Simulation/Analysis Proposal

***Milestones*:**

The detailed milestones will depend on when new staff can be recruited. It is expected that all groups will participate in this WP.

Prose text to justify the work to be added!

1. **DESY test beam**
   1.1. Establish analysis framework
   1.2. Include existing digitisation code to mokka (or post processor?)
   1.3. First MC samples, electrons, ideal conditions (+possible cosmics?)
   1.4. Understand beam environment (profile, energy spread, …)
   1.5. Understand wire chamber behaviour
   1.6. Simple simulation of wire chamber in Mokka
   1.7. MC samples, electrons, realistic conditions, incl. hodoscope
   1.8. Comparison of MC/data, for both electrons and cosmics.

2. **Hadron test beam**
   2.1. Maintain all available hadronic shower codes
   2.2. Report defining requirements (beam energy, type, run schedule) for host lab.
   2.3. **First MC samples of ideal test beam conditions, 1-2 hadronic models**
   2.4. Understand beam environment (profile, energy spread, particle content, …)
   2.5. Simulation of beam line environment
   2.6. Second MC samples, realistic beam conditions, 1-2 hadronic models
   2.7. Understand Cerenkov counters
   2.8. Separation into species specific samples (efficiency, purity), various impact positions
   2.9. Large MC production, full set of models, as above
   2.10. Confront models with data, decide on best model(s), estimate uncertainties
   2.11. **Publish test beam results, impact on detector design**

3. **Energy flow algorithms**
   3.1. Review of existing work/code (SNARK, REPLIC, etc.)
   3.2. Identify factors critical to resolution and simple physics benchmark processes (linking all detectors, but in limited regions, e.g. τ decay, $Z^0 \rightarrow$ jets, …)
   3.3. Algorithm brainstorming: at least 2 contrasting approaches to energy flow
   3.4. Define tools required by algorithm (e.g. calo. clustering)
   3.5. Controlled comparison of existing codes: single process/detector geometry
   3.6. First implementation of single new algorithm
   3.7. Understand interplay between hadronic modelling uncertainties and energy flow
   3.8. Physics benchmark comparison, feedback on tools
   3.9. Continue development and evaluation/refinement of different algorithms.

4. **Global detector design** *(using energy flow)*
   4.1. Identify complete physics benchmark processes (incl. background rejection)

4.2. Scope definition: input from proponents of all conceptual designs; what is appropriate to vary (+ what is not)
4.3. Apply first benchmark physics analysis to first detector concept/parameter set
4.4. Analysis used for alternative detector concepts (through LCWS/ECFA-DESY, etc.)
4.5. Extend study using additional physics benchmark analyses
4.6. Variation of detector parameters (radius, sampling frequency, segmentation) for each conceptual design
4.7. Comparison of results leading to optimal design for each concept

5. **Integration with world LC software activities**
5.1. Participation in software workshops as/when announced
5.2. Dissemination of UK simulation results/tools

6. **Active detector technology**
6.1. Geometry implementation in Mokka, for full detector and small scale beam test
6.2. Simulation studies supporting studies of alternative detector technologies (e.g. MAPS)

7. **Physics studies** (*supporting energy flow and global detector design tasks)*
7.1. Define aspects of detector to be tested (intrinsic resolutions, particle separation), define set of complete physics benchmark processes
7.2. Implement simple, robust version of single analysis using generic tools (not necessarily "state-of-the-art")
7.3. Develop additional physics benchmark analyses
7.4. Understand interplay between hadronic modelling uncertainties and energy flow

Gantt chart:

BDS WP - Collimator Design	**FY'05**				**FY'06**				**FY'07**			
Quarter	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1. DESY test beam												
1.1 Establish analysis framework	===											
1.2 Existing digitisation code to mokka	===											
1.3 1st MC samples, ideal beam env., +cosmics	===											
1.4 Understand beam environment	===											
1.5 Understand wire chamber	===											
1.6 Implement wire chamber simulation	===											
1.7 MC samples, realistic conditions	===											
1.8 Data/MC comparisons, electrons and cosmics	===	===	===									
2. Hadron test beam												
2.1 Maintain hadronic shower codes	===	===	===	===	===	===	===	===	===	===	===	===
2.2 Report: test beam requirements	===											
2.3 Small MC samples, ideal conditions		===	===									
2.4 Understand beamline environment		===	===									
2.5 Simulate beamline environment			===	===								
2.6 MC samples, realistic conditions			===	===	===							
2.7 Understand Cerenkov counters				===	===							
2.8 Species specific samples				===	===	===						
2.9 Production MC samples, all models					===	===	===					
2.10 Compare data/all MC models					===	===	===	===	===			
2.11 Publish results, impact on design								===	===			
3. Energy flow algorithm												
3.1 Review existing packages (Snark, replic, etc.)	===	===										
3.2 Identify resolution limiting factors; simple physics benchmarks			===									
3.3 Algorithm brainstorming, >2 approaches	===	===	===	===								
3.4 Define essential tools		===	===									
3.5 Existing algorithms study: 1 detector/process			===	===								
3.6 1st implementation of 1 new algorithm				===	===							
3.7 Investigate interplay with hadronic modelling					===	===						
3.8 Compare physics benchmarks, tools feedback						===	===					
3.9 Further development/evaluation/refinemenent							===	===	===	===	===	===
4. Global detector design												
4.1 Identify complete physics benchmarks	===	===										
4.2 Scope definition, all conceptual designs		===	===									
4.3 1st benchmark analysis to 1 detector concept			===	===	===							
4.4 Analysis used for alternative det. concepts				===	===							
4.5 Extend to additional physics benchmarks					===	===	===	===				
4.6 Det. parameter variation, all concepts							===	===	===	===		
4.7 Comparison of results, optimisation				===	===	===	===	===	===	===	===	===
5. Integration with world LC s/w activity												
5.1 Workshop participation		===		===		===		===		===		===
5.2 Tools/Results dissemination			===		===		===		===		===	

6. Active detector technology												
6.1 Mokka implementation of MAPS concept	===	===	===									
6.2 Simulation studies supporting MAPS			===	===	===	===	===					
7. Physics studies												
7.1 Define complete physics benchmarks	===	===										
7.2 Implement robust analysis with generic tools		===	===	===								
7.3 Additional physics benchmark analyses				===	===	===	===	===	===			
7.4 Investigate role of hadronic modelling					===	===	===	===	===	===	===	

Deliverables:
The deliverables at end FY07 will include:
1. Published analysis of electron test beam
2. Published analysis of hadron test beam
3. Code for generic energy flow algorithm
4. Contribution to detector CDR and TDR
5. Positions of responsibility in global LC software activity
6. Report on impact of alternative detector technologies
7. Framework for physics analysis benchmarking of detector designs

1.5 Request
Future Effort

Name	**Institution**	**Type**	**FTE** 05	**FTE** 06	**FTE** 07	**Funding**
D.R.Ward	Cambridge	Academic	0.?	0.?	0.?	HEFCE
M.A.Thomson	Cambridge	Academic	0.?	0.?	0.?	HEFCE
N.K.Watson	Birmingham	Acadmic	0.?	0.?	0.?	HEFCE
C.M.Hawkes	Birmingham	Acadmic	0.?	0.?	0.?	HEFCE
A.Other	Manchester	Acadmic	0.?	0.?	0.?	HEFCE
B.Other	Imperial	Acadmic	0.?	0.?	0.?	HEFCE
C.Other	UCL	Acadmic	0.?	0.?	0.?	HEFCE
D.Other	RAL PPD	Staff	0.?	0.?	0.?	CCLRC
F.Salvatore?	RHUL?	Acadmic	0.?	0.?	0.?	HEFCE
RA-1	?	RA	1	1	1	PPARC
RA-2	?	RA	1	1	1	PPARC
Total FTE			2.00	2.00	2	
Total new			2	2	2	

Existing Staff
:

- Ward will…
- Watson will ...

New Staff:

- RA-1: Will ….
- RA-2: Will …

Travel

Justification:
Participation in ECFA/LCWS workshops will be essential for much of the work with increased interaction between different regions. *Should bid high here as anticipate travel to other regions will become essential.*

1.6 Risk assessment

Table 1.6a : Definition of risk levels

Risk Level	Meaning
1	Low Risk: minor error might happen, could be easily corrected since no technical challenge is involved. Scope of the project is unchanged. Minor impact on schedule (<3 months) or cost (<5%) might be necessary.
2	Medium Risk: A small downgrading of the final objectives might be required. Alternatively a small delay (<1 year) and cost increase might be necessary (<20%) to maintain the initial objectives.
3	High Risk: Significant downgrading of the objectives might be required. Alternatively more R&D, more time (>1 year) and more money (>20%) would be required.

Table 1.6b : Risk assessment

Task	Risk	Action	Risk Level	Consequence