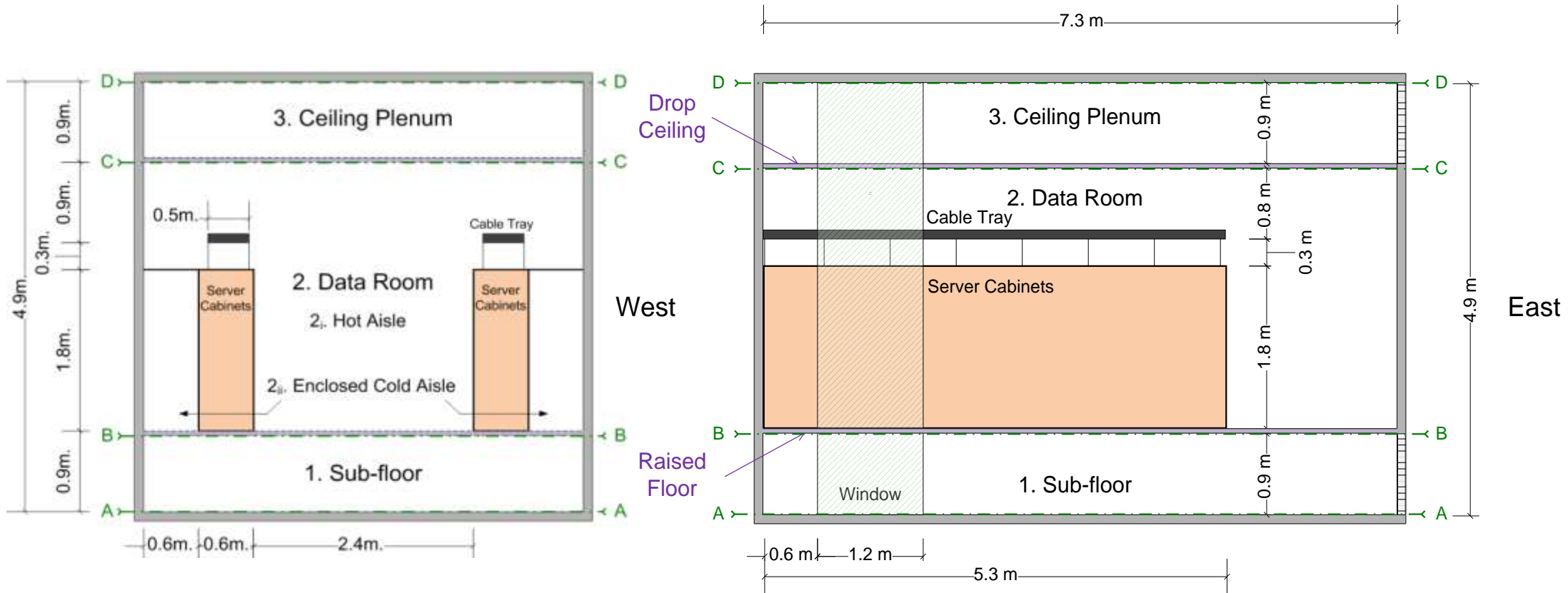




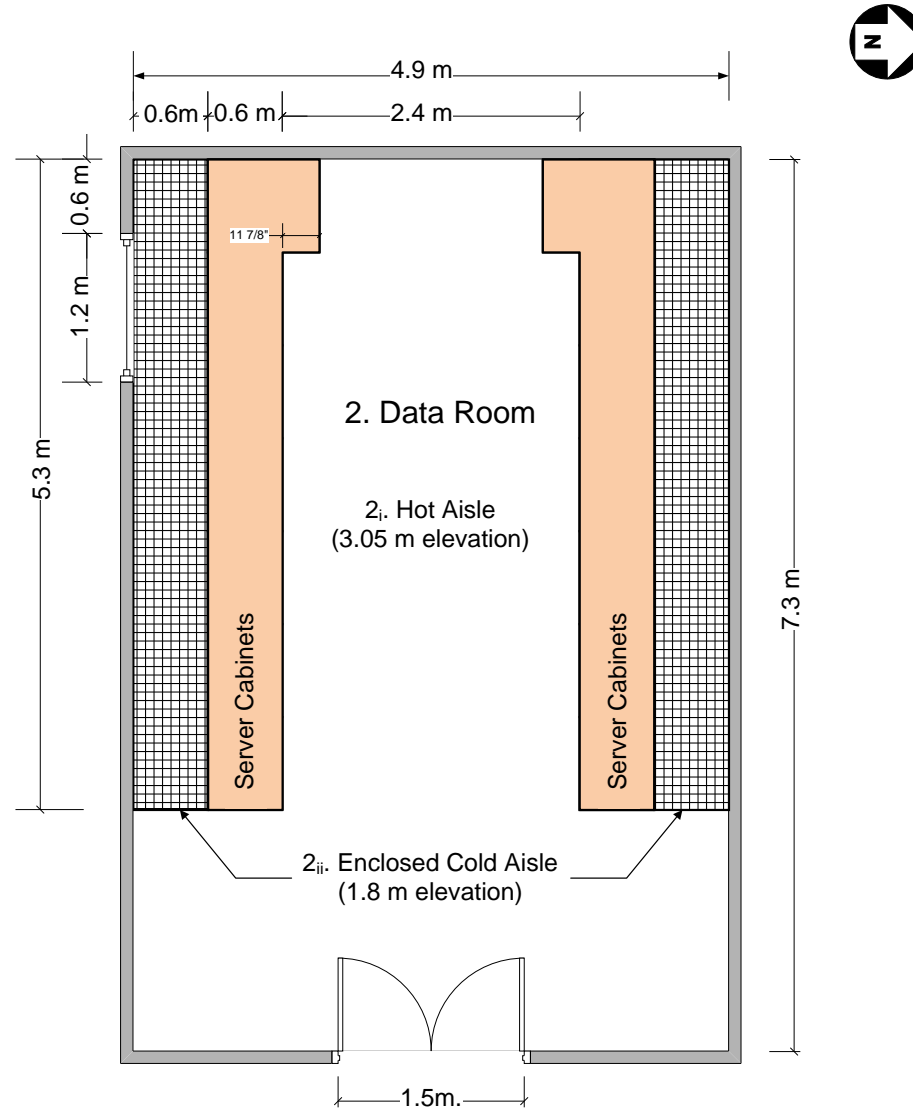
Large Scale Data Center Testing at FM Global

Sai Thumuluru

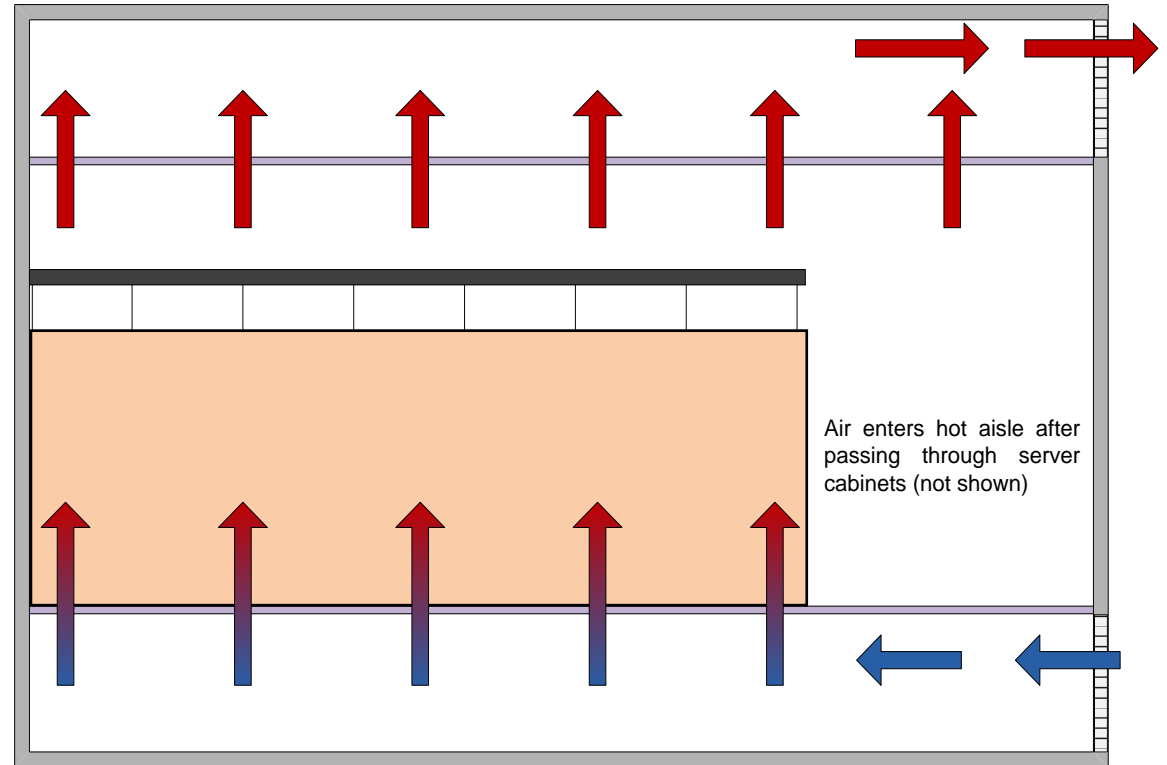
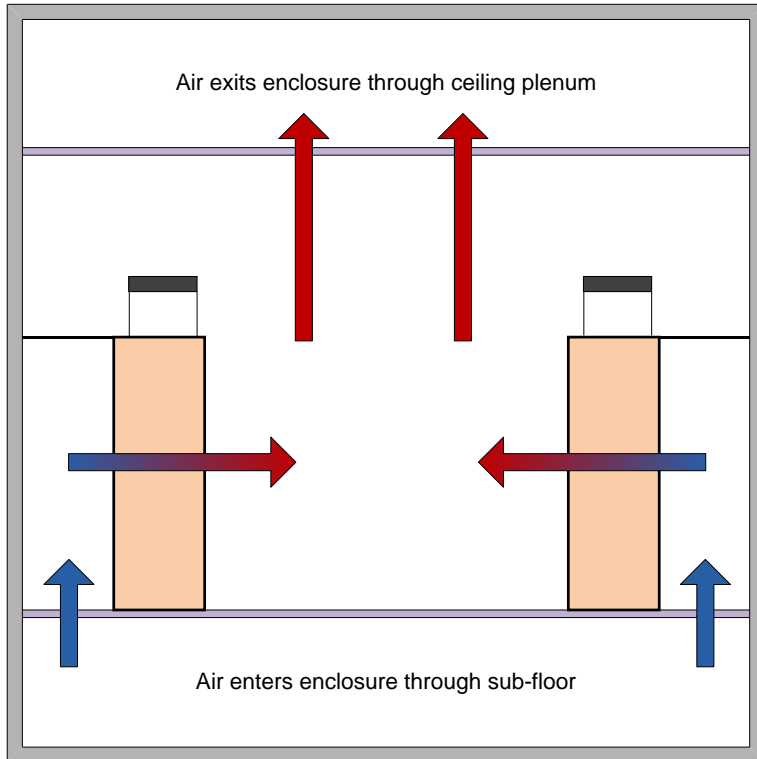
Test Setup



Test Setup



Test Setup



Test Setup Pictures



Test Summary

Initial Tests: Characterization of Airflow	Smoke Tests: 10 full scale tests
100 locations across sub-floor, cold aisle, hot aisle, ceiling of server room, ceiling plenum	4 types of smoke source (propylene, foam, circuit boards, cables)
2 air exchange rates	4 smoke source locations
	2 air exchange rates

Measurements

Quantity	Instrumentation
Air flow characterization	Sonic anemometer
Smoke concentration	3 Laser & gravimetric systems
Flow velocity	14 bi-directional velocity probes
Temperature	Thermocouples (13)
Flow rate	5 pitot probes (exhaust duct)
Room pressure	Static pressure probes
Smoke Obscuration	27 smoke detectors (9 Aspirated, 9 Spot 1, 9 Spot 2)

Test Matrix

Test #	Smoke source	Location	Air exchange rate (ACH)
1	Propylene	Hot Aisle	265
2	Propylene	Hot Aisle	78
3	Propylene	Sub-floor	78
4	Propylene	Sub-floor	265
5	Foam	Cold Aisle	265
6	Foam	Cold Aisle	78
7	Circuit Boards	Cabinet	78
8	Circuit Boards	Cabinet	265
9	Cables	Sub-floor	265
10	Cables	Sub-floor	78

Sample Test Images

