



Istituto Nazionale di Fisica Nucleare
SEZIONE DI ROMA TOR VERGATA

Southern Wide-field-of-view Gamma-Ray Observatory (SWGO)

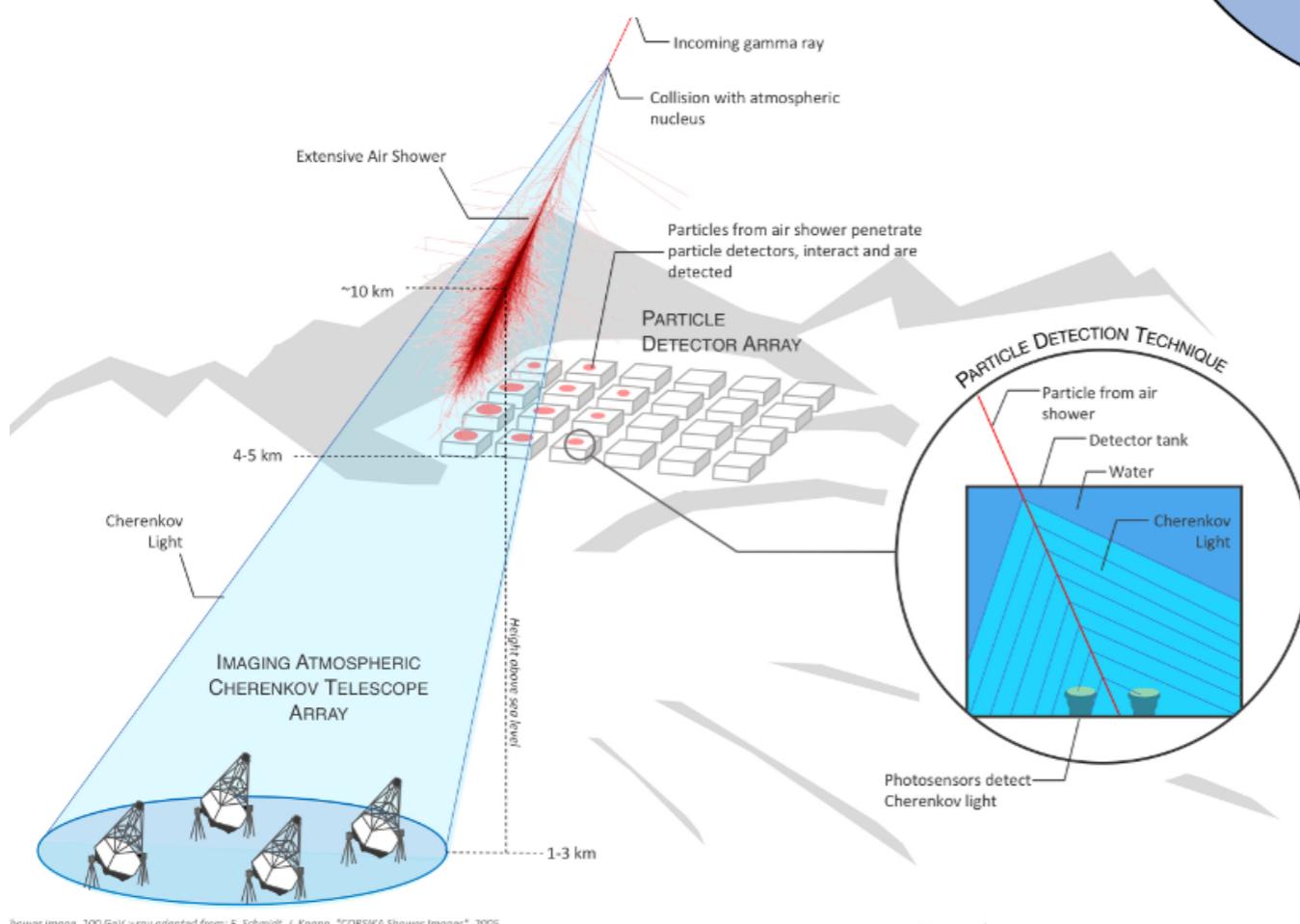
G. Di Sciascio in sostituzione di Barbara Liberti

INFN - Roma Tor Vergata, Italy

Consiglio di Sezione Roma Tor Vergata, 14 Luglio 2022

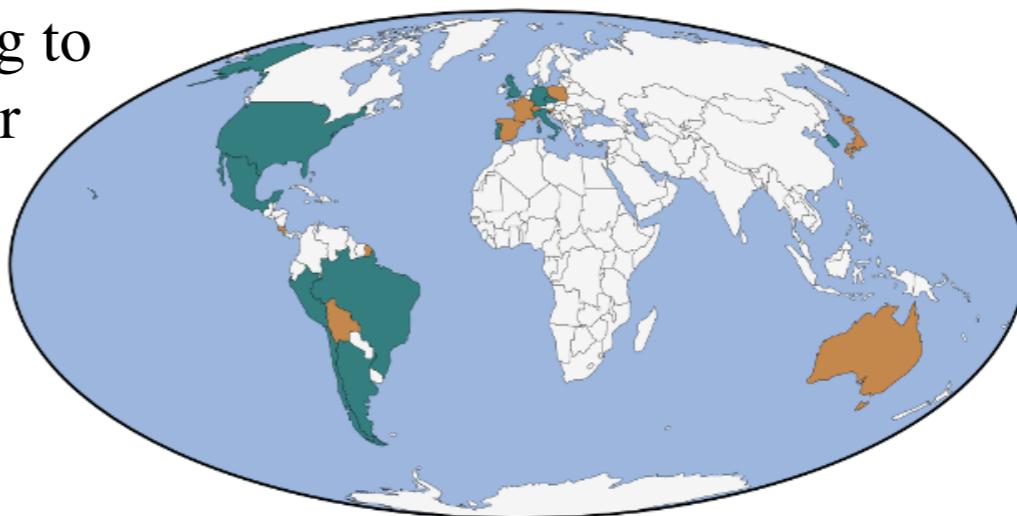
SWGO

The **Southern Wide-field-of-view Gamma-Ray Observatory (SWGO)** is a collaboration aiming to design and construct a VHE EAS array of Water Cherenkov Detectors (WCD) in the Southern Hemisphere.



Shower image, 200 GeV γ -ray adapted from: F. Schmidt, J. Knapp, "CORSIKA Shower Images", 2005,
<https://www-zeuthen.desy.de/~jknapp/sv/showerimages.html>

Not to scale



Countries in SWGO

Institutes

Argentina*, Brazil, Chile, Czech Republic, Germany*, Italy, Mexico, Peru, Portugal, South Korea, United Kingdom, United States*

Supporting scientists

Australia, Bolivia, Costa Rica, France, Japan, Poland, Slovenia, Spain, Switzerland

*also supporting scientists

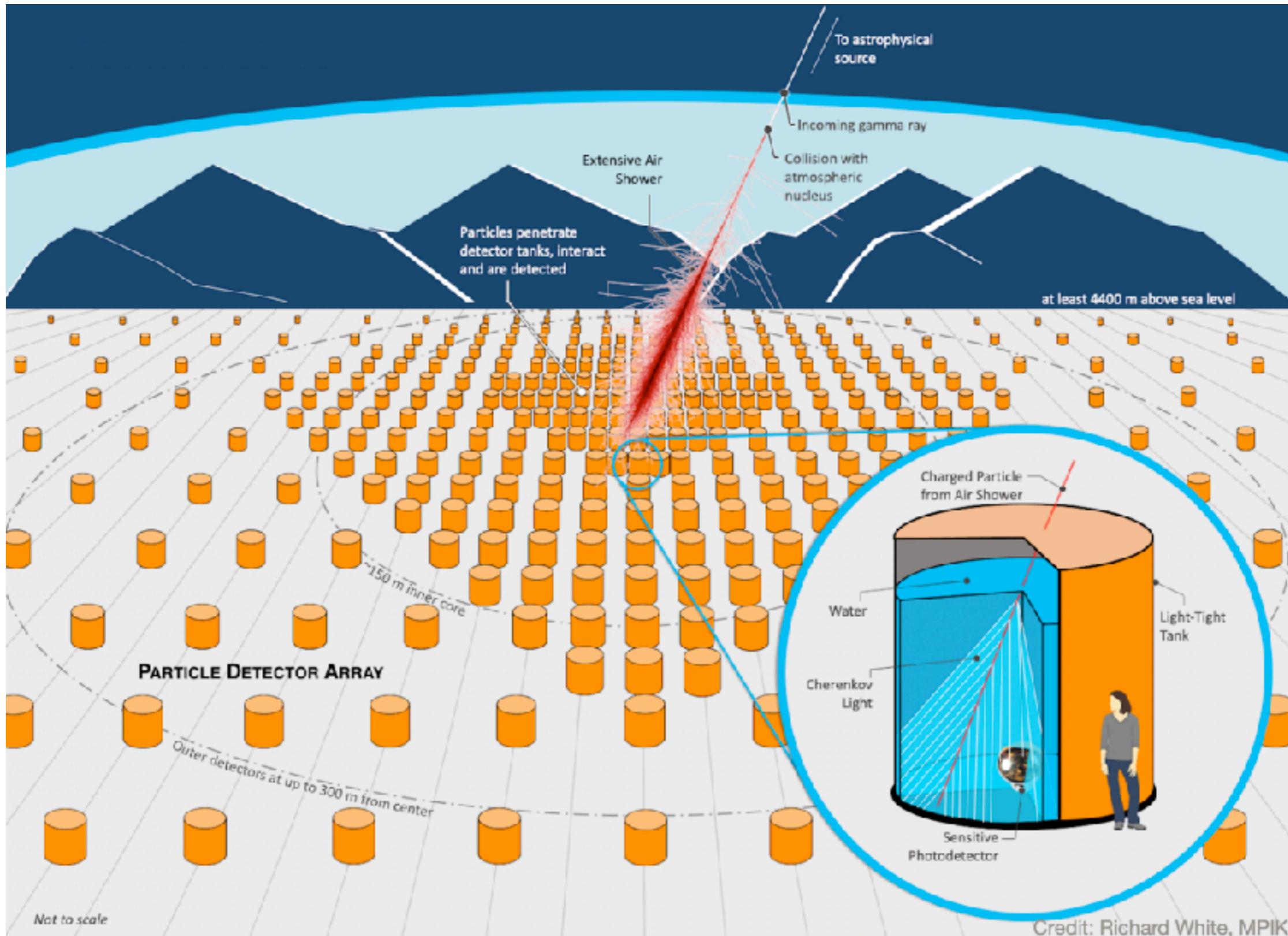
SWGO will use air-shower tracking to provide continuous monitoring of a large field of view at energies above 100 GeV.

It is designed as a monitoring instrument and an alert system for IACTs.

It will cover unaccessible sky regions for HAWC and LHAASO.

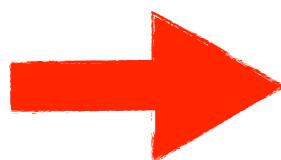
Website: <https://www.swgo.org>

SWGO: a water Cherenkov based array



Limiti del presente progetto SWGO

- Necessita' di procurarsi enormi quantitativi di acqua: in zone desertiche ad altissima quota cosa non banale!
- Energia di soglia non troppo bassa: 500 - 700 GeV. *Necessario almeno 100 GeV per fenomeni flaring (GRB)*
- Energia massima non troppo alta: circa 100 TeV. *Dopo gli spettacolari risultati di LHAASO necessario arrivare a 10 PeV*
- Discriminazione del fondo non semplice su un grande intervallo di energia, soprattutto oltre 50 TeV



Un rivelatore ibrido fatto con **RPC + water Cherenkov** potrebbe migliorare la sensitività'

Una vecchia idea di noi a Roma Tor Vergata...

Particle arrays vs water Cherenkov

From an experimental point of view, the sampling of secondary particles at ground can be realized with *two different approaches*

- (1) **Particle Counting**. A measurement is carried out with thin ($\ll 1$ radiation length) counters providing *a signal proportional to the number of charged particles* (as an example, plastic scintillators or RPCs). The typical detection threshold is in the keV energy range.
- (2) **Calorimetry**. *A signal proportional to the total incident energy of electromagnetic particles* is collected by a thick (many radiation lengths) detector. An example is a detector constituted by many radiation lengths of water to exploit the Cherenkov emission of secondary shower particles. The Cherenkov threshold for electrons in water is 0.8 MeV and the light yield ≈ 320 photons/cm or ≈ 160 photons/MeV emitted at 41° .

Detecting gamma-rays with moderate resolution and large field of view: Particle detector arrays and water Cherenkov technique

Michael DuVernois and Giuseppe Di Sciascio

*Un capitolo in un'opera Springer in 4 volumi
su tutto lo scibile dell'astrofisica*

The STACEX proposal

Southern TeV Astrophysics and Cosmic rays Experiment

A Wide FoV Detector for Gamma-Ray Astrophysics in the Range
100 GeV - 10 TeV in the Southern Hemisphere

G. Di Sciascio, R. Santonico, M. Tavani

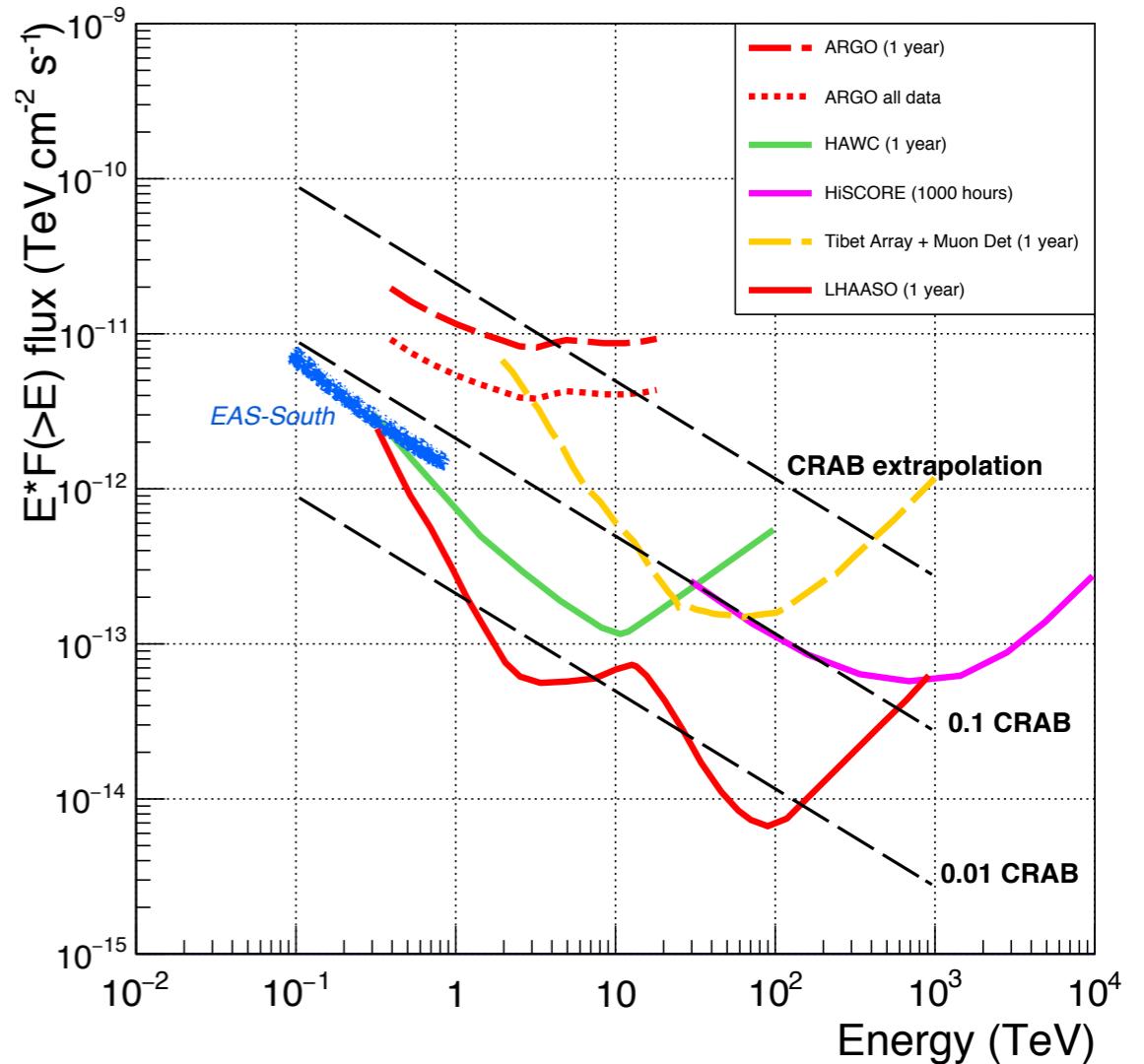
March 9, 2015

Abstract

We present the concept of a new wide-FoV high-altitude detector in the Southern hemisphere dedicated to gamma-ray astronomy in the range 100 GeV - 10 TeV. The new instrument is based on large-area particle detectors (Resistive Plate Chambers, RPCs) already tested and implemented in the ARGO shower array experiment. The new experiment will have a sensitivity better than 10% Crab Nebula flux per year at 100 GeV with a very good angular resolution. It will be unique and complementary to CTA-South and other TeV detectors planned to be active during the next decade. We consider here a possible site in Argentina at the 4800 m asl of the Alto Chorrillos region, currently hosting also the Long Latin American Millimeter Array (LLAMA).

unpublished note

*updated ARGO carpet operated at 5000 m asl
Instrumented area 150 x 150 m²
hypothesis: $Q_f = 2$ below TeV*



Very preliminary calculation made with ARGO simulation and reconstruction codes and with ARGO trigger logic

STACEX Workshop 2016



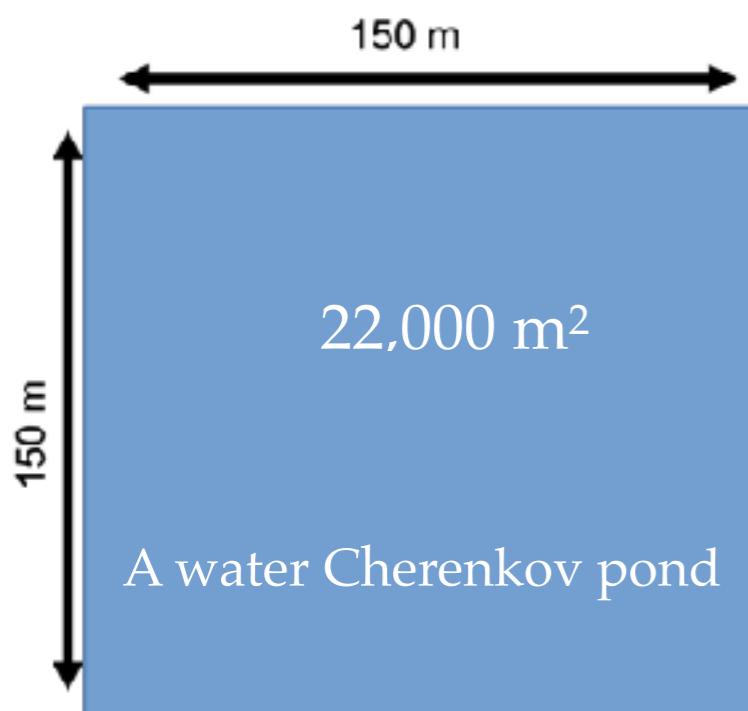
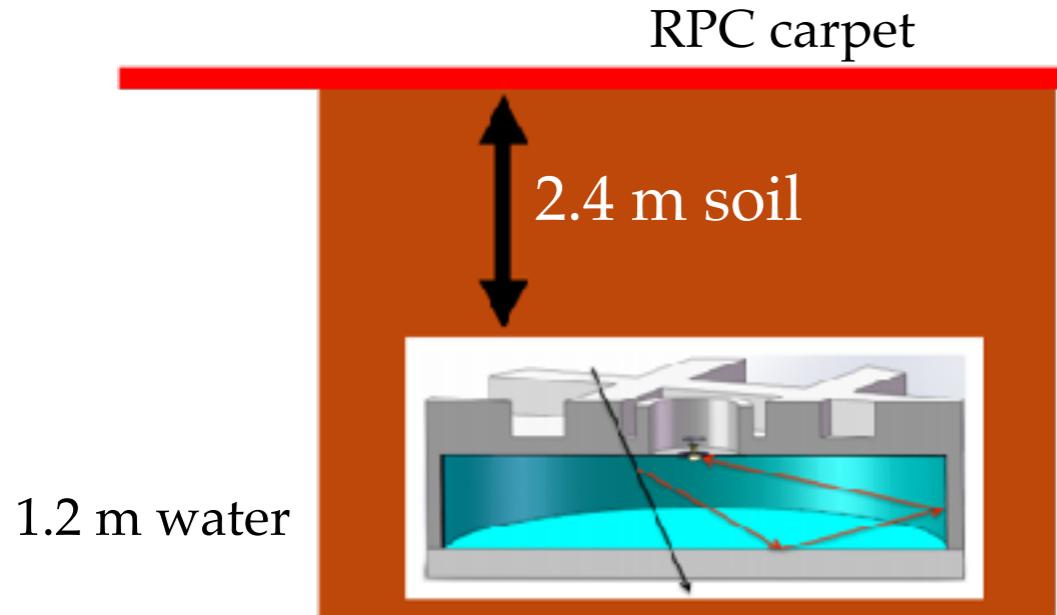
Scientific Program					
WORKSHOP					
"TOWARDS A LARGE FIELD-OF-VIEW TEV EXPERIMENT IN THE SOUTH"					
January 14-15, 2016, University of Tor Vergata, Rome					
Thursday, January 14					
14:00 - 14:15	Welcome/Introduction	M. Tavani/R. Santonico	PDF	09:30 - 10:00	Evidence for a Presence of a Powerful PeVatron in the Galactic Center: Is it Sgr A? F. Aharonian
14:15 - 14:35	Status of Current Wide FoV Experiments/Projects	G. Di Sciascio	PDF	10:00 - 10:30	Galactic Gamma-Ray Emission at Very High Energy P. Uपारि
14:35 - 15:00	HAWC and Ideas for a Southern HAWC	M. Du Vernois	PDF	10:30 - 10:50	Galactic Cosmic Rays A. Chiavassa
15:00 - 15:20	CTA	G. Pareschi	PDF	10:50 - 11:10	CR Spectrum, Composition and Arrival Direction Distribution at the South Pole P. Desiati
15:20 - 15:40	LATTES	G. Maltsev	PDF	11:10 - 11:30	Coffee Break
15:40 - 16:10	Marta RPCS	P. Fonte	PDF	11:30 - 11:50	ASTRI S. Vercellone
16:10 - 16:30	Studies on LATTES Performance at Low Energies	R. Conceição	PDF	11:50 - 12:10	Neutrino Telescopes in a Multi-messenger Context G. De Bonis
16:30 - 16:50	Coffee Break			12:10 - 12:30	Fermi and VHE Sources P. Giommi
16:50 - 17:15	Simulation Framework for LATTES	B. Tomé	PDF	12:30 - 12:50	Observing the High Energy Fermi Sources with the Air Shower Arrays: the Case for LHAASO and LATTES B. D'Ettore Piazzoli
17:15 - 17:35	ARGO-YBJ Legacy to Next Generation Wide FoV Experiments	R. Iuppa	PDF	13:00 - 15:00	Lunch
17:35 - 18:00	Electronics for LATTES Prototypes	P. Assisi	PDF	15:00 - 17:00	Round table chaired by Tavani/Santonico
18:00 - 18:20	New Electronics for RPCs (TBC)	R. Cardarelli	PDF		
18:20	End			17:00	End
	Social Dinner				

<http://www.iaps.inaf.it/stacex/index.html>

Friday, January 15

09:30 - 10:00	Evidence for a Presence of a Powerful PeVatron in the Galactic Center: Is it Sgr A?	F. Aharonian
10:00 - 10:30	Galactic Gamma-Ray Emission at Very High Energy	P. Uपारि
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17:00	End	

STACEX



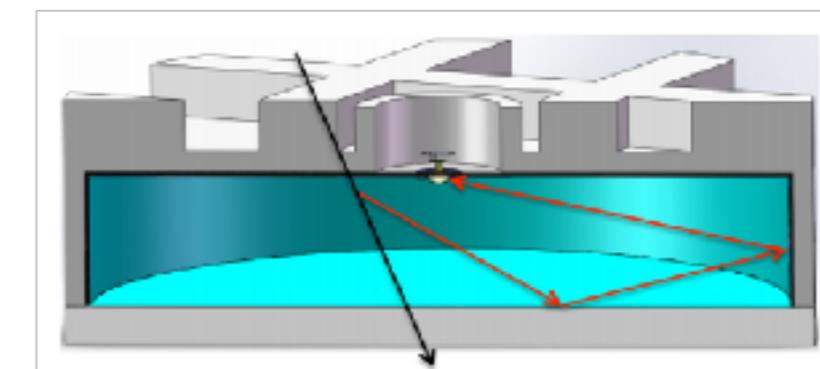
PROCEEDINGS
OF SCIENCE

ONLINE ICRC 2021
THE ASTROPARTICLE PHYSICS CONFERENCE
Berlin | Germany
37th International Cosmic Ray Conference
12–23 July 2021

STACEX: RPC-based detector for a multi-messenger observatory in the Southern Hemisphere

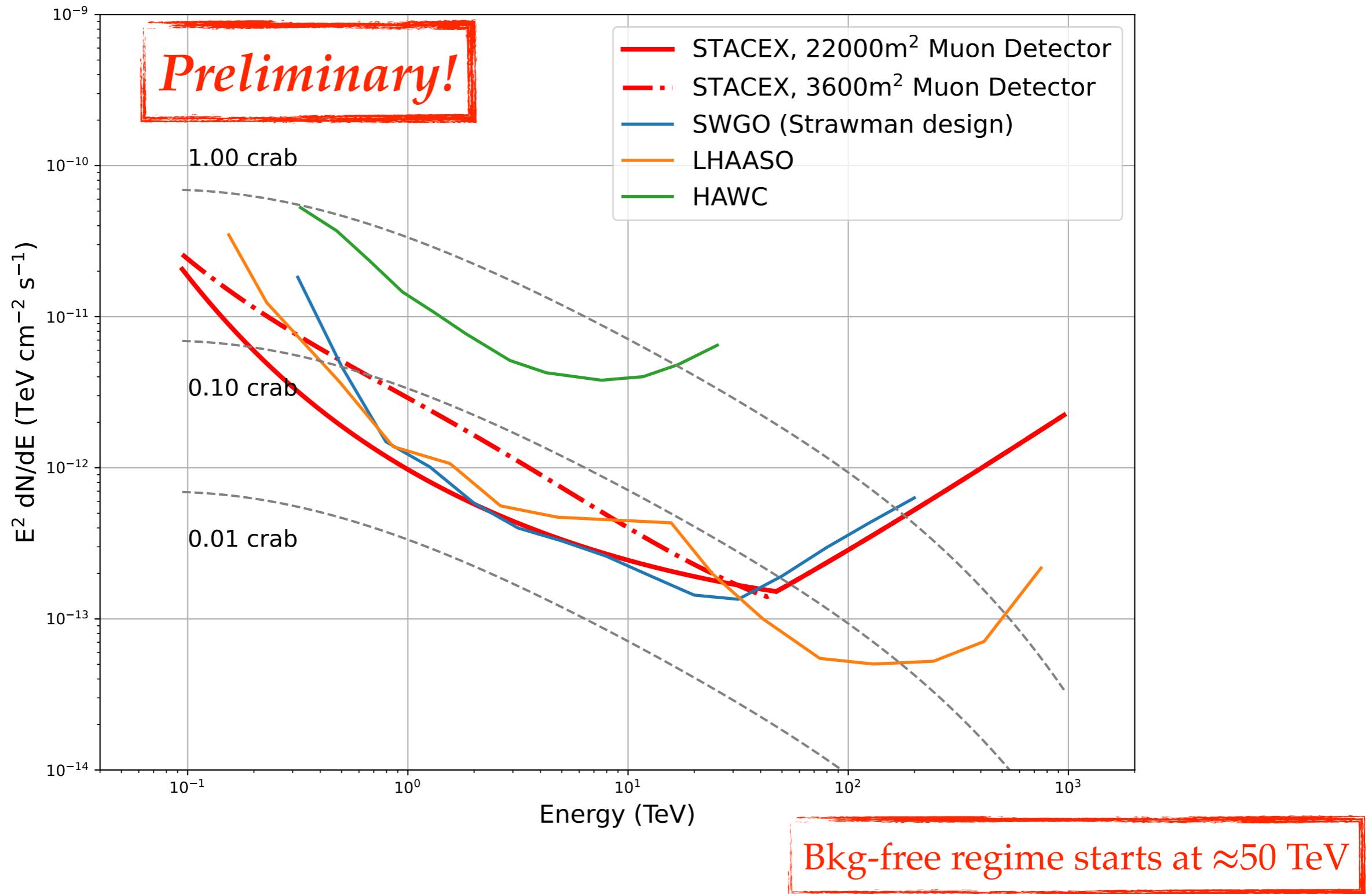
Fernandez Gonzalo Rodriguez,^{a,*} Bigongiari Ciro,^b Bulgarelli Andrea,^c Camarri Paolo,^{d,e} Cardillo Martina,^a Di Sciascio Giuseppe,^e Fioretti Valentina,^c Piano Giovanni,^a Santonico Rinaldo^{d,e} and Tavani Marco^a

Few muons at low energy → full coverage pond to increase the bkg rejection capability at lower energies.



water Cherenkov detector LHAASO-like
1.2 m of water + 8'' PMT downward

Sensitivity of the “core” detector



CTA+/INFRA project for CTA-S enhancement

Proposta a trazione INAF

- Call dedicata alle **ESFRI ([PNIR 2021-27](#))**
- **IR di categoria globale e di categoria A (alta priorità): CTA(INAF), ET(INFN), KM3-NET(INFN)**
- Total budget (Physycal Science&Engineering) 400M€/1080€ (linea intervento 3.1.1), target minimo proposta 15M€ (IVA incl.), target 20 proposte selezionate (art.2 c3 dell'avviso) per raggiungere uno dei target del PNRR (mediamente quindi 50M€ a progetto)
- 40% iniziativa SUD
- Parità genere 40% nuovi reclutamenti (t.d.) e dottorandi di genere femminile
- **Durata progetto 30 mesi**
➤ **Spese rendicontabili comunque entro 2025**

CTA al momento ha un finanziamento incompleto, la configurazione minima finanziata è:

CTA-N: 4 LST + 9 MST

CTA-S: 0 LST + 14MST +37 SST

N. Giglietto, CSN2 15/02/2022

N. Giglietto, CSN2 15/02/2022



WP 1520 R&D:

Partecipazione a SWGO per attività di R&D

Coordinamento: INFN-TO/UNITO (A. Chiavassa)

- (INFN) Sviluppo tecnologico per osservazioni a largo campo di vista e alte energie (i.e. simili a SWGO) INAF, INFN (INFN-RM2, INFN-PD, INFN TO, INFN NA) sensori SiPM, per implementare water Cherenkov tanks (allerte veloci a transienti alte energie)
- (INAF) RPC per estendere il range dinamico di SWGO verso le basse energie (G. Di Sciascio sez INFN–RM2 ma associato INAF)

Un R&D per studiare le potenzialità' di un rivelatore ibrido RPC+water Cherenkov

Costi, ripartizioni e compiti

U.O.	compiti	Costi (Infra+Instr) (k€)	Personale t.d.+phd (k€)	Totale (k€)
Totale	All wps	81000	8000	89000
INAF	3LST, 9SST, varie	64500	5700	70200
INFN*	Camere LST, SiPM R&D, SWGO-Water Cherenkov	13300	1400	14700
UNI*		2800	1200	4000
CTAO	infrastructure	2300	€ 0,00	2300
INFN-BA	Camere LST + SiPM R&D	6400	100	6500
INFN-CT	Infras+WPs, R&D	400	100	500
INFN-NA	Infras, outreach, swgo,r&D	500	200	700
INFN-PI	Camere FEE LST	4600	200	4800
INFN-PD	Specchi LST, SWGO	400	100	500
INFN-RM2	SWGO-RPC	600	100	700
INFN-TO	SWGO	300	100	400

Richieste CTA+ tagliate del 20%, ma del 50% per i WP di R&D, dopo negoziazione al ministero

SWGO-INFN a Roma Tor Vergata

Per formalizzare la presenza di Roma Tor Vergata anche come sezione INFN,
che riceverà i fondi PNRR... Senza sigla

Camarri Paolo: 20%

Cardillo Martina: 20% non ancora associato

Feroci Marco: 10%

Liberti Barbara: 20%

Miozzi Silvia: 30%

Morselli Aldo: 10%

Muleri Fabio: 30%

Piano Giovanni: 20% non ancora associato

Rodriguez Fernandez Gonzalo: 10%

Tavani Marco: 10% non ancora associato

Vittorini Valerio: 10% non ancora associato