

Notes from Pixel Mechanics Meeting
June 18, 2001

Present: Anderssen, Johnson, Wirth, Goozen, Gilchriese, Stillwater, Weber, Ryan, Jones, Wise

1. Sector drawing status. Dave is working on drawings and will meet with Eric/Jon on Thursday. Dave to check in, Eric to add drawing numbers supplied by EDMS. Eric to create pdfs to upload to EDMS. Schedule for completion of tooling drawings(for fab) needs to be clarified. Tooling is hoped to be ready(for tube bending) in July, assuming tubes arrive on schedule.
2. Sector materials- No news on carbon-carbon plates or tubes. Foam has been delivered and preliminary inspection looks OK and agreement with Allcomp. Foam density is over the spec but has been accepted.
3. Coolant connections - measurements of variseals appear to show systematic increase in leakage as temperature is lowered. This will be better quantified. Is there hysteresis? Does the leak rate stabilize at low temperature? Status of RFQ/contract with second laser welding vendor(Isis, formerly Laserfab) to be checked. Fred has lure-lok fittings in aluminum, PEEK, glass-filled PEEK and expects samples to be ready for test by end of week.
4. Sector 11 tests. Doug reported and is doing this. This is the first 8-sector designed prototype. Thermal performance tests(pre-rad) are complete and look good. Maximum delta T before any tests is 6.7C. After 50 thermal cycles to -35, thermal shock with LN2 to -35, pressurization to 8 bar, and then another 50 cycles to -35, the maximum deltaT is 7.7C. Tests of the sector 12(with rigid epoxy instead of CGL attaching the tube) will be done this week. Irradiation may be done at high rate facility in Sacramento to speed up irradiation but this wont happen until early July.
5. Sector thermal QC fixture - design is progressing by Cliff. Drawing of Pt on kapton should assume current thickness of Pt as on silicon heaters. Should proceed as soon as possible with making Pt-on-kapton heaters since long lead time.
6. TVH. See attached notes from Allison. Drawings done in ProE. Has order translator, micrometer head. Allison, Doug, Tom J., Eric, Neal...have to take laser safety course(next scheduled class is June 29). Re-setup of TVH is at least 2 weeks away according to Eric.
7. Friction tests. Tai showed concept for rotary static and dynamic test set up to test materials for sliders against rail material. Drawings to be finished by next week and parts ordered. Plan to use existing rack mounted computer for data acquisition when automated, first version is "by hand".
8. Ring inside frame. First tests are complete and results posted on Fred's web site <http://www-atlas.lbl.gov/~goozen/supportframe.html>. The results look good so far. Next steps are to remove ring and replace and understand how repeatable this is.
9. Fred has developed a concept for survey based on a commercial instrument. I append this.
10. B-layer support tube. Eric has complete first model of B-layer support tube and has sent it to Bill Miller.

11. Endplate region and pixel support. Eric will work on pixel support concept and needs endplate model from Bill.

TVH test fixture update

Allison Ryan

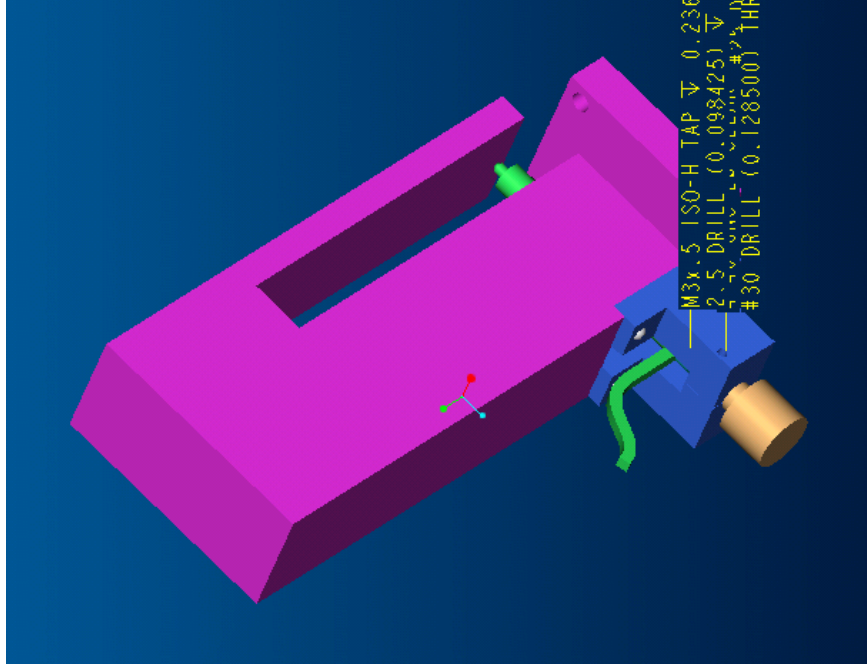
Atlas Pixel Mechanics Meeting

6-18-01

Test Assembly

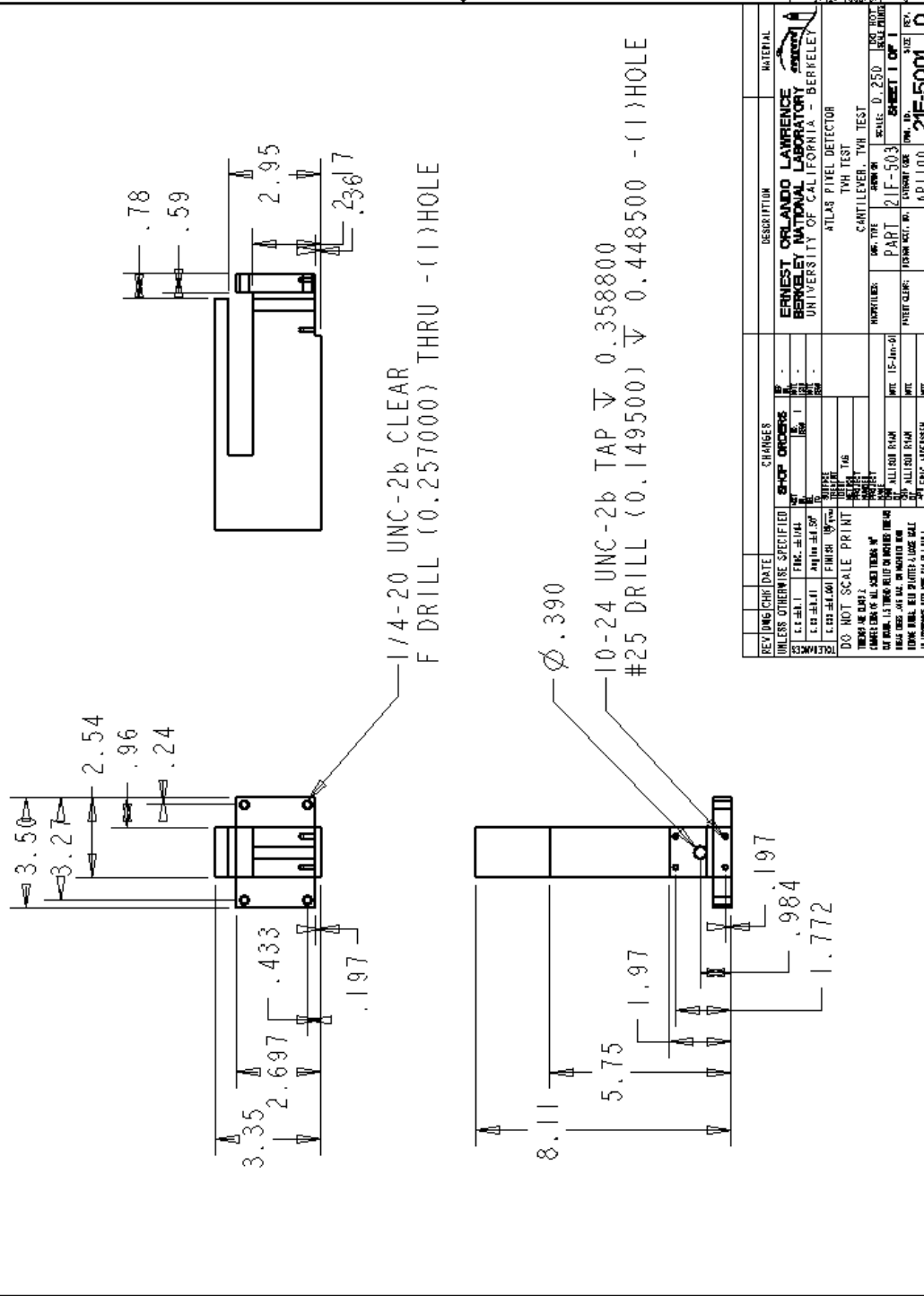
Includes

- Cantilever
- Back plate
- Piezo translator
- Translator end plug
- Micrometer head



Cantilever drawing

ENG. NO. 21F-5001
 SIZE 0 1
 REV. 0 1



REV	DATE	DESCRIPTION	MATERIAL
1		ATLAS PIXEL DETECTOR CANTILEVER, TVR TEST	ALUMINUM
2		CHANGES SHOP ORDERS	
3		UNLESS OTHERWISE SPECIFIED FIN. SURF. TO BE AS SHOWN	
4		DO NOT SCALE PRINT	
5		CHANGES OF ALL SIZES TO BE MADE BY THE DRAWING ENGINEER	
6		THIS DRAWING IS THE PROPERTY OF ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY	
7		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
8		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
9		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
10		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
11		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
12		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
13		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
14		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
15		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
16		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
17		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
18		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
19		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
20		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
21		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
22		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
23		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
24		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
25		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
26		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
27		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
28		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
29		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
30		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
31		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
32		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
33		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
34		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
35		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
36		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
37		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
38		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
39		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
40		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
41		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
42		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
43		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
44		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
45		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
46		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
47		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
48		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
49		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	
50		IT IS TO BE KEPT IN THE OFFICE OF THE DRAWING ENGINEER	

ERNEST ORLANDO LAWRENCE
 BERKELEY NATIONAL LABORATORY
 UNIVERSITY OF CALIFORNIA - BERKELEY

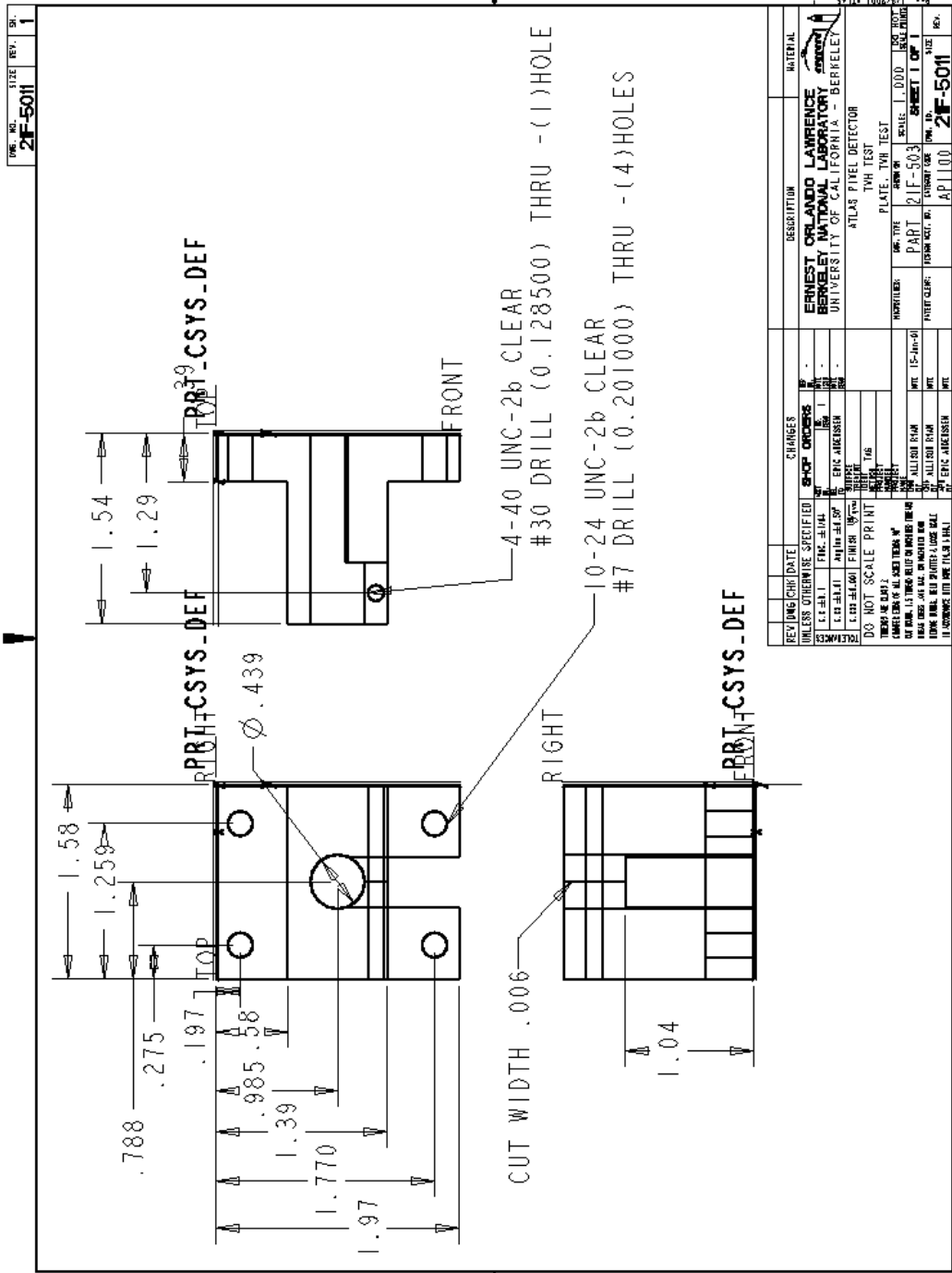
ATLAS PIXEL DETECTOR
 CANTILEVER, TVR TEST

SCALE: 0.250
 SHEET 1 OF 1

DATE: APR 10 1960
 SIZE: 0

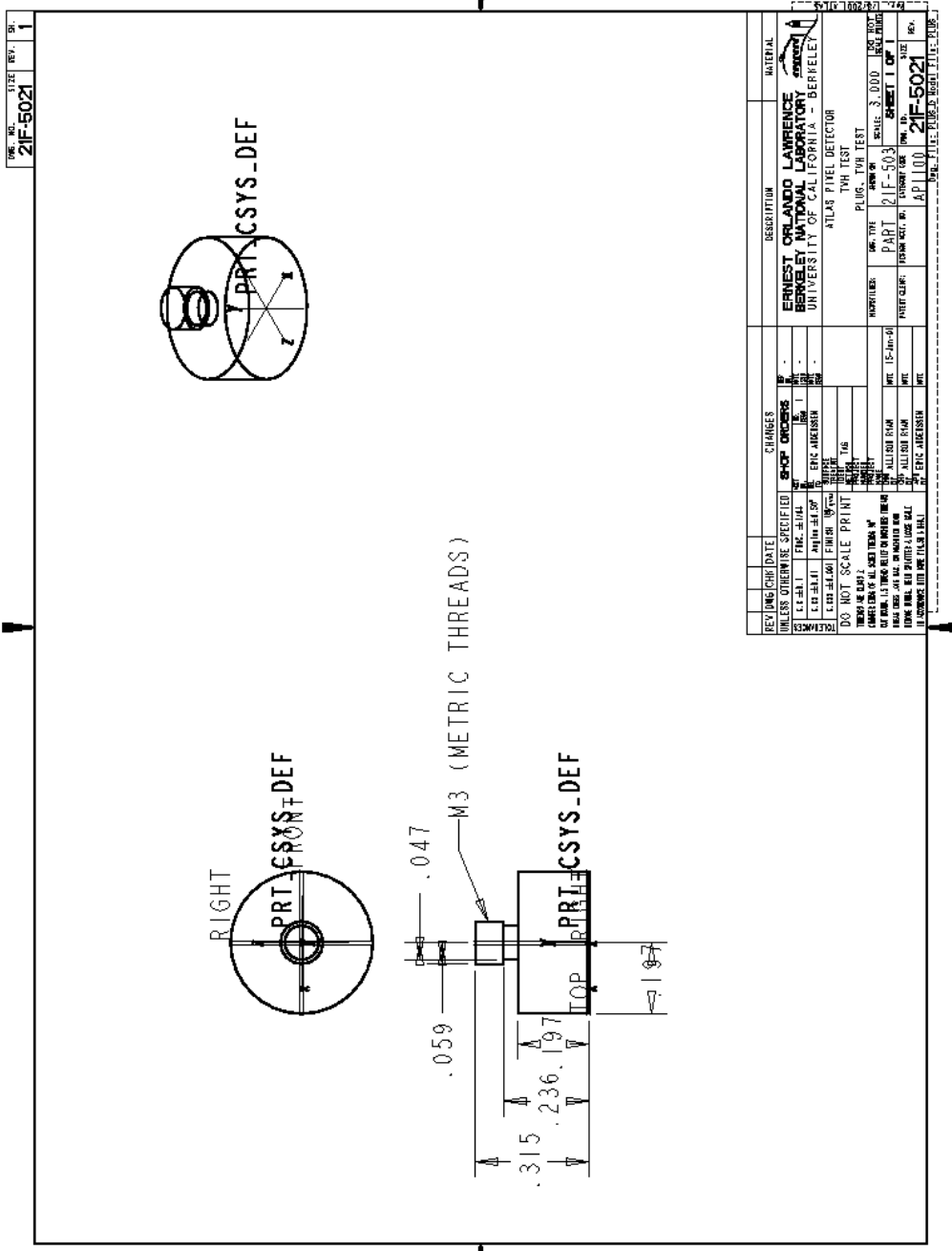
FILE: 21F-5001

Back plate drawing



REV	DATE	DESCRIPTION	MATERIAL
1		ATLAS FUEL DETECTOR	
2		PLATE, TWI TEST	
3		SCALE 1.000	
4		DRG. THE PART 2F-503	
5		UNLESS OTHERWISE SPECIFIED	
6		STOCK ORDERS	
7		LETTER I	
8		LETTER J	
9		LETTER K	
10		LETTER L	
11		LETTER M	
12		LETTER N	
13		LETTER O	
14		LETTER P	
15		LETTER Q	
16		LETTER R	
17		LETTER S	
18		LETTER T	
19		LETTER U	
20		LETTER V	
21		LETTER W	
22		LETTER X	
23		LETTER Y	
24		LETTER Z	
25		LETTER AA	
26		LETTER AB	
27		LETTER AC	
28		LETTER AD	
29		LETTER AE	
30		LETTER AF	
31		LETTER AG	
32		LETTER AH	
33		LETTER AI	
34		LETTER AJ	
35		LETTER AK	
36		LETTER AL	
37		LETTER AM	
38		LETTER AN	
39		LETTER AO	
40		LETTER AP	
41		LETTER AQ	
42		LETTER AR	
43		LETTER AS	
44		LETTER AT	
45		LETTER AU	
46		LETTER AV	
47		LETTER AW	
48		LETTER AX	
49		LETTER AY	
50		LETTER AZ	
51		LETTER BA	
52		LETTER BB	
53		LETTER BC	
54		LETTER BD	
55		LETTER BE	
56		LETTER BF	
57		LETTER BG	
58		LETTER BH	
59		LETTER BI	
60		LETTER BJ	
61		LETTER BK	
62		LETTER BL	
63		LETTER BM	
64		LETTER BN	
65		LETTER BO	
66		LETTER BP	
67		LETTER BQ	
68		LETTER BR	
69		LETTER BS	
70		LETTER BT	
71		LETTER BU	
72		LETTER BV	
73		LETTER BW	
74		LETTER BX	
75		LETTER BY	
76		LETTER BZ	
77		LETTER CA	
78		LETTER CB	
79		LETTER CC	
80		LETTER CD	
81		LETTER CE	
82		LETTER CF	
83		LETTER CG	
84		LETTER CH	
85		LETTER CI	
86		LETTER CJ	
87		LETTER CK	
88		LETTER CL	
89		LETTER CM	
90		LETTER CN	
91		LETTER CO	
92		LETTER CP	
93		LETTER CQ	
94		LETTER CR	
95		LETTER CS	
96		LETTER CT	
97		LETTER CU	
98		LETTER CV	
99		LETTER CW	
100		LETTER CX	
101		LETTER CY	
102		LETTER CZ	
103		LETTER DA	
104		LETTER DB	
105		LETTER DC	
106		LETTER DD	
107		LETTER DE	
108		LETTER DF	
109		LETTER DG	
110		LETTER DH	
111		LETTER DI	
112		LETTER DJ	
113		LETTER DK	
114		LETTER DL	
115		LETTER DM	
116		LETTER DN	
117		LETTER DO	
118		LETTER DP	
119		LETTER DQ	
120		LETTER DR	
121		LETTER DS	
122		LETTER DT	
123		LETTER DU	
124		LETTER DV	
125		LETTER DW	
126		LETTER DX	
127		LETTER DY	
128		LETTER DZ	
129		LETTER EA	
130		LETTER EB	
131		LETTER EC	
132		LETTER ED	
133		LETTER EE	
134		LETTER EF	
135		LETTER EG	
136		LETTER EH	
137		LETTER EI	
138		LETTER EJ	
139		LETTER EK	
140		LETTER EL	
141		LETTER EM	
142		LETTER EN	
143		LETTER EO	
144		LETTER EP	
145		LETTER EQ	
146		LETTER ER	
147		LETTER ES	
148		LETTER ET	
149		LETTER EU	
150		LETTER EV	
151		LETTER EW	
152		LETTER EX	
153		LETTER EY	
154		LETTER EZ	
155		LETTER FA	
156		LETTER FB	
157		LETTER FC	
158		LETTER FD	
159		LETTER FE	
160		LETTER FF	
161		LETTER FG	
162		LETTER FH	
163		LETTER FI	
164		LETTER FJ	
165		LETTER FK	
166		LETTER FL	
167		LETTER FM	
168		LETTER FN	
169		LETTER FO	
170		LETTER FP	
171		LETTER FQ	
172		LETTER FR	
173		LETTER FS	
174		LETTER FT	
175		LETTER FU	
176		LETTER FV	
177		LETTER FW	
178		LETTER FX	
179		LETTER FY	
180		LETTER FZ	
181		LETTER GA	
182		LETTER GB	
183		LETTER GC	
184		LETTER GD	
185		LETTER GE	
186		LETTER GF	
187		LETTER GG	
188		LETTER GH	
189		LETTER GI	
190		LETTER GJ	
191		LETTER GK	
192		LETTER GL	
193		LETTER GM	
194		LETTER GN	
195		LETTER GO	
196		LETTER GP	
197		LETTER GQ	
198		LETTER GR	
199		LETTER GS	
200		LETTER GT	
201		LETTER GU	
202		LETTER GV	
203		LETTER GW	
204		LETTER GX	
205		LETTER GY	
206		LETTER GZ	
207		LETTER HA	
208		LETTER HB	
209		LETTER HC	
210		LETTER HD	
211		LETTER HE	
212		LETTER HF	
213		LETTER HG	
214		LETTER HH	
215		LETTER HI	
216		LETTER HJ	
217		LETTER HK	
218		LETTER HL	
219		LETTER HM	
220		LETTER HN	
221		LETTER HO	
222		LETTER HP	
223		LETTER HQ	
224		LETTER HR	
225		LETTER HS	
226		LETTER HT	
227		LETTER HU	
228		LETTER HV	
229		LETTER HW	
230		LETTER HX	
231		LETTER HY	
232		LETTER HZ	
233		LETTER IA	
234		LETTER IB	
235		LETTER IC	
236		LETTER ID	
237		LETTER IE	
238		LETTER IF	
239		LETTER IG	
240		LETTER IH	
241		LETTER II	
242		LETTER IJ	
243		LETTER IK	
244		LETTER IL	
245		LETTER IM	
246		LETTER IN	
247		LETTER IO	
248		LETTER IP	
249		LETTER IQ	
250		LETTER IR	
251		LETTER IS	
252		LETTER IT	
253		LETTER IU	
254		LETTER IV	
255		LETTER IW	
256		LETTER IX	
257		LETTER IY	
258		LETTER IZ	
259		LETTER JA	
260		LETTER JB	
261		LETTER JC	
262		LETTER JD	
263		LETTER JE	
264		LETTER JF	
265		LETTER JG	
266		LETTER JH	
267		LETTER JI	
268		LETTER JJ	
269		LETTER JK	
270		LETTER JL	
271		LETTER JM	
272		LETTER JN	
273		LETTER JO	
274		LETTER JP	
275		LETTER JQ	
276		LETTER JR	
277		LETTER JS	
278		LETTER JT	
279		LETTER JU	
280		LETTER JV	
281		LETTER JW	
282		LETTER JX	
283		LETTER JY	
284		LETTER JZ	
285		LETTER KA	
286		LETTER KB	
287		LETTER KC	
288		LETTER KD	
289		LETTER KE	
290		LETTER KF	
291		LETTER KG	
292		LETTER KH	
293		LETTER KI	
294		LETTER KJ	
295		LETTER KK	
296		LETTER KL	
297		LETTER KM	
298		LETTER KN	
299		LETTER KO	
300		LETTER KP	
301		LETTER KQ	
302		LETTER KR	
303		LETTER KS	
304		LETTER KT	
305		LETTER KU	
306		LETTER KV	
307		LETTER KW	
308		LETTER KX	
309		LETTER KY	
310		LETTER KZ	
311		LETTER LA	
312		LETTER LB	
313		LETTER LC	
314		LETTER LD	
315		LETTER LE	
316		LETTER LF	
317		LETTER LG	
318		LETTER LH	
319		LETTER LI	
320		LETTER LJ	
321		LETTER LK	
322		LETTER LL	
323		LETTER LM	
324		LETTER LN	
325		LETTER LO	
326		LETTER LP	
327		LETTER LQ	
328		LETTER LR	
329		LETTER LS	
330		LETTER LT	
331		LETTER LU	
332		LETTER LV	
333		LETTER LW	
334		LETTER LX	
335		LETTER LY	
336		LETTER LZ	
337		LETTER MA	
338		LETTER MB	
339		LETTER MC	
340		LETTER MD	
341		LETTER ME	
342			

End plug drawing



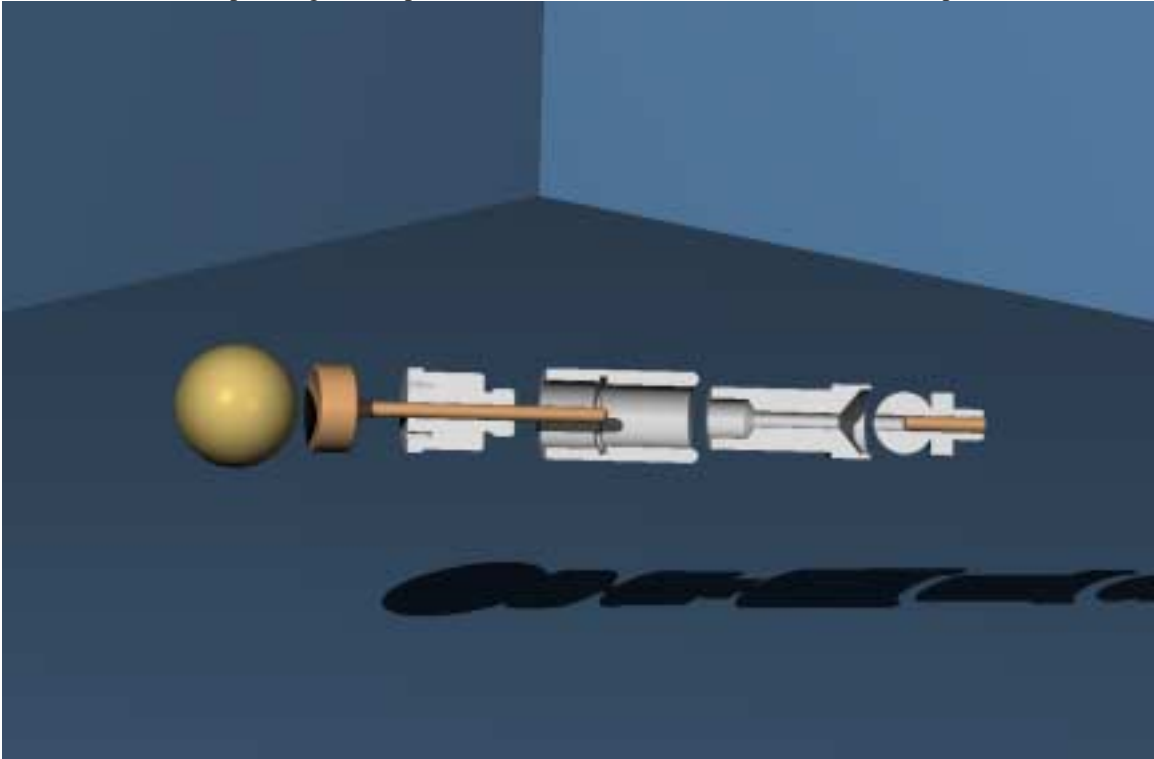
This part forms the interface between the piezo translator and the micrometer head, preventing concentrated loading on the piezo

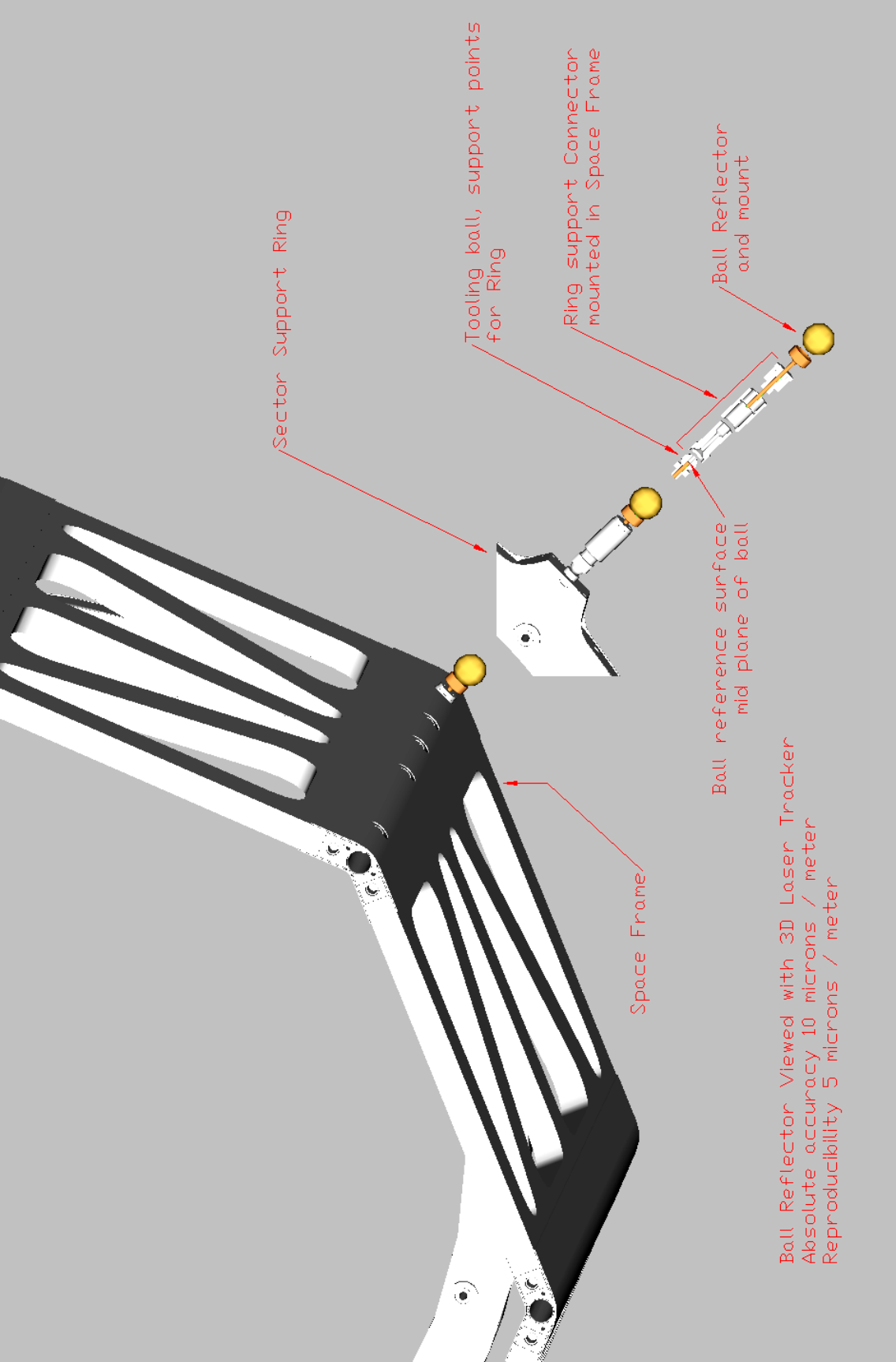
Atlas Pixal Survey

With detectors mounted on sectors and using mounting holes to construct datum measure all detector targets relative to datum on both sides.

With sectors mounted on sector support ring and using support balls for datum re-measure subset of targets relative support ball datum.

After sector support ring is mounted in space frame the position of ring support balls is transferred through the space frame by a probe with a magnetic cup at one end that supports a ball reflector. The probe runs down the axis of the support ball connector that is bonded into the space frame. By making two measurements one with the probe full in and another practically in the location of the ball is known. Other sockets to except a magnetic cup for the ball reflectors would be bonded into the space frame





Sector Support Ring

Tooling ball, support points for Ring

Ring support Connector mounted in Space Frame

Ball Reflector and mount

Ball reference surface mid plane of ball

Space Frame

Ball Reflector Viewed with 3D Laser Tracker
Absolute accuracy 10 microns / meter
Reproducibility 5 microns / meter

Measuring principle of the 3D Laser Tracker LTD500

Basic Principle

The combination of horizontal and vertical angle measurements with distance measurements allows determining the 3D coordinates of a reflector within any tool or part coordinate system. Motors support fully automated measurements and a position detector guarantees high speed tracking capabilities.

Leica's Key Technology

While the angles are measured with high precision encoders, distances can be derived from Leica's patented absolute or interferometric distance measuring devices.

Laser Tracker LT(D) 500

The LT500 incorporates the interferometer technology for precise and fast tracking and scanning jobs.

The LTD500 with the additional absolute distance measuring device increases productivity, flexibility and automation.

Flexible positioning

The Laser Tracker can be mounted on Leica's portable stand or any other state of the art height adjustable device. In addition vertical positioning of the measurement head is possible.

High precision horizontal and vertical angle encoders

Hand held reflector for object probing

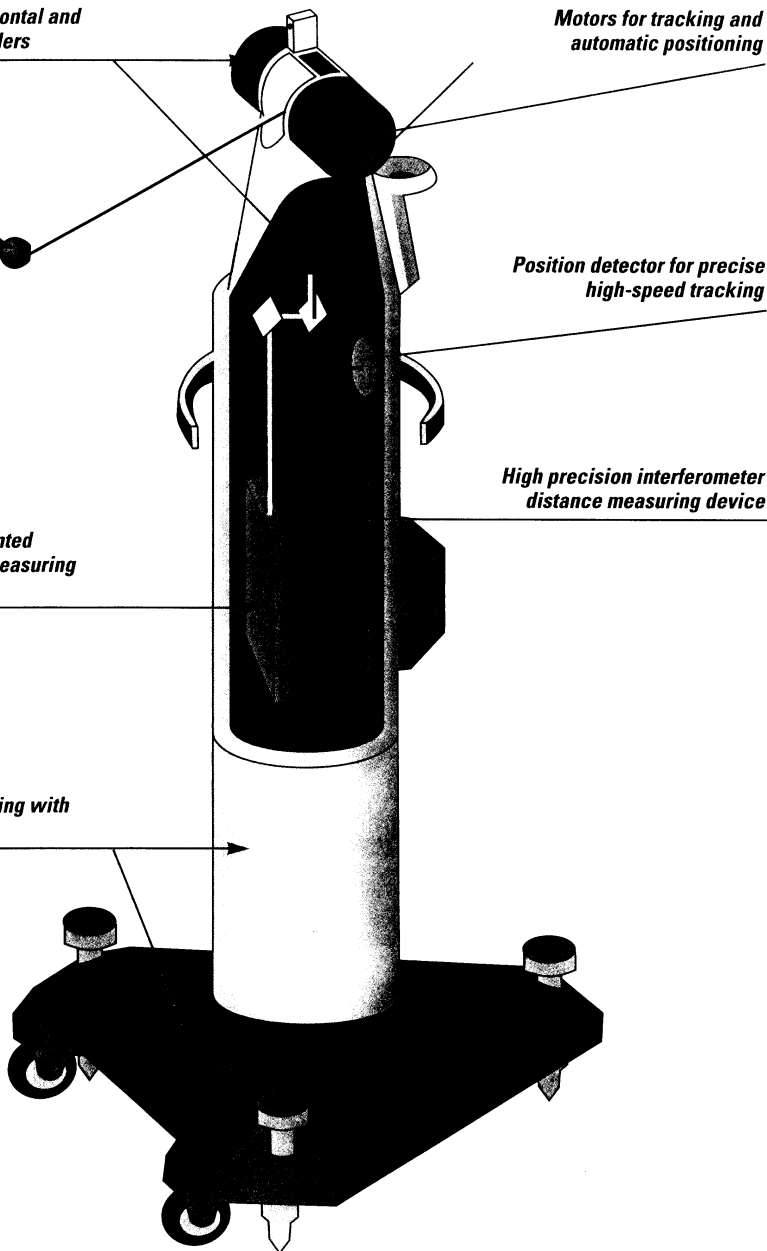
Motors for tracking and automatic positioning

Position detector for precise high-speed tracking

High precision interferometer distance measuring device

High precision patented absolute distance measuring device

Convenient positioning with portable stand



Specifications

Tracking

Max. target speed

at right angles to the laser beam > 4.0 m/s
in the direction of the laser beam > 6.0 m/s

Max. acceleration

in all directions > 2 g

Range of measurement

horizontal $\pm 235^\circ$
vertical $\pm 45^\circ$ *APPROX. 120° ± 5ms*
distance 0–35 m (0–115')
Retroreflector air path corner cube,
catyey, solid glass
corner cube

Accuracy

Angle resolution 0.14"
Distance resolution *2 SIGMA* 1.26 μm
Reproducibility of a coordinate* ± 5 ppm ($\mu\text{m}/\text{m}$)
Absolute accuracy of a coordinate*
for non-moving target (static) ± 10 ppm ($\mu\text{m}/\text{m}$)
for moving target (dynamic) ± 20 –40 ppm ($\mu\text{m}/\text{m}$)

Laser Interferometer

Principle of operation Single-beam interferometer heterodyne
Class 2 Laser Product < 0.3 mW/CW
Wave length 633 nm (visible)
Beam diameter (1/e²) ca. 4.5 mm

Absolut Distance Meter (only LTD500)

Principle of operation light polarization modulation
Resolution 1 μm
Accuracy* $\pm 0,05$ mm (0.002")
Measurement range 2–35 m (7–115")
Class 1 Laser Product < 0.5 mW/2 sec.
Wave length 780 nm (infrared)
Beam diameter ca. 10 mm

Note:
The accuracy shown above (*) is stated as a 2 σ (sigma) value.
In North America, it is customary to state accuracy as a 1 σ (sigma) value.
In an approximation 1 σ values can be derived by deviding 2 σ values by two.

LTD500 is manufactured under the following US patents: Nr. 4714339 and Nr. 5530549.
Other US and international patents pending.

Ambient Conditions

Working temperature (three ranges) $+5^\circ$ – $+40^\circ$ C $+41^\circ$ – $+104^\circ$ F
Storage temperature -10° – $+60^\circ$ C $+14^\circ$ – $+140^\circ$ F
Relative humidity 10–90%
(non-condensing)

Air pressure/elevation

operation 0–3000 m 0–10000 ft
storage 0–7000 m 0–23000 ft

Dimensions and Weight

Sensor unit

dimensions LT500/LTD500 220 x 280 x 855 mm
8.7" x 11" x 33.7"
transit axis height 805 mm 31.7"
weight LT500 30.0 kg 66.1 lb
weight LTD500 31.5 kg 69.0 lb

Controller

dimension 455 x 350 x 200 mm
17.9" x 13.8" x 7.9"
weight 10.5 kg 23.1 lb

Recommended System Computer

Personal Computer Compaq PentiumTM
Operating system Windows[®] 95, 97, 98 or
NT4.0
Rate of measurement up to 1000 points/sec.
Real time output via parallel interface



LT500

LTD500