

**4-momentum Transfer Squared**

**(Action A29, 2007)**

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This is the result of Action A29 (2007):

*Review the quantities and units dimension for data differential with respect to 4-momentum transfer and submit a LEXFOR entry on it.*

These proposals were taken into account in dictionary transmission 9096 and the latest version of LEXFOR (February, 2008)

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### Memo CP-E/125

**Date:** November 5, 2007  
**To:** Distribution  
**From:** OTSUKA Naohiko  
**Subject:** Differential cross section for 4-momentum transfer squared

According to the action list of the last NRDC meeting, I prepared a summary of codes and LEXFOR entry for differential cross section for 4-momentum transfer squared. Relevant codes are summarized below.

Dictionary	Code	Dimension	Reaction type	CINDA quantity	Web quantity
24 (Data Headings)	- $t$	EC2			
25 (Units)	GEV2/C2	EC2			
	MB/GEV2/C2	D4			
26 (Family flag)	EC2 (*), D4				
32 (Parameters)	DT				
213 (Reaction type)	DT			DT	DA
236 (Quantity)	,DT	D4	DT		

(\*) Not in dictionary, must be defined.

#### Dictionary 24 (Data Headings)

We need a new data type (I2) for 4-momentum transfer squared. Usually this differential cross section is given for elastic scattering, for which 4-momentum transfer squared depends on scattering angle (See LEXFOR entry proposal). Therefore I would like to propose a new **data type "69"** for 4-momentum transfer squared. Data heading  $-t$  is for a simple independent variable. Therefore **plotting flags (I7) "1000000"** is proposed.

#### Dictionary 26 (Family flag)

Family code EC2 in dictionary 24 and 25 must be defined in dictionary 26.

EC2                                    2425            4-momentum transfer squared

**Dictionary 213 (Reaction type)**

Differential cross section for 4-momentum transfer squared requires  $-t$  as an independent variable. I proposed data type “69” for  $-t$  for dictionary 24. Therefore we need **independent variable family code “4”** (=the first digit of data type minus 2, as mentioned in the last page of dictionary manual - IAEA-NDS-213 August 2007).

Below is a proposed LEXFOR entry for “Secondary 4-momentum transfer distribution”.

**LEXFOR entry: Secondary 4-momentum transfer distribution**

Below is an explanation of differential cross section for 4-momentum transfer squared, to be added into LEXFOR entry “Differential data”.

**Secondary Energy Distributions** ( $d\sigma/dE'$ )

...

**Secondary Momentum Distributions** ( $d\sigma/dp'$ )

1. Linear momentum distribution: probability for a particle to be emitted with a given

...

2. Linear momentum distribution for a correlated pair: Probability that a particle  $a$  and a particle

...

**Secondary 4-momentum transfer distributions** ( $d\sigma/dt$ )

Probability for a particle to be emitted with a given 4-momentum transfer squared  $t$ ; given as  $\sigma(t) = d\sigma/dt$ , where 4-momentum transfer squared of the particle is defined by  $t = (E' - E)^2 - (\vec{p}' - \vec{p})^2$  for scattering of the particle  $(E, \vec{p}) \rightarrow (E', \vec{p}')$ . Note that  $t$  is a Lorentz scalar, and  $t = -4p^2 \sin^2(\theta/2) < 0$  for elastic scattering and  $t = -4EE' \sin^2(\theta/2) < 0$  for relativistic limit. The data are given in units of cross section per unit of 4-momentum squared (e.g.,  $\text{mb}/(\text{GeV}/c)^2$ ).

**REACTION coding:** DT in SF6.

**Unit type:** D4 (e.g., MB/GEV2/C2)

The 4-momentum transfer squared is given under the data heading  $-t$  with the opposite sign.

(End of CP-E/125)