



Crafting Epic Boss Fights In

PsychoNauts 2

#GDC23

Beca Vessal (She/Her)

- Senior gameplay programmer with AI specialization at Double Fine
 - Gameplay programmer – 8 years experience
 - Psychonauts 2
 - Level specific systems
 - AI: NPC, Animal AI, and Boss systems
- Food and travel adventurer
- Love memes
- Once cooked scrambled eggs for Gordon Ramsay

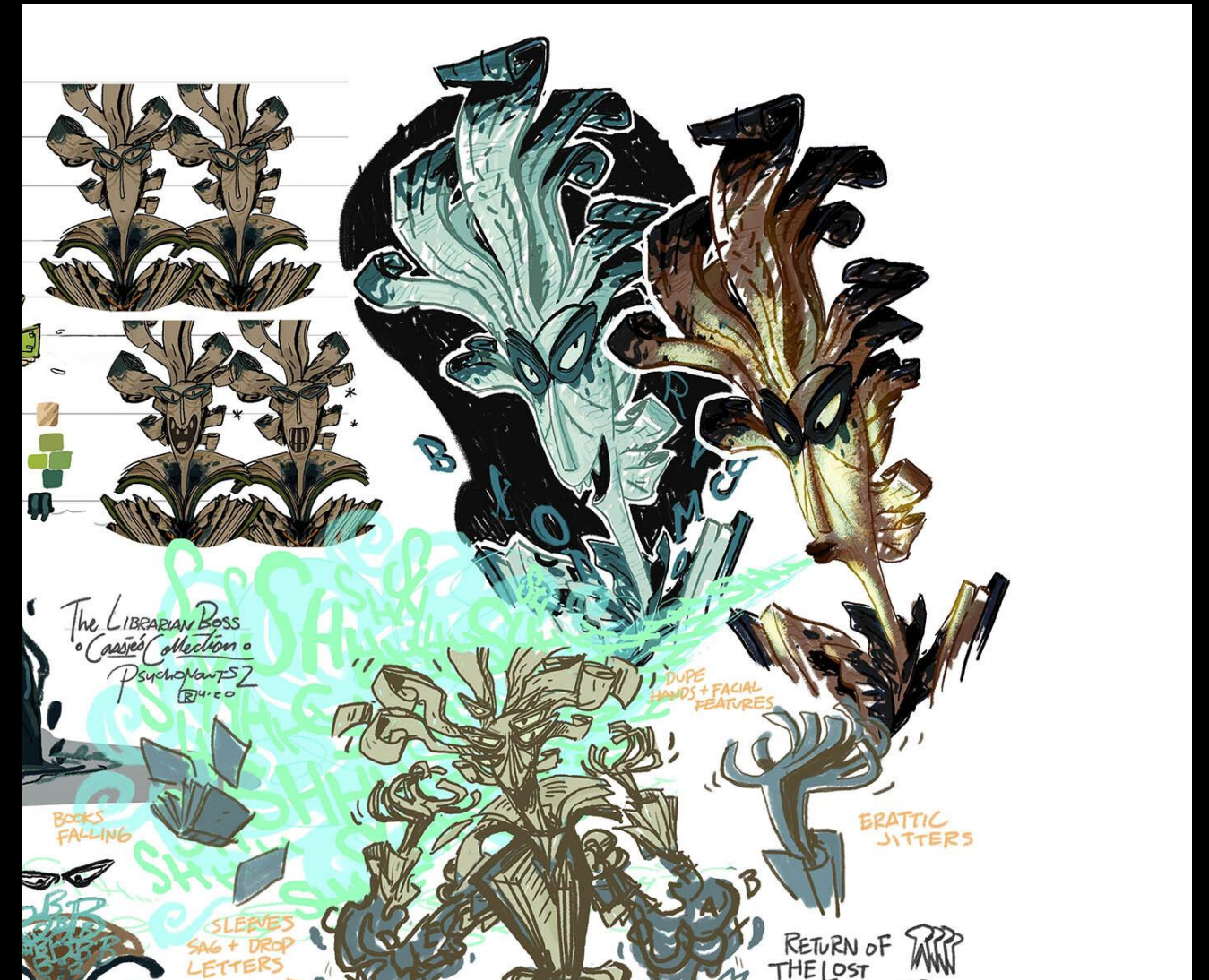


Credited Shipped Titles



Talk Outline

- Psychonauts 2 Boss System - Core Requirements
- Traditional Solutions
- Our Solution: Maneuver System
- Creating & Tuning Attacks and Attack Combos



Psychonauts 2 Boss System – Core Requirements

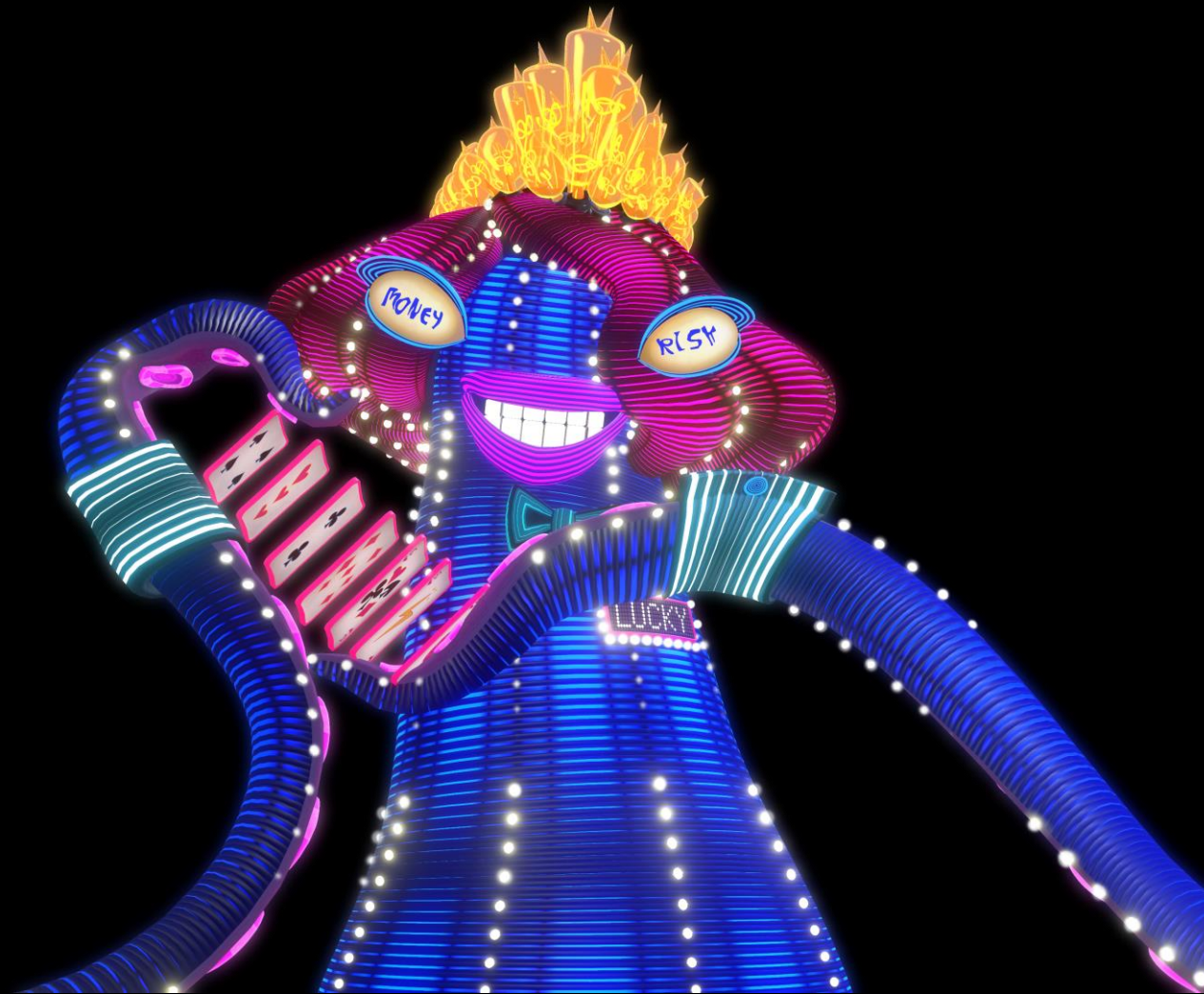
- Flexible designer friendly system
- Simultaneous team collaboration
- Boss responsiveness
- Unique, challenging, and fun boss phases
- Deliver dialog at appropriate times
- Boss attack cooldowns
- Support characters for Raz



Featured Psychonauts 2 Bosses



Die-Brarian (Cassie) Boss



Luctopus (Lucky) Boss

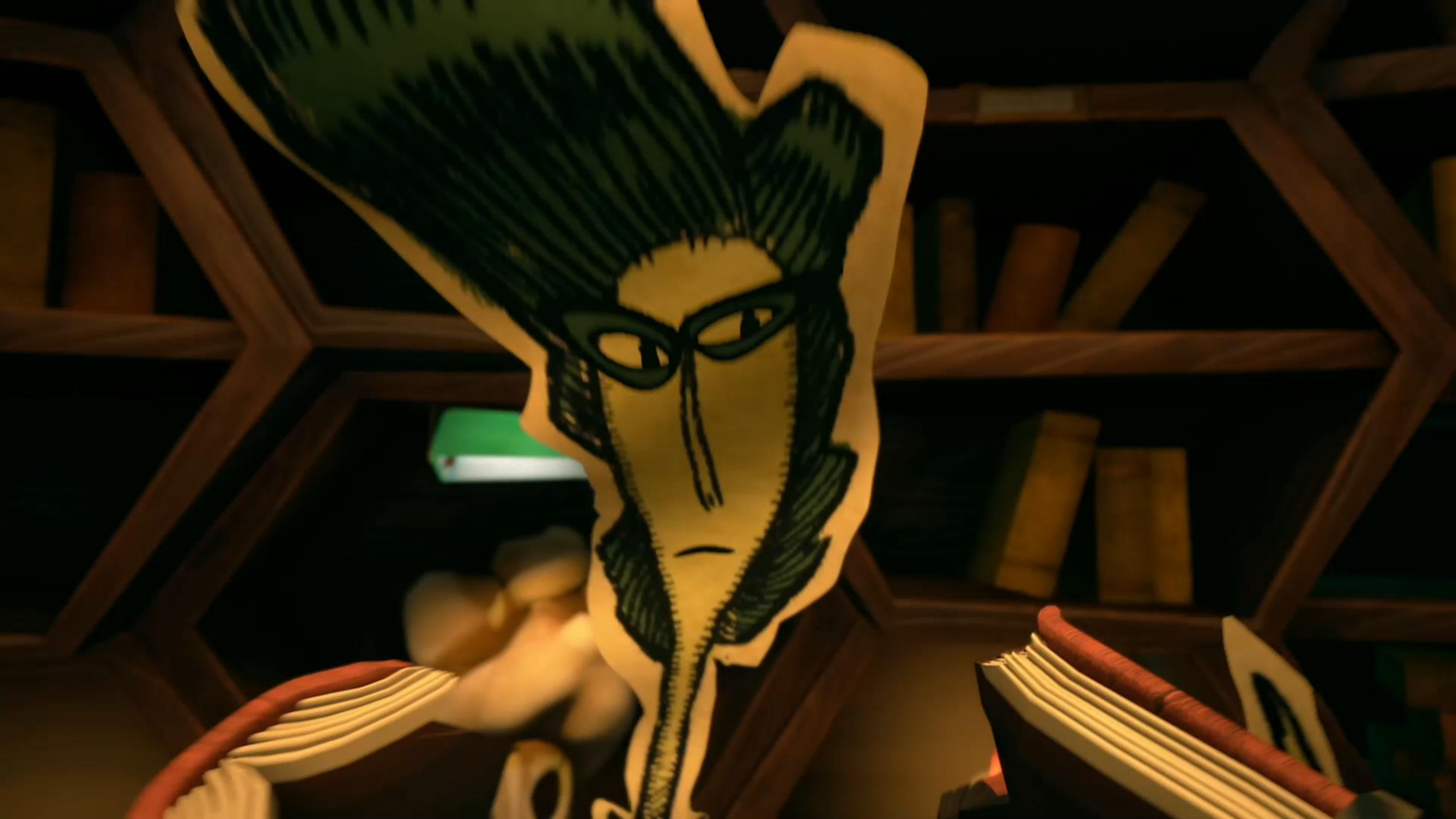


Maligula Boss

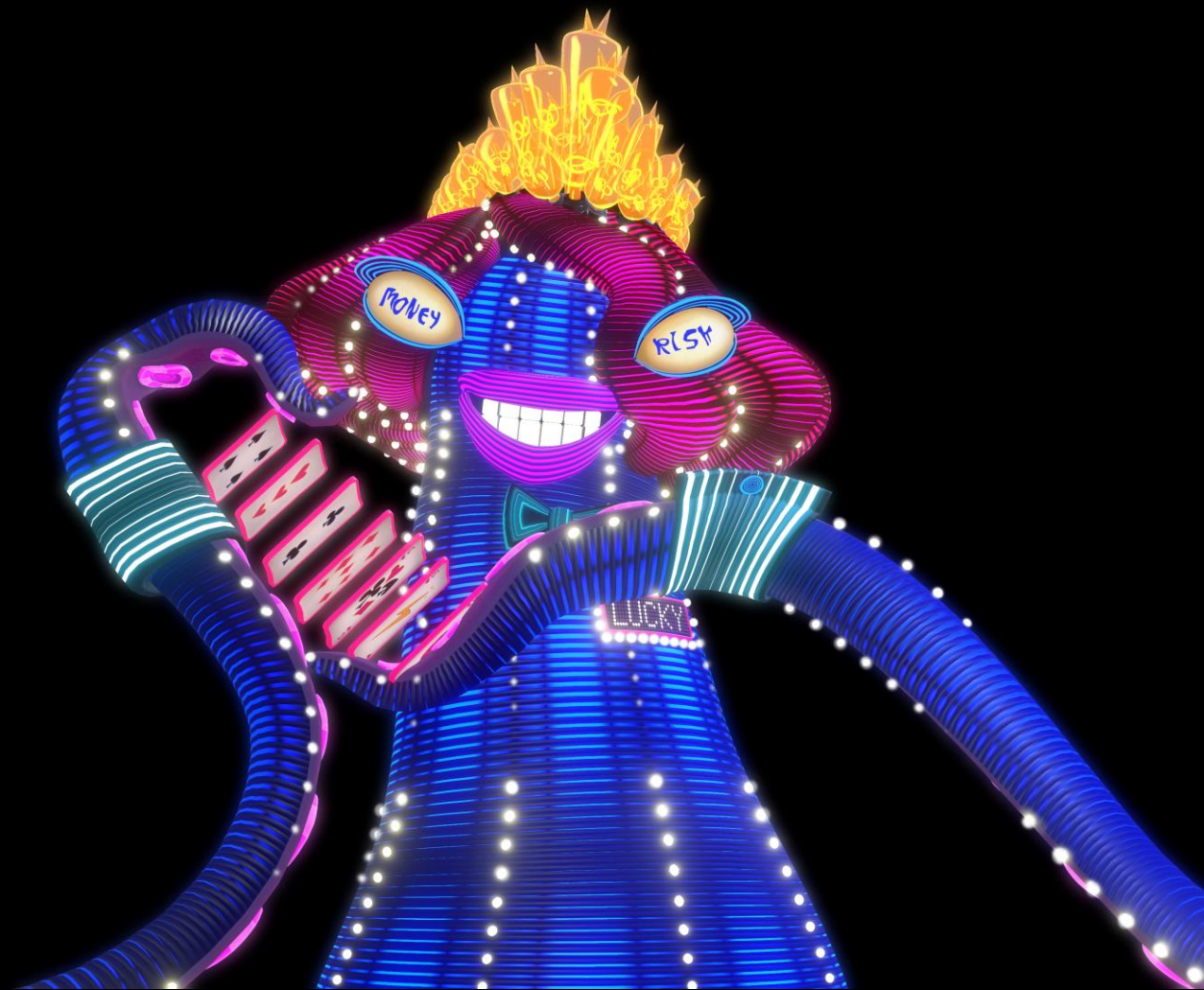
Cassie Boss Intro



Die-Brarian (Cassie) Boss



Lucky Boss Intro



Luctopus (Lucky) Boss



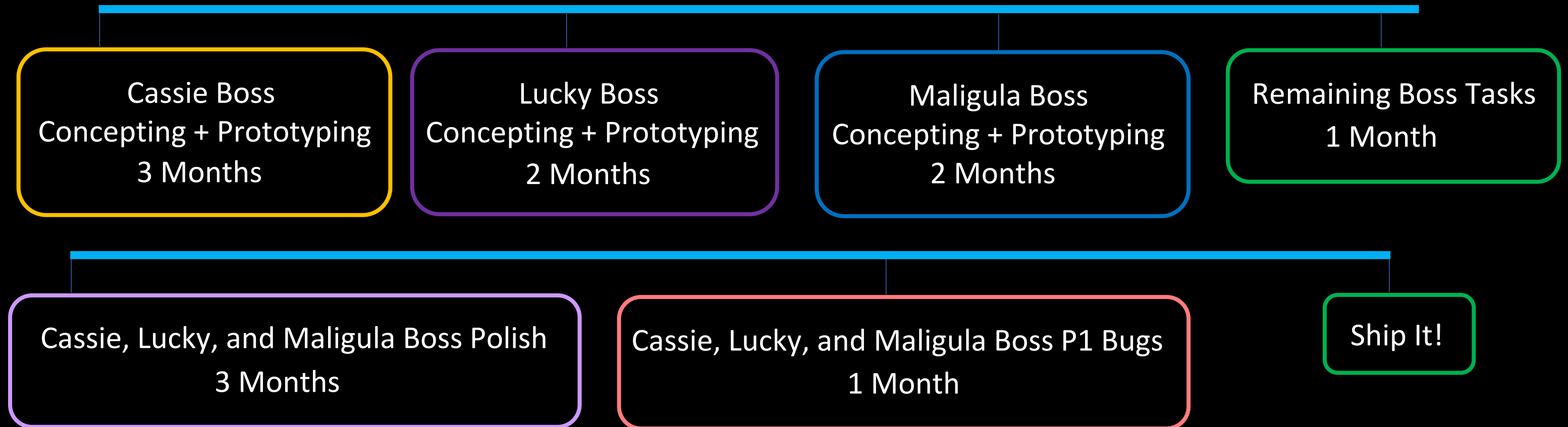
Maligula Boss Intro



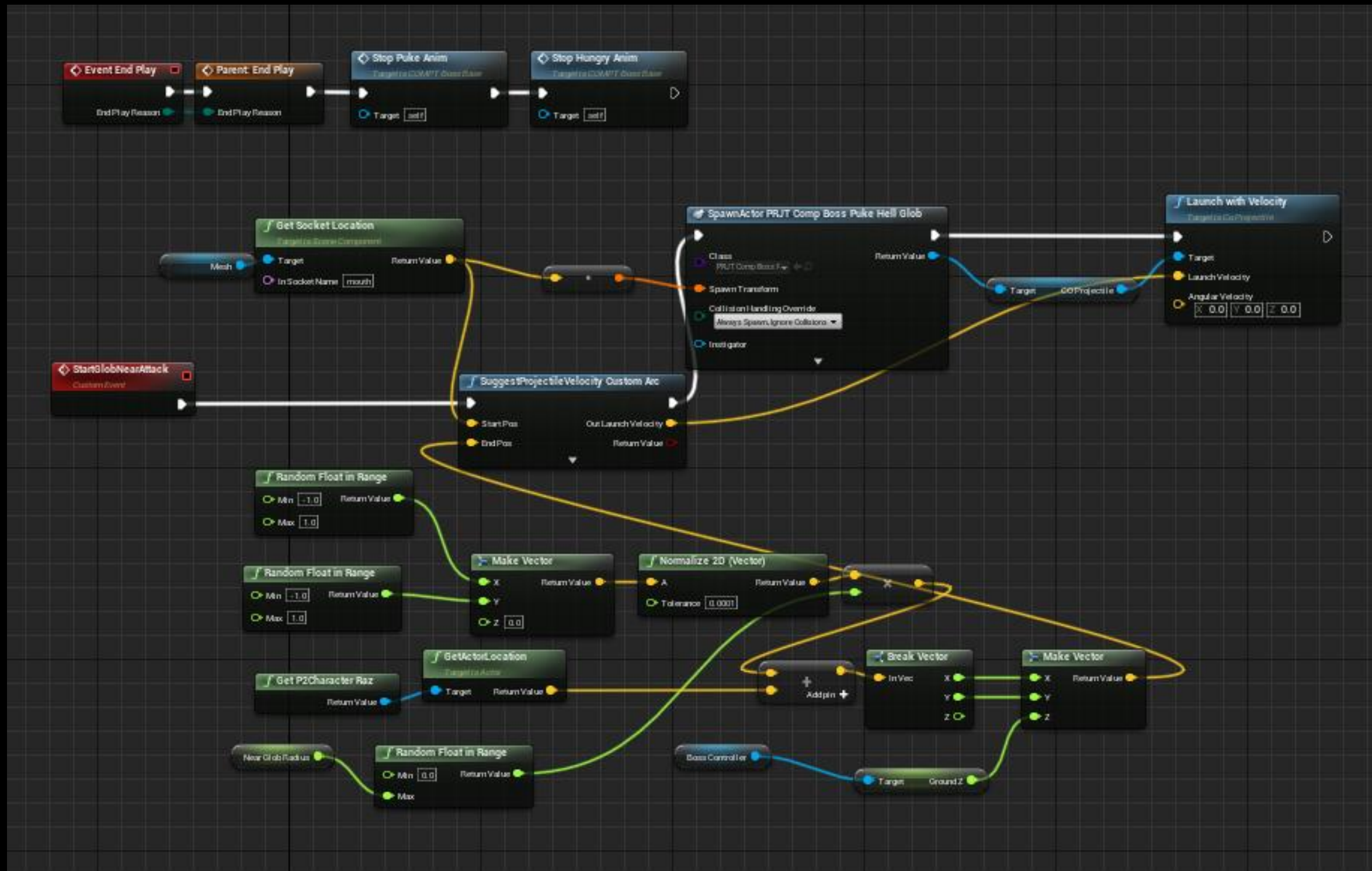
Maligula Boss



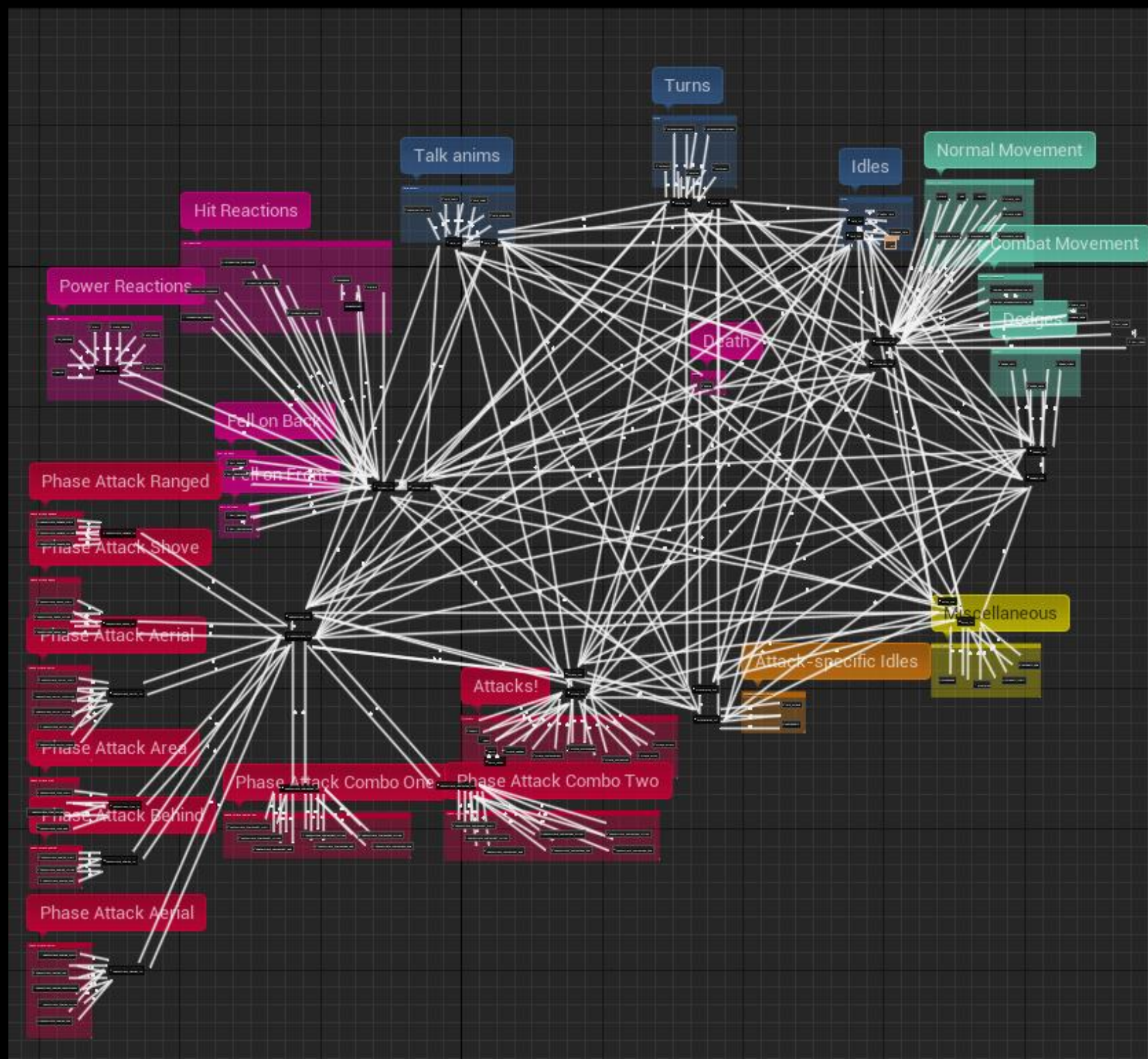
Psychonauts 2 Boss Dev Timeline



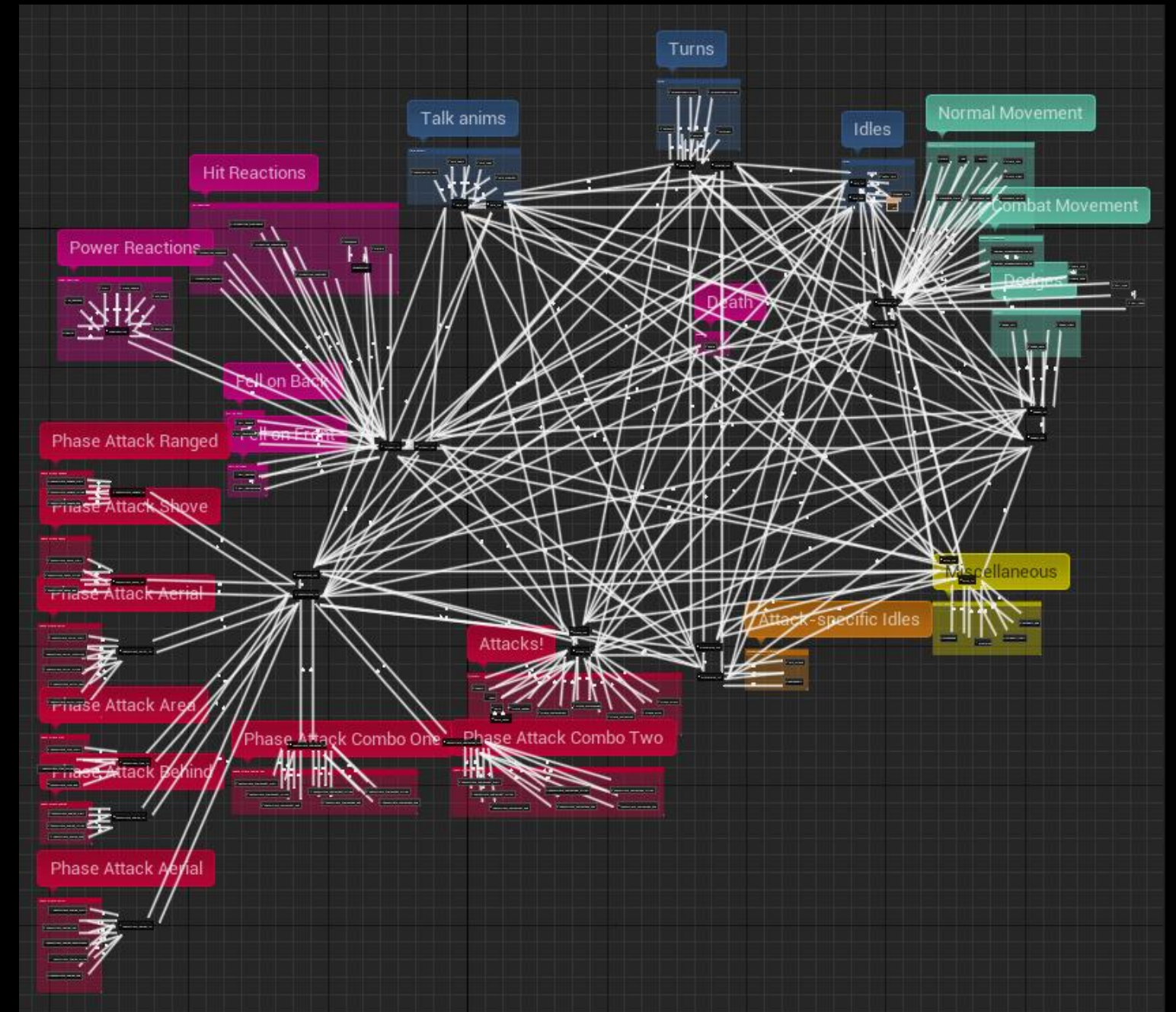
Traditional Solutions – Boss Blueprint (BP)



Traditional Solutions – Animation State Graph



Internal Research – Maneuver System



Maneuver

Data

Action



Base Maneuver Action

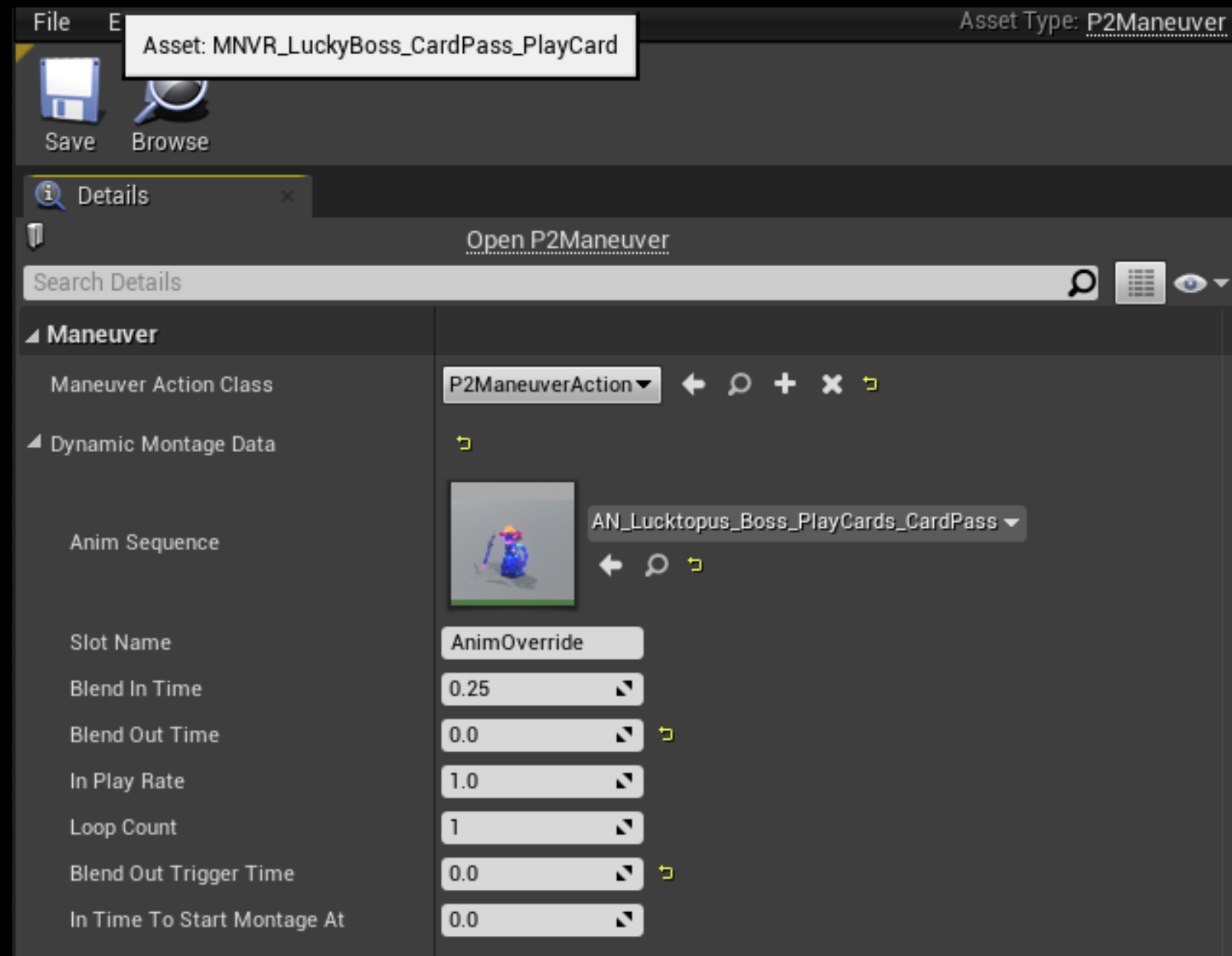
```
UCLASS(Blueprintable, BlueprintType)
...
class UP2ManeuverAction : public UP2CharacterAction
{
    GENERATED_UCLASS_BODY()
    ...

public:
    virtual void SetData(UP2Maneuver* pManeuverData, const FManeuverContext& context);

    virtual void SetCharacter(AP2Character* pCharacter) override;
    virtual void Started_Native() override;
    virtual void Interrupted_Native() override;
    virtual void Update_Native(float fDeltaSeconds) override;
    virtual void Ended_Native() override;

    UFUNCTION(BlueprintPure, Category = "Maneuver", DisplayName = "Get Maneuver Data")
    UP2Maneuver* GetManeuverData() const;
}
```


Maneuver Data Example - Basic



Maneuver Data Example - Attack

Details

Open P2ProjectileAttack

Search Details

P2Projectile Attack

Projectile Class: PRJT_LuckyBossBomb

Number Of Projectiles: 3

Projectile Spawn Socket Name: BombSocket

Should Attach to Socket: ☒

ShouldInstantSpawnAndLaunch: ☐

Spawn Delay: 0.0

Animation Time: 0.0

Projectile Type: Lobbed

Missile

Lob with Constant Speed

Arc Parameter (Lobbed Type): 0.77

Lob With Variable Speed

Maneuver Action Class: MNVRACTN_LuckyBoss_BombSpitHeadTrack

Dynamic Montage Data

Anim Sequence: AN_Lucktopus_Boss_Attack_Bomb_Spit_Loop

Slot Name: DefaultSlot

Blend In Time: 0.0

Blend Out Time: 0.0

In Play Rate: 1.0

Loop Count: -1

Blend Out Trigger Time: 0.0

In Time To Start Montage At: 0.0



Details

Open P2ProjectileAttack

Search Details

P2Projectile Attack

Projectile Class: PRJT_LuckyBossBomb

Number Of Projectiles: 3

Projectile Spawn Socket Name: BombSocket

Should Attach to Socket: ☒

ShouldInstantSpawnAndLaunch: ☐

Spawn Delay: 0.0

Animation Time: 0.0

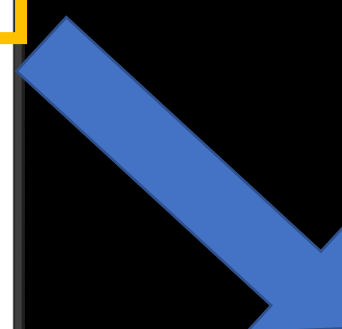
Projectile Type: Lobbed

Missile

Lob with Constant Speed

Arc Parameter (Lobbed Type): 0.77

Lob With Variable Speed



Maneuver Action Class: MNVRACTN_LuckyBoss_BombSpitHeadTrack

Maneuver Action

C++

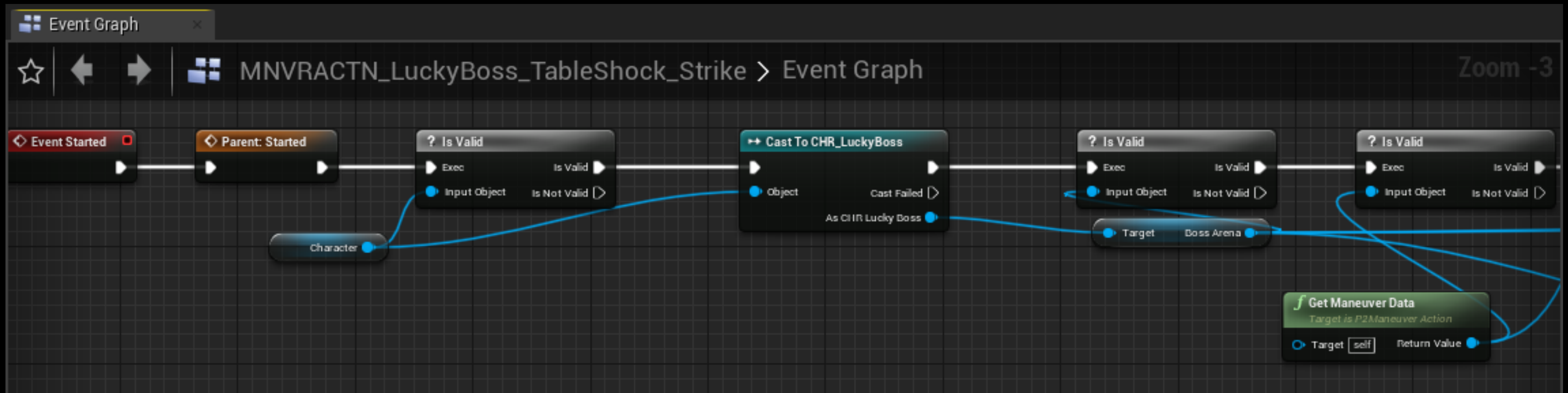


MNVRACTN_
LuckyBoss_
TableShock

Maneuver Action Example – Code

```
3  #include "Character/Actions/P2ManeuverAction.h"
4
5  #include "P2ManeuverAction_ProjectileAttack.generated.h"
6
7  UCLASS()
8  class UP2ManeuverAction_ProjectileAttack : public UP2ManeuverAction
9  {
10     GENERATED_BODY()
11
12     protected:
13
14         virtual void Started_Native() override;
15         virtual void Ended_Native() override;
16
17         virtual void ReceiveNotify(const FManeuverNotify& Notify) override;
18
19     private:
20
21         AActor* m_pSpawnedProjectile = nullptr;
22         FTimerHandle m_TimerHandle;
23         FTimerHandle m_InstantSpawnTimerHandle;
24         FTimerHandle m_SpawnDelayTimerHandle;
25         int iNumberOfProjectilesSpawned = 0;
26
```


Maneuver Action Example – Blueprint (BP)



Maneuver Chain

▲ 0

Default Maneuver

▶ Conditional Branch

▲ 1

Default Maneuver

▶ Conditional Branch

▲ 2

Default Maneuver


▶ Conditional Branch

▲ 3

Default Maneuver

▶ Conditional Branch

2 members ▼




MNVR_LuckyBoss_BombSpit_PlayCard ▼

← 🔍 ↻

↻

2 members ▼




MNVR_LuckyBoss_BombSpit_Telegraph ▼

← 🔍 ↻

↻

2 members ▼




MNVR_LuckyBoss_BombSpitLoop ▼

← 🔍 ↻

↻

2 members ▼

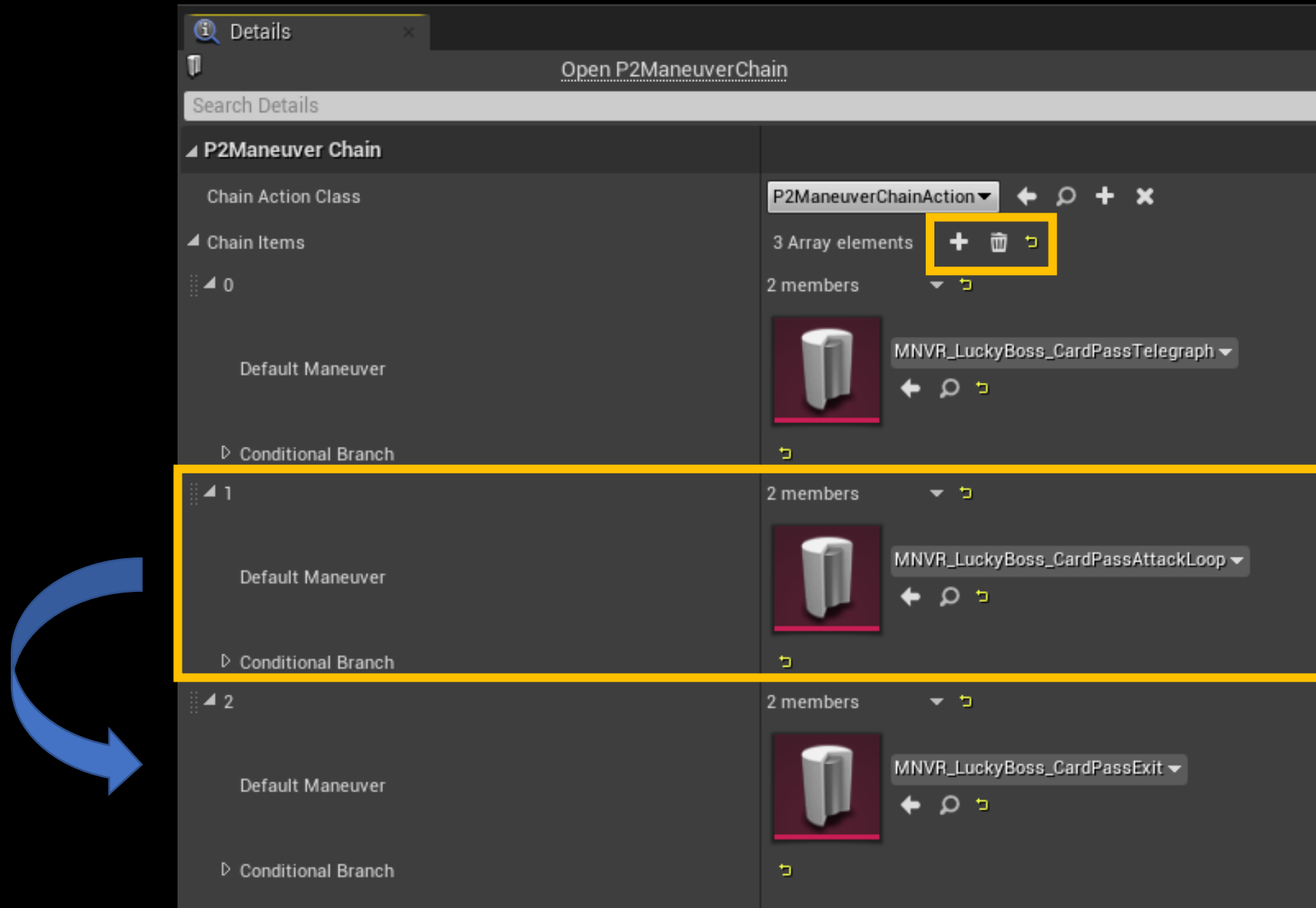


MNVR_LuckyBoss_BombSpit_Recovery ▼

← 🔍 ↻

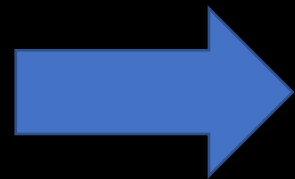
↻

Crafting Attack

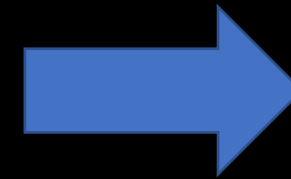


Common Attack Pattern with Maneuver Chain

Telegraph



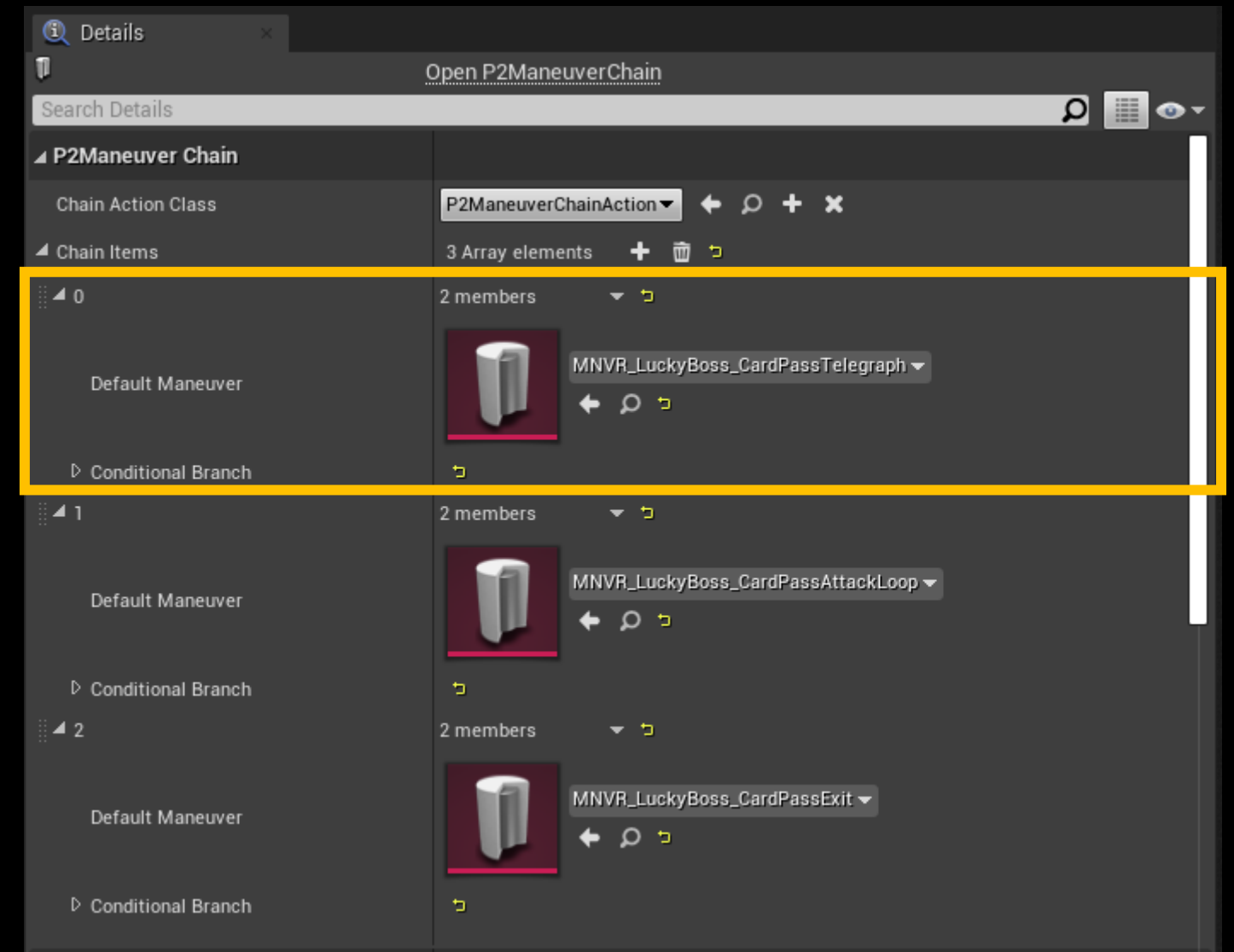
Attack



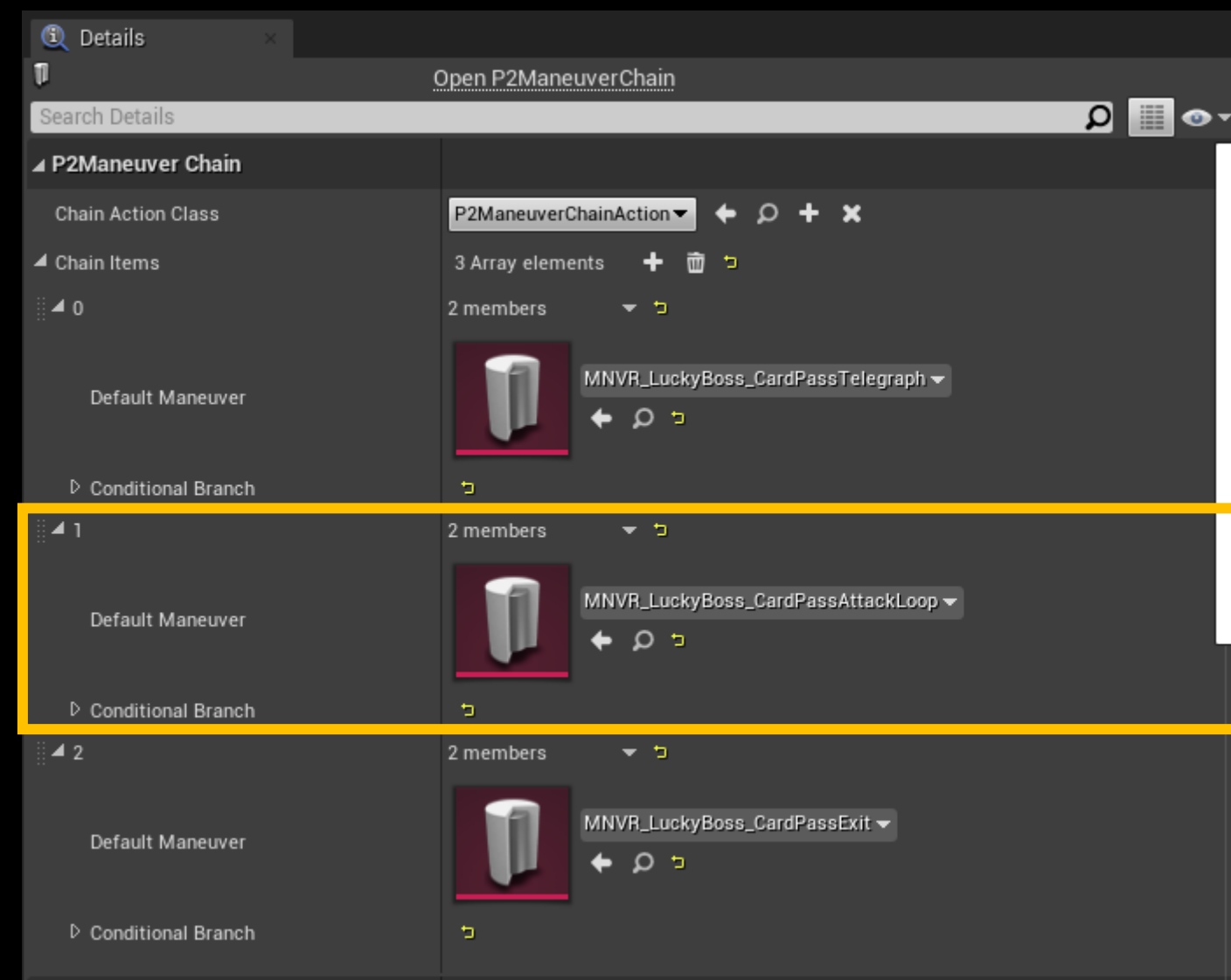
Recovery



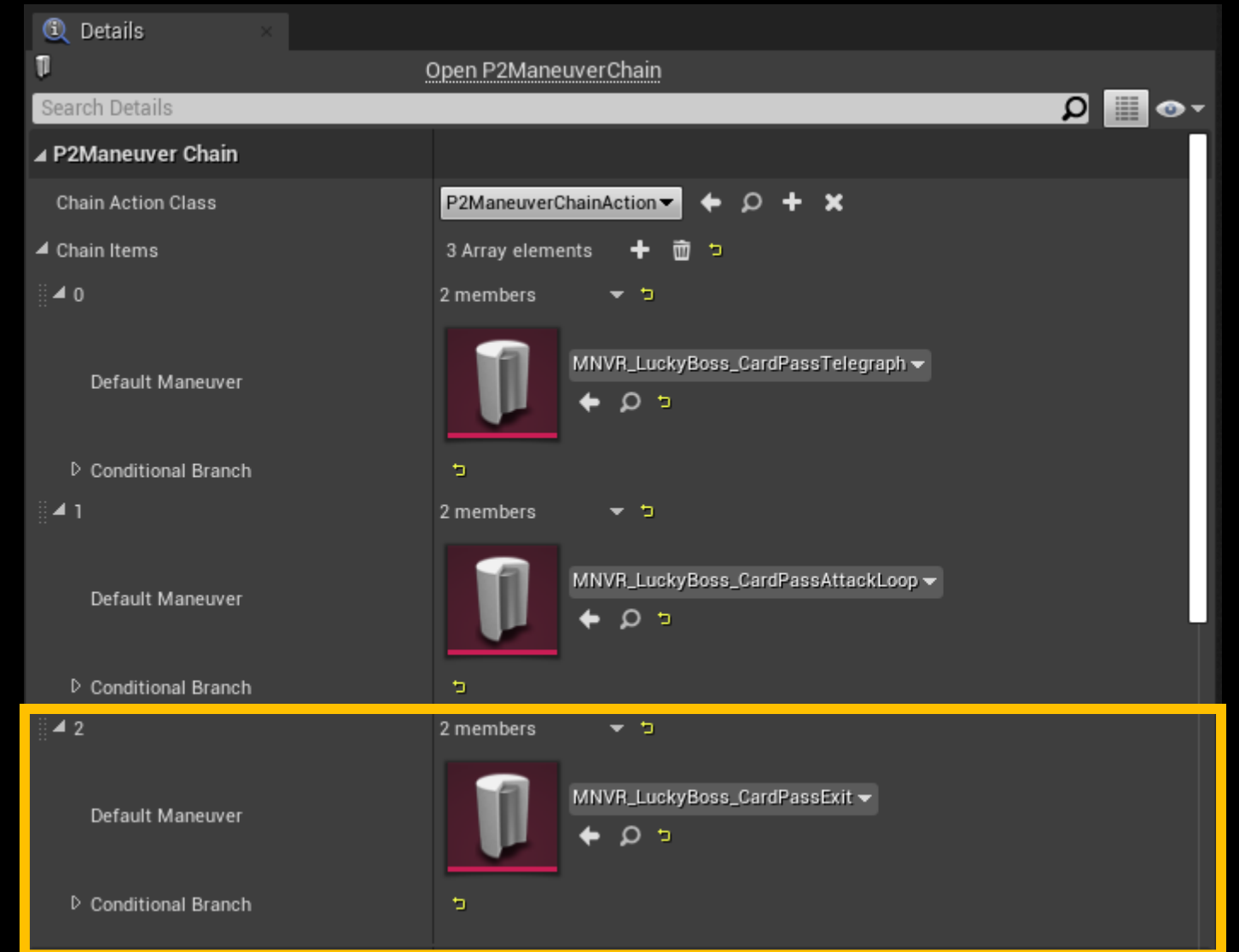
Telegraph Maneuver



Card Pass Attack Maneuver



Recovery Maneuver





Luctopus

MONEY

RISK

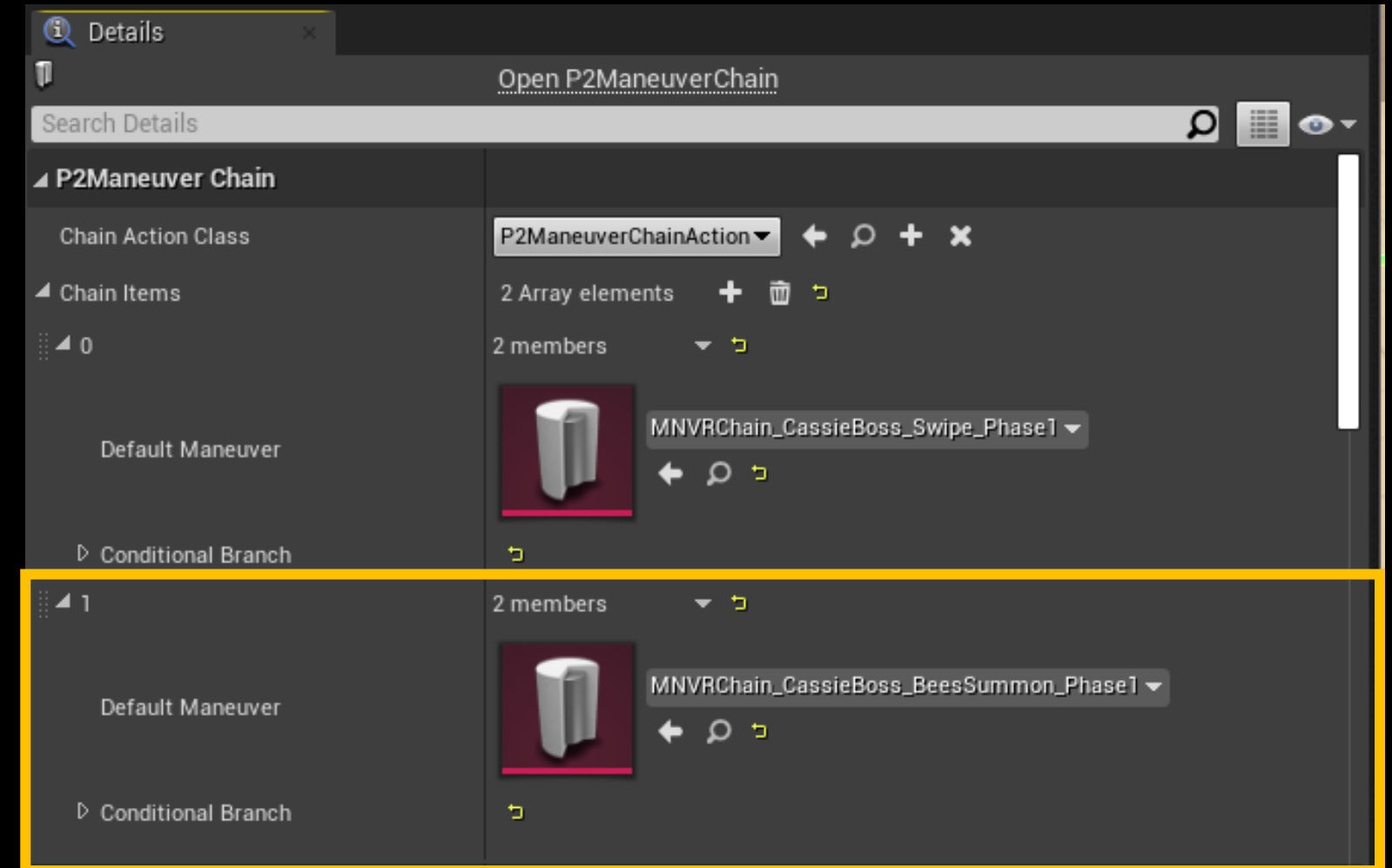
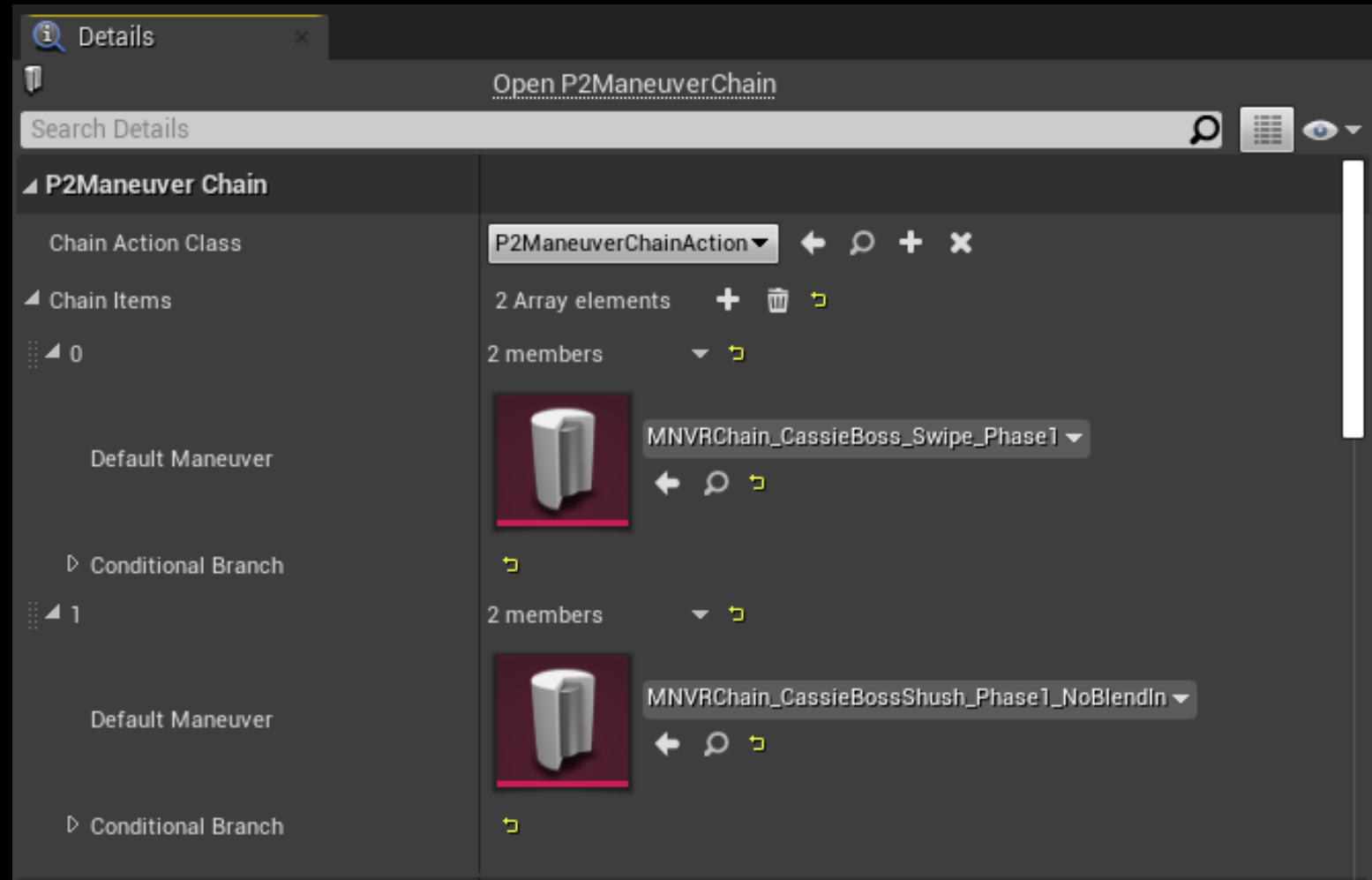
LB

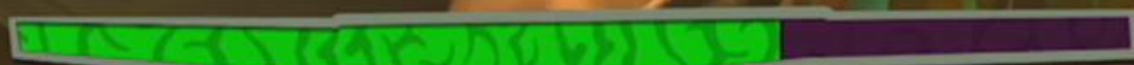
LT

RB

RT

Crafting Attack Combos





Die-Brarian



LB



LT



RB

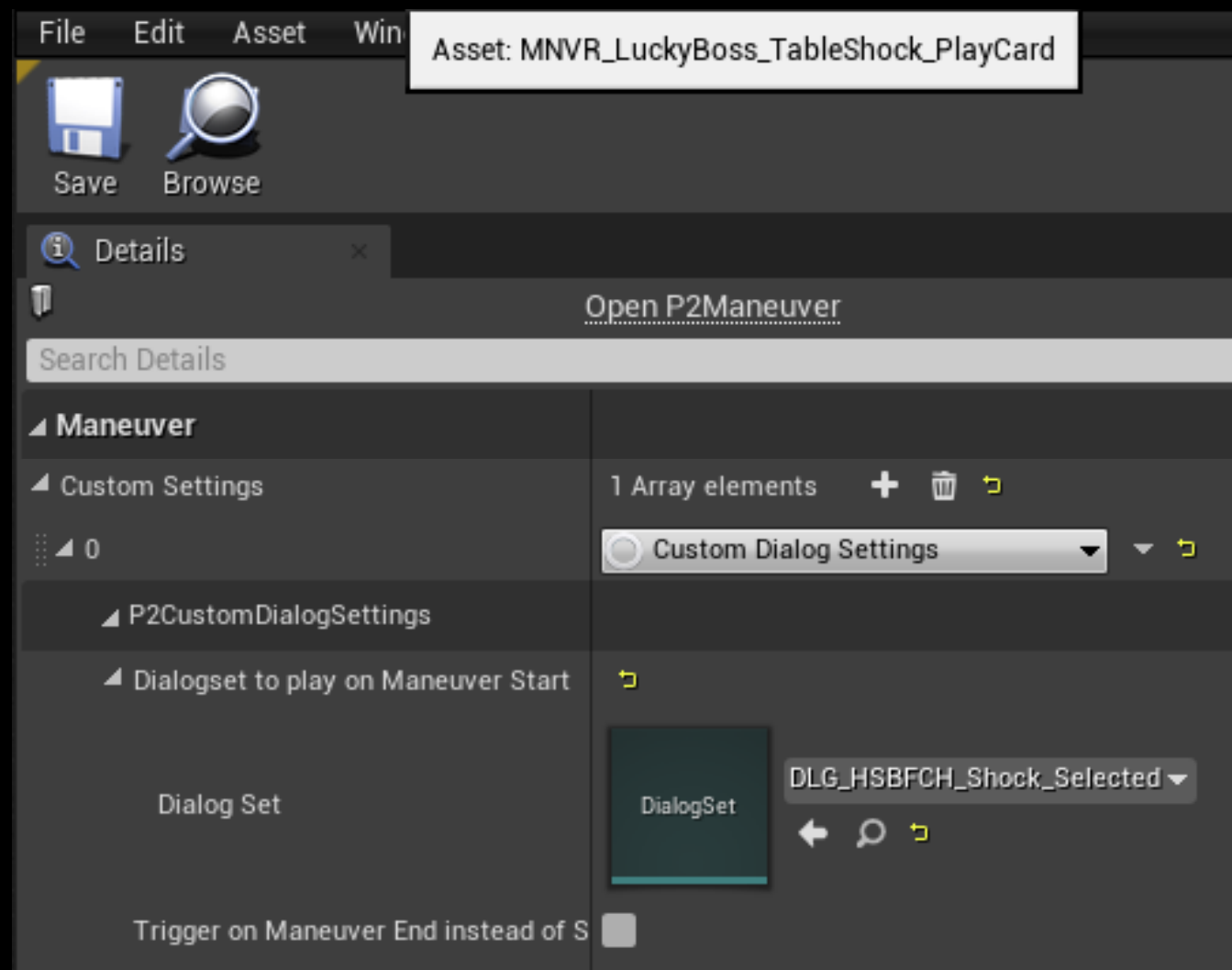


RT

Cassie:

If you won't clean up after yourself, I WILL!

Dialog per Maneuver



Choosing Maneuvers



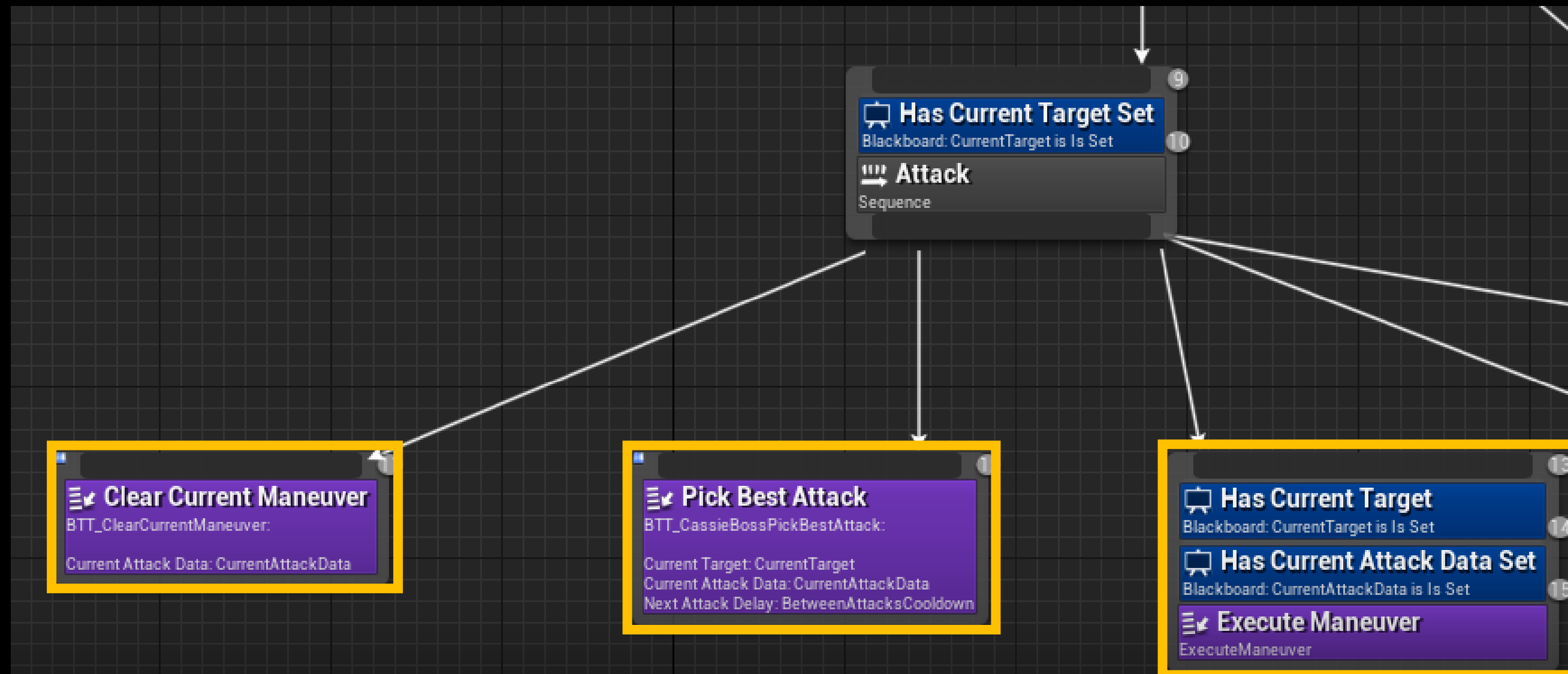
Boss AI State – Maneuvers Per Phase

Psychonauts AI State	
▲ Boss Phase Attacks	3 Array elements + 🗑️ ↺
0	1 members ▼ ↺
1	1 members ▼ ↺
2	1 members ▼ ↺



Boss Phase Attacks	
▲ 0	3 Array elements + 🗑️ ↺
▲ Maneuvers	1 members ▼ ↺
0	7 Array elements + 🗑️ ↺
	MNVR_CassieBoss_SpawnMinions_Phase1 ▼
1	MNVRChain_CassieBoss_Shoot_Phase1 ▼
2	MNVRChain_CassieBoss_BeesSummon_Phase ▼
3	MNVRChain_Phase1_BookDrop ▼
4	MNVRChain_Phase1_Swipe_Shush ▼
5	MNVRChain_CassieBoss_SwipePostShoot_Pha ▼
6	MNVRChain_CassieBossShush_Phase1_Blendl ▼

Boss AI State - Behavior Tree – Choosing Maneuver



Maneuver Conditions

Custom Settings

0

AI Maneuver Criteria

Min Max Distance to Start Attack Criteria

Min Max Path Range to Start Attack Criteria

Require Target on Nav

Require Path to Target

Perform Sweep Check

Min Max Facing Angle to Target

Require LOS

Requires Reservation

Live Actor Type

Max Count Of Live Actor Type

Initial Cooldown

Cooldown

Cooldown Global

Cooldown Maneuver Group

Maneuver Group Name

Priority

Only Allowed After These Maneuvers

Min Time Since All Minions Died

Max Number Of Minions

2 Array elements

Custom AI Maneuver Criteria

X 0.0

Y 0.0

X 0.0

Y 0.0

X 0.0

Y 180.0

CHR_BigFan_CassieBoss

1

0.0

0.0

0.0

0.0

None

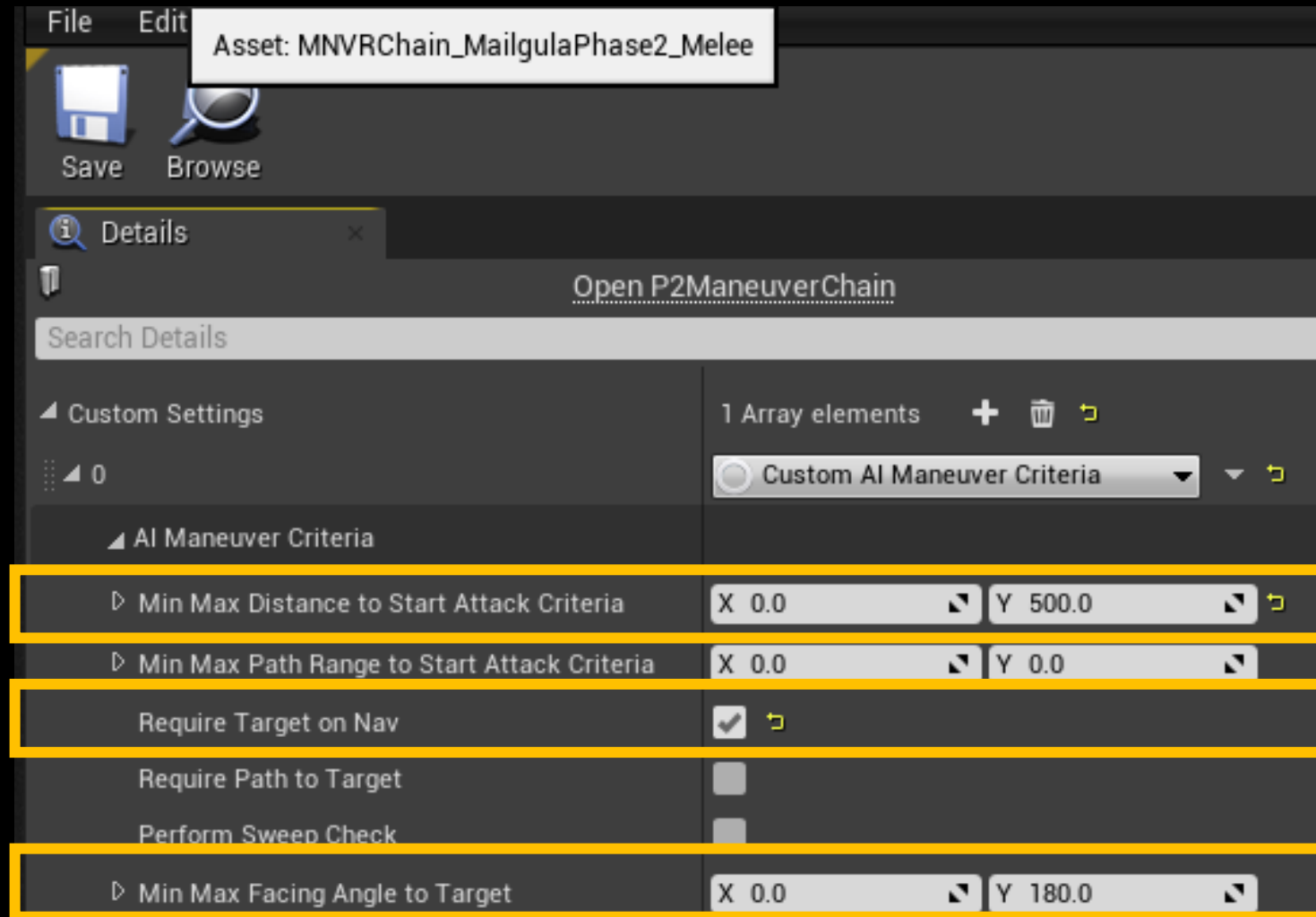
2

0 Array elements

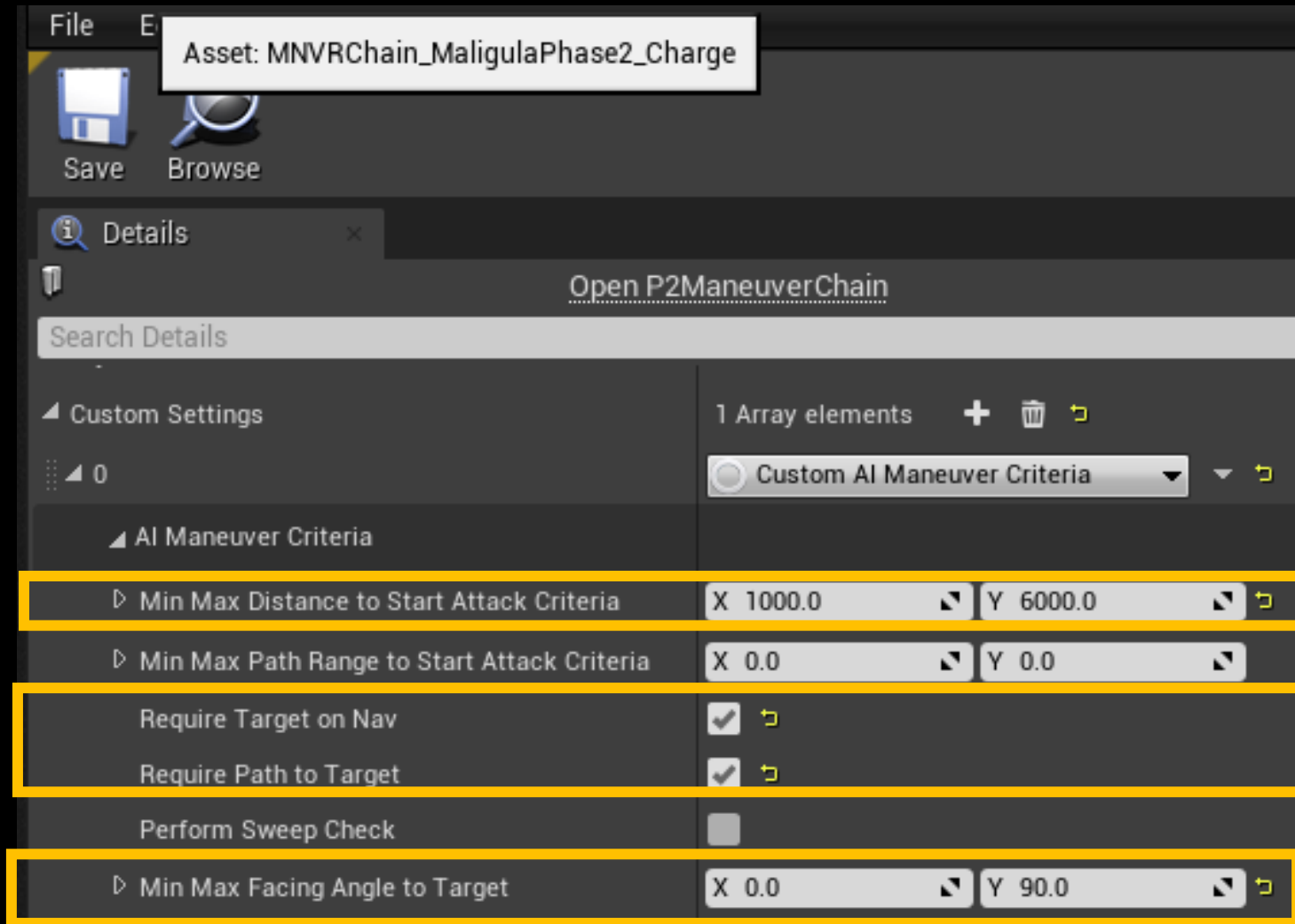
60.0

-1

Maligula Melee Attack Conditions



Maligula Charge Attack Conditions



Reusing Same Maneuvers

File Edit Asset View Help Asset Type: P2ProjectileAttack

Asset: MNVR_LuckyBoss_BombSpitLoop

Save Browse

Details

Open P2ProjectileAttack

Search Details

P2Projectile Attack

Projectile Class	PRJT_LuckyBossBomb
Number Of Projectiles	3
Projectile Spawn Socket Name	BombSocket
Should Attach to Socket	<input checked="" type="checkbox"/>
ShouldInstantSpawnAndLaunch	<input type="checkbox"/>
Spawn Delay	0.0
Animation Time	0.0
Projectile Type	Lobbed
Missile	
Lob with Constant Speed	
Arc Parameter (Lobbed Type)	0.77
Lob With Variable Speed	

File Edit Asset View Help Asset Type: P2ProjectileAttack

Asset: MNVR_MaligulaPhase2_WaterSnake_Strike

Save Browse

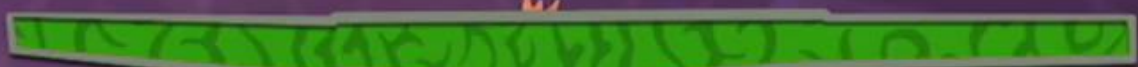
Details

Open P2ProjectileAttack

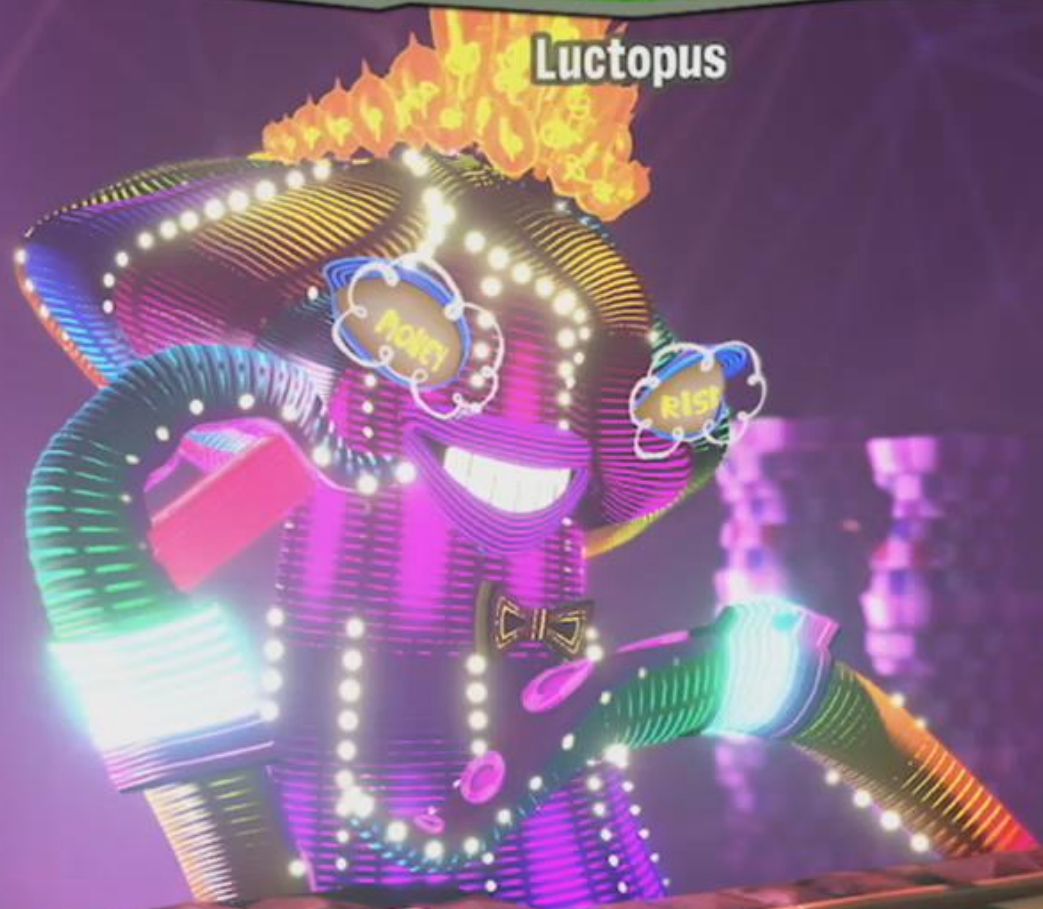
Search Details

P2Projectile Attack

Projectile Class	PRJT_MaligulaBoss_WaterSnake
Number Of Projectiles	3
Projectile Spawn Socket Name	WaterSnakeProjectileSocket
Should Attach to Socket	<input checked="" type="checkbox"/>
ShouldInstantSpawnAndLaunch	<input checked="" type="checkbox"/>
Spawn Delay	0.0
Animation Time	0.0
Projectile Type	Missile
Missile	
Launch Speed (Missile Type)	0.0
Lob with Constant Speed	
Lob With Variable Speed	



Luctopus



LB



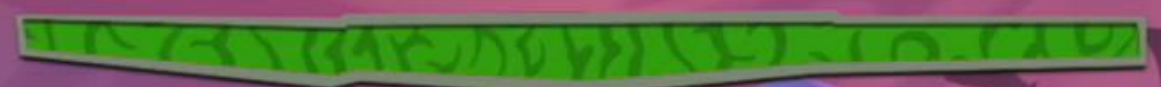
LT



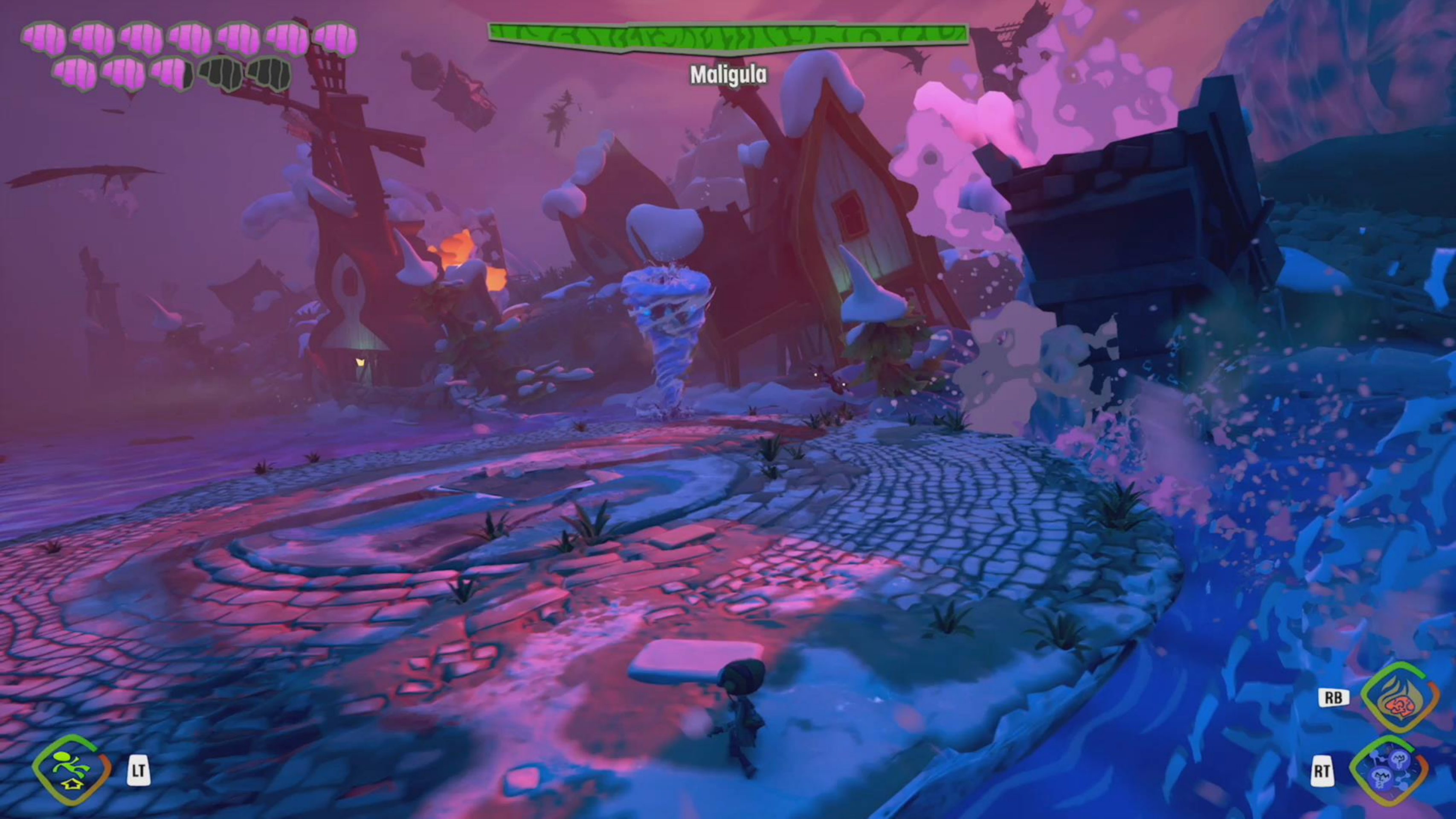
RB



RT



Maligula



LT

RB



RT



Tuning Attacks - Basic

Details

Open P2ProjectileAttack

Search Details

▲ P2Projectile Attack

Projectile Class

PRJT_LuckyBossBomb

← 🔍 + × ↻

Number Of Projectiles

3

↕ ↻

Projectile Spawn Socket Name

BombSocket

↻

Should Attach to Socket

☒

ShouldInstantSpawnAndLaunch

☐

Spawn Delay

0.0

↕ ↻

Animation Time

0.0

↕ ↻

Projectile Type

Lobbed

↻

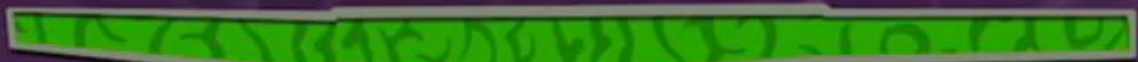
▶ Missile

▲ Lob with Constant Speed

Arc Parameter (Lobbed Type)

0.77

↕ ↻



Luctopus



Luctopus:

Ooh, you're in luck! This card comes with a free prize!

Tuning Attacks – More Difficult

Details

Open P2ProjectileAttack

Search Details

▲ P2Projectile Attack

Projectile Class

PRJT_LuckyBossBomb

Number Of Projectiles

5

Projectile Spawn Socket Name

BombSocket

Should Attach to Socket

☒

ShouldInstantSpawnAndLaunch

☐

Spawn Delay

0.0

Animation Time

0.0

Projectile Type

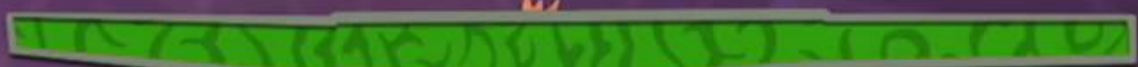
Lobbed

▶ Missile

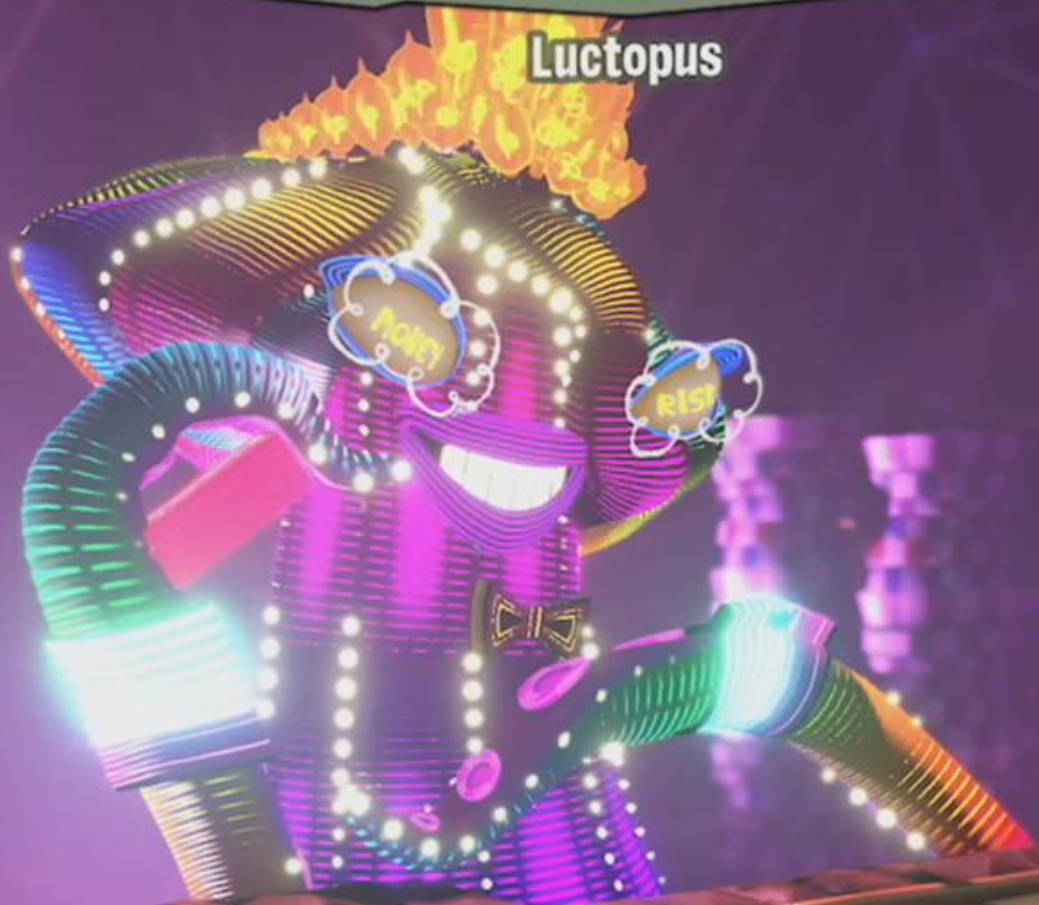
▲ Lob with Constant Speed

Arc Parameter (Lobbed Type)

0.5



Luctopus



LB



LT







RB













RT

Tuning Attack Conditions

 Open P2SpawnMinionsManeuver

Search Details   

▲ AI Maneuver Criteria	
▷ Min Max Distance to Start Attack Crite	X 0.0  Y 0.0 
Initial Cooldown	0.0 
Cooldown	0.0 
Cooldown Global	0.0 
Cooldown Maneuver Group	0.0 
Maneuver Group Name	None
Priority	2  
Only Allowed After These Maneuvers	0 Array elements  
Min Time Since All Minions Died	60.0  

Adjusting Timing of Attacks

Details

Open P2TimedManeuver

Search Details


P2Timed Maneuver

Animation Time

0.4

Dynamic Montage Data

Anim Sequence

 AN_Cassie_Boss_Attack_BeeSummon_2Telegraph

Slot Name

DefaultSlot

Blend In Time

0.0

Blend Out Time

0.0

In Play Rate

1.0

Loop Count

1

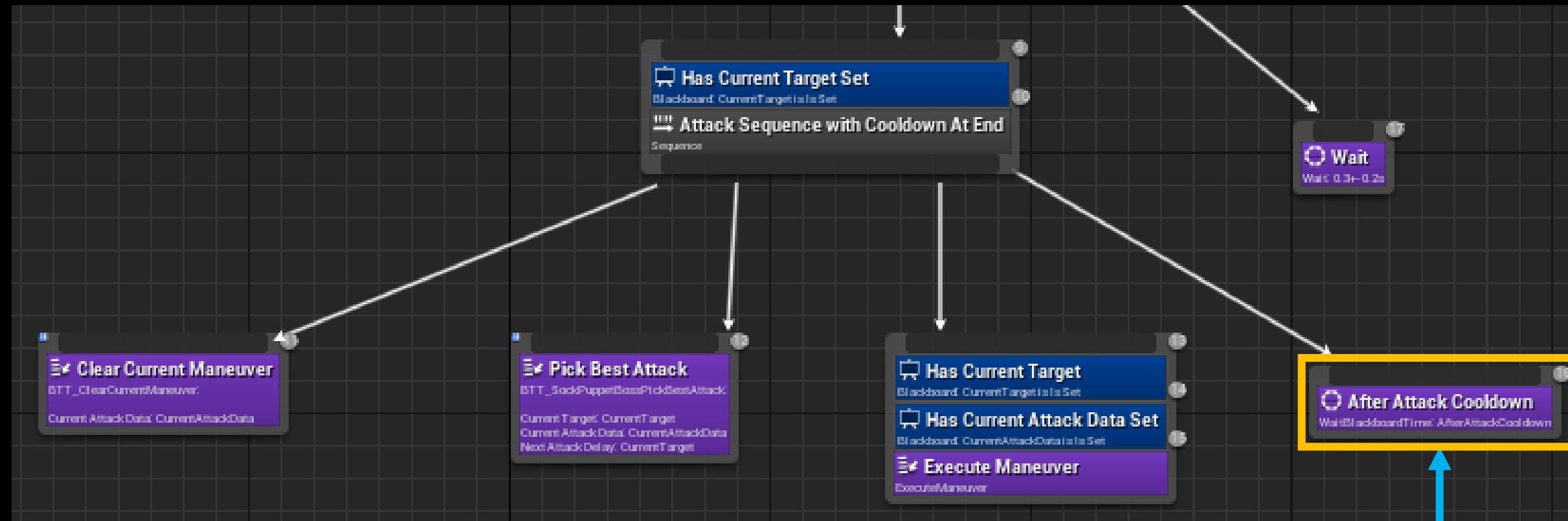
Blend Out Trigger Time

0.0

In Time To Start Montage At

0.0

Tuning Between Attacks Cooldown

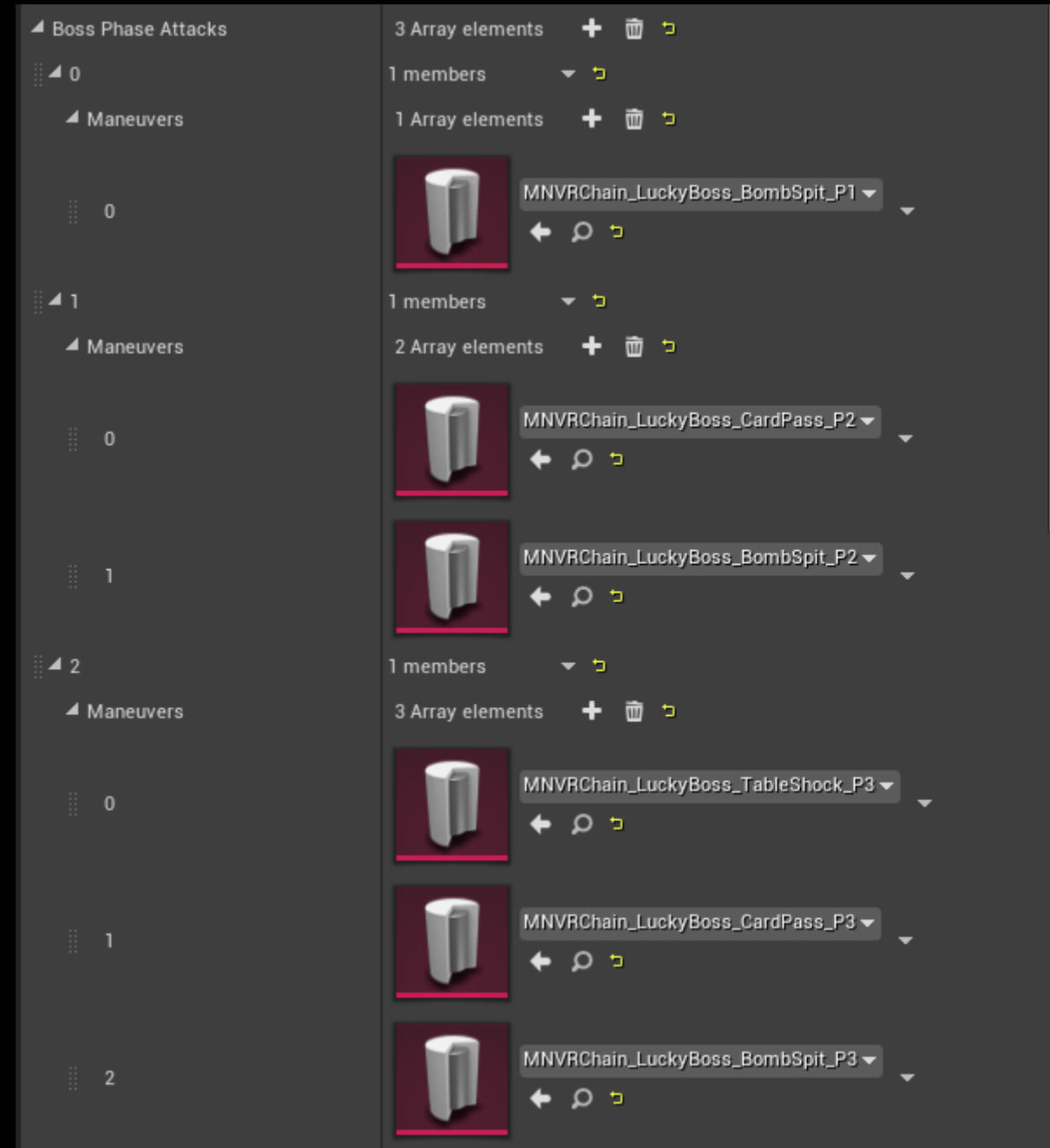


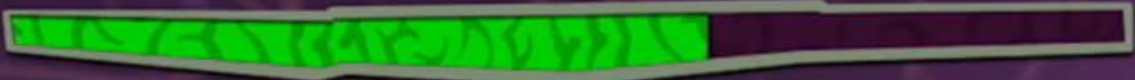
Psychonauts AI State

After Attack Cooldown

4.0

Adding Difficulty and Variety of Attacks Per Phase





Luctopus



LB



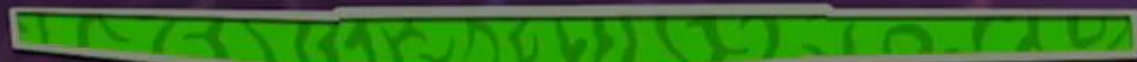
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RB



RT



6/100

16/106



Luctopus



LB



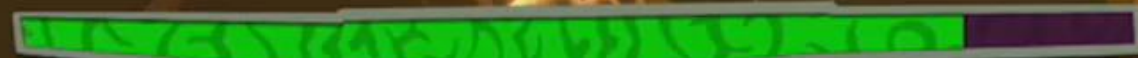
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RB



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Die-Brarian



LB



LT


RB



RT

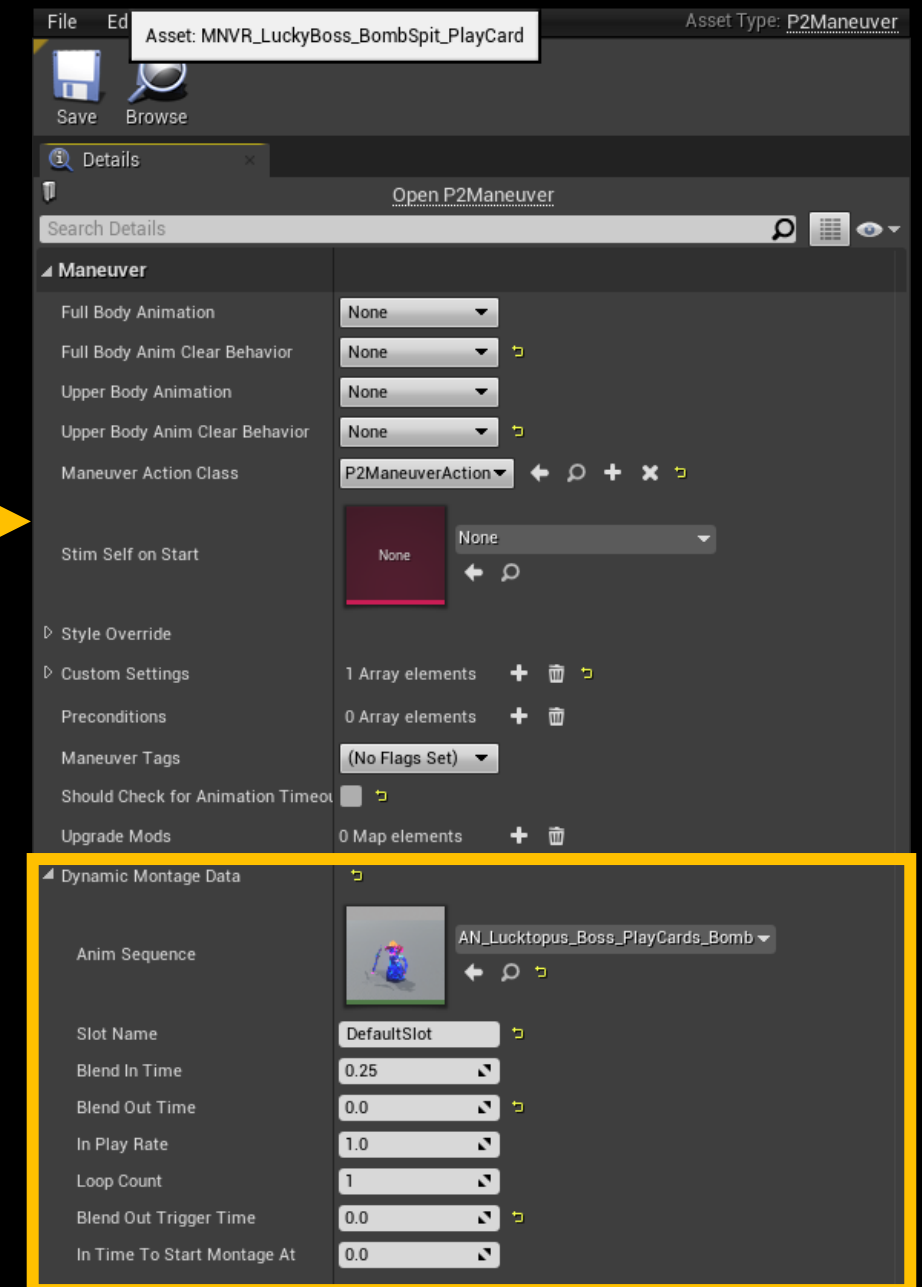
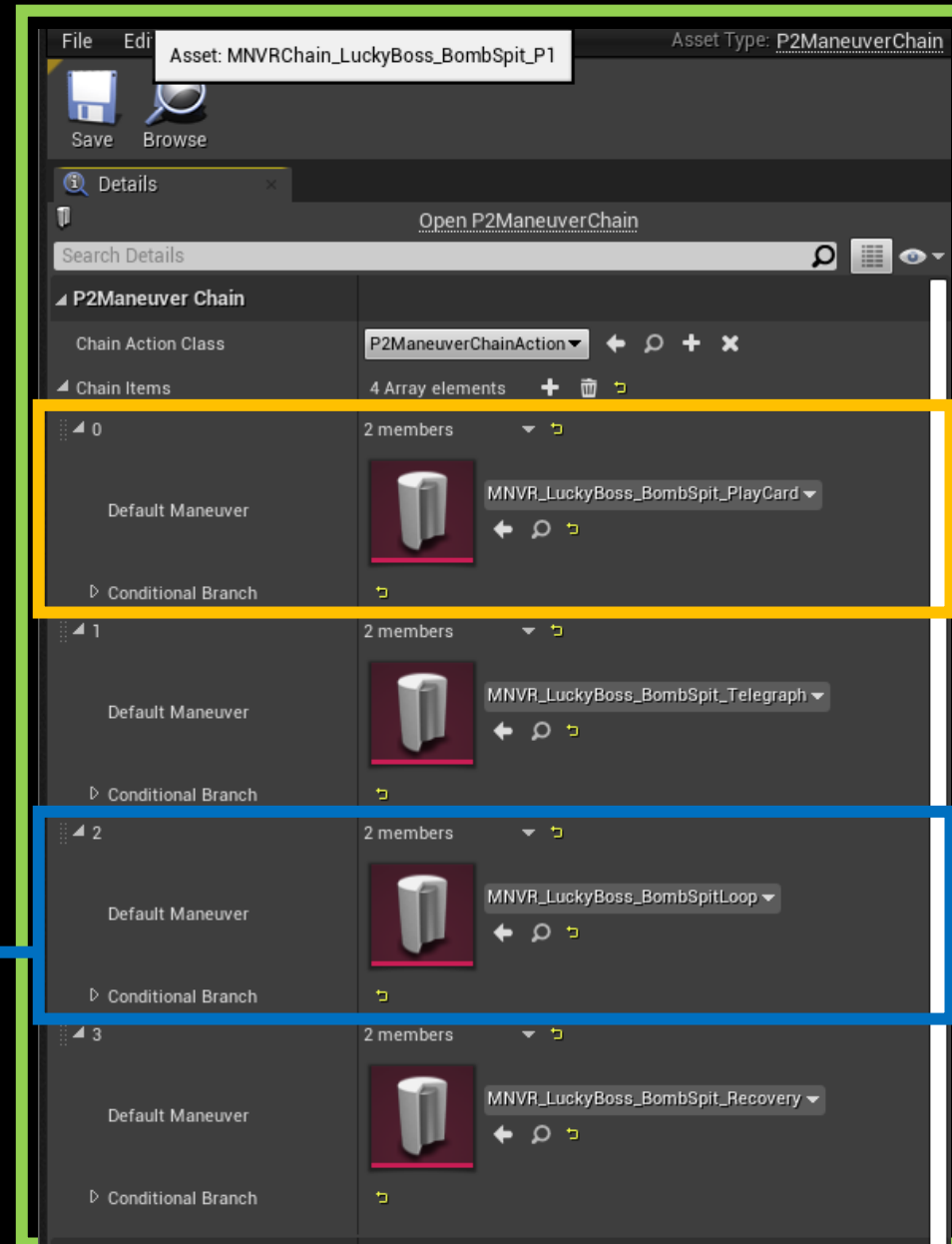
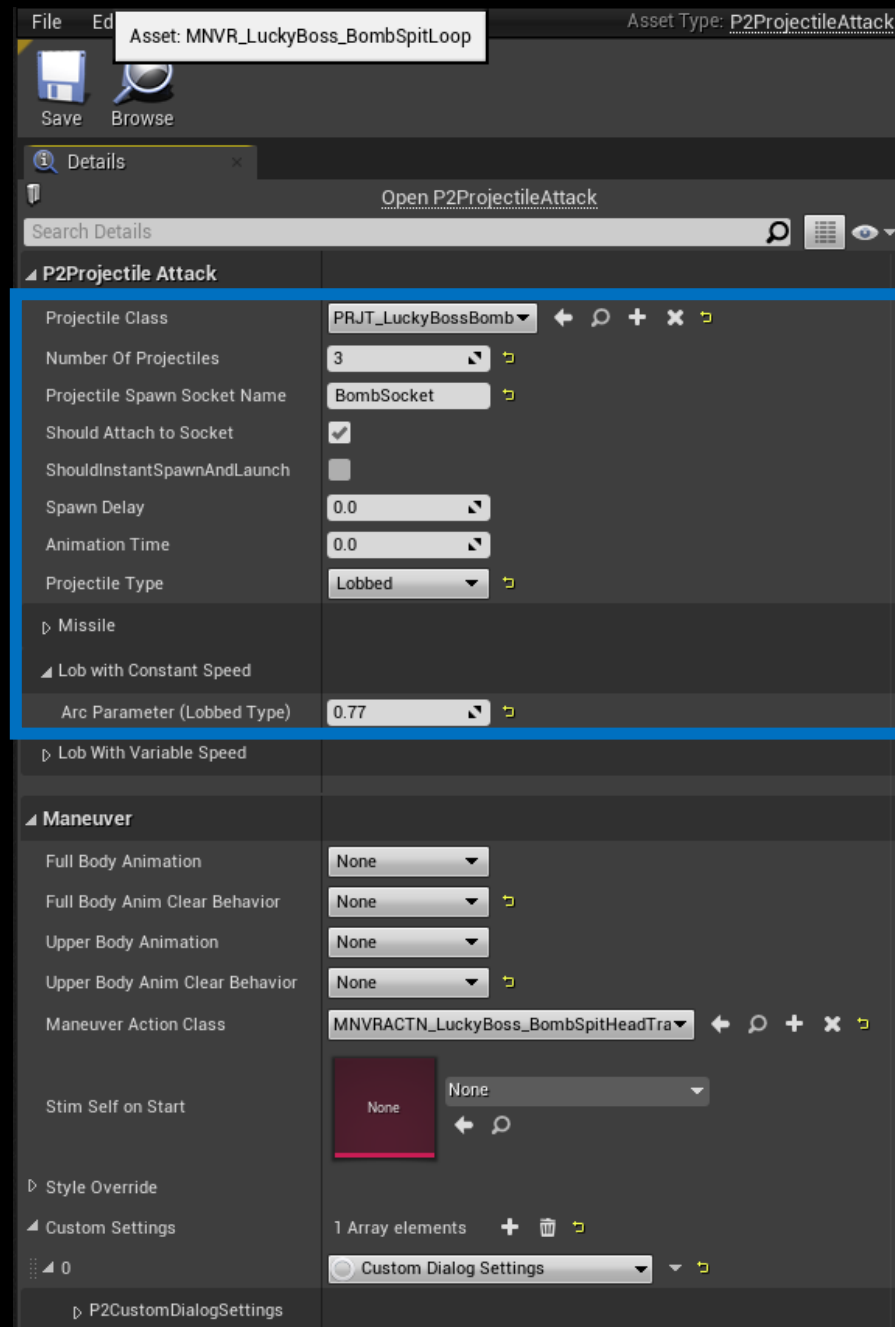


Support Character Assist as Maneuver

Maneuver Options	4 Array elements + -
0	2 members -
Conditions To Select	3 Array elements + -
0	<input type="radio"/> MANEUVER - Has Cooldown Expired? -
P2ConditionalManeuver_HasCooldownExpired	
Initial Cooldown	5.0 -
Cooldown	60.0 -
P2 Conditional	
1	<input type="radio"/> MANEUVER (Boss) - Has Any Minions Out? -
P2 Conditional	
Invert Condition	<input checked="" type="checkbox"/> -
2	<input type="radio"/> MANEUVER - Actor of Class Exists -
P2ConditionalManeuver_ActorOfClassExists	
Actor Class	CASS_CassieBoss_MurderProp - + - x
P2 Conditional	
Maneuver	 MNVR_MurderPropLaunch_Phase1 -



Simultaneous Team Collaboration



Postmortem – Placeholder Animation

- Remove the need for a placeholder animation
 - Could still have optional anim montage property




Postmortem – Maneuver Conditions

- Add/Remove maneuver conditions on each maneuver/maneuver chain

Custom Settings	
0	2 Array elements + -
AI Maneuver Criteria	Custom AI Maneuver Criteria -
Min Max Distance to Start Attack Criteria	X 0.0 Y 0.0
Min Max Path Range to Start Attack Criteria	X 0.0 Y 0.0
Require Target on Nav	
Require Path to Target	
Perform Sweep Check	
Min Max Facing Angle to Target	X 0.0 Y 180.0
Require LOS	
Requires Reservation	
Live Actor Type	CHR_BigFan_CassieBoss
Max Count Of Live Actor Type	1
Initial Cooldown	0.0
Cooldown	0.0
Cooldown Global	0.0
Cooldown Maneuver Group	0.0
Maneuver Group Name	None
Priority	2
Only Allowed After These Maneuvers	0 Array elements + -
Min Time Since All Minions Died	60.0
Max Number Of Minions	-1

Postmortem – Maneuver Anim Sequence

Dynamic Montage Data	
Anim Sequence	 AN_Lucktopus_Boss_Attack_Pass_Enter ▾ ← 🔍 ↻
Slot Name	DefaultSlot ↻
Blend In Time	0.0 🔍 ↻
Blend Out Time	0.0 🔍 ↻
In Play Rate	1.0 🔍
Loop Count	1 🔍
Blend Out Trigger Time	0.0 🔍 ↻
In Time To Start Montage At	0.0 🔍

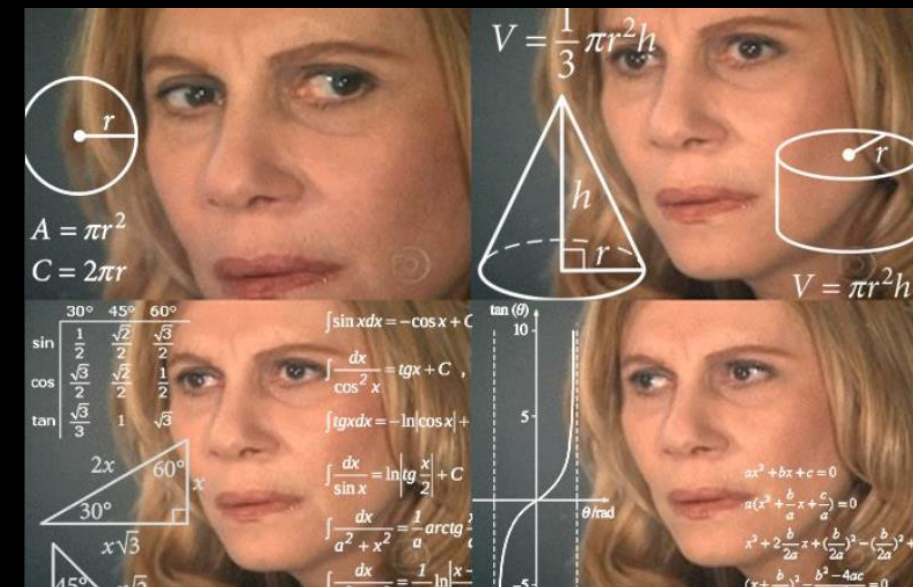
Why Use Maneuvers?

- Flexible designer friendly system ✓
- Simultaneous team collaboration ✓
- Boss responsiveness ✓
- Unique, challenging, and fun boss phases ✓
- Deliver dialog at appropriate times ✓
- Boss attack cooldowns ✓
- Support characters for Raz ✓
- Could be used for general boss fights ✓



Boss Programming Team Credits

- Boss Programming Team
 - Primary Programmer: Beca Vessal
 - Devin Kelly-Sneed (Maneuver system)
 - Chad Dawson (Boss spawner support, Maligula boss phase 3, Maligula boss level scripting support)
 - Aaron Jacobs (Camera support)
 - Matt Enright (Snakenado Maligula tornado attack)
 - Bert Chang (Enforcer enemy in Cassie boss)



Many Thanks!



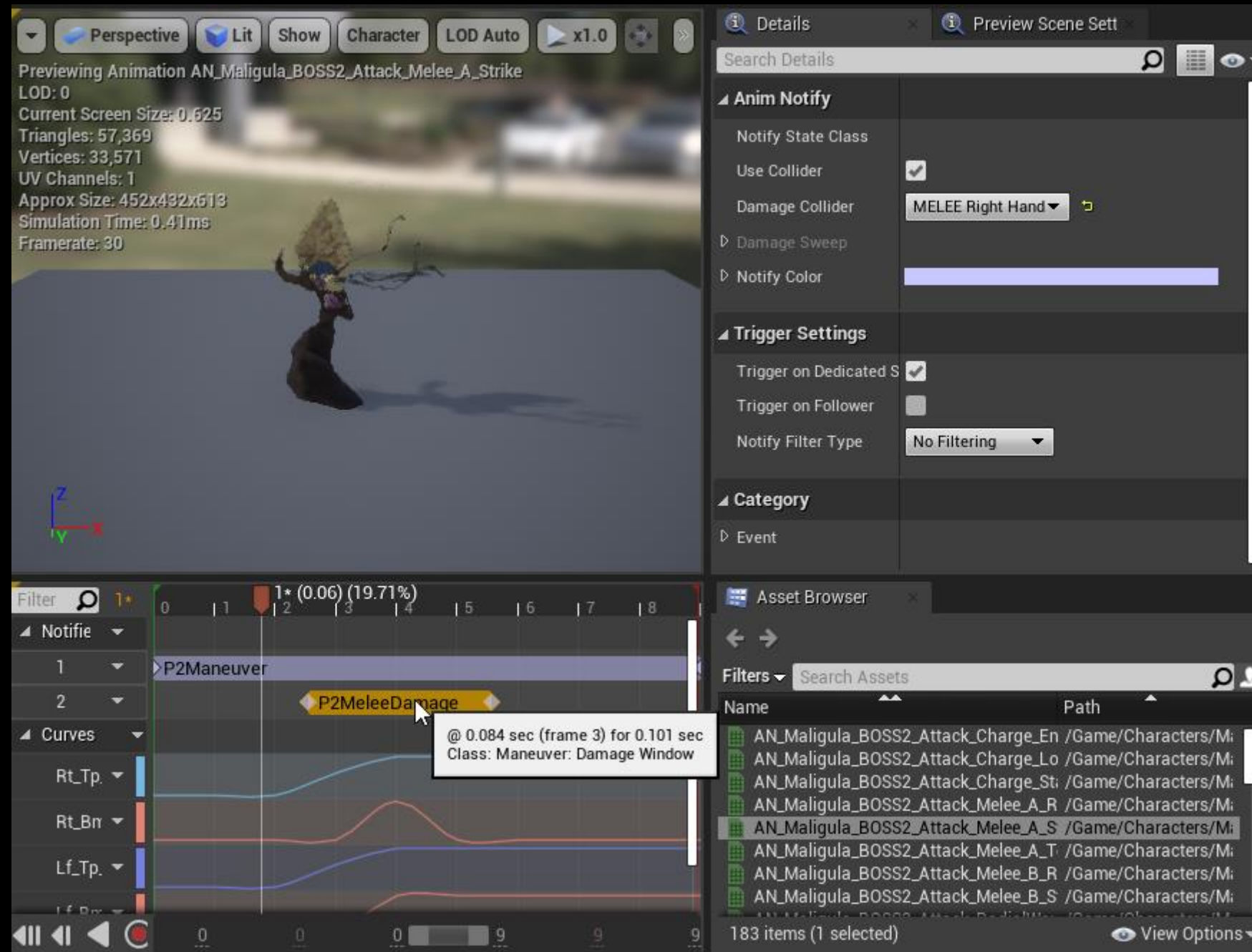
Contact

- Email: rebeccaVessal@doublefine.com
- Twitter: @IcyRagemora
- LinkedIn: Rebecca Vessal - [linkedin.com/in/rebecca-vessal/](https://www.linkedin.com/in/rebecca-vessal/)

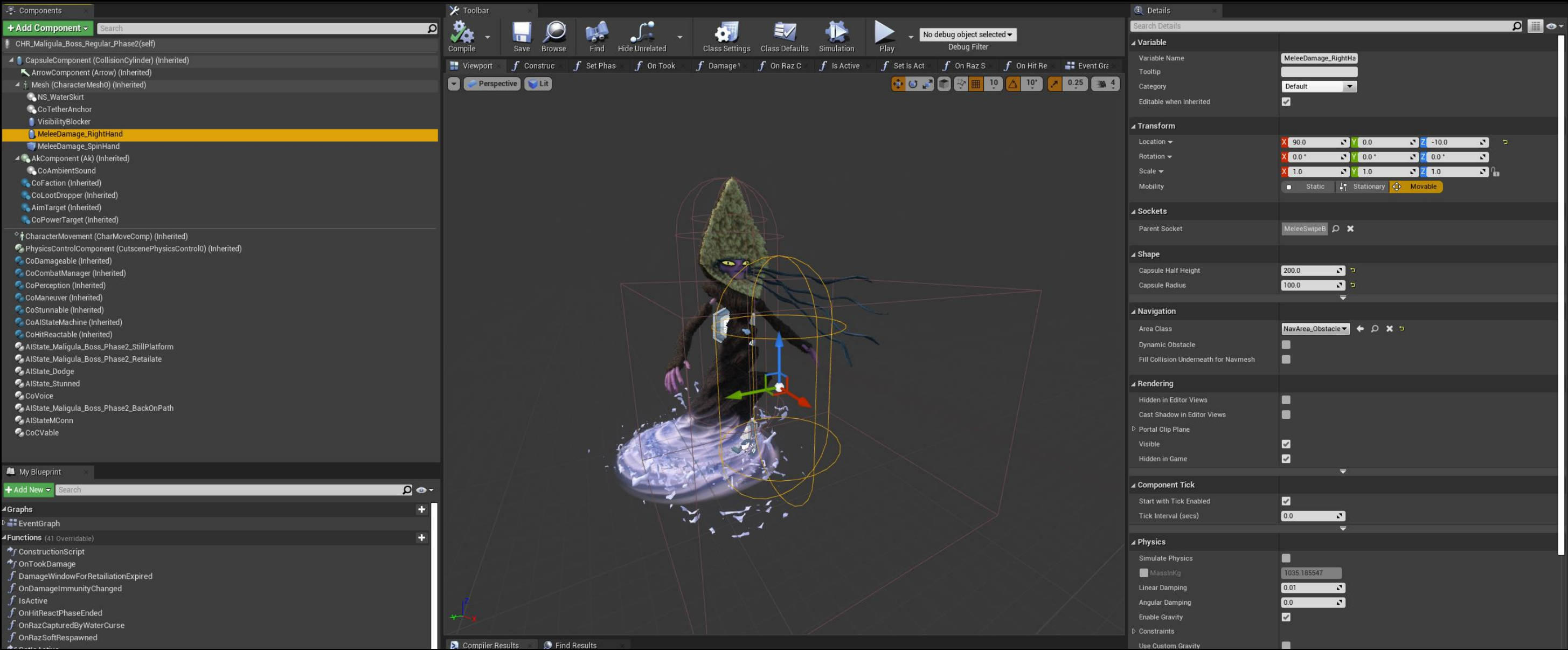


Appendix

Attack Damage Window



Attack Collider



Psychonauts 2 Boss Setup Guide

- Google Doc (View Only) link: https://docs.google.com/document/d/1ylo8XlFBFbgx-wXA3VFd_1wd339IDKOLwEappv2ejMk/edit?usp=sharing

