

Status of VXDTF-related modules

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What happened since last F2F meeting (Jan 2015)?

Been there, done that:

- Continued working on observers (segFinder)
- Refactoring FilterCalculator (using SPs, some tweaks, not in repository)
- Study of $\theta 90^\circ$ -issue (cause finally found and fixed, thanks to Martin Ritter and Peter Kvasnicka!)
- Bugfixes (as always)
- SPTCNetworkProducer- + TrackSetEvaluatorGreedyModule (started)

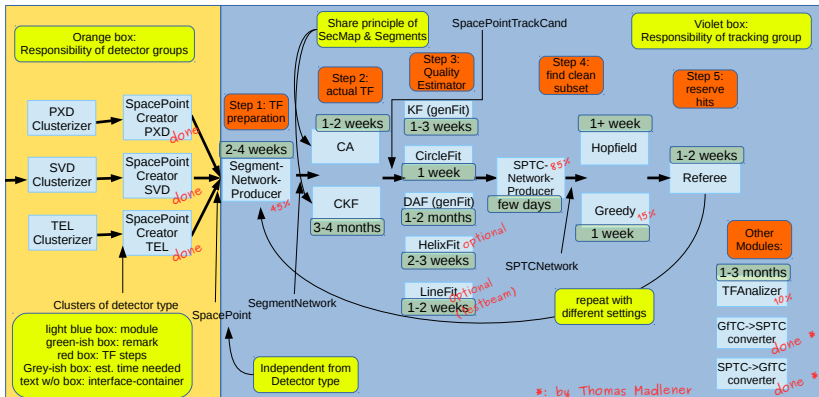


slide from last F2F meeting in Prague January 2015

Next proposed steps - ordered (time planned):

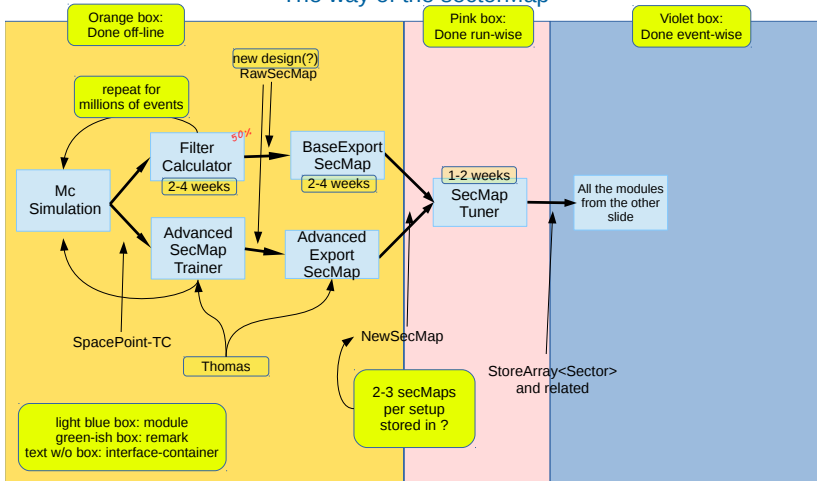
- Quick and dirty efficiency-finetuning for connecting the dots-conference (?) (1-3 week)
 - Converting VXDTF-, TFRedesign- and *done for FilterCalculator, imho not working for old TF* FilterCalculatorModule to SpacePoints (should then easily be migrated to tracknodes of segmentNetwork)
- Finishing Observer-stuff (1-2 weeks) *done (2-hit-filters, no TFanalyzer connection, got more complicated)*
- Starting to use new sectorMap-container → to be coordinated with Eugenio
- Migrating to segmentNetwork, finishing its module
- Implementing SelectionVariables for nbFinder and others
- Migrating modules: CA, Hopfield, KF(genfit-pipe), CF, Greedy, Referee (simple version) *got more complicated, cont'd, but mostly solved by now*
- Connecting the modules, make sure everything works
- Expected milestone to be reached: end of April *fortunately, no year mentioned_*

Future state of the trackFinderVXD-approach (event-part)



- done, but not directly listed above: observers (2-hit), B3Vector3, Filters
- estimated time needed for essential stuff: 8-15 months, redesign only: 4-9 months
- not mentioned here: IntelligentSpacePointCreatorSVD → Andrzej Bozek (or someone delegated by him, current status unknown)

The way of the sectorMap



Test setup

Setup A

- 5000 evtGen-standard-events
- beam pipe, PXD, SVD, magnetic field cut off at $r = 15$ cm
- VXD and SVD runs (marked as such)
- no extra background added

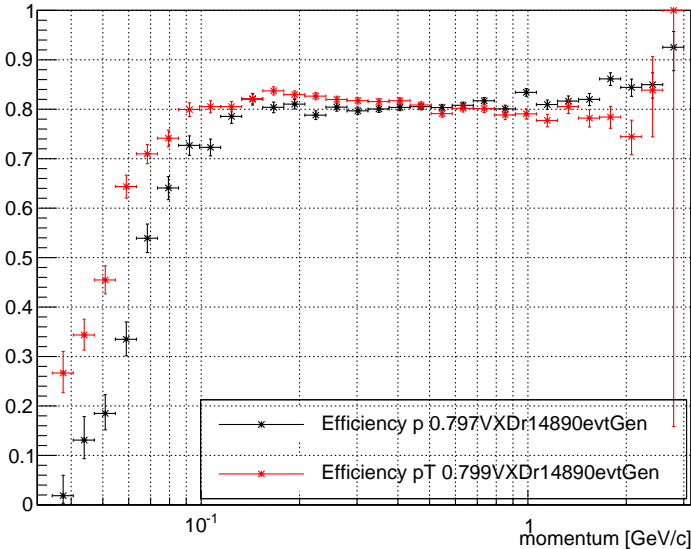
Setup B

- 5000 events with 10 tracks of one particle type (marked as such)
- beam pipe, PXD, SVD, magnetic field cut off at $r = 15$ cm
- VXD runs only
- no extra background added



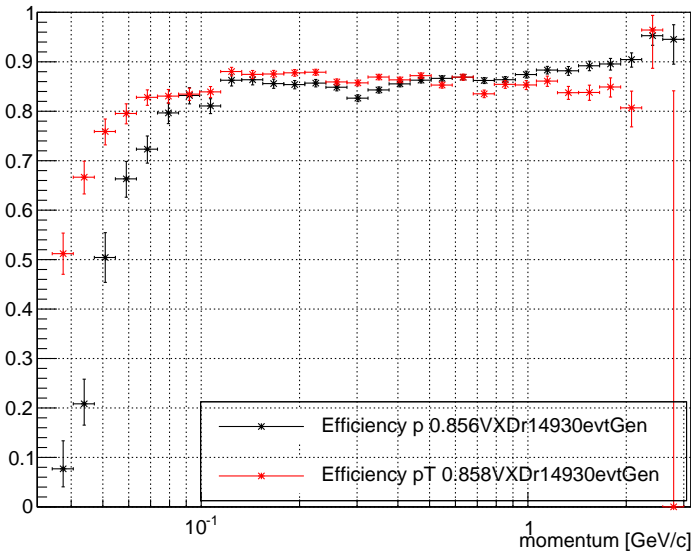
Setup A - r14890 - evtGen no BG VXD

Efficiency vs momentum



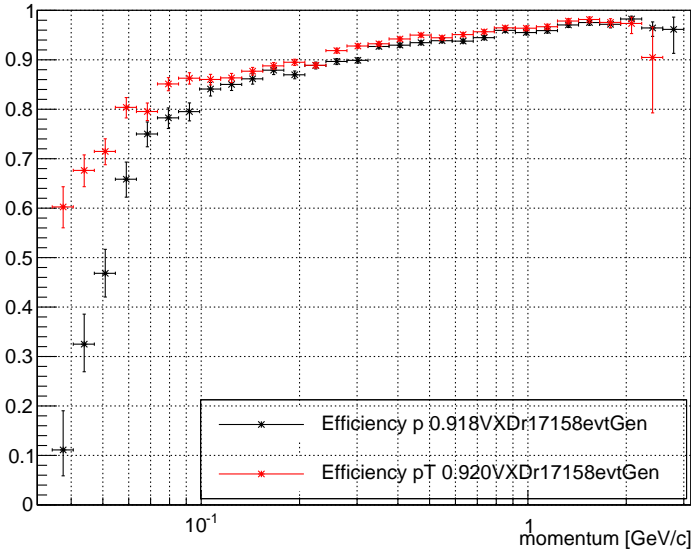
Setup A - r14930 - evtGen no BG VXD

Efficiency vs momentum



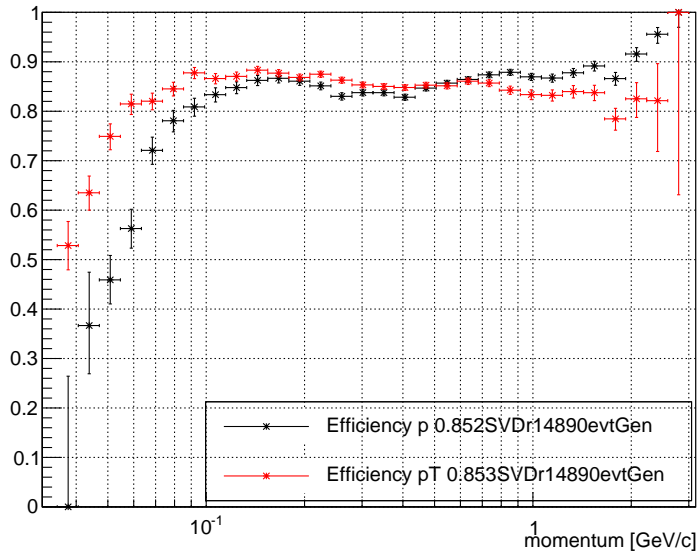
Setup A - r17158 - evtGen no BG VXD

Efficiency vs momentum



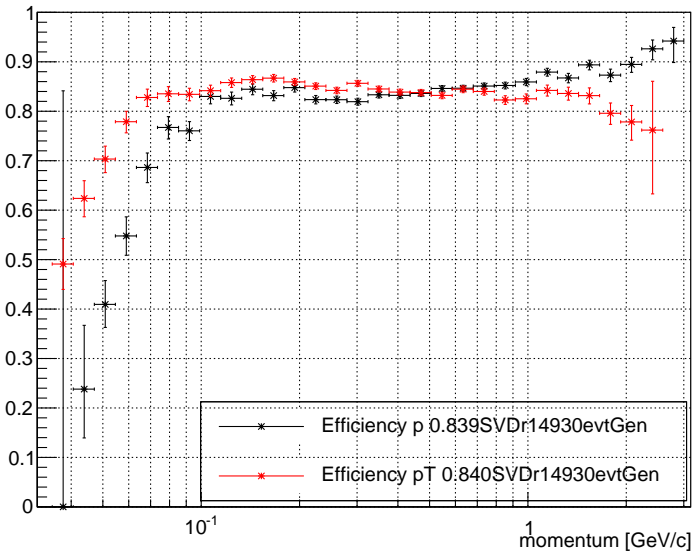
Setup A - r14890 - evtGen no BG SVD

Efficiency vs momentum



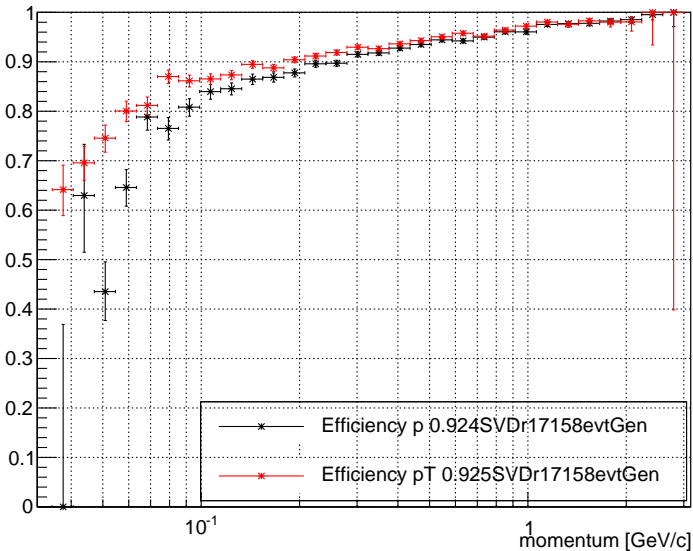
Setup A - r14930 - evtGen no BG SVD

Efficiency vs momentum



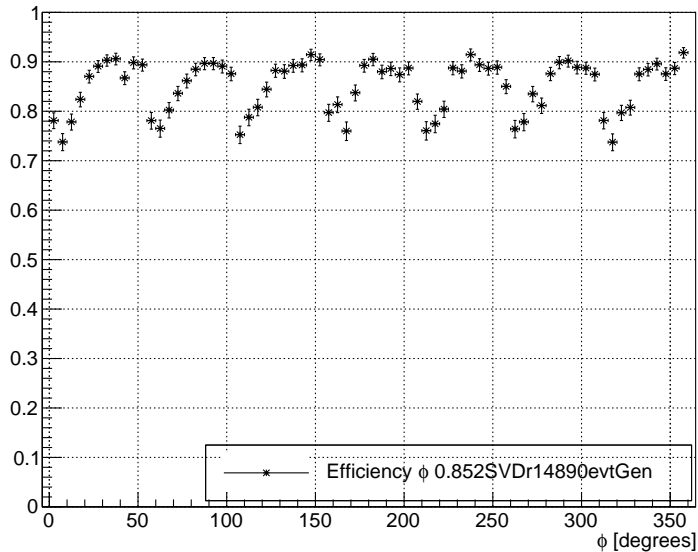
Setup A - r17158 - evtGen no BG SVD

Efficiency vs momentum



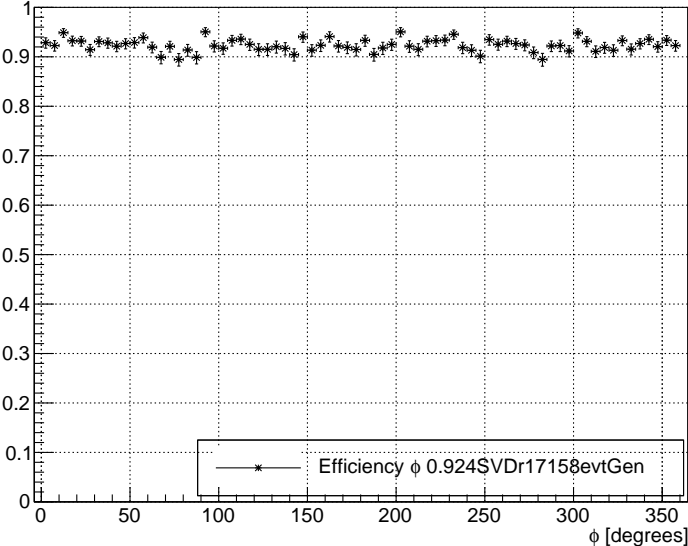
Setup A - r14890 - evtGen no BG SVD

Efficiency of ϕ

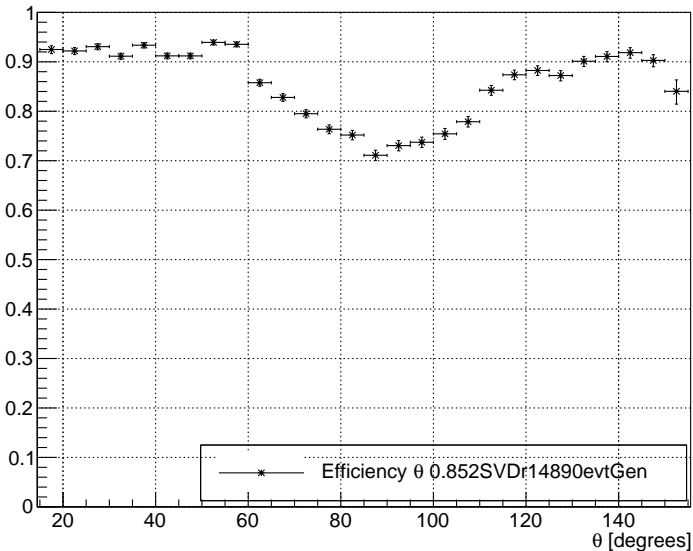


Setup A - r17158 - evtGen no BG SVD

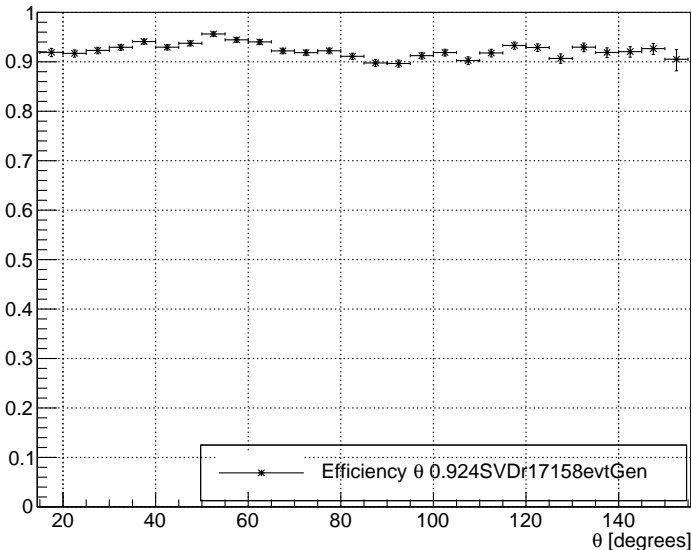
Efficiency of ϕ



Setup A - r14890 - evtGen no BG SVD

Efficiency of θ 

Setup A - r17158 - evtGen no BG SVD

Efficiency of θ 

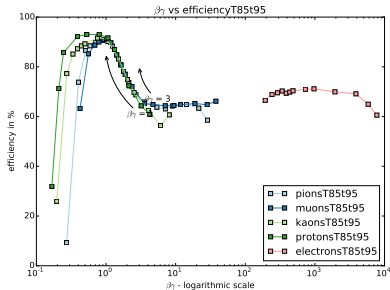
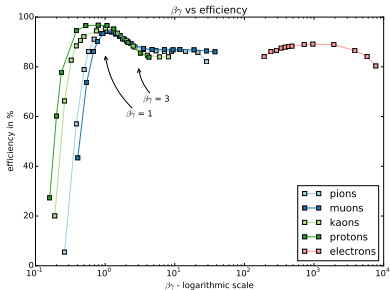
Setup A overview

Table : comparing the results

Revision	hitRatioPXD	hitRatioSVD	Efficiency	Ghost
r14890SVD	x	84.9%	85.18%	6.47%
r14890VXD	19.7%	81.5%	79.62%	5.4%
r14930SVD	x	83.5%	83.89%	5.84%
r14930VXD	78.9%	81.9%	85.52%	6.32%
r17158SVD	x	91.6%	92.4%	6.26%
r17158VXD	85.4%	87.8%	91.75%	6.12%



Setup B - $\beta\gamma$ vs efficiency (before fix)

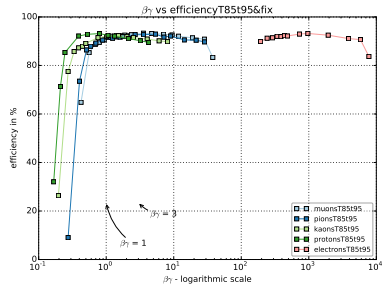
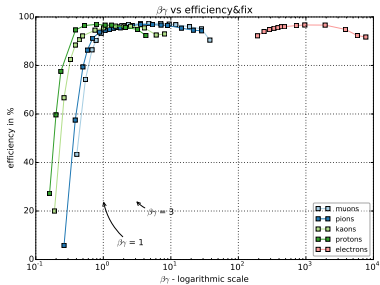


$\beta\gamma$ vs efficiency - full $\theta 12^\circ - 152^\circ$

$\beta\gamma$ vs efficiency - $\theta 85^\circ - 95^\circ$



Setup B - $\beta\gamma$ vs efficiency - fix

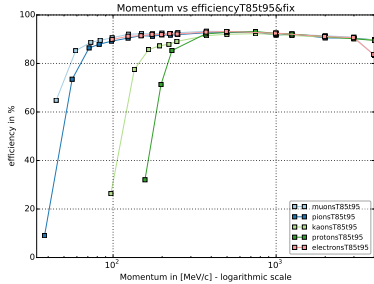
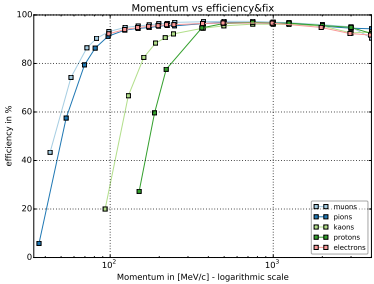


$\beta\gamma$ vs efficiency - full $\theta 12^\circ - 152^\circ$

$\beta\gamma$ vs efficiency - $\theta 85^\circ - 95^\circ$ using Peters fix



Setup B - momentum vs efficiency - fix



momentum vs efficiency - full $\theta 12^\circ - 152^\circ$

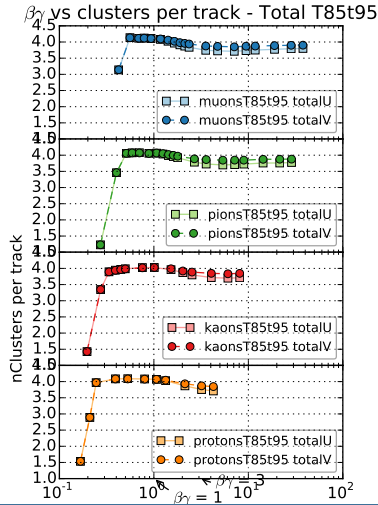
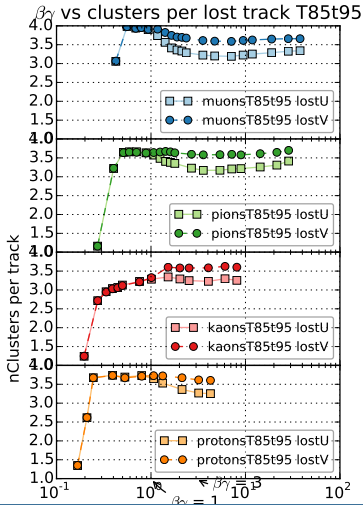
momentum vs efficiency - $\theta 85^\circ - 95^\circ$ using Peters fix



Setup B - $\beta\gamma$ vs clusters (lost) tracks (before fix)

$\beta\gamma$ vs clusters in lost tracks (left), $\theta 85^\circ - 95^\circ$

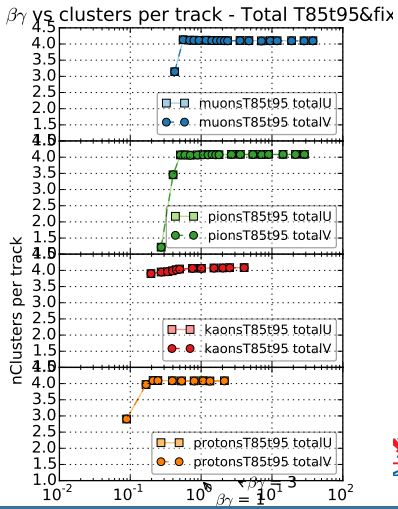
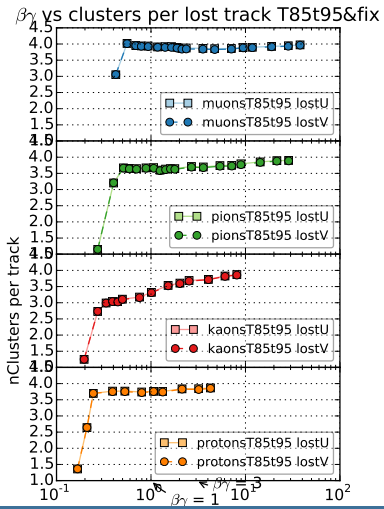
$\beta\gamma$ vs clusters in all tracks (right), $\theta 85^\circ - 95^\circ$



Setup B - $\beta\gamma$ vs clusters (lost) tracks - fix

$\beta\gamma$ vs clusters in lost tracks (left), $\theta 85^\circ - 95^\circ$

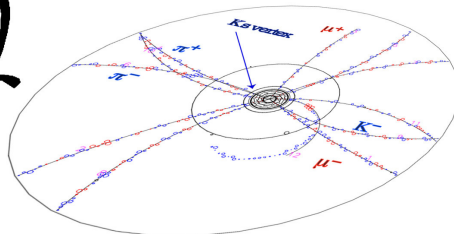
$\beta\gamma$ vs clusters in all tracks (right), $\theta 85^\circ - 95^\circ$



Next proposed steps - order of implementation:

- SPTCNetworkProducer
- TrackSetEvaluatorGreedy
- TrackSetEvaluatorHopfield
- if secMap not ready yet:
 - QualityEstimatorCircleFit
 - SpacePointReferee
- FilterCalculator/SecMapTrainerBase
- ExportSecMap/RawSecMapMerger
- SectorMapTuner
- SegmentNetworkProducer
- TrackFinderVXD CelloMat
- TrackFinderVXD ComboKalFit
- QualityEstimatorKalmanFilter
- QualityEstimatorDAF
- TrackFinderVXD Analyzer, after finishing TrackSetEvaluatorModules mixed all in between

that's all, folks!



Any suggestions, ideas or requests?

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FilterCalculator - 50% done

- add newFilters, remaster as much as possible without breaking the interface
- fork, newModule: SecMapTrainerBase
- change to support for new secMap
- estimation: 2-4 weeks

ExportSecMap - 0% done

- fork newModule: RawSecMapMerge
- implement new secMap-design (2- & 3-hit maps)
- merge raw files
- take care of RAM-consumption (depending on Thomas Madlener's future plans and design of secMap)
- estimation: 2-4 weeks



SectorMapTuner - runOnly 0% done

- load static secMap from root file
- apply tuning parameters
- make the map accessible on StoreArray
- estimation: 1-2 weeks

SpacePointCreatorSVD - 100% done

- SVDClusters (or combinations of it) → SpacePoints

IntelligentSpacePointCreatorSVD - 0% done ?

- responsibility of Andrzej Bozek, Job: combine clusters intelligently
- estimation: 2-4 months

SpacePointCreatorPXD - 100% done

- PXDClusters → SpacePoints

SpacePointCreatorTEL - 100% done

- TelClusters → SpacePoints

SegmentNetworkProducer - 45% done

- access secMap on StoreArray
- add virtual interaction point and find sectors for given SpacePoints → if found: trackNodes ↔ spacePoints
- find compatible sectors
- apply segFinder-Filters → segments connecting trackNodes
- apply nbFinder-Filters → friends connecting segments
- store segmentNetwork to StoreArray
- estimation: 2-4 weeks

TrackFinderVXDCelloMat - 0% done

- encapsulate old algorithm
- load segmentNetwork
- apply cellular automaton on network (interface to be designed)
- collect TCs as SpacePointTrackCands
- calculate seed and store SPTCs on StoreArray
- estimation: 1-2 weeks

TrackFinderVXDComboKalFit - 0% done

- load segmentNetwork from storeArray
- for each allowed treeSeed, extrapolate to each sensor allowed by sectorCombi
- collect x (parameter, $1 \leq x \leq 5$) best fits and store for further extrapolations
- final trees of trackCands: store best y (parameter, $1 \leq y \leq 5$) TCs of single trees
- on-the-fly (genfitTrackCand)seed-parameter estimation
- estimation 3-4 months

QualityEstimatorCircleFit - 0% done

- convert interface from VXDTFTrackCanditates to SpacePointTrackCands
- estimation: 1 week



QualityEstimatorKalmanFilter - 0% done

- take TC and apply seed needed for fitting
- bad-ass-way: convert SpacePointTrackCands to genfit::TrackCand before, apply old interface
- estimation bad-ass: 1 week
- efficient-way: start with that module after finishing TrackFinderVXDComboKalFit, use as much as possible from that module
- estimation efficient: 1 week
- correct way: make genfit compatible (how?), new interface to be written
- estimation correct: 3+ weeks



QualityEstimatorStraightLine - 0% done

- take TC and apply seed needed for fitting
- needed for runs without magnetic field and for testbeams
- low priority (any volunteers?)
- estimation: 1-2 weeks

QualityEstimatorHelixFit - 0% done

- take TC and apply seed needed for fitting
- code partially already in FW, question whether should be completed
- lowPriority (any volunteers?)
- estimation: 2-3 weeks



QualityEstimatorDAF - 0% done

- take tree of TCs and determine the best one using DAF
- mostly piping into genfit
- open question is how to do the interface (synergies with TrackFinderVXDComboKalFit and QualityEstimatorKalmanFilter apparent)
- estimation: 1-2 months

SPTCNetworkProducer - 85% done

- take all given SpacePointTrackCands and weave into network of SpacePointTrackCands ↔ nodes/SPTCAvatar
- connect nodes when TCs are overlapping ↔ links/TCCompetitors
- overlapping: Cluster-wise or SP-wise, parameter choice
- prepare for fast acces and state-update (needed for TrackSetEvaluatorXY-Modules)
- not fully clear what happens for several passes (update or recreate network?)
- estimation: < 1 week (already working, but some changes during implementation of TrackSetEvaluatorXY-modules probable)

TrackSetEvaluatorGreedy - 15% done

- load SPTCNewtork
- sort by QI, apply-Greedy algorithm (new interface needed)
- new storeArray with non-overlapping TCs only (or simply kill bad TCs and leave them rotting in their storeArray)
- estimation: 1 week

TrackSetEvaluatorHopfield - 0% done

- load SPTCNewtork
- apply Hopfield Neural network algorithm (new interface needed)
- fill or kill SPTCs like Greedy
- estimation: 1+ week

SpacePointReferee - 0% done

- best x% (parameter) of TCs reserve the SP/Clusters (parameter) for further iterations
- not completely clear how to store relevant info (not thought about that yet in detail)
- estimation 1-2 weeks

SPTC2GFTCConverter - 100% done

- Written and maintained by Thomas Madlener

GFTC2SPTCConverter - 100% done

- Written and maintained by Thomas Madlener

TFAnalyzer - 10% done

- fork, newModule: TrackFinderVXDAnalyzer
- analysis module compatible with new design
- collect data from modules and store specific info to root files (eg efficiency vs pT, acceptance rate of dist3D for good combis...)
- correct implementation:
 - heavily depending on observers, design only fixed yet for seg- and nbFinder (== segmentNetworkModule). completely unclear for everything else
 - problem of correctly linking data in an oo-way for not to lose info too early
- actual implementation: on-the fly, minimal effort, only when needed
- estimation: difficult, since many unsolved questions, 1-3 months

The redesign task-force

Who participates actively

- Eugenio Paoloni: the *sectorMap-Creator* (design for interfaces, off-line and on-line)
- Thomas Madlener: personal coach for the sectorMaps (training of the cuts, choosing sector size, filter types, pT-cuts, ...)
- Rudolf Frühwirth: father of the trackFinder (TF concept is his initial idea, now consulting task)
- Martin Heck: convener (mainly consulting tasks)
- Jakob Lettenbichler: midwife of the TF (responsible for the rest)



Setup A - r14890 - evtGen no BG SVD

Time consumption of each relevant part of the TF - normalized to 1 = median (median vs mean)

