

# Summary of Cluster and Cosmology WG Proceedings

Thomas Reiprich, for the CWG

# Overview [info requested by PS]

1. Membership, external collaborators
2. Outline of splinter session contents
3. Projects (completed, ongoing, and planned, including PV phase and early eRASS)

# CWG Membership: 43 Members

- [RalfBender](#)
- [FrankBertoldi](#)
- [SebastianBocquet](#)
- [VadimBurwitz](#)
- [MarcusBrueggen](#)
- [HermannBrunner](#)
- [MarcellaBrusa](#)
- [JohanComparat](#)
- [MariaPaulus](#)
- [NicolasClerc](#)
- [KonradDennerl](#)
- [KlausDolag](#)
- [DominiqueEckert](#)
- [ThomasErben](#)
- [GhazalehErfanianfar](#)
- [AlexisFinoguenov](#)
- [SebastianGrandis](#)
- [FlorianHofmann](#)
- [JacobIlderChitham](#)
- [MathildeJauzac](#)
- [FlorianKaefer](#)
- [MatthiasKlein](#)
- [GeorgLamer](#)
- [AndreaMerloni](#)
- [KonstantinosMigkas](#)
- [JosephMohr](#)
- [KirpalNandra](#)
- [NaomiOta](#)
- [FlorianPacaud](#)
- [CristianoPorciani](#)
- [PeterPredehl](#)
- [MiriamRamos](#)
- [ThomasReiprich](#)
- [RobertoSaglia](#)
- [MaraSalvato](#)
- [JeremySanders](#)
- [PeterSchneider](#)
- [TimSchrabback](#)
- [AxelSchwope](#)
- [StellaSeitz](#)
- [VeronicaStrazzullo](#)
- [JochenWeller](#)
- [ChaoliZhang](#)

# CWG External Collaborators





- Successfully completed projects (proposed paper was written):
  - A. Pillepich et al. (2018)
  - F. Zandanel, ..., F. Prada et al. (2018)
- Currently running projects:
  - A. Saro (till 2019-03-27)
  - P. Popesso (till 2020-02-11)
- Possible interest for new projects (but not proposed, yet):
  - A. Pillepich (Illustris TNG etc.)
  - F. Prada, A. Klypin (N-body sims, power spectrum)

# Potsdam Meeting CWG Splinter Session Agenda



## 9:00 - 10:30 Tuesday: How do we create the cluster catalog?





- X-ray source catalog creation (Lamer/Brunner)
- Goals and status of the CFC (cluster finding challenge) (Sanders)  [19-03-cfc.pdf](#)  [19-03-cfc.pptx](#)
- MCMF overview with focus on lessons learned from RASS+DES and application to eRASS1 and eRASS8 (Klein)  [eROSITAMeetingPotsdamMCMF.pdf](#)
- Discussion and plans going forward

## 11:00 - 12:30 Tuesday: What is a cluster selection function?






- Overview of selection function modeling in SPT-SZ and MARD-Y3, implications for eROSITA (Grandis)  [SGrandisPresentation\\_selectionfct.pdf](#)
- Modeling of the selection function using sky simulations within a fixed cosmology (Comparat)  [comparat\\_sky\\_sim\\_fixed\\_cosmo.pdf](#)
- Review of the eROSITA selection function modeling based on SIXTE simulations (Ramos)  [MRamosCeja\\_eROSITAMeeting\\_Clerc18\\_Potsdam0319.pdf](#)  Journal Paper
- Scaling relations, scatter and sky simulations- what are the connections and complementarity?
- Discussions and plans going forward

## 14:30 - 16:00 Tuesday: How do we cross-compare and then combine mass calibration information?






For remote participants:  <https://zoom.us/j/589330749> - Or call in via +49 30 3080 6188 - Or find other call in numbers:  <https://zoom.us/u/aci9MEQwxK> - Meeting-ID: 589 330 749

-  [Strategy for the incorporation of diverse mass calibration information \(dynamical/weak lensing\) within the eROSITA-DE cluster analyses](#) (Mohr)
- Overview of DES WL analysis (Paulus)  [MPaulus\\_eROSITA\\_Potsdam\\_DESWL.pdf](#)
- Overview of the HSC WL analysis (Oguri)
- HST and HAWK-I weak lensing constraints on the high redshift end (Schrabback)  [highz\\_20190305.pdf](#)
- Discussion and plans going forward
  - Other datasets (KiDS?)  [kids\\_20190305.pdf](#)
  - New ideas and new directions- importance of strong lensing, relevance of CMB lensing, etc




## 16:30 - 18:00 Tuesday: What is our plan for the cluster cosmology analysis?

- Cluster cosmology context and multi-wavelength competition (Bocquet)  [Bocquet\\_cosmo\\_context\\_competition.pdf](#)
- Empirical mass calibration and cosmological studies using the MARD-Y3 RASS+DES sample (Grandis)  [SGrandisPresentation\\_masscalib.pdf](#)
- Pipelines from the most recent X-ray cluster cosmology work (Pacaud+, Schellenberger+) (Reiprich)  [talk](#)
- Cosmological fitting with the CR/HR method (Clerc)  [clerc\\_CWG\\_Potsdam.pdf](#)
- Discussion and cosmology plans going forward (see  [eRASS1 Cosmology Plan](#))








## 9:00 - 10:30 Wednesday: What are our plans for non-cosmology cluster science?

- Discussion of the [A3391/95](#) PV phase observation and analysis plan (Reiprich)  [talk](#)
- Presentation of [additional science ideas](#) together with comment on timescale and resources (add short title)
  -  [Intro slides](#)
  - Very extended clusters/superclusters (Reiprich) See [MiriamRamos](#) Ringberg talk about A. Perez' master thesis about the Virgo cluster  [here](#)
  - Anisotropy of the Lx-T relation (Reiprich) See KonstantinosMigkas paper  [here](#)
  - Baryon fraction of galaxy groups and AGN feedback (Eckert)  [fgas\\_groups.pdf](#)
- Discussion and plan going forward (including also new proposals for cluster calibration targets)

## 11:00 - 12:30 Wednesday: HSC+eROSITA planning with eFEDS and eRASS1







- Review of the eFEDS key projects (Finoguenov)  [finoguenov\\_cwg\\_potsdam19b.pdf](#)
- Short key projects presentations  [FPacaud\\_eROSITA\\_MassCalibration.pdf](#)  [RamosOta\\_eFEDS\\_BCprojects.pdf](#)
- Plans for the eRASS1 coverage of the HSC survey
- Discussion and plans going forward

## 14:30 - 16:00 Wednesday: Details of X-ray source catalog creation

- Input from Observations
  - Detailed X-ray cluster characterization (Kaefer)  [kaefer\\_cluster\\_characterisation\\_new.pdf](#)
  - Survey cluster X-ray characterization (Eckert)  [eckert\\_Potsdam.pdf](#)
  - Insights into flux boosting by AGN from X-ray survey data (Klein)  [MCMFandAGN.pdf](#)
- Pipelines
  - Updates on the eROSITA survey characteristics and software (Lamer)  [detection\\_update.pdf](#)
  - Performance of the cluster outskirts detection pipeline (Kaefer)  [kaefer\\_outskirts\\_detection.pdf](#)
  - Performance of the Bonn Wavelet Pipeline (Ramos)  [MRamosCeja\\_eROSITAMeeting\\_SrcDet\\_Potsdam0319.pdf](#)
- Discussion, impacts on the CFC
  - Including: Future alternatives for cluster detection (Ramos)  [RamosCeja\\_CMF\\_Erler18.pdf](#)

### 16:30 - 18:00 Wednesday: Multi-lambda followup

Joint discussion of multi-lambda followup plans with AGN WG.

-  [Status of the DECam surveys and the PS region of the eROSITA-DE sky \(Zenteno\)](#)
-  [Salvato\\_AGN\\_FollowUp.pdf](#) Followup for AGN (Salvato)
- MCMF for clusters, implications for AGN (Klein)  [MCMF\\_CL\\_AGN\\_followup\\_discussion.pdf](#)
- Spectroscopic followup with SDSS-IV Special plates (Dwelly)  [SDSS-IV\\_SDSS-V\\_spectroscopy\\_tdewelly.pdf](#)
- Spectroscopic followup with SDSS-V (Dwelly)  [SDSS-IV\\_SDSS-V\\_spectroscopy\\_tdewelly.pdf](#)
- Spectroscopic followup with 4MOST (Comparat)  [comparat\\_follow-up-4most.pdf](#)

# Completed, ongoing, planned pre-launch projects, and projects using *eROSITA* data

- Currently 29 pre-launch (“preparatory”) projects listed on CWG wiki.
- Many completed (also many papers), many running, some dormant.
- Up to now five “official” eROSITA\_DE publications.
- Current major collaborative project: Cluster Finder Challenge (CFC, Jeremy et al.)

EROSITAwiki: [CWG\\_prep\\_task\\_list](#)

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## List of all running and completed specific eROSITA cluster preparatory tasks

Note the goal here is **not** to list all cluster science papers of CWG members where the name eROSITA is mentioned but to provide a concise summary of concrete eROSITA preparatory work that is underway, e.g., predictions of the eROSITA performance for cluster characterization.

Please use this format:

[https://wiki.mpe.mpg.de/eRosita/CWG\\_prep\\_task\\_list](https://wiki.mpe.mpg.de/eRosita/CWG_prep_task_list)

### Prep task

1. *Running number* (CWG\_prep-1, CWG\_prep-2):
2. *Title*:
3. *Abstract* (goals; results, if any):
4. *Primary contact person*:
5. *Collaborators*:
6. *Status* (planned/running/completed, with rough timeframe):
7. *Comments* (if any):
8. *Publication link* (if any):

### Prep task

1. *Running number*: CWG\_prep-1
2. *Title*: The X-ray cluster survey with eRosita: forecasts for cosmology, cluster physics and primordial non-Gaussianity
3. *Abstract*: The eRosita telescope will survey the X-ray sky with unprecedented sensitivity. Assuming a detection limit of 50 photons in the (0.5-2.0) keV energy band with a typical exposure time of 1.6 ks, we predict that eRosita will detect  $\sim 9.3 \times 10^4$  clusters of galaxies more massive than  $5 \times 10^{13} h^{-1} M_{\odot}$ , with the currently planned all-sky survey. Their median redshift will be  $z \approx 0.35$ . We perform a Fisher-matrix analysis to forecast the constraining power of eRosita on the  $\Lambda$  cold dark matter ( $\Lambda$ CDM) cosmology and, simultaneously, on the X-ray scaling relations for galaxy clusters. Special attention is devoted to the possibility of detecting primordial non-Gaussianity. We consider two experimental probes: the number counts and the angular clustering of a photon-count limited sample of clusters. We discuss how the cluster sample should be split to optimize the analysis and we show that redshift information of the individual clusters is vital to break the strong degeneracies among the model parameters. For example, performing a 'tomographic' analysis based on photometric-redshift estimates and combining one- and two-point statistics will give marginal  $1\sigma$  errors of  $\Delta\sigma_8 \approx 0.036$  and  $\Delta\Omega_m \approx 0.012$  without priors, and improve the current estimates on the slope of the luminosity-mass relation by a factor of 3. Regarding primordial non-Gaussianity, eRosita clusters alone will give  $\Delta f_{NL} \approx 9, 36$  and  $144$  for the local, orthogonal and equilateral model, respectively. Measuring redshifts with spectroscopic accuracy would further tighten the constraints by nearly 40 per



## Official Publications of the CWG

Please read the Publication Policy (Section 3.3.) in the [eROSITA Policy Document](#) first.

When starting a project that may lead to a publication, please make sure the WG is aware of this, e.g., by adding a [prep task](#) to the wiki and by discussing it during WG meetings.

After making your final copy available here for the three week internal review period, please send a quick email to the [eroclusters mailing list](#) and announce it.

These publications should be moved to eROPUB once it is available.

Please use this format (copy/paste, leave this template unchanged):

<https://wiki.mpe.mpg.de/eRosita/CWGPubs>

### Publication

1. *Running number* (CWG\_pub-1, CWG\_pub-2):
2. *Title*:
3. *Abstract* (goal, results if any):
4. *First author*:
5. *Coauthors*:
6. *Relation to prep task* (if any, e.g., CWG\_prep-1, CWG\_prep-2):
7. *(To be) submitted to* (e.g., A&A, MNRAS, ApJ, Nature, ...):
8. *Status* (pending/submitted/public):
9. *Date created*:
10. *Last modified*:
11. *Comments* (if any):
12. *Publication link*:

### Publication

1. *Running number* (CWG\_pub-1, CWG\_pub-2): CWG\_pub-1
2. *Title*: Synthetic simulations of the extragalactic sky seen by eROSITA. I- Pre-launch selection functions from Monte-Carlo simulations
3. *Abstract* (goal, results if any): See [CWG\\_prep-13](#) description.
4. *First author*: N. Clerc
5. *Coauthors*: M. E. Ramos-Ceja, J. Ridl, G. Lamer, H. Brunner, F. Hofmann, J. Comparat, F. Pacaud, F. Kaefer, T. Reiprich, A. Merloni, C. Schmid, T. Brand, J. Wilms, P. Friedrich, A. Finoguenov, T. Dauser, I. Kreykenbohm
6. *Relation to prep task* (if any, e.g., CWG\_prep-1, CWG\_prep-2): [CWG\\_prep-13](#)

EROSITAwiki: [CWG\\_ClusterFindingChallenge](#)[CWG\\_prep\\_task\\_list](#) » [PvReiprich](#) » [eFEDS](#) » [CWG\\_prep\\_tasks](#) » [CWG\\_Cluster...ngChallenge](#)[FrontPage](#)[RecentChanges](#)[FindPage](#)[HelpContents](#)[EroClusters](#)[CWG\\_Cluster...ngChallenge](#)[Edit](#)[Info](#)[Subscribe](#)[Add Link](#)[Attachments](#)

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# Page for Organization of the Cluster Finder Characterization Challenge

[https://wiki.mpe.mpg.de/eRosita/CWG\\_ClusterFindingChallenge](https://wiki.mpe.mpg.de/eRosita/CWG_ClusterFindingChallenge)

We decided at the October Ringberg meeting that it would be good to carry out a Cluster Finding Challenge with more realistic eROSITA image simulations with the goal of characterizing the performance of the existing cluster finding pipelines. Previous comparisons between eSASS source detection and various wavelet-based methods within the eROSITA context within the CWG can be found [here](#) and [here](#). General info on cluster-specific X-ray source detection has been compiled [here](#) over the years.

## Simulations

To achieve the goals of estimating/predicting the performance of the cluster finding pipelines on eROSITA we need to include more realistic simulations. In this way we build upon the previously published tests based on beta models (see [Synthetic simulations of the extragalactic sky seen by eROSITA. I. Pre-launch selection functions from Monte-Carlo simulations](#)).

## Cluster Simulation Streams

There are some streams of simulations that have been discussed:

- Jeremy's sampling method that draws upon a library of Chandra and XMM observations of ~150 clusters selected by SZE (from SPT survey). These cluster images have had their AGN removed. Each cluster has a redshift and a mass measurement (derived from the SZE signature) that is accurate at the 25% level (1 sigma). This sample has masses  $M_{500} > 3 \times 10^{14}$  and extends to redshift  $z \sim 1.5$ . These clusters are an approximately mass selected sample that exhibits a broad range of morphological properties. (add key references here)
- Images produced from the radial profiles from Dominique's XMM sample and Florian's study of the HochFlugs sample. Here the profiles are drawn from real samples of clusters (flux limited or luminosity limited) and can be used to simulate clusters of a given mass and redshift through some slight stretching and perhaps also the introduction of an ellipticity. (add key references here)
- Magneticum simulations from Klaus will provide an additional stream for simulations. Klaus is looking into building a light-cone that would be appropriate for eROSITA. His simulations include X-ray AGN and includes groups and clusters with appropriate projections over a broad range of redshift. (add key references here)

In general, if the simulations are aimed to be more realistic than what is already available then it is important that clusters are drawn from a realistic and relevant population of clusters. This means the sample should cover various types of clusters in the right proportion, and the mass ( $\sim 5 \times 10^{13} - 1 \times 10^{15}$ ) and redshift range ( $\sim 0.1 - 0.7$ ) should match the expected bulk of eROSITA clusters. If real images are used, one key aspect is that they realistically cover the outer parts of clusters since we plan on selecting

# Completed, ongoing, planned pre-launch projects, and projects using *eROSITA* data

- CalPV phase
  - 8 new calibration clusters provided to M. Freyberg
  - Abell 3391/95 system (discussed updates since Ringberg meeting, action item review)
  - eFEDS (science projects/WPs and leaders mostly identified)
- eRASS1/2 phase (depending on data quality/flares)
  - Cosmology (made progress identifying key WPs and likely leading persons)
  - Other currently proposed science projects (approval pending)
    - Large (super-) clusters (3 projects)
    - $L_X$ - $T$  relation (anisotropy)
    - Galaxy groups (2 projects)
    - Combing optical and X-ray morphology indicators

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## PV Project: eROSITA's First Galaxy Cluster Outskirts and WHIM Detection

PI: [ThomasReiprich](#)<https://wiki.mpe.mpg.de/eRosita/PvReiprich>

The following people contributed to the proposal: Kaustuv Basu, FrankBertoldi, MarcusBrueggen, KlausDolag, DominiqueEckert, Jens Eler, JuergenKerp, KonstantinosMigkas, [FlorianPacaud](#), [MiriamRamos](#), [JeremySanders](#), Gerrit Schellenberger, SophiaThoelken, [WeiweiXu](#), ChaoliZhang

If you would like to contribute to the project as well, please add your name here:


FirstnameLastname [brief description of proposed contribution]

[NaomiOta](#) [anlysis/calibration/comparison with Suzaku]

**Abstract:** The Performance Verification (PV) phase offers the opportunity (i) to demonstrate eROSITA's potential to the astronomical community and the general public, (ii) to address scientific questions that cannot be answered by any other instrument, and (iii) to provide first results on the design-driving galaxy cluster science. eROSITA outperforms all other existing spectro-imaging X-ray instruments in its field-of-view, grasp, and soft spectral response. Ideal targets where eROSITA can make a difference are, therefore, objects and structures that extend over about one degree or more, with rich spectral features at soft energies. This includes, in particular, nearby galaxy clusters and superclusters. In recent years the study of galaxy cluster outskirts has become a major new research direction, where still many new discoveries are expected (e.g., Reiprich et al. 2013). Cluster outskirts temperatures are low (<few keV), making them particularly suitable for eROSITA observations. Furthermore, since the Warm Hot Intergalactic Medium (WHIM, <1 keV) is assumed to make up most of the "missing" baryons, major efforts have been undertaken in the past to detect it in X-ray absorption and emission, with mixed success. Indeed, characterization of the WHIM and of cluster outskirts are some of the key science drivers for the future Athena mission. Employing existing X-ray and Sunyaev-Zeldovich (SZ) observations, we perform detailed eROSITA SIXTE simulations and demonstrate that eROSITA can detect the densest, hottest WHIM fraction between clusters in nearby superclusters, due to its wide field-of-view and good soft spectral response; therefore, we propose here to observe two or more such systems in the PV phase for 100–150 ks each in raster scan. On top of enabling a scientific breakthrough very early on in the mission, perfect press release images will result. Furthermore, the proposed observations will have legacy value for many years to come; they will not be superseded by the eROSITA survey.

Recommended target: A3391/3395 (100ks)

Coordinates: RA=96.706 (06H 26M 49S), Dec=-54.072 (-54D 04M 19S); Galactic LII=262.799, BII=-25.164; to be optimized

The system is visible for eROSITA any time (  [visibility plot](#)).

Observing Mode: Field Scan (2.5x2.5 deg2)



# eROSITA Final Equatorial Field Depth Survey (eFEDS)

## Motivation for a PV phase survey on cluster side

The key goal of the eROSITA mission is to bring our understanding of the dark matter and dark energy of the Universe to a new level. The major progress promised by the eROSITA mission in these research fields is ultimately related to its ability to survey quickly and efficiently large areas of the X-ray sky, hence producing cluster sample of unprecedented size. This is essential to perform precision cosmological studies and to understand the structure formation. eFEDS will demonstrate the unique survey science capabilities of eROSITA and will enable key cluster scaling-relation calibration work: the eFEDS (eROSITA Final Equatorial-Depth Survey), reaching the average depth of the eRASS8 (2.5ks) over an area of  $\sim 100$  deg<sup>2</sup>. Only by combining eROSITA (X-ray cluster detections) with weak lensing surveys (cluster mass measurement) will we be able to perform stringent tests of the cosmological concordance model, including possible time evolution of dark energy, the validity of general relativity on cosmological scales, and constraining the nature of dark matter. Thus, it is critical to provide a proper match of the eROSITA survey to the planned weak lensing calibration fields. The deepest of these is the equatorial Subaru Hyper-Suprime Cam SSP field, extending between 8h and 16h in RA. The eFEDS will reach to eRASS8 depths on these fields, as required for cluster calibration during the 2018-2022 era. The overall time granted to this programme is 350 ks. These observations will be used to calibrate the X-ray observable vs cluster-mass relation for clusters in the range  $\log M = 14.1-14.7$  and  $z < 0.7$ .

## eFEDS cluster science projects

<https://wiki.mpe.mpg.de/eRosita/eFEDS>

- (1) Construction of the X-ray cluster catalog
- (2) Characterization of the X-ray sources
- (3) Optical identification of X-ray sources using DECaLS, PS1, KIDS data
- (4) Joint projects with HSC are described on the separate wiki:

<http://hscerosita.pbworks.com/w/page/124298769/Clusterprojects>

eROSITA time provides X-ray catalogs, selection function, calculated X-ray cluster properties, performs stacking analysis on external catalogs. It is expected that the shear profiles of clusters used in the scaling relation papers will be released to the team.

- (5) Spectroscopic identification of X-ray sources using GAMA spectroscopy
- (6) Calibration of the X-ray clusters using dynamical mass measurements.

## Projects under discussion

### A) Mass calibration and cluster cosmology for eFEDS clusters

- A1: Identification of eFEDS extended X-ray sources as galaxy clusters using HSC data. Comparison between HSC, DECaLS and PS1 cluster identification.
- A2: Robust WL mass measurement for eFEDS clusters
- A3: Calibration of mass-X scaling relations with HSC weak lensing for cluster cosmology
- A4: Cosmological constraints from an abundance of eFEDS clusters
- A5: Optical properties of eFEDS clusters
- A6: Multivariate scaling relations

### B) X-ray and multi-wavelength studies for optically-selected clusters

- B1: Stacked X-ray analysis of optically selected clusters out to  $z \sim 1.4$
- B2: Scaling relations for optical clusters

### C) X-ray and multi-wavelength studies for shear-selected clusters

- C1: Scaling relations for shear-selected clusters
- C2: Exploring (possible) X-ray underluminous clusters
- C3: Stacking X-ray analysis for shear-selected clusters

### D) Comparing the properties of X-ray, optically- and shear-selected samples

- D1: Cross-matching of optically/shear and X-ray selected clusters for understanding selection functions
- D2: Selection-function study using numerical simulation data

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# [https://wiki.mpe.mpg.de/eRosita/CWG\\_eRASS1\\_plan\\_countscosmology](https://wiki.mpe.mpg.de/eRosita/CWG_eRASS1_plan_countscosmology)

## Cluster Counts Cosmology Plan: eRASS1

This is a description of a workflow for carrying out a weak lensing mass calibrated analysis of an eRASS1 selected cluster sample. We review some context for this study first and then present the workflow itself. After this is a listing of the team of interested people. Finally, there is a collection of additional comments and links that have been triggered during the creation of the plan.

### A. Context for the eRASS1 Cosmology Plan

#### A1. Sky area:

We have adopted 13,452 deg<sup>2</sup> of eROSITA-DE extragalactic sky (defined to be 30<sup>o</sup>>DEC>-85<sup>o</sup> with further exclusion of high Galactic column and stellar density regions) in our DeROSITAS observing proposals (Zenteno+). We adopt this as the nominal coverage for our planning.

See discussion in previous forecast papers ([Merloni+12](#), [Pillepich+12](#), [Pillepich+18](#), [Grandis+19](#)).

#### A2. Optical followup data:

We envision defining the cluster catalog using optical imaging datasets that are deep enough to follow the cluster sample to z~1.

There is about 9,000 deg<sup>2</sup> currently covered with imaging deep enough for cluster confirmation/redshift estimation to z~1.1

DES + DECaLS + HSC + KiDS + DeROSITAS

The following numbers come from Daniel Lang, who is working on the Zenteno team (18 Sept 2018).

DES = 3 762 deg<sup>2</sup> complete



# Workplan, source detection, selection function

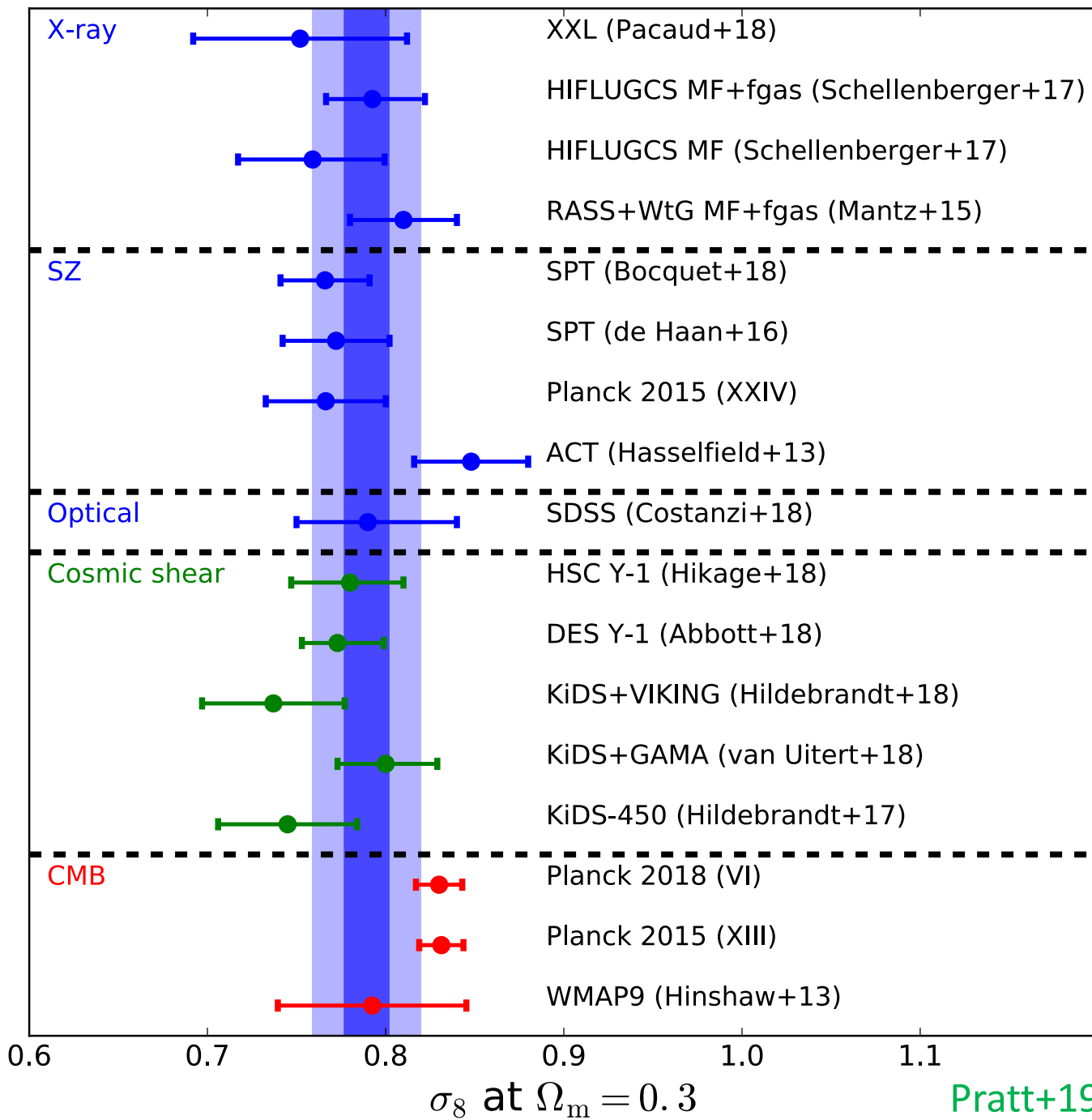
- CFC, three pipelines with long heritage from real data ready to be run on simulations:
  - eSASS: boxdetect, maxlike: Georg, Hermann, ...
  - Wavelets, Sextractor, maxlike: Miriam, Florian P., ...
  - Wavelets, core excluded: Florian K., Alexis, Dominique, ...
  - **Fall back option** is eSASS.
- Selection function comes from CFC, for the optimal source detection algorithm. **Fall back** selection function is available from Clerc, Ramos-Ceja et al. (2018).

# Workplan, ID, weak lensing

- ID:  $\frac{3}{4}$  of DE sky covered by DECam, HSC, and VST (and WISE) surveys. More coming. **Fall back:** Use what is easily digestible by MCMF (M. Klein).
- WL: shear profiles available for at least  $\sim 15\%$  (maybe up to  $\sim 30\%$ ) of DE sky by DES, HSC, and KiDS. Minimal **fall back** is  $\sim 1800$  sq.deg published by DES collaboration.

# Workplan, cosmology

- Plan everything for eRASS1. Minimal **fall back** is eRASS2 (if eRASS1 data have insufficient quality).
- Further discussion needed on optimal selection cuts (S/N, mass, redshift). Minimal **fall back**: “low-risk” cuts in all of them.
- Four existing pipelines have been applied to real data, X-ray (Pacaud+18, Schellenberger+17, Clerc+12) and SZ (Bocquet+18) clusters. Another branch to be applied to RASS clusters (Grandis+).
- CWG members published the most recent cluster cosmology papers.



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- CalPV phase
  - 8 new calibration clusters provided to M. Freyberg
  - Abell 3391/95 system (discussed updates since Ringberg meeting, action item review)
  - eFEDS (science projects/WPs and leaders identified)
- eRASS1/2 phase (depending on data quality/flares)
  - Cosmology (made progress identifying key WPs and likely leading persons)
  - Other currently proposed science projects (approval pending)
    - Large (super-) clusters (3 projects)
    - $L_X$ - $T$  relation (anisotropy)
    - Galaxy groups (2 projects)
    - Combing optical and X-ray morphology indicators

## Science Proposals

<https://wiki.mpe.mpg.de/eRosita/CWGscienceprops>

Until eROPUB is available, on this page, concrete, specific, and very focussed science proposals making use of early eRASS data (eRASS1 or eRASS2) are listed that are not part of the core cluster counts cosmology and that are not part of the PV phase. Please take note of the overall categories and the required structure of proposals.

**Overall categories:** (Clearly, there will be projects that would fit in more than one category. Simply select the one that best fits to your case.)

1. Structure, astrophysics, and chemistry of nearby galaxy clusters
2. Superclusters and filaments
3. Scaling relations
4. Multiwavelength studies
5. Large scale structure (excluding the core cluster counts cosmology work)
6. Galaxy groups

Please use this format:

### Proposal

1. *Running number* (CWG-1, CWG-2, ...):
2. *Added by, on:*
3. *Modified by, on:*
4. *Collaborators:*
5. *Category:*
6. *Title:*
7. *Abstract:*
8. *Required data products* (e.g., eRASS:2 cluster catalog in Dec<-20, eRASS:1 photon event lists for 10 sq.deg at RA/Dec, ASKAP/EMU radio data):
9. *Contributions to preparatory tasks* (e.g., source detection testing, forecasts, background analysis):
10. *Comments* (e.g., external collaborators):
11. *Approval status* (pending/approved in WG telecon/meeting on):
12. *Timeframe* (e.g., start after eRASS:2 cluster catalog release, completion after ~1 yr):
13. *Progress* (not started/running/completed):