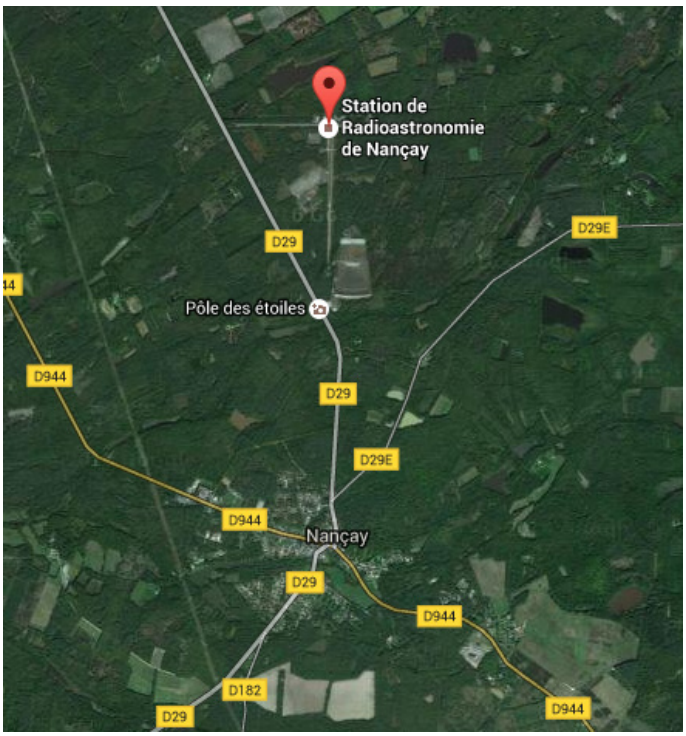
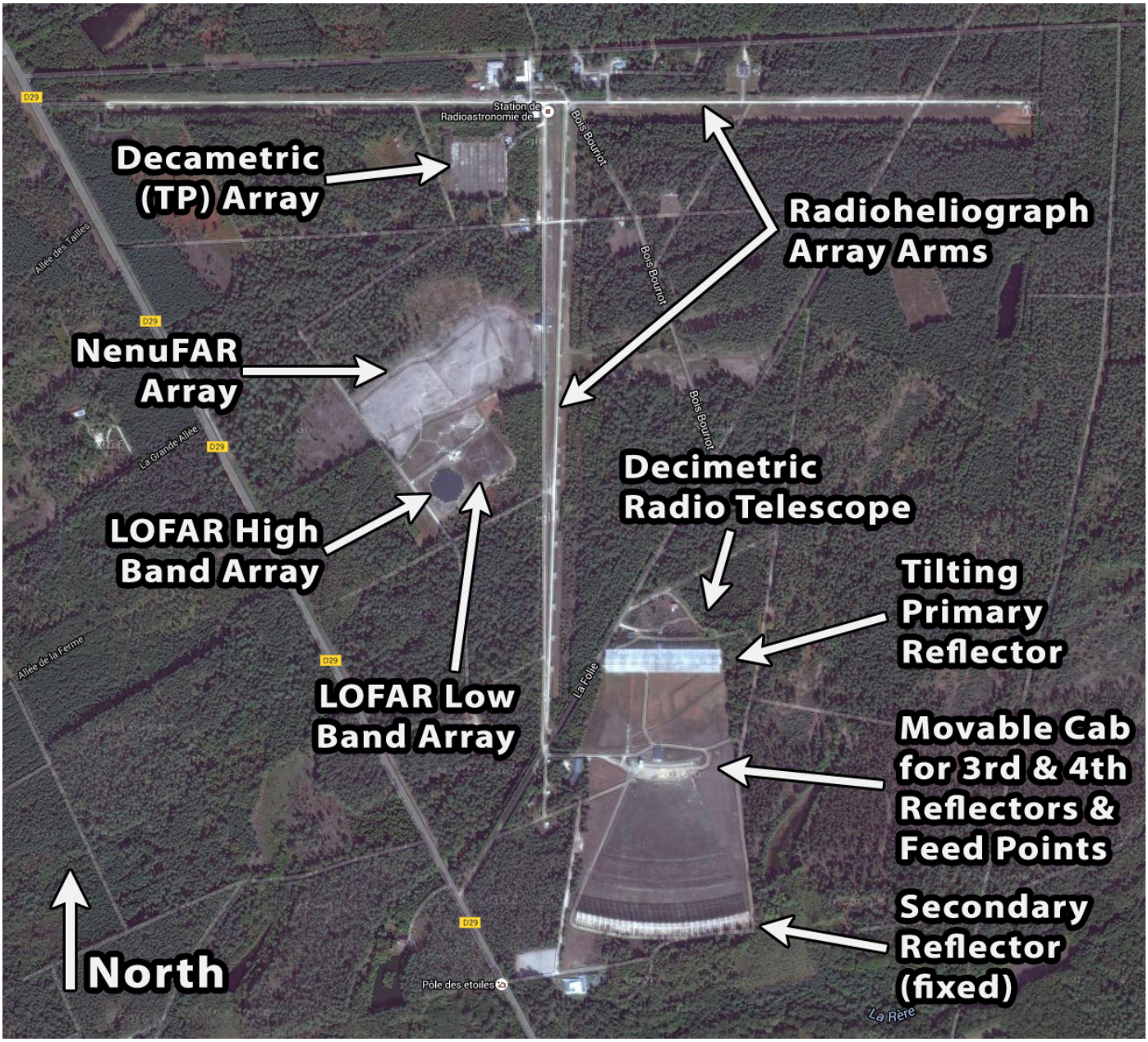
Nançay Radio Astronomy Field Station Trip Report

Dave Typinski, December 2016

Operated under the auspices of the Paris Observatory, the Nançay Field Station hosts many radio telescopes. It lies a little over two hours by car south of Paris, France, roughly one mile north of the tiny hamlet of Nançay. I had the distinct pleasure of visiting this facility on May 19, 2016 with Baptiste Cecconi, a radio astronomer at the Paris Observatory's facility in Meudon (a suburb of Paris), who gave Renaud Savalle and me a personal tour of the Nançay station. Renaud is a software engineer working on the VO Paris web site; part of his task is to write software to convert Radio Jove data into CDF files. We might have talked more, but he speaks no more English than I do French. Regardless, he's a very nice guy.

What follows is a pictorial essay about the Nançay station. The telescopes cover the RF spectrum from the HF band to microwaves.



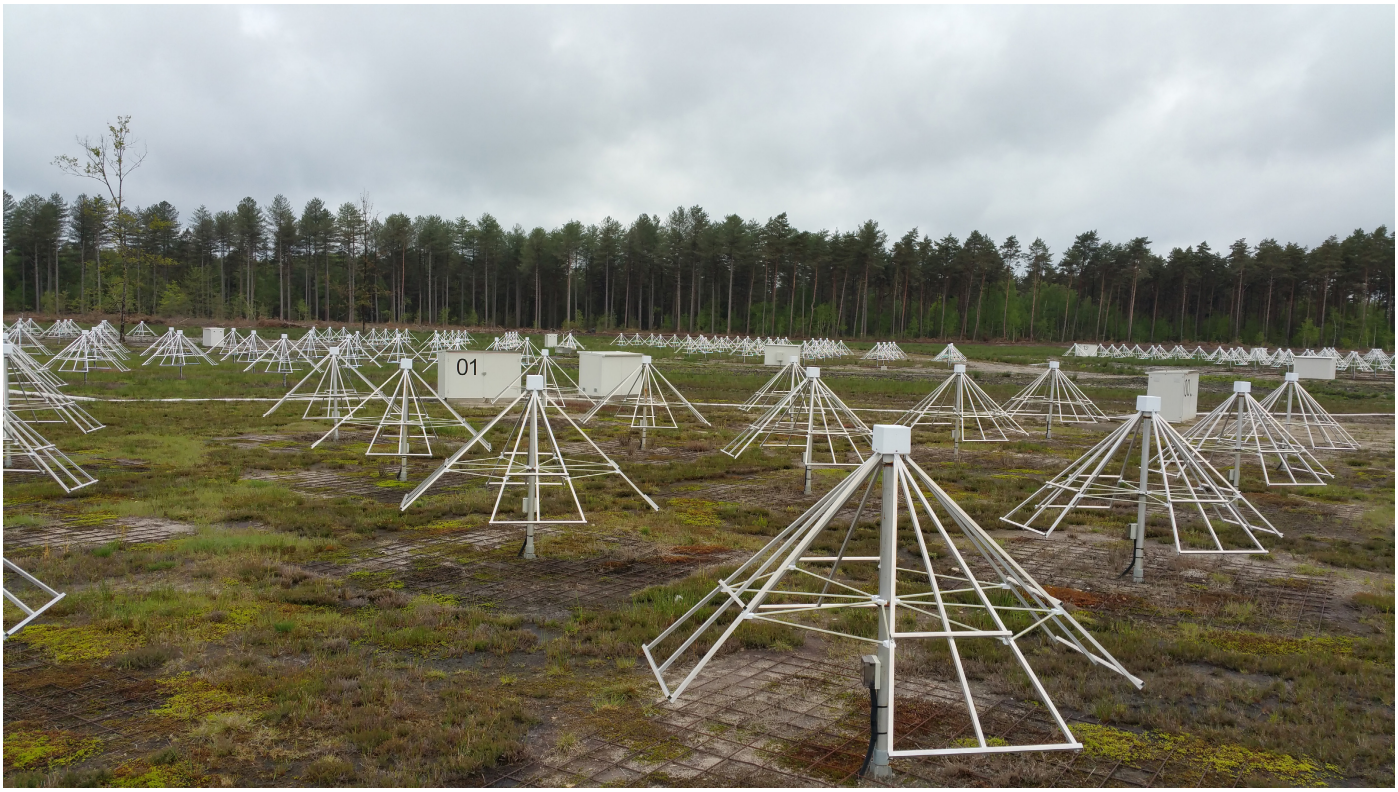


Here is the layout of the facility showing several of the larger telescopes. There are sevaral smaller telescopes that are not shown.

This is the T-shaped radioheliograph array. The figure-8 shaped feed points (two of which are seen leaning up against a shack) provide RCP and LCP outputs. Top image looking south from the center of the T, bottom image looking east.

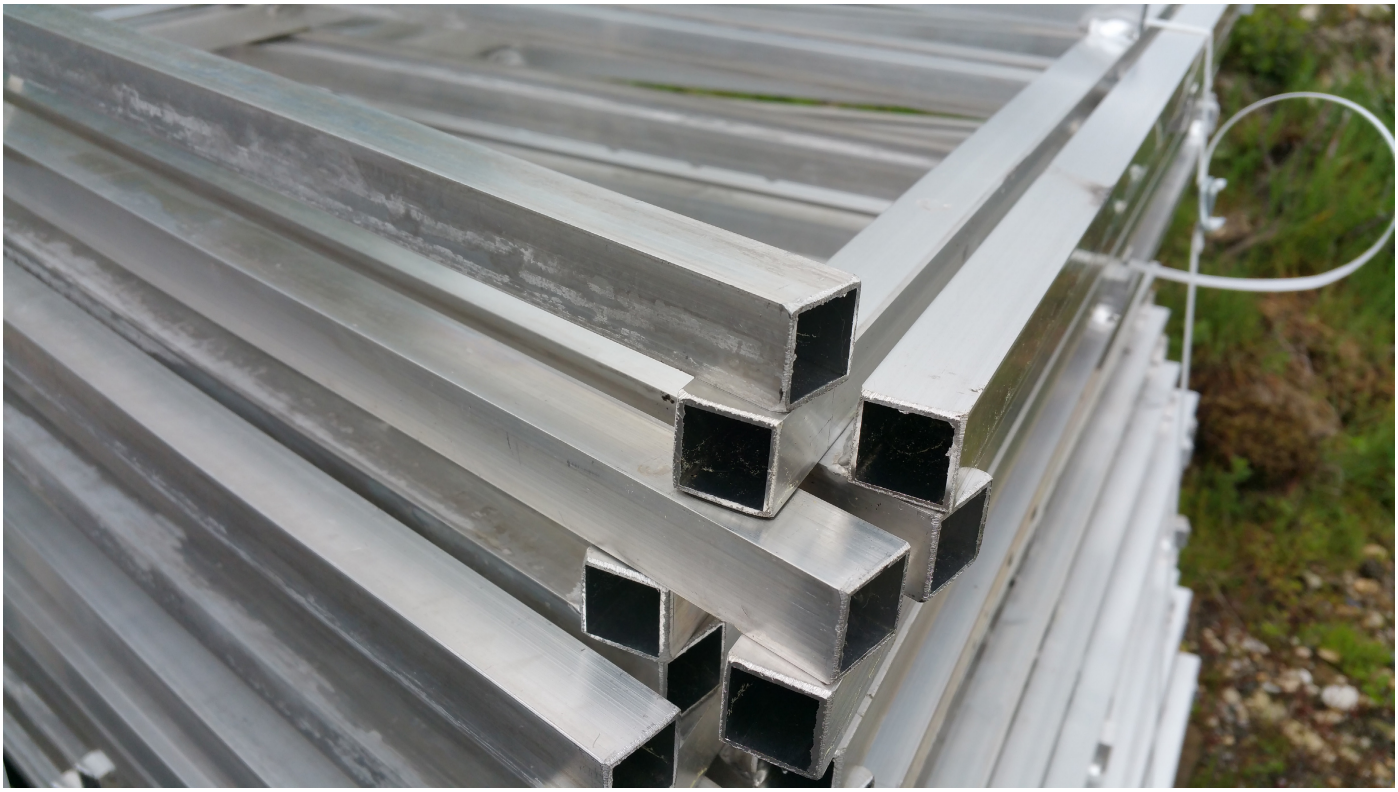
One of two captured German 7.5 m Würzburg radar antennas moved from the French coast to Nançay in 1957. The two dishes formed a neutral hydrogen interferometer; the dishes are on a 380 m railroad track. They haven't been used in a long time.

I have no idea what this is and Baptiste wasn't sure either. It looks like a VHF-band array of three Yagis on a tiltable ground plane. There are several of these units sitting here and there around the observatory.



This is the Nenu-FAR array unders construction. The pile of iron oxide in the top picture is a stack of ground planes ready for installation. This array uses elements based on the LWA design, but will have over twice as many elements as the LWA-1 in Socorro, New Mexico. The feed lines from each group (a "pod") of 12 orthogonal pairs of droopy bowtie dipoles goes to a small cabin. The cabin for Pod 1 is seen here labeled "01."

Nenu-FAR parts stacked up like cord wood, ready for installation.



More Nenu-FAR parts.

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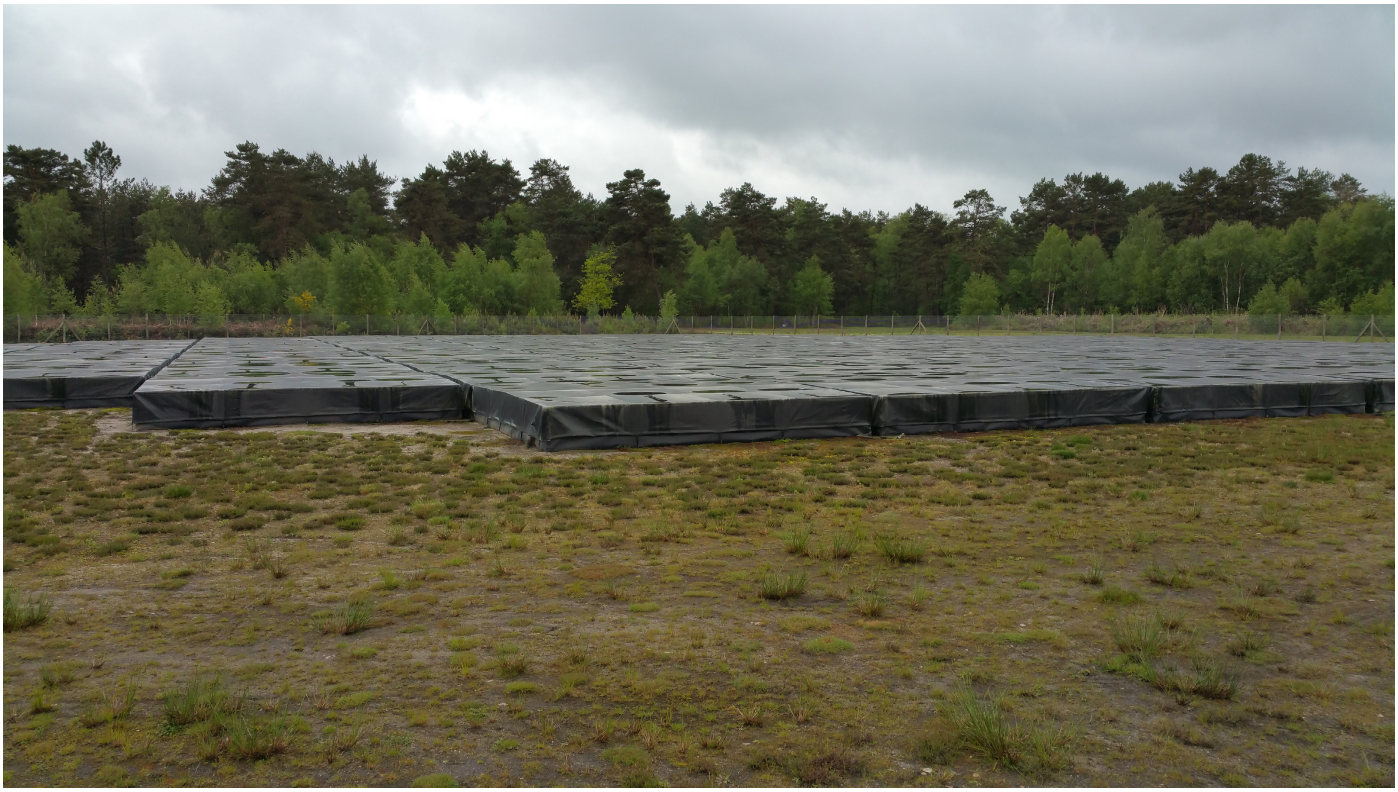
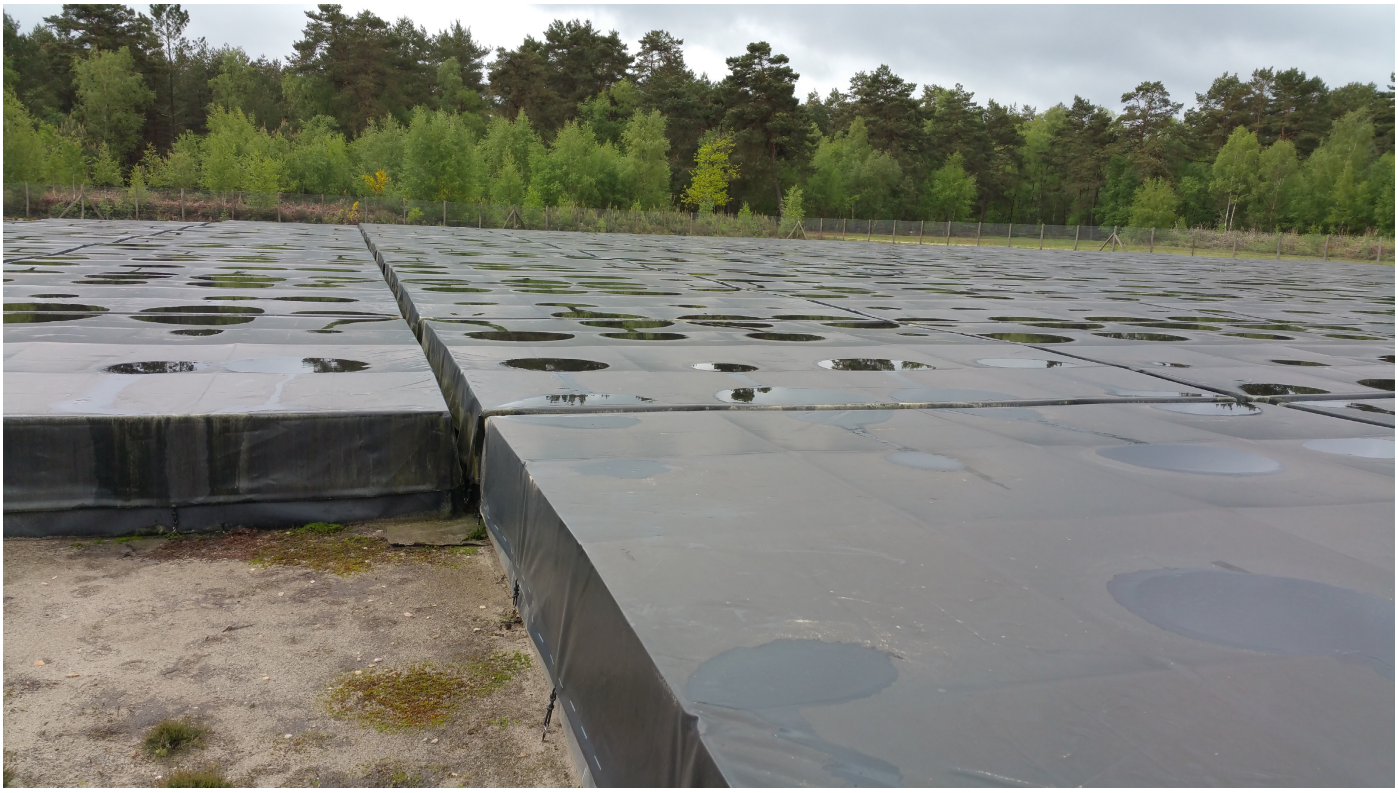
Calling this piece of real estate leading to the Nenu-FAR and LOFAR arrays a “road” is far too charitable. Like all radio observatory access “roads,” it is more like a soggy goat path (or moose path if you live in Alaska). In the top picture, the “road” is to the left of the ditch.

Here is the LOFAR low-band array.

One of many LOFAR low-band orthogonal dipole pairs. A very elegantly simple design. Feed point active balun is potted into the hockey-puck-shaped affair covered with bird exhaust.





Here is the LOFAR high-band array.

The LOFAR receiver shack, a 20′ sea container. These racks contain the digitizers for all the high-band and low-band array elements.

View of the radioheliograph north-south arm looking north from the southern end. No cell phones, no WiFi and no ... dogs and cats? Must be a French thing.

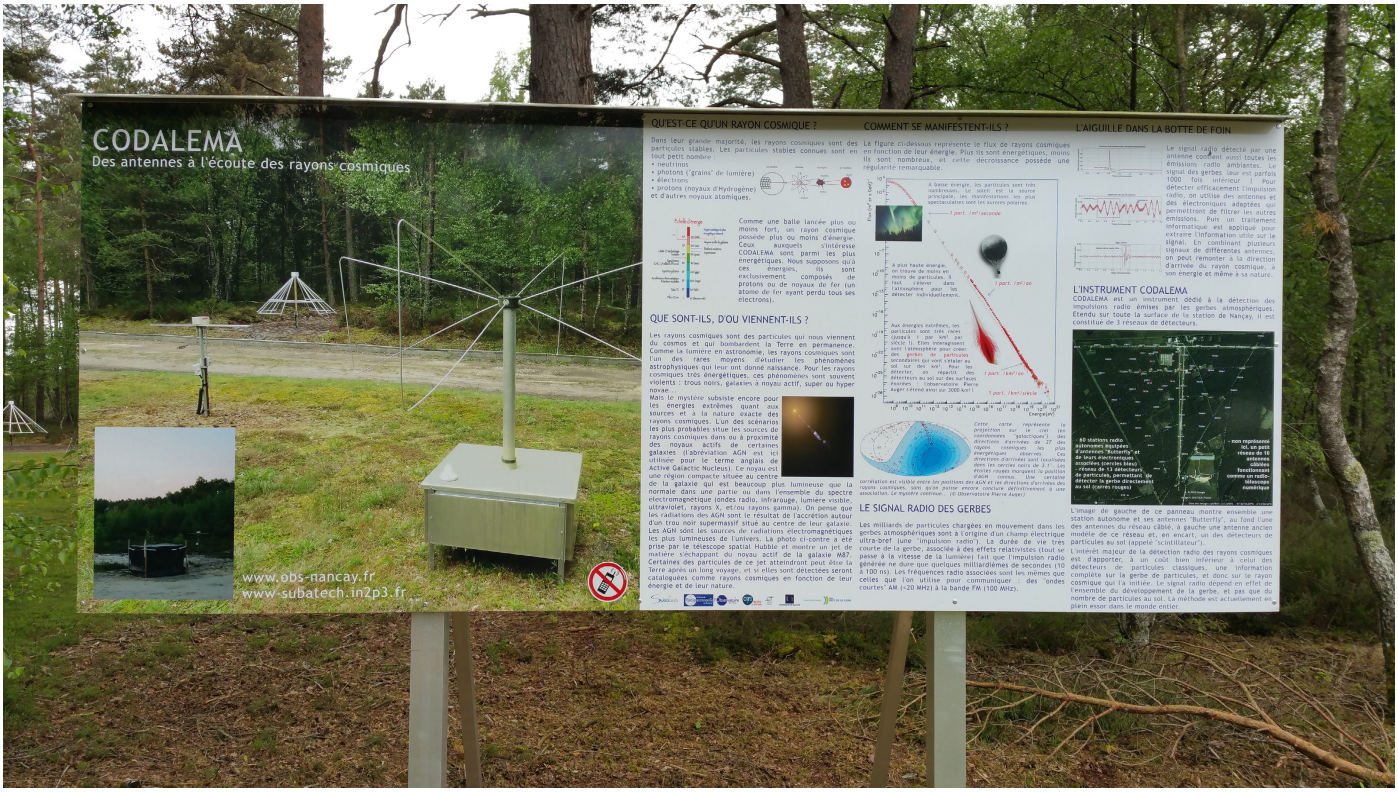
Radioheliograph array element.

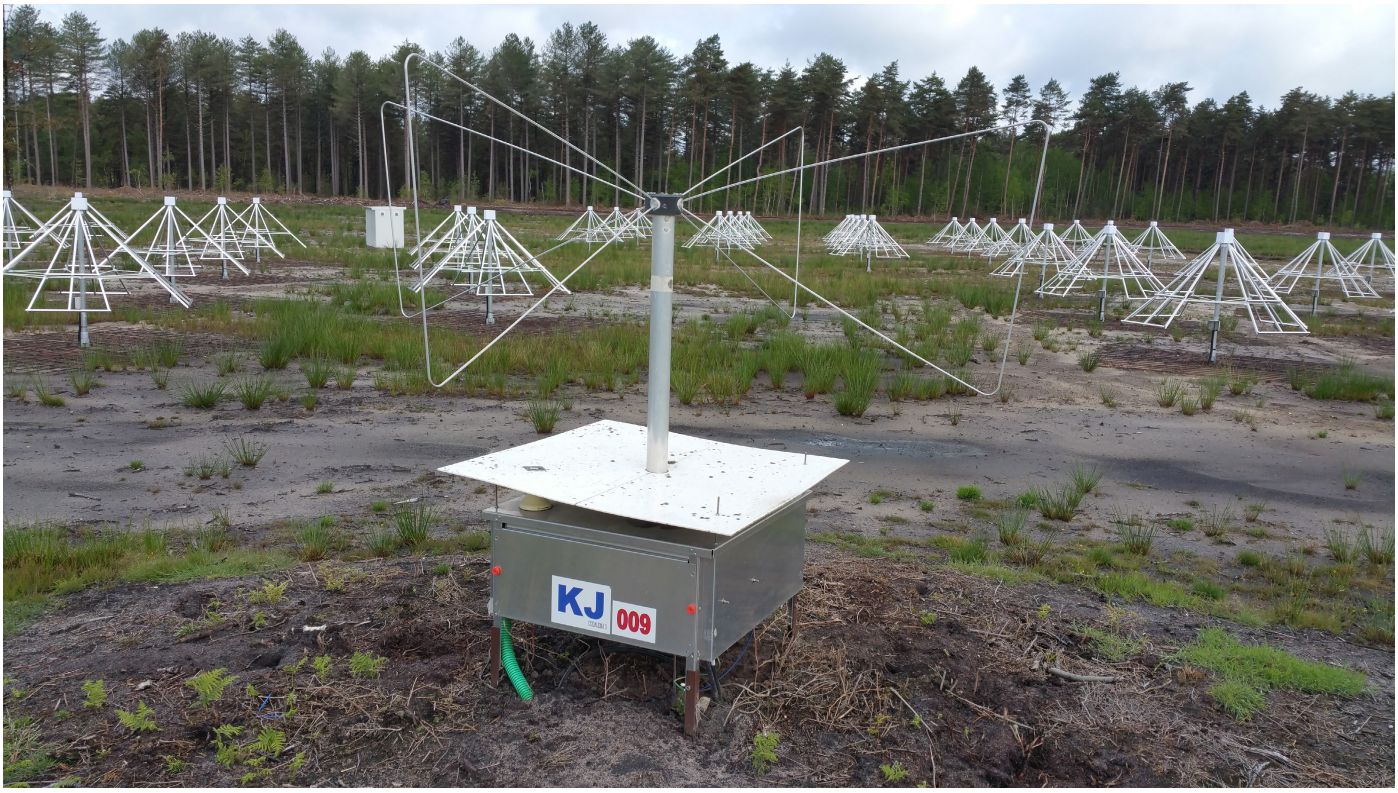
The decimetric radio telescope, or Le Gran Radiotelescope. When they say Gran, they mean it. This instrument is HUGE. The primary (tiltable, flat) reflector is 130′ x 660′; the specrical secondary reflector (shown above) is 115′ tall by 980′ wide and stands a quarter mile south of the primary reflector. The instrument is used to observe emission from 1 to 3.5 GHz.

The primary reflector doesn't look that big from afar... but it is. The reflector is made of independently movable sections. The alignment between sections is kept to within 40 thousandths of an inch.

View looking south from the primary reflector to the secondary reflector and the feed point cab (seen at the left side of the secondary reflector from this angle). The feed point cab moves from right to left (from this vantage point) on rails to keep the beam centered on a desired set of coordinates as the Earth rotates.

Top: a detail view of the bull gear driving one section of the tiltable primary reflector. Bottom: the control room for the big telescope. Very simple RFI shielding method. Instead of making every piece of equipment RF-quiet, just wrap the whole building in a chain link fencing.

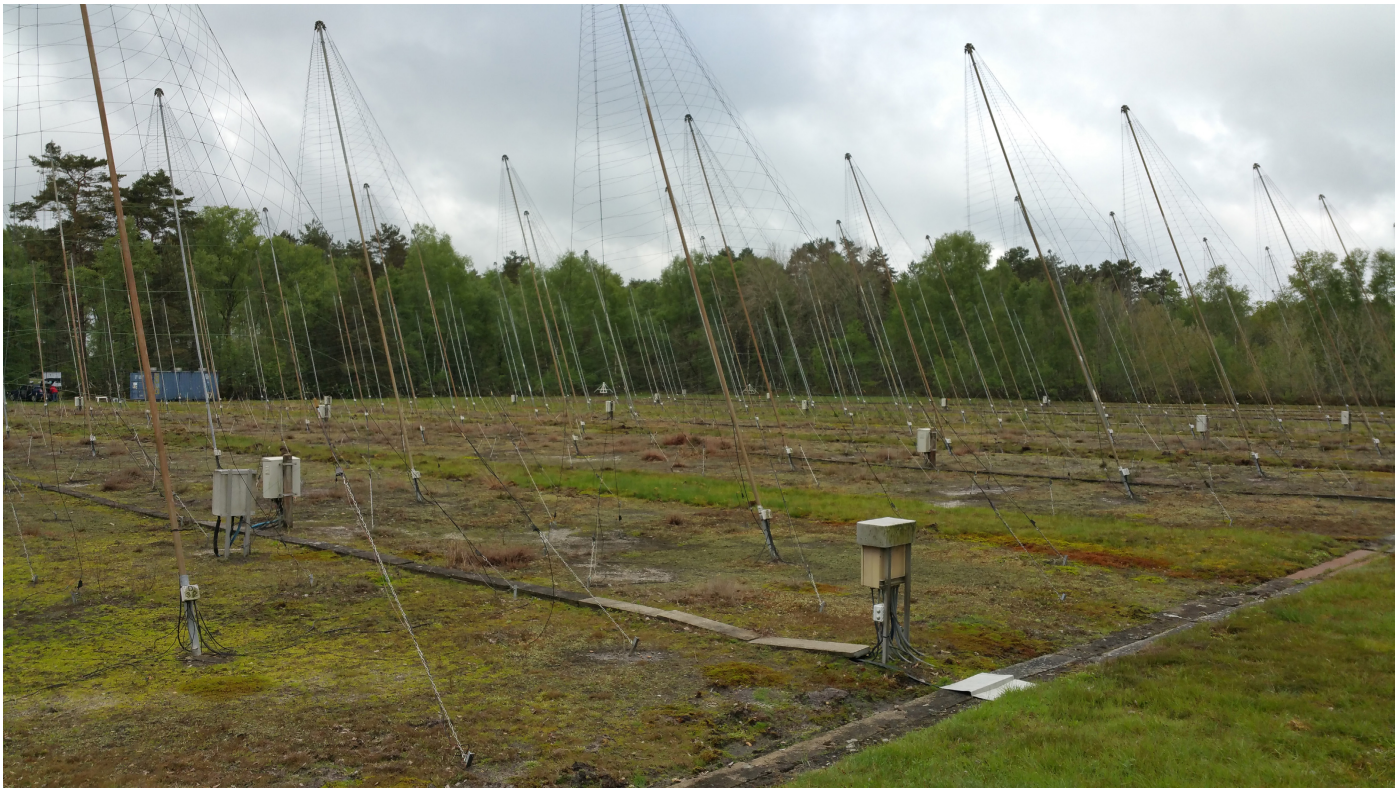




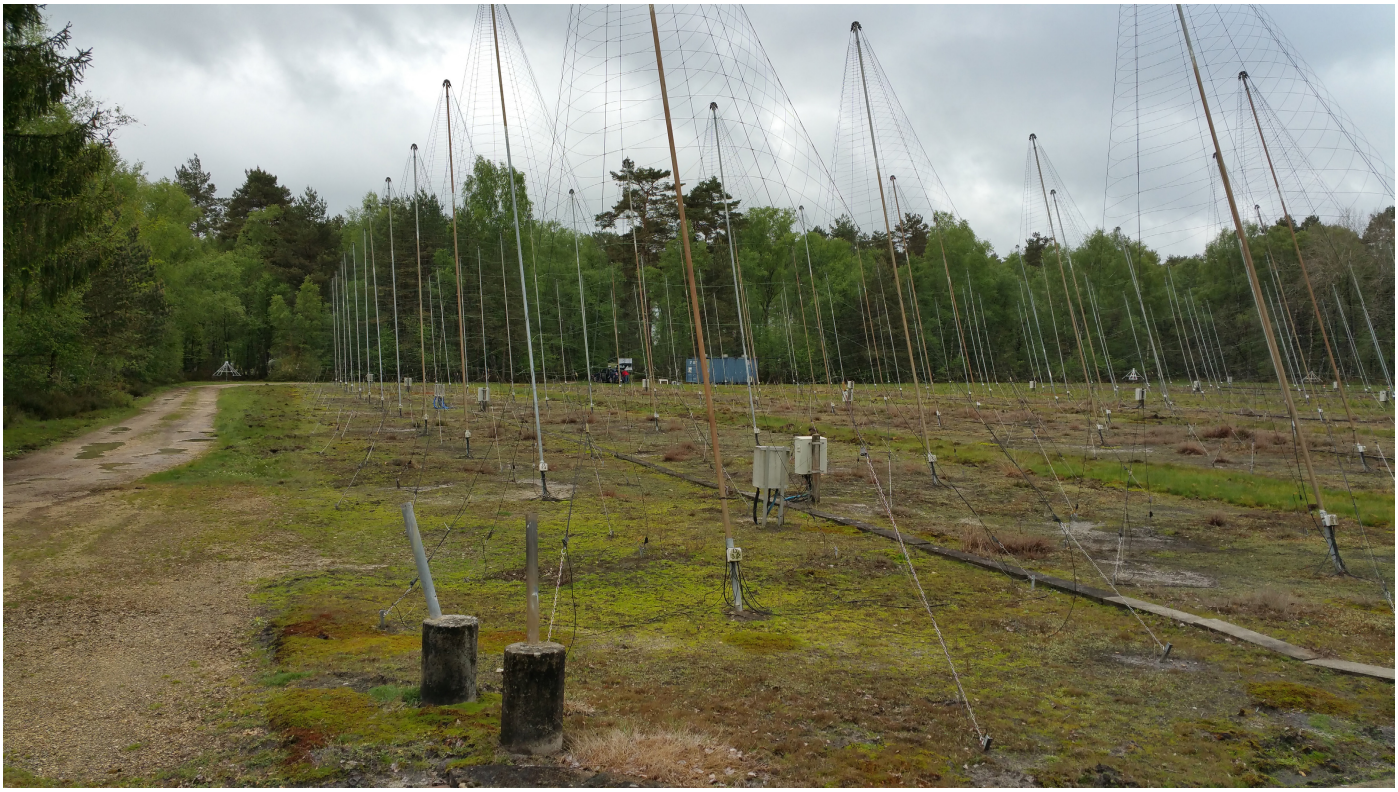
The CODALEMA cosmic ray detector. There are several of these antennas scattered over the grounds.

Top: circular polarized feed point assembly. Bottom: view looking south along the N-S radioheliograph arm. The giant secondary reflector of the decimetric array is seen above the trees to the left of the Würzburg radar dish.

Finally, the Nançay Decametric Array, or NDA. This is the control room for this instrument.

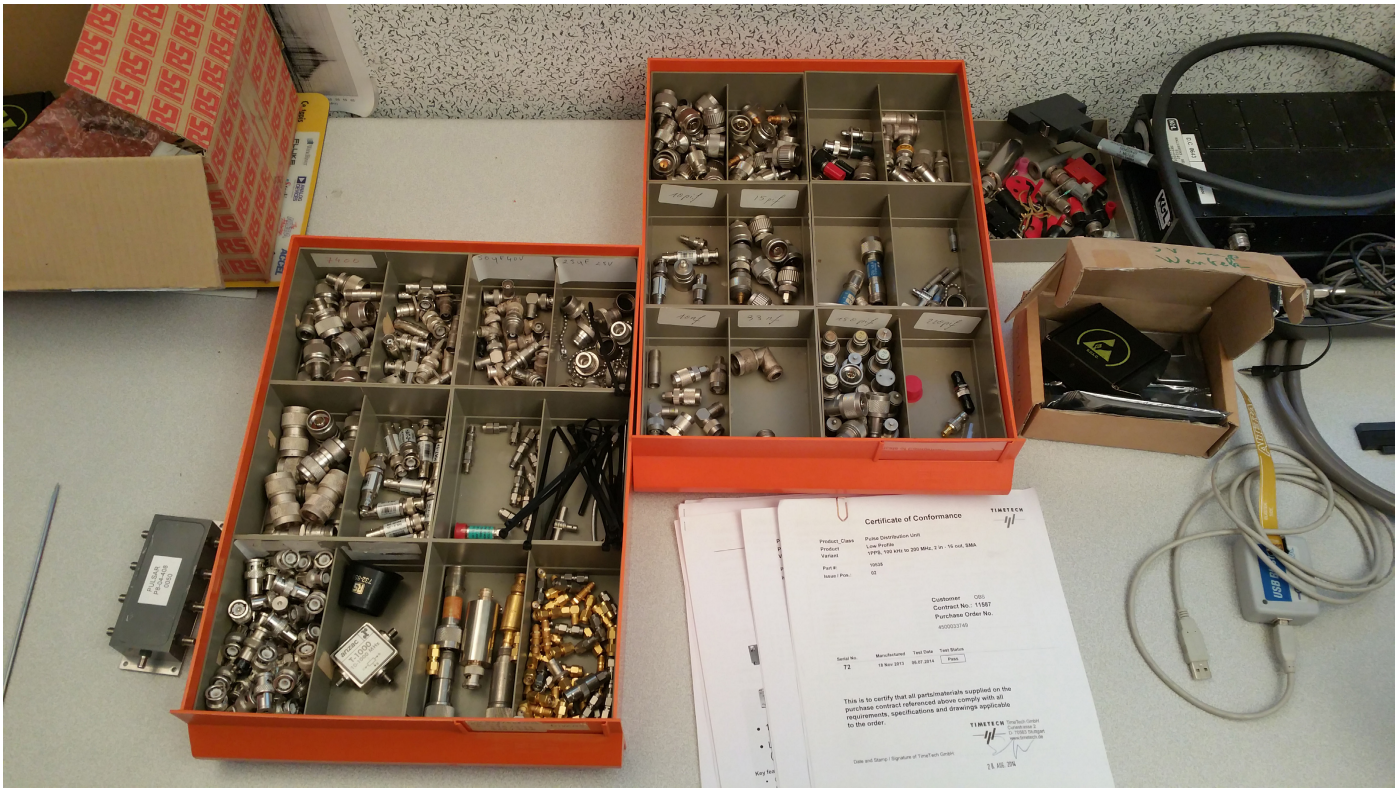


The NDA consists of 144 conical log spiral antennas (72 RCP and 72 LCP). Also called teepee, or TP, antennas after their resemblance to Native American teepees. Since Nançay is so far north, the TP's are tilted 25° to the south so Jupiter isn't as far off axis of each element. This helps the polarization response of the array. Each element is made of eight spiral wires; the three "active" pairs of wires being controlled at the feed points at the top of each antenna by PIN diodes, in turn controlled by a computer in the control room.



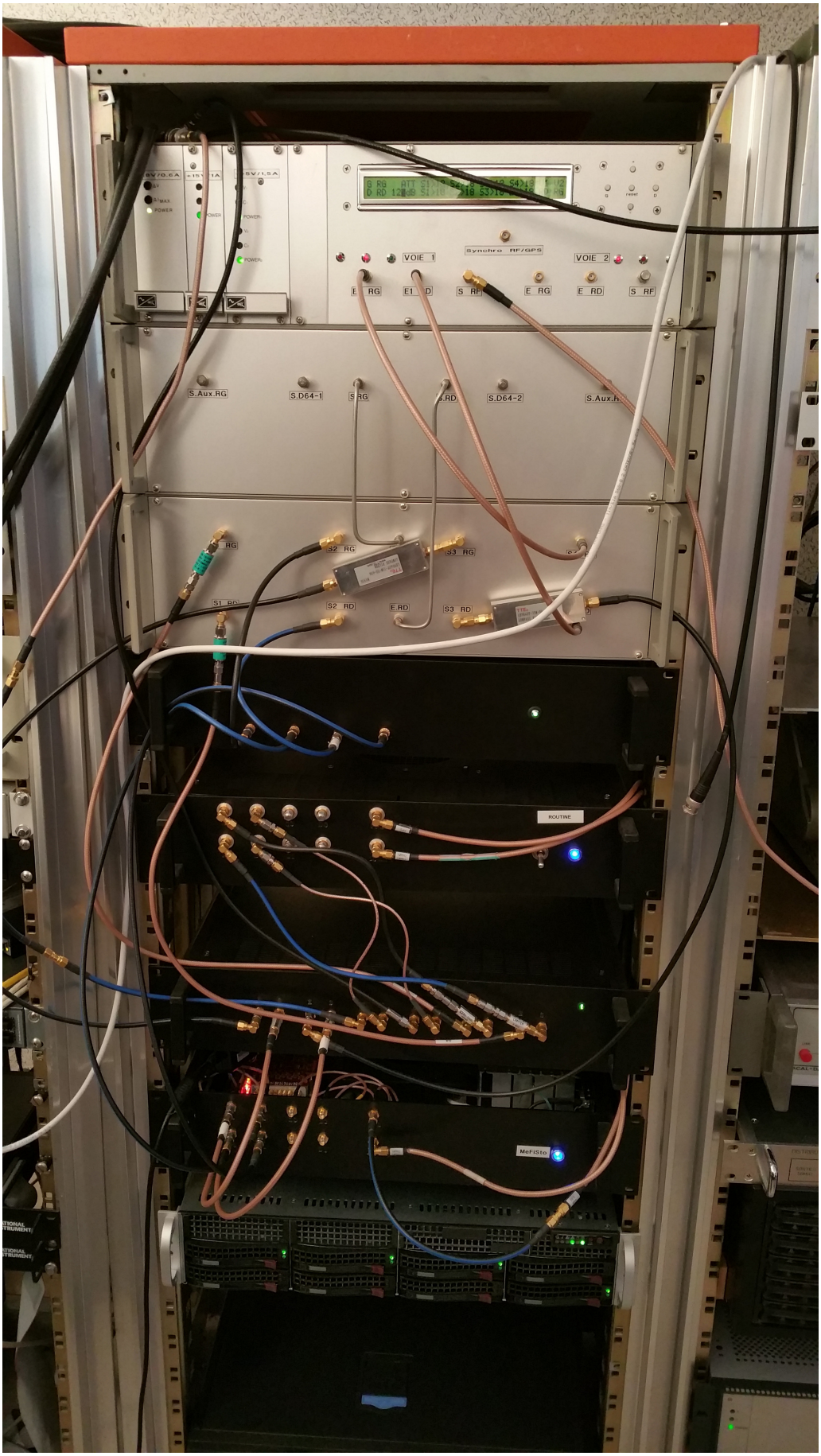
View looking south from the NDA control room and a zoomed-in view of the top of one TP element.

Top: view looking south from the north side of the TP array. RCP TP's on the left and LCP TP's on the right. Bottom picture is the view from the NW corner of the array looking east toward the control building.



Top: view from the SW corner of the array looking NE toward the control building. Bottom: you know it's an operating observatory when there are bins of RF connectors and coaxial attenuator pads just lying around.

The equipment rack containing the beam steering computer (top) and the receivers (beneath the computer) for the NDA.



Top: every observatory must have one of these – a hut with random spools of coax cable, some chairs, and aa table for whatever. Bottom: another building shielded by being ensconced in chain link fencing.

The entrance to this building has an interesting RFI-shielding labyrinth.

The tour group: Baptiste Cecconi, most excellent tour guide, top left and Renaud Savalle, top right, in the NDA receiver room; and your author, bottom, at the NDA TP array.