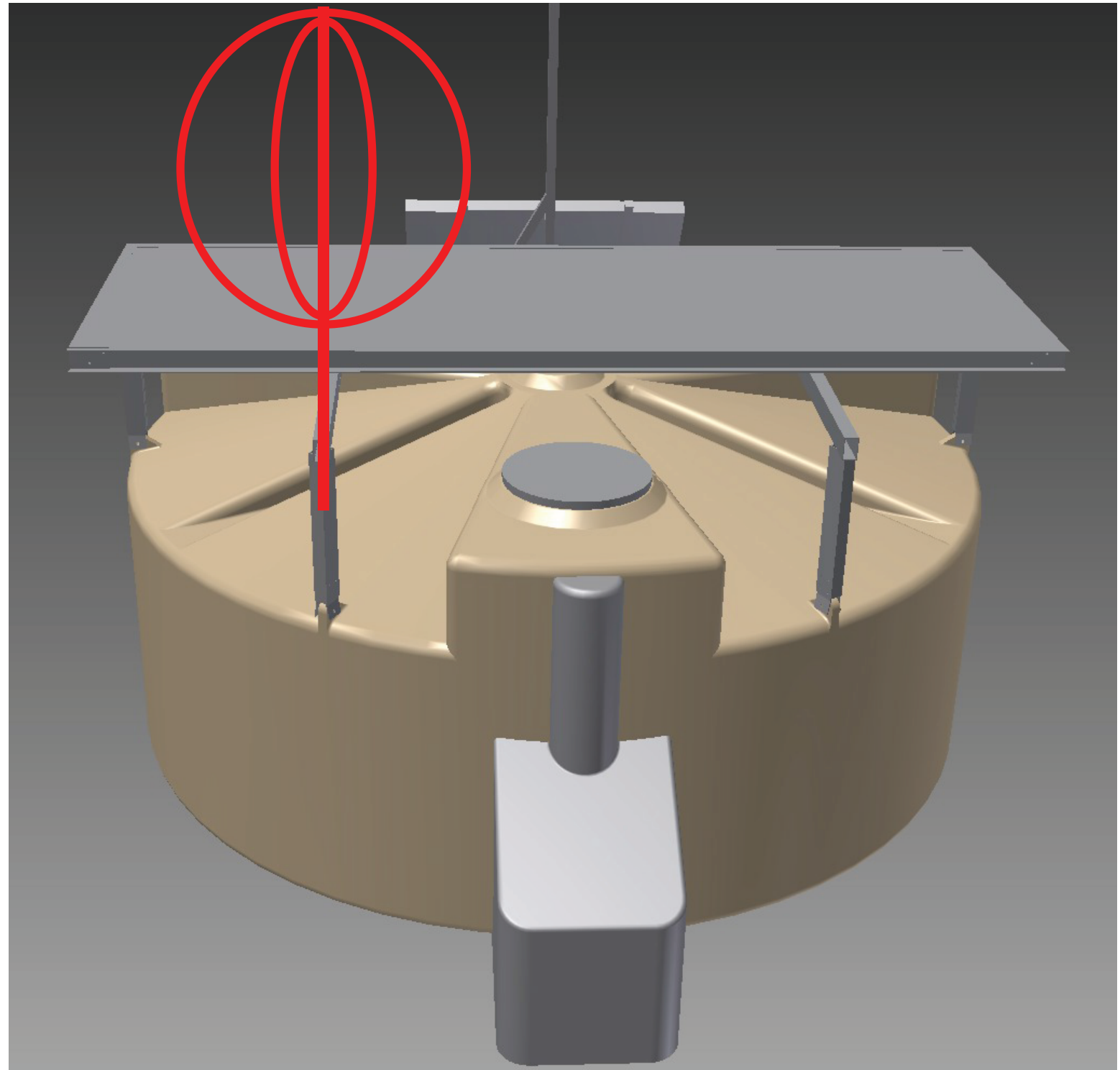


Radio Upgrade of the Pierre Auger Observatory

Collaboration Board

- the project
- finances
- schedule

*aim for ONE integrated system,
comprised of WCD, SSD, and
radio detector (RD)*



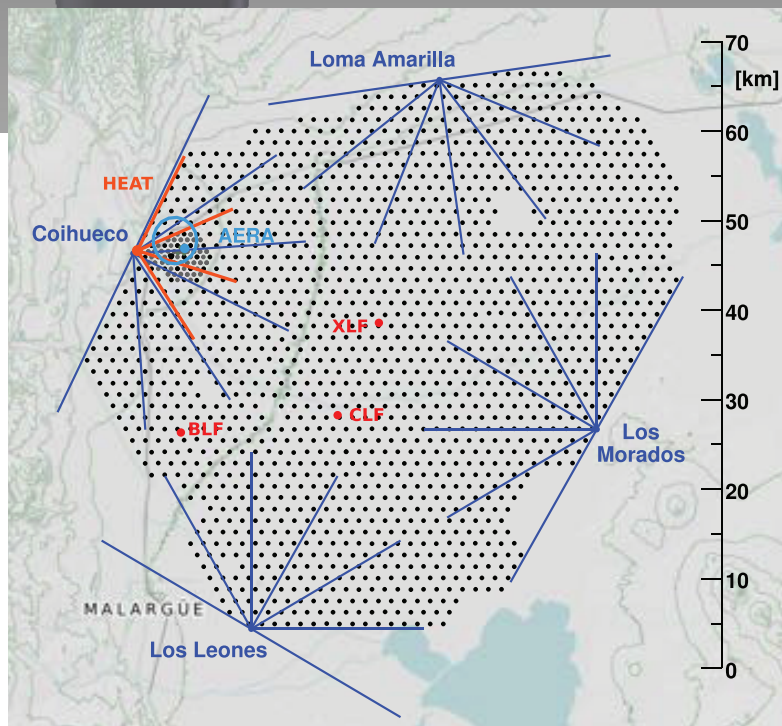
A 3000 km² radio detector at the Pierre Auger Observatory



Surface detector station

with

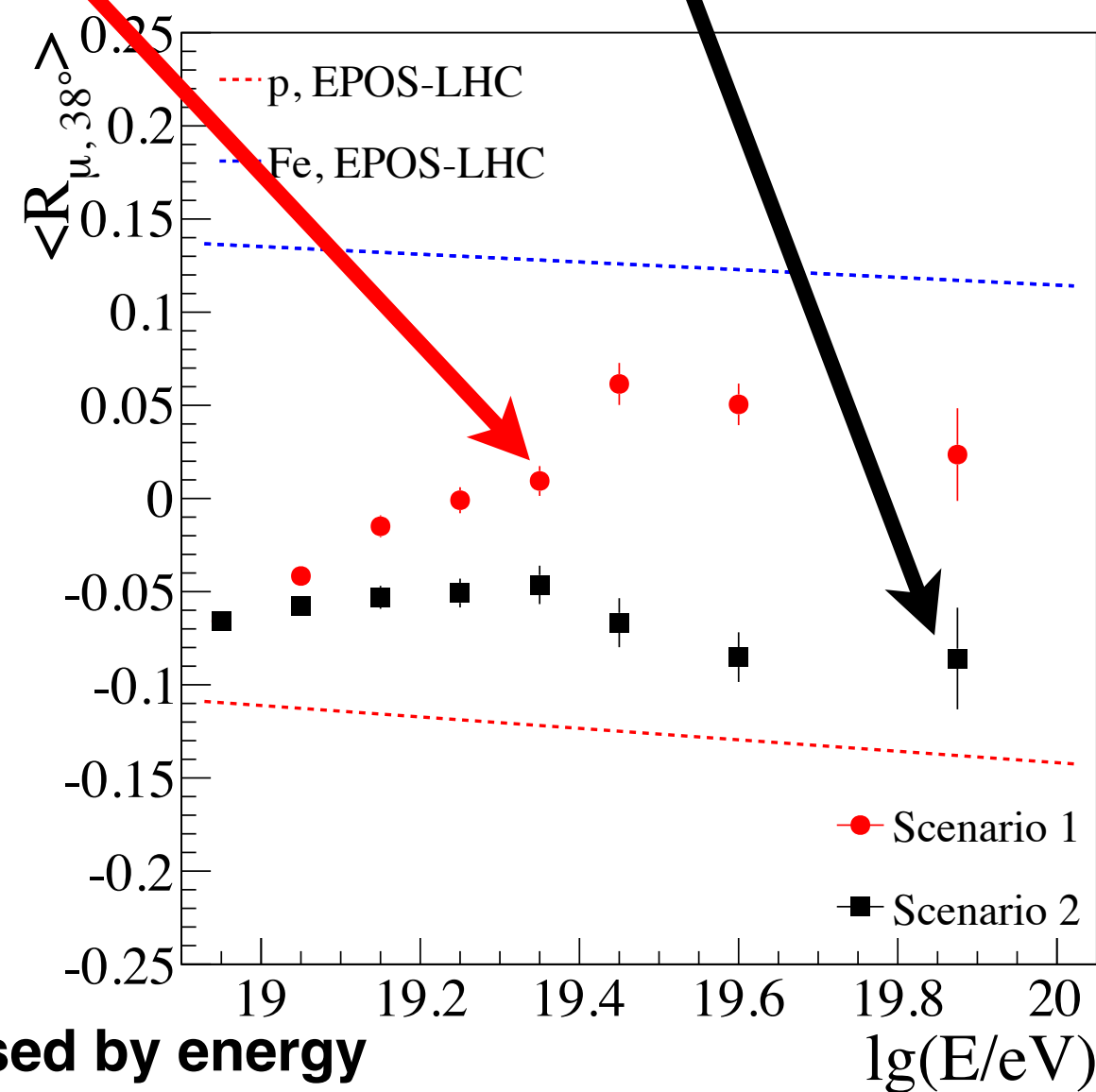
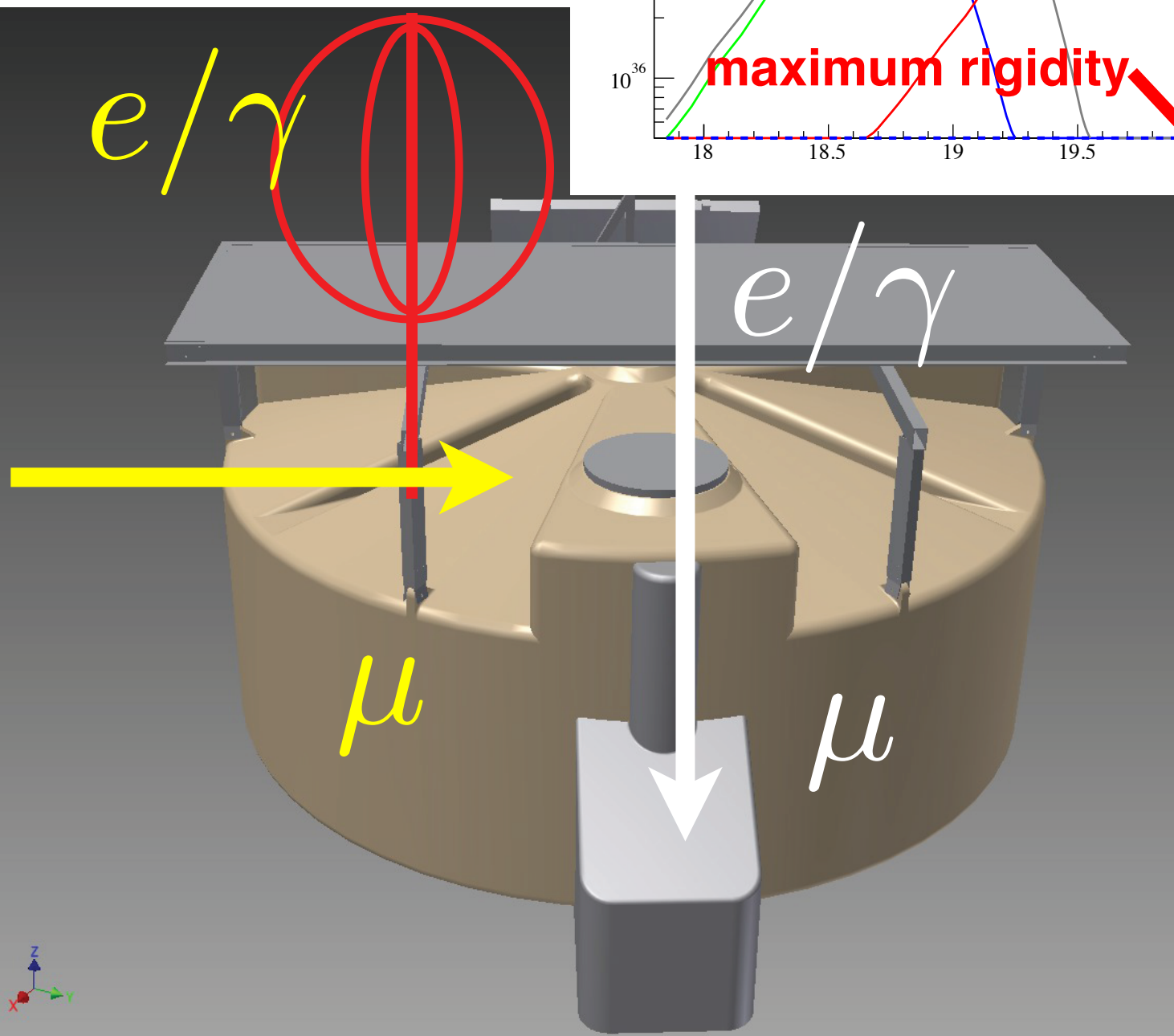
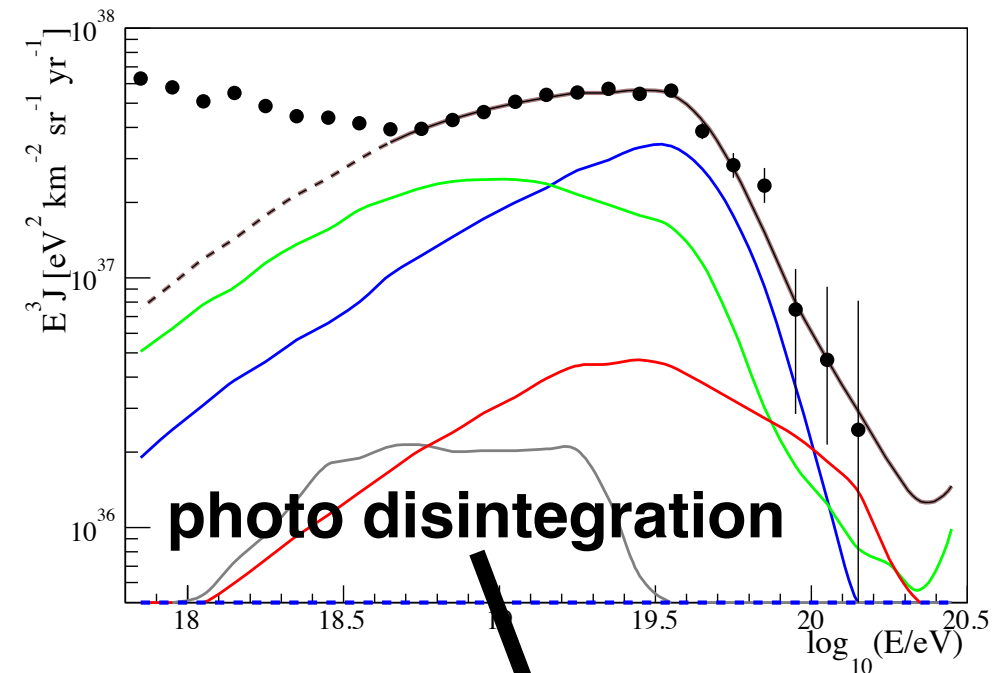
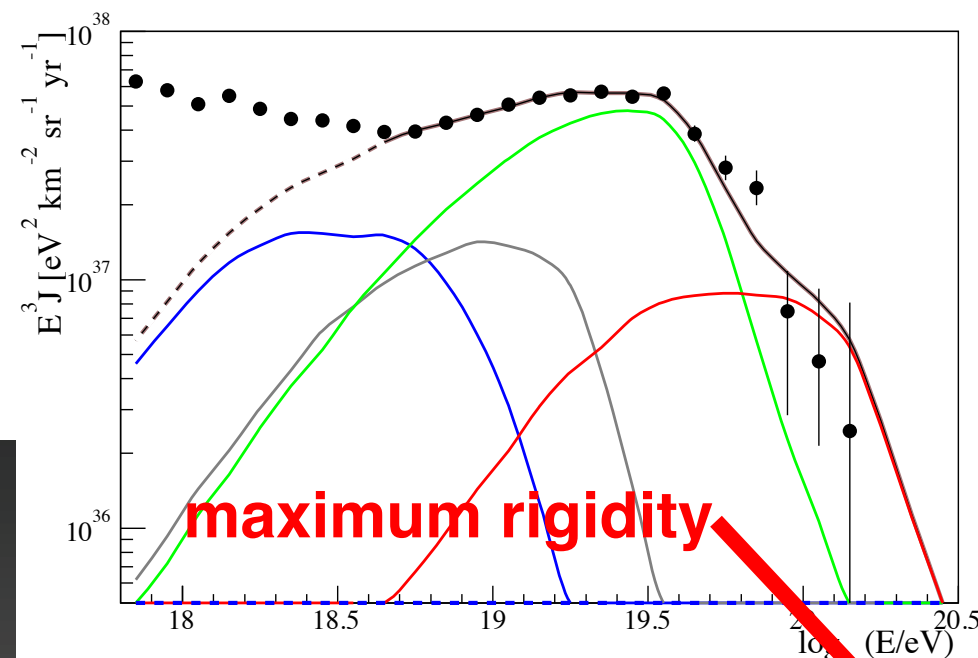
- water Cherenkov detector
- scintillator detector
- radio antenna



Objective:

- origin of cosmic rays
- type of particle up to highest energies
- extend e/m-muon separation to high zenith angles --> HAS (i.e. increase exposure of SSD analyses)
- increase the sky coverage/overlap with TA
- absolute energy calibration from 1st principles
- independent mass scale
- clean e/m measurement --> shower physics

Why?



Will clarify if the observed flux suppression is caused by energy loss effects during the cosmic-ray propagation or the maximum energy of particles injected by astrophysical sources.

CB Paris, 10 June 2017

AREA extension upgrade complement

Jörg presented [a proposal for a radio upgrade](#) ([AERA upgrade slides](#)).

Lukas asks Jörg to clarify the request to the CB:

- General support
- Support letter from spokesperson to be used in funding requests in Germany and the Netherlands.

Vote

VOTE: 25 in favor, 0 against, 2 abstentions. **Support approved**

thank you very much for your support!

Radio Upgrade of the Pierre Auger Observatory

Budget

The **costs per RD station** (based on existing prototypes and experience from AERA and the Tunka experiment) break down to:

450 €	for the radio antenna and the pre-amplifier, and mechanical structure
650 €	for the analogue filter and the digitizer, interfacing cables and connectors
400 €	to adapt the UUBs
200 €	for solar panel
100 €	for shipping and deployment
1800 €	sum
270 €	15% contingency, spares, inflation
2070 €	total cost per RD station

This yields the following budget for the complete project:

126 k€	for 61 RD stations on the 750 m dense grid
3312 k€	for 1600 RD stations on the 1500 m grid
81 k€	for design and prototyping (70 k€ + 15% contingency)
173 k€	for the central DAQ and communication system (150 k€+ 15% contingency, spares)
3692 k€	total project costs

*~3.7 M€ total
hardware costs*

Pierre Auger Observatory upgrade		Cost
SSD scintillator upgrade	47%	8504 k€
UUB electronics upgrade	20%	3605 k€
AMIGA muon detector upgrade	12%	2122 k€
Radio upgrade	21%	3692 k€
Total		17923 k€

Radio Upgrade of the Pierre Auger Observatory

Budget

- **3.5 M€ ERC Advanced Grant *Hörandel* personnel (PhD stud., post docs, engineers) + ~1 M€ hardware**



European Research Council
Established by the European Commission

- **2.7 M€ NWO-Groot application *de Jong, Hörandel, et al* decision expected in July 2018**



- **1 M€ NOVA application *Hörandel et al* decision expected in Summer 2018**



- **~70 k€ R&D funds from Germany**



Bundesministerium
für Bildung
und Forschung

Radio Upgrade of the Pierre Auger Observatory

NWO site visit 11 May 2018



*Many thanks to Antonella,
Ralph, Ingo for their
enormous support!*



Netherlands Organisation for Scientific Research

Radio Upgrade of the Pierre Auger Observatory

Budget

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400 €	to adapt the UUBs
200 €	for solar panel
100 €	for shipping and deployment
1800 €	sum
270 €	15% contingency, spares, inflation
2070 €	total cost per RD station

rough estimate
mechanical mount:
~200 € (side), 300 € (center)

Tunka: 85 € (100 USD) for antenna+LNA

—> 285 € - 385 €

This yields the following budget for the complete project:

126 k€	for <u>61 RD stations</u> on the <u>750 m dense grid</u>
3312 k€	for <u>1600 RD stations</u> on the <u>1500 m grid</u>
81 k€	for design and prototyping (70 k€ + 15% contingency)
173 k€	for the central DAQ and communication system (150 k€)
3692 k€	total project costs

Hörandel + engineers are working on estimate.
Complex issue ...
expect to be within budget

contribution to UUB

140 € Luxor ECO line M72 LX-200
(without VAT, need to work this out)

includes upgrade of comms backbone

Radio Upgrade of the Pierre Auger Observatory

Time line

- as of **today** we have ~1M€ out of the required ~3.7 M€ for hardware
~27% —> 449 out of 1661 stations (842 km²)
most likely the costs will be below budget, i.e. in practice we most likely have already more stations at present
- **financial decisions** expected in **July** (NWO) and **Summer** (NOVA)
—> financial situation should be clear at November 2018 meeting
- TB is informed and integrated in R&D process
- aim for **CDR** of the radio upgrade during **November** meeting
—> freeze design before end of October 2018
- ask **CB** for formal **decision** during **November** 2018 meeting