



Description of the StadiumCell Trial at Rutgers University WINLAB & Louis Brown Rutgers Athletic Center



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The Motivation

As wireless data usage has been doubling since 2007 (when the iPhone was unleashed) wireless networks have been straining to support the demand.

With over half of Americans using smartphones, and with usage on smartphones increasing as well, wireless data use continues to surge.

The growth in data usage is particularly challenging in some venues where usage patterns are unusually correlated and atypical.

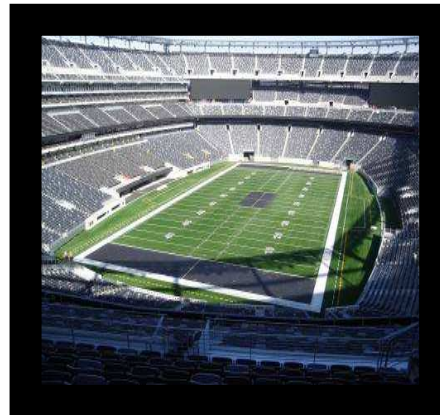
- At the 2012 Superbowl there was more uplink traffic than downlink, normally downlink traffic is 7 times the reverse. (People were videocasting from their seats.)
- Data traffic peaks in unison at critical times in games or concerts or political events.
- The geographic density of users is exceptionally high for a few hours then the density drops to near zero for many more days.
- The “stadiumcell” is a type of small cellular base station aimed at addressing such challenges.

Trial Objectives

Increase Confidence in Product and overall Solution

Identify “real world” deployment preferences & issues

Enable Better/Earlier Commercial deployments via early learnings



FEATURES IN TRIAL – Q3 2012

- Small, lightweight unit that is mountable on a wall, the side of a building or pole (and perhaps demo pan and tilt, mount options and implications)
- Integrated directional antennas enabling higher throughput, lower interference leading to a higher degree of sectorization and greater power efficiency
- Single Long Term Evolution (LTE) carrier and sector per cubeDOCK (3 sectors for trial) (2 BBU)
- 2 path receive diversity and 2x2 MIMO enabled by cross-polarization
- Compatible with the Alcatel-Lucent 9926 Digital 2U NodeB (d2U)
- Power supply: 120/240 V AC
- Passive convection cooling (no fans for noise-free operation)
- Frequency Operating band AWS Band 4 (currently non-commercial)
- Carrier bandwidth: 10 MHz
- Maximum transmission power: AWS is 1 W conducted output power (5 W EIRP) at each antenna (will be testing with much less power ~10-100mW)
- Fiber optic connection with CPRI line rate 3 between cube and baseband unit (located on site in a telecom closet)
- Interference management/mitigation learnings and techniques from Murray Hill/Barcelona testing

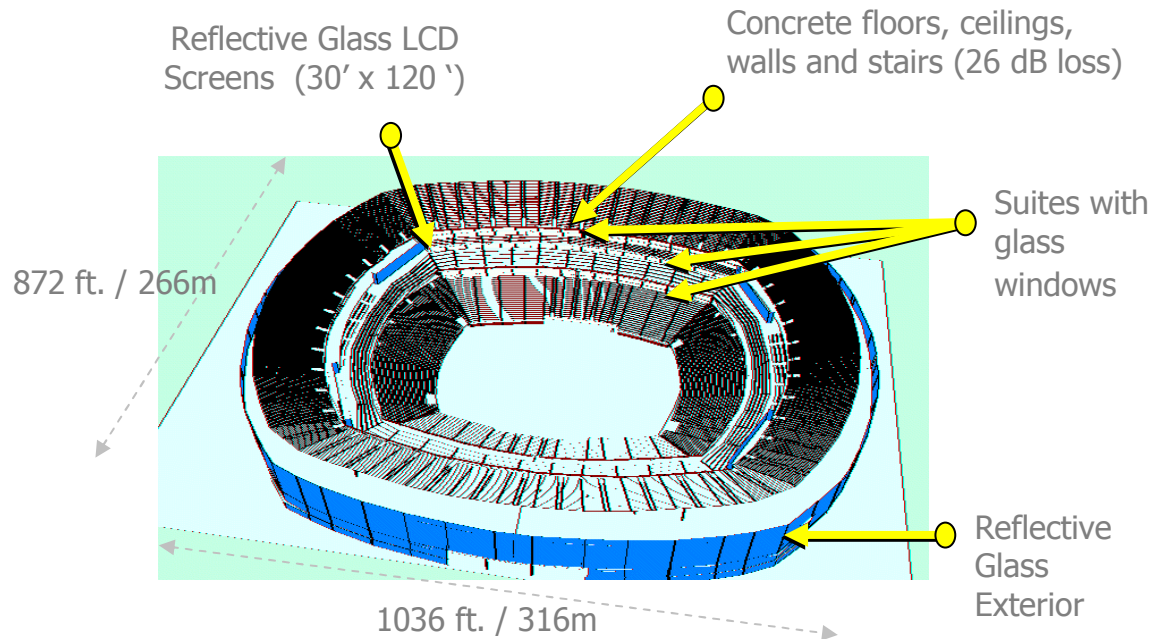
BELL LABS MODELS & TOOLS

Know
Before You
Build

Key Questions:

Impact of product features in real-world deployments?

Feasibility of candidate deployment scenarios?



Realistic Stadium Model

Key CTO/Bell Labs Models to address this problem

Bell Labs WiSE Ray Tracing for 3D Propagation Models

Real 3D Antenna Patterns

Channel Models

System Performance Analysis Framework

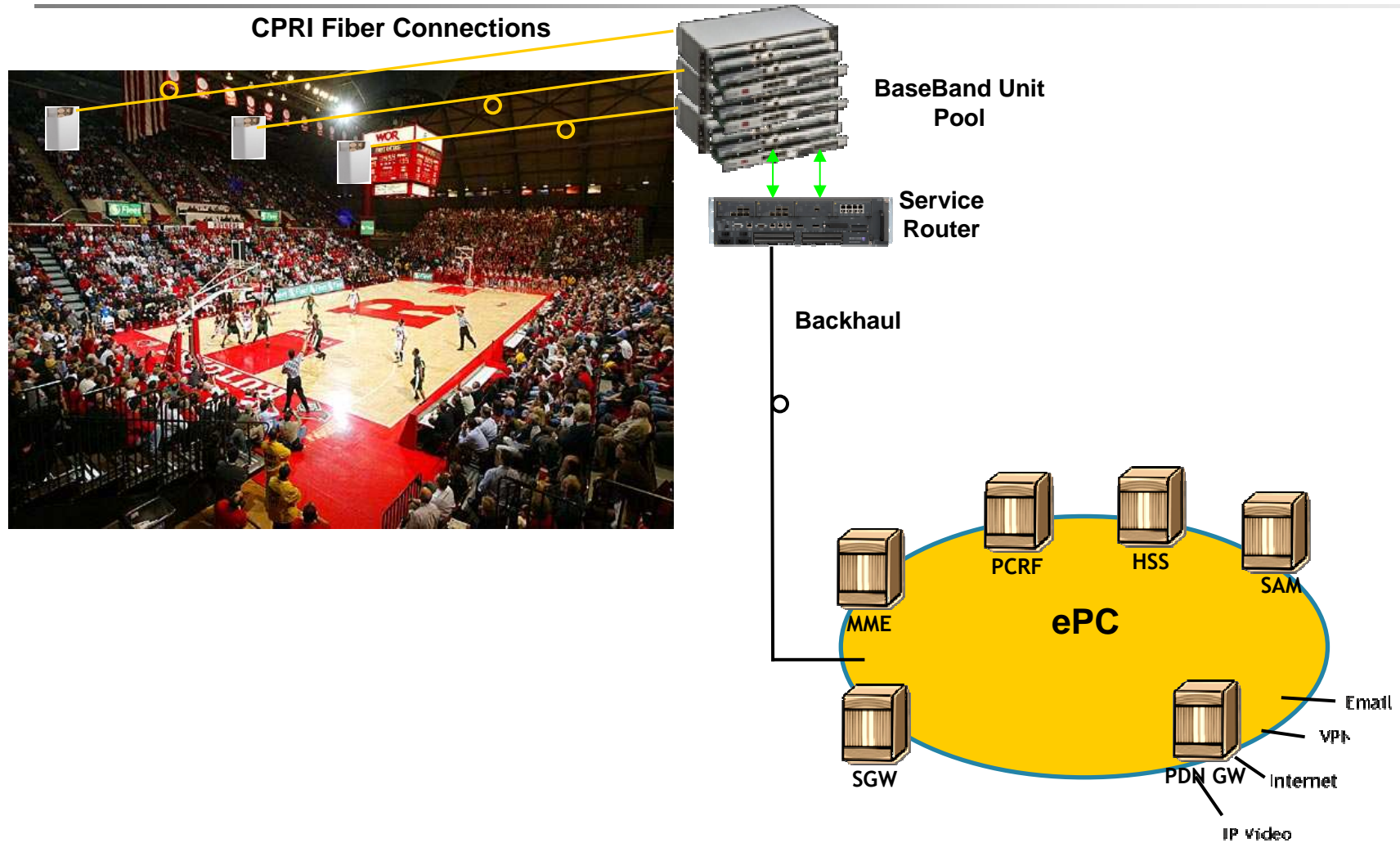
Rutgers Athletic Center (RAC)

The Louis Brown Rutgers Athletic Center (RAC) is an ideal venue for testing and developing the stadiumcell product family, its cavernous 8000 person gymnasium resonates not just with cheering fans but with multi-path propagation of radio waves.

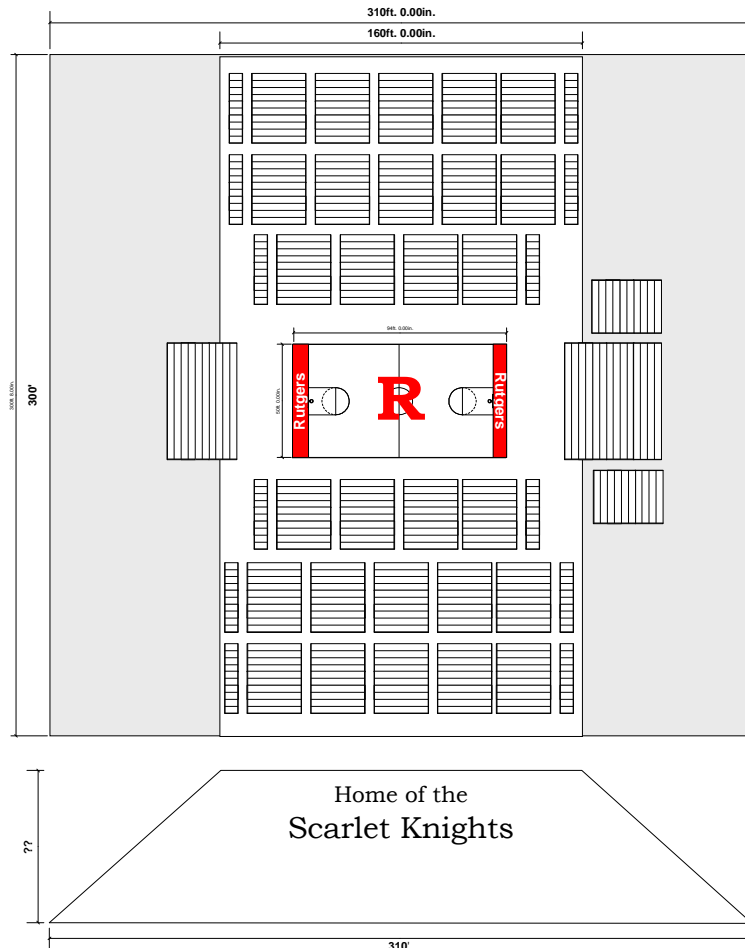
It challenges and tests the best of Bell Lab's radio planning capabilities while showing off the product design to great effect.



Rutgers RAC Stadium Trial Architecture



Dimensions of the RAC



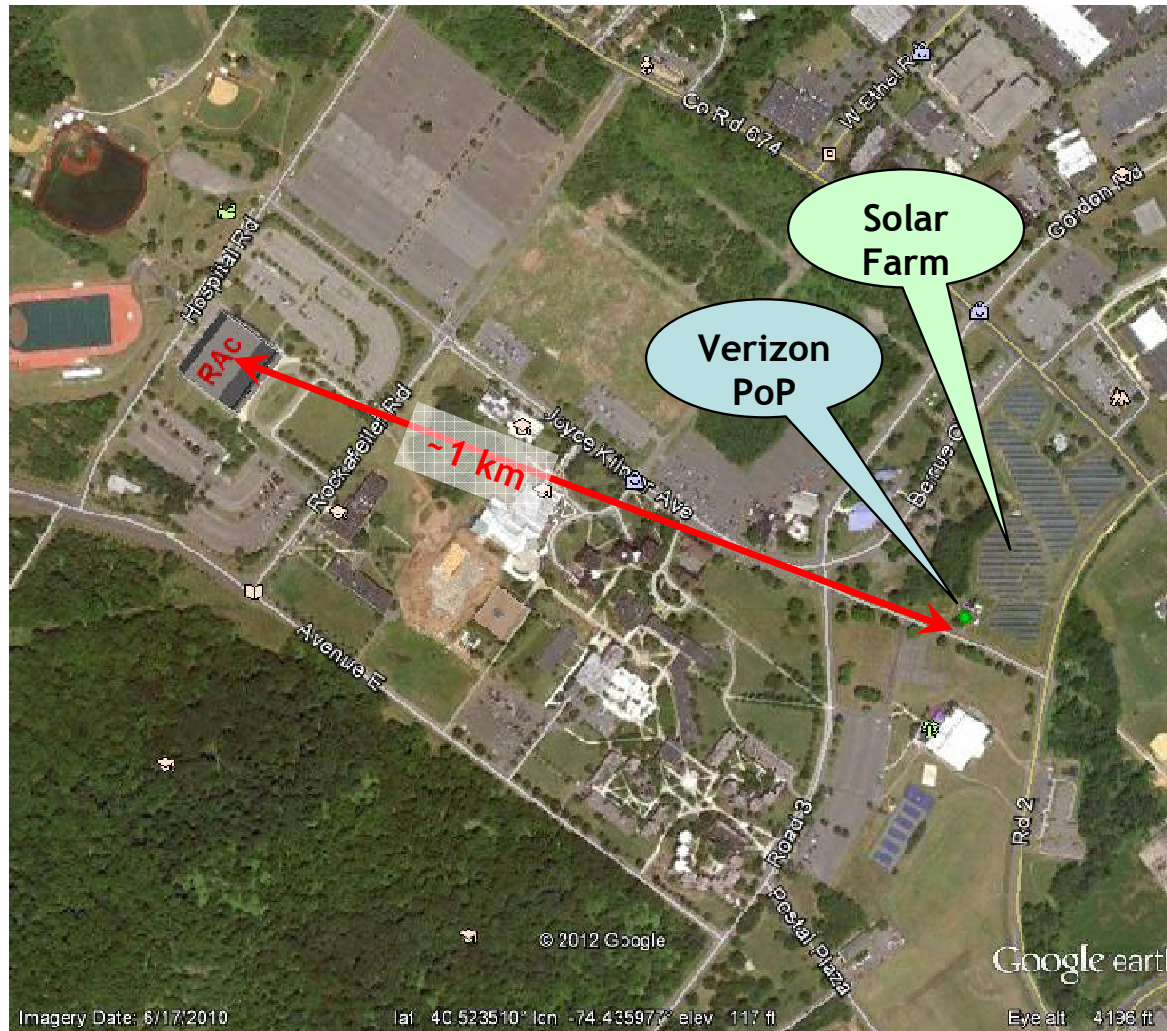
Alcatel-Lucent requires detailed 3D plans of the inside of the RAC for RF planning purposes. Please include the height of the bleachers, the locations of columns and power outlets, any catwalks and the plans for the central scoreboard.

If architectural plans are available in computer form, that would be ideal, but not necessary.

The concession stand entranceway, electrical and telephone services as well if possible.

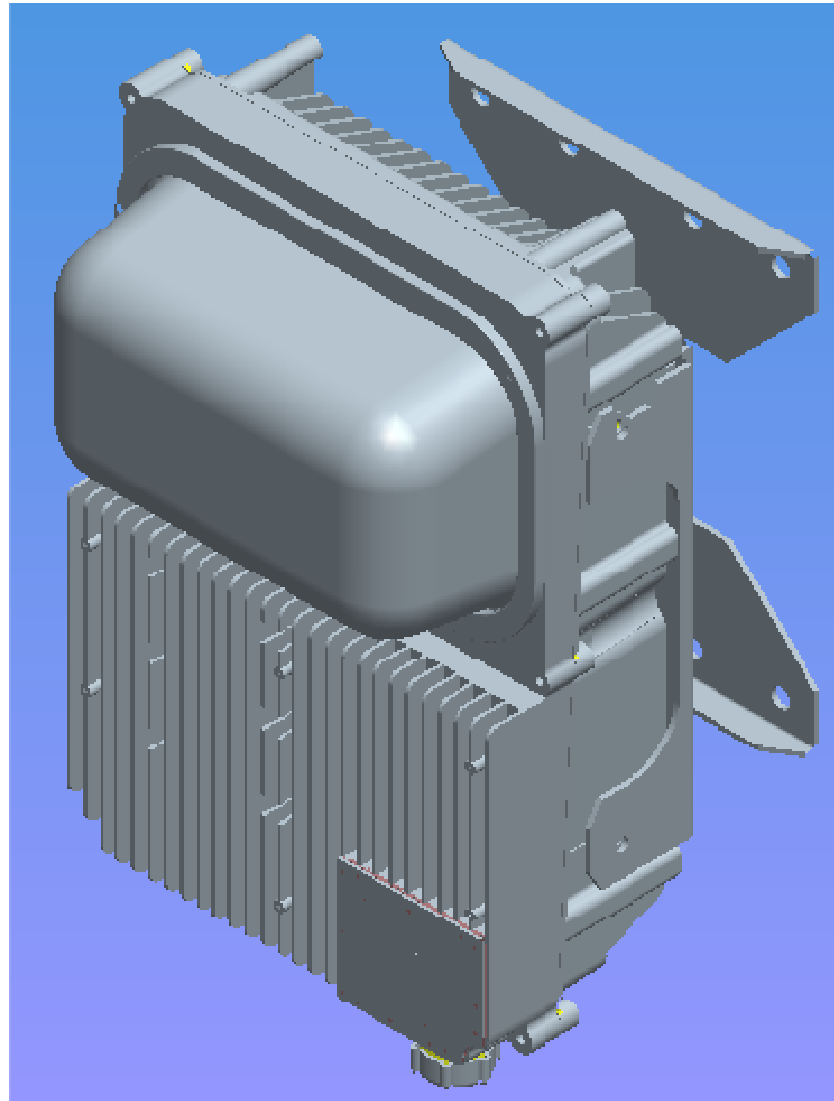
An electrical closet with room for two pizza boxes (2U rack mountable BBUs) is also needed.

The RAC in context



Verizon has a point of presence within a km of the RAC, just down the road on Joyce Kilmer Ave. all on Rutgers property.

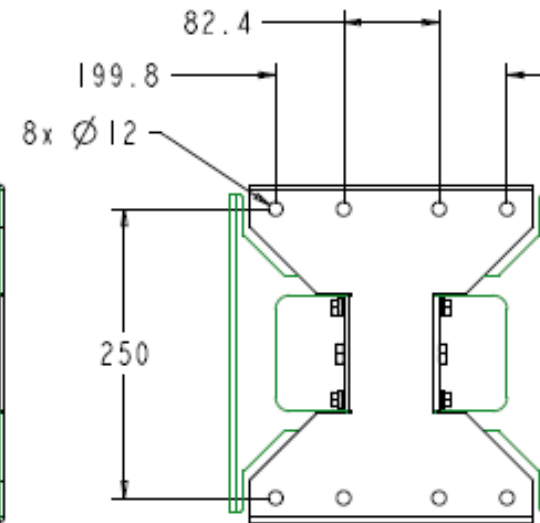
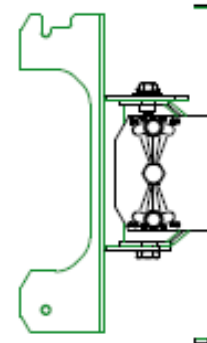
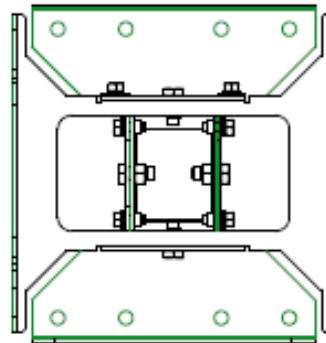
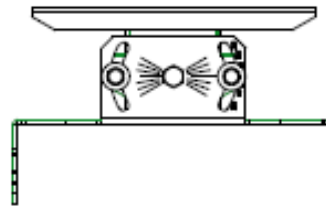
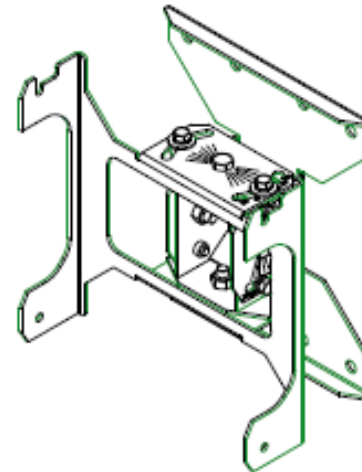
Stadium Cube (Prototype Trial hardware)



Stadium Cube

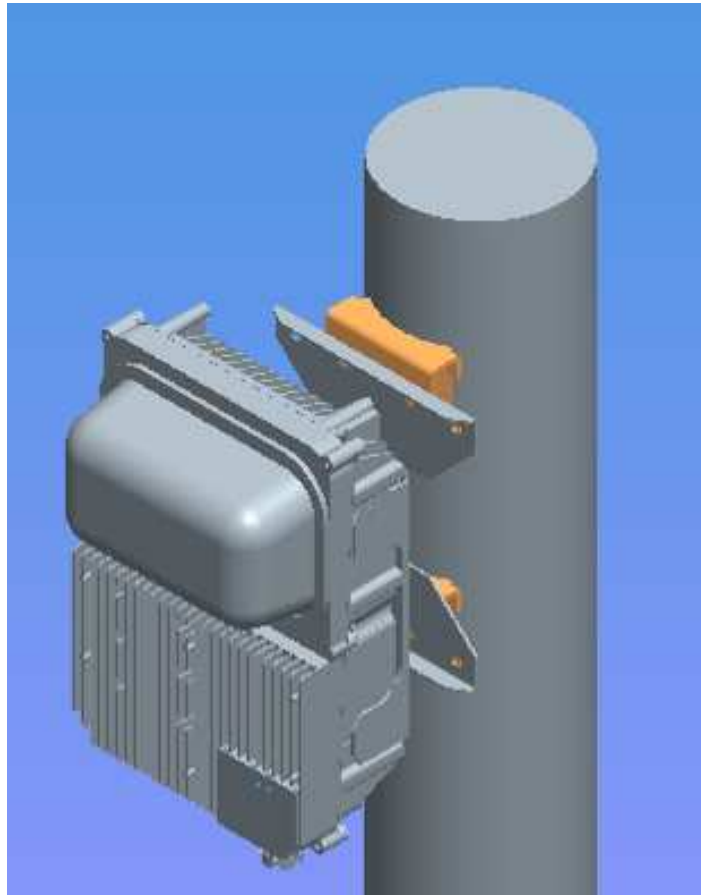
(Prototype Trial hardware) – Wall Mount

- wall mount bracket (shown).
- provides tilt and rotation of cubedock relative to the mounting surface.
- pole mountable (using additional standard RRH pole mount hardware).

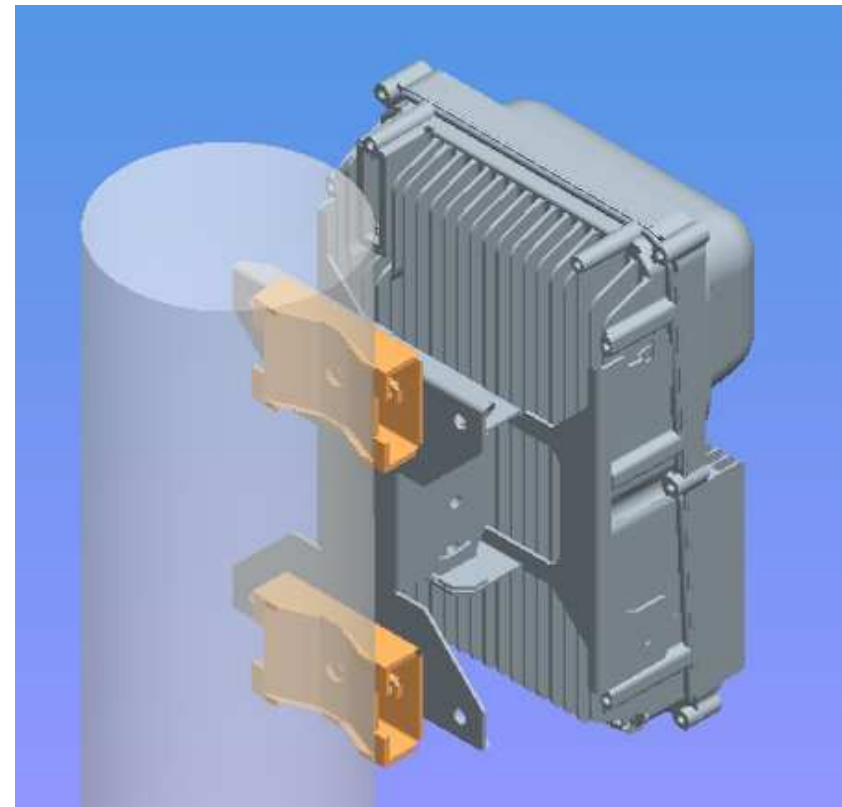


Stadium Cube (Prototype Trial hardware)

Pole Mount



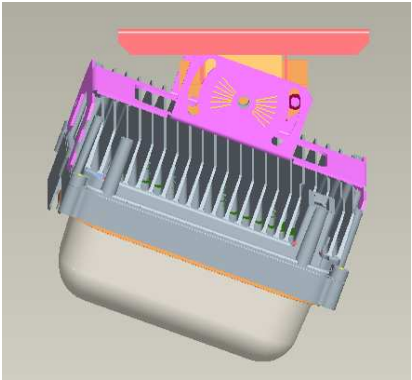
- pole mountable (using additional standard RRH pole mount hardware).
- Pole mount kits available to mount to various diameter poles.



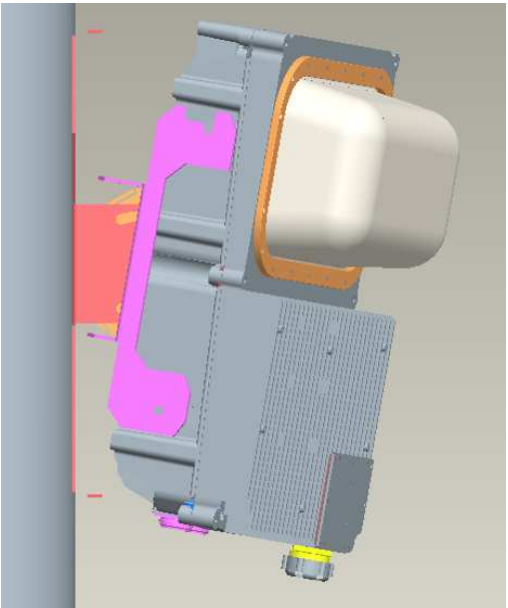
Stadium Cube (Prototype Trial hardware)

10 deg tilt/20 deg rotation simultaneously

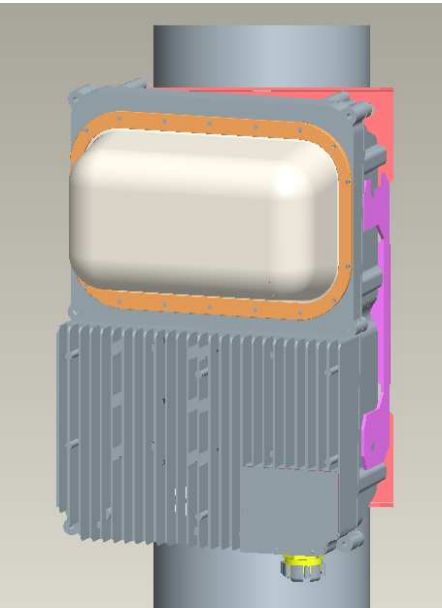
Max tilt & rotation (not simultaneously):
Max tilt: +/- 20 deg
Max rotation: +/- 30 deg



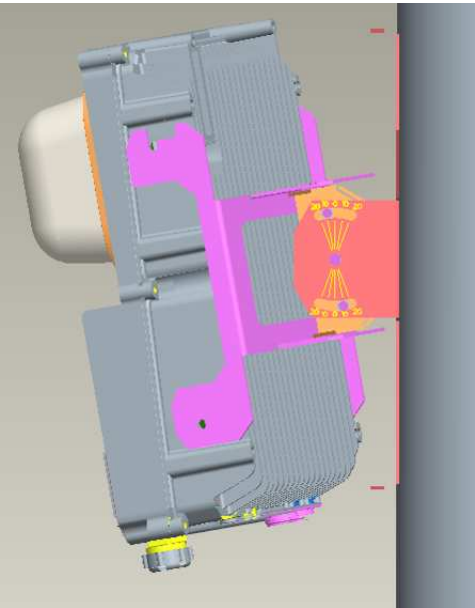
Top



Left



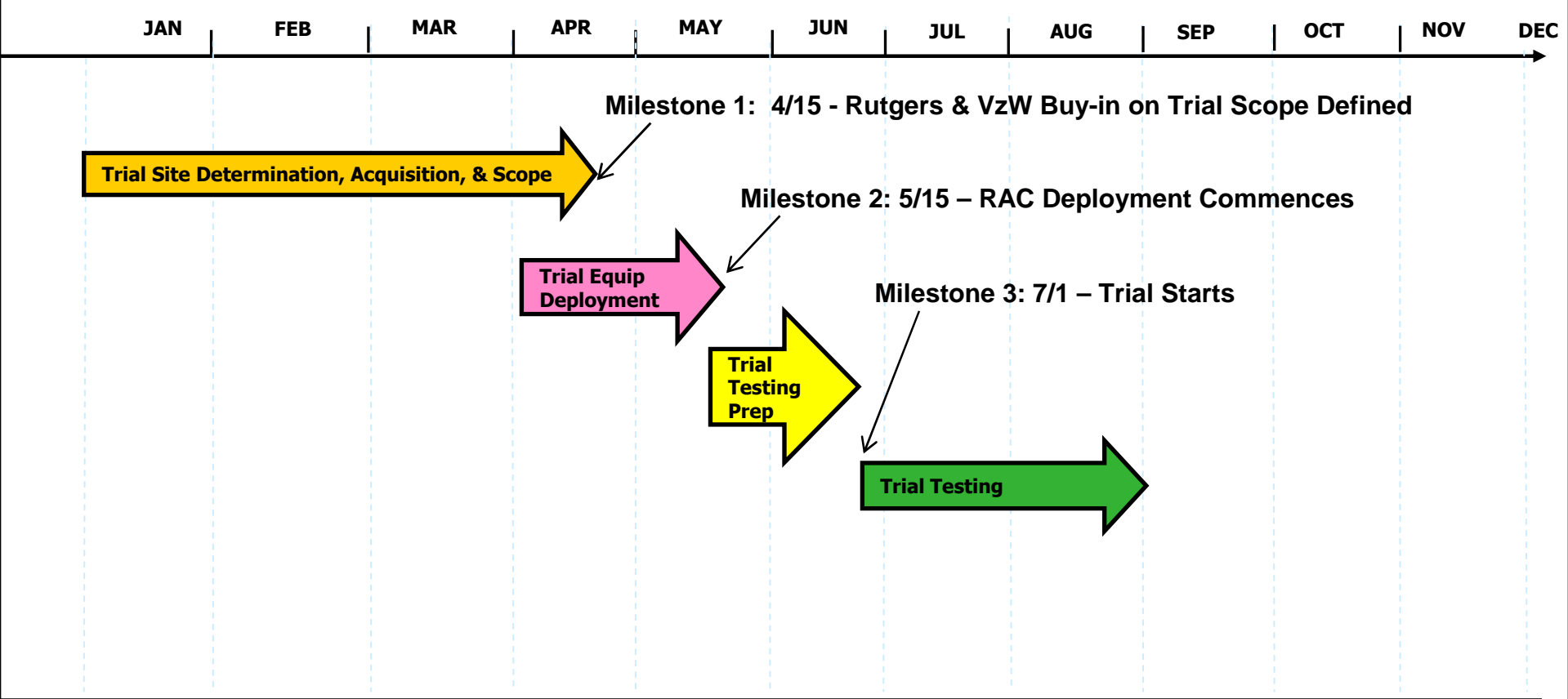
Front



Right

Rutgers RAC Stadium Trial Schedule

2012



Trial Assumptions

1. Timely RAC Availability
2. Siting of Macrocell
3. Backhaul installation