



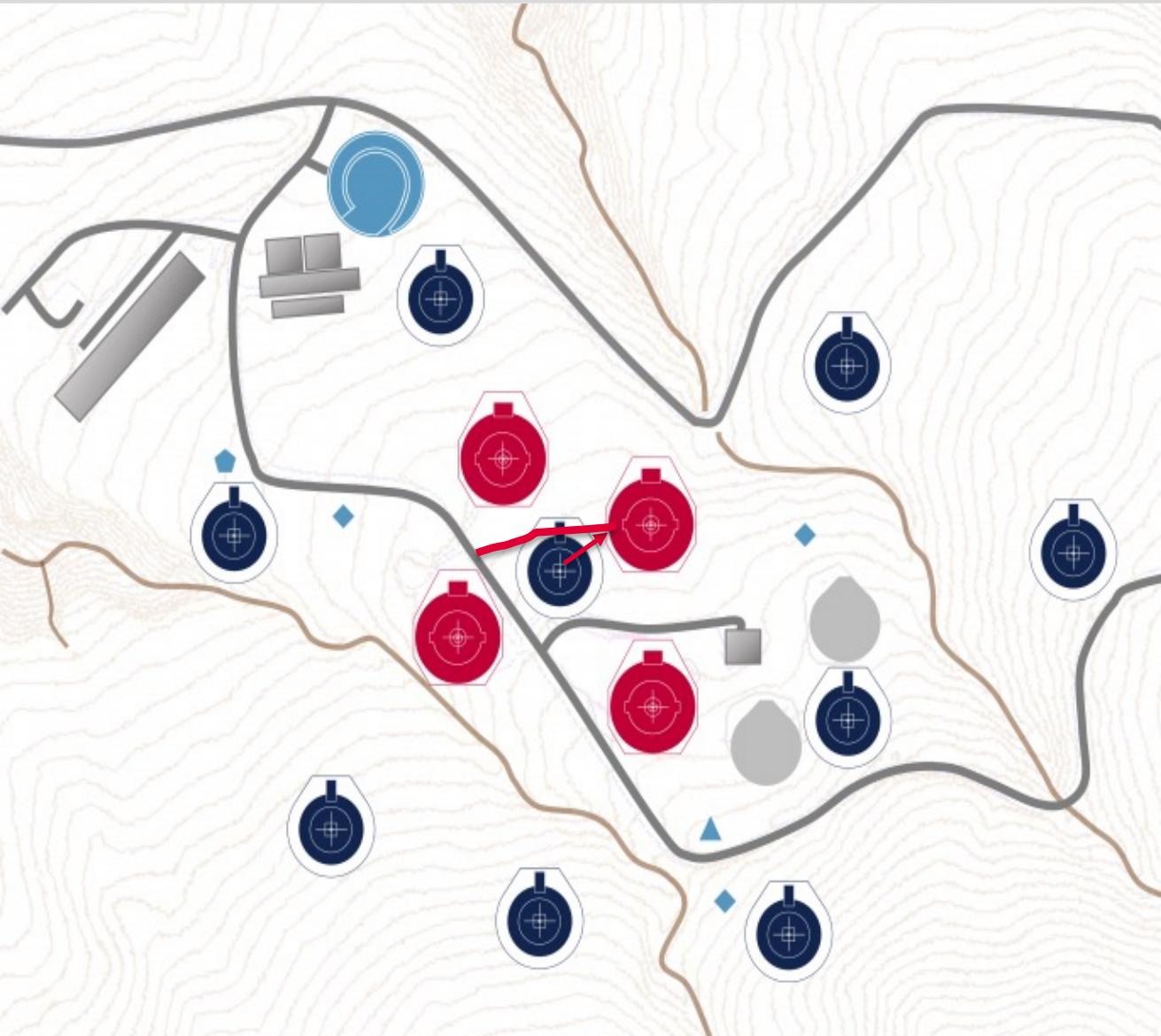
cherenkov
telescope
array

MSTN-15 position: CTAO point of view

David Bristow, Stephen Brown, Paolo Calisse, Stefano Stanghellini,
Wolfgang Wild, Nick Whyborn, Roberta Zanin

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Northern array: as-requested coordinates



MSTN-15 position needs to be modified because in conflict with our internal LSTN-04 access road

IAC suggests a position 10 m away in the NW direction toward LSTN-04

Northern Array: scientific assessment



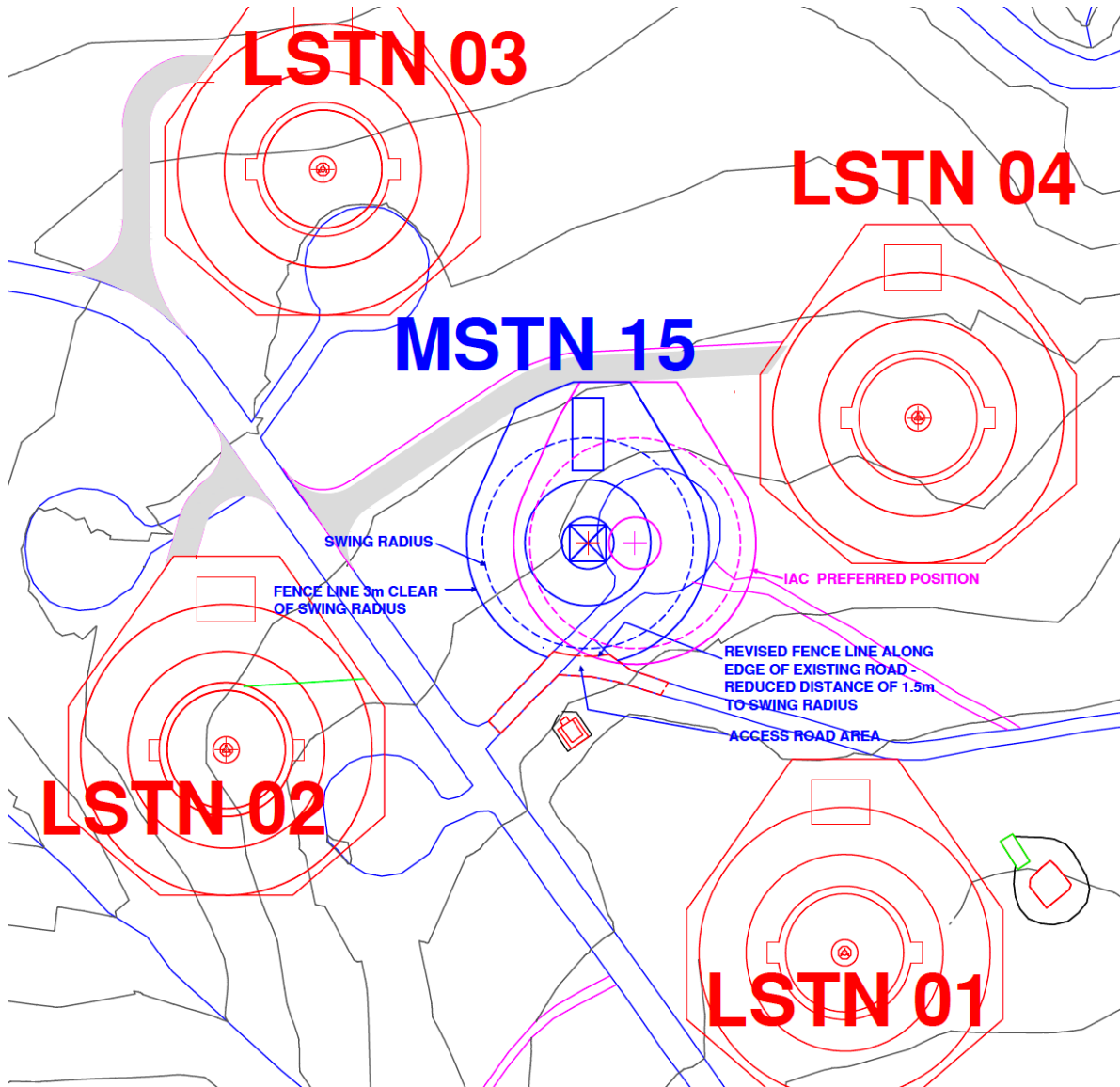
- **When considering the IAC-suggested position**
 - the MSTN-15 would suffer up to 10% shadowing**
(loss in optical effective area)
 - **when the LST is pointing both towards the MSTN-15 and along its line of sight or at zenith**
 - **at an MST zenith distance which is 5-8 degree smaller than the one found for the original MSTN-15 position**
 - shadowing becomes relevant at 52 deg
- **Science-wise.** Very limited science cases: the LST and MST sub-arrays operating independently at specific direction
- **Operations-wise.** Two options:
 1. the production of the MST-sub-array IRFs will have to take the LST pointing into account, and model the shadowing
 2. implement appropriate scheduling constraints

Compromise solution



- With the aim of keeping the best possible symmetry and limited as much as possible the shadowing, CTAO proposed a compromise solution on December 24, 2022
 - This solution keeps into account the human-made constraints, safety regulations
 - This solution is acceptable for the MST consortium despite the fact that the radius between the swing radius and the fence has been reduced to the safety minimum in some area

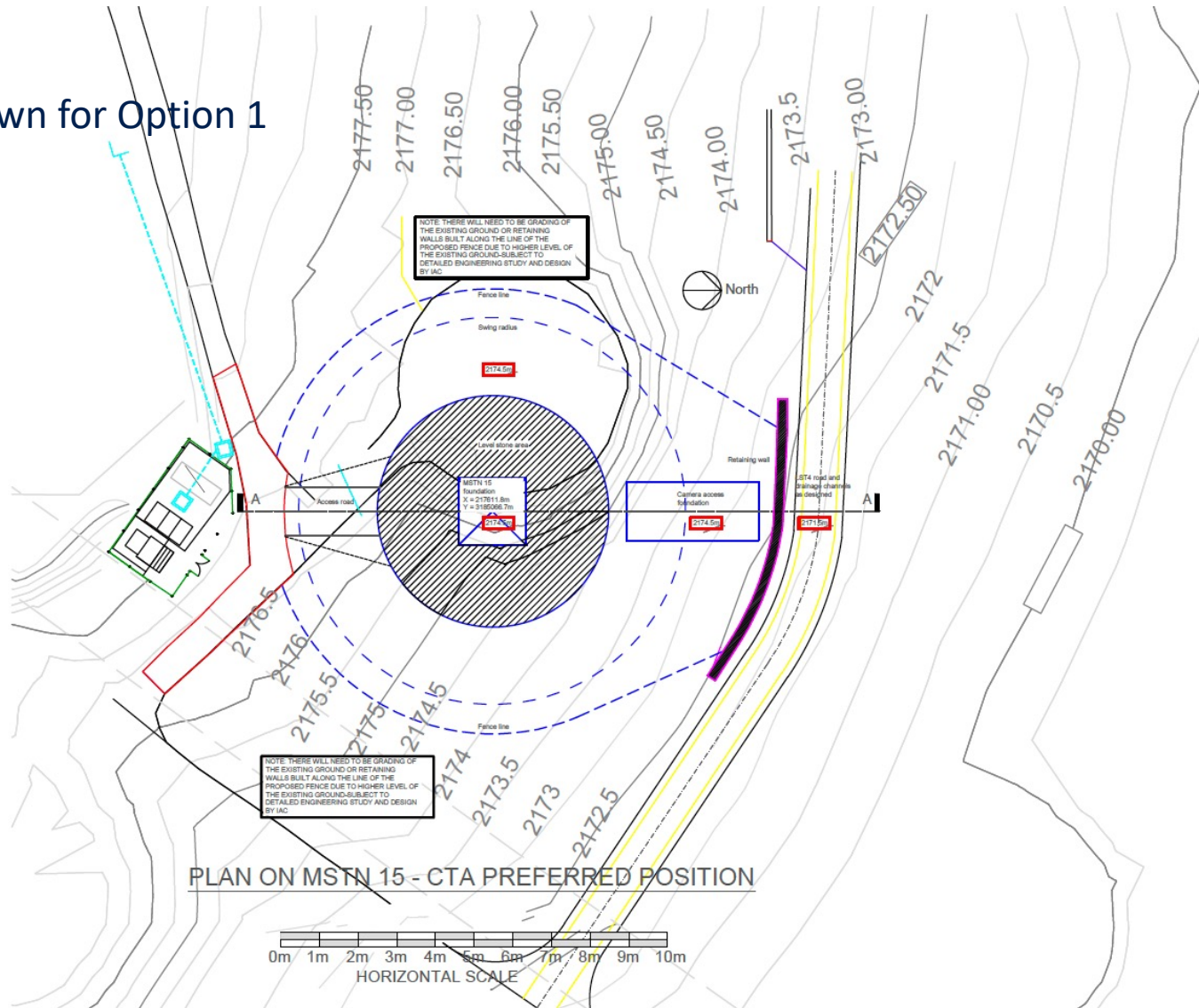
MSTN-15 CTAO-proposed solution



Engineering Concept Study MSTN-15

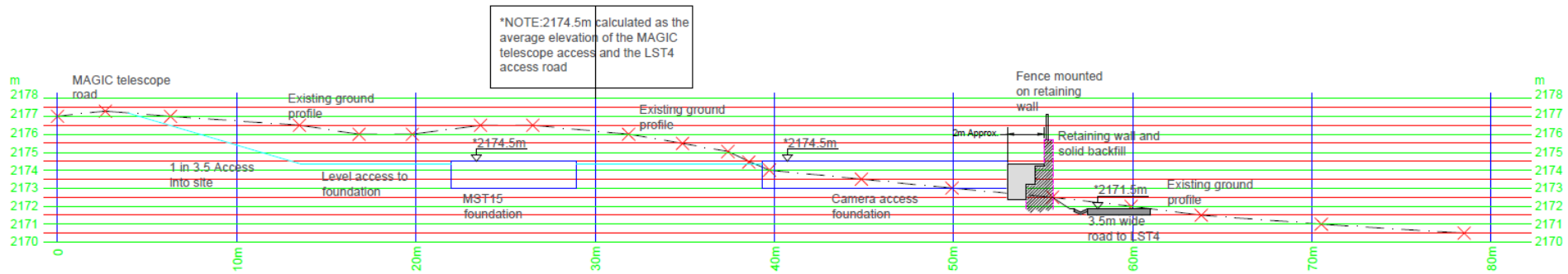


Plan Drawn for Option 1



Coordinates at Telescope Foundation Centre – X = 217611.8 – Y = 3185066.7

Engineering study on the MSTN-15 position



Section Drawn for Option 1

Concept Study - Option 1



- **Option 1 - Concept Study based on the preferred position –**
 - Centre of Telescope Foundation X = 217611.8 – 3185066.7
 - Level at top of Foundation 2174.5m against 3metre high retaining wall to the LSTN4 Access road and to each side of the CMS Foundation at a variable height.
 - Camera removal from CMS with Mobile Crane from LSTN4 Access road.
 - Downside increased quantity of earth removal and extensive Retaining Wall Structure Construction.
 - Access to Foundation from LSTN4 Access Road from the North West.
 - *Note: A detailed Engineering study is required to this Concept Study.*

Concept Study – Option 2



- **Option 2 - Concept Study based on the preferred position –**
 - Centre of Telescope Foundation X = 217611.8 – 3185066.7
 - Level at top of Foundation 2171.5m to Road Level LSTN4 Access Road.
 - Improved Access for Camera Removal from CMS from LSTN4 Road.
 - Downside increased quantity of earth removal and extensive Retaining Wall Structure Construction.
 - Consider this has a major **cost** implication on current budget.
 - *Note: A detailed Engineering study is required to this Concept Study.*

Concept Study – Option 3



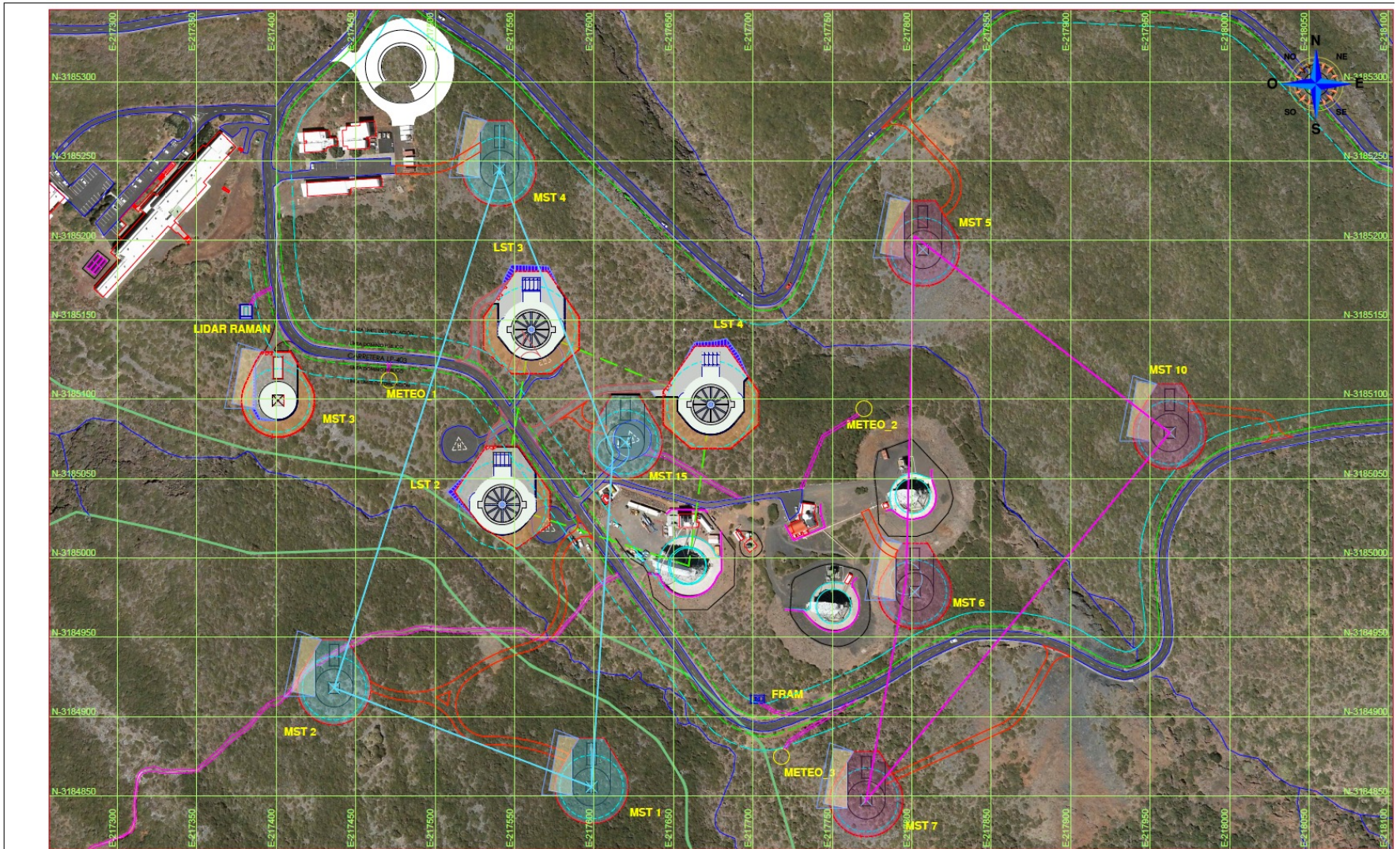
- **Option 3 - Concept Study based on the preferred position –**
 - Centre of Telescope Foundation $X = 217611.8 - 3185066.7$
 - Level at top of Foundation 2177.5m. To give access at ground Level from MAGIC Road.
 - Downside – 6metre high retaining wall required against the LSTN4 Access road and to each side of the CMS Foundation at a variable height.
 - Downside increased quantity of earth fill under the CMS and against retaining wall to LSTN4 road.
 - Consider this may have a **cost** implication of current budget.
 - *Note: A detailed Engineering study is required to this Concept Study.*

- Engineering-wise this position is very critical and requires a detailed engineering study.
 - Independent on the exact position, i.e. IAC-proposed or CTAO-proposed
- Science-wise this position is affected by up to 10% shadowing from the LSTs for observations at high zenith distances (the most centric is the lowest it is), but it is fundamental for the cross calibration between telescopes of different type
- The CTAO-proposed compromise solution is supported also by the MST consortium

Thank you!



MSTN-15



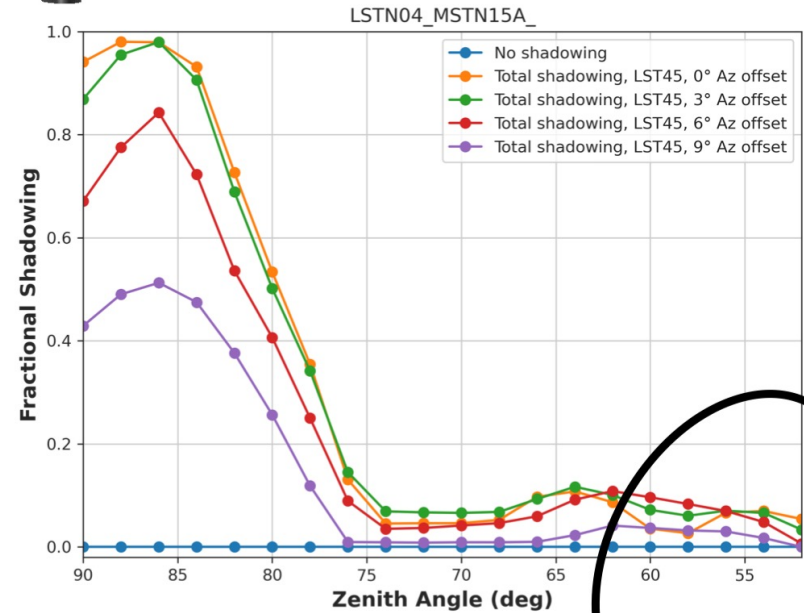
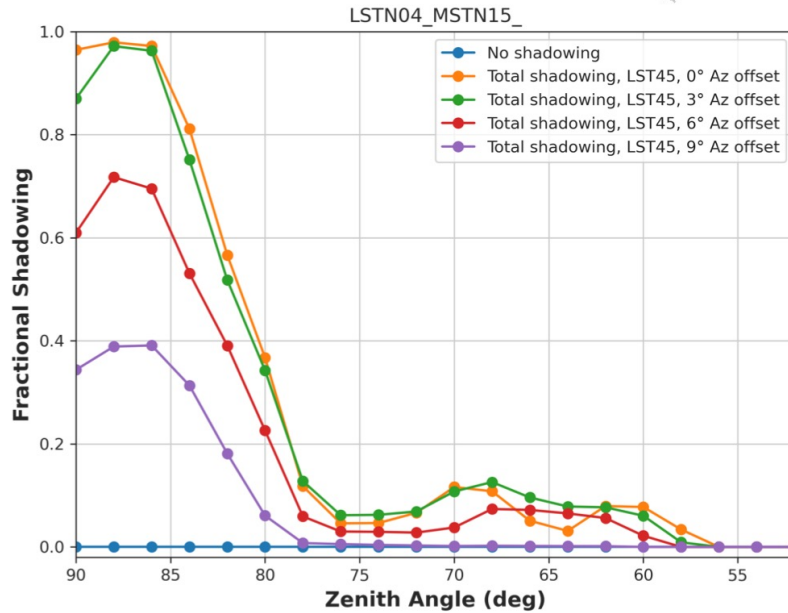
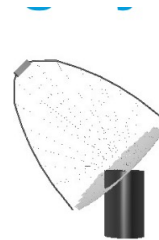
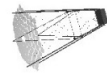
TELESCOPICO	X (UTM)	Y (UTM)	Z	TELESCOPICO	X (UTM)	Y (UTM)	Z
MST1	217504.417	3184955.910	0.000	MET5	217821.086	3185202.723	0.000
MST2	217436.441	3184918.090	0.000	MET5-despl	217826.987	3185194.244	0.000
MST4	217540.420	3185244.720	0.000	MET6	217796.447	3184967.031	0.000
MST5	217611.841	3185066.730	0.000	MET6-despl	217801.871	3184978.630	0.000
MST10-despl	217623.753	3185072.285	0.000	MET7	217771.398	3184847.458	0.000
				MET10	2179623.378	3186078.800	0.000



Northern Array: central MST position



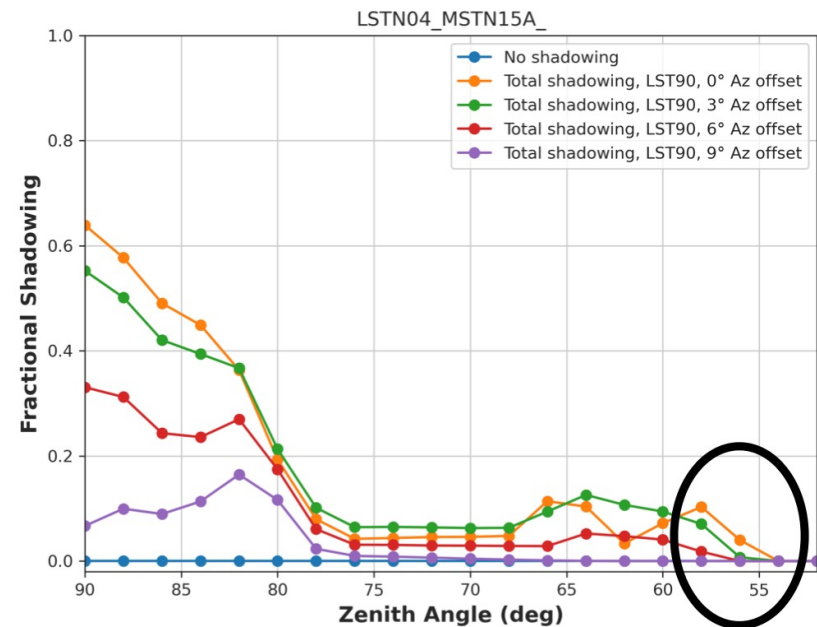
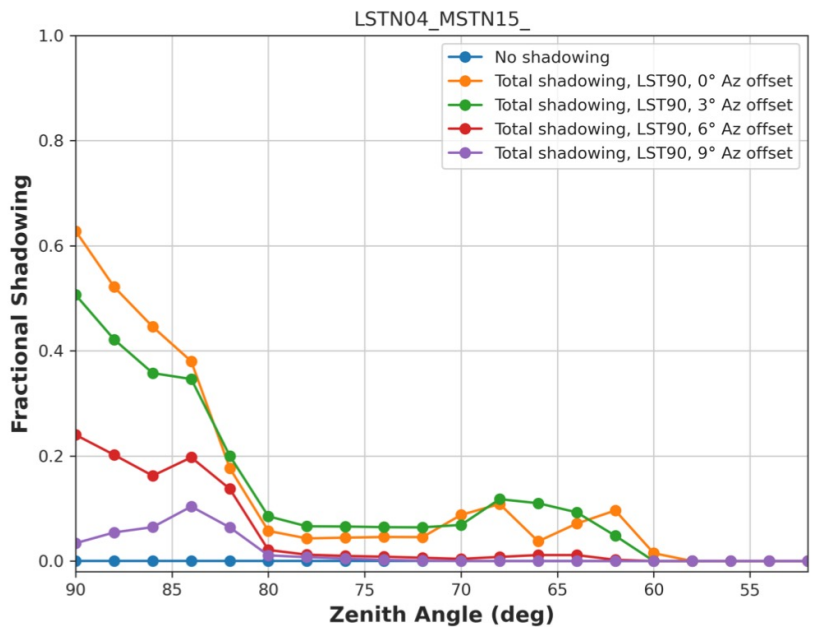
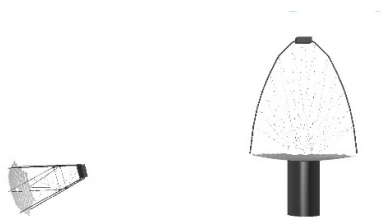
LSTN-04 pointing towards MST with 45° zenith angle



Northern Array: central MST position



LSTN-04 pointing upward



Credits to Tobias Kleiner, Orel & Gernot