



An Introduction to SNP Testing

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Agenda



- Delta Genomics
- Microsatellites vs SNPs
- Transition Process, Challenges and Solutions
- SNP Advantages and Utility
- What happens to your samples at the lab?

Delta Genomics

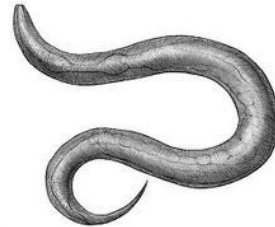


- Incorporated in 2011 as a Not-for-Profit Organization
- Spun-out of the University of Alberta on April 1, 2014
- 11 Current Employees
- Located in downtown Edmonton (the old Bay Building)



Delta Genomics

- Processed 42,564 samples in 2014
- Processed 36,315 samples in 2015
- Processed 12,651 samples in first quarter of 2016



DeltaGenomics



The Goal of Delta Genomics

To increase the **profitability, competitiveness,**
and **sustainability** of the Canadian Livestock
Industry

Introduction to DNA



- Made up of units called Base Pairs
- Four types of Base Pairs: A, T, G, C
- Mammals have roughly 3 billion base pairs



Introduction to DNA

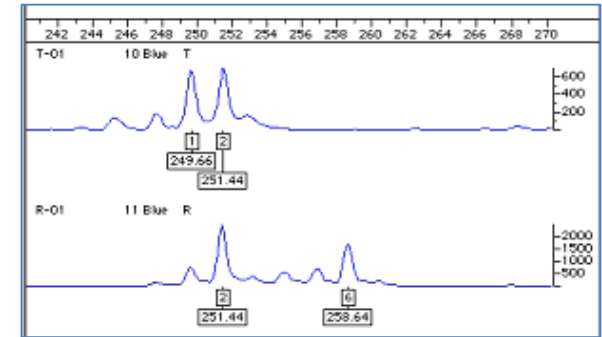
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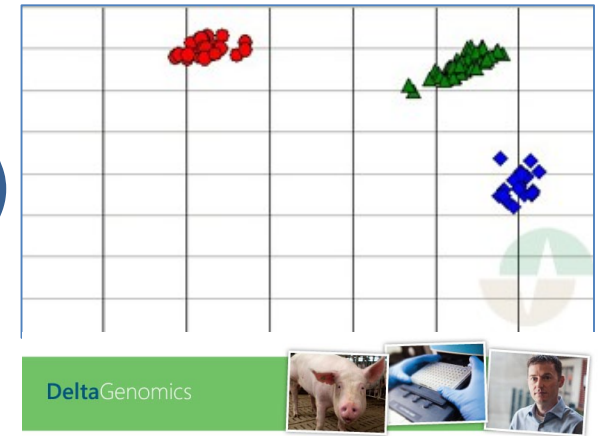
Paris Japonica: 149 Billion Base Pairs

DNA vs SNP Testing

Microsatellite testing = “DNA” Testing



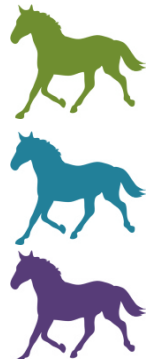
SNP Testing (also a type of DNA testing)



MicroSatellites



Microsatellites






	ATGC	ATGC	ATGC	ATGC	ATGC	20
	ATGC	ATGC	ATGC	ATGC		16
	ATGC	ATGC				8

Microsatellites tell us how large these repeated regions are: Measure of **SIZE**



SNPs

(Single Nucleotide Polymorphisms)

	A	T	T	G	C	A	A	G	T	T	A	G	C	C	A	G
	A	T	T	T	C	A	A	G	T	T	A	G	C	C	A	G
	A	T	T	G	C	A	A	G	T	T	A	G	C	A	A	G

SNPs tell us which Base Pair is at a specific location in the DNA: Measure of **DNA CONTENT**

Microsatellite to SNP Transition

Microsatellite Testing

- Parentage
- 12-30 markers

Basic SNP Testing

- Parentage
- 95-120 markers

High Density SNP Testing

- Parentage
- Establish Genetic Evaluation Program
- Prolific animals with EPDs

Low Density SNP Testing

- Parentage
- Use Genetic Evaluation Program
- Animals with EPDs



SNP Transition Challenges

1. Transition Costs

- A subset of animals will require two laboratory tests:
 - Old sires and dams are SNP tested, or
 - New animals are both DNA and SNP tested
- Programming changes to databases

2. Database Configuration

- Databases that are currently setup to receive 12-30 markers per animal will need programming updates

3. Genetic Evaluation Program Establishment

- Specialized geneticists are required to establish genetic evaluation calculations for each breed
- Genetic information and measured traits are required!

SNP Transition Solutions

1. The application of genomics to agricultural industries has been, and continues to be, funded by many agencies
2. Databases and interfaces are becoming much more user friendly and flexible to changing technologies
3. Once the data is compiled, development of the genetic evaluation calculations is straight-forward for the geneticists

SNP Transition Advantages

Pros

Cons

Genetic Evaluations

Combination Testing

More Accurate
Parentage

Cheaper Parentage

Database
Programming

SNP Transition Costs



SNP Utility - Parentage



- Cheaper parentage
- More accurate parentage
- Global parentage searches



SNP Utility – Conditions & Traits



SNP Utility – Genetic Evaluation

- A tool for selecting sires and dams that match your breeding goals
 - Increased bottom line without increased labour
 - Create efficiencies
 - Environmentally friendly
 - Low maintenance herd
 - Animal Welfare
 - World leader in production
 - Show winners



Genetic Evaluation as a Tool

- Expected Progeny Differences (EPDs) are Economically Relevant Traits that are already measured
 - Birth Weight
 - Calving Ease
 - Weaning/Yearling Weights
 - Milk Production
 - Carcass Traits
 - Residual Feed Intake



Genetic Evaluation as a Tool

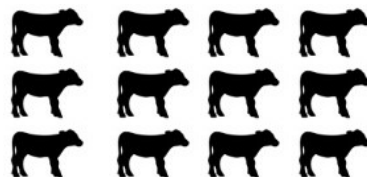
- *Caveat Emptor!*
- The accuracy of EPDs is vital to making the best decisions that align with your goals
- Without genomics, EPD accuracy is increased as more progeny EPDs are recorded in the pedigree



Acc = Low



Acc = Mid



Acc = High



Genetic Evaluation as a Tool

Accuracy Effects Possible/Predicted Outcomes

Accuracy %	Birth Weight	Wean Weight	Milk Production
10%	± 2.4	± 10.4	± 8.7
30%	± 1.8	± 8.1	± 6.8
50%	± 1.3	± 5.8	± 4.9
75%	± 0.8	± 2.9	± 2.4
90%	± 0.3	± 1.2	± 1.0



Genetic Evaluation as a Tool

EPDs + Genomics = Genomically-Enhanced EPDs (gEPDs)

- Genomics increases the accuracy of EPDs earlier in the animal's life so better breeding decisions that align with your goals can be made sooner



DeltaGenomics



Genetic Evaluations - Production

Day 43

Day 57

Day 71

Day 85

1957



2003



Genetic Evaluations – Feed Efficiency

Past Success in feed efficiency (Plastow 2012)

1972



836 pounds



220 pounds

FCR: 3.8



32%

2007



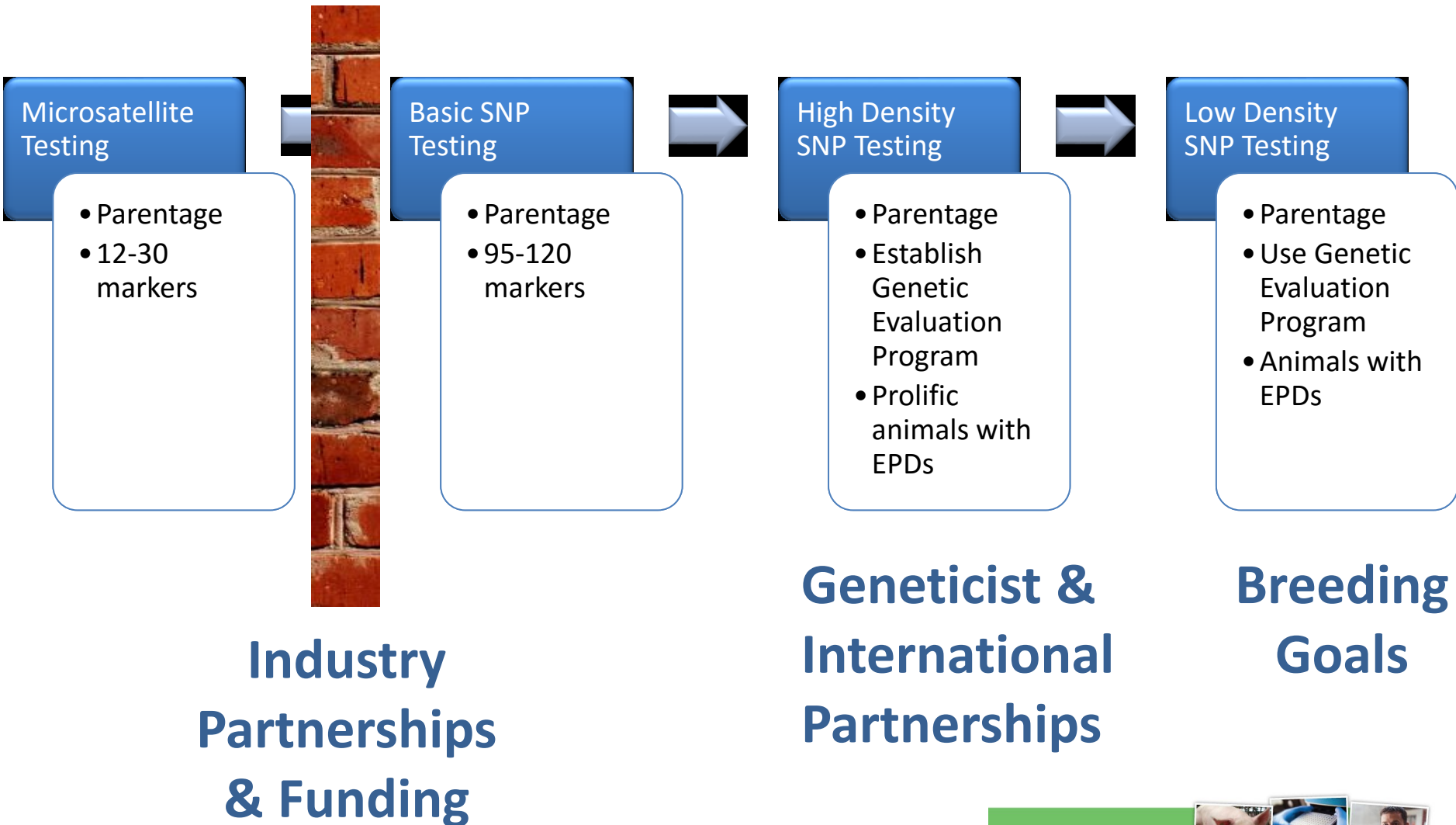
715 pounds



275 pounds

FCR: 2.6

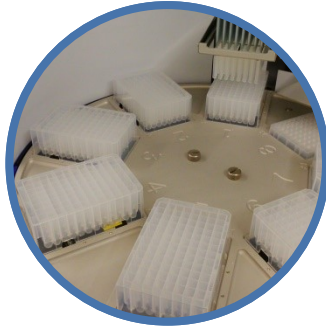
Microsatellite to SNP Transition



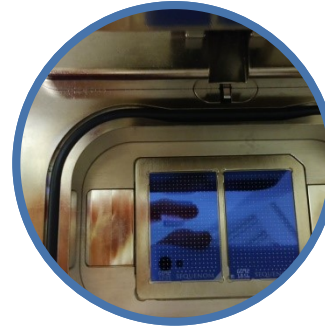
SNP Lab: The Process



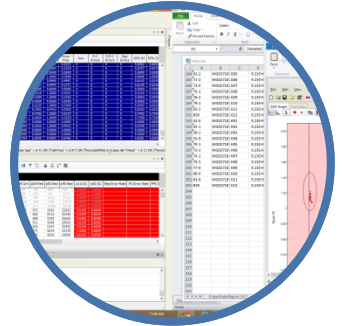
Sample
Inventory



DNA
Extraction



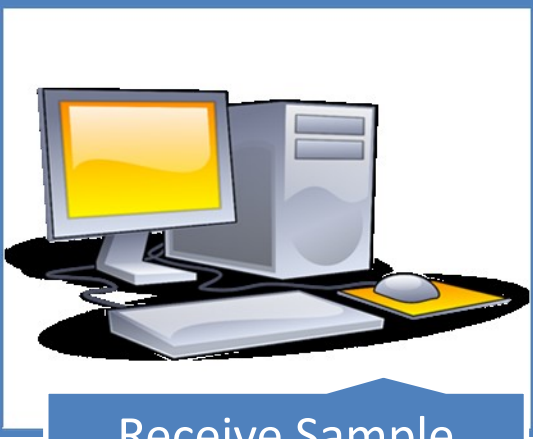
SNP
Genotyping



Data
Analysis



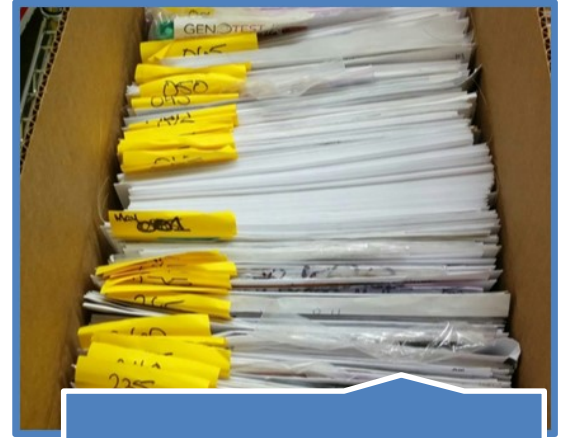
1-2 Days



Receive Sample Information

[illegible]

Match Samples to Test Requests

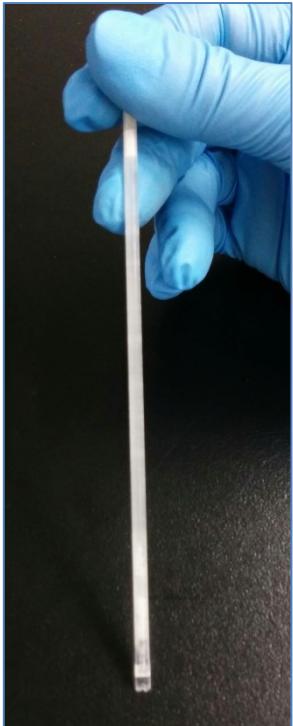


Store Samples



Sample Types

The Good

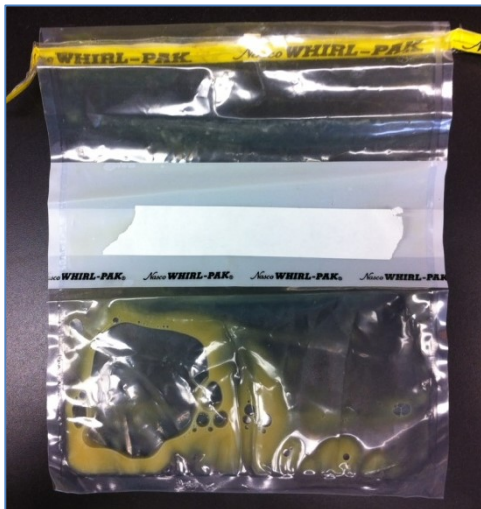
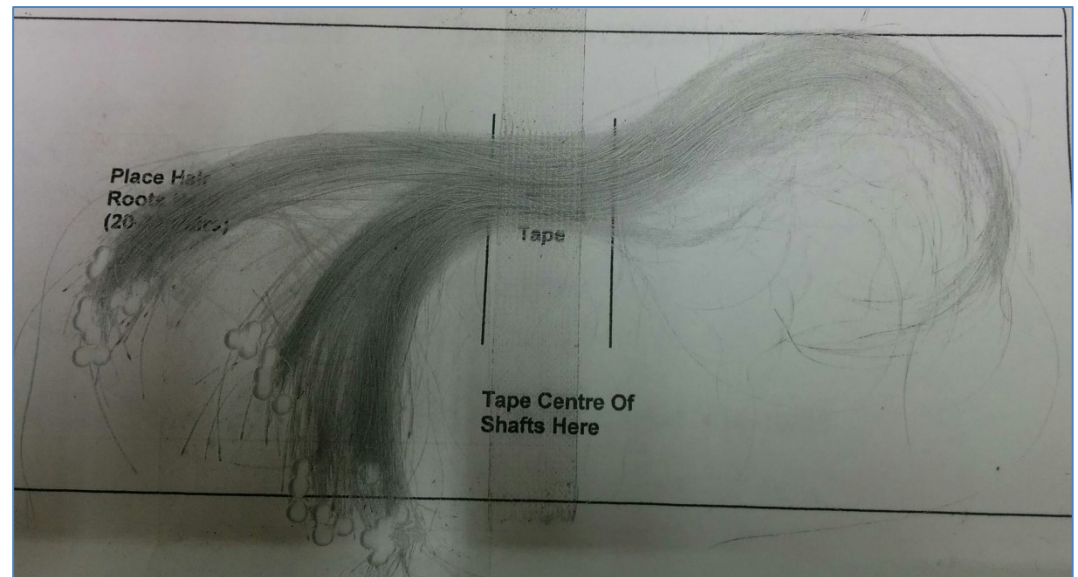


DeltaGenomics



Sample Types

The Bad



2. DNA Extraction

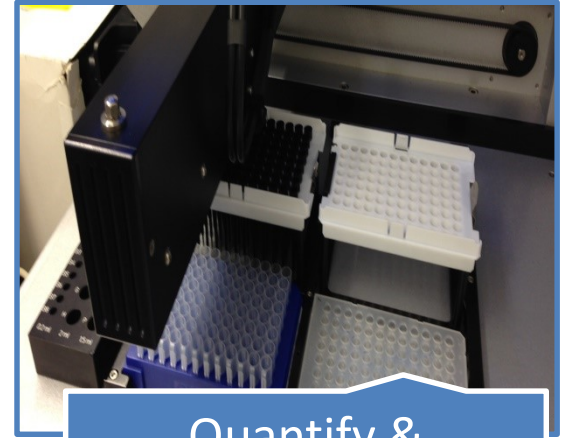
2-3 Days



Clean & Cut



Digest & Extract



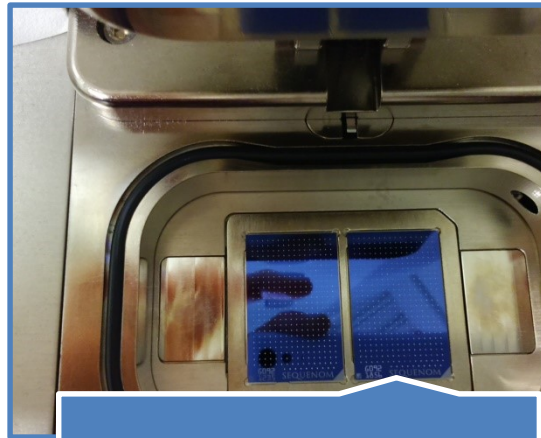
Quantify & Normalize

3. SNP Genotyping

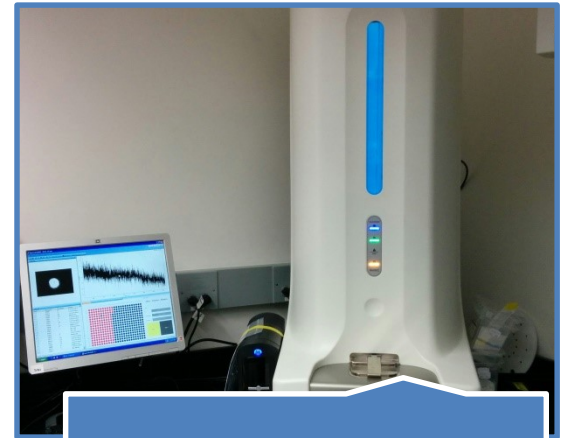
Basic Parentage: 2-3 Days



192 Animals



SpectroChip



Chip Scanning

3. SNP Genotyping

High or Low Density: 3 Days



96 Animals



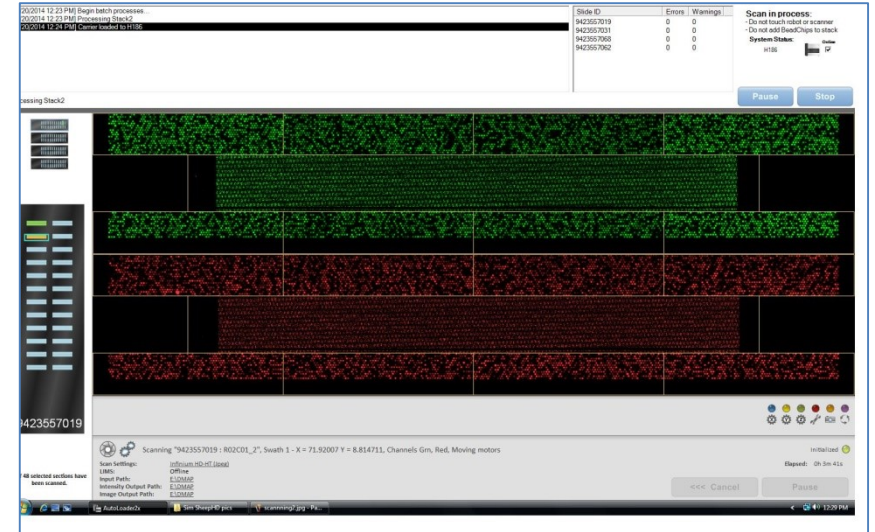
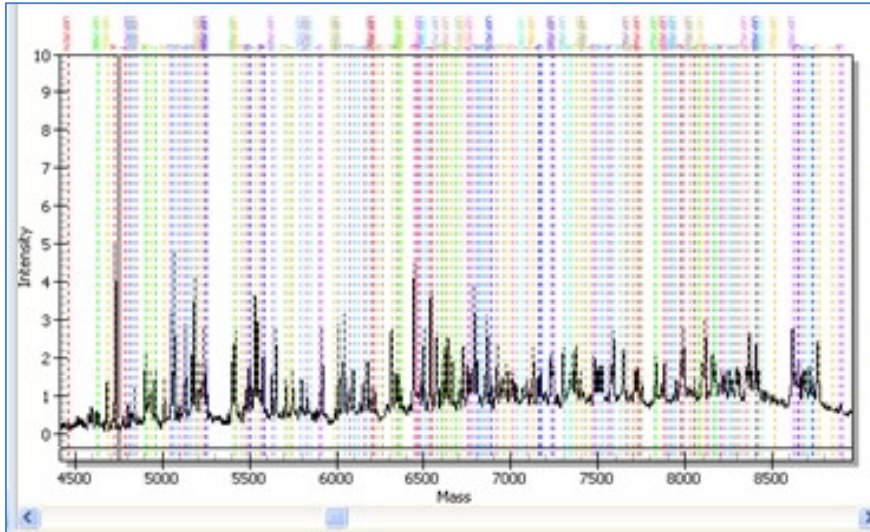
BeadChip



Chip Scanning

4. Data Analysis: Part 1

1-2 Days



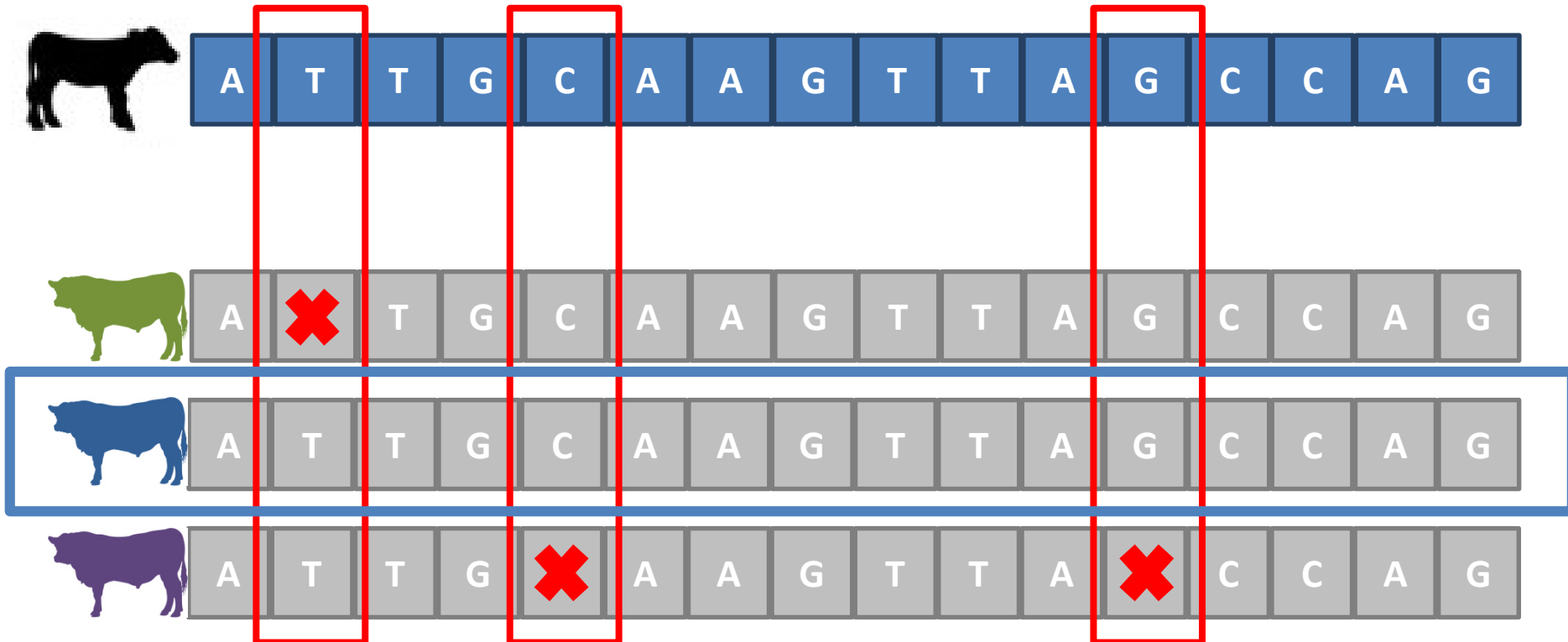
↓ SNPs

A T T G C A A G T T A G C C A G

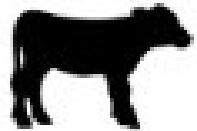


4. Data Analysis: Part 2

1-2 Days



4. Data Analysis: Part 2



A	T	T	G	C	A	A	G	T	T	A	G	C	C	A	G
A	T	T	G	C	A	A	G	T	T	A	G	C	C	A	G



Genomics





Thank-you!

