

Fundamentals of Breath Testing

2021 Lakeside Missouri DWI Institute

Chuck Rathburn, September 18, 2021



Everybody chill the fuck out

I got this



Faith is not part of the Scientific Method

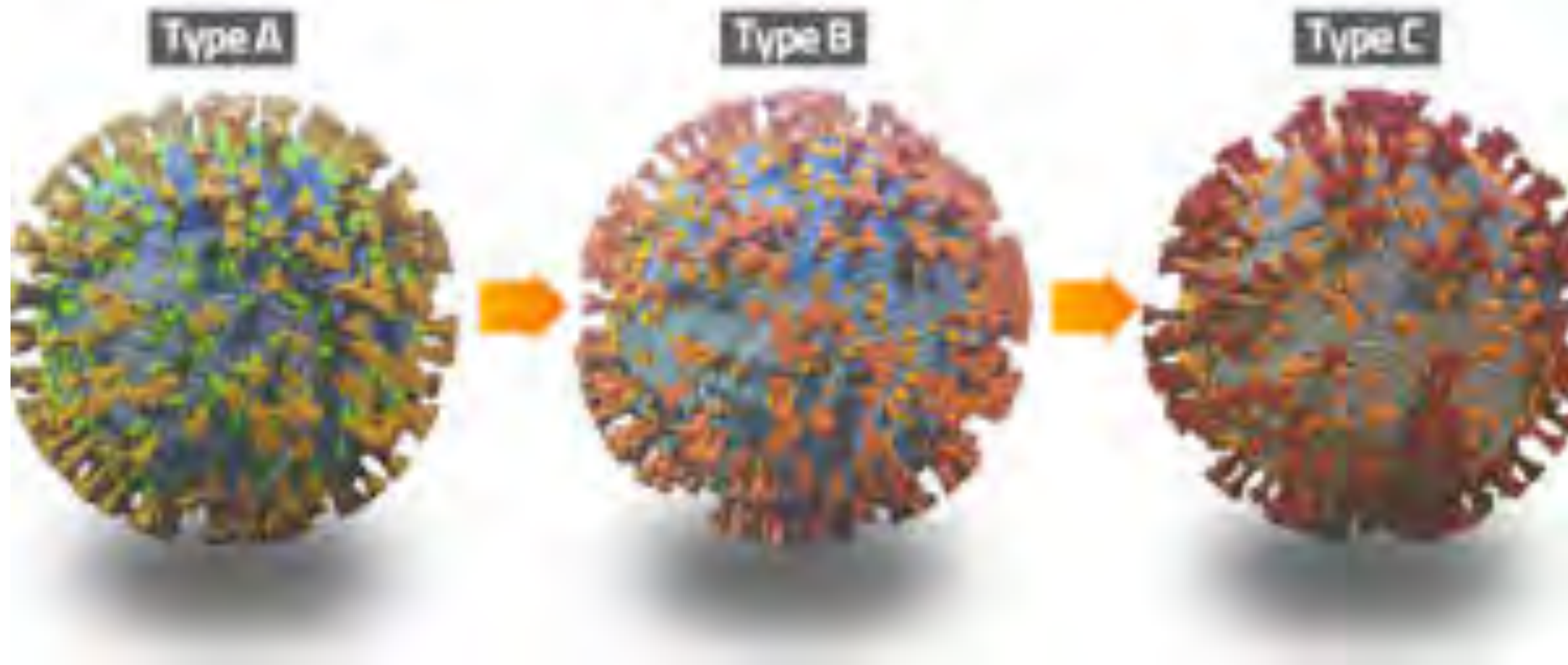
Janine Arvizu
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COVID-19



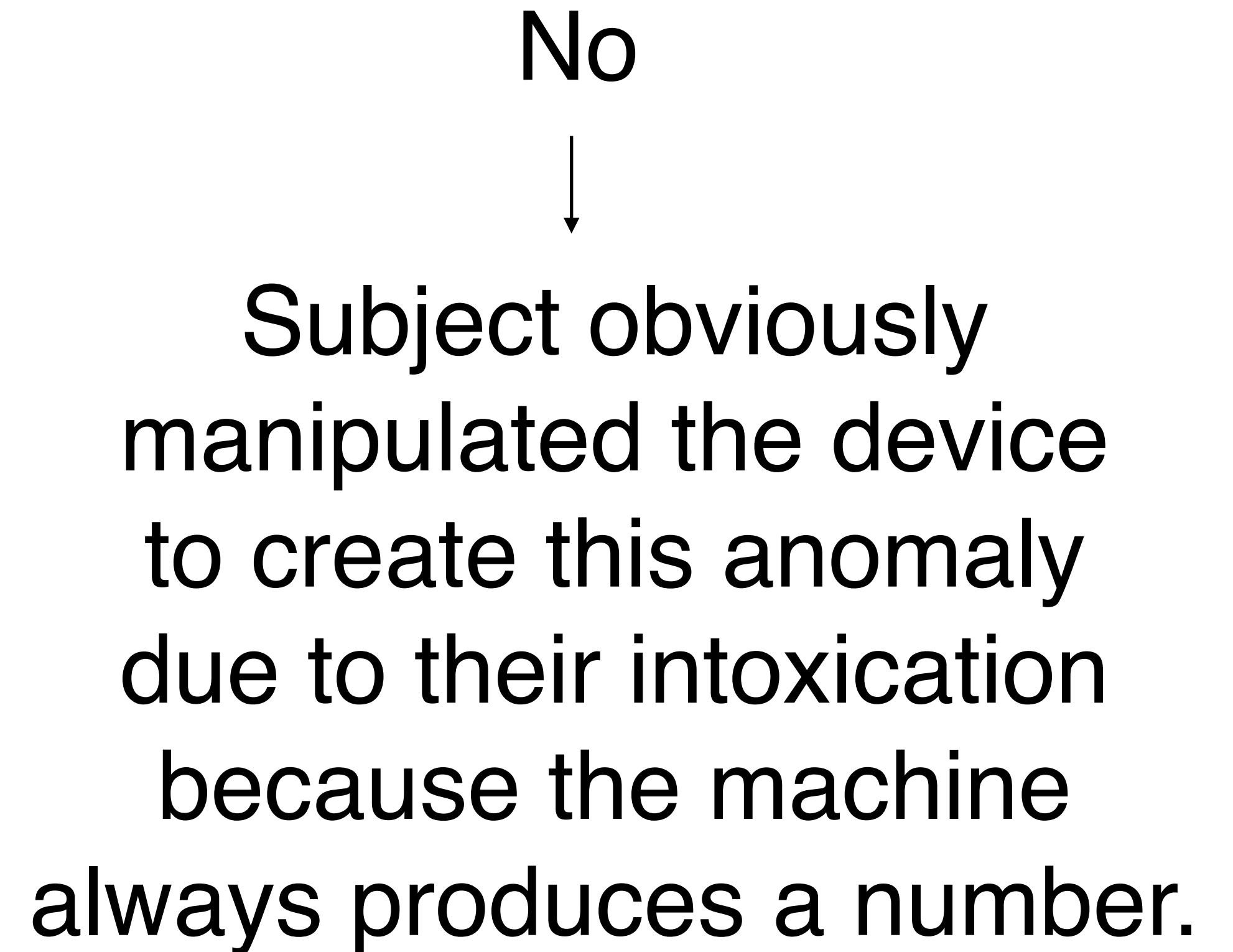
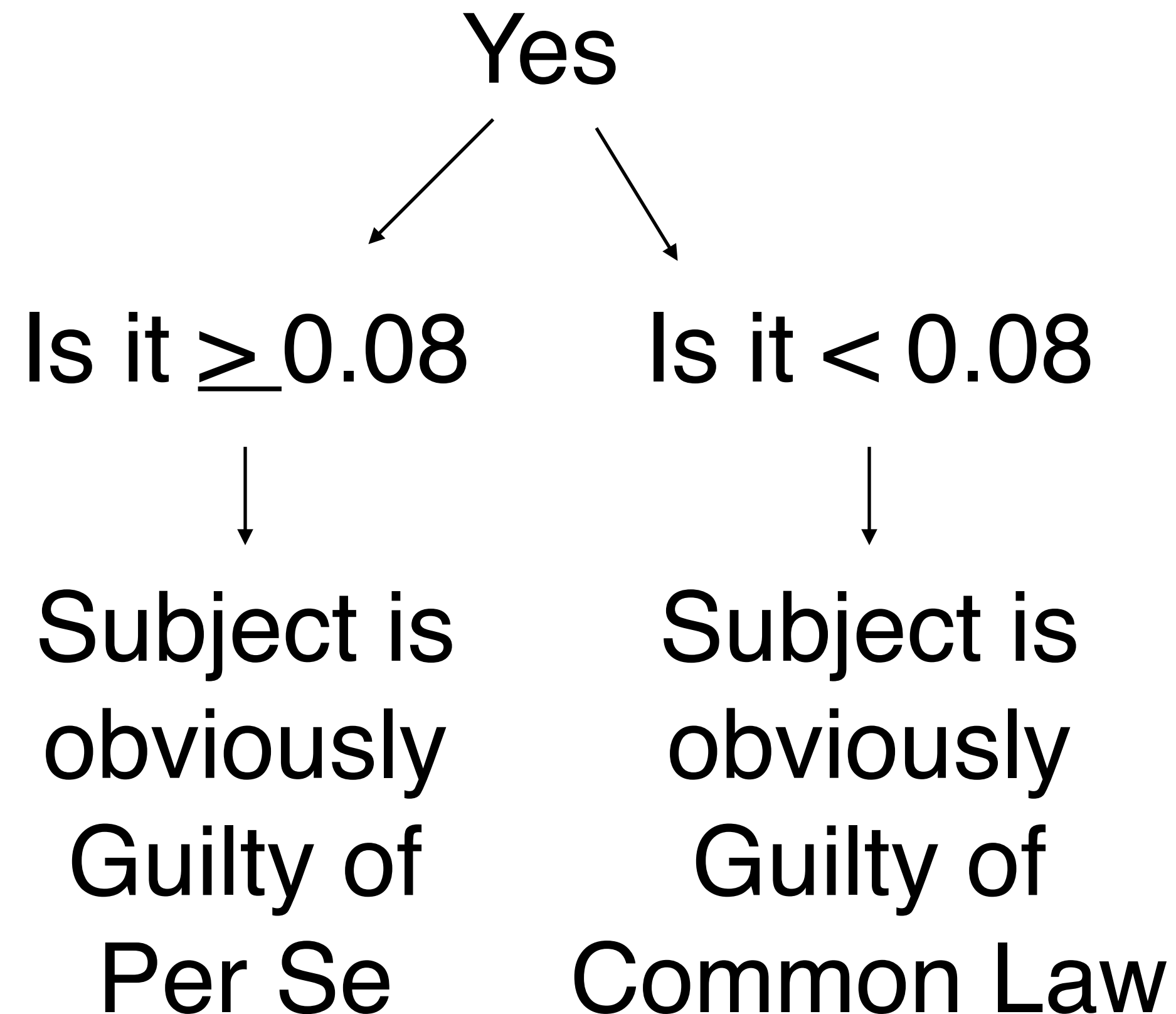
Not 2020's virus

COVID-19 Will Mutate



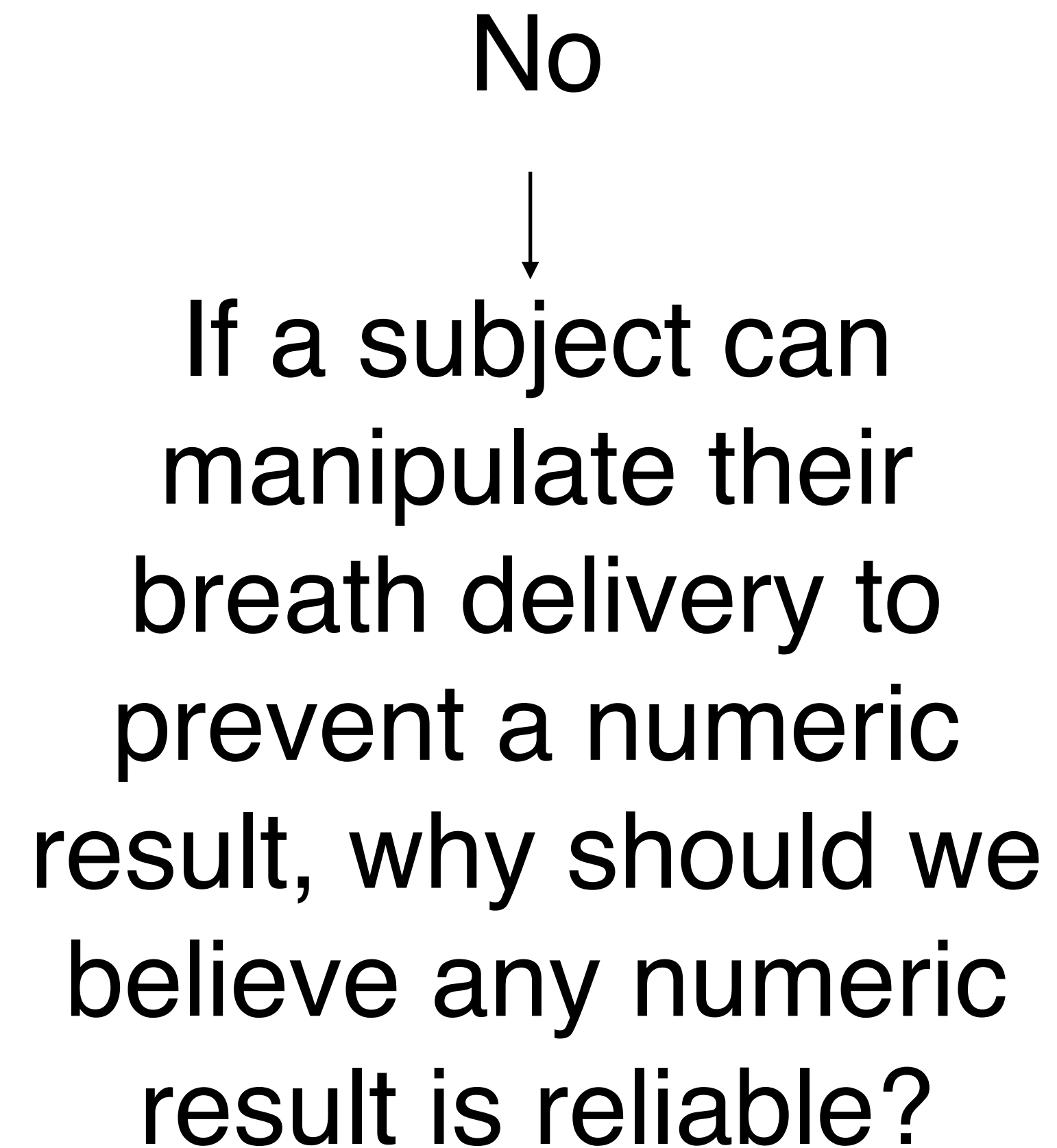
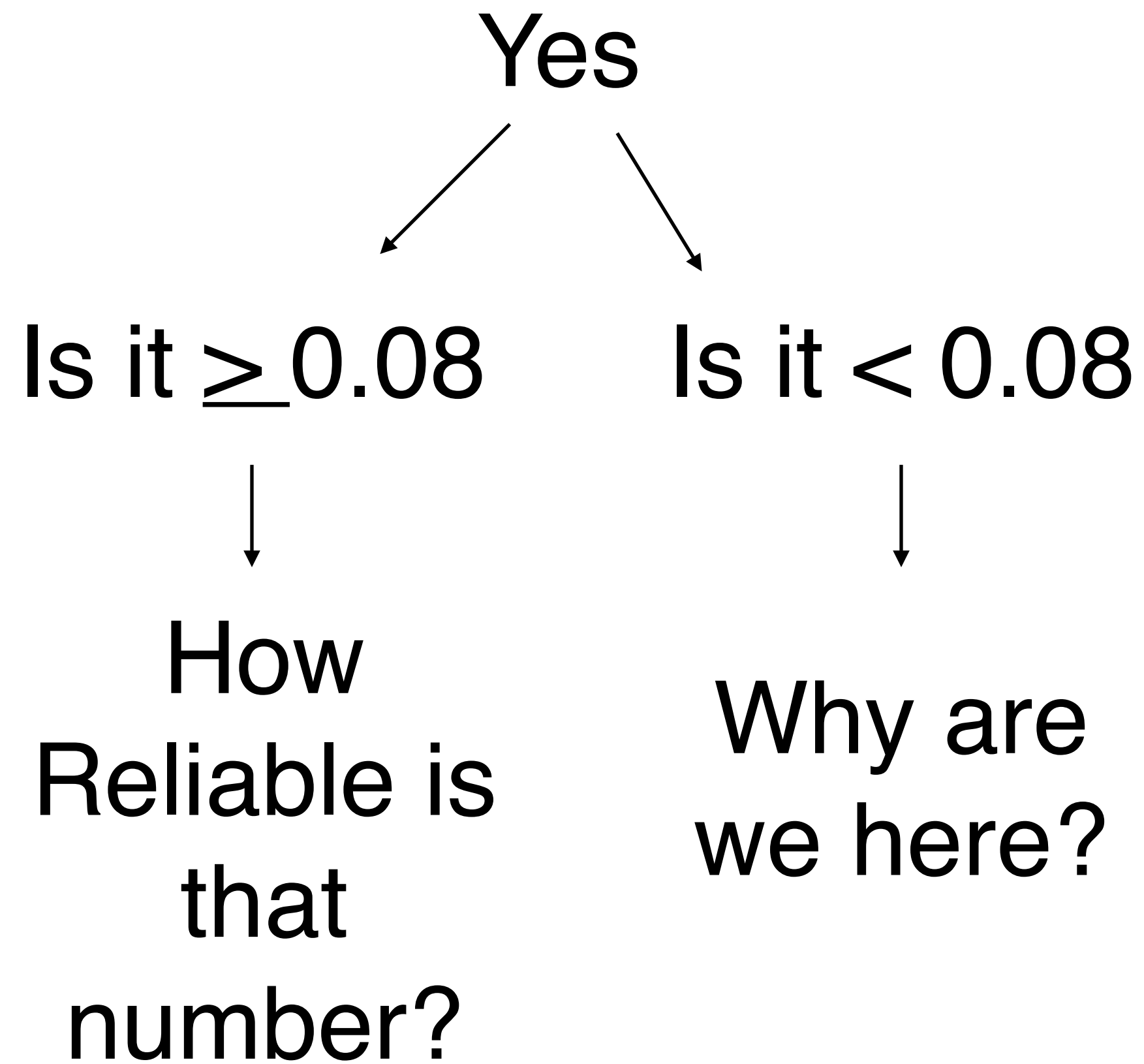
The State's Theory of a Breath Case

Is there a number on the Breath Evidence Ticket?



The Defense Theory of a Breath Case

Is there a number on the Breath Evidence Ticket?



Never Assume



Testing for Alcohol

1. Blood Testing
2. Breath Testing
3. Urine Testing
4. Perspiration Testing (SCRAM)

Blood Testing

1. Specific for Alcohol
2. Expensive
3. Not immediate

Breath Testing

1. Inexpensive
2. Immediate
3. Inexact

Drunkometer



Breathalyzer



Evidential instruments



← BAC DataMaster

Intoxilyzer 5000 →



Defending a Breath Test Case



They're a Computer and Voltage Meter



What you need to know scientifically

1. How does the human body absorb, distribute, metabolize and eliminate alcohol (Widmark)?
2. What is Henry's Law?
3. What is the Beer-Lambert Law (Lambert-Beer Law)?
4. What is infrared spectrophotometry?

Widmark Formula

$$\text{Total Number of Drinks} = \frac{\text{Weight in Pounds} \times 16 \times \text{Widmark's Rho} \left(\text{Alcohol Concentration} + \text{Widmark's Beta} \right)}{\text{Specific Gravity of Alcohol (0.79) times the Alcohol content (for 80 proof [40\%] equals 0.4) equals roughly .32}}$$

Specific Gravity of Alcohol (0.79) times the Alcohol content (for 80 proof [40%] equals 0.4) equals roughly .32

Henry's Law

Head
space

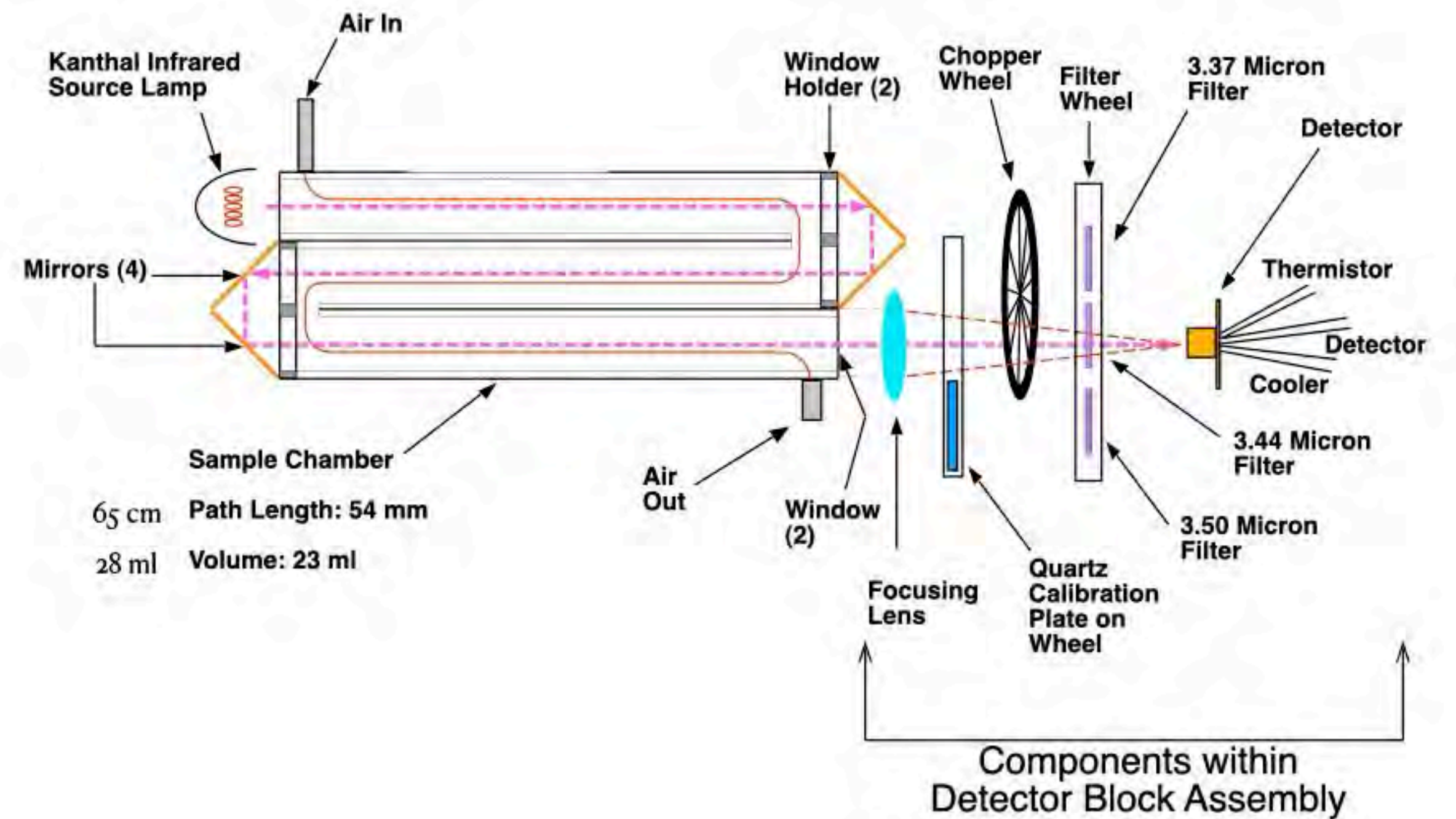
Solution



Beer - Lambert Law

For a defined path length (the sample chamber)
the transmitted energy (IR energy)
containing an absorbing system
(the alcohol in the sample)
will proportionately decrease with
an increase in concentration of the
absorbing system.

DMT OPTICAL BENCH



What you need to know about a breath test

1. How should a breath test be administered?
2. How does it accept a sample for Analysis?
3. What happened when a non-numeric result was produced?
4. How do we challenge the results?

Factors impacting BAC

1. The type of alcohol consumed
2. The quantity of alcohol consumed
3. The time over which it is consumed
4. The subject's weight
5. The subject's gender
6. The subject's stomach content

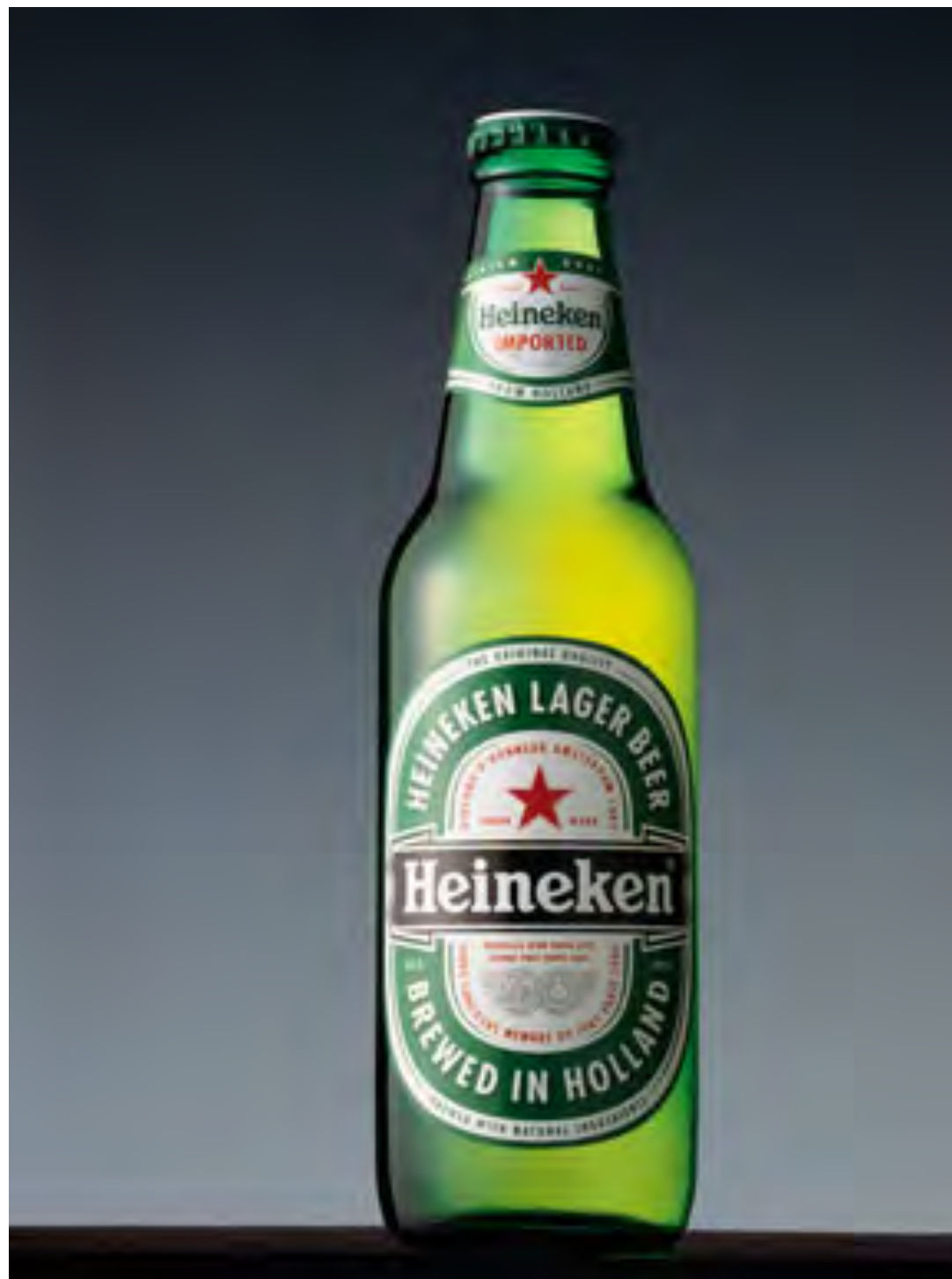






What is a drink

12 oz (4.2%)
12 oz (5%)



4 oz (12.5%)
5 oz (12.5)



1.25 oz (40%)
1.5 oz (40%)



Just how much *FUEL* is there in one can of Four Loko?



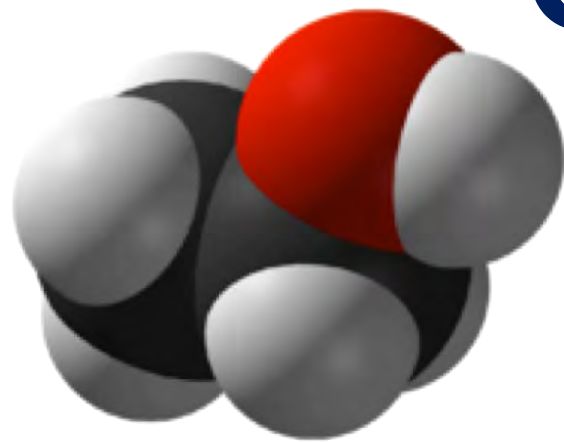
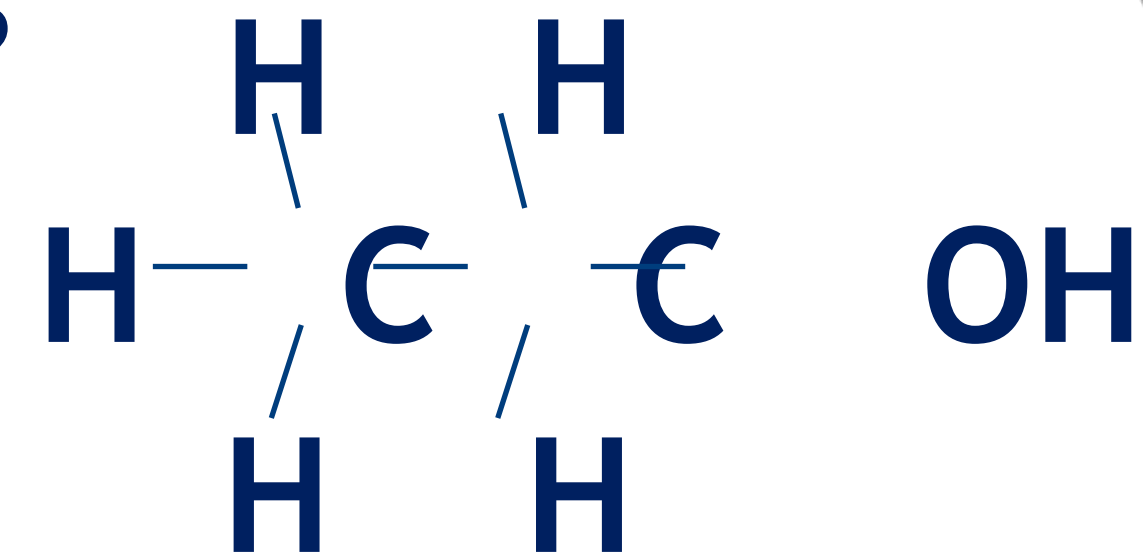
One 23.5 ounce can of Four Loco at 12% alcohol by volume contains the same amount of alcohol as 5.7 shots of 80 proof distilled spirits, 5.7 bottles of beer and 5.7 glasses of red wine

Ethyl Alcohol (Ethanol) Intended for Human Consumption

Chemical Symbols

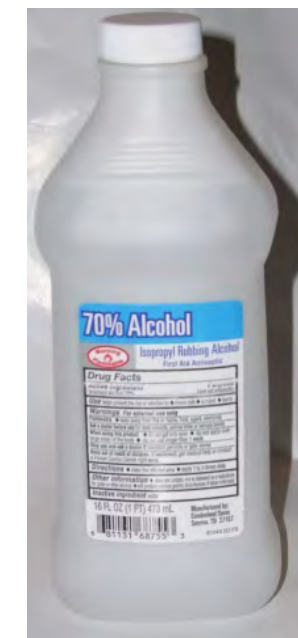
ETOH

C₂H₅OH



Some Types of Alcohol

- Methyl Alcohol (Methanol)
- Ethyl Alcohol (Ethanol)
- Isopropyl Alcohol (Isopropanol)



Understanding How Alcohol Affects the Human Body

1. Absorption
2. Distribution
3. Metabolism
4. Elimination

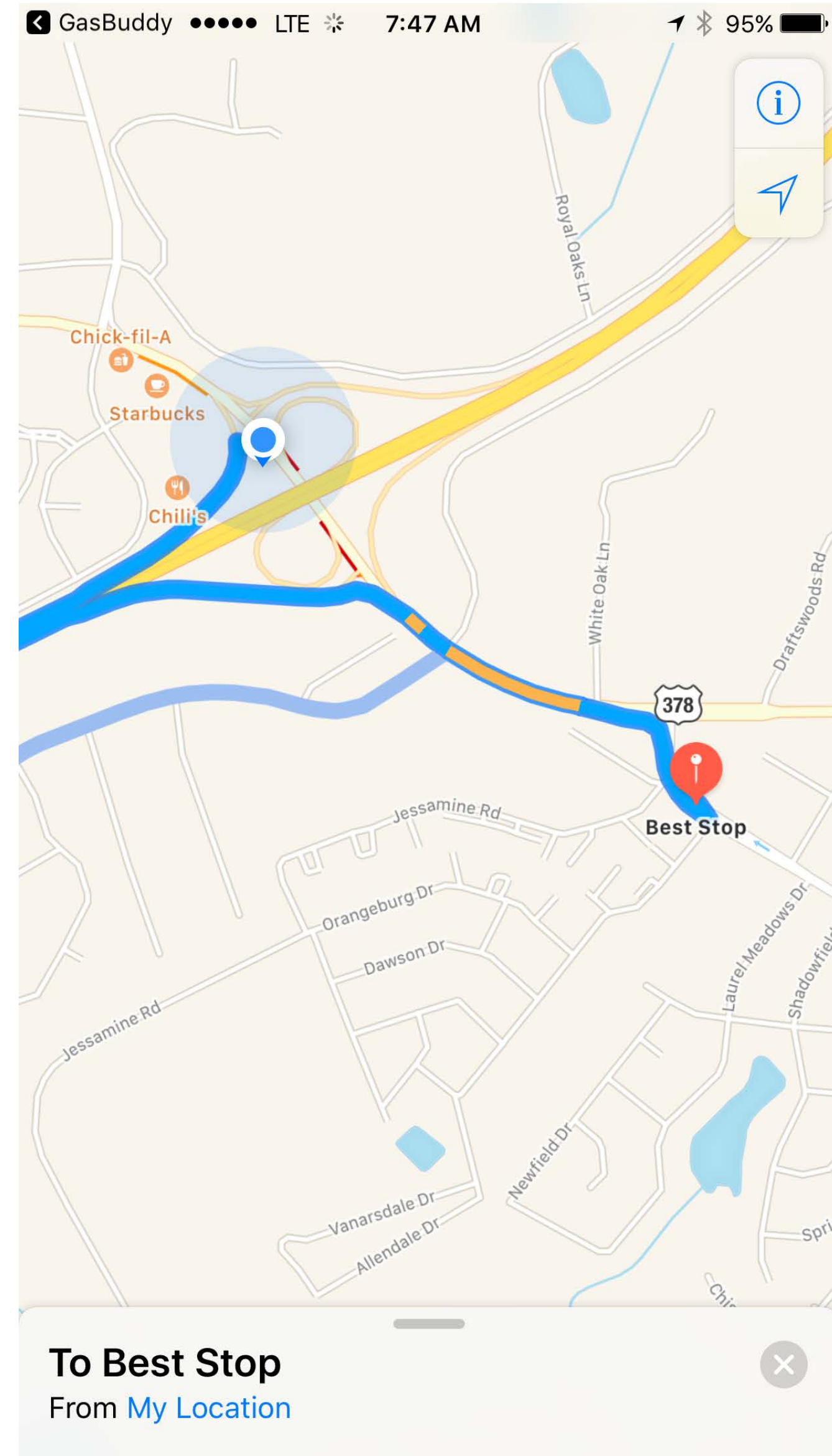
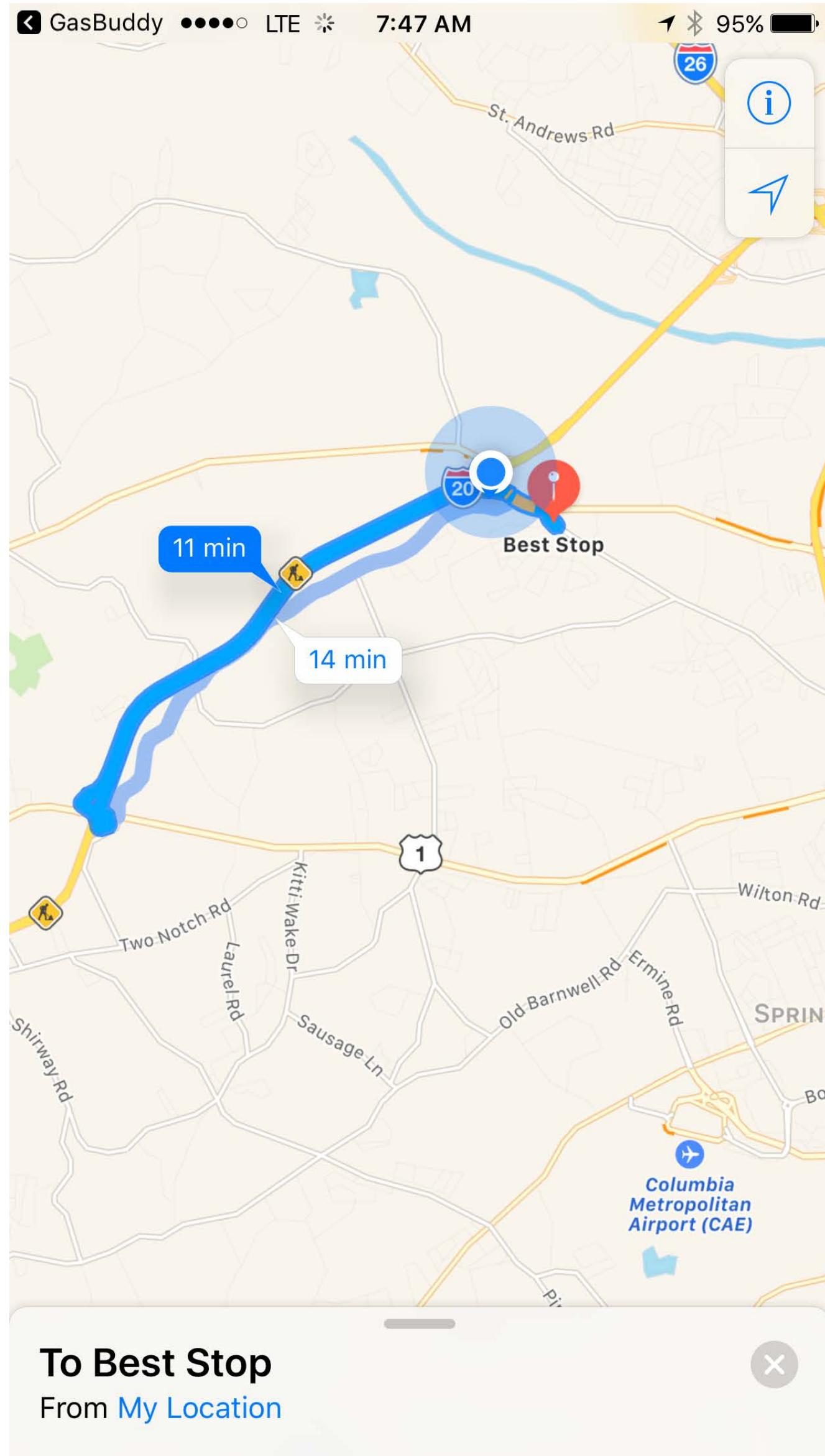
Widmark Explained



Test Result

1. A numeric value that is recorded on the breath evidence ticket and a full test sequence is completed.
2. Invalid
3. Filters not in agreement (Interference detected)
4. Incomplete
5. Refused
6. Error code

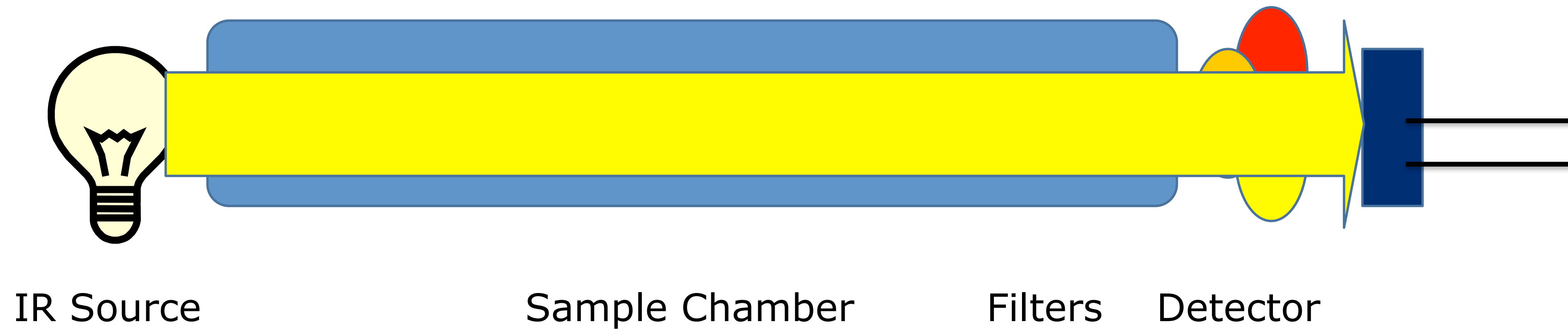
Computers Never Make Mistakes



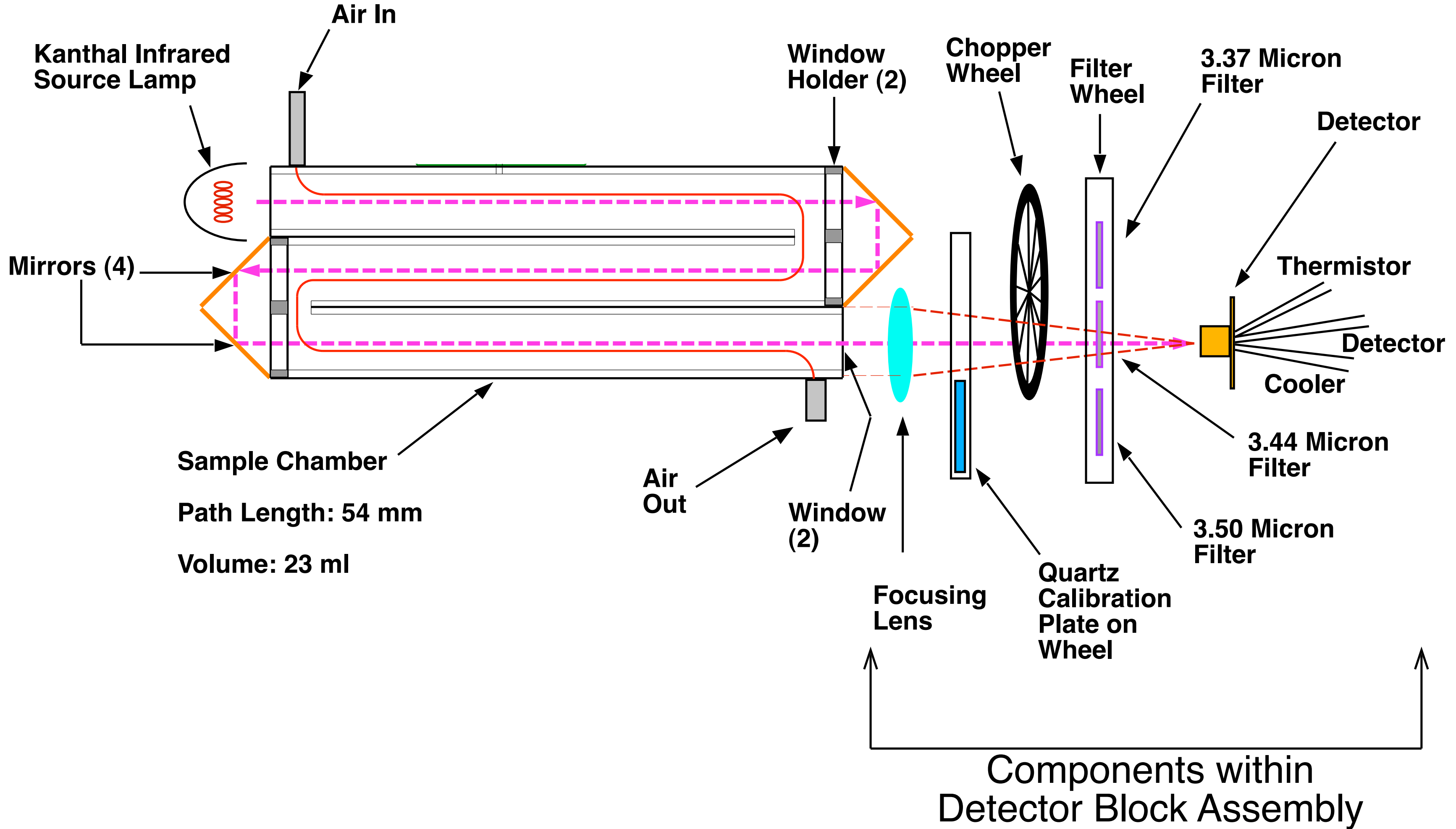
We are supposed to trust the Machine



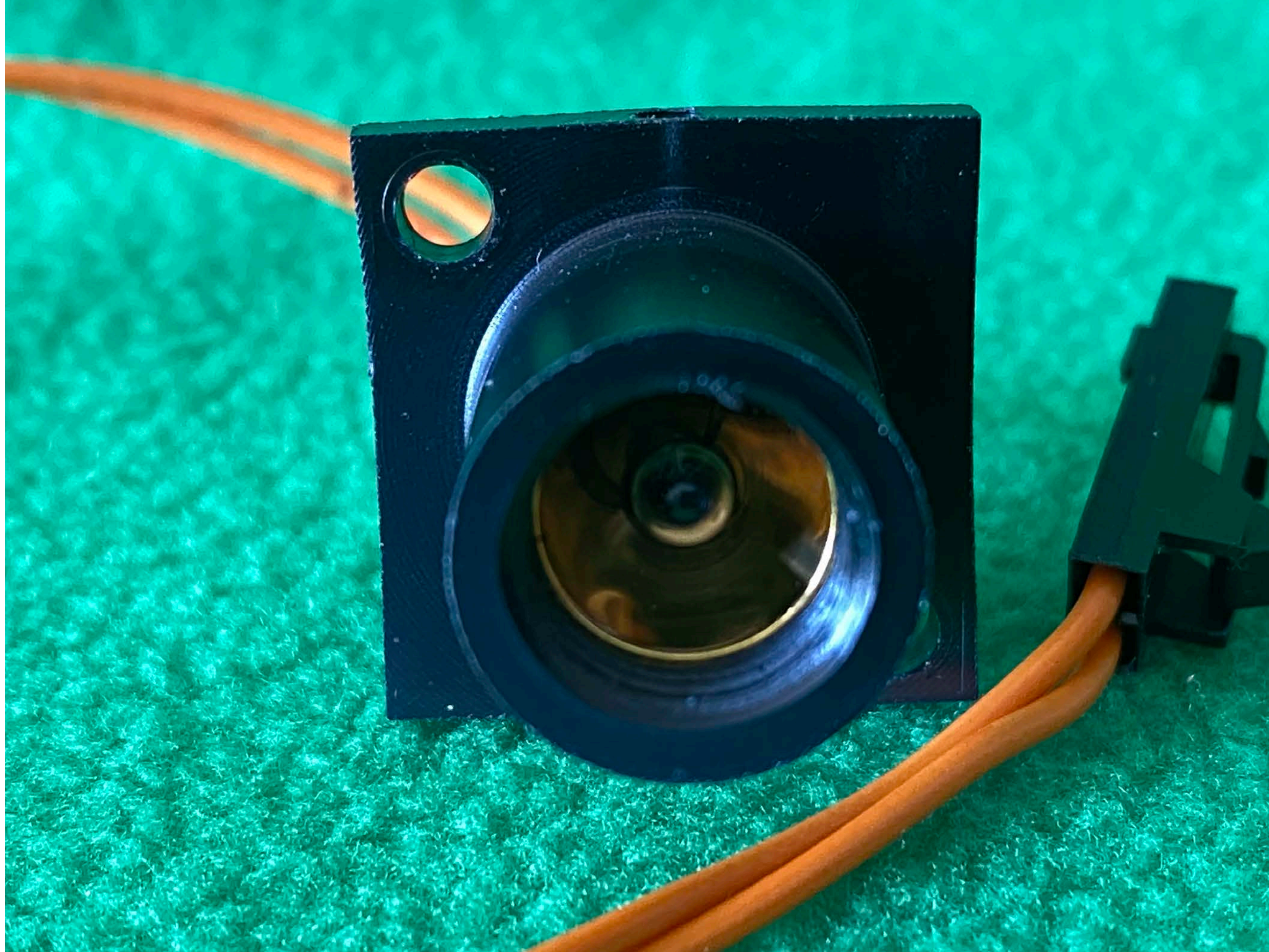
The basic components of an Infrared System



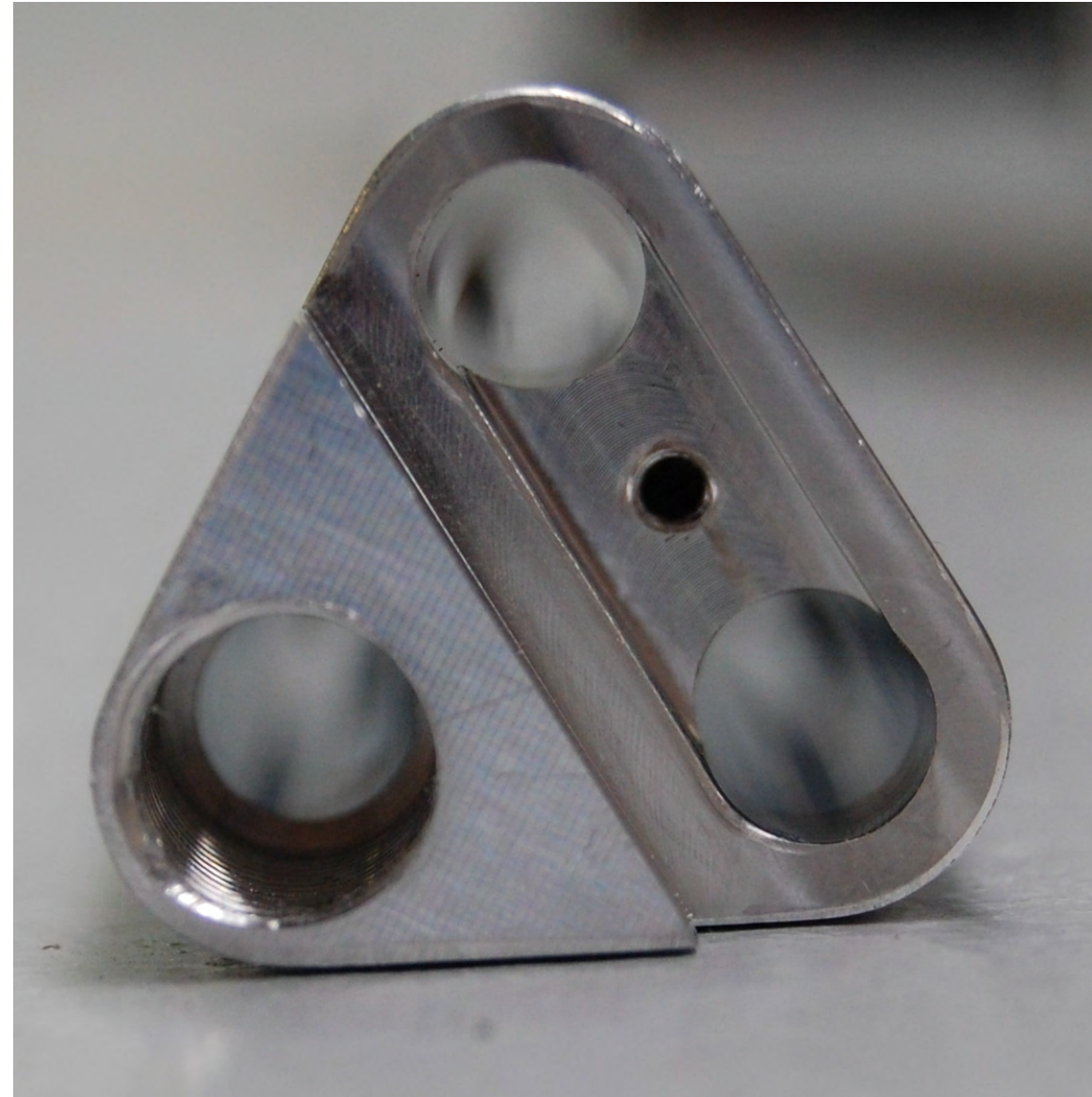
DMT Optical Bench



Light Source



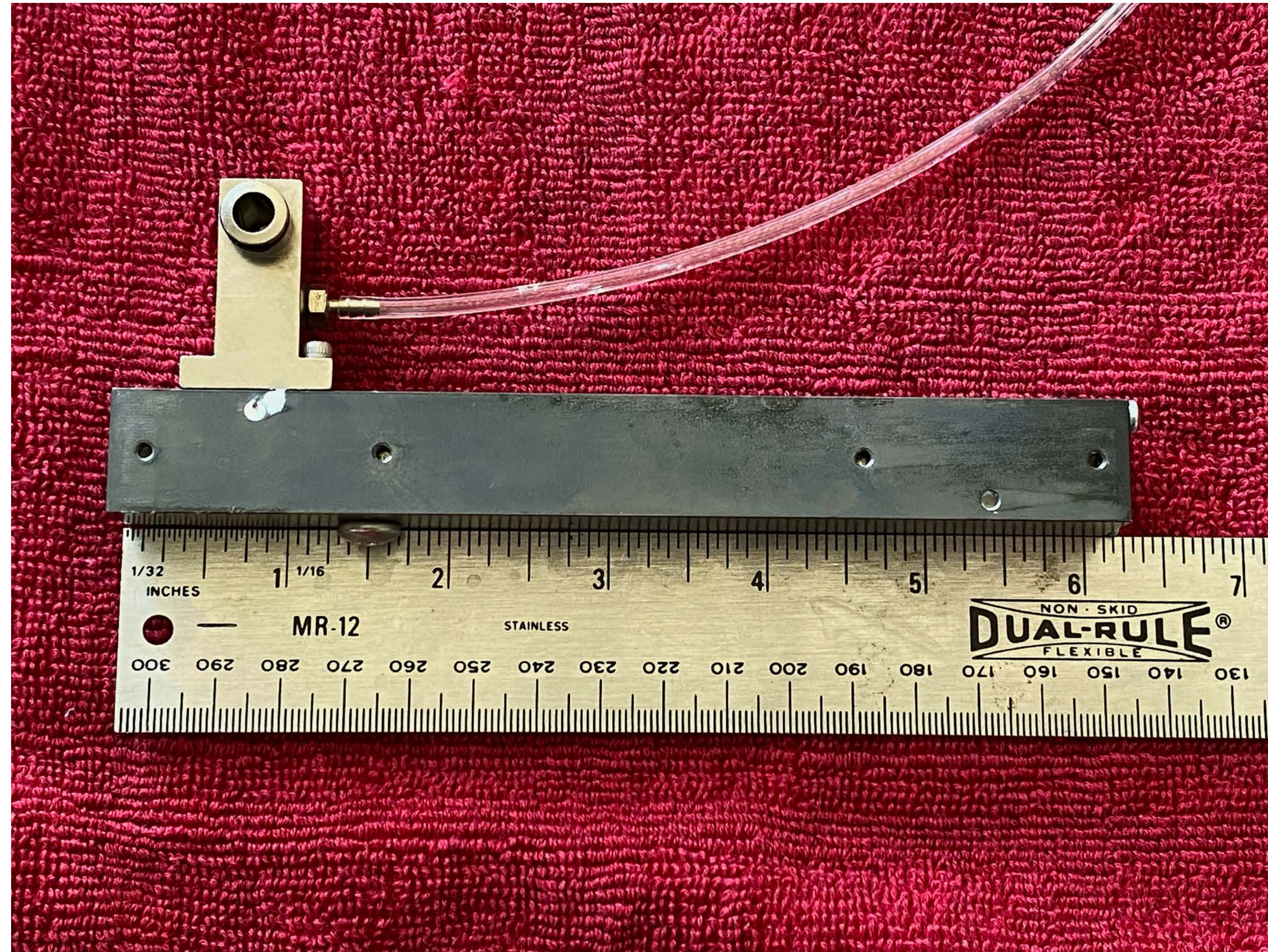
DMT Sample Chamber



Intoxilyzer 8000 Sample Chamber

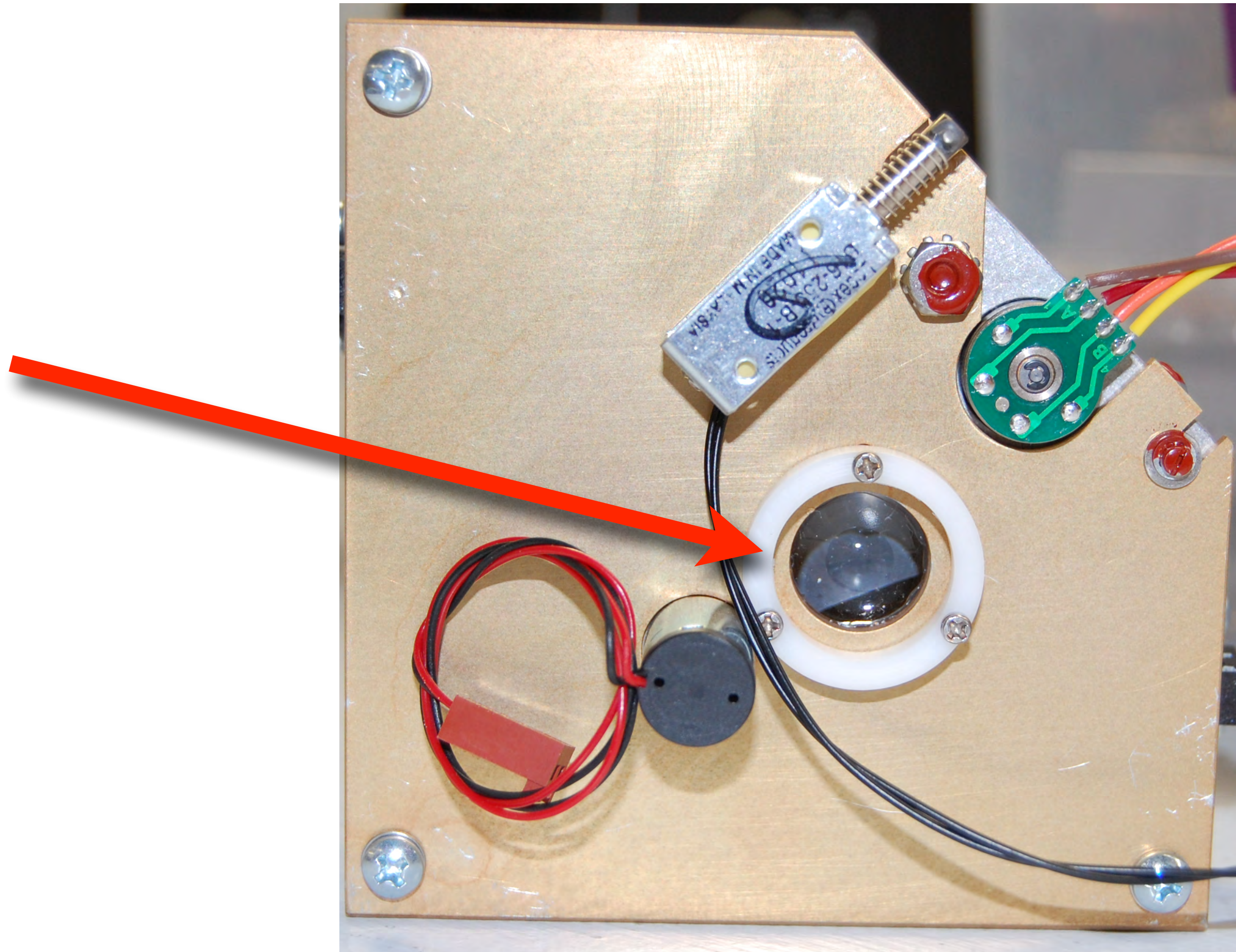


EC/IR II Sample Chamber



DMT Components

Focusing Lens



DataMaster Filters

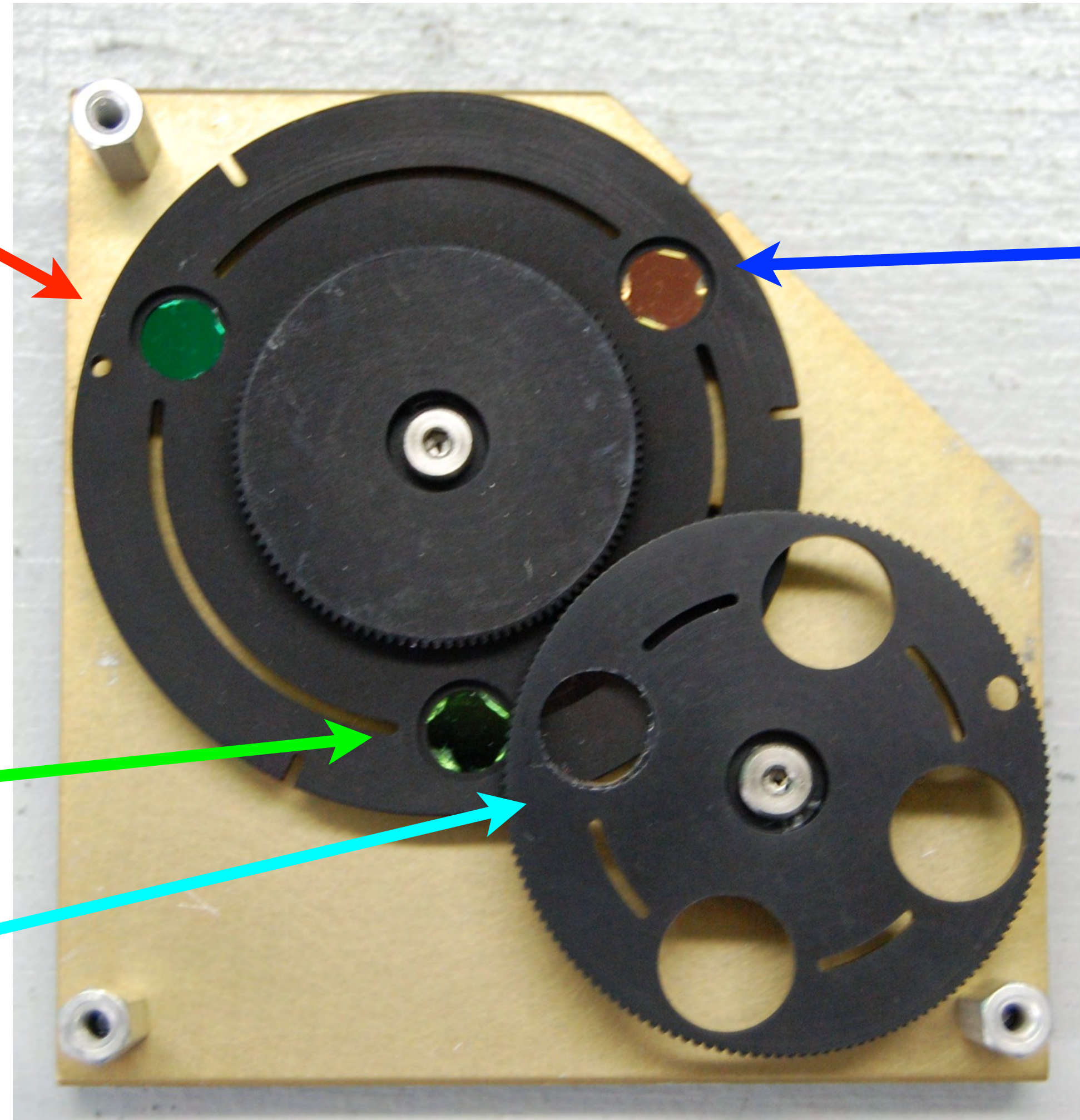
3.50

3.44

Filters With Quartz Wheel

3.37

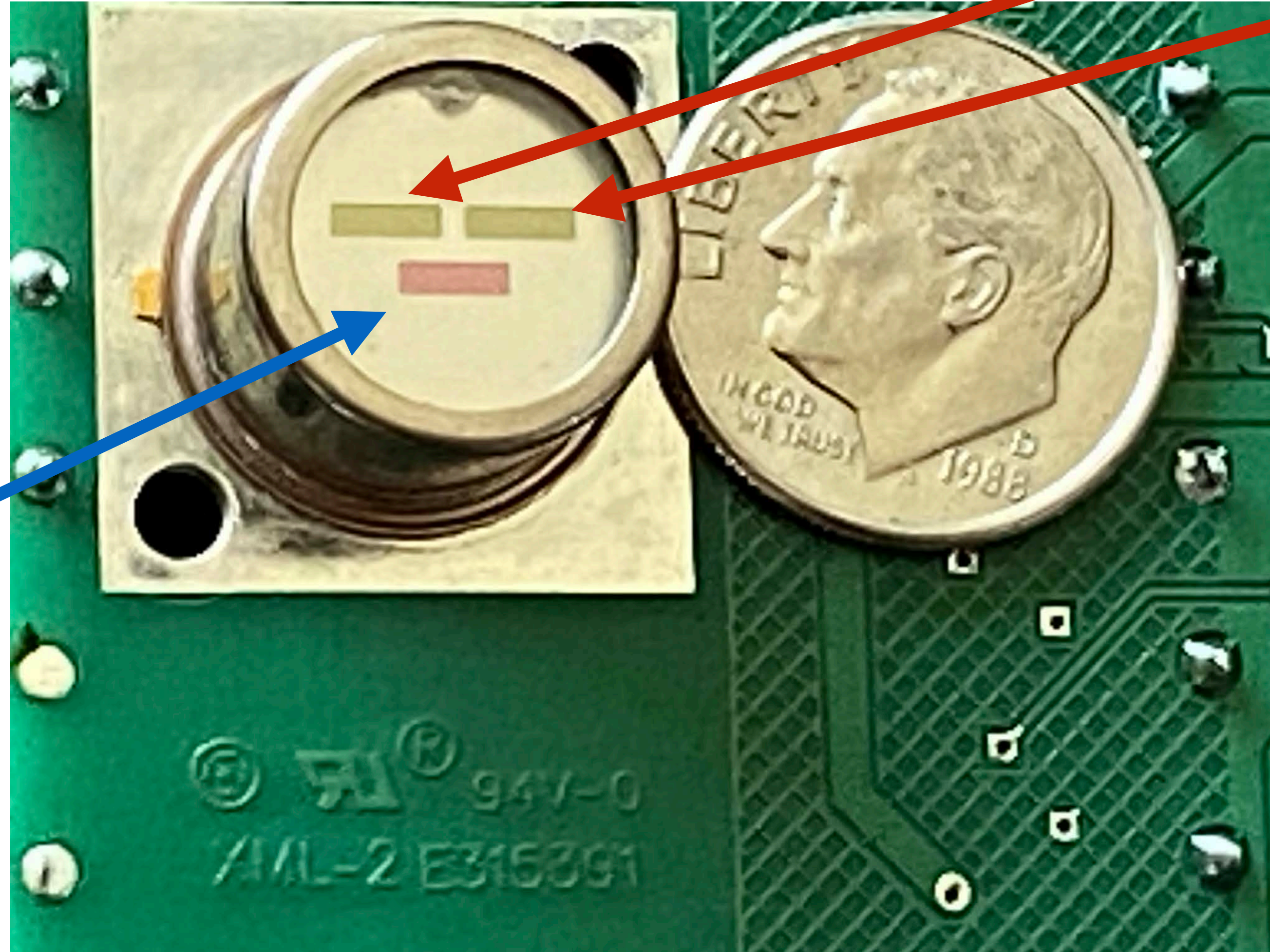
Quartz Standard



EC/IR II Filters

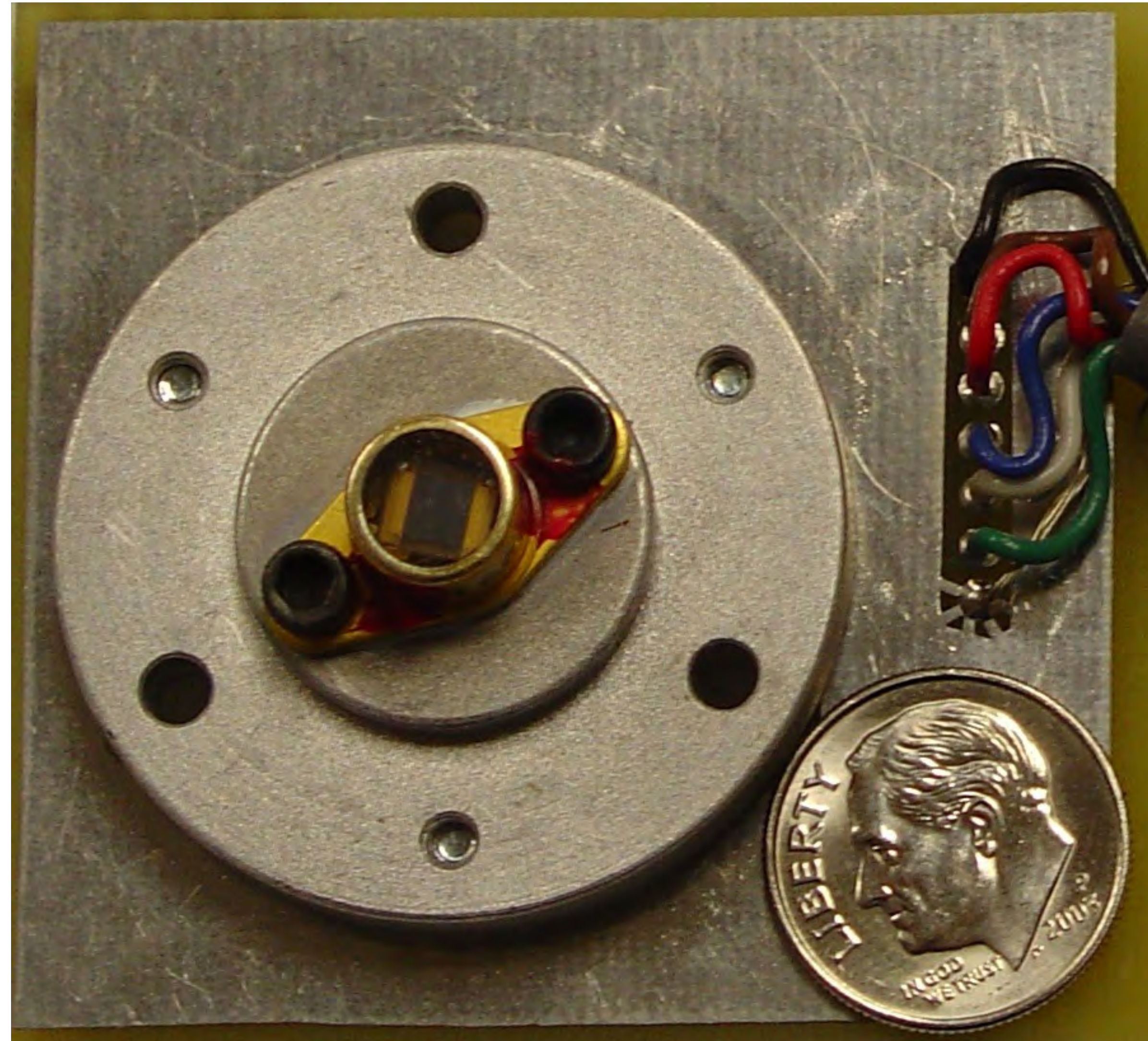
**3.46 μ
Alcohol**

**4.25 μ
Carbon
Dioxide**

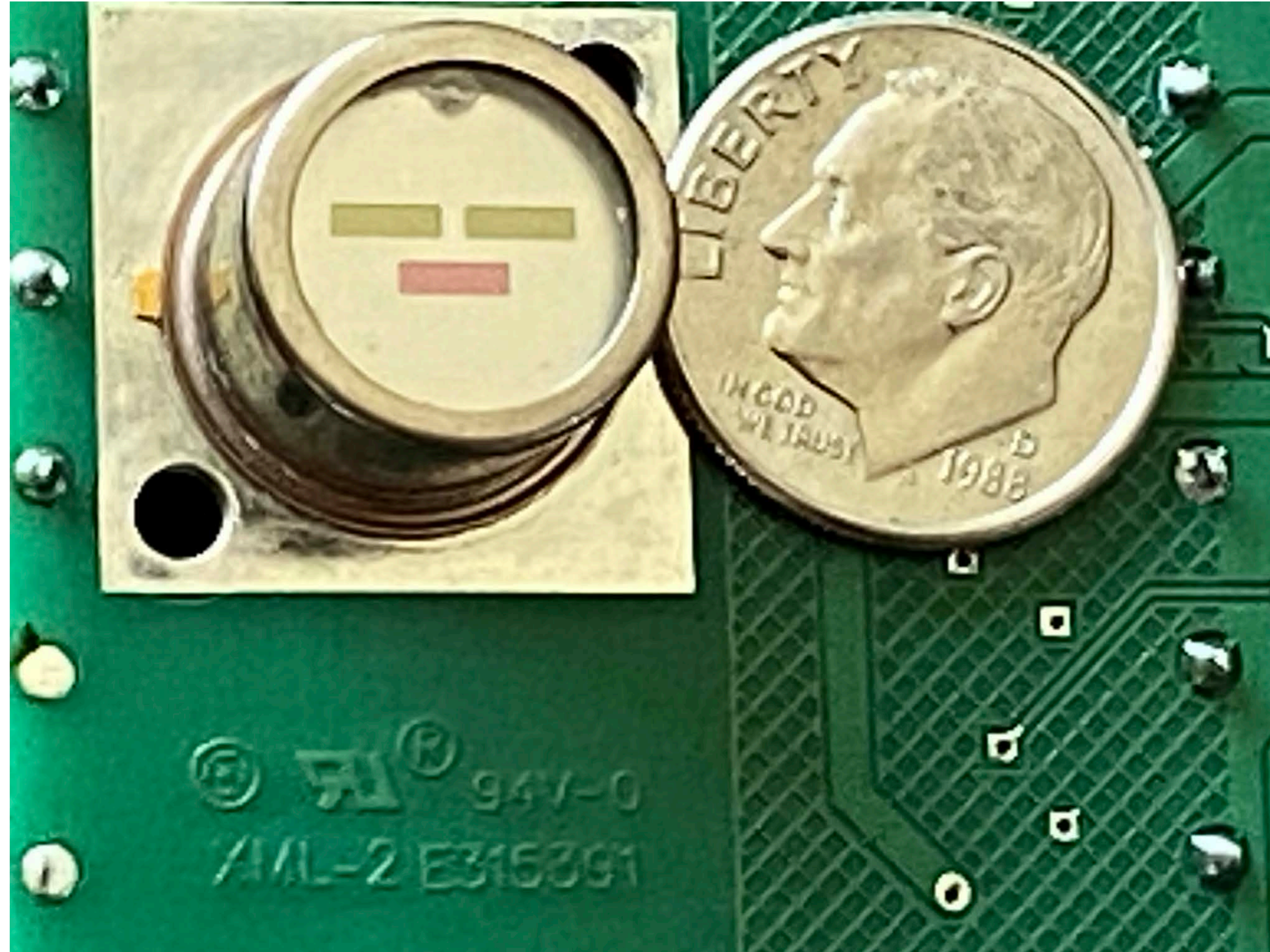


DMT Detector

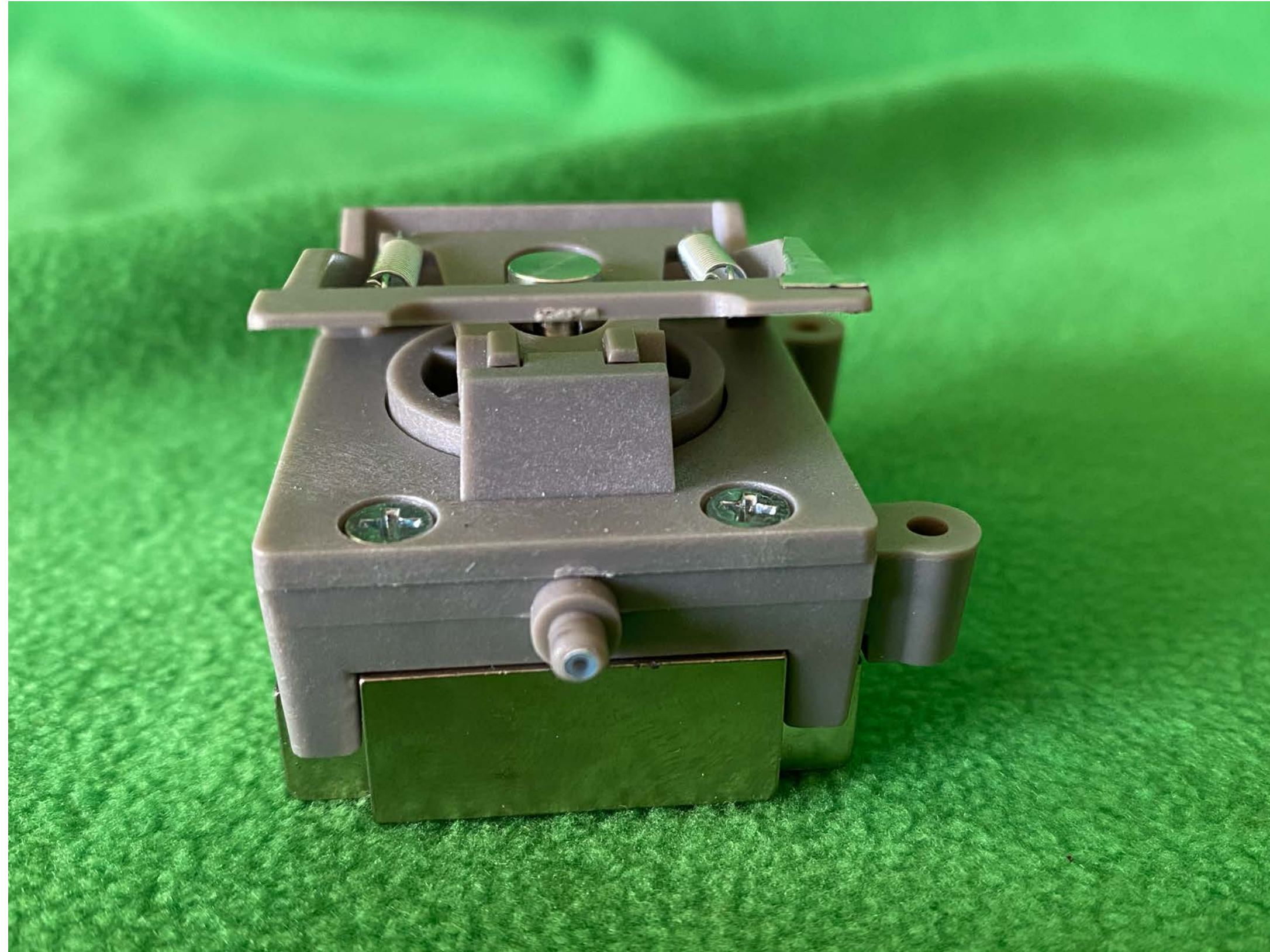
Lead Selenide Detector



EC/IR II Detector



Intoximeteres Fuel Cell



Current Configurations

Component:	detector	filters	lamp	notes
Intox 5000EN	Quantum; cooled (3.4)	4, broad	Projector	
Intox 8000	Pyro (9.4)	2, broad	Pulsed	
Draeger	Pyro (9.5)	1, broad	Pulsed	Secondary fuel cell
EC/IR	Pyro (3.5)?	2, ??	Pulsed	Fuel cell for quantification; IR for mouth alcohol
DataMaster	Quantum; cooled (3.4)	3, narrow	Steady State	Optional fuel cell on DMT

Infrared Specificity

Compound	3.37	3.4	3.44	3.5	9.5	FC
Water	Y	N	N	N	N	N
Methanol	Y	Y	Y	Y	Y	Y
Isopropanol	Y	Y	Y	N	Y	Y
Acetaldehyde	Y	Y	Y	Y	Y	Y
Toluene	Y	Y	Y	N	N	N
Benzene	Y	Y	Y	N	Y	N
Acetone	Y	Y	Y	Y	N	N

Basic Technology Comparisons

Basic Detector Technology	Fuel Cell	Quantum IR @ 3.3-3.5 μ	Quantum @ 3.4 and Fuel Cell	Pyro Thermal @ 3.5 μ + 9.4 μ	Pyro Thermal @ 9.4 μ + Fuel Cell
Specificity to Other Alcohols	1	8	8	3	3
Specificity to Toluene	10	8	10	8	8
Specificity to Acetaldehyde	1	8	1	8	8
Specificity to Acetone	10	10	10	8	8
Cost to Build	Cheap	Expensive	Expensive	cheap	cheap
Response Time	Slow	Instantaneous	Fast	Moderate Slow	Moderate Slow
Lamp Technology	N/A	Kanthol	Kanthol	Pulsed	Pulsed
Emitter time	N/A	Fast	Fast	Slow	Slow
Comparative Cost	N/A	Expensive	Expensive	Cheap	Cheap
System Drift	3	10	8	6	6
Repeatability	6	10	9	6	7
Slope Detection	1	10	10	4	4

Sample Acceptance for DMT

1. Subject must provide a sample at a rate of 2.87 liters per minute (this flow rate is not tested for accuracy).
2. Subject must provide a minimum sample of 1.5 liters in one continuous blow.
3. Flow rate must drop below minimum flow rate.
4. The last two averaged detector readings must agree within ≤ 0.001

Kurt Dubowski

STAGES OF ACUTE ALCOHOLIC INFLUENCE/INTOXICATION

BLOOD-ALCOHOL CONCENTRATION grams/100 mL	STAGE OF ALCOHOLIC INFLUENCE	CLINICAL SIGNS/SYMPTOMS
0.01-0.05	Subclinical	Influence/effects usually not apparent or obvious Behavior nearly normal by ordinary observation Impairment detectable by special tests
0.03-0.12	Euphoria	Mild euphoria, sociability, talkativeness Increased self-confidence; decreased inhibitions Diminished attention, judgment and control Some sensory-motor impairment Slowed information processing Loss of efficiency in critical performance tests
0.09-0.25	Excitement	Emotional instability; loss of critical judgment Impairment of perception, memory and comprehension Decreased sensory response; increased reaction time Reduced visual acuity & peripheral vision; and slow glare recovery Sensory-motor incoordination; impaired balance; slurred speech; vomiting; drowsiness
0.18-0.30	Confusion	Disorientation, mental confusion; vertigo; dysphoria Exaggerated emotional states (fear, rage, grief, etc) Disturbances of vision (diplopia, etc.) and of perception of color, form, motion, dimensions Increased pain threshold Increased muscular incoordination; staggering gait; ataxia Apathy, lethargy
0.25-0.40	Stupor	General inertia; approaching loss of motor functions Markedly decreased response to stimuli Marked muscular incoordination; inability to stand or walk Vomiting; incontinence of urine and feces Impaired consciousness; sleep or stupor
0.35-0.50	Coma	Complete unconsciousness; coma; anesthesia Depressed or abolished reflexes Subnormal temperature Impairment of circulation and respiration Possible death
0.45+	Death	Death from respiratory arrest

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Pharmacotherapy

BAC (%) ^a (mmol/L)	Effect
0.02–0.03 (4–8)	No loss of coordination, slight euphoria, and loss of shyness
0.04–0.06 (9–14)	Feeling of well-being, relaxation, lower inhibitions, sensation of warmth. Euphoria. Some minor impairment of reasoning and memory, lowering of caution
0.07–0.09 (15–21)	Slight impairment of balance, speech, vision, reaction time, and hearing. Euphoria. Judgment and self-control are reduced, and caution, reason, and memory are impaired. It is illegal to operate a motor vehicle in some states at this level
0.10–0.125 (22–27)	Significant impairment of motor coordination and loss of good judgment. Speech can be slurred; balance, vision, reaction time, and hearing impaired. Euphoria. It is illegal to operate a motor vehicle at this level of intoxication
0.13–0.15 (28–34)	Gross motor impairment and lack of physical control. Blurred vision and major loss of balance. Euphoria is reduced, and dysphoria is beginning to appear
0.16–0.20 (35–43)	Dysphoria (anxiety, restlessness) predominates; nausea can appear. The drinker has the appearance of a “sloppy drunk”
0.25 (54)	Needs assistance in walking; total mental confusion. Dysphoria with nausea and some vomiting
0.30 (65)	Loss of consciousness
≥0.40 (>87)	Onset of coma, possible death caused by respiratory arrest

BAC, blood alcohol concentration.

^aGrams of ethyl alcohol per 100 mL of whole blood.