Calorimeter Software and Analysis Activities

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LPNHE-Paris

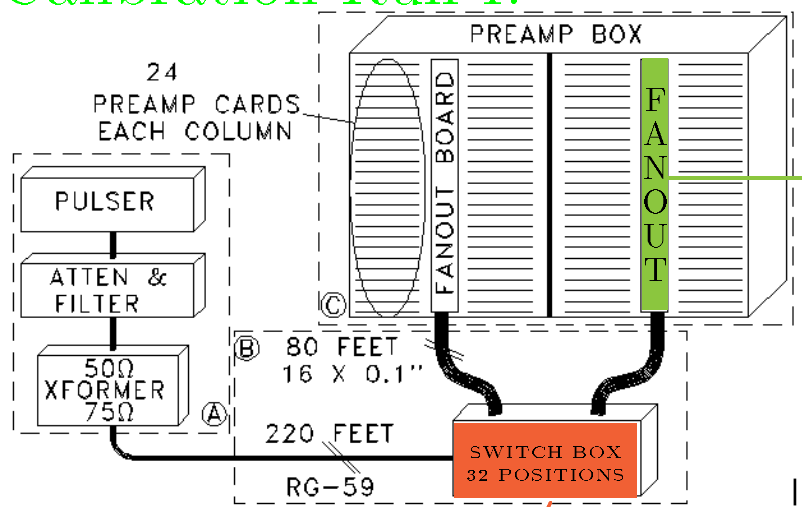
- Pulser Calibration Software
- Calorimeter Reconstruction
- Stop Analysis

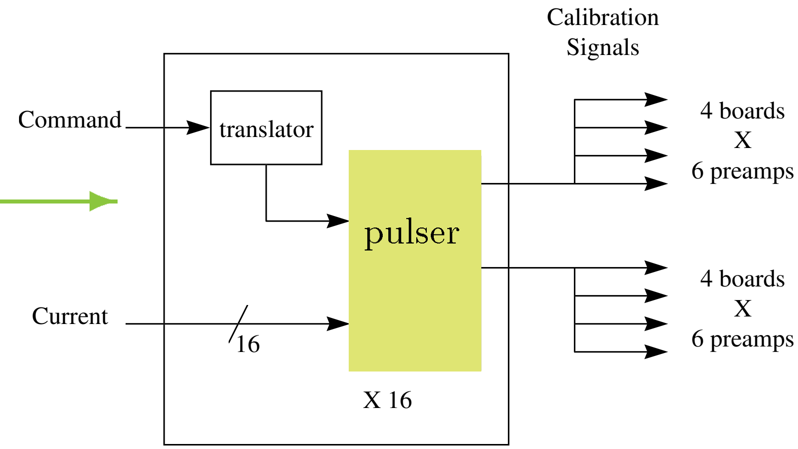
DØ Software and Data Analysis Meeting
Praha, September 25$^{\mathrm{th}}$ 1999

Run I → Run II:

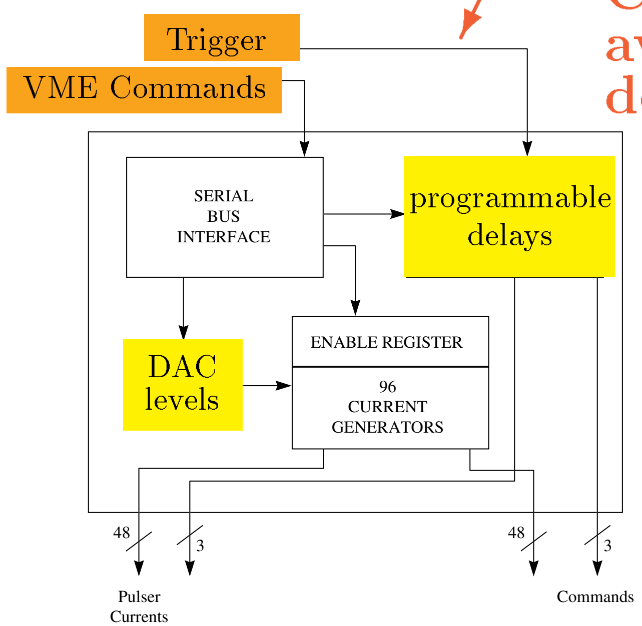
La calibration en ligne Run I → Run II

Calibration Run I:





FANOUT ACTIF
avec les pulsers



CONTROLEUR
avec les unités
de commande

→ Adaptation au nouveau “timing”

→ Amélioration de l’intercalibration:
Run I : < 1.5 %
Run II: < 1.0 %

→ Plus de flexibilité

On-Line Calibration Activities in France

- Hardware Installation: Nov-Dec/99 (LAL-Paris)
- Development of Related Software (∗) (Paris-Stony Brook)

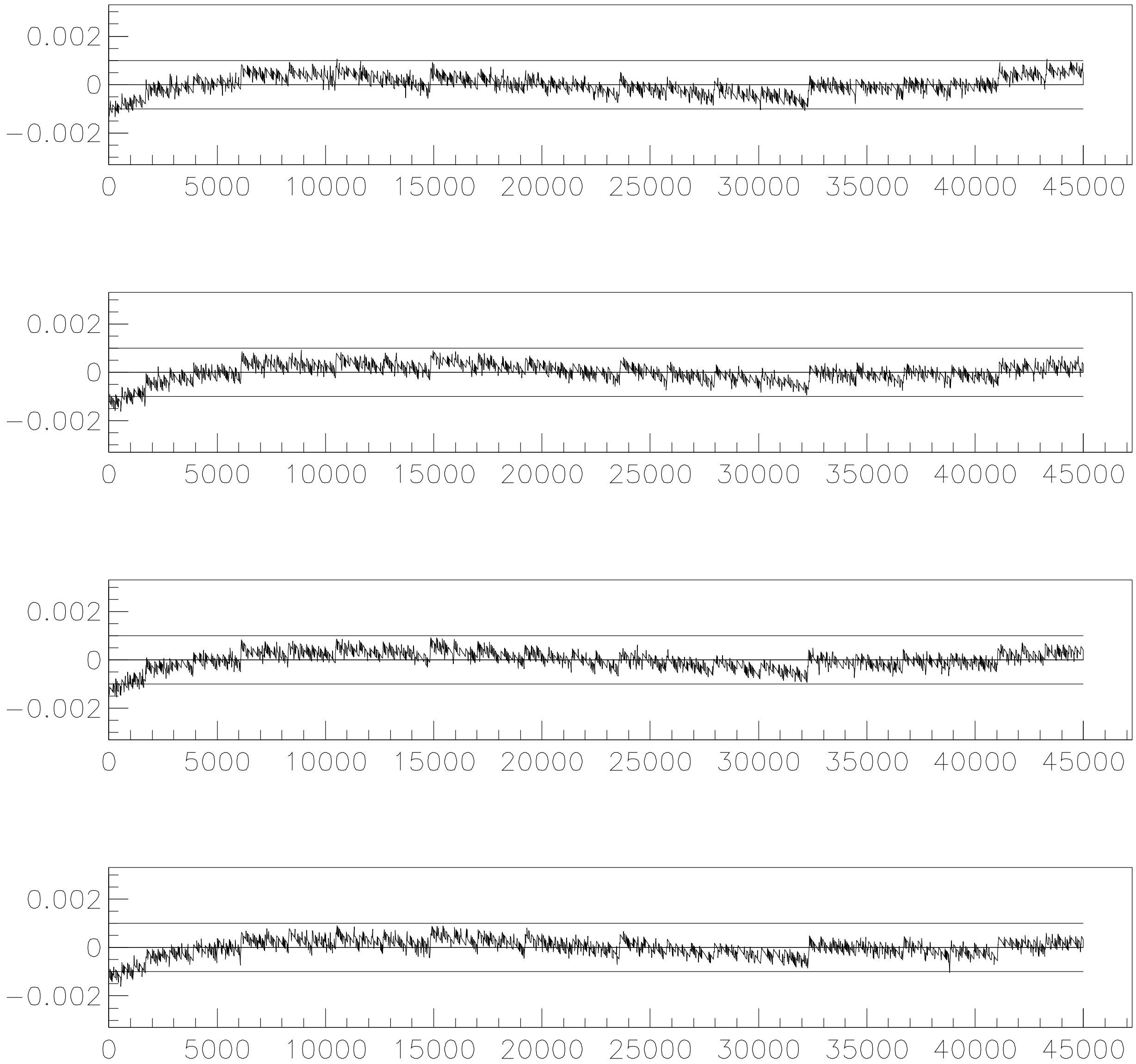
LAL-ORSAY:
Patrick CORNEBISE
Pierre IMBERT
Yves JACQUIER
Gisèle MARTIN
Pierre PETROFF
Christophe DE LA TAILLE

LPNHE-PARIS:
Philippe BAILLY
Ursula BASSLER (∗)
Gregorio BERNARDI
Jean-François HUPPERT (∗)
Hervé LEBBOLO
Frédéric MACHEFERT (∗)
Bob OLIVIER (∗)
Alain VALLEREAU

Pulser Linearity

Reading only Pulser Output directly via an ADC

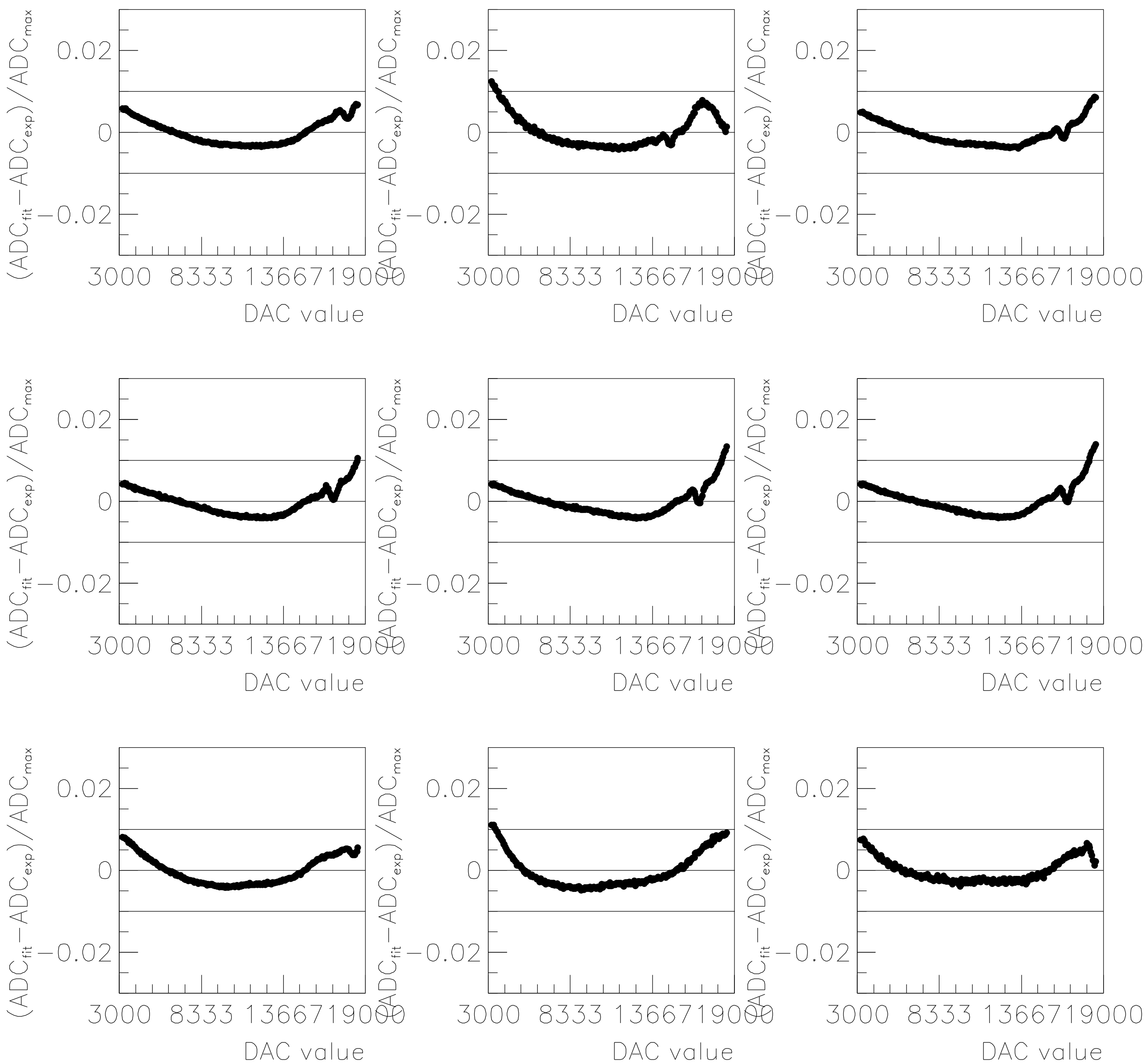
$\Rightarrow$ Pulser Linearity $< 0.1\%$



Full Chain Linearity

Full Read-Out (Preamps + Shaper)

$\Rightarrow$ Linearity $< 1\%$



Pulser Software Development

Pulser Control Software:

- manages communication from GUI to the pulser
- produces "Event Header" with pulser status

CALIB (with Mrinmoy Bhattacharjee):

- produces Database-files with
  - 0-suppression thresholds
  - inter-cell/-gain calibration constants

$\Rightarrow$ push button procedure for non-experts

EXAMINE

- "commissioning" (with Dean Schamberger):
  test procedures for calorimeter "debugging"

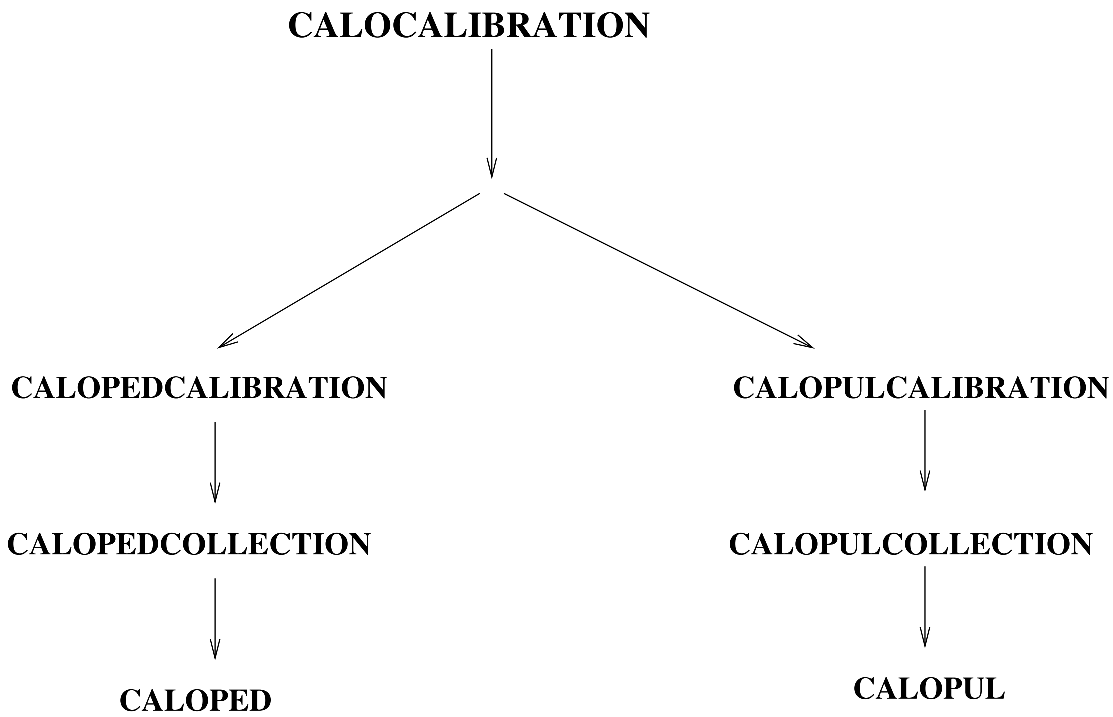
$\Rightarrow$ experts use of pulsers

- "monitoring" (Florencia Canelli):
  histograms produced during regular data-taking

Calorimeter Databases

CALIB Program ⇒ Online Database:

(Mrinmoy Bhattacharjee + Zhou Zhang)



⇒ Offline Database ⇒ RECO Program

Calorimeter database

Structure of Database Tables based on design of Ela Barberis and Vicky White

DØ Calibration		
CalibId	tstart	tend
1	t_1	t_2
2	t_2	t_3

CaloCalibration		
CaloCalibId	tstart	tend
1	t_1	t_2
2	t_2	t_3

CaloPedCalibration		
PedCalibId	tstart	tend
1	t_1	t_2
2	t_2	t_3

CaloGainCalibration		
GainCalibId	tstart	tend
1	t_1	t_2
2	t_2	t_3

CaloGainCollection			
GainId	PatternId	tstart	tend
1	1	t_1	t_2
1	2	t_1	t_2
1	3	t_1	t_2
2	1	t_2	t_3
2	2	t_2	t_3

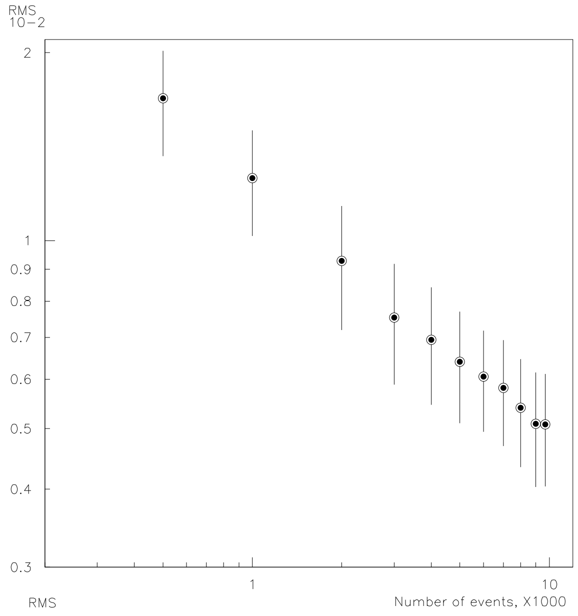
CaloGain			
channel	value1	value2	value3
1	x0	x1	x2
2	x0	x1	x2
3	x0	x1	x2

Offline Calibration Studies

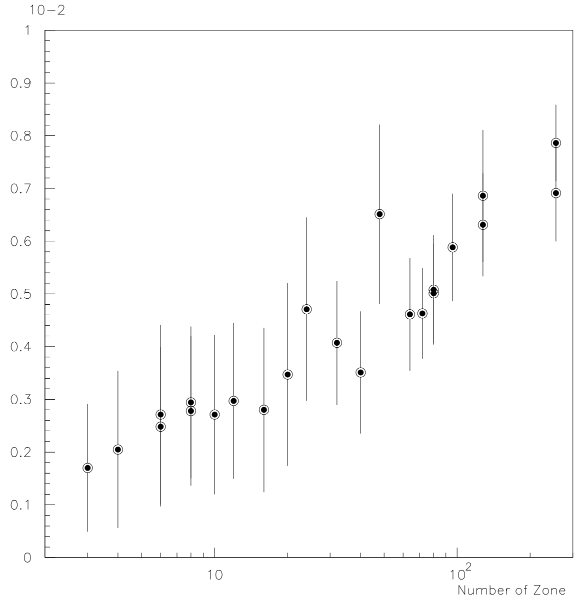
Sylvain Negroni, Elemer Nagy, CPPM Marseille

- First study of calibration needs with $Z \to e^+e^-$ using Fast MC (PMCS):

introducing random mis-calibration
in different calorimeter zones,
$\Rightarrow$ precision obtained on calibration coefficients?



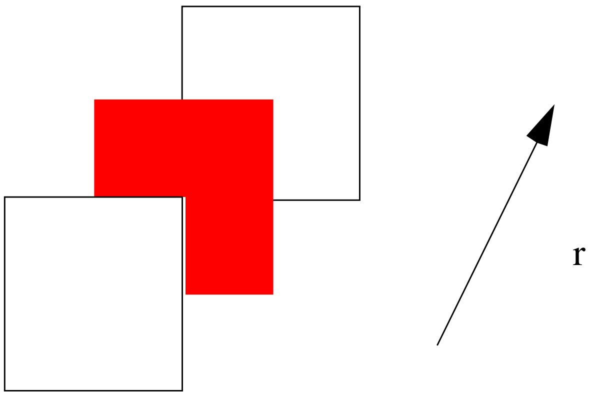
$\Rightarrow$ resolution of calibration coefficients, dividing the calorimeter in 80 zones, increasing the number of $Z \to ee$ events.



$\Rightarrow$ for 10k $Z \to ee$ events, increasing the number of zones.

NADA
- A New Hot Cell Killer

Bob Olivier, Greg Bernardi, *Paris-Berkeley $\not\!\!E_t$ project*

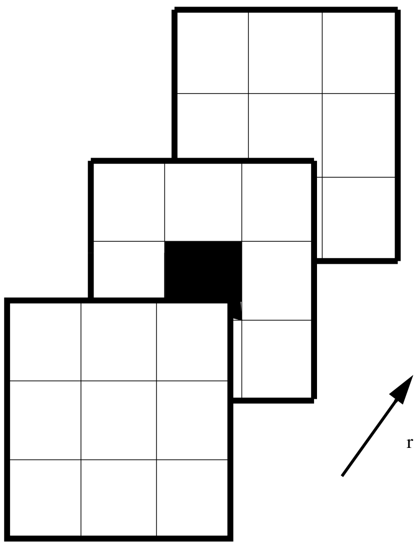


AIDA: Run I Hot Cell Killer

$E_{cand} > 10\mathrm{GeV}$

$\frac{\langle E_T^{long.neigh.}\rangle}{E_T^{cand}} \leq 0.05$

$\Rightarrow$ good efficency,
high misidentification



NADA: "New Anomalous Deposit Algorithm"

$E_{cand} > 10\mathrm{GeV}, 1\mathrm{GeV}$

$E_{cube} = \sum_i E^i_{cell} > E^{cut}_{cell}$

$E_{cube} < E^{cut}_{cube}$

$E^{cut}_{cell} = E^{cut}_{cube} = 100\mathrm{MeV}, 300\mathrm{MeV}$

$\Rightarrow$ still good efficency,
but low misidentification

Detailed description in DØ-note 3687
Implementation in Run II-Reco

NADA - AIDA Comparison

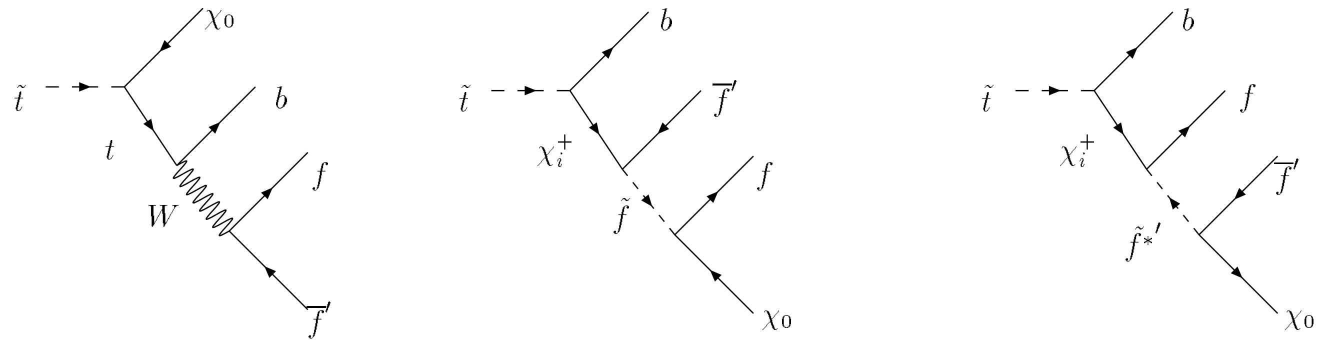
	$E_{cell}^{cut} = 100$ MeV $E_{cube}^{cut} = 100$ MeV	$E_{cell}^{cut} = 300$ MeV $E_{cube}^{cut} = 300$ MeV	AIDA
$E^{cand} > 10\text{GeV}$			
	ID-rate	=	=
CC	67%	93 %	99 %
ICR	66%	91 %	99 %
EC	58%	88 %	99 %
	mis-ID-rate	=	=
CC	0%	0 %	5 %
ICR	0%	0 %	14 %
EC	0%	0 %	4 %
	HC in Data	=	=
CC	0.08%	0.10 %	19 %
ICR	0%	0.03 %	9 %
EC	0%	0 %	13 %
$E^{cand} > 1\text{GeV}$			
	ID-rate	=	=
CC	66%	93 %	99 %
ICR	65%	91 %	99 %
EC	55%	85 %	99 %
	mis-ID-rate	=	=
CC	0.1%	0.8 %	3 %
ICR	0.9%	2.0 %	16 %
EC	0.0%	0.3 %	4 %
	HC in Data	=	=
CC	1.6%	5 %	24 %
ICR	6%	13 %	36 %
EC	2%	0.8 %	10 %

$\not\!\!E_t$ improvement: Stop search

Paris, *with Dhiman Chakraborty*

Boehm et al.: New Stop search channel

$\Rightarrow$ Four-Body Stop decay: $\tilde{t}_1 \rightarrow b\chi_1^0 f \bar{f}'$



Experimental signatures:

$$
\begin{array}{lccc}
6\ jets & & + & \not\!\!E_t \\
4\ jets & & + & \not\!\!E_t \\
4\ jets & +l & + & \not\!\!E_t \\
2\ jets & & + & \not\!\!E_t \\
2\ jets & +l & + & \not\!\!E_t \\
2\ jets & +l+l' & + & \not\!\!E_t
\end{array}
$$

search based on top analysis

+ improved $\not\!\!E_t$ reconstruction

+ MC implementation of four-body decay

$\Rightarrow$ DØ-note to be posted