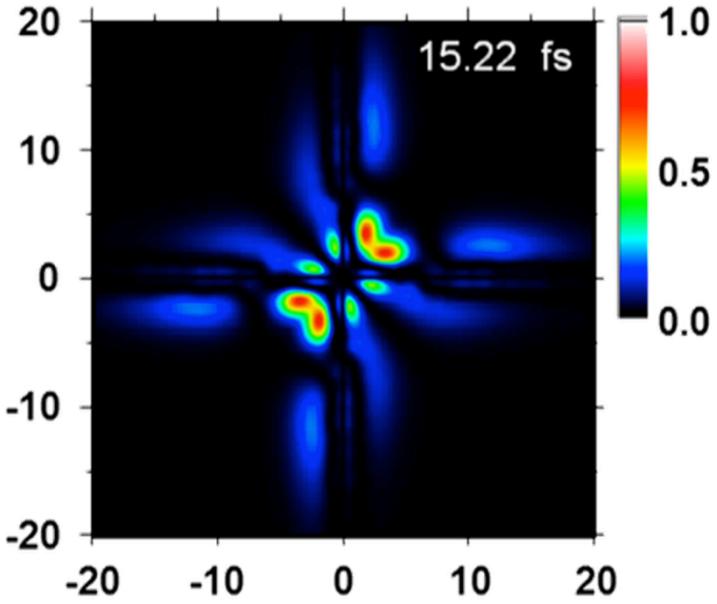
Python for gamma-ray astronomy:

Welcome

Jim Hinton


15.22 fs
20
10
0
-10
-20
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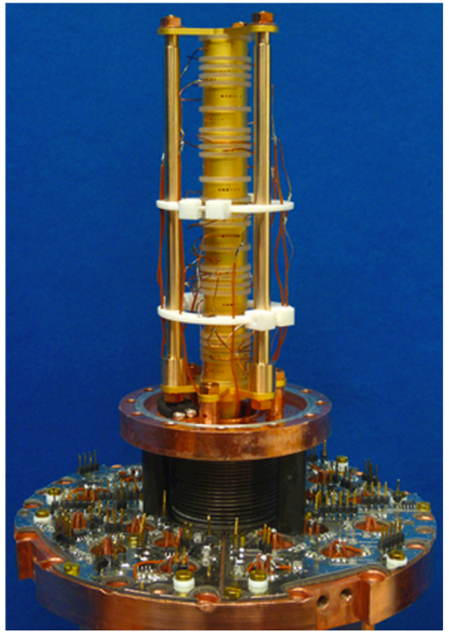
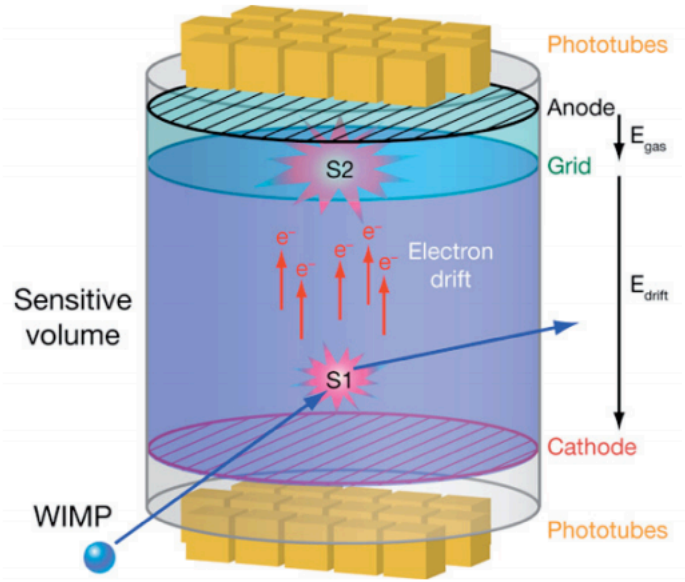
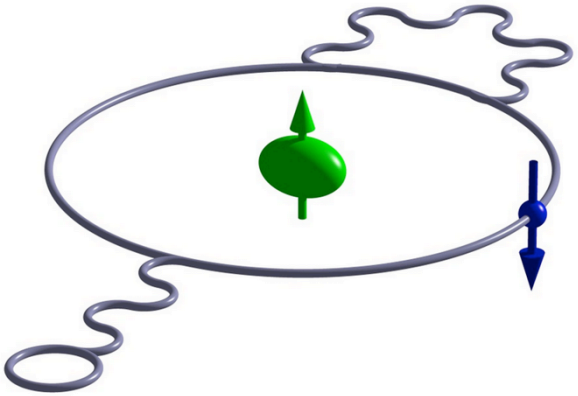
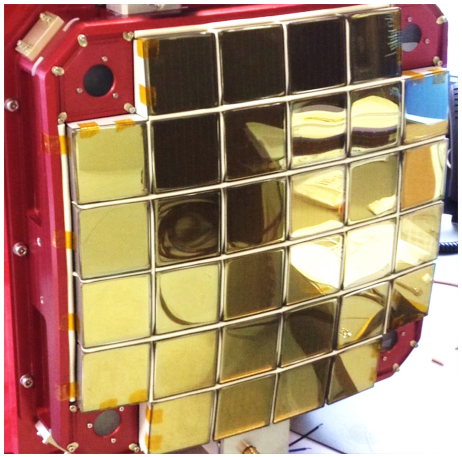
0
10
20
1.0
0.5
0.0

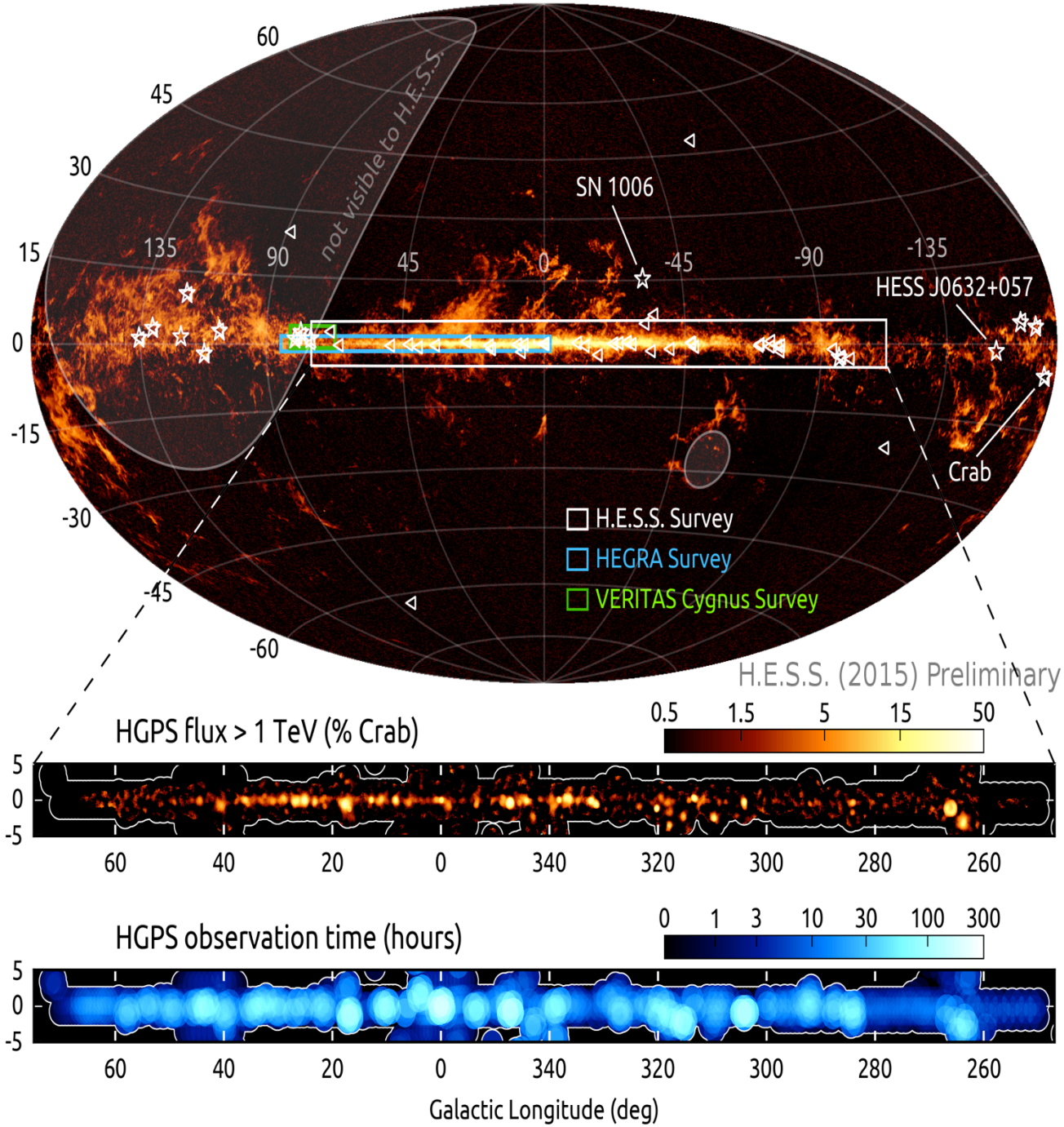



Phototubes
Anode
Grid
Cathode
Phototubes
S2
S1
Electron drift
Sensitive volume
WIMP
E_gas
E_drift






H.E.S.S.


not visible to H.E.S.S.
SN 1006
HESS J0632+057
Crab
H.E.S.S. Survey
HEGRA Survey
VERITAS Cygnus Survey
H.E.S.S. (2015) Preliminary
HGPS flux > 1 TeV (% Crab)
0.5 1.5 5 15 50
HGPS observation time (hours)
0 1 3 10 30 100 300
Galactic Longitude (deg)

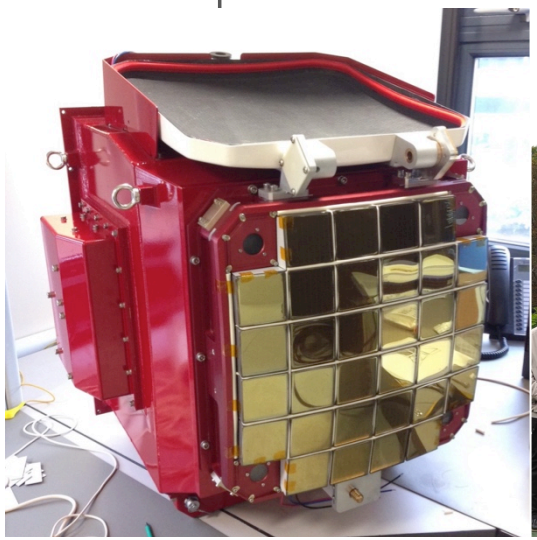
CTA Project

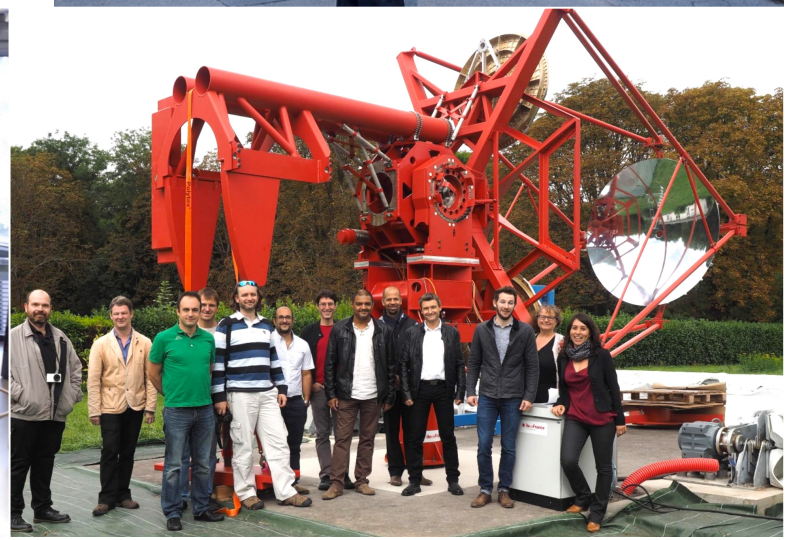
cherenkov telescope array

- Major international observatory
  - Huge step in performance from HESS etc
  - ~100 telescopes on two sites
  - 30+ countries, >1000 scientists
  - First science ~2018
  - Completion early 2020s
  - Operation as an international user facility

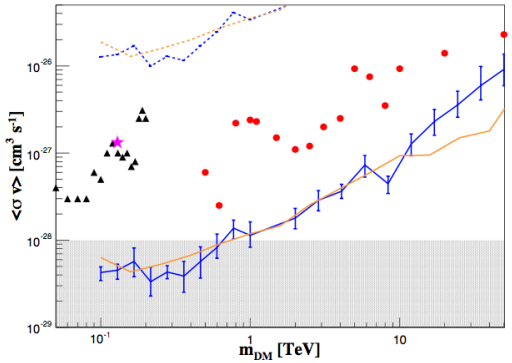
MPIK in CTA

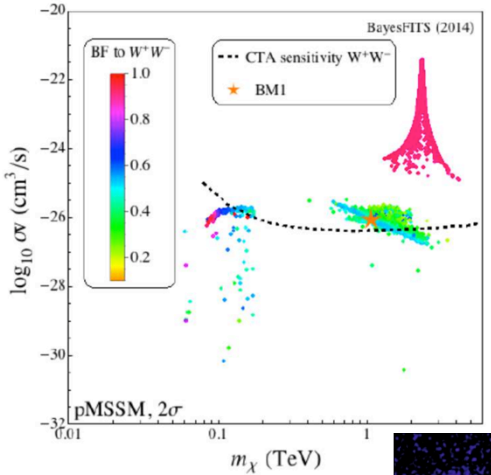
- Simulations, Data pipelines, Science prep. +
- Cameras
  - FlashCam – medium sized telescope camera (2 tonnes)
  - CHEC – small sized telescope camera – (40 kg)

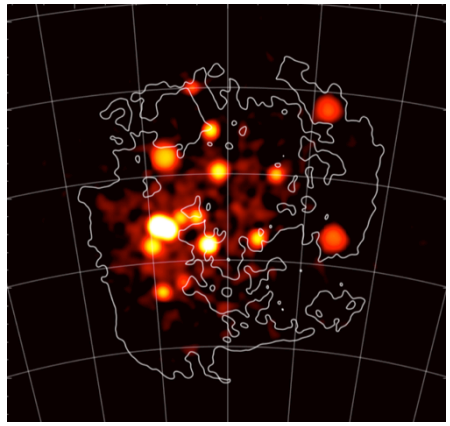


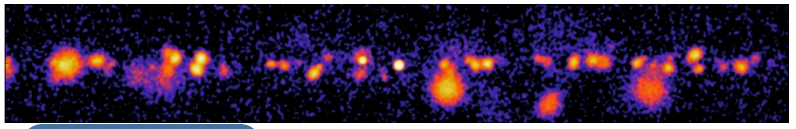


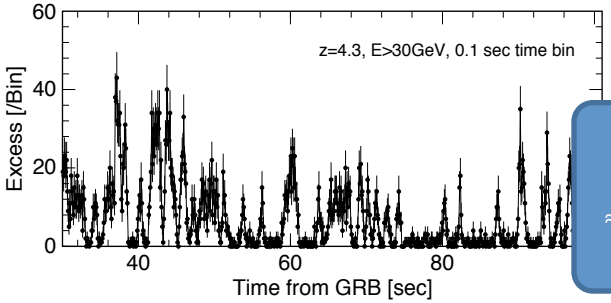
(+Host of the CTA Project Office)

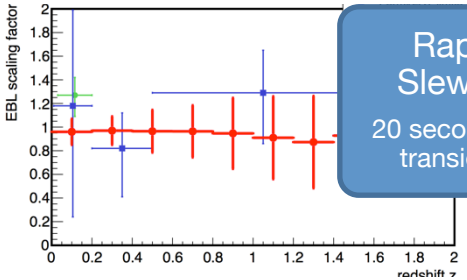












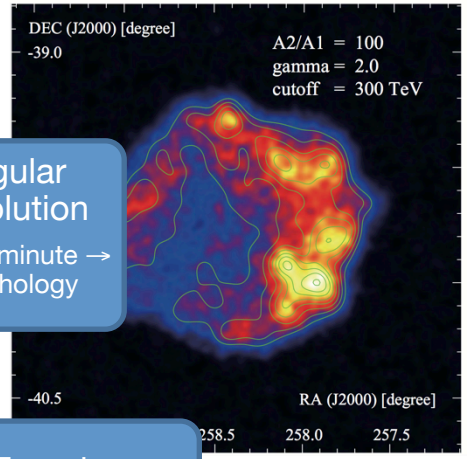
Energy Resolution
≈10% → lines, features

Sensitivity & Collection Area
×10 → all topics

Field of View
≈8° → surveys, extended objects

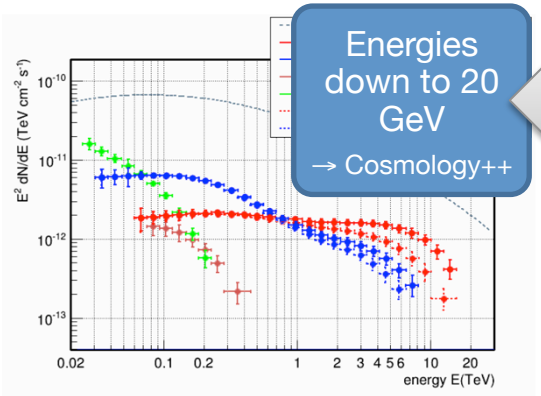
Rapid Slewing
20 seconds → transients

Angular Resolution
Few arcminute → morphology

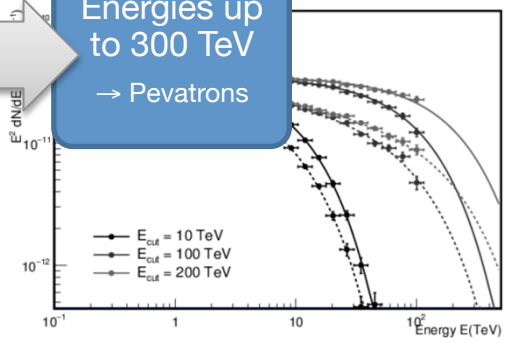


cta
cherenkov telescope array

Energies down to 20 GeV
→ Cosmology++



Energies up to 300 TeV
→ Pevatrons



CTA Data

- 100 PB raw data per year
  - Factor 100 reduction needed on site
- Complex analysis
  - Multiple telescope types
  - Wide range of observing conditions (weather, sub-arrays, zenith++)
  - Multi-level reduction, many alternative algorithms …
- Commitment to user support and high quality end-user products / archive
- Overall a very significant challenge!
- **Need robust high-performance pipelines**
  - **But with minimised input of resources and minimising eventual maintenance cost**

Python for CTA

- Just decided to use Python for the CTA data pipelines!
- Why not?

> "I've never used it!"
> "I only like C!"
> "New things (1990s) make me nervous!"

Karl Kosack
CTA Project Committee
Nov. 2015

- Selling argument:

  Many Complex tasks already written for you in external support libraries

  - **less for us to maintain and develop**