

Fluorine testing of prepared ski bases

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Background

- Fluorinated waxes
 - Increased water and dirt repellency
 - Lower friction – faster skis
- Health risk
- Environmental problems
- Very expensive



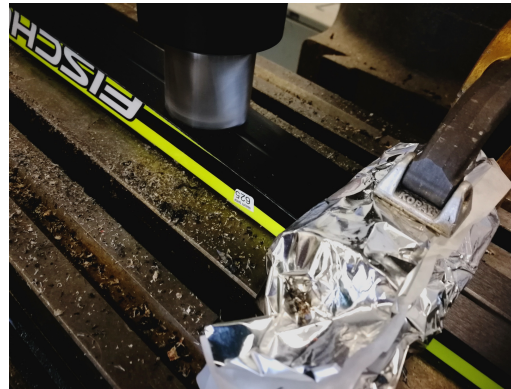
Swix

CH6 ca. 8kr (fluorine free glider)
LF6 ca. 16kr (low fluorine glider)
HF6X ca. 80kr (high fluorine glider)
FC6X ca. 300kr (fluorine powder)

Preparation of test samples



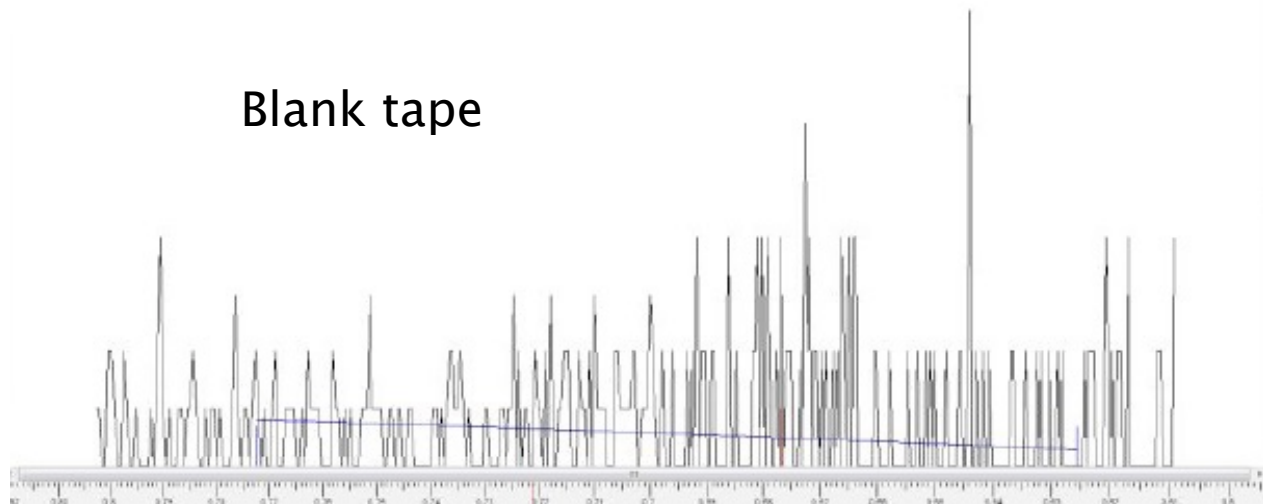
| Sample ID | Type of Wax |
|----------------------|------------------|
| Sample P1_1 and P1_2 | clean (as blank) |
| Sample P1_1 and P1_2 | CH wax |
| Sample P1_1 and P1_2 | HF wax |
| Sample P1_1 and P1_2 | HF + FP wax |
| Sample P1_1 and P1_2 | HF + FP + LF wax |
| Sample P1_1 and P1_2 | HF + FP + Ga wax |



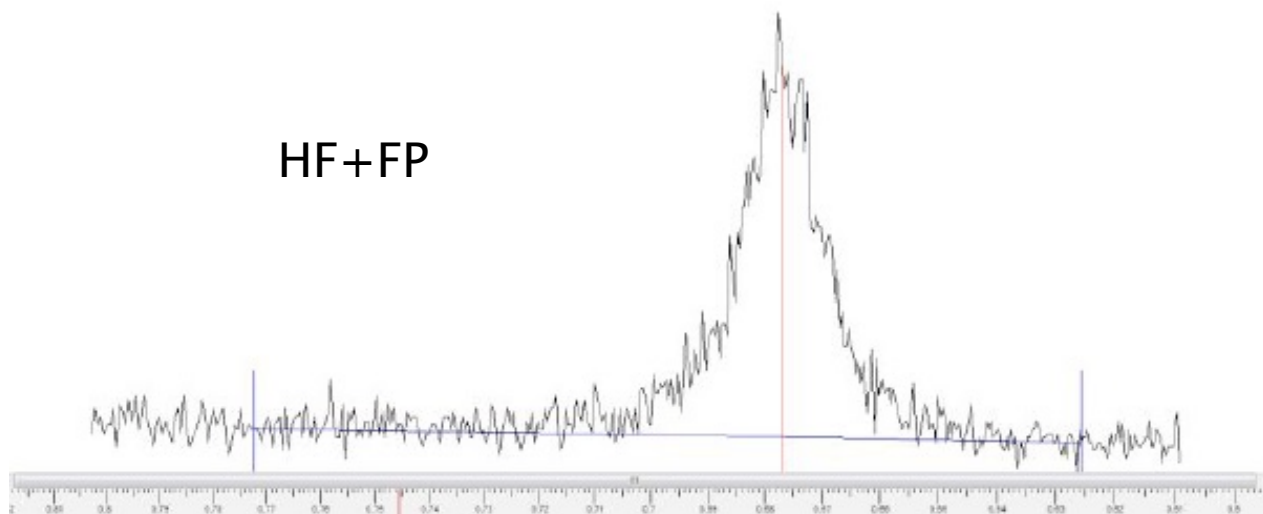
Transfer technique



Blank tape



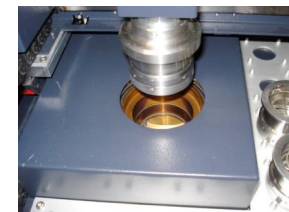
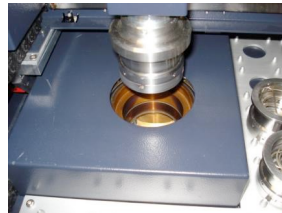
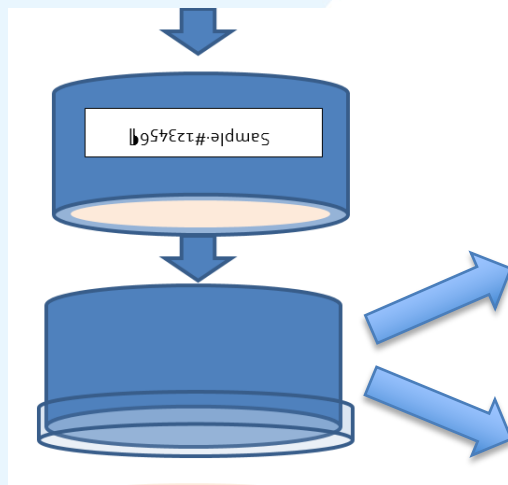
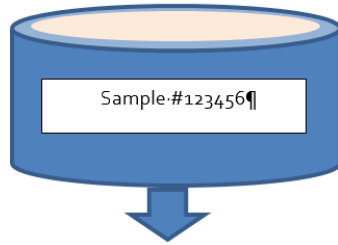
HF+FP



First results

- Proper and secure identification of skis with fluorinated ski wax
- Signal intensity correlated to fluorine content
- Direct method
 - + Best sensitivity
 - + Detect all surface fluorine
 - Modification of instrument required
- Transfer method
 - Lower sensitivity
 - Detect removable fluorine
 - + No instrument modification

Transfer method



Development of sampler



















Calibration of sampler





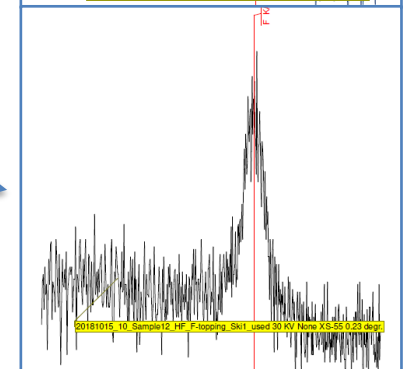
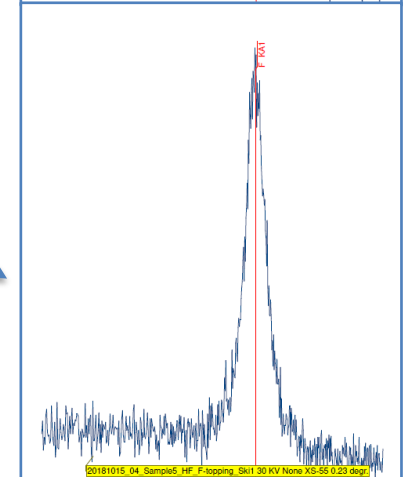
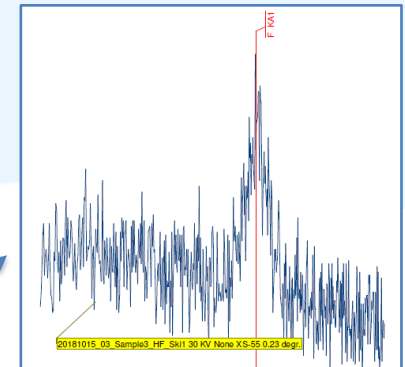


Overnight transfer to Fraunhofer, Freising

|  Waybill: 6479350861 Signed for by: HECKMAIR | | Friday, October 12, 2018 at 10:37 Origin Service Area: > GARDERMOEN - KJELLER - NORWAY Destination Service Area: > MUNICH - FREISING - GERMANY | |  1 Piece |
|--|--|---|-------|---|
| Friday, October 12, 2018 | | Location | Time | Piece |
| 17 | Delivered - Signed for by: HECKMAIR | FREISING | 10:37 |  1 Piece |
| 16 | With delivery courier | MUNICH - GERMANY | 07:54 |  1 Piece |
| 15 | Arrived at Delivery Facility in MUNICH - GERMANY | MUNICH - GERMANY | 07:07 | |
| 14 | Departed Facility in MUNICH - GERMANY | MUNICH - GERMANY | 06:32 |  1 Piece |
| 13 | Processed at MUNICH - GERMANY | MUNICH - GERMANY | 06:22 |  1 Piece |
| 12 | Arrived at Sort Facility MUNICH - GERMANY | MUNICH - GERMANY | 06:05 |  1 Piece |
| 11 | Departed Facility in LEIPZIG - GERMANY | LEIPZIG - GERMANY | 04:42 |  1 Piece |
| 10 | Processed at LEIPZIG - GERMANY | LEIPZIG - GERMANY | 01:49 |  1 Piece |
| 9 | Arrived at Sort Facility LEIPZIG - GERMANY | LEIPZIG - GERMANY | 01:35 |  1 Piece |
| 8 | Clearance processing complete at LEIPZIG - GERMANY | LEIPZIG - GERMANY | 01:26 | |
| 7 | Customs status updated | LEIPZIG - GERMANY | 00:13 | |
| Thursday, October 11, 2018 | | Location | Time | Piece |
| 6 | Departed Facility in COPENHAGEN - DENMARK | COPENHAGEN - DENMARK | 23:49 |  1 Piece |
| 5 | Transferred through COPENHAGEN - DENMARK | COPENHAGEN - DENMARK | 23:49 |  1 Piece |
| 4 | Departed Facility in OSLO - NORWAY | OSLO - NORWAY | 21:06 |  1 Piece |
| 3 | Processed at OSLO - NORWAY | OSLO - NORWAY | 20:55 |  1 Piece |
| 2 | Arrived at Sort Facility OSLO - NORWAY | OSLO - NORWAY | 18:07 |  1 Piece |
| 1 | Shipment picked up | GARDERMOEN - NORWAY | 10:38 |  1 Piece |

First Calibration Results

| Glider type | Ski | Response in KCps |
|-------------------|---------------|------------------|
| CH Ski1 | Unused ski | 0,00 |
| CH Ski2 | Unused ski | 0,00 |
| HF Ski1 | Unused ski | 0,08 |
| HF+F-topping Ski1 | Unused ski | 0,22 |
| HF+F-topping Ski2 | Unused ski | 0,16 |
| Field blank | No ski | 0,00 |
| CH Ski1 | Ski used 5 km | 0,00 |
| CH Ski2 | Ski used 5 km | 0,00 |
| HF Ski1 | Ski used 5 km | 0,00 |
| HF+F-topping Ski1 | Ski used 5 km | 0,07 |
| HF+F-topping Ski2 | Ski used 5 km | 0,07 |
| Field blank | No ski | 0,00 |



Costs

| | |
|------------------------------------|-------------|
| Design and production of samplers: | NOK 150 000 |
| Calibration | NOK 136 000 |
| First Field Test | NOK 176 200 |
| Total | NOK 462 200 |

| | |
|----------------------------------|-----------|
| Price per sample (analysis only) | NOK 1 100 |
|----------------------------------|-----------|

Additional costs for sampling and sample transfer

F-testing seems expensive, but:

| | |
|-------------------------|-----------|
| One box of fluor powder | NOK 1 299 |
|-------------------------|-----------|

| | |
|------------------------------------|-----------|
| Rental prepping area (smøreplass): | NOK 9 500 |
|------------------------------------|-----------|

| | |
|--------|-------------|
| Ski-TV | NOK 700 000 |
|--------|-------------|

Reduced reputation for Cross Country Skiing as a “Clean” activity