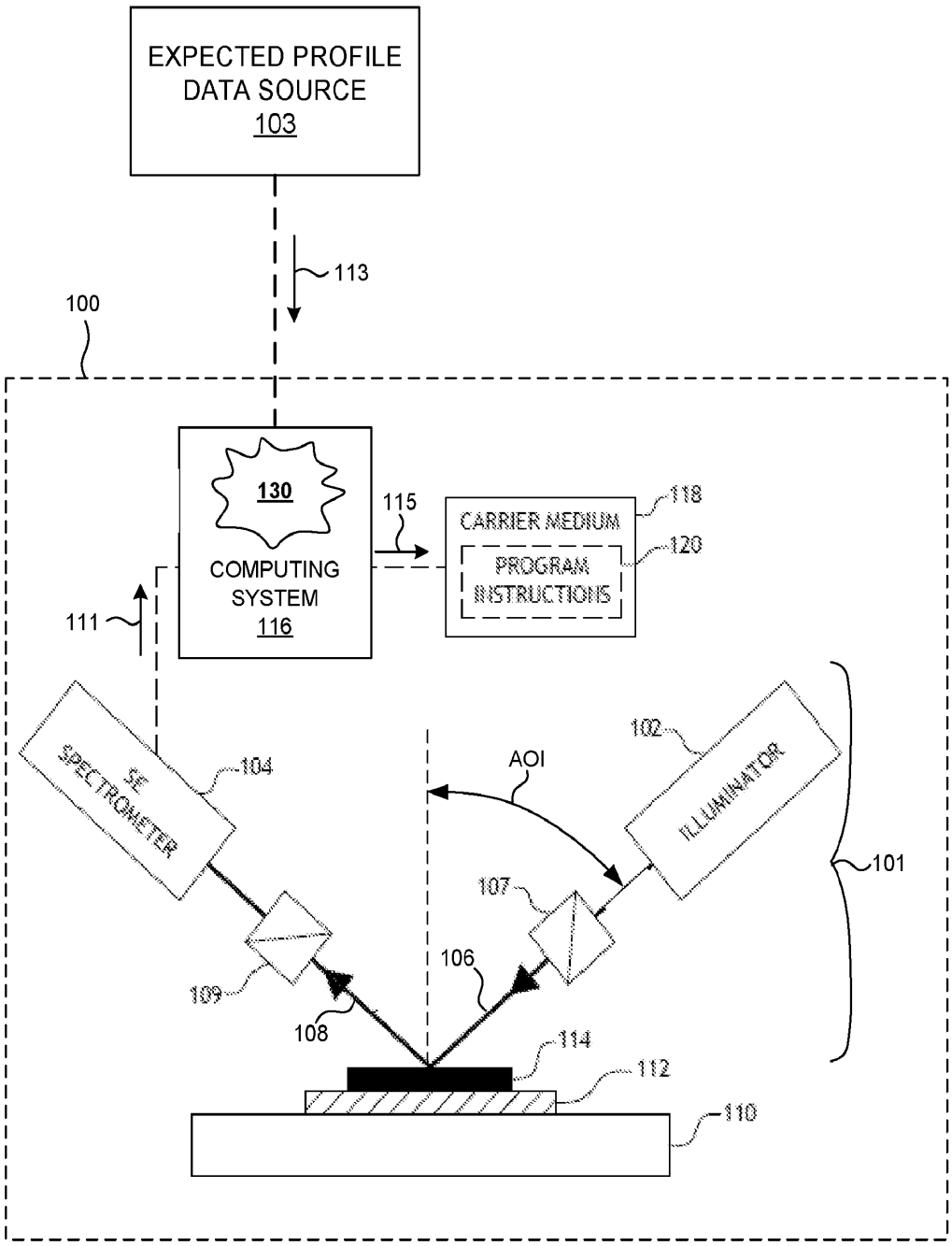
EXPECTED PROFILE DATA SOURCE
103
113
100
130
COMPUTING SYSTEM
116
115
CARRIER MEDIUM
PROGRAM INSTRUCTIONS
118
120
111
SE SPECTROMETER
104
AOI
102
ILLUMINATOR
101
107
106
109
108
114
112
110

FIG. 1

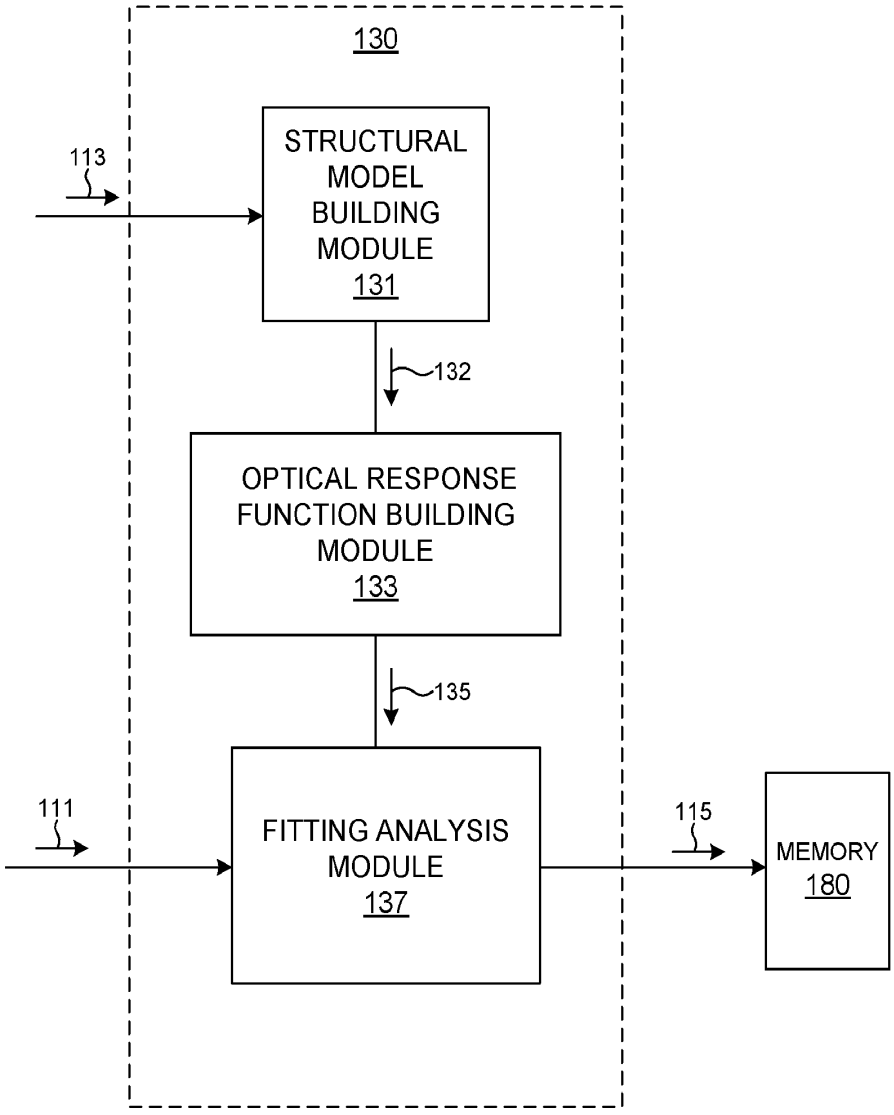
130
113
STRUCTURAL MODEL BUILDING MODULE 131
132
OPTICAL RESPONSE FUNCTION BUILDING MODULE 133
135
111
FITTING ANALYSIS MODULE 137
115
MEMORY 180

FIG. 2

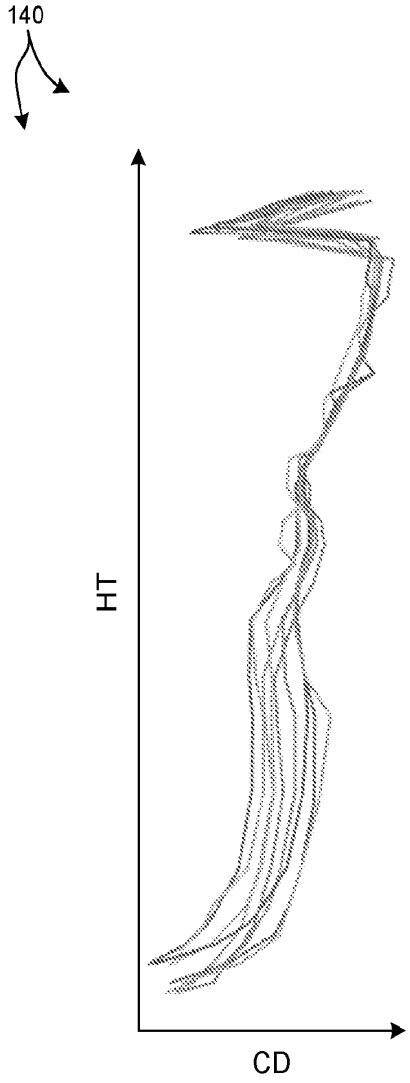

FIG. 3

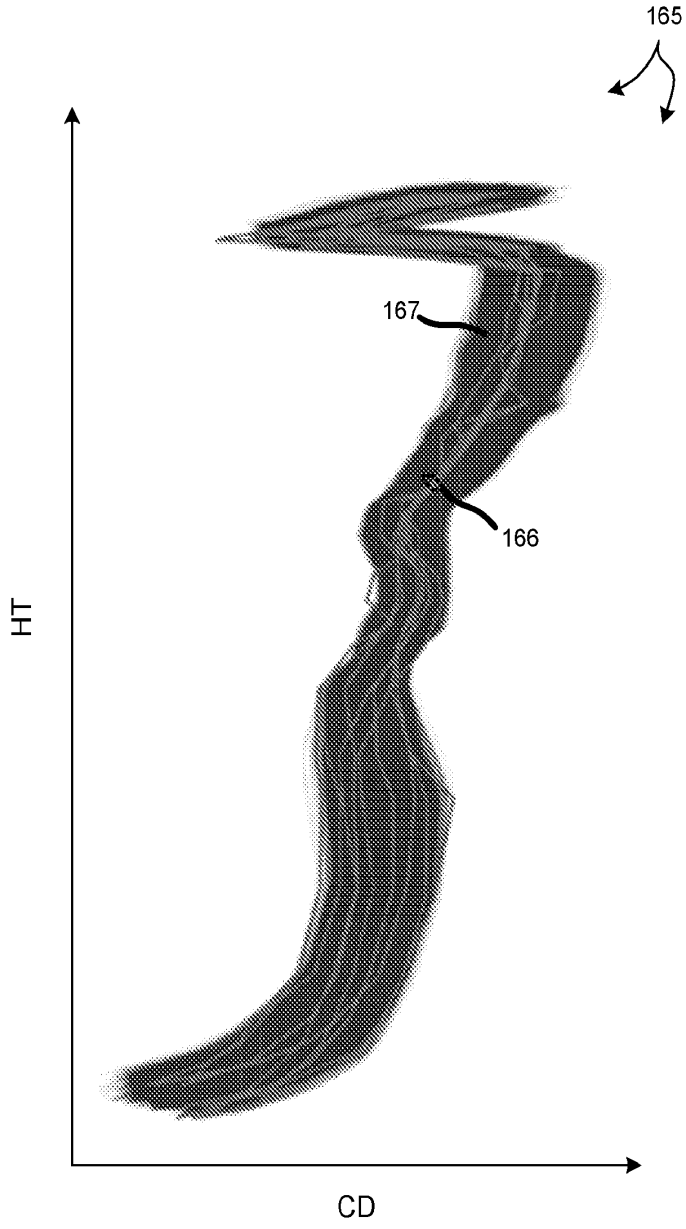

FIG. 4

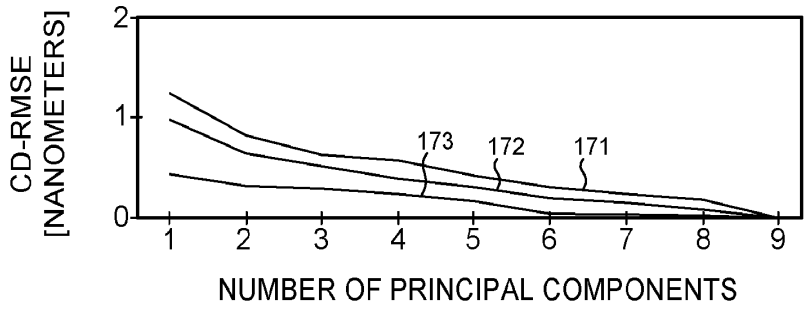
CD-RMSE
[NANOMETERS]
2
1
0
173
172
171
1
2
3
4
5
6
7
8
9
NUMBER OF PRINCIPAL COMPONENTS

FIG. 5

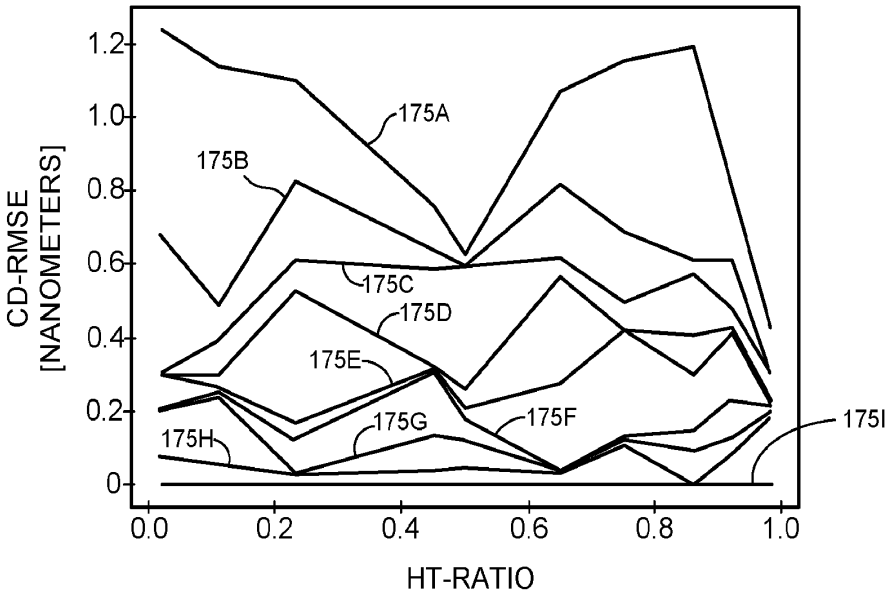
CD-RMSE
[NANOMETERS]
1.2
1.0
0.8
0.6
0.4
0.2
0
175A
175B
175C
175D
175E
175F
175G
175H
175I
0.0
0.2
0.4
0.6
0.8
1.0
HT-RATIO

FIG. 6

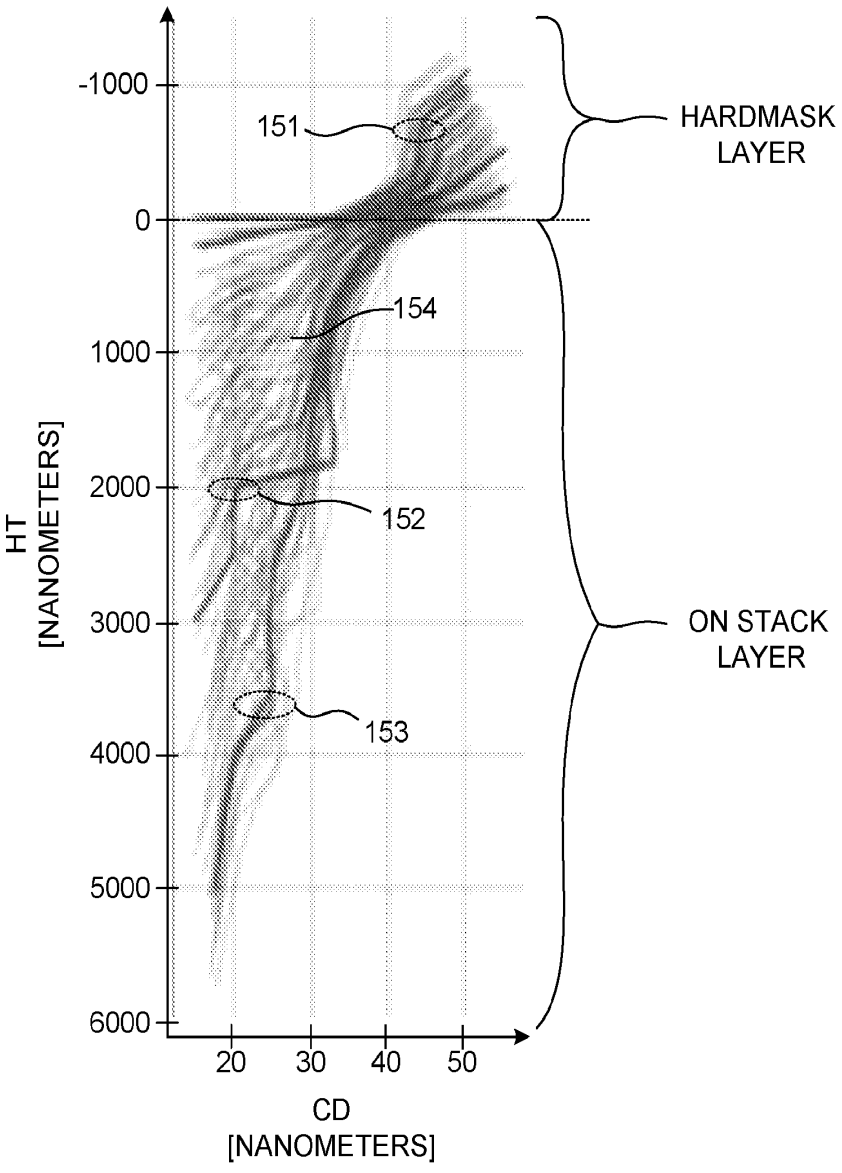
-1000
0
1000
2000
3000
4000
5000
6000
HT
[NANOMETERS]
20
30
40
50
CD
[NANOMETERS]
151
154
152
153
HARDMASK
LAYER
ON STACK
LAYER

FIG. 7

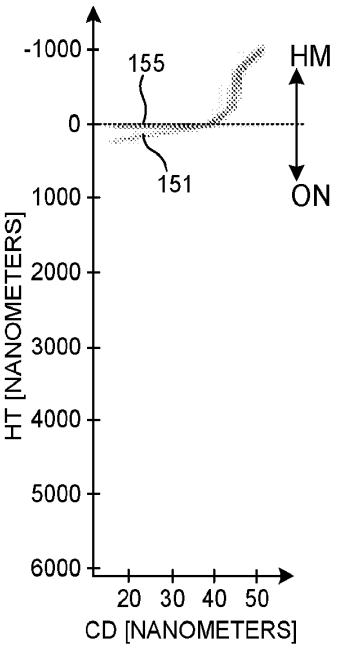

FIG. 8A

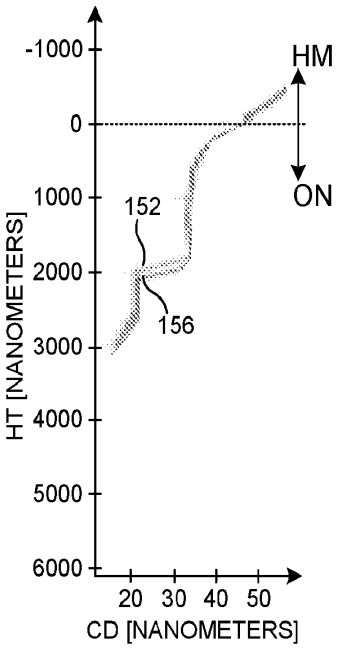

FIG. 8B

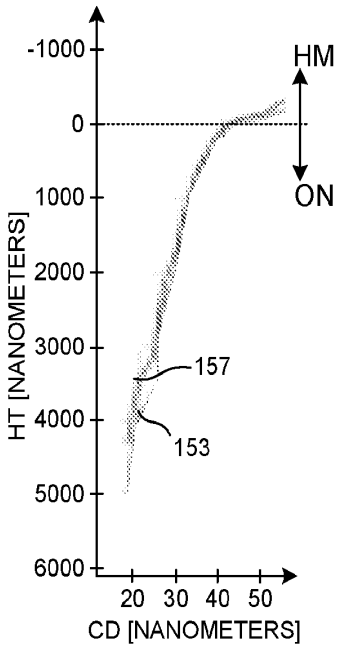

FIG. 8C

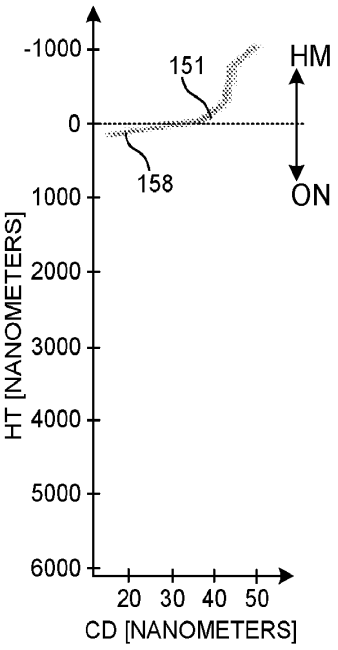

FIG. 9A

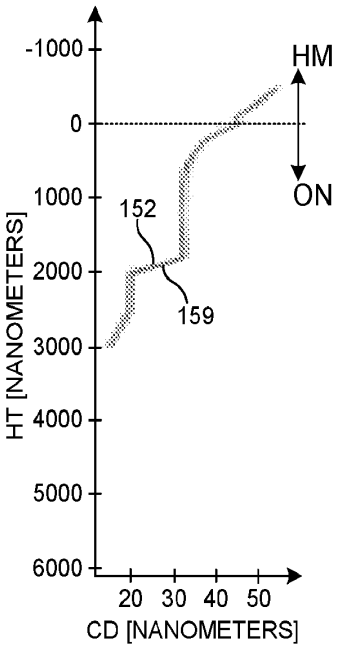

FIG. 9B

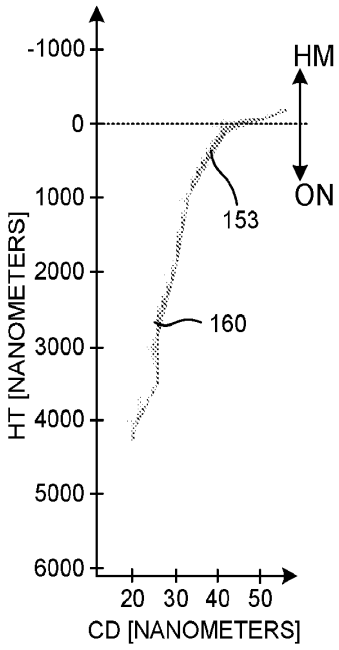

FIG. 9C

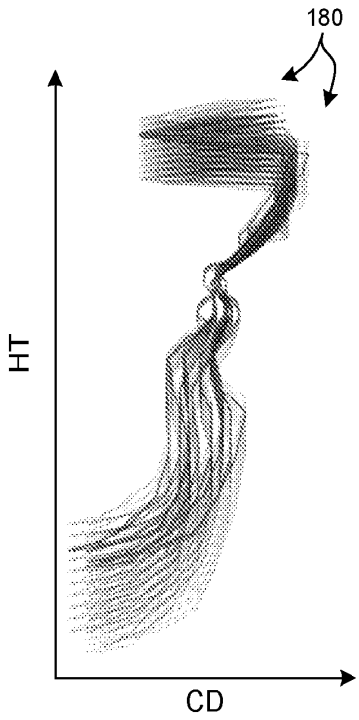

FIG. 10

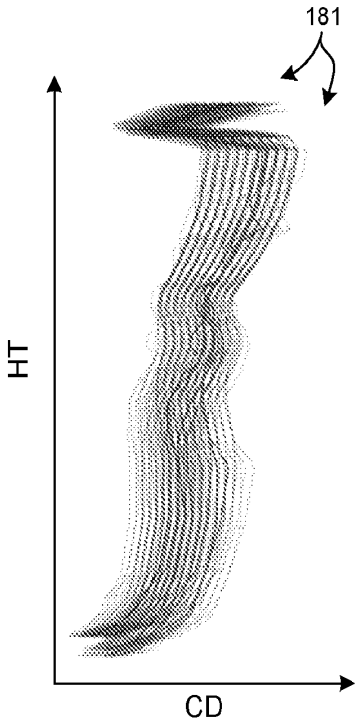

FIG. 11

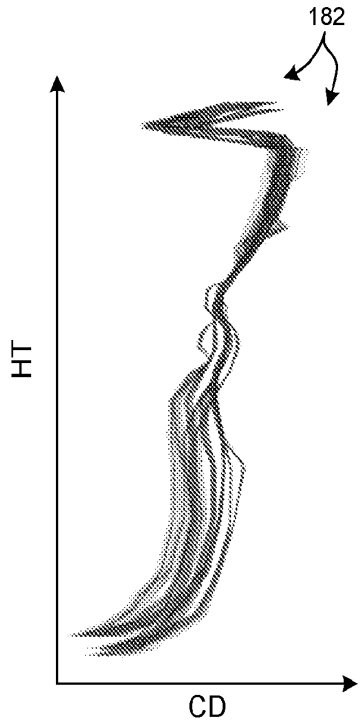

FIG. 12

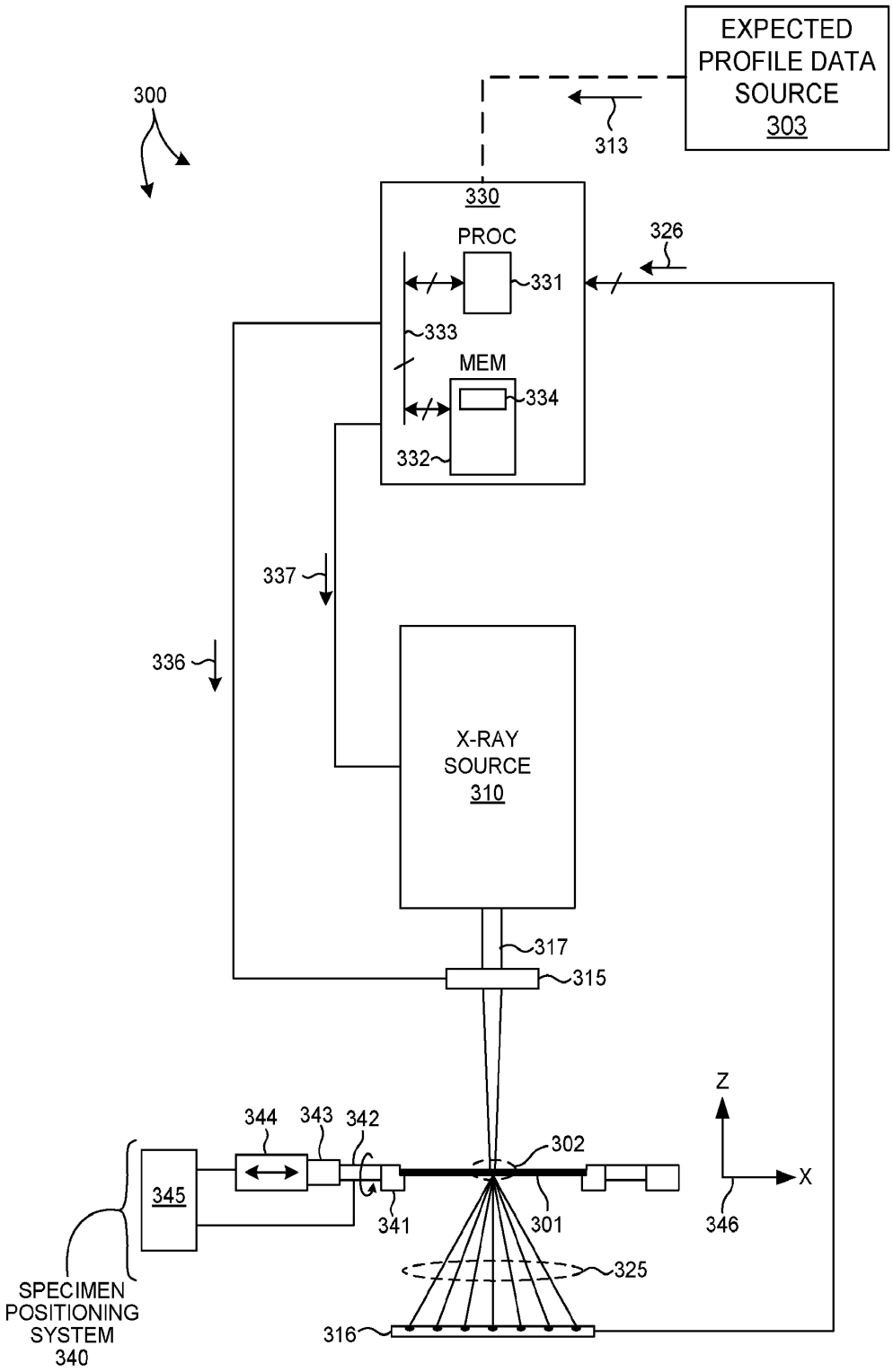
EXPECTED PROFILE DATA SOURCE 303
313
300
330
PROC
331
326
333
MEM
334
332
337
336
X-RAY SOURCE 310
317
315
344
343
342
302
345
341
301
325
316
Z
X
346
SPECIMEN POSITIONING SYSTEM 340

FIG. 13

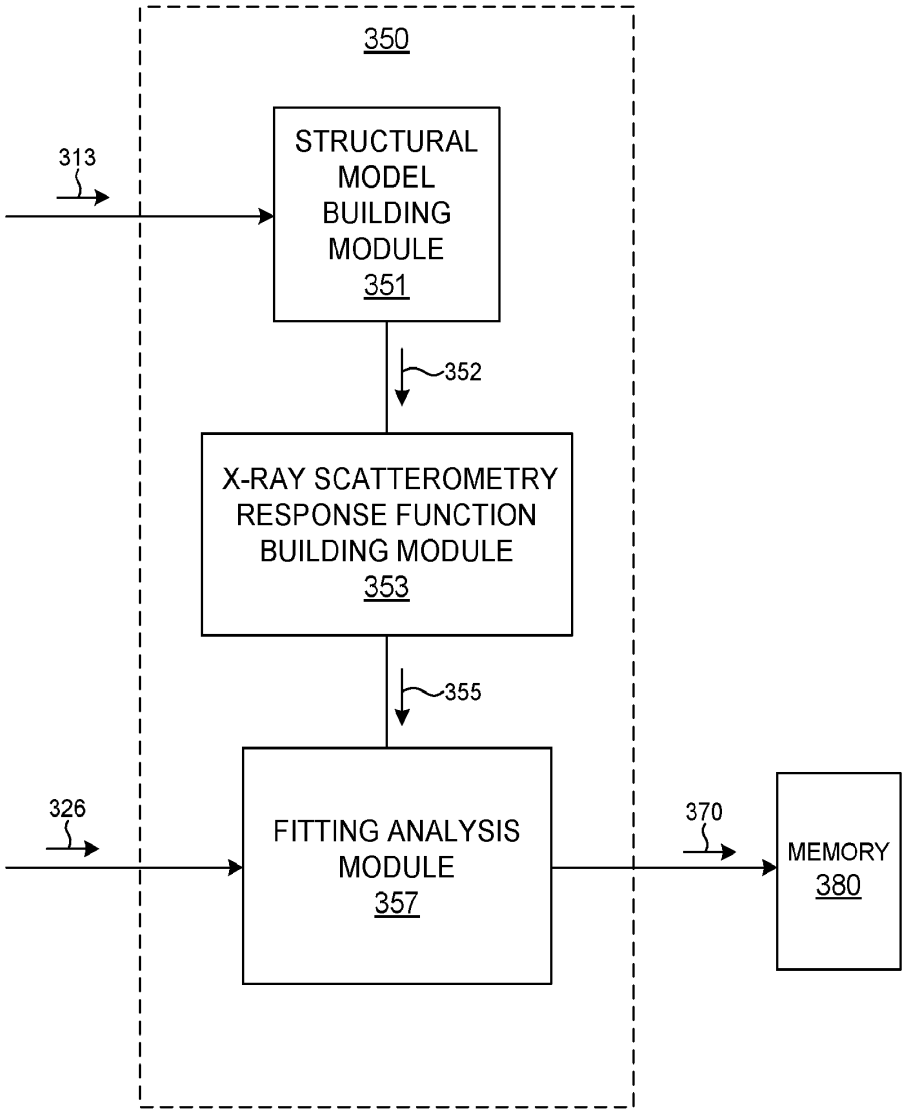
350
313
STRUCTURAL MODEL BUILDING MODULE 351
352
X-RAY SCATTEROMETRY RESPONSE FUNCTION BUILDING MODULE 353
355
326
FITTING ANALYSIS MODULE 357
370
MEMORY 380

FIG. 14

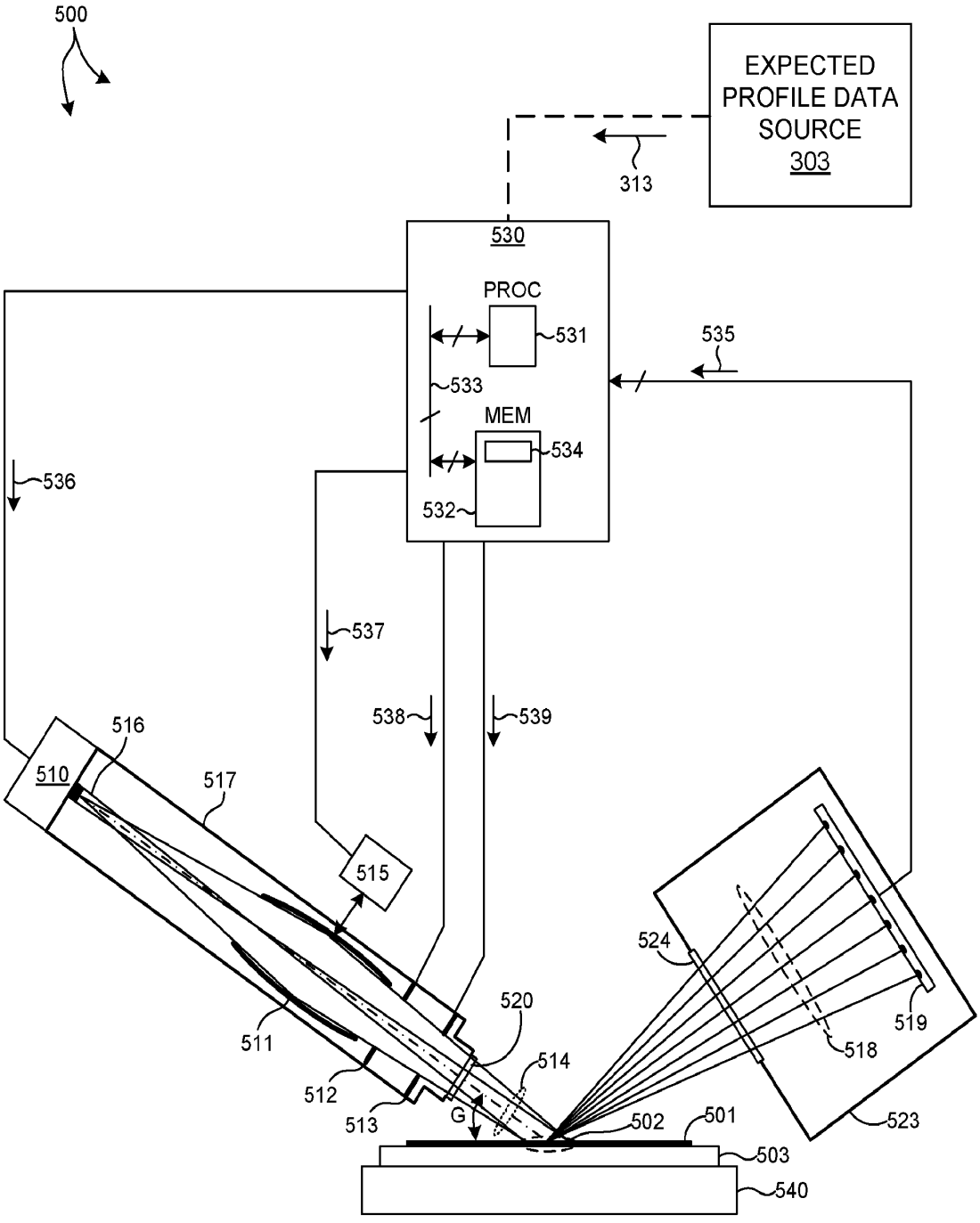
500
EXPECTED PROFILE DATA SOURCE 303
313
530
PROC
531
533
MEM
534
532
535
536
537
538
539
516
510
517
515
524
520
519
518
511
514
512
513
G
502
501
523
503
540

FIG. 15

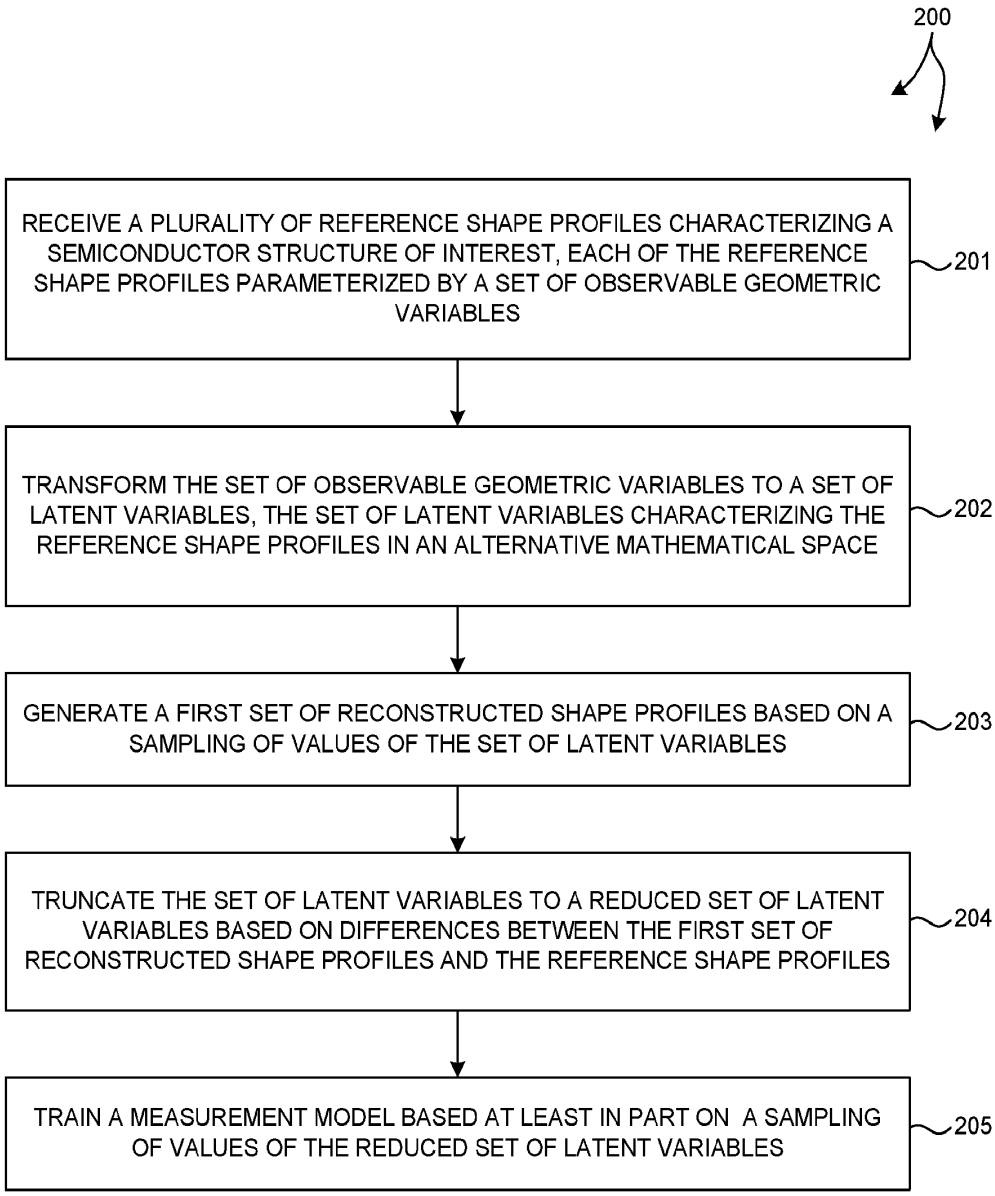
200
RECEIVE A PLURALITY OF REFERENCE SHAPE PROFILES CHARACTERIZING A SEMICONDUCTOR STRUCTURE OF INTEREST, EACH OF THE REFERENCE SHAPE PROFILES PARAMETERIZED BY A SET OF OBSERVABLE GEOMETRIC VARIABLES
201
TRANSFORM THE SET OF OBSERVABLE GEOMETRIC VARIABLES TO A SET OF LATENT VARIABLES, THE SET OF LATENT VARIABLES CHARACTERIZING THE REFERENCE SHAPE PROFILES IN AN ALTERNATIVE MATHEMATICAL SPACE
202
GENERATE A FIRST SET OF RECONSTRUCTED SHAPE PROFILES BASED ON A SAMPLING OF VALUES OF THE SET OF LATENT VARIABLES
203
TRUNCATE THE SET OF LATENT VARIABLES TO A REDUCED SET OF LATENT VARIABLES BASED ON DIFFERENCES BETWEEN THE FIRST SET OF RECONSTRUCTED SHAPE PROFILES AND THE REFERENCE SHAPE PROFILES
204
TRAIN A MEASUREMENT MODEL BASED AT LEAST IN PART ON A SAMPLING OF VALUES OF THE REDUCED SET OF LATENT VARIABLES
205

FIG. 16