A Population of TeV Pulsar Wind Nebulae in the H.E.S.S. Galactic Plane Survey

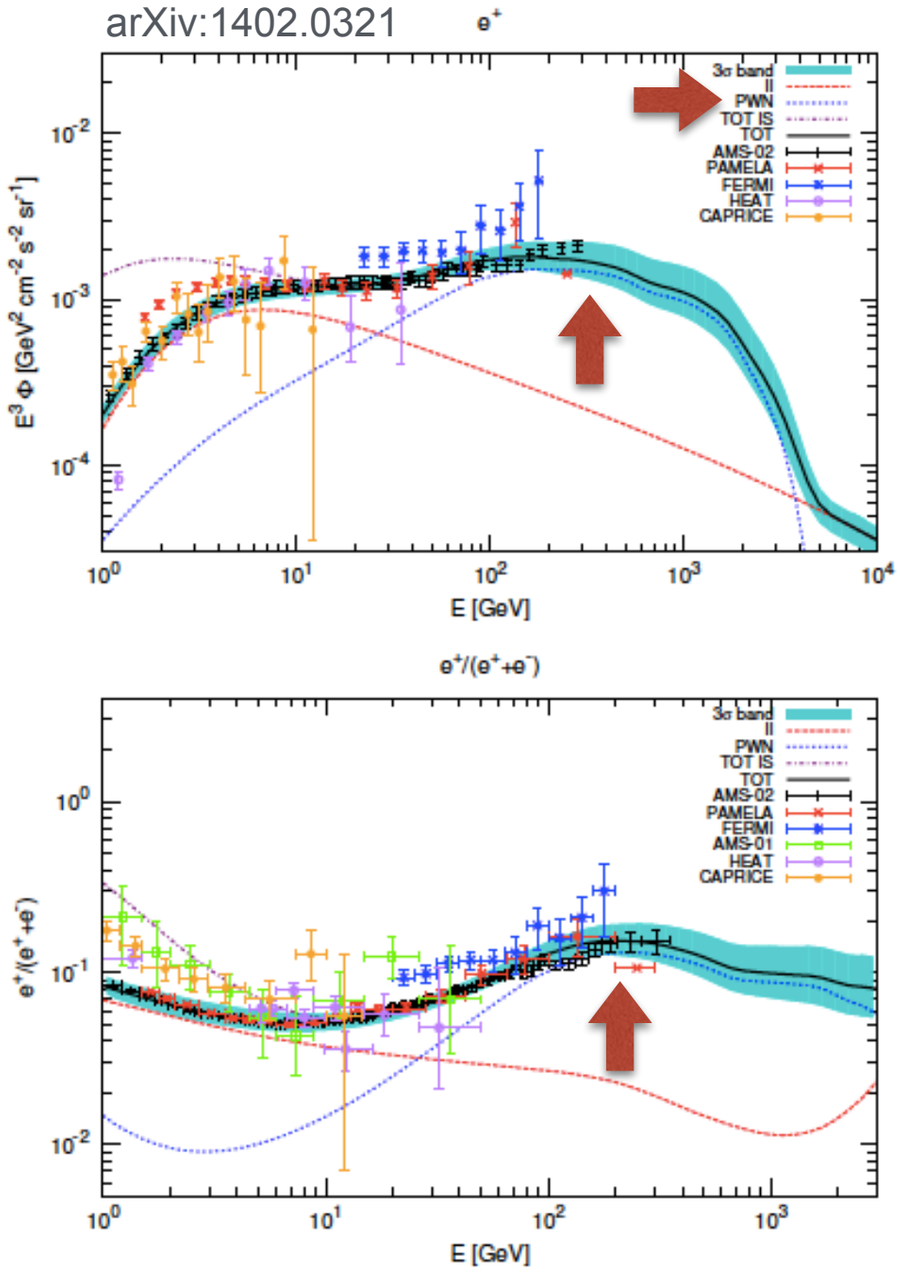
S. Klepser*, A. Förster, M. Mayer, K. Valerius
for the H.E.S.S. Collaboration
ICRC, The Hague, Summer 2015

A Population of PWNe (or Plerions) in the HGPS

S. Klepser*, A. Förster, M. Mayer, K. Valerius
for the H.E.S.S. Collaboration
ICRC, The Hague, Summer 2015

Motivations for this Study I

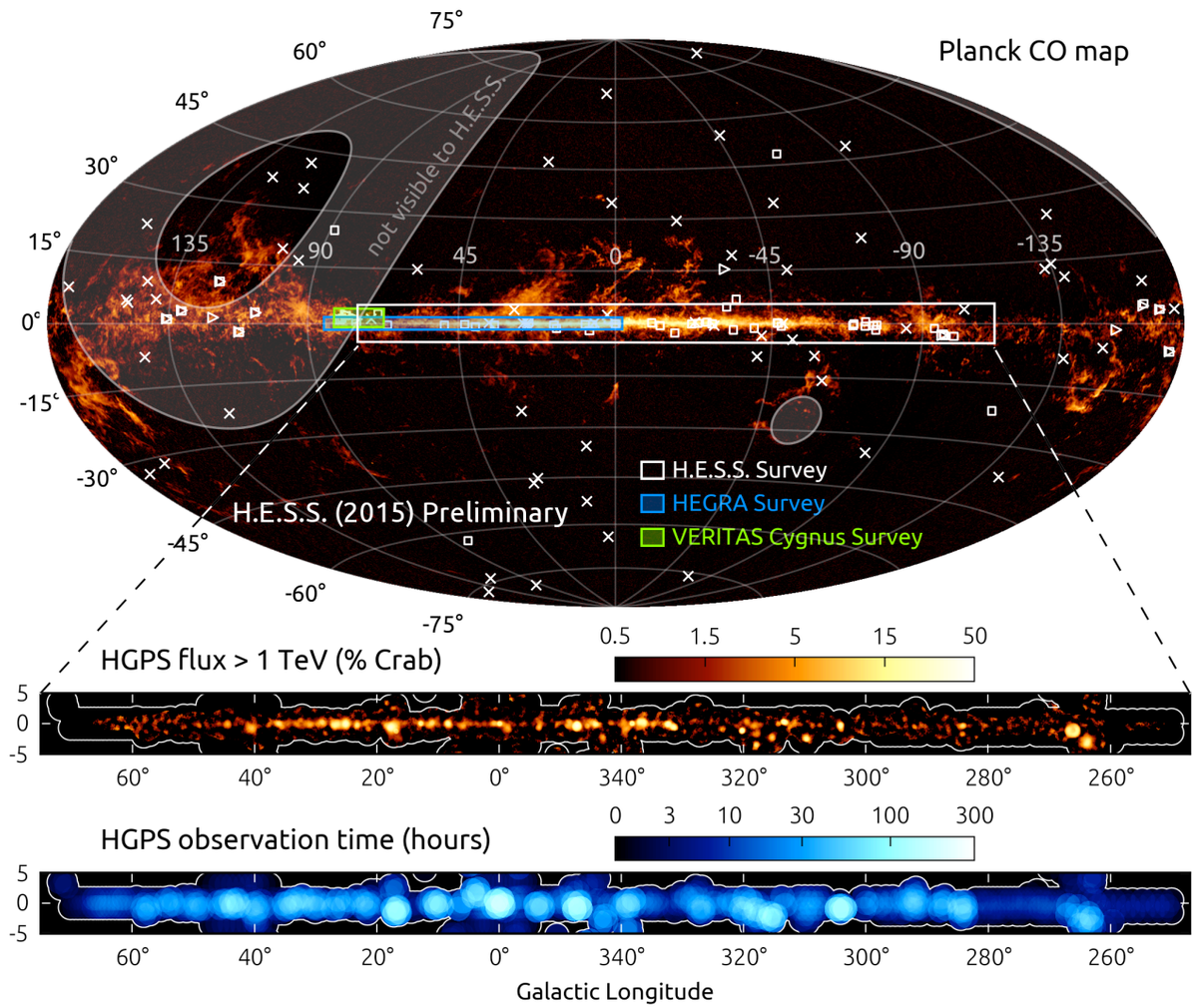
- Pulsar systems are the null hypothesis for the local positron excess



Motivations for this Study II

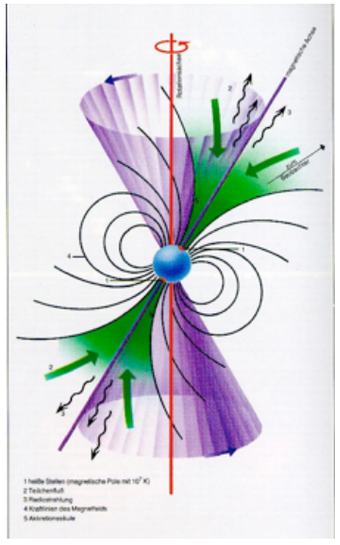
- Plerions are the most frequent type of TeV-detected particle accelerator in the Galaxy

H.E.S.S. Galactic Plane Survey (HGPS, Tue, 14:00)

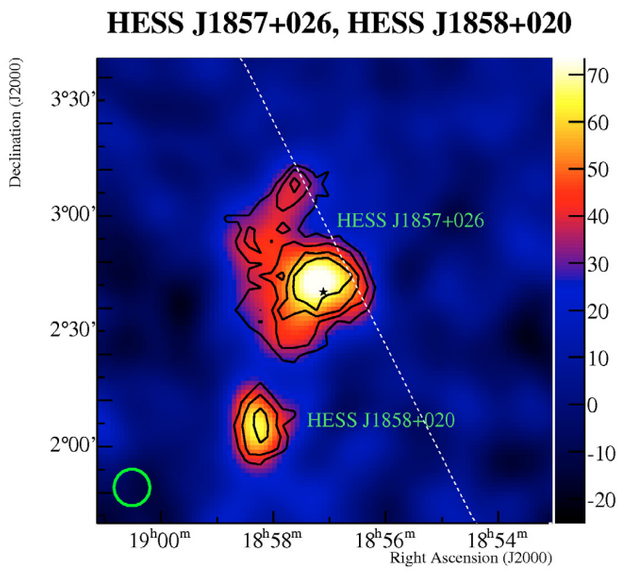


Motivations for this Study III

- There are many TeV-only detected PWN *candidates*

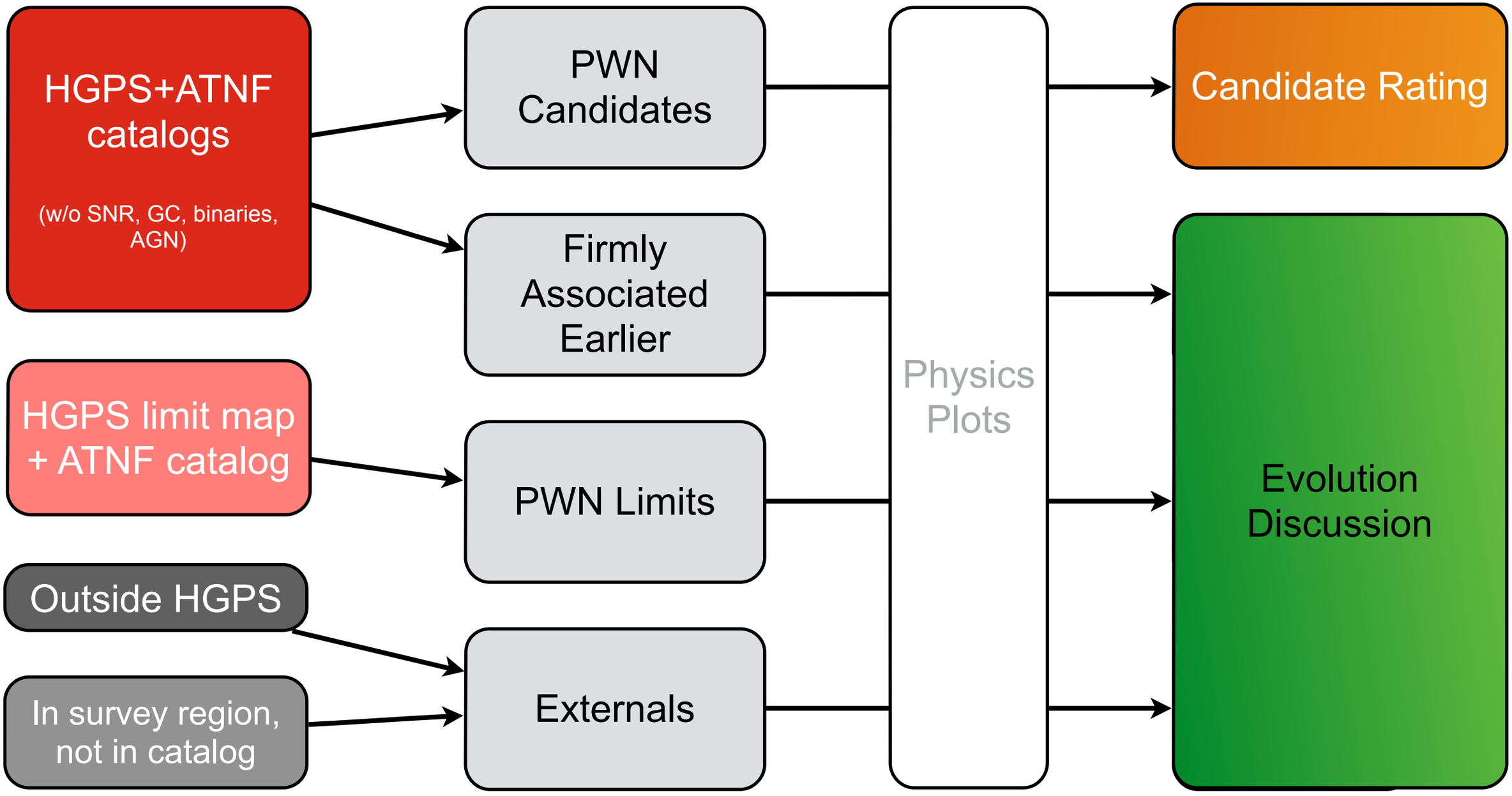


+



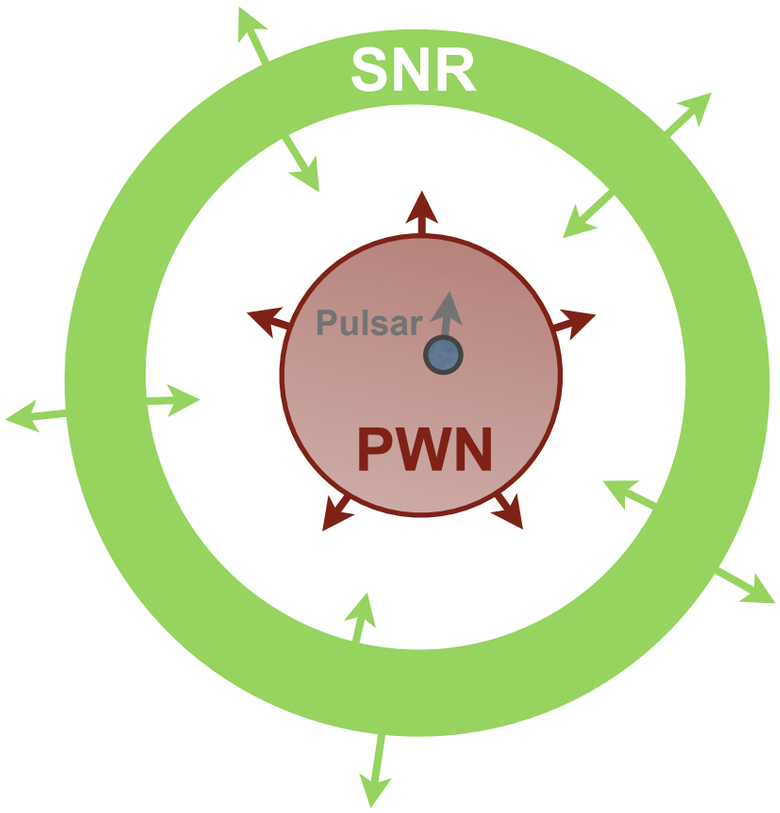
= PWN?

The data we bring together



PWN Evolution in a Nutshell

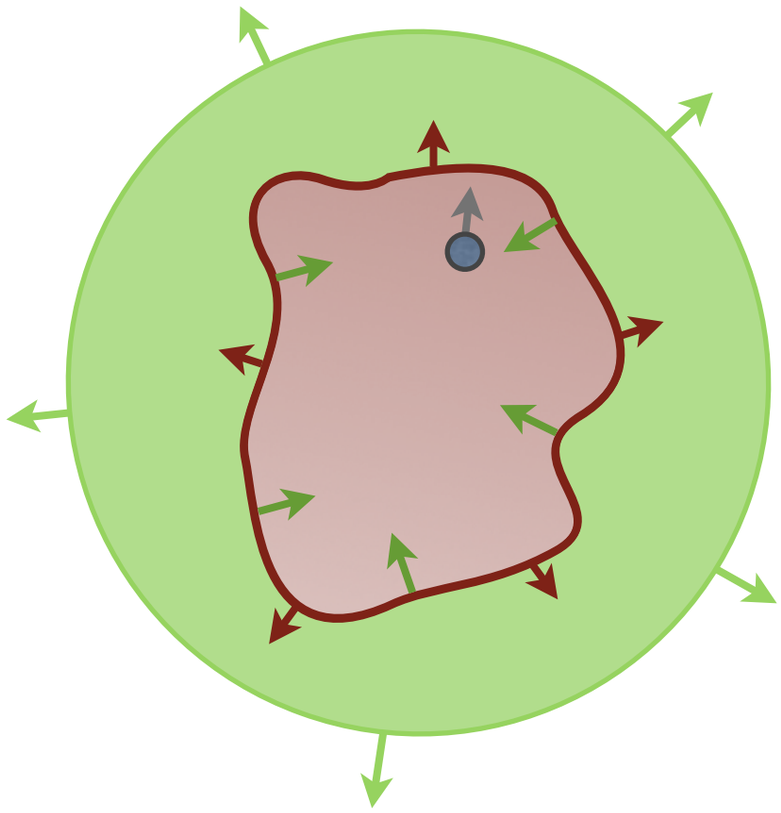
Free expansion



- Easy & independent
- $R \sim t^{6/5}$
- All the Crab wisdom, e.g.
  - Kennel & Coroniti 1984
  - Martín++, 2012
  - ...

2-6 kyr

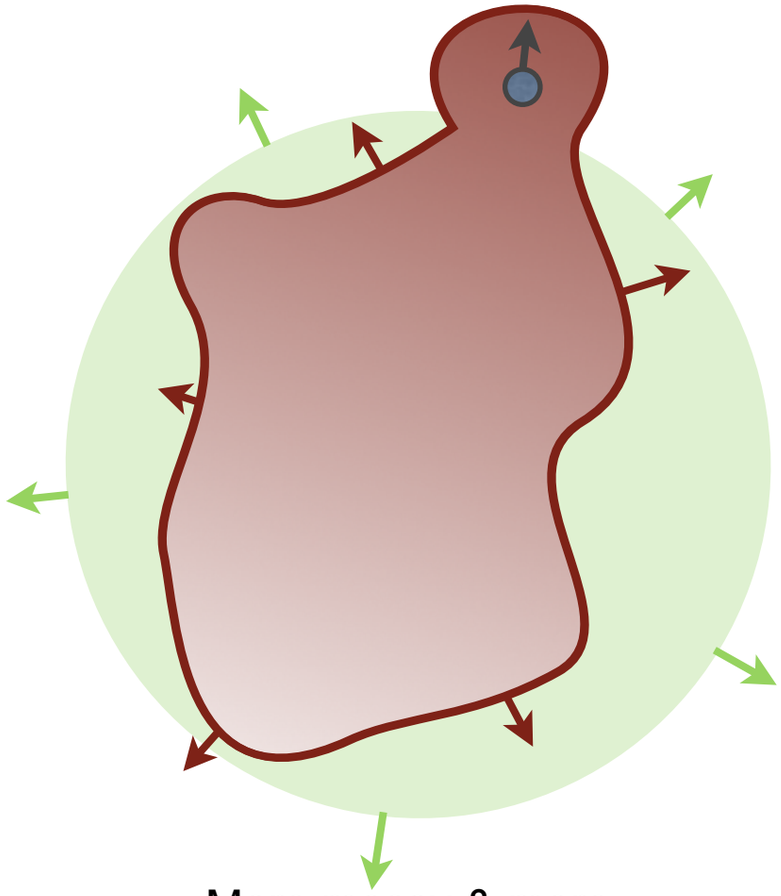
Reverse shock interaction



- Messy & depending on SNR development
- Oscillative reverbations
- Analytically $R \sim t^{0.3}$
- Only over-idealized and/or numerical wisdom
  - Swaluw++ 2001,2004
  - ...

20-100 kyr?

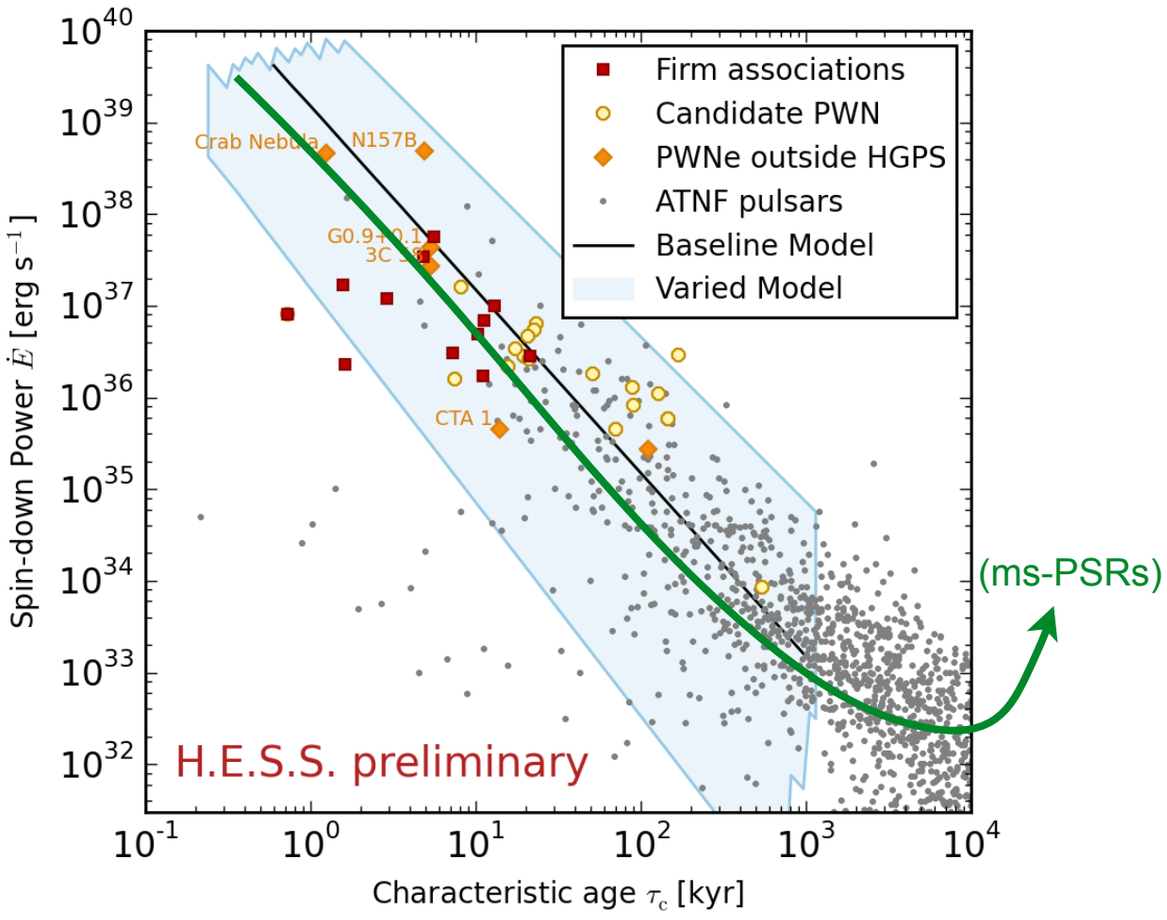
Relic stage

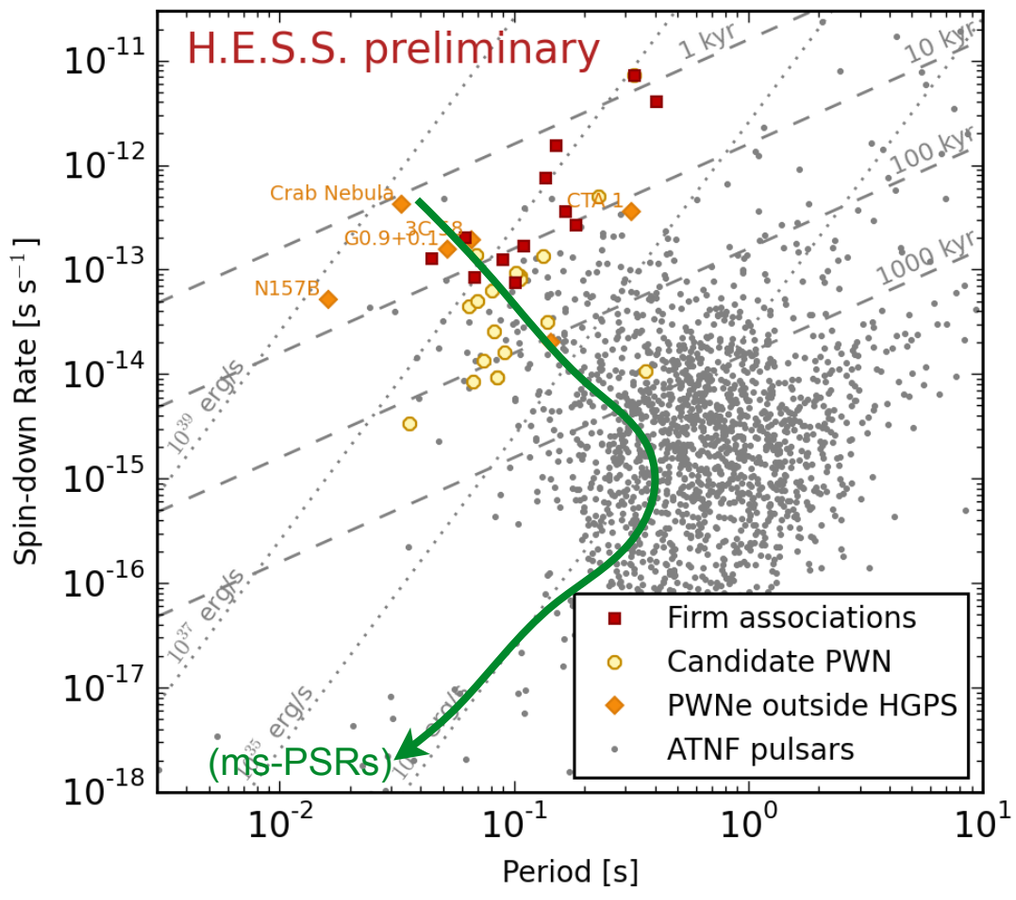


- More messy & more depending on SNR dev. & surroundings
- R ~ undefined
- Only case-by-case wisdom

Characterising Evolution

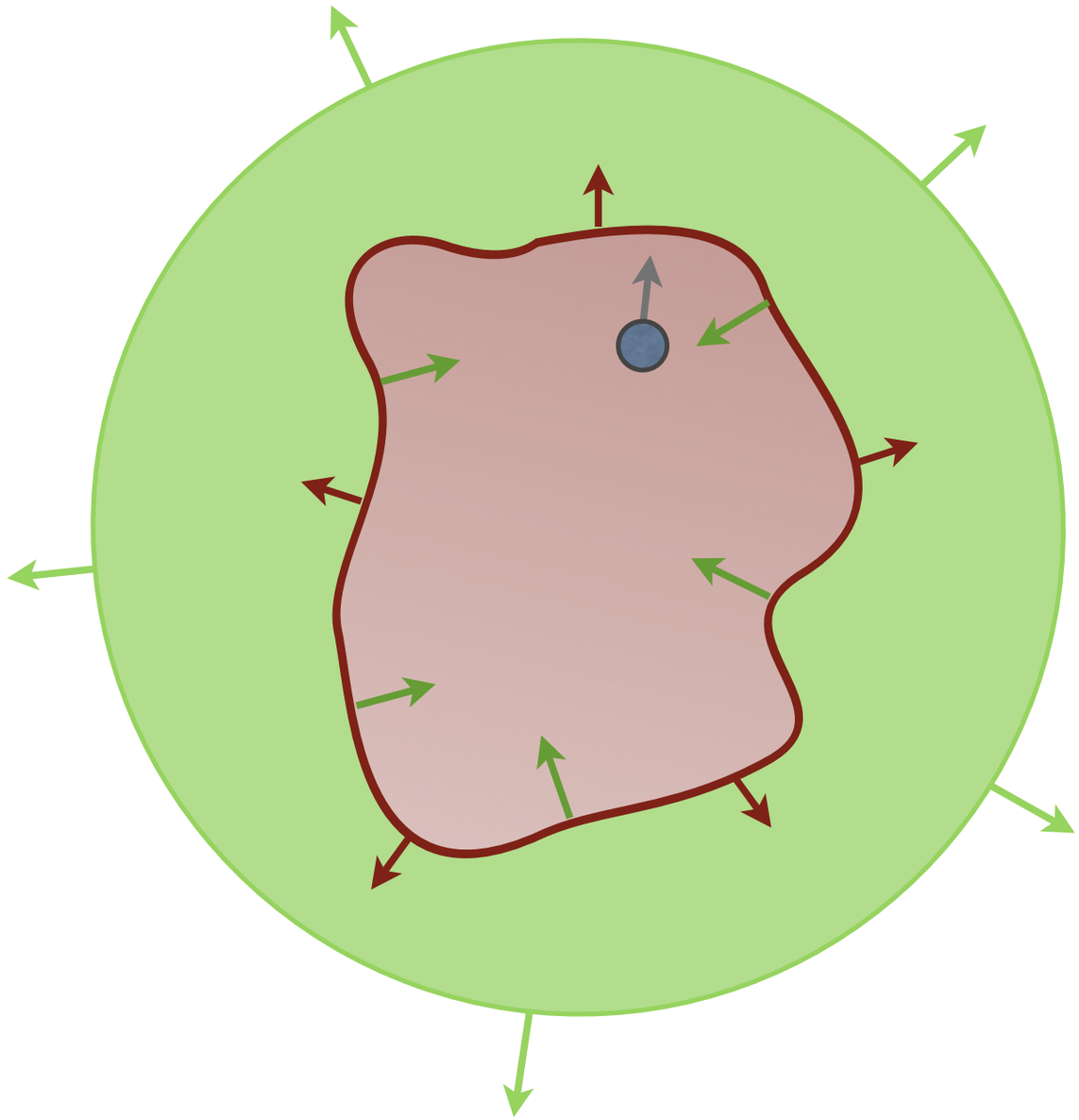
- Abscissae: Characteristic Age and Edot





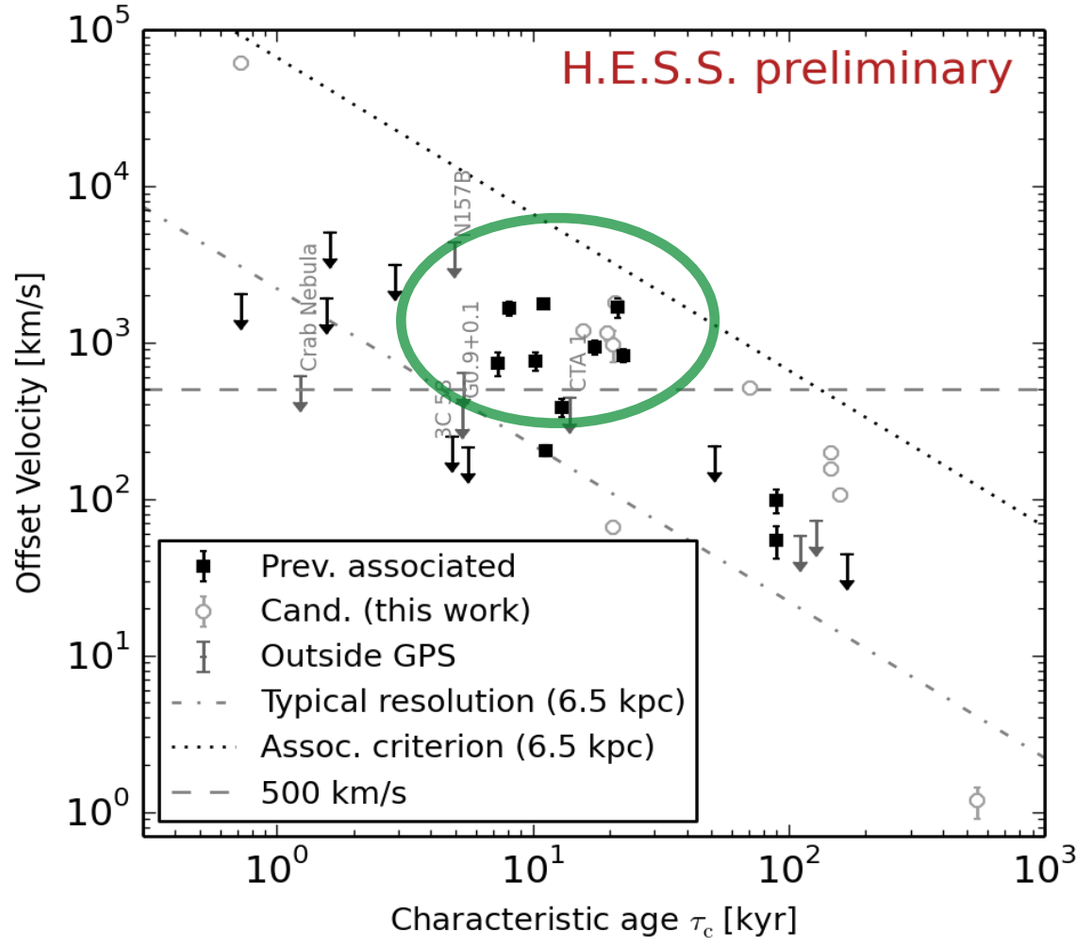
Characterising Evolution

- Ordinates:
  - Pulsar offset
  - PWN Extension
  - PWN Luminosity



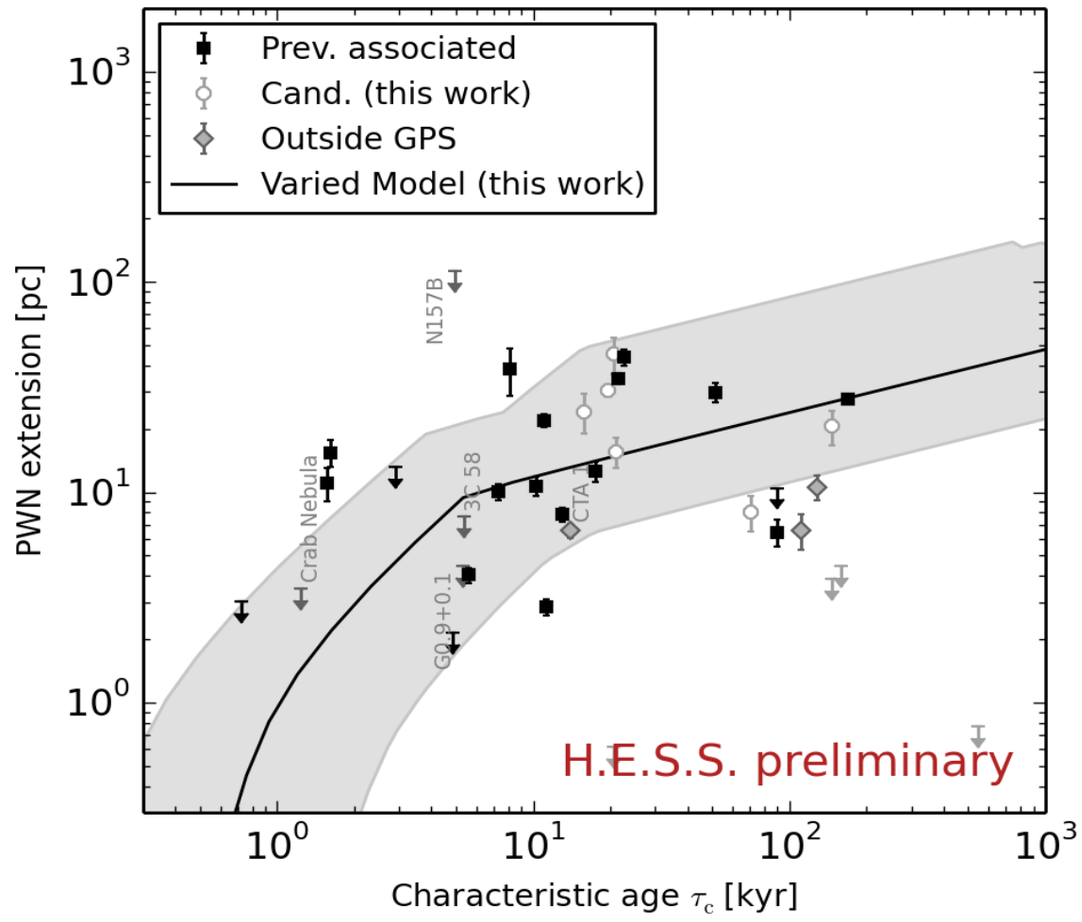
Pulsar Offset

- Typical offset velocity is larger than typical PSR motion
- SNR crushing in middle-aged PWNe!



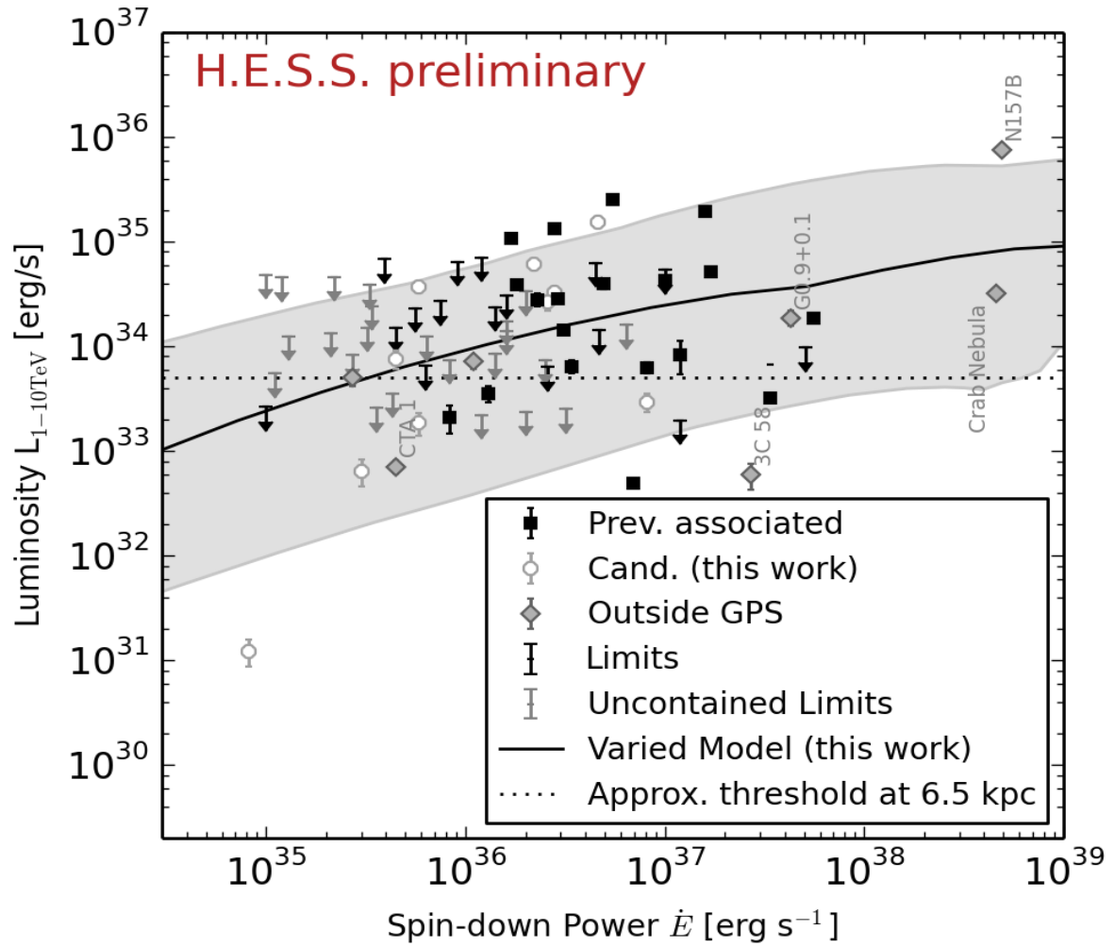
Pulsar Extension

- Expanding with time
- Consistent with theory
  - (precise coefficients not much constraint though…)



PWN Luminosity

- Fading of old PWNe
- First time possible to see it, thanks to the HGPS limits!



Summary and Outlook

- TeV astronomy is good for population studies now
- First glimpses at what is a "typical PWN evolution"
- Paper is on the way, release in sync with HGPS
  (Talk on Tue, 14:00)