Creating and utilising an Armagh-Bangor Meteor Database*

or

*Working title

"What I would like ML to do for me"

Apostolos Christou
Armagh Observatory and Planetarium
Northern Ireland
apostolos.christou@armagh.ac.uk

EPN Fireball Workshop
12 June, 2021

ARMAGH OBSERVATORY & PLANETARIUM
EXPLORING THE COSMOS SINCE 1790
europlanet 2024 Research Infrastructure
DfC Department for Communities www.communities-ni.gov.uk

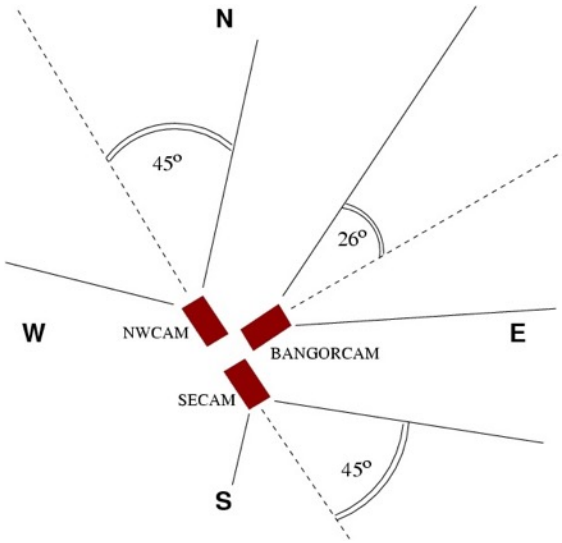
Structure of Talk

- Where the data comes from
- status ie where we are now
- what we want to do with the data

Student support has been crucial

-Prakash Atreya (PhD: 2005-2009)
-Takuya Fujiki (IAESTE; summer 2012)
-Leonie Frantzen (IAESTE; summer 2017)
-Rafael Gurtner (IAESTE; summer 2018)
-Liming "Echo" Zhao (IAESTE, summer 2019)

The Armagh-Bangor Meteor Network



—3 cameras (1 medium angle, 2 wide-angle) at Armagh, 1 camera operated by R. Cobain@Bangor, NI

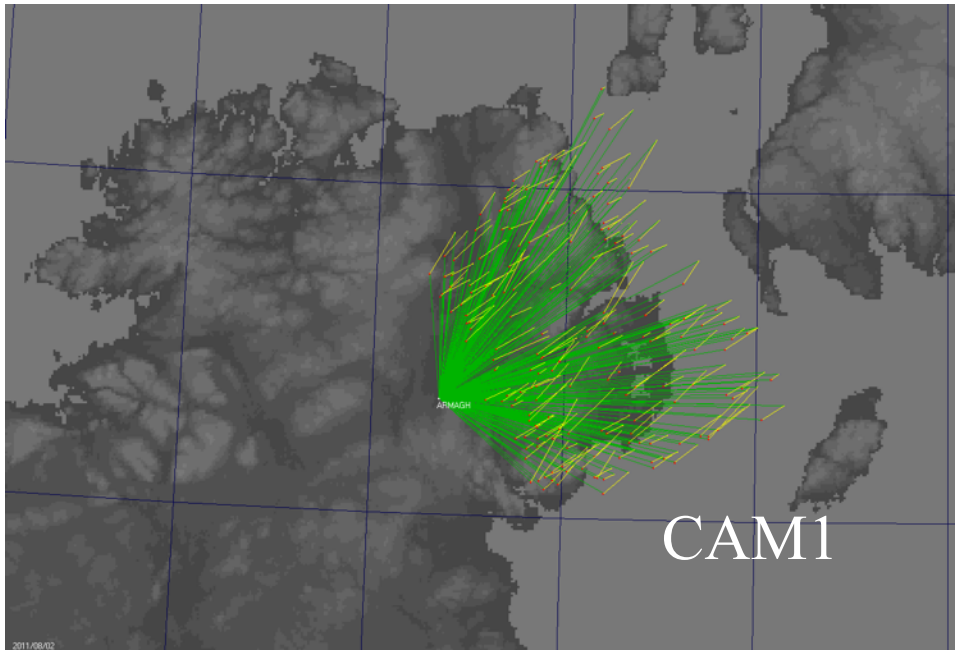
—Sky coverage above 30 deg altitude

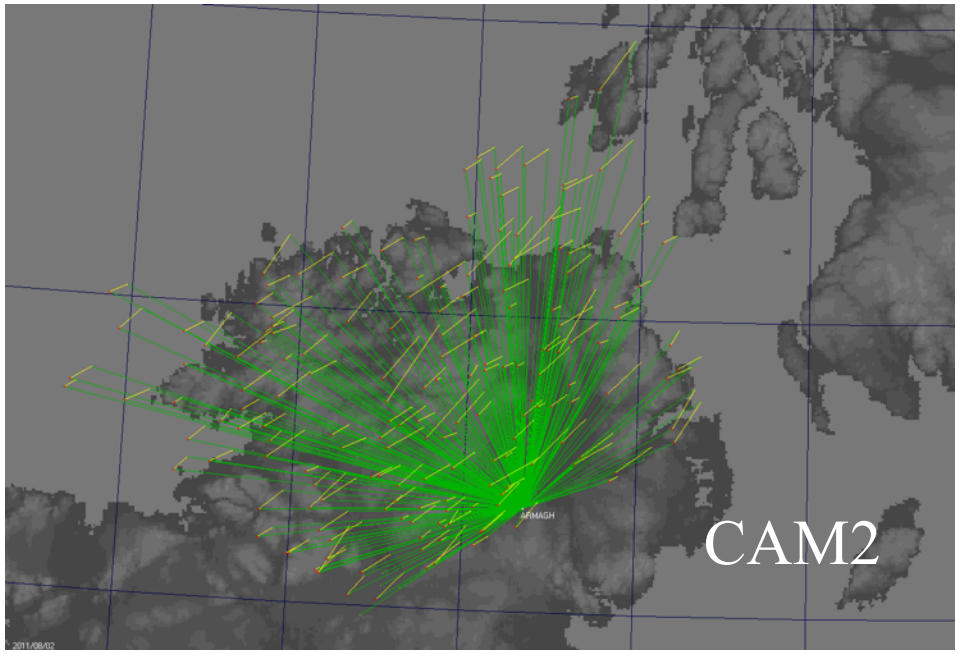
—Continuous operation July 2005 - July 2019

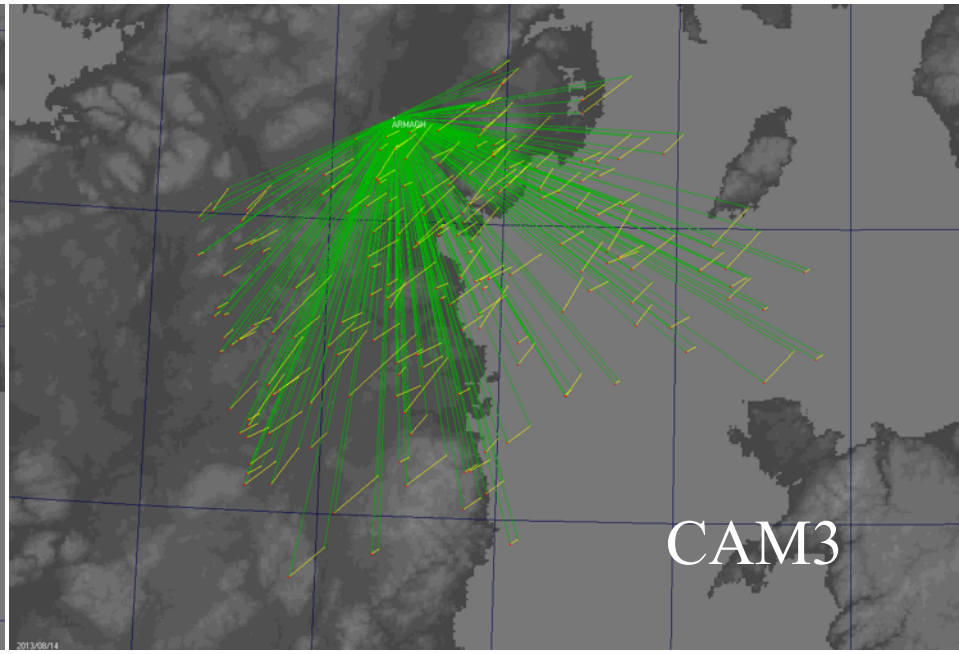
—Video signal -> USB-2-Video interface -> PC HDD

—Meteor Detection w UFOCapture v2, time sync w NISTtime 32-bit

Meteors classified by *UFOAnalyzer* as "PER", 2011-2014







At the system core..

Watec 902DM2S

720x494, 60 fields/sec

Computar F/0.8 DC auto-iris

- 6.0 mm: 52x35 deg
- 3.8 mm: 90x55 deg

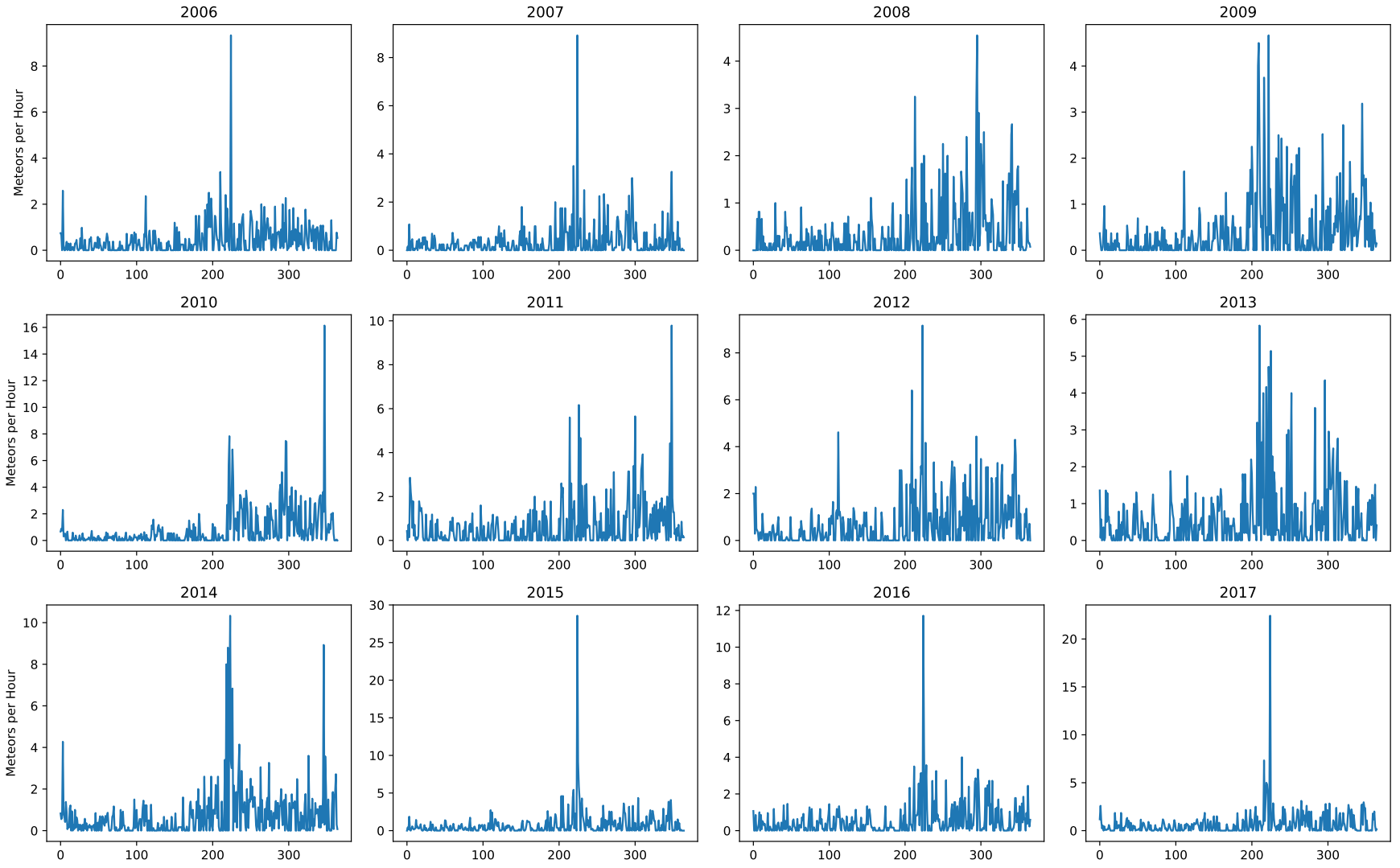
Objectives

- Study of minor showers : activity profile, radiant, orbits (from double station), and if possible identify parent objects.

- Characterizing the sporadic background and its annual and inter-annual variation including sporadic fireball counts.

- Study of major showers and outbursts (if good coverage).

[slide by Prakash Atreya presentation at IMC 2006]



Figures by Rafael Gurtner

After the first five years..

- July 2005 – Jun 2010
- 16250 hrs of operation (~9hrs/night)

- 6309 single-station meteors
- 1281 double station meteors (20% of s.s.)

[slide from presentation during IMC 2010 at Armagh]

after 13 years..

- July 2005 – June 2018
- 44500 hrs of operation (~9hrs/night)
- 14300 hours of sky visibility (~1/3 year)
- 25757 single-station meteors
- 0.2x25757 ~ 5000 ?? double station meteors

Continuous operation suspended in June 2019

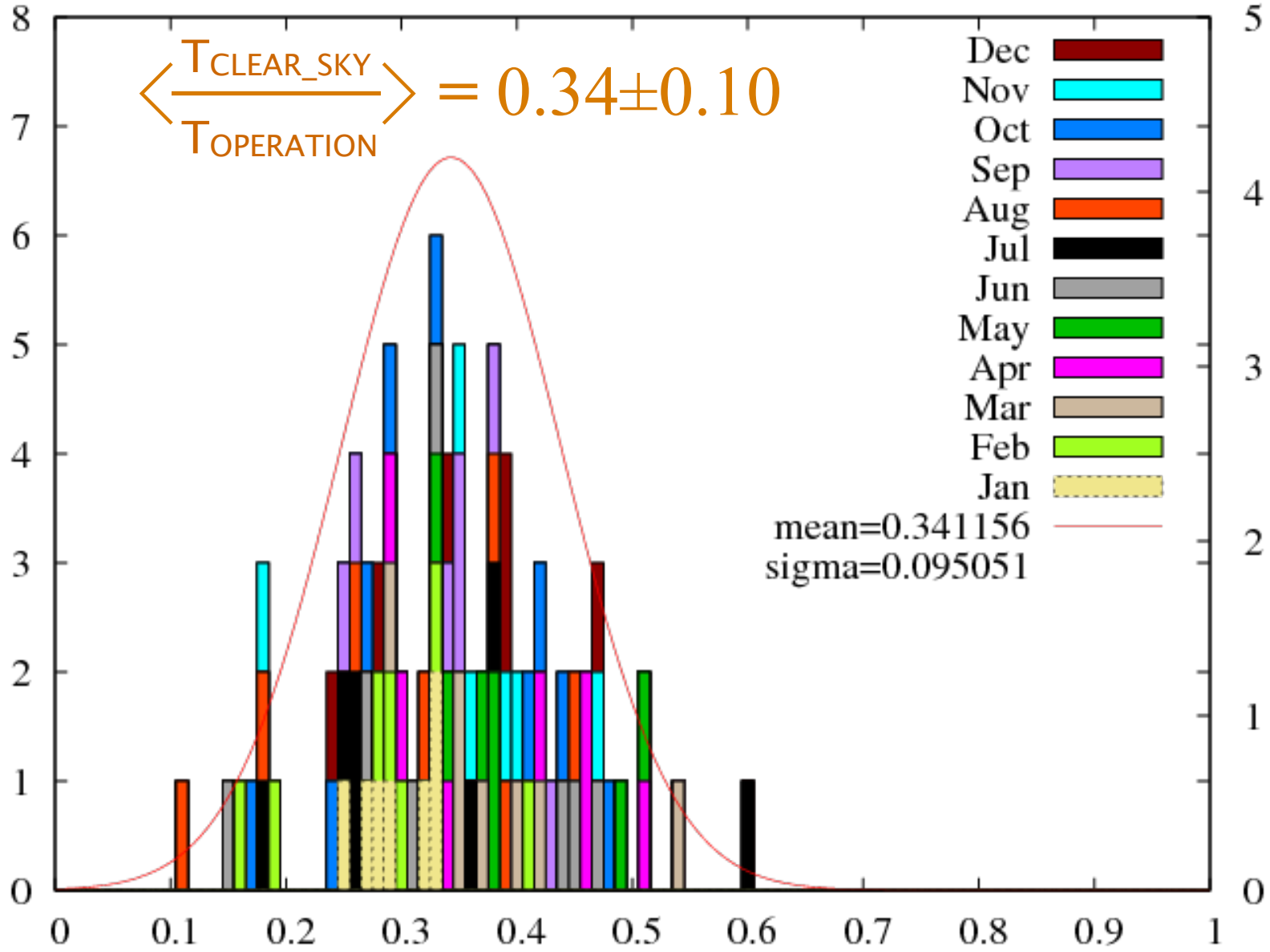
[slide from presentation during 2018 NEMETODE worskhop at Dunsink Obs]

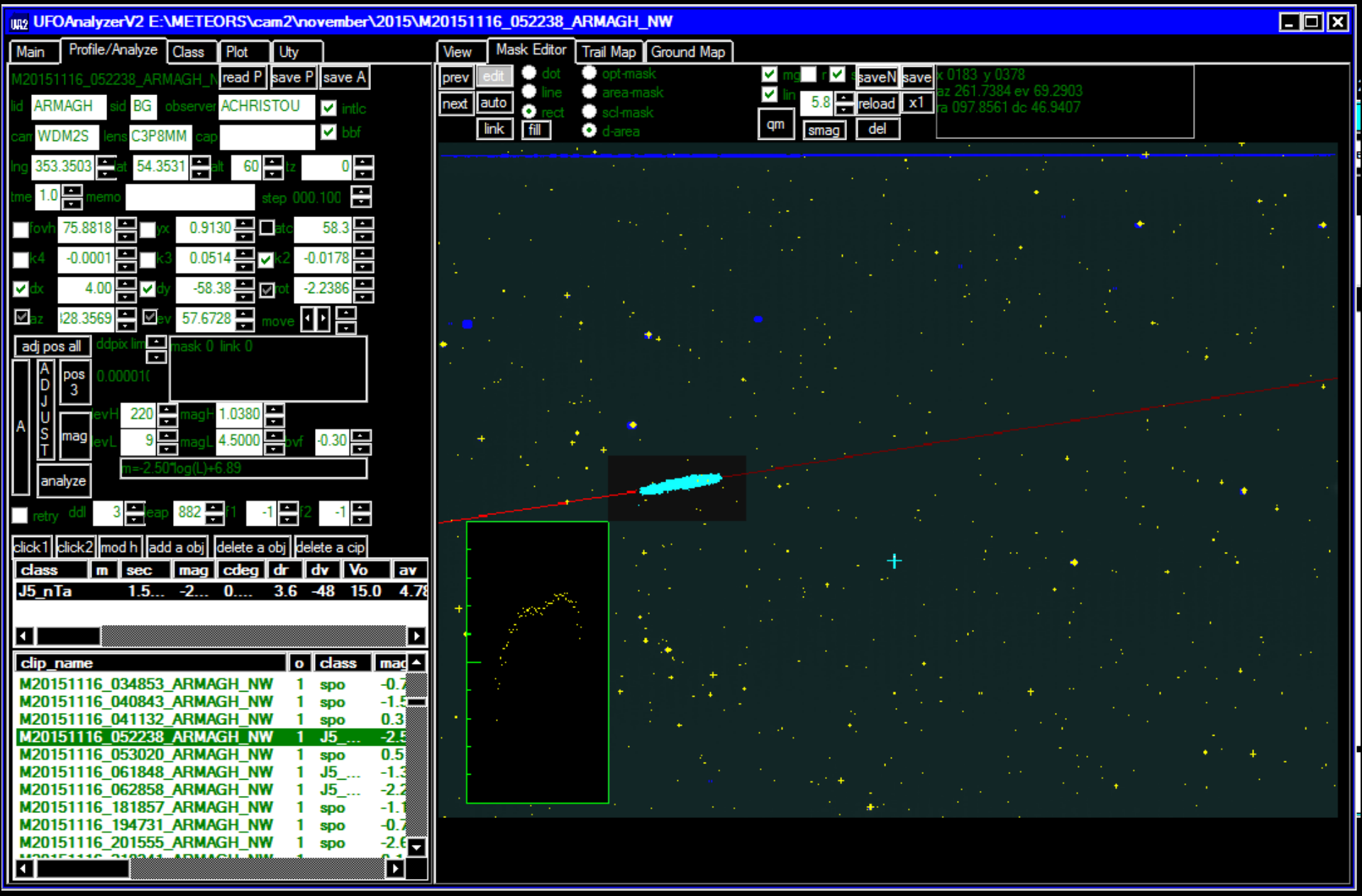
Correcting for weather

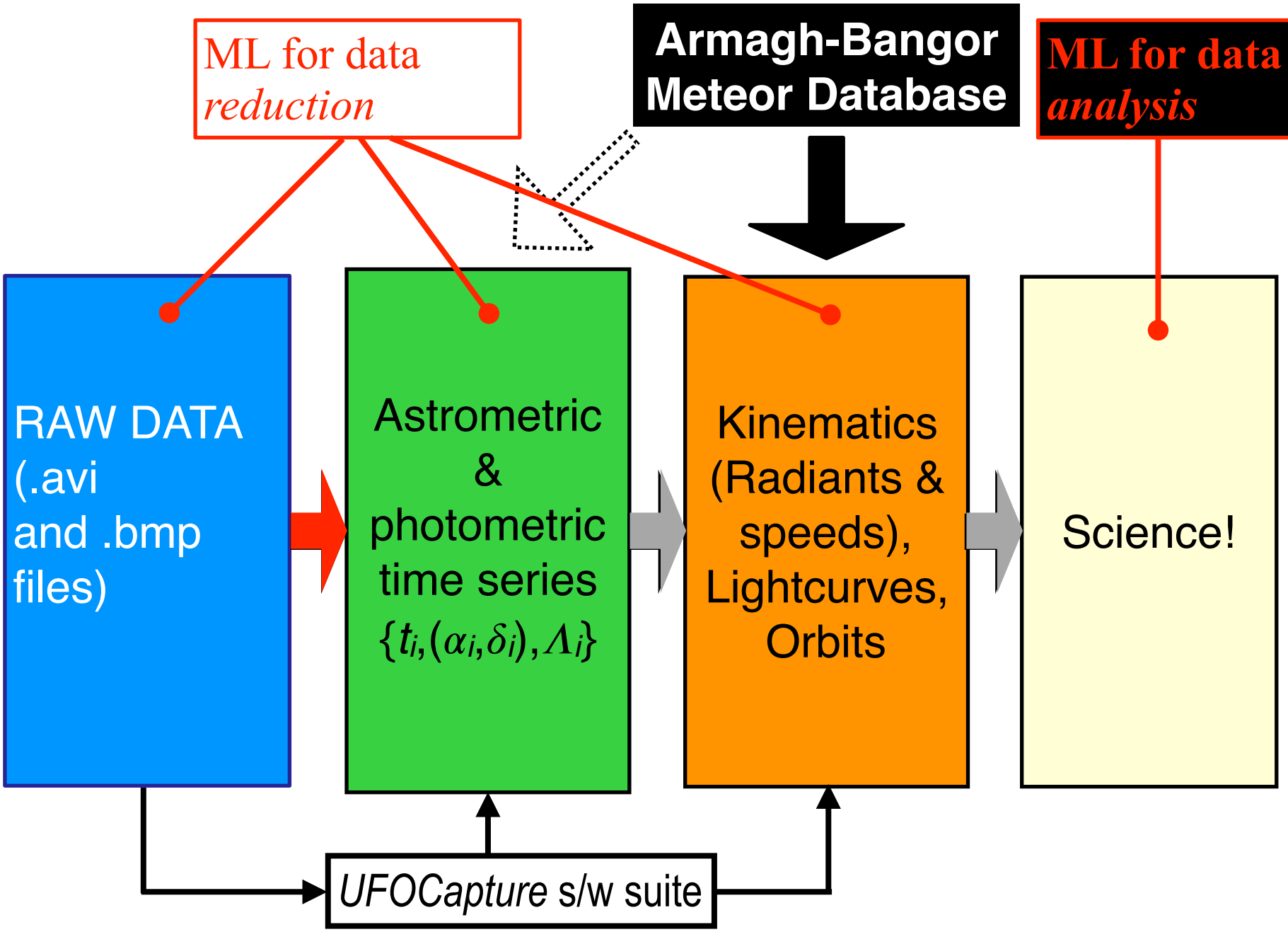
- Cameras provide simultaneous weather record
- Our "alphabet" code: A is start, B is start + 1hr,etc
- three (3) sky states: CR (clear-1.0), PC (p.cloudy-0.5) & CL (cloudy-0.0)
- Sky visibility can then be estimated as CR+0.5*PC
- A simple, robust, daily-updated, weighting system

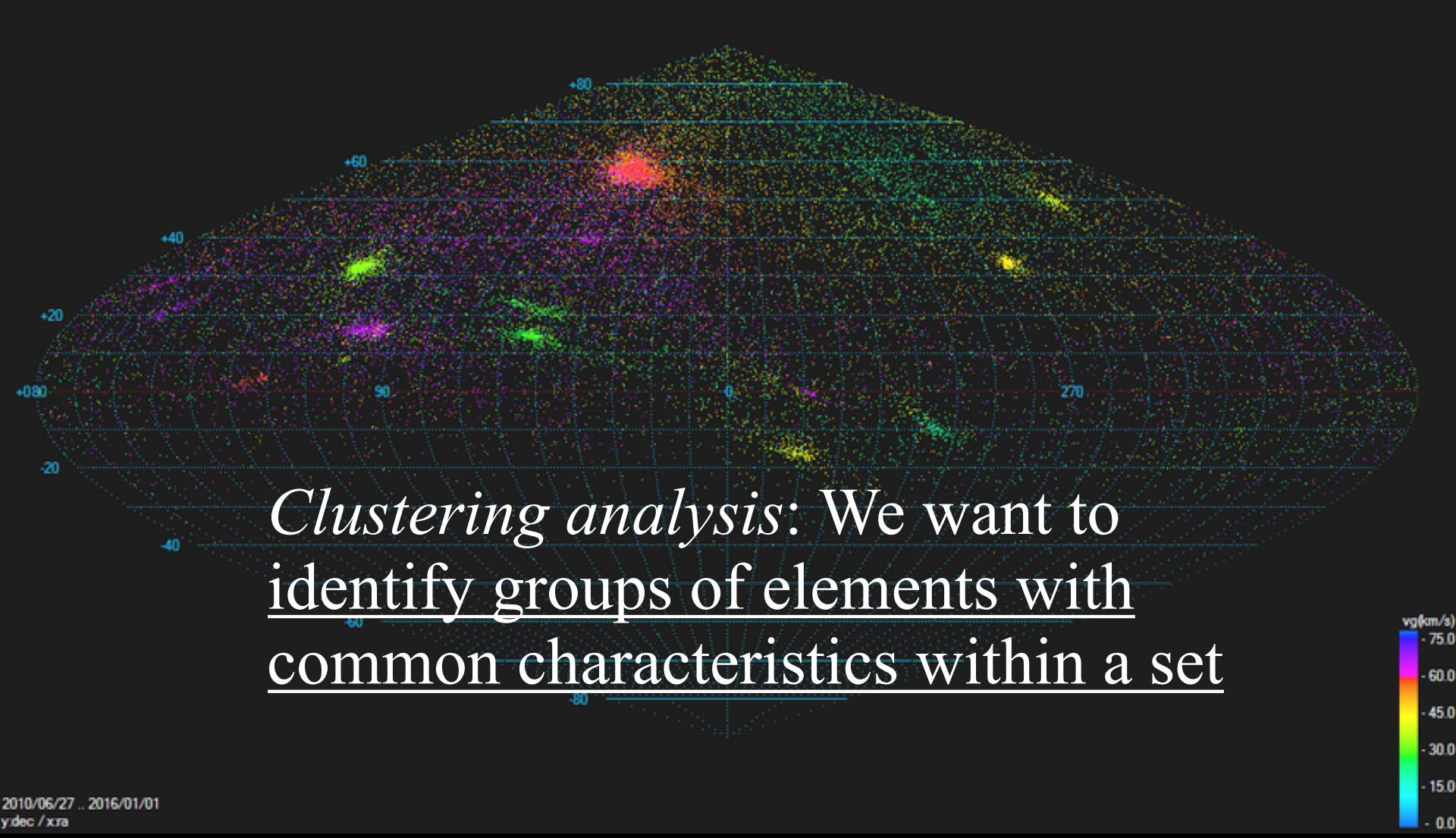
2006/03/23	Y	2	Y	0	Y	0	19.75 05.50	EFGH	ABC	N
2006/03/24	Y	0	Y	0	Y	0	19.75 05.50			Y
2006/03/25	Y	0	Y	0	Y	0	19.75 05.50			N
2006/03/26	Y	1	Y	1	Y	0	19.75 05.50	DFI		Y
2006/03/27	Y	0	Y	0	Y	0	20.75 06.50			Y
2006/03/28	Y	0	Y	0	Y	0	20.75 06.50			Y
2006/03/29	Y	4	Y	2	Y	2	20.75 06.50		ABCDEFGHIJ	N
2006/03/30	Y	0	Y	0	Y	0	21.00 06.00			N
2006/03/31	Y	0	Y	0	Y	0	21.00 06.00			Y
2006/04/01	Y	1	Y	1	Y	1	21.00 06.00	ABCGHIJ	DEF	N
2006/04/02	Y	Y	Y	0	Y	1	21:00 06:00	ADEF		Y
2006/04/03	Y	2	Y	1	Y	1	21.00 06.00		GHIJ	Y

Figure by Leonie Frantzen




UFOAnalyzerV2 E:\METEORS\cam2\november\2015\M20151116_052238_ARMAGH_NW
Main
Profile/Analyze
Class
Plot
Uty
M20151116_052238_ARMAGH_N
read P
save P
save A
lid ARMAGH
sid BG
observer ACHRISTOU
intlc
cam WDM2S
lens C3P8MM
cap
bbf
lng 353.3503
lat 54.3531
alt 60
tz 0
tme 1.0
memo
step 000.100
fovh 75.8818
yx 0.9130
atc 58.3
k4 -0.0001
k3 0.0514
k2 -0.0178
dx 4.00
dy -58.38
rot -2.2386
az 128.3569
ev 57.6728
move
adj pos all
ddpix lim
mask 0 link 0
0.00001(
pos 3
A
ADJUST
mag
evH 220
magH 1.0380
evL 9
magL 4.5000
ovf -0.30
m=-2.50*log(L)+6.89
analyze
retry
ddl 3
eap 882
f1 -1
f2 -1
click1
click2
mod h
add a obj
delete a obj
delete a cip
class m sec mag cdeg dr dv Vo av
J5_nTa 1.5... -2... 0.... 3.6 -48 15.0 4.78
clip_name o class mag
M20151116_034853_ARMAGH_NW 1 spo -0.7
M20151116_040843_ARMAGH_NW 1 spo -1.5
M20151116_041132_ARMAGH_NW 1 spo 0.3
M20151116_052238_ARMAGH_NW 1 J5_... -2.5
M20151116_053020_ARMAGH_NW 1 spo 0.5
M20151116_061848_ARMAGH_NW 1 J5_... -1.3
M20151116_062858_ARMAGH_NW 1 J5_... -2.2
M20151116_181857_ARMAGH_NW 1 spo -1.1
M20151116_194731_ARMAGH_NW 1 spo -0.7
M20151116_201555_ARMAGH_NW 1 spo -2.6
View
Mask Editor
Trail Map
Ground Map
prev
edit
next
auto
link
fill
dot
line
rect
opt-mask
area-mask
scl-mask
d-area
qm
lin
5.8
reload
x1
smag
del
saveN
save
x 0183 y 0378
az 261.7384 ev 69.2903
ra 097.8561 dc 46.9407


ML for data
reduction
Armagh-Bangor
Meteor Database
ML for data
analysis
RAW DATA
(.avi
and .bmp
files)
Astrometric
&
photometric
time series
$\{t_i,(\alpha_i,\delta_i),\Lambda_i\}$
Kinematics
(Radiants &
speeds),
Lightcurves,
Orbits
Science!
UFOCapture s/w suite



Clustering analysis: We want to identify groups of elements with common characteristics within a set

Figure from Srba et al, 2016:*Central European MetEor NeTwork: Current status and future activities*, **WGN**, 44, 71-74

Scientific Focus for EPN

(dependent on data availability & quality)

- Time variations (meteor outbursts)
- Photometric properties (mag distribution, lightcurves)
- Observational Biases (eg same shower under different moon phases)


Thank You!