CAPTURING RAPIDLY CHANGING METADATA (RCM): CURRENT STATUS AND NEXT STEPS:

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OUTCOME OF 2021 FDSN VIRTUAL MEETING

- WG-5 agreed to evaluate GeoCSV for RCM using the FDSN Framework Process
- WG-5 formed a Proposal Review Team to Evaluate the Framework Proposal and Develop a Recommendation
- The Review Team consisted of
  - Asia – Chin-Jen Lin Academia Sinica/IES
  - North America – Adam Ringler, USGS (chair)
  - Europe – Joachim Wassermann, LMU
- The Review Team Recommended the Adoption of the GeoCSV concept with additional suggestions related to incorporation of the RCM into StationXML

EXPANSION BEYOND "MOVING STATIONS"

- Examples of changing values not easily accommodated in SEED
  - Moving stations (latitude, longitude, elevation, depth) (i.e. MERMAIDs, ice sheets, glaciers, creeping slopes, etc.)
  - Variable sample rates
  - Frequently changing gains (i.e. H_2O Observatory)
  - Different algorithmic estimates of calculated sensor orientation (OBS)
- GeoCSV is flexible enough to allow capture of all relevant Rapidly Changing Metadata we are aware of

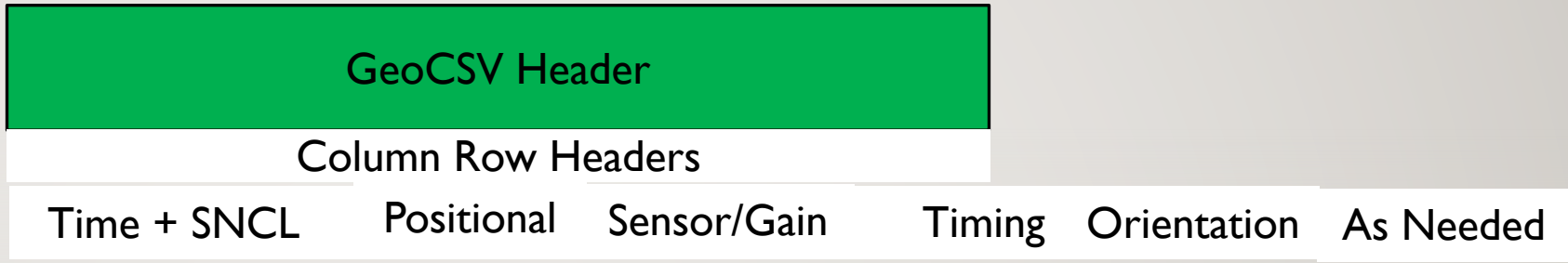
GOALS OF THE GEOCSV FOR RCM FORMAT

- A standard way of capturing metadata in an easy-to-understand manner supporting FAIR principles
- Easy to generate in a field setting by non-software experts
- A format that captures information not now in StationXML
- The ultimate goal is to include this metadata in StationXML

IDENTIFIED GEOCSV COMPONENTS

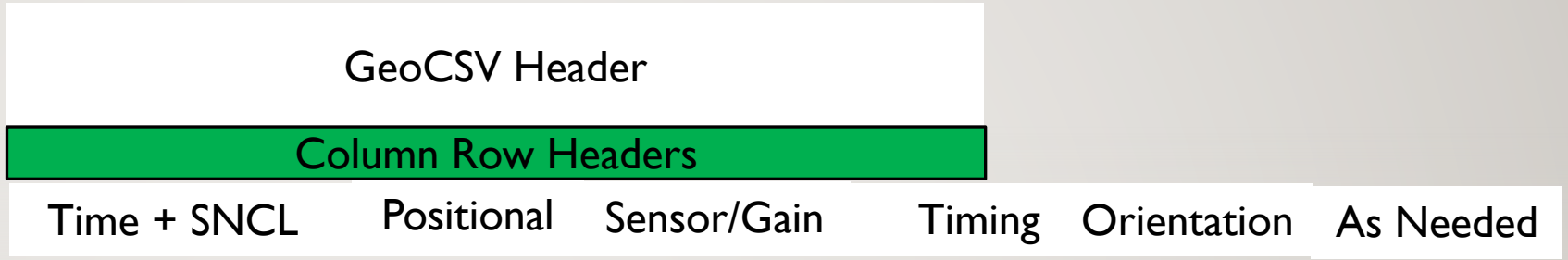
- GeoCSV Header
- Column Identifiers
- A series of Elements as needed
  - Time and SNCL Information (normally necessary)
    - Start time, network, Station, Location, Channel
  - Positional Information
    - Latitude, Longitude, Elevation, Depth
  - Sensor information
    - SensorDescription, Scale, Scale Frequency, Scale Units
  - Timing Information
    - SampleRate, TimeDelay, TimeCorrection
  - Orientation Information
    - Dip, Azimuth, Uncertainties

GEOCSV HEADER



- GeoCSV Header
  - #dataset: GeoCSV 2.0
  - #created: 2021-07-28T23:25:20Z
  - #automaid: v3.4.2 (https://github.com/earthscopeoceans/automaid (doi: 10.5281/zenodo.5057096))
  - #delimiter: ','
  - #lineterminator: '\n'

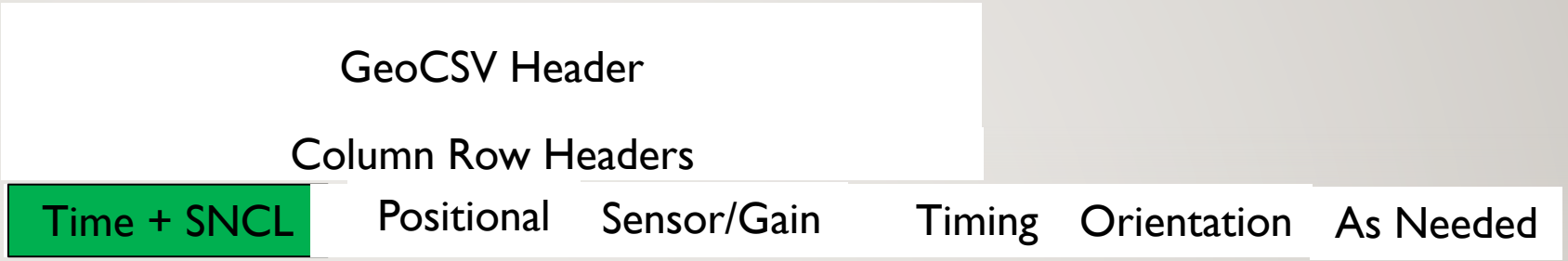
COLUMN ROW HEADERS



degrees_north	**degrees_east**	**meters**	**meters**
float	**float**	**float**	**float**
latitude	**longitude**	**elevation**	**depth**

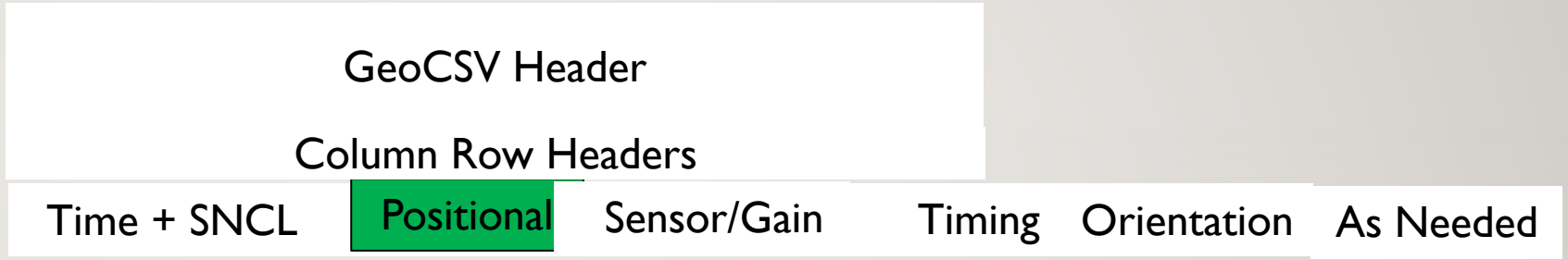
TIMES AND SNCL ELEMENT

- Start Time
- End Time (opt)
- Station
- Network
- Channel
- Location



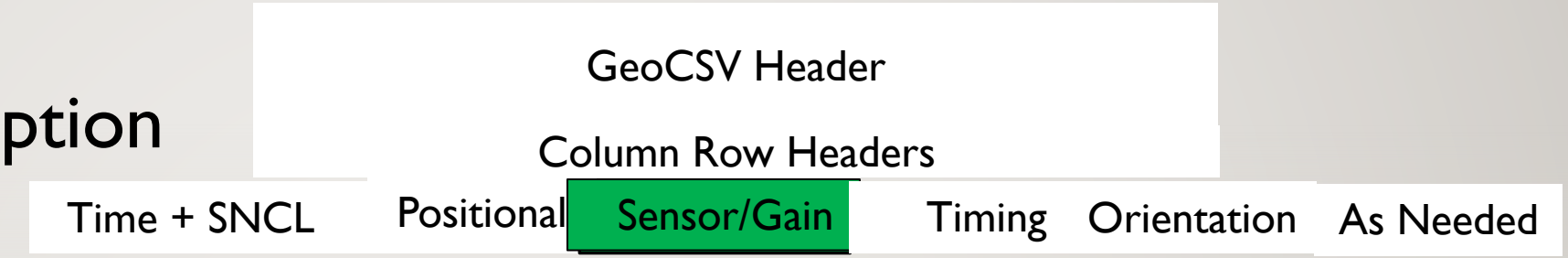
POSITIONAL ELEMENT

- Latitude
- Longitude
- Elevation
- Depth



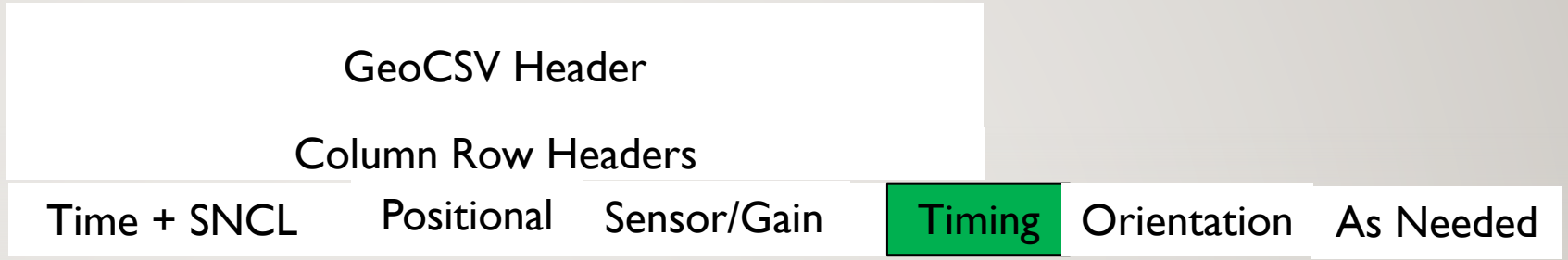
SENSOR AND SENSOR GAIN ELEMENT

- Sensor Description
- Scale Factor
- Scale Frequency
- Scale Units



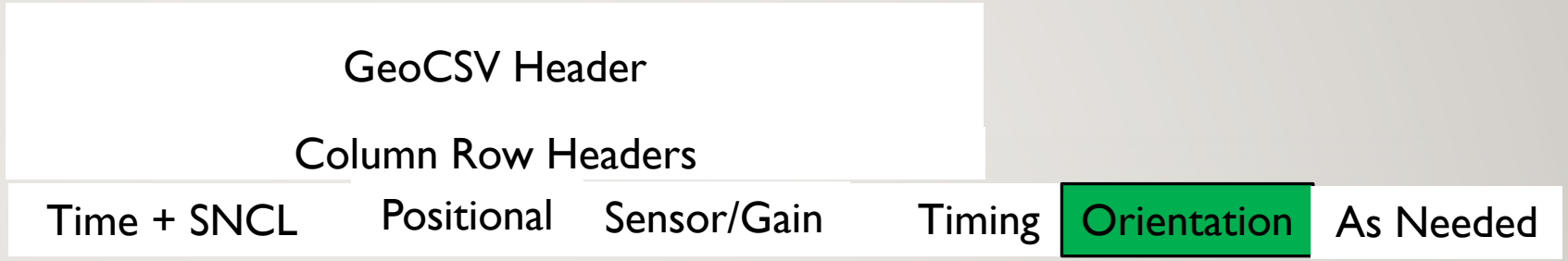
TIMING ELEMENT

- Sample Rate
- Time Delay
- Time Correction Applied

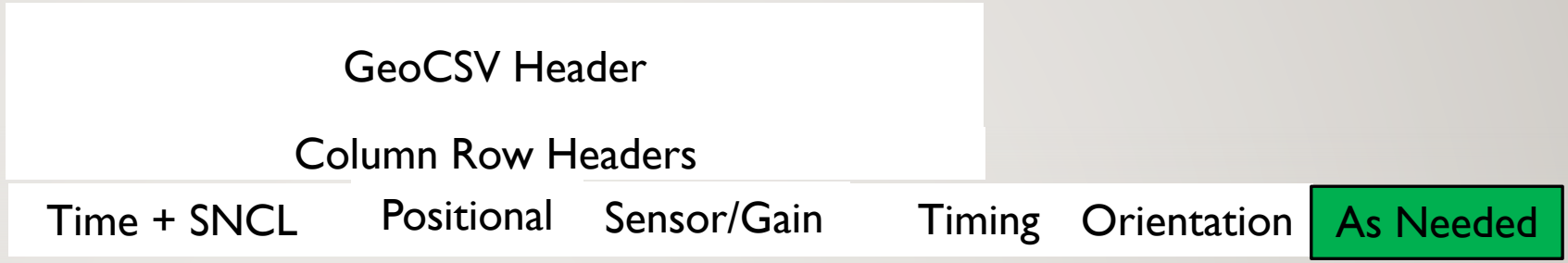


ORIENTATION ELEMENT

- Dip
- Azimuth
- Azimuthal Uncertainty



ADDITIONAL ELEMENTS AS NEEDED



When a new element is needed, these elements can be added with the approval of WG II

EXAMPLE FOR CAPTURING DRIFT OF THE ROSS ICE SHELF

#dataset: GeoCSV 2.0									
#created: 2023-06-17T12:25:20Z									
#Reference url: http://ds.iris.edu/data/reports/XH_2014_2017/									
#delimiter: ','									
#lineterminator: '\n'									
#field_unit	ISO8601	unitless	unitless	unitless	unitless	degrees_north	degrees_east	meters	meters
#field_type	datetime	string	string	string	string	float	float	float	float
Method/Identifier	StartTime	Network	Station	Location	Channel	Latitude	Longitude	Elevation	Depth
GPS Q330 GPS Clock	2014-12-31T23:00:40Z	XH	DR01	*	*	-77.77508	178.34172	30	0
GPS Q330 GPS Clock	2015-12-31T03:10:28Z	XH	DR01	*	*	-77.76594	178.34611	19	0
GPS Q330 GPS Clock	2016-01-20T01:08:44Z	XH	DR01	*	*	-77.75806	178.34989	16	0
GPS Q330 GPS Clock	2014-12-31T23:30:38Z	XH	DR05	*	*	-78.64047	-179.09994	19	0
GPS Q330 GPS Clock	2015-12-31T22:50:24Z	XH	DR05	*	*	-78.63164	-179.09239	9	0
GPS Q330 GPS Clock	2016-11-16T17:53:01Z	XH	DR05	*	*	-80.86433	178.43481	8	0
GPS Q330 GPS Clock	2014-12-31T23:43:19Z	XH	RS01	*	*	-78.18889	169.96239	14.3	0
GPS Q330 GPS Clock	2015-12-31T17:58:39Z	XH	RS01	*	*	-78.18333	169.965	1.4m	0

Times and SNCL Element

Positional Element

Experiment XH 2015-2017 Actual number of rows is >12,000

15 EXAMPLE OF POST DEPLOYMENT OBS ORIENTATIONS

#dataset: GeoCSV 2.0								
#created: 2023-06-19T18:52:20Z								
#Reference doi: 10.1785/0120160165								
#delimiter: ','								
#lineterminator: '\n'								
#field_unit	ISO8601	unitless	unitless	unitless	unitless	SEED Convention	Seed Convention	azimuth uncertinty
#field_type	datetime	string	string	string	string	float	float	float
Method/Identifier	StartTime	Network	Station	Location	Channel	dip	azimuth	azimuthal uncertainty
DLOpy	2006-04-22T00:00:00Z	YS	PL38	0	BH1	-90	179.37	2.20
STACH	2006-04-22T00:00:00Z	YS	PL38	0	BH1	-90	179.58	7.10
Laske et al	2006-04-22T00:00:00Z	YS	PL38	0	BH1	-90	178.60	0.73
DLOpy	2006-04-22T00:00:00Z	YS	PL40	0	BH1	-90	168.32	1.00
STACH	2006-04-22T00:00:00Z	YS	PL40	0	BH1	-90	278.38	3.61
Laske et al	2006-04-22T00:00:00Z	YS	PL40	0	BH1	-90	277.14	0.87
DLOpy	2006-04-22T00:00:00Z	YS	PL47	0	BH1	-90	277.13	1.14
STACH	2006-04-22T00:00:00Z	YS	PL47	0	BH1	-90	278.38	3.61
Laske et al	2006-04-22T00:00:00Z	YS	PL47	0	BH1	-90	277.14	0.87

Times and SNCL Element

Orientation Element

Experiment YS 2006-2007

NEXT STEPS – GEOCSV EXAMPLES

- Continue capturing metadata in GeoCSV format for projects that have RCM and managing the data at existing federated data centers
  - MERMAID data is available now
  - Moving stations on glaciers and ice sheets
  - OBSIP and other outreach to OBS community
- Form a Technical Advisory Group from WG membership to
  - recommend how RCM should be incorporated into StationXML
  - Other Technical Details
    - Wildcarding conventions
    - Representation of unknown values

PROPOSAL DEVELOPMENT

- Pursue Funding Support for Technical Completion Phase of incoporating RCM into StationXML
  - Develop a work specification with the Technical Advisory Group
  - Select a consulting firm to do the development work
  - Submission of the proposal to a funding agency
- Timeline
  - Beta version 6 months after funding
  - Release version 18 months after funding
- Adoption by FDSN at 2025 IASPEI meeting
- FDSN develops plans to make modifications to relevant tools that use StationXML

THANK YOU

COMMITTEE RECOMMENDATION

GeoCSV Proposal Review

On February 9, 2022 the review team (Chin-Jen Lin, Adam Ringler, and Joachim Wassermann) discussed the GeoCSV proposal over Zoom. The meeting was also attended by Tim Ahern, where he clarified a number of questions the review team had.

The review team found the GeoCSV to be a good approach to temporary metadata that had a temporal dependance to it. One of the few shortcomings in the Standard for the Exchange of Earthquake Data (SEED) format is that it is unable to deal with a large number of metadata changes. GeoCSV seems like a good compromise to deal with cases where the metadata will have many changes, making epochal boundaries in SEED difficult to deal with.

The example spreadsheet provided something that seems easy to populate. We also think this being an interim step for the more complete solution of being included in StationXML is valuable. However, we propose that the WGII team should evaluate the pros and cons of other formats differing from CSV for easier and possibly automatic integration into stationXML (e.g., JSON or YAML) by keeping the format simple and human readable.

Given our findings the review team approves the GeoCSV proposal and sees no reason to not go ahead on the implementation.

Chin-Jen Lin, Adam Ringler, Joachim Wassermann