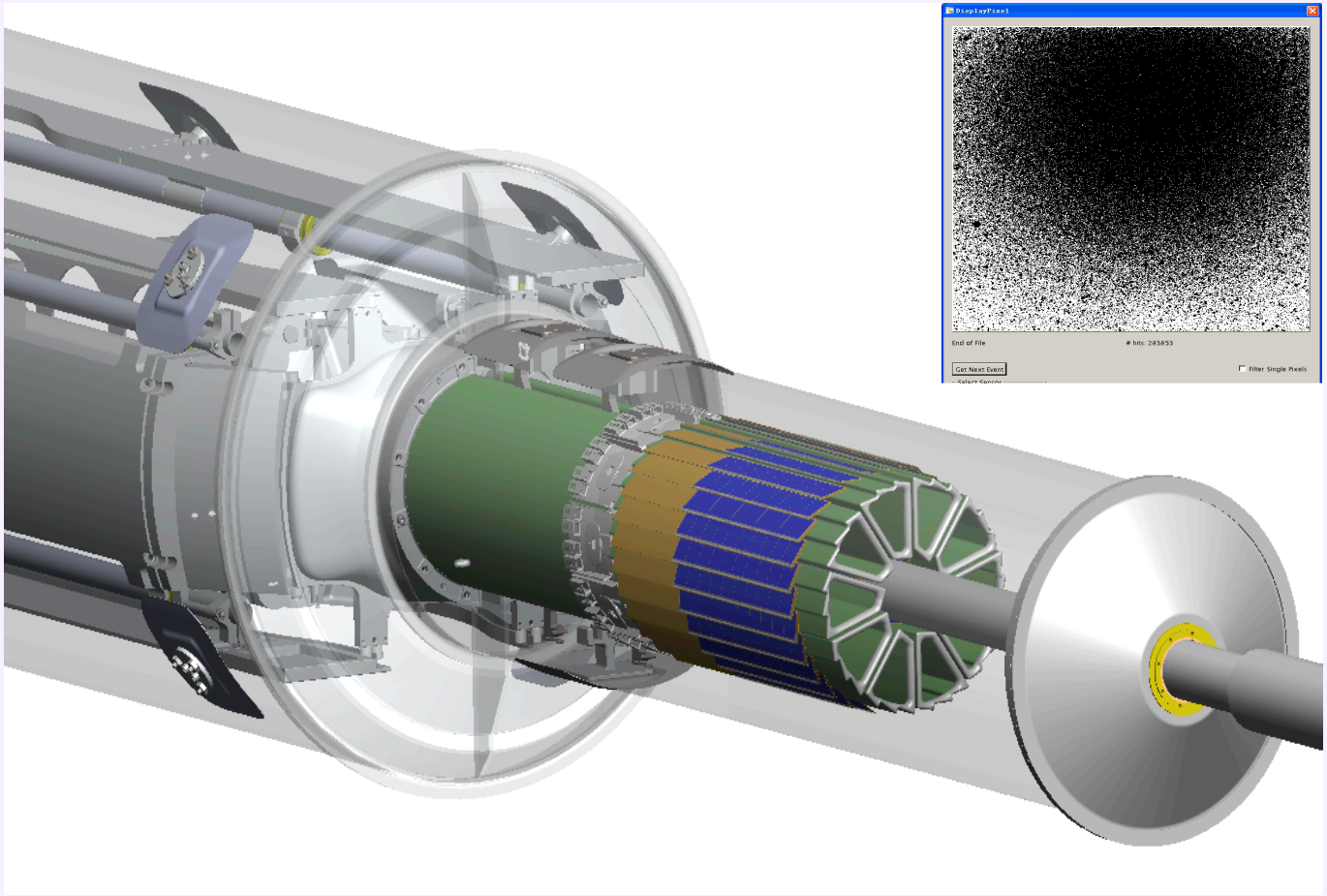
HFT Software Status

S. Margetis, KSU



Outline

- Schedule/timeline - Milestones
- Manpower update
- General Update
  - Activities
  - Activities for next calendar year

- Dates that drive the priorities/schedule are:
  - ***PIXEL prototype*** installation next Fall (2012) for Run-13
    - 2-4 PXL re-configurable sectors
    - *NO SSD/IST*
  - ***Full HFT* installation** in Fall-2013 for Run-14 data taking

Task Overview and FTE needs

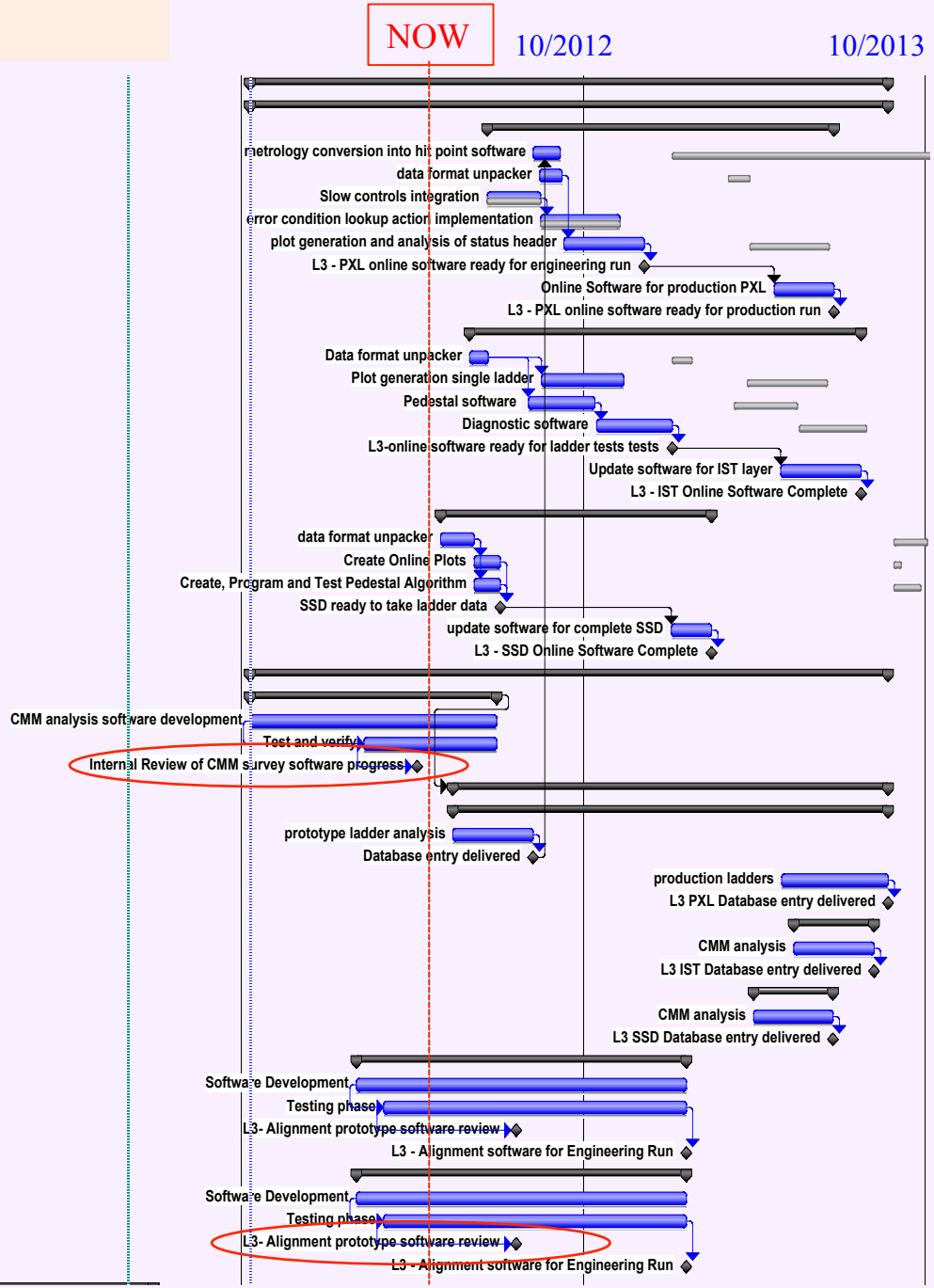
FTEY	Software task	
	Offline	
2	Hit Reconst.	IST
		Pixel
0.2	Tracking	
0.2	Event Vertex	
0.5	Decay Vertex	
2	Calibration Db	SSD
		IST
		PXL
1	Alignment	SSD
		IST
		PXL
	Simulation	
1.1	Geometry	SSD
		IST
		PXL
0.8	Fast/Slow Sim.	SSD
		IST
		PXL
0.5	Embed./Pileup	IST
	Assoc/Analysis	

Total= 8.3

- List is for ***Offline*** tasks only
- FTE estimates *do not* include BNL-core group contributed effort in tracking/ vertex-ing/calibrations etc.
- Numbers are on the under-estimate side
- It comes down to about 4 FTE/year for ~two years
  - We have about half of that

Schedule/Milestones

1.6	**Software**	**0%**	**464 days**
1.6.1	**Online**	**0%**	**464 days**
1.6.1.1	**PXL**	**0%**	**251 days**
1.6.1.1.1	metrology conversion into hit point software	0%	20 days
1.6.1.1.2	data format unpacker	0%	17 days
1.6.1.1.3	Slow controls integration	0%	40 days
1.6.1.1.4	error condition lookup action implementation	0%	60 days
1.6.1.1.5	plot generation and analysis of status header	0%	60 days
1.6.1.1.6	L3 - PXL online software ready for engineering run	0%	0 days
1.6.1.1.7	Online Software for production PXL	0%	45 days
1.6.1.1.8	L3 - PXL online software ready for production run	0%	0 days
1.6.1.2	**IST**	**0%**	**284 days**
1.6.1.2.1	Data format unpacker	0%	14 days
1.6.1.2.2	Plot generation single ladder	0%	61 days
1.6.1.2.3	Pedestal software	0%	50 days
1.6.1.2.4	Diagnostic software	0%	50 days
1.6.1.2.5	L3-online software ready for ladder tests tests	0%	0 days
1.6.1.2.6	Update software for IST layer	0%	60 days
1.6.1.2.7	L3 - IST Online Software Complete	0%	0 days
1.6.1.3	**SSD**	**0%**	**195 days**
1.6.1.3.1	data format unpacker	0%	25 days
1.6.1.3.2	Create Online Plots	0%	1 mon
1.6.1.3.4	Create, Program and Test Pedestal Algorithm	0%	20 days
1.6.1.3.5	SSD ready to take ladder data	0%	0 days
1.6.1.3.7	update software for complete SSD	0%	30 days
1.6.1.3.8	L3 - SSD Online Software Complete	0%	0 days
1.6.1.4	**Calibration and alignment**	**0%**	**464 days**
1.6.1.4.1	**Survey Software**	**0%**	**180 days**
1.6.1.4.1.2	CMM analysis software development	0%	9 mons
1.6.1.4.1.1	Test and verify	0%	5 mons
1.6.1.4.1.9	Internal Review of CMM survey software progress	0%	0 days
1.6.1.4.5	**CMM analysis**	**0%**	**318 days**
1.6.1.4.5.1	**Analysis of PXL**	**0%**	**318 days**
1.6.1.4.5.1.10	prototype ladder analysis	0%	3 mons
1.6.1.4.5.1.11	Database entry delivered	0%	0 days
1.6.1.4.5.1.12	production ladders	0%	4 mons
1.6.1.4.5.1.13	L3 PXL Database entry delivered	0%	0 days
1.6.1.4.5.2	**Analysis of IST**	**0%**	**60 days**
1.6.1.4.5.2.5	CMM analysis	0%	3 mons
1.6.1.4.5.2.6	L3 IST Database entry delivered	0%	0 days
1.6.1.4.5.3	**Analysis of SSD**	**0%**	**60 days**
1.6.1.4.5.3.1	CMM analysis	0%	3 mons
1.6.1.4.5.3.2	L3 SSD Database entry delivered	0%	0 days
1.6.1.6	**Global Alignment**	**0%**	**240 days**
1.6.1.6.1	Software Development	0%	12 mons
1.6.1.6.2	Testing phase	0%	11 mons
1.6.1.6.3	L3- Alignment prototype software review	0%	0 days
1.6.1.6.4	L3 - Alignment software for Engineering Run	0%	0 days
1.6.1.8	**Self Alignment**	**0%**	**240 days**
1.6.1.8.9	Software Development	0%	12 mons
1.6.1.8.10	Testing phase	0%	11 mons
1.6.1.8.11	L3- Alignment prototype software review	0%	0 days
1.6.1.8.12	L3 - Alignment software for Engineering Run	0%	0 days



LEVEL-3 Milestones

Software			
3	Review of CMM software progress	4/5/12	5/17/12
3	Alignment software Review	9/20/12	9/20/12
3	PXL CMM database delivered for prototype	11/15/12	11/15/12
3	PXL online software ready for engineering run	12/4/12	12/4/12
3	IST online software for ladder tests	1/13/13	1/13/13
3	Alignment software ready for engineering run	1/18/13	1/18/13
3	SSD online software complete	5/14/13	5/14/13
3	IST online software complete	7/24/13	7/24/13
3	IST CMM database delivered	8/17/13	8/17/13
3	PXL CMM database delivered for production sectors	8/22/13	8/22/13
3	PXL online software ready for production run	10/1/13	10/1/13

- Survey/Alignment/Db/Online are immediate on-project activities
- Geometry/Offline/Analysis should be there too

Areas of activities since CD2/3 (a year ago)

- HFT Geometry model
- HFT Survey & Alignment related work
- Slow/Fast PXL response simulation
- Prototype (BUR) simulations/tracking
- Offline structures (Hits etc)
- Simulation environment (UPC e^- background, Pileup)
- Conventions (naming scheme defined), Db

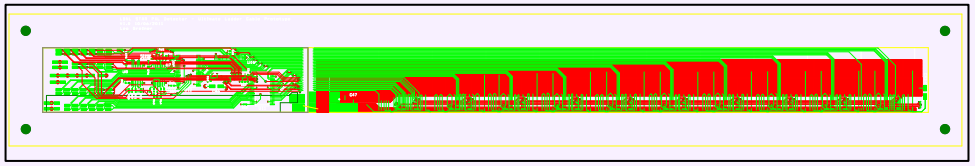
- Hit/Event vertex finders/Kalman fitter for decays
- Evaluation/Analysis framework (see Jonathan's talk)
- Tests of new STV tracker, VMC environment

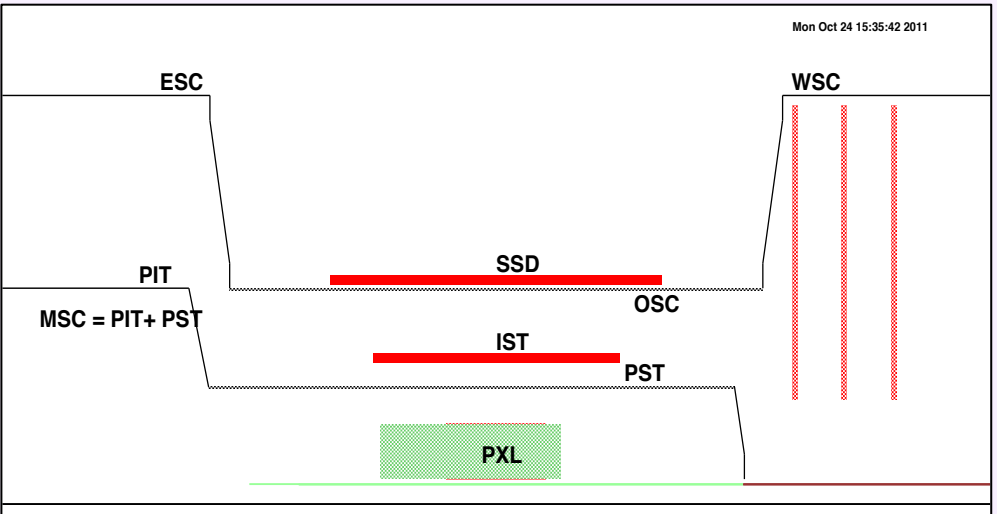
- **'Online' data format/slow controls/online QA/Db considerations**

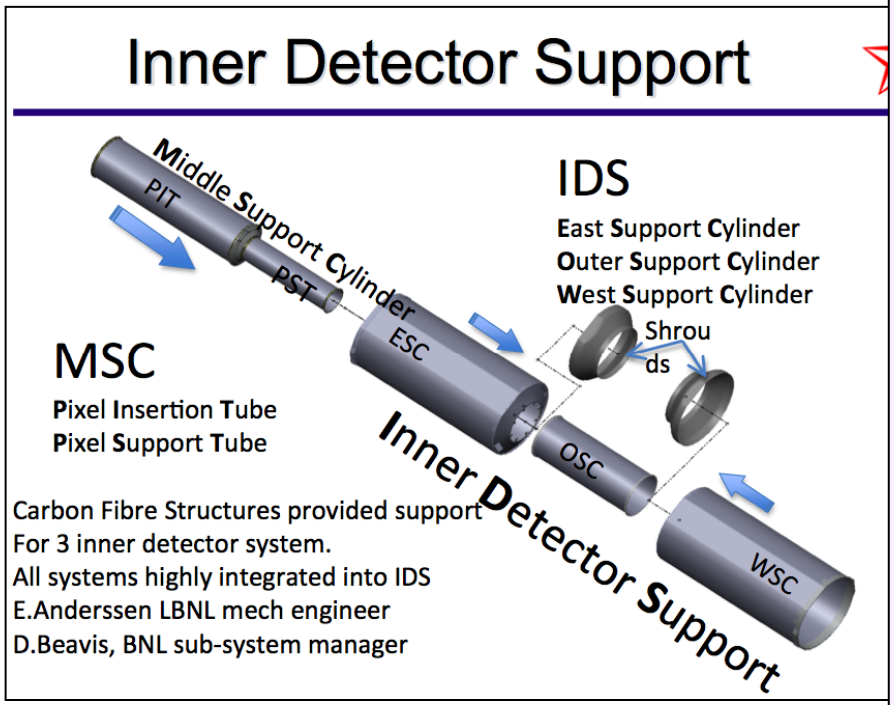
RED = On-scope activity

HFT Geometry model update

- Creating the Y2013 [a/b] geometry in AgML based on Solid-Works Models
- We had an internal review in March, working on recommendations etc
- Work on SSD/IST in progress
- Work on details of support structures etc in progress
- Manpower probably O.K. but help is more than welcomed (no skills)





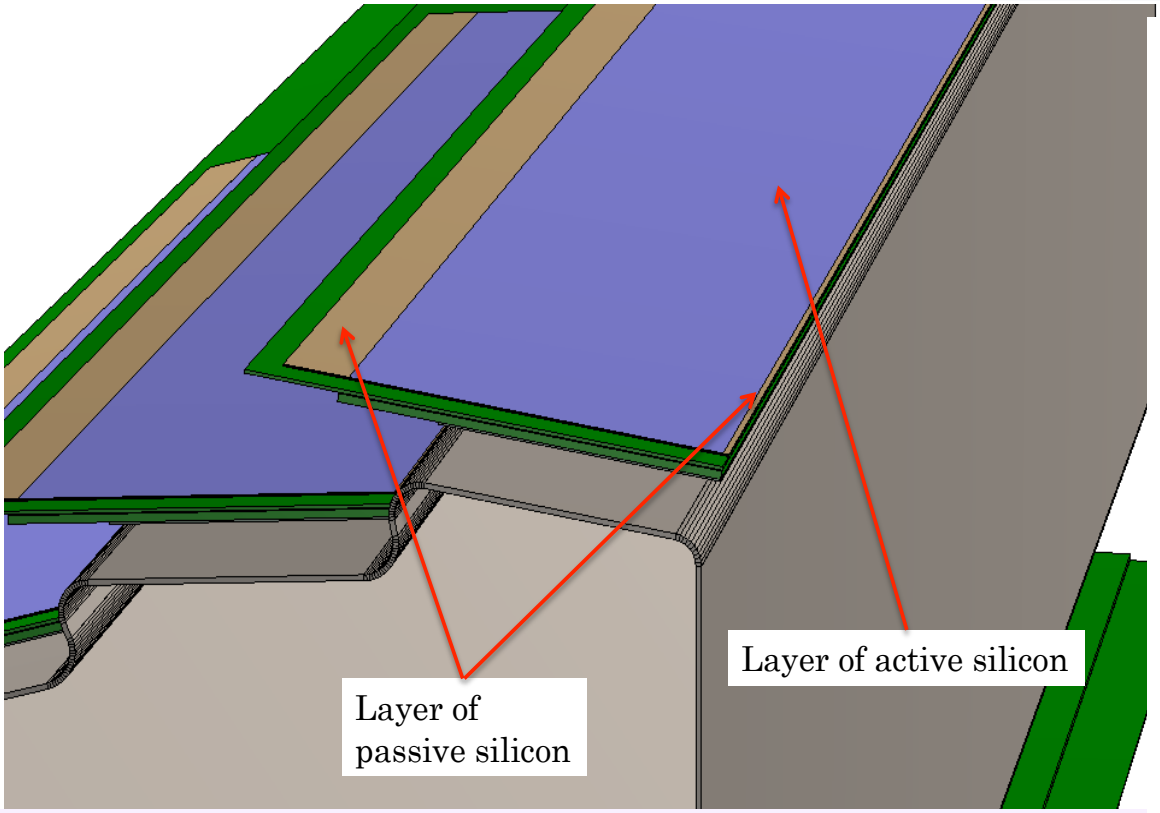


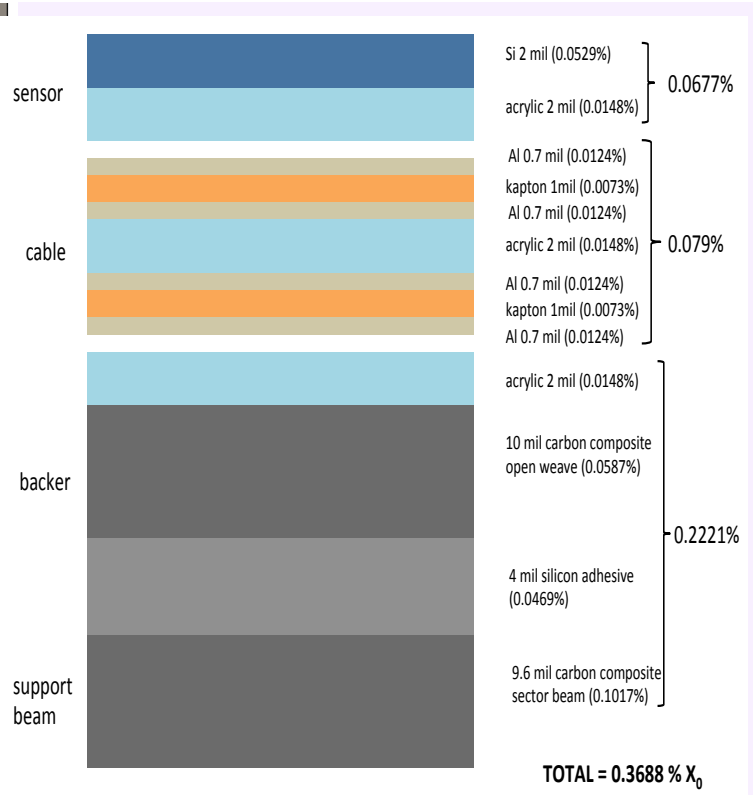
PXL sector modeling in GEANT

- detailed work on structure and thickness
- optimization in progress

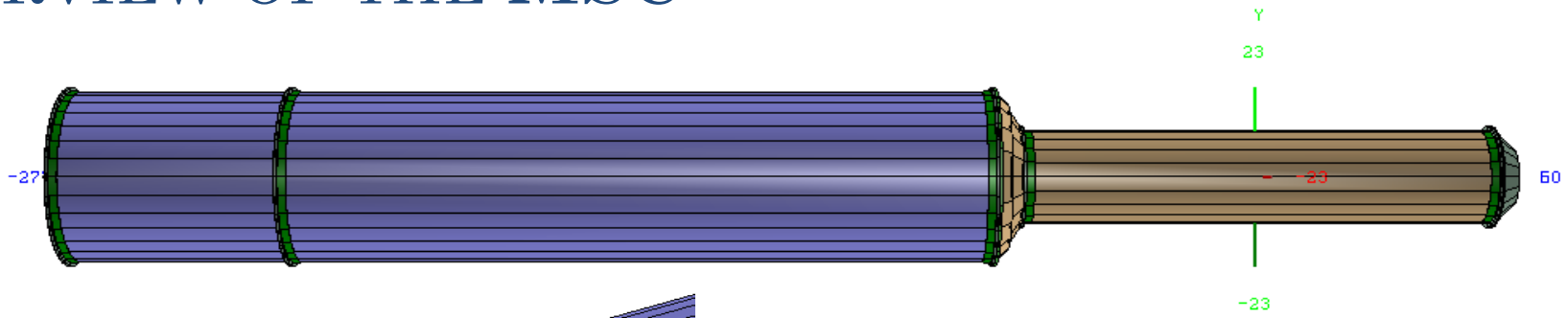
SUMMARY OF MATERIAL BUDGET

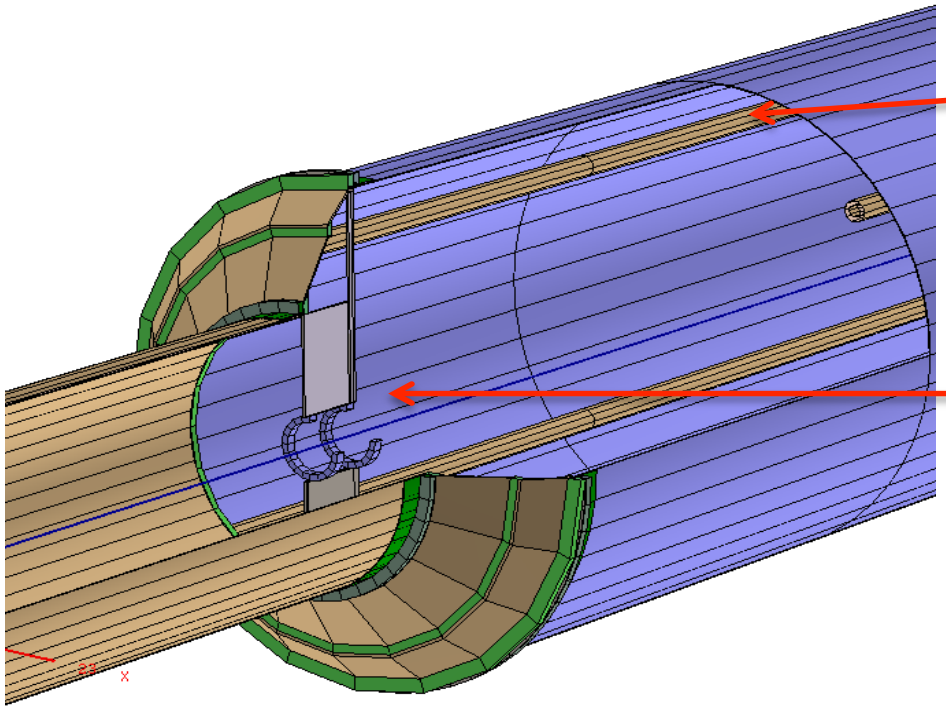
GEANT NAME	piece	shape	Composition / mixture	Radiation length [cm]	Density[g/cm^3]
PLAC	Silicon active	box	Si	9.36	2.33
SIFR	Silicon passive	box	Si	9.36	2.33
SIFL	Silicon passive	box	Si	9.36	2.33
GLUA	adhesive	box	O(0.164) C(0.763) H(0.073)	34.7	1.2(*)
GLUB	adhesive	box	O(0.164) C(0.763) H(0.073)	34.7	1.2(*)
GLUC	adhesive	box	O(0.164) C(0.763) H(0.073)	34.7	1.2(*)
ALCA	Aluminum cable	box	Al	23.7(*)	2.7(*)
CBFK	Carbon Fiber backing	box	C	68(*)	1.3(*)





Overview of the MSC





rails

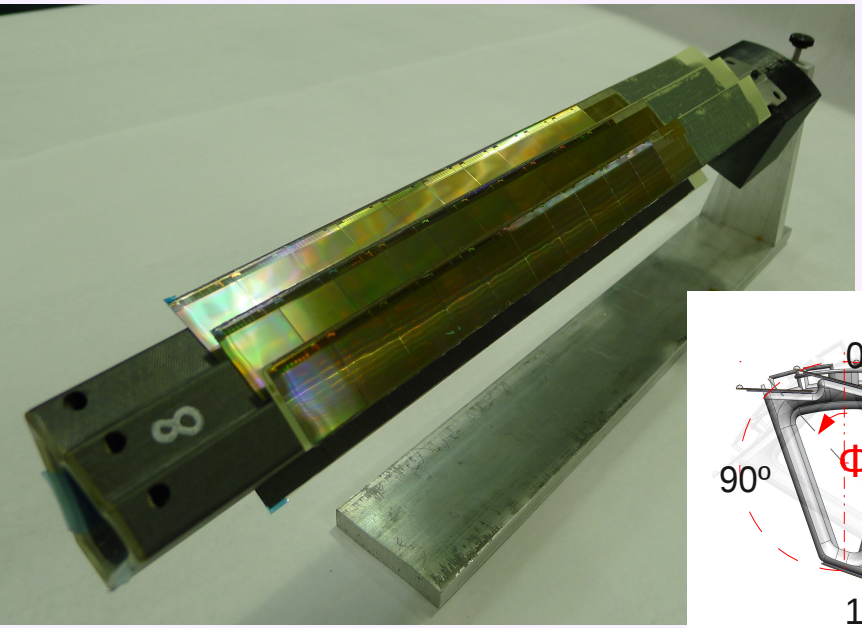
Rings surroundings the beam pipe

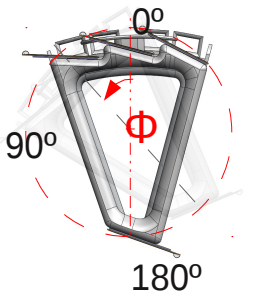
•: temporary until implementation of real material (slide 39)

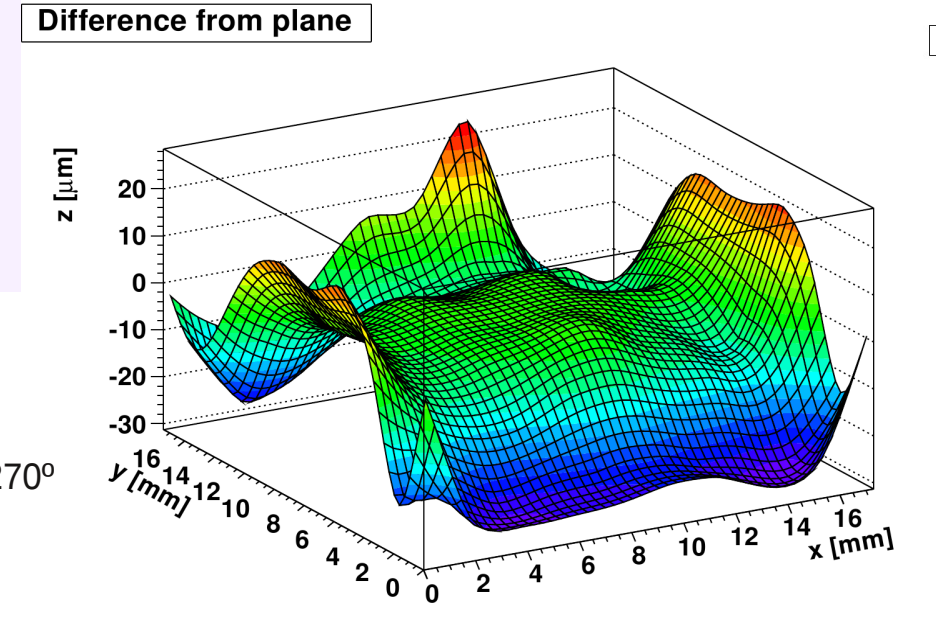
GEANT NAME	piece	Composition / mixture	Radiation length	density
ALL(*)	Carbon Fiber	C	23.9	1.3(*)

HFT Survey work

- PXL+SSD work has already begun
  - Single chip and 3-chip ladder done. Full PXL sector (photo) ready to go
  - SSD ladder preliminary survey done
  - IST preliminary work on prototype ladder about to begin at BNL
- We had an internal review on procedures/general scheme in May
- A lot of detailed work in front of us, but expertise is building up
- Manpower issue addressed but there are tasks available

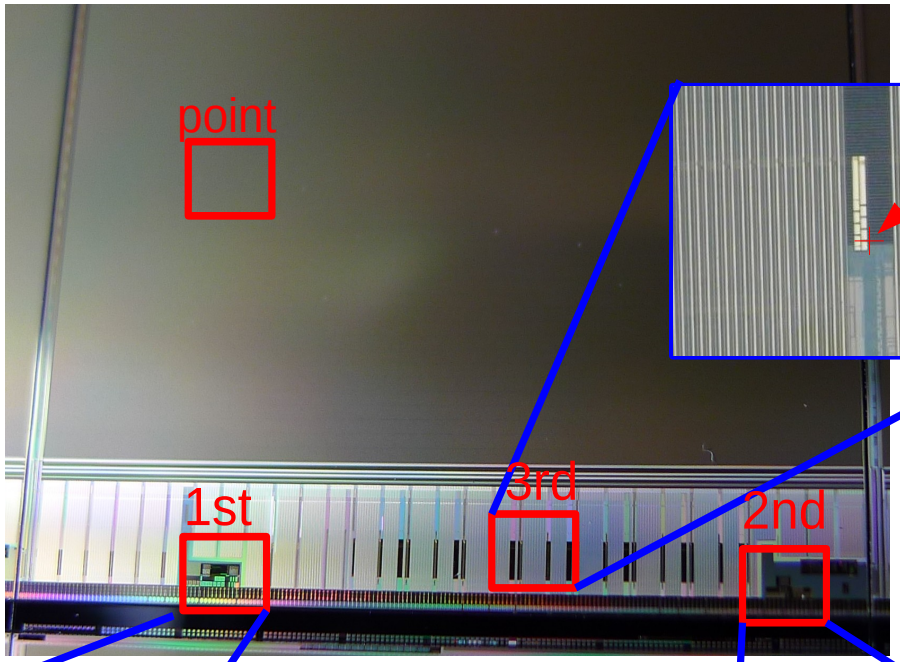






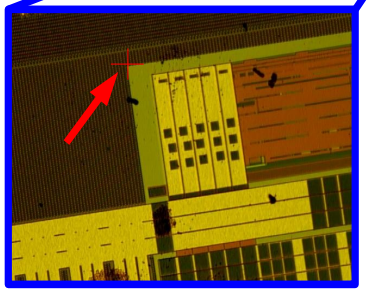
Sensor's features for individual pixel coordinates identified
- Need be programmable

x=4594.225 µm
y=10000.00 µm
z=0 µm

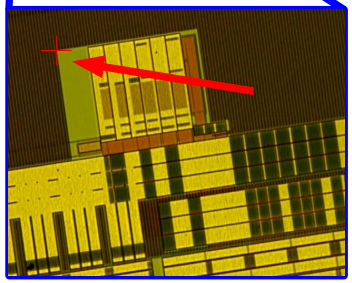


x=? µm
y=? µm
z=0 µm

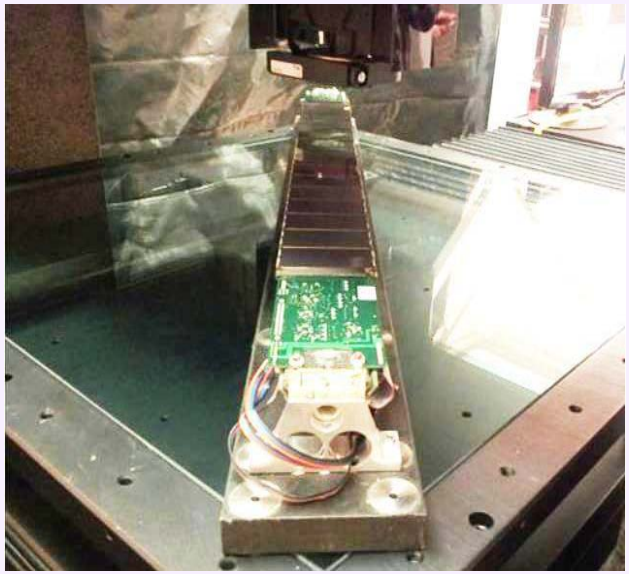
x=4594.225 µm
y=920.775 µm
z=0 µm

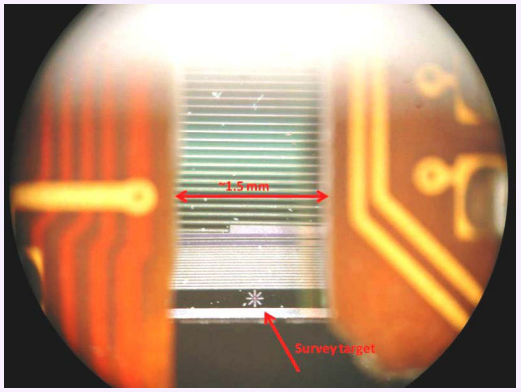


x=18165.075 µm
y=871.6 µm
z=0 µm

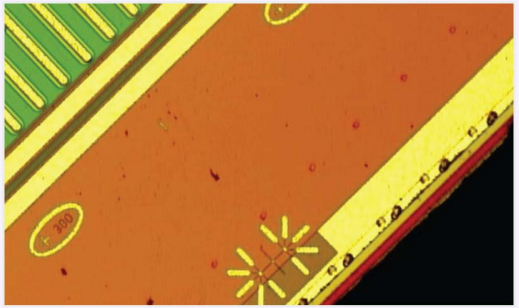


SSD

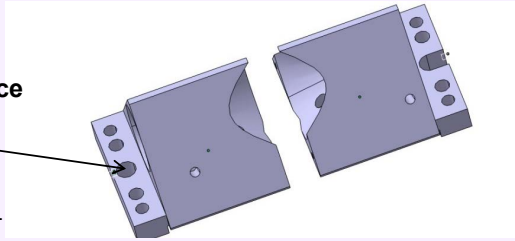


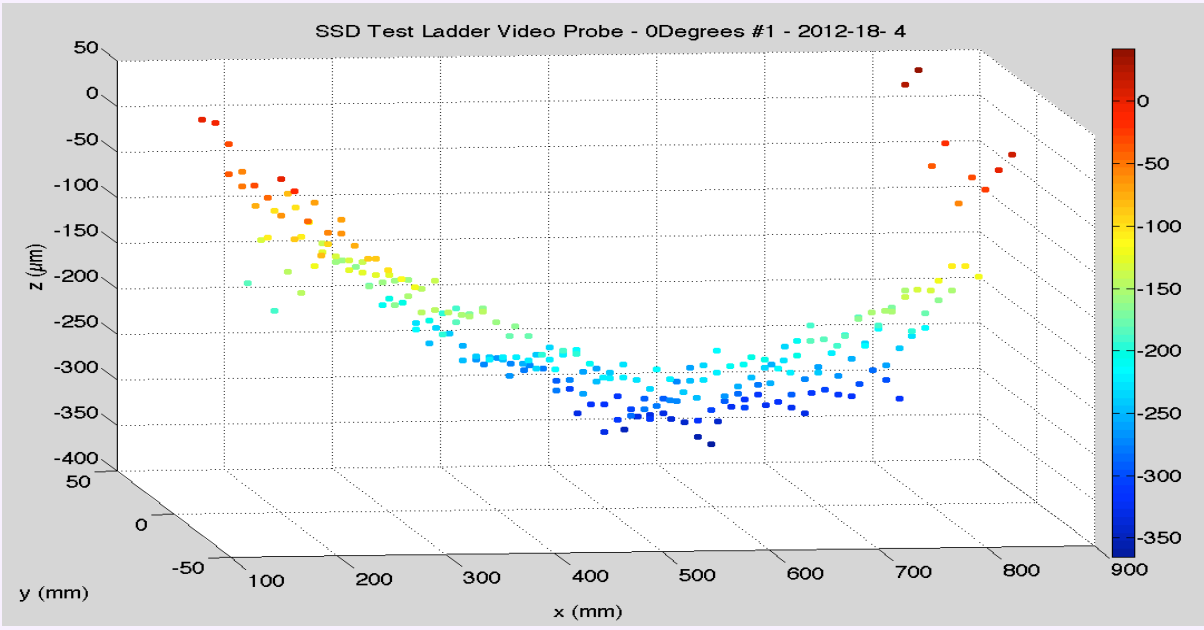


Target on end of wafer (backside)



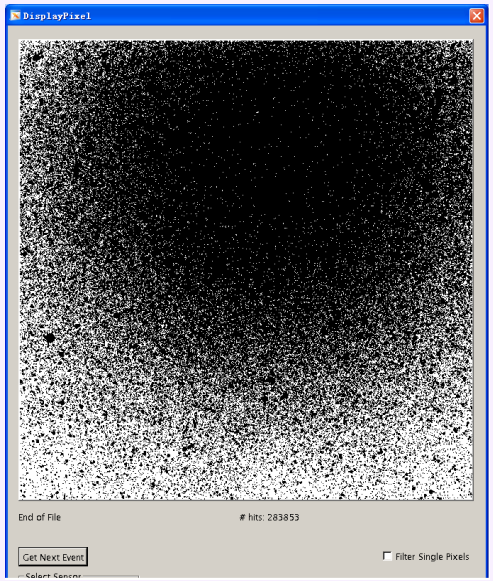
Targets on edges of wafer (front)

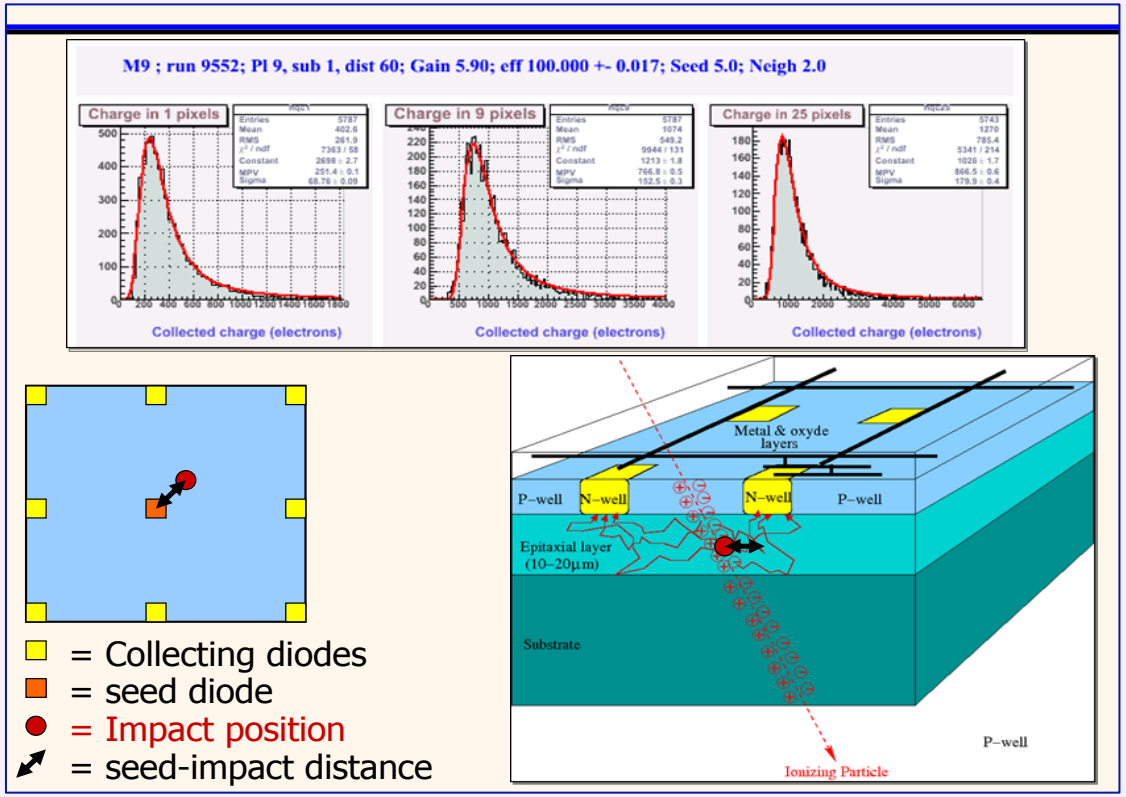




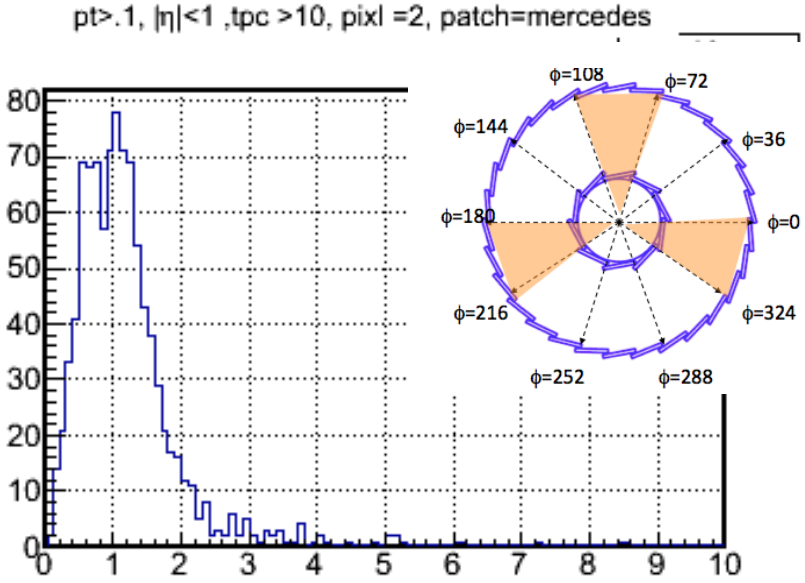
Slow/Fast PXL response simulation

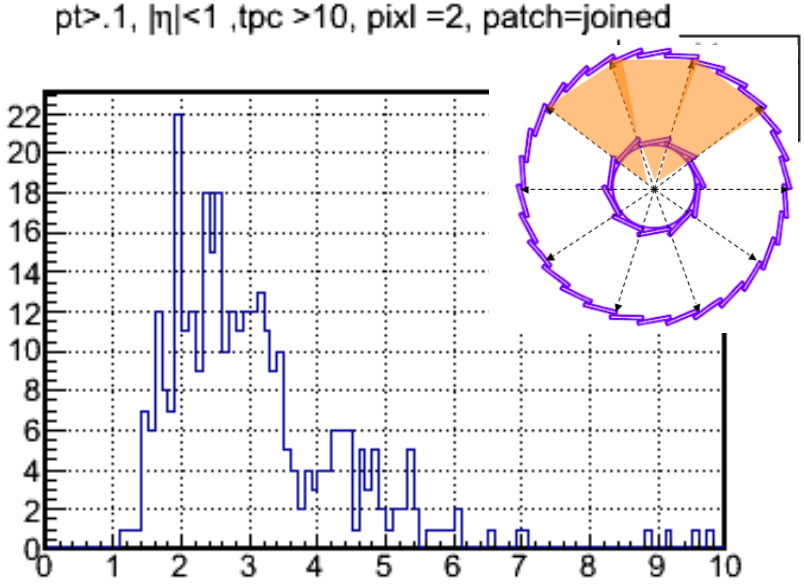
- Most work done by IPHC (Strasburg) people
- The have developed a Root program, DIGMAPS, for response studies
- Analyzed CERN test-beam data with our sensors to fix parameters
- We are about to get their tune to use for our studies and compare with default "geometrical mean" approach. Then, build fast simulator with appropriate errors.
- SSD exists, IST is relatively simple (but still not there yet)
- Need people to actively pursue these tasks





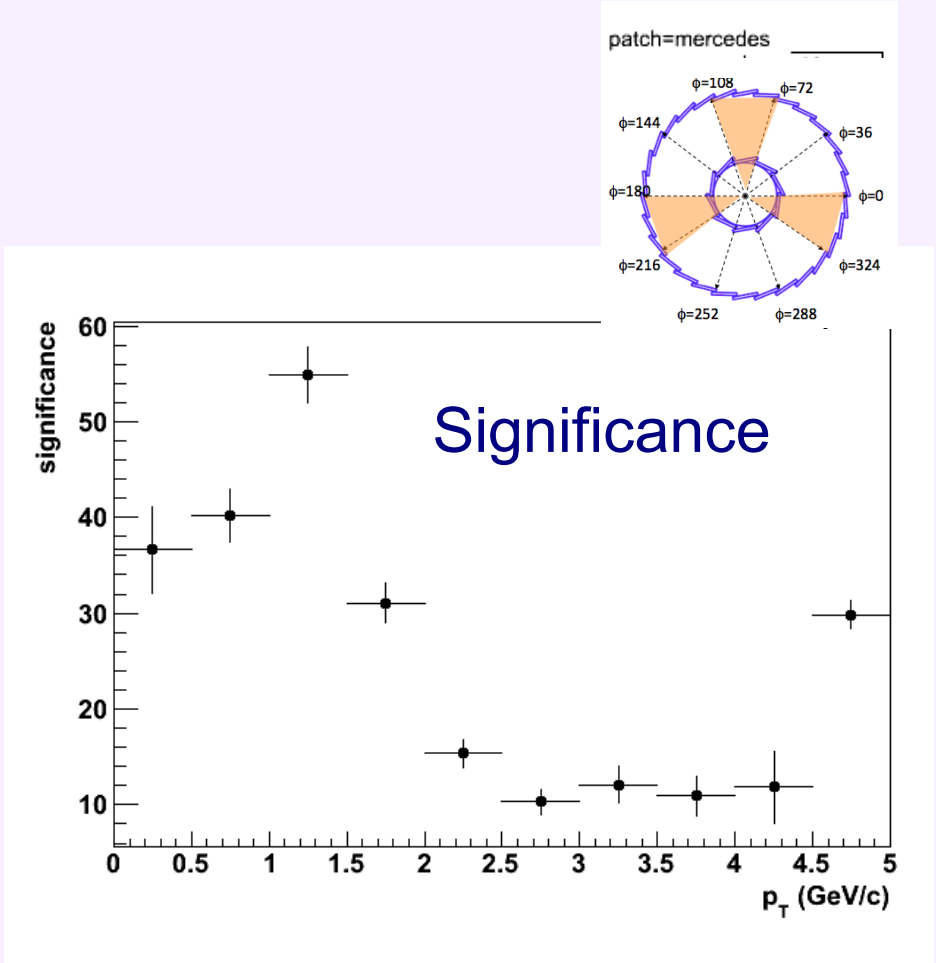
- Tracking (Physics?) with TPC+PXL prototype ?
  - BUR simulations done and presented (Hao/Jonathan)
  - Simulations show (see next slide too) that there are physics opportunities but reality might be different
  - This connects to the bigger issue of Tracking and whether inside-out tracking is possible. Is CA useful ? We work in that direction.
  - This is vital work for the project. ANY help and idea is invaluable.

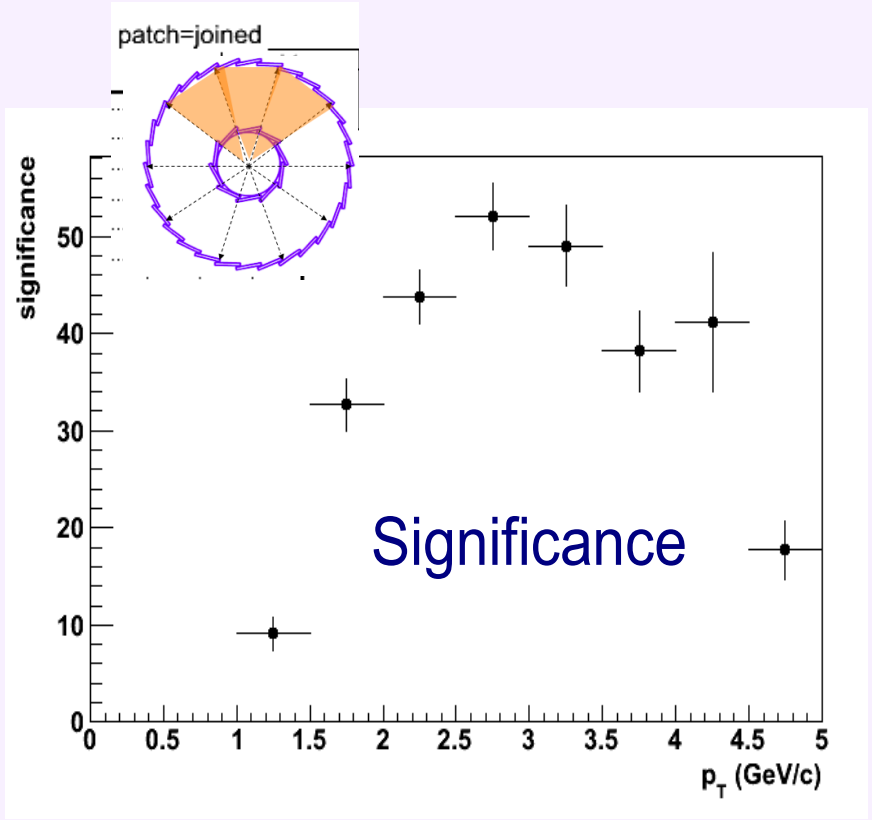




acceptance D0

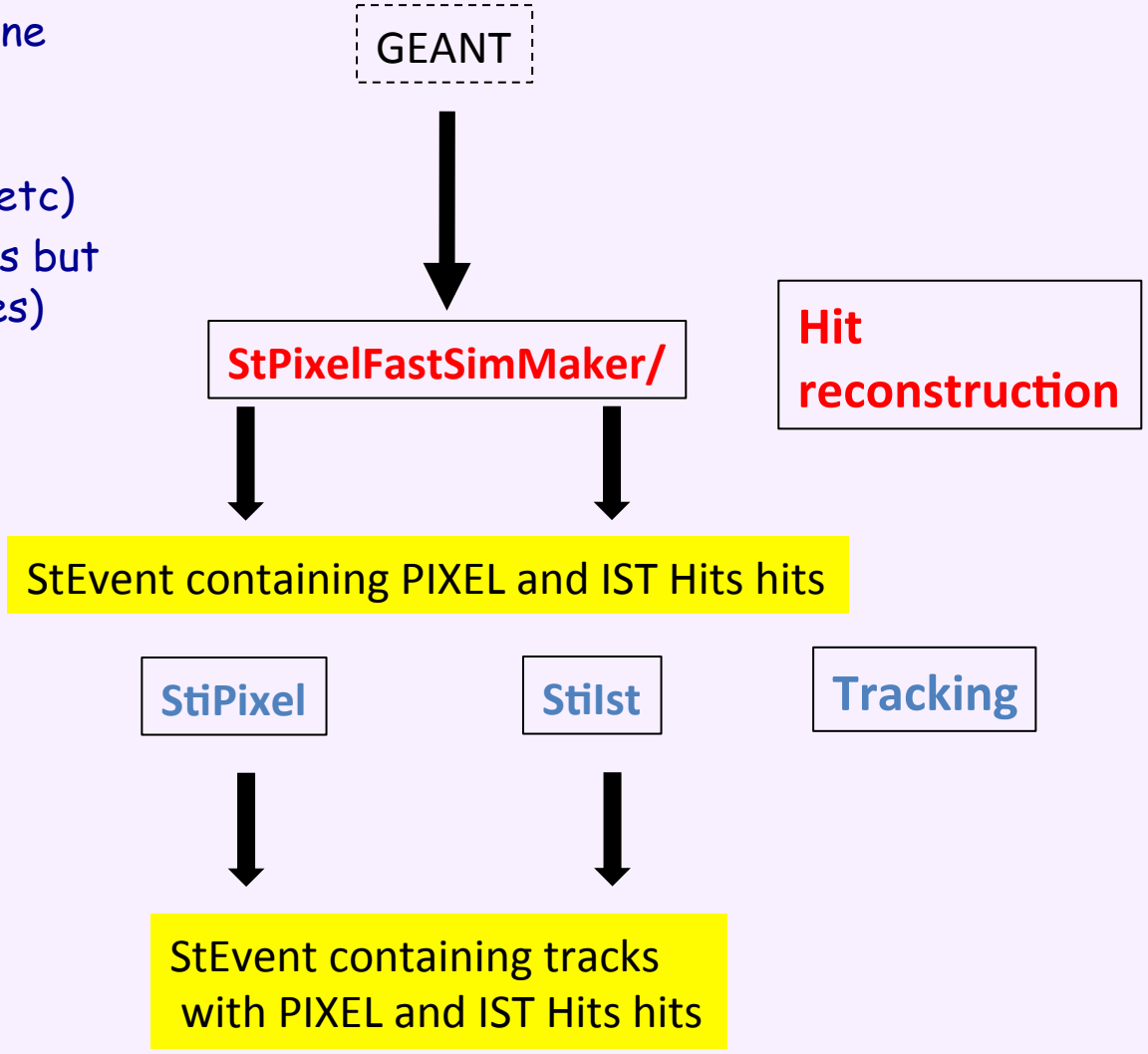
BUR (Hao) results based on full simulations

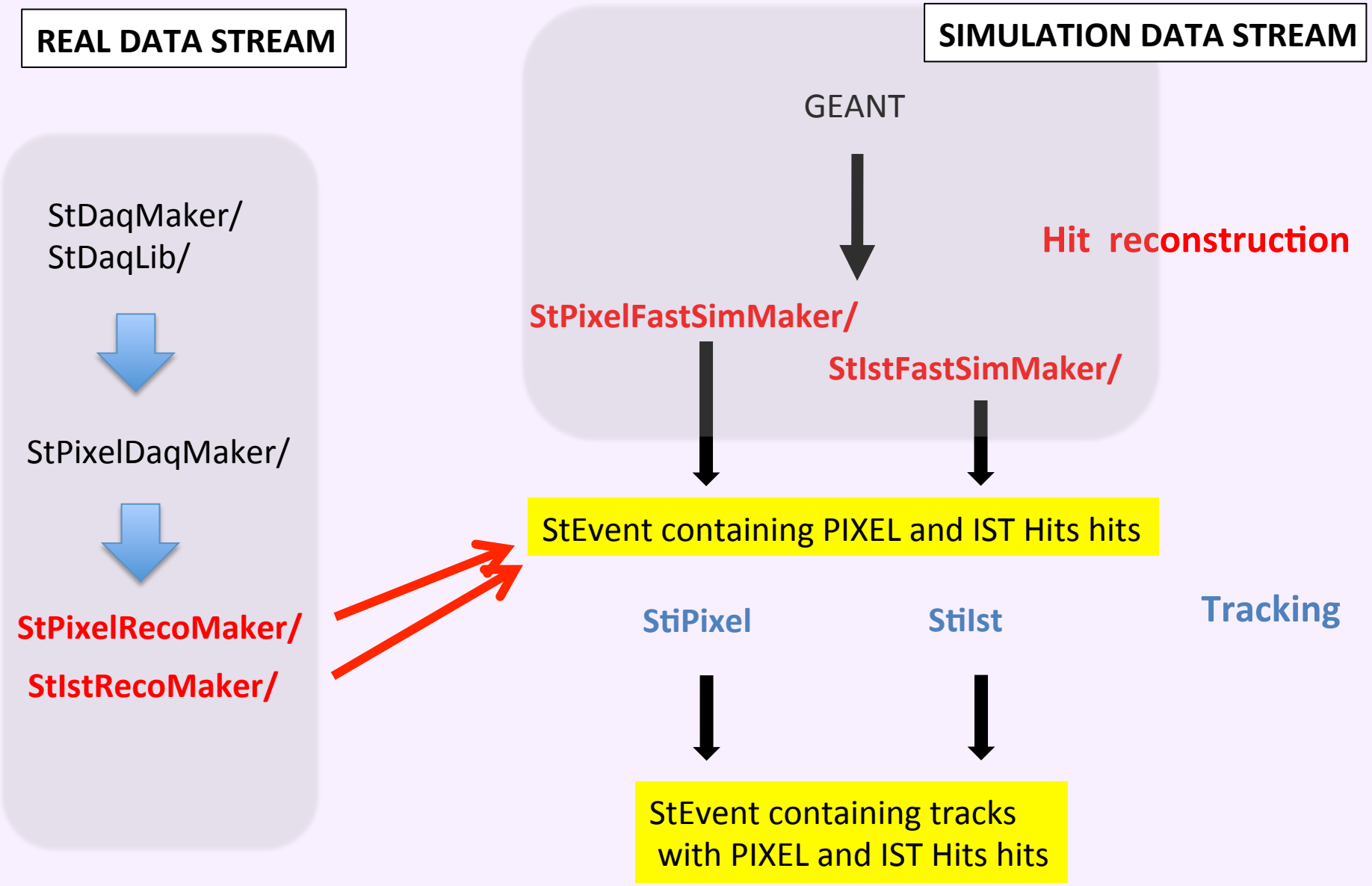


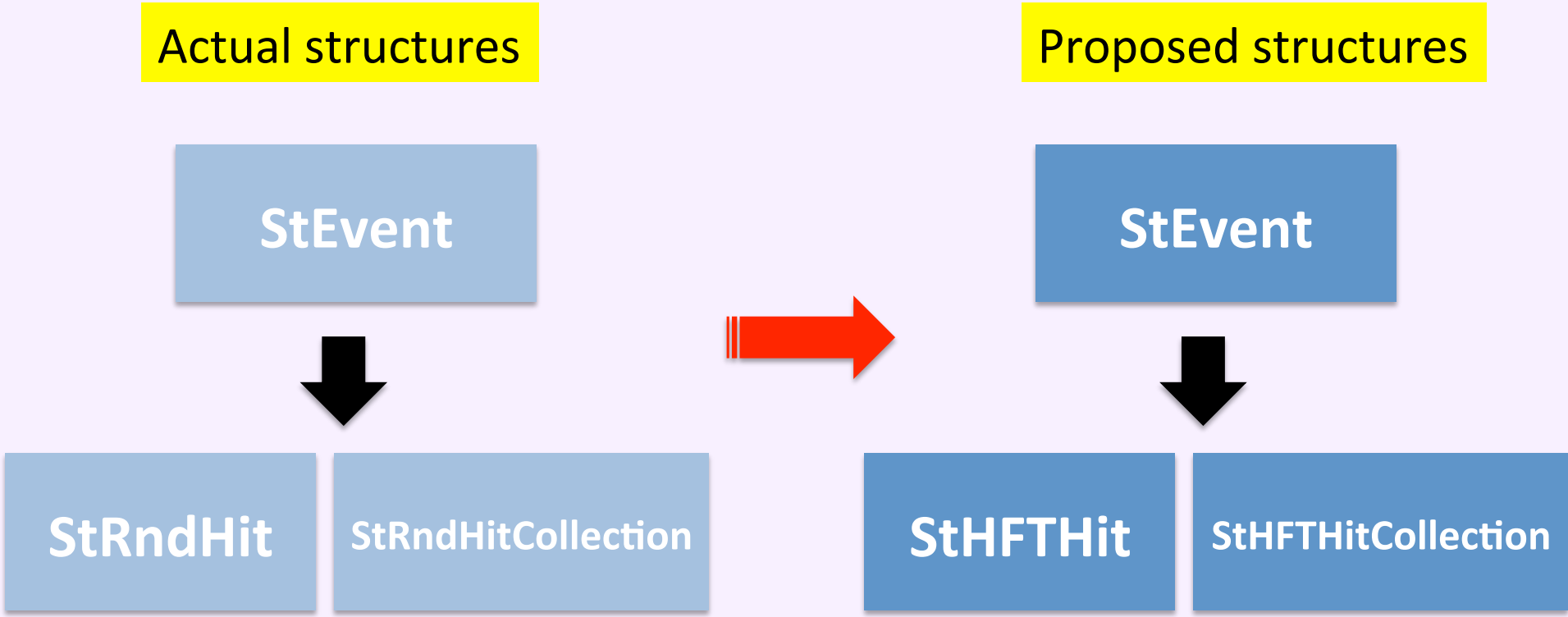


Offline chain

- Need to establish working chain
- Modify structures/makers to our needs
- Closely tied to S&C territory, one needs to be careful
- Need to stay informed on new strategies (e.g. no minimc need etc)
- We 've gone through initial loops but far from being done (see 2 slides)
- Expert help invaluable



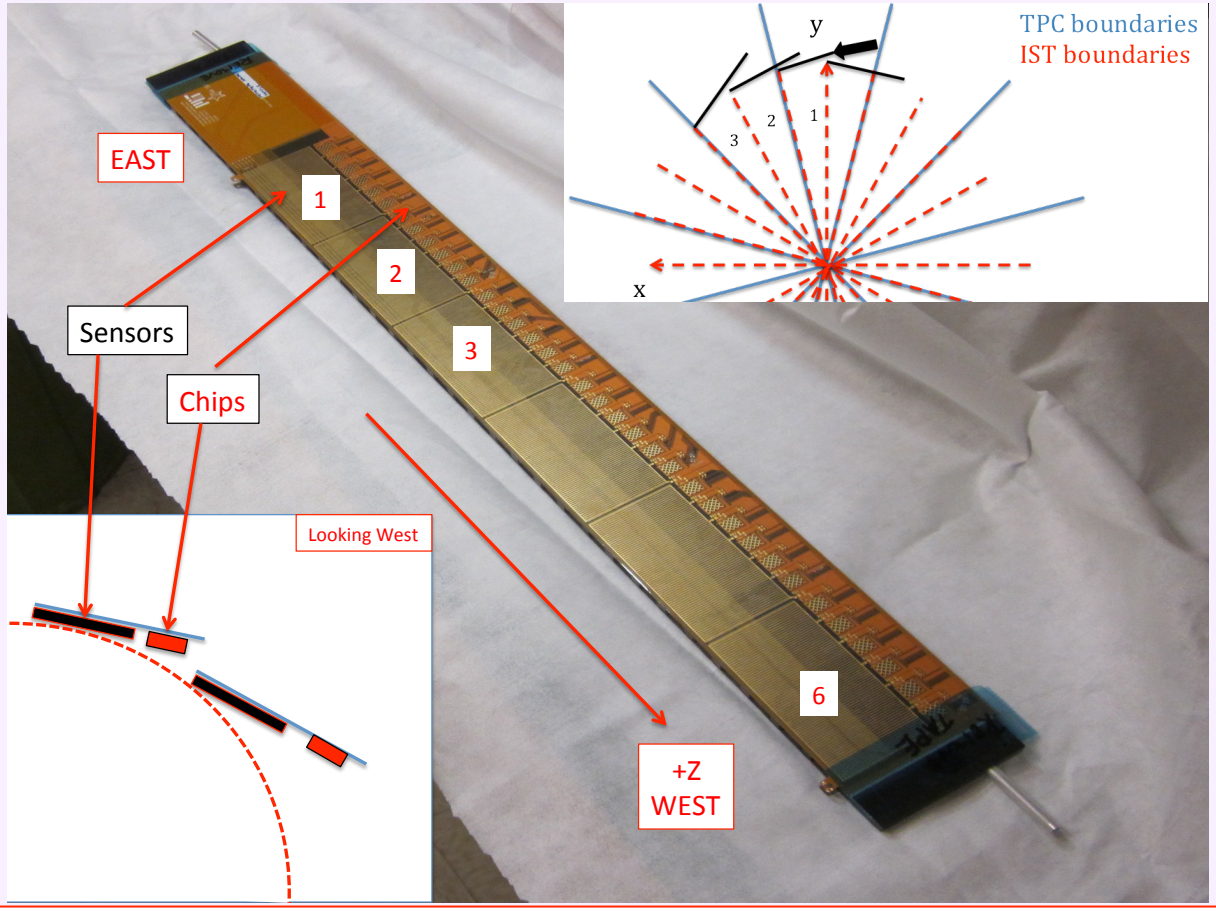

REAL DATA STREAM
SIMULATION DATA STREAM
GEANT
StDaqMaker/
StDaqLib/
Hit reconstruction
StPixelFastSimMaker/
StIstFastSimMaker/
StPixelDaqMaker/
StEvent containing PIXEL and IST Hits hits
StPixelRecoMaker/
StIstRecoMaker/
StiPixel
StiIst
Tracking
StEvent containing tracks
with PIXEL and IST Hits hits



- A unique **PIXEL/IST** hit structure and hit collection
- No sub collection (LayerHitCollection, SectorHitCollection) because it is redundant :
  - Make the hits collection ***isSortable()*** to retrieve the hits the way we want.

Numbering convention for detector elements

- We have defined and documented the scheme for all HFT elements
- Complies with STAR conventions
- IST example is shown below



http://drupal.star.bnl.gov/STAR/event/2012/03/09/hft-software/hft-numbering-schemedoc-10

Miscellaneous

- Simulation environment (UPC e^- background, Pileup mechanism)
  - We did improve our understanding and way of generating this
  - We still need to put all this to work with STAR's official pileup scheme
- Event vertex finders
  - Important evaluation work goes on now
- Web Docs
  - Jonathan and I are organizing better our Off-Drupal personal doc areas
  - Jerome provided an afs area for Off-Drupal (really public) access
  - Drupal pages need rework from scratch

Still to do

Besides things I have already mentioned above

- Raw data unpackers/Cluster-Hit finders
- Tests of new STV tracker, VMC environment
- 'Online' data format/slow controls/online QA/Db considerations
- **Make sure we are ready when data starts flowing**

Software task		BNL	IPHC	UCLA	KSU	NPI	~~MXT~~ UIC	LBL	Purdue	USTC
Offline										
Hit Reconst.	IST						X			
	Pixel							X	X	
Tracking		X	X							
Event Vertex		X			X	X				
Decay Vertex		X	X		X	X				X
Calibration Db	SSD	X			X			X		
	IST	X					X			
	PXL	X						X	X	
Alignment	SSD	X			X			X		
	IST	X			X		X			
	PXL	X			X			X	X	
Simulation										X
Geometry	SSD	X			X			X		
	IST	X					X			
	PXL	X						X		
Fast/Slow Sim.	SSD				X			X		
	IST				X		X			
	PXL		X					X	X	
Embed./Pileup	IST				X		X	X	X	X
Assoc/Analysis		X			X	X				

NEEDS UPDATE

Summary

- In my opinion we are just warming up as a group
- Most of the work is still ahead of us
- Many and diverse areas need attention, work, people