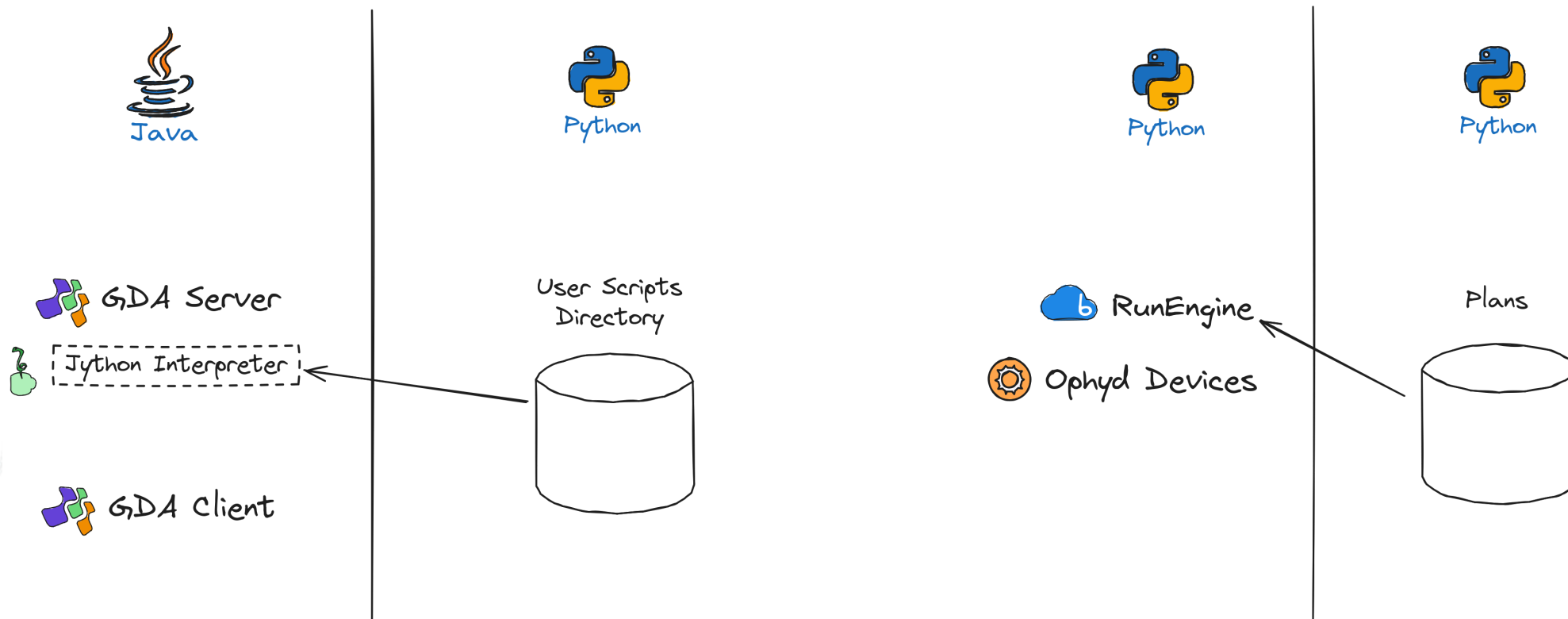


Python as a Statically Typed Language

Callum Forrester

GDA and Bluesky

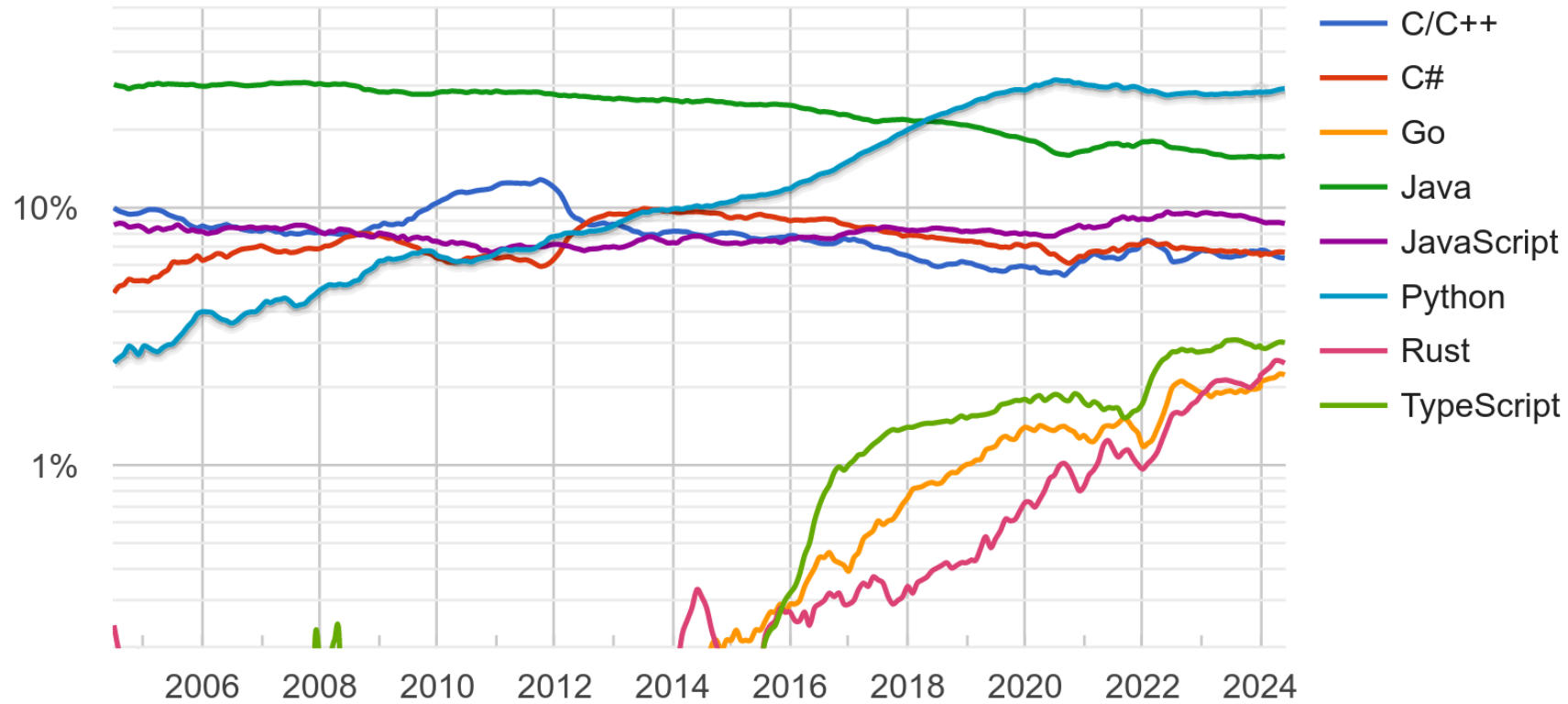


Modern Python

```
def evens(values: list[int]) -> Iterable[int]:  
    return (value for value in values if value % 2 == 0)
```

```
a = list(evens([1, 2, 3, 4]))[0]  
b = evens([1, 2, 3, 4])[0] # Error!  
c = evens(2) # Error!
```

PYPL Popularity of Programming Language



<https://pypl.github.io/PYPL.html>

Diamond Project Template



PYRIGHT



DevContainers



GitHub

<https://github.com/DiamondLightSource/python-copier-template>

Opt-Out

Pyright

```
def squared(x: float | None) -> float:  
    return x * x
```

```
>> Operator "*" not supported for types "float | None" and "float | None"
```

Java

```
float squared(Optional<Float> x) {  
    return x * x;  
}
```

```
>> Operator '*' cannot be applied to 'Optional<Float>'
```

Pyright in Strict Mode

- <https://github.com/DiamondLightSource/bluesky-stomp>
- <https://github.com/bluesky/scanspec>

Type Annotations Required

```
- def calculate(self, bounds=True, nested=False) -> list[Frames[Axis]]:  
+ def calculate(self, bounds: bool = True, nested: bool = False) -> list[Frames[Axis]]:  
    raise NotImplementedError(self)
```

<https://github.com/bluesky/scanspec/pull/143>

Generics Required

```
- def _make_schema(members: tuple[type, ...], handler):  
+ def _make_schema(members: tuple[type[Any], ...], handler: Callable[[Any], CoreSchema]) -> dict[str, CoreSchema]:  
    return {member.__name__: handler(member) for member in members}
```

<https://github.com/bluesky/scanspec/pull/143>

Type Narrowing

```
- def if_instance_do(x: Any, cls: type, func: Callable):  
+ def if_instance_do(x: Any, cls: type[C], func: Callable[[C], T]) -> T:  
    if isinstance(x, cls):  
        return func(x)  
    else:  
        return NotImplemented
```

<https://github.com/bluesky/scanspec/pull/143>

Type Narrowing

```
- def if_instance_do(x: Any, cls: type[Any], func: Callable[..., Any]) -> None:  
+ def if_instance_do(x: Any, cls: type[C], func: Callable[[C], T]) -> T:  
  if isinstance(x, cls):  
    return func(x)  
  else:  
    return NotImplemented
```

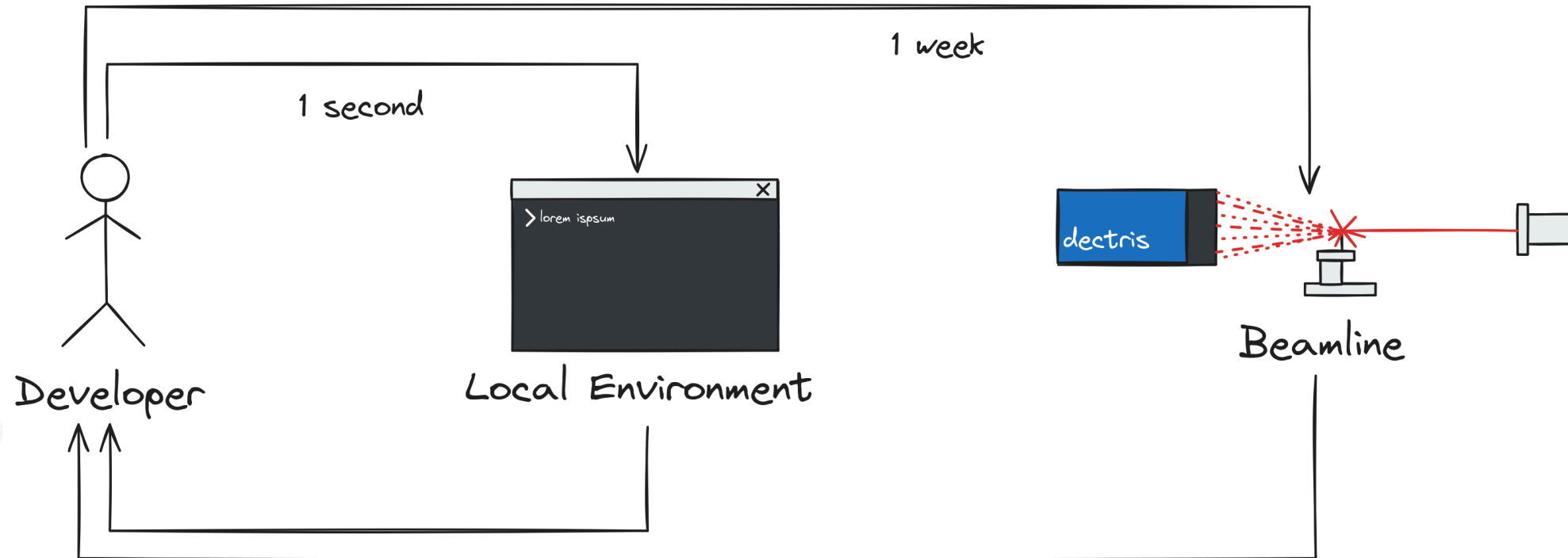
<https://github.com/bluesky/scanspec/pull/143>

Type Narrowing

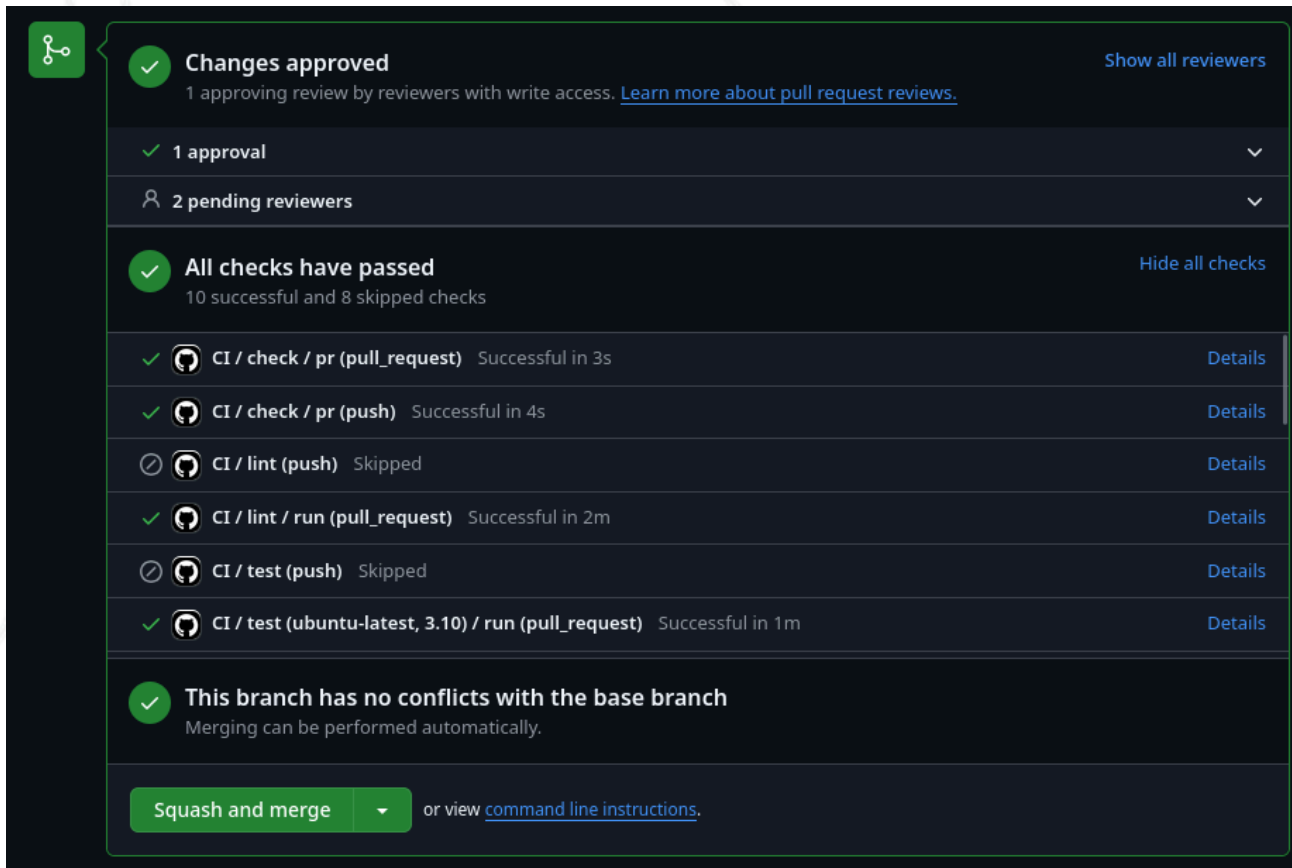
```
- def zip(self, other: Spec[Any]) -> Zip[T]:  
+ def zip(self, other: Spec[U]) -> Zip[T | U]:  
  return Zip(self, other)
```

<https://github.com/bluesky/scanspec/pull/143>

Pros: Faster Iteration



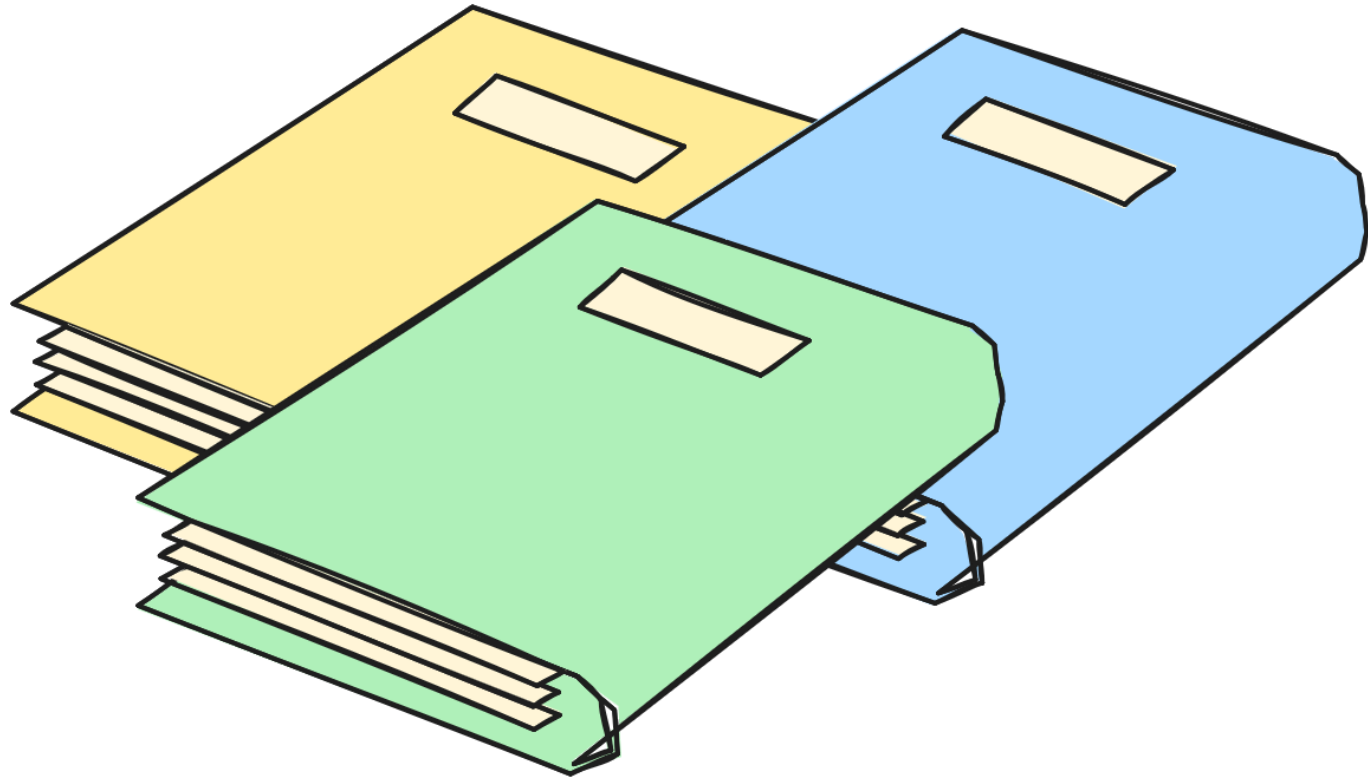
Pros: Deploy with Confidence



The screenshot displays a pull request interface with the following elements:

- Changes approved:** A green checkmark icon, the text "Changes approved", and a link "Show all reviewers". Below it, it states "1 approving review by reviewers with write access. [Learn more about pull request reviews.](#)"
- Approval Summary:** A bar showing "1 approval" and "2 pending reviewers", each with a dropdown arrow.
- All checks have passed:** A green checkmark icon, the text "All checks have passed", and a link "Hide all checks". Below it, it states "10 successful and 8 skipped checks".
- CI Check List:** A list of CI jobs with their status and duration:
 - ✓ CI / check / pr (pull_request) Successful in 3s [Details]
 - ✓ CI / check / pr (push) Successful in 4s [Details]
 - ⊗ CI / lint (push) Skipped [Details]
 - ✓ CI / lint / run (pull_request) Successful in 2m [Details]
 - ⊗ CI / test (push) Skipped [Details]
 - ✓ CI / test (ubuntu-latest, 3.10) / run (pull_request) Successful in 1m [Details]
- Conflict Status:** A green checkmark icon, the text "This branch has no conflicts with the base branch", and the note "Merging can be performed automatically."
- Action Bar:** A green button labeled "Squash and merge" with a dropdown arrow, followed by the text "or view [command line instructions.](#)"

Drawbacks: Learning Curve



Drawbacks: The Rest of the Ecosystem

```
- from scipy import interpolate  
+ from scipy import interpolate # type: ignore  
...  
- tck, _ = interpolate.splprep(scaled_arrays, k=2, s=0)  
+ tck, _ = interpolate.splprep(scaled_arrays, k=2, s=0) # type: ignore
```

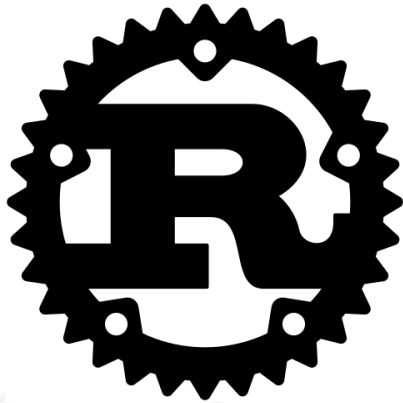
<https://github.com/bluesky/scanspec/pull/143>

Drawbacks: The Rest of the Ecosystem

```
- arrow_artists = list(  
+ arrow_artists = cast(  
+     list[Line3D],  
+     list(  
         filter(  
             lambda artist: isinstance(artist, _Arrow3D)  
             and artist.get_visible()  
             and artist.get_in_layout(),  
             extra_artists,  
         )  
     )  
+ )
```

<https://github.com/bluesky/scanspec/pull/143>

Isn't This a Solved Problem?



Future: Cookie

<https://github.com/scientific-python/cookie>

Useful Links

- <https://peps.python.org/pep-0484/>
- <https://github.com/microsoft/pyright/blob/main/docs/configuration.md>
- <https://github.com/DiamondLightSource/python-copier-template>
- <https://github.com/bluesky/scanspec/pull/143>

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