

THERMAL BARRIER OPTIONS

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THERMAL BARRIER DISCUSSION

- **WHAT**
 - BARRIER BETWEEN SCT/TRT IS ACTIVELY COOLED, AND NOT PART OF THIS DISCUSSION
 - END CAPS AND INNER BORES OF THERMAL BARRIERS FOR BARREL AND FORWARD ARE
- **WHY: OXYGENATED SILICON**
 - APPARENT_PIXEL ADVANTAGE FOR USING OXYGENATED SI (LAYER 1)
 - MAXIMUM_OPERATING TEMPERATURE INCREASES TO OC
 - WARM TIME WITH OPERATION AT OC INCREASES TO 60DAY/YR
- **WHY NOW**
 - PIXEL SUPPORT FRAME FDR IS IN DEC 2000
 - THERMAL BARRIERS ARE INTEGRATED WITH THE SUPPORT FRAME-FINAL DESIGN STARTING_NOW
 - SCT SUPPORT FRAME FDR IS ALREADY PAST
 - IS THE THERMAL BARRIER DESIGN ADEQUATELY ADDRESSED IF CHANGES ARE MADE NOW
 - FINAL DESIGN WORK NOW ON BASELINE
- **THERMAL BARRIERS OTHER THAN SCT/TRT BOUNDARY ARE REQUIRED DURING MAINTENANCE**
 - MAINTAIN NON-CONDENSING OUTER SURFACE WHILE INSIDE IS CHILLED
 - KEEP INTERIOR COLD GAS DRY
- **QUESTIONS TO ANSWER TODAY**
 - IS THE B-LAYER REMOVABLE WITHOUT REMOVING THE FORWARD
 - DO PIXEL LAYERS 1 AND 2 SHARE THE THERMAL ENVIRONMENT WITH SCT BARRELS OR WITH THE B-LAYER
- **WHAT ARE THE CONSEQUENCES OF THE ABOVE DECISIONS**
 - THREE OPTIONS ARE PRESENTED WITH CONSEQUENCES IMPOSED BY THE REQUIREMENTS OF THE SYSTEM

PIXEL DETECTOR

OVERVIEW OF CHOICES

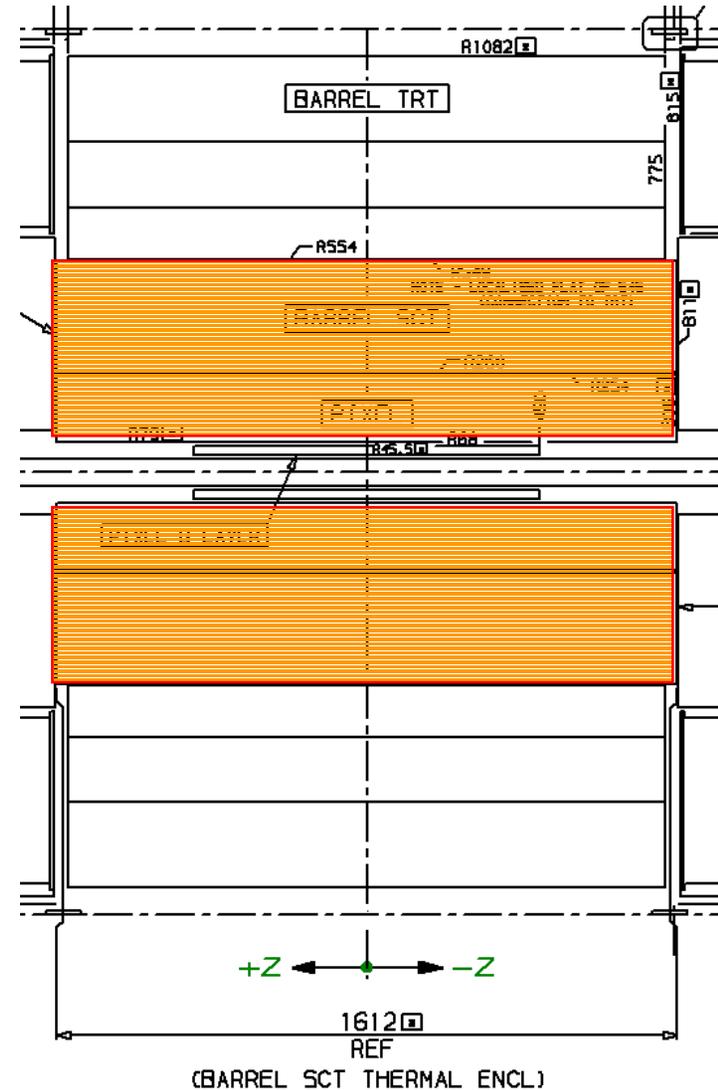
- **(A) CHANGE NOTHING - CURRENT BASELINE**
 - B-LAYER TOOLING AND FARADAY CAGE INTEGRATED INTO THERMAL BARRIER
 - NO MATERIAL BETWEEN SCT AND PIXELS
 - SCT AND PIXEL SERVICES SHARE VOLUME
- **(B) MOVE BETWEEN SCT AND PIXELS**
 - B-LAYER SUPPORT RAIL AND FARADAY CAGE REMAIN INSIDE PIXELS BETWEEN L1 AND BL
 - INTRODUCE THERMAL BARRIER INTO GAP BETWEEN PIXEL/SCT
 - INTRODUCE INDEPENDENT FARADAY CAGE FOR PIXELS BETWEEN SCT AND PIXELS
 - SCT AND PIXEL SERVICES DON'T SHARE VOLUME
 - TAKE UP MORE SPACE IN Z. POWER TO THERMAL BARRIER INCREASES. TOTAL MATERIAL INCREASES
- **(C) SEAL OFF TO BEAM-PIPE**
 - B-LAYER SUPPORT RAIL REMAINS, FARADAY CAGE SEALS TO BEAMPIPE
 - NO MATERIAL BETWEEN SCT AND PIXELS. LESS MATERIAL THAN BASELINE
 - B-LAYER SERVICES EXIT WITH REST OF BARREL
 - MORE SPACE REQUIRED IN CURRENT SERVICE ROUTING
 - NO MATERIAL ALONG BEAMPIPE
 - SERVICES OUT BOTH SIDES POSSIBLE
 - BUT B-LAYER NOT INSERTABLE FROM ENDS

AUXILIARY CONSIDERATIONS

- **X-RAY SURVEY REQUIREMENTS IMPLY SEVERAL PRE-EXISTING CONSTRAINTS**
 - SCT ALREADY OPERATES INDEPENDENT OF PIXEL INSTALLATION
 - SAME EQUIPMENT CAN BE USED IN EVENT OF PIXEL ABSENCE
- **B-LAYER INSTALLATION**
 - STRUCTURE FOR B-LAYER INSTALLATION DOES NOT MOVE EVEN IF THERMAL BARRIER DOES
- **SERVICE ROUTING**
 - SERVICES FOR PIXELS SHARE Z-SPACE IN PHI WITH SCT SERVICES IN CURRENT LAYOUT
 - TUBE INSULATION ENDS ONLY AFTER PENETRATING A THERMAL BARRIER
 - THIS IS POORLY UNDERSTOOD FOR THE B-LAYER
 - GAP BETWEEN FORWARD AND BARREL REPRESENTS A LARGE LEAK INTO VOLUME
- **GROUNDING AND SHIELDING**
 - SHIELDING REQUIREMENTS POORLY UNDERSTOOD
 - TO BE EFFECTIVE IS A NON-NEGLIGIBLE AMOUNT OF CONDUCTOR
 - IF THE B-LAYER IS INSTALLED SEPARATELY, THIS IMPLIES THAT THERE IS SOMETHING BETWEEN LAYER 1 AND THE B-LAYER ALREADY, IN ADDITION TO THE INSTALLATION RAIL
 - B-LAYER SHIELDING UNCERTAIN IN CASES (A) AND (B)

(A) CHANGE NOTHING (BASELINE)

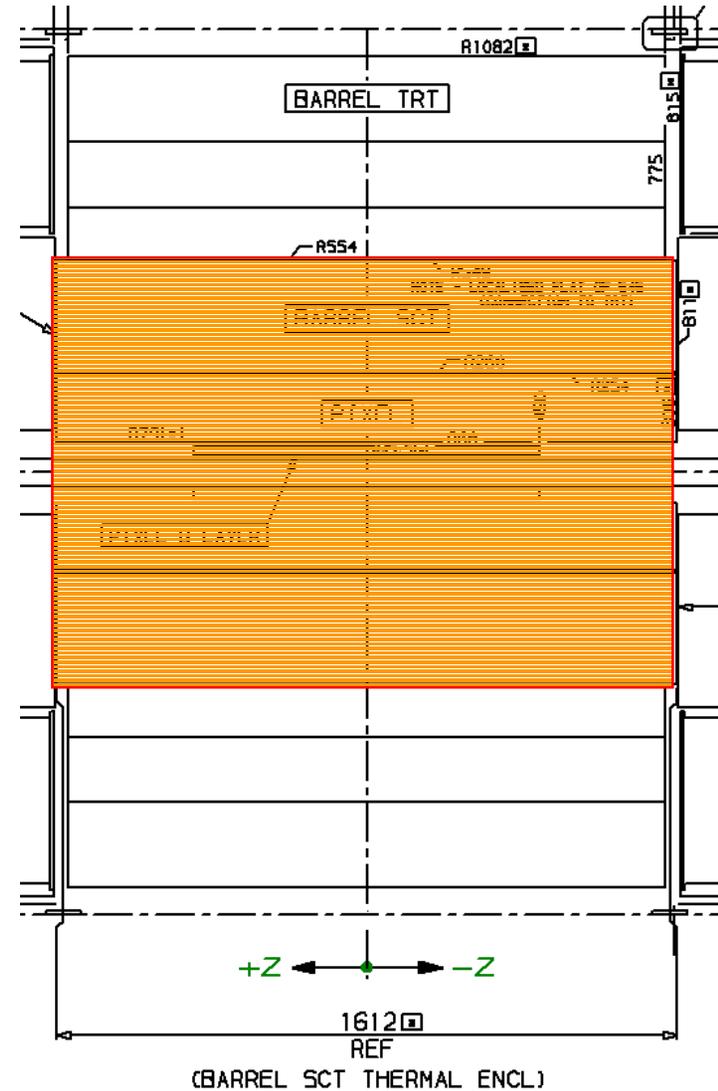
- **SCT AND PIXELS SHARE ENCLOSURE ENVIRONMENT**
 - THERMAL BARRIER BORE BETWEEN B-LAYER AND LAYER 1 OF PIXELS
 - ENDCAP FROM SCT/TRT BARRIER TO BORE
 - FARADAY CAGE IS SHARED
 - IF PIXEL THERMAL SHIELD GOES AWAY, MATERIAL IS STILL NEEDED FOR FARADAY CAGE
- **B-LAYER INSTALLATION RAIL INTEGRATED INTO BORE OF THERMAL BARRIER**
 - RAIL BENEFITS FROM THE STIFFNESS OF THE THERMAL BARRIER
 - NOT ALL MATERIAL CAN BE REMOVED WITH REMOVAL OF THERMAL BARRIER
- **MOST CONSERVATIVE**
 - IF OXYGENATED SI BENEFITS NOT REALIZED
 - B-LAYER CAN BE REPLACED



In the absence of a decision, this option will be pursued
(is being currently pursued)

(C) THERMAL SCREEN SEALS TO BEAM PIPE

- **PRESENTED FOR COMPLETENESS--
OXYGENATED SILICON ALLOWS B-LAYER TO
LIVE LONGER AS WELL**
 - B-LAYER MIGHT LIVE FOR UP TO 5YRS
- **ADVANTAGES**
 - SERVICES OUT BOTH SIDES A POSSIBILITY
 - NO SERVICES ALONG BEAMPIPE
 - B-LAYER INSTALLATION EASIER STILL
 - MINIMUM MATERIAL
- **IMPACTS**
 - COUPLES REMOVAL OF B-LAYER TO ACCESS TO ID BARREL
 - INCREASES PIXEL SERVICE BURDEN IN GAP AND ALONG CRYOSTAT BY 10%
 - SEALING TO BEAMPIPE NOT CLEAR IN THIS REGION

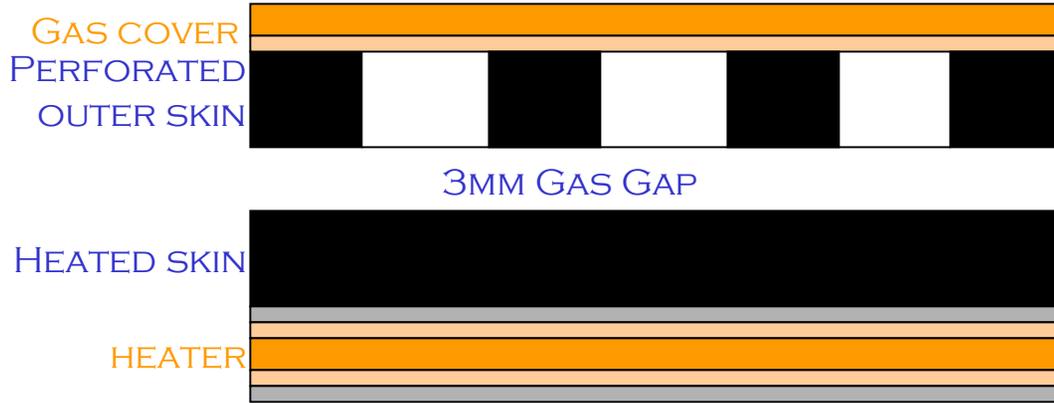


PIXEL DETECTOR

CONCLUSIONS

- **CURRENT BASELINE IS CONSERVATIVE SOLUTION FOR INITIAL OPERATION OF ATLAS**
 - **MORE OPERATIONAL SAFETY MARGIN - RELIANCE ON OXYGENATED SILICON REDUCED**
 - **B-LAYER CAN BE REPLACED**
 - **INSTALLATION OF PIXELS INTO SCT/TRT IN CRYOSTAT STILL POSSIBLE**
 - **CAN MEET PIXEL FDR SCHEDULE**
- **SIMPLIFYING SOMEWHAT UPGRADE THAT MIGHT OCCUR IN >2007? NOT HIGHEST PRIORITY**

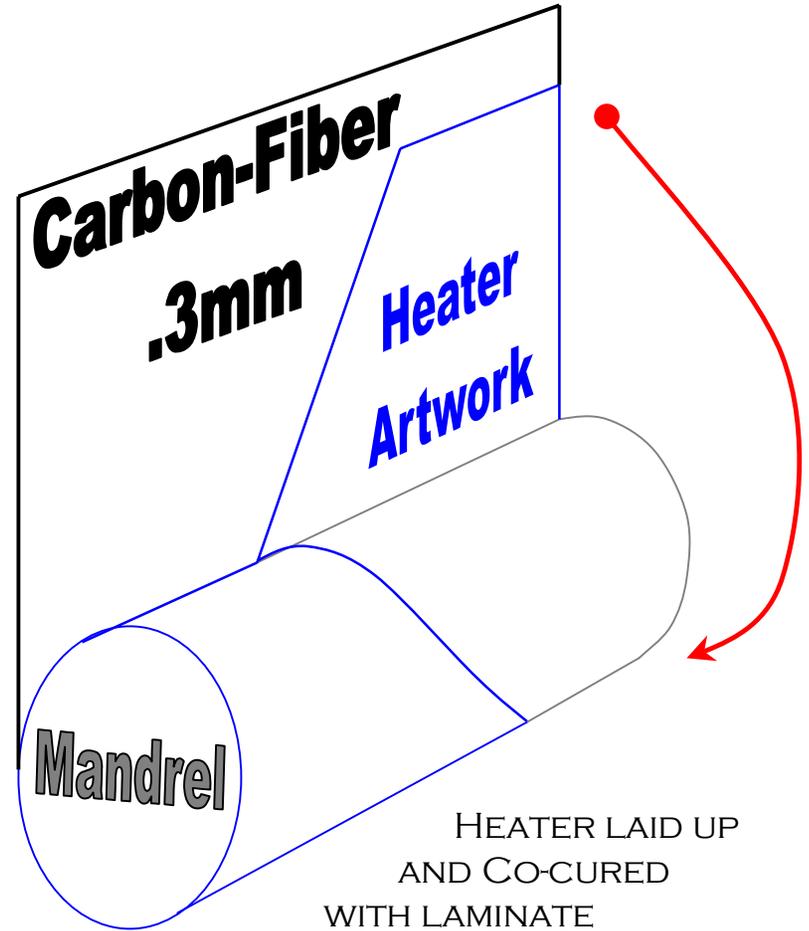
MATERIAL ESTIMATE FOR THERMAL SHIELD SUBSTRATE



COMPONENT	X ₀	THICKNESS	%X ₀
HEATED CARBON SHELL	25CM	.030CM	0.120%
KAPTON	28.4CM	.005CM	0.017%
ALUMINUM TRACES	8.9CM	.0025CM	0.028%
ADHESIVE	28CM	.004CM	0.014%
LIGHTWEIGHTED CARBON SHELL	25CM	.030CM X 30% COVERAGE	0.036%
KAPTON COVERS	28.4CM	.005CM	0.018%
ADHESIVE	28CM	.0025CM X 30% COVERAGE	0.003%

HEATED SKIN

COLD SIDE



%X₀ NORMAL INCIDENCE 0.236%

MATERIAL ESTIMATES FOR DIFFERENT OPTIONS

- **OPTION A**

- R80, Z=0-800 [0.236% X_0]
 - BORE THERMAL BARRIER BETWEEN L1 AND B-LAYER
- Z800, R=80-500 [0.236% X_0]
 - RADIAL EXTENT OF THERMAL BARRIER

- **OPTION B**

- R80, Z=0-800 [0.179% X_0]
 - FARADAY CAGE AND SUPPORT FOR B-LAYER RAIL (LIKE HEATED SKIN X0)
- Z800, R=80-250 [0.179% X_0]
 - FARADAY CAGE AT END OF PIXELS (RADIAL ELEMENT)
- R250, Z=0-800 [0.415% X_0]
 - FARADAY CAGE OVER PIXELS **PLUS** THERMAL SCREEN (0.236 + 0.179)
- Z800, R=80-500 [0.236% X_0]
 - SCT THERMAL SCREEN RADIAL EXTENT

- **OPTION C**

- Z800, R=35-500 [0.236% X_0]
 - RADIAL EXTENT SEALS TO BEAMPIPE

ALL ESTIMATES ARE MISSING CHUNKS OF MATERIAL AT BENDS AND TERMINATIONS-THE MORE LINES IN AN ESTIMATE, THE MORE OF THESE THAT ARE MISSING