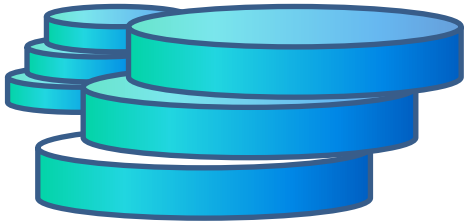


DB support for NEMO phase 2 and KM3NeT-Italy

Cristiano Bozza – University of Salerno / INFN – Roma, Nov 2013

Presentation Plan

- Overview of DB system in KM3NeT
- KM3NeT DB activity in Italy
- NEMO phase 2 DB activity

Working team: Cristiano Bozza (UNISalerno), Natalia Deniskina (INFN Napoli)

Tight interaction with Arnauld Albert, Kay Graf (KM3NeT Europe)

Overview of DB system in KM3NeT

DB Servers

Done
In progress
To do

km3net Oracle DB @ CCIN2P3
Users, sites, institutions, PBS, products, tests, parameters, calibrations, slow control data, bookkeeping data
+posttrigger data? +reconstructed data?

km3ita Oracle DB @ UNISA → UNINA (GRID CC)
KM3NeT Italian users, PBS, products, tests, parameters, calib., bookkeeping data, SlowCtl data,
+posttrigger data? +reconstructed data?
NEMO slow control data

scdbfase2
MySql DB @
INFN LNS
NEMO slow
control data

km3ita Oracle DB @ INFN LNS
It. users, PBS, products, tests, parameters, calib., SlowCtl data, bookkeeping data
+posttrigger data? +reconstructed data?
NEMO slow control data

Overview of DB system in KM3NeT

Licensing

- CCIN2P3 (free for us)
  Oracle DB Server Enterprise Ed. Perpetual
  + Oracle Real Application Cluster (3 servers)
  + Oracle Data Guard

- INFN – KM3NeT Italy @ UNINA
  Oracle Standard Edition, 1 Processor 2 Year

- INFN – KM3NeT Italy @ LNS
  Oracle Standard Edition ONE, 1 Processor 1 Year

Overview of DB system in KM3NeT

Licensing

- More (or cheaper) licenses to come when KM3NeT becomes a CERN-recognized experiment

- INFN survey on Oracle usage in experiments – let's wait and see if there are INFN-Oracle negotiations / agreements in the next future

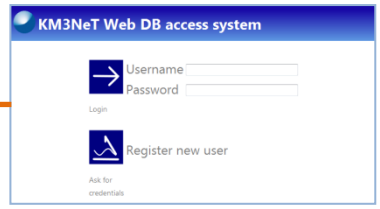
Overview of DB system in KM3NeT

Web Servers

Done
In progress
To do

km3net Oracle DB @ CCIN2P3

http://km3netdbweb.in2p3.fr/
VM @ CCIN2P3



http://km3netsrv01.na.infn.it

http://km3netsrv01.na.infn.it:81
http://193.205.188.228:8080

km3ita Oracle DB @ UNISA → UNINA (GRID CC)

scdbfase2
MySql DB @
INFN LNS
NEMO slow
control data

km3ita Oracle DB @ INFN LNS

Local Website @ INFN LNS?

Overview of DB system in KM3NeT

Data replication techniques

- Read→Write (MySql →Oracle)
  Uses a scheduled job (*crontab* entry) to run a dedicated copy program

- Oracle DBLink + materialized view
  (periodically refreshing – uses an Oracle job)

- Oracle DBLink + copy (remote insert)
  (uses an Oracle job)

Overview of DB system in KM3NeT

Data access technology

Guideline: “Make data access easy and flexible!”

- Interactive (GUI) data access: use webserver application
- Programmatic data access: use *wget* or *curl* (available as GNU tools by default in any Linux distro) using webservers as access points
- No communication client required: if you can read a file, you can access the DB

Overview of DB system in KM3NeT

Data access technology

Guideline: “Make data access easy and flexible!”

- Data formats: the webserver encodes data “on-the-fly”, so any data format could be supported
- Priority given to “streamable” ASCII n-tuple
- Other dataformats (e.g. ROOT/gzip) require full file to be generated before starting the transmission, which can easily be done if the webserver has a local disk buffer

Overview of DB system in KM3NeT

Data access technology

Guideline: “Make data access easy and flexible!”

- Any program/framework that can issue HTTP requests can be used to insert/retrieve data to/from the DB via the nearest webserver access point

- The webserver application can also manage a local *cache* of files extracted from the DB

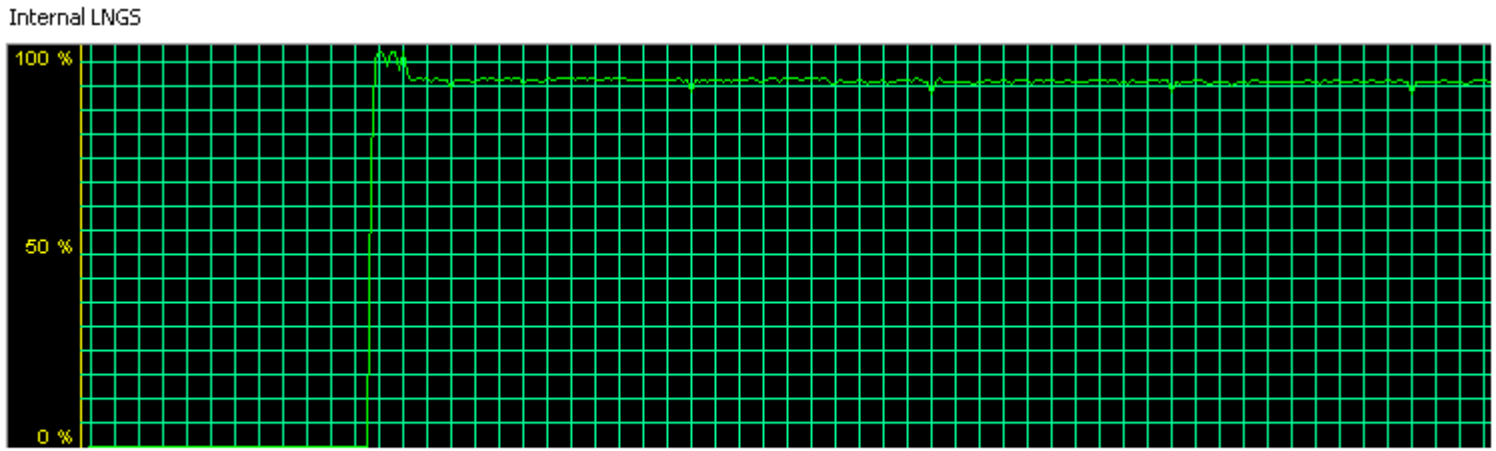
- Integration into GRID storage infrastructure planned (installation at UNINA to be used for development/testing)

(Oracle 12c developed for GRID/Cloud)

Overview of DB system in KM3NeT

Data throughput

Oracle performance: 1 machine on 1 Gbps connection



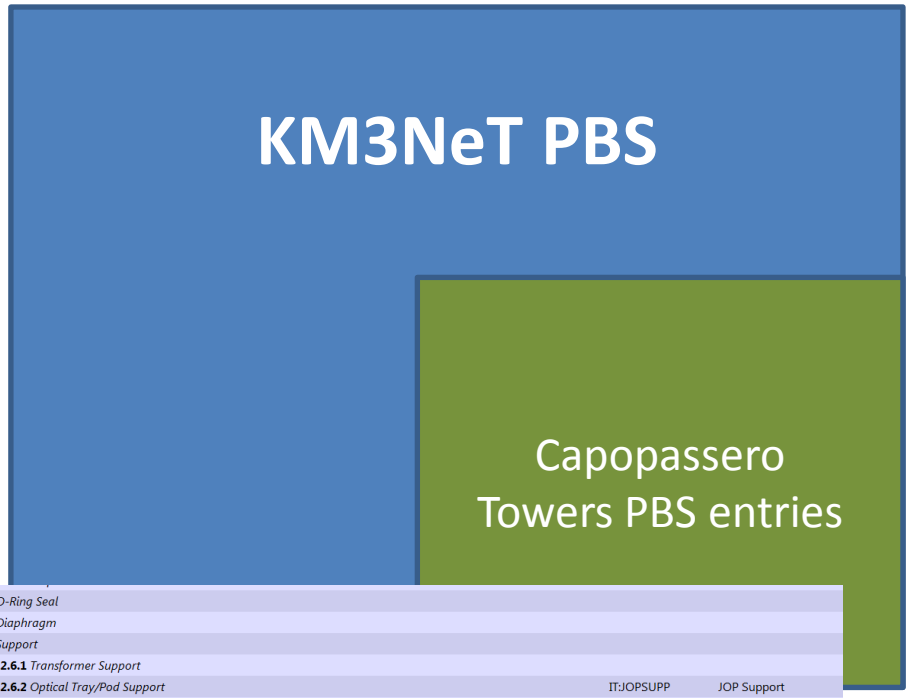
Adapter Name	Network Utiliza…	Link Sp…	State
External LNGS	0 %	1 Gbps	Operational
Internal LNGS	91 %	1 Gbps	Operational

Multiple web access points: multiply performance by using Oracle data caching!

High performance demands proper table optimization: design with user needs in mind

KM3NeT DB activity in Italy

Construction/integration



2.3.2.4 *O-Ring Seal*		
2.3.2.5 *Diaphragm*		
2.3.2.6 *Support*		
2.3.2.6.1 *Transformer Support*		
2.3.2.6.2 *Optical Tray/Pod Support*	IT:JOPSUPP	JOP Support
2.3.2.6.3 *Power Tray/Pod Support*	IT:JPPSUPP	JPP Support
2.3.2.6.4 *Control Tray/Electronic Pod Support*	IT:EPSUPP	EP Support
2.3.2.6.5 *Charger tray*		
2.3.2.6.6 *Acoustic Transponder Support*		
2.3.2.6.7 *JOP Cylinder*		
2.3.2.6.8 *EP Cylinder*		
2.3.2.6.9 *JPP Cylinder*		
2.3.2.6.10 *JMA Cylinder*		
2.3.2.6.11 *JOP Blind cap*		
2.3.2.6.12 *EP Blind cap*		
2.3.2.6.13 *JPP Blind cap*		
2.3.2.6.14 *JMA Blind cap*		
2.3.2.6.15 *JOP Drilled cap*		
2.3.2.6.16 *EP Drilled cap*		
2.3.2.6.17 *JPP Drilled cap*		
2.3.2.6.18 *JMA Drilled cap*		

- KM3NeT Italy towers are now a part of the KM3NeT PBS
- Still missing in the DB, but ready in the next days: “containermapping” info, i.e. physical containment
- All documentation already provided by M. Anghinolfi, R. Papaleo, M. Musumeci

KM3NeT DB activity in Italy

Construction/integration

- KM3NeT: Product identification through UPI
  (#PBS/VARIANT/VERSION.SERIALNUMBER#)

- Alternate id possible for IT towers (i.e. short name + SERIALNUMBER)

- KM3NeT: Mapping to producer/partnumber/producer serial number

- KM3NeT: Datasheets hosted into DB
  (also envisaged to host datasheet tables, numbers, parameters)

- KM3NeT: Product integration info (instructions, drawings, etc.) hosted on Google Drive and linked to DB via HTTP
  (also possible to host on web server and link to DB via HTTP, or host document in the DB and generate web page dynamically)

KM3NeT DB activity in Italy

Construction/integration/calibration

• KM3NeT: Production-testing-integration tracking tables ready on DB, still empty

• Tablet app to track production/testing/integration under development, critically needs complete DB info to work

• Tablet app now includes a free barcode reading library; other libraries for QR or DataMatrix also available freely or for moderate costs

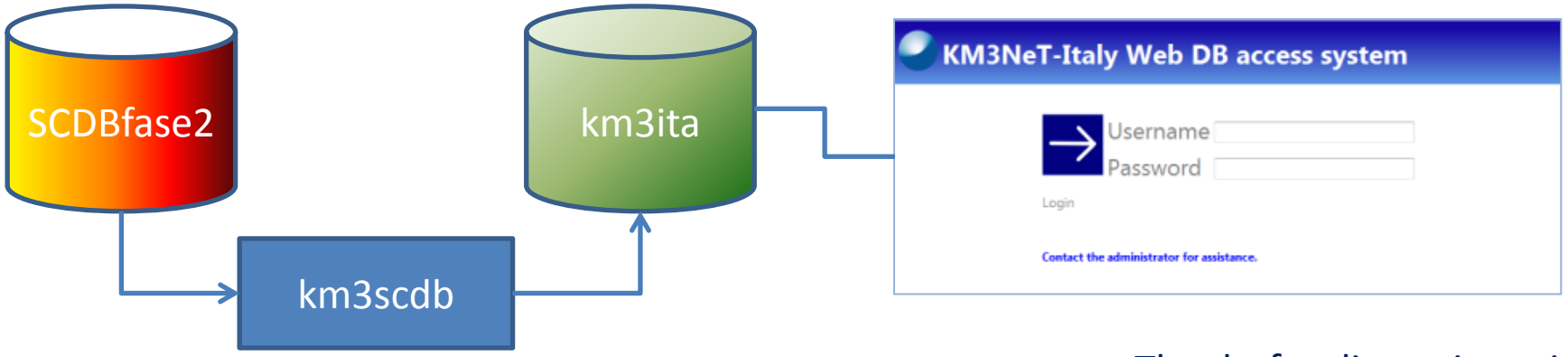
• KM3NeT: tables for testing parameters and calibration output ready on DB, still empty

• KM3NeT: filling tables through wget/curl-based scripts or direct access (C++/Java HTTP clients)

NEMO phase 2 DB activity

A tool for DB + Web data access

Start from SCDBfase2 (Slow Control DB) implemented on MySQL (by A. Rovelli and C. Distefano) and make data available on Oracle (km3ita) on the Web



km3scdb: Mono-based application running on *cron* to read *scdbfase2* and recode data for *km3ita*

Thanks for discussion with
S. Biagi, T. Chiarusi, L. A. Fusco, C. Nicolau, M. G. Pellegriti

NEMO phase 2 DB activity

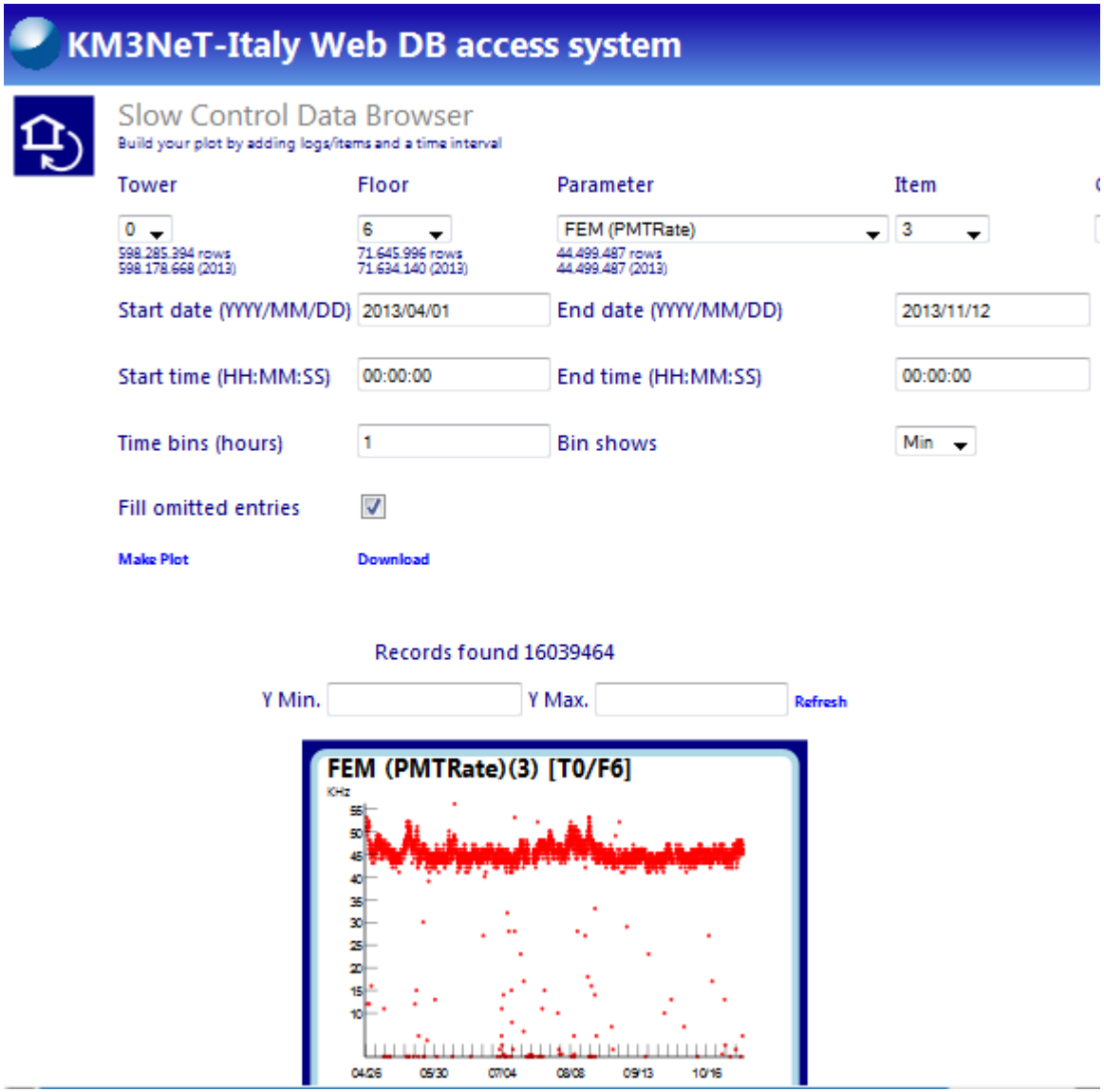
Two data access pages implemented so far: **general Slow Control data** and PMT pedestals

The webserver can automatically fill the skipped entries

All the monitored quantities can be shown

Data rebinning for plotting is flexible (min/max/avg)

Data download is also possible (just copy the "Download" shortcut)



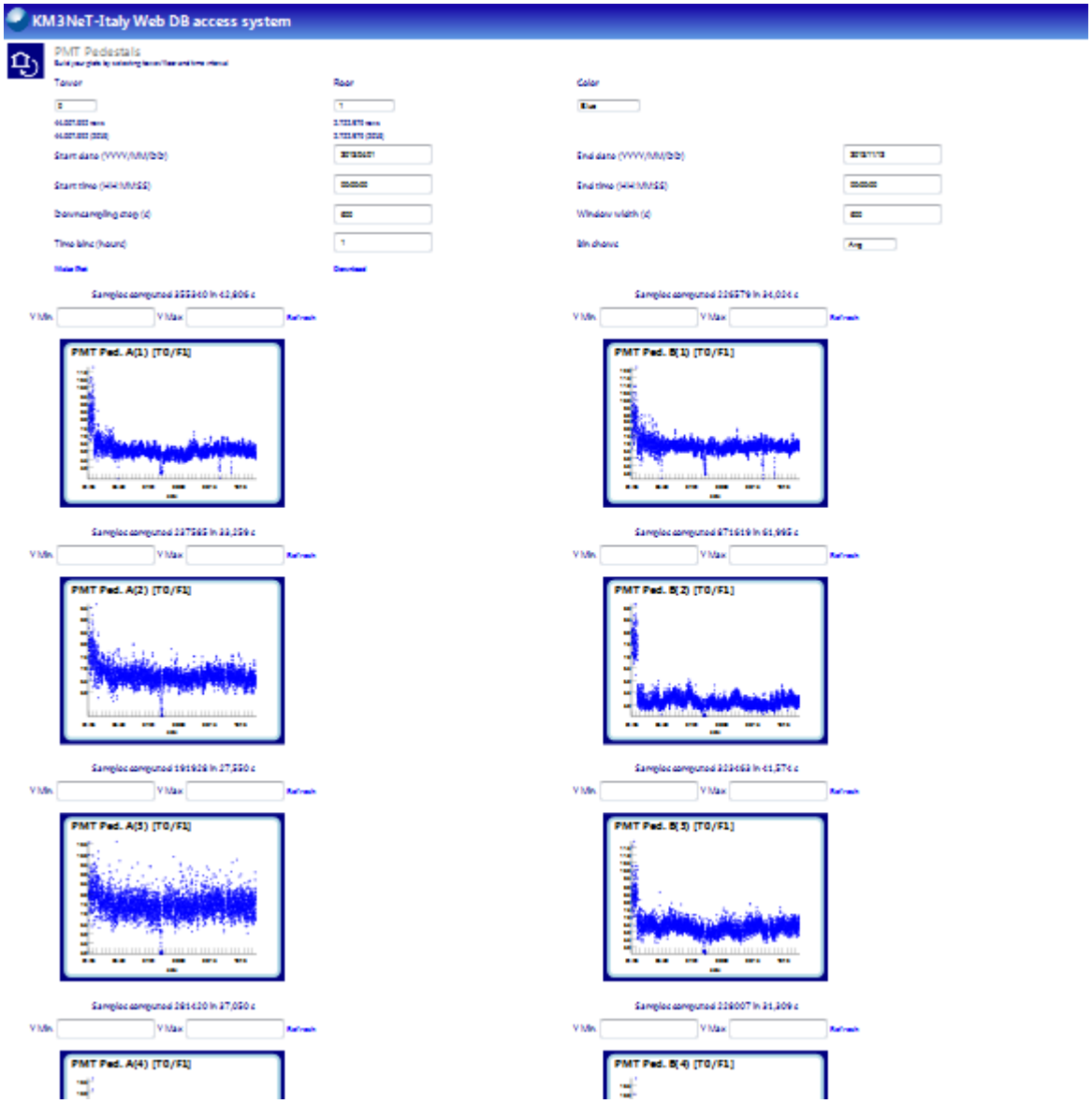
/slowctl._?t=0&f=6&m=66&i=3&start=2013/04/01 &end=2013/11/12

NEMO phase 2 DB activity

Two data access pages implemented so far: general Slow Control data and **PMT pedestals**

The webserver automatically fills the skipped entries and computes moving averages

Download the data by copying the “download” shortcut and pasting to command line using *curl*



NEMO phase 2 DB activity

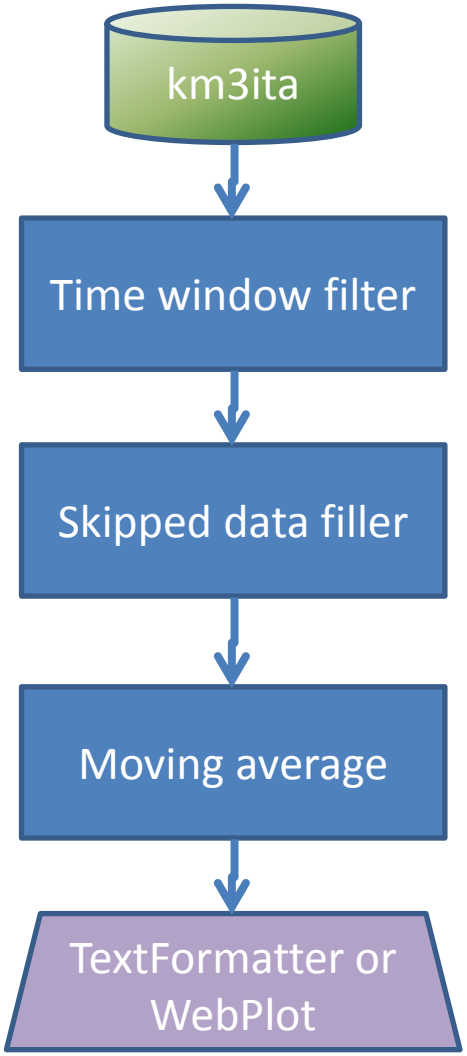
Direct data access (or access including skipped measurements)

The output file format can be tuned: the web server can be upgraded to remove/add data columns if needed

date day	PMTRate[1](KHz)	
2013/11/4-00:00:00.000	0.00000000	42
2013/11/4-00:00:01.000	0.00001157	47
2013/11/4-00:00:02.000	0.00002315	44
2013/11/4-00:00:03.000	0.00003472	48
2013/11/4-00:00:04.000	0.00004630	46
2013/11/4-00:00:05.000	0.00005787	51
2013/11/4-00:00:06.000	0.00006944	47
2013/11/4-00:00:07.000	0.00008102	49
2013/11/4-00:00:08.000	0.00009259	49
2013/11/4-00:00:09.000	0.00010417	46
2013/11/4-00:00:10.000	0.00011574	50
2013/11/4-00:00:11.000	0.00012731	43
2013/11/4-00:00:12.000	0.00013889	43
2013/11/4-00:00:13.000	0.00015046	47
2013/11/4-00:00:14.000	0.00016204	41
2013/11/4-00:00:15.000	0.00017361	50
2013/11/4-00:00:16.000	0.00018519	50
2013/11/4-00:00:17.000	0.00019676	41
2013/11/4-00:00:18.000	0.00020833	49
2013/11/4-00:00:19.000	0.00021991	49
2013/11/4-00:00:20.000	0.00023148	49

NEMO phase 2 DB activity

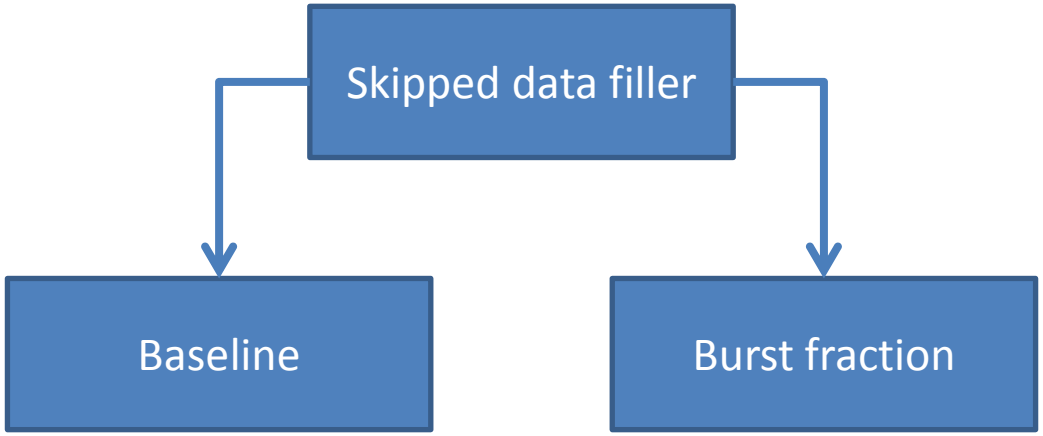
Time series modular processing pipeline in the web server



DataSource and DataConsumer class interfaces

Processing objects can be data sources or data consumers or both

DataSources “fan-out” data: extract data once, broadcast data to several processing units, prepare several outputs altogether



Different and fine-tuneable DataConsumers can produce different output formats

NEMO phase 2 DB activity

Data flow in the web server

Main GUI pages

Multiple DB connections used in round-robin to ensure low latency

km3ita

Time window filter
Skipped data filler
Moving average
TextFormatter or WebPlot

Data extraction and processing threads

Time window filter
Skipped data filler
Moving average
TextFormatter or WebPlot

"Task connections" created for each specific data serving job

NEMO phase 2 DB activity

Coming soon

- PMT Baseline computation
- Burst fraction

… other ideas are welcome!

NEMO phase 2 DB activity

DB + Webserver support to data analysis

- DB + Webserver do not replace traditional analysis tools
- They can make data distribution simple and quick, producing output formatted as to make life as easy as possible
- Standardized, routine monitoring plots can be implemented on the Web for convenience
- The ability to read data as if they were stored in files, with user-defined formats, helps integration in existing environments and in the GRID
- Notice that access performance depends on the way data are stored: data management requires planning