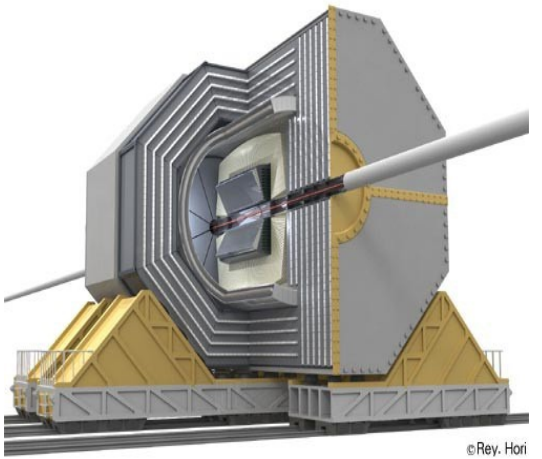
ILD software status
readiness for LOI

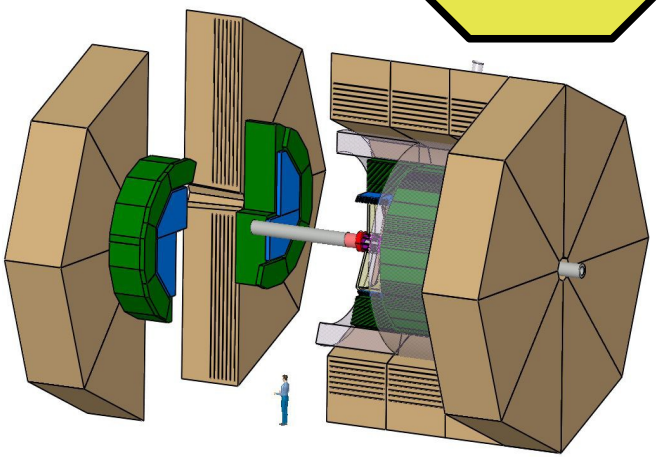
Frank Gaede
DESY
ECFA2008, Warsaw, Poland
June 9-12, 2008

Outline

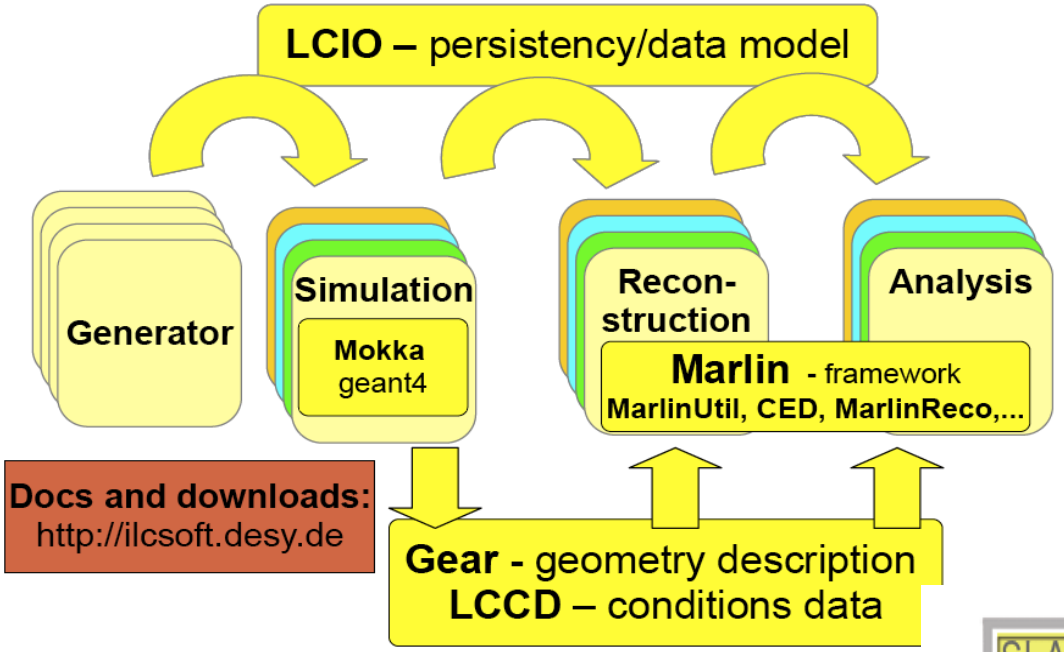


- a number of talks given on software tools in three sessions during this meeting -> see for details
- nice overview & summary given by Mark Thomson in plenary this morning
- -> this talk will just highlight a view important points
  - LDC & GLD-frameworks
  - reconstruction tools
  - DST files
  - Grid Monte Carlo production

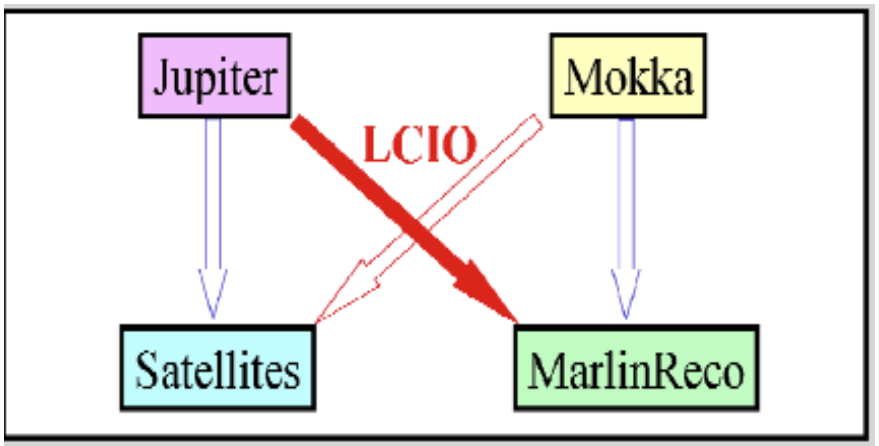
ILD

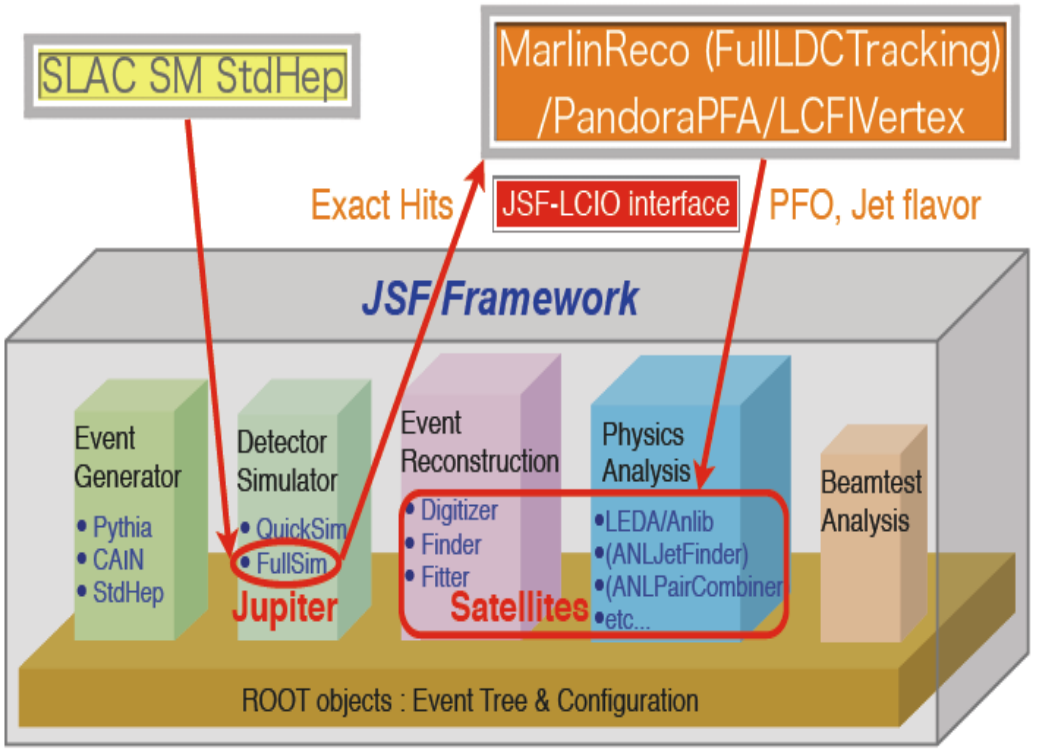


LDC & GLD sw frameworks



- two independent frameworks had been developed in the 2 regions
- -> LCIO & GEAR provide basis for interoperability





ILD-LDC-interoperability

Jupiter
geant4

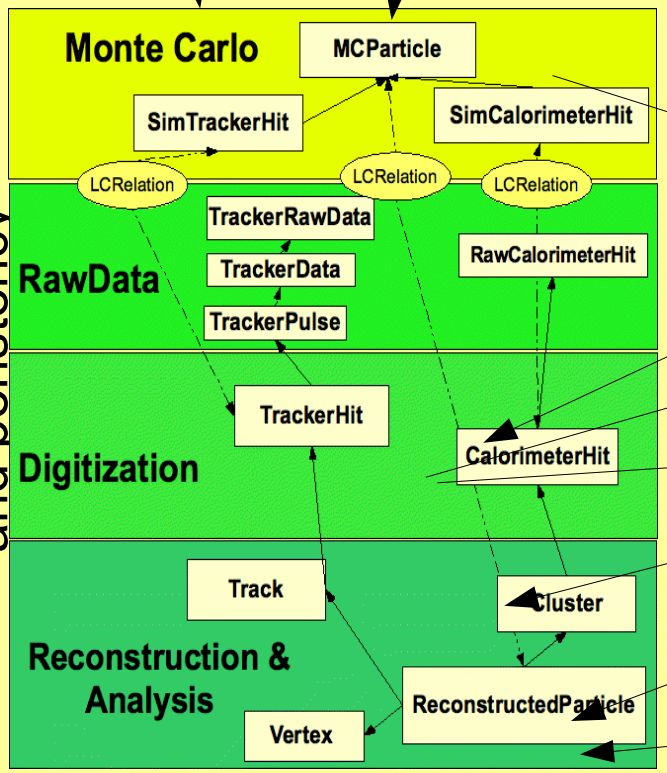
Mokka
geant4

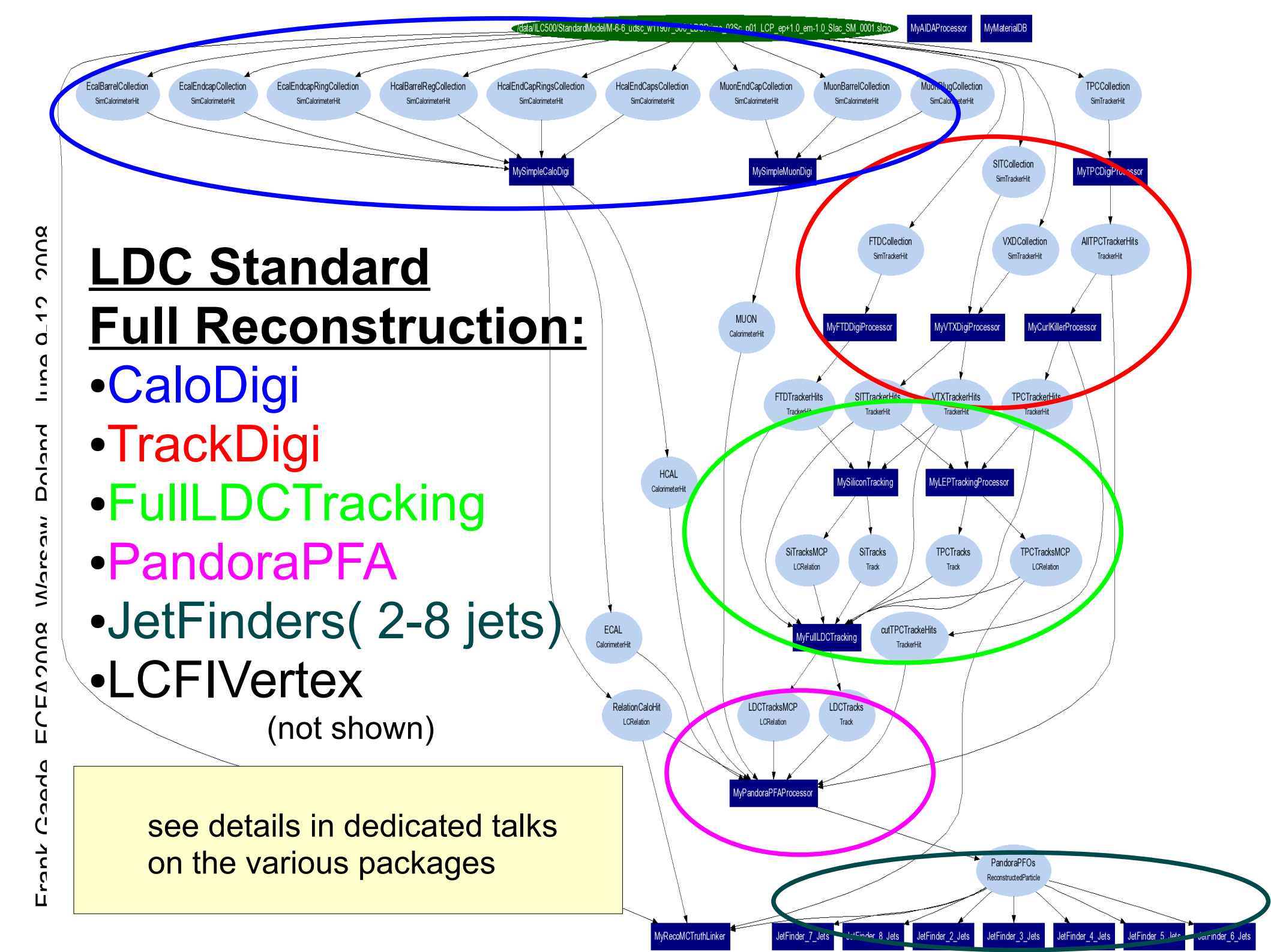
GEometry **A**PI for **R**econstruction

MarlinReco et al

- Track&CaloDigi
- FullLDCTracking
- PandoraPFA
- DurhamJetFinder
- LCFIVertex- flav.tag
- Full&DSTOutput

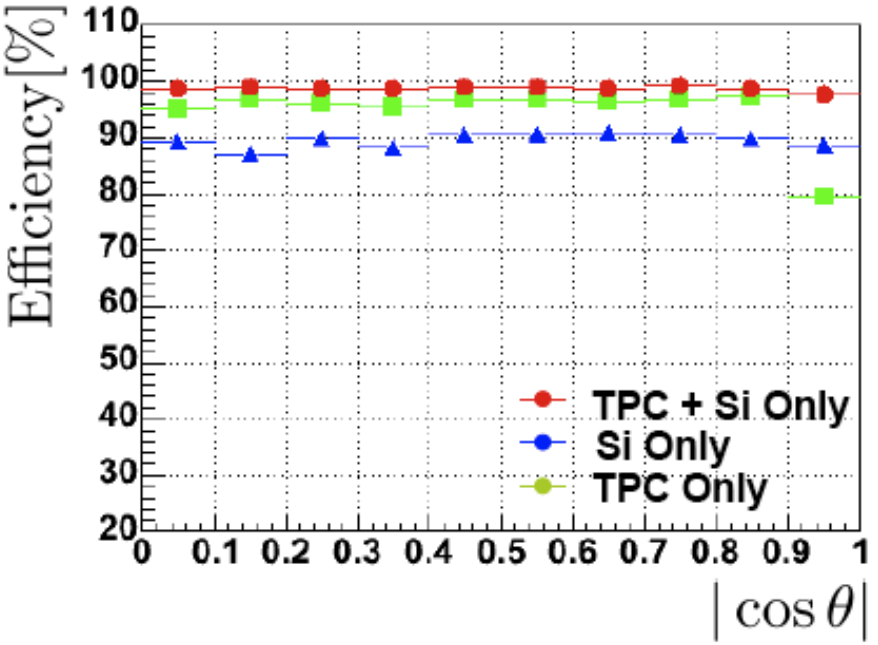
LCIO Event Data Model and peristency

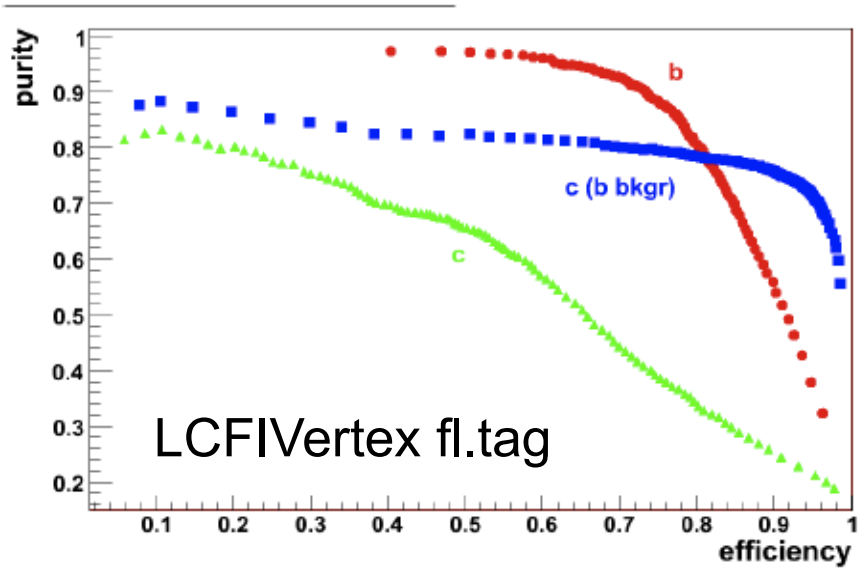



LDC Standard
Full Reconstruction:
•CaloDigi
•TrackDigi
•FullLDCTracking
•PandoraPFA
•JetFinders(2-8 jets)
•LCFIVertex
(not shown)
see details in dedicated talks
on the various packages
MyAIDAProcessor
MyMaterialDB
EcalBarrelCollection
EcalEndcapCollection
EcalEndcapRingCollection
HcalBarrelRegCollection
HcalEndCapRingsCollection
HcalEndCapsCollection
MuonEndCapCollection
MuonBarrelCollection
MuonPlugCollection
TPCCollection
SimCalorimeterHit
SimTrackerHit
MySimpleCaloDigi
MySimpleMuonDigi
SITCollection
MyTPCDigiProcessor
FTDCollection
VXDCollection
AllTPCTrackerHits
TrackerHit
MUON
CalorimeterHit
MyFTDDigiProcessor
MyVTXDigiProcessor
MyCurlKillerProcessor
FTDTrackerHits
SITTrackerHits
VTXTrackerHits
TPCTrackerHits
HCAL
MySiliconTracking
MyLEPTrackingProcessor
SiTracksMCP
SiTracks
TPCTracks
TPCTracksMCP
LCRelation
Track
ECAL
MyFullLDCTracking
cutTPCTrackeHits
RelationCaloHit
LDCTracksMCP
LDCTracks
MyPandoraPFAProcessor
PandoraPFOs
ReconstructedParticle
MyRecoMCTruthLinker
JetFinder_7_Jets
JetFinder_8_Jets
JetFinder_2_Jets
JetFinder_3_Jets
JetFinder_4_Jets
JetFinder_5_Jets
JetFinder_6_Jets
Frank Gaede, ECFA2008, Warsaw, Poland, June 9-12, 2008

reconstruction tools

Tracking efficiency





PandoraPFA v02-01 + FullLDCTracking

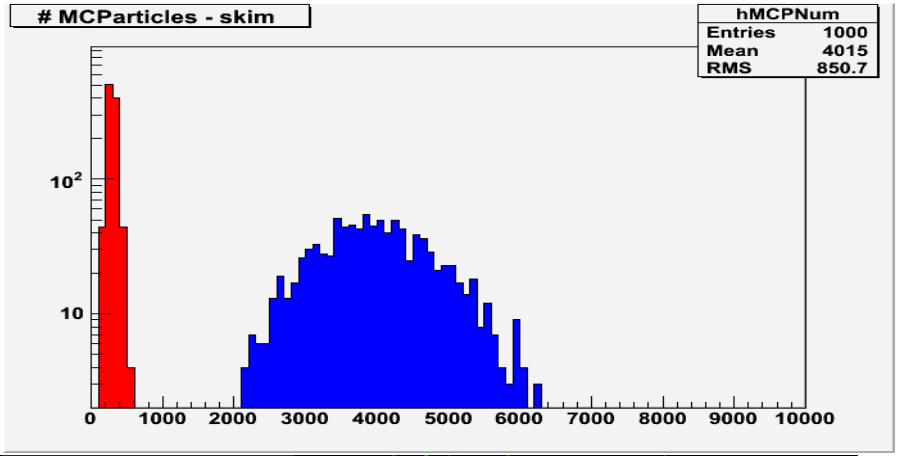
E_{JET}	$\sigma_E/E = \alpha/\sqrt{E_{jj}}$ $\lvert\cos\theta\rvert<0.7$	σ_E/E_j
45 GeV	0.24	3.5 %
100 GeV	0.31	3.1 %
180 GeV	0.43	3.2 %
250 GeV	0.56	3.6 %

- reconstruction tools have been improved and modified to be compatible with the LDCPRime and GLDPrime model
- some finalization still to be done (eg. flavour tag Neural Nets)
- need to start 'serious' tests on recently simulated LOI data

-> see dedicated talks for details

'DSTs' with LCIO

- DSTs produced with
  - StandardConfig/mc2008/stdreco.xml
- apply MCParticle skim:
  - store full generated event
  - + reconstucted particles & parents
  - decays in flight & conversions
- store LCFIVertex flavour tag in ParticleID objects (C.Lynch)
  - flavour tags b,c,b-bg
  - NN input quantities
  - true jet flavour & charge




```
////////////////////////////////
EVENT: 0
RUN: 2011907
DETECTOR: LDCPrime_02Sc
COLLECTIONS: (see below)
////////////////////////////////
```

COLLECTION NAME	COLLECTION TYPE	NUMBER OF ELEMENTS
FTFinal_2Jets	ReconstructedParticle	2
FTFinal_3Jets	ReconstructedParticle	3
FTFinal_4Jets	ReconstructedParticle	4
FTFinal_5Jets	ReconstructedParticle	5
FTFinal_6Jets	ReconstructedParticle	6
FTFinal_7Jets	ReconstructedParticle	7
FTFinal_8Jets	ReconstructedParticle	8
IPVertex	Vertex	1
LDCTracks	Track	70
MCParticlesSkimmed	MCParticle	202
PandoraClusters	Cluster	64
PandoraPFOs	ReconstructedParticle	65
RecoMCTruthLink	LCRelation	65
ZVRESVertices_2Jets	Vertex	1
ZVRESVertices_3Jets	Vertex	1
ZVRESVertices_4Jets	Vertex	1
ZVRESVertices_5Jets	Vertex	1
ZVRESVertices_6Jets	Vertex	1
ZVRESVertices_7Jets	Vertex	1
ZVRESVertices_8Jets	Vertex	1

some numbers udsc @ 500 GeV		
type	kB/evt	f_I/O /Hz
SIM	950	10
REC	1800	3
DST	23	250

Note: f_I/O numbers are examples only - simple Marlin job on my PC

Monte Carlo production on the Grid

Proposed (preliminary)		
Process	fb^{-1}	#events
ee->6f	500	1197236
ee->4f	50	3358252
ee->2f	20	1192784
ee->hX	500	299278
nn(n*g)	20	841726
ee->ee	0.1	6953510
eg->eg	0.1	344270
gg->X	0.1	554782
ee->gg(n*g)	10	306954
rest	1	517376
Total		15566168

Sub-Detector	Parameter	GLD	LDC	GLD'	LDC'
TPC	R_{inner} (m)	0.45	0.30	0.45	0.30
	R_{outer} (m)	2.00	1.58	1.80	1.80
	Z_{max} (m)*	2.50	2.16	2.35	2.35
Barrel ECAL	R_{inner} (m)**	2.10	1.60	1.85	1.82
	Material	Sci/W	Si/W	Sci/W	Sci/W
Barrel HCAL	Material	Sci/W	Sci/Fe	Sci/Fe	Sci/Fe
Endcap ECAL	Z_{min} (m)***	2.80	2.30	2.55	2.55
Solenoid	B-field	3.0	4.0	3.50	3.50
VTX	Inner Layer (mm)	20	16	18	18

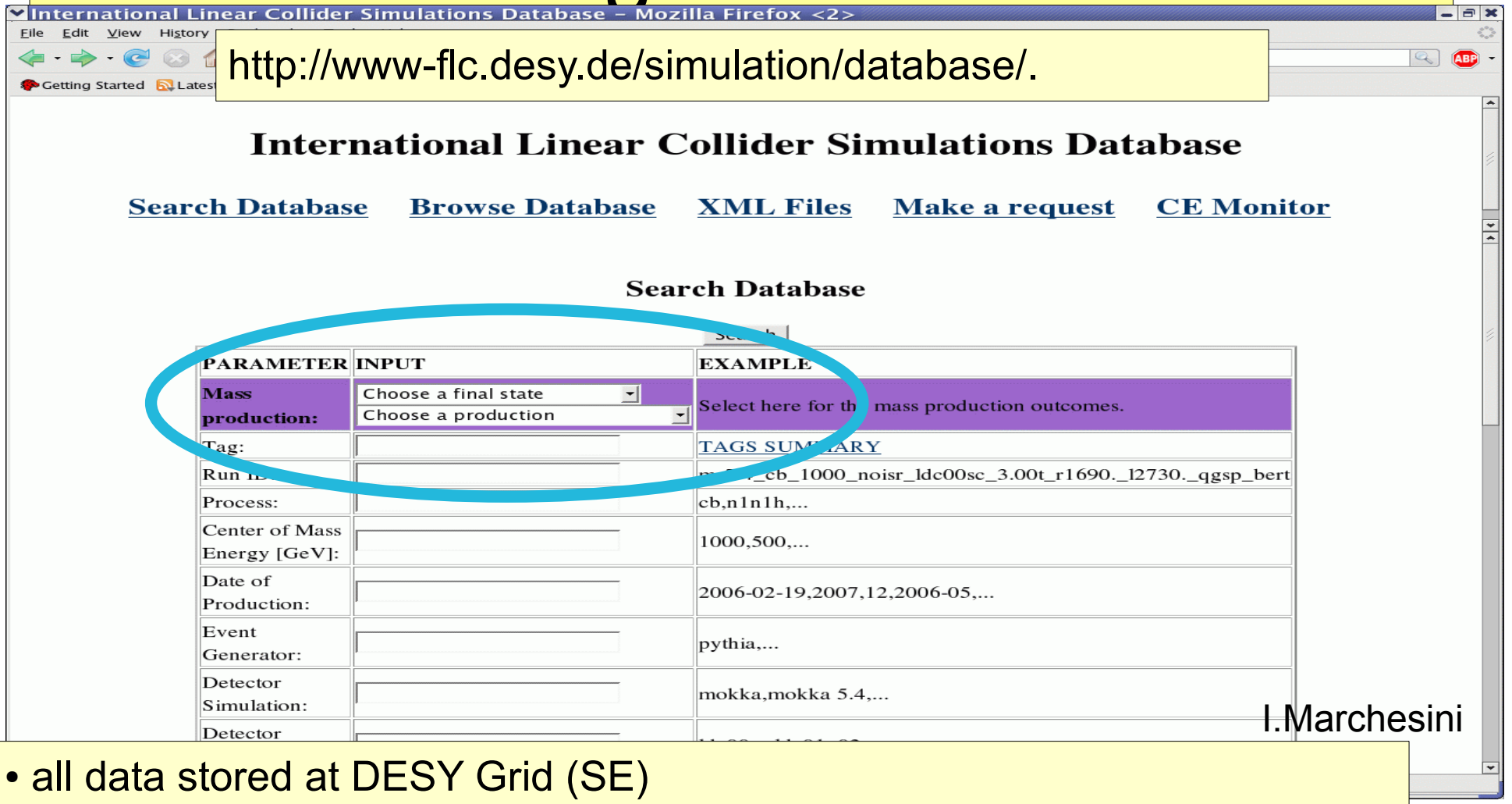
- use the Grid to produce a significant Monte Carlo data set
  - (as proposed by WWS software panel)
- use Standard Model generator files produced at SLAC
- -> produce 15M events for LDCPrime configuration
- + signal samples, detector variations,....
- -> computing infrastructure set up by DESY group
  - job submissions scripts, databases, monitoring tools,...
  - grid software installations

First round of LDCPrime mass production

- first round of production started last week (~4 days)
- Detector Model **LDCPrime_02Sc** and **Mokka-06-06-p03**
- currently : ~10-15% of the final sample
- expect ~2 months in total

Proposed (preliminary)			Produced		
Process	**fb^{-1}**	**#events**	**Process**	**fb^{-1}**	**#events**
ee->6f	500	1197236	ee->6f	108	258462
ee->4f	50	3358252	ee->4f	7	452332
ee->2f	20	1192784	ee->2f	1.5	86016
ee->hX	500	299278	ee->hX	27	16277
nn(n*g)	20	841726	nn(n*g)	4	173508
ee->ee	0.1	6953510	ee->ee	0	748
eg->eg	0.1	344270	eg->eg	0	0
gg->X	0.1	554782	gg->X	0	2005
ee->gg(n*g)	10	306954	ee->gg(n*g)	0	0
rest	1	517376	rest	0	0
			calibration		7400
Total		**15566168**			**996748**

accessing the data files



I.Marchesini

- all data stored at DESY Grid (SE)
- browse the data catalogue on the web
- -> retrieve logical grid file name
  - copy the data to your computer using Grid tools
  - or analyze the data on the grid

GLD physics sample production

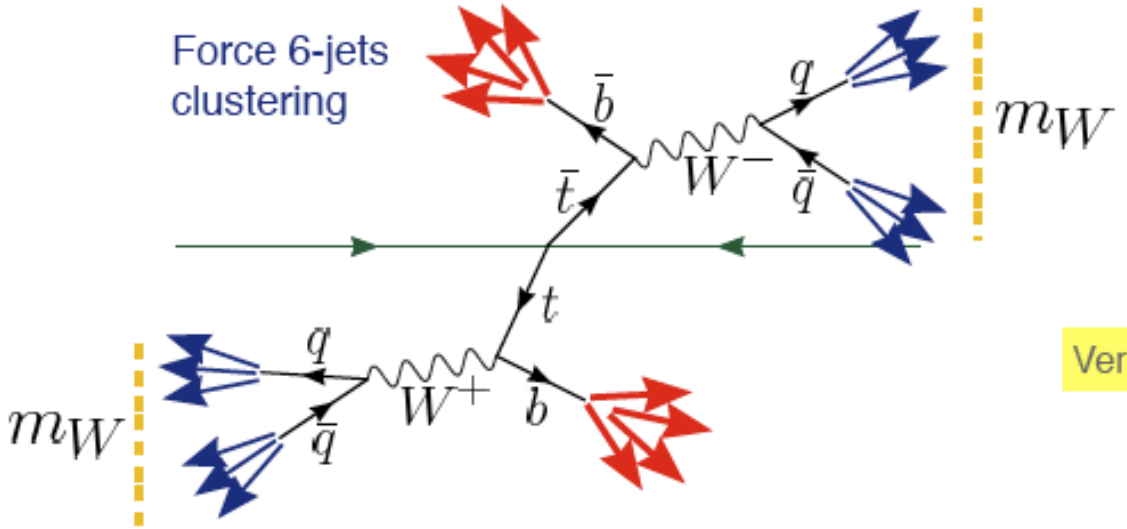
				Jupiter samples		
Calibration samples			# Events	gldapr08	gldprim_v04	j4ldc_v04
	Thomson's uds91		10000	done	done	done
	Thomson's uds200		10000	done	done	done
	PythiaZPole uds		10000	done	done	done
	PythiaZPole ccbar		10000	done	done	done
	PythiaZPole bbbar		10000	done	done	done
	jsf's uds 91		2500	done	done	done
	jsf's uds 200		2500	done	done	done
	jsf's uds 500		20000	done	done	done
				Jupiter Production		
	Process	Int. Lum(1/fb)	# Events	gldapr08	gldprim_v04	j4ldc_v04
250 GeV	zh->eeH	250	5000	done	done	done
	zh->μμH	250	5000	done	done	done
	zh->ννH	250	12500	done	done	done
	zh->qqH	250	40000	done	done	done
	zz->eeqq	250	20000	done	done	done
	zz->μμqq	250	20000	done	done	done
	zz->ννqq	250	77500	done	done	done
	zz->qqqq	250	168000	9300	done	93000
	zz->ττqq	250	20000	0	done	0
	ww->enuenu	250				
	ww->munumunu	250				
				Jupiter Production		
	Process	Int. Lum(1/fb)	# Events	gldapr08	gldprim_v04	j4ldc_v04
500 GeV	smuon(e-L)	500	14750	done	done	done
	smuon(e-R)	500	61000	done	done	done
	xcxc(e-L)	500	79000	done	done	done
	xcxc(e-R)	500	500	done	done	done
	xn2xn2(e-L)	500	14750	done	done	done
	bblnqq(e-L)	100	54000	0	done	0
	bblnqq(e-R)	100	24000	0	done	0
	bbqqqq(e-L)	150	126000	0	done	0
	bbqqqq(e-R)	150	51000	0	done	0
	tau-pair	12.4	57500	done	done	done
	tau-pair	100		0	in progress	0

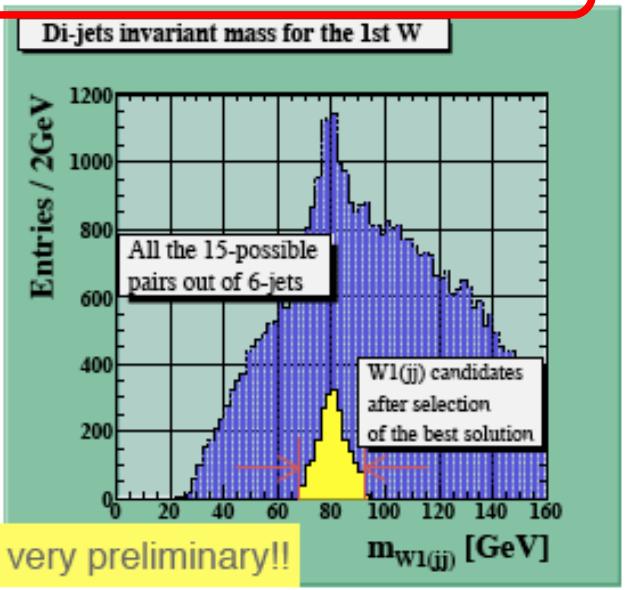
Job summary: http://ilcphys.kek.jp/soft/samples/apr08/

- GLD-ILD focused on producing dedicated physics signal samples
- three detector models for optimization: GLD, GLDPrime, j4LDC

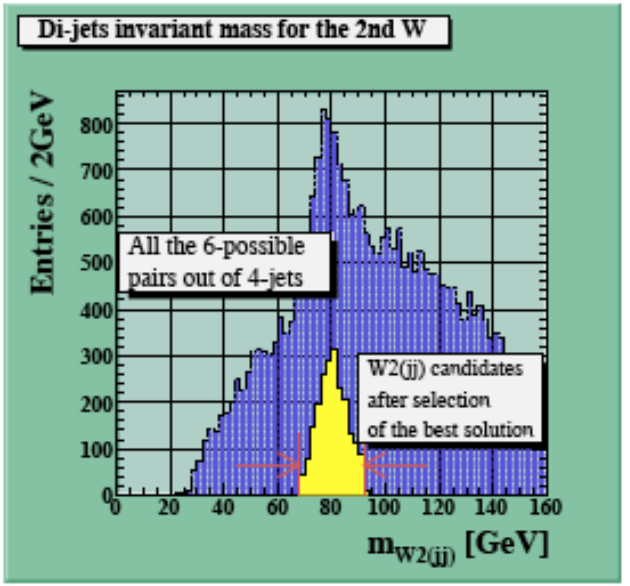
physics analysis - example

- SLAC SM StdHep -> Jupiter -> MarlinReco/PandoraPFA
  -> JSF & Sattelites (LEDA, Anlib)





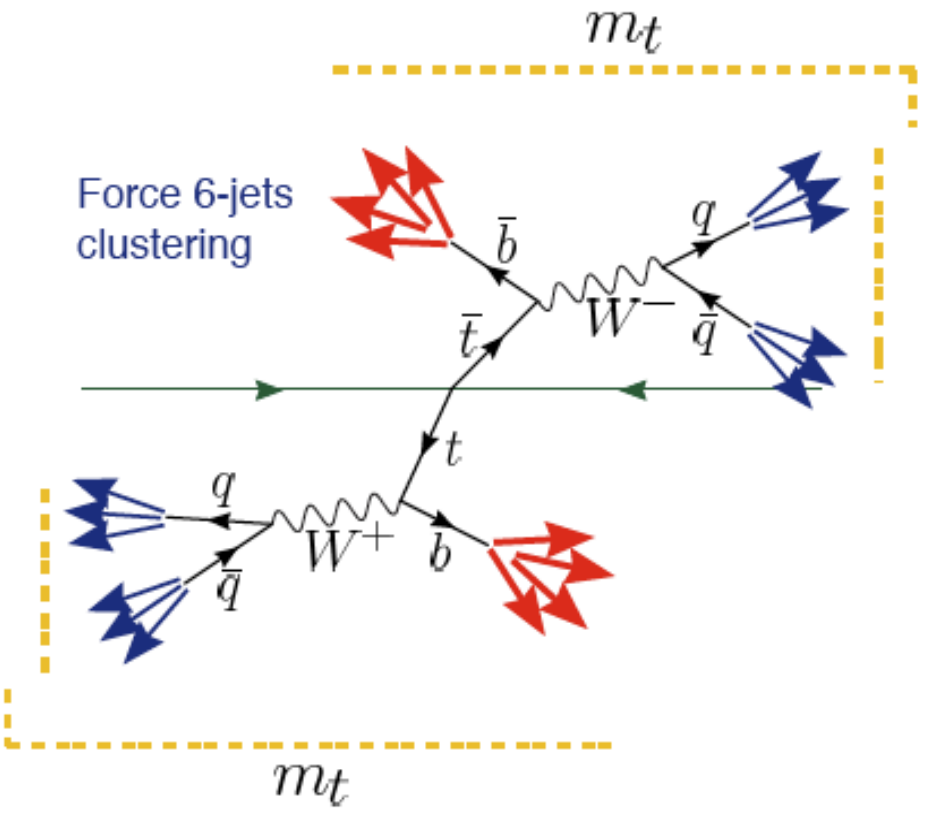
Very very preliminary!!

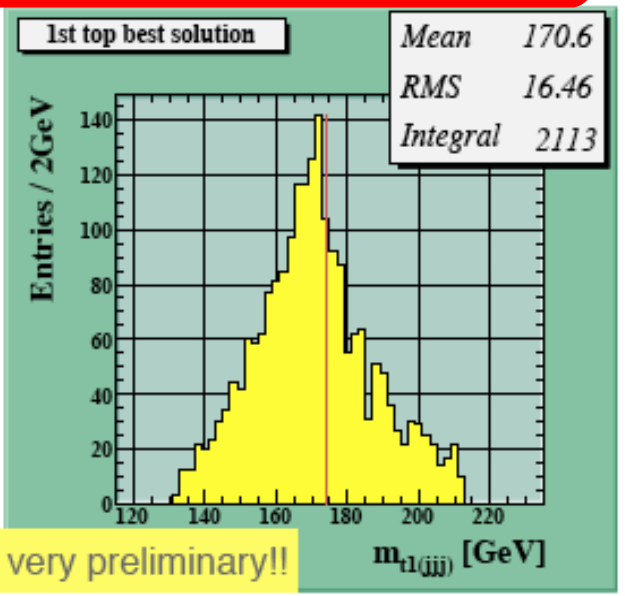


- $\chi^2 = (m_{w1} - m_w)^2/\sigma_{mw}^2 + (m_{w2} - m_w)^2/\sigma_{mw}^2$
  $+ (m_{t1} - m_t)^2/\sigma_{mt}^2 + (m_{t2} - m_t)^2/\sigma_{mt}^2$
- Reduction of both process & combinatorial BG:
  - Double b-tagging is powerful tool
  - Not yet implemented LCFIVertex to this analysis

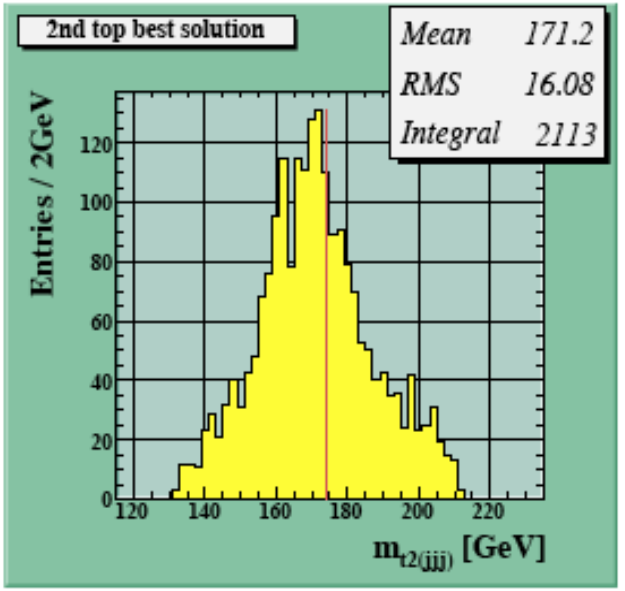
physics analysis - example

- SLAC SM StdHep -> Jupiter -> MarlinReco/PandoraPFA
  -> JSF & Sattelites (LEDA, Anlib)





Very very preliminary!!



- $\chi^2 = (m_{w1} - m_w)^2/\sigma_{mw}^2 + (m_{w2} - m_w)^2/\sigma_{mw}^2$
  $+ (m_{t1} - m_t)^2/\sigma_{mt}^2 + (m_{t2} - m_t)^2/\sigma_{mt}^2$
- w/o b-tagging => tight Di-jet mass cut: Eff(sel)=68%
- Need to check jet-parton correspondence

Summary

- LDC&GLD have a mature software frameworks
  - interoperability provided through LCIO and GEAR
- recent focus is improving the core tools for LOI mass production – done for simulators Mokka & Jupiter
- Marlin based reconstruction tools – used by both – are in good shape - some finalization needed
- simulation mass production started successfully
- first physics analyses under development

- **ild software is in good shape for the LOI !**
- however still quite some work to do:
  - think about inclusion of beam background !?
  - start reconstruction for testing and validation
  - -> might need some iterations on improving reconstruction
  - provide reconstructed DSTs for physics working groups
  - write/finalize physics analyses
  - ...
  - optimize detector and write LOI ....