

D/TOS-QCA Final Presentation Day 2002. ESA/ESTEC, Tuesday April 9th, 2002

Study of Front and Back Irradiation of various SDRAMs/SRAMs using different Accelerators.

- Final Presentation of ESTEC Contract No. 13528/99/NL/MV, COO-9/10.
 - Evaluation objectives
 - Devices tested
 - Sample preparation
 - UCL ions characteristics
 - JYFL ions characteristics
 - SRAM results
 - SDRAM results
 - Conclusion

Evaluation objectives

- 3 main objectives
- Aim of this evaluation was to :
 - Compare results on same parts from different accelerators
 - Compare the results between two different samples preparation methods
 - Evaluate different SRAMs/SDRAMs components from different sources



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SRAM Memories

- The following devices have been provided by ESA for this evaluation exercise

Part Type	Manufacturer	Date Code	Size	Voltage Supply	Comment
K6T8016C3M	Samsung	49	512Kx16	5V	
K6T4008VIC	Samsung	52	512Kx8	3V3	
K6T4008C1B	Samsung	46	512Kx8	5V	
K6T4008C1C	Samsung	43	512Kx8	5V	
HM62W8511HJP	Hitachi	9906	512Kx8	3V3	Center VCC and VSS type pinout
HM62W8511HLJP	Hitachi	102	512Kx8	5V	Center VCC and VSS type pinout
HM628512BLFP	Hitachi	108	512Kx8	5V	



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SDRAM Memories

- The following devices have been provided by ESA for this evaluation exercise

Part Type	Manufacturer	Size
MT48LC16M8	MICRON	4 Meg x 8 x 4 banks
TC59SM708	TOSHIBA	4 Meg x 8 x 4 banks
HY57V56820	HYUNDAI	8 Meg x 8 x 4 banks
HYB39S2568	INFINEON	8 Meg x 8 x 4 banks
K4S560832B	SAMSUNG	8 Meg x 8 x 4 banks



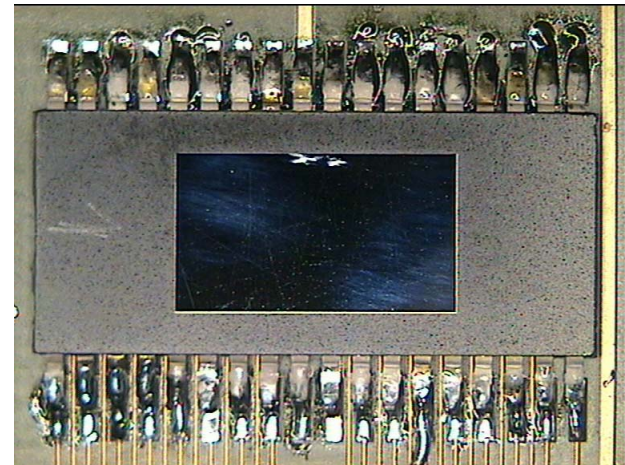
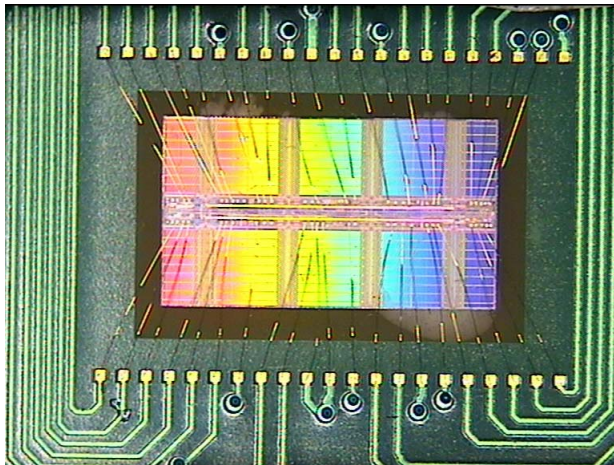
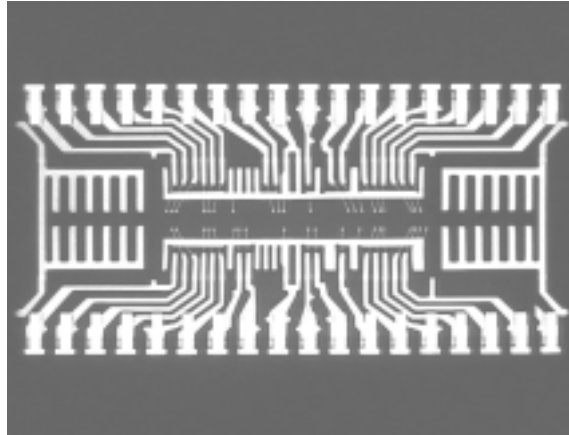
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Sample preparation

- Chemical etch of the package epoxy
 - All SRAMs with the exception of Hitachi Center VCC and VSS type pinout
- Die rebond
 - All SDRAMs and Hitachi Center VCC and VSS type pinout
- Back lapping (50µm target)
 - All SDRAMs and Hitachi Center VCC and VSS type pinout

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HM62W8511



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UCL Heavy Ions source

Ion Specy	Energy (MeV)	LET (MeV/(mg/cm ²))	Range μm
10-B	41	1.7	80
20-Ne	78	5.85	45
40-Ar	150	14.1	42
84-Kr	316	34	43
132-Xe	459	55.9	43

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JYFL, Department of Physics, University of Jyvaskyla, Finland

- Two sets have been used:

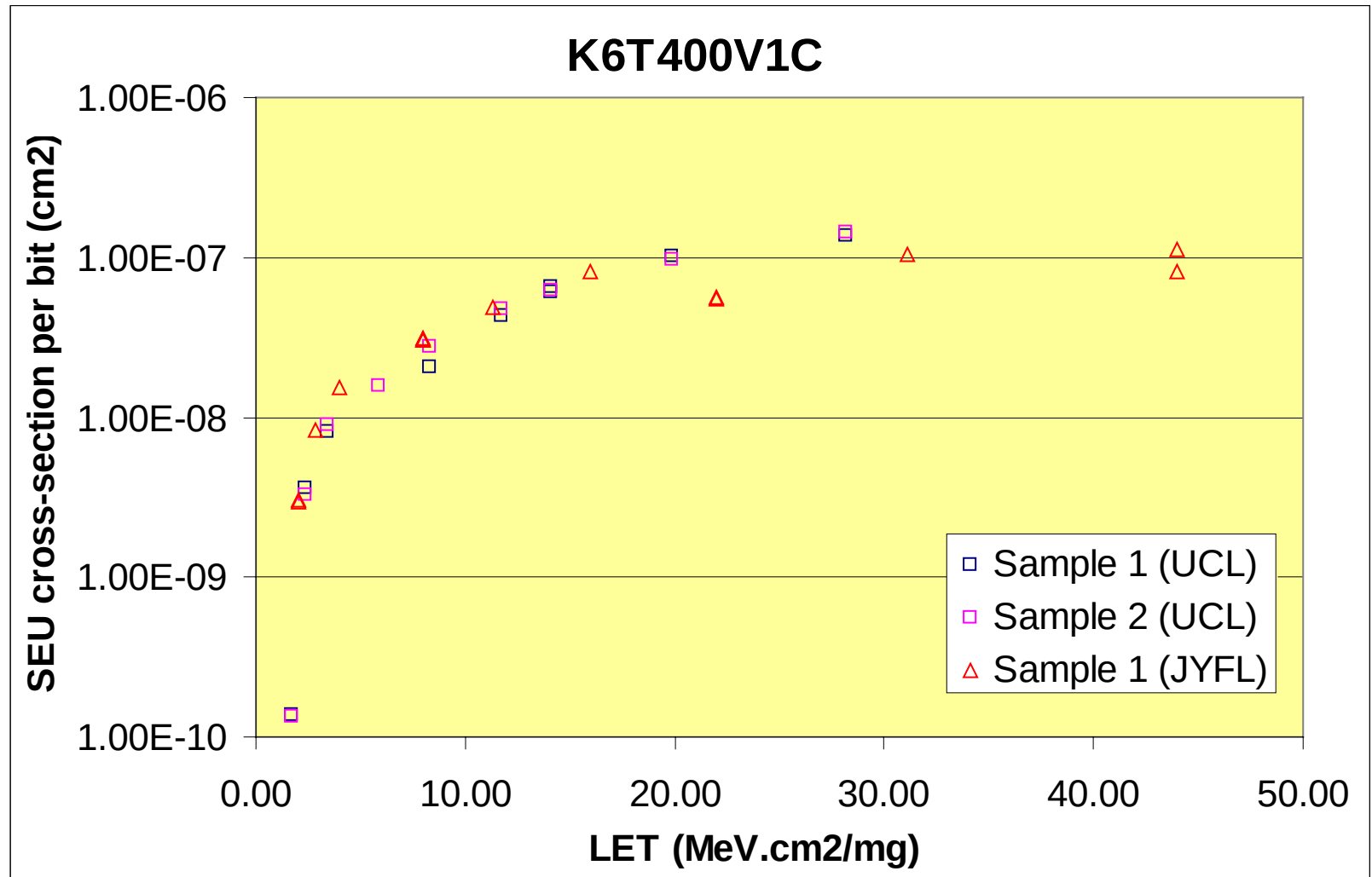
SRAMs characterization

Specy	Energy MeV	LET MeV/(mg/cm ²)	Range μm
14-N	86	2	108
28-Si	172	8	74
56-Fe	345	22	64

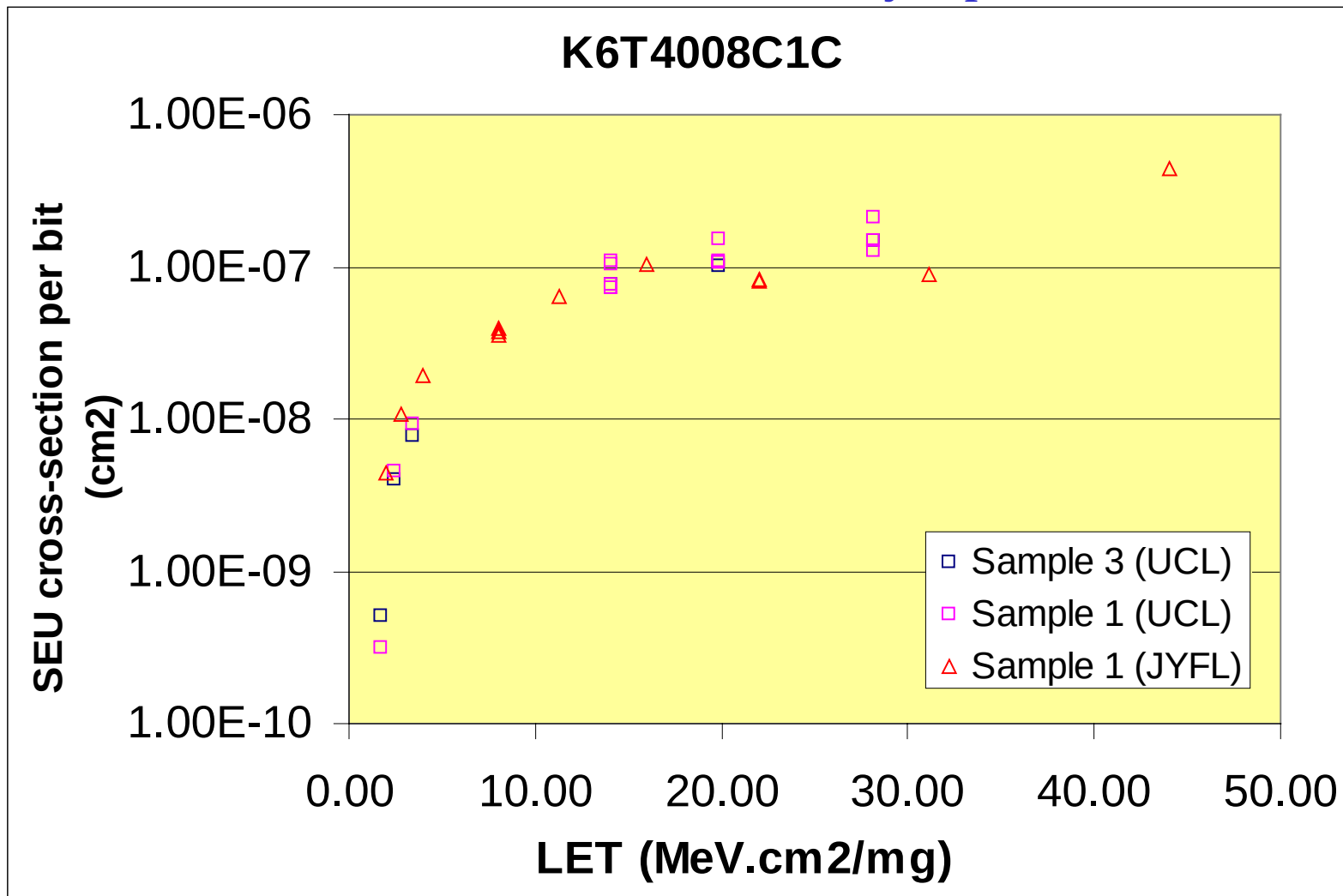
SDRAMs characterization

Specy	Energy MeV	LET MeV/(mg/cm ²)	Range μm
15-N	140	2	211
30-Si	280	7	127
56-Fe	523	18	95

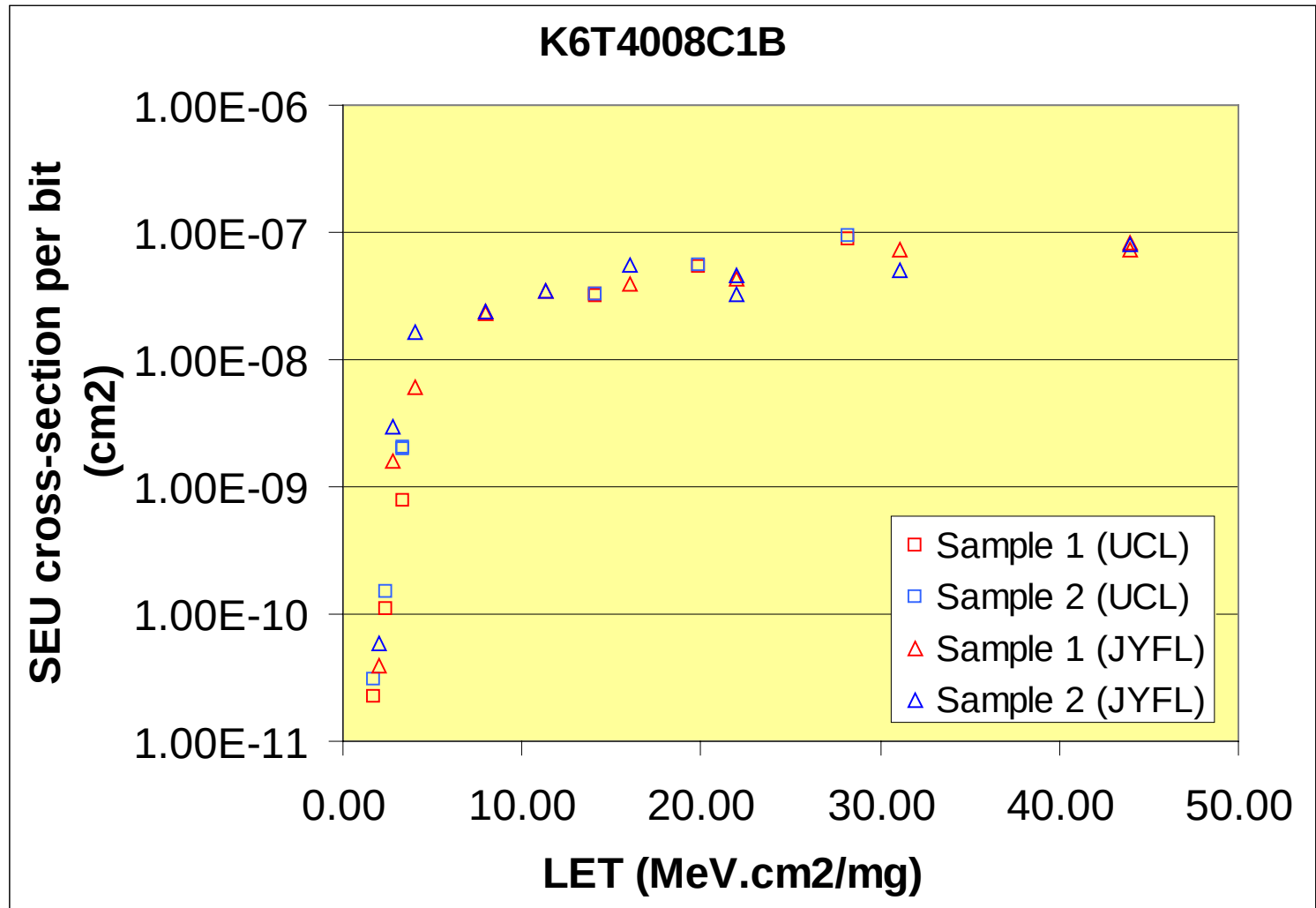
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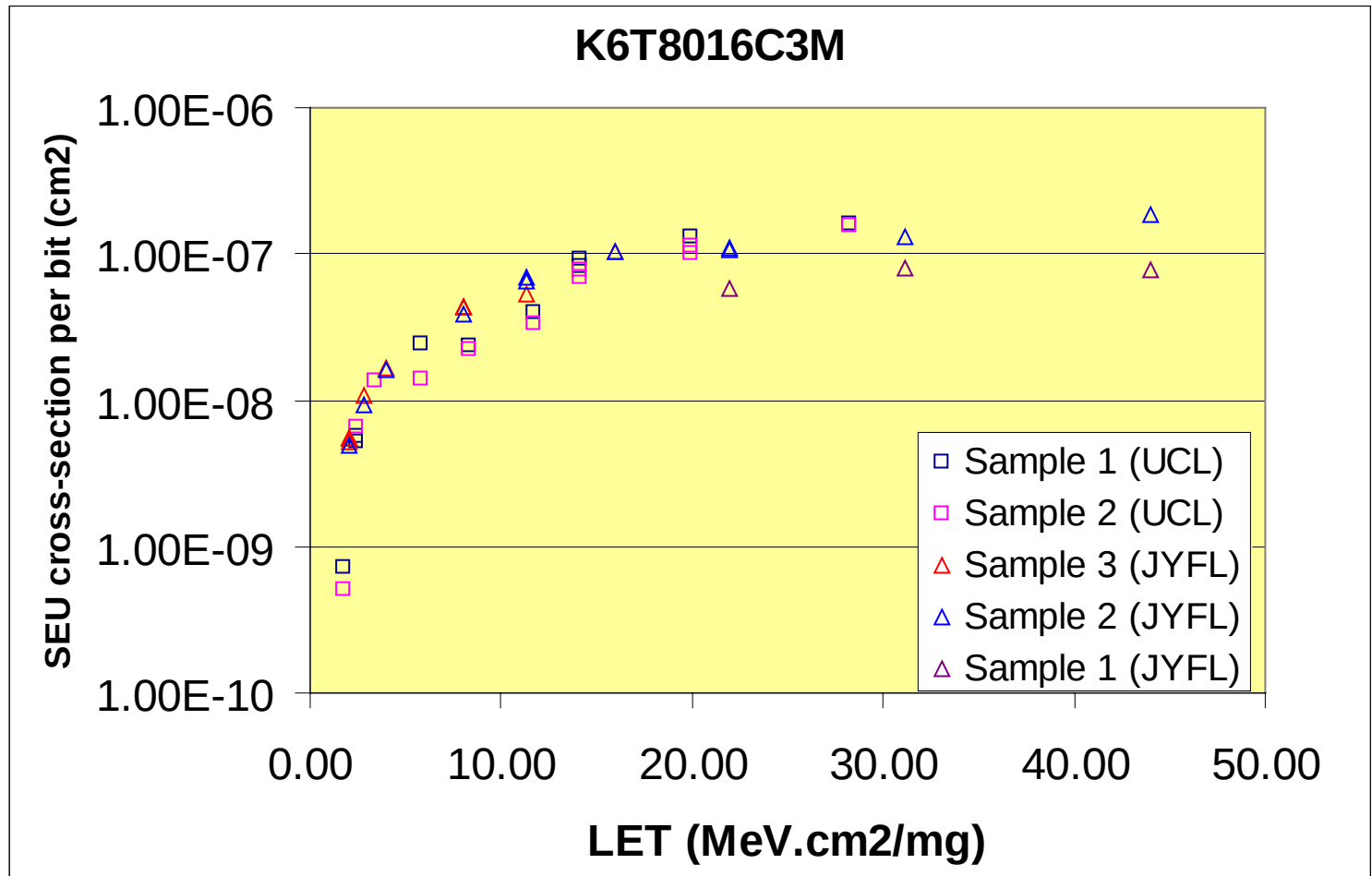
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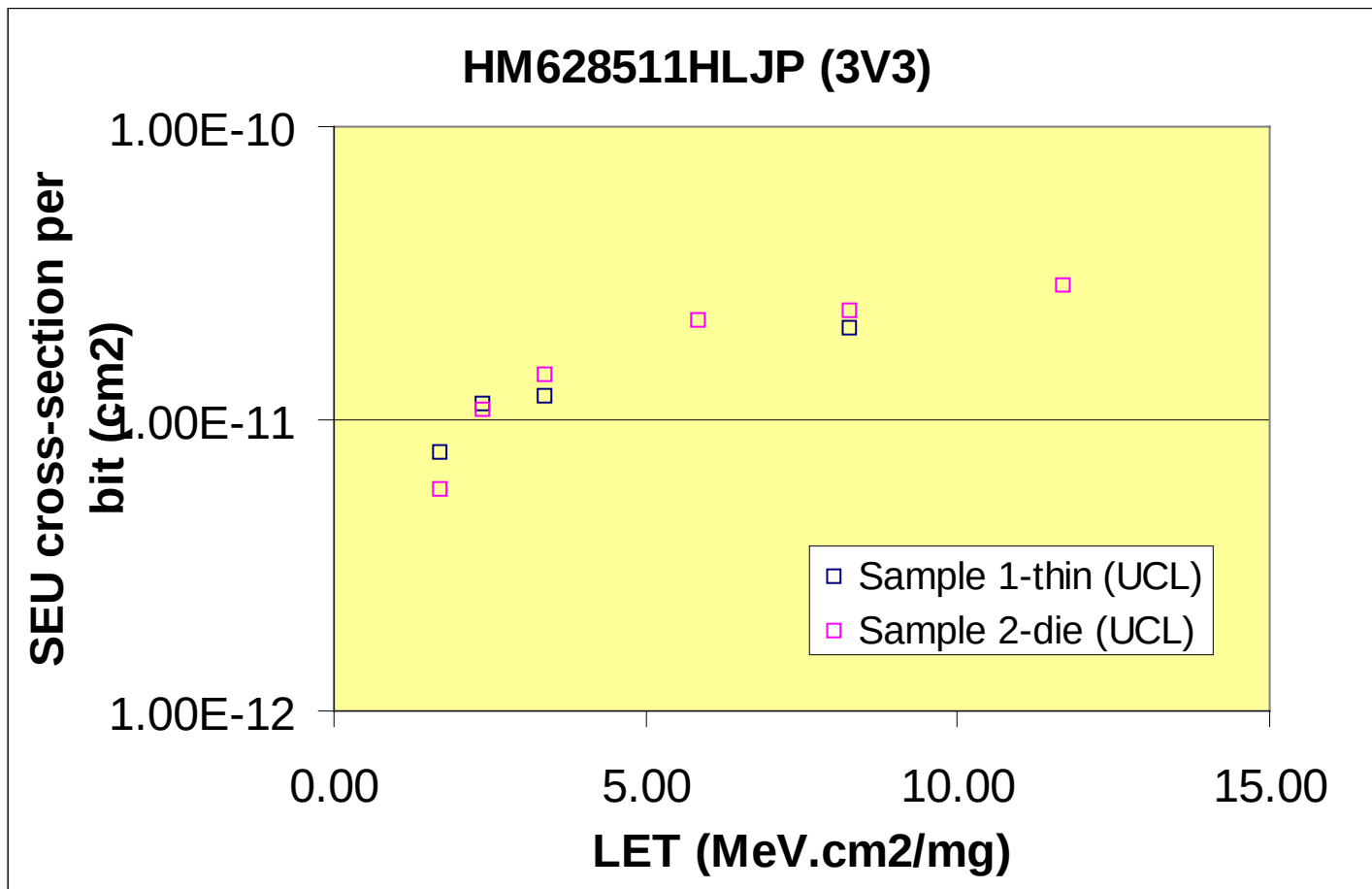
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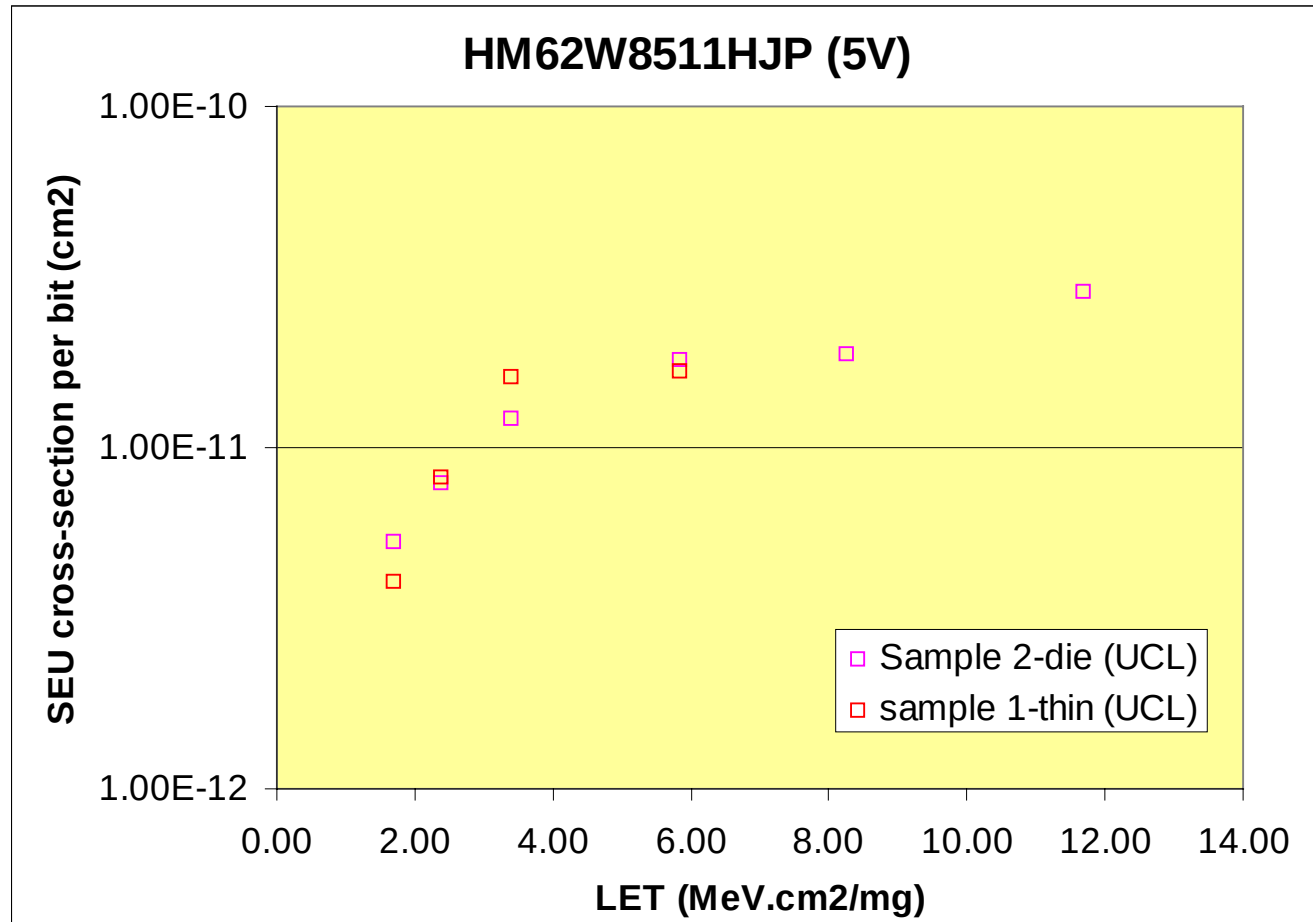


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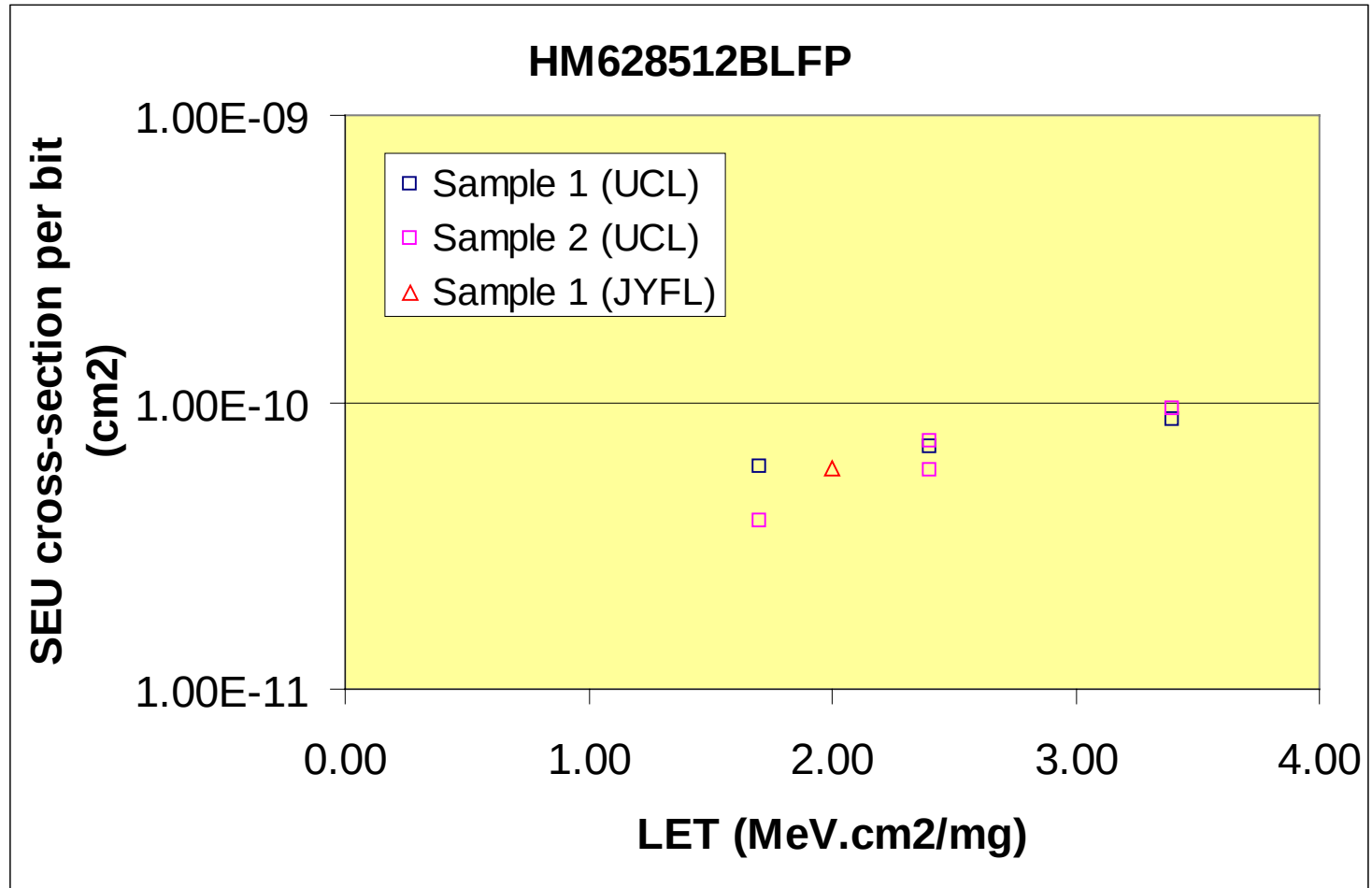
Latch-up threshold between 8 and 11.7 $\text{MeV}/(\text{mg}/\text{cm}^2)$

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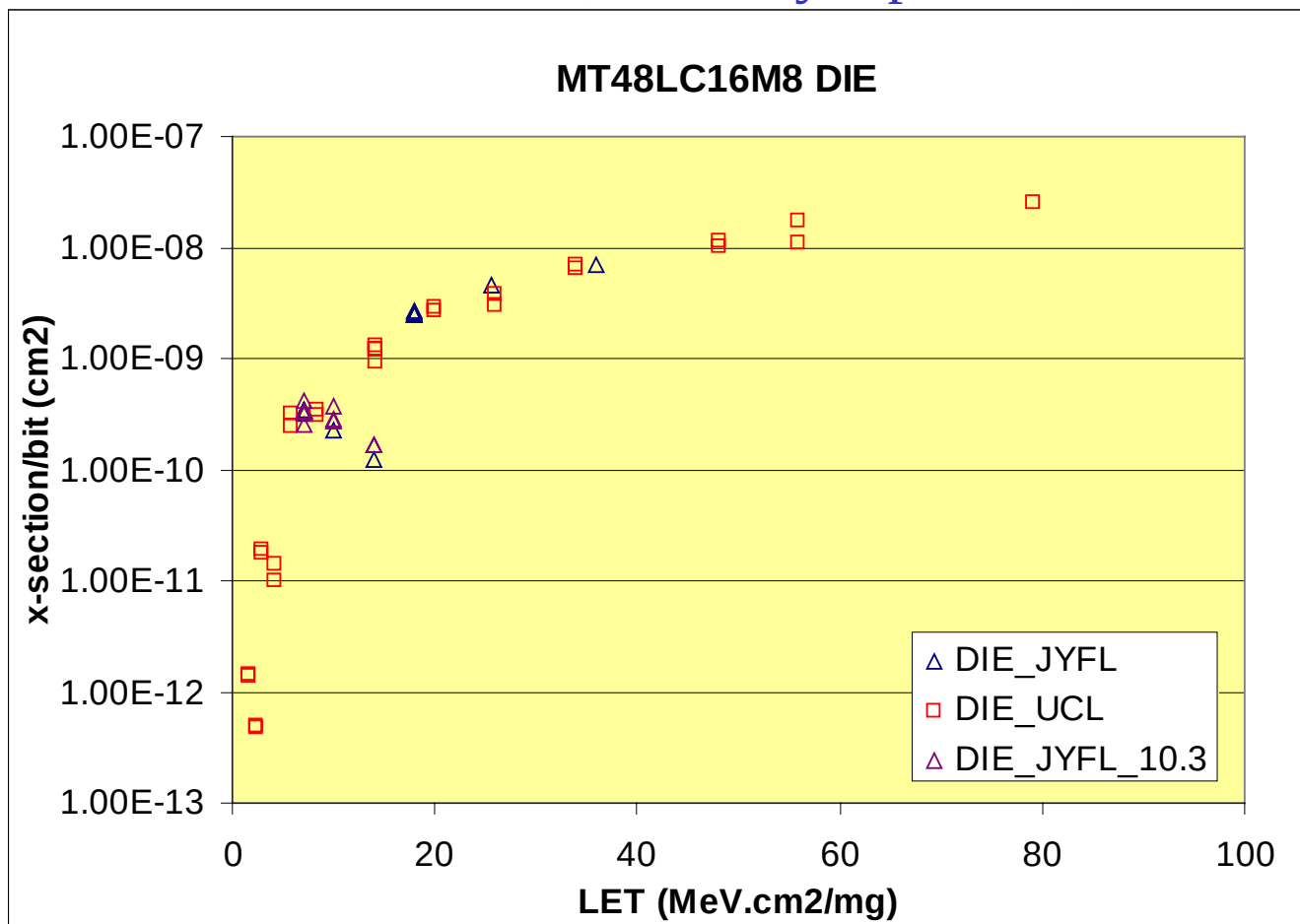
Latch-up threshold between 8 and 11.7 MeV/(mg/cm²)

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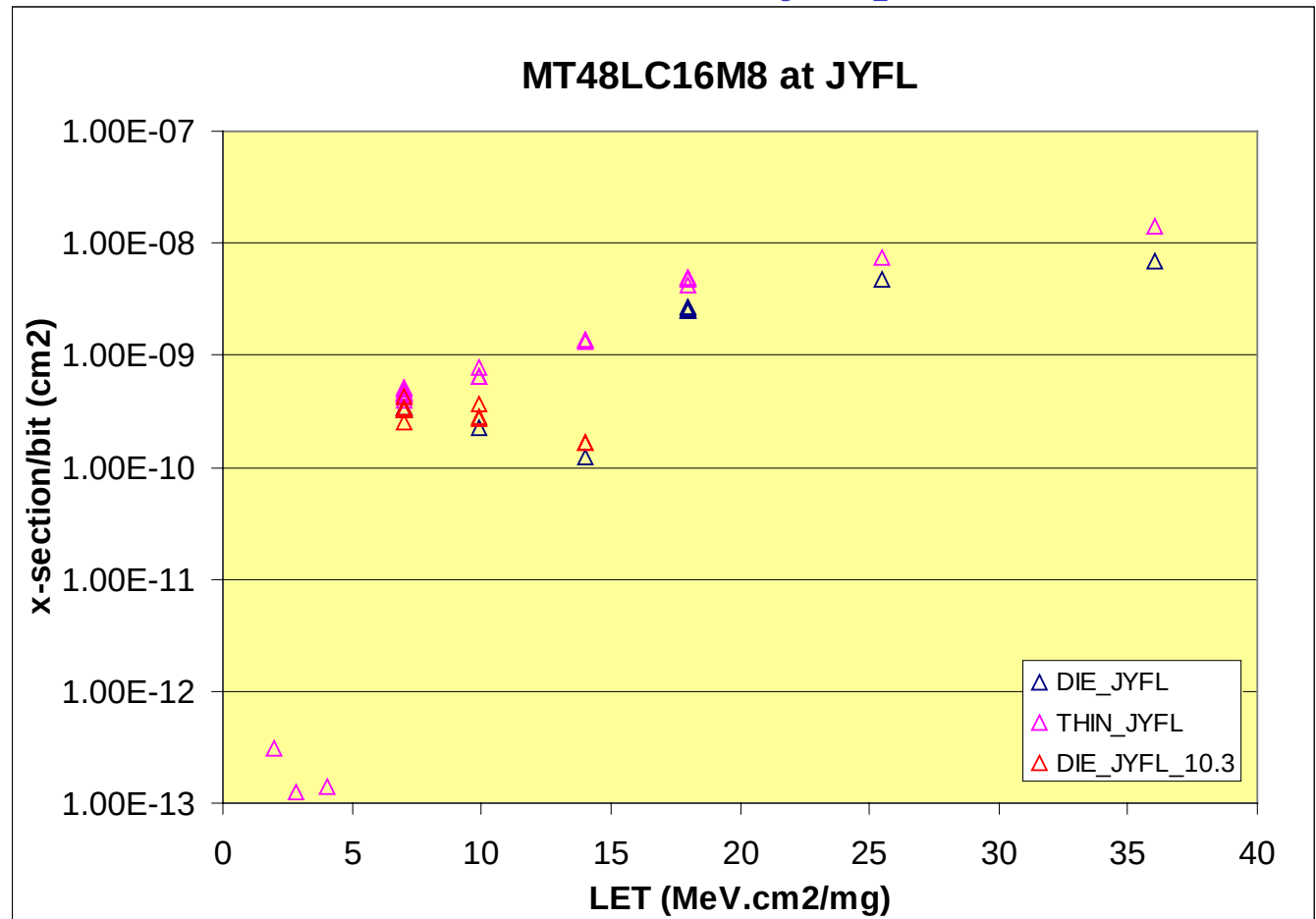
Latch-up threshold between 2 and 2.4 MeV/(mg/cm²)

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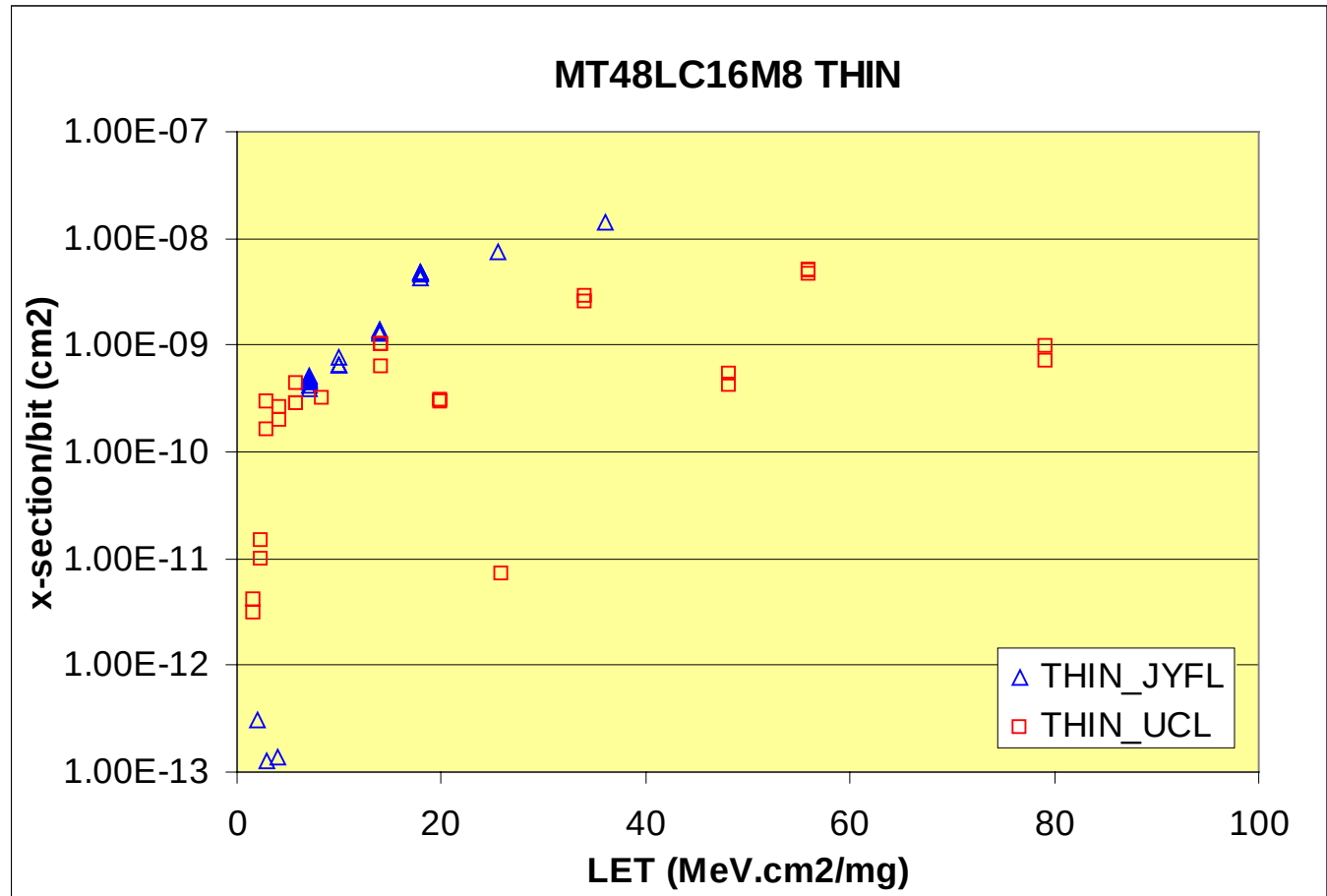
Micron SDRAM, data comparison between UCL and JYFL accelerators

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Micron SDRAM, data comparison between front and back irradiation

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Micron SDRAM, back irradiation at JYFL and UCL using tilt angles

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Conclusion

- SRAM:
 - 4 different devices (part type, voltage supply, die revision) have been characterized (LET threshold and asymptotic cross-section)
 - Good fit between JYFL and UCL results
 - Hitachi: both types are sensitive to latch-up at low LET values
 - HM628512BLFP SEL threshold between 2 and 2.4 MeV/(mg/cm²)
 - HM62W8511HJP & HM62W8511HLJP SEL threshold between 8 and 11.7 MeV/(mg/cm²)
- SDRAM:
 - Good correlation between front and back irradiation
 - Angle effect at low LET for Micron device
 - Jyvaskyla high energy ions (>100 μ m range) adequate for back irradiation
- Sample preparation is a critical issue
- Need for more ions species to cover the LET range of interest with no tilt angle
- Need for accurate beam calibration