost (FY06)
Run at luminosity $\diamond 10^{35} / \text{cm}^2 \times \text{sec}$	Flexibility in distributing angular acceptance over adjacent channels
Acceptance $\Delta f = 2\pi$ in angular range $5^\circ \leq \theta \leq 35^\circ$	Designing mirrors with no support/alignment parts within acceptance. No dead zones between mirror segments
Total Thickness $\leq 200 \text{mg}/\text{cm}^2$	Developing technology of mirror construction using materials of low density at no residual stress
Reliability	Maintenance free mirror. PMTs, other components (such as HV dividers, Winston Cones, magnetic shields) can be reached and replaced if necessary in HTCC working position

WORKING PARAMETERS

Channels_____ 96 (6 sectors (2x8) channels each)

Working Gas_____ CO₂@1atm (working volume 65"610" of length)

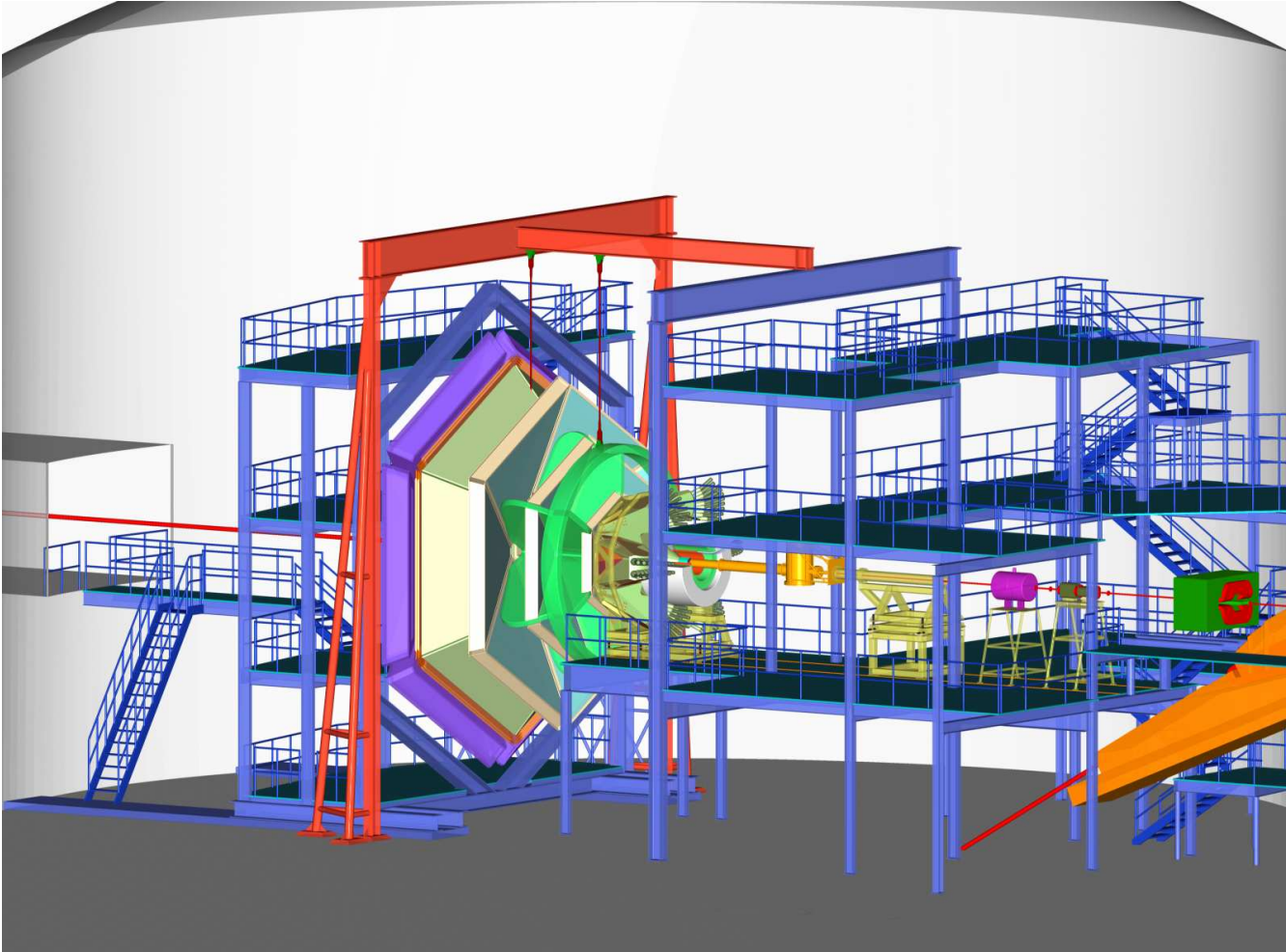
Mirror Type_____ Multifocal Elliptical

Photomultipliers _____ XP4508 (5", Quartz face plate)

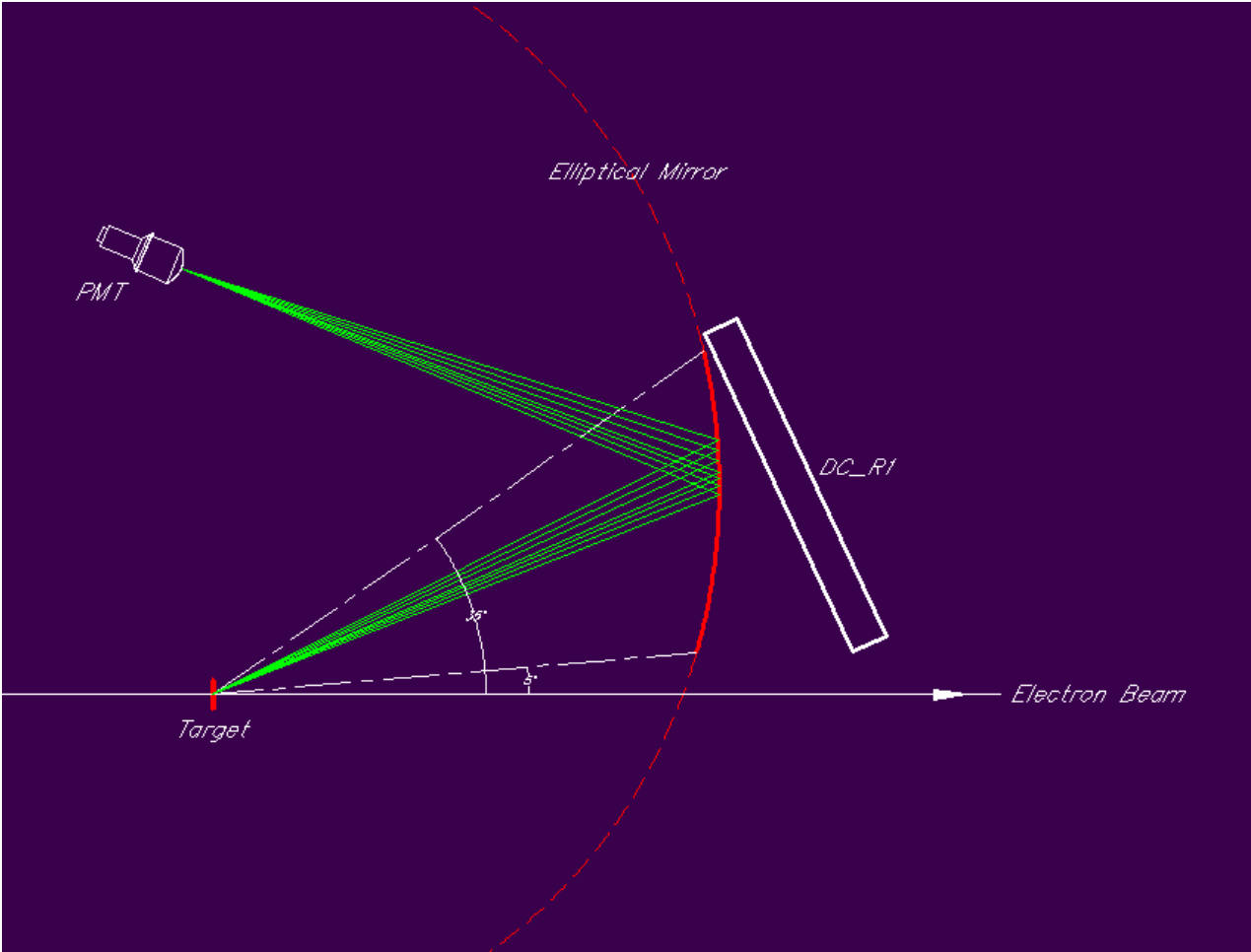
Threshold_____ 4.9GeV/c (π -mesons)

Rejection Factor_____ > 2000@ p < 4.9GeV/c

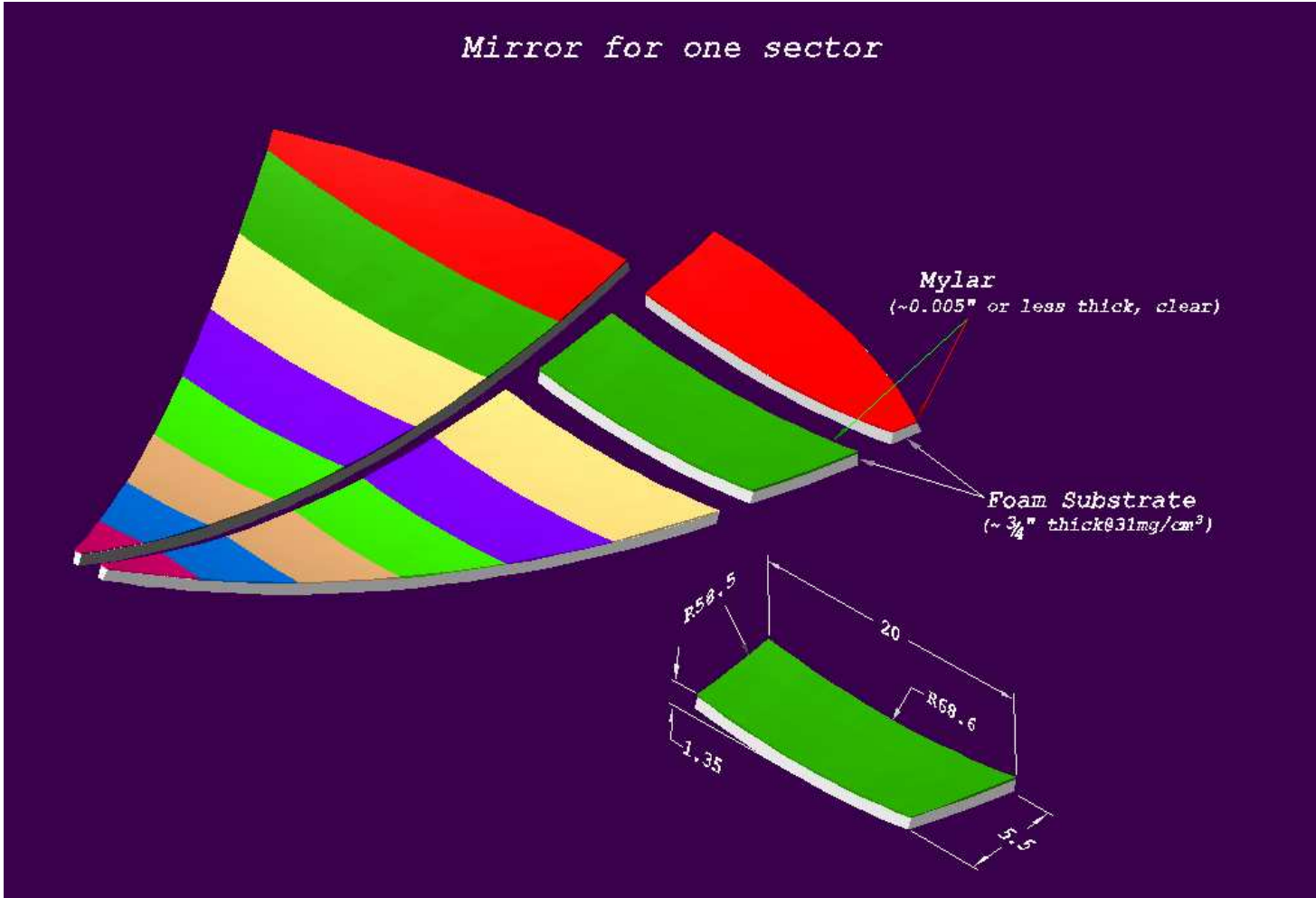
HTCC for CLAS12



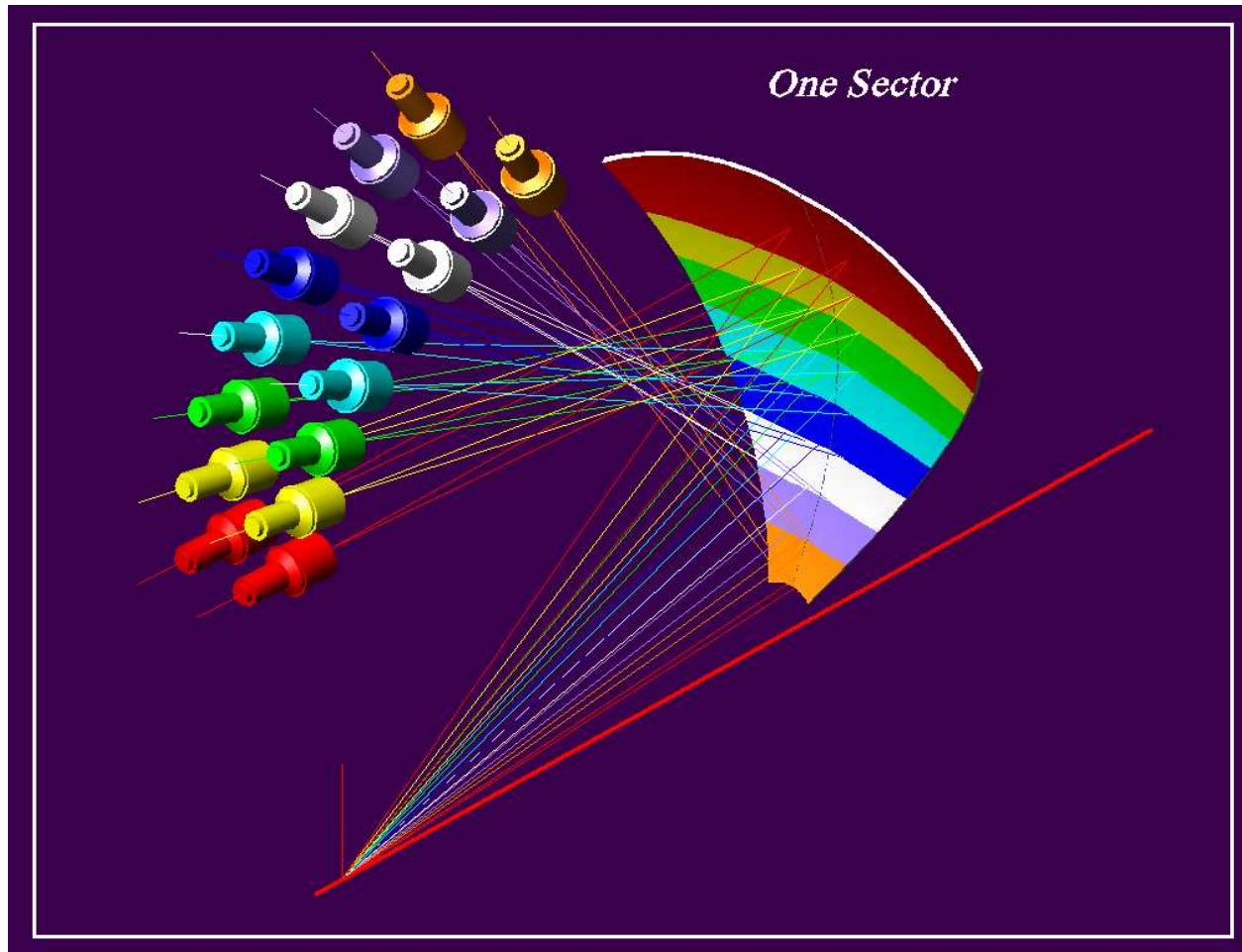
HTCC concept



Mirror assembly concept

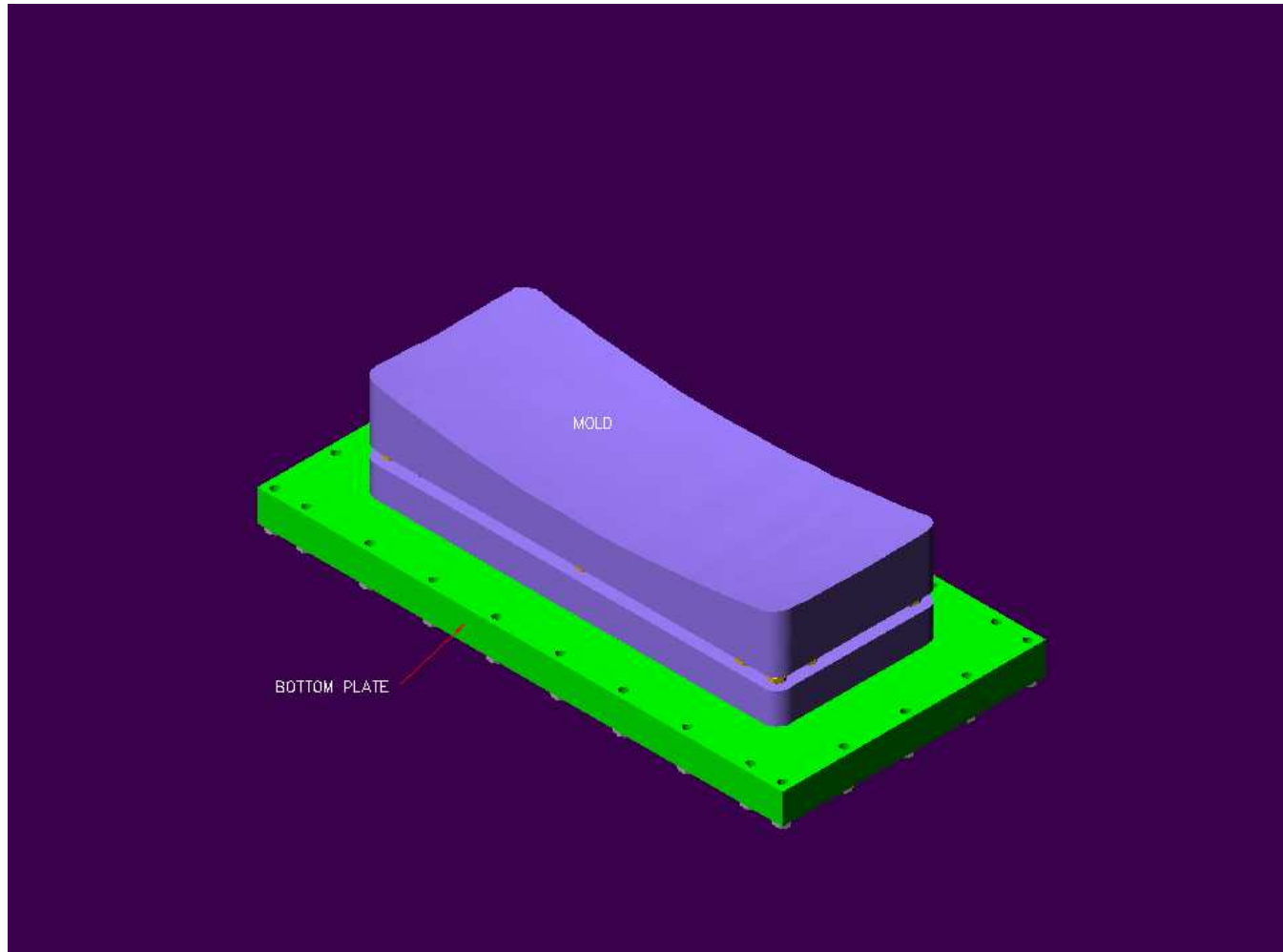


Geometry used in R&D (FY06)

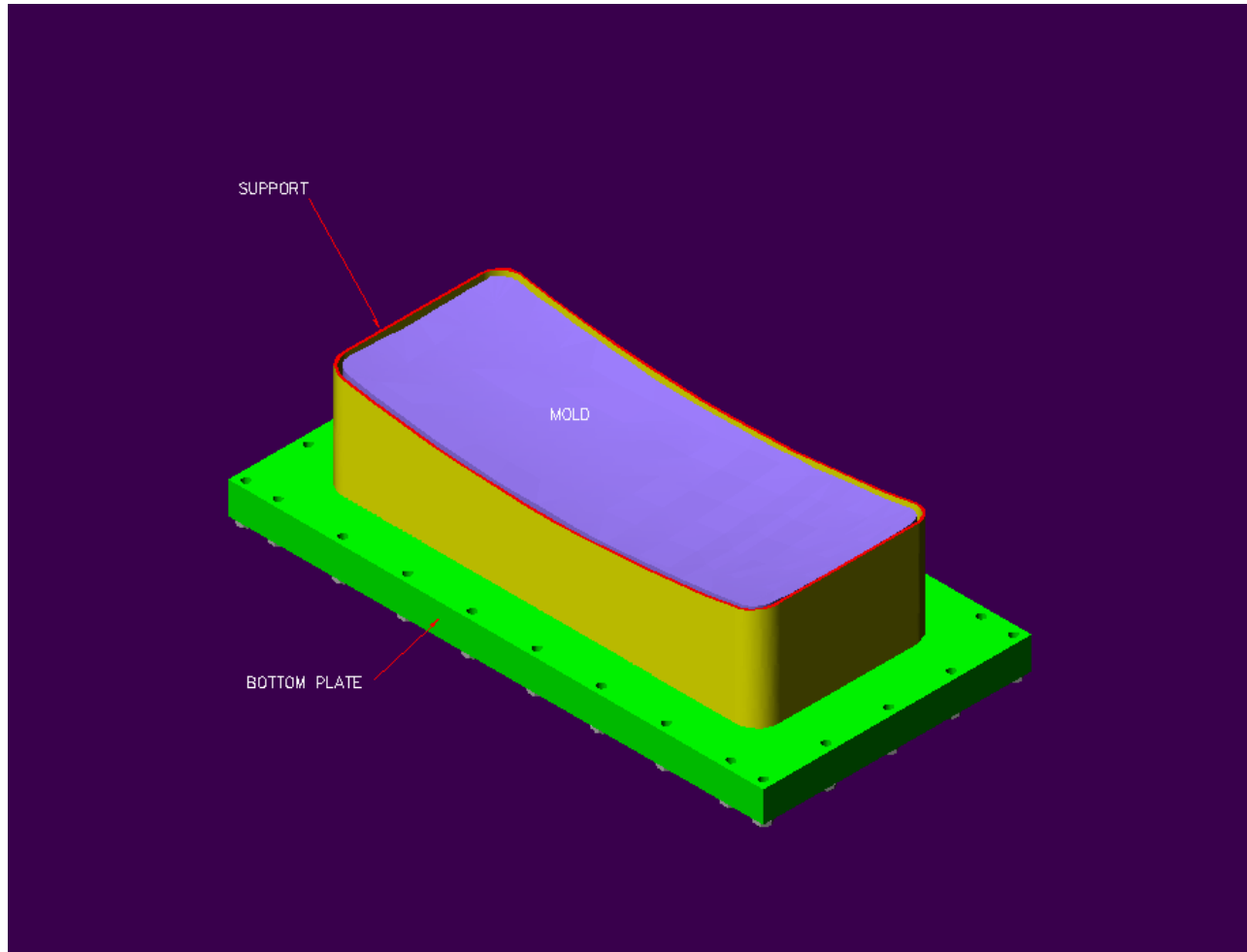


Building Mirror Prototype

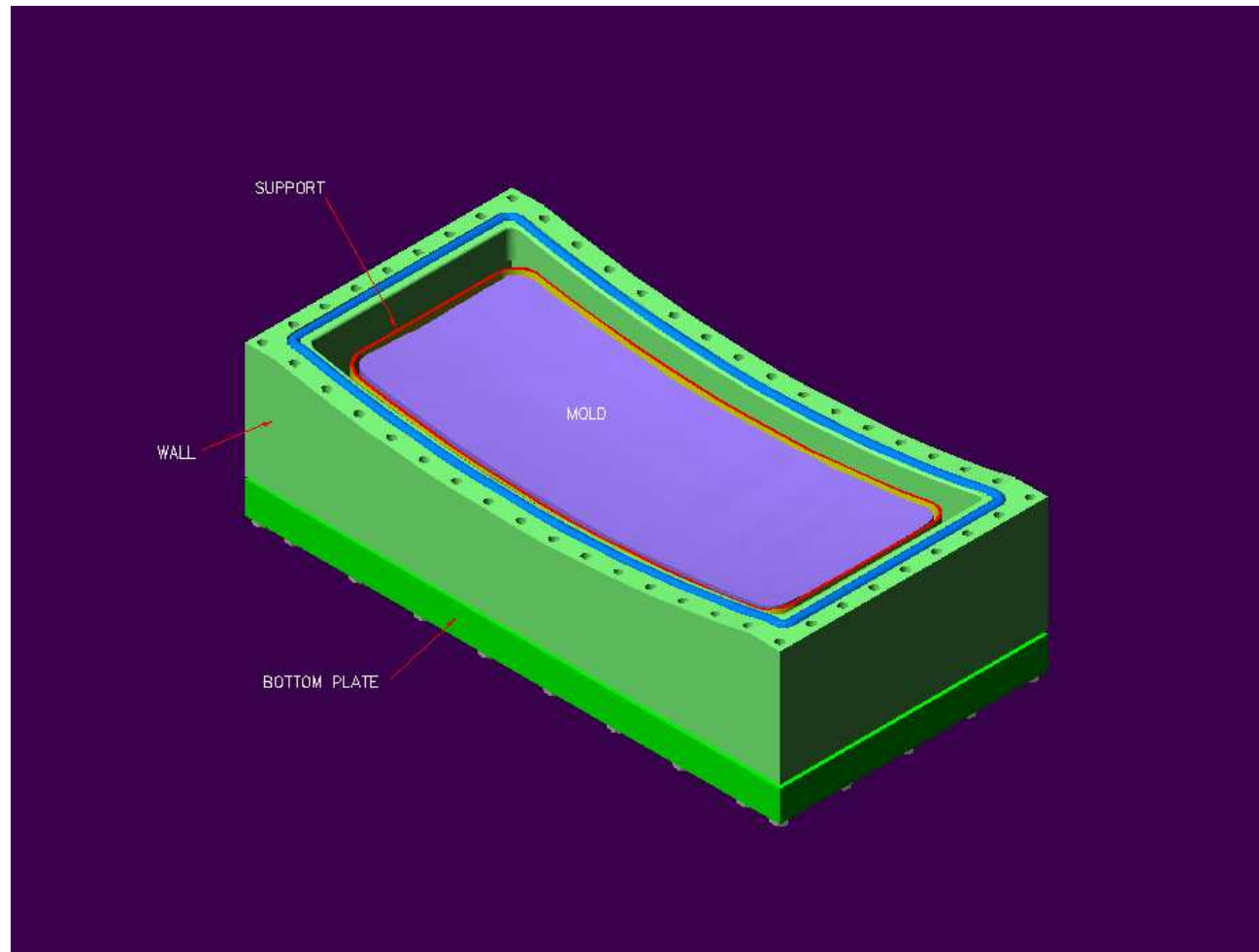
(Touch-free Technology)



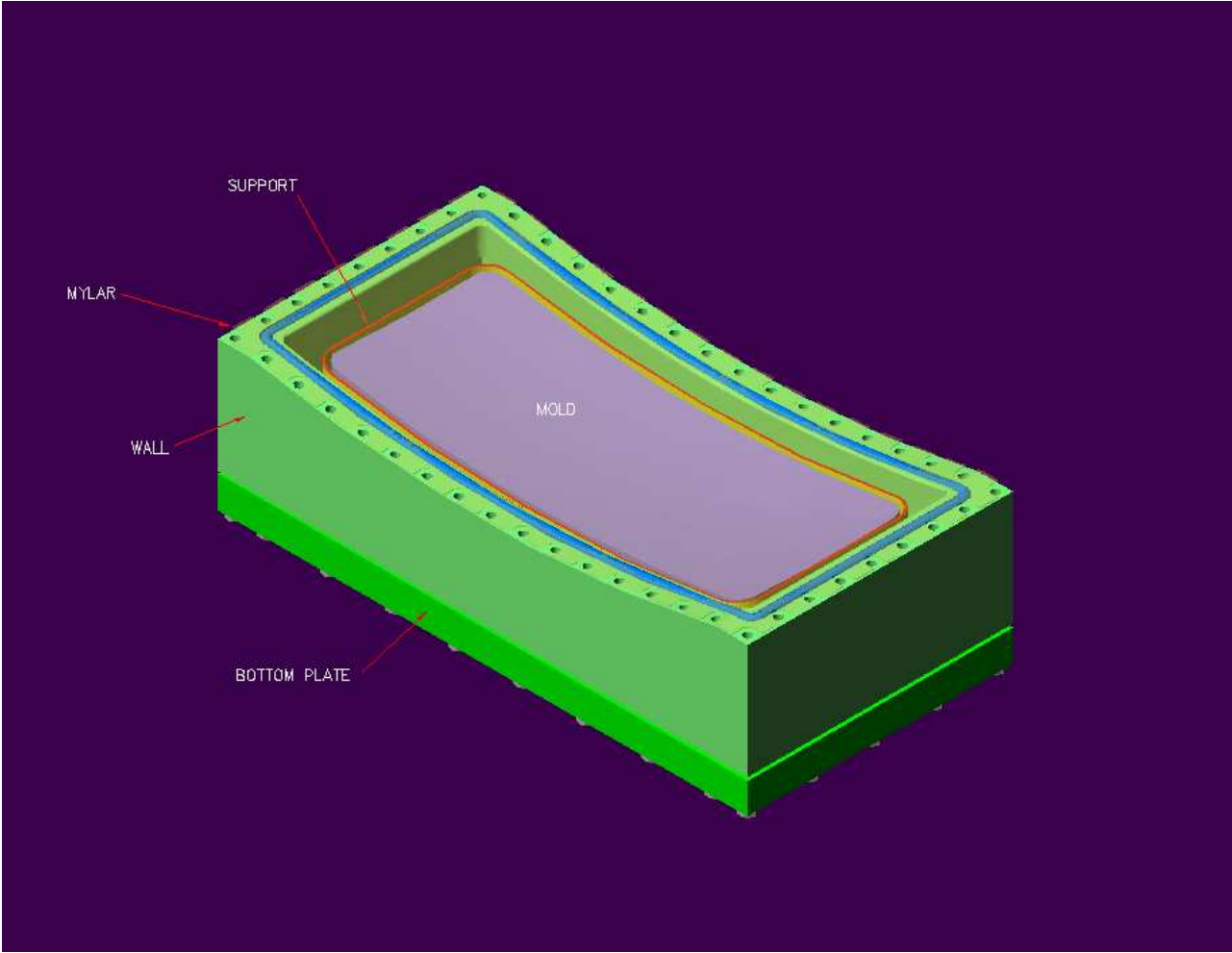
Building Mirror Prototype



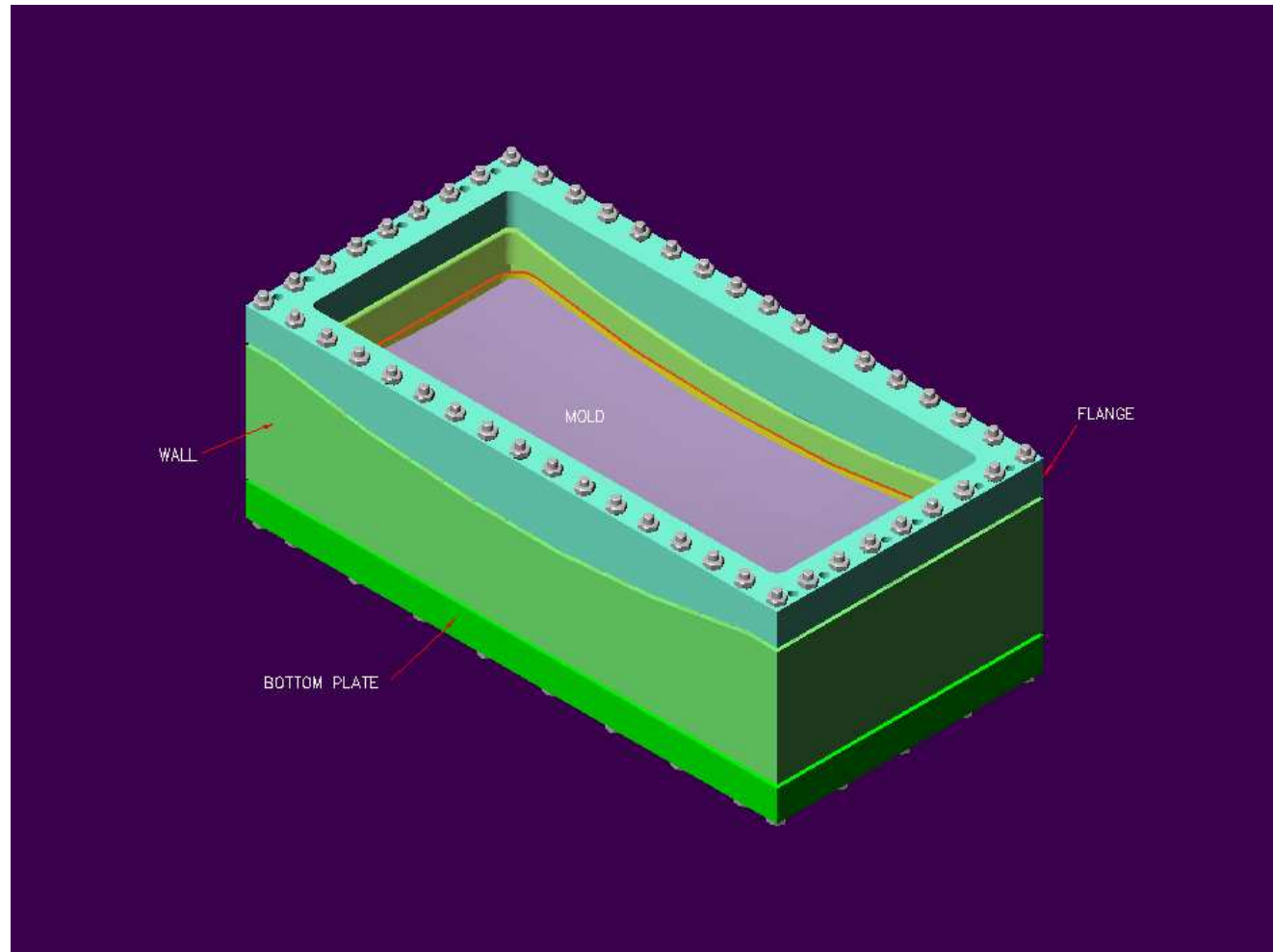
Building Mirror Prototype



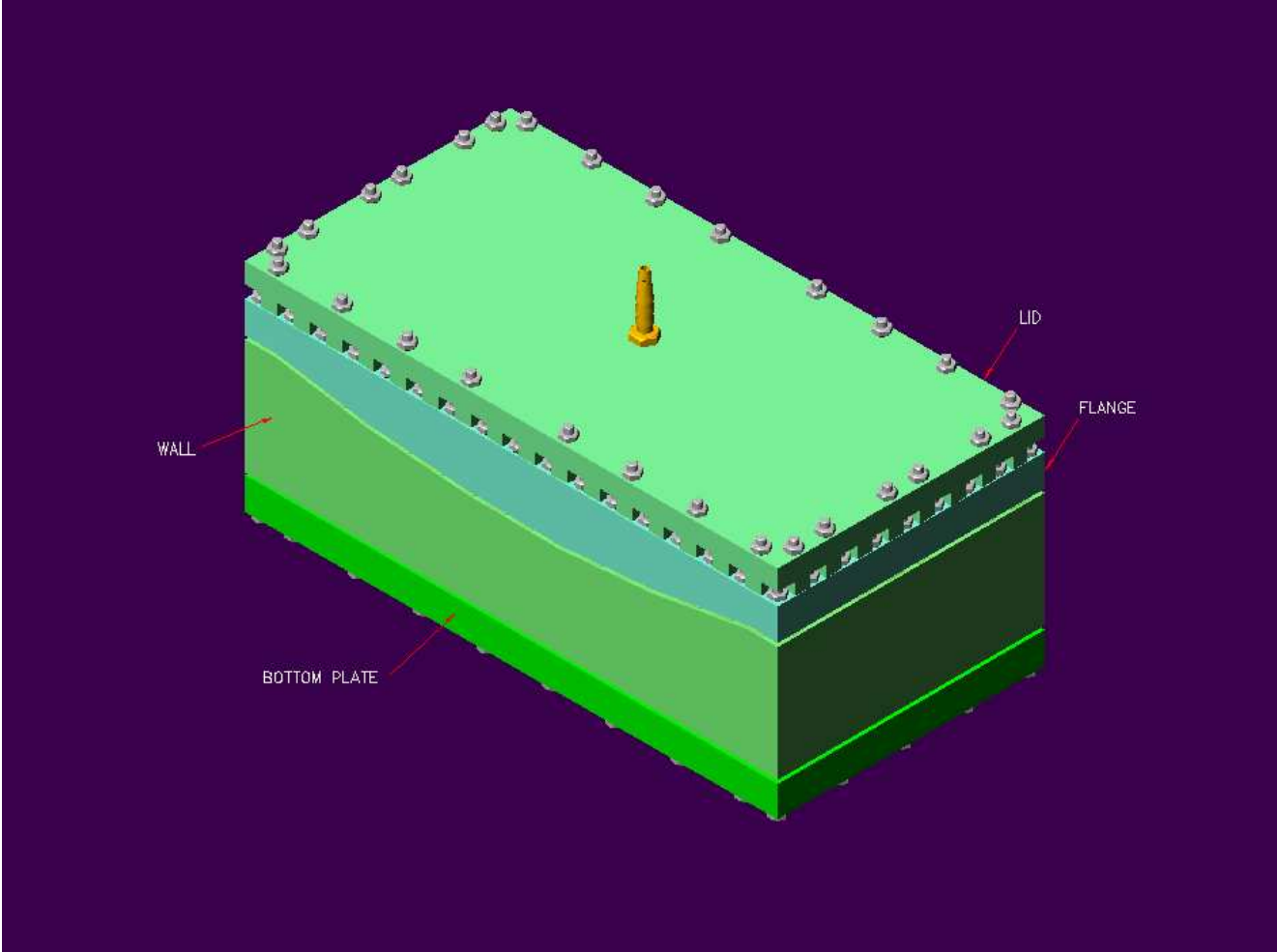
Building Mirror Prototype



Building Mirror Prototype



Building Mirror Prototype



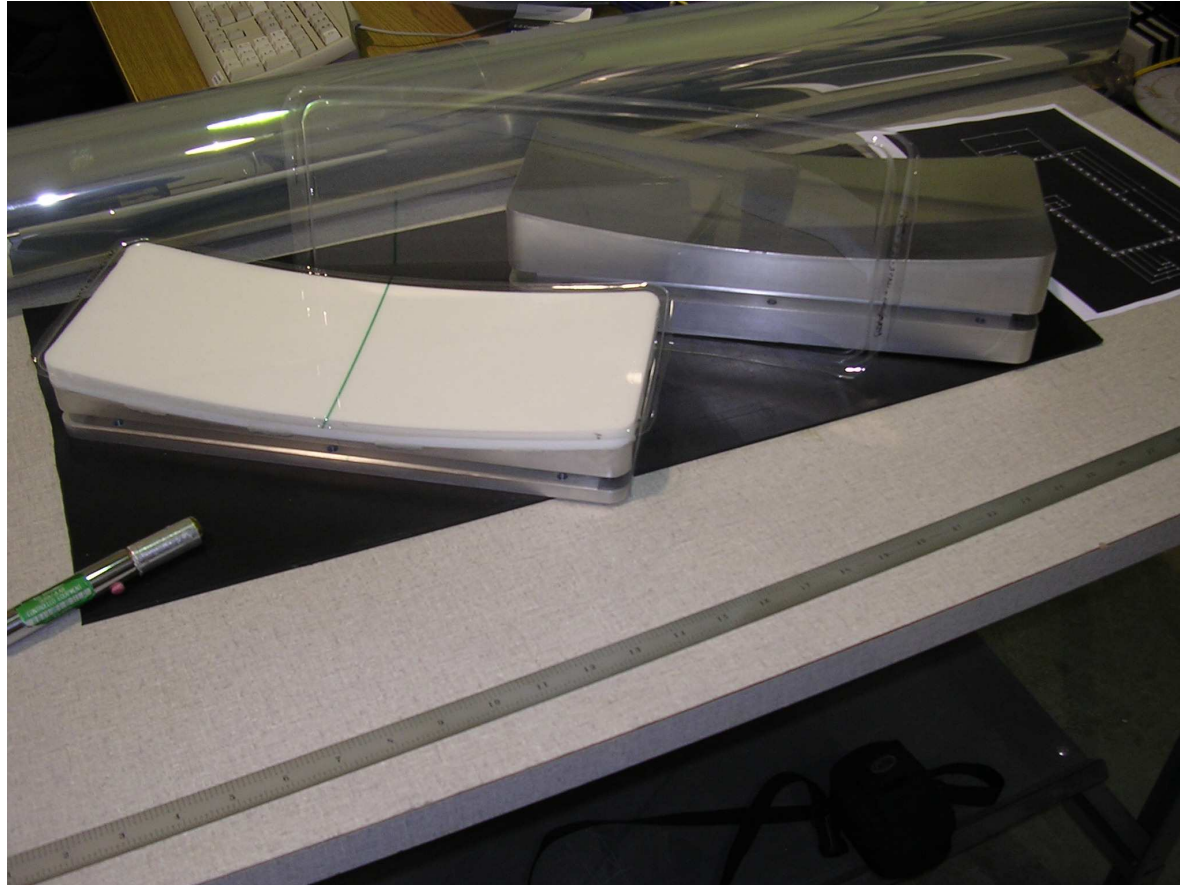
Building Mirror Prototype



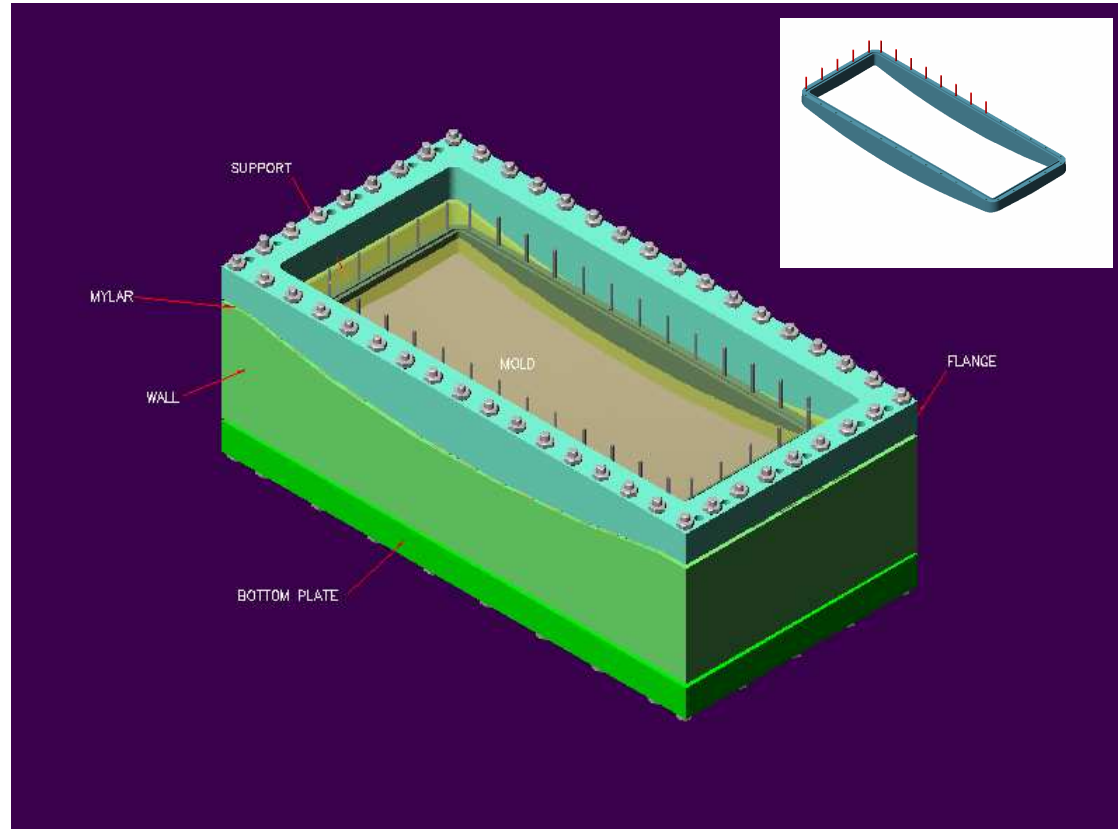
Building Mirror Prototype



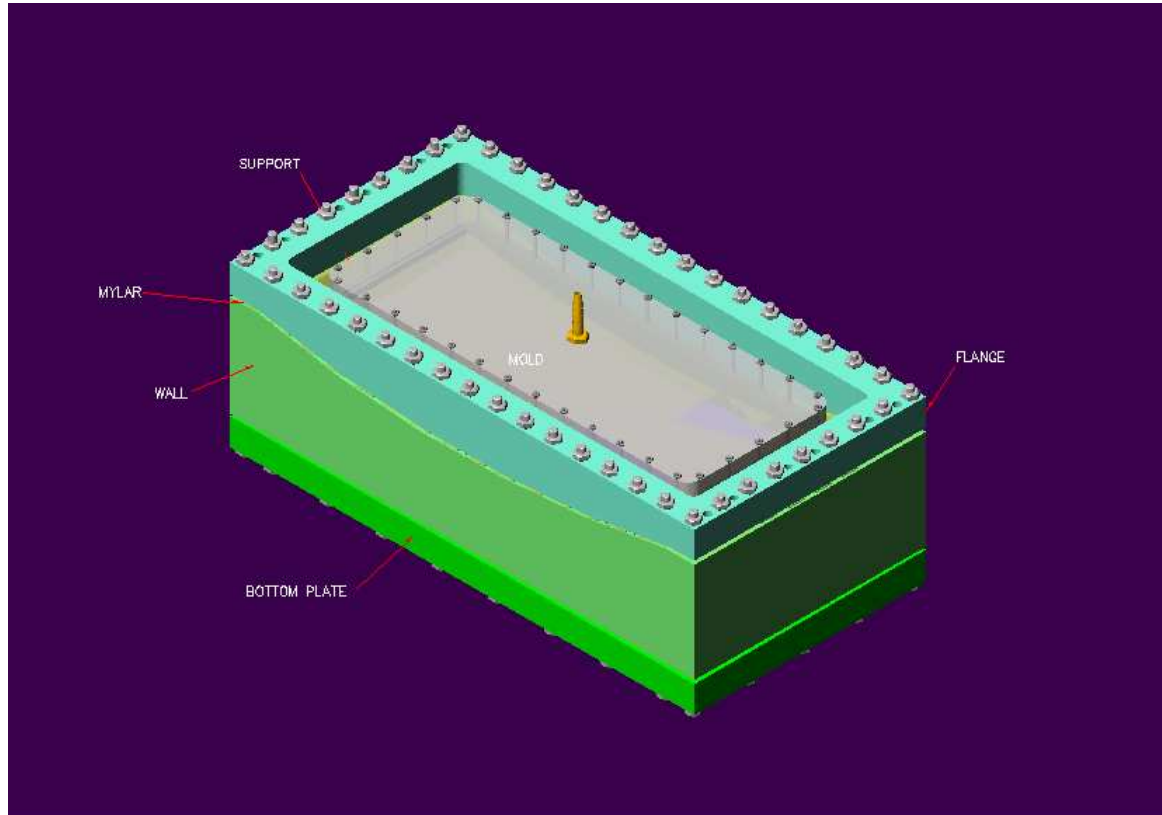
Building Mirror Prototype



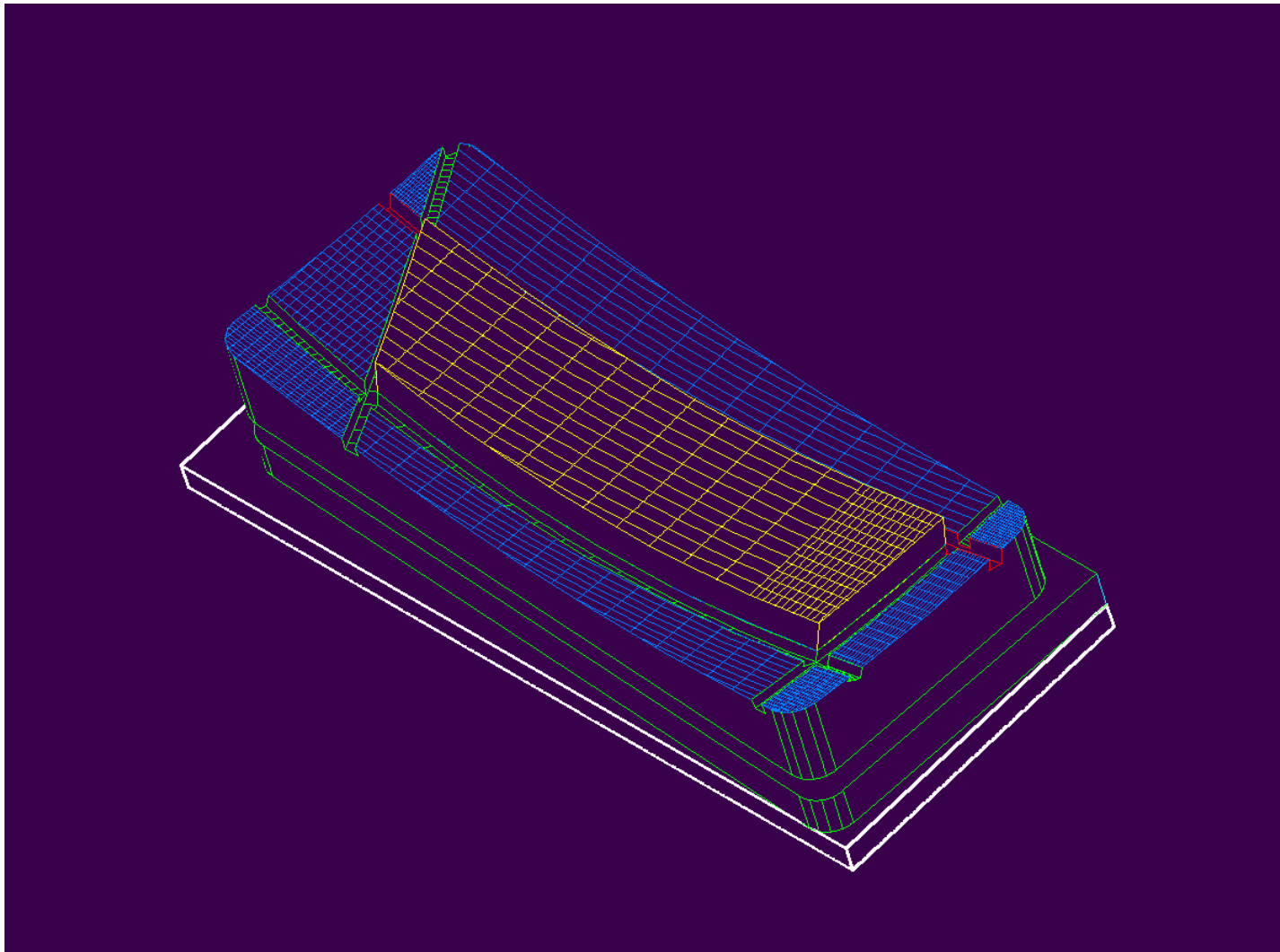
Building Multifocal Mirror Prototype



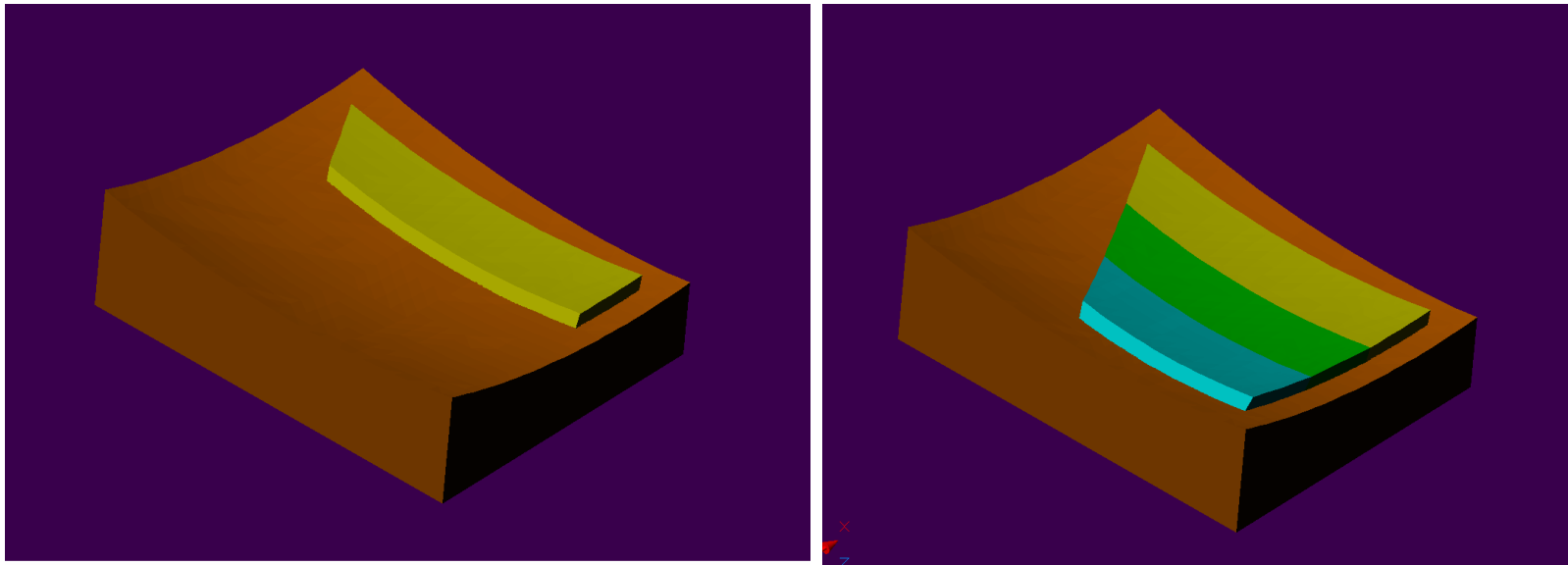
Building Multifocal Mirror Prototype



Building Multifocal Mirror Prototype

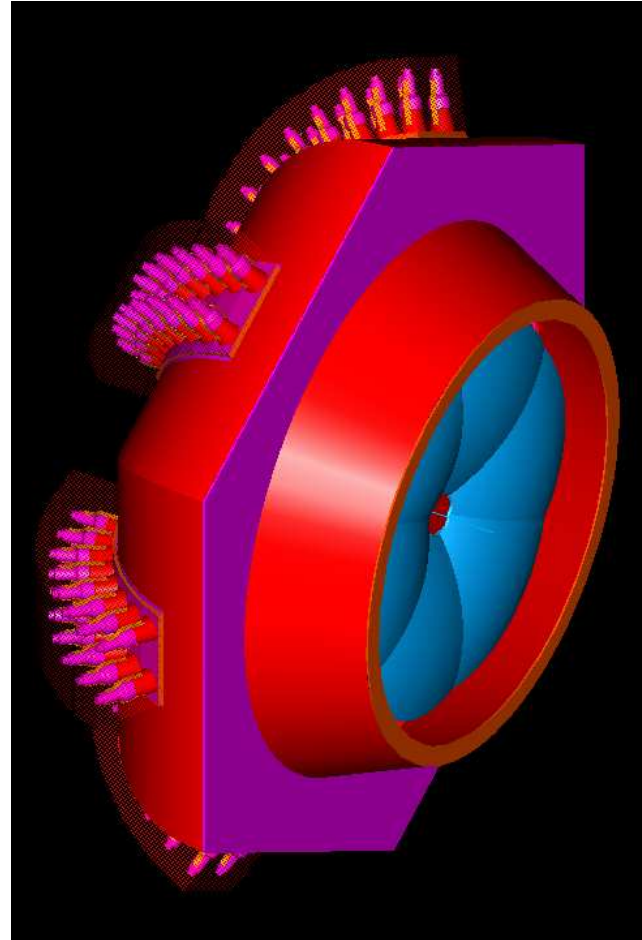


Building Multifocal Mirror Prototype



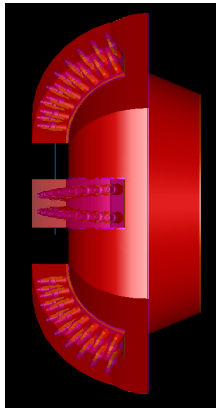
HTCC Design Status

1. Concept of the HTCC single module design has been chosen
2. Optimizing design solutions to finalize HTCC geometry (several changes already have been implemented, further modifications are not excluded)
3. Shape of the HTCC body, major structural parts are being designed
4. Design of Mirror mounting is in progress
5. Mounting of HTCC in CLAS12 is being analyzed to work out required design specifications



In FY07

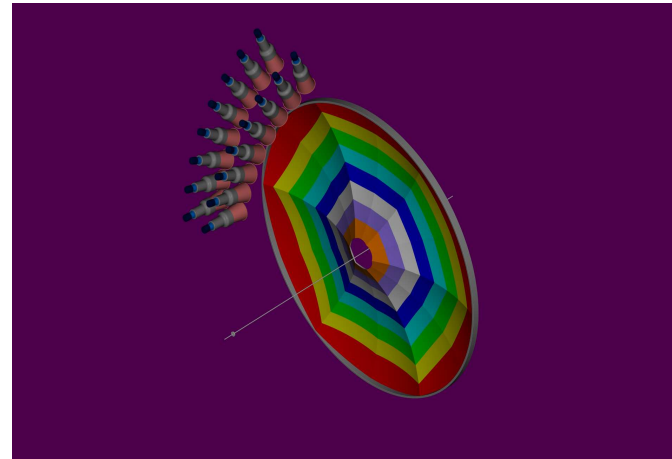
- Completion of all tests and subsequent analysis of obtained results to finalize list of components for HTCC
(Depends on progress in procurement of the 5" XP4508B photomultiplier tubes)
- Running MC simulations to check parameters necessary for the HTCC design
(Updated Field Map, Winston Cones, latest version of geometry, 12 rows of PMTs uniformly distribute over entire f - range, rate estimates per channel)
- Design of the HTCC
(It is planned to have a complete design of the working mirror for all 6 sectors and partial design of HTCC structural components)
- Building and testing $\frac{1}{2}$ -scaled multifocal mirror prototype consisting of 3 elliptical mirrors that will allow establishing of complete construction technology and provide more accurate cost estimates for manufacturing of major parts
- TDR (draft ready **by March 2007**), updated bottom up cost estimates with backup documentation provided (**by June 2007**)



Designing HTCC

Questions to be answered in FY07:

1. What kind of **Magnetic Shields** do we need (tests)
2. What would be the difference [HTCC performance wise] if PMTs with “**Plano-concave**” face plate are used instead of PMTs with **Convex-concave** face plate
3. Can **WC** successfully be substituted by **cones** in HTCC
4. What **deviation** from the nominal geometry that **might** be required by design to keep a construction cost lower would **be acceptable**
5. Estimate how **rigid** would be the mirror after tests of 1/2-scaled prototype



HTCC working group:

S. Boyarinov
K. Hafidi
K. Joo
D. Kashy
V. Kubarovsky

J. Price
Y. Sharabian
P. Stoler
A. Vlassov