Report from 'Relationship' session at LCWS'02 Jeju/Korea

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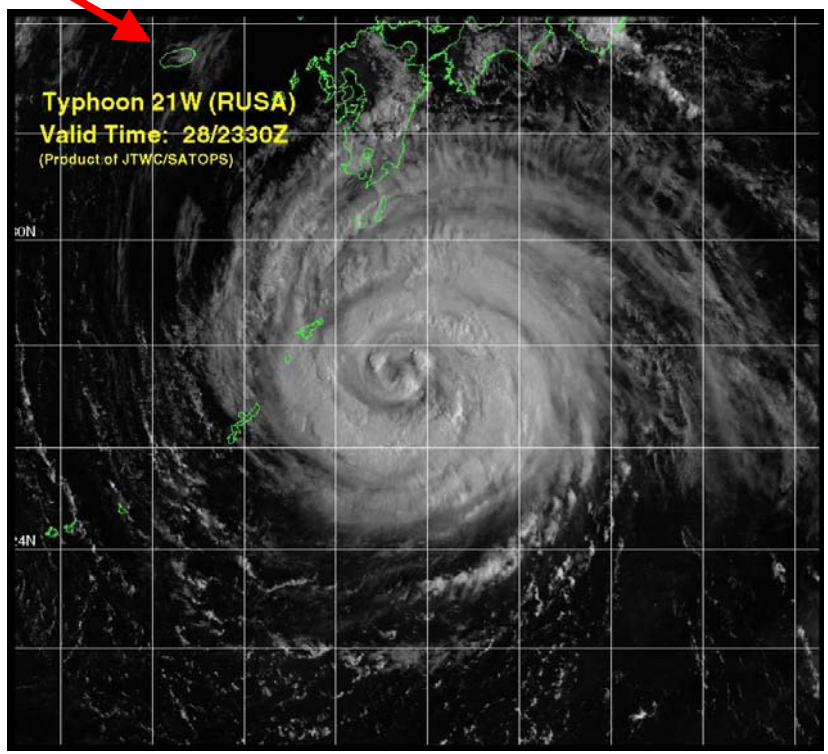
LHC/LC meeting, CERN
07/10/02

Jeju Island



'Relationship'-Session at LCWS

1.5h plenary session devoted to relationship between HC and LC programs

3 talks:

Y.K. Kim, Tevatron prospects

A. De Roeck, LHC prospects

K. Desch, Relationship between LC and LC programs for exploring new physics

+ 30' discussion

Relations

Relationship between Hadron Colliders (HC) and Linear Collider (LC):

1. Since the LC will start after the start of LHC, it must add significant amount of information:

$$HC+LC>HC$$

2. Neither LC nor HC's can draw the whole picture alone. There are probably pieces which can only be explored by the LHC due to the higher mass reach. Joint interpretation of the results will improve the overall picture:

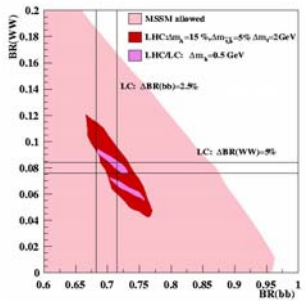
$$HC \oplus LC>HC+LC$$ ← LHC/LC group!

3. Overlapping running of both machines will further increase the potential of both machines and might be mandatory, depending on the physics scenario realized:

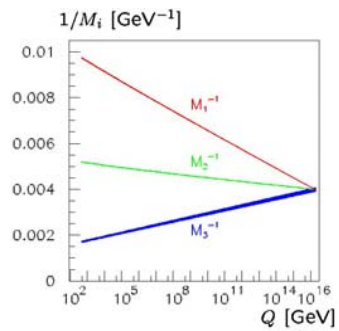
$$HC \otimes LC>HC \oplus LC$$ ← LHC/LC group!

Examples for: HC ⊕ LC > HC + LC

Combined interpretation of HC and LC data

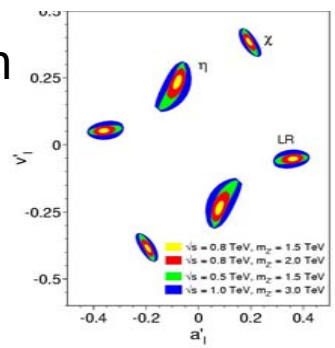


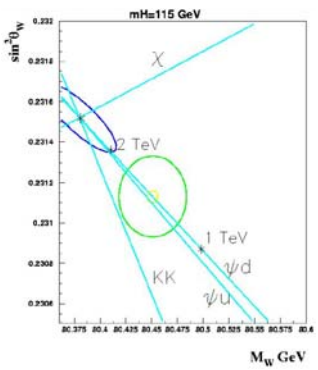
Higgs: Consistency of direct BR-measurements with prediction from LHC+LC mass measurements (MSSM)
KD,Heinemeyer,Gross,Moortgat,Weiglein



SUSY: RGE extrapolation of SUSY parameter measurements at LHC + LC
Blair,Porod,Zerwas

New Resonances: Coupling structure from LC (high energy + Giga-Z) if mass from LHC
Riemann; Richard





HC ⊗ LC > HC ⊕ LC

Combined >analyses< of HC and LC data

With simultaneous running of LHC and LC:

Results from one machine can have immediate impact on the analyses of the other

Results of one machine can guide the searches for the other

Might redesign trigger etc.

Impact on further direction (e.g. Super LHC, more lumi or more energy?)

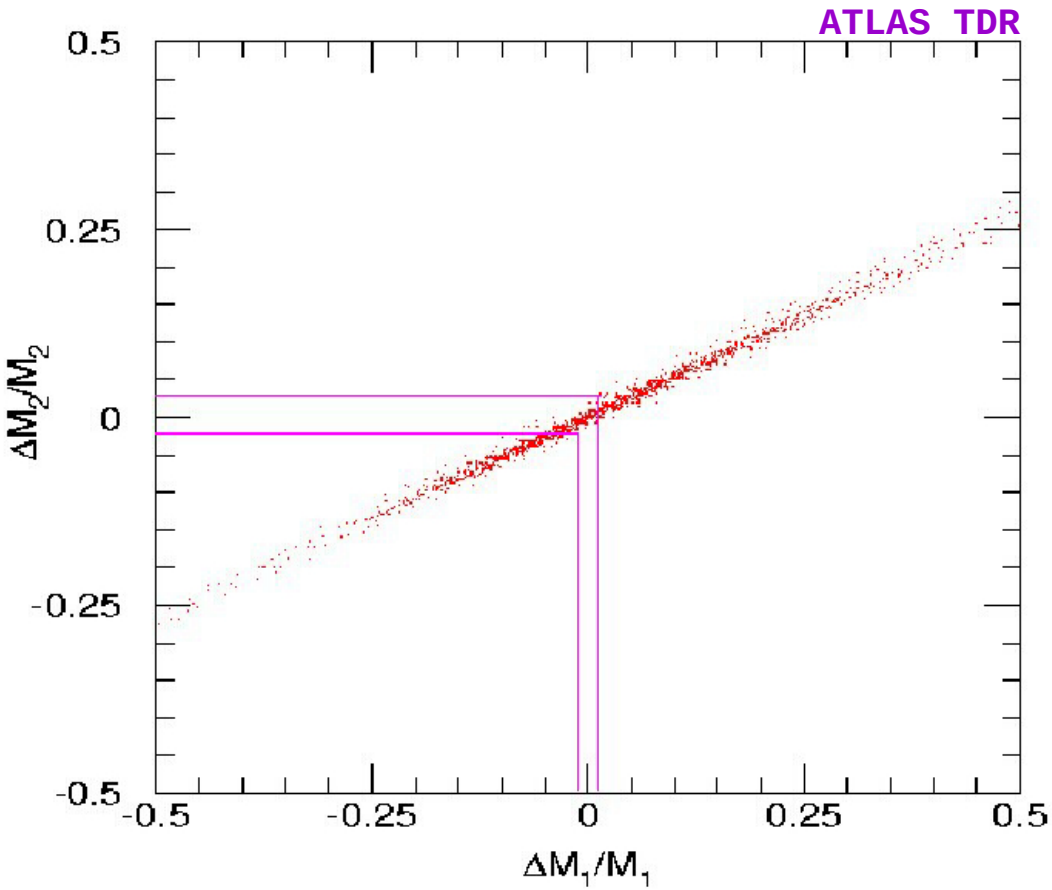
Impact next (multi-TeV) machine planning (c.f. LEP⊗SLC⊗Tevatron!)

Examples ⇨

HC ⊗ LC > HC ⊕ LC

At LHC, mass reconstruction of SUSY particles depends on knowledge Of LSP-mass.

Precise measurement of LSP-mass at LC improves mass resolution for heavier states at LHC



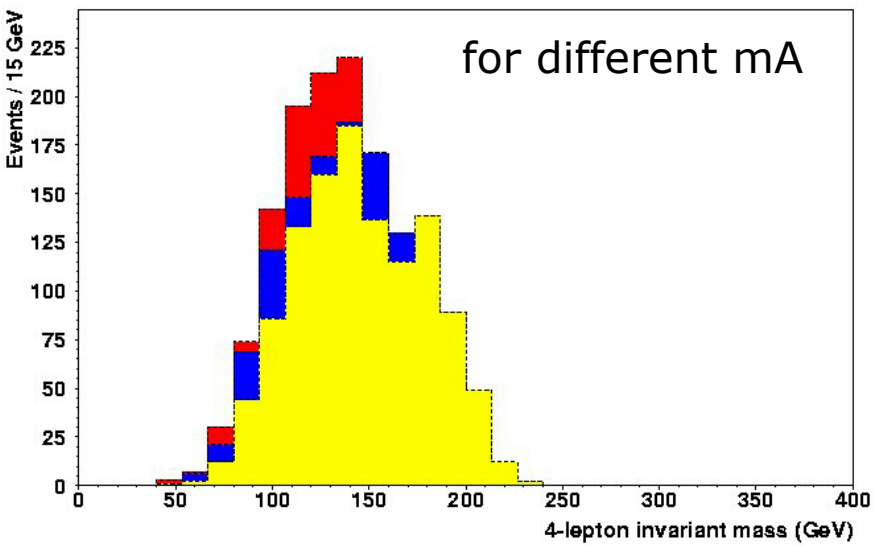
HC ⊗ LC > HC ⊕ LC

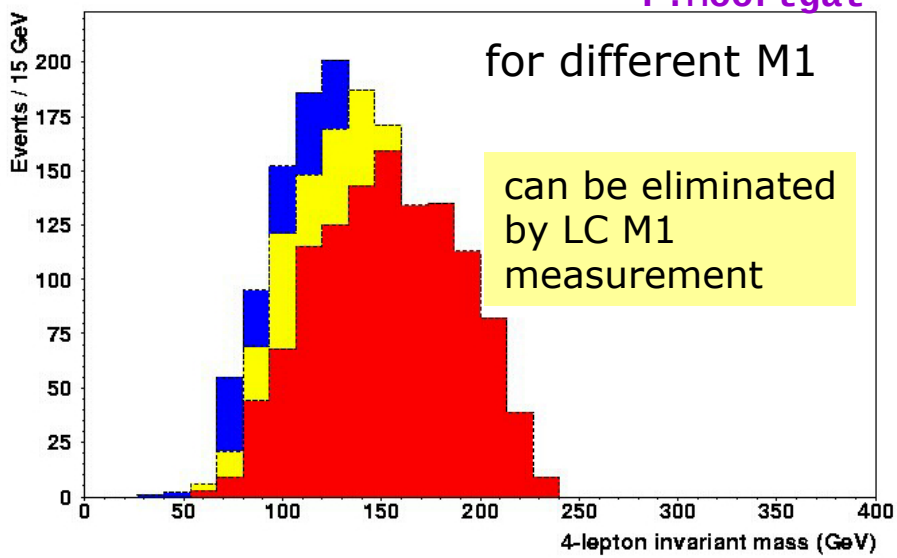
Example for LSP mass dependence: $A \to \tilde{\chi}_2^0 \tilde{\chi}_2^0 \to \ell\ell\ell\ell \tilde{\chi}_1^0 \tilde{\chi}_1^0$

Use 4-lepton-mass as estimator for m_A

$m_A = 330\,GeV$	$\to$	$-8\,GeV$	$M_1 = 50\,GeV$	$\to$	$+17\,GeV$
$m_A = 340\,GeV$	$\to$	$-4\,GeV$	$M_1 = 55\,GeV$	$\to$	$+5\,GeV$
$m_A = 350\,GeV$	$\to$	$< M_{lll} > = 137\,GeV$	$M_1 = 60\,GeV$	$\to$	$< M_{lll} > = 137\,GeV$
$m_A = 360\,GeV$	$\to$	$+4\,GeV$	$M_1 = 65\,GeV$	$\to$	$-4\,GeV$
$m_A = 370\,GeV$	$\to$	$+8\,GeV$	$M_1 = 70\,GeV$	$\to$	$-15\,GeV$

F.Moortgat





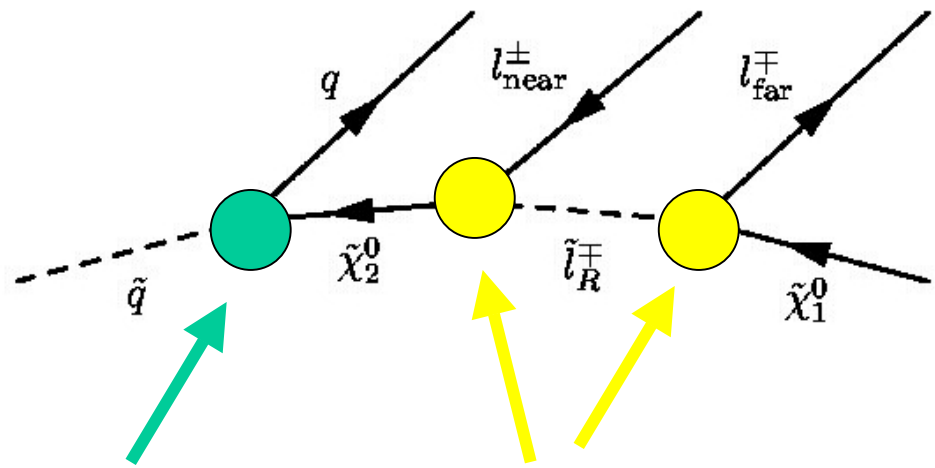
HC ⊗ LC > HC ⊕ LC

Cascade decays of squarks: if heavy, only accessible at LHC
hard to measure properties, if BR's of lower members of decay chain unknown.

F.Paige

A.Parker
D.Tovey

Example:



only accessible at LHC if these are known from LC

Different final states have different acceptance corrections
Can be combined if relative BR's are known

Discussion

- General consensus that $\oplus$ and $\otimes$ are important
- quantitative studies encouraged, work of this group acknowledged
- physics case for simultaneous running not (yet?) convincing for everyone:

- reanalysis of LHC data possible when LC input available if data properly archived ??

- how deeply are the analyses really entangled? (LSP mass dependency can be parametrized, more involved cases also?)

- can one construct examples which would require operational modifications (trigger, detector modifications, running conditions)?

- finally, don't forget the more general arguments:
  - want to disentangle TeV scale physics as fast as technically possible
  - historical 'good relationship' of HC and LC, e.g. Tevatron+LEP/SLD