



SENSITIVITY AND DISCOVERY POTENTIAL FOR GALACTIC POINT- LIKE SOURCES



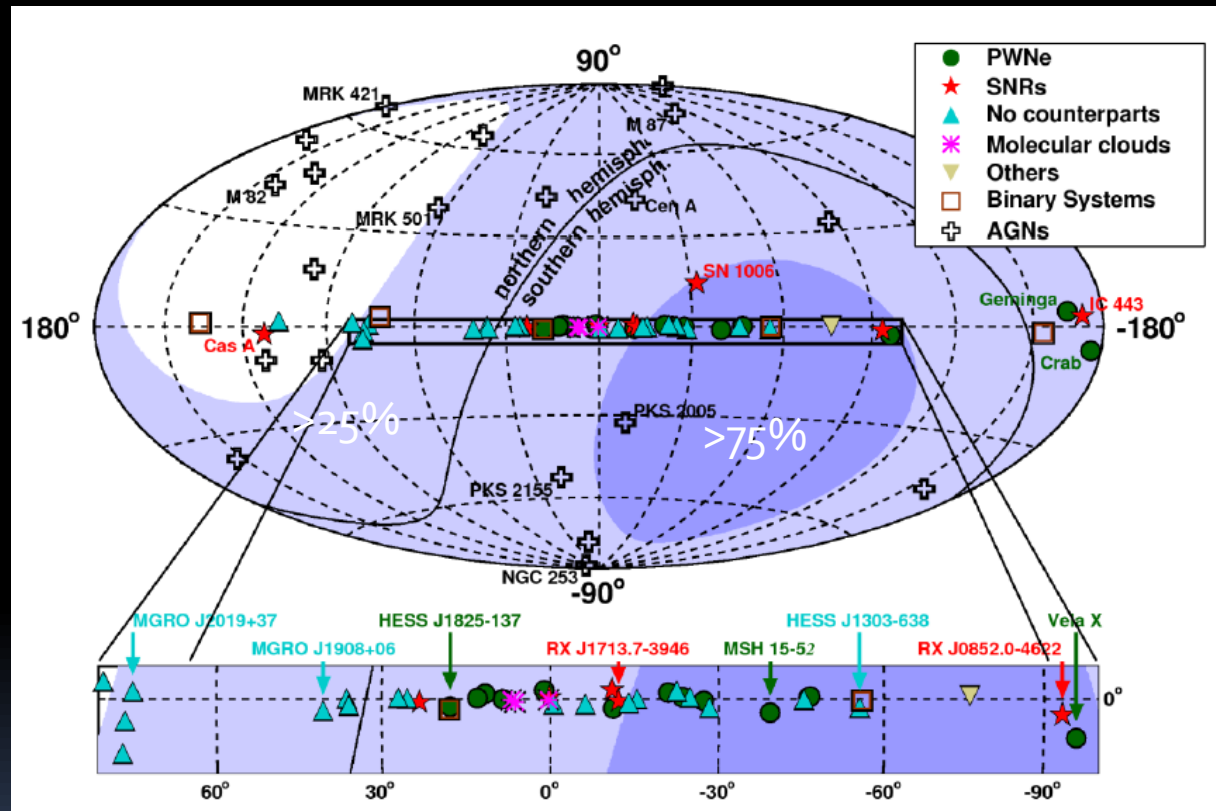
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for the KM₃NeT collaboration

Physics case

- Origin of Cosmic Rays and Astrophysical n sources
 - Galactic Candidate n Sources (SNRs, Fermi Bubbles, microquasar,...)
 - Extragalactic Candidate n Sources (AGN, GRB, ...)
- Detection from Galactic sources and in particular from SNRs is one of the main physics objective of KM₃NeT
 - Detector optimization

Sky view of a Mediterranean Sea telescope (up-going neutrinos)

From Mediterranean
24h per day visibility
up to $d \sim -50^\circ$



➤ KM₃NeT coverage of most of the sky (87%) including the Galactic Centre

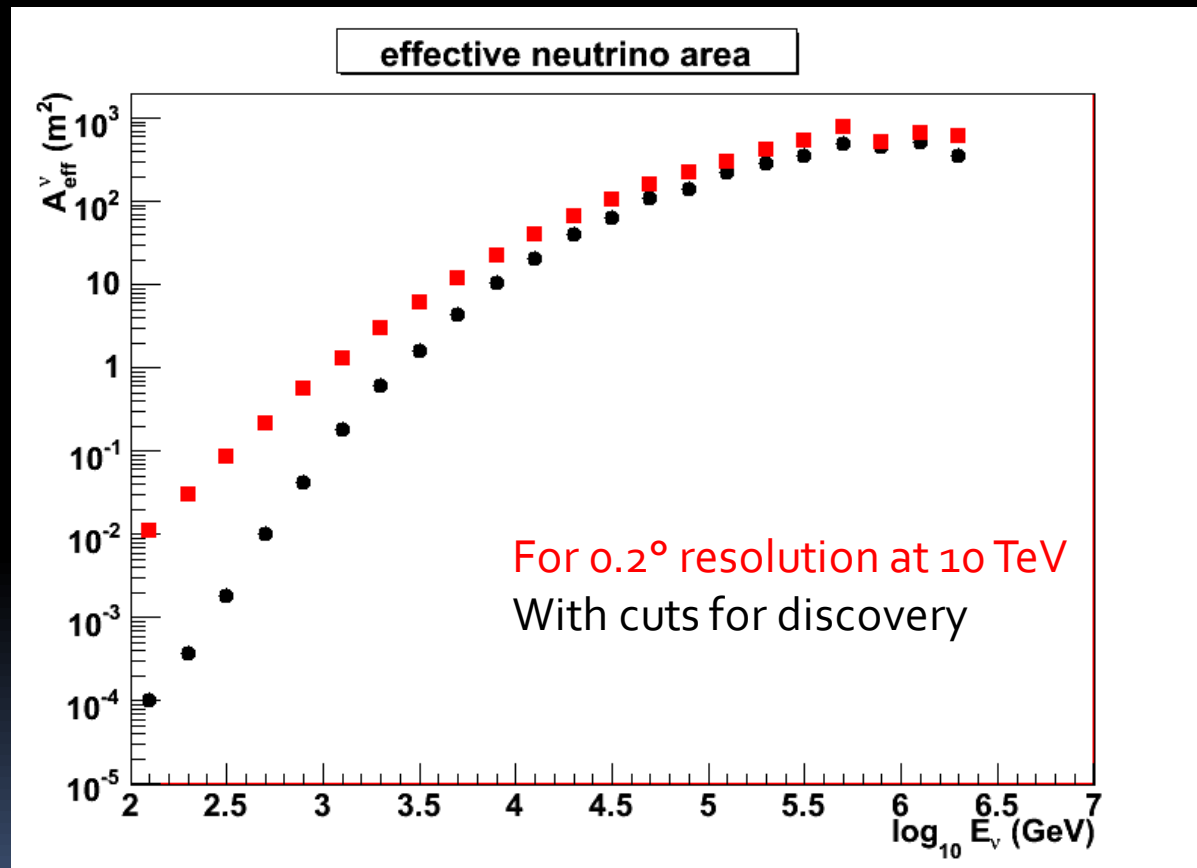
The KM₃NeT detector

- ▶ DOMTOWER: 20 storey (DOMBAR), 40 m spacing
 - ▶ DOMBAR 6 m long with 2 multi-PMT OM (DOM)
 - ▶ *PRO => local 3D OM arrangement resolve ambiguities in the reconstruction of the muon azimuthal angle, compact transport and ease deployment procedure*
 - ▶ *Allow implementation of very efficient, high purity trigger*
- ▶ Multi-PMT Optical Module
 - ▶ *PRO => Single vs multi-photon hit separation, better background rejection*
- ▶ Detector optimisation in progress
- ▶ Deployment of first DU prototype planned in 2012

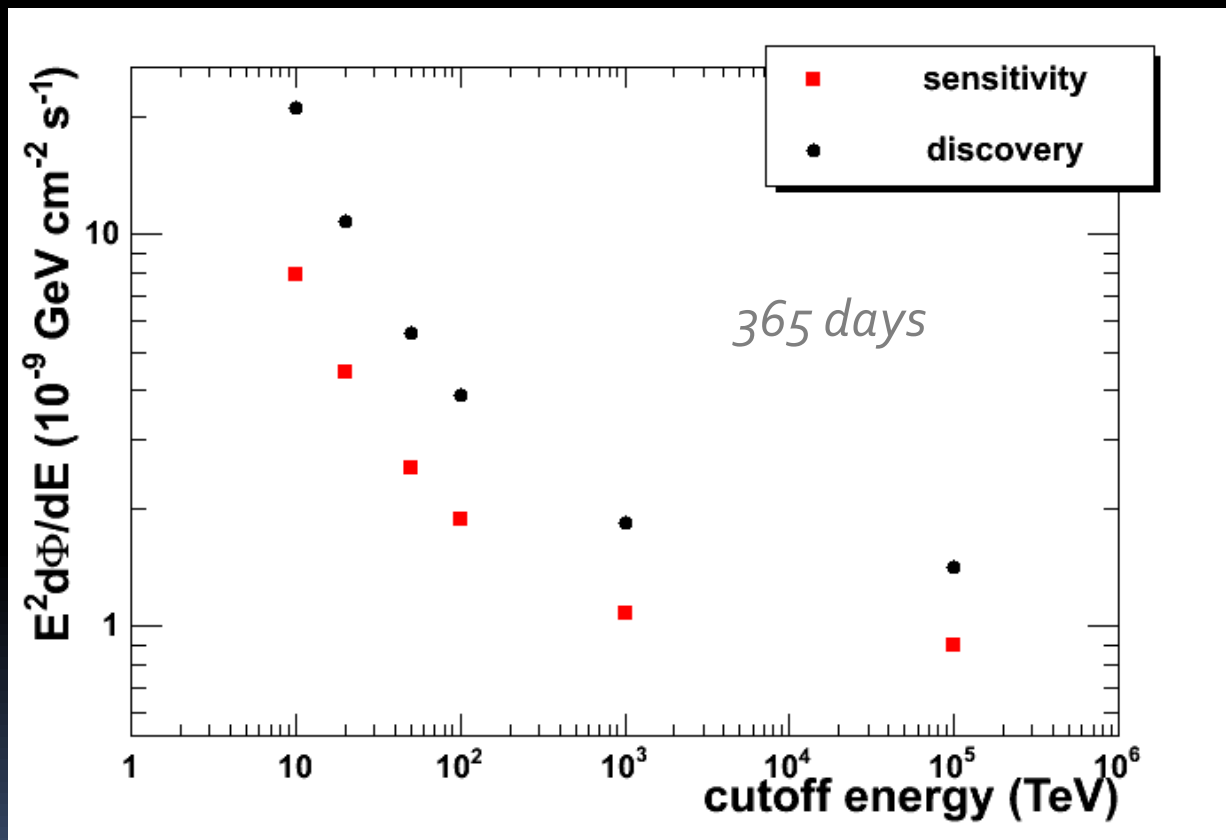
Simulations

- Antares code modified for KM₃NeT
- Trigger and Reconstruction modified for Multi-PMT
- For known candidate sources -> reconstruction exploit info on direction

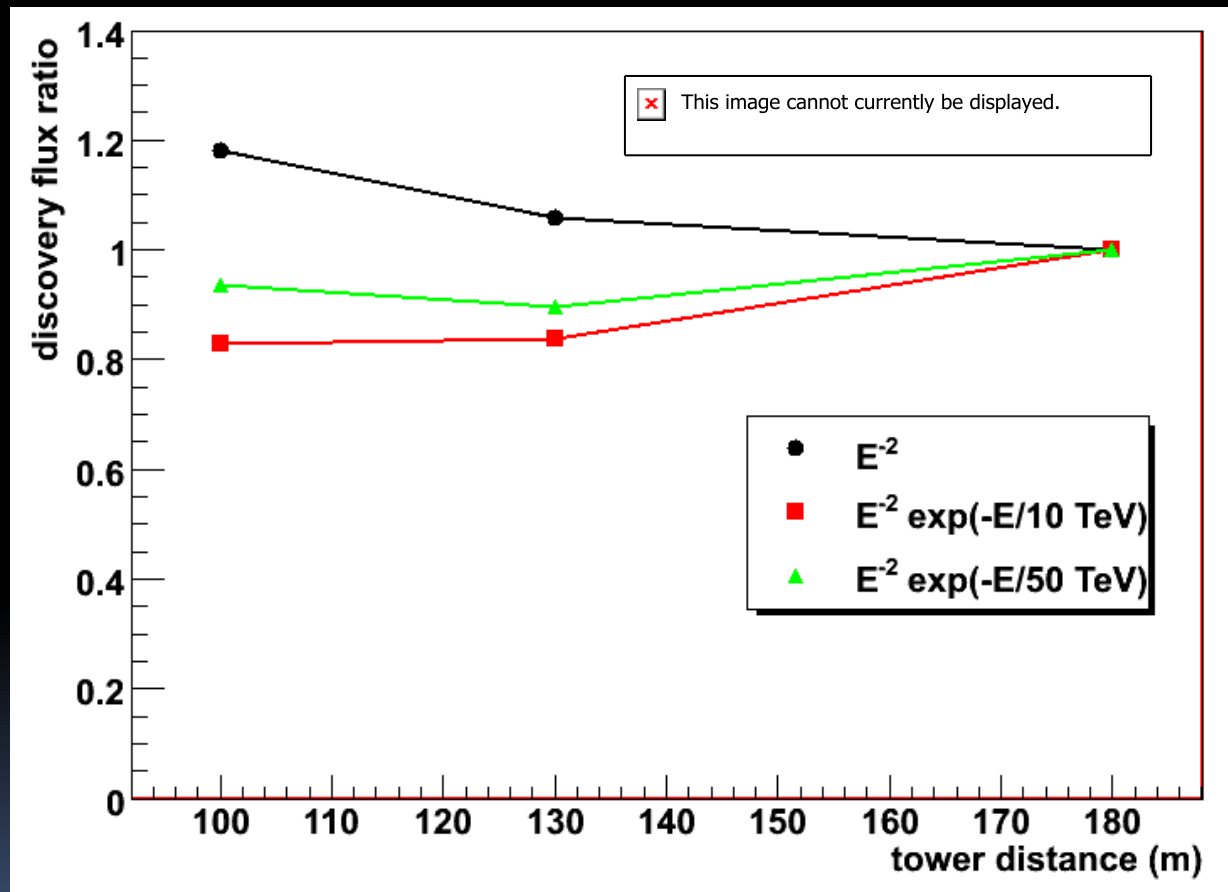
Effective neutrino area: up-going neutrinos



Sensitivity and 5σ discovery vs Energy Cut-off (E^{-2} spectrum)

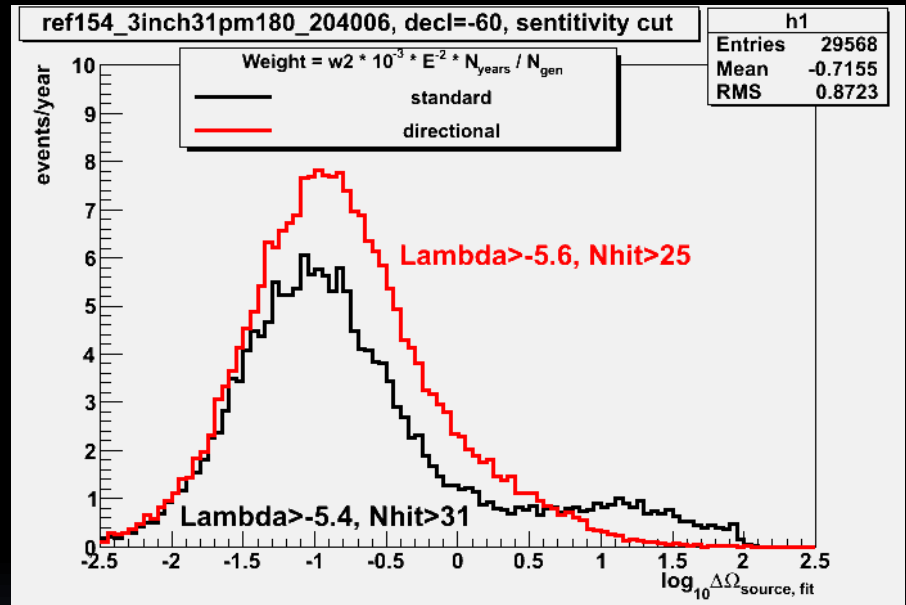


Point-like Discovery vs DU distance



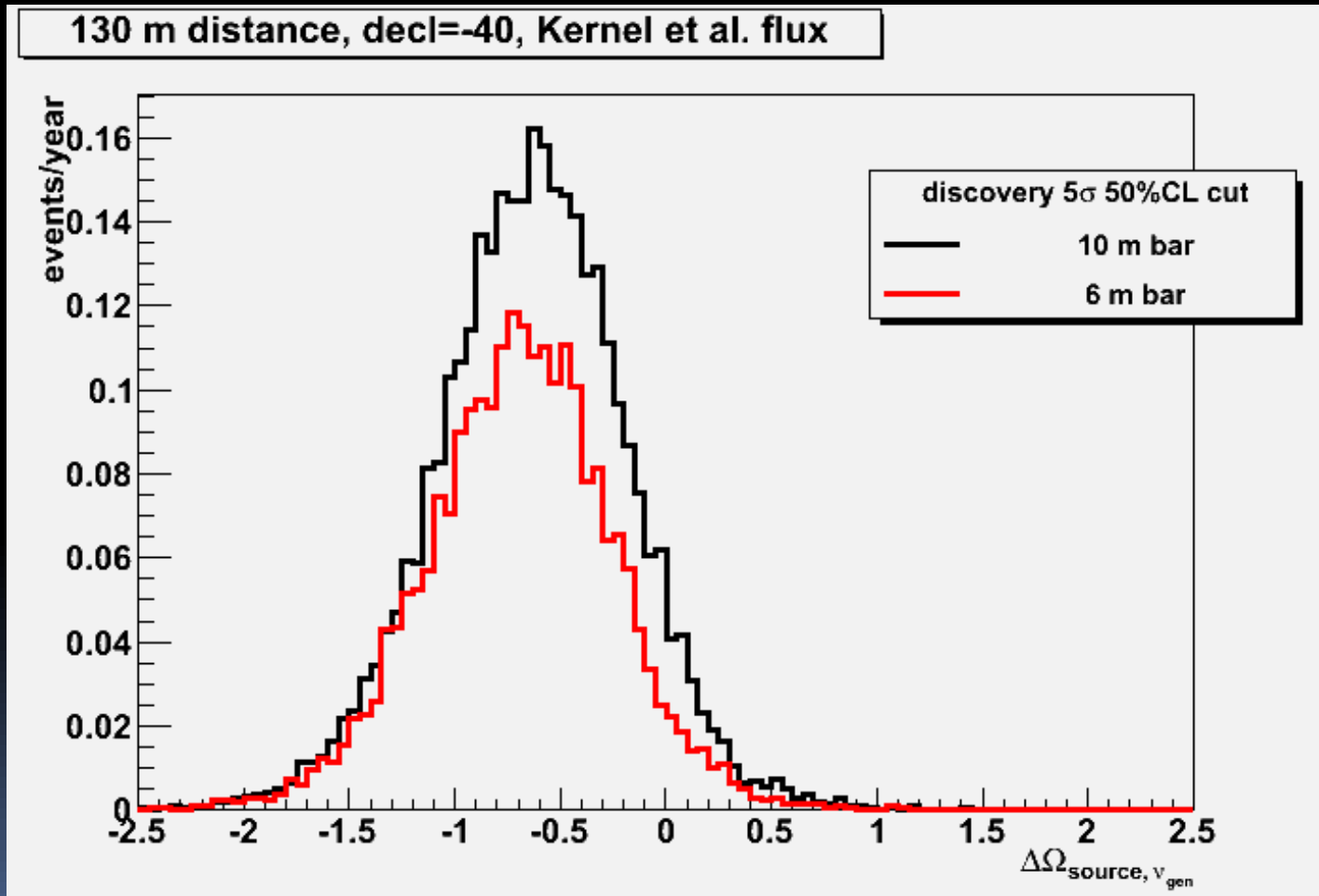
Point-like angular accuracy for known sources - E^{-2} spectrum -

310 DU Detector
 180m DU spacing,
 20m storey spacing
 6m storey length



Reconstr.	Sensitivity	Disc. 3σ 50%	Disc. 5σ 50%
Standard	$1.14 \cdot 10^{-9}$	$1.61 \cdot 10^{-9}$	$1.88 \cdot 10^{-9}$
Directional	$0.89 \cdot 10^{-9}$	$1.26 \cdot 10^{-9}$	$1.41 \cdot 10^{-9}$

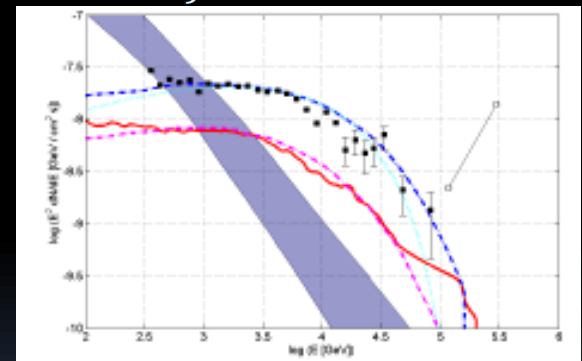
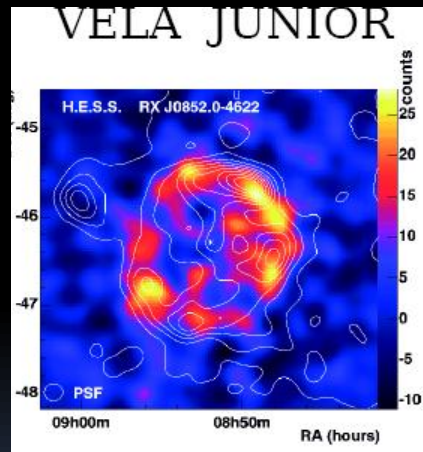
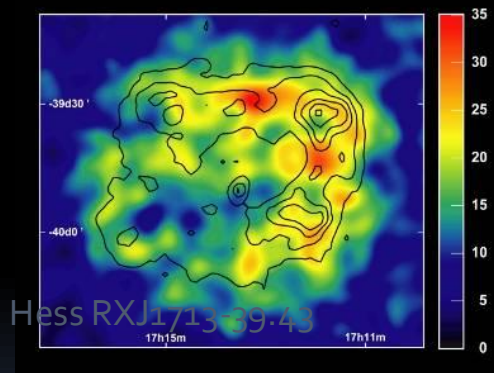
Bar length dependence – Point-like source



Galactic Candidate γ Sources: SNRs

Origin of Cosmic Rays => SNR paradigm, hints from VHE γ but no conclusive evidence about CR acceleration RXJ1713-39.43 and Vela JR best candidates

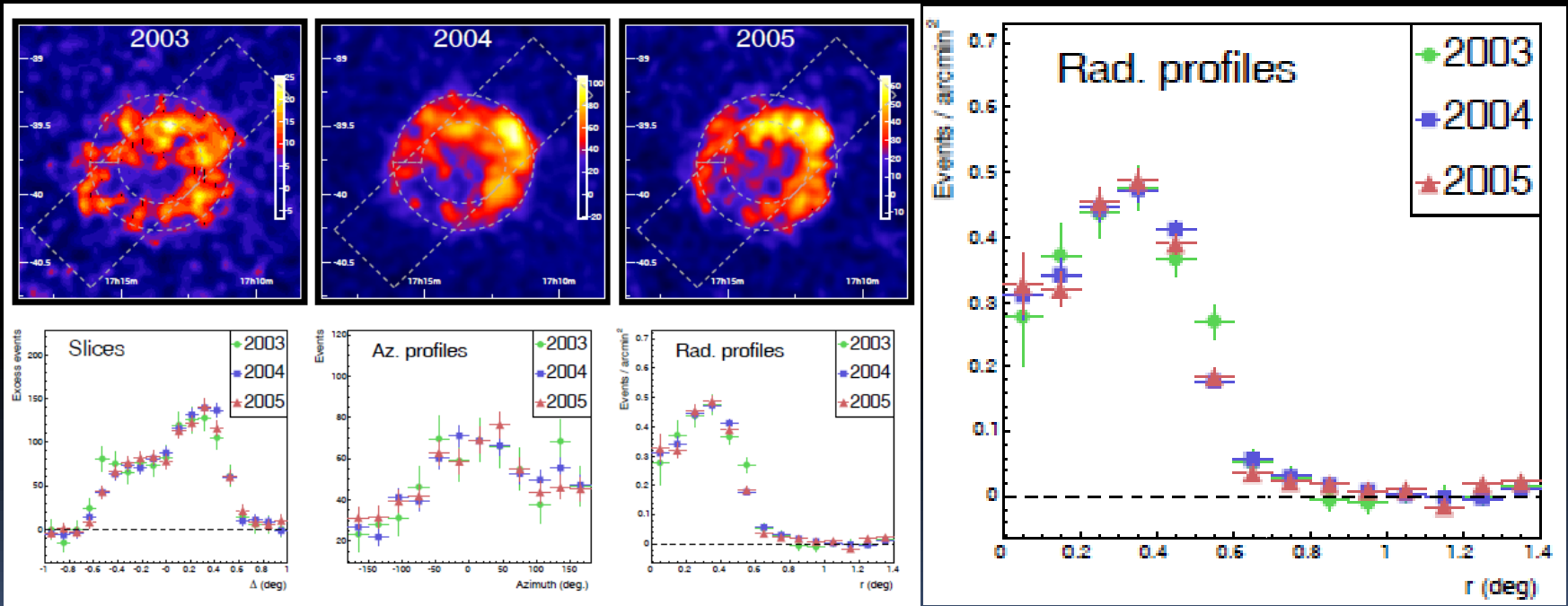
RXJ1713-39.43
IF hadronic mechanisms => ν spectrum can be calculated from VHE γ spectrum (solid red line Vissani)



RXJ1713 morphology

- H.E.S.S. observations

F. Aharonian et al. *Astronomy and Astrophysics* 2008



RXJ1713-39.46 Simulation

- Flat disk with 0.6° radius -> conservative
- Energy Spectrum and Flux from Kelner et al.

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- Binned Analysis
- Reconstruction based on Likelihood without Energy Dependence

RXJ1713 Detection vs bar length

RXJ1713	bar	years for discovery	signal	bkg
3σ ext. 0.6°	6 m	2.9	7.90	4.77
5σ ext. 0.6°	6 m	8.0	21.81	12.86
3σ ext. 0.6°	10 m	2.5	8.71	5.96
5σ ext. 0.6°	10 m	6.9	25.0	17.7

- Detection time decrease with increasing bar length

RXJ1713 detection vs source extension

RXJ1713	bar	years for discovery	signal	bkg
3σ point-like	10 m	1.1	3.22	0.46
5σ point-like	10 m	3.1	9.27	1.40
3σ ext. 0.5°	10 m	2.1	8.33	5.34
5σ ext. 0.5°	10 m	5.8	22.60	14.07
3σ ext. 0.6°	10 m	2.5	8.71	5.96
5σ ext. 0.6°	10 m	6.9	25.0	17.7

- Strong dependence on source extension
- Next step => take into account source morphology



To do list

- Continue optimisation for Galactic Sources
- Include energy dependence on Likelihood
- Study impact of RXJ1713 morphology on detection
- ...