Device for measuring BDF using CCD camera

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Computer graphics requires BDF measurements for representing real surfaces

BDF modeling without using real measurement data is not enough for creating adequate images

Approach to measurement device design

Adequate imagery requires big amount of BDF data. That increases measurement time importance.

BDF data amount can be lowered by using irregular sampling point distribution. Maximum density as usual is required in directions close to specular for BRDF and passthrough for BTDF

Way to decrease device complexity and data amount is to make simultaneous measurements of different BDF data

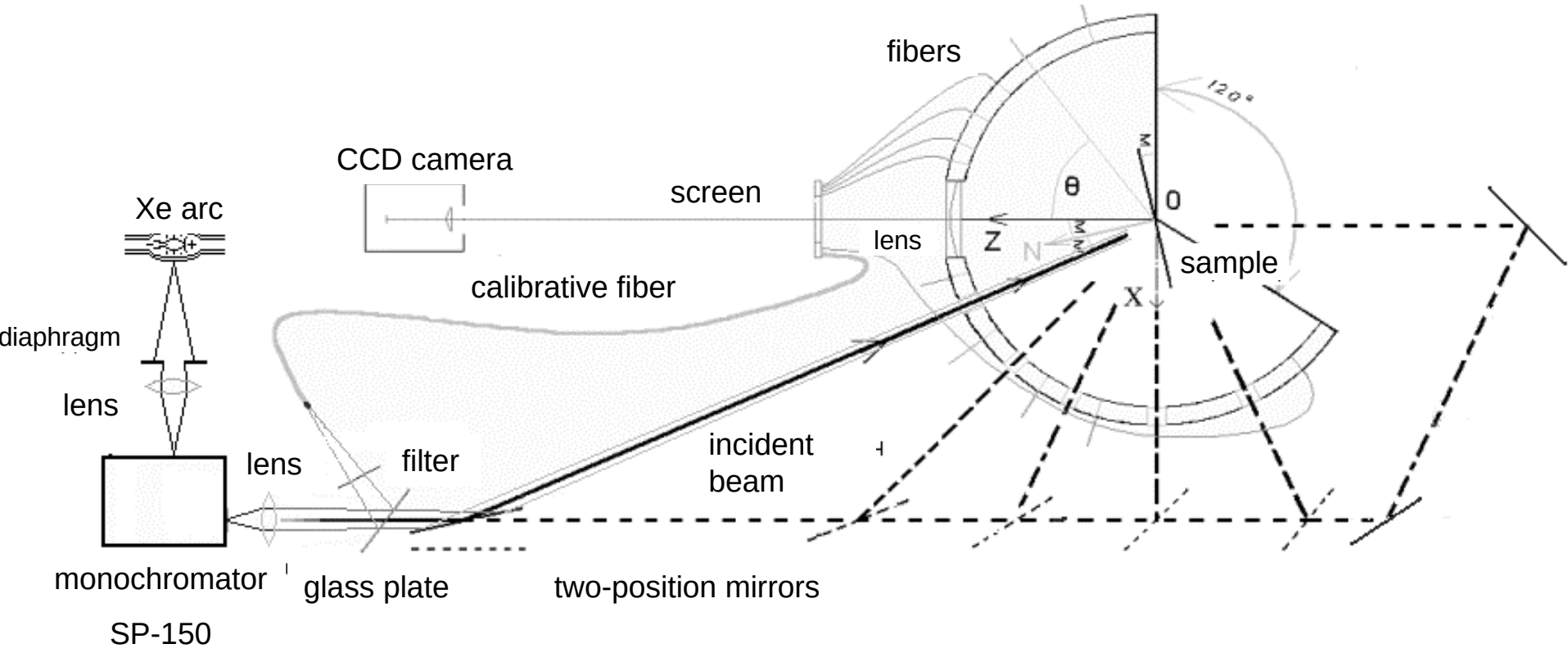
Existing solutions

1. Muracami goniospectrofotometer GCMS-4.
   3-coordinate robot, simultaneous spectral measurement, successive space sampling point measurement
2. Gratz University device by Karner et al.
   Point light, CCD camera, simultaneous 2D sampling
3. Ward et al.
   CCD camera(fish eye lens), camera catches light from sample reflected from semitransparent specular half-sphere, sample is lighted by collimated light beam through half-sphere

General design principles

- Simultaneous space point measurements by CCD camera
- Successive spectral point measurements using scanning program-controlled monochromator
- Closest 10° to specular direction are registered as image via lens, camera is focused on lens focal plane for angle resolution improvement
- Other points are measured discrete via fibers

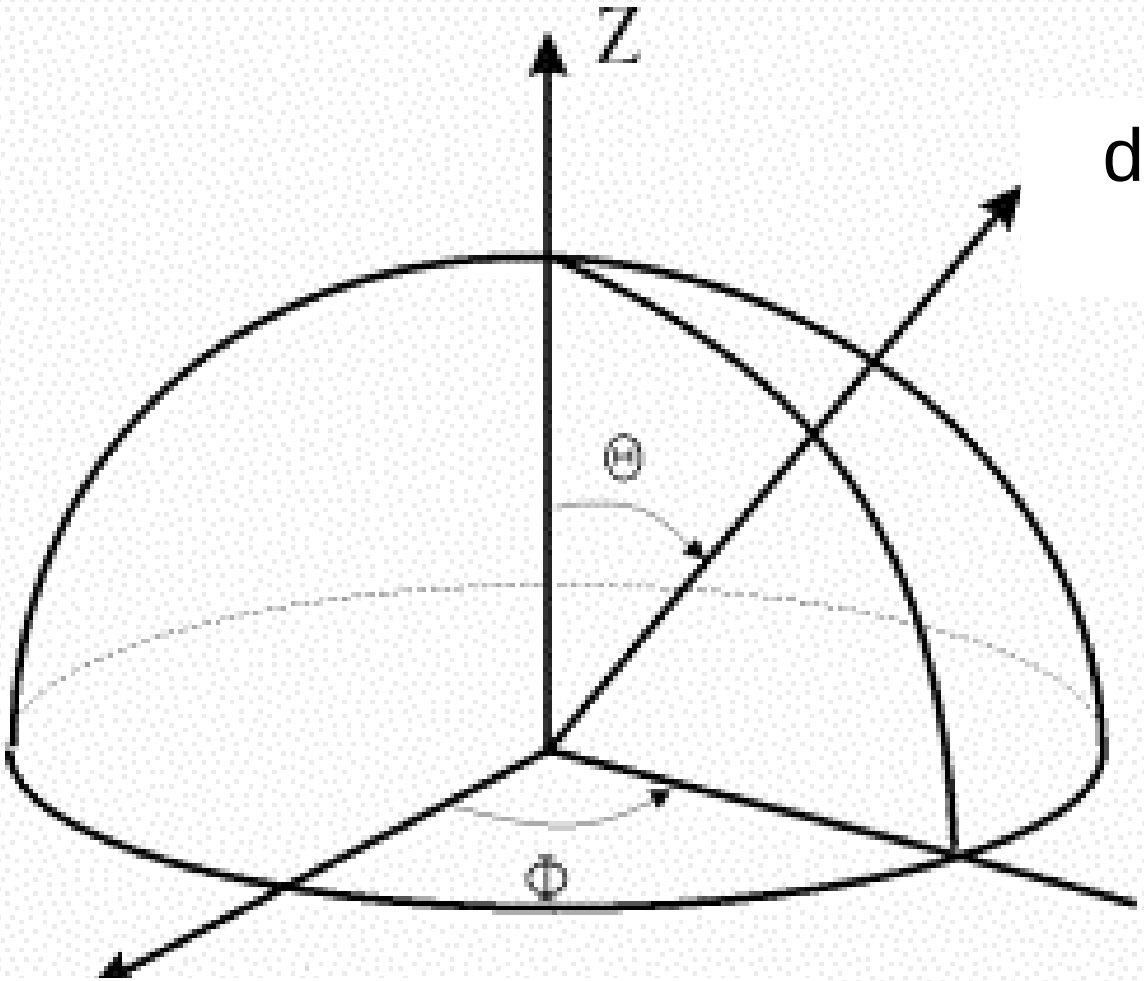
General device scheme



Goals achieved

- Device was tested and practically used
- Sample measurement time for 6 incident angles - 2.5 hrs (including manual actions)
- Current implementation uses about 90 space points for each incident angle, this number can be raised numerous times without measurement time increase
- Device was used in tasks of computer graphics and for measurement surfaces of different materials in technical design of emitting optical devices

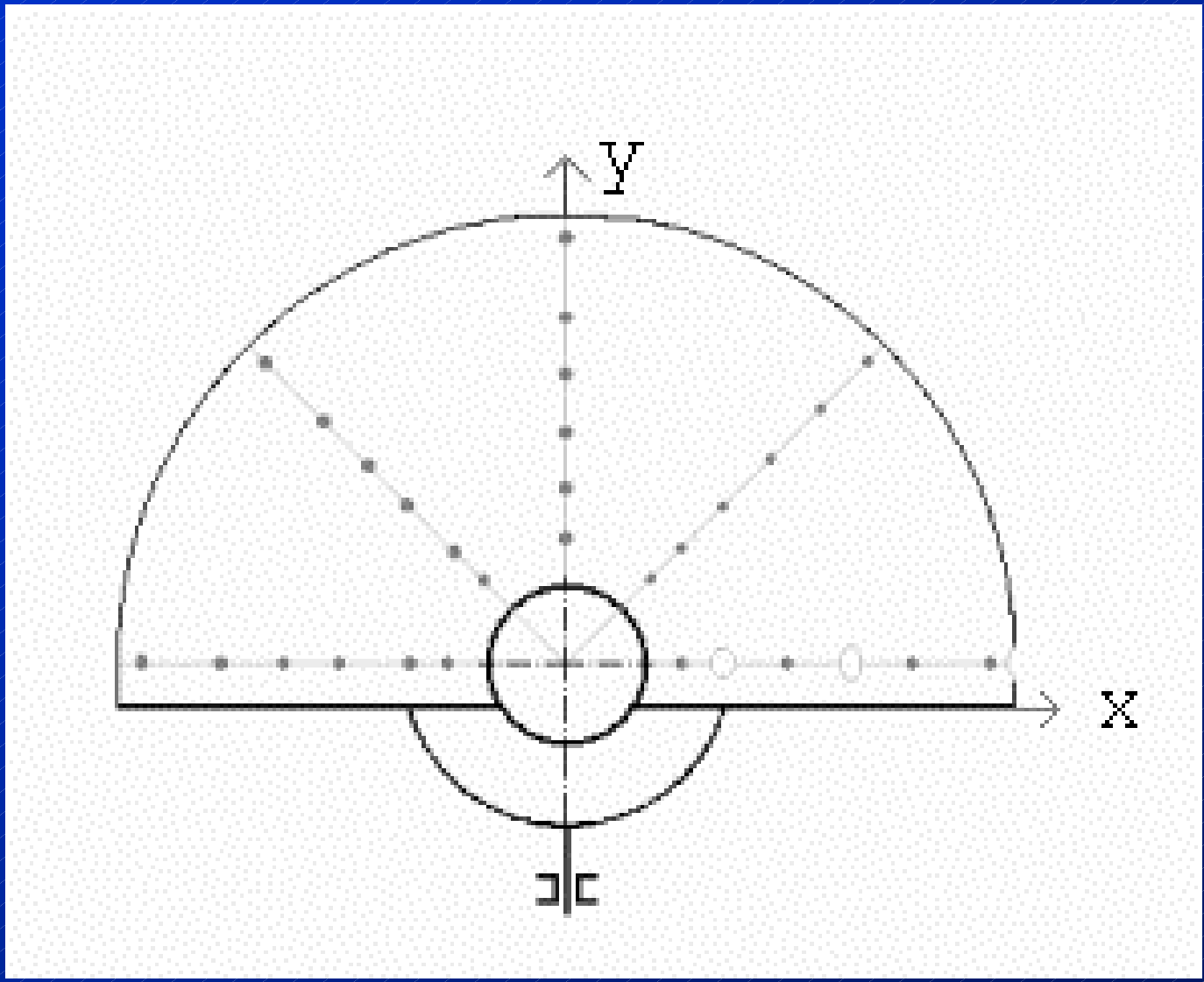
Coordinate system



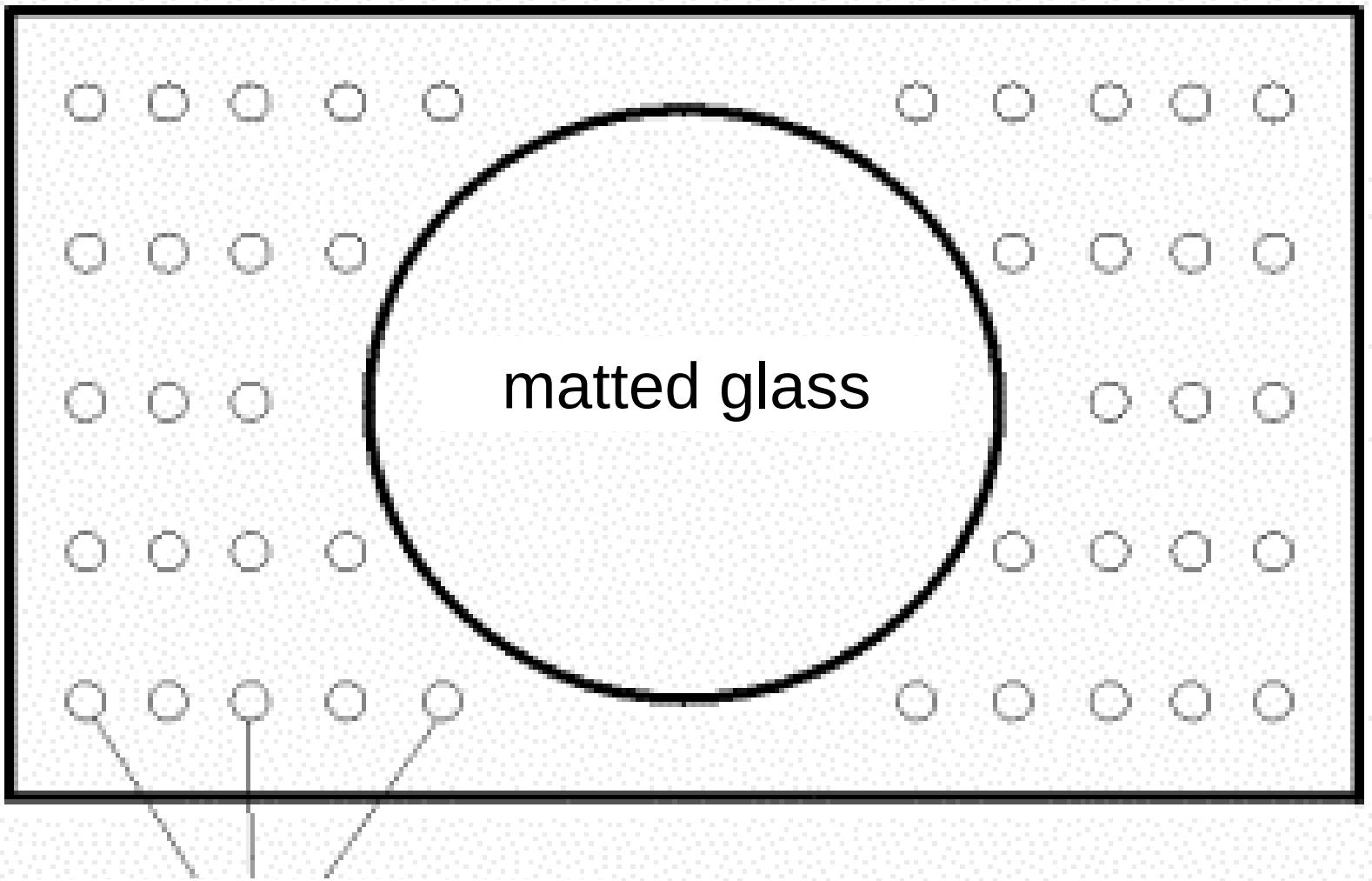
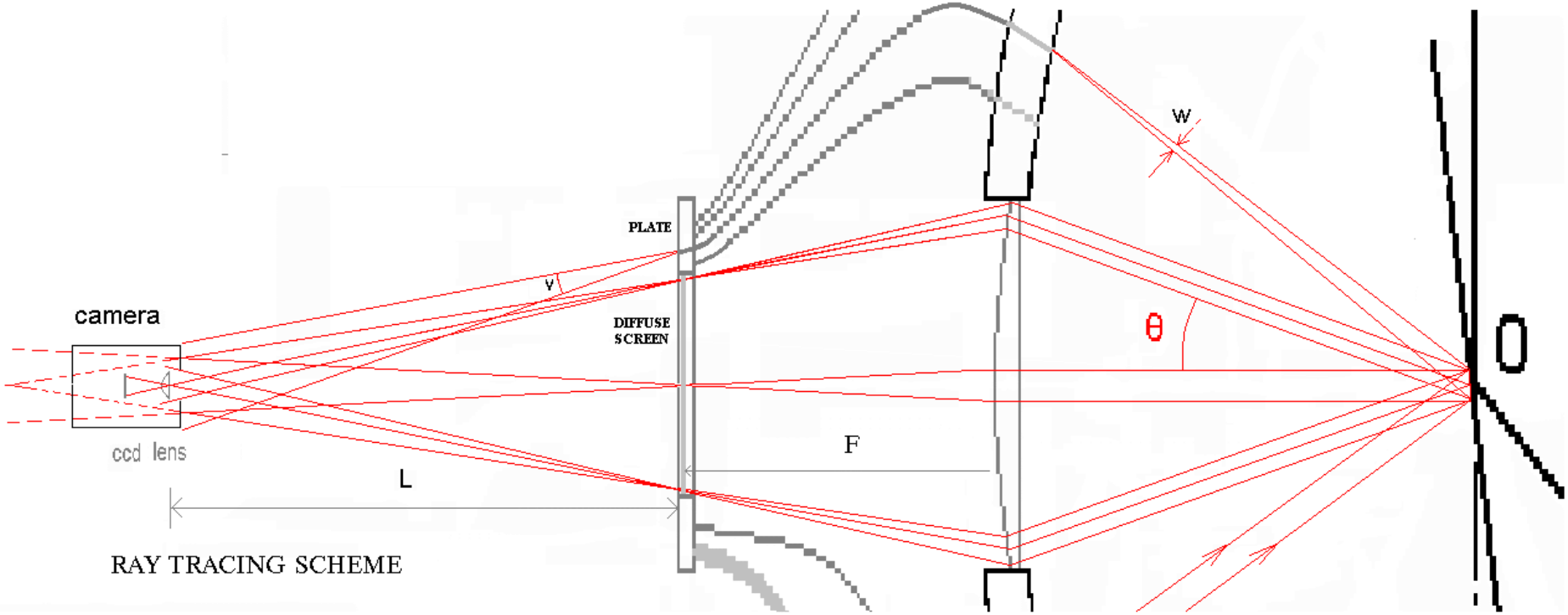
direction of view

projection of incident beam

Receiving fiber ends placement in the device



Scheme of screen



Ray passthrough scheme