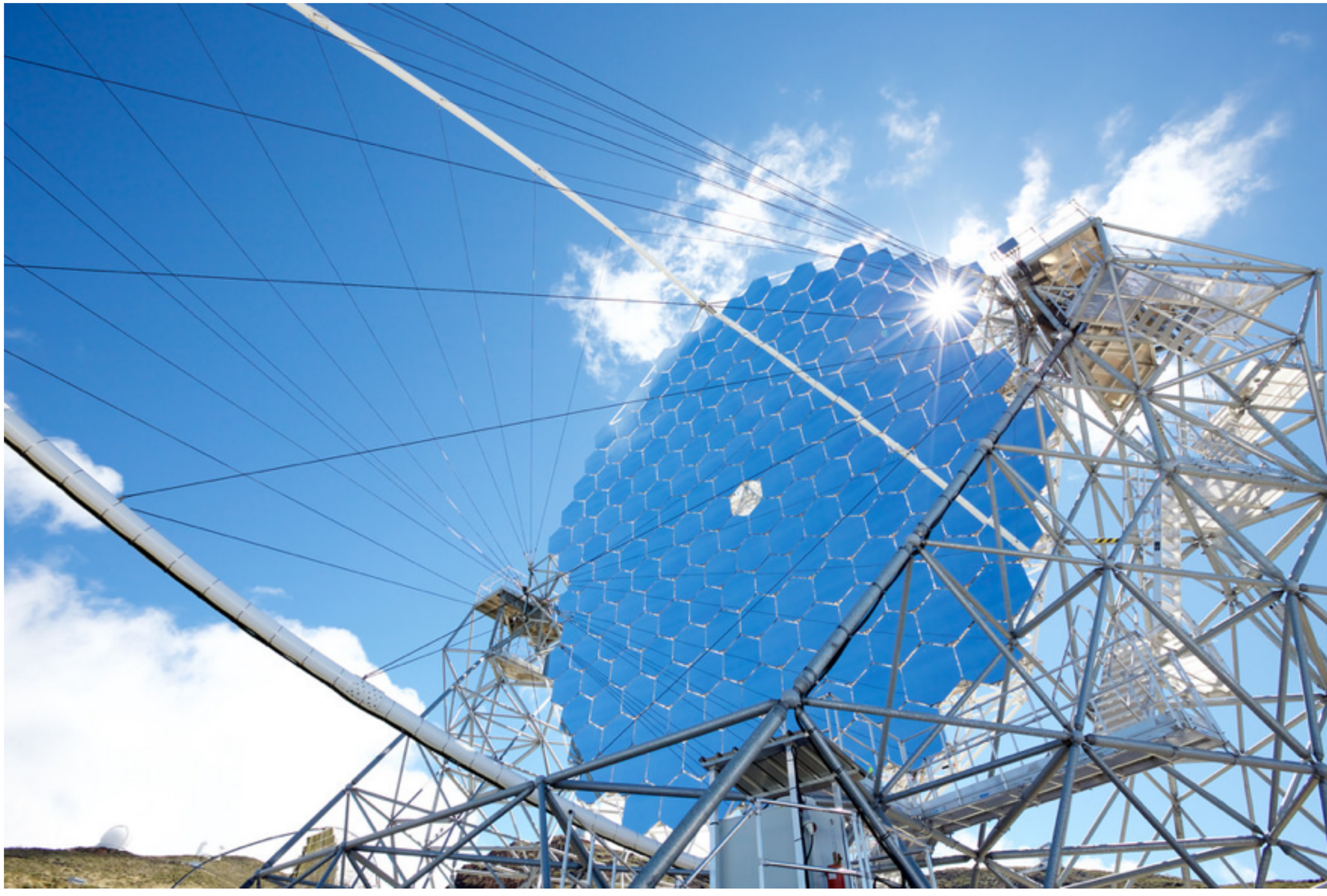


Transient/MWL
SWG status of activities
2019-03-19

Franz

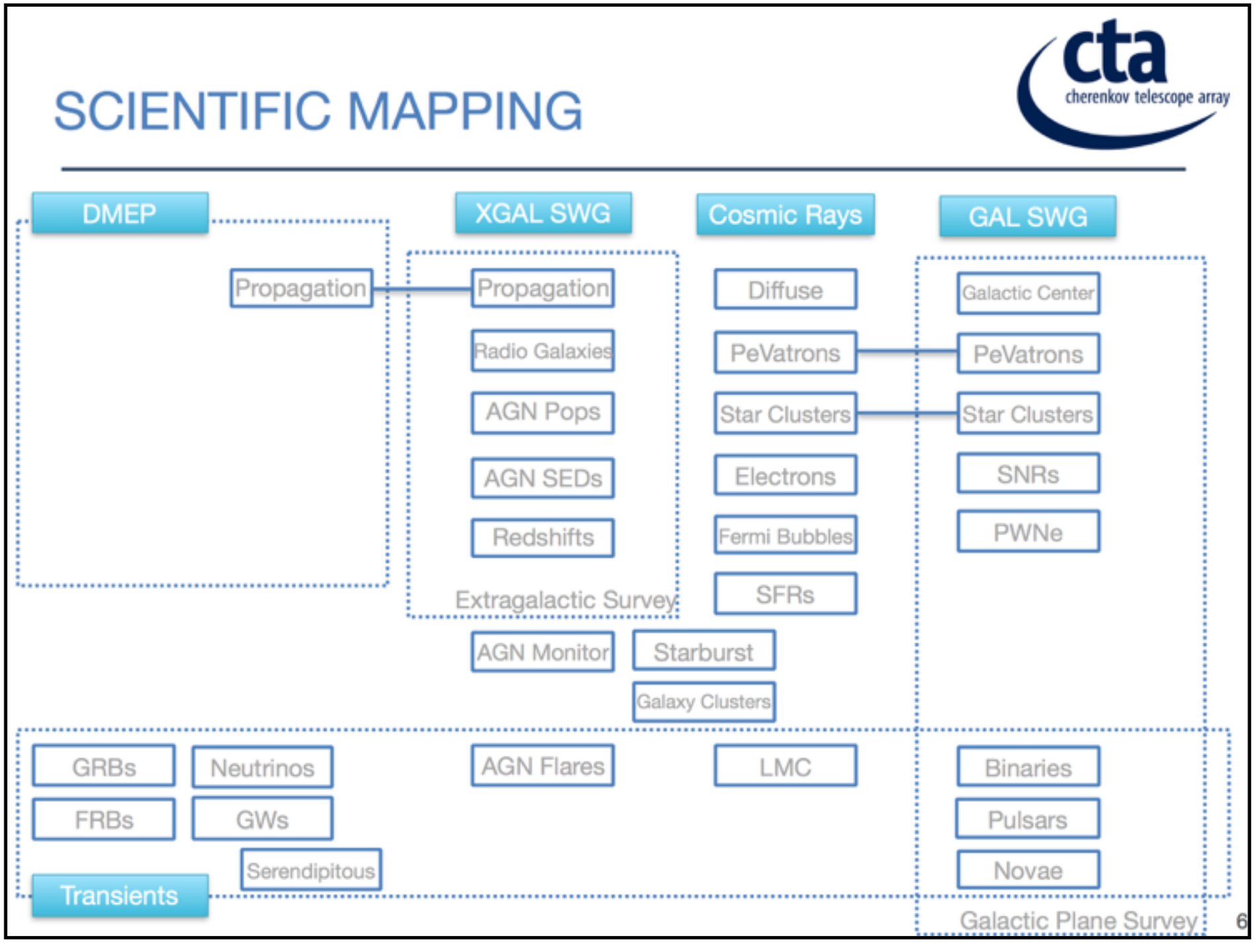
News from the PWG

- Consortium papers list
  - Look at the link provided by Vitor
  - Partecipate to the papers
  - Reserved Targets for CTAC — Key Science Cases and the Science with CTA book.
  - In every CTAC meeting starting in Lugano there will be a presentation about each paper in this list.
- In the Transient PWG
  - Detection rates and studies of Gamma Ray Bursts with the Cherenkov Telescope Array
  - Chasing the counterpart of gravitational wave alerts with the Cherenkov Telescope array: prospect and strategy
  - Neutrino Target of Opportunity program for the Cherenkov Telescope Array
  - (Detectability of) Galactic Transient Sources with Cherenkov Telescope Array
- Possible Non Consortium papers
  - Discuss with SAPO and SWG

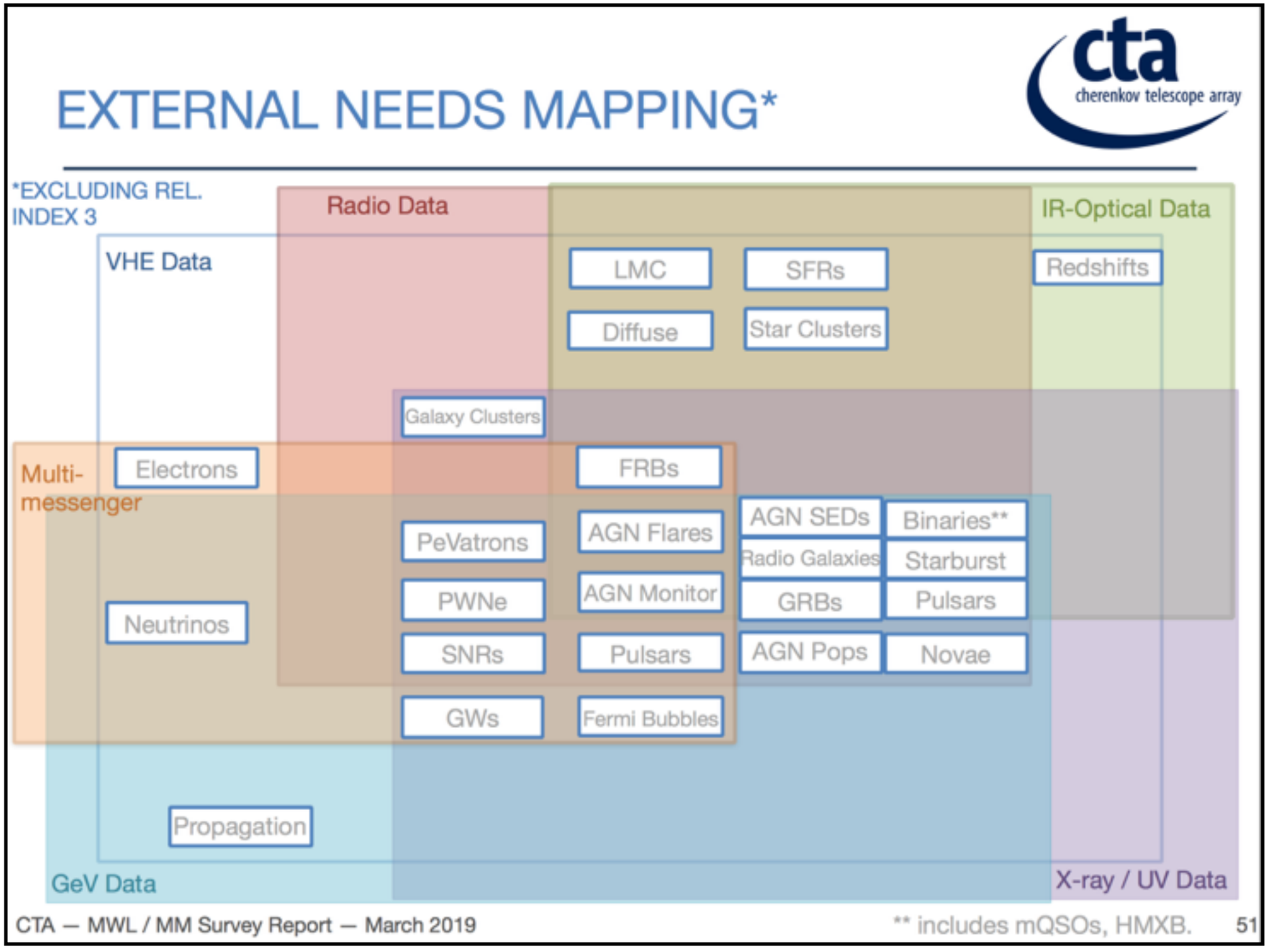
Consortium papers

Subject of the paper	SWG	Preliminary Editorial board
Prospects for the Detection of Gamma Ray Emission from the Perseus Galaxy Cluster with CTA	CR/Diffuse/Dark Matter	Gianfranco Brunetti, Moritz Hütten, Judit Pérez-Romero, Miguel Sánchez-Conde, Stephan Zimmer
The Sensitiviy of CTA to Electron at the Highest Energies	CR/Diffuse	Daniel Parsons, Harm Schoorlemmer, Rubén López-Coto
Prospects form a deep survey of the LMC with CTA	CR/Diffuse/Dark Matter/Galactic	Maria Isabel Bernardos, Fabio Iocco, Pierrick Martin
High-energy astrophysics of the Galactic Center region with the Cherenkov Telescope Array	Diffuse/CR, Galactic	Aion Viana, Daniele Gaggero, Dario Grasso, Dmitry Malyshev, Karl Kosack, Stefan Funk
PeVatron sensitivity with CTA	Galactic	Ekrem Oguzhan Anguner, Heide Costantini, Pierre Cristofari, Cyril Trichard, Gaia Verna
Survey of the Galactic Plane with the Cherenkov Telescope Array	Galactic	Acero F., et a. (lots of people)
(Detectability of) Galactic Transient Sources with Cherenkov Telescope Array	Transient/MWL	Alicia López Oramas, Sandro Mereghetti, Sylvain Chaty, Alessandro Papitto, Brian Humensky, Pierre Cristofari, Lara Sidoli
Neutrino Target of Opportunity program for the Cherenkov Telescope Array	Transient/MWL/ Extragalactic	Elisa Bernardini, Anthony Brown, Marcos Santander, Konstancja Satalecka, Fabian Schussler
Detection rates and studies of Gamma Ray Bursts with the Cherenkov Telescope Array	Transient/MWL	G. Ghirlanda et al. (lots of people)
Chasing the counterpart of gravitational wave alerts with the Cherenkov Telescope array: prospect and strategy	Transient/MWL	A. Stamerra, B. Patricelli, T. Di Girolamo, A. Carosi, F. Schüssler
Active Galactic Nuclei population studies at the very high energies in the Cherenkov Telescope Array era	Extragalactic	Tarek Hassan, A. Brown, A. Dominguez, B. Fraga, M. Nievas- Rosillo, A. Zech
Probing cosmological gamma-ray propagation with the Cherenkov Telescope Array	Extragalactic	Jonathan Biteau, Manel Meyer, Ievgen Vovk, Julien Lefaucheur, Humberto Martinez Huerta
Sensitivity of CTA to a dark matter signal from the Galactic center region	Dark Matter	Torsten Bringmann, Christopher Eckner, Anastasia Sokolenko, Lili Yang, Gabrijela Zaharijas
Search for Dark Matter in Dwarf Spheroidal Galaxies with the Cherenkov Telescope Array	Dark Matter	Michele Doro, Aldo Morselli, Gonzalo Rodriguez Fernandez, Francesco G.Saturni
Sensitivity of CTA to Line-like features from Dark Matter.	Dark Matter	Eirik Hatlen, Clara Bertinelli Salucci, Heidi Sandaker and Torsten Bringmann

MWL activities



MWL activities



Preparation for CTA Symposium (May 6-9)

- Contribution on Transient/MWL group related subjects
  - G.Stratta — CTA Real Time Analysis output from the follow-up of a short GRB
  - B.Patricelli — Searching for Gamma-Ray counterparts to GWs from merging BNSs with CTA
  - A.Bulgarelli — The CTA Real-Time Analysis for the multiwavelength and multimessenger era
  - U.Barres de Almeida — The science of the Cherenkov Telescope Array and its multi-messenger synergies

Consortium paper on GRBs by the Transient/MWL PWG

Report on CTA F2F meeting

The start under best auspices → GRB 190114C !! :-)

Introduction (S. Inoue) on the previous Consortium Paper on GRB detection

PoSyTIVE project structure and discussion:

- ★ WP1: Population of Long and Short GRBs (G. Ghirlanda)
- ★ WP2: Prompt emission model (Z. Bosnjak)
- ★ WP3: Afterglow emission model (L. Nava)
- ★ WP4: Detection of GRBs (F. Longo & T. Stolarczyk)
- ★ WP5: MW follow up (S. D. Vergani)

STATUS

- First checks on Gammapy vs ctools

TO DOs:

- Study of differences in analysis
  - Ctools versus Gammapy
  - Differences in IRF
- Preparation for the population analysis

Consortium paper on GRBs by the Transient/MWL PWG

Report on CTA F2F meeting

PAPER STRUCTURE

1. Introduction
   a. Comparison with previous paper
   b. Motivation
   c. State-of-the-art
2. Model
   a. Population
   b. Prompt
   c. Afterglow
3. SIMULATIONS
   a. Detectability
   b. Ctools
   c. Gammapy
4. RESULTS
   a. Detection rates (Swift and comment about bright and well localised GBM GRBs)
   b. Properties of population detected by CTA (physical parameter space)
   c. Impact on detection strategies (LST, MST, …)
5. GRB 190114C
   a. Compatibility with predicted rate
   b. Simulation for CTA (move at larger z)

Consortium paper on GRBs by the Transient/MWL PWG

Report on CTA F2F meeting

TIMELINE

Submission (to CTA): end of October

- end of Feb: extended BAT6 to 100 GRBs and SBAT4 to 25
- end of Feb: subsample of full pop with new file format
- mid April: reach convergence between gammapy and ctools and test on new file format
- mid April: simulated prompt and afterglow emission for the subsample of detectable GRBs
- end of May: first draft with Model and Simulations sections
- end of June: results from the simulation of the full population
- end of July: internal first draft

Consortium paper on GRBs by the Transient/MWL PWG

- Where we are?
- Ready to simulate the “big” population
  - Visibility criteria
  - Cross checks for afterglow simulation ongoing
  - Still to be done the validation wrt to LAT prompt properties
- Gammapy analysis&simulation well advanced
  - Need to provide a ctools based pipeline
  - Help is needed …
  - ctools much “slower”?
- Cross check and comparisons with RTA ongoing

GW Consortium paper by the Transient/MWL PWG

Scheme of activities

FUTURE DEVELOPMENT **TO BE DONE**

Barbara | Lara | Thomas | Monica

Population of BNS mergers

19000 BNS merger with:
- sky map
- source in sky map
- uniformly distributed in sky
- clumpy galaxy distribution

sGRB model

Phenomenological model of on-axis sGRB.
Spectra + LC + vary PL index (between models)

simple modelling for off-axis emission.
rescale off-axis model

+ off-axis emission and afterglow/delayed emission

Pointing pattern

- Define pointing pattern from sky map
- get duration of pointing
- pointing optimization:
- - the sooner the better
- - source in the fov to simulate the pointing

Pointing duration

INPUT: SGRB model(s)
CTA sensitivity/IRF
OUTPUT: duration of pointing
Add a distribution of the time delay around 3 minutes (average for GW events).

For each pointing beginning at t_1, the observation ending time t_2 happens when the integrated flux is equal to the sensitivity of CTA for $t_2 - t_1$

Different model for simulation

Simulations

INPUTS: model, source position, pointings, duration, parameters for IRF choice
OUTPUT: simulate each pointing and find if the source is present

Merging: Either each pointing is simulated separately or it's merged with previous pointing(s) and then analised: then the source detection is performed.
Search: clustering algorithms in (x, y, t)? Li&Ma with ON/OFF for the significance. Wavelet for detection? others? False positives in the detection?
Stop criteria: next pointing is too long, we hit some maximum observation time (CTA plan, physical constraints, source below horizon, dawn, etc...).
Hot spot found! --> keep observing that place

Repository using redmine in preparation (similar to the GRB group)

GW Consortium paper by the Transient/MWL PWG

Phase 1 (now!)

Make the machinery work!

- **Basic *working* chain** from task-1 to task-4
  - 2D maps + distance distribution
  - LC and spectrum template for sGRB (e.g. the 090510 with rescaled luminosity as in Patricelli+2018)
  - **simple geometrical off-axis for top-hat jet**
  - **Ctools scripts to derive detection from full-CTA and single ZA (20 deg)**
  - **Simple Implementation of strategy (e.g. enhance coverage; set pointing sequence using galaxies as priors;...) -> Meeting in Saclay-IRFU**

models for each GW event are now in production

done

in progress

not yet started

in **BOLD** *changes respect to previous report in January*

GW Consortium paper by the Transient/MWL PWG

Phase 2 (start: Jan.2019)

Tune up the machinery

- Improve and finalise the chain
  - Use 3D maps or 2D maps+enhanced distance distribution
  - LC and spectra from GRB Fermi/LAT catalogue (expect.: Dec. 2018) and from reasonable assumptions on VHE emission
  - **estimation of off-axis emission and delayed emission**
  - Improve Ctools and Gammapy scripts interfacing with task-2 and task-4
  - Include IRF at different ZA; include IRF for threshold configurations; IRF for divergent mode (if available)
  - Set simulations to optimise strategy on GW alerts parameters (distance, FAR, ...) and on Array configurations

done

in progress

not yet started

in **BOLD** *changes respect to previous report in January*

Summer School in Sexten (June 24 - 28, 2019)

- Dedicated to Multimessenger analysis in the CTA era
- Program being finalised in these days
- Analysis of CTA, Fermi and GW data foreseen

SEXTEN CENTER FOR ASTROPHYSICS

- More info will be posted at this link