HEPHY

Institute of High Energy Physics

Current Status of the VXD Track Finding Modules

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F2F Meeting in Pisa

May 12th, 2014

Overview of the main topics of the last months

Testbeam Hamburg

- Track finding was possible
- Still some issues to deal with
- Top priority for the next weeks

VXD TF modules complete redesign

- VXDTF will be replaced by several modules
- Concentrating on test driven design
- Some basic decissions still unresolved

Bachelor students / Projects

- Stefan Ferstl, display interface, mostly completed
- Thomas Fabian, extensive Filter studies, ongoing
- Thomas Madlener, mainly Rudis student, but supporting work has to be done by me

University lectures

- Attending „Classification and discriminance analysis“
- Attending „Statistics“

Testbeam Hamburg Jan. 2014

- Extremely informative, effective and stressful weeks
- Main goal achieved, tracking and ROI finding was possible
- TF was fast enough and stayed below RAM threshold
- Many short term decisions multiplied work to be done
- Revealed issues in the TF which have to be fixed
- Topic still not closed

Open issues of testbeam related aspects

Telescope support

- On a first glance, simple task (partial TEL <-> PXD sw compatibility)
- Caused need for changing many smaller things
- Main problem: assuring that the CA stays a directed Graph without loops
- Still parked in a separate branch, needs to be merged with trunk

Thorough study of testbeam data

- Not done yet, only some runs tested locally
- Coupled with Tobias' (et al) project – real time conference
- Eventually Bachelor studend will do this

Some issues revealed by stressing the code

- Sometimes strange behavior of filters
- Bugs in the filters themselves
- Bug in producing cutoffs for secMap
- Baseline-TF is only working for very, very easy cases
- Code difficult to maintain
- Detailed tests for proving well defined behavior of the TF needed (essential)

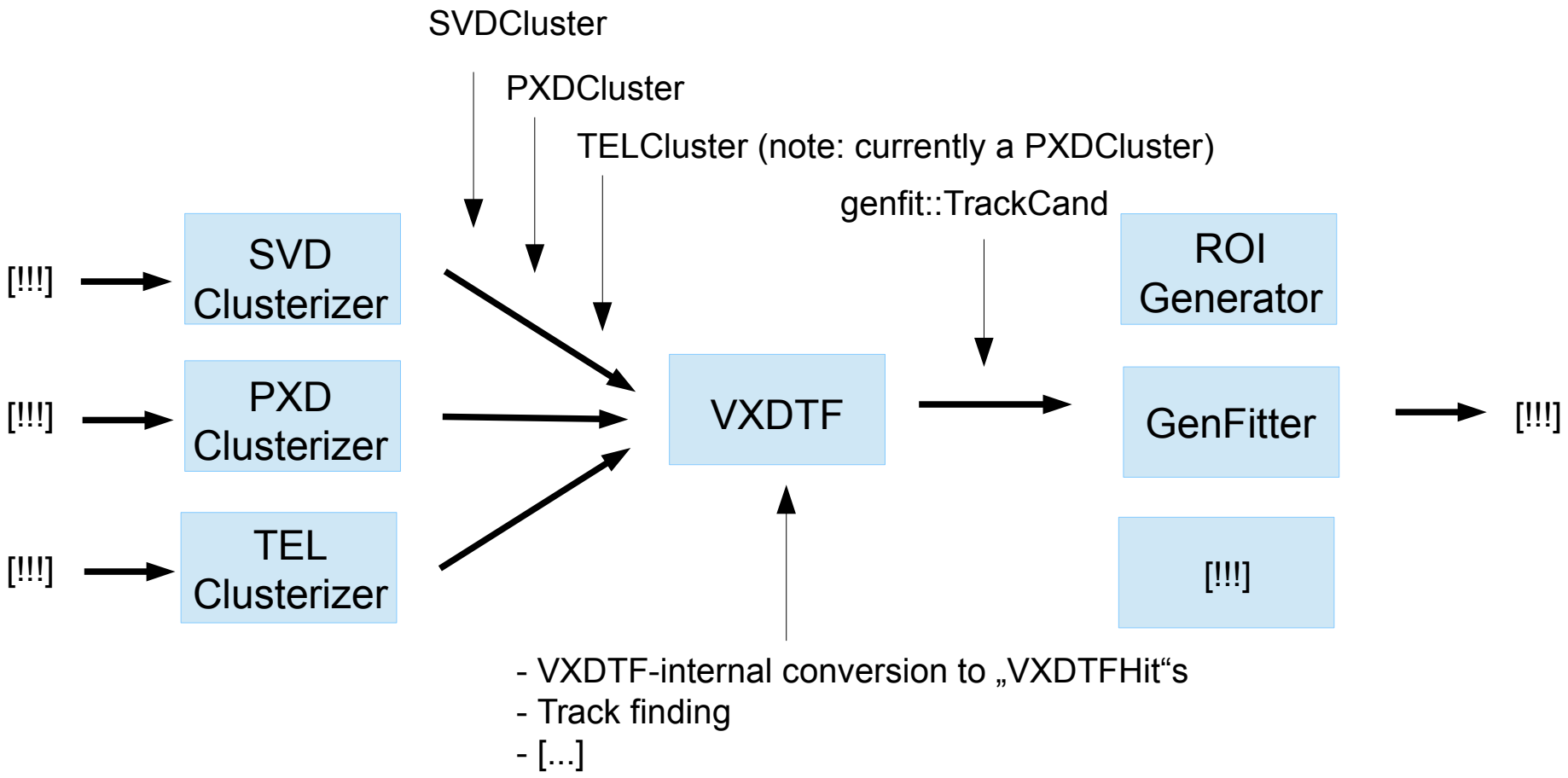
Testbeam stuff to do (ongoing):

- Merging code with current release
- Solving issues which surfaced within the last few days
  - Memory corruption resulting in a segfault
  - Creating new secMaps for everything (secMap container changed)
- Verifying Telescope support again (was working in March, still the case after merging?)
- Visual (Display) and statistical (DQM-plots) verification of VXDTF performance

VXDTF redesign

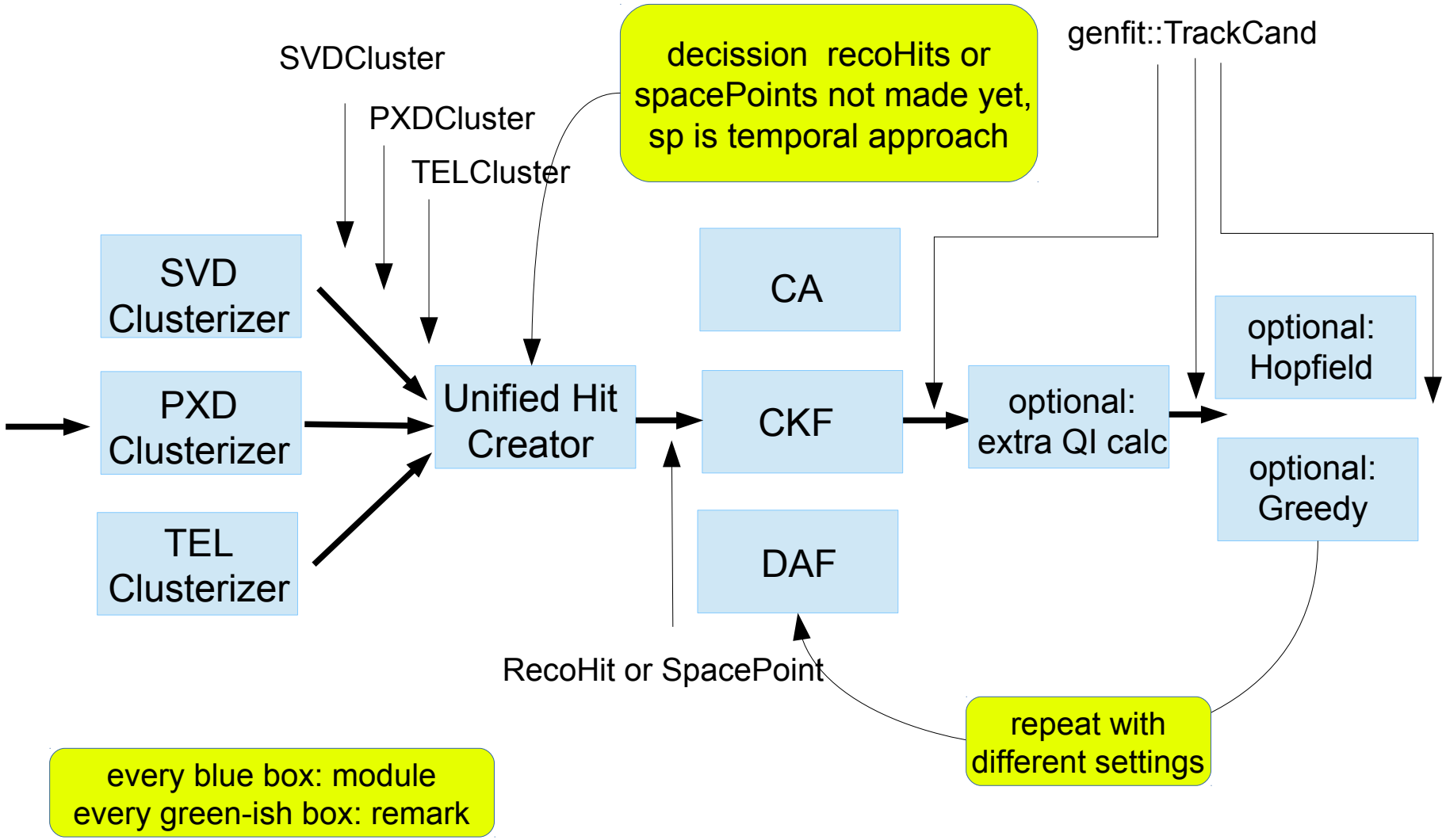
- Essential for further steps
  - Improvement of test-coverage (near 100% is the goal, so far it's 10% at best)
  - Splitting into several modules increases flexibility
  - Preparation for new TFs (CKF, DAF (both using genFit)
  - Increase maintainability of the Code
- (Of course) has to be done asap (after TB finish)

Current state of this part of the reconstruction chain

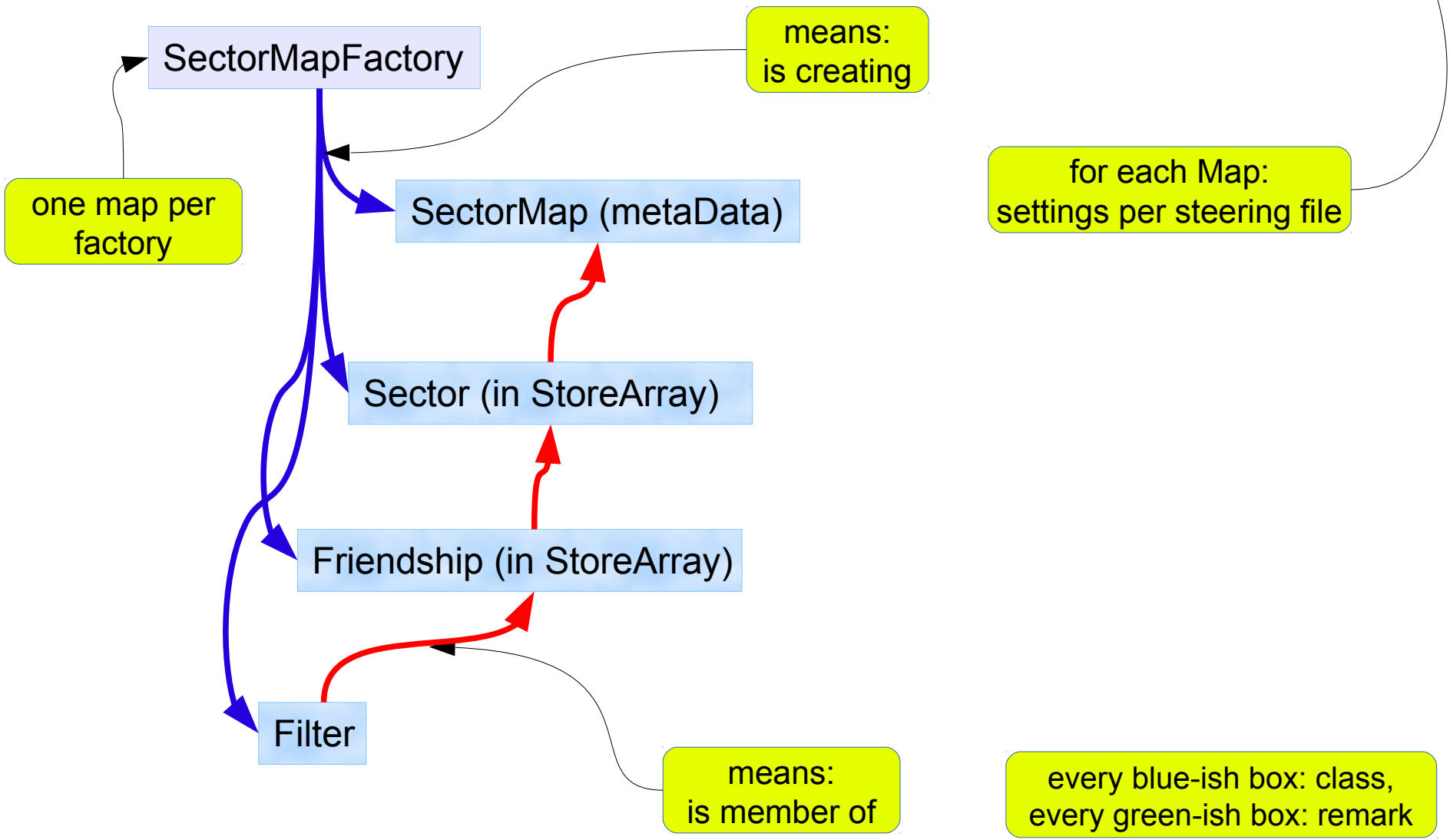


[!!!] : shortcut for „a lot of important stuff which is not part of this discussion“

Future state of the trackFinder VXD-approach (event-part)



Planned SectorMapCreatorModule (beginRun/endRun)



VXDTF redesign stuff to do (pending):

- RunWise:
  - SecMapCreator: some basic stuff is working, done: 25%
- EventWise:
  - SpacePointCreator: working for PXD, done 40%
  - CA-module: toDo: restructuring code of VXDTF, 0%
  - CKF: use genFit::processTrackPartially for CKF-implementation, 0%
  -DAF: genFit interface, 0%

Supervising Stefan Ferstl - project thesis

- Dealing with the issue of the VXDTF being a black box
- Covering everything and every step
- Output usable for detailed analysis or Display-module
- Analysis-output „Feature complete“ only bug-fixing left
- Display, awaiting comments from Christian Pulvermacher

Supervising Thomas Fabian – bachelor thesis

- Detailed study of filters used for the CA (e.g. Angle3D)
- Done in several steps
  - Check of every single filter implemented (tracking/tests)
  - Implementing improvements and three new filters
  - Using output provided by Stefan for analysis of „usefulness“ of each filter (doing correlations between filters, fake rate, …) - goal: reduce number of filters, chose best ones
- Currently starting with last point, analysis
- A very time-consuming supervising task

Suporting Thomas Madlener – bachelor thesis

- Study of using neuronal networks and a secMap for lowMomentum tracking (simplified matlab environment, but real Belle2-McData)
- Mostly supervised by Rudi, but I have to provide secMaps and mcData in their custom format, 95% done
- Kept me from working on previous topics but should be mostly done now

Outlook – May 2014

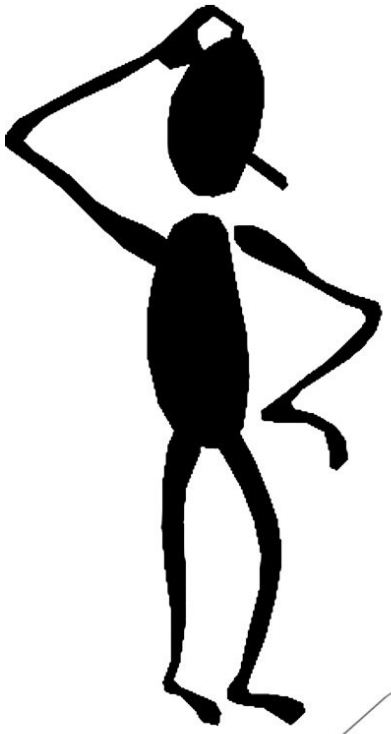
- F2F-Meeting, Pisa (now)
- DEPFET-Meeting, Seeon (Bavarian Metropolis – 25.-28.5.)
- Meantime: working on TB-stuff (see slides 3-5)
- Goal: not being the showstopper for Tobias' trip to the real time conference (26.-30.5.) in Nara, Japan

Outlook – June 2014

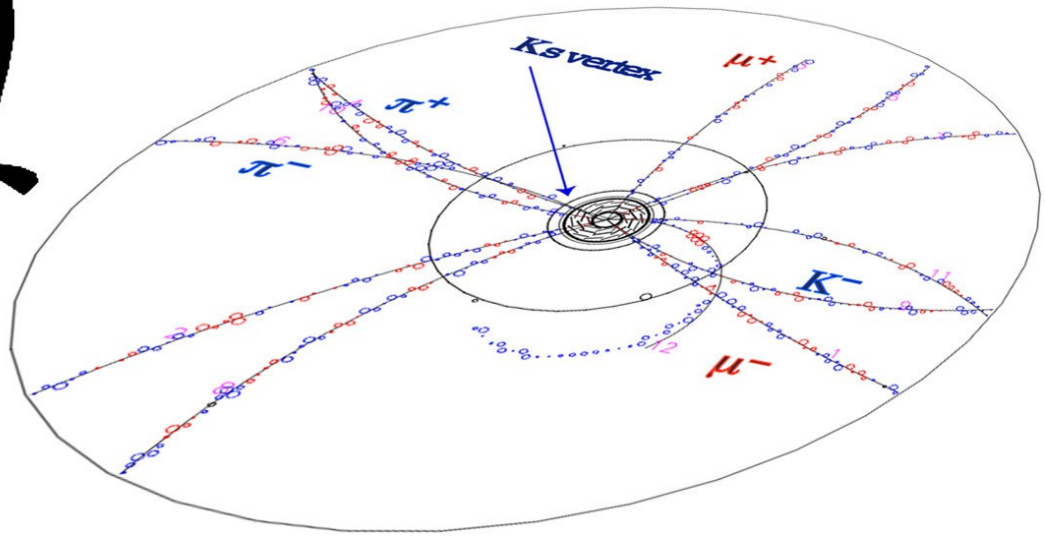
- Tidy up the code a bit
- Implement minor things of the redesign, write tests
- Prepare for:
- tCSC 2014, Split – 14.-22.6.
- Rest of the month – learning
- Exam in statistics – 30.6.

Outlook – Summer 2014

- July
  - Exam in classification and discriminant analysis – 7.7.
  - Holidays
- August, September: finishing redesign
- Autumn
  - Starting CKF and DAF implementation
  - TB preparation (?)



Thank you!



what would be my wishlist for recoHits?

- !! detector independent interface (so far: SVD,SVD2D & PXDRecoHits)
- !! sensor-independent (->for global coordinates and error)
- !! local coordinates scaled between 0-1 (relative coordinates)
- ! some way to mark it as reserved for other TFs
- possibility to store infos about segments

Exclamation marks indicate that this would be really needed, the other stuff could be done internally too

Detailed sketch for the new sectorMap-approach

SectorMapFactory

- one factory per setup
- creates own StoreArray for its Sectors
- another StoreArray for SectorFriendship
- links them by relations and pointers(to storeArray-entries)
- creates storeObjPtr for metaData („SectorMap“)

module executing factory creates all factories at beginRun

SectorMap :: storeObjPtr

- carries metadata like name of StoreArrays
- sorted container of <Sector*> for direct access
- defines origin/secMapCenter and sorting type

Sector :: RelationArray

- only static info like SectorFriendship
- form directed graph with other sectors (direction by secID or distance2Origin)
- container of <FriendRelations*> for direct access
- carries ActiveSector* (reset every event)
- carries segmentMaker called by ActivatedSector

Detailed sketch for the new sectorMap-approach II

SectorFriendship :: RelationArray

- one Friendship allowed for each compatible combination with current sector
- combination can contain any number of sectors in chain (useful lengths: 1-3)
- Carries only the filters allowed for that combi & secMap

Filter :: RelationArray

- can be a filter for any number of hits (currently there are 2-X-hitfilters)
- Filter applied only for current Friendship → cutoffs only for local case
- creates/updates compatibilityTable for each possible hit-combi
- following filters only execute their stuff on combis which are still alive

ActivatedSector (:: RelationArray?)

- 1:1 relation to a sector of current sectorMap
- created once per event (lightweight, maybe not inheriting anything)
- container of <Hits*> for direct access
- hits are passed to segmentMaker of Sector
- stores segments