



# The stealth dish

*An update...*

***Mario Armando Natali, IONAA***

***[mario.natali@gmail.com](mailto:mario.natali@gmail.com)***

***ARI Perugia***



# The stealth dish ... *one year later*

Why a stealth dish... : Challenges and advantages

## CHALLANGES

- ✓ Accuracy and repeatability of positioning.
- ✓ Complex mechanism.
- ✓ Much higher overall weight.
- ✓ Stability.

## ADVANTAGES

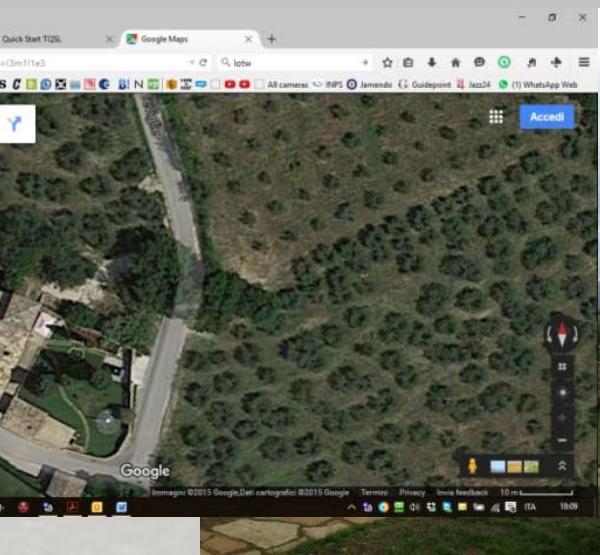
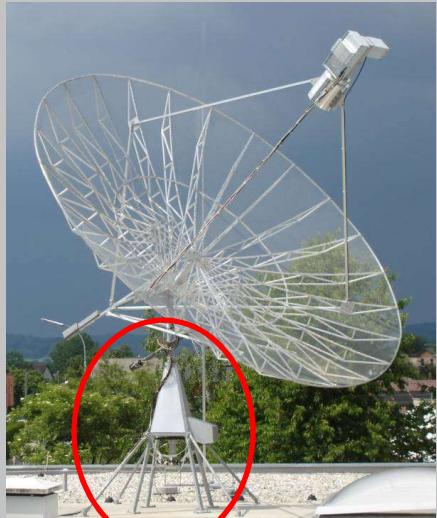
- ✓ Very easy access to the feeder and to the rotators.
- ✓ Fast feeder exchange.
- ✓ Lower overall profile when in «resting» position that minimize lightening risk.
- ✓ «One man» operation.
- ✓ Fast Az El movements that allows fast object tracking.
- ✓ «curiosity» minimization...
- ✓ .... Good sleep during thunderstorms .....



# The stealth dish

***Why a stealth dish .... : a bit of history***

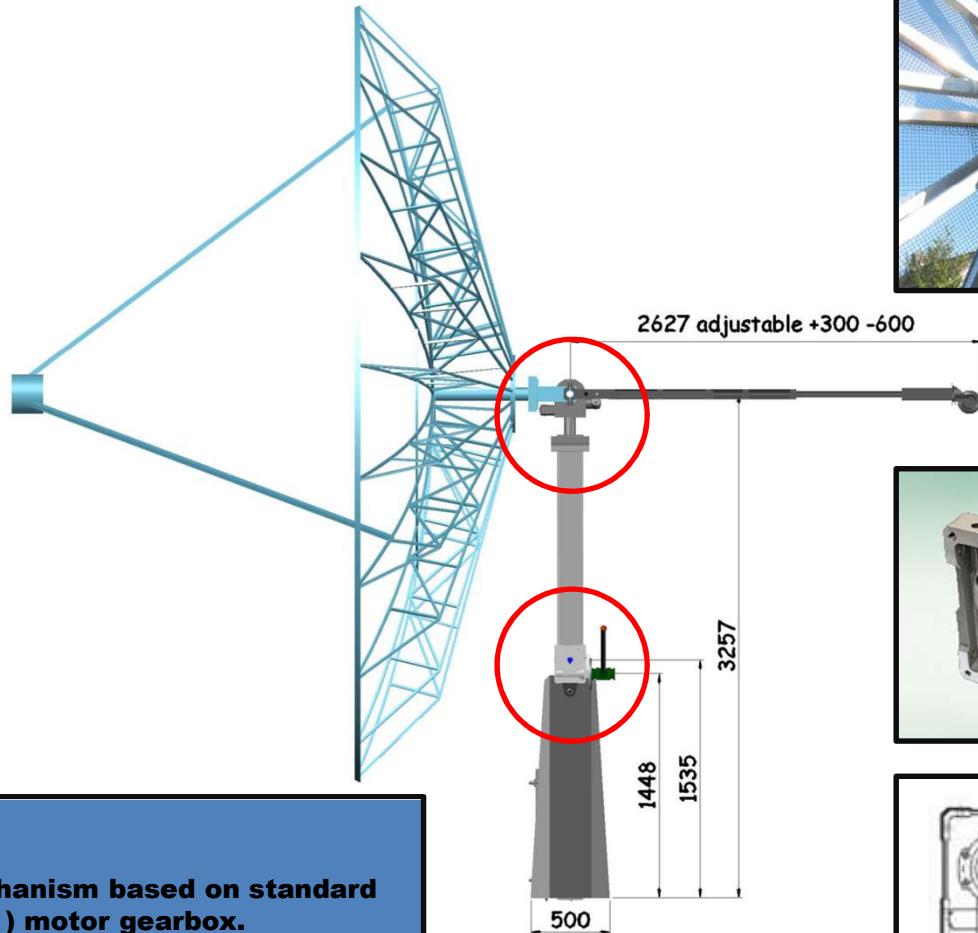
**..... From Braunau am Inn to Assisi**



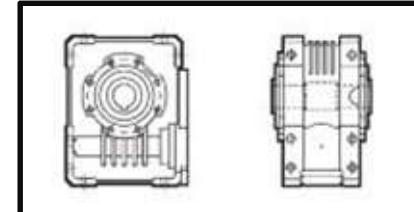


# The stealth dish

## *Mechanical design : tower design*



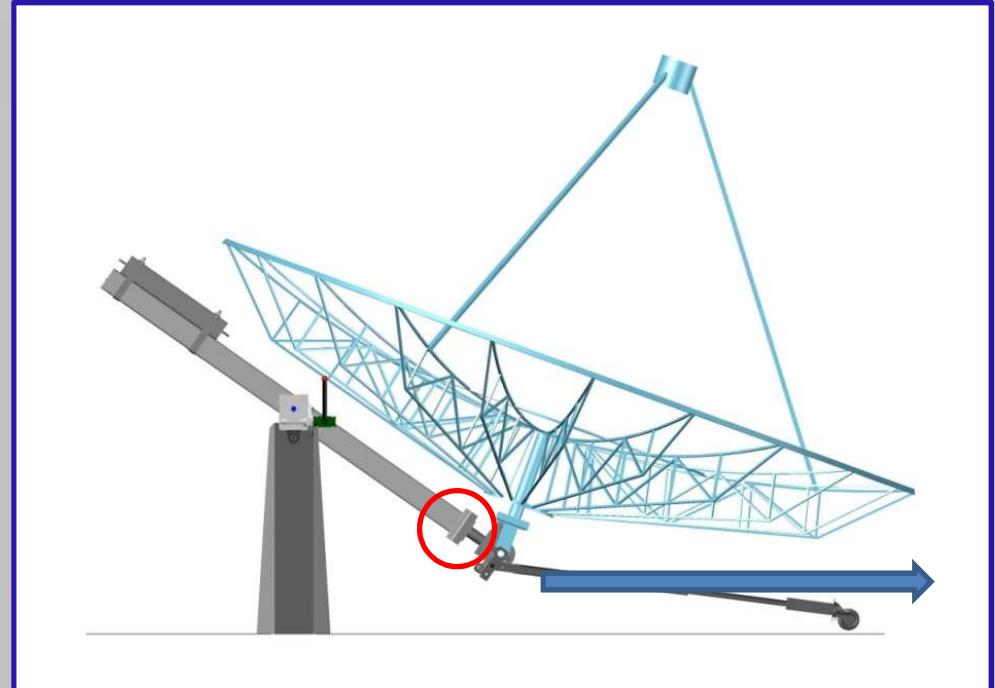
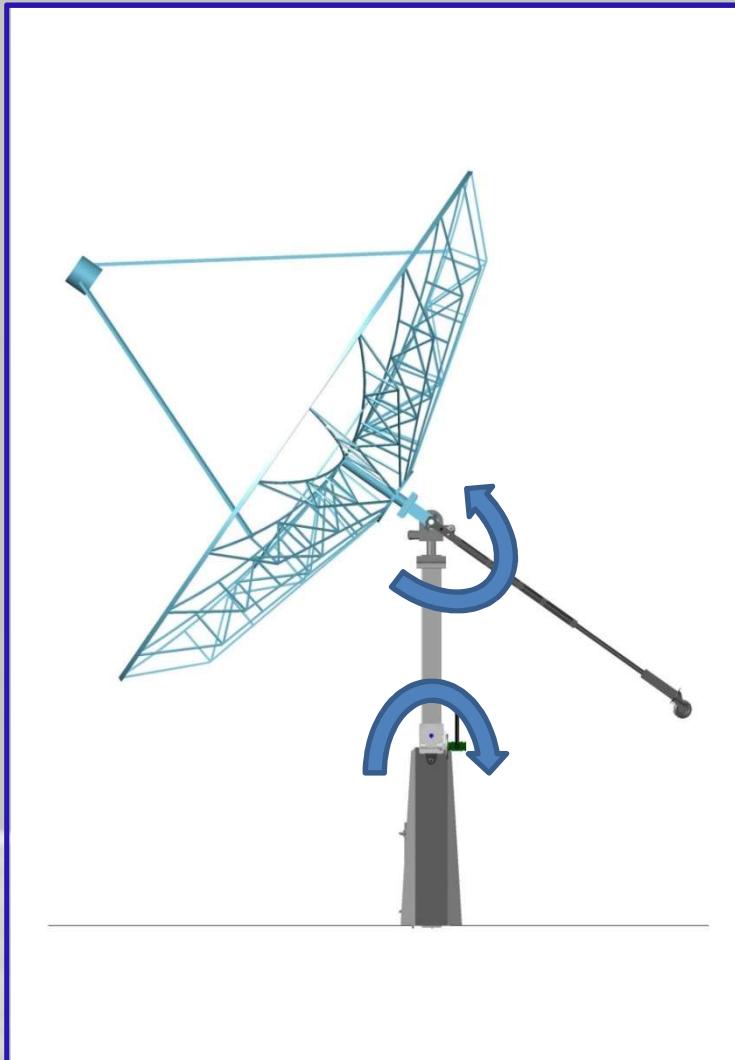
- ✓ 5m dish.
- ✓ 0,5 f/D.
- ✓ Tilting mechanism based on standard ( Bonfiglioli ) motor gearbox.
- ✓ Manual movement easily upgradable to motorized.
- ✓ SPID BIG – RAS/HR Az El rotator.





# The stealth dish

*Mechanical design : tower design*

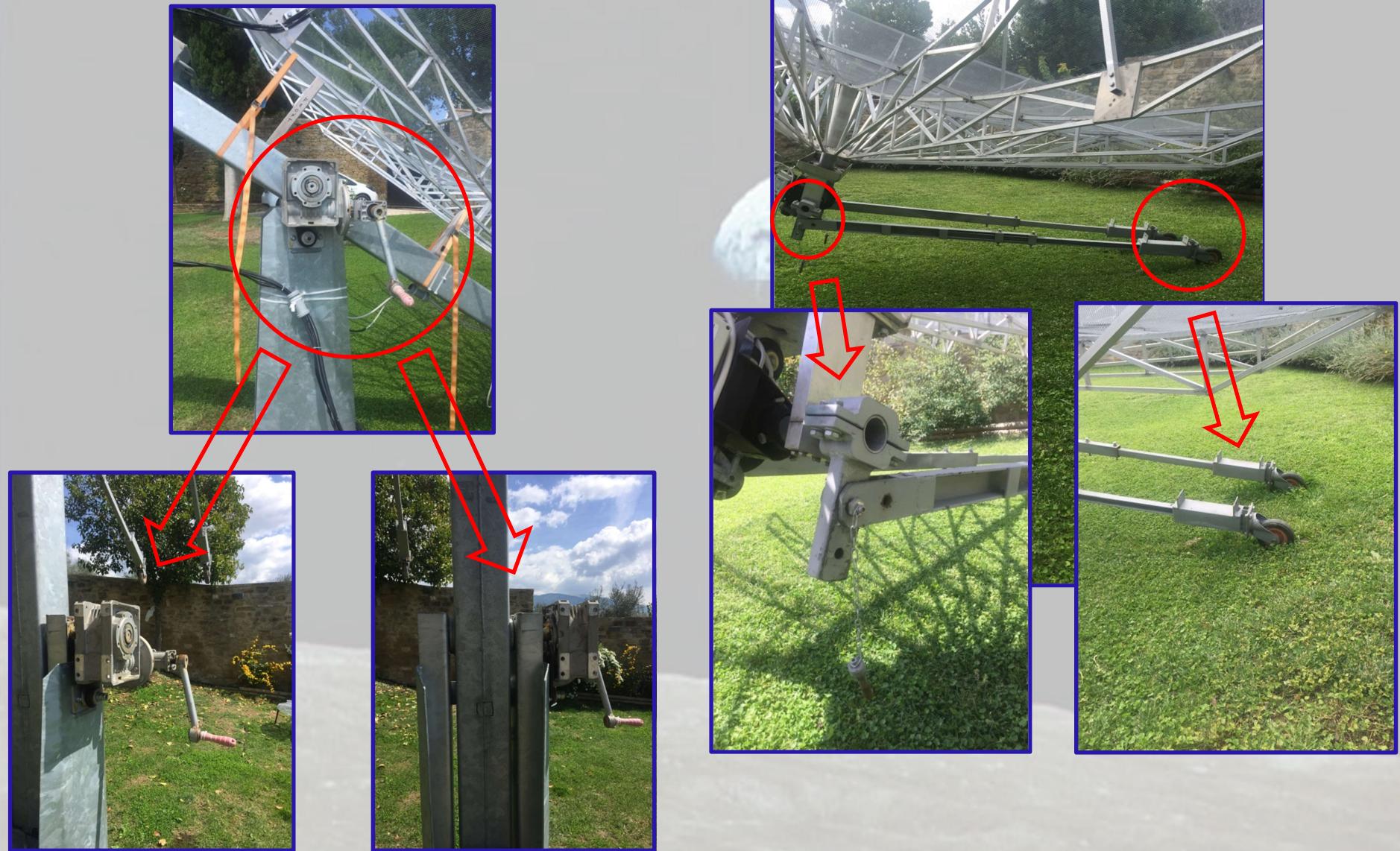


- ✓ **Counterbalancing weights with wheels to allow easy maintenance and safe resting position.**
- ✓ **Removable tower top that allows tower extension.**



# The stealth dish

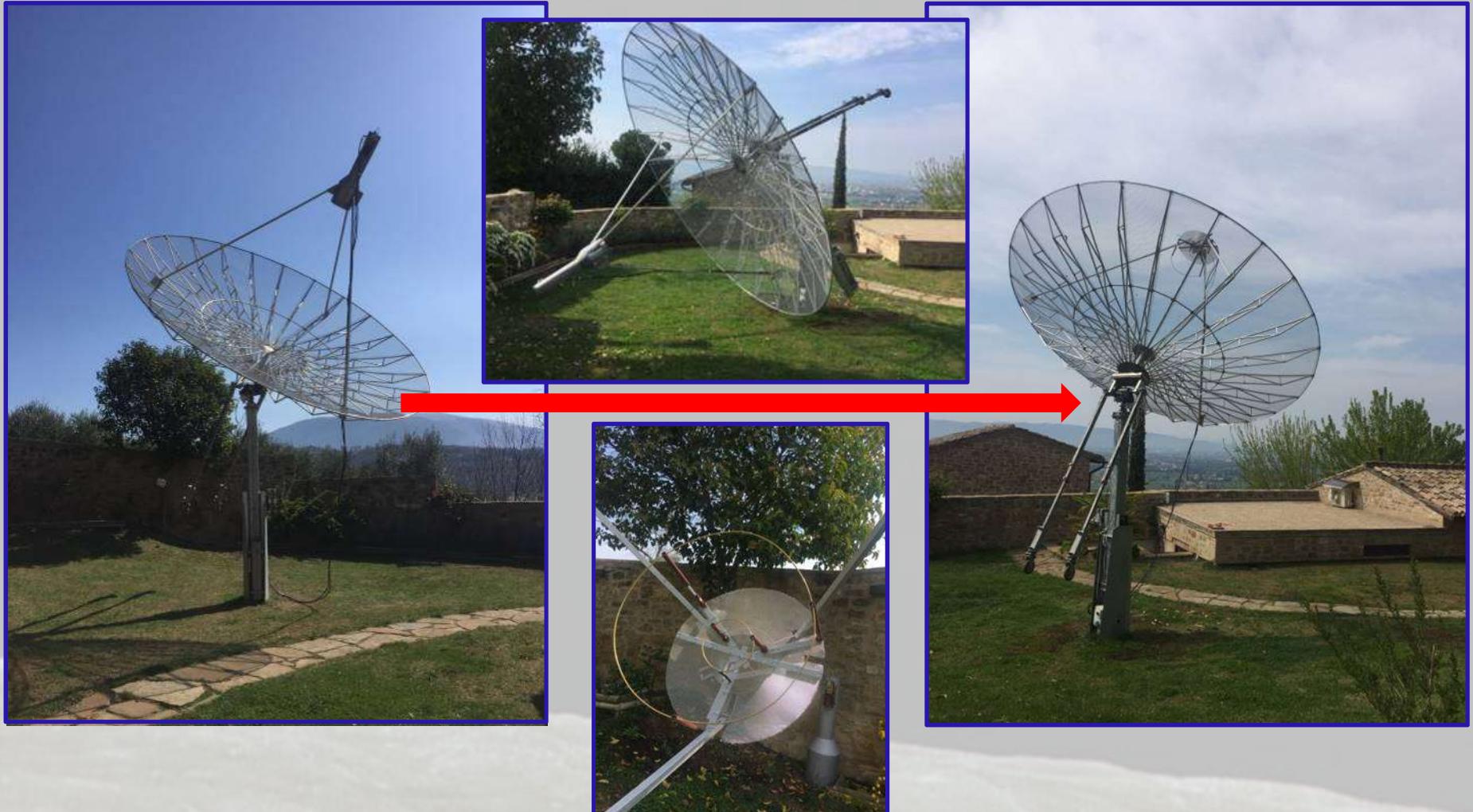
*Mechanical design : tower design*





# The stealth dish

*Mechanical design : tower design*



**Very easy access to the focus point that allows easy maintenance and fast feeder exchange.**



# The stealth dish

## Mechanical design : the plinth

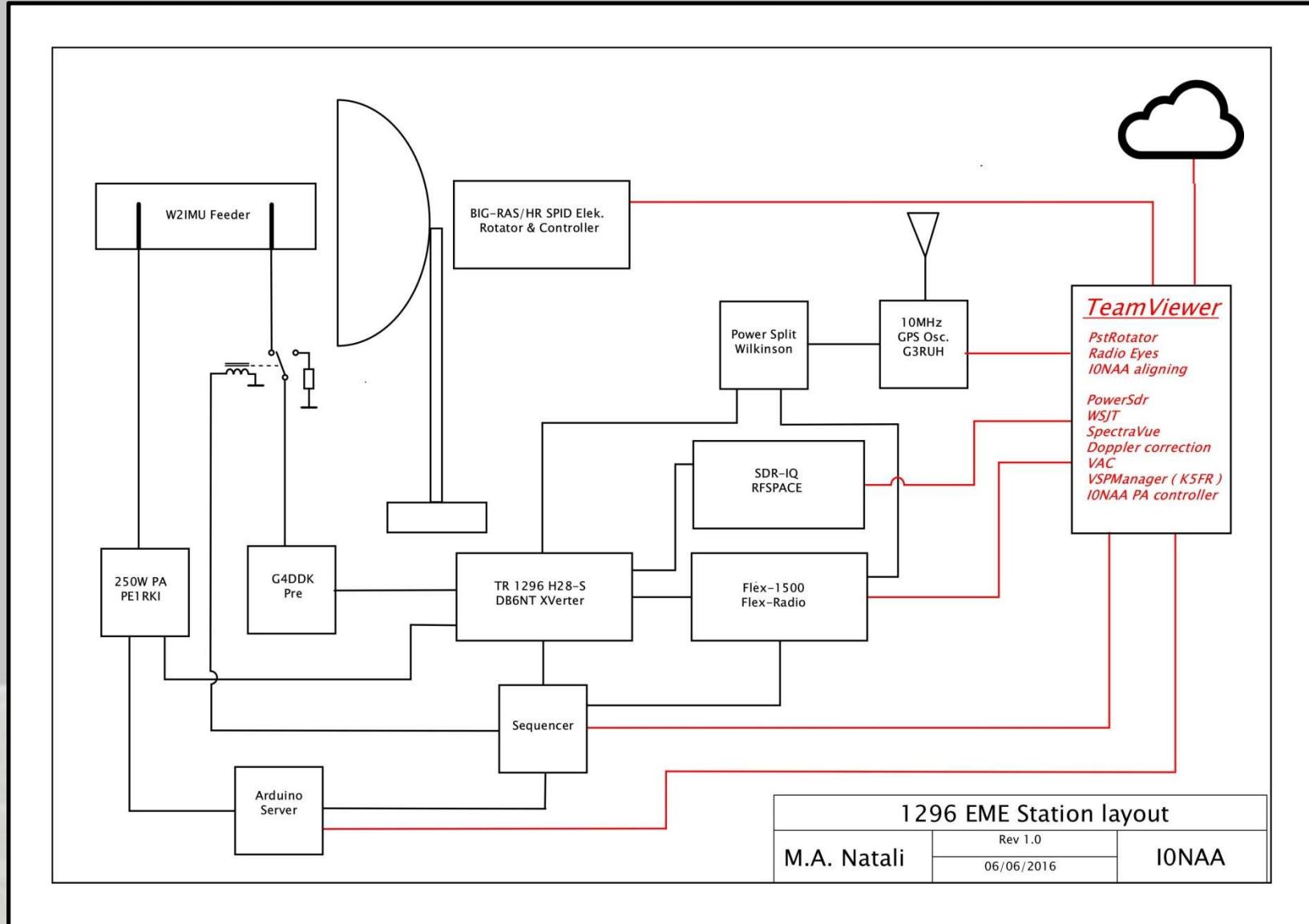


PLINTH CALCULATIONS					
Plinth					
Width	190	Cm	Weight of plinth ( stabilizing moment )	144.40 KN	
Lenght	190	Cm			
Height	160	Cm			
Specific weight of CLS	25	KN/mc			
Antenna					
Dish diameter	5	m	Dish area	19.63	M^2
Tower height	3	m	Total weight	8.83 KN	
Tower weight	400	Kg			
Rotatotor weight	50	Kg			
Dish weight	200	Kg			
Counterbalance weight	100	Kg			
Extra weight due to snow	150	Kg			
Wind					
Max wind velocity	140	KM/H	Wind load per m^2	0.95	KN
Cx	1.33		Total force of wind	24.67	KN
Safety factor					
Safety factor	2		Tilting moment	67.0	KN
System is stable					



# The stealth dish

## *Technical characteristics : the station*





# The stealth dish

## Technical characteristics : the results

Murmur Rev. 3.0.0 03-Apr-2017 - IONAA mario.natali@gmail.com

<b>Location</b> Assisi-Bevigliie	<b>Latitude</b> 43.0922	<b>Longitude</b> 12.5772	<b>UTC Time</b> 4/15/2017 3:13:34 PM	<b>Local Time</b> 4/15/2017 5:13:34 PM	<b>Rev. History</b>
				<b>EXIT</b>	
<b>SAVE current set as default</b>	<b>SET Observation location</b>	<b>CALCULATE</b>			
<input checked="" type="radio"/> Dish antenna <input type="radio"/> Other antenna				<b>TRACK noise sources</b>	<b>Next 24h Pulsar visibility</b>
Dish diameter 5 m	Wave length 0.23 m	Effective ant. aperture 9.81 $m^2$	Dish area 19.63 $m^2$	Above horizon	<b>Next 24h Pulsar tracking</b>
Dish efficiency 50 %				B0329+54	1 Month Pulsar visibility
Sensitivity constant Ks 1					1 Month Pulsar tracking
Frequency 1296 Mhz					
Line loss before LNA 0.1 dB					
LNA Noise figure 0.28 dB					
LNA gain 38 dB					
Line loss after LNA 0.5 dB					
Receiver noise figure 4 dB					
T <sub>sky</sub> 10 K					
T spillover 5 K					
T atmosphere 0 K					
Integration time 7200 sec.					
Integration bandwidth 2000 KHz					
<b>MDS</b> 97.52 mJy				<b>List of detectable PULSARS</b> based on ATNF Pulsar catalogue ( limited to the strongest 60 Pulsars )	<b>Minimum S/N</b> > 10
					S/N >10 suggested for reliable results
<i>The analysis does not take into account the polarization of the signal as this parameter is strongly depending on the specific Pulsar. Please evaluate carefully case by case as this may deteriorate performance up to 3dB.</i>				<b>Above horizon</b>	Right Ascension (J2000) 53.25 deg
				B0329+54	Declination (J2000) 54.58 deg
					Width of pulse at 50% of peak 6.6 msec.
					Barycentric period 0.71452 sec.
					Dispersion measure 26.76 cm^-3 pc
					Flow 400Mhz 1500.0 mJy
					Flow 1,400Mhz 203.0 mJy
				<b>Max. integration bandwidth</b> (without de-dispersion)	34 Mhz
					Calculated S/N 21.56
					Azimuth 310.29 deg
					Elevation 66.47 deg
				<b>Show all PSR List</b>	Evaluation done only for following frequency intervals : 390Mhz-500Mhz and 1,000Mhz - 1,500Mhz

**Calculations done with «Murmur» program to predict Pulsar detectability**



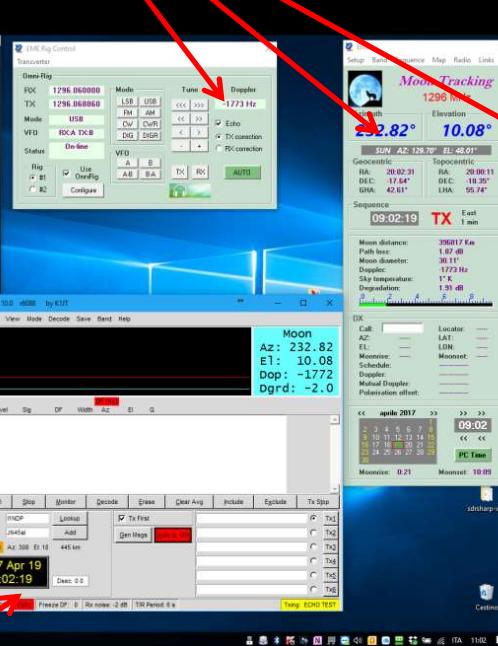
# The stealth dish

## *Technical characteristics : the results*

PowerSDR



PstRotator



IONAA PA Server



I1NDP doppler correction



WSJT10

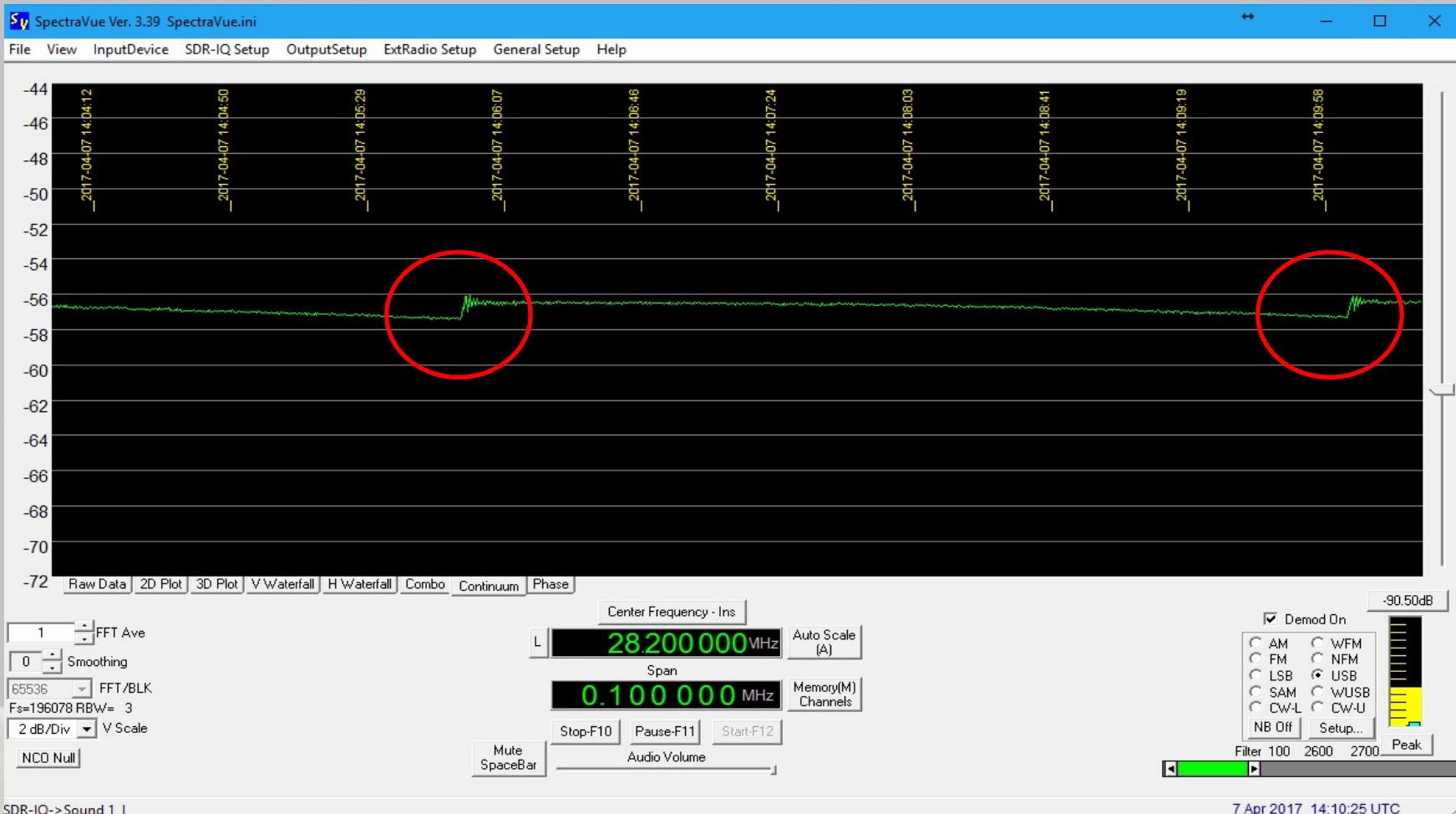
Murmur

Echo with 250W.



# The stealth dish

## Space for improvement : Oscillations



**Mechanical stability of the dish holder block must be improved and a dampen mechanism to the rotator elevation should be added to avoid oscillation @ start-stop.**



# The stealth dish

## Space for improvement : Automatic pointing

IONAA - Square spiral search ENGINEERING TEST

Enter COM speed Enter COM number

WAVE-IN Devices available in this PC:

Choose one device to perform analysis

Analyzing input signal from device #

Set exploration parameters Get Rotor position

Azimuth Elevation

Range

Set Motor speed Hard Start/Stop ON

< > Hard Start/Stop OFF

GO !

Square spiral search real time

Real time signal value

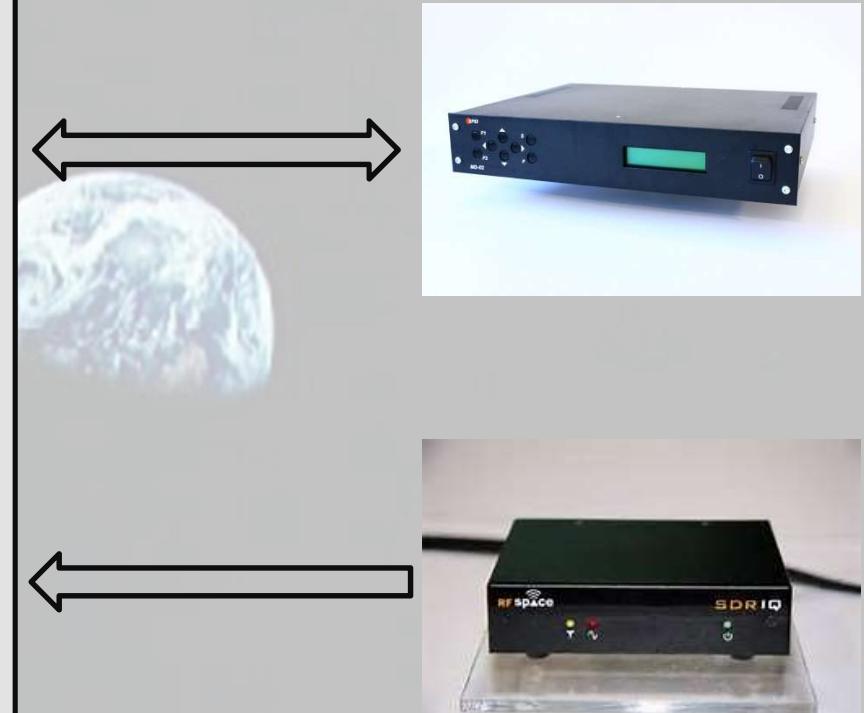
Max signal value

Azimuth offset

Elevation offset

Square Spiral Search Pattern

STOP Exit



**Pointing repeatability must be improved as incremental encoders ( and moving tower ) require at the beginning of each session a re-alignment of Az/EI using sun noise. Square Spiral Search Pattern program is in development, but most likely absolute encoders will be the final fix.**



# The stealth dish

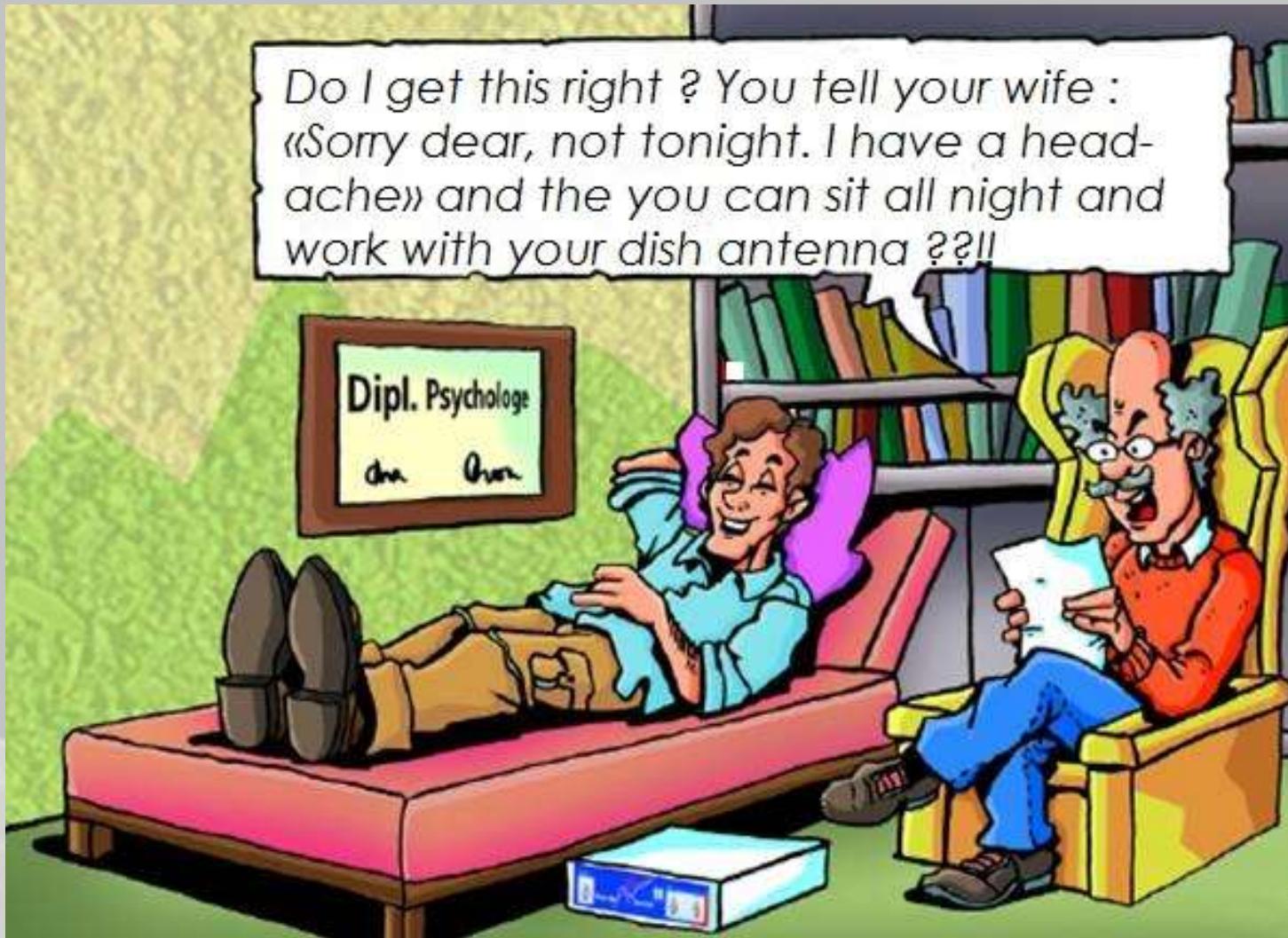
**Some caveat .....**

BIG DISHES ARE VERY INTERESTING  
TOOLS AND CAN GENERATE A LOT OF  
STIMULATING IDEAS .... BUT BE  
CAREFULL .. CAN ALSO BE VERY  
DANGEROUS .....



# The stealth dish

**Some caveat .....**



Derived from [https://www.omicron-lab.com/fileadmin/assets/RFGeek\\_Jokes/Wife\\_Headache\\_Large.jpg](https://www.omicron-lab.com/fileadmin/assets/RFGeek_Jokes/Wife_Headache_Large.jpg)



# The stealth dish



# Thank you !