

Searching for optical counterparts of gravitational waves and neutrino triggers

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D. Dornic et al. (neutrinos trigger)

E. Chassande et al. (GW trigger)

S. Basa (image analysis)

- Strategy to associate GW triggers to astronomical sources
- Strategy to associate neutrino triggers to astronomical sources
- The TAROT experience
- Extension to a Telescope Network

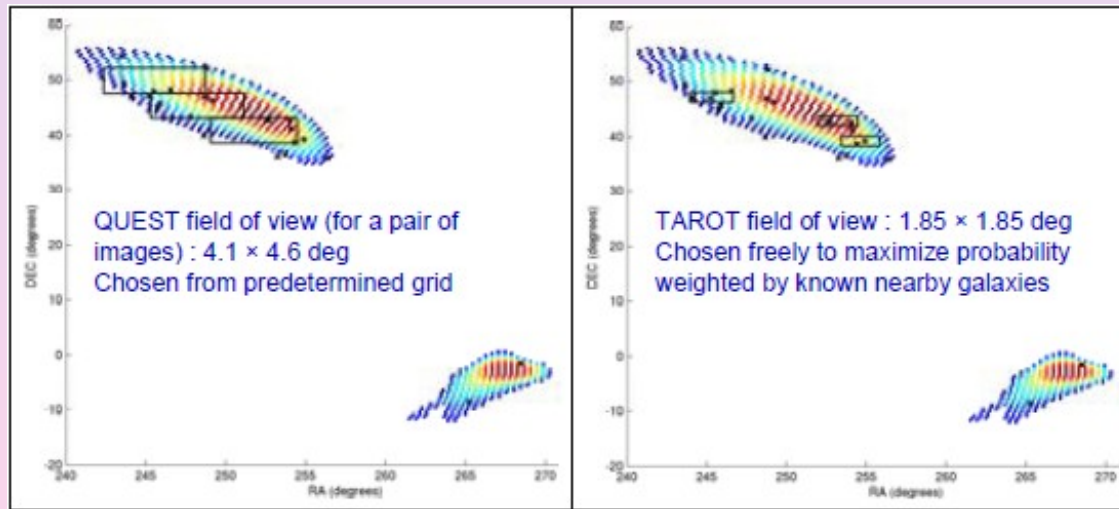
Strategy to associate GW triggers to astronomical sources

Identify simultaneous GW event candidates ASAP:

3 interferometers: Ligo Handford, Ligo Linvingston, Virgo Pisa
A stellar-mass black hole / neutron star binary inspiral can be detected out to a maximum distance of ~50 Mpc

Determine apparent arrival direction:

Coherent WaveBurst and Omega Pipeline can localize very strong GW signals to better than one degree (in 15-30 minutes) :



GW large islands
+ Hyper Leda <50 Mpc
= small islands

Obtain prompt optical images follow up:

TAROT, QUEST, and Pi of the Sky (soon Rotse, Sky Mapper) => **Loocup**

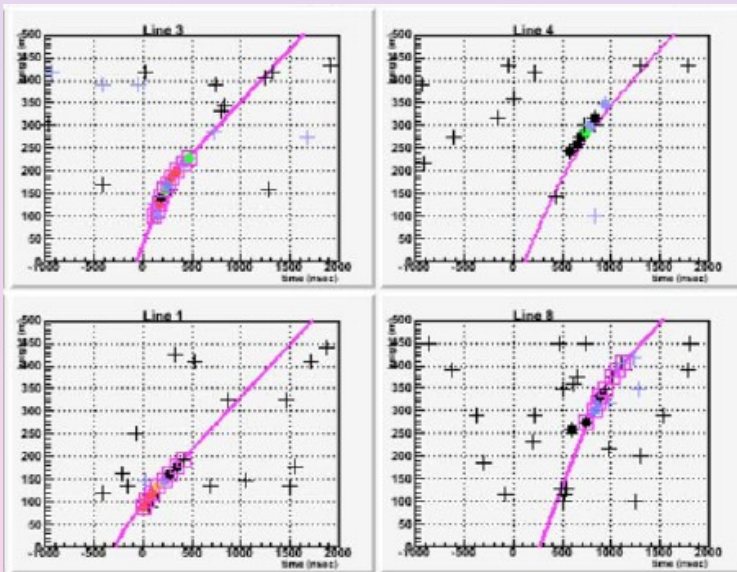
Strategy to associate neutrino triggers to astronomical sources

Identify simultaneous photomultiplier event candidates ASAP:

Antares : 10 lines using photomultipliers for Cherenkov muons / TeV neutrino
Candidates until a distance of ~ 10 Mpc

Determine apparent arrival direction:

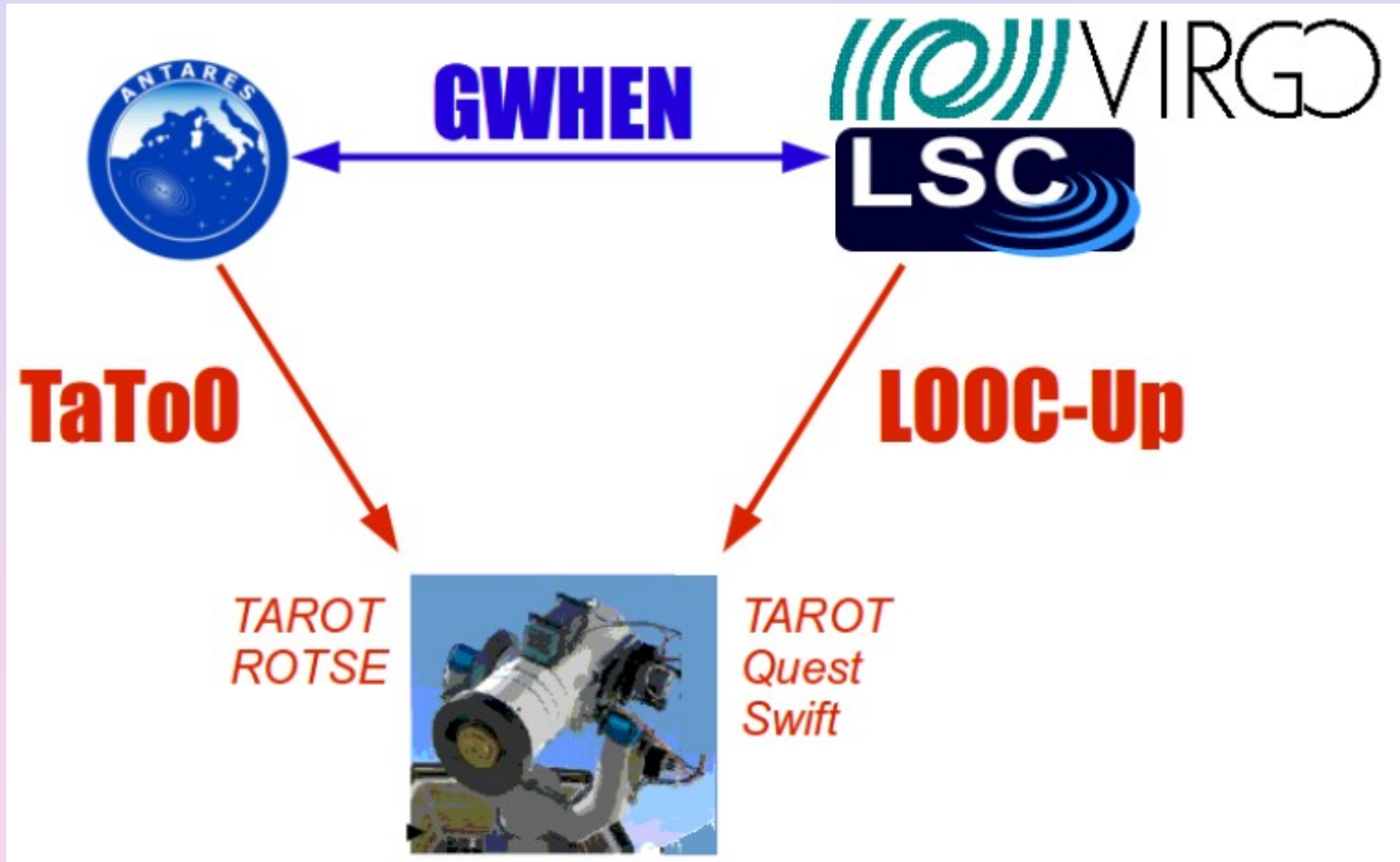
Triangulation of photomultipliers: 1° and 0.5° after refinement (few hours)



Obtain prompt optical images + follow up:

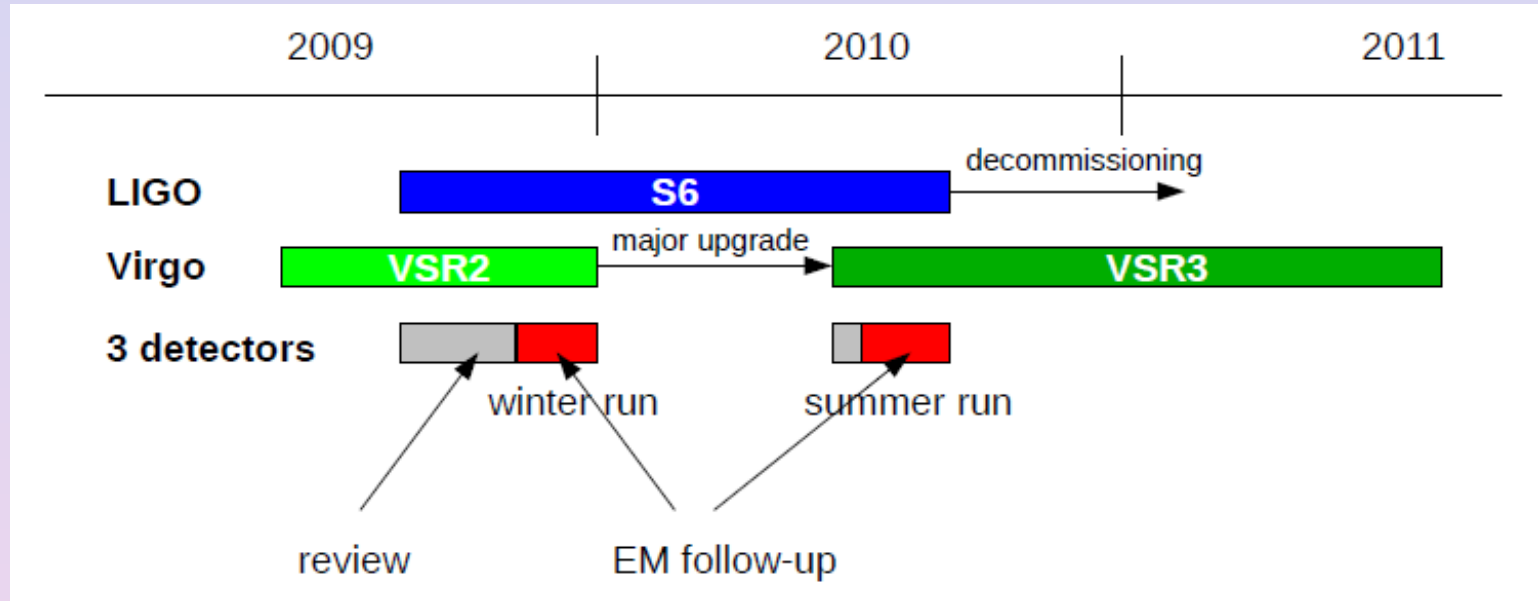
- TAROT, Rotse => TaToO

Coincidences between GW and neutrino triggers



Analyse des images commune : S. Basa

Timeline



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
ANTARES KM3NeT	5L	10L	12L							KM3NeT	
VIRGO	VSR1		VIRGO+						Advanced VIRGO		
LIGO	LSR1		eLIGO						Advanced LIGO		

The TAROT experience

2 télescopes robotiques en fonctionnement continu :

- **TAROT Calern** : depuis 1998 (D=25cm , FoV=2°)
- **TAROT LA Silla** : depuis 2006 (D=25cm , FoV=2°)

Swift GRB triggers:

- 100 triggers observed since 2004 (Klotz et al. 2009 AJ 137)

Antares triggers:

- 13 triggers observed since 2009
(not published)

Loocup triggers:

- 3 triggers observed since 2010 (not published) 6

Extension to a Telescope Network

3 finished robotic telescopes :

- **TAROT Calern** : since 1998 (D=25cm , FoV=2°)
- **TAROT La Silla** : since 2006 (D=25cm , FoV=2°)
- **Zadko Gingin** : since 2010 (D=100cm , FoV=0.3°)

3 projects of robotic telescopes :

- AstrAcad OHP** : project 2013 (D=50cm , FoV=0.5°)
- F-GFT San Pedro Martir** : project 2014 (D=100cm , FoV=0.5°)
- ONA Algeria** : project 2015 (D=60cm , FoV=1°)