

1. SM\_2D:  

Three small square boxes, each containing three diagonal X's.

 1.0.0

**SM\_2D**

• **SM\_2D**:  
    – **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D**

• **SM\_2D**:  
    – **SM\_2D** S-**SM\_2D** **SM\_2D** (GPU **SM\_2D**)

• **SM\_2D**:  
    – **SM\_2D** **SM\_2D** **SM\_2D** (**SM\_2D** **SM\_2D**)

• **SM\_2D**:

    – **SM\_2D** **SM\_2D** 1% **SM\_2D** **SM\_2D**

Table 1:  

## 1.1. SM\_2D⊗⊗⊗⊗?

1.1.1. :

**SM\_2D** **SM\_3D** **SM\_4D** **SM\_5D** **SM\_6D** **SM\_7D** **SM\_8D** **SM\_9D** **SM\_10D** **SM\_11D** **SM\_12D** **SM\_13D** **SM\_14D** **SM\_15D** **SM\_16D** **SM\_17D** **SM\_18D** **SM\_19D** **SM\_20D** **SM\_21D** **SM\_22D** **SM\_23D** **SM\_24D** **SM\_25D** **SM\_26D** **SM\_27D** **SM\_28D** **SM\_29D** **SM\_30D** **SM\_31D** **SM\_32D** **SM\_33D** **SM\_34D** **SM\_35D** **SM\_36D** **SM\_37D** **SM\_38D** **SM\_39D** **SM\_40D** **SM\_41D** **SM\_42D** **SM\_43D** **SM\_44D** **SM\_45D** **SM\_46D** **SM\_47D** **SM\_48D** **SM\_49D** **SM\_50D** **SM\_51D** **SM\_52D** **SM\_53D** **SM\_54D** **SM\_55D** **SM\_56D** **SM\_57D** **SM\_58D** **SM\_59D** **SM\_60D** **SM\_61D** **SM\_62D** **SM\_63D** **SM\_64D** **SM\_65D** **SM\_66D** **SM\_67D** **SM\_68D** **SM\_69D** **SM\_70D** **SM\_71D** **SM\_72D** **SM\_73D** **SM\_74D** **SM\_75D** **SM\_76D** **SM\_77D** **SM\_78D** **SM\_79D** **SM\_80D** **SM\_81D** **SM\_82D** **SM\_83D** **SM\_84D** **SM\_85D** **SM\_86D** **SM\_87D** **SM\_88D** **SM\_89D** **SM\_90D** **SM\_91D** **SM\_92D** **SM\_93D** **SM\_94D** **SM\_95D** **SM\_96D** **SM\_97D** **SM\_98D** **SM\_99D** **SM\_100D**.

### 1.1.2.

□(□□□)□ □□□(□□ □□)□ □□ □□□□ □□□□. □ □□□□ □□□□ □□□□; □□ □□□□ □□□□ □□□□ □□□□

- 

“**确定性**(deterministic)”**指****定****义****的****是****一****种****数****学****结****构****，****其****中****每****一****个****元****素****都****有****唯一****的****前****驱****和****后****继****。**

### 1.1.3. $\otimes$ $\otimes$ : $\otimes$ “ $\otimes\otimes\otimes$ ” $\otimes$ ?

A sequence of five boxes, each containing two vertical lines, followed by a colon.

  :    

- $\boxtimes$ :  
  - $\boxtimes$ :     ( $\boxtimes$ )

XXXXX **(SM\_2D)**: XXX XXXXXXX XXX XXX

- : ( )
  - :

XXXXXX XXXXX XXXXX XXXXX XXXXXXX, XXXXXXX XXXXXXX XXXXX XXXXX XXXXX XXXXXXX.

1.2.

SM\_2D ແກ້ວມະນຸຍາ ໂດຍ ສະແດງ ທີ່ ດັ່ງນີ້. ຖ້າ ຕ້ອງ ສະແດງ GPU ຢ່າງ(CUDA) ສະແດງ, ສະແດງ ທີ່ ດັ່ງນີ້, ສະແດງ ທີ່ ດັ່ງນີ້, ສະແດງ ທີ່ ດັ່ງນີ້ ແລະ ສະແດງ ທີ່ ດັ່ງນີ້ S-ບັນດາ ສະແດງ.

### 1.3. C++ ( )

### 1.3.1. C++

### 1.3.1.1. “struct”⊗⊗⊗⊗?

**struct** (结构体) 是 C 语言中的一种复合数据类型。

☒: “Person” ☒☒☒☒ ☒☒☒ ☒☒☒☒:

- $\boxed{\times \times} (\boxed{\times \times \times})$
  - $\boxed{\times \times} (\boxed{\times \times})$
  - $\times (\boxed{\times \times})$

### 1.3.1.2. “GPU 箱”箱 箱箱?

**GPU** (显卡) 是计算机的图形处理器。它能够处理 GPU 相关的任务：

- GPU ကို အမြန် ပေါ်လောက် ရန်
  - အမြန် CPU ကို အမြန် ပေါ်လောက် ရန်
  - အမြန် အမြန် အမြန် အမြန်, 1,000 အမြန် အမြန် အမြန် အမြန်

### 1.3.1.3. “⊗”⊗⊗⊗⊗?

CUDA                                        <img alt="GPU icon" data-bbox="10883 8

#### 1.3.1.4. “⊗⊗⊗(phase space)”⊗⊗⊗?

“**2D**”**：**

- $\boxed{x}$   $\boxed{y}$   $\boxed{z}$ ? ( $x, z$   $\boxed{\Theta}$ )
  - $\boxed{x}$   $\boxed{y}$   $\boxed{z}$ ? ( $\boxed{\Theta}$  theta)
  - $\boxed{x}$   $\boxed{y}$   $\boxed{z}$   $\boxed{w}$   $\boxed{v}$ ? (E)

### 1.3.2.

XXXXX	✗
✗	C++17 with CUDA
✗ ✗ ✗	15,000
GPU ✗	XXXXXXX 4.3 GB
✗	✗ ✗ 1% ✗, ✗ ✗ 15% ✗
✗	RTX 2080+ (Compute Capability 7.5+)

Table 2:  

### 1.3.3.

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## 1.4.

### 1.4.1. SM\_2D මෙහි මුදල?

SM 2D :

GPU (CUDA) S-MCS, MCS, S-SIM

#### 1.4.2.

图 10：SM\_2D 模型的 2D 网格。SM\_2D 模型的 2D 网格由 1000 个单元组成。

XXXX: XXX XXX XXXXX XXX XXXXXXX 1% XXXXXXX.

$\boxtimes\boxtimes$ :  $\boxtimes\boxtimes\boxtimes$   $\boxtimes\boxtimes$   $\boxtimes\boxtimes\boxtimes$   $\boxtimes\boxtimes\boxtimes$   $\boxtimes\boxtimes\boxtimes$   $\boxtimes\boxtimes\boxtimes\boxtimes$ .

### 1.4.3.

XXXXX	XX
run_simulation.cpp	XX XXX
sim.ini	XX XX
src/core/	XXXX XX (XX, XXX, XXX)
src/physics/	XX XX (MCS, XX, X)
src/cuda/kernels/	CUDA XX (K1-K6 XXXXX)
src/lut/	NIST XXX X XX-XXX XXX
src/source/	XX XX (XX, XXXX)
src/boundary/	XX XX X XX XX
src/audit/	XX XX
src/validation/	XX XX
src/utils/	XX, XXX XXX
tests/	XX XXX (GoogleTest)

Table 3:

#### 1.4.4. :

**src/core/:** 代码核心模块 - 包含物理引擎逻辑  
**src/physics/:** 物理引擎逻辑  
**src/cuda/kernels/:** CUDA GPU 算法  
**src/audit/:** 审计模块 - 监控系统状态

.....

- core = 
  - physics =  
  - cuda/kernels =  
  - audit =  

1.5.  

### 1.5.1. CUDA

6 CUDA

$\otimes\otimes$	$\otimes\otimes$	$\otimes\otimes\otimes\otimes\otimes\otimes$
1	K1	$\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$ ( $\otimes\otimes\otimes\otimes\otimes$ )
$\downarrow$		
2	K2 + K3	$\otimes\otimes: \otimes\otimes\otimes\otimes\otimes\otimes$ <ul style="list-style-type: none"> <li>• K2: <math>\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes</math></li> <li>• K3: <math>\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes</math></li> </ul>
$\downarrow$		
3	K4	$\otimes\otimes: \otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$
$\downarrow$		
4	K5	$\otimes\otimes: \otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$
$\downarrow$		
5	K6	$\otimes\otimes: \otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes/\otimes\otimes\otimes\otimes$
$\circlearrowright$		$\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$

Table 4: CUDA  $\otimes\otimes\otimes\otimes\otimes\otimes$

### 1.5.2. $\otimes\otimes\otimes$ : $\otimes\otimes\otimes\otimes\otimes\otimes$ ?

K2 ( $\otimes\otimes\otimes$ ) $\otimes\otimes\otimes\otimes\otimes\otimes$  -  $\otimes\otimes\otimes\otimes\otimes$ .  $\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$ .

K3 ( $\otimes\otimes\otimes\otimes$ ) $\otimes\otimes\otimes\otimes\otimes\otimes$  -  $\otimes\otimes\otimes\otimes\otimes$ .  $\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$  “ $\otimes\otimes\otimes\otimes$ ”  $\otimes\otimes\otimes\otimes\otimes\otimes\otimes$ .

$\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$  3-5 $\otimes\otimes\otimes\otimes\otimes$ .

### 1.5.3. $\otimes\otimes\otimes$

$\otimes\otimes$	$\otimes\otimes$
K1: ActiveMask	$\otimes\otimes\otimes\otimes$ ( $E < 10$ MeV)
K2: CoarseTransport	$\otimes\otimes\otimes\otimes\otimes\otimes\otimes$ ( $E > 10$ MeV)
K3: FineTransport	$\otimes\otimes\otimes\otimes\otimes\otimes\otimes$ ( $\otimes\otimes\otimes\otimes$ )
K4: BucketTransfer	$\otimes\otimes\otimes\otimes\otimes$
K5: ConservationAudit	$\otimes\otimes\otimes\otimes\otimes$
K6: SwapBuffers	$\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$

Table 5: CUDA  $\otimes\otimes\otimes\otimes\otimes\otimes$

#### 1.5.4. CUDA ပုဂ္ဂနည်းလမ်း

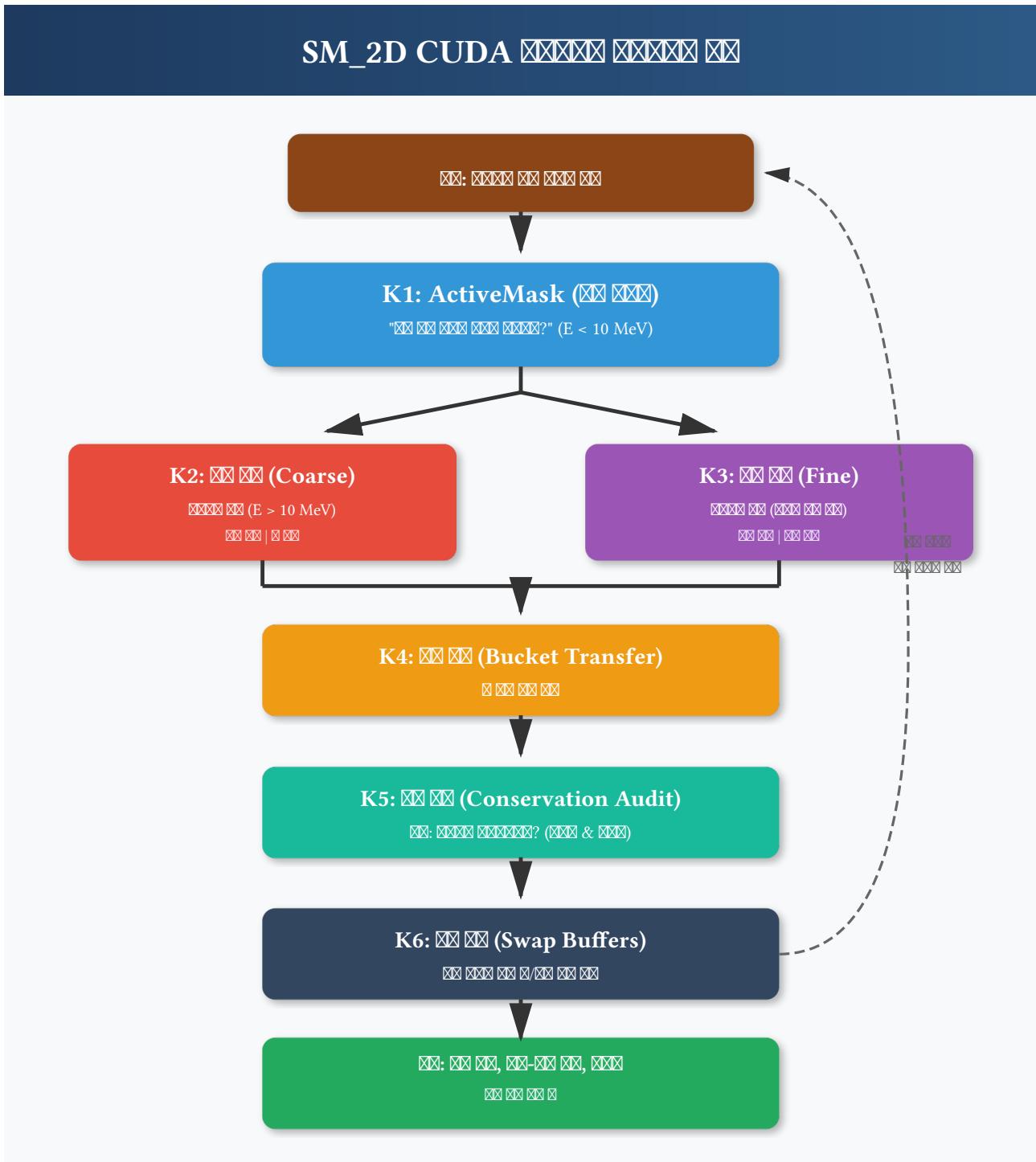


Figure 1: CUDA ပုဂ္ဂနည်းလမ်း - ပုဂ္ဂနည်းလမ်းအတွက်

#### 1.6. ပုဂ္ဂနည်းလမ်း

##### 1.6.1. ပုဂ္ဂနည်းလမ်း

###### 1.6.2. ပုဂ္ဂနည်းလမ်း: “ $x, z$ ”မှာ ပုဂ္ဂနည်းလမ်း?

ပုဂ္ဂနည်းလမ်းမှာ ပုဂ္ဂနည်းလမ်းမှာ ပုဂ္ဂနည်းလမ်း ပါ။ ပုဂ္ဂနည်းလမ်း:

ပုဂ္ဂနည်းလမ်း? ( $x, z$ ) ပုဂ္ဂနည်းလမ်း? ( $\theta$ ) ပုဂ္ဂနည်းလမ်း? (E)

ပုဂ္ဂနည်းလမ်း သို့မဟုတ် ပုဂ္ဂနည်းလမ်းမှာ (bin) ပါ။

$\otimes\otimes$	$\otimes\otimes$
$\theta$ ( $\otimes\otimes$ )	$-90^\circ \otimes\otimes + 90^\circ \otimes\otimes$ 512 $\otimes$ $\otimes\otimes$ - $\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$
$E$ ( $\otimes\otimes\otimes$ )	0.1 $\otimes\otimes$ 250 MeV $\otimes\otimes$ 256 $\otimes$ $\otimes\otimes$ ( $\otimes\otimes\otimes$ ) - $\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes\otimes$
x_sub	$\otimes\otimes\otimes$ 4 $\otimes$ $\otimes\otimes$ ( $\otimes\otimes\otimes$ ) - $\otimes\otimes\otimes\otimes\otimes$
z_sub	$\otimes\otimes\otimes$ 4 $\otimes$ $\otimes\otimes$ ( $\otimes\otimes\otimes$ ) - $\otimes\otimes\otimes\otimes\otimes$

Table 6: 4

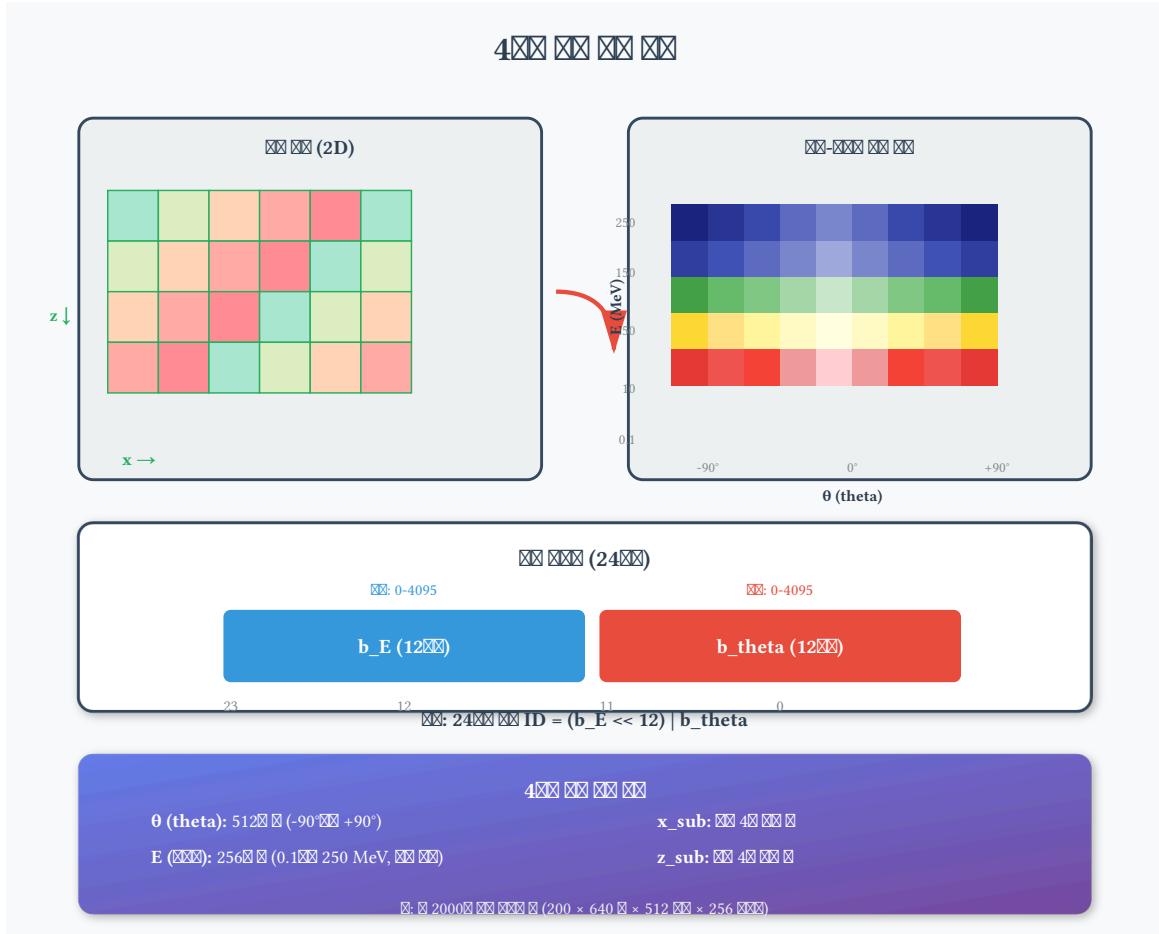


Figure 2: 4  8

### 1.6.3. $\boxtimes$ (Bins)

A horizontal sequence of six identical boxes. Each box contains a 2x5 grid of black 'X' characters. After the sixth box, there is a colon character.

$\text{MeV}$	$\text{Bin ID}$
255	250 MeV - 256 MeV
200	200 MeV - 208 MeV
150	100 MeV - 152 MeV
100	50 MeV - 108 MeV
50	10 MeV - 58 MeV
20	1 MeV - 18 MeV
0	0.1 MeV - 16 MeV

Table 7:  $\text{MeV}$  Binning ( $\text{MeV}$ ,  $\approx 256\text{B}$ )

#### 1.6.4. $\text{MeV}$ Binning: $\text{MeV}$ Range?

$\text{MeV}$  vs  $\text{MeV}$ :

$\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range

- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range
- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range

$\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range

- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range

- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range

$\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range!

#### 1.6.5. $\text{MeV}$ - $\text{MeV}$ Block

```
// 24bit ID ID = (b_E << 12) | b_theta
uint32_t block_id = encode_block(theta_bin, energy_bin);

// 16bit ID ID 512bit ID ID
uint16_t local_idx = encode_local_idx_4d(theta_local, E_local, x_sub, z_sub);
```

#### 1.6.6. $\text{MeV}$ Block: Dense-Sparse

**Dense**:  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range (Dense) **Block-sparse**:  $\text{MeV}$  range  $\text{MeV}$  range

$\text{MeV}$ :  $\text{MeV}$  range

- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range  $\text{MeV}$  range
- $\text{MeV}$ :  $\text{MeV}$  range  $\text{MeV}$  range

$\text{MeV}$ : 70%  $\text{MeV}$  range!

#### 1.6.7. $\text{MeV}$ Block

$\text{MeV}$	$\text{MeV}$	$\text{MeV}$
$E > 10 \text{ MeV}$	$\text{MeV}$ (K2)	$\text{MeV}$ range, $\text{MeV}$ range
$E \leq 10 \text{ MeV}$	$\text{MeV}$ (K3)	$\text{MeV}$ range $\text{MeV}$ range

Table 8:  $\text{MeV}$  Block

XXXX XXX: XXXXXX XXX XXXXX
XXXX (0 mm)
└── XXXXX XXX (E > 10 MeV)
→ K2 (XXXX X) XXX - XXX XXX
→ XXXX XXXXX XXX
└── XXXX XXX XXX (E <= 10 MeV)
→ K3 (XXXX X) XXX - XXX XXX
→ XXXXX XXXXX XXX XXX
→ XXX XXX XXX
XXXX XXX (150 MeV XXX 30 cm)

Table 9: XXXX XXX XXXXXX

### 1.6.8. XXX XXX XXXXX: XXXX XXX

XXXX XXX XXX XXX XXXXX:

- XXX: XXX XXX
- XXX: XXX XXX (XXXX XXX XXX)

XXXX XXX XXX XXX XXXXX:

- XXX: XXX XXX
- XXX: XXXX XXX XXXXX XXXXX

XXXX XXX (SM\_2D):

- XXXXXXX XXX XXX (XXXX XXX)
- XXXXXXX XXX XXX (XXXX XXX)
- XXX: XXXX XXX!

## 1.7. XXX XXX

### 1.7.1. XXX XXX XXX (XXXXXX)

$$\sigma_{\text{theta}} = \left( 13.6 \frac{\text{MeV}}{\beta cp} \right) \times \sqrt{\frac{x}{X_0}} \times \frac{\left[ 1 + 0.038 \times \ln\left(\frac{x}{X_0}\right) \right]}{\sqrt{2}}$$

### 1.7.2. XXX XXXXX: XXXXXX XXXXX?

XXXX XXX XXX XXX XXX XXX XXX XXX.

XXXX XXX XXXXX:

- XXX XXX XXX XXX (XXXX XXX XXX)
- XXX XXX XXX XXX XXX XXX XXX

Характеристики траектории движения в 2D и 3D:

- Траектория линейная ( $\alpha = \beta = 0^\circ$ )
- Траектория криволинейная ( $\alpha = \beta = 0^\circ$ ,  $X_0 = 360.8\text{mm}$ )
- Траектория криволинейная ( $\alpha = \beta = 45^\circ$ )

$X_0 (\text{м})$ : **360.8 mm** - Траектория "линейная" 2D:  $\frac{1}{\sqrt{2}}$  - 2D криволинейная 3D траектория

### 1.7.3. Траектория (трэглинг)

$$\kappa = \frac{\xi}{T_{\max}} \text{ - коэффициент трэглинга:}$$

$\kappa (\text{мм})$	$\alpha$	$\beta$
$\kappa > 10$	Линейная	Линейная
$0.01 < \kappa < 10$	Криволинейная	Криволинейная
$\kappa < 0.01$	Линейная	Линейная

Table 10: Траектория траекторий

### 1.7.4. Трэглинг: что это такое?

Трэглинг (straggling) - "разброс траекторий" в пространстве.

Характеризует разброс траекторий:

- $\kappa \gg 1$ : Траектории прямые - траектории линейные (линейный)
- $\kappa \ll 1$ : Траектории изогнутые - траектории криволинейные (криволинейный)

Трэглинг - это разброс траекторий в пространстве. Трэглинг - это характеристика траекторий.

### 1.7.5. Трэглинг: что это такое

$\kappa$  - "разброс траекторий" и "разброс траекторий" в пространстве:

Трэглинг ( $\kappa > 10$ ): Траектории прямые

- $\kappa \gg 1$  ( $\alpha = \beta = 0^\circ$ )
- $\kappa \ll 1$
- $\kappa = 1$

Трэглинг ( $0.01 < \kappa < 10$ ): Траектории изогнутые

- Криволинейные траектории
- $\kappa = 1$
- $\kappa \ll 1$

Трэглинг ( $\kappa < 0.01$ ): Траектории прямые

- $\kappa \gg 1$
- "Линейные" траектории

### 1.7.6. Фактор

$$W \times \exp(-\sigma(E) \times ds)$$

### 1.7.7. Трэглинг: что это такое

Фактор трэглинга определяет разброс траекторий в пространстве.

Фактор трэглинга:

- **Ø** ØØØ ØØØ ØØØ ØØØ (ØØ)
- **Ø** Ø Ø ØØ ØØ (ØØ ØØ)
- **Ø** ØØØ ØØØ ØØØ

ØØØ ØØØ ØØØØØ: “Ø ØØØ ØØØ ØØØØØ?”

ØØØ ØØ ØØ ICRU 63.

#### 1.7.8. ØØ ØØ (R ØØ)

$$ds = \min(0.02 \times R, 1 \text{ mm}, \text{cell\_size})$$

ØØØØØ ØØ ØØ ØØ ØØ ØØ-ØØØ LUTØ ØØØØØ.

#### 1.7.9. ØØ ØØØ: ØØ ØØ

ØØØØØØ ØØ ØØ ØØ “ØØ”Ø ØØØØ. ØØØ Ø ØØ ØØ ØØ ØØØØØ.

ØØ Ø: ØØØØ ØØ ØØ ØØ: ØØ ØØØØØ

ØØØ: ØØØ ØØ ØØ (ØØ ØØ Ø ØØ ØØ ØØ) ØØ

- ØØØØ (Ø ØØ): Ø Ø ØØ
- ØØØØ (Ø ØØ): Ø Ø ØØ
- ØØØ ØØØ ØØ ØØØØ!

### 1.8. ØØØ ØØØØ

ØØ	ØØ	ØØ
PsiC_in/out	ØØ 1.1 GB	ØØ ØØ ØØ - ØØ ØØØØ ØØ Ø
EdepC	0.5 GB	ØØØ ØØ - ØØ ØØ ØØ
AbsorbedWeight	0.5 GB	ØØ/Ø ØØ - ØØ ØØ
AbsorbedEnergy	0.25 GB	Ø ØØØ ØØ - ØØ ØØ
BoundaryLoss	0.1 GB	ØØ ØØ - ØØØØØØ ØØ ØØ
ActiveMask/List	0.5 GB	ØØ Ø ØØ - ØØØ

Table 11: GPU ØØØ ØØØØ

ØØ: 4.3 GB GPU ØØØ

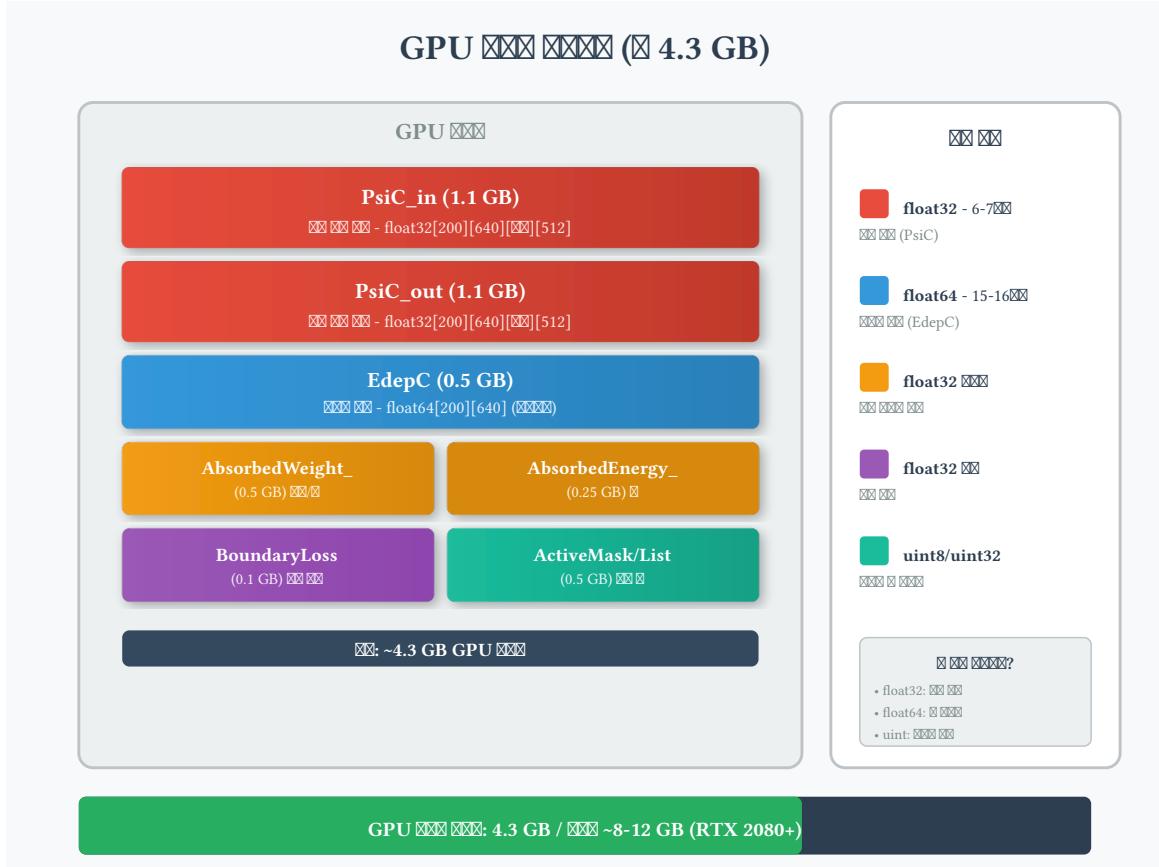


Figure 3: GPU Memory Layout Diagram

#### 1.8.1. ຂໍ້ມູນ ແລະ ພາຍໃນ ປະເທດ?

ພາຍໃນ ຂໍ້ມູນ ຕ່າງໆ ດັວກ ທີ່ ດັວກ ຖ້າ ດັວກ ຕ່າງໆ ດັວກ ທີ່ ດັວກ.

ຂໍ້ມູນ ດັວກ ປະເທດ:

- 32 (32)
- 64 (64 64)
- 128 (128 128 128)
- 256 ດັວກ “32” (32) ດັວກ 32x32

4.3 GB ດັວກ 1 ຊົ່ວໂມງ 3,100 ດັວກ ດັວກ ດັວກ ດັວກ!

#### 1.9. ດັວກ ດັວກ

ດັວກ	ດັວກ	ດັວກ
ດັວກ ດັວກ ດັວກ	±2%	ດັວກ: ດັວກ ດັວກ ດັວກ ດັວກ ດັວກ
ດັວກ ດັວກ (ດັວກ ດັວກ)	±15%	ດັວກ: ດັວກ ດັວກ ດັວກ
ດັວກ ດັວກ (ດັວກ)	±20%	ດັວກ: ດັວກ (ດັວກ) ດັວກ
ດັວກ	< $10^{-6}$	ດັວກ ດັວກ: ດັວກ ດັວກ ດັວກ
ດັວກ	< $10^{-5}$	ດັວກ ດັວກ: ດັວກ ດັວກ ດັວກ

Table 12: ດັວກ ດັວກ ດັວກ

ດັວກ ດັວກ: 32

### 1.9.1. **SM\_2D**: **SM\_2D**

**SM\_2D** **SM\_2D** **SM\_2D**:

**SM\_2D** **SM\_2D** **±2%**:

- **SM\_2D** **SM\_2D** 2% **SM\_2D** **SM\_2D** **SM\_2D**
- 2% **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D**
- **SM\_2D** **SM\_2D** < 1% **SM\_2D** **SM\_2D** **SM\_2D**!

**SM\_2D** <  $10^{-6}$ :

- **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D**
- **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D**
- **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D** **SM\_2D**!

## 1.10. **SM** **SM**

<b>SM</b>	<b>SM</b>	<b>SM</b>
EnergyGrid	core	<b>SM</b> <b>SM</b> <b>SM</b> - <b>SM</b> 256 <b>SM</b> <b>SM</b>
AngularGrid	core	<b>SM</b> <b>SM</b> <b>SM</b> - <b>SM</b> 512 <b>SM</b> <b>SM</b>
PsiC	core	<b>SM</b> <b>SM</b> <b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b> <b>SM</b>
RLUT	lut	<b>SM</b> - <b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b> <b>SM</b>
PencilSource	source	<b>SM</b> <b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b> <b>SM</b>
GaussianSource	source	<b>SM</b> <b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b> <b>SM</b>
GlobalAudit	audit	<b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b>
BraggPeakResult	validation	<b>SM</b> <b>SM</b> - <b>SM</b> <b>SM</b>

Table 13: **SM** **SM** **SM**

### 1.10.1. **SM** **SM**: **SM** **SM**?

**SM** **SM**.

**SM**: **SM** **SM**

- **SM** = **SM** (**SM**)
- **SM** = **SM** (**SM** **SM**)

**SM**: **EnergyGrid** **SM**

- **SM**: 256 **SM** **SM**
- **SM**: **SM** **SM** **SM** **SM** **SM**
- **SM**: **SM** **SM** **SM** **SM**

## 1.11. **SM** **SM**

**SM** **SM** **SM** - **SM** **SM** **SM** **SM** **SM** **SM** **SM** **SM** - **SM** **SM** **SM** **SM** **SM** **SM** **SM** **SM** - **SM** **SM** **SM** **SM** **SM** **SM** **SM** **SM** CUDA **SM** **SM** - **SM** **SM** **SM** API **SM** - **SM** **SM**

## 1.12. **SM** **SM**

### 1.12.1. **SM** **SM** **SM**

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## ☒☒☒☒ (Bragg Peak)

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二

## CSDA $\boxtimes$ (CSDA Range)

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2

#### ☒☒☒☒ (Deterministic)

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☒☒ (Phase Space)

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二

## (Straggling)

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二

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MCS

- - .

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LUT

- -

—

## Kernel

- GPU 算法

—

☒ (Bin)

-    (  ).

—

### (Attenuation)

-

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### ☒ (Cross-section)

- ☒ ☐☐☐☐☐ ☐☐☐ ☐.

=

### ☒☒ (Penumbra)

- ☐☐☐ ☐☐ ☐☐☐☐ ☐.

## 1.13. ☐☐☐☐

☒	☒
NIST PSTAR	☒☒☒ ☐☐☐ ☐
PDG 2024	☒☒ ☐☐☐☐ ☐
ICRU 63	☒☒☒ ☐ ☐
Vavilov 1957	☒☒ ☐☐ ☐

Table 14: ☐☐☐☐

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**SM\_2D** ☐☐☐ ☐☐ ☐☐ ☐☐☐ ☐

MIT ☐☐☐ - ☐ 1.0.0