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Comparing BaSTI simulations with observational data: a simple use case

Use Case Steps

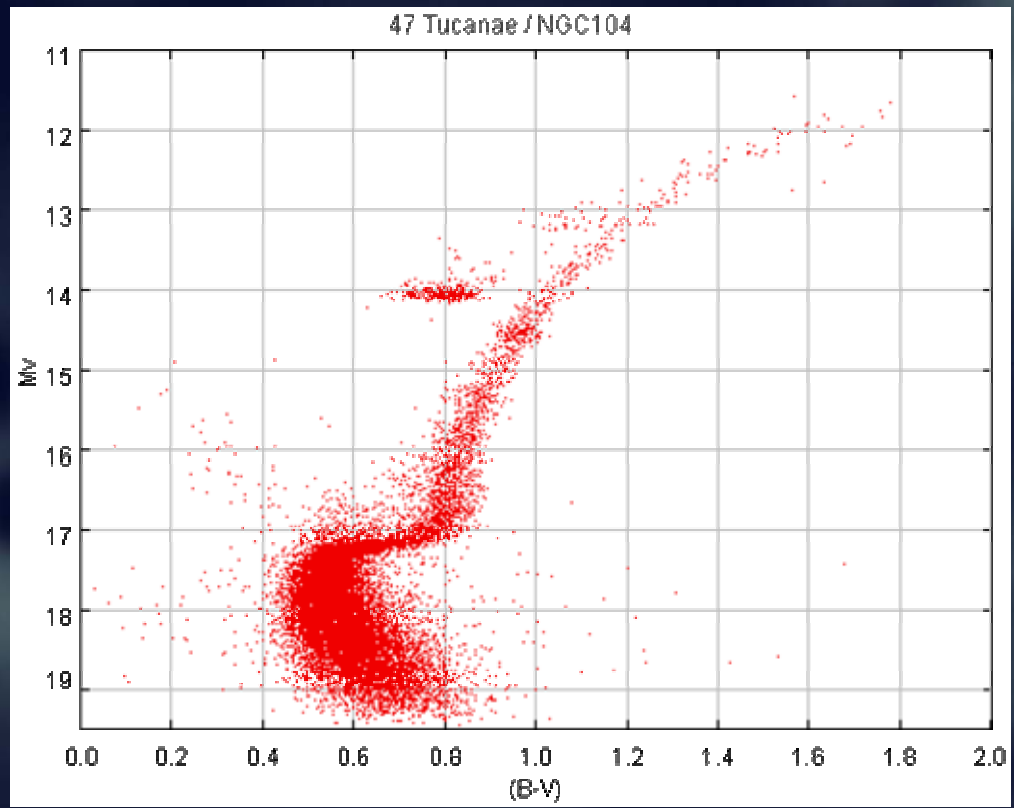
- get observational data for a cluster
  - globular cluster in this example (fine also for other stellar clusters' types)
- download BaSTI simulated isochrones at various ages and metallicities
  - find best fitting metallicity
- get BaSTI simulated ZAHB tracks at identified metallicity
  - determine cluster distance from DM
- superimpose BaSTI isochrones for given metallicity using the determined DM
  - obtain cluster's age checking Turn Off point

Observational Data

Globular cluster

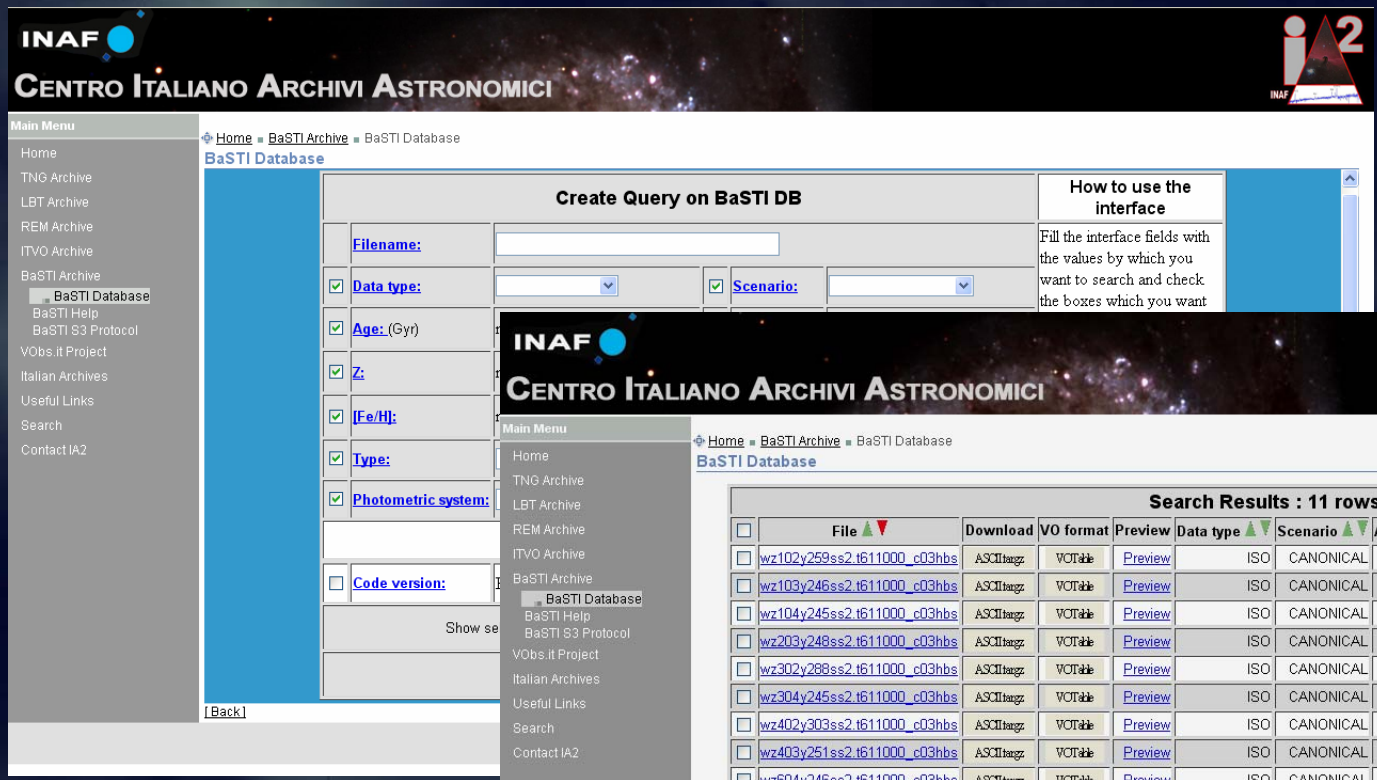
with ‘unknown’:

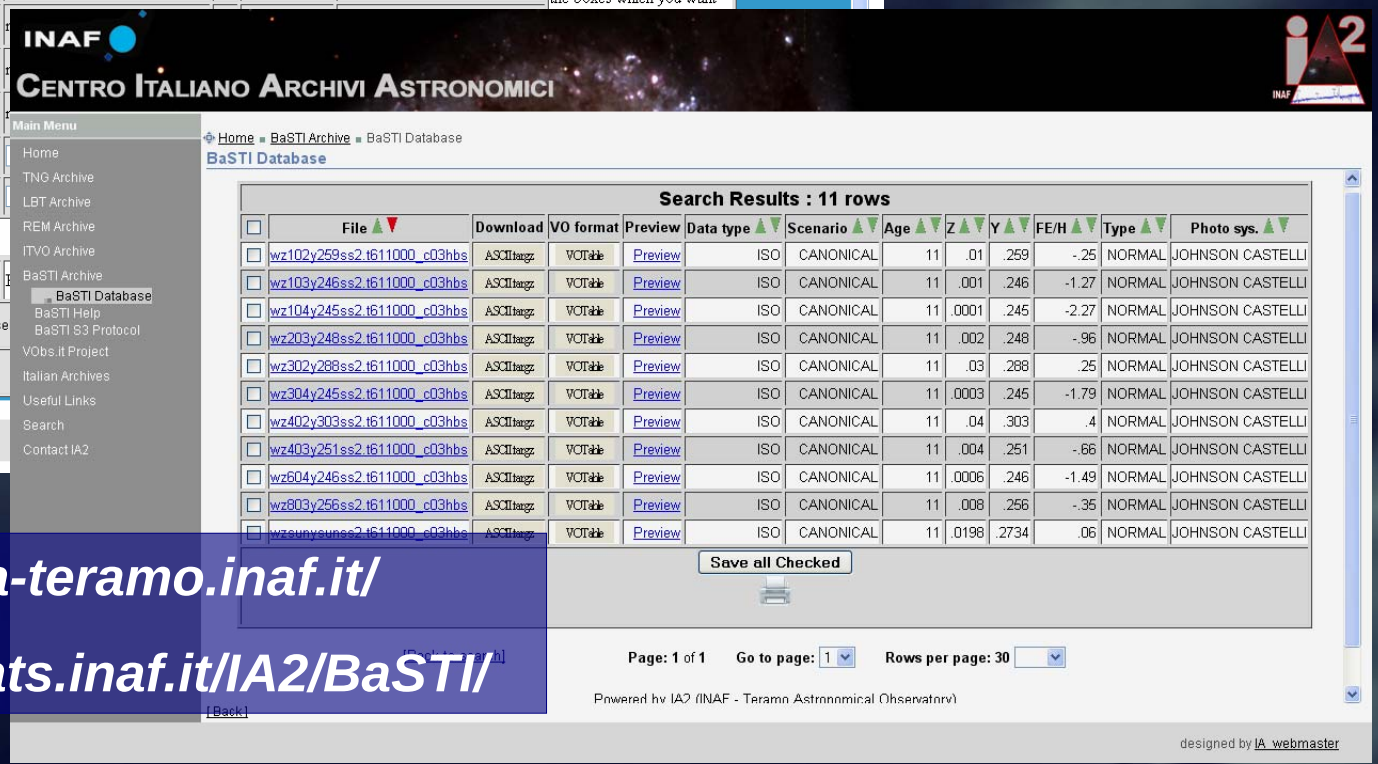
- metallicity
- distance
- age



HST data, see: **Gilliland, R.L. & al. 2000 ApJ, 545, L47**

BaSTI Web Portal





File	Download	VO format	Preview	Data type	Scenario	Age	Z	Y	FE/H	Type	Photo sys.
wz102y259ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.01	.259	-.25	NORMAL	JOHNSON CASTELLI
wz103y246ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.001	.246	-1.27	NORMAL	JOHNSON CASTELLI
wz104y245ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.0001	.245	-2.27	NORMAL	JOHNSON CASTELLI
wz203y248ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.002	.248	-.96	NORMAL	JOHNSON CASTELLI
wz302y268ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.03	.268	.25	NORMAL	JOHNSON CASTELLI
wz304y245ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.0003	.245	-1.79	NORMAL	JOHNSON CASTELLI
wz402y303ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.04	.303	.4	NORMAL	JOHNSON CASTELLI
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wz604y246ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.0006	.246	-1.49	NORMAL	JOHNSON CASTELLI
wz803y256ss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.008	.256	-.35	NORMAL	JOHNSON CASTELLI
wzsunysunss2.t611000_c03hbs	ASCII targz	VOTable	Preview	ISO	CANONICAL	11	.0198	.2734	.06	NORMAL	JOHNSON CASTELLI

http://albione.oa-teramo.inaf.it/

http://wwwas.oats.inaf.it/IA2/BaSTI/

BaSTI Portal Tools

Home ▪ BaSTI Archive ▪ BaSTI Database

BaSTI Database

BaSTI Stellar MicroSimulations Previewer

File Information: simulation type: **Isochrone**, mixture: **SCALED SOLAR MODEL**, Z: **.01**, Y: **.259**, age: **11** Gyr.
Data can be downloaded as ASCII or XML tables.
The image below is updatable using the input form on the left (see help). To download it use [righ-click]+[Save Image as...] (or something similar, depending on your browser). The images below and the update form itself take advantage of STILTS (Mark Taylor, Bristol, UK) started in its *server* mode.

Change Plot Contents and Style

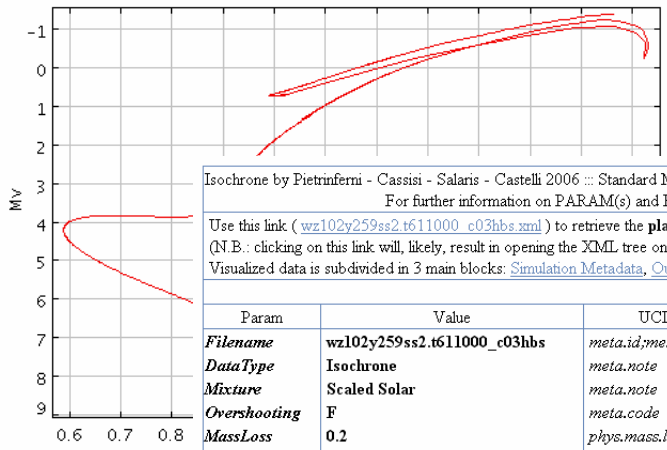
Axis Data

x values: (B-V)
y values: Mv

Plot Symbol Properties

Shape:
Size:
Color: name / [or] code RRGGBB
Connection line: DotToDot
Transparency:
Hide:

Graphic and Axis Properties



Isochrone by Pietrinferni - Cassisi - Salaris - Castelli 2006 ::: Standard Model - Scaled solar model & transformations (Castelli 1999) + BaSeL Library (2002) + Empirical Transf. for C-Stars
For further information on PARAM(s) and FIELD(s) see: "http://wwwas.oats.inaf.it/IA2/index.php?option=com_wrapper&Itemid=87"

Use this link (wz102y259ss2.t611000_c03hbs.xml) to retrieve the **plain** XML VOTable
(N.B.: clicking on this link will, likely, result in opening the XML tree on your browser. Use **right-click + "Save link as ..."**, or similar, to download it).
Visualized data is subdivided in 3 main blocks: Simulation Metadata, Output Fields and Data Table.

Simulation Metadata (back to top)

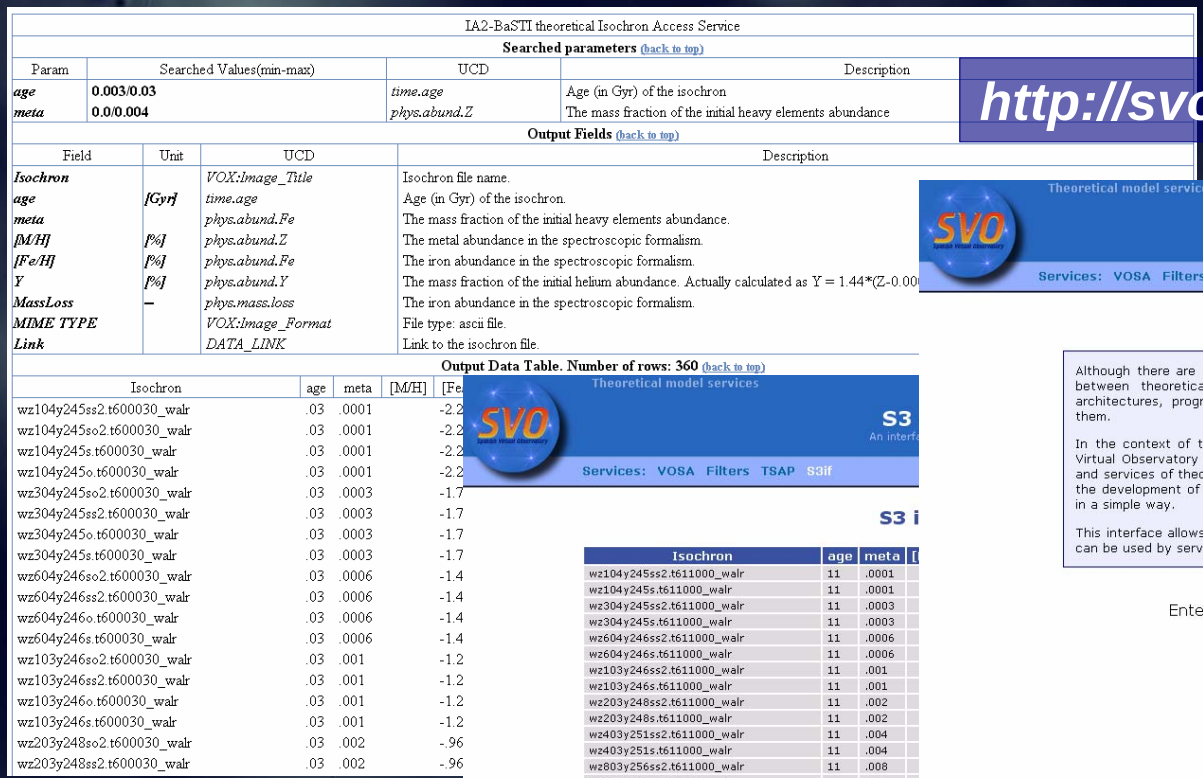
Param	Value	UCD	Description
Filename	**wz102y259ss2.t611000_c03hbs**	*meta.id;meta.file*	Name of the converted ASCII file
DataType	**Isochrone**	*meta.note*	Type of data simulation
Mixture	**Scaled Solar**	*meta.note*	Heavy elements distribution
Overshooting	**F**	*meta.code*	Overshooting parameter
MassLoss	**0.2**	*phys.mass.loss*	mass loss according to the Reimers (1975) law
PhotSystem	**Johnson-Cousins**	*meta.note*	Adopted photometric system used to translate theoretical simulation
Type	**Normal**	*meta.note*	Extent of the evolution's simulation
CodeVersion	**2007**	*meta.note*	FRANEC code version used
RadOpacity	**Ferguson 2005**	*meta.note*	Prescription followed to include the low temperature radiative opacity
Np	**2000**	*meta.number*	Number of points in the simulation, i.e. rows in the VOTable
[M/H]	**-.253**	*phys.abund.Z*	The metal abundance in the spectroscopic formalism
Z	**.0100**	*phys.abund.Z*	The mass fraction of the initial heavy elements abundance
Y	**.259**	*phys.abund.Y*	The mass fraction of the initial helium abundance. Actually calculated as Y = 1.44*(Z-0.0001).
Age	**11.0000**	*time.age*	Age (in Gyr) of the isochron
CheckDate	**17-02-2006**	*time.processing*	Expresses data computation for further controls or revisions

Output Fields (back to top)

Field	UCD	Description
(M/Mo)in	*phys.mass;arith.ratio*	Initial mass, in solar units, of the structure
M/Mo	*phys.mass;arith.ratio*	Mass of the structure
log(L/Lo)	*phys.luminosity;arith.ratio*	Logarithmic luminosity, in solar units, of the structure

STILTS powered

BaSTI S3



IA2-BaSTI theoretical Isochron Access Service

Searched parameters (back to top)

Param	Searched Values(min-max)	UCD	Description
age	0.003/0.03	*time.age*	Age (in Gyr) of the isochron
meta	0.0/0.004	*phys.abund.Z*	The mass fraction of the initial heavy elements abundance

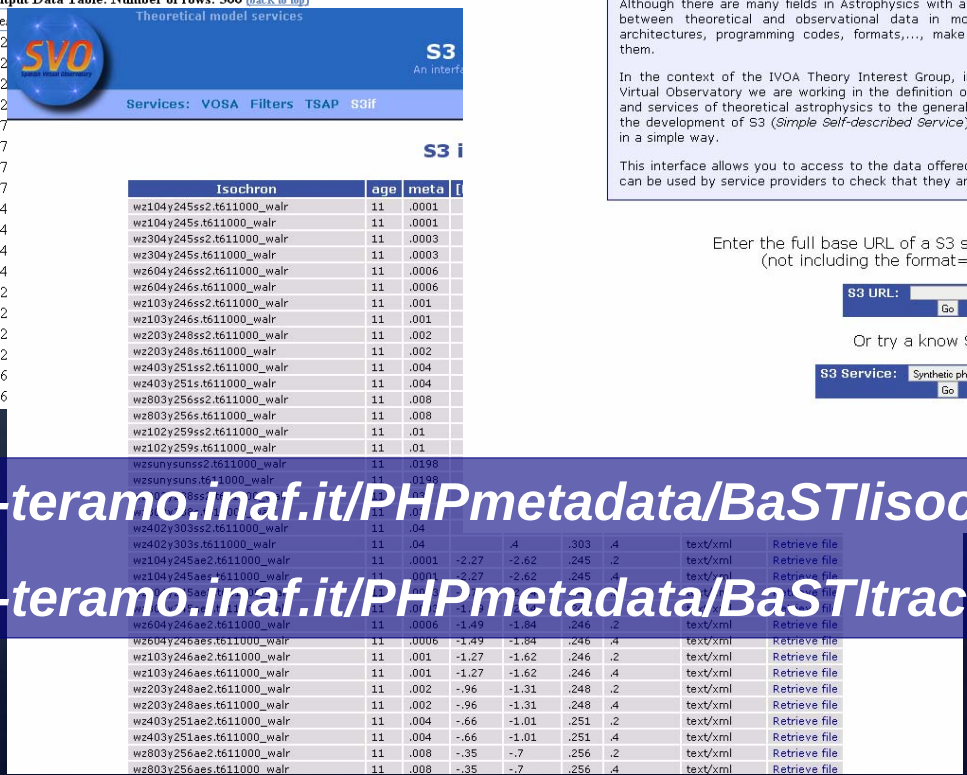
Output Fields (back to top)

Field	Unit	UCD	Description
Isochron		*VOX:Image_Title*	Isochron file name.
age	*[Gyr]*	*time.age*	Age (in Gyr) of the isochron.
meta		*phys.abund.Fe*	The mass fraction of the initial heavy elements abundance.
[M/H]	*[%]*	*phys.abund.Z*	The metal abundance in the spectroscopic formalism.
[Fe/H]	*[%]*	*phys.abund.Fe*	The iron abundance in the spectroscopic formalism.
Y	*[%]*	*phys.abund.Y*	The mass fraction of the initial helium abundance. Actually calculated as Y = 1.44*(Z-0.00
MassLoss	–	*phys.mass.loss*	The iron abundance in the spectroscopic formalism.
MIME TYPE		*VOX:Image_Format*	File type: ascii file.
Link		*DATA_LINK*	Link to the isochron file.

Output Data Table. Number of rows: 360 (back to top)

Isochron	age	meta	[M/H]	[Fe
wz104y245ss2.t600030_walr	.03	.0001		-2.2
wz104y245so2.t600030_walr	.03	.0001		-2.2
wz104y245s.t600030_walr	.03	.0001		-2.2
wz104y245o.t600030_walr	.03	.0001		-2.2
wz304y245so2.t600030_walr	.03	.0003		-1.7
wz304y245ss2.t600030_walr	.03	.0003		-1.7
wz304y245o.t600030_walr	.03	.0003		-1.7
wz304y245s.t600030_walr	.03	.0003		-1.7
wz604y246so2.t600030_walr	.03	.0006		-1.4
wz604y246ss2.t600030_walr	.03	.0006		-1.4
wz604y246o.t600030_walr	.03	.0006		-1.4
wz604y246s.t600030_walr	.03	.0006		-1.4
wz103y246so2.t600030_walr	.03	.001		-1.2
wz103y246ss2.t600030_walr	.03	.001		-1.2
wz103y246o.t600030_walr	.03	.001		-1.2
wz103y246s.t600030_walr	.03	.001		-1.2
wz203y248so2.t600030_walr	.03	.002		-.96
wz203y248ss2.t600030_walr	.03	.002		-.96

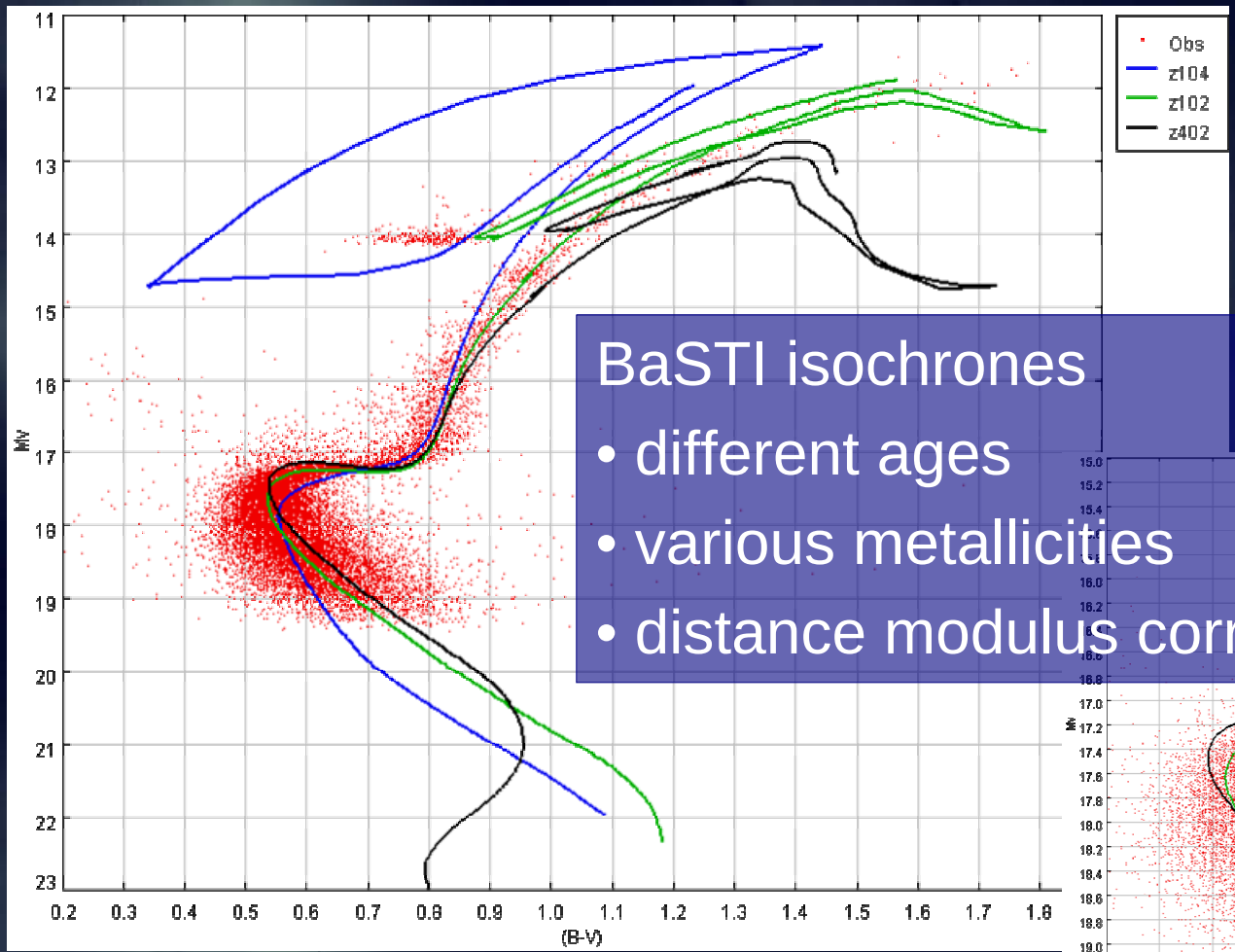
http://svo.laeff.inta.es/theory/s3if/



http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTIisochron.php

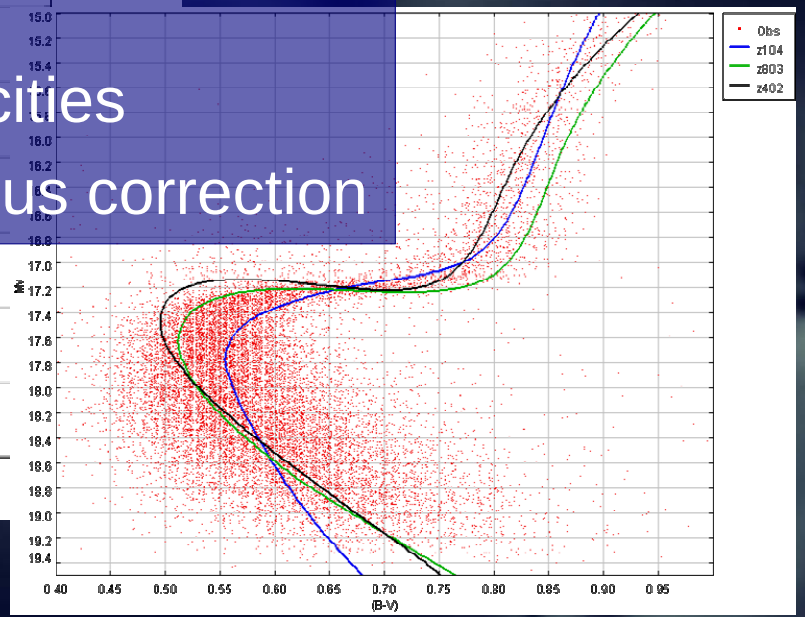
http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTItrack.php

BaSTI Isochrones



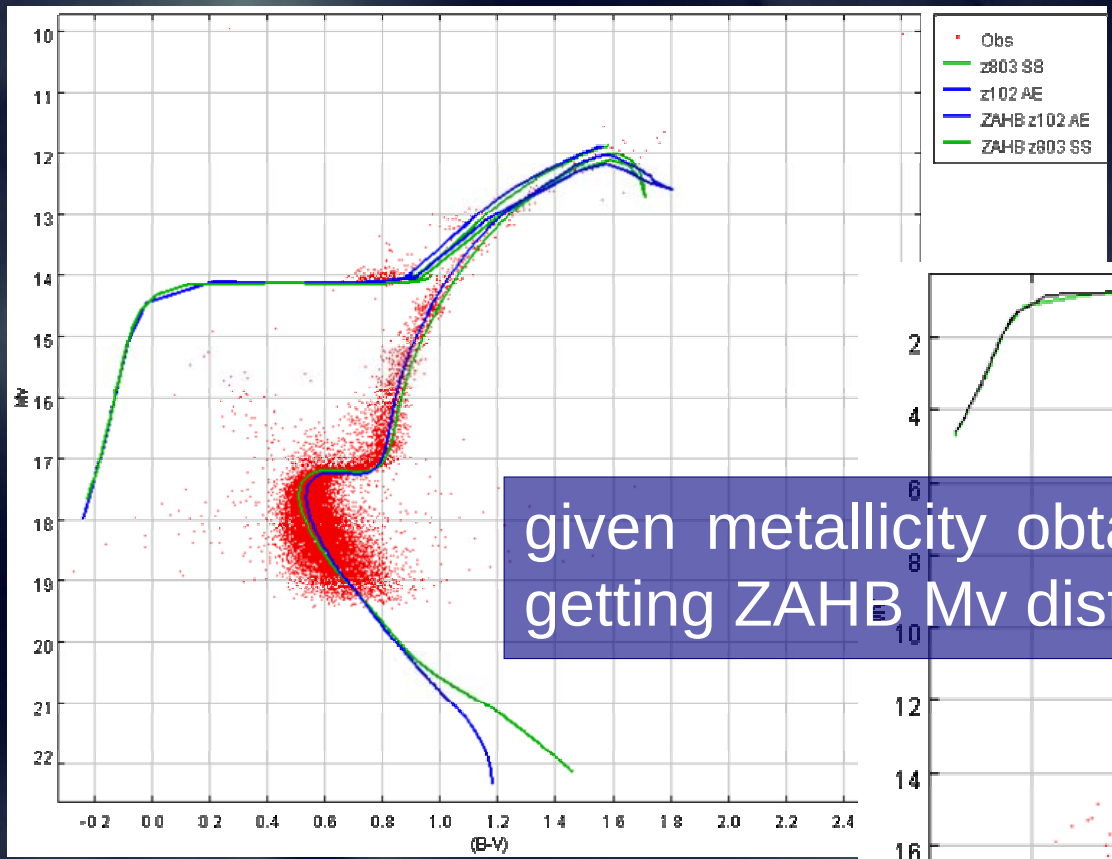
step 1
metallicity

BaSTI isochrones
- different ages
- various metallicities
- distance modulus correction



z = 0.01 (α-enh) ; 0.008 (scaled solar)

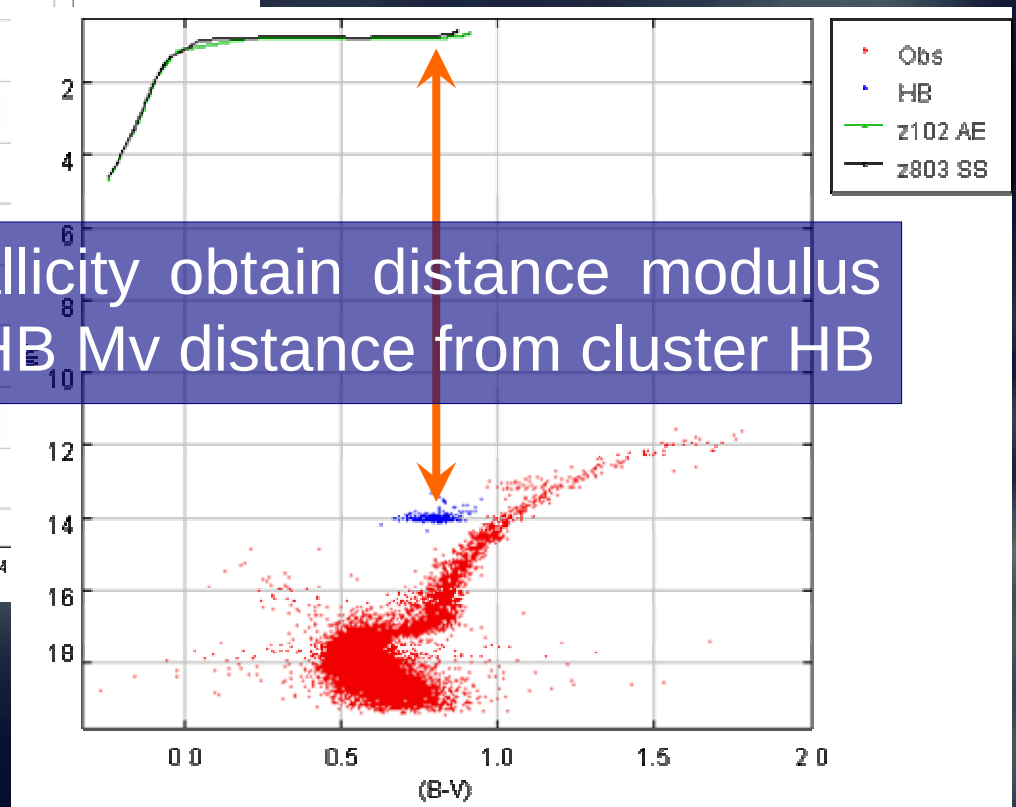
BaSTI ZAHB



step 2

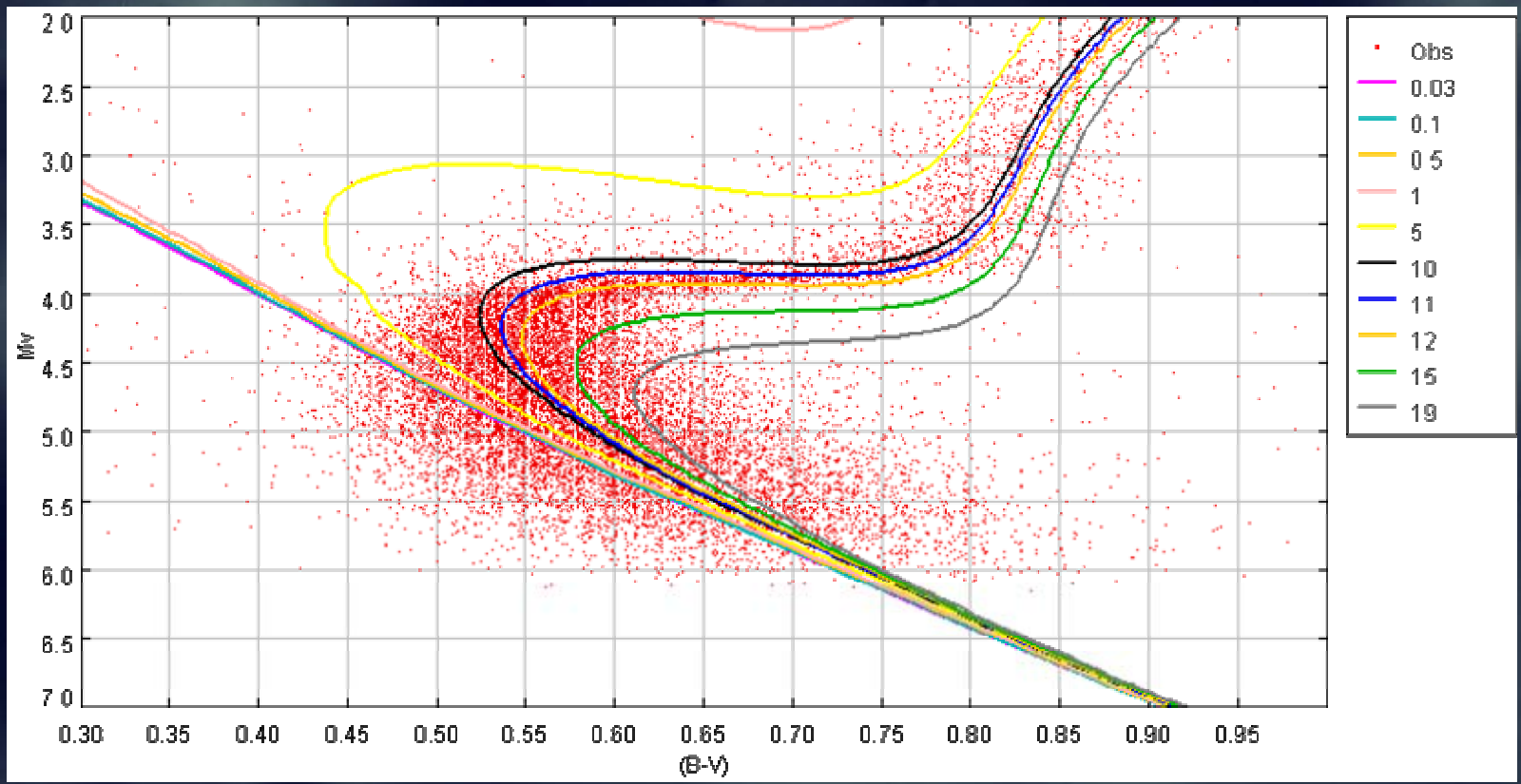
distance

given metallicity obtain distance modulus
getting ZAHB Mv distance from cluster HB



MD = 13.3 ➡ ~ 15k ly

BaSTI Isochrones



step 3
age

age ~ 11 Gyr

metallicity and DM defined
check Turn Off point to obtain age

Reiteration

- example use case was presented ‘cheating’ ☺ (on results of course…)
  - target results taken from: **Gratton & al. 2003 A&A, 408** and **Percival & al. 2002 ApJ, 573**
- iteration on steps actually a must to obtain good results

	[Fe/H]	DM	Age [Gyr]
BaSTI	*-0.6*	*13.3*	*11*
Gratton & al.	*-0.66±0.04*	*13.47±0.03*	*11.2±1.1*
Percival & al.	*-0.7±0.07*	*13.37±0.11*	*11.0±1.4*

Comments (use case)

- simple but performances can be easily improved
  - better outlined steps and hints
  - more in-depth use of VO tools (not only visualization aided results)
- (except from spectra) first observational vs. simulation comparison based use case
- (once detailed) could it be added to the EURO-VO scientific workflows page?

Comments (on VO)

- tools
  - easy to use and stable
  - difficult to use them at their maximum capabilities with theoretical data
- interfaces
  - need to be improved, use cases can help
- standards
  - used the BaSTI S3 (also through the Spanish VO S3 interface)
  - SimDB/SimDAP